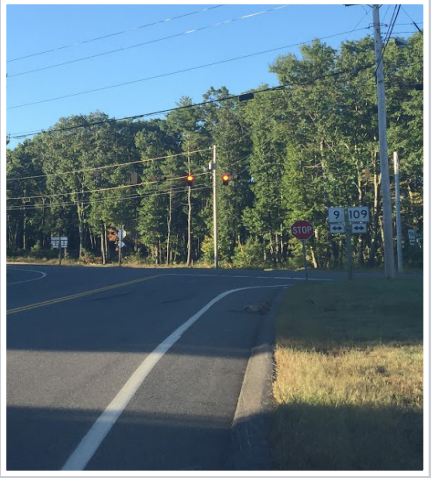

ROUTE 109
CORRIDOR STUDY

July 11, 2017

FINAL REPORT

Prepared for:

MaineDOT
Maine Turnpike Authority
Town of Wells

TY LIN INTERNATIONAL

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EXECUTIVE SUMMARY

The Town of Wells, the Maine Department of Transportation (MaineDOT), and the Maine Turnpike Authority (MTA) have come together in a collaborative effort to consolidate improvement recommendations for the east-west Route 109 corridor. To assist with this, MaineDOT has contracted with T. Y. Lin International (TYLI) to perform a corridor study of Route 109 in Wells from the westerly intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road 1.5 miles east to the Intersection of Routes 109 and 9 (Sanford Road) and Chapel Road. This Wells Route 109 Corridor Study (Study) develops recommendations that consider a balance of future corridor growth, safety concerns in the corridor, and multimodal mobility. The primary study goals are the following:

1. Evaluate the potential for adding additional capacity on Route 109 to increase mobility.
2. Identify cost-effective safety improvements at intersections and other High Crash Locations (HCLs) in the Study Area.
3. Maintain safe and efficient access to and from the Turnpike.
4. Consider separating local and through traffic as much as practicable.
5. Evaluate access management conditions with the intent of improving access to Route 109.

ES-1: Existing Transportation Data

A significant amount of existing transportation data was compiled for this study from previously gathered MaineDOT data and other resources including:

- **Average Annual Daily Traffic Volumes (AADT)** – According to tube counts performed by MaineDOT in 2013, the highest traffic volume on Route 109 in the study area is located east of the Maine Turnpike Exit 19 Ramps (16,300 vehicles per day) and the west of the Maine Turnpike Exit 19 Ramps (15,150 vehicles per day). West of Chapel Road there were approximately 14,970 vehicles per day in 2013, and southeast of Branch Road there were 8,800 vehicles per day.
- **Intersection Turning Movement Volumes** – With the exception of Chapel Road (counted in 2013), all turning movement counts were performed in July of 2016. These were 12 hour counts conducted from 6am to 6pm by MaineDOT at the following locations:
  - Route 109 (Sanford Road) and Branch Road/Crediford Road – July 21, 2016 (Thursday)
  - Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street – July 14, 2016 (Thursday)
  - Routes 109 & 9 (Sanford Road) and Maine Turnpike Exit 19/Wells Transportation Center – July 14, 2016 (Thursday)
  - Routes 109 & 9 (Sanford Road) and Spencer Drive – July 14, 2016 (Thursday)
  - Routes 109 & 9 (Sanford Road) and Chapel Road – August 15, 2013 (Thursday)
- **Vehicle Classification** – Heavy vehicle percentages were recorded as part of the turning movement counts in the corridor. Heavy vehicle volumes were observed entering and exiting Spencer Drive – a large warehouse area. In addition heavy vehicles were also observed at the Maine Turnpike Exit 19 intersection both exiting the Turnpike and related to movements at the Wells Transportation Center. A large

heavy vehicle percentage was also observed between Garden Street and North Berwick Road.

- **Bicycle/Pedestrian Volumes** – While only one pedestrian was observed during peak count periods, there are no pedestrian facilities and few bicycle facilities available for use.
- **Speed Study** – Travels speeds were recorded by MaineDOT on September 27, 2016 at 777 Sanford Road – just west of the Turnpike, and under the Turnpike Bridges from 10:30 – 11:30 am and 12:10 – 1:10 pm respectively. The studies indicate that there is some speeding in the corridor – vehicles at 777 Sanford Road are traveling at approximately 4-7 mph over the speed limit (westbound and eastbound respectively, while vehicles under the Turnpike bridges are traveling approximately 9 mph over the speed limit for both directions (according to the 85th percentile speeds).
- **Crash History** – There are two high crash locations within the corridor, and another intersection with a significant number of crashes:
  - **Route 109 (Sanford Road) and Branch Road/Crediford Road:** There were 21 crashes from 2013 – 2015 with a Critical Rate Factor (CRF) of 4.64. The majority of crashes (19) were caused by a failure to yield and are possibly correctable by a signal. One crash resulted in a minor injury and seven crashes resulted in a possible injury.
  - **Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street:** There were 14 crashes from 2013 to 2015 with a CRF of 2.38. The majority of crashes were caused by a combination of driver inattention and following too closely on northbound on Route 9 (North Berwick Road). One crash resulted in a serious injury and three crashes resulted in possible injuries.
  - **Routes 109 and 9 (Sanford Road) and Maine Turnpike Exit 19/Wells Transportation Center:** While not an HCL, there were 22 crashes from 2013 – 2015 with a CRF of 0.78. The majority of crashes were related to rear-end collisions where drivers were following too closely, speeding or distracted. Of the 22 crashes, 10 occurred in December and January. Two of the crashes resulted in injuries and four resulted in possible injuries.
- **Existing Intersection Level of Service:**
  - The unsignalized intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road operates with little to no delay on the free-flow mainline and substantial delays to the stopped minor approaches.
  - The unsignalized intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street operates with little to no delay on the free-flow mainline and approximately 30-50 seconds of delay on the stopped minor approaches.
  - The signalized intersection of Routes 109 & 9 (Sanford Road) and Maine Turnpike Exit 19/Wells Transportation Center operates acceptably but at capacity for many movements during the AM and PM Peak Hours.
  - The unsignalized intersection of Routes 109 & 9 (Sanford Road) and Spencer Drive experiences acceptable levels of service during the existing condition with very minor delays on Spencer Drive while waiting for a gap to get out.
  - The signalized intersection of Route 109 & 9 (Sanford Road) and Chapel Road experiences delays during westbound from vehicles turning left onto Chapel Road during the AM and PM Peaks are seen.
- **Signal Warrant Analysis** – Signal warrant evaluations were conducted at the intersections of Route 109 (Sanford Road) and Branch Road/Crediford Road and Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street. Both intersections met basic signal warrants. The intersection of Route 9 (North Berwick Road)/Garden Street was also evaluated alternately because of the high volume of through traffic opposing left turning movements. This also met signal warrants.

- **MaineDOT Customer Service Levels –** MaineDOT has a process for prioritizing highway and bridge candidate projects for the biennial work plan according to Customer Service Levels (CSLs). MaineDOT has provided CSL ratings regarding Safety, Condition and Service for this corridor. Facilities are rated on an A-F scale, with A being the best and F being the worst.
  - **Safety CSL:** The Safety CSL includes consideration of Crash History, Paved Roadway Width, Pavement Rutting, and Bridge Reliability. The corridor ranges from A-B on the mainline and C-D on Crediford and Branch Roads respectively.
  - **Condition CSL:** The Condition CSL includes consideration of Pavement Condition, Roadway Strength, Bridge Condition, and Ride Quality. The corridor ranges from A-B on the mainline.
  - **Service CSL:** The Service CSL includes consideration of posted roads and congestion. With the exception of the eastbound approach at the Turnpike Exit 19 Intersection that has a C rating and the stretch from Chapel Road west to the Turnpike Exit 19 intersection that has a D rating, the remainder of the corridor has A-B ratings.
- **Access Management –** There are several noted access management deficiencies throughout the corridor related to entrance separation, intersection corner clearance, number of entrances and drive locations. These are noted in **Table 1.**

TABLE 1: ACCESS MANAGEMENT DEFICIENCIES

Location	Deficiencies
Route 109 and Branch Road/Crediford Road	Too many driveways Inadequate corner clearance Drive location on mainline
Route 109 between Branch Road/Crediford Road and Route 9/Garden Street	Driveway spacing standards not met
Route 109 at Route 9/Garden Street	Does not meet minimum corner clearance requirements
Routes 9/109 between Route 9/Garden Street and MTA Exit 19	Inadequate drive spacing requirements
Routes 9/109 bewteen MTA Exit 19 and Spencer Drive	Inadequate drive spacing requirements
Routes 9/109 between Spencer Drive and Chapel Road	Inadequate drive spacing requirements

ES-2: No-Build Future Background Growth Projections

Analysis was conducted for a 20 year growth of the study area traffic volumes, representing the year 2036. Through a combined effort with the Town, MTA, and MaineDOT, future growth percentages for each intersection turning movement were determined with the basic premise being that through traffic growth was approximately 20%, the Turnpike traffic growth was approximately 30% and side streets varied based on anticipated development.

ES-3: Future Recommendations

- **Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road:**
  - Installation of traffic signal
  - Preliminary planning cost: $200,000
- **Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street:**
  - Restrict movements to and from Nella Street with flush Route 109 island
  - Remove Route 9 island and modify approach to a combined through-left and right approach.
  - Add left turn on Route 109 westbound onto Route 9
  - Preliminary planning cost: $230,000
- **Intersection of Routes 109 & 9 (Sanford Road) and Maine Turnpike Exit 19/Wells Transportation Center:**
  - Add adaptive signal control and update signal heads
  - Modify eastbound Route 109 approach to a double left and through-right
  - Install two overhead guide sign structures on eastbound Route 109
  - Extend the two eastbound Route 109 departure lanes by 250 feet
  - Widen for bike lanes
  - Modify existing drainage structures as needed
  - Preliminary planning cost: $670,000
- **Intersection of Routes 109 & 9 (Sanford Road) and Spencer Drive:**
  - Lengthen left turn bay eastbound onto Spencer Drive
  - Separate left and right lanes at Spencer Drive approach
  - Extend the turn bay on Spencer Drive
  - Modify the island on Spencer Drive
  - Preliminary planning cost: $55,000
- **Intersection of Route 109 & 9 (Sanford Road) and Chapel Road:**
  - Add permissive-protected phase for westbound Route 109 left-turn and update the signal heads accordingly.
  - Widen eastbound Route 109 approach to allow right turning vehicles space to get by through vehicles.
  - Preliminary planning cost: $130,000
- **Pedestrian Improvements:**
  - A sidewalk from the entrance to the Wells Transportation Center east to the existing sidewalk will be construction. This includes signal upgrades at Chapel Road
  - The sidewalk will be a 5 foot bituminous sidewalk
  - Preliminary planning cost: $975,000
- **Bicycle Improvements:**
  - A minimum of 5 ft shoulders are to be striped for bicycle use
  - With the exception of the widening at Route 9, all other widening is paid for as part of vehicular improvements and/or implemented as part of narrowing lanes and restriping shoulders
  - Preliminary planning cost: $95,000

ES-4: Public Involvement

Three meetings were held with the Steering Group to develop preliminary recommendations:

- **Project Kick-off Meeting:** Held June 16, 2016 to discuss corridor challenges and needs for improvement.
- **Existing Conditions Review**: Held November 28, 2016 to discuss a review of existing conditions for the corridor including traffic volumes, operations, safety, bicycle and pedestrian accessibility, etc. Future growth projections and estimated future conditions with no improvements were also discussed.
- **Recommendations Review**: Held December 16, 2016 to discuss possible recommendations for alleviating corridor congestion, improving safety, and adding pedestrian and bicycle facilities.
- **Public Meeting**: A public meeting was held February 6, 2017 at the Wells High School Auditorium. The meeting was attended by MaineDOT, Maine Turnpike Authority, T. Y. Lin International and the Town of Wells.
- **Report Review**: A meeting was held March 27, 2017 at the Town of Wells. The meeting was attended by MaineDOT, Maine Turnpike Authority, TYLin International and the Town of Wells and discussed final recommendations and modifications for the project.

