FINAL

ENGINEERING STUDY

NH Route 111 at Ermer Road Intersection

State Project #43790
Salem, New Hampshire

PREPARED FOR

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APPENDICES

1

Introduction

This project is largely funded under the Federal Highway Safety Improvement Program (HSIP) which is a core Federal-aid program dedicated to achieving a significant reduction in traffic fatalities and serious injuries on all public roads. On this project the HSIP funding will be applied to address the known serious crash history that includes crashes with serious injuries and fatalities. Today, traffic on NH Route 111 operates under free flow conditions through the intersection and the Ermer Road approaches are stop controlled. The safety concerns are primarily related to vehicles turning into and out of the side streets.

This engineering study discusses the project purpose and need, as well as identifies challenges and opportunities within the project limits. This document also evaluates alternatives and provides recommended solutions for further project development.

1.1 Project Description

The project area is in northern Salem, New Hampshire along NH Route 111 only 1/3 miles from the Derry Town Line. This project is focused on the NH Route 111 intersection with Ermer Road as depicted on the map below. NH Route 111 generally runs in an east-west direction, is legislatively categorized as a Class II Secondary Highway, is functionally classified as a Principal Arterial, is under New Hampshire Department of Transportation (NHDOT) District 5 jurisdiction, and has a posted speed limit of 50 miles per hour (mph) in both directions approaching the unsignalized intersection with Ermer Road. Ermer Road is generally aligned in a north-south direction, is legislatively classified as a Class V Local Road, is functionally classified as a Local Road, is under Town of Salem jurisdiction, and has a posted speed limit of 30 mph in both directions approaching the unsignalized intersection with NH Route 111.

1.1.1 Regional Context

This section of Ermer Road experiences high peak hour commuter volumes partially because of the project's relative proximity to Interstate 93 and the Massachusetts State Line, including the Town of Methuen and the City of Lawrence, as well as the relative proximity to other major highways, such as Interstate 495.

1.2 Local Concerns

An important initial step in the project development process is the Local Concerns Meeting at which the public is invited to express their interest and opinions on various aspects of the project area. The purpose of the meeting is for Town of Salem officials and the consultant team to understand the public's vision for the project, their concerns, and any local knowledge they are willing to share. This component of the project is a data gathering effort and solutions are generally not discussed or presented.

Such a meeting was held for this project on October 16, 2023 as part of a public Town Council meeting at Salem High School media center. The Town of Salem notified the public through the local newspaper, the Town's website, and immediate abutters were notified by mail. The meeting was broadcast on local television.

VHB presented the project considerations, explained the project development process, and fielded questions and comments. The attendees agreed that there are safety concerns at the intersection, and some gave impassioned accounts of the severe crashes that have occurred there. There were also attendees that expressed a strong desire to install a traffic signal at the intersection, but it was premature for the design team to discuss solution alternatives. Minutes of the meeting are included in Appendix B.

1.3 Project Purpose and Need

The project Purpose and Need Statement helps define the goals of the project as well as the deficiencies that the project will attempt to address. The solution alternatives that are developed are measured by whether and how well they satisfy the Purpose and Need Statement.

Purpose:

To address safety concerns at the NH Route 111 / Ermer Road Intersection.

Need:

The project need is largely defined by the motor vehicle crash history that includes severe crashes with injuries and fatalities.

Contributing factors include:

- High relative speeds on NH Route 111
- High peak hour volumes and short acceptance gaps on NH Route 111
- Two-lane approaches on Ermer Road that affect sight lines for entering vehicles
- Slightly skewed Ermer Road approaches

The motor vehicle crash history at this location includes severe crashes with injuries and fatalities due to the above factors.

2

Documentation of Existing Conditions

2.1 Introduction

Prior to developing solution alternatives, it is first necessary to document the existing physical, environmental, operational, and land use conditions. This step involves data gathering such as online searches, field-based observations and measurements, and agency consultations. The following section describes the data gathering efforts and results.

2.2 Summary of Data Collection

2.2.1 Base Mapping

VHB completed ground survey within the project area in 2023. This work included topographic survey and development of 3D base map files. Relevant Geographic Information System (GIS) files and ortho-photography were also obtained.

2.2.2 Field Reviews

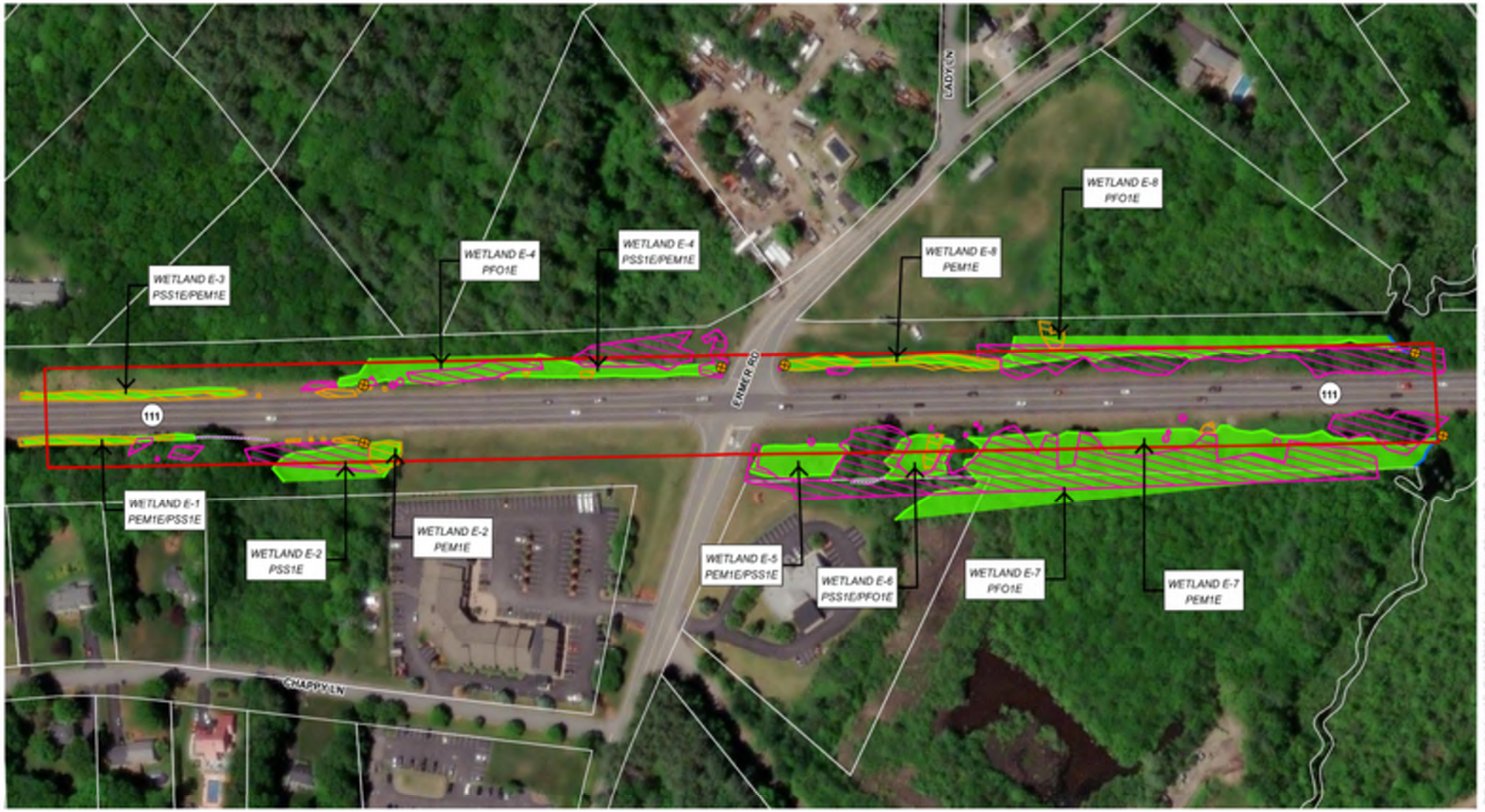
VHB engineers, cultural resources personnel, and environmental scientists conducted field reviews of the project area to document existing conditions in each

of their respective areas of expertise. VHB wetland scientists field delineated the existing wetlands that are present in all four quadrants surrounding the project intersection. They also located and categorized existing invasive plants within the project area. The photograph below shows a wetland northeast of the intersection, with traffic on NH Route 111 visible in the background.

The field work also included collecting photographs of existing roadway and natural resource conditions along the corridor as required under the Local Public Agency (LPA) process. The figure on the next page depicts the results of VHB's wetlands and invasives mapping. It should be noted that Wetland E-7 in the northeast quadrant of the project area is designated a prime wetland.

Figure 1: Natural Resources Map

Ermer Road/NH 111 | Salem, NH



2.2.3 Environmental Database Research

To quickly learn of known environmental constraints, VHB environmental scientists consulted published maps and databases including:

- The National Wetland Inventory Maps,
- The State and National Register of Historic Places,
- New Hampshire Division of Historical Resource Enhanced Mapping & Management Information Tool (EMMIT),
- The Natural Resources Conservation Service (NRCS) county soil survey,
- New Hampshire Department of Environmental Services (NHDES) One Stop Database (primarily Waste Management),
- NH GRANITView database (primarily Conservation and Public Lands, Wildlife), and
- United States Fish and Wildlife Service's Information, Planning, and Conservation (IPaC) System.

2.2.4 Resource Agency Database Consultations

Not all environmental databases are publicly available. In some cases, useful data is available through a written request to specific agencies. VHB consulted resource agencies such as:

- The New Hampshire Natural Heritage Bureau to identify known populations of state-listed threatened or endangered species,
- The United States Fish and Wildlife Service to identify known populations of federally listed threatened and endangered species, as well as to learn of any known sensitive wildlife resources,
- The New Hampshire Department of Natural and Cultural Resources to learn if any Land and Water Conservation Fund (LWCF) sites might be in the project area,

- The Office of Strategic Initiatives to learn if any Land Conservation Investment Program or Conservation Land Stewardship sites might be in the project area.

VHB documents consultations by letter to the respective agencies identifying the project location and outlining the nature of the project and the scoping effort. To date.

2.2.5 Cultural Resources

The cultural resources coordination is ongoing as required under NEPA and Section 106. It includes preparation of the New Hampshire Division of Historic Resources (NHDHR) Request for Project Review (RPR) to initiate agency coordination with New Hampshire Department of Transportation (NHDOT) and NHDHR. The RPR includes a project description, summary of agency contacts, the results of the site file research, site photographs, and figures showing the proposed project. The latter includes plan views of the proposed project. For this project it is unlikely that the review will result in any concerns given the absence of above ground resources and because the work will be on previously disturbed ground within the existing roadway rights-of-way.

2.2.6 Traffic Data

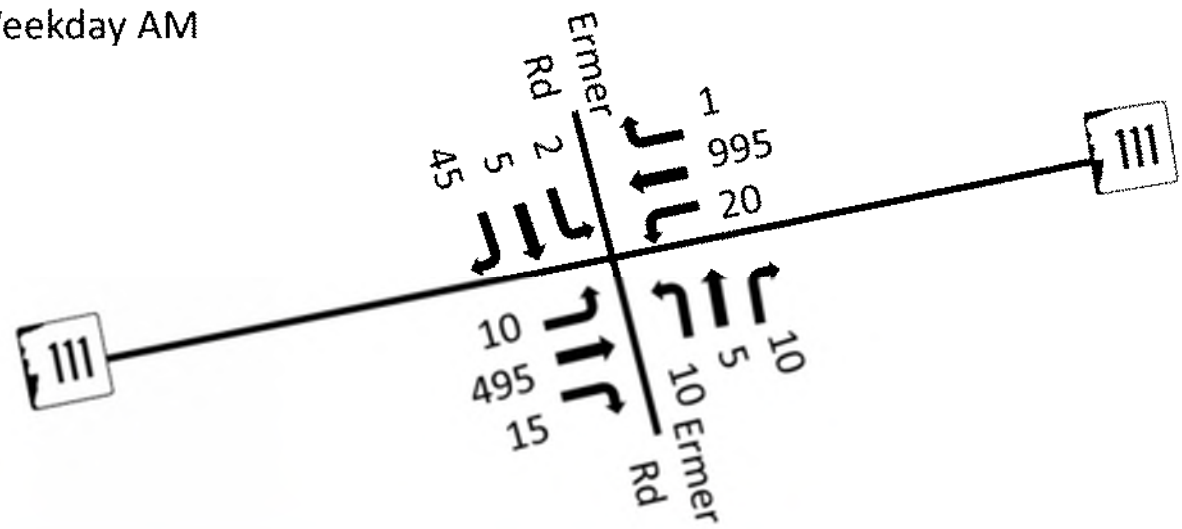
At the NH Route 111 and Ermer Road intersection, the NH Route 111 eastbound and westbound approaches each consist of a single travel lane with directional flow separated by double solid line yellow (DSLY) centerlines. The Ermer Road northbound approach consists of a two-lane approach with aerial imagery showing the configuration of a shared left-turn/through lane and an exclusive right-turn lane, with other images showing a shared left-turn/through lane and a shared through/right-turn lane but with only one receiving lane on the north side of the intersection. Directional flows along the Ermer Road legs of the intersection are separated by raised islands near NH Route 111 that taper back to DSLY centerlines. The Ermer Road northbound and southbound approaches are under STOP-sign (R1-1)

control. Overhead lighting is provided on all four quadrants of the intersection. There are no sidewalks or crosswalks provided in the vicinity of the intersection.

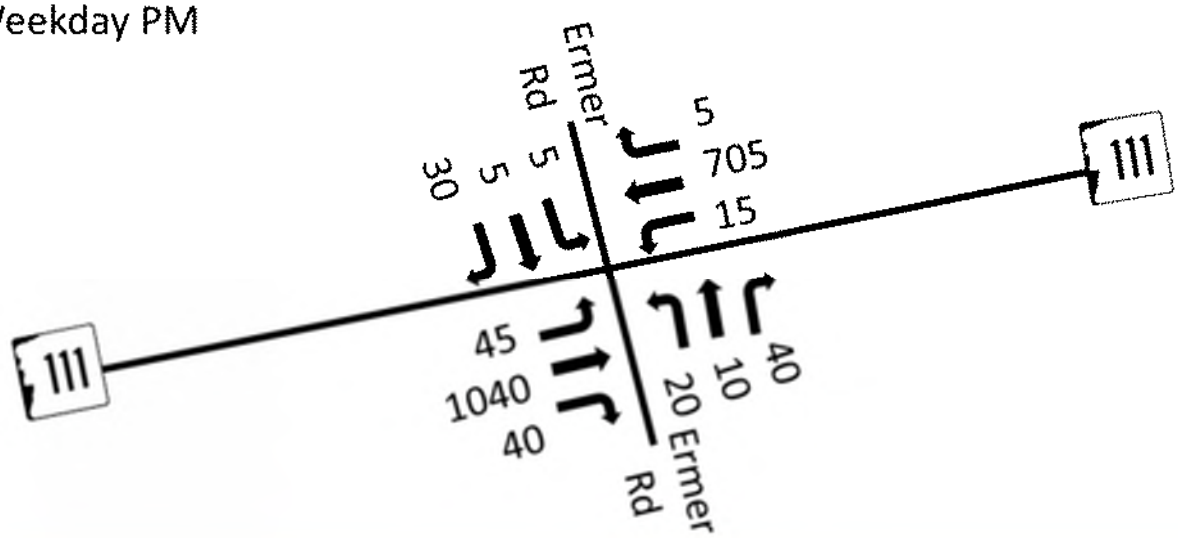
In December 2022, Accurate Counts, a traffic counting vendor to VHB, collected weekday and Saturday turning movement counts at the project intersection. VHB then applied adjustment factors to the raw traffic data in developing traffic volumes representing an anticipated opening (interim) year of 2026 and a future design year of 2042. These traffic volumes were developed by researching NHDOT historical traffic volumes in determining average-month seasonal adjustments, coronavirus disease 2019 (COVID-19) pandemic adjustments, and an annual growth rate. In addition, the opening year and future design year traffic volumes considered planned land development projects in the area.

The following figures graphically depict the 2022 Existing, 2026 Interim Year, and 2042 Design Year traffic volumes. These traffic volumes were used as the basis for evaluating intersection operations and design alternatives for the NH Route 111 and Ermer Road intersection.

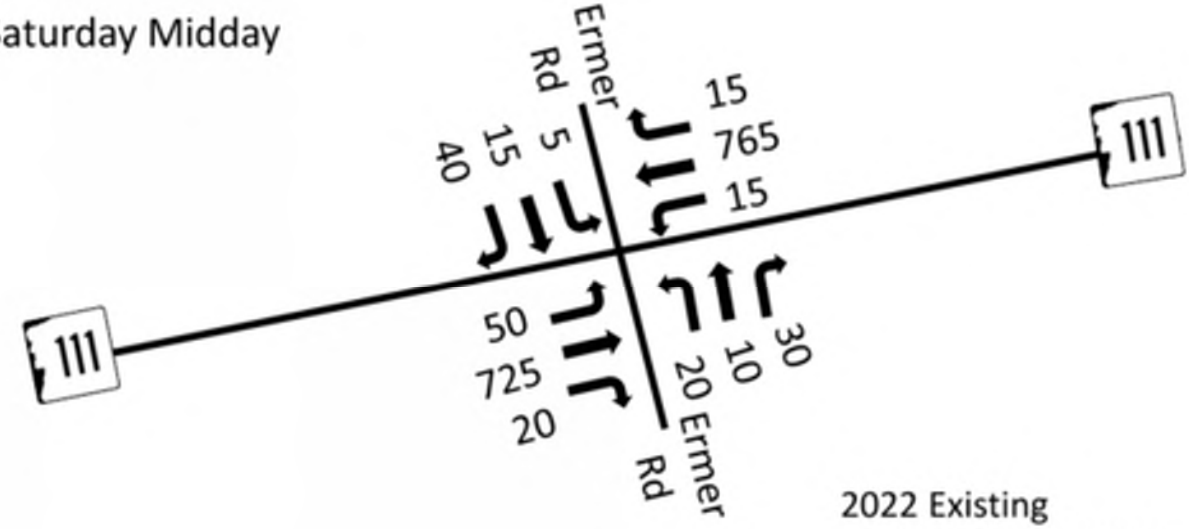
Weekday AM



Weekday PM

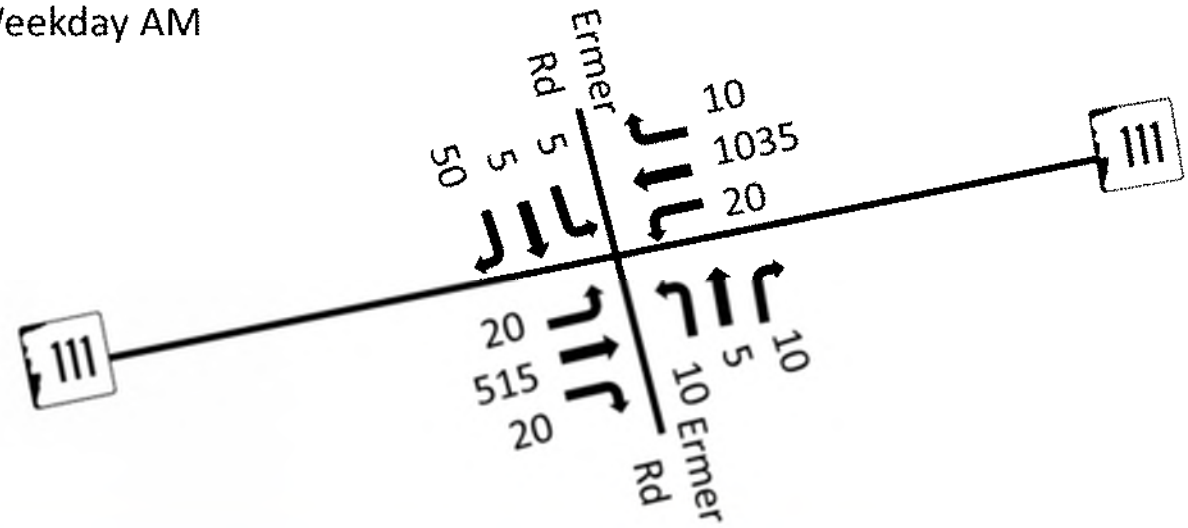


Saturday Midday

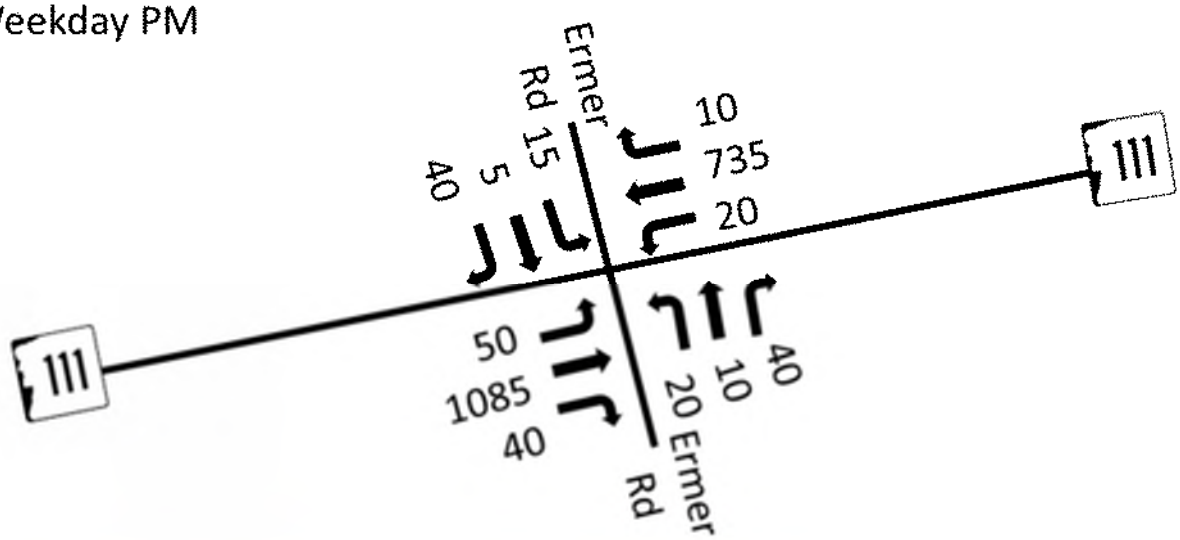


2022 Existing
Peak Hour Traffic Volumes

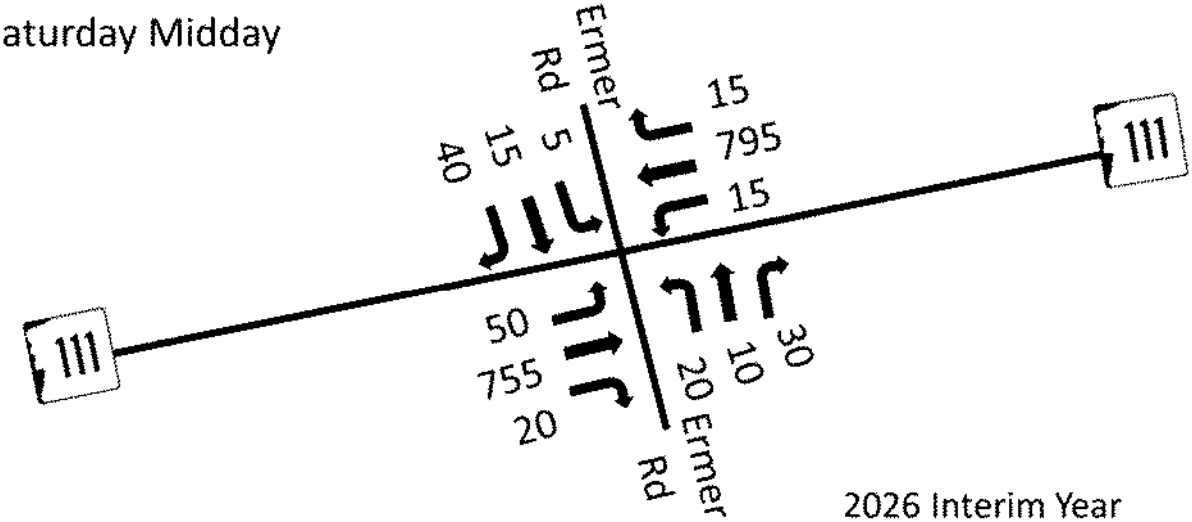
Weekday AM



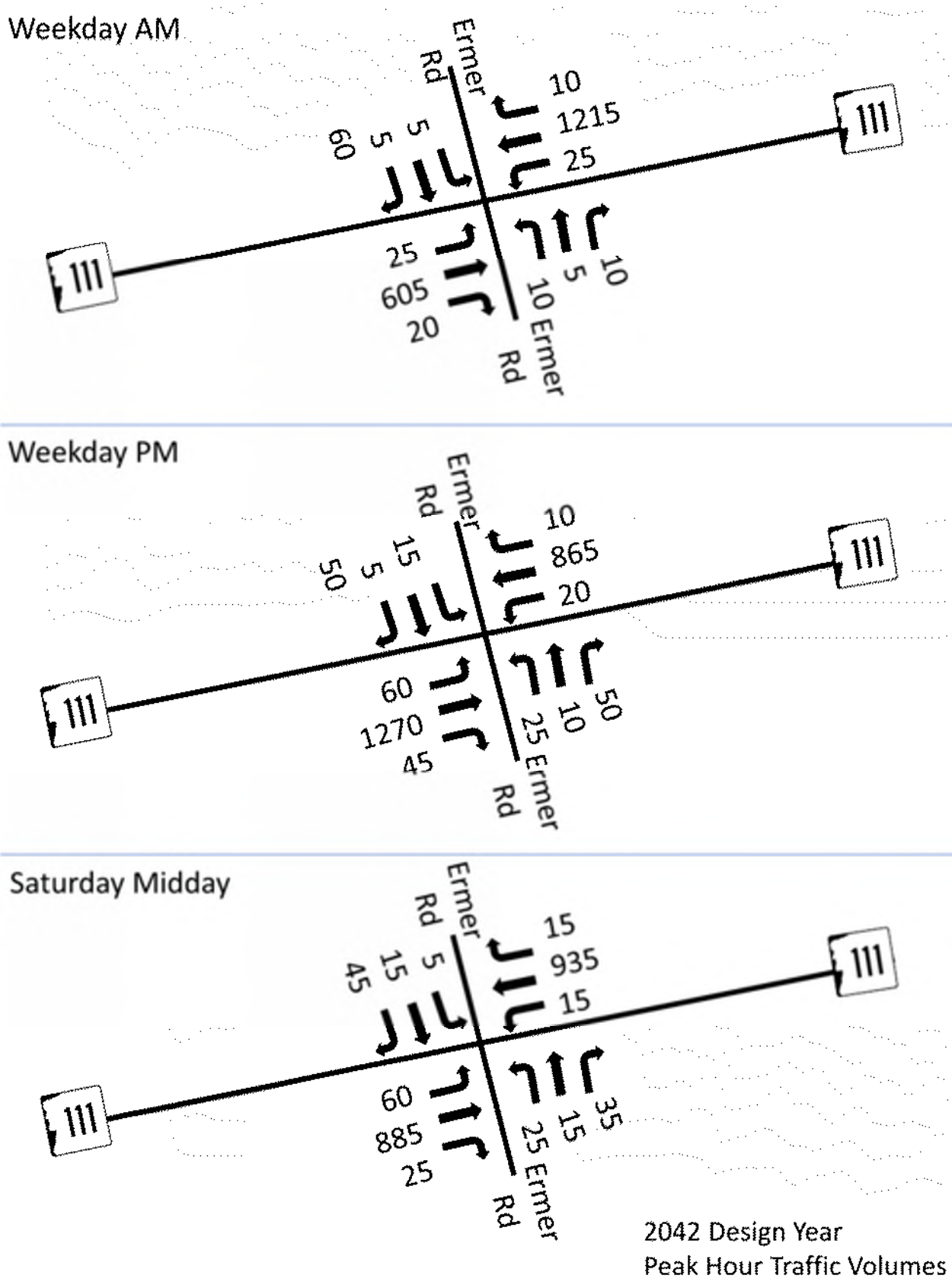
Weekday PM



Saturday Midday



2026 Interim Year
Peak Hour Traffic Volumes

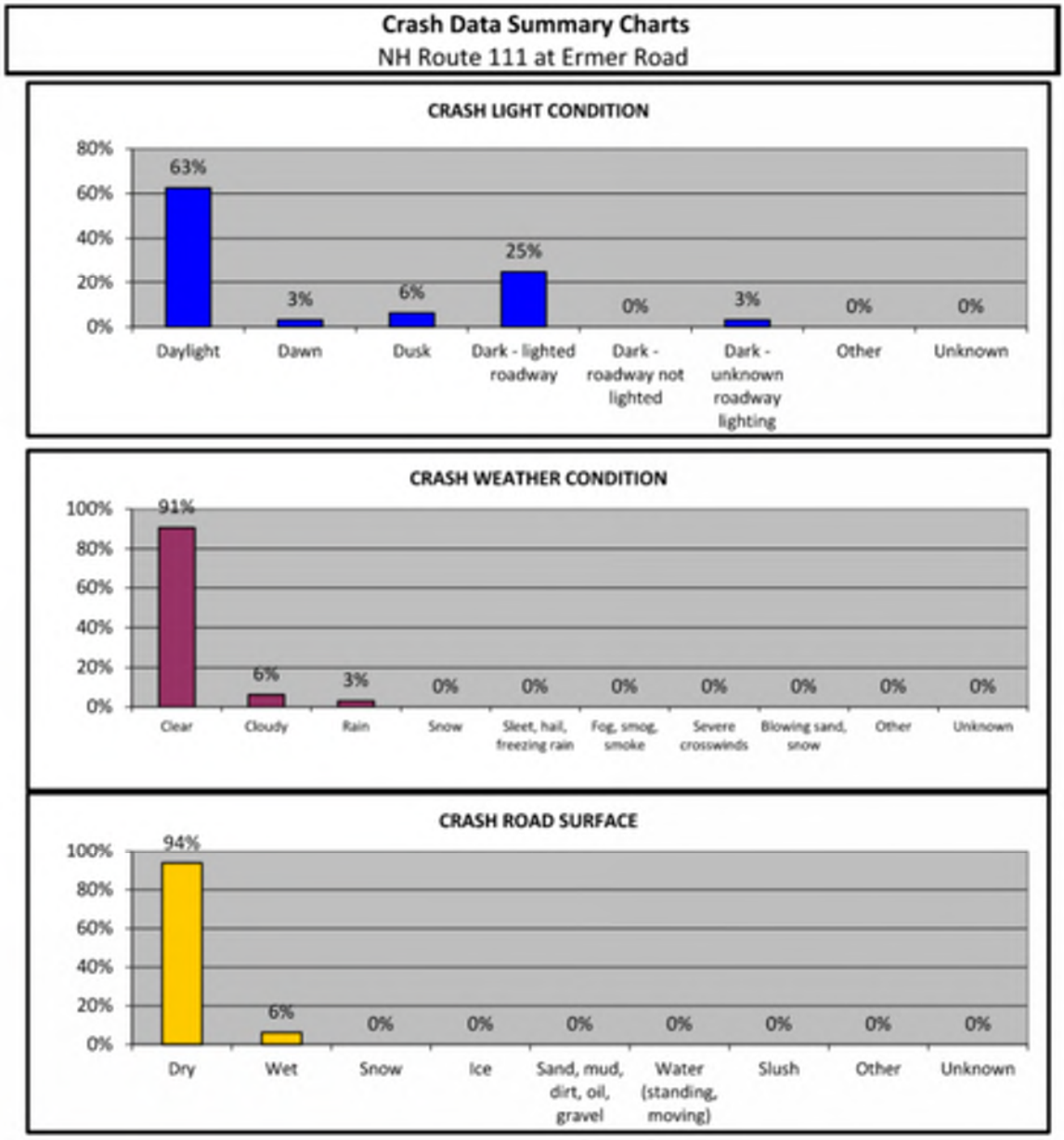

Weekday AM
Ermer Rd
60 5 5
10
1215
25
111
111
25
605
20
10 5 10
10 Ermer Rd
Weekday PM
Ermer Rd
50 5 15
10
865
20
111
111
60
1270
45
25 10 50
25 Ermer Rd
Saturday Midday
Ermer Rd
45 15 5
15
935
15
111
111
60
885
25
25 15 35
25 Ermer Rd
2042 Design Year
Peak Hour Traffic Volumes