SECTION 1: INTRODUCTION

T.Y. Lin International (TYLI) was contracted by the Maine Department of Transportation (MaineDOT) to perform a study of 1.5 miles of Route 109 in Wells, Maine that carries approximately 16,000 vehicles per day as shown in **Figure 1**. The corridor is a key York County east-west roadway and services connections to local residential land uses, businesses along Route 109, York County Community College, coastal recreational destinations, and functions as an alternative to Route 1.

Route 109 is a Priority 1 Corridor classified to the west of the Maine Turnpike Exit 19 as an "Other Principal Arterial" and to the east as a "Minor Arterial." There are three bridges in the study limits: Bridge Number 1479, 1323, and 3200. Both Bridges 1479 and 1323 carry vehicles on I-95 over Route 109 (Southbound and Northbound respectively). Bridge 3200 carries vehicles over the B&M Railroad.

While incremental changes have improved intersections along the corridor, a longer-term assessment of the corridor is needed to address concerns of growing traffic volumes, heavy truck volumes, development opportunities, and a high incidence of crashes.

The Route 109 Corridor Study is intended to develop recommendations that will address current concerns and future development needs of vacant land in the Route 109 area. The study scope includes the following:

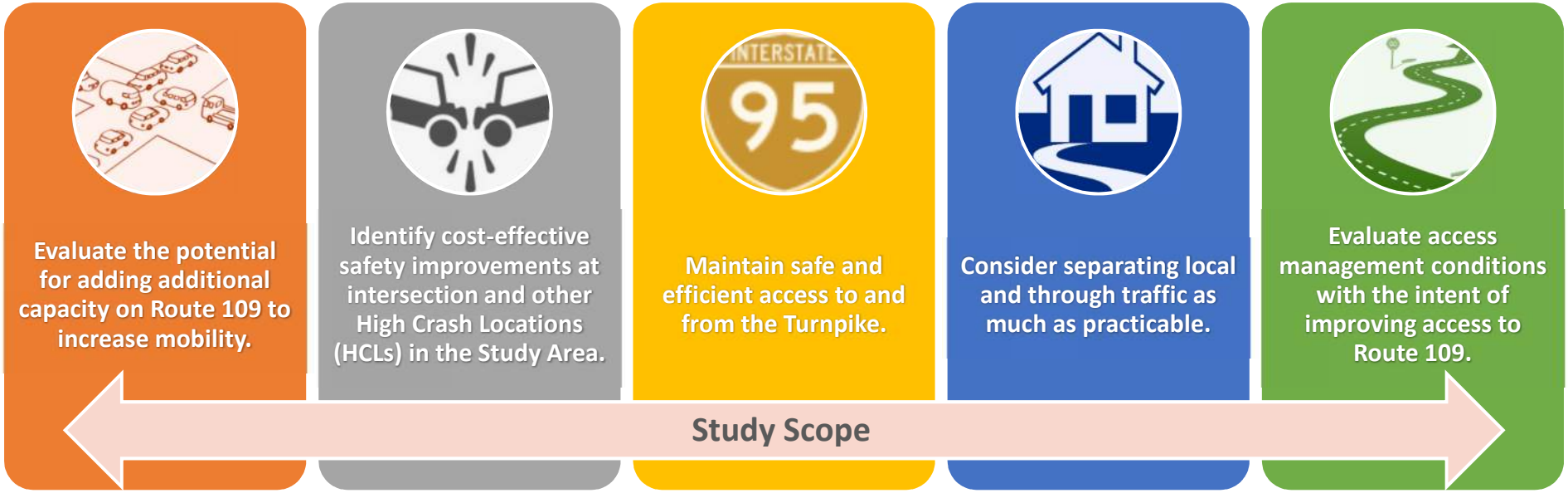


FIGURE 1: STUDY AREA

SECTION 2: EXISTING CONDITIONS

2.1: Review of Available Data

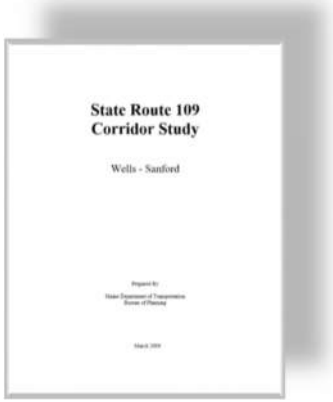
The Route 109 corridor is an east-west corridor located in the southerly part of Maine in York County. As shown in **Figure 1**, the study section is located in Wells, from the intersection with Branch Road to the intersection with Chapel Road, approximately 1.5 miles in length. Regional and local traffic on side roads and at the interstate has increased, causing mobility pressure along the corridor. In addition, there are two high crash locations on the corridor highlighting safety concerns and a review of pedestrian and bicycle facilities is included. In order to provide recommendations for improvements, existing conditions have been studied and are summarized in the section as follows.

2.1.1: Known Materials

There are several relevant studies and documents that pertain to the Route 109 Corridor Study. The information in these studies identified short and long term corridor concerns as well as previous ideas and attempts to improve the corridor. The studies will provide the baseline for this study and include but are not limited to the following:

Town of Wells, Maine Comprehensive Plan Update

The Town of Wells Comprehensive Plan Update, from February 2005 was submitted by the Southern Maine Regional Planning Commission in cooperation with the Town of Wells Planning Department. The Plan outlines the vision for Wells "…to preserve and promote Wells' small-town historic traditional rural New England seacoast community character, appearance and values for a better quality of life."



March 2006 Maine State Route 109 Corridor Study

The March 2006 State Route 109 Corridor Study from Wells to Sanford was prepared by the MaineDOT Bureau of Planning. The document outlines existing conditions of the corridor, future conditions of the roadway, signalized and unsignalized intersections, and future recommendations. Among other things, the report recommends realigning the intersection of Branch Road and Route 109, the implementation of connector roads, access management techniques and raised median islands.

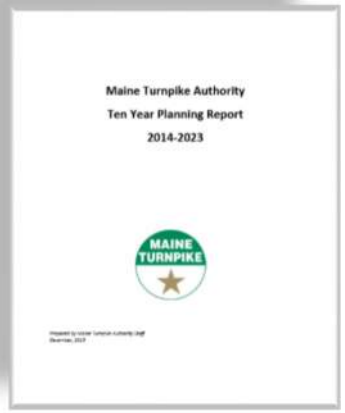
Central York County Connections Study

The goal of the Central York County Connections Study "is to identify a series of recommendations designed to preserve or enhance transportation connections between central York County, US Route 1 and the Maine Turnpike." The study proposes adding a second left turn lane from Maine Turnpike Exit 19 to eastbound Route 109 and extending the second eastbound lane on Route 109 beyond the Maine Turnpike overpass. It also recommends upgrading signal controllers and detection to Adaptive Signal Control (and regularly retiming the signals until it is implemented).

Wells Sidewalk Development Plan

The Wells Sidewalk Development Plan was prepared in combination with the Wells Comprehensive Plan and guides sidewalk construction in the area. The study area along Route 109 begins at the Wells Transportation Center and continues east towards Route 1. The project includes sidewalks along the southerly side of Route 109 for the entire stretch to Route 1 and proposes a sidewalk along the northerly side from Chapel Road to Route 1. To accomplish the sidewalk construction, poles, signs, and mailboxes would need to be relocated, some areas of roads widened (along steep embankment areas), and trees would need to be removed.

Maine Turnpike Authority Ten Year Planning Report 2014 – 2023



The Maine Turnpike Authority Ten Year Planning Report was prepared by Maine Turnpike Authority Staff dated December 2013. The plan serves to identify major transportation projects and to identify and address anticipated needs. The report provides this information with neighboring communities, transportation partners, and other stakeholders. With relevance to the Route 109 corridor, it recommended proceeding with the additional left-turn lane on the Turnpike Exit 19 approach to Route 109. (Note: This intersection improvement has been implemented at the intersection of the Exit 19 On and Off Ramps, the Wells Transportation Center and Route 109 and 9 as part of a subsequent project).

Exit 19/Route 109 Memorandum from TYLI to the MTA (November 26, 2014)

In the memorandum dated November 26, 2014 from TYLI to the Maine Turnpike Authority, TYLI evaluated the introduction of a second left-turn lane (shared with the through movement to the Wells Transportation Center) from the Turnpike Exit 19 approach to Route 109 and necessary modifications to the traffic signal as recommended by the MTA's 10 year report. This change was subsequently constructed along with additional signal upgrades that included a new controller cabinet (resulting from a crash).

Memorandum from Wells Town Manager to the MaineDOT Commissioner (December 21, 2015)

This memorandum seeks funding to update a portion of the 2006 Route 109 Corridor Study. The update was requested to help alleviate the effects of increased vehicular traffic along the corridor by commuters and users traveling on Route 9A as a bypass road and to continue to improve the corridor as it continues to grow and serve the local and visiting community.

2.1.2: Hourly Traffic Variation

Average hourly traffic volume variation was derived from data collected between August 2013 and 2014 at the permanent count station on the MTA Exit 19 Ramps, north of Route 109. This permanent count station provides seasonal, weekly, and time of day travel patterns in the study area. **Figure 2** illustrates hourly volume variation using the average total volume for each hour of the day during this one year period. It separates lines into the average weekday, Friday, Saturday, and Sunday for a total 24 hour duration. **Figure 2** shows a distinctive morning and afternoon peak during the week with a mid-day peak on the weekend. This follows true in both peaks and volumes for spring, fall, and winter; however summer shows a slightly less distinctive peak, as depicted on **Figure 3**.

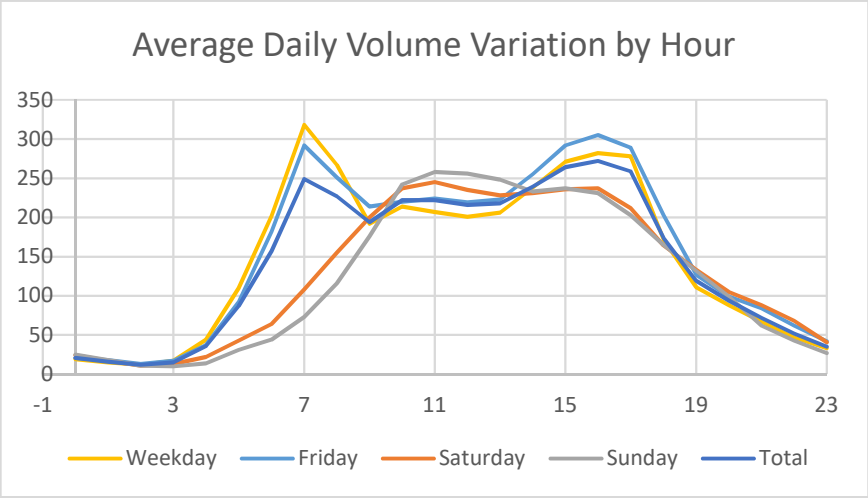


FIGURE 2: AVERAGE DAILY VOLUME VARIATION BY HOUR

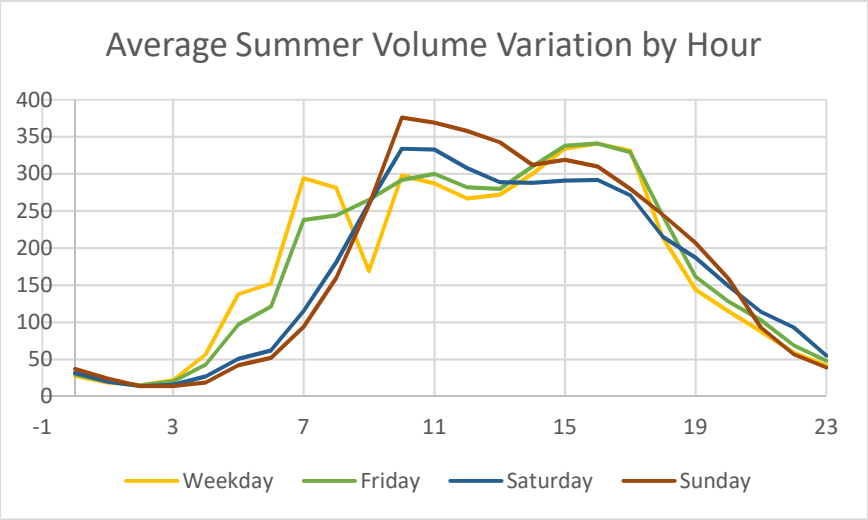


FIGURE 3: AVERAGES SUMMER VOLUME VARIATION BY HOUR

The permanent count station was also examined in order to determine the highest hours of the year. Of the top 30 highest hours, the common time periods were found to be summer and holiday weekends. The 30th highest hourly volume is approximately 16% higher than the 100th highest hourly volume.

2.1.3: Monthly Traffic Volume Variation

Monthly variation is presented in a similar manner to the hourly variation. The average total volume at the Turnpike permanent count station (August 2013 – July 2014) for each month is illustrated on **Figure 4**. Similar to other tourist areas, July has the highest average monthly total followed by August and June, while the winter months of January and February have the least.

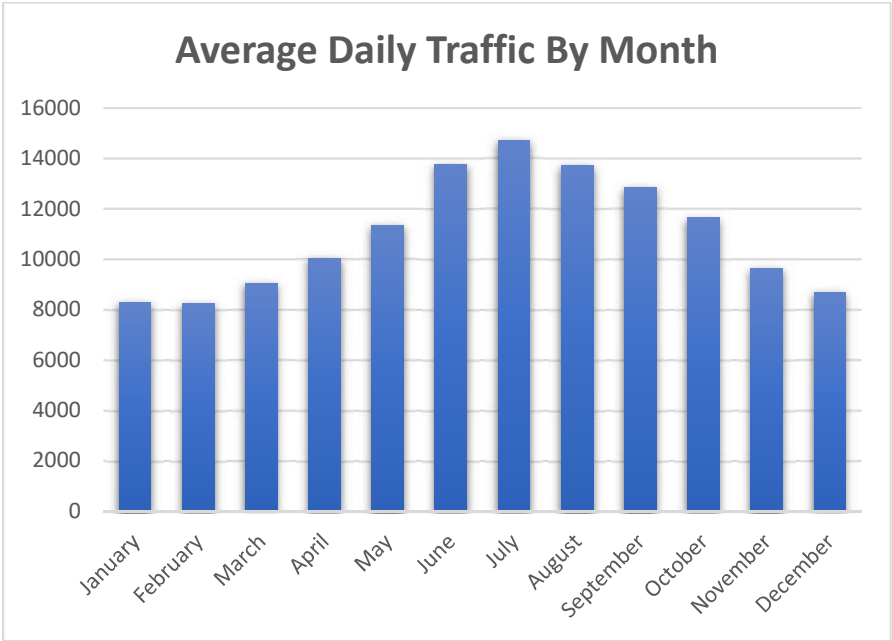


FIGURE 4: AVERAGE DAILY TRAFFIC BY MONTH

2.1.4: Intersection Turning Movement Volumes

Intersection turning movement counts were conducted by MaineDOT as noted in **Table 2**. All of the counts were 12 hour counts performed by MaineDOT using Scout video monitors and verified by tube counters during the summer of 2016 with the exception of Chapel Road (counted in 2013).

TABLE 2: INTERSECTION TURNING MOVEMENT COUNT LOCATIONS

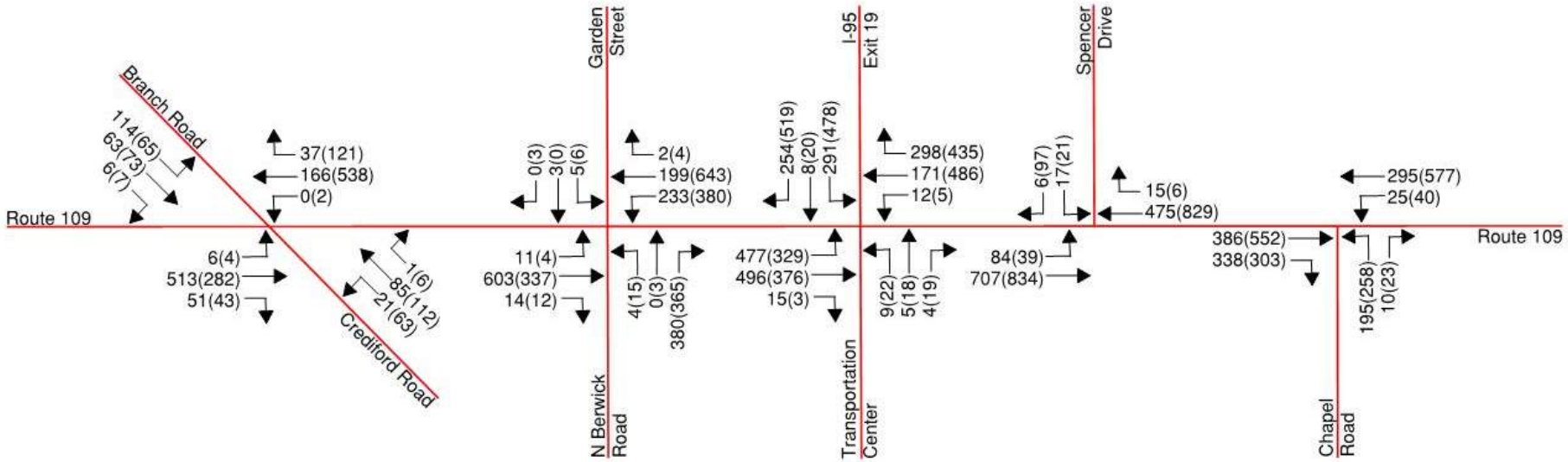
Mainline	Minor Road	Date	Day	Weather
Route 109	Branch Road Crediford Road	7/21/2016	Thursday	Sunny
Routes 9/109	Garden Street/ Route 9	7/14/2016	Thursday	Sunny
Routes 9/109	Turnpike Exit 19 Wells Trans. Ctr.	7/14/2016	Thursday	Sunny
Route 9/109	Spencer Drive	7/14/2016	Thursday	Sunny
Routes 9/109	Chapel Road	8/15/2013	Thursday	Sunny

Peak hours for each location were determined to help balance volumes throughout the corridor. An AM Peak Hour and a PM Peak Hour was selected for analysis. The peak hour for each intersection and the overall corridor peak hour are noted in **Table 3**. Full count information is found in **Appendix A**.

TABLE 3: INTERSECTION PEAK HOUR TIMES

Mainline	Minor Road	AM Peak		PM Peak		Date
Route 109	Branch Road Crediford Road	7:45	8:45	3:30	4:30	7/21/2016
Routes 9/109	Garden Street State Route 9	7:15	8:15	4:15	5:15	7/14/2016
Routes 9/109	Exit 19 Ramp Wells Trans Ctr	7:30	8:30	3:30	4:30	7/14/2016
Routes 9/109	Spencer Drive	7:45	8:45	3:00	4:00	7/14/2016
Routes 9/109	Chapel Road	8:00	9:00	3:15	4:15	8/15/2013
Overall Peak		7:45	8:45	3:30	4:30	

Because counts were conducted in July and August, the 2015 MaineDOT Count Book suggests that no seasonal adjustments are required. This was confirmed looking at data from the MTA permanent count station, which also showed July and August as peak travel months. The 2016 Existing Design Hour traffic volumes during the AM and PM peak hours are shown on **Figure 5**.



XXX – AM Peak Hour

(XXX) – PM Peak Hour

FIGURE 5: 2016 EXISTING BALANCED TRAFFIC VOLUMES (DHVS)

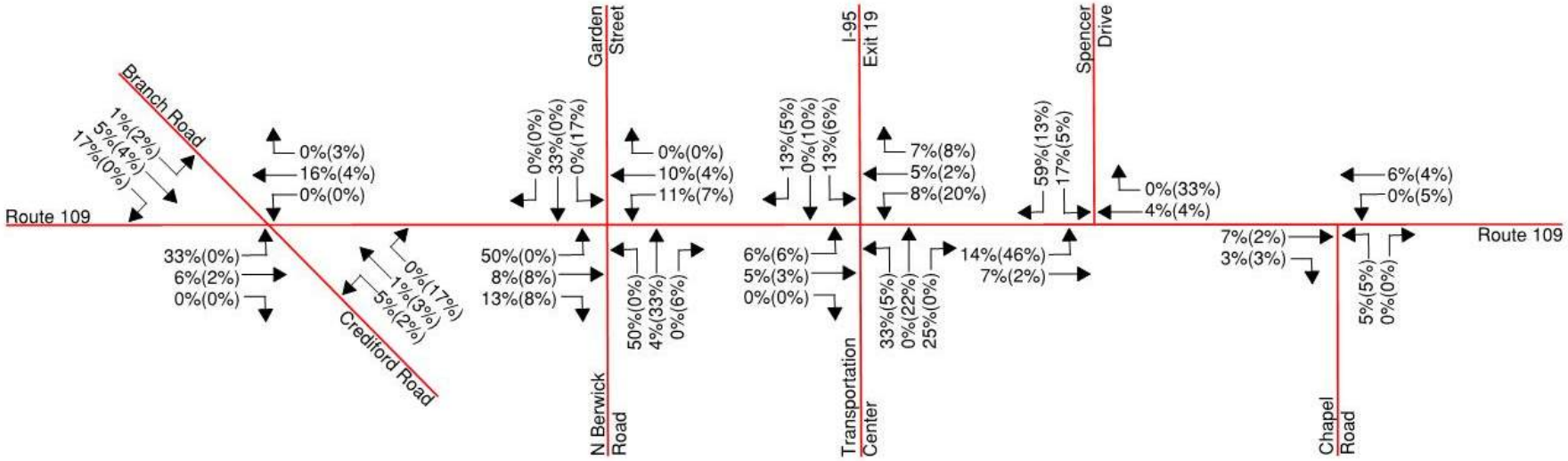
2.1.5: Existing Average Annual Daily Traffic Volumes

Table 4 represents historical Average Annual Daily Traffic Volumes between 2007 and 2015 obtained from the 2009 and 2015 MaineDOT Count Books. The data provided is along the Route 109 study area corridor and includes the Maine Turnpike Ramps at Exit 19.

Table 4: Average Annual Daily Traffic Volumes (2007-2015)									
	2007	2008	2009	2010	2011	2012	2013	2014	2015
Route 9A (Crediford Road) NE/o Route 9 (North Berwick Road)	1820			1990			2050		
Route 9A (Branch Road) N/o Route 109 (Sanford Road)							2620		2720
Route 9A (Crediford Road) S/o Route 109									2460
Route 9 (Branch Road) Ne/o Meeting House Road	2200			2800					
Route 9 (Branch Road) SW/o Meeting House Road	1920			1920			2140		
Route 9/109 (Sanford Road) E/o Chapel Road							9420		
Route 9/109 (Sanford Road) W/o Chapel Road							14970		
Route 9/109 E/o Ramp to Maine Turnpike				15130			15150		
Route 9/109 W/o Ramp to Maine Turnpike				16360			16300		
Route 9 (N Berwick Road) SW/o Route 9A (Crediford Road)	8540			8370					
Route 9 (N Berwick Road) SW/o Route 9/109 (Sanford Road)	6880			6980			6980		
Chapel Road S/o Route 9/109 (Sanford Road)							7270		
MTA SB On Ramp From Route 9/109 (Sanford Road)					2930	2820	2760	3000	3380
MTA SB Off Ramp to Route 9/109 (Sanford Road)					3630	3400	3600	3950	4160
MTA SB N/o Off Ramp to Route 9/109 (Sanford Road)					22510	22470	22800	23520	24330
MTA NB Off Ramp to Route 9/109 (Sanford Road)					3000	3140	2880	3240	3320
MTA NB On Ramp from Route 9/109 (Sanford Road)					3930	3980	4000	4140	4200
MTA NB N/o On Ramp from Route 9/109 (Sanford Road)					22530	22480	22750	23310	24450
Route 109 (Sanford Road) SE/o Route 9A (Branch Road)	9240			9180			8800		9360
Route 109 (Sanford Road) NW/o Route 9A (Branch Road)	8190			7770			8490		9100
Garden Street NE/o Route 9/109 (Sanford Road)				100					
Wells Trans Center Road s/o Route 9/109 (Sanford Road)				720					

2.1.6: Vehicle Classification

Figure 6 depicts heavy truck percentages estimated from the turning movement counts conducted at the study intersections. Heavy vehicle volumes were observed entering and exiting Spencer Drive – large warehouse area. In addition heavy vehicles were also observed at the Main Turnpike Exit 19 Intersection both exiting the Turnpike and related to movements at the Wells Transportation Center. A large heavy vehicle percentages was also observed between Garden Street and North Berwick Road.