2.2.7 Crash Data

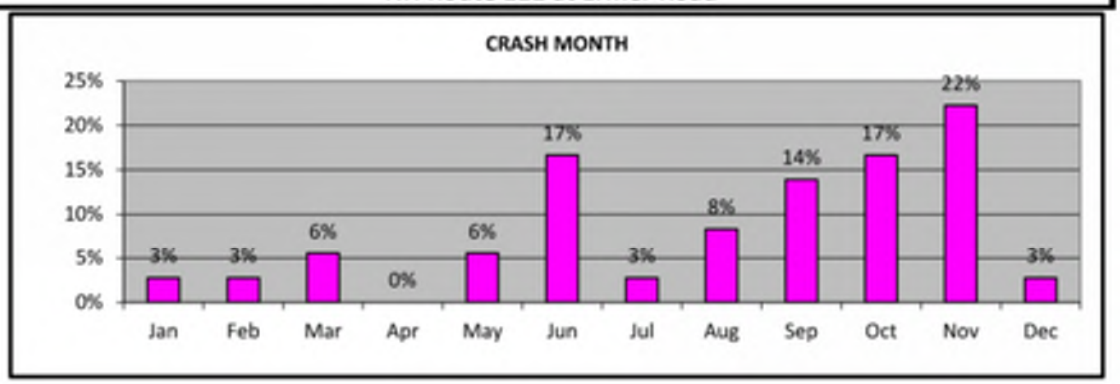
2016-2022 Vehicle Crash Summary

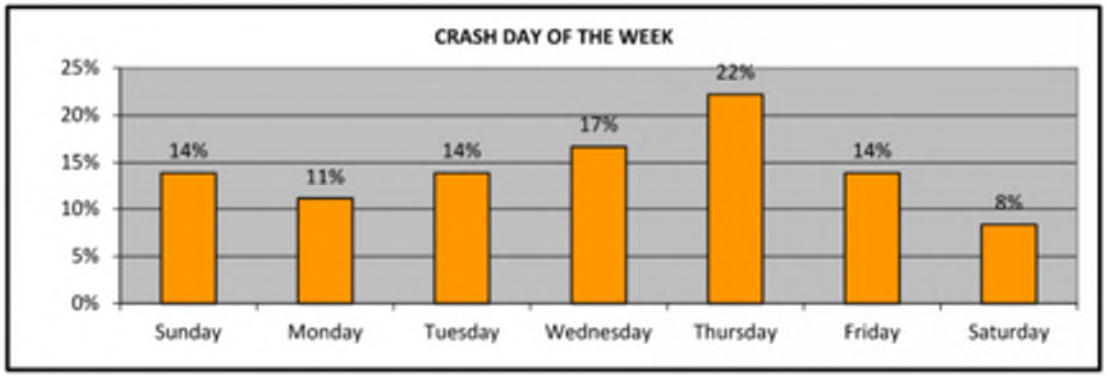
	NH Route 111 at Ermer Road
Total Crashes:	**36**
Year	
2016	5
2017	5
2018	2
2019	4
2020	3
2021	9
2022	8
Collision Type	
Angle	15
Head-on	1
Rear-end	9
Sideswipe	3
Single-vehicle crash	4
Unknown/Not reported	4
Crash Severity	
Fatal injury	1
Non-fatal injury	9
Property damage only	22
Not reported	4
Time of Day	
Weekday, 7:00 AM - 9:00 AM	2
Weekday, 4:00 PM - 6:00 PM	13
Saturday, 11:00 AM - 2:00 PM	0
Weekday, other time	13
Weekend, other time	8
Pavement Conditions	
Dry	34
Wet	2
Snow, ice, and slush	0
Unknown/Not reported	0

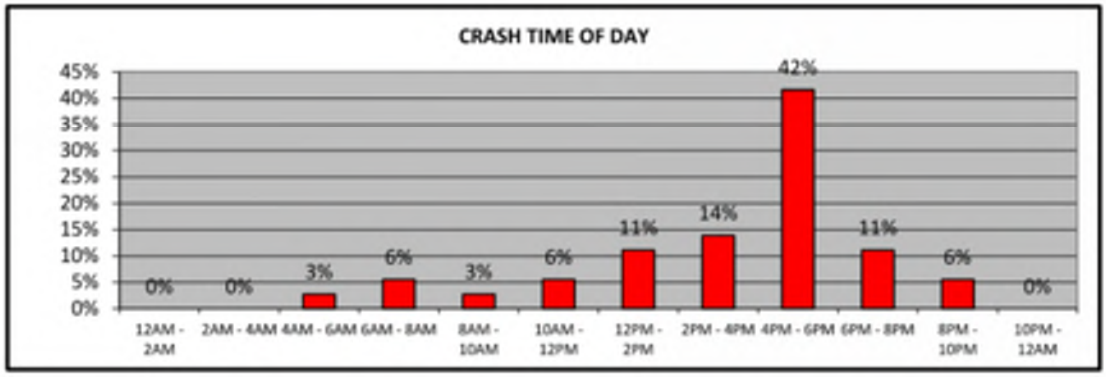
The above crash data was provided by the Salem Police Department. Subsequent to receiving this data, another fatality was identified to have occurred in 2023 at the intersection involving a motorcyclist entering NH Route 111 from the Ermer Road northbound approach that collided with a NH Route 111 eastbound automobile. Details of the crash have not been provided. Following are graphical summaries of the crash data:

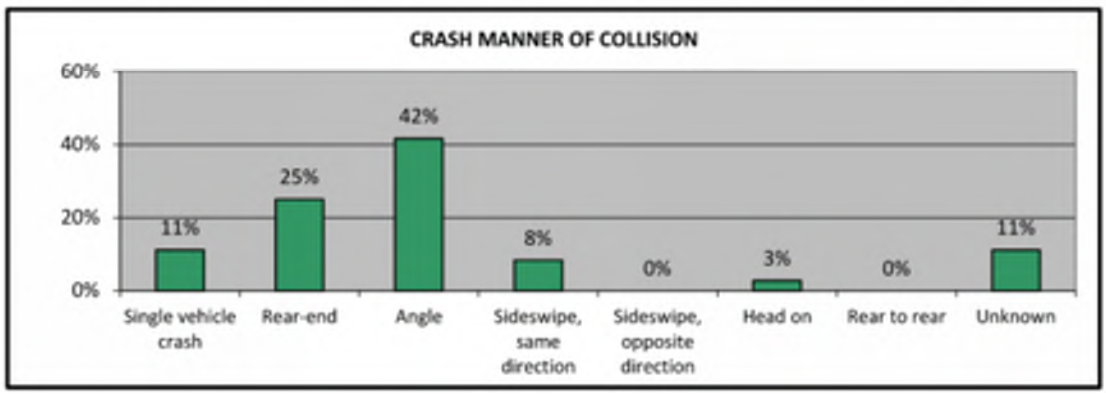


Crash Data Summary Charts
NH Route 111 at Ermer Road









2.2.8 Bicycle and Pedestrian Accommodations

NH Route 111 has 10 to 12-foot-wide striped paved shoulders with rumble strips close to the edge line stripes. NH Route 111 also has 12-foot travel lanes. The shoulders are more than adequate for bicycle accommodations, although the moderately high vehicle speeds and high peak hour traffic volumes detract from the bicyclist's perceived safety.

There are no sidewalks or crosswalks within or reasonably near the project limits, and pedestrian activity through the intersection is primarily on Ermer Road and is infrequent due to the surrounding land use, with only limited pedestrian origins and destinations in the immediate area.

2.3 Design Considerations and Guidelines

The following standards and guidelines will govern the design:

- Traffic controls, including signage and pavement markings, will follow the applicable guidance contained in the USDOT *Manual on Uniform Traffic Control Devices* (MUTCD), (11th edition, pending NHDOT adoption).
- Roundabout design will follow the design principles in NCHRP Report 1043.
- Roadway geometry will follow the AASHTO Policy on Geometric Design of Highways and Streets 7th edition, and roadside geometry will follow the AASHTO Roadside Design Guide 4th edition.
- Accessibility design criteria will follow the applicable principles in the Americans with Disabilities Act Accessibility Guidelines (ADAAG) as well as the Public Right of Way Accessibility Guidelines (PROWAG).
- Applicable NHDOT design guidelines and practices will also be followed.

3

Alternatives Analysis

3.1 Introduction

The observations from the data collection phase, combined with applied design principles and public input, shape the range of design solutions that are possible and/or appropriate to satisfy the project Purpose and Need Statement. This chapter documents the solutions that were considered and the results of their evaluation.

3.2 Improvement Alternatives

The development and evaluation of design alternatives for this project followed a rather complex path in that the alternative that the town officials originally envisioned, the signalization alternative, was not supported by technical analysis. VHB conducted traffic signal warrant analysis, and the signal did not satisfy the volume-based warrants for even the design year. The primary reason the warrants were not met is that the minor (Ermer Road) approaches have low traffic volumes. Warrant 7A, the "safety" warrant, was also not satisfied even with the intersection's crash history because the warrant stipulates that "adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency." Such countermeasures have not been tried at this intersection.

NHDOT subsequently authorized VHB to undertake safety analysis for a range of improvement alternatives. NHDOT originally entertained endorsing the signalized intersection alternative if the safety analysis predicted that it would provide a significant crash reduction in lieu of actually constructing trial countermeasures. VHB performed the safety analysis, and the analysis showed that the traffic signal did not perform as well as hoped. The signalized intersection was ranked 8th out of the 9 alternatives that were considered.

The following is a ranking of the alternatives that were considered, listed in order from highest to lowest by:

A**nnual estimated lives saved, and serious injuries prevented**:

3.39 Roundabout

2.46 Conversion to Restricted Crossing U-Turn Intersection (RCUT)

2.26 Install Left Turn Lanes on NH Route 111

2.17 Raised Median on NH Route 111 Prohibiting Lefts and Crossing Traffic

1.23 Left Turn/Thru Prohibition on Ermer Road

1.07 Lane Reduction on Ermer Road (from 2 to 1)

1.07 Intersection Advance Warning Signs (ICWS)

1.01 Signalization with Left Turn Lanes on NH Route 111

0.37 Realign Both Ermer Road Approaches to Reduce Offset Skew

0.00 No-Build

Following are descriptions and evaluations for each of the alternatives, listed in the above order, considering a range of factors in addition to the predicted safety performance.

3.2.1 Roundabout

3.2.1.1 Description

This Build alternative includes the following primary components:

- Construct a single-lane modern roundabout
- Introduce long curving splitter islands on the NH Route 111 approaches to control the entry speeds.
- Incorporate street lighting to make the roundabout and associated splitter islands more visually recognizable at night and to enhance pedestrian crossing safety if sidewalks are included as shown below.

This Build Alternative is discussed in greater detail as follows.

3.2.1.2 Operations

Analyses were performed at the NH Route 111 and Ermer Road intersection to examine operations under 2026 Interim Year and 2042 Design Year weekday AM, weekday PM, and Saturday midday peak hour traffic volume conditions with the construction of a roundabout. The intersection analyses were based on the concepts

and procedures in the Highway Capacity Manual (HCM) 6th edition using the Trafficware Synchro Software computer program. This software program is an NHDOT approved traffic analysis tool for determining intersection capacity operations. In addition, the PTV Vissim microscopic traffic flow simulation software program was used and produced similar results as the Synchro model. For the purposes of this Engineering Study, the following operational results were determined for a single-lane and a hybrid roundabout alternative:

Table A Intersection Analysis Summary: 2026 Interim Year NH Route 111 and Ermer Road

	Single-Lane Roundabout				Hybrid Roundabout [a]			
Peak Hour/Lane Group	v/c	Delay	LOS	95th % Queue	v/c	Delay	LOS	95th % Queue
Weekday AM								
NH 111 EB Approach	0.51	8.3	A	75	--	--	--	--
NH 111 EB Left/Through	--	--	--	--	0.24	5.0	A	25
NH 111 EB Through/Right	--	--	--	--	0.26	5.0	A	25
NH 111 WB Approach	0.86	21.0	C	300	--	--	--	--
NH 111 WB Left/Through	--	--	--	--	0.41	6.9	A	50
NH 111 WB Through/Right	--	--	--	--	0.44	7.0	A	50
Ermer Rd NB Approach	0.05	5.7	A	0	0.05	4.9	A	0
Ermer Rd SB Approach	0.19	11.2	B	25	0.15	8.6	A	25
Weekday PM								
NH 111 EB Approach	1.00	43.0	E	550	--	--	--	--
NH 111 EB Left/Through	--	--	--	--	0.48	7.9	A	75
NH 111 EB Through/Right	--	--	--	--	0.51	8.1	A	75
NH 111 WB Approach	0.71	13.4	B	175	--	--	--	--
NH 111 WB Left/Through	--	--	--	--	0.34	6.2	A	50
NH 111 WB Through/Right	--	--	--	--	0.36	6.2	A	50
Ermer Rd NB Approach	0.24	14.3	B	25	0.19	10.5	B	25
Ermer Rd SB Approach	0.17	9.0	A	25	0.14	7.3	A	25
Saturday Midday								
NH 111 EB Approach	0.69	12.1	B	150	--	--	--	--
NH 111 EB Left/Through	--	--	--	--	0.33	5.8	A	25
NH 111 EB Through/Right	--	--	--	--	0.35	5.9	A	50
NH 111 WB Approach	0.73	13.8	B	175	--	--	--	--
NH 111 WB Left/Through	--	--	--	--	0.34	6.2	A	50
NH 111 WB Through/Right	--	--	--	--	0.37	6.2	A	50
Ermer Rd NB Approach	0.16	8.6	A	25	0.13	6.9	A	0
Ermer Rd SB Approach	0.14	8.4	A	0	0.12	6.8	A	0

v/c = volume-to-capacity ratio.
Delay in seconds.
Queue lengths in feet (unsignalized intersections produce number of vehicles multiplied by standard traffic engineering practice vehicle spacing of 25 feet/vehicle).
a NH Route 111 eastbound and westbound approaches = 1 Left/Through Lane and 1 Through/Right Lane.

Table B Intersection Analysis Summary: 2042 Design Year NH Route 111 and Ermer Road

	Single-Lane Roundabout				Hybrid Roundabout [a]			
Peak Hour/Lane Group	v/c	Delay	LOS	95th % Queue	v/c	Delay	LOS	95th % Queue
Weekday AM								
NH 111 EB Approach	0.57	9.3	A	100	--	--	--	--
NH 111 EB Left/Through	--	--	--	--	0.27	5.3	A	25
NH 111 EB Through/Right	--	--	--	--	0.29	5.3	A	25
NH 111 WB Approach	1.01	44.9	F	575	--	--	--	--
NH 111 WB Left/Through	--	--	--	--	0.48	7.9	A	75
NH 111 WB Through/Right	--	--	--	--	0.51	8.1	A	75
Ermer Rd NB Approach	0.04	6.0	A	0	0.04	5.1	A	0
Ermer Rd SB Approach	0.22	14.1	B	25	0.17	10.3	B	25
Weekday PM								
NH 111 EB Approach	1.16	94.5	F	975	--	--	--	--
NH 111 EB Left/Through	--	--	--	--	0.55	9.1	A	100
NH 111 EB Through/Right	--	--	--	--	0.59	9.5	A	100
NH 111 WB Approach	0.82	18.6	C	250	--	--	--	--
NH 111 WB Left/Through	--	--	--	--	0.39	6.8	A	50
NH 111 WB Through/Right	--	--	--	--	0.41	6.9	A	50
Ermer Rd NB Approach	0.32	19.7	C	25	0.24	13.5	B	25
Ermer Rd SB Approach	0.17	10.0	A	25	0.14	7.9	A	0
Saturday Midday								
NH 111 EB Approach	0.81	17.3	C	250	--	--	--	--
NH 111 EB Left/Through	--	--	--	--	0.39	6.5	A	50
NH 111 EB Through/Right	--	--	--	--	0.42	6.6	A	50
NH 111 WB Approach	0.86	21.8	C	300	--	--	--	--
NH 111 WB Left/Through	--	--	--	--	0.41	7.1	A	50
NH 111 WB Through/Right	--	--	--	--	0.43	7.1	A	50
Ermer Rd NB Approach	0.18	10.2	B	25	0.14	8.0	A	25
Ermer Rd SB Approach	0.16	10.0	B	25	0.13	7.9	A	0

v/c = volume-to-capacity ratio.
Delay in seconds.
Queue lengths in feet (unsignalized intersections produce number of vehicles multiplied by standard traffic engineering practice vehicle spacing of 25 feet/vehicle).
a NH Route 111 eastbound and westbound approaches = 1 Left/Through Lane and 1 Through/Right Lane.

The 2026 Interim Year weekday PM peak hour traffic volumes with a single-lane roundabout are shown to result in the NH Route 111 eastbound approach operating at capacity (volume-to-capacity [v/c] ratio = 1.00), level of service (LOS) E, and a 95th percentile queue of 550 feet. With the 2026 Interim Year weekday AM and Saturday midday peak hour traffic volumes, the four approaches are projected to operate at LOS C or better with available capacity (v/c ratio <1.00).

With the 2042 Design Year conditions, the single-lane roundabout would result in the NH Route 111 westbound approach and the NH Route 111 eastbound approach operating over capacity (v/c ratios >1.00), LOS F, and 95th percentile queues between 575 and 975 feet during the weekday AM and PM peak hours, respectively. The 2042 Design Year Saturday midday peak hour traffic volumes are projected to operate at LOS C or better with available capacity (v/c ratio <1.00).

A multi-lane "hybrid" roundabout was also considered in which a shared left-turn/through lane and a shared through/right-turn lane would be provided on the NH Route 111 approaches and single lanes on the Ermer Road approaches. This geometric design would provide one circulating lane along the east and west sides of the roundabout and two circulating lanes on the north and south sides. Should the multilane roundabout alternative be selected, the 2026 Interim Year and 2042 Design Year traffic volume conditions project the approaching lanes to operate at LOS B or better during the weekday AM, weekday PM, and Saturday midday peak hours. Although the hybrid roundabout design would produce better operational results, the single-lane roundabout design was selected as the delays and queues would occur over a short period of time and a multilane roundabout may be overdesigned for the remainder of the day. In addition, the traffic signals to the east and west (i.e., NH Route 111 with Island Pond Road/Haverhill Road and with Zachery's Crossing) may meter the traffic volumes that entering the NH Route 111 and Ermer Road intersection suggesting that the traffic volumes evaluated within the analyses may not be realized without improvements to those signalized intersections. Lastly, single lane roundabouts tend to have lower crash rates than multilane roundabouts.

3.2.1.3 Right-of-Way

It appears that the widening associated with the construction of the single lane roundabout could be accomplished completely within the existing public rights of

way. The existing NH Route 111 right-of-way is approximately 240-feet wide, and the Ermer Road right-of-way widens out on both approaches at NH Route 111.

3.2.1.4 Utilities

There are existing overhead utilities running along the north side of NH Route 111 and running along the west side of Ermer Road. It appears that one pole in the southwest quadrant of the intersection will require relocation. There are also four existing streetlights that will be impacted and reset or replaced to provide lighting for the roundabout.

3.2.1.5 Potential Resource Impacts

It appears that constructing the roundabout would result in approximately 0.13 acres of wetland impacts. It does not appear that the prime wetland in the northeast quadrant will be directly impacted. Based on the conceptual design plan the area of significant ground disturbance will be under 100,000 SF and therefore an Alteration of Terrain permit will not be triggered. Furthermore, the area contributing to each of the conceptual closed drainage point discharges will be well under NHDOT's MS4 permit threshold.

3.2.1.6 Bike and Pedestrian Accommodations

The conceptual roundabout design includes multiuse sidewalks around all four sides to convey bike and pedestrian passage. The NH Route 111 approaches have wide shoulders that narrow to only a few feet at the roundabout, and there would be aprons for bicyclists to exit the roadway before reaching the narrow points.
There would also be crosswalks across each approach with pedestrian refuge in each of the raised splitter islands. There is no requirement to add enhancements such as Rectangular Rapid Flashing Beacons at the crosswalks, and given the low expected pedestrian activity none are proposed at this time, but they should be considered on the NH Route 111 crossings given the high traffic volumes. If a multilane roundabout

is eventually constructed there would be a requirement to enhance the multilane crosswalks.

It should be noted that the Town and not NHDOT will maintain the sidewalks per NHDOT policy. For this reason, the Town was initially hesitant to include the sidewalks in the project, and NHDOT indicated that they would not require sidewalks so long as they were determined to not be necessary through the public participation process. The current concept plan includes the sidewalks, but the town may choose not to include them at a later date.

3.2.1.7 Cost

The estimated project costs for this alternative are as follows based on a conceptual opinion of construction and right-of-way costs, including contingencies, PE costs, and assumed construction engineering and inspection costs.

Construction:	$2,378,000
PE:	$ 250,000
ROW:	$ 0
CE:	$ 220,000
Project Total:	$ 2,848,000

3.2.2 Conversion to Restricted Crossing U-Turn Intersection (RCUT)

3.2.2.1 Description

This unsignalized Build alternative includes the following primary components:

- An approximately 2,000-foot-long raised median with 400-foot-long left turn lane pockets on NH Route 101 that lead to stop-controlled breaks in the median that allow left turns only into Ermer Road.
- Median-restricted right turns out of each Ermer Road approach.

- Left turn lane pockets on NH Route 101 that lead to yield-controlled breaks in the median to allow for U-Turns to reverse direction toward right-turn lanes into Ermer Road.

This Build alternative is discussed in greater detail as follows.

3.2.2.2 Operations

This alternative, though somewhat unconventional for this region, is predicted to provide very good safety benefits while also providing good operations. One benefit is that the through movements on NH Route 111 remain in free flow, and access to NH Route 111 from Ermer Road is good since left turns are prohibited. The left and through movements out of Ermer Road are accommodated through the U-Turns in the median where there is ample storage.

3.2.2.3 Right-of-Way

It appears that this alternative would not result in permanent impacts, although temporary impacts are likely in the vicinity of the U-Turns because they must be large enough to accommodate large trucks.

3.2.2.4 Utilities

Utility poles along the north side of NH Route 111 would need to be relocated to provide adequate clear zone for the widened roadway. Roadway lighting would also

be needed at the main intersection, the U-Turns, and the ends of the NH Route 111 median.

3.2.2.5 Potential Resource Impacts

This alternative would result in wetland impacts due to the required widening. The impact area is conceptually estimated to be 0.3 acres.

3.2.2.6 Bike and Pedestrian Accommodations

The proposed design does not include pedestrian accommodations. NH Route 111 would maintain high-speed free-flow conditions, which would prevent the installation of a crosswalk without signalized stop controls. Similarly, bike accommodations would be lacking and crossing NH 111 would be difficult because cyclists would need to use the U-Turns along with motorists.

3.2.2.7 Cost

This would be the costliest alternative due to the extensive roadway widening. The total roadway width would be increased by approximately 40-feet and the raised median would be approximately 2,000 feet long. The project costs would likely exceed $4 million.

3.2.3 Install Left Turn Lanes on NH Route 111

3.2.3.1 Description

This Build alternative includes the following primary components:

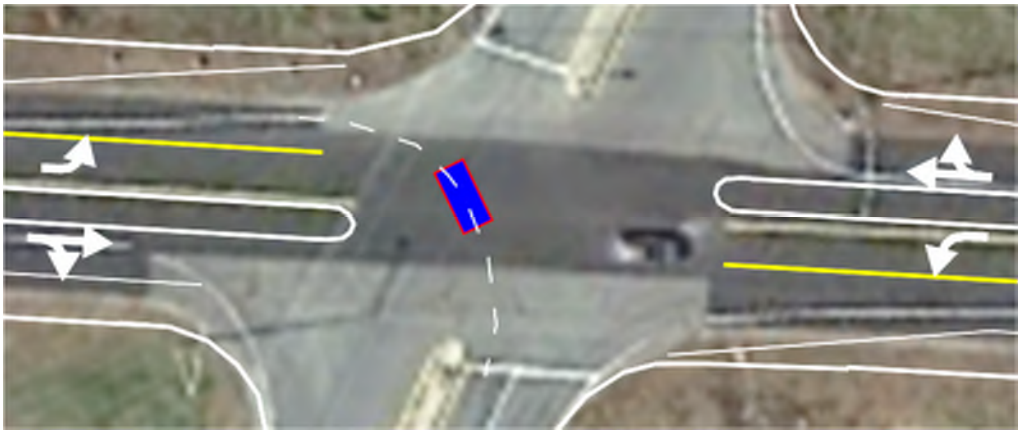
- Widen NH Route 111 to allow for the creation of offset left turn lanes serving lefts into Ermer Road. The lefts on NH Route 111 would be separated from the Through/Right lanes by painted medians.

- The Ermer Road approaches would remain unchanged, though this alternative could be combined with some of the alternatives that modify the Ermer Road approaches.

This Build Alternative is discussed in greater detail as follows.

3.2.3.2 Operations

This alternative provides good safety benefits while also providing adequate operations. The through movements on NH Route 111 remain uncontrolled, and separating the left turns out from the through movements would improve safety and reduce delay on the mainline. The left and through movements out of Ermer Road are slightly improved because the modifications on NH Route 111 provide an area for vehicles that are entering NH Route 11 from Ermer Road to dwell if needed, effectively making two-stage left turns.



Offsetting the NH Route 111 left turns to the left also provides better sight lines for

left turning vehicles on the mainline as well as the vehicles turning left out of Ermer Road.

3.2.3.3 Right-of-Way

It appears that this alternative would not result in permanent impacts, although temporary impacts are possible due to the amount of roadway widening required.

3.2.3.4 Utilities

It appears that the utility poles along the north side of NH Route 111 would need to be relocated to provide adequate clear zone for the widened roadway. Roadway lighting would also need to be relocated at the main intersection.

3.2.3.5 Potential Resource Impacts

This alternative would result in wetland impacts due to the required widening. The impact area is conceptually estimated to be under 0.1 acres.

3.2.3.6 Bike and Pedestrian Accommodations

The proposed design does not include pedestrian accommodations. NH Route 111 would maintain high-speed free-flow conditions, which would prevent the installation of a crosswalk without signalized stop controls. Similarly, bike accommodations would not be upgraded, although crossing NH 111 would be improved slightly because cyclists could take advantage of the dwell space created in the middle of the intersection by the offset left turns to make a two-stage crossing, albeit under traffic.

3.2.3.7 Cost

The estimated project costs for this alternative are moderately low since the work mainly consists of roadway widening on NH Route 111.

3.2.4 Raised Median on NH Route 111 Prohibiting Lefts and Crossing Traffic

3.2.4.1 Description

This Build alternative includes the following primary components:

- Construct an approximately 600-foot-long raised median on NH Route 111 to prohibit though and left turn movements from Ermer Road and to prohibit left turns into Ermer Road from NH Route 111.
- Widen NH Route 111 to accommodate the raised median.
- Reconfigure the Ermer Road approaches to be single lane and right turn only.

This Build Alternative is discussed in greater detail as follows.

3.2.4.2 Operations

This Build Alternative would operate very well since all left turns would be prohibited. The exception is that Ermer Road would no longer be continuous, so the motorists seeking to cross NH Route 111 would need to seek alternate routes or find a convenient location to reverse direction. The same is true for motorists seeking to turn left out of or into Ermer Road. By eliminating left turns the raised median would reduce conflicts and improve safety but impact access.

3.2.4.3 Right-of-Way

It appears that this alternative would not result in permanent or temporary property impacts because the roadway widening is minor, and the available right-of-way is ample.

3.2.4.4 Utilities

It appears that utility impacts would be minor if at all. Roadway lighting would be added to illuminate the ends of the raised median.

3.2.4.5 Potential Resource Impacts

It appears that this alternative could be constructed with minimal or no impact to the adjacent wetlands.

3.2.4.6 Bike and Pedestrian Accommodations

The proposed design does not include pedestrian accommodations. NH Route 111 would maintain high-speed free-flow conditions, which would prevent the installation of a crosswalk without signalized stop controls. Similarly, bike accommodations would be lacking and crossing NH 111 would be rendered impossible.

3.2.4.7 Cost

The estimated project costs for this alternative are moderately low since the work mainly consists of minor roadway widening on NH Route 111, median construction, and minor reconfiguration of the Ermer Road approaches

3.2.5 Left Turn/Thru Prohibition on Ermer Road

3.2.5.1 Description

This Build alternative includes the following primary components:

- Reconfigure the Ermer Road approaches to single lane right turns only.

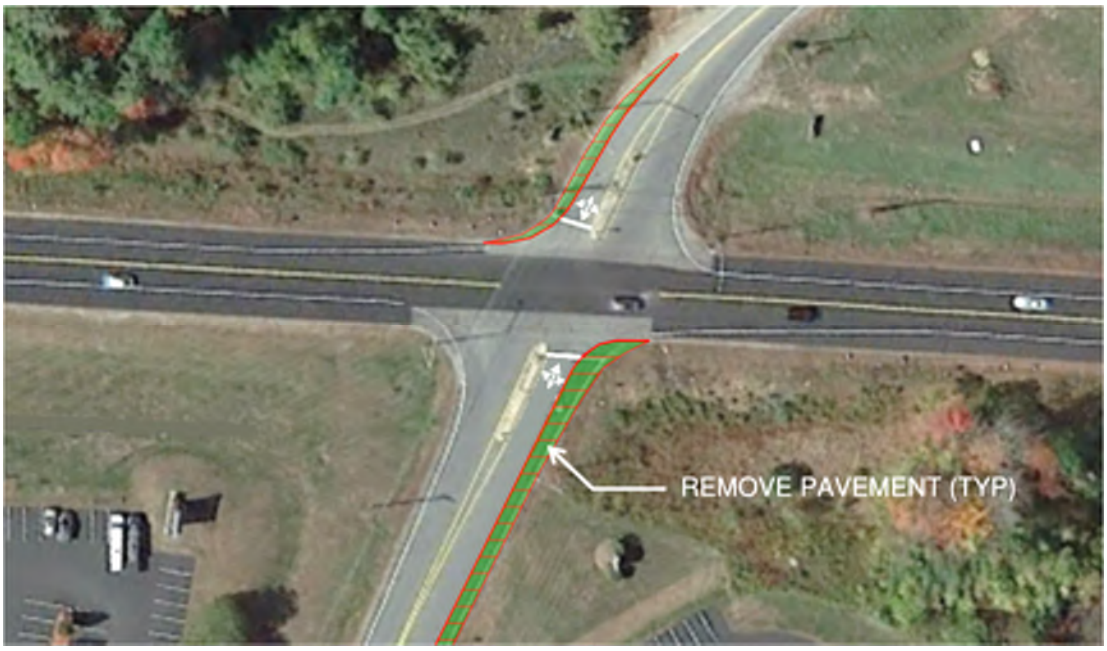
3.2.5.2 Operations

This Build Alternative would provide a safety benefit and operate well for the mainline since left turns out of Ermer Road would be eliminated. The exception is that motorists seeking to cross NH Route 111 from Ermer Road would need to seek alternate routes or find a convenient location to reverse direction. The same is true for motorists seeking to turn left out of Ermer Road. There is a real concern that it would still be physically possible to make left turns out of Ermer Road and some motorists may opt to do so in violation of the regulatory signs to the contrary. Through and left turning vehicles on NH Route 111 would still be sharing the high-speed lane, so crossing and rear-end crash concerns would still exist.

3.2.6 Lane Reduction on Ermer Road (from 2 to 1)

3.2.6.1 Description

This is a minor modification of the Ermer Road approaches that could potentially be constructed as a low-cost short-term safety improvement to address the concern that vehicles stopped side-by-side tend to block each other's sight lines when attempting to enter NH Route 111.



3.2.6.2 Operations

This alternative would have a minor impact on Ermer Road operations. Ermer Road left turning vehicles tend to have to wait longer to find gaps than right turning vehicles and will therefore increase overall delay on the side street approaches because the right turning vehicles will no longer be able to bypass the left turning vehicles in the queue. This alternative does not address the concerns with left turning and through vehicles in the same high speed travel lane on NH Route 111.

3.2.7 Intersection Advance Warning Signs (ICWS)

3.2.7.1 Description

The Build alternative would install Intersection Conflict Warning Systems (ICWS) on NH Route 111. The ICWS would consist of warning signs with flashing lights to alert drivers on the mainline that vehicles are approaching the intersection on the minor street (Ermer Road). The goal of ICWS is to reduce the risk of severe crashes at intersections, and in this case at an unsignalized intersection where a major road crosses a minor road. This alternative does not affect operations, and it has a low predicted safety benefit. This alternative does not address the concerns with left turning and through vehicles in the same high speed travel lane on NH Route 111.

3.2.8 Signalization with Left Turn Lanes on NH Route 111

3.2.8.1 Description

This Build alternative includes the following primary components:

- Widen NH Route 111 by approximately 32-feet to accommodate a striped (or raised) median, exclusive left turn lanes, and additional through-right lanes on NH Route 111.
- Install traffic signals to control the intersection traffic.
- The Ermer Road approaches may remain largely unchanged.

3.2.8.2 Operations

This alternative would provide minimal safety benefits. As was previously noted, the intersection does not meet traffic signal warrants so NHDOT would not endorse it. This, when combined with relatively high cost and unimpressive safety performance, drops this alternative from further consideration.

3.2.9 Realign Both Ermer Road Approaches to Reduce Offset Skew

3.2.9.1 Description

This Build alternative includes the following primary components:

- Reconfigure / reconstruct the Ermer Road approaches to reduce the skew angles.

3.2.9.2 Operations

This alternative is predicted to provide the lowest safety benefits of the Build alternatives. It would not address the concerns with left turning and through vehicles

in the same high speed travel lane on NH Route 111. It would also include relatively costly construction and may result in wetland and/or property impacts. This alternative was not considered further.

3.2.10 No-Build Alternative

3.2.10.1 Description

The No-Build alternative is always considered as an option if the Build alternatives are not found to be feasible or prudent. The following can be said about the No-Build alternative:

- There are no initial construction costs and no direct impacts
- The Purpose and Need is not satisfied
- Safety concerns will continue
- It will continue to be difficult to access NH Route 111 from the side streets during peak traffic conditions

3.2.10.2 Advantages

No initial construction cost.

No resource area impacts.

3.2.10.3 Disadvantages

No safety benefits would be provided.

The Purpose and Need would not be satisfied.

3.3 Summary of Recommendations

The Single Lane Roundabout Build alternative is recommended since it satisfies the Purpose and Need by providing superior predicted safety performance. The roundabout would control vehicular speeds more than the other alternatives, and

single-lane roundabouts are known to result in fewer crashes than multilane roundabouts.

Based on discussions with NHDOT and the Town it was determined that the sensitivity analysis that was performed herein helps justify the selection of the one lane roundabout. If future traffic conditions grow to the point that operations suffer to an unacceptable level, the roundabout could be expanded into a multilane / hybrid roundabout that would process more traffic. But the Town and the NHDOT were not in favor of building the multilane roundabout just to manage the daily peak conditions. A full two-lane roundabout was considered since it would provide excellent operations but was considered too large and costly compared to the single lane roundabout which would be expected to control speeds better and provide slightly better safety performance.

On August 5, 2024, the Salem Town Council considered Town staff, consultant, and public testimony and then voted to endorse the single lane roundabout alternative with pedestrian accommodations. Discussion points in support of roundabout included:

- Superior predicted safety performance
- Expandable to two-lanes in the future if traffic growth creates severe delays
- No property impacts expected
- NHDOT endorsement

The evaluation matrix on the following page is provided for convenience in comparing the various design alternatives. The scoring under some of the criteria was subjective and based on engineering judgment. High scores are best.

Evaluation Matrix

ALTERNATIVE	Lives Saved and Serious Injuries Prevented	Satisfies Purpose & Need	Operations	Resource Impacts	Right-of-Way Impacts	Bike-Ped Accommoations	Full Side Road Access	Cost	Cost	TOTAL	
Roundabout - Two Lane	**3.39**	**High**	**5**	**3**	**4**	**4**	**5**	**High**	**2**	26.4	
Roundabout - One Lane	**3.39**	**High**	**3**	**4**	**5**	**5**	**5**	**Med**	**3**	28.4	
Conversion to Restricted Crossing U-Turn Intersection (RCUT)	**2.46**	**High**	**3**	**2**	**3**	**1**	**5**	**High**	**1**	17.5	
Install left turn lanes on NH-111	**2.26**	**Med**	**3**	**3**	**5**	**1**	**5**	**Med**	**3**	22.3	
Raised median on NH-111 prohibiting lefts and crossing traffic	**2.17**	**High**	**2**	**4**	**5**	**1**	**1**	**Low**	**4**	19.2	
Left turn/Thru prohibition on Ermer Road	**1.23**	**Med**	**3**	**5**	**5**	**1**	**1**	**Low**	**5**	21.2	
Lane reduction on Ermer Rd (from 2 to 1)	**1.07**	**Low**	**2**	**5**	**5**	**2**	**5**	**Low**	**5**	25.1	
Intersection advance warning signs (ICWS)	**1.07**	**Low**	**N/A**	**5**	**5**	**2**	**5**	**Low**	**5**	23.1	
Signalization with left turn lanes on NH-111	**1.01**	**Low**	**4**	**3**	**5**	**5**	**5**	**High**	**3**	26.0	
Realign both Ermer Rd approaches to reduce skew	**0.37**	**Low**	**3**	**4**	**4**	**2**	**5**	**Low**	**4**	22.4	
No Build	**0.00**	**No**	**3**	**5**	**5**	**1**	**4**	**None**	**5**	23.0	

Notes on Rating Values:

Operations: Subjective combined rating of access and delay. The base condition is the no-build =3 with side street delay.
Resource Impacts: No-build = 5 (none), R-Cut = 2 (high)
Right-of-Way Impacts: No-build = 5 (none), R-Cut = 3 (medium)
Bike-Ped Accommodations: Roundabout with sidewalks = 5, No-cross access = 1,
Side Road Access: How well are the Ermer Road approaches served. Full access = 5, No cross access = 1

4

Assessment of Probable Costs

Cost Summary

The following is a summary of probable cost for the recommended improvement alternative, the single lane roundabout, as described in the previous sections. The conceptual opinion of probable cost includes contingencies, and more comprehensive estimates will be developed during the preliminary design phase.

Construction:	$ 2,352,480
PE:	$ 250,000
ROW:	$ 0
CE:	$ 220,000
Project Total:	$ 2,822,000

An itemized conceptual cost estimate is included on the page that follows.

CONSTRUCTION COST ESTIMATE

PROJECT : SALEM #43790 - Ermer Road Safety Improvements

LOCATION : **Salem - NH Route 111 / Ermer Road Intersection**

VHB PROJECT NO. 52946.00 BY: GLB

TYPE: **Study Level Conceptual Estimate** DATE: 10/30/2024

	MAJOR ITEMS DESCRIPTION	UNIT	UNIT PRICE	QUANTITY	TOTAL COST
203.1	COMMON EXCAVATION	CY	$ 30.00	2000	$60,000
203.4	MUCK EXCAVATION	CY	$ 25.00	420	$10,500
203.6	EMBANKMENT IN PLACE	CY	$ 14.00	2400	$33,600
304.1	SAND	CY	$ 30.00	600	$18,000
304.4	CRUSHED STONE (FINE GRADATION) (F)	CY	$ 45.00	800	$36,000
304.5	CRUSHED STONE (COURSE GRADATION) (F)	CY	$ 45.00	500	$22,500
403.11923	HBP 3/4" BINDER MIX, MACHINE METHOD, HIGH STRENGTH	TON	$ 120.00	800	$96,000
403.11942	HBP 1/2"SURFACE MIX, MACHINE METHOD, HIGH STRENGTH, QA/QC TIER 2	TON	$ 120.00	600	$72,000
403.19	HBP - TEMPORARY	TON	$ 200.00	50	$10,000
417	COLD PLANING BITUMINOUS SURFACES	SY	$ 8.00	4500	$36,000
585.3	STONE FILL, CLASS C	CY	$ 100.00	100	$10,000
603.00315	15" R.C. PIPE, 3000D	LF	$ 260.00	500	$130,000
604.0007	POLYETHELENE LINER	EA	$ 250.00	10	$2,500
604.124	CATCH BASINS TYPE B, 4-FOOT DIAMETER	UNIT	$ 5,000.00	10	$50,000
608.13	3" BITUMINOUS SIDEWALK (F)	SY	$ 40.00	1000	$40,000
608.36	6" REINFORCED CONCRETE SIDEWALK (F)	SY	$ 100.00	1200	$120,000
608.38	8" REINFORCED CONCRETE SIDEWALK (F)	SY	$ 160.00	700	$112,000
608.54	DETECTABLE WARNING DEVICES, CAST IRON	SY	$ 450.00	40	$18,000
609.01	STRAIGHT GRANITE CURB	LF	$ 50.00	2930	$146,500
609.02	CURVED GRANITE CURB	LF	$ 75.00	120	$9,000
609.01123	STRAIGHT GRANITE CURB, 12" HIGH WITH 3"X3" MOUNTABLE BEVELED EDGE	LF	$ 100.00	380	$38,000
614.524	FIBER REINFORCED POLYMER HANDHOLE - 28" X 41"	EA	$ 2,000.00	12	$24,000
614.72114	2" PVC CONDUIT, SCHEDULE 40	LF	$ 30.00	1500	$45,000
614.72118	2" PVC CONDUIT, SCHEDULE 80	LF	$ 40.00	200	$8,000
615.0301	TRAFFIC SIGN TYPE C	SF	$ 90.00	450	$40,500
618.61	UNIFORMED OFFICERS W/ VEHICLE	HR	$ 75.00	1500	$112,500
618.7	FLAGGERS	HR	$ 40.00	3000	$120,000
619.1	MAINTENANCE OF TRAFFIC	UNIT	$ 100,000.00	1	$100,000
619.253	PORTABLE CHANGEABLE MESSAGE SIGN (UNIT WEEK)	UWK	$ 300.00	100	$30,000
625.525	STREET LIGHTS INCLUDING POLES, FOUNDATIONS AND LUMINAIRES	EA	$ 4,000.00	12	$48,000
628.2	SAWED BITUMINOUS PAVEMENT	LF	$ 4.00	1000	$4,000
645.53	SILT FENCE	LF	$ 5.00		$0
645.7	STORM WATER POLLUTION PREVENTION PLAN	U	$ 5,000.00	1	$5,000
645.71	MONITORING SWPPP AND EROSION AND SEDIMENT CONTROLS	HR	$ 100.00	150	$15,000
646.51	TURF ESTABLISHMENT WITH MULCH, TACKIFIERS AND LOAM	SY	$ 6.00	3000	$18,000
650.2	LANDSCAPING	U	$ 20,000.00	1	$20,000
692	MOBILIZATION	UNIT	$ 120,000.00	1	$120,000
698.13	FIELD OFFICE TYPE C	MON	$ 2,500.00	10	$25,000
699	MISCELLANEOUS TEMPORARY EROSION AND SEDIMENT CONTROL	$	$ 4,000.00	1	$4,000
	SUBTOTAL				**$1,809,600**
				MISCELLANEOUS ITEMS (10%)	**$180,960**
				CONTINGENCIES (20%)	**$361,920**
				TOTAL ESTIMATED CONSTRUCTION COST	**$2,352,480**
				ENGINEERING (PE)	**$250,000**
				ROW	**$0**
				CONSTRUCTION ENGINEERING, INSPECTION AND TESTING	**$220,000**
				ESTIMATED PROJECT TOTAL:	**$2,822,000**

APPENDICES

APPENDIX A – Conceptual Plan of Recommended Alternative

SINGLE LANE ROUNDABOUT
CONCEPTUAL DESIGN PLAN

NH RTE. 111

ERMER ROAD

18'-0"

20'-0"

80'-0"

ERMER ROAD

NH RTE. 111

40 0 40 80

SCALE IN FEET

N

APPENDICES

APPENDIX B – Relevant Meeting Documentation

Meeting Notes

Date:	October 16, 2023	Notes Taken By:	Greg Bakos
Place:	Salem High School Auditorium	Re:	Salem 43790 – Ermer Road Local Concerns Meeting
Project No.:	52946.00		

ATTENDEES:

Salem Town Council
Nick Sanders – NHDOT Project Manager
Roy Sorenson – Salem Public Works Director
Members of the public in person and online
Greg Bakos – VHB Project Manager

This meeting was held to review the results of VHB's safety analysis and consider options for the best path forward.

Roy Sorenson introduced the project and Greg Bakos presented slides that included a project history, traffic data, crash data, the results of data gathering efforts, and the project funding.

There was a focus on safety and potential solutions. Greg explained that volume-based traffic signal warrants are not met in the current or future design years. It was explained that the safety-based traffic signal warrant is met in terms of the crash history, but hat the MUTCD stipulation 7(A) which states that "Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency" has not been met. When this came to light VHB proposed to NHDOT that safety analysis tools could predict the effectiveness of countermeasures rather than conducting actual physical trial installations. NHDOT authorized VHB to conduct that analysis on 10 countermeasure alternatives, including traffic signals, and as of this meeting the results were in review at NHDOT. Greg did disclose that the traffic signal alternative was not stacking up well in terms of effectiveness in reducing crashes. It was explained that the results and recommendations would be brought forward in an Alternatives Presentation Meeting.

The meeting was opened for Board discussion and public comment on their concerns as follows.

- There was general consensus that people avoid trying to cross NH 111 or take lefts out of Ermer Road during peak hours.
- An individual that works in one of the Ermer Road businesses on the corner gave an impassioned accounting of the 2023 fatality and pleaded for a traffic signal to be installed.
- A business owner noted that there are many near misses that don't get recorded at the intersection.
- Larry Belaire supported the idea of making the Ermer Road approaches one lane to eliminate the condition where side-by-side vehicles obstruct sight lines for each other.
- Michele Federico noted that cars are going faster all the time, and a solution is taking too long.
- Beth Gagnon noted that the side street delays are long and people take risks to enter NH111 as a result.
- John Torres said people avoid taking the lefts off of NH111 because they may get rear-ended.
- Councilor Bettencourt noted that there are a lot of close calls not reflected in the statistics and that he is strongly in favor of a traffic signal, and frustrated by the hoops that must be cleared to get there.

- Council suggested that near-term low-cost improvements should be considered if they will make a difference while long-term solutions are worked on. Council also sent a strong message to "not come back without a traffic signal".

Nick Sanders, the NHDOT project manager, introduced himself at the end of the discussions and indicated that the Department takes the public concerns seriously and that the team will return with its findings at a subsequent meeting.

Meeting Notes

Date:	December 4, 2023	Notes Taken By:	Greg Bakos
Place:	Salem High School	Re:	Salem 43790 – Ermer Road Alternatives Update Meeting
Project No.:	52946.00		

ATTENDEES:

Salem Town Council
Nick Sanders – NHDOT Project Manager
Bill Lambert, NHDOT Safety Engineer
Roy Sorenson – Salem Public Works Director
Members of the public in person and online
Greg Bakos – VHB Project Manager

This meeting was held to present the updated safety analysis and alternatives recommendations to Town Council and the public. Roy Sorenson introduced the project and Greg Bakos presented slides that included a project history, traffic data, crash data, the results of data gathering efforts, and the project funding.

Greg explained that ten alternatives were evaluated from a safety effectiveness perspective. The alternatives were listed from highest to lowest estimated annual lives saved and serious injuries prevented. The roundabout alternative ranked highest and the traffic signal alternative ranked next to lowest. Greg presented conceptual design figures of the top four alternatives and explained that alternatives below the top four are not considered viable and would not be presented in detail.

Greg then explained that the R-Cut alternative would be most costly and impactful and does not perform as well as the roundabout, so it also drops out. The alternative that would simply install left turn lanes on NH Route 111 also dropped out because it does not address the severe crashes and is relatively costly. This left the roundabout and the raised median as the last two alternatives for consideration. The median alternative would provide an appreciable crash reduction but would not be acceptable to the community because it would create a discontinuity in Ermer Road and would prohibit left turns in or out of the Ermer Road approaches.

The recommendation to the Town Council was to construct a two-lane hybrid roundabout.

The meeting was opened for Board discussion and public comment on their concerns as follows.

- There were Council members and members of the public that were not convinced that a roundabout is the right solution for this intersection. There were some misconceptions about how it would function.
- There was a concern that trucks would have difficulty navigating the roundabout.
- There were questions about the data and the results.

Town Council did not endorse an alternative, but requested that the design team provide more information while Council thinks about what was presented.

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SALEM MUNICIPAL SERVICES
Roy E. Sorenson - *Director*
www.townofsalemnh.org

ENGINEERING DIVISION
33 GEREMONTY DRIVE
SALEM, NH 03079
TEL: 603-890-2033 FAX: 603-898-1223

Date: June 27, 2024
To: Town Council
From: John P. Klipfel, Engineering Director
Through: Joseph Devine, Interim Town Manager
Cc: Roy E. Sorenson, Municipal Services Director

RE: Ermer Road / NH Route 111 Intersection – Alternatives Meting

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Town Council:

The purpose of this agenda item is for Town Council to consider endorsing the conceptual Ermer Road / NH 111 intersection solution alternative that is recommended by VHB and Town staff and supported by NHDOT. Town Council is being asked to vote on a preferred alternative at this meeting. The Town's consultant, VHB, will be presenting information on the recommended alternative.

It was previously determined that a roundabout solution would be most effective at reducing fatalities and serious injuries and would slow traffic and provide improved access from the side streets. Single and multi-lane roundabouts were evaluated, and the single lane option is recommended due to its better predicted safety, lower impacts and cost, and despite the multi-lane version providing better operations.

Note that the cost of the roundabout would exceed the current project funding, but NHDOT has indicated that there would be additional funds available to address the serious safety concerns at this intersection.

Town endorsement of an alternative at this stage will allow the completion of the engineering study phase so preliminary engineering can proceed.

Background:

As you are aware there are significant concerns for public safety at the intersection of NH Route 111 and Ermer Road and these have only increased with the passing decades.

NHDOT is in support of funding roadway improvements at this intersection. The project is to be funded through the Highway Safety Improvement Program (HSIP) which provides reimbursement for 90% of the total project costs, with a 10% match customarily provided by the community. The project will be managed through the Local Public Agency (LPA) Program and will provide the Town a higher level of control over development and schedule.

Meeting Notes

Date:	July 1, 2024	Notes Taken By:	Greg Bakos
Place:	Salem High School	Re:	Salem 43790 – Ermer Road Alternatives Update Meeting
Project No.:	52946.00		

ATTENDEES:

Salem Town Council
John Klipfel, Town Engineer
Roy Sorenson – Salem Public Works Director
Members of the public in person and online
Greg Bakos – VHB Project Manager

This meeting was held to present additional information on the recommended alternative to Town Council and the public. John introduced the project and Greg Bakos presented slides that included a brief project history, traffic data, crash data, and details of the recommended solution alternative.

One focus of the presentation was comparing single vs. multi-lane roundabout alternatives. It was shown that the single lane alternative would have long peak hour queues in one direction during the 2042 design year, but that it would perform adequately in the 2026 build year.

Greg presented an updated single lane roundabout concept that includes bike and pedestrian accommodations and long splitter islands on NH Route 111 to help slow approaching vehicles. He also showed an aerial image of the 144-foot diameter two-lane roundabout in Tuscan Village that some people are familiar with and explained that the single lane Ermer Road roundabout that is proposed would be 156-feet in diameter and could be expanded to an even wider two-lane roundabout in the future if necessary.

Greg then presented a 3D traffic simulation on the proposed roundabout concept plan to show how traffic is predicted to operate.

There was additional discussion, and public input was again accepted.

There was a concern that the sidewalks that were shown would be a burden on town forces to maintain in the winter because they are remote from other sidewalks.

Town Council was not able to move to accept the recommended alternative at this meeting but would hear it at a subsequent meeting.

2 Bedford Farms Drive, Suite 200, Bedford, New Hampshire 03110
P 603.391.3900 **F** 603.518.7495 www.vhb.com

Meeting Notes

Date:	August 5, 2024	Notes Taken By:	Greg Bakos
Place:	Salem High School	Re:	Salem 43790 – Ermer Road Town Council Meeting
Project No.:	52946.00		

ATTENDEES:

Salem Town Council
Charles Willeke, NHDOT
Roy Sorenson – Salem Public Works Director
Members of the public in person and online
Greg Bakos – VHB Project Manager

Roy Sorenson presented the second read of a resolution to accept the recommended alternative including sidewalks and crosswalks.

There was discussion about whether the sidewalks and crosswalks would be included in the project. Greg stated that RRFB's would probably be recommended across NH Route 111. Roy recommended that if the crosswalks are included in the project that the Town consider extending sidewalks on Ermer Road because there are none today.

The owner of the plaza at 15 Ermer Road testified that he believes the sidewalks and crosswalks would never get used. He also restated that he feels a traffic signal is the best solution. He also related his experience at two rotaries in Massachusetts and feels vehicles entering the roundabout on NH Route 111 would have the right of way.

There was brief discussion among Council members. The resolution was approved.

APPENDICES

APPENDIX C – Traffic Signal Warrant Analysis

2009 MUTCD

TRAFFIC SIGNAL WARRANT ANALYSIS (VOLUME BASED)

Intersection: NH 111 at Ermer Rd

Major Street Direction: Eastbound-Westbound

Year: 2044 **Condition:** Design Year

Operating speed on major roadway: 50 mph

Population of Community: 28,776 people

Number of approaches: 4

Warrant 1 EIGHT-HOUR VEHICULAR VOLUME		Minimum*	Adjusted Minimum**
Warrant 1A MINIMUM VEHICULAR VOLUME (8 hours of day)			
Major Street :	2 Lane(s) on each approach	600	420
Minor Street :	2 Lane(s) on each approach	200	140
Warrant 1B INTERRUPTION OF CONTINUOUS TRAFFIC (8 hours of day)			
Major Street :	2 Lane(s) on each approach	900	630
Minor Street :	2 Lane(s) on each approach	100	70
80 PERCENT SATISFACTION OF WARRANT 1A **AND** WARRANT 1B		Warrant 1A	Warrant 1B
Major Street :	2 Lane(s) on each approach	336	504
Minor Street :	2 Lane(s) on each approach	112	56

Required approach volumes

Warrant 2 FOUR HOUR VEHICULAR VOLUME

Major Street : 2 Lane(s) on each approach — If "verify" indicated, see Figure 4C-1 or 4C-2.

Minor Street : 2 Lane(s) on each approach — 25 = accuracy of regression equations

Warrant 3 PEAK HOUR VOLUME

Major Street : 2 Lane(s) on each approach — If "verify" indicated, see Figure 4C-3 or 4C-4.

Minor Street : 2 Lane(s) on each approach — 25 = accuracy of regression equations

Hour	Entering Vol. Minor Road+	Entering Vol. on Major Road Eastbound	Entering Vol. on Major Road Westbound	Tot. Ent. Vol. On Major Rd	Meets the following volume-based warrants? 1A	1B	80%(1A&1B)	2	3
6:00 - 7:00 AM				0	No	No	No	No	No
7:00 - 8:00 AM	75	573	1,302	1,875	No	Yes	No	No	No
8:00 - 9:00 AM	52	694	1,144	1,838	No	No	No	No	No
9:00 - 10:00 AM	45	606	751	1,356	No	No	No	No	No
10:00 - 11:00 AM	50	643	695	1,338	No	No	No	No	No
11:00 - 12:00 AM	68	654	678	1,333	No	No	No	No	No
12:00 - 1:00 PM	67	720	693	1,413	No	No	No	No	No
1:00 - 2:00 PM	64	770	725	1,495	No	No	No	No	No
2:00 - 3:00 PM	61	1,064	801	1,865	No	No	No	No	No
3:00 - 4:00 PM	63	1,347	818	2,165	No	No	No	No	No
4:00 - 5:00 PM	78	1,392	856	2,248	No	Yes	No	No	No
5:00 - 6:00 PM	71	1,387	863	2,249	No	Yes	No	No	No
6:00 - 7:00 PM	66	1,029	580	1,609	No	No	No	No	No
					No	**No**	**No**	**No**	**No**
				Warrants Met?		**1**		**2**	**3**
						NO		**No**	**No**

*From the criteria described for the warrant in the MUTCD.

**If the operating speed is higher than 40mph or the population is less than 10,000 then the volumes can be adjusted to 70%. (If no adjusted minimum, the minimum from the previous column is showr

+If more than one approach, report the approach that has the higher volume.

NON-VOLUME-BASED WARRANTS

Warrant 4, Minimum Pedestrian Volume: No

Peak Four Hour Pedestrian Volumes: (non-concurrent)

Total Peds per hour at Main/Water Intersection

Warrant 5, School Crossing: No

See MUTCD for details.

Warrant 6, Coordinated Signal System: No

See MUTCD for details.

Warrant 7, Crash Experience: No

# of accidents "correctable by signalization" occuring in the last 12 months: 0

Warrant 8, Roadway Network: No

See MUTCD for details.

Warrant 9, Near a Grade Crossing: No

See MUTCD for details.

Source: *Manual on Uniform Traffic Control Devices* (MUTCD); 2009 Edition [2009]

last updated: 08/05/05 [version]

APPENDICES

APPENDIX C – Traffic Counts Data

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022

Groups Printed- Cars - Trucks

	Elmer Rd From North			Route 111 From East			Elmer Rd From South			Route 111 From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	1	3	7	4	215	1	9	2	5	1	90	1	339
07:15 AM	1	4	9	4	235	0	4	0	5	2	95	2	361
07:30 AM	1	2	7	2	233	1	1	0	2	3	99	3	354
07:45 AM	1	0	15	6	229	0	2	0	1	2	105	3	364
Total	4	9	38	16	912	2	16	2	13	8	389	9	1418
08:00 AM	0	2	8	5	196	0	3	0	4	2	110	3	333
08:15 AM	0	0	11	6	231	0	2	4	0	4	128	6	392
08:30 AM	0	1	3	1	199	0	5	1	3	4	97	7	321
08:45 AM	1	3	4	9	170	1	1	1	3	4	122	8	327
Total	1	6	26	21	796	1	11	6	10	14	457	24	1373
09:00 AM	1	0	6	2	132	0	2	2	1	3	97	3	249
09:15 AM	1	2	3	2	128	0	4	0	4	5	107	13	269
09:30 AM	0	3	6	5	130	0	4	0	3	3	101	4	259
09:45 AM	0	1	3	6	132	0	4	3	5	4	90	3	251
Total	2	6	18	15	522	0	14	5	13	15	395	23	1028
10:00 AM	0	0	4	1	116	2	3	4	9	2	102	6	249
10:15 AM	2	0	1	2	129	1	3	2	3	2	104	6	255
10:30 AM	0	1	7	3	129	1	2	0	2	4	122	6	277
10:45 AM	2	1	5	8	104	1	3	1	4	3	98	5	235
Total	4	2	17	14	478	5	11	7	18	11	426	23	1016
11:00 AM	2	0	3	4	124	1	9	1	5	5	101	4	259
11:15 AM	1	1	3	6	111	1	4	3	3	4	102	5	244
11:30 AM	3	3	4	4	123	0	2	1	8	3	103	6	260
11:45 AM	1	6	5	5	105	1	3	3	7	4	125	6	271
Total	7	10	15	19	463	3	18	8	23	16	431	21	1034
12:00 PM	1	4	8	4	101	1	7	3	8	2	113	7	259
12:15 PM	2	2	9	6	113	2	8	1	5	7	128	5	288
12:30 PM	1	3	3	4	122	1	4	1	2	6	116	3	266
12:45 PM	0	2	2	6	135	0	3	3	3	5	115	7	281
Total	4	11	22	20	471	4	22	8	18	20	472	22	1094
01:00 PM	4	3	3	3	127	1	7	1	7	4	122	10	292
01:15 PM	2	3	2	2	134	1	2	2	4	8	115	7	282
01:30 PM	1	3	1	2	115	3	4	2	2	5	104	6	248
01:45 PM	2	0	5	1	128	1	5	1	9	3	155	11	321
Total	9	9	11	8	504	6	18	6	22	20	496	34	1143
02:00 PM	0	4	7	3	133	1	4	0	7	5	153	7	324
02:15 PM	1	4	4	4	113	1	3	1	3	4	160	5	303
02:30 PM	1	4	6	1	150	2	5	3	3	14	214	5	408
02:45 PM	3	0	3	5	159	1	4	3	8	5	186	4	381
Total	5	12	20	13	555	5	16	7	21	28	713	21	1416
03:00 PM	0	0	9	5	134	1	4	2	8	17	225	5	410
03:15 PM	0	2	8	4	139	0	4	3	4	7	212	6	389
03:30 PM	0	0	4	2	130	3	4	2	5	10	219	7	386
03:45 PM	0	1	6	8	158	1	3	0	6	11	240	6	440
Total	0	3	27	19	561	5	15	7	23	45	896	24	1625
04:00 PM	1	1	6	6	142	1	4	1	9	11	223	8	413
04:15 PM	3	1	10	2	158	2	5	0	6	14	212	11	424
04:30 PM	0	0	5	5	160	1	2	2	10	11	232	3	431
04:45 PM	1	3	6	2	133	0	6	3	8	6	250	15	433
Total	5	5	27	15	593	4	17	6	33	42	917	37	1701
05:00 PM	0	0	7	6	180	2	4	3	12	9	237	5	465

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022

Groups Printed- Cars - Trucks

	Elmer Rd From North			Route 111 From East			Elmer Rd From South			Route 111 From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
05:15 PM	0	4	5	5	142	2	5	2	4	6	239	10	424
05:30 PM	0	4	5	6	135	1	2	1	6	12	223	9	404
05:45 PM	1	3	8	5	133	1	3	3	6	10	227	7	407
Total	1	11	25	22	590	6	14	9	28	37	926	31	1700
06:00 PM	0	3	5	2	101	2	6	3	8	8	210	5	353
06:15 PM	0	2	4	3	114	0	1	6	5	6	171	3	315
06:30 PM	1	0	4	5	99	1	3	2	5	8	169	0	297
06:45 PM	0	1	5	3	86	0	1	3	4	8	145	5	261
Total	1	6	18	13	400	3	11	14	22	30	695	13	1226
Grand Total	43	90	264	195	6845	44	183	85	244	286	7213	282	15774
Apprch %	10.8	22.7	66.5	2.8	96.6	0.6	35.7	16.6	47.7	3.7	92.7	3.6	
Total %	0.3	0.6	1.7	1.2	43.4	0.3	1.2	0.5	1.5	1.8	45.7	1.8	
Cars	42	88	262	191	6586	40	181	82	239	280	6923	274	15188
% Cars	97.7	97.8	99.2	97.9	96.2	90.9	98.9	96.5	98	97.9	96	97.2	96.3
Trucks	1	2	2	4	259	4	2	3	5	6	290	8	586
% Trucks	2.3	2.2	0.8	2.1	3.8	9.1	1.1	3.5	2	2.1	4	2.8	3.7

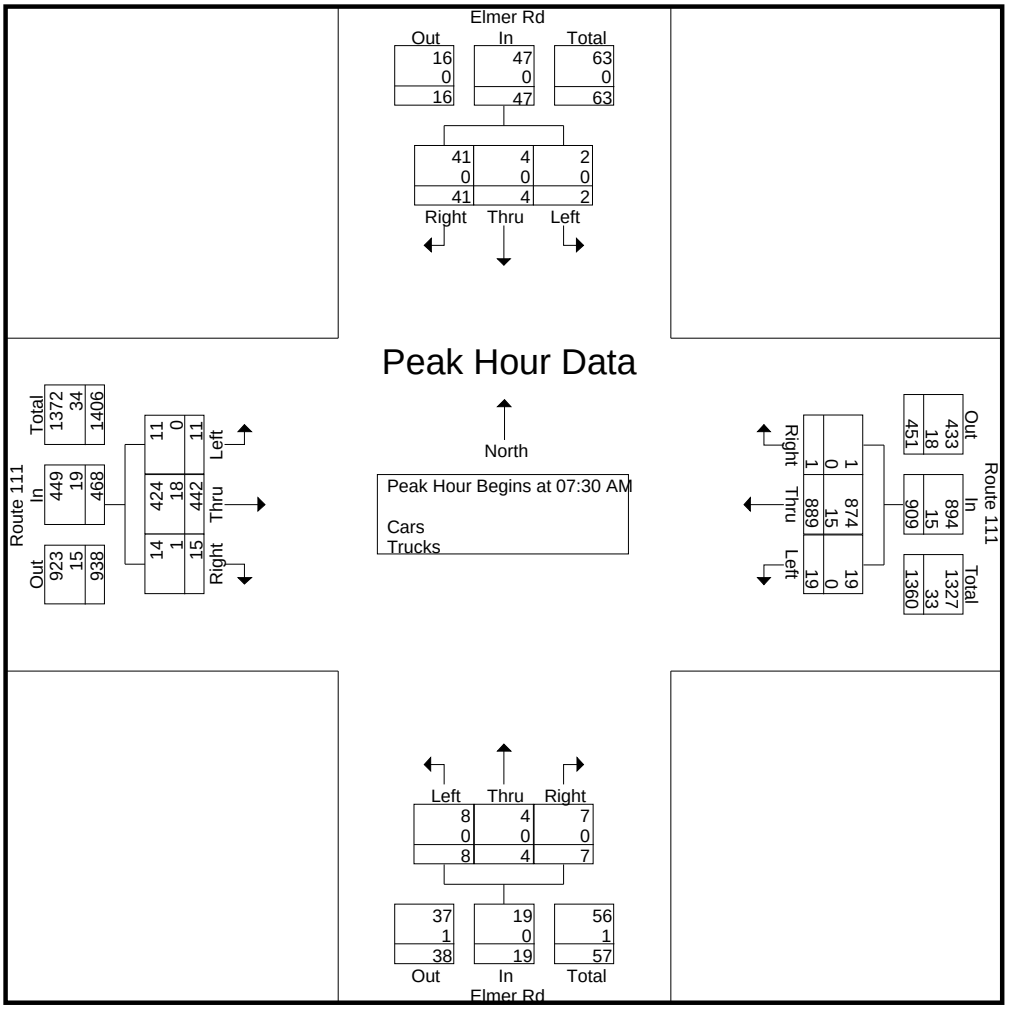
	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	**1**	**2**	7	10	2	**233**	**1**	236	1	0	2	3	3	99	3	105	354
07:45 AM	1	0	**15**	**16**	**6**	229	0	235	2	0	1	3	2	105	3	110	364
08:00 AM	0	2	8	10	5	196	0	201	**3**	0	**4**	**7**	2	110	3	115	333
08:15 AM	0	0	11	11	6	231	0	**237**	2	**4**	0	6	**4**	**128**	**6**	**138**	**392**
Total Volume	2	4	41	47	19	889	1	909	8	4	7	19	11	442	15	468	1443
% App. Total	4.3	8.5	87.2		2.1	97.8	0.1		42.1	21.1	36.8		2.4	94.4	3.2		
PHF	.500	.500	.683	.734	.792	.954	.250	.959	.667	.250	.438	.679	.688	.863	.625	.848	.920
Cars	2	4	41	47	19	874	1	894	8	4	7	19	11	424	14	449	1409
% Cars	100	100	100	100	100	98.3	100	98.3	100	100	100	100	100	95.9	93.3	95.9	97.6
Trucks	0	0	0	0	0	15	0	15	0	0	0	0	0	18	1	19	34
% Trucks	0	0	0	0	0	1.7	0	1.7	0	0	0	0	0	4.1	6.7	4.1	2.4