XXX – AM Peak Hour

(XXX) – PM Peak Hour

FIGURE 6: VEHICLE CLASSIFICATION

2.1.7: Pedestrian and Bicycle Volumes

While residential uses exist in the study area, there is a lack of sidewalks throughout the corridor to accommodate pedestrians. Because of the heavy vehicular volume and general roadway conditions, very few bicycles and pedestrians were observed in the corridor during the collection of traffic data. In fact, only one pedestrian was observed at the intersection of Route 109 and Route 9/Garden Street crossing Route 9.

2.1.8: Speed Study

A speed study for this project corridor was conducted in two locations, 777 Sanford Road and under the Turnpike, on September 27, 2016 from 10:30 am to 1:10 pm as noted in **Table 5**. Study locations are shown in **Figure 7**.

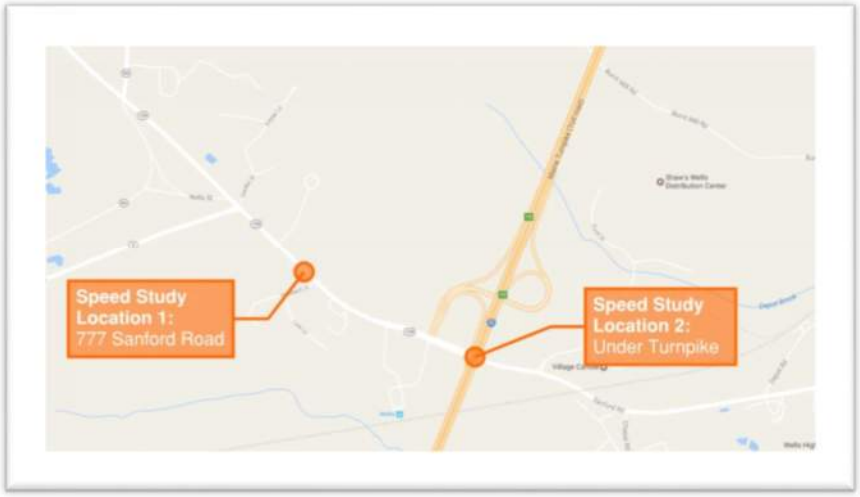


Figure 7: Speed Study Locations

Several measures are used to evaluate data obtained as part of a speed study. These include:

- Median: The middle speed observed if all observed speeds are placed in a list from low to high.
- Mode: The speed recorded most often during the study period.
- 85th Percentile: This is the speed at or below which 85% of all vehicles travel during the speed study. This is often used as a guideline to set speed limits.
- Average: The sum of all speeds observed divided by the number of speeds recorded.

Table 5 indicates that the first location, west of the Turnpike has an average speed slightly higher than the speed limit, varying between 41 and 43 mph directionally. The 85th percentile speed at this location is approximately 4-7 mph higher than the speed limit in that area westbound and eastbound respectively.

The second location, under the Turnpike, has an average speed 5-6 mph above the speed limit with an 85th percentile speed that is approximately 9 mph higher than the speed limit in that area.

TABLE 5: ROUTE 109 CORRIDOR SPEED STUDY RESULTS

Road	Route 109			
Date	9/27/2016			
Times	10:30 – 11:30 am		12:10 – 1:10 pm	
Location	777 Sanford Road		Under Turnpike	
Speed	40 mph zone		35 mph zone	
Direction	WB	EB	WB	EB
Median	40	43	41	40
Mode	40	41	40	40
85th Percentile	44	47	44	44
Average	41	43	41	40

A graphical representation of the speed data is illustrated on **Figure 8** and **Figure 9.** The green line represents the speed limit at the study location.

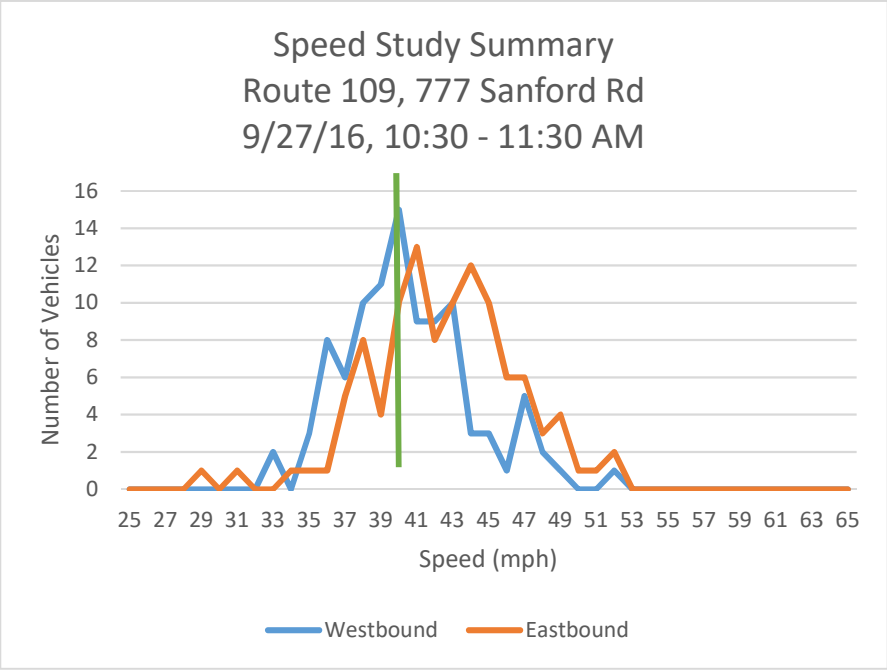


FIGURE 8: 777 SANFORD ROAD SPEED STUDY SUMMARY

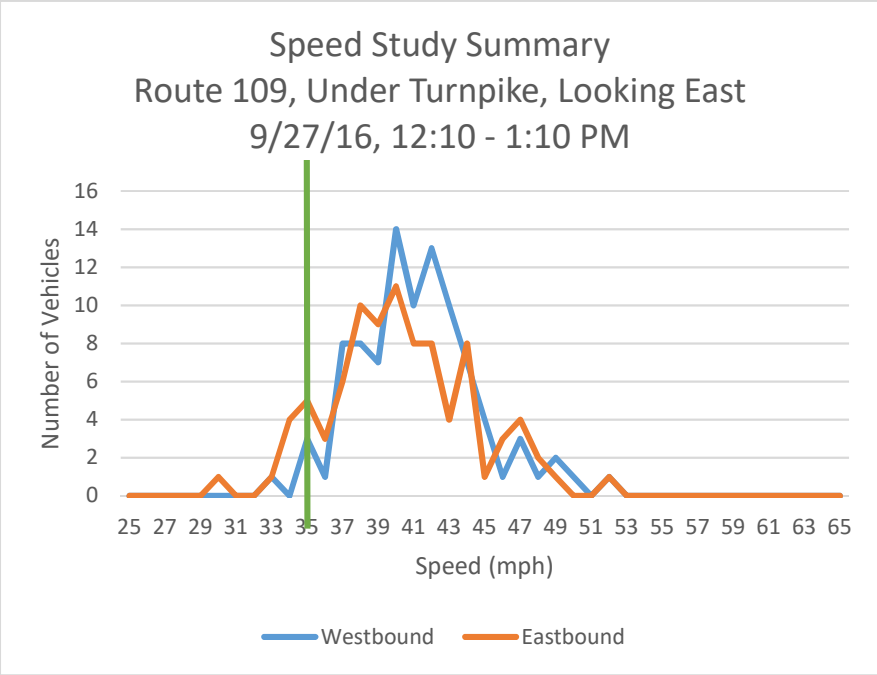


FIGURE 9: UNDER I-95 BRIDGES SPEED STUDY SUMMARY

2.2: Assessment of Current Conditions

In order to assess current corridor conditions, two roadway characteristics were examined: the crash history and current intersection operations. These will be reviewed in the following sections.

2.2.1: Crash History

To be classified as a High Crash Location (HCL), MaineDOT has established criteria where an intersection or road segment must meet two requirements: there must be 8 or more crashes during a consecutive 3 year study period and the intersection must have a critical rate factor (CRF) greater than or equal to 1.0. The critical rate factor is a comparison of the study locations with other comparable locations in the state.

Figure 10 summarizes the crash information for intersections and roadway segments for the three-year period 2013 – 2015. There are two HCLs in the study corridor: at the intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road and the intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street. A summary of each location is provided as follows. Complete crash histories can be found in **Appendix B: Crash History**.

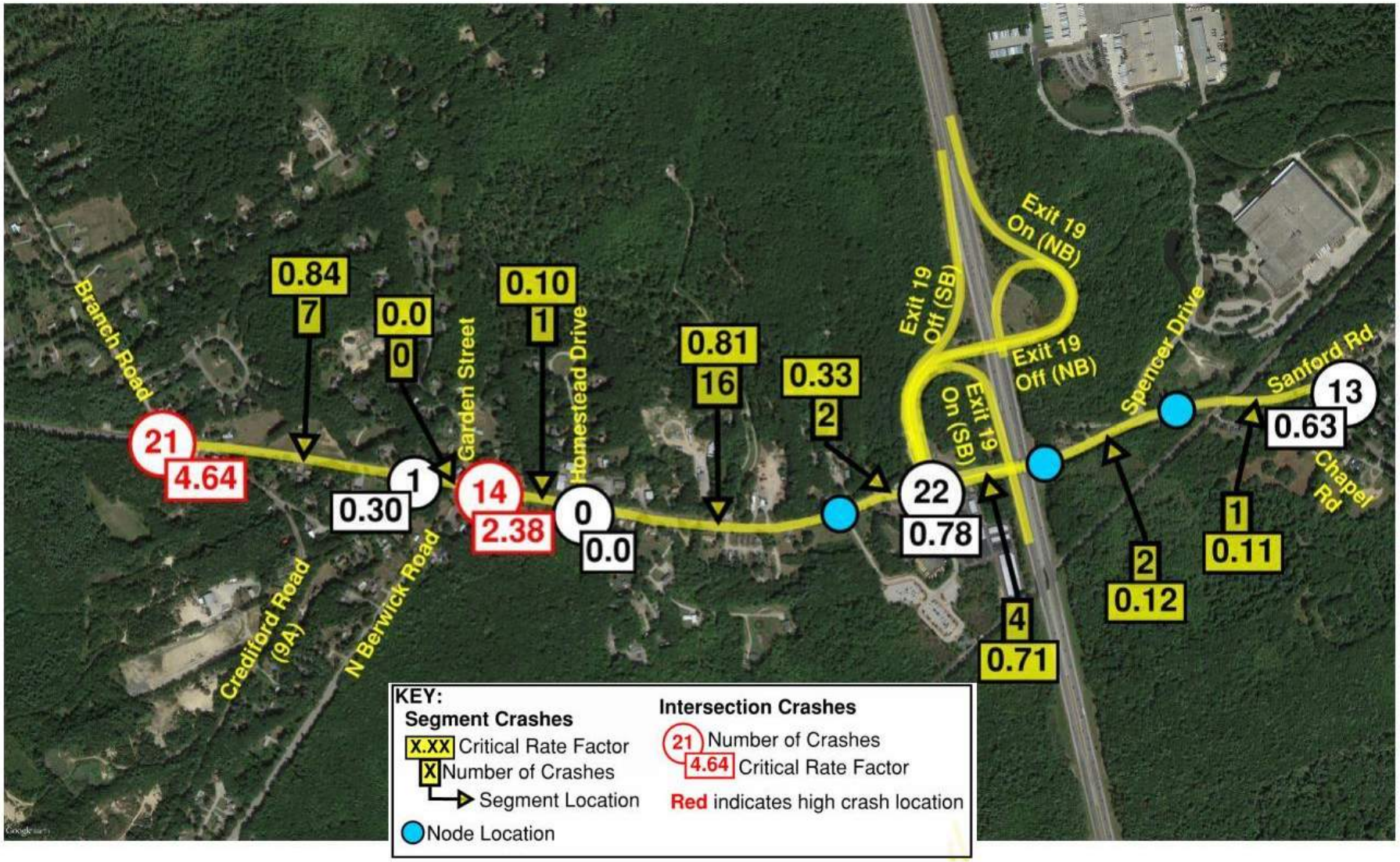


FIGURE 10: 2013-2015 CORRIDOR CRASH HISTORY

Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road

There were 21 crashes at the intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road from 2013 to 2015 with a CRF of 4.64 – or over 4 ½ times greater than similar intersections in the state. A summary of the crashes at this location appears below in **Figure 11**. The majority of crashes (19) were caused by a failure to yield. There are no other discernable patterns in relation to driver characteristics, types of vehicles, time of the year or days of the week. There was 1 crash with a minor injury and 7 crashes with a possible injury. The remainder of crashes were property damage only. While all of the crashes but 1 occurred during the day, 7 crashes occurred under cloudy conditions and 4 crashes occurred in the rain. All collision diagrams were provided by MaineDOT.