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 3



Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

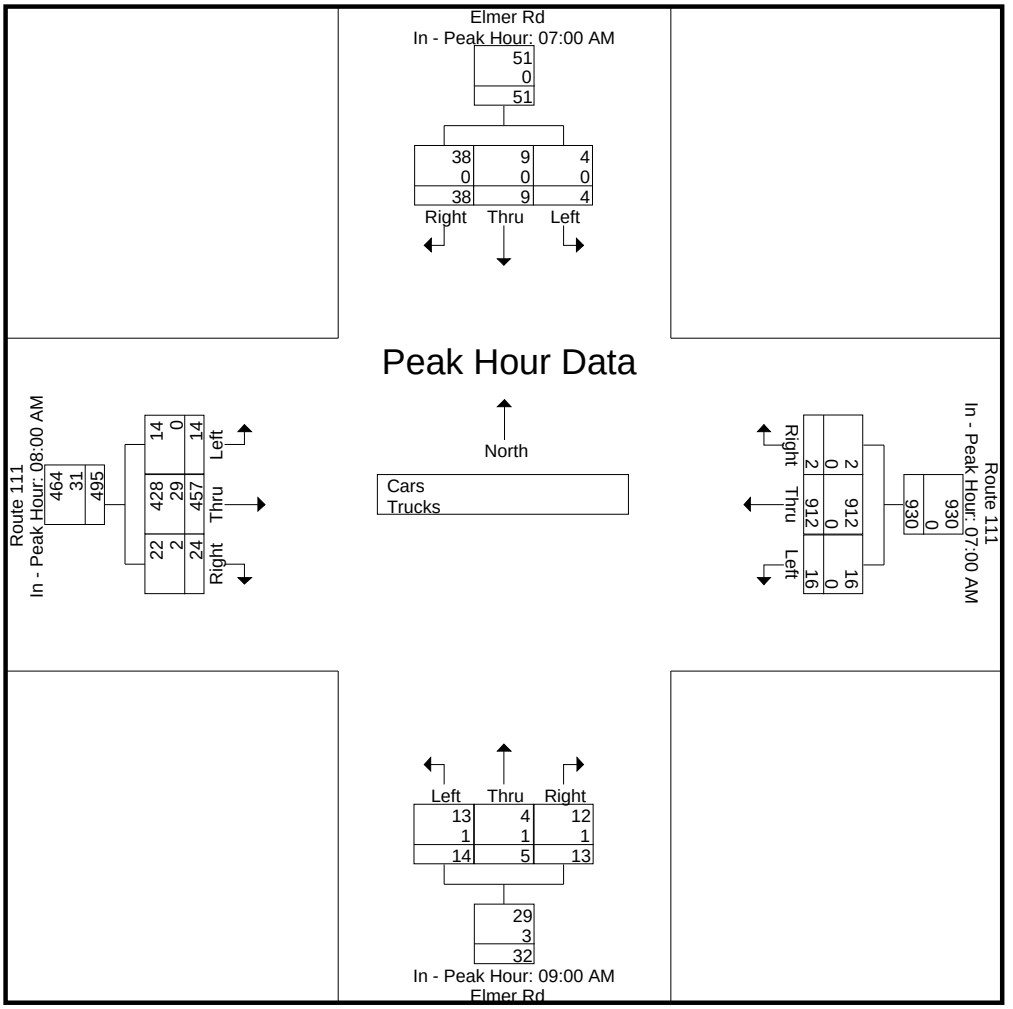
	07:00 AM				07:00 AM				09:00 AM				08:00 AM			
+0 mins.	**1**	3	7	11	4	215	**1**	220	2	2	1	5	2	110	3	115
+15 mins.	1	**4**	9	14	4	**235**	0	**239**	**4**	0	4	8	**4**	**128**	6	**138**
+30 mins.	1	2	7	10	2	233	1	236	4	0	3	7	4	97	7	108
+45 mins.	1	0	**15**	**16**	**6**	229	0	235	4	**3**	**5**	**12**	4	122	**8**	134
Total Volume	4	9	38	51	16	912	2	930	14	5	13	32	14	457	24	495
% App. Total	7.8	17.6	74.5		1.7	98.1	0.2		43.8	15.6	40.6		2.8	92.3	4.8	
PHF	1.000	.563	.633	.797	.667	.970	.500	.973	.875	.417	.650	.667	.875	.893	.750	.897
Cars	4	9	38	51	16	912	2	930	13	4	12	29	14	428	22	464
% Cars	100	100	100	100	100	100	100	100	92.9	80	92.3	90.6	100	93.7	91.7	93.7
Trucks	0	0	0	0	0	0	0	0	1	1	1	3	0	29	2	31
% Trucks	0	0	0	0	0	0	0	0	7.1	20	7.7	9.4	0	6.3	8.3	6.3

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 4



Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 01:00 PM

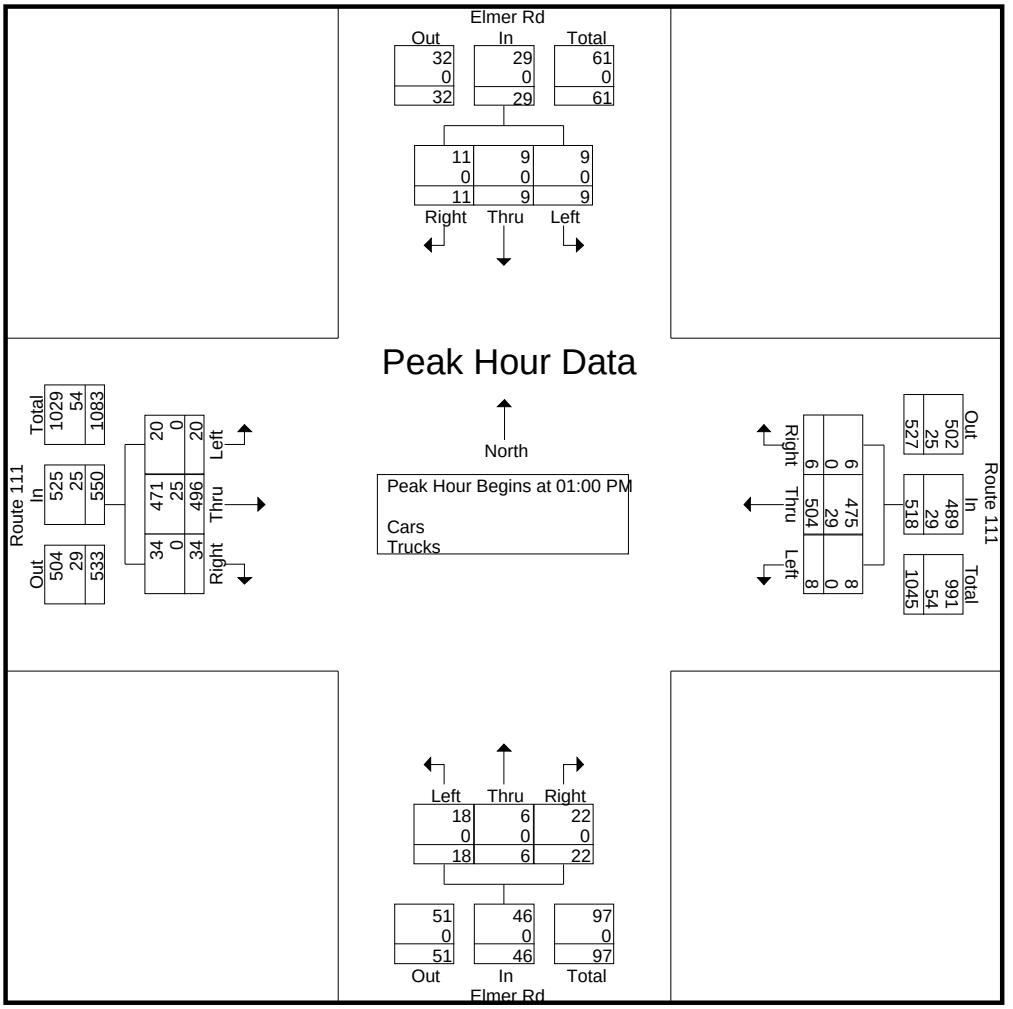
01:00 PM	**4**	**3**	3	**10**	**3**	127	1	131	**7**	1	7	**15**	4	122	10	136	292
01:15 PM	2	3	2	7	2	**134**	1	**137**	2	**2**	4	8	**8**	115	7	130	282
01:30 PM	1	3	1	5	2	115	**3**	120	4	2	2	8	5	104	6	115	248
01:45 PM	2	0	**5**	7	1	128	1	130	5	1	**9**	15	3	**155**	**11**	**169**	**321**
Total Volume	9	9	11	29	8	504	6	518	18	6	22	46	20	496	34	550	1143
% App. Total	31	31	37.9		1.5	97.3	1.2		39.1	13	47.8		3.6	90.2	6.2		
PHF	.563	.750	.550	.725	.667	.940	.500	.945	.643	.750	.611	.767	.625	.800	.773	.814	.890
Cars	9	9	11	29	8	475	6	489	18	6	22	46	20	471	34	525	1089
% Cars	100	100	100	100	100	94.2	100	94.4	100	100	100	100	100	95.0	100	95.5	95.3
Trucks	0	0	0	0	0	29	0	29	0	0	0	0	0	25	0	25	54
% Trucks	0	0	0	0	0	5.8	0	5.6	0	0	0	0	0	5.0	0	4.5	4.7

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 5



Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

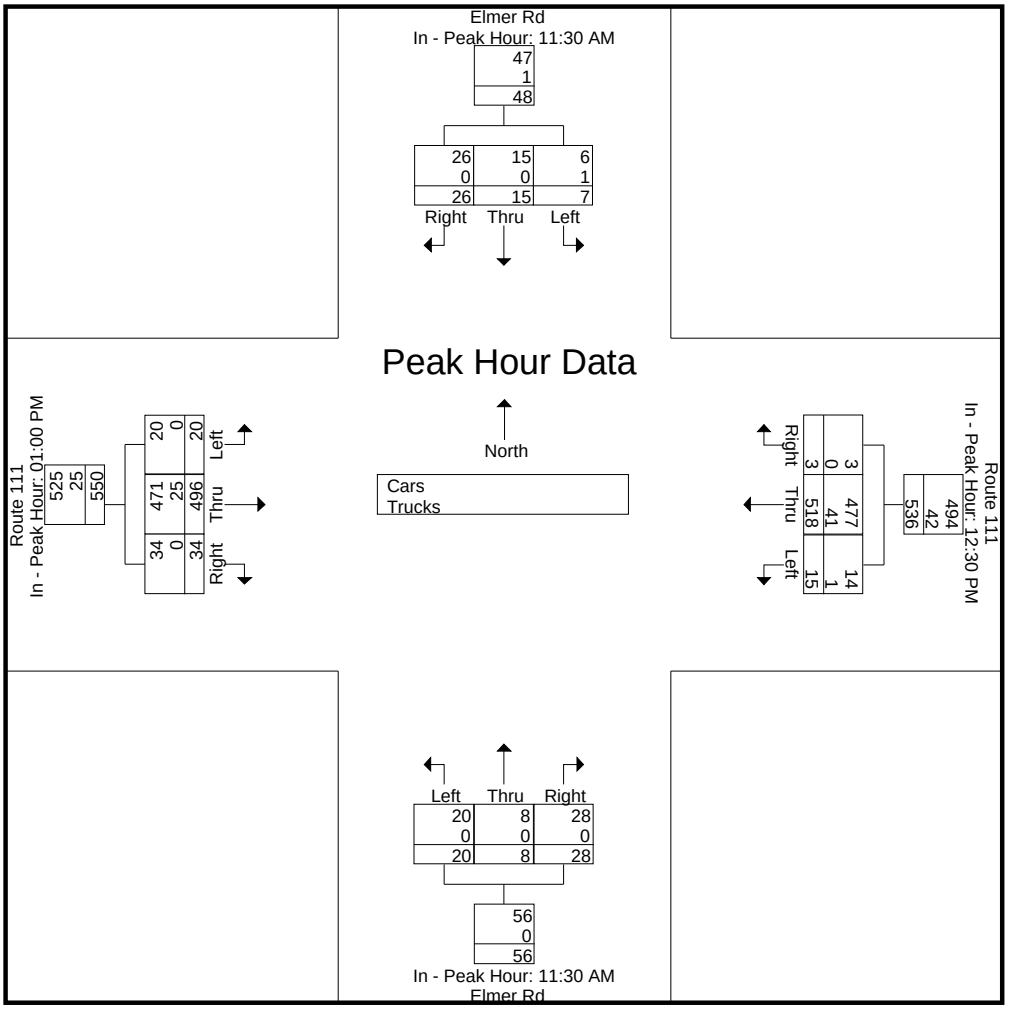
	11:30 AM				12:30 PM				11:30 AM				01:00 PM			
+0 mins.	**3**	3	4	10	4	122	**1**	127	2	1	**8**	11	4	122	10	136
+15 mins.	1	**6**	5	12	**6**	**135**	0	**141**	3	**3**	7	13	**8**	115	7	130
+30 mins.	1	4	8	**13**	3	127	1	131	7	3	8	**18**	5	104	6	115
+45 mins.	2	2	**9**	13	2	134	1	137	**8**	1	5	14	3	**155**	**11**	**169**
Total Volume	7	15	26	48	15	518	3	536	20	8	28	56	20	496	34	550
% App. Total	14.6	31.2	54.2		2.8	96.6	0.6		35.7	14.3	50		3.6	90.2	6.2	
PHF	.583	.625	.722	.923	.625	.959	.750	.950	.625	.667	.875	.778	.625	.800	.773	.814
Cars	6	15	26	47	14	477	3	494	20	8	28	56	20	471	34	525
% Cars	85.7	100	100	97.9	93.3	92.1	100	92.2	100	100	100	100	100	95	100	95.5
Trucks	1	0	0	1	1	41	0	42	0	0	0	0	0	25	0	25
% Trucks	14.3	0	0	2.1	6.7	7.9	0	7.8	0	0	0	0	0	5	0	4.5

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 6



Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 04:15 PM

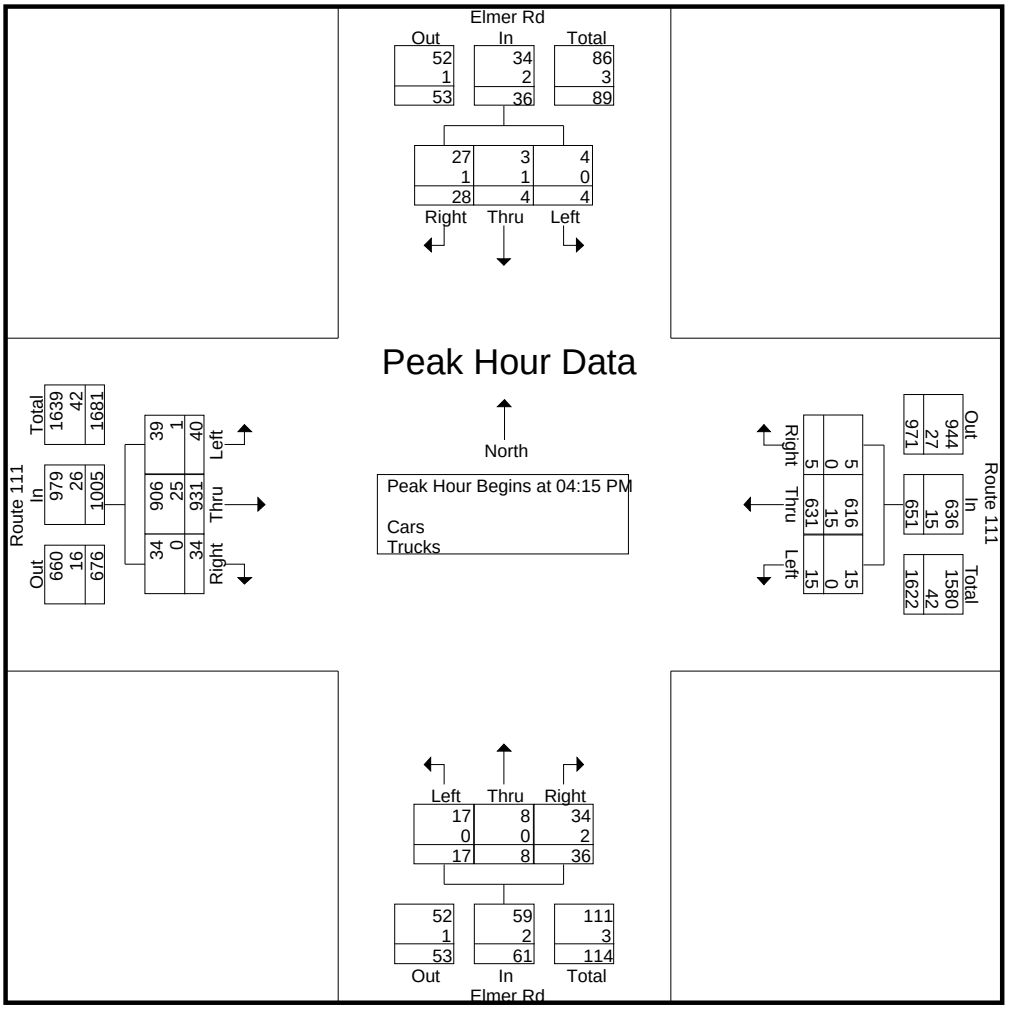
04:15 PM	**3**	1	**10**	**14**	2	158	**2**	162	5	0	6	11	**14**	212	11	237	424
04:30 PM	0	0	5	5	5	160	1	166	2	2	10	14	11	232	3	246	431
04:45 PM	1	**3**	6	10	2	133	0	135	**6**	**3**	8	17	6	**250**	**15**	**271**	433
05:00 PM	0	0	7	7	**6**	**180**	2	**188**	4	3	**12**	**19**	9	237	5	251	**465**
Total Volume	4	4	28	36	15	631	5	651	17	8	36	61	40	931	34	1005	1753
% App. Total	11.1	11.1	77.8		2.3	96.9	0.8		27.9	13.1	59		4	92.6	3.4		
PHF	.333	.333	.700	.643	.625	.876	.625	.866	.708	.667	.750	.803	.714	.931	.567	.927	.942
Cars	4	3	27	34	15	616	5	636	17	8	34	59	39	906	34	979	1708
% Cars	100	75.0	96.4	94.4	100	97.6	100	97.7	100	100	94.4	96.7	97.5	97.3	100	97.4	97.4
Trucks	0	1	1	2	0	15	0	15	0	0	2	2	1	25	0	26	45
% Trucks	0	25.0	3.6	5.6	0	2.4	0	2.3	0	0	5.6	3.3	2.5	2.7	0	2.6	2.6

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 7



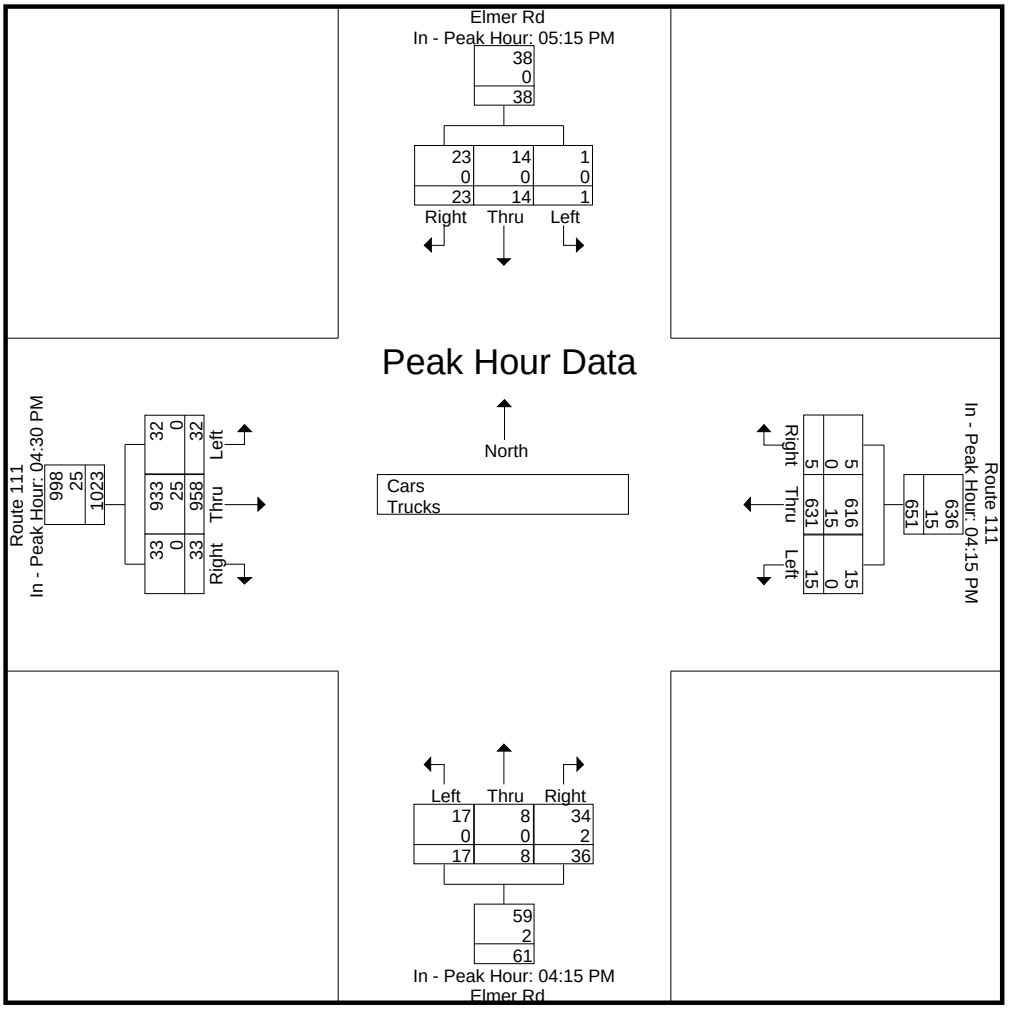
Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:15 PM				04:15 PM				04:15 PM				04:30 PM			
+0 mins.	0	**4**	5	9	2	158	**2**	162	5	0	6	11	**11**	232	3	246
+15 mins.	0	4	5	9	5	160	1	166	2	2	10	14	6	**250**	**15**	**271**
+30 mins.	**1**	3	**8**	**12**	2	133	0	135	**6**	**3**	8	17	9	237	5	251
+45 mins.	0	3	5	8	**6**	**180**	2	**188**	4	3	**12**	**19**	6	239	10	255
Total Volume	1	14	23	38	15	631	5	651	17	8	36	61	32	958	33	1023
% App. Total	2.6	36.8	60.5		2.3	96.9	0.8		27.9	13.1	59		3.1	93.6	3.2	
PHF	.250	.875	.719	.792	.625	.876	.625	.866	.708	.667	.750	.803	.727	.958	.550	.944
Cars	1	14	23	38	15	616	5	636	17	8	34	59	32	933	33	998
% Cars	100	100	100	100	100	97.6	100	97.7	100	100	94.4	96.7	100	97.4	100	97.6
Trucks	0	0	0	0	0	15	0	15	0	0	2	2	0	25	0	25
% Trucks	0	0	0	0	0	2.4	0	2.3	0	0	5.6	3.3	0	2.6	0	2.4

Accurate Counts
978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 8



Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022

Groups Printed- Cars

	Elmer Rd From North			Route 111 From East			Elmer Rd From South			Route 111 From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	1	3	7	4	215	1	9	2	5	1	90	1	339
07:15 AM	1	4	9	4	235	0	4	0	5	2	95	2	361
07:30 AM	1	2	7	2	233	1	1	0	2	3	99	3	354
07:45 AM	1	0	15	6	229	0	2	0	1	2	105	3	364
Total	4	9	38	16	912	2	16	2	13	8	389	9	1418
08:00 AM	0	2	8	5	189	0	3	0	4	2	105	2	320
08:15 AM	0	0	11	6	223	0	2	4	0	4	115	6	371
08:30 AM	0	1	3	1	197	0	5	1	3	4	90	7	312
08:45 AM	1	3	4	9	161	1	1	1	3	4	118	7	313
Total	1	6	26	21	770	1	11	6	10	14	428	22	1316
09:00 AM	1	0	6	2	125	0	2	1	0	3	86	3	229
09:15 AM	1	2	3	2	120	0	3	0	4	5	104	11	255
09:30 AM	0	3	6	5	122	0	4	0	3	3	96	4	246
09:45 AM	0	1	3	6	124	0	4	3	5	4	82	3	235
Total	2	6	18	15	491	0	13	4	12	15	368	21	965
10:00 AM	0	0	4	1	108	1	3	4	9	2	93	6	231
10:15 AM	2	0	1	2	121	1	3	2	3	2	94	6	237
10:30 AM	0	1	7	3	123	1	2	0	2	4	109	6	258
10:45 AM	2	1	5	7	98	1	3	1	4	3	91	5	221
Total	4	2	17	13	450	4	11	7	18	11	387	23	947
11:00 AM	2	0	3	4	117	1	9	1	5	5	93	4	244
11:15 AM	1	1	3	6	106	1	3	3	3	4	91	5	227
11:30 AM	3	3	4	4	115	0	2	1	8	3	94	6	243
11:45 AM	1	6	5	5	100	1	3	3	7	4	115	6	256
Total	7	10	15	19	438	3	17	8	23	16	393	21	970
12:00 PM	1	4	8	4	96	0	7	3	8	2	106	7	246
12:15 PM	1	2	9	6	105	2	8	1	5	7	121	5	272
12:30 PM	1	2	3	4	112	1	4	1	2	6	102	3	241
12:45 PM	0	2	2	5	125	0	3	3	2	5	112	7	266
Total	3	10	22	19	438	3	22	8	17	20	441	22	1025
01:00 PM	4	3	3	3	116	1	7	1	7	4	118	10	277
01:15 PM	2	3	2	2	124	1	2	2	4	8	109	7	266
01:30 PM	1	3	1	2	112	3	4	2	2	5	93	6	234
01:45 PM	2	0	5	1	123	1	5	1	9	3	151	11	312
Total	9	9	11	8	475	6	18	6	22	20	471	34	1089
02:00 PM	0	4	7	3	126	1	4	0	7	5	145	7	309
02:15 PM	1	4	4	4	101	1	3	1	3	4	156	5	287
02:30 PM	1	4	6	1	144	1	5	3	3	14	209	5	396
02:45 PM	3	0	3	5	156	1	4	3	8	5	177	4	369
Total	5	12	20	13	527	4	16	7	21	28	687	21	1361
03:00 PM	0	0	9	5	131	1	4	2	8	16	221	5	402
03:15 PM	0	2	8	3	135	0	4	2	3	6	203	6	372
03:30 PM	0	0	4	2	125	3	4	1	5	10	212	5	371
03:45 PM	0	1	6	8	156	1	3	0	6	9	237	6	433
Total	0	3	27	18	547	5	15	5	22	41	873	22	1578
04:00 PM	1	1	6	6	138	1	4	1	9	10	217	8	402
04:15 PM	3	1	10	2	155	2	5	0	4	13	207	11	413
04:30 PM	0	0	4	5	156	1	2	2	10	11	227	3	421
04:45 PM	1	2	6	2	128	0	6	3	8	6	247	15	424
Total	5	4	26	15	577	4	17	6	31	40	898	37	1660
05:00 PM	0	0	7	6	177	2	4	3	12	9	225	5	450
05:15 PM	0	4	5	5	139	2	5	2	4	6	234	10	416
05:30 PM	0	4	5	5	132	1	2	1	6	12	222	7	397

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 10

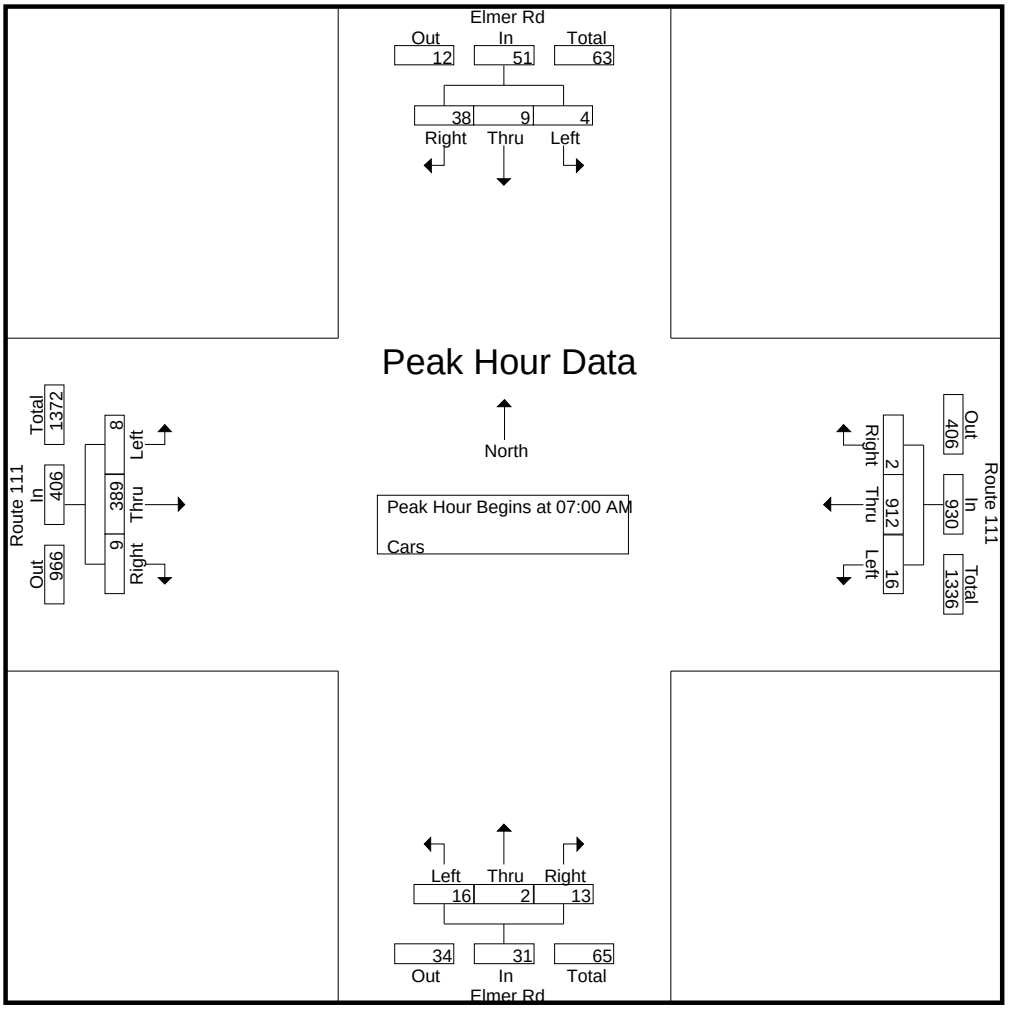
Groups Printed- Cars

	Elmer Rd From North			Route 111 From East			Elmer Rd From South			Route 111 From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
05:45 PM	1	3	8	5	129	1	3	3	6	10	224	7	400
Total	1	11	25	21	577	6	14	9	28	37	905	29	1663
06:00 PM	0	3	5	2	99	1	6	3	8	8	207	5	347
06:15 PM	0	2	3	3	108	0	1	6	5	6	168	3	305
06:30 PM	1	0	4	5	93	1	3	2	5	8	167	0	289
06:45 PM	0	1	5	3	84	0	1	3	4	8	141	5	255
Total	1	6	17	13	384	2	11	14	22	30	683	13	1196
Grand Total	42	88	262	191	6586	40	181	82	239	280	6923	274	15188
Apprch %	10.7	22.4	66.8	2.8	96.6	0.6	36.1	16.3	47.6	3.7	92.6	3.7	
Total %	0.3	0.6	1.7	1.3	43.4	0.3	1.2	0.5	1.6	1.8	45.6	1.8	

	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	**1**	3	7	11	4	215	**1**	220	**9**	**2**	**5**	**16**	1	90	1	92	339
07:15 AM	1	**4**	9	14	4	**235**	0	**239**	4	0	5	9	2	95	2	99	361
07:30 AM	1	2	7	10	2	233	1	236	1	0	2	3	**3**	99	**3**	105	354
07:45 AM	1	0	**15**	**16**	**6**	229	0	235	2	0	1	3	2	**105**	3	**110**	**364**
Total Volume	4	9	38	51	16	912	2	930	16	2	13	31	8	389	9	406	1418
% App. Total	7.8	17.6	74.5		1.7	98.1	0.2		51.6	6.5	41.9		2	95.8	2.2		
PHF	1.00	.563	.633	.797	.667	.970	.500	.973	.444	.250	.650	.484	.667	.926	.750	.923	.974

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 11



Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

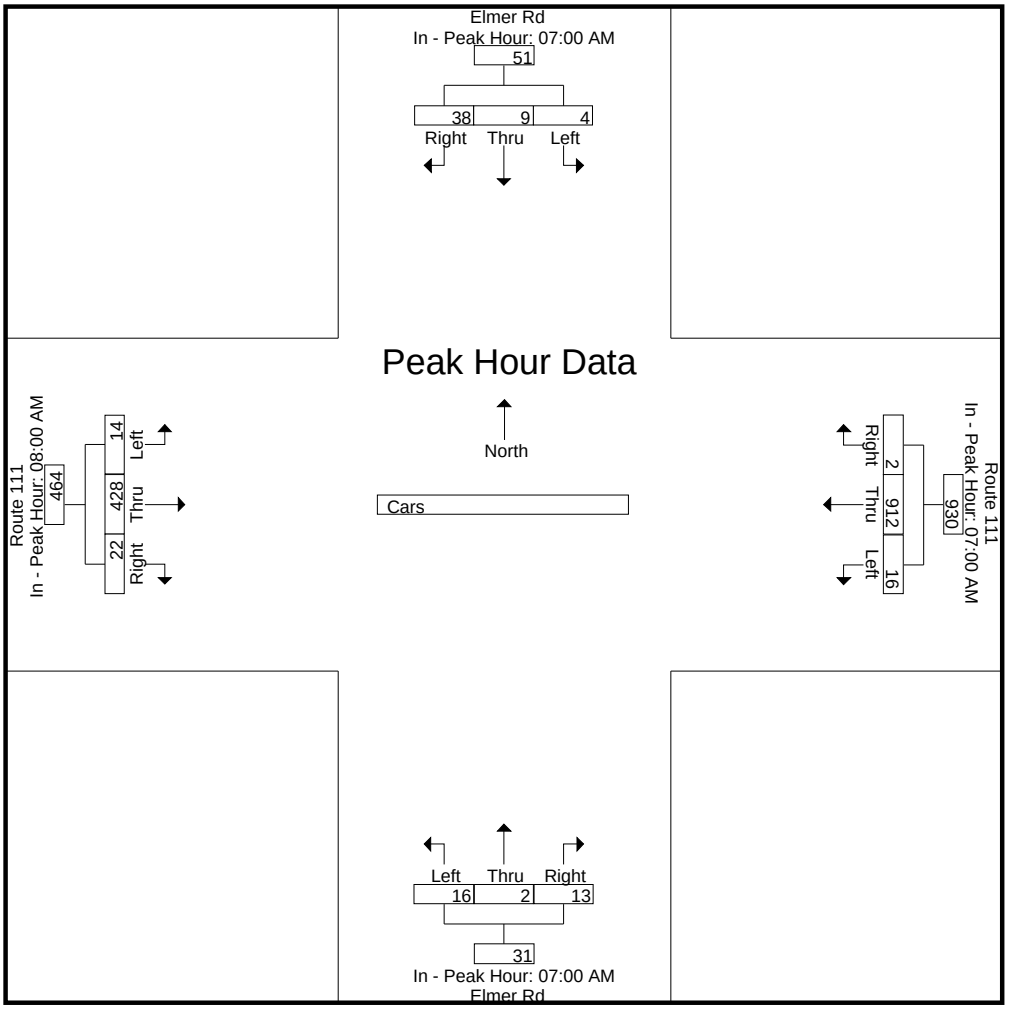
	07:00 AM				07:00 AM				07:00 AM				08:00 AM			
+0 mins.	**1**	3	7	11	4	215	**1**	220	**9**	**2**	**5**	**16**	2	105	2	109
+15 mins.	1	**4**	9	14	4	**235**	0	**239**	4	0	5	9	**4**	115	6	125
+30 mins.	1	2	7	10	2	233	1	236	1	0	2	3	4	90	**7**	101
+45 mins.	1	0	**15**	**16**	**6**	229	0	235	2	0	1	3	4	**118**	7	**129**
Total Volume	4	9	38	51	16	912	2	930	16	2	13	31	14	428	22	464
% App. Total	7.8	17.6	74.5		1.7	98.1	0.2		51.6	6.5	41.9		3	92.2	4.7	
PHF	1.000	.563	.633	.797	.667	.970	.500	.973	.444	.250	.650	.484	.875	.907	.786	.899

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 12



Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 01:00 PM

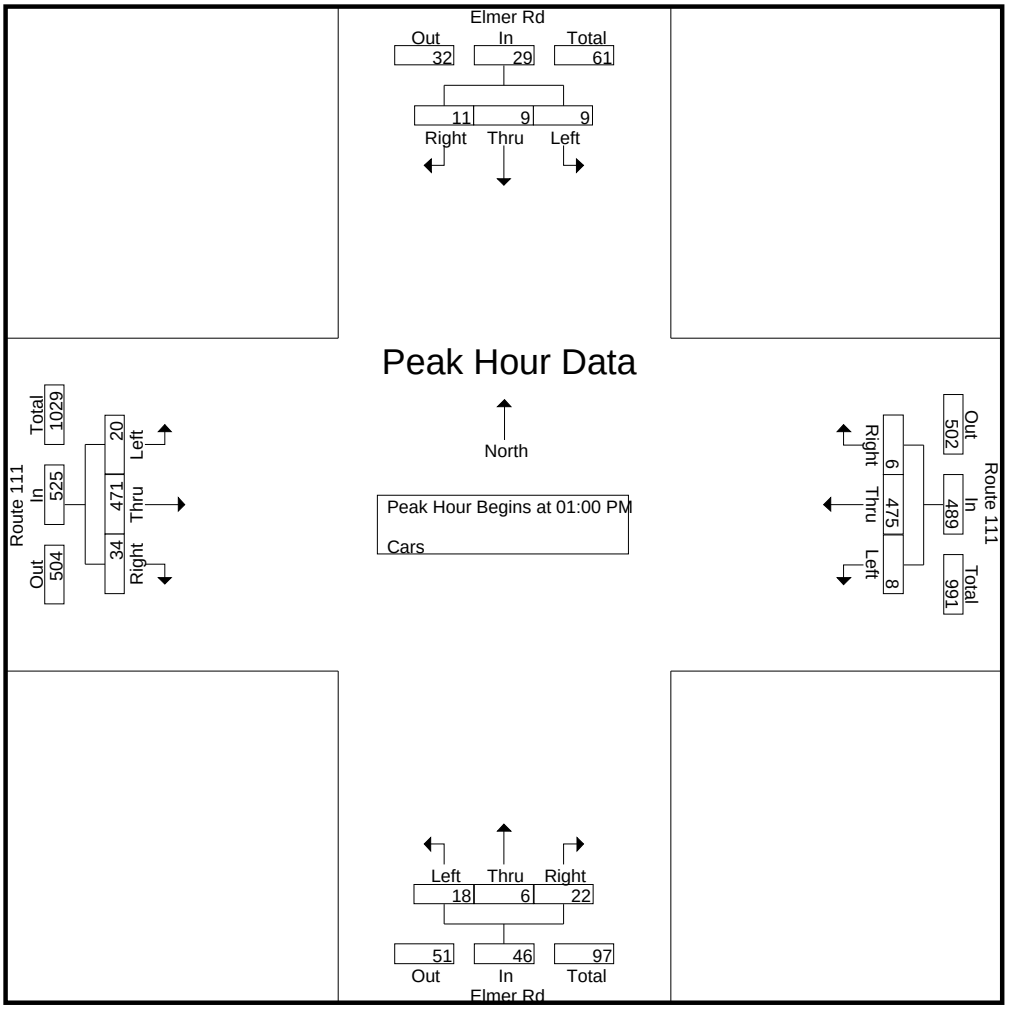
01:00 PM	**4**	**3**	3	**10**	**3**	116	1	120	**7**	1	7	**15**	4	118	10	132	277
01:15 PM	2	3	2	7	2	**124**	1	**127**	2	**2**	4	8	**8**	109	7	124	266
01:30 PM	1	3	1	5	2	112	**3**	117	4	2	2	8	5	93	6	104	234
01:45 PM	2	0	**5**	7	1	123	1	125	5	1	**9**	15	3	**151**	**11**	**165**	**312**
Total Volume	9	9	11	29	8	475	6	489	18	6	22	46	20	471	34	525	1089
% App. Total	31	31	37.9		1.6	97.1	1.2		39.1	13	47.8		3.8	89.7	6.5		
PHF	.563	.750	.550	.725	.667	.958	.500	.963	.643	.750	.611	.767	.625	.780	.773	.795	.873

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 13



Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

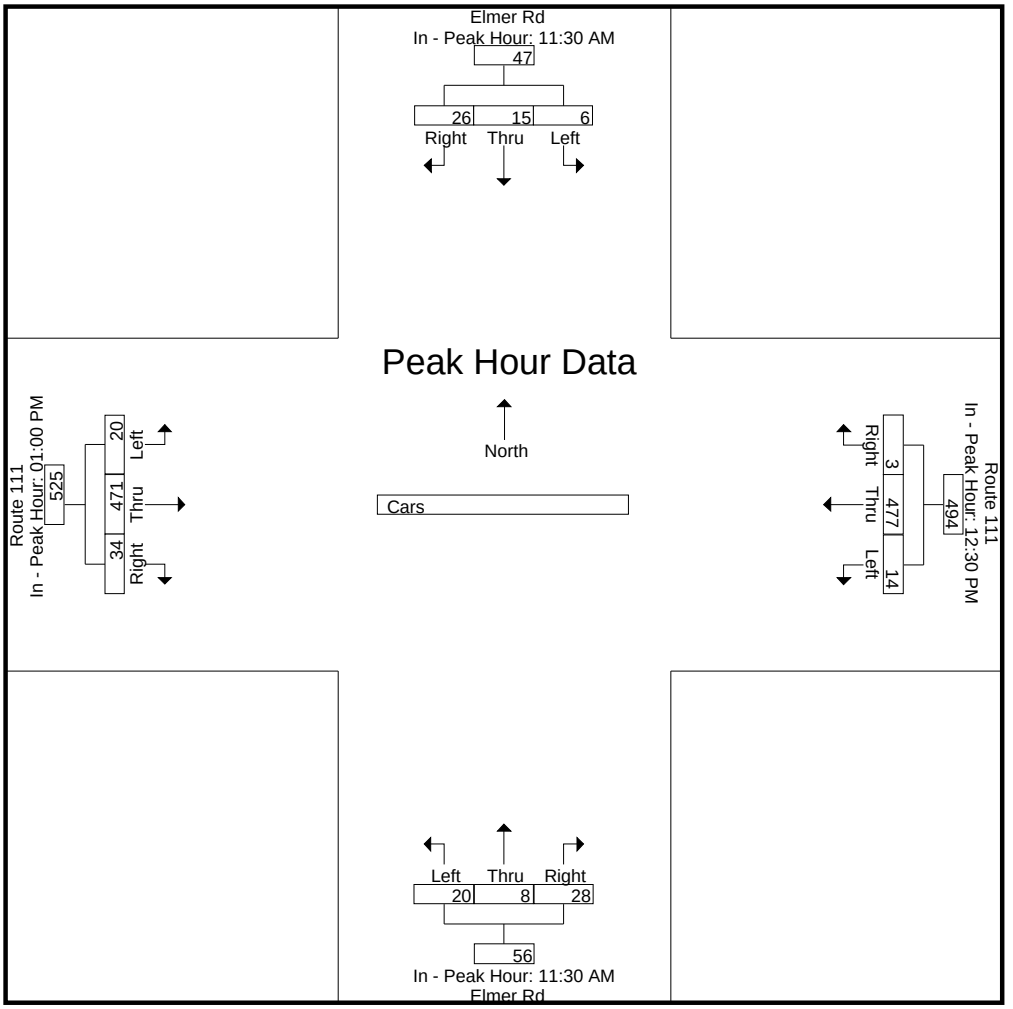
	11:30 AM				12:30 PM				11:30 AM				01:00 PM			
+0 mins.	**3**	3	4	10	4	112	**1**	117	2	1	**8**	11	4	118	10	132
+15 mins.	1	**6**	5	12	**5**	**125**	0	**130**	3	**3**	7	13	**8**	109	7	124
+30 mins.	1	4	8	**13**	3	116	1	120	7	3	8	**18**	5	93	6	104
+45 mins.	1	2	**9**	12	2	124	1	127	**8**	1	5	14	3	**151**	**11**	**165**
Total Volume	6	15	26	47	14	477	3	494	20	8	28	56	20	471	34	525
% App. Total	12.8	31.9	55.3		2.8	96.6	0.6		35.7	14.3	50		3.8	89.7	6.5	
PHF	.500	.625	.722	.904	.700	.954	.750	.950	.625	.667	.875	.778	.625	.780	.773	.795

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 14



Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 04:30 PM

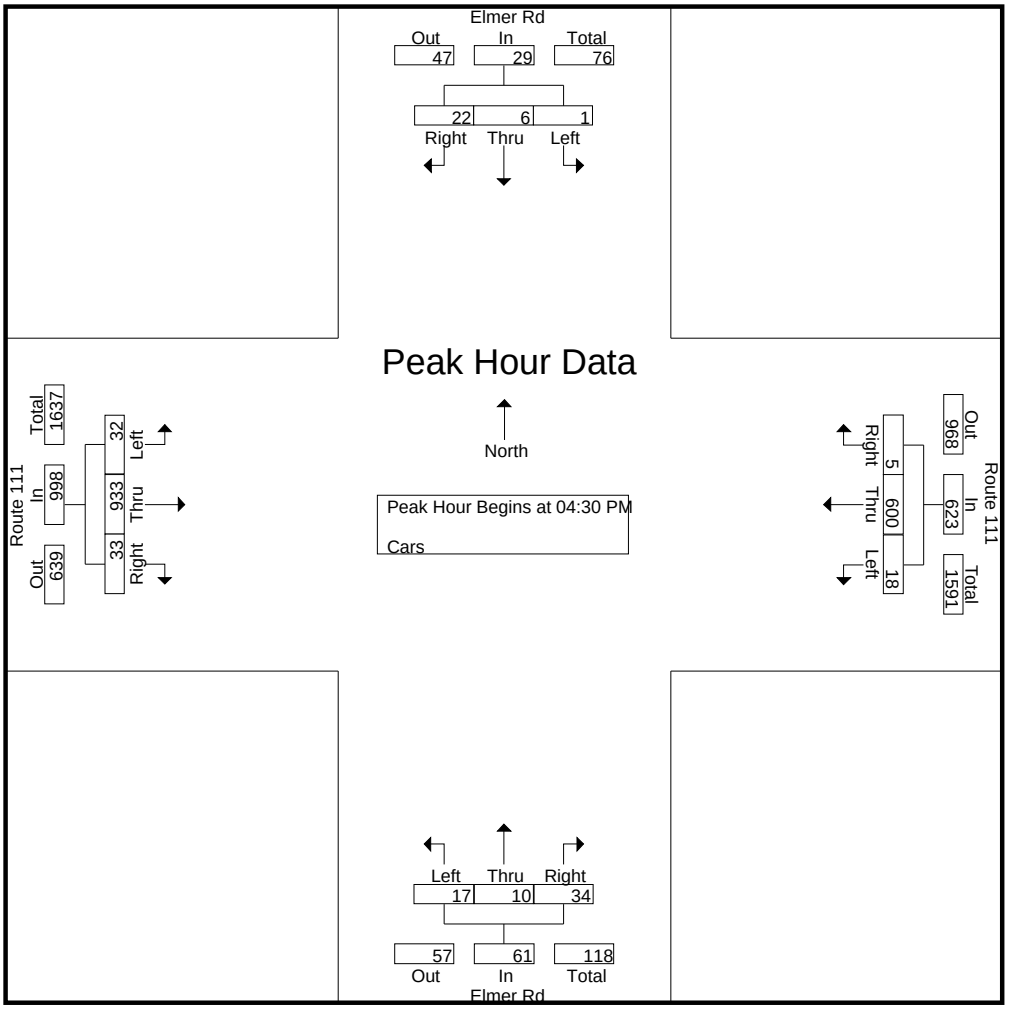
04:30 PM	0	0	4	4	5	156	1	162	2	2	10	14	**11**	227	3	241	421
04:45 PM	**1**	2	6	**9**	2	128	0	130	**6**	**3**	8	17	6	**247**	**15**	**268**	424
05:00 PM	0	0	**7**	7	**6**	**177**	**2**	**185**	4	3	**12**	**19**	9	225	5	239	**450**
05:15 PM	0	**4**	5	9	5	139	2	146	5	2	4	11	6	234	10	250	416
Total Volume	1	6	22	29	18	600	5	623	17	10	34	61	32	933	33	998	1711
% App. Total	3.4	20.7	75.9		2.9	96.3	0.8		27.9	16.4	55.7		3.2	93.5	3.3		
PHF	.250	.375	.786	.806	.750	.847	.625	.842	.708	.833	.708	.803	.727	.944	.550	.931	.951

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 15



Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

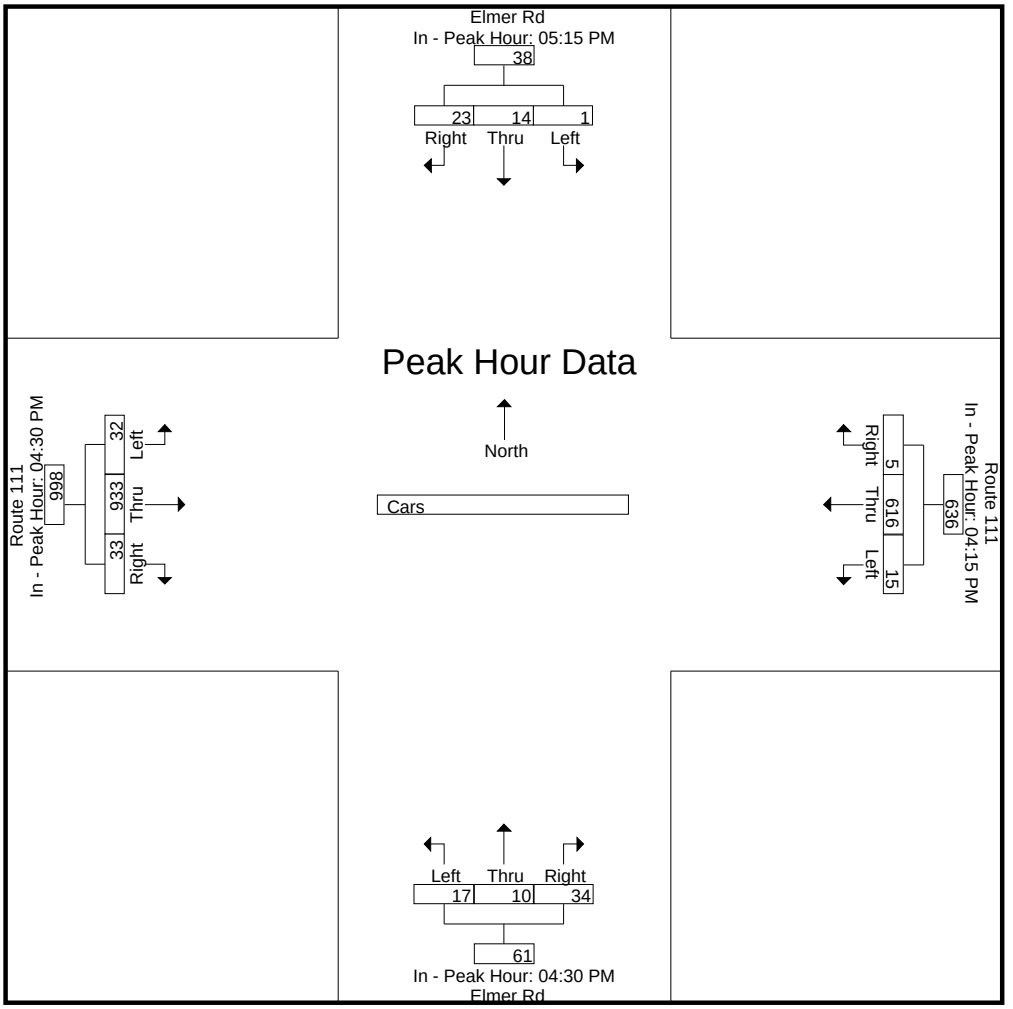
	05:15 PM				04:15 PM				04:30 PM				04:30 PM			
+0 mins.	0	**4**	5	9	2	155	**2**	159	2	2	10	14	**11**	227	3	241
+15 mins.	0	4	5	9	5	156	1	162	**6**	**3**	8	17	6	**247**	**15**	**268**
+30 mins.	**1**	3	**8**	**12**	2	128	0	130	4	3	**12**	**19**	9	225	5	239
+45 mins.	0	3	5	8	**6**	**177**	2	**185**	5	2	4	11	6	234	10	250
Total Volume	1	14	23	38	15	616	5	636	17	10	34	61	32	933	33	998
% App. Total	2.6	36.8	60.5		2.4	96.9	0.8		27.9	16.4	55.7		3.2	93.5	3.3	
PHF	.250	.875	.719	.792	.625	.870	.625	.859	.708	.833	.708	.803	.727	.944	.550	.931

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 16



Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 17

Groups Printed- Trucks

	Elmer Rd From North			Route 111 From East			Elmer Rd From South			Route 111 From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	7	0	0	0	0	0	5	1	13
08:15 AM	0	0	0	0	8	0	0	0	0	0	13	0	21
08:30 AM	0	0	0	0	2	0	0	0	0	0	7	0	9
08:45 AM	0	0	0	0	9	0	0	0	0	0	4	1	14
Total	0	0	0	0	26	0	0	0	0	0	29	2	57
09:00 AM	0	0	0	0	7	0	0	1	1	0	11	0	20
09:15 AM	0	0	0	0	8	0	1	0	0	0	3	2	14
09:30 AM	0	0	0	0	8	0	0	0	0	0	5	0	13
09:45 AM	0	0	0	0	8	0	0	0	0	0	8	0	16
Total	0	0	0	0	31	0	1	1	1	0	27	2	63
10:00 AM	0	0	0	0	8	1	0	0	0	0	9	0	18
10:15 AM	0	0	0	0	8	0	0	0	0	0	10	0	18
10:30 AM	0	0	0	0	6	0	0	0	0	0	13	0	19
10:45 AM	0	0	0	1	6	0	0	0	0	0	7	0	14
Total	0	0	0	1	28	1	0	0	0	0	39	0	69
11:00 AM	0	0	0	0	7	0	0	0	0	0	8	0	15
11:15 AM	0	0	0	0	5	0	1	0	0	0	11	0	17
11:30 AM	0	0	0	0	8	0	0	0	0	0	9	0	17
11:45 AM	0	0	0	0	5	0	0	0	0	0	10	0	15
Total	0	0	0	0	25	0	1	0	0	0	38	0	64
12:00 PM	0	0	0	0	5	1	0	0	0	0	7	0	13
12:15 PM	1	0	0	0	8	0	0	0	0	0	7	0	16
12:30 PM	0	1	0	0	10	0	0	0	0	0	14	0	25
12:45 PM	0	0	0	1	10	0	0	0	1	0	3	0	15
Total	1	1	0	1	33	1	0	0	1	0	31	0	69
01:00 PM	0	0	0	0	11	0	0	0	0	0	4	0	15
01:15 PM	0	0	0	0	10	0	0	0	0	0	6	0	16
01:30 PM	0	0	0	0	3	0	0	0	0	0	11	0	14
01:45 PM	0	0	0	0	5	0	0	0	0	0	4	0	9
Total	0	0	0	0	29	0	0	0	0	0	25	0	54
02:00 PM	0	0	0	0	7	0	0	0	0	0	8	0	15
02:15 PM	0	0	0	0	12	0	0	0	0	0	4	0	16
02:30 PM	0	0	0	0	6	1	0	0	0	0	5	0	12
02:45 PM	0	0	0	0	3	0	0	0	0	0	9	0	12
Total	0	0	0	0	28	1	0	0	0	0	26	0	55
03:00 PM	0	0	0	0	3	0	0	0	0	1	4	0	8
03:15 PM	0	0	0	1	4	0	0	1	1	1	9	0	17
03:30 PM	0	0	0	0	5	0	0	1	0	0	7	2	15
03:45 PM	0	0	0	0	2	0	0	0	0	2	3	0	7
Total	0	0	0	1	14	0	0	2	1	4	23	2	47
04:00 PM	0	0	0	0	4	0	0	0	0	1	6	0	11
04:15 PM	0	0	0	0	3	0	0	0	2	1	5	0	11
04:30 PM	0	0	1	0	4	0	0	0	0	0	5	0	10
04:45 PM	0	1	0	0	5	0	0	0	0	0	3	0	9
Total	0	1	1	0	16	0	0	0	2	2	19	0	41
05:00 PM	0	0	0	0	3	0	0	0	0	0	12	0	15
05:15 PM	0	0	0	0	3	0	0	0	0	0	5	0	8
05:30 PM	0	0	0	1	3	0	0	0	0	0	1	2	7

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 18

Groups Printed- Trucks

	Elmer Rd From North			Route 111 From East			Elmer Rd From South			Route 111 From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
05:45 PM	0	0	0	0	4	0	0	0	0	0	3	0	7
Total	0	0	0	1	13	0	0	0	0	0	21	2	37
06:00 PM	0	0	0	0	2	1	0	0	0	0	3	0	6
06:15 PM	0	0	1	0	6	0	0	0	0	0	3	0	10
06:30 PM	0	0	0	0	6	0	0	0	0	0	2	0	8
06:45 PM	0	0	0	0	2	0	0	0	0	0	4	0	6
Total	0	0	1	0	16	1	0	0	0	0	12	0	30
Grand Total	1	2	2	4	259	4	2	3	5	6	290	8	586
Apprch %	20	40	40	1.5	97	1.5	20	30	50	2	95.4	2.6	
Total %	0.2	0.3	0.3	0.7	44.2	0.7	0.3	0.5	0.9	1	49.5	1.4	

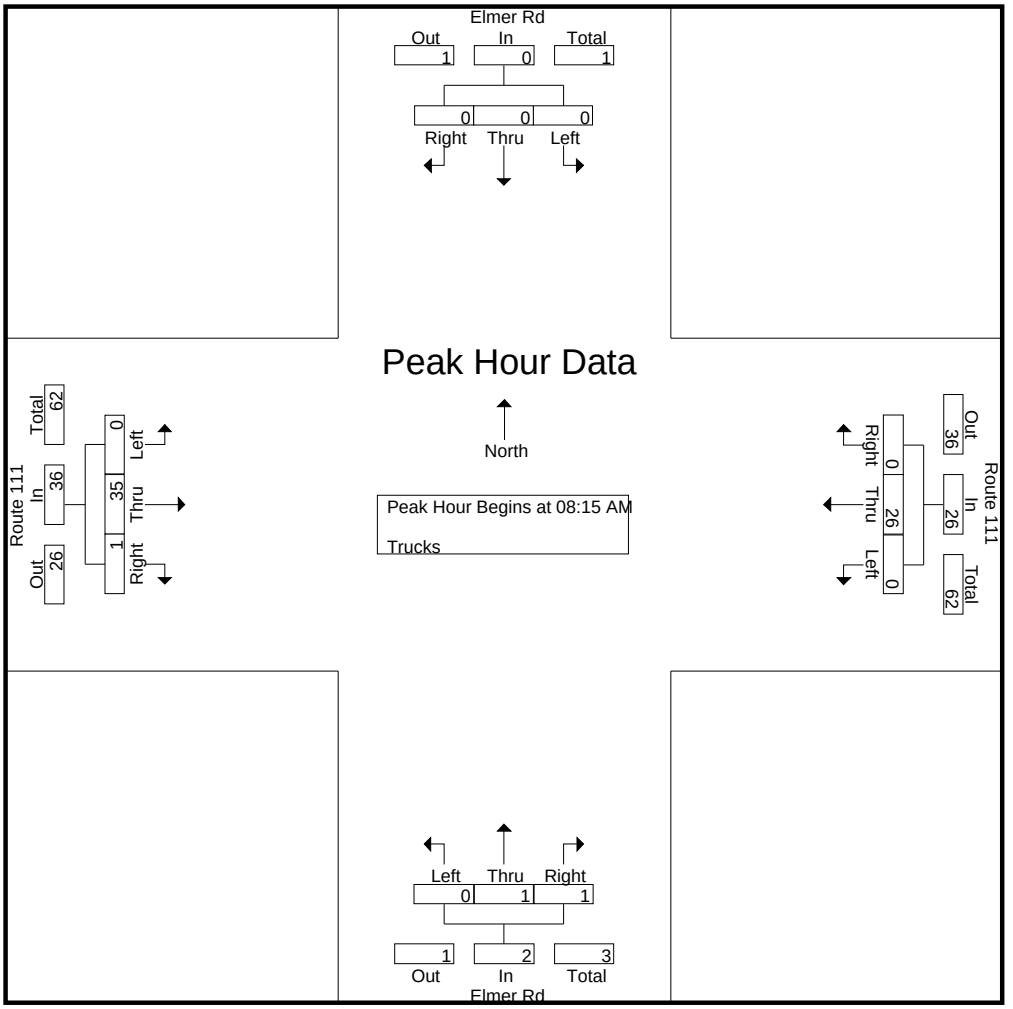
	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:15 AM																	
08:15 AM	0	0	0	0	0	8	0	8	0	0	0	0	0	**13**	0	**13**	**21**
08:30 AM	0	0	0	0	0	2	0	2	0	0	0	0	0	7	0	7	9
08:45 AM	0	0	0	0	0	**9**	0	**9**	0	0	0	0	0	4	**1**	5	14
09:00 AM	0	0	0	0	0	7	0	7	0	**1**	**1**	**2**	0	11	0	11	20
Total Volume	0	0	0	0	0	26	0	26	0	1	1	2	0	35	1	36	64
% App. Total	0	0	0		0	100	0		0	50	50		0	97.2	2.8		
PHF	.000	.000	.000	.000	.000	.722	.000	.722	.000	.250	.250	.250	.000	.673	.250	.692	.762

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 19



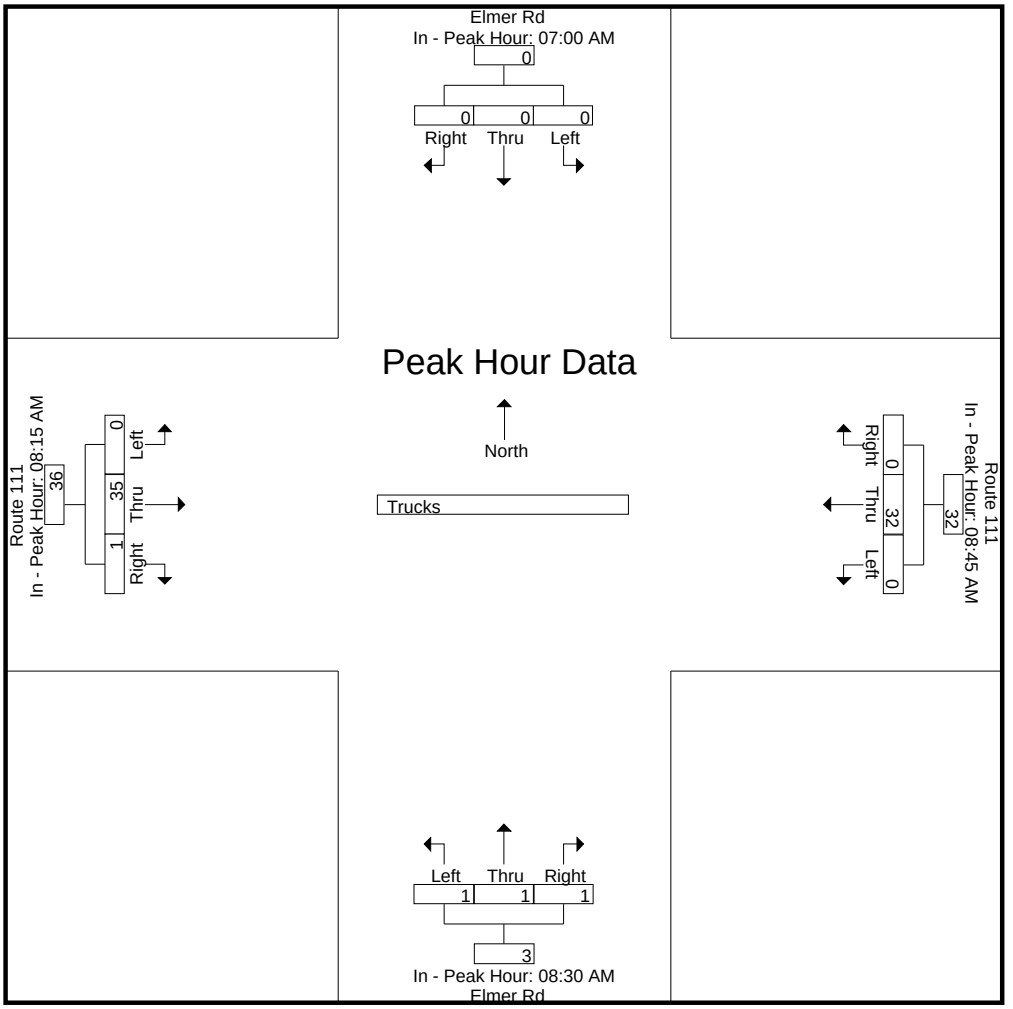
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:00 AM				08:45 AM				08:30 AM				08:15 AM			
+0 mins.	0	0	0	0	0	**9**	0	**9**	0	0	0	0	0	**13**	0	**13**
+15 mins.	0	0	0	0	0	7	0	7	0	0	0	0	0	7	0	7
+30 mins.	0	0	0	0	0	8	0	8	0	**1**	**1**	**2**	0	4	**1**	5
+45 mins.	0	0	0	0	0	8	0	8	**1**	0	0	1	0	11	0	11
Total Volume	0	0	0	0	0	32	0	32	1	1	1	3	0	35	1	36
% App. Total	0	0	0		0	100	0		33.3	33.3	33.3		0	97.2	2.8	
PHF	.000	.000	.000	.000	.000	.889	.000	.889	.250	.250	.250	.375	.000	.673	.250	.692