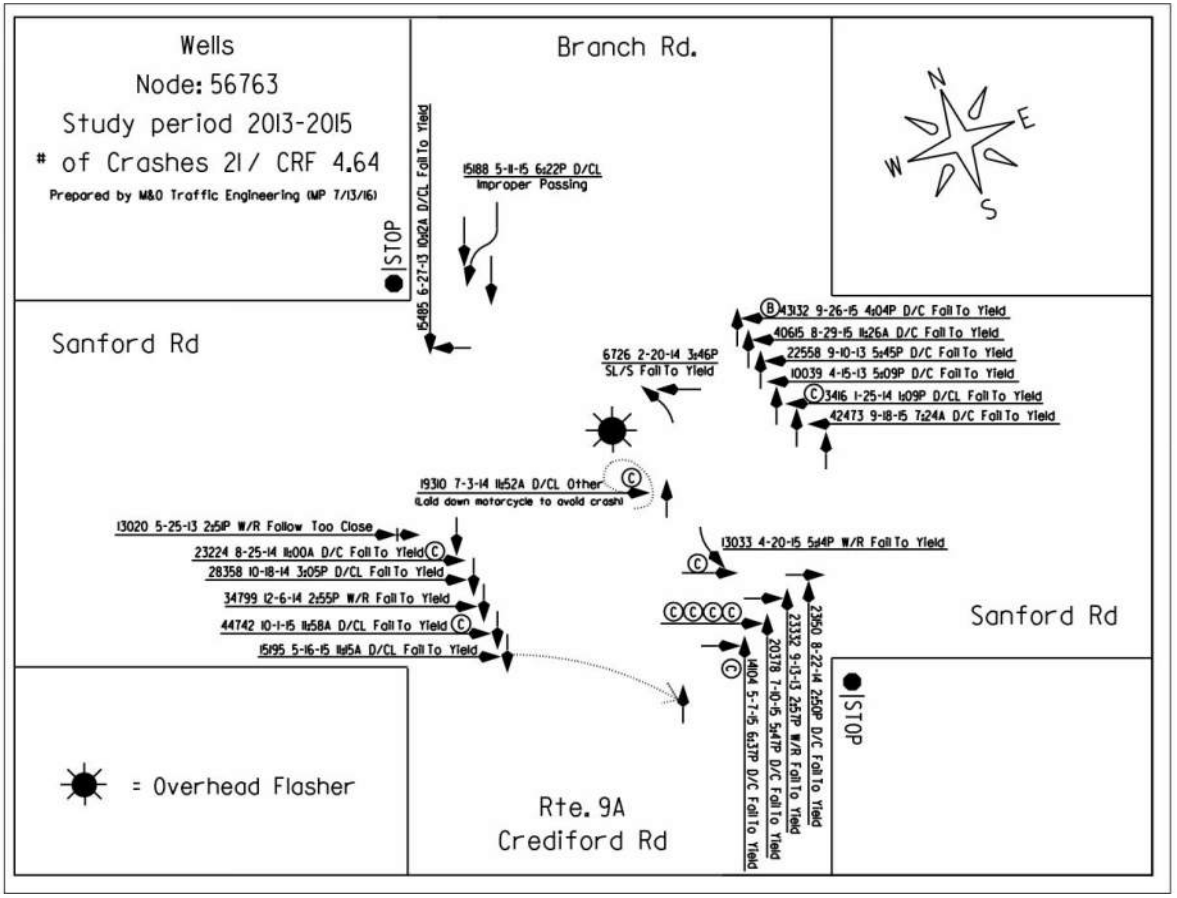


FIGURE 11: COLLISION DIAGRAM FOR THE INTERSECTION OF ROUTE 109 (SANFORD ROAD) AND CREDIFORD ROAD/BRANCH ROAD

Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street

There were 14 crashes at the Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street intersection from 2013 to 2015 with a CRF of 2.38 – or just over 2 times more crashes than similar intersections in the state. A summary of the crashes at this location is depicted in **Figure 12**. The majority of crashes were caused by a combination of driver inattention and following too closely northbound on Route 9 (North Berwick Road). This is a typical collision type given the geometry of the intersection and many motorists making "rolling stops" while looking for gaps in traffic and rear-ending the vehicle in front that makes a sudden stop when trying to find a gap to get out. There are no discernable patterns in relation to driver characteristics, types of vehicles, time of the year or day of the week. There was 1 crash with a serious injury and 3 crashes with a possible injury. The remainder of crashes were property damage only. All collision diagrams were provided by MaineDOT.

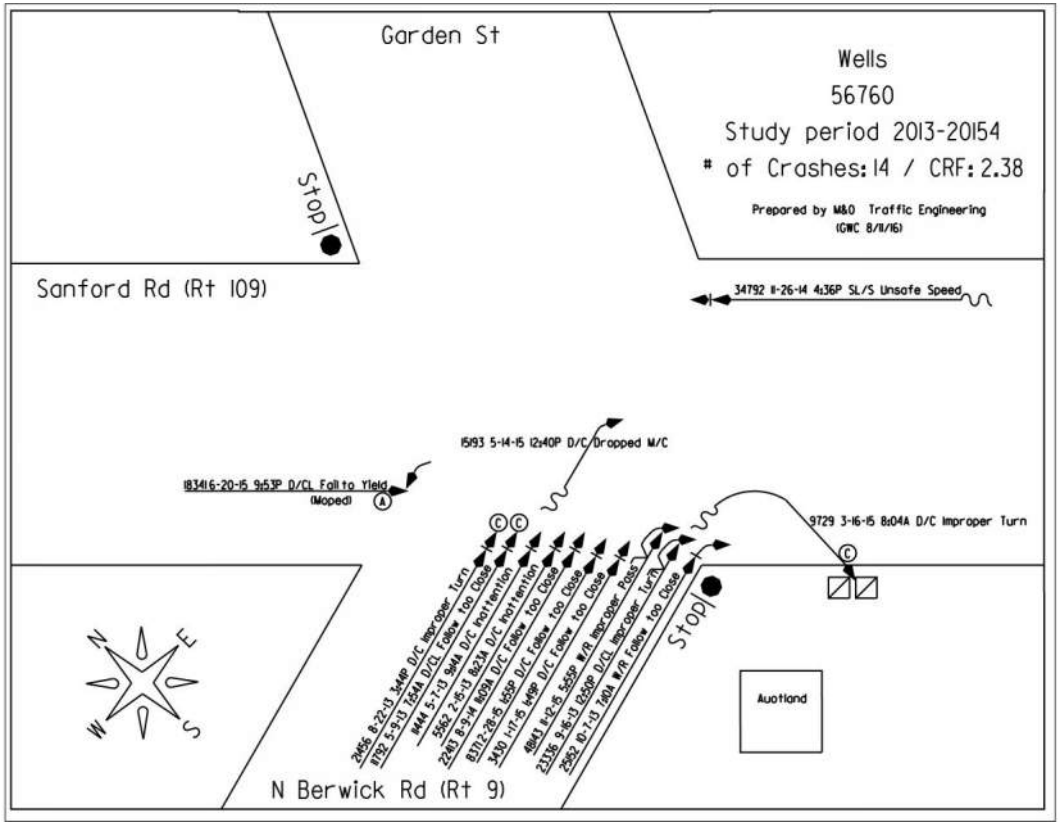


FIGURE 12: COLLISION DIAGRAM FOR THE INTERSECTION OF ROUTE 109 (SANFORD ROAD) AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

Intersection of Routes 109 & 9 (Sanford Road) and MTA Exit 19/Wells Transportation Center

While not an HCL (the CRF was less than 1), the intersection of Routes 109 and 9 (Sanford Road) and Maine Turnpike Exit 19/Wells Transportation Center has a high number of crashes – 22. **Figure 13** indicates traveling east and west on Routes 109 & 9 (Sanford Road), the majority of crashes are related to rear-end collisions where drivers were following too closely, speeding, or distracted. Exiting the Turnpike, drivers rear-ended others making the right turn from the Turnpike Exit 19 approach onto Routes 109 and 9 westbound and going straight through the intersection to the Wells Transportation Center. These crashes were caused by vehicles following too closely and drivers who were distracted. There are no discernable patterns in relation to driver characteristics, types of vehicles, or day of the week. Ten of the 22 crashes occurred during the winter months of December and January. There were 2 crashes with minor injuries and 4 crashes with a possible injury, the remainder of crashes were property damage only. All collision diagrams were provided by MaineDOT.

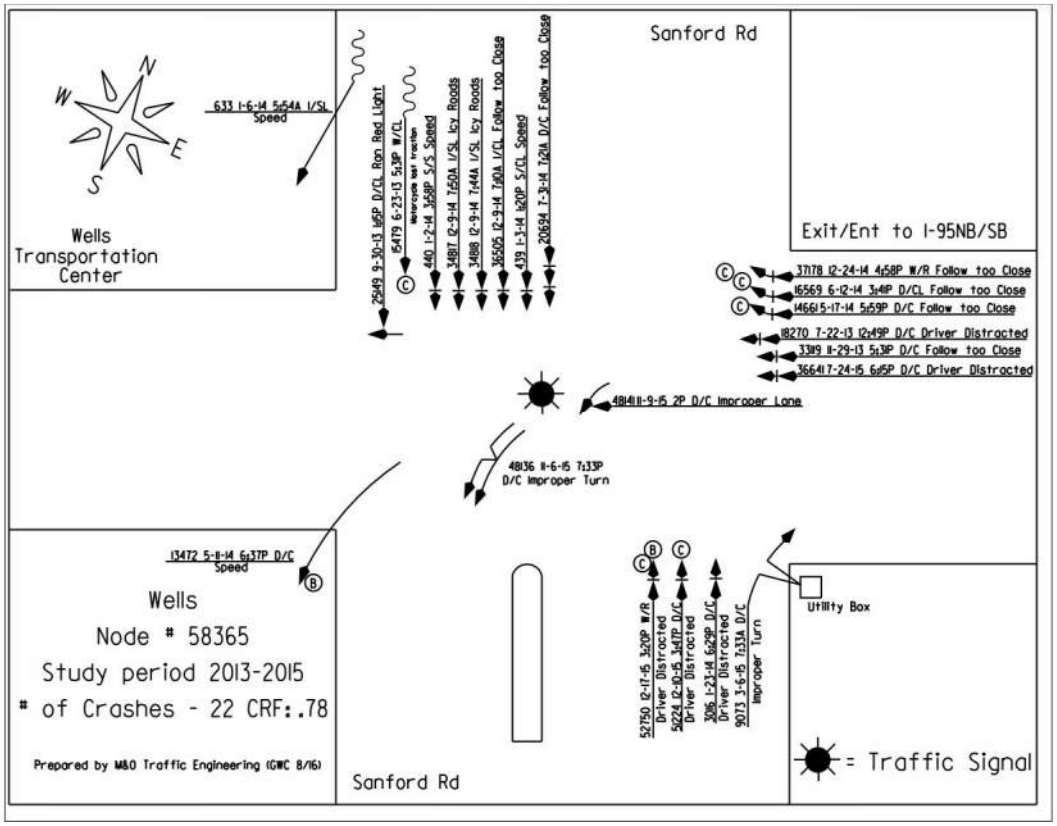


FIGURE 13: COLLISION DIAGRAM FOR ROUTES 109 & 9 (SANFORD ROAD) AND MTA EXIT 19/WELLS TRANSPORTATION CENTER

2.2.2: Intersection Level of Service

The standard used to evaluate traffic operating conditions of the transportation system is referred to as the Level of Service (LOS). This is a qualitative assessment of the quantitative effect of factors such as speed, volume of traffic, geometric features, traffic interruptions, delays, and freedom to maneuver.

Level of Service provides a measurement of the delay experienced at an intersection as a result of traffic operations at that intersection. In general, there are six levels of service: Level of Service A to Level of Service F. The highest, Level of Service A, describes a condition of free-flow operations where the effects of incidents are easily absorbed. Level of Service B, describes a state in which maneuverability and speed limits are beginning to be restricted by other motorists although level of comfort is still high. In Level of Service C, experienced drivers are still comfortable but maneuverability is noticeably restricted. Level of Service D brings noticeable congestion and driver comfort levels decrease. In Level of Service E, roadway capacity is reached and disruptions are much more prevalent – driver comfort has declined. Finally, Level of Service F is the result of volumes greater than roadway capacity with congestion and possible stopped conditions. MaineDOT has determined that Levels of Service A-D are acceptable conditions for intersections.

The measures of delay for each Level of Service rating for unsignalized and signalized intersections are found in **Table 6**.

TABLE 6: LEVEL OF SERVICE CRITERIA

LOS	Signalized Intersection	Unsignalized Intersection
A	≤10 sec	≤10 sec
B	10–20 sec	10–15 sec
C	20–35 sec	15–25 sec
D	35–55 sec	25–35 sec
E	55–80 sec	35–50 sec
F	>80 sec	>50 sec

Queue lengths were estimated and represents the distance of vehicles waiting at the stop bar or making a turn. Most commonly reported is the 95th percentile queue, which is defined as the queue that will not be exceeded 95% of the time. A vehicle length of 20 feet can be used to estimate the number of vehicles in queue. While it does not impact the level of service directly, it is another measure of the effectiveness of the intersection.

SimTraffic computer models were used to analyze the study intersections. For SimTraffic, the Trafficware version 9 standard output was used, based on 5 runs of 60 minutes of simulation. It should be noted that the analysis is based upon an optimized signal timing scenario as intersections are currently being retimed. The 2016 Existing report printouts can be found in **Appendix C: 2016 Existing SimTraffic Reports** and results are seen in the tables that follow.

Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road

Table 7 summarizes the SimTraffic results at the intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road. Branch Road is an unsignalized intersection with flashing beacons, side streets operate in the stopped condition. Due to the heavy through volumes on Route 109, movements from Branch Road and Crediford Road have failing levels of service with long delays and queues. Route 109 traffic operates in the free-flow condition with little to no delay.

TABLE 7: 2016 EXISTING LEVEL OF SERVICE RESULTS: ROUTE 109 (SANFORD ROAD) AND BRANCH ROAD/CREDIFORD ROAD

		Route 9A (Branch Road)			Route 109			Route 9A (Crediford Road)			Route 109			Overall
		From North			From East			From South			From West			
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	Volume	114	63	6	0	166	37	21	85	1	6	513	51	
	LOS	F			A			F			A			F
	Delay (sec/veh)	426.2			0			242.7			0.1			93.4
	Queue (feet)	1059			12			448			47			
PM Peak	Volume	65	73	7	2	538	120	63	112	6	4	282	43	
	LOS	F			A			F			A			F
	Delay (sec/veh)	245.2			0			382.6			0.3			82.3
	Queue (feet)	627			4			950			31			

Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street

Table 8 summarizes the SimTraffic results at the intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street. The intersection is an unsignalized intersection with stop signs on the side streets. While operating slightly better than the previous intersection with Branch Road/Crediford Road, side streets show failing levels of service trying to turn onto Route 109. Route 109 operates in the free-flow condition with little to no delay.

TABLE 8: 2016 EXISTING LEVEL OF SERVICE RESULTS: ROUTE 109 (SANFORD ROAD) AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

		Garden Street			Route 9/109			Route 9			Route 109			Overall
		From North			From East			From South			From West			
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	Volume	5	3	0	233	199	2	4	0	380	11	603	14	
	LOS	C			A	A		E			A			B
	Delay (sec/veh)	24.5			4.8	0.4		38.2			0.1			12.0
	Queue (feet)	33			206	52		361			50			
PM Peak	Volume	6	0	3	380	643	4	15	3	365	4	337	12	
	LOS	E			A	A		F			A			C
	Delay (sec/veh)	48.7			3.7	1.1		69.9			0.2			17.8
	Queue (feet)	32			387	103		642			53			

Intersection of Routes 109 & 9 (Sanford Road) and MTA Exit 19/Wells Transportation Center

Table 9 summarizes the SimTraffic results of the signalized intersection at Route 109 (Sanford Road) and MTA Exit 19/Wells Transportation Center.

There are several challenges in moving traffic quickly and efficiently through the intersection:

- High truck volumes turning left towards Route 1 and the industrial park.
- Traffic northbound from the Wells Transportation Center and southbound from the Turnpike Exit 19 ramps operates with split phasing causing long cycle lengths.
- There is a high volume of vehicles turning left onto the Turnpike Exit 19 Ramps from eastbound Routes 109 and 9. This movement operates in a protected phase only and causes inefficiencies with westbound Route 109 and 9 through traffic.

Despite these challenges, all lanes operate acceptably, although near capacity, under the existing conditions.

TABLE 9: 2016 EXISTING LEVEL OF SERVICE RESULTS: ROUTES 109 & 9 (SANFORD ROAD) AND MTA EXIT 19/WELLS TRANSPORTATION CENTER

		MTA Exit 19			Route 9/109			Wells Trans Center			Route 9/109			Overall
		From North			From East			From South			From West			
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	Volume	348	9	220	8	273	462	13	8	17	265	349	8	
	LOS	C	C	A	D	D	D	A	C	A	C	B	C	B
	Delay (sec/veh)	24.8	21.2	1.5	40.0	47.7	39.9	6.5	34.4	9.3	25.3	11.8	20.8	18.4
	Queue (feet)	253	189	87	47	182	108	146	41	28	337	339	191	
PM Peak	Volume	435	20	519	5	475		425	22	18	17	329	342	3	
	LOS	D	D	A	D	D	D	A	D	C	D	B	D	C
	Delay (sec/veh)	45.4	52.5	3.9	52.8	37.7	50.9	4.1	50.1	33.5	47.9	13.7	35.4	26.6
	Queue (feet)	367	377	285	49	319	333	229	51	65	322	318	322	

Intersection of Routes 109 & 9 (Sanford Road) and Spencer Drive

Table 10 summarizes the SimTraffic results at the T-Intersection of Routes 109 and 9 (Sanford Road) and Spencer Drive. The intersection is an unsignalized intersection where Routes 109 and 9 are free-flow and Spencer Drive is stop-controlled. Minor delay is seen on Spencer Drive as drivers wait for gaps in traffic to turn onto Route 109 and 9 (Sanford Road) but these aren't significant.

TABLE 10: 2016 EXISTING LEVEL OF SERVICE RESULTS: ROUTES 109 & 9 (SANFORD ROAD) AND SPENCER DRIVE

		Spencer Drive		Route 9/109		Route 9/109		Overall
		From North		From East		From West		
		Left	Right	Through	Right	Left	Through	
AM Peak	Volume	6	17	475	15	84	707	
	LOS	B		A		A	A	A
	Delay (sec/veh)	14.3		0.2		2.3	0	0.4
	Queue (feet)	61		0		60	54	
PM Peak	Volume	21	97	829	6	39	834	
	LOS	B		A		A	A	A
	Delay (sec/veh)	14.1		0.1		7.2	0	1.2
	Queue (feet)	116		11		81	46	

Intersection of Routes 109 & 9 (Sanford Road) and Chapel Road

Table 11 summarizes the SimTraffic results at the T-Intersection of Routes 109 and 9 (Sanford Road) and Chapel Road. The intersection is a signalized intersection where all movements operate permissively. The westbound left onto Chapel Road during the peak hour experiences long delays as they try to find a gap in eastbound Routes 109 and 9 traffic volumes.

TABLE 11: 2016 EXISTING LEVEL OF SERVICE RESULTS: ROUTE 109 & 9 (SANFORD ROAD) AND CHAPEL ROAD

		Route 9/109 From East		Chapel Road From South		Route 9/109 From West		Overall
		Left	Thru	Left	Right	Thru	Right	
AM Peak	Volume	25	295	195	10	386	338	
	LOS	D	A	B		A		A
	Delay (sec/veh)	37.0	4.7	9.4		8.9		8.5
	Queue (feet)	206	52	361		50		
PM Peak	Volume	40	577	258	23	552	303	
	LOS	E	A	B		B		B
	Delay (sec/veh)	71.4	8.3	15.8		14.5		13.9
	Queue (feet)	76	330	180		524		

2.2.3: Traffic Signal Warrants

At locations where poor levels of service and safety deficiencies were identified, a traffic signal warrant analysis was conducted. This warrant analysis is based on nine guidelines set forth by the Manual on Uniform Traffic Control Devices, (MUTCD 2009), FHWA. The warrants provide thresholds related to major and minor street volumes for peak, four, and eight hour time periods, collision safety considerations, pedestrian volumes and school crossing factors, other coordinated signals in the vicinity and roadway network considerations, as well as intersections near railroad grade crossings. If any of these thresholds are met, a signal may be *considered* for installation.

Because right turns are not the typical triggers for signal need, they are often removed from total volumes analyzed or discounted to reduce their effect. For this study, the Oregon Method, used by MaineDOT as a method for discounting right turns, was used.

Two intersections within the study area were considered as possible future signal locations. These intersections were the Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road and the Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street.

Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road

As shown in **Table 12,** for the Intersection of Route 109 and Branch Road/Crediford Road there were four warrants met with discounted right turns – the eight, four and peak hour volume warrants as well as the crash experience warrant – indicating a signal may help improve the safety of this intersection. Full results of the analysis are found in **Appendix G: Traffic Signal Warrants**, and indicate the intersection does meet warrants for a traffic signal.

TABLE 12: TRAFFIC SIGNAL WARRANTS AT THE INTERSECTION OF ROUTE 109 (SANFORD ROAD) AND BRANCH ROAD/CREDIFORD ROAD

Warrant	Met/Not Met
Warrant 1: Eight-Hour Vehicular Volume	Met
Warrant 2: Four-Hour Vehicular Volume	Met
Warrant 3: Peak Hour	Met
Warrant 4: Pedestrian Volume	Not Met
Warrant 5: School Crossing	Not Met
Warrant 6: Coordinated Signal System	Not Met
Warrant 7: Crash Experience	Met
Warrant 8: Roadway Network	Not Met
Warrant 9: Intersection Near a Grade Crossing	Not Met

Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street

While intersection warrants are typically designed to take into account opposing movements between the major and minor streets, this intersection also has a heavy left-turning movement on the major road. Because of this, the signal was evaluated using the traditional methods for signal warrants and alternately with the heavy left-turning movement serving as the minor approach.

Table 13 indicates the warrants were met for the four hour volume and peak hour volume for both methods of evaluation. It is important to note that a signal is not installed definitively when warrants are met. Particularly in this case, sufficient gaps provided from a placement of a signal at the Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road and updated geometric and signal timing improvements at the Intersection

of Routes 9/109 (Sanford Road) and MTA Exit 19/Wells Transportation Center may provide enough gaps for movements at this location.

TABLE 13: TRAFFIC SIGNAL WARRANTS AT THE INTERSECTION OF ROUTE 109 (SANFORD ROAD) AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

Warrant	Met/Not Met	
	Traditional	Left-turn Minor
Warrant 1: Eight-Hour Vehicular Volume	Not Met	Not Met
Warrant 2: Four-Hour Vehicular Volume	Met	Met
Warrant 3: Peak Hour	Met	Met
Warrant 4: Pedestrian Volume	Not Met	Not Met
Warrant 5: School Crossing	Not Met	Not Met
Warrant 6: Coordinated Signal System	Not Met	Not Met
Warrant 7: Crash Experience	Not Met	Not Met
Warrant 8: Roadway Network	Not Met	Not Met
Warrant 9: Intersection Near a Grade Crossing	Not Met	Not Met
Warrant 9: Intersection Near a Grade Crossing	Not Met	Not Met

2.3: Transportation Infrastructure Inventory

A review of the existing infrastructure was conducted as part of this study. Among things reviewed include roadway and intersection geometry, bicycle and pedestrian facilities, MaineDOT customer service levels, and examination of access management.