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 20



Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 12:15 PM

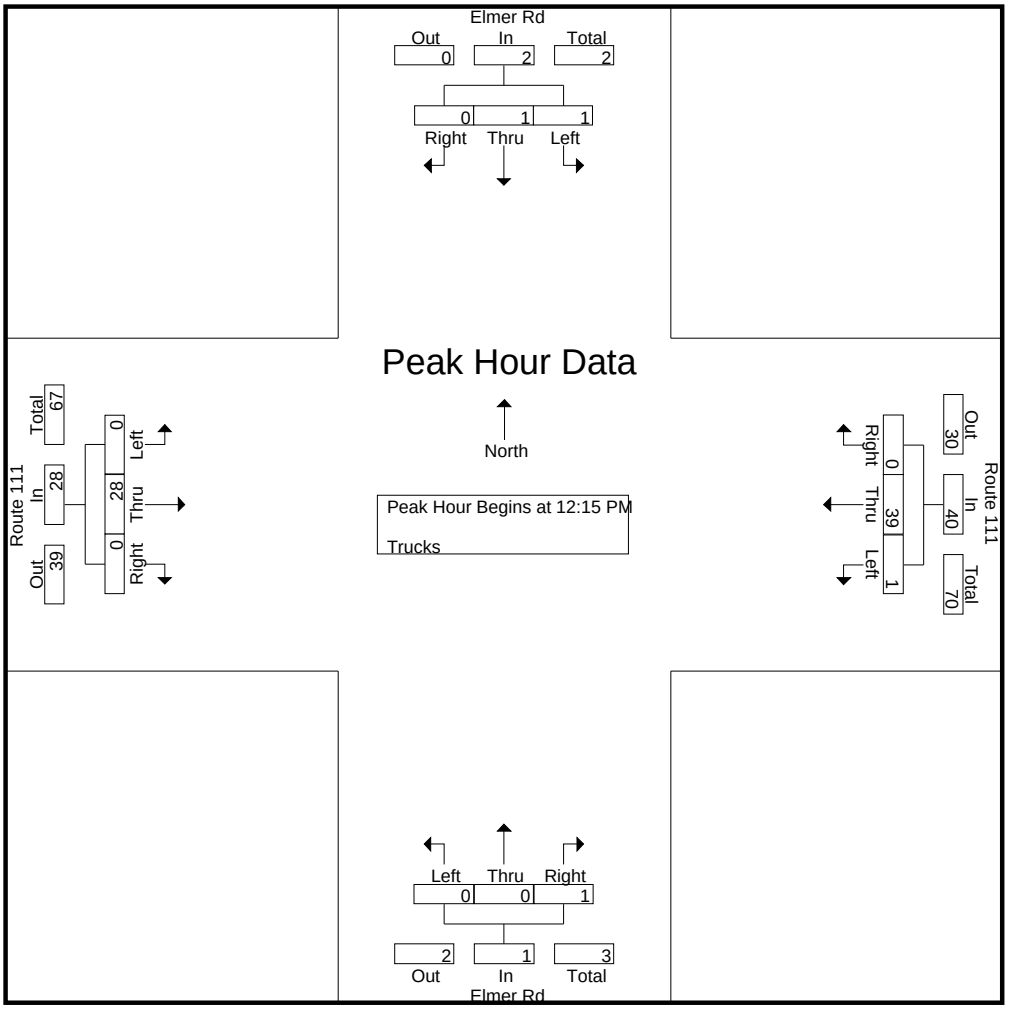
12:15 PM	**1**	0	0	**1**	0	8	0	8	0	0	0	0	0	7	0	7	16
12:30 PM	0	**1**	0	1	0	10	0	10	0	0	0	0	0	**14**	0	**14**	**25**
12:45 PM	0	0	0	0	**1**	10	0	**11**	0	0	**1**	**1**	0	3	0	3	15
01:00 PM	0	0	0	0	0	**11**	0	11	0	0	0	0	0	4	0	4	15
Total Volume	1	1	0	2	1	39	0	40	0	0	1	1	0	28	0	28	71
% App. Total	50	50	0		2.5	97.5	0		0	0	100		0	100	0		
PHF	.250	.250	.000	.500	.250	.886	.000	.909	.000	.000	.250	.250	.000	.500	.000	.500	.710

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 21



Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

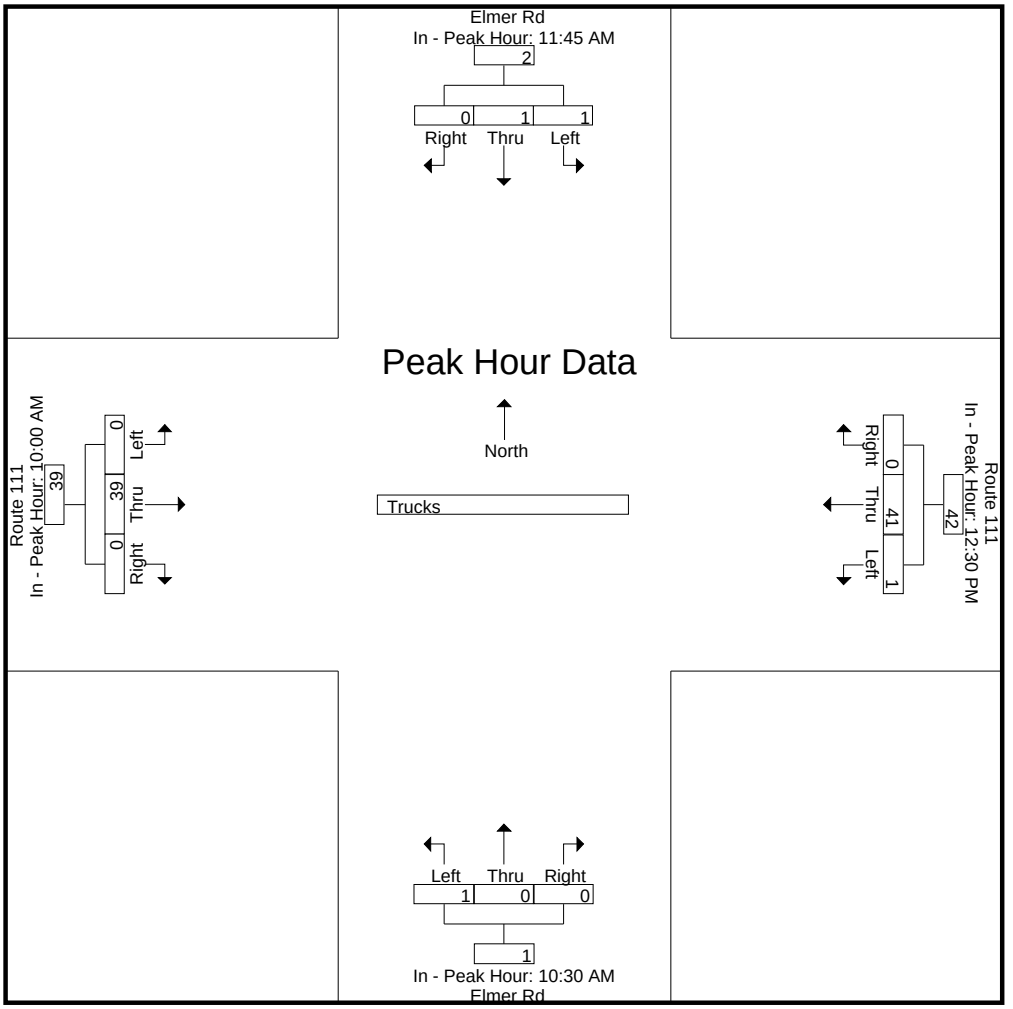
	11:45 AM				12:30 PM				10:30 AM				10:00 AM			
+0 mins.	0	0	0	0	0	10	0	10	0	0	0	0	0	9	0	9
+15 mins.	0	0	0	0	**1**	10	0	**11**	0	0	0	0	0	10	0	10
+30 mins.	**1**	0	0	**1**	0	**11**	0	11	0	0	0	0	0	**13**	0	**13**
+45 mins.	0	**1**	0	1	0	10	0	10	**1**	0	0	**1**	0	7	0	7
Total Volume	1	1	0	2	1	41	0	42	1	0	0	1	0	39	0	39
% App. Total	50	50	0		2.4	97.6	0		100	0	0		0	100	0	
PHF	.250	.250	.000	.500	.250	.932	.000	.955	.250	.000	.000	.250	.000	.750	.000	.750

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 22



Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 02:00 PM

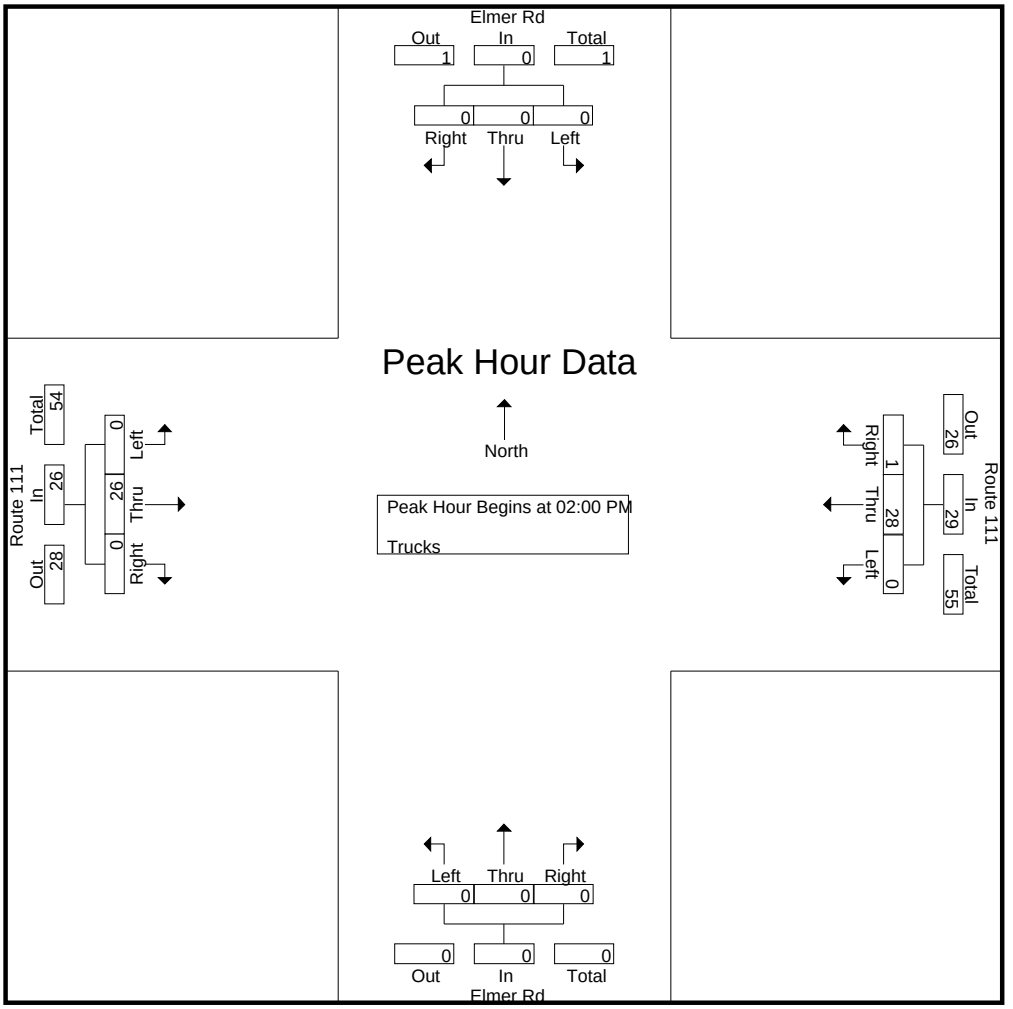
02:00 PM	0	0	0	0	0	7	0	7	0	0	0	0	0	8	0	8	15
02:15 PM	0	0	0	0	0	**12**	0	**12**	0	0	0	0	0	4	0	4	**16**
02:30 PM	0	0	0	0	0	6	**1**	7	0	0	0	0	0	5	0	5	12
02:45 PM	0	0	0	0	0	3	0	3	0	0	0	0	0	**9**	0	**9**	12
Total Volume	0	0	0	0	0	28	1	29	0	0	0	0	0	26	0	26	55
% App. Total	0	0	0		0	96.6	3.4		0	0	0		0	100	0		
PHF	.000	.000	.000	.000	.000	.583	.250	.604	.000	.000	.000	.000	.000	.722	.000	.722	.859

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 23



Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

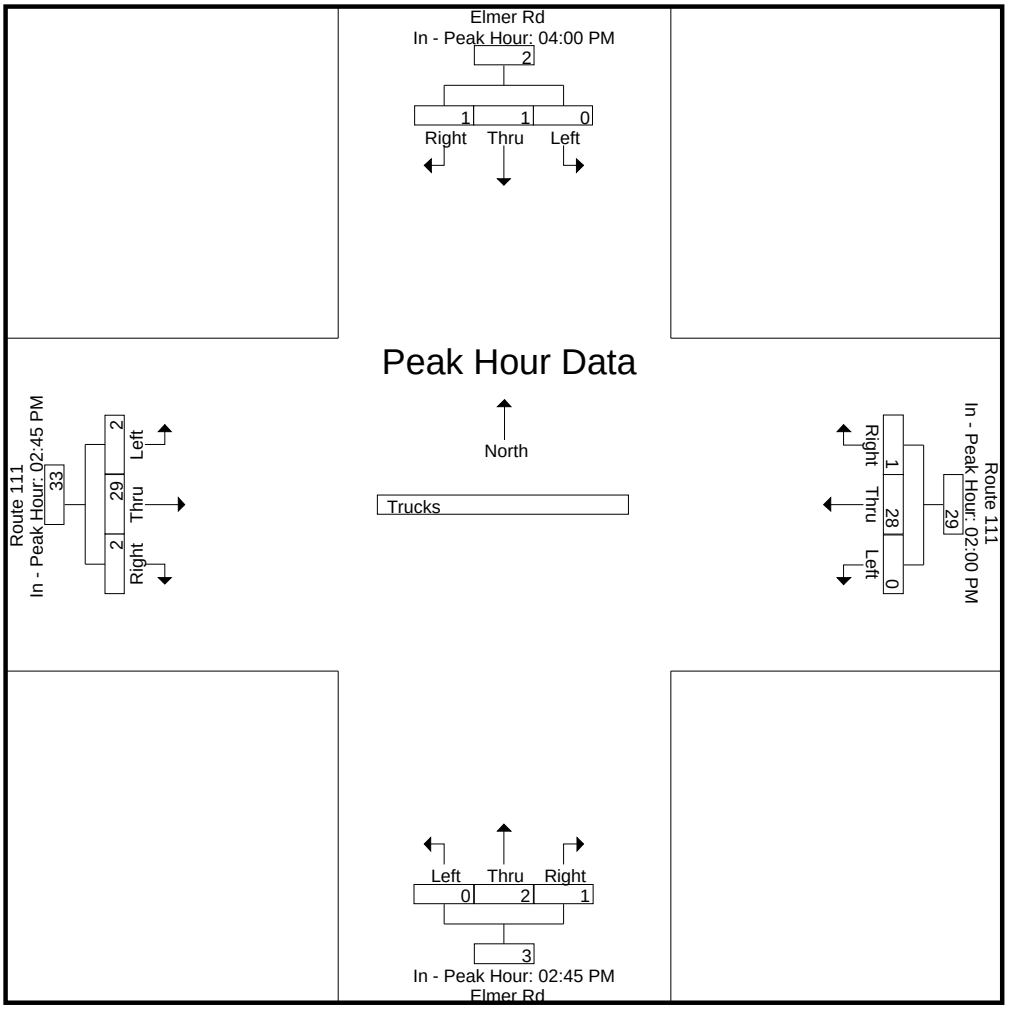
	04:00 PM				02:00 PM				02:45 PM				02:45 PM			
+0 mins.	0	0	0	0	0	7	0	7	0	0	0	0	0	**9**	0	9
+15 mins.	0	0	0	0	0	**12**	0	**12**	0	0	0	0	**1**	4	0	5
+30 mins.	0	0	**1**	**1**	0	6	**1**	7	0	**1**	**1**	**2**	1	9	0	**10**
+45 mins.	0	**1**	0	1	0	3	0	3	0	1	0	1	0	7	**2**	9
Total Volume	0	1	1	2	0	28	1	29	0	2	1	3	2	29	2	33
% App. Total	0	50	50		0	96.6	3.4		0	66.7	33.3		6.1	87.9	6.1	
PHF	.000	.250	.250	.500	.000	.583	.250	.604	.000	.500	.250	.375	.500	.806	.250	.825

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 24



Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022

Groups Printed- Bikes Peds

	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022

Groups Printed- Bikes Peds

	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0		0	0	0		0	0	0		0	0	0				
Total %																	0	0	

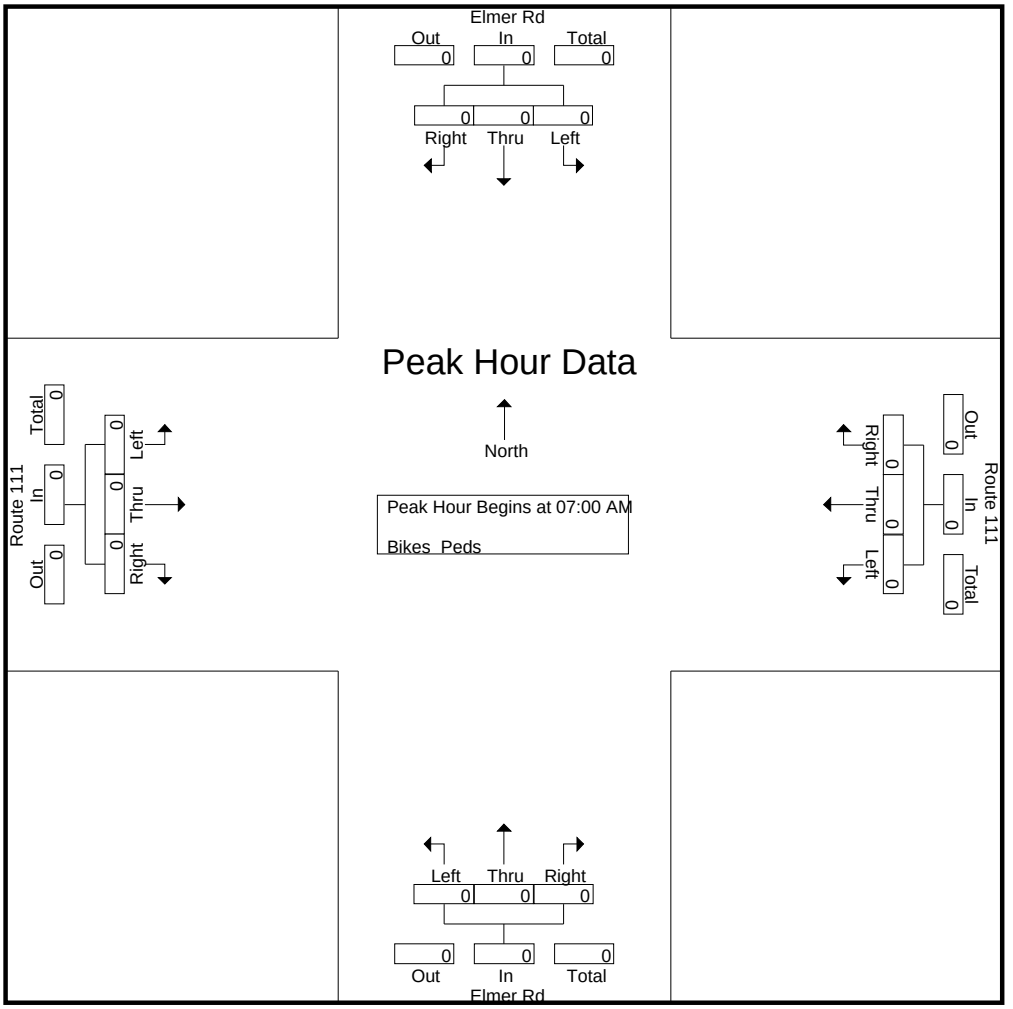
	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 27



Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

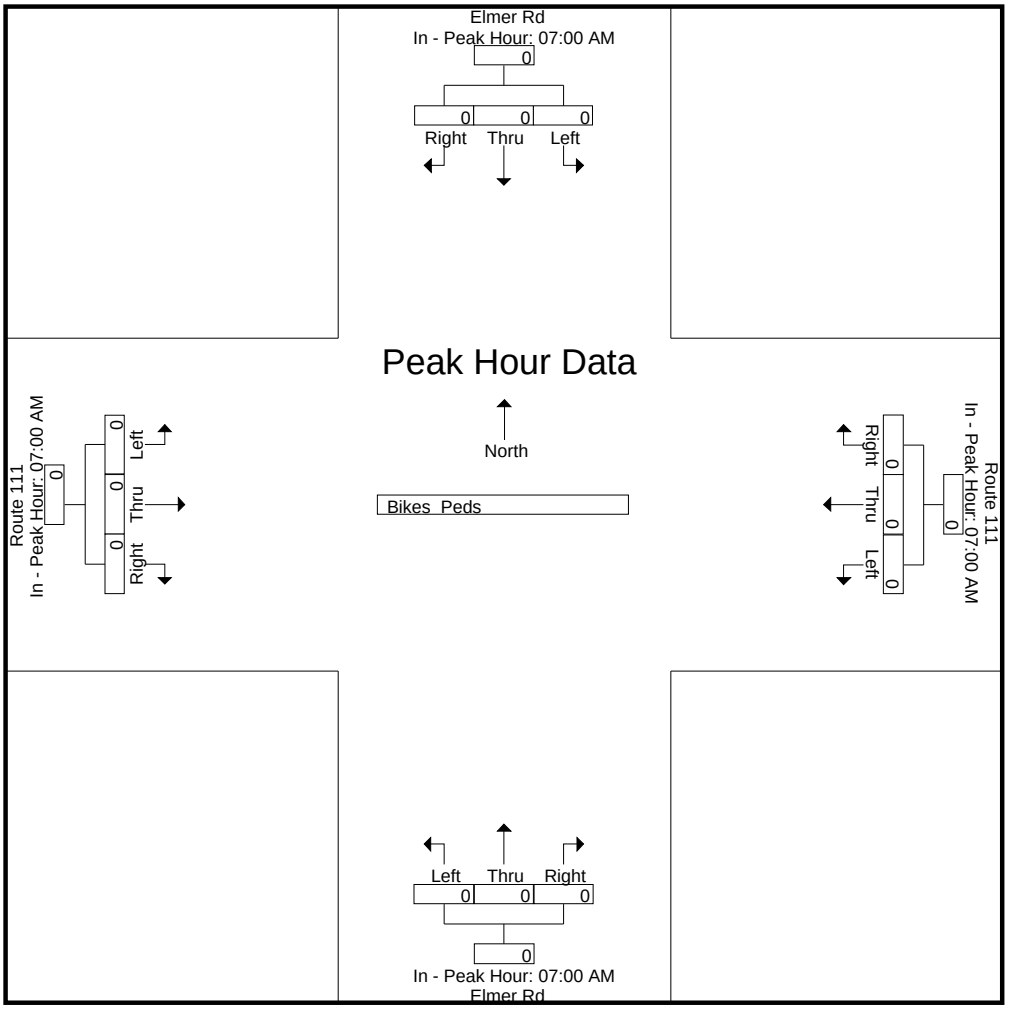
	07:00 AM				07:00 AM				07:00 AM				07:00 AM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0	
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 28



Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 10:00 AM

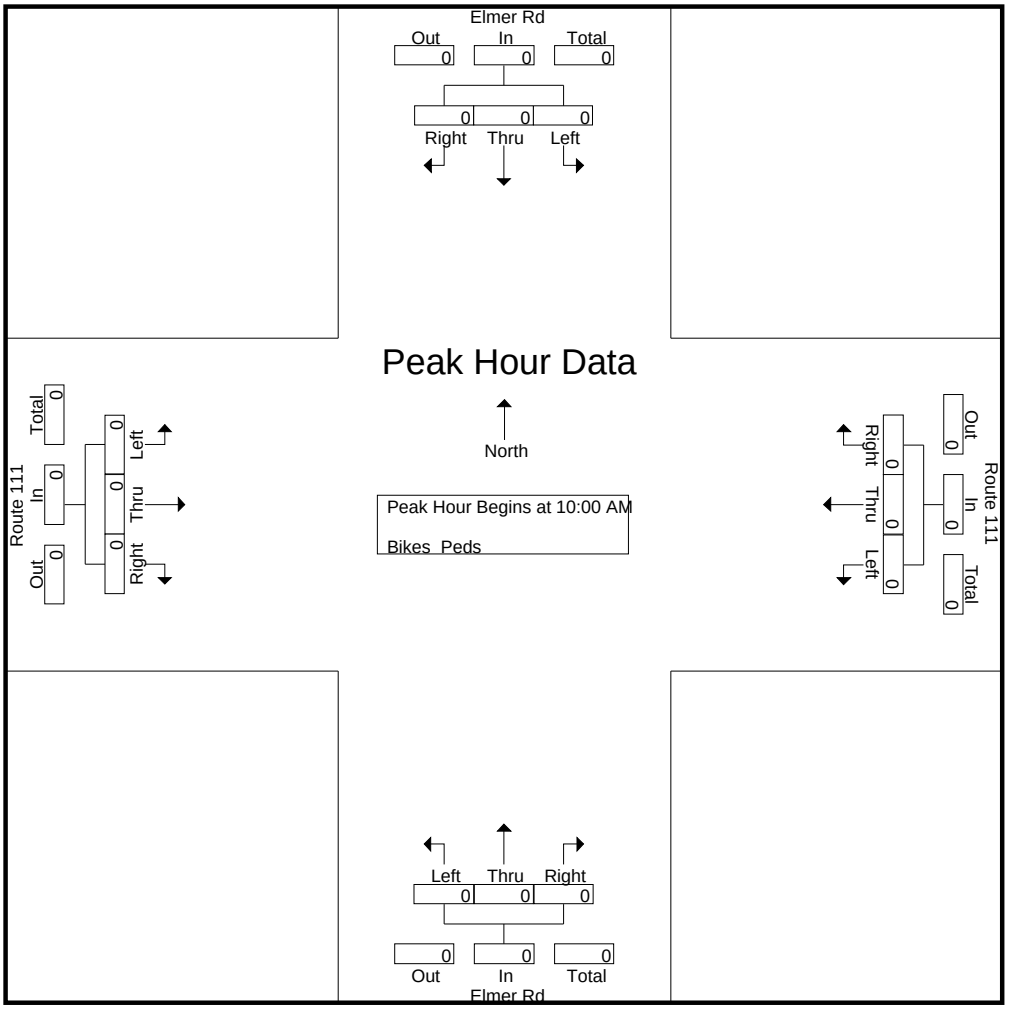
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0			
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 29



Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

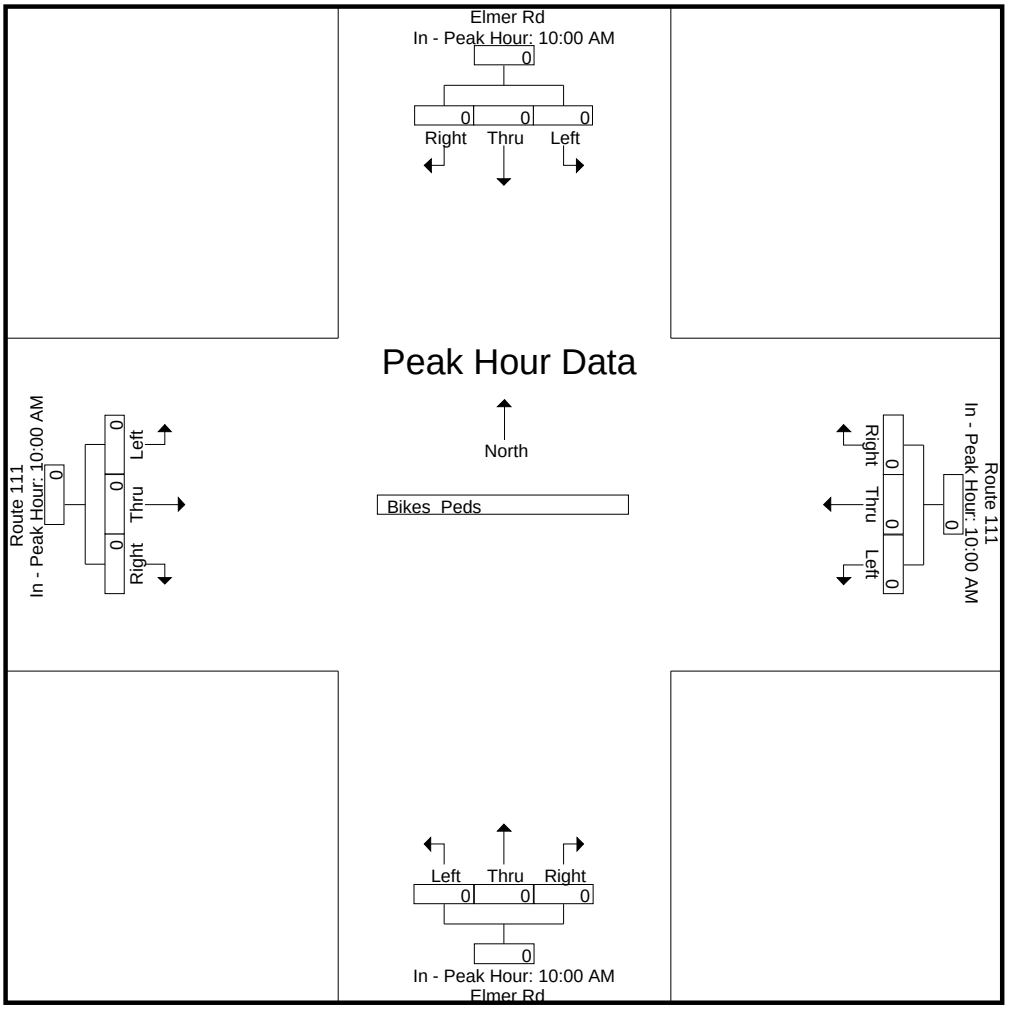
	10:00 AM				10:00 AM				10:00 AM				10:00 AM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0	
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 30



Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 02:00 PM

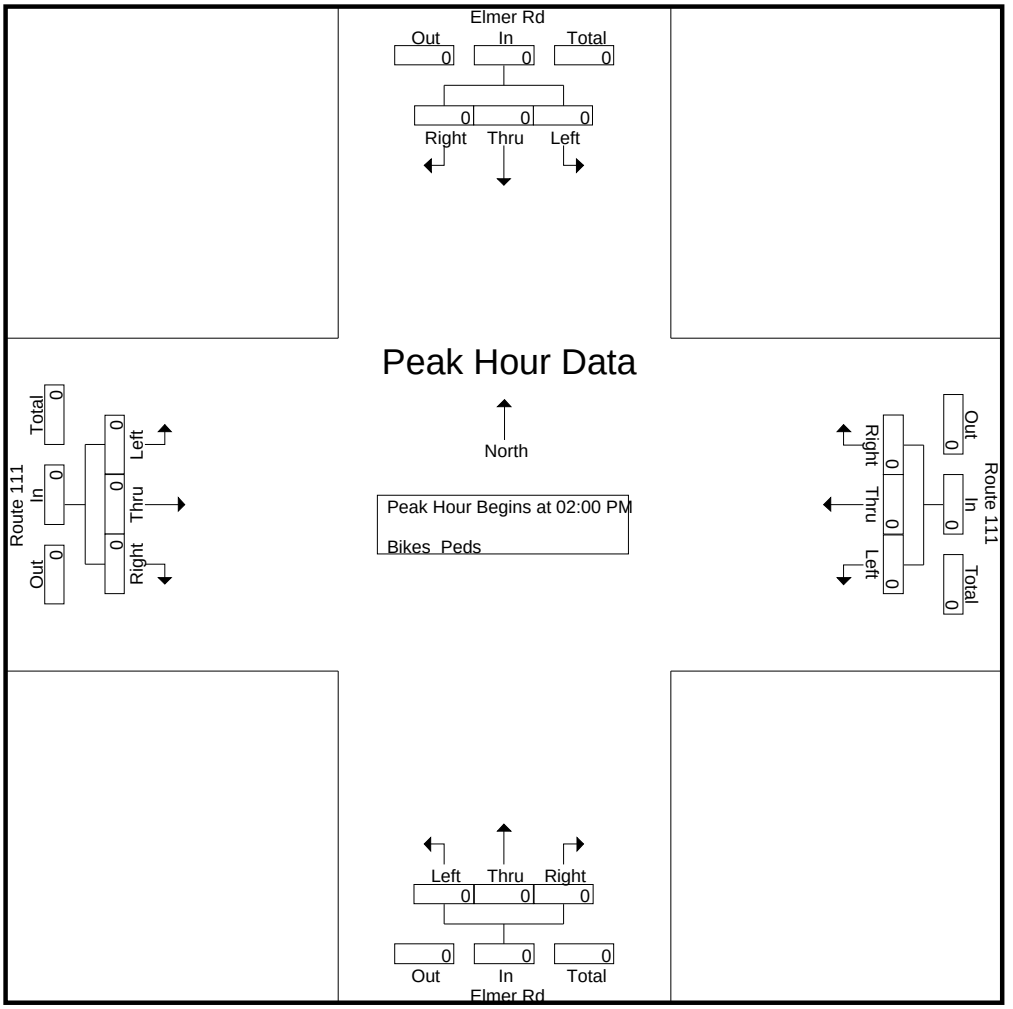
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0			
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 31