2.3.1: Geometry

The corridor is a 1.5 mile long stretch of mostly two-lane road. There is one passing zone in front of Garden Street and there are two westbound lanes from Spencer Drive to the Maine Turnpike Exit 19 intersection terminating approximately 250 feet west of the intersection and eastbound from the Turnpike Exit 19 intersection for approximately 250 feet terminating just prior to the I-95 bridges.

Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road

Figure 14 depicts the four leg intersection with single lane approaches with flashing yellow and red signals. Lane widths on Route 109 are approximately 11½ feet with 7 foot shoulders west of the intersection and 6 foot shoulders east of the intersection. Side road lane widths are approximately 12-13 feet in width with negligible shoulders.

Segment of Route 109 (Sanford Road) between Branch Road/Crediford Road and Route 9 (North Berwick Road)/Garden Street

Figure 15 depicts the two lane section with a mixture of business and residential use. Lanes are approximately 11½ feet wide with varying 6-7 foot shoulders. The regulatory speed limit is 40mph.

FIGURE 14: INTERSECTION OF ROUTE 109 (SANFORD ROAD) AND BRANCH ROAD/CREDIFORD ROAD

FIGURE 15: SEGMENT OF ROUTE 109 (SANFORD ROAD) BETWEEN BRANCH ROAD/CREDIFORD ROAD AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street

Figure 16 depicts the four-leg intersection with single lane approaches and a short westbound left-turn bypass lane. Lane widths on Route 109 are approximately 12 feet with negligible westbound shoulders and approximately 6 foot shoulders eastbound. Garden Street is approximately 26 feet wide and is stop controlled with no marked shoulders and Route 9 is approximately 12 feet wide before the intersection and up to more than 20 feet wide at the stop bar.

FIGURE 16: INTERSECTION OF ROUTE 109 (SANFORD ROAD) AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

Segment of Route 109 (Sanford Road) between Route 9 (North Berwick Road)/Garden Street and MTA Exit 19/Wells Transportation Center

Figure 17 depicts the segment of Route 109 which widens at the approach with the intersection at the Turnpike Exit 19. This is a two lane section with a mixture of business and residential land uses. Lanes are approximately 12 feet wide with varying 7-8 foot shoulders. From Hubbard Lane to Garden Street, the speed limit is 40 mph; from Hubbard Lane to the Transportation Center, the speed limit is 35 mph. In addition, there is a lane drop westbound departing the Turnpike Exit 19 Intersection.

FIGURE 17: SEGMENT OF ROUTE 109 (SANFORD ROAD) BETWEEN ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET AND MTA EXIT 19/WELLS TRANSPORTATION CENTER

Intersection of Routes 109 and 9 (Sanford Road) and MTA Exit 19/Wells Transportation Center

Figure 18 depicts the four leg intersection with multi-lane signalized approaches. The MTA approach is three lanes with a left, combined through/left, and right lane configuration. The northbound Wells Transportation Center has a left lane and a combined through/right lane. These two approaches operate as split traffic signal phases due to the double left turn lane from the Turnpike Exit 19 approach. Westbound on Route 109 there is a left, two through lanes and a right lane approach. Eastbound on Route 109 there is a left, through, and through/right lane configuration approach. Eastbound and westbound receiving lanes both have a two lane configuration that drops to one lane downstream of the intersection.

FIGURE 18: INTERSECTION OF ROUTE 109 AND 9 (SANFORD ROAD) AND MTA EXIT 19/WELLS TRANSPORTATION CENTER

Segment of Routes 109 and 9 (Sanford Road) between MTA Exit 19/Wells Transportation Center and Spencer Drive

Figure 19 depicts that westbound Route 109 is a 12 foot two-lane section of road with 1-2 foot shoulders. Eastbound Route 109 has a one lane section of road with 0-5 foot shoulders. This segment has a regulatory speed limit of 35 mph. There is a lane drop eastbound just after the intersection that stops prior to the Turnpike bridges.

FIGURE 19: SEGMENT OF ROUTE 109 AND 9 (SANFORD ROAD) BETWEEN MTA EXIT 19/WELLS TRANSPORTATION CENTER AND SPENCER DRIVE

Intersection of Routes 109 and 9 (Sanford Road) and Spencer Drive

Figure 20 depicts this is a three-leg intersection. The intersection is stop controlled on Spencer Drive and operates free-flow on Route 109. West of the intersection there are two departure lanes and two approach lanes: a left and through lane. Lanes are approximately 12 feet wide with minimal shoulders and steep slopes east of the intersection.

FIGURE 20: INTERSECTION OF ROUTE 109 & 9 (SANFORD ROAD) AND SPENCER DRIVE

Segment of Routes 109 and 9 (Sanford Road) between Spencer Drive and Chapel Road

Figure 21 depicts the two-lane section with little development. This section contains a bridge that crosses over the B&O Railroad tracks. Lanes are approximately 12 feet in width with 9 foot shoulders. This segment of road has a regulatory speed limit of 35 mph.

FIGURE 21: SEGMENT OF ROUTE 109 & 9 (SANFORD ROAD) BETWEEN SPENCER DRIVE AND CHAPEL ROAD

Intersection of Routes 109 & 9 (Sanford Road) and Chapel Road

Figure 22 depicts the signalized three-leg intersection. East of the intersection there are two approach lanes, a left and through lane. All other legs are single lane approaches and receiving lanes. Lanes are approximately 12 feet wide with minimal shoulders.

FIGURE 22: INTERSECTION OF ROUTE 109 & 9 (SANFORD ROAD) AND CHAPEL ROAD

2.3.2: Bicycle Facilities

Figure 23 depicts the only marked bicycle facility in the corridor. There are no connecting facilities on either side of the intersection. Throughout the rest of the corridor, shoulders are the only other type of facility available, and not all are wide enough for safe bicycle use.

FIGURE 23: EXAMPLE OF STRIPED BICYCLE FACILITIES (AT MTA INTERSECTION)

2.3.3: Sidewalks and Crosswalks

While there are currently no sidewalks or crosswalks in the corridor, the Wells Sidewalk Plan proposes a 5-foot sidewalk from the intersection with Wells Transportation Center to Route 1. The existing sidewalk on Route 109 (at the Wells Elementary School) is shown in **Figure 24**, which is about 0.9 miles from the Turnpike Exit 19 intersection, just to the east of Chapel Road. Curbing is largely granite.

FIGURE 24: EXISTING SIDEWALK INFRASTRUCTURE OUTSIDE THE STUDY AREA

2.3.4: MaineDOT Customer Service Levels

MaineDOT has developed a process for prioritizing highway and bridge candidate projects for the biennial work plan according to Customer Service Levels (CSLs). Route 109 is considered to be a Priority 1 Highway (the highest priority) and MaineDOT has provided CSL ratings regarding Safety, Condition, and Service. Facilities are rated on an A-F scale; specific information regarding each rating is included as follows. More specific information regarding how ratings are determined is located on the MaineDOT website at:

http://maine.gov/mdot/about/assets/docs/CSLMethodology.pdf.

CSL Safety

Figure 25 includes consideration of Crash History, Pavement Roadway Width, Pavement Rutting and Bridge Reliability. Crash history includes the two types of motor vehicles crashes most likely related to the highway – head-on and run-off-the-road crashes. The A-F scale compares these crash rates with the statewide average. Pavement Roadway width compares the measure of the full pavement width with acceptable widths noted by the Highway Corridor Priority. If the minimum is not met, the segment is reduced by one letter grade. Pavement Rutting looks at rutting related to wheel paths as it can collect water and contribute to hydroplaning and icy conditions. This is measured with the A-F scale and is based on hydroplaning tests. The final contributing factor, Bridge Reliability is measured as a pass or fail – if the rating is 3 or less (which is still safe but may require more inspection or remedial work), the letter grade is reduced one letter.

High crash locations contribute to reduced conditions on the segment between the Maine Turnpike Exit 19 and Spencer Drive (LOS B). High crashes at the intersection of Branch Road and Crediford Road also contribute to reduced customer service levels – ranging from a level C to D.

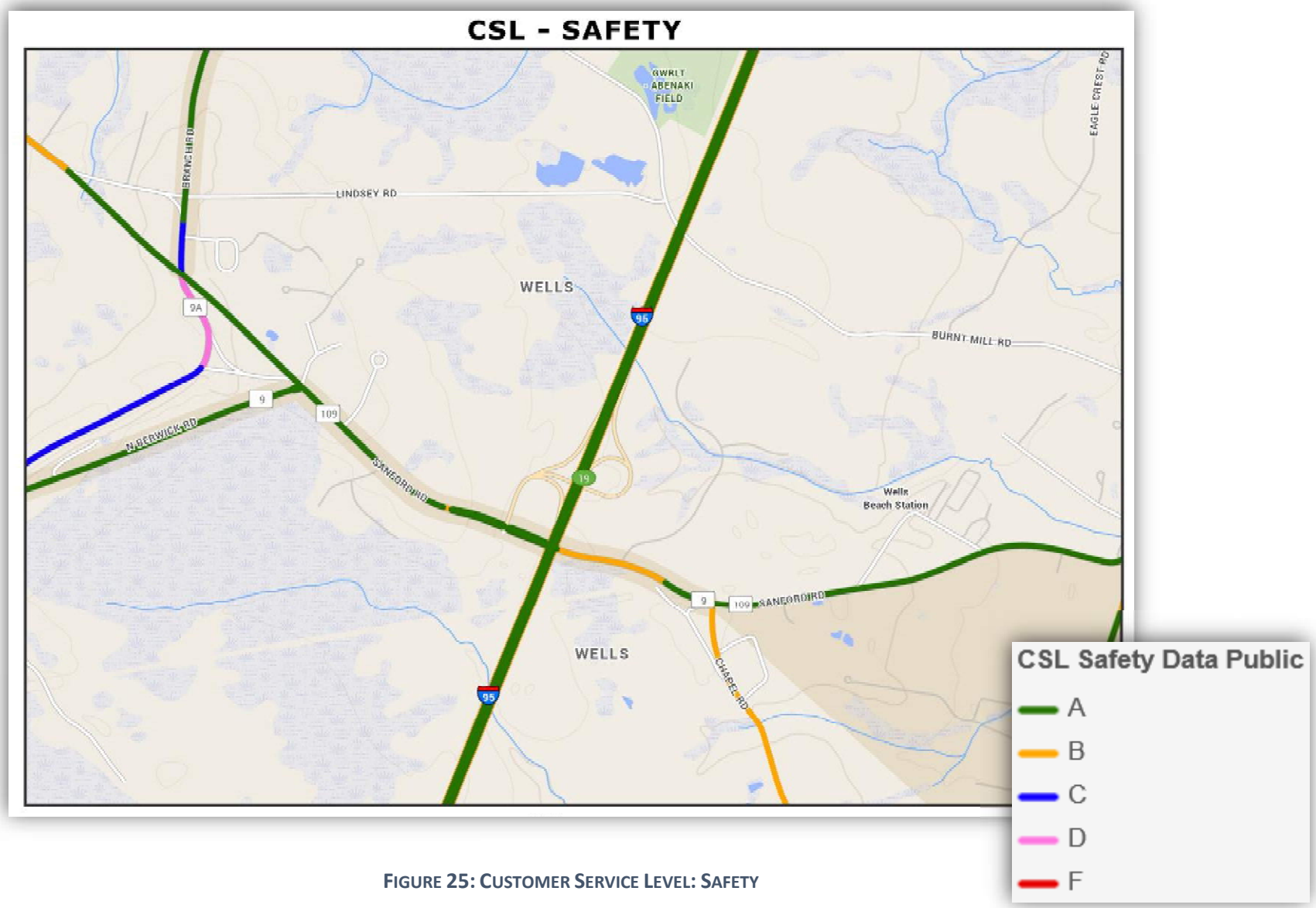


FIGURE 25: CUSTOMER SERVICE LEVEL: SAFETY

CSL Condition

Figure 26 includes consideration of Pavement Condition, Roadway Strength, Bridge Condition, and Ride Quality. Pavement Condition is measured on a 0-5 scale that related to the International Roughness Index, rutting and two basic types of cracking. The scale A-F for this varies by Highway Corridor Priority. Roadway Strength is measured using the falling weight deflectomer and is uniform across all priorities. Bridge Condition converts the 0-9 National Bridge Inventory rating to a pass or fail.