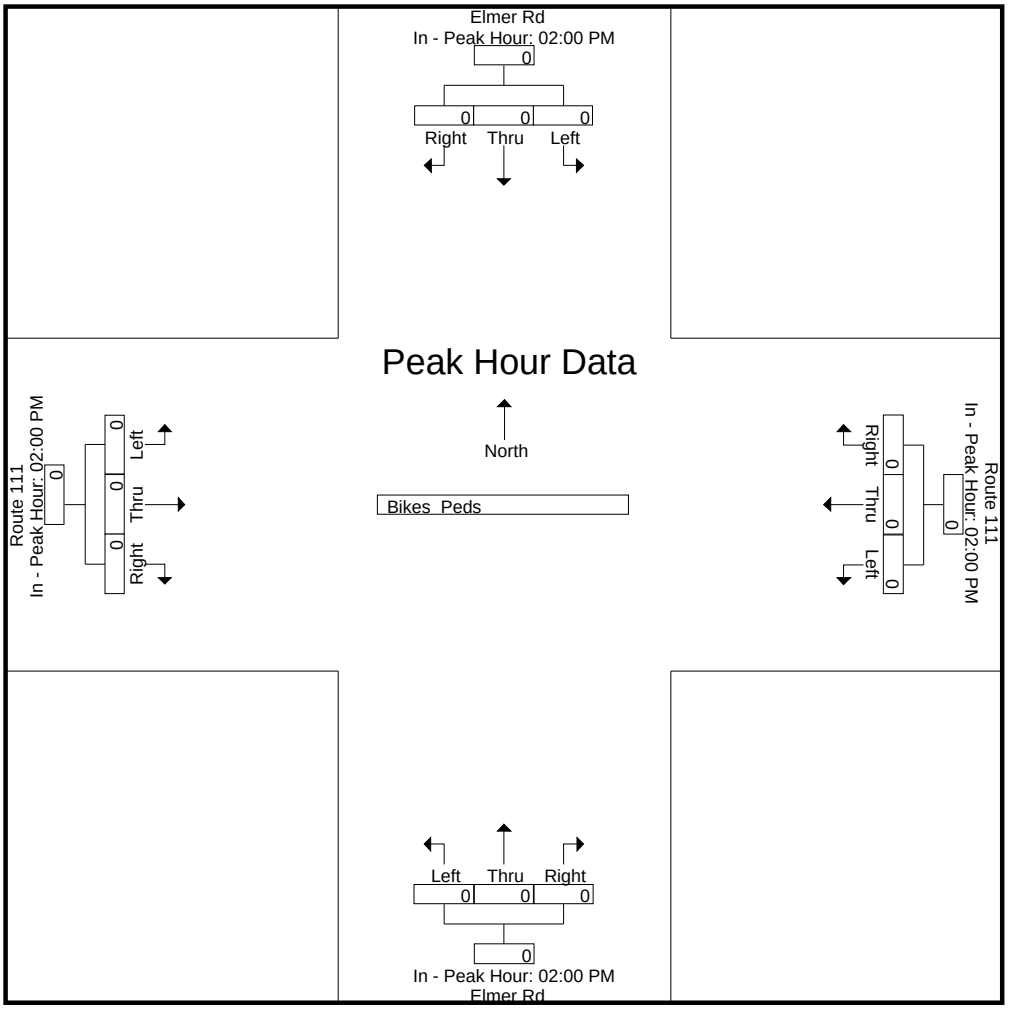
Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	02:00 PM				02:00 PM				02:00 PM				02:00 PM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0	
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts
978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Cloudy

File Name : 52946001
Site Code : 52946001
Start Date : 12/1/2022
Page No : 32



Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 1

Groups Printed- Cars - Trucks

	Elmer Rd From North			Route 111 From East			Elmer Rd From South			Route 111 From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
11:00 AM	0	0	4	5	157	2	6	1	2	6	112	2	297
11:15 AM	0	1	5	5	152	0	3	1	2	5	127	2	303
11:30 AM	1	2	4	3	138	2	5	1	8	15	120	7	306
11:45 AM	0	2	12	1	152	1	5	5	7	7	143	3	338
Total	1	5	25	14	599	5	19	8	19	33	502	14	1244
12:00 PM	1	2	8	3	156	5	3	1	2	8	133	2	324
12:15 PM	3	5	5	3	136	2	3	2	4	7	157	3	330
12:30 PM	0	3	9	8	131	1	5	1	1	5	127	4	295
12:45 PM	0	3	3	0	141	1	1	2	5	10	143	5	314
Total	4	13	25	14	564	9	12	6	12	30	560	14	1263
Grand Total	5	18	50	28	1163	14	31	14	31	63	1062	28	2507
Apprch %	6.8	24.7	68.5	2.3	96.5	1.2	40.8	18.4	40.8	5.5	92.1	2.4	
Total %	0.2	0.7	2	1.1	46.4	0.6	1.2	0.6	1.2	2.5	42.4	1.1	
Cars	5	18	50	28	1157	14	31	14	31	63	1056	28	2495
% Cars	100	100	100	100	99.5	100	100	100	100	100	99.4	100	99.5
Trucks	0	0	0	0	6	0	0	0	0	0	6	0	12
% Trucks	0	0	0	0	0.5	0	0	0	0	0	0.6	0	0.5

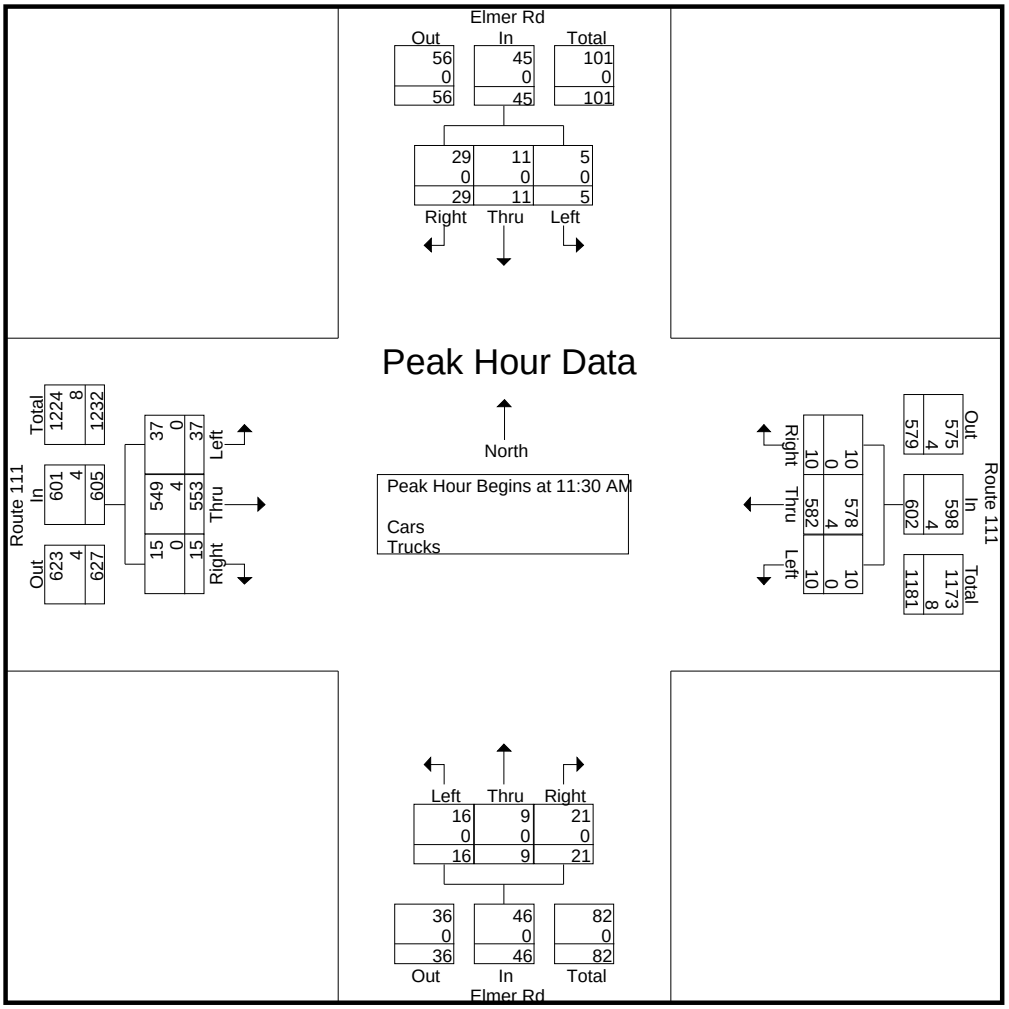
	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 11:30 AM																	
11:30 AM	1	2	4	7	**3**	138	2	143	**5**	1	**8**	14	**15**	120	**7**	142	306
11:45 AM	0	2	**12**	**14**	1	152	1	154	5	**5**	7	**17**	7	143	3	153	**338**
12:00 PM	1	2	8	11	3	**156**	**5**	**164**	3	1	2	6	8	133	2	143	324
12:15 PM	**3**	**5**	5	13	3	136	2	141	3	2	4	9	7	**157**	3	**167**	330
Total Volume	5	11	29	45	10	582	10	602	16	9	21	46	37	553	15	605	1298
% App. Total	11.1	24.4	64.4		1.7	96.7	1.7		34.8	19.6	45.7		6.1	91.4	2.5		
PHF	.417	.550	.604	.804	.833	.933	.500	.918	.800	.450	.656	.676	.617	.881	.536	.906	.960
Cars	5	11	29	45	10	578	10	598	16	9	21	46	37	549	15	601	1290
% Cars	100	100	100	100	100	99.3	100	99.3	100	100	100	100	100	99.3	100	99.3	99.4
Trucks	0	0	0	0	0	4	0	4	0	0	0	0	0	4	0	4	8
% Trucks	0	0	0	0	0	0.7	0	0.7	0	0	0	0	0	0.7	0	0.7	0.6

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 2



Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

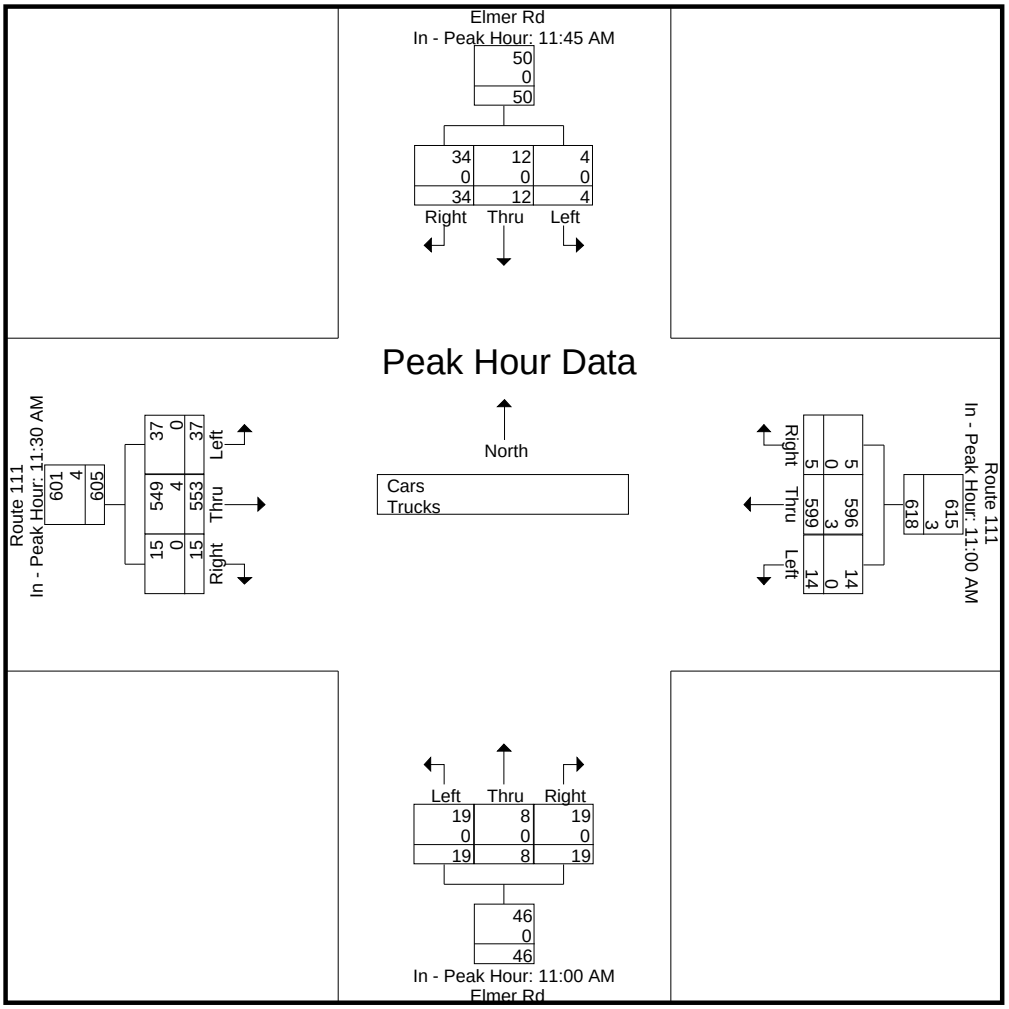
	11:45 AM				11:00 AM				11:00 AM				11:30 AM			
+0 mins.	0	2	**12**	**14**	**5**	**157**	**2**	**164**	**6**	1	2	9	**15**	120	**7**	142
+15 mins.	1	2	8	11	5	152	0	157	3	1	2	6	7	143	3	153
+30 mins.	**3**	**5**	5	13	3	138	2	143	5	1	**8**	14	8	133	2	143
+45 mins.	0	3	9	12	1	152	1	154	5	**5**	7	**17**	7	**157**	3	**167**
Total Volume	4	12	34	50	14	599	5	618	19	8	19	46	37	553	15	605
% App. Total	8	24	68		2.3	96.9	0.8		41.3	17.4	41.3		6.1	91.4	2.5	
PHF	.333	.600	.708	.893	.700	.954	.625	.942	.792	.400	.594	.676	.617	.881	.536	.906
Cars	4	12	34	50	14	596	5	615	19	8	19	46	37	549	15	601
% Cars	100	100	100	100	100	99.5	100	99.5	100	100	100	100	100	99.3	100	99.3
Trucks	0	0	0	0	0	3	0	3	0	0	0	0	0	4	0	4
% Trucks	0	0	0	0	0	0.5	0	0.5	0	0	0	0	0	0.7	0	0.7

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 4

Groups Printed- Cars

	Elmer Rd From North			Route 111 From East			Elmer Rd From South			Route 111 From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
11:00 AM	0	0	4	5	157	2	6	1	2	6	112	2	297
11:15 AM	0	1	5	5	152	0	3	1	2	5	127	2	303
11:30 AM	1	2	4	3	135	2	5	1	8	15	120	7	303
11:45 AM	0	2	12	1	152	1	5	5	7	7	141	3	336
Total	1	5	25	14	596	5	19	8	19	33	500	14	1239
12:00 PM	1	2	8	3	156	5	3	1	2	8	131	2	322
12:15 PM	3	5	5	3	135	2	3	2	4	7	157	3	329
12:30 PM	0	3	9	8	129	1	5	1	1	5	126	4	292
12:45 PM	0	3	3	0	141	1	1	2	5	10	142	5	313
Total	4	13	25	14	561	9	12	6	12	30	556	14	1256
Grand Total	5	18	50	28	1157	14	31	14	31	63	1056	28	2495
Apprch %	6.8	24.7	68.5	2.3	96.5	1.2	40.8	18.4	40.8	5.5	92.1	2.4	
Total %	0.2	0.7	2	1.1	46.4	0.6	1.2	0.6	1.2	2.5	42.3	1.1	

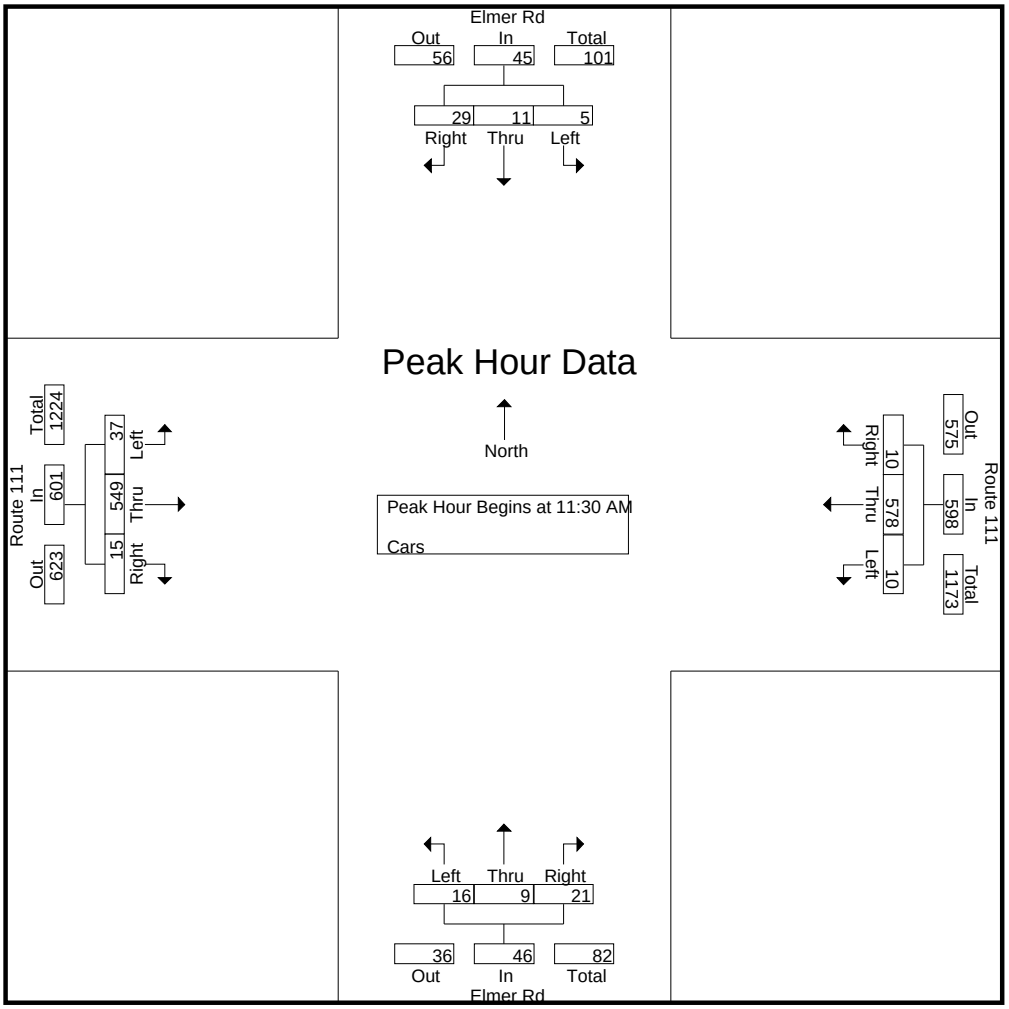
	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 11:30 AM																	
11:30 AM	1	2	4	7	**3**	135	2	140	**5**	1	**8**	14	**15**	120	**7**	142	303
11:45 AM	0	2	**12**	**14**	1	152	1	154	5	**5**	7	**17**	7	141	3	151	**336**
12:00 PM	1	2	8	11	3	**156**	**5**	**164**	3	1	2	6	8	131	2	141	322
12:15 PM	**3**	**5**	5	13	3	135	2	140	3	2	4	9	7	**157**	3	**167**	329
Total Volume	5	11	29	45	10	578	10	598	16	9	21	46	37	549	15	601	1290
% App. Total	11.1	24.4	64.4		1.7	96.7	1.7		34.8	19.6	45.7		6.2	91.3	2.5		
PHF	.417	.550	.604	.804	.833	.926	.500	.912	.800	.450	.656	.676	.617	.874	.536	.900	.960

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 5



Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

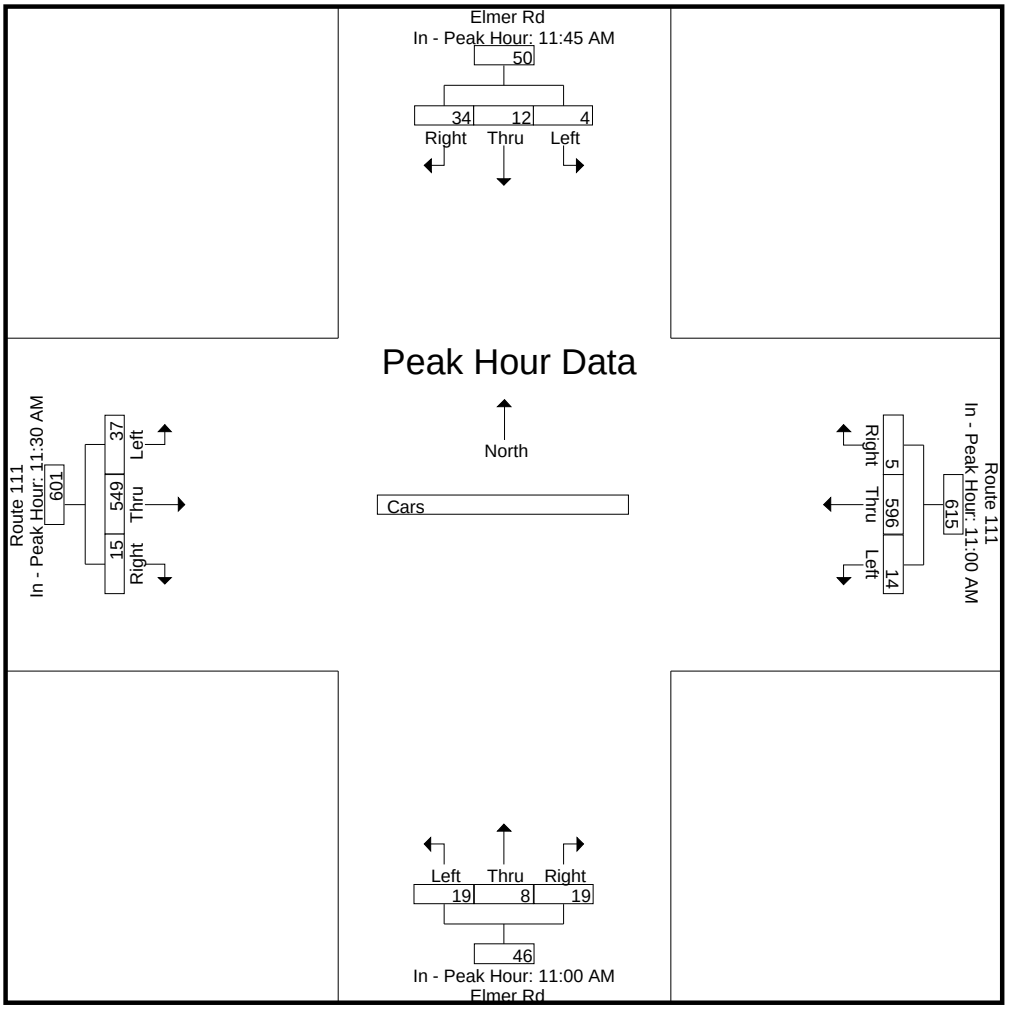
	11:45 AM				11:00 AM				11:00 AM				11:30 AM			
+0 mins.	0	2	**12**	**14**	**5**	**157**	**2**	**164**	**6**	1	2	9	**15**	120	**7**	142
+15 mins.	1	2	8	11	5	152	0	157	3	1	2	6	7	141	3	151
+30 mins.	**3**	**5**	5	13	3	135	2	140	5	1	**8**	14	8	131	2	141
+45 mins.	0	3	9	12	1	152	1	154	5	**5**	7	**17**	7	**157**	3	**167**
Total Volume	4	12	34	50	14	596	5	615	19	8	19	46	37	549	15	601
% App. Total	8	24	68		2.3	96.9	0.8		41.3	17.4	41.3		6.2	91.3	2.5	
PHF	.333	.600	.708	.893	.700	.949	.625	.938	.792	.400	.594	.676	.617	.874	.536	.900

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 6



Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022

Groups Printed- Trucks

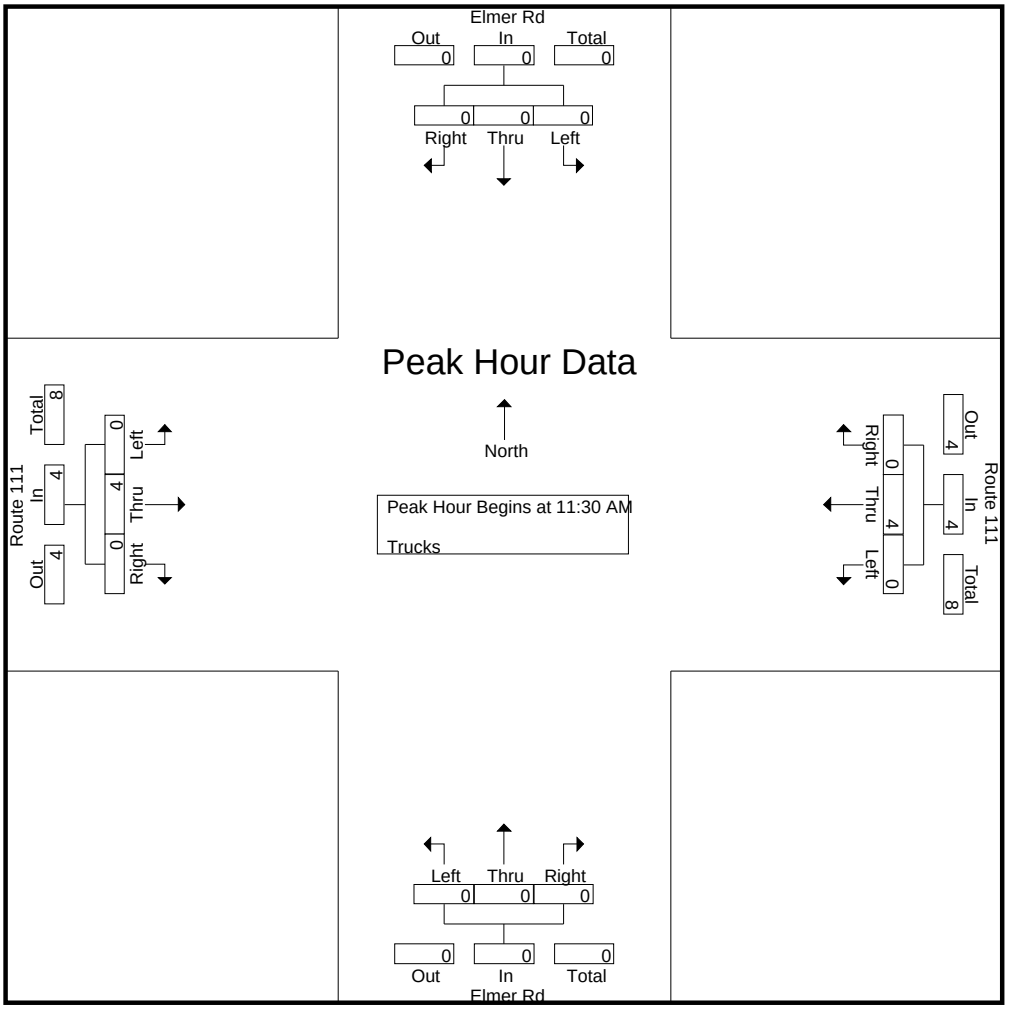
	Elmer Rd From North			Route 111 From East			Elmer Rd From South			Route 111 From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	3	0	0	0	0	0	0	0	3
11:45 AM	0	0	0	0	0	0	0	0	0	0	2	0	2
Total	0	0	0	0	3	0	0	0	0	0	2	0	5
12:00 PM	0	0	0	0	0	0	0	0	0	0	2	0	2
12:15 PM	0	0	0	0	1	0	0	0	0	0	0	0	1
12:30 PM	0	0	0	0	2	0	0	0	0	0	1	0	3
12:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	1
Total	0	0	0	0	3	0	0	0	0	0	4	0	7
Grand Total	0	0	0	0	6	0	0	0	0	0	6	0	12
Apprch %	0	0	0	0	100	0	0	0	0	0	100	0	
Total %	0	0	0	0	50	0	0	0	0	0	50	0	

	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 11:30 AM																	
11:30 AM	0	0	0	0	0	**3**	0	**3**	0	0	0	0	0	0	0	0	**3**
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**	0	**2**	2
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
12:15 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
Total Volume	0	0	0	0	0	4	0	4	0	0	0	0	0	4	0	4	8
% App. Total	0	0	0		0	100	0		0	0	0		0	100	0		
PHF	.000	.000	.000	.000	.000	.333	.000	.333	.000	.000	.000	.000	.000	.500	.000	.500	.667

Accurate Counts
978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 8



Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

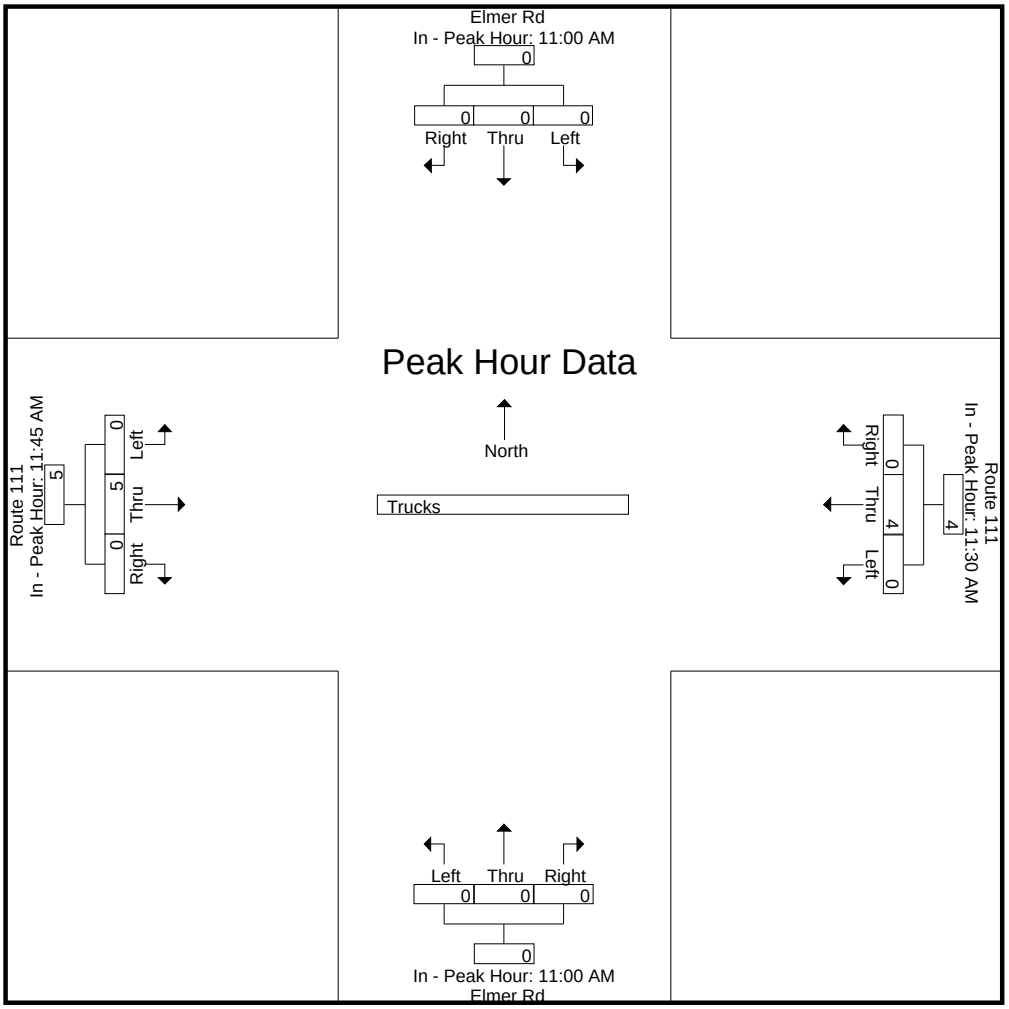
	11:00 AM				11:30 AM				11:00 AM				11:45 AM			
+0 mins.	0	0	0	0	0	**3**	0	**3**	0	0	0	0	0	**2**	0	**2**
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
Total Volume	0	0	0	0	0	4	0	4	0	0	0	0	0	5	0	5
% App. Total	0	0	0		0	100	0		0	0	0		0	100	0	
PHF	.000	.000	.000	.000	.000	.333	.000	.333	.000	.000	.000	.000	.000	.625	.000	.625

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 9



Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 10

Groups Printed- Bikes Peds

	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0		0	0	0		0	0	0		0	0	0				
Total %																	0	0	

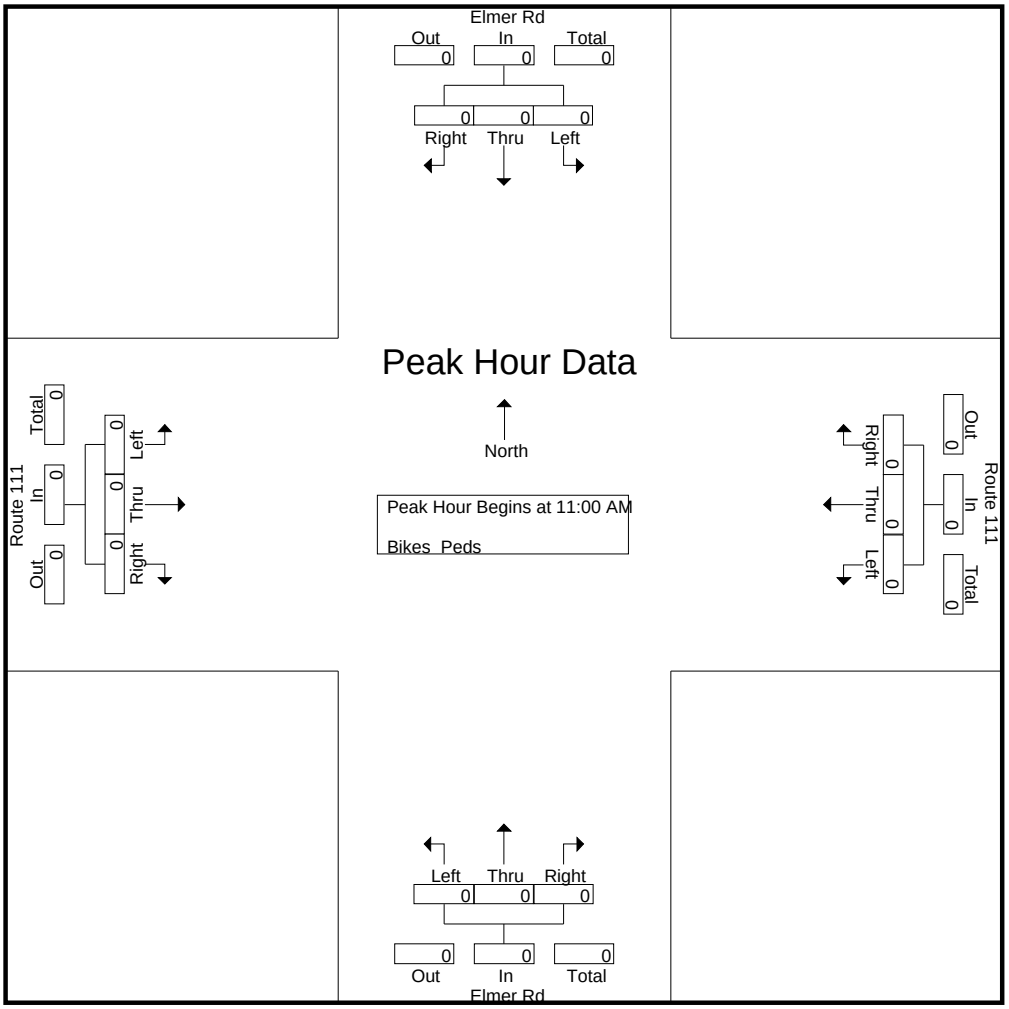
	Elmer Rd From North				Route 111 From East				Elmer Rd From South				Route 111 From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 11:00 AM																	
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 11



Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

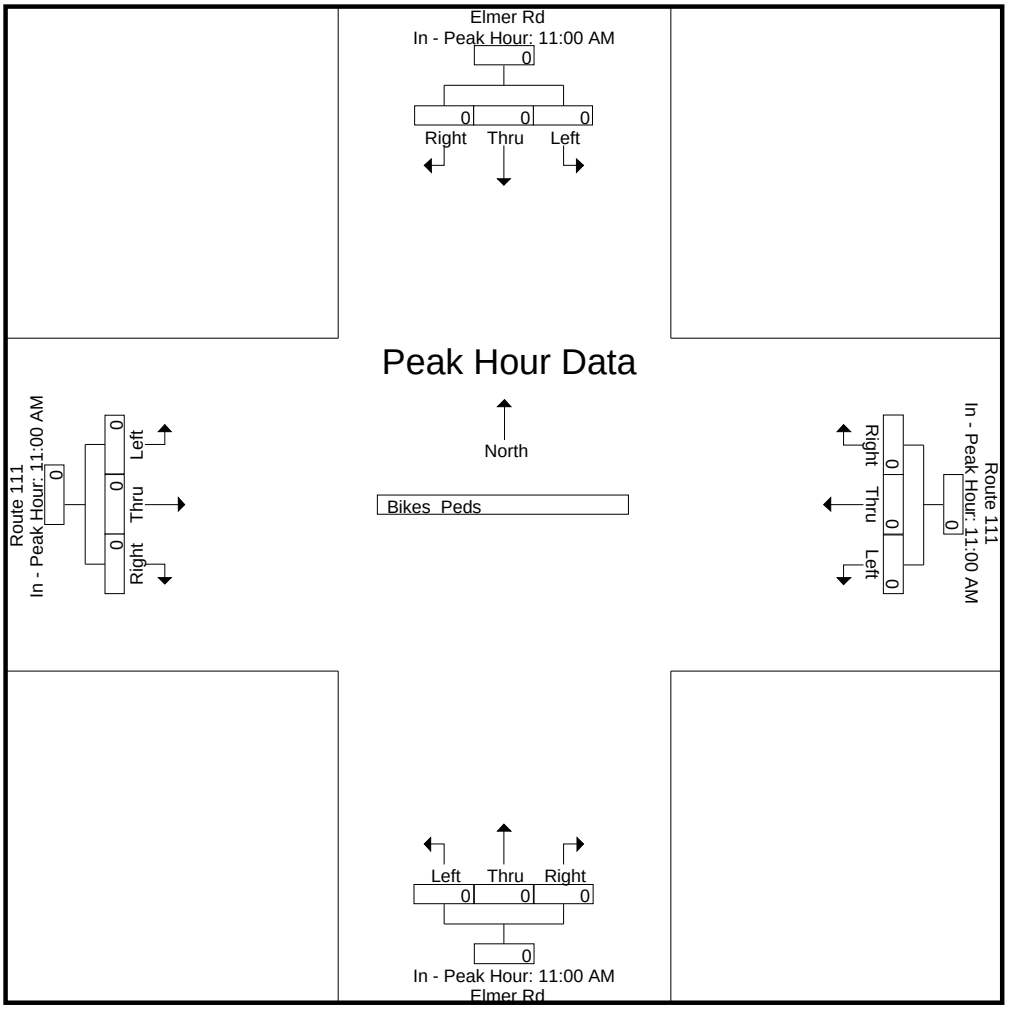
	11:00 AM				11:00 AM				11:00 AM				11:00 AM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0	
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Elmer Road
E/W Street : Route 111
City/State : Salem, NH
Weather : Rain

File Name : 529460S1
Site Code : 52946001
Start Date : 12/3/2022
Page No : 12



APPENDICES

APPENDIX C – Pandemic Adjustment Data

LOCATION INFO	
Location ID	02489001
Type	SPOT
Fnct'l Class	4
Located On	Rockingham Rd
Loc On Alias	NH 28 SOUTH OF LIBBEY RD NORTH INTERSECTION (SB-NB) (01489005-01489006)

Direction	2-WAY
County	ROCKINGHAM
Community	WINDHAM
MPO ID	
HPMS ID	
Agency	New Hampshire DOT

Weekday AM Peak:
585/582 = x 1.005
Weekday PM Peak:
809/807 = 1.002
Weekday Daily:
9,085/9,036 = x 1.005

Time	15-min Interval 1st	2nd	3rd	4th	Hourly Count	% Diff
0:00-1:00	8	6	6	5	25	17.4
1:00-2:00	5	5	5	3	18	25.0
2:00-3:00	4	4	4	3	15	-28.6
3:00-4:00	6	7	6	8	27	16.0
4:00-5:00	14	20	28	35	97	-18.7
5:00-6:00	44	48	65	65	222	-16.5
6:00-7:00	87	90	115	112	404	-10.1
7:00-8:00	115	138	146	139	538	-7.9
8:00-9:00	145	154	157	126	582	-6.2
9:00-10:00	119	116	125	115	475	4.3
10:00-11:00	125	124	136	131	516	11.0
11:00-12:00	138	138	139	141	556	17.0
12:00-13:00	152	143	148	144	587	16.2
13:00-14:00	144	148	149	149	590	7.4
14:00-15:00	170	172	180	187	709	3.0
15:00-16:00	201	201	207	198	807	-2.6
16:00-17:00	200	199	205	192	796	-3.8
17:00-18:00	205	186	159	139	689	5.8
18:00-19:00	130	117	113	105	465	16.8
19:00-20:00	92	79	74	70	315	25.0
20:00-21:00	75	63	61	54	253	29.5
21:00-22:00	50	45	42	38	175	37.3
22:00-23:00	35	30	26	21	112	48.9
23:00-24:00	22	15	14	12	63	17.2
Total	Counts = 22				9036	5.0

Time	60-min Interval 1st	2nd	3rd	4th	Hourly Count	% Diff
0:00-1:00	-	-	-	-	44	70.8
1:00-2:00	-	-	-	-	24	52.6
2:00-3:00	-	-	-	-	21	4.9
3:00-4:00	-	-	-	-	34	38.6
4:00-5:00	-	-	-	-	108	-8.0
5:00-6:00	-	-	-	-	222	-16.5
6:00-7:00	-	-	-	-	437	-2.3
7:00-8:00	-	-	-	-	585	0.5
8:00-9:00	-	-	-	-	540	-13.6
9:00-10:00	-	-	-	-	460	1.1
10:00-11:00	-	-	-	-	458	-0.9
11:00-12:00	-	-	-	-	483	2.9
12:00-13:00	-	-	-	-	531	6.2
13:00-14:00	-	-	-	-	534	-2.6
14:00-15:00	-	-	-	-	600	-13.7
15:00-16:00	-	-	-	-	711	-15.2
16:00-17:00	-	-	-	-	783	-5.5
17:00-18:00	-	-	-	-	809	21.8
18:00-19:00	-	-	-	-	563	35.6
19:00-20:00	-	-	-	-	380	43.2
20:00-21:00	-	-	-	-	290	42.7
21:00-22:00	-	-	-	-	220	58.8
22:00-23:00	-	-	-	-	155	78.0
23:00-24:00	-	-	-	-	93	54.8
Total	Counts = 22				9085	5.5

Count Criteria

Local Id	02489001
Start Date	12/01/2022
End Date	12/31/2022
Aggregation	AVG
Include Abnormal	False
Selected Days	Monday Tuesday Wednesday Thursday Friday

Count Criteria

Local Id	02489001
Start Date	12/01/2019
End Date	12/31/2019
Aggregation	AVG
Include Abnormal	False
Selected Days	Monday Tuesday Wednesday Thursday Friday

LOCATION INFO	
Location ID	02489001
Type	SPOT
Fnct'l Class	4
Located On	Rockingham Rd
Loc On Alias	NH 28 SOUTH OF LIBBEY RD NORTH INTERSECTION (SB-NB) (01489005-01489006)

Direction	2-WAY
County	ROCKINGHAM
Community	WINDHAM
MPO ID	
HPMS ID	
Agency	New Hampshire DOT

Saturday Midday Peak:
685/640 = x 1.070
Saturday Daily:
8,481/7,221 = x 1.174

Time	15-min Interval 1st	2nd	3rd	4th	Hourly Count	% Diff
0:00-1:00	14	8	8	9	39	60.0
1:00-2:00	6	10	7	5	28	66.7
2:00-3:00	5	3	4	4	16	-22.2
3:00-4:00	5	4	4	3	16	-35.9
4:00-5:00	6	13	11	13	43	-92.5
5:00-6:00	15	20	29	25	89	-98.6
6:00-7:00	31	29	31	38	129	-110.4
7:00-8:00	46	56	61	70	233	-85.6
8:00-9:00	65	77	101	98	341	-57.9
9:00-10:00	105	105	115	113	438	-3.8
10:00-11:00	133	135	142	144	554	18.1
11:00-12:00	146	145	156	156	603	25.0
12:00-13:00	157	166	163	154	640	24.8
13:00-14:00	154	153	156	144	607	10.2
14:00-15:00	156	149	141	140	586	-16.0
15:00-16:00	148	144	151	144	587	-34.1
16:00-17:00	137	128	131	128	524	-44.9
17:00-18:00	123	111	112	98	444	-37.7
18:00-19:00	102	95	77	68	342	-13.9
19:00-20:00	75	69	61	63	268	9.0
20:00-21:00	60	56	60	57	233	21.4
21:00-22:00	59	46	47	45	197	48.6
22:00-23:00	52	46	36	30	164	82.8
23:00-24:00	30	27	25	18	100	61.4
Total			Counts = 5		7221	-17.4

Time	60-min Interval 1st	2nd	3rd	4th	Hourly Count	% Diff
0:00-1:00	-	-	-	-	72	109.7
1:00-2:00	-	-	-	-	37	90.2
2:00-3:00	-	-	-	-	21	4.9
3:00-4:00	-	-	-	-	17	-30.0
4:00-5:00	-	-	-	-	44	-90.7
5:00-6:00	-	-	-	-	91	-96.9
6:00-7:00	-	-	-	-	156	-96.5
7:00-8:00	-	-	-	-	259	-76.8
8:00-9:00	-	-	-	-	389	-45.6
9:00-10:00	-	-	-	-	514	12.2
10:00-11:00	-	-	-	-	615	28.4
11:00-12:00	-	-	-	-	685	37.4
12:00-13:00	-	-	-	-	718	36.0
13:00-14:00	-	-	-	-	681	21.6
14:00-15:00	-	-	-	-	698	1.4
15:00-16:00	-	-	-	-	697	-17.2
16:00-17:00	-	-	-	-	635	-26.3
17:00-18:00	-	-	-	-	531	-20.2
18:00-19:00	-	-	-	-	437	10.6
19:00-20:00	-	-	-	-	335	31.0
20:00-21:00	-	-	-	-	263	33.3
21:00-22:00	-	-	-	-	225	60.9
22:00-23:00	-	-	-	-	217	104.6
23:00-24:00	-	-	-	-	144	92.4
Total			Counts = 4		8481	-1.4

Count Criteria

Local Id	02489001
Start Date	12/01/2022
End Date	12/31/2022
Aggregation	AVG
Include Abnormal	False
Selected Days	Saturday

Count Criteria

Local Id	02489001
Start Date	12/01/2019
End Date	12/31/2019
Aggregation	AVG
Include Abnormal	False
Selected Days	Saturday

APPENDICES

APPENDIX C – Seasonal Adjustment Data

Year 2019 Monthly Data

Group 4 Averages: Urban Highways

Month	ADT	Adjustment to Average	Adjustment to Peak
January	11,431	1.12	1.23
February	11,848	1.08	1.18
March	12,141	1.06	1.15
April	12,860	1.00	1.09
May	13,551	0.95	1.03
June	13,785	0.93	1.02
July	13,942	0.92	1.01
August	14,016	0.92	1.00
September	13,379	0.96	1.05
October	13,339	0.96	1.05
November	12,265	1.05	1.14
December	11,496	1.12	1.22

Average ADT: 12,838
Peak ADT: 14,016

GROUP	COUNTER	TOWN	LOCATION
04	02051003	BOW	NH 3A south of Robinson Rd
04	02089001	CHICHESTER	NH 28 (Suncook Valley Rd) north of Bear Hill Rd
04	02091001	CLAREMONT	NH 12/103 east of Vermont SL
04	62099056	CONCORD	NH 106 (Sheep Davis Rd) at Loudon TL (north of Ashby Rd)
04	72099278	CONCORD	US 3 (Fisherville Rd) north of Sewalls Falls Rd
04	02125001	DOVER	Dover Point Rd south of Thornwood Ln
04	02133021	DURHAM	US 4 east of NH 108
04	82197076	HAMPTON	US 1 (Lafayette Rd) south of Ramp to NH 101
04	*02229022*	*HUDSON**	*Circumferential Hwy east of Nashua TL*
04	02253025	LEBANON	NH 120 1 mile south of Hanover TL (south of Lahaye Dr)
04	02255001	LEE	NH 125 (Calef Hwy) north of Pinkham Rd
04	02287001	MARLBOROUGH	NH 12 at Swanzey TL
04	02297001	MERRIMACK	US 3 (Daniel Webster Hwy) north of Hilton Dr
04	*02303001*	*MILFORD**	*NH 101A at Amherst TL (west of Overlook Dr)*
04	*02315051*	*NASHUA**	*NH 111 (Bridge / Ferry St) at Hudson TL*
04	02339001	NEWPORT	NH 10 1 mile south of Croydon TL (north of Corbin Rd)
04	02345001	NORTH HAMPTON	US 1 (Lafayette Rd) north of North Rd
04	*62387052*	*RINDGE**	*US 202 at Jaffrey TL (north of County Rd)*
04	02445001	TEMPLE	NH 101 at Wilton TL (west of Old County Farm Rd)
04	02489001	WINDHAM	NH 28 at Derry TL (north of Northland Rd)

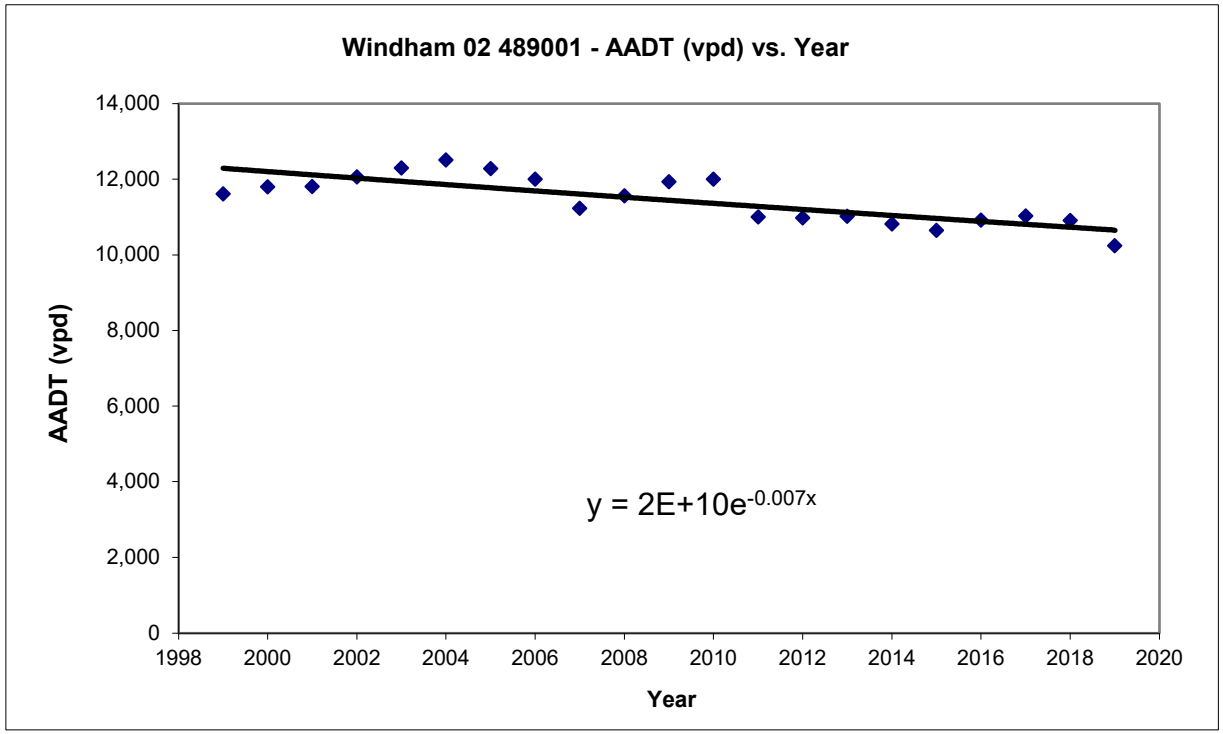
** denotes counter that is not included in calculation*

APPENDICES

APPENDIX C – Historical Traffic Growth Data

Station 02489001
Windham - NH 28 At Derry TL
Group 4
Region E
FC 7

	AADT	Annual Change
1999	11609	
2000	11796	1.61%
2001	11812	0.14%
2002	12062	2.12%
2003	12299	1.96%
2004	12509	1.71%
2005	12284	-1.80%
2006	12000	-2.31%
2007	11232	-6.40%
2008	11563	2.95%
2009	11932	3.19%
2010	12000	0.57%
2011	11000	-8.33%
2012	10978	-0.20%
2013	11019	0.37%
2014	10815	-1.85%
2015	10647	-1.55%
2016	10917	2.54%
2017	11026	1.00%
2018	10914	-1.02%
2019	10246	-6.12%
	CAGR	-0.62%
	Exp	-0.70%
	Avg	-0.66%



APPENDICES

APPENDIX C – 2024 Interim Year Synchro Analysis for Single Lane and Hybrid Roundabouts

Intersection	
Intersection Delay, s/veh	15.9
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	654	1109	37	82
Demand Flow Rate, veh/h	680	1131	37	82
Vehicles Circulating, veh/h	35	46	661	1136
Vehicles Exiting, veh/h	1183	652	54	41
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.3	21.0	5.7	11.2
Approach LOS	A	C	A	B

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	680	1131	37	82
Cap Entry Lane, veh/h	1331	1317	703	433
Entry HV Adj Factor	0.961	0.981	1.000	1.000
Flow Entry, veh/h	654	1109	37	82
Cap Entry, veh/h	1280	1291	703	433
V/C Ratio	0.511	0.859	0.053	0.189
Control Delay, s/veh	8.3	21.0	5.7	11.2
LOS	A	C	A	B
95th %tile Queue, veh	3	12	0	1

Intersection	
Intersection Delay, s/veh	29.3
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	1264	879	87	93
Demand Flow Rate, veh/h	1300	896	90	95
Vehicles Circulating, veh/h	56	92	1280	910
Vehicles Exiting, veh/h	949	1278	76	78
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	43.0	13.4	14.3	9.0
Approach LOS	E	B	B	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	1300	896	90	95
Cap Entry Lane, veh/h	1303	1256	374	545
Entry HV Adj Factor	0.972	0.981	0.967	0.979
Flow Entry, veh/h	1264	879	87	93
Cap Entry, veh/h	1267	1233	362	534
V/C Ratio	0.998	0.713	0.241	0.174
Control Delay, s/veh	43.0	13.4	14.3	9.0
LOS	E	B	B	A
95th %tile Queue, veh	22	7	1	1

Intersection	
Intersection Delay, s/veh	12.6
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	907	896	88	75
Demand Flow Rate, veh/h	915	905	88	75
Vehicles Circulating, veh/h	41	99	899	918
Vehicles Exiting, veh/h	952	888	57	86
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	12.1	13.8	8.6	8.4
Approach LOS	B	B	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	915	905	88	75
Cap Entry Lane, veh/h	1323	1247	552	541
Entry HV Adj Factor	0.991	0.990	1.000	1.000
Flow Entry, veh/h	907	896	88	75
Cap Entry, veh/h	1311	1235	552	541
V/C Ratio	0.691	0.726	0.160	0.139
Control Delay, s/veh	12.1	13.8	8.6	8.4
LOS	B	B	A	A
95th %tile Queue, veh	6	7	1	0

Intersection	
Intersection Delay, s/veh	6.3
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	654	1109	37	82
Demand Flow Rate, veh/h	680	1131	37	82
Vehicles Circulating, veh/h	35	46	661	1136
Vehicles Exiting, veh/h	1183	652	54	41
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.0	6.9	4.9	8.6
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Left
Designated Moves	LT	TR	LT	TR	LTR	LTR
Assumed Moves	LT	TR	LT	TR	LTR	LTR
RT Channelized						
Lane Util	0.471	0.529	0.470	0.530	1.000	1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	4.328
Entry Flow, veh/h	320	360	532	599	37	82
Cap Entry Lane, veh/h	1307	1378	1294	1366	810	541
Entry HV Adj Factor	0.960	0.962	0.980	0.982	1.000	1.000
Flow Entry, veh/h	307	346	521	588	37	82
Cap Entry, veh/h	1255	1327	1268	1341	810	541
V/C Ratio	0.245	0.261	0.411	0.439	0.046	0.152
Control Delay, s/veh	5.0	5.0	6.9	7.0	4.9	8.6
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	1	2	2	0	1

Intersection	
Intersection Delay, s/veh	7.4
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1264	879	87	93
Demand Flow Rate, veh/h	1300	896	90	95
Vehicles Circulating, veh/h	56	92	1280	910
Vehicles Exiting, veh/h	949	1278	76	78
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.0	6.2	10.5	7.3
Approach LOS	A	A	B	A

Lane	Left	Right	Left	Right	Left	Left
Designated Moves	LT	TR	LT	TR	LTR	LTR
Assumed Moves	LT	TR	LT	TR	LTR	LTR
RT Channelized						
Lane Util	0.470	0.530	0.470	0.530	1.000	1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	4.328
Entry Flow, veh/h	611	689	421	475	90	95
Cap Entry Lane, veh/h	1282	1354	1240	1313	478	655
Entry HV Adj Factor	0.972	0.972	0.981	0.981	0.967	0.979
Flow Entry, veh/h	594	670	413	466	87	93
Cap Entry, veh/h	1247	1317	1217	1288	462	641
V/C Ratio	0.477	0.509	0.339	0.362	0.188	0.145
Control Delay, s/veh	7.9	8.1	6.2	6.2	10.5	7.3
LOS	A	A	A	A	B	A
95th %tile Queue, veh	3	3	2	2	1	1

Intersection	
Intersection Delay, s/veh	6.1
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	907	896	88	75
Demand Flow Rate, veh/h	915	905	88	75
Vehicles Circulating, veh/h	41	99	899	918
Vehicles Exiting, veh/h	952	888	57	86
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.8	6.2	6.9	6.8
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Left
Designated Moves	LT	TR	LT	TR	LTR	LTR
Assumed Moves	LT	TR	LT	TR	LTR	LTR
RT Channelized						
Lane Util	0.470	0.530	0.470	0.530	1.000	1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	4.328
Entry Flow, veh/h	430	485	425	480	88	75
Cap Entry Lane, veh/h	1300	1371	1232	1305	661	651
Entry HV Adj Factor	0.991	0.991	0.991	0.990	1.000	1.000
Flow Entry, veh/h	426	481	421	475	88	75
Cap Entry, veh/h	1288	1359	1222	1292	661	651
V/C Ratio	0.331	0.354	0.345	0.368	0.133	0.115
Control Delay, s/veh	5.8	5.9	6.2	6.2	6.9	6.8
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	2	2	2	0	0

APPENDICES

APPENDIX C – 2042 Design Year Synchro Analysis for Single Lane and Hybrid Roundabouts

Intersection	
Intersection Delay, s/veh	31.2
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	722	1302	28	79
Demand Flow Rate, veh/h	751	1327	28	79
Vehicles Circulating, veh/h	38	45	733	1328
Vehicles Exiting, veh/h	1369	716	56	44
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.3	44.9	6.0	14.1
Approach LOS	A	E	A	B

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	751	1327	28	79
Cap Entry Lane, veh/h	1327	1318	653	356
Entry HV Adj Factor	0.962	0.981	1.000	1.000
Flow Entry, veh/h	722	1302	28	79
Cap Entry, veh/h	1276	1293	653	356
V/C Ratio	0.566	1.007	0.043	0.222
Control Delay, s/veh	9.3	44.9	6.0	14.1
LOS	A	F	A	B
95th %tile Queue, veh	4	23	0	1

Intersection	
Intersection Delay, s/veh	60.8
Intersection LOS	F

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	1479	994	95	79
Demand Flow Rate, veh/h	1521	1013	98	81
Vehicles Circulating, veh/h	46	105	1490	1030
Vehicles Exiting, veh/h	1064	1483	77	88
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	94.5	18.6	19.7	10.0
Approach LOS	F	C	C	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	1521	1013	98	81
Cap Entry Lane, veh/h	1317	1240	302	483
Entry HV Adj Factor	0.972	0.981	0.969	0.980
Flow Entry, veh/h	1479	994	95	79
Cap Entry, veh/h	1280	1216	293	473
V/C Ratio	1.155	0.817	0.325	0.168
Control Delay, s/veh	94.5	18.6	19.7	10.0
LOS	F	C	C	A
95th %tile Queue, veh	39	10	1	1

Intersection	
Intersection Delay, s/veh	18.9
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	1066	1048	84	73
Demand Flow Rate, veh/h	1076	1058	84	73
Vehicles Circulating, veh/h	39	111	1055	1070
Vehicles Exiting, veh/h	1104	1028	60	99
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	17.3	21.8	10.2	10.0
Approach LOS	C	C	B	B

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	1076	1058	84	73
Cap Entry Lane, veh/h	1326	1232	470	463
Entry HV Adj Factor	0.991	0.990	1.000	1.000
Flow Entry, veh/h	1066	1048	84	73
Cap Entry, veh/h	1314	1220	470	463
V/C Ratio	0.811	0.859	0.179	0.158
Control Delay, s/veh	17.3	21.8	10.2	10.0
LOS	C	C	B	B
95th %tile Queue, veh	10	12	1	1

Intersection	
Intersection Delay, s/veh	7.1
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	722	1302	28	79
Demand Flow Rate, veh/h	751	1327	28	79
Vehicles Circulating, veh/h	38	45	733	1328
Vehicles Exiting, veh/h	1369	716	56	44
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.3	8.0	5.1	10.3
Approach LOS	A	A	A	B

Lane	Left	Right	Left	Right	Left	Left
Designated Moves	LT	TR	LT	TR	LTR	LTR
Assumed Moves	LT	TR	LT	TR	LTR	LTR
RT Channelized						
Lane Util	0.470	0.530	0.470	0.530	1.000	1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	4.328
Entry Flow, veh/h	353	398	624	703	28	79
Cap Entry Lane, veh/h	1303	1375	1295	1367	762	459
Entry HV Adj Factor	0.961	0.962	0.980	0.981	1.000	1.000
Flow Entry, veh/h	339	383	612	690	28	79
Cap Entry, veh/h	1253	1322	1270	1341	762	459
V/C Ratio	0.271	0.289	0.482	0.514	0.037	0.172
Control Delay, s/veh	5.3	5.3	7.9	8.1	5.1	10.3
LOS	A	A	A	A	A	B
95th %tile Queue, veh	1	1	3	3	0	1

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1479	994	95	79
Demand Flow Rate, veh/h	1521	1013	98	81
Vehicles Circulating, veh/h	46	105	1490	1030
Vehicles Exiting, veh/h	1064	1483	77	88
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.3	6.8	13.5	7.9
Approach LOS	A	A	B	A

Lane	Left	Right	Left	Right	Left	Left
Designated Moves	LT	TR	LT	TR	LTR	LTR
Assumed Moves	LT	TR	LT	TR	LTR	LTR
RT Channelized						
Lane Util	0.470	0.530	0.470	0.530	1.000	1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	4.328
Entry Flow, veh/h	715	806	476	537	98	81
Cap Entry Lane, veh/h	1294	1366	1226	1299	400	592
Entry HV Adj Factor	0.972	0.973	0.981	0.981	0.969	0.980
Flow Entry, veh/h	695	784	467	527	95	79
Cap Entry, veh/h	1258	1328	1203	1274	388	580
V/C Ratio	0.553	0.590	0.388	0.413	0.245	0.137
Control Delay, s/veh	9.1	9.5	6.8	6.9	13.5	7.9
LOS	A	A	A	A	B	A
95th %tile Queue, veh	4	4	2	2	1	0

Intersection	
Intersection Delay, s/veh	6.9
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1066	1048	84	73
Demand Flow Rate, veh/h	1076	1058	84	73
Vehicles Circulating, veh/h	39	111	1055	1070
Vehicles Exiting, veh/h	1104	1028	60	99
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	6.5	7.1	8.0	7.9
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Left
Designated Moves	LT	TR	LT	TR	LTR	LTR
Assumed Moves	LT	TR	LT	TR	LTR	LTR
RT Channelized						
Lane Util	0.470	0.530	0.470	0.530	1.000	1.000
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.328	4.328
Entry Flow, veh/h	506	570	497	561	84	73
Cap Entry Lane, veh/h	1302	1374	1219	1292	579	572
Entry HV Adj Factor	0.990	0.991	0.991	0.990	1.000	1.000
Flow Entry, veh/h	501	565	492	555	84	73
Cap Entry, veh/h	1290	1362	1208	1279	579	572
V/C Ratio	0.389	0.415	0.408	0.434	0.145	0.128
Control Delay, s/veh	6.5	6.6	7.1	7.1	8.0	7.9
LOS	A	A	A	A	A	A
95th %tile Queue, veh	2	2	2	2	1	0

APPENDICES

APPENDIX D – Photo Documentation of Existing Conditions

View of intersection from Ermer Road, facing NW.

View of intersection from southbound Ermer Road, facing SE.

View along the south edge of NH111 East from the SE corner of the NH111-Ermer Road intersection. Note the vegetation at the bottom of the slope leading away from the road.

View facing SW, across Ermer Road, down the south edge of NH111 West.

View facing SW away from intersection down NH111 West. Note the slope leading form the roadway.

View of SW corner of Ermer Road and NH111, facing NW.

View of eastern edge of Ermer Road, facing S. Note the proximity of the utility pole as well as the location of the edge of pavement.

View along west side of Ermer Road, facing S. Note the proximity of the building to the edge of pavement as well as the height of the embankment.

View toward eastbound NH111 from Ermer Road, pointed NE. Note the proximity of the light pole to the edge of pavement as well as the slope leading away from the roadway.

View on the north side of NH111 West from Ermer Road, pointed SW. Note the proximity of the utility pole to the edge of pavement. Note the slope as well leading away from the roadway as well as the vegetation at the bottom of the slope.

View facing north on the NW corner of Ermer Road and NH111. Note the culvert in the foreground as well as the utility pole

View on the northeast corner of Ermer and NH111 looking toward the intersection, facing SW. Note the culvert outlet in the foreground.

View facing NE down NH111 East away from the intersection. Note that ahead on the left edge is the catch basin.

Close up of catch basin on western edge of Eastbound NH111.

View over the western edge on eastbound NH111. The existing culvert is not visible from the roadway.

View over the eastern edge of eastbound NH111, facing SE. Culvert not visible from roadway.

View facing SW toward the Ermer Road-NH111 intersection from NH111 east of intersection. Note centerline and edgeline rumble strips.

View facing NE toward the Ermer Road-NH111 intersection from NH111 west of intersection.

View facing SW toward the intersection from NH111. Note the oncoming vehicle traveling NE attempting a left turn onto Ermer Road, causing the vehicle behind them to overtake them.

View facing NE toward intersection from east edge of NH111. Note the blue vehicle attempting to make a left turn, causing the white vehicle to overtake them.