Finally, Ride Quality is measured using the International Roughness Index (RI) which measures inches per mile of deviation varying by Highway Corridor Priority. From Branch Road to North Berwick Road the level of service has been measured to be an A, for the remainder of the study area, a LOS B was determined. This is related to the bridges which were rated to be in good condition with some maintenance needed.

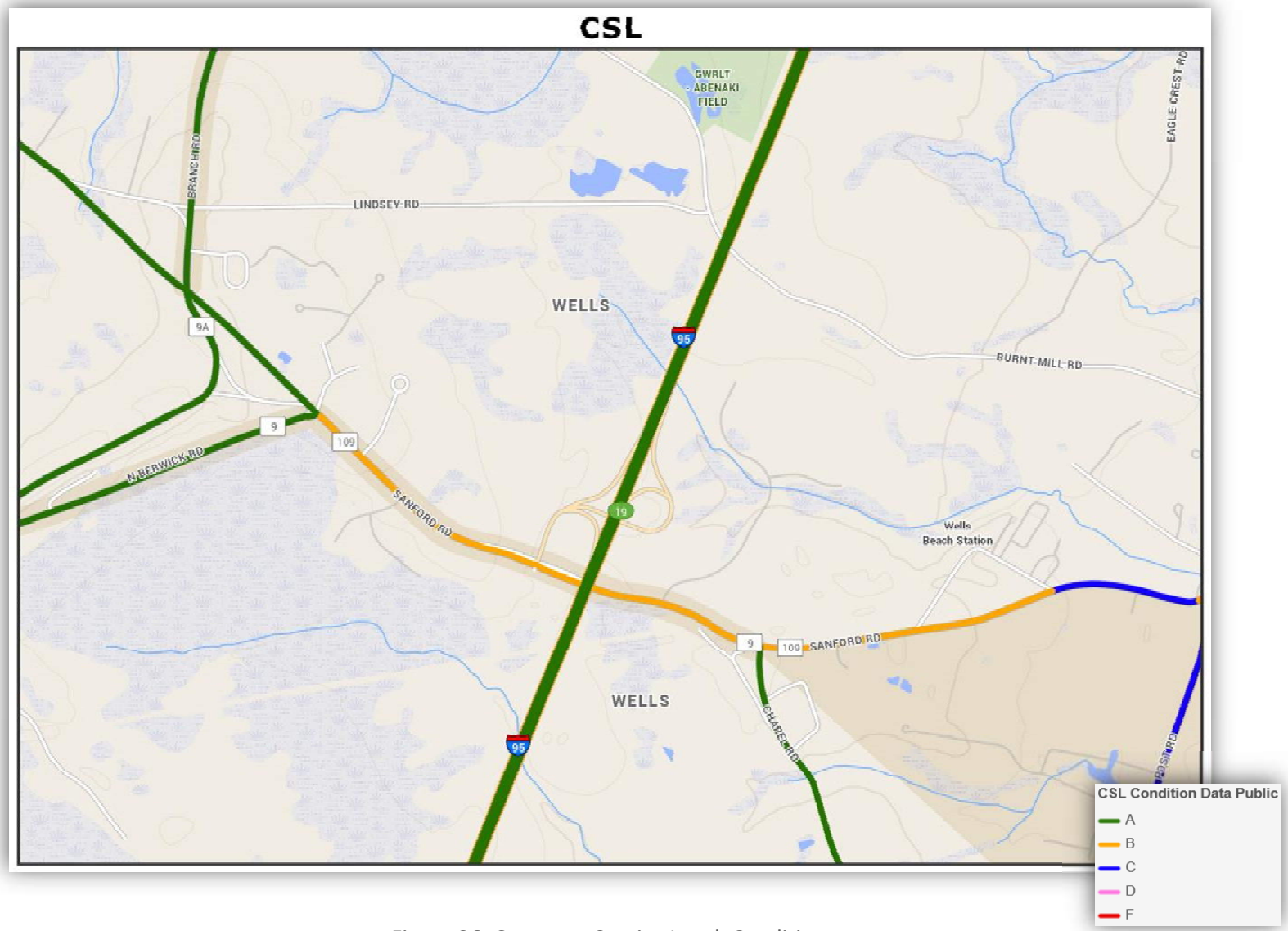


Figure 26: Customer Service Level: Condition

CSL Service

Figure 27 includes consideration of Posted Bridges and Congestion. Posted Bridges follow an A-F scale based on load restriction and Highway Corridor Priority. Congestion is measured uniformly across Highway Corridor Priority and uses a ratio of peak traffic flows to highway capacity to obtain an A-F score; peak summer months are specifically included to capture the tourism industry. This area does experience congestion during peak hours. Delays are most notably evident between the intersection of the Maine Turnpike Exit 19 and Chapel Road (LOS D). The remainder of the corridor and the ramps themselves vary between LOS A and LOS B, with some congestion on the eastbound approach to the Turnpike Exit 19 intersection (LOS C).

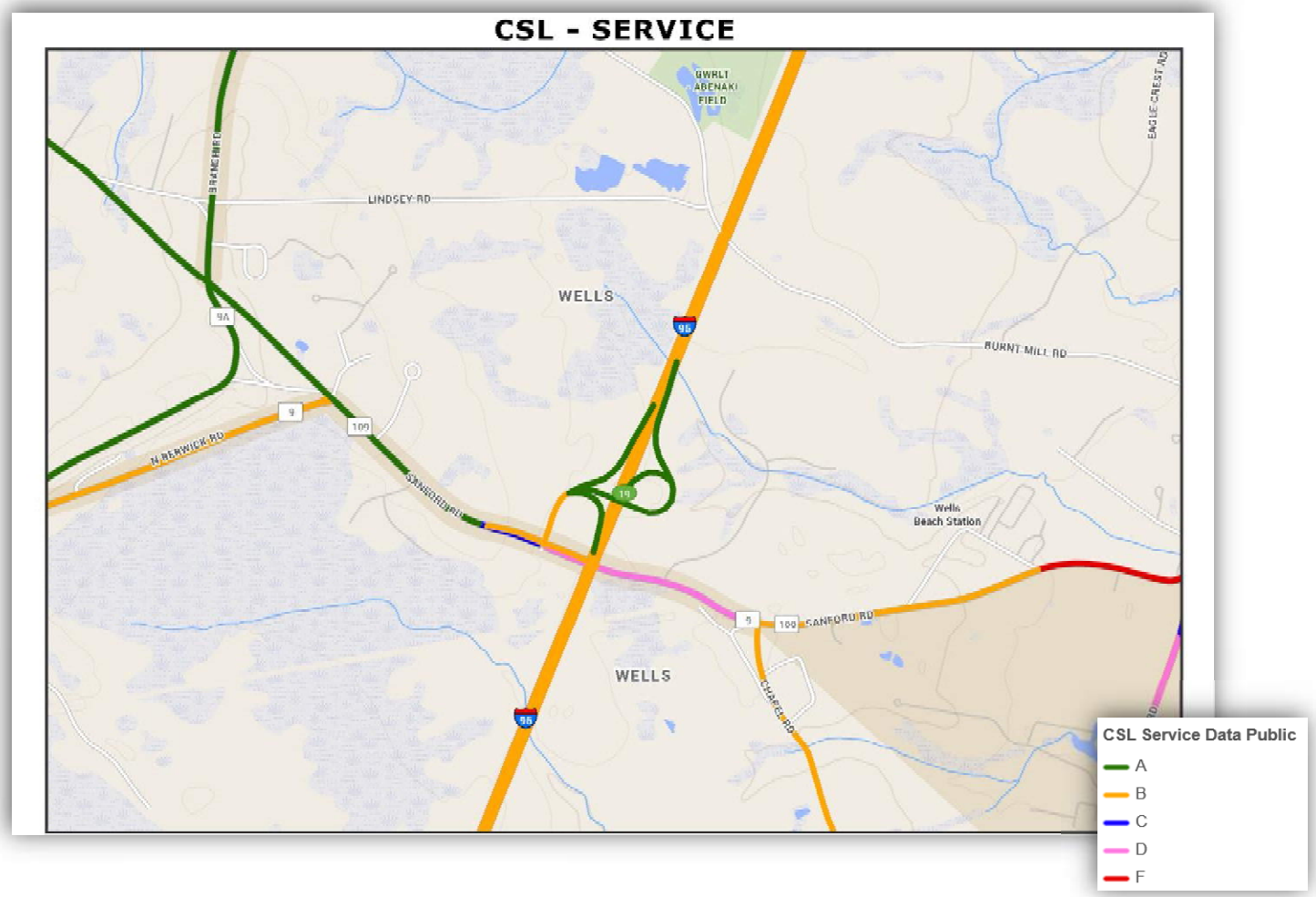


FIGURE 27: CUSTOMER SERVICE LEVEL: SERVICE

2.3.5: Access Management

Existing access management deficiencies within the study corridor were generally identified following a review of MaineDOT and Town standards. An assessment of existing driveway conditions was performed and consisted of reviewing: the number of driveways for each property; the width of driveways; the spacing of driveways; and how close driveways are to intersections (corner clearance). The purpose of access management is to provide vehicular access to land development in a manner that preserves the safety and efficiency of a transportation system.

MaineDOT Standards

Entrance Spacing Standards

Table 14 defines entrance spacing standards according to speed limits.

Table 14: MaineDOT Entrance Spacing Standards

Posted Speed (mph)	Entrance Separation (ft)
25 or less	Not applicable
30	Not applicable
35	Not applicable
40	175
45	265
50	350
55 or more	525

Arterial Corner Clearance

The minimum corner clearance for entrance onto Arterials must be 125 feet.

Number of Entrances

Except for forestry management and farming activities, lots on Arterials will be limited to one two-way or two one-way entrances.

Entrance Width

If 30% or less of the traffic projected to use the proposed entrance will be larger vehicles, the width of a two-way entrance within the highway right of way must be between 22 and 30 feet inclusive. If more than 30% of the traffic projected to use the proposed entrance will be heavy vehicles, the width of a two-way entrance within the highway right of way must be between 30 and 42 feet.

Town of Wells Standards

- If feasible, driveways that abut two roads shall locate their drive onto the lower volume road.
- On streets other than local or private streets, an on-site vehicular turnaround shall be provided so that vehicles do not have to back out into the public street.
- Minimum sight distance from a drive must be 10 feet for every mile per hour of posted speed limit on the street.

Locations that do not meet Access Management Standards

Several location in the corridor do not meet the previously mentioned access management standards. The locations are provided below, in **Figure 28**.

FIGURE 28: ACCESS MANAGEMENT DEFICIENCY LOCATIONS

Location 1, represented by **Figure 29** (a gas station and apartment building), does not meet access management standards for the number of driveways, corner clearance or location of drives on Route 109.

FIGURE 29: ACCESS MANAGEMENT DEFICIENCIES AT INTERSECTION OF ROUTE 109 (SANFORD ROAD) AND BRANCH ROAD/CREDIFORD ROAD

Location 2, represented on **Figure 30,** depicts driveways that do not meet driveway spacing standards.

FIGURE 30: ACCESS MANAGEMENT DEFICIENCIES ALONG ROUTE 109 (SANFORD ROAD) BETWEEN INTERSECTION WITH BRANCH ROAD/CREDIFORD ROAD AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

Location 3, represented on **Figure 31**, depicts driveways to a parking lot that does not meet minimum corner clearance requirements.

FIGURE 31: ACCESS MANAGEMENT DEFICIENCIES AT INTERSECTION OF ROUTE 109 (SANFORD ROAD) AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

Location 4, represented on **Figure 32**, depicts driveways along Route 109 (Sanford Road) that do not meet spacing requirements.

FIGURE 32: ACCESS MANAGEMENT DEFICIENCIES ALONG ROUTE 109 (SANFORD ROAD) BETWEEN INTERSECTION WITH ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET AND MTA EXIT 19/WELLS TRANSPORTATION CENTER

Location 5, represented on **Figure 33,** depicts driveways along Route 109 near Hubbard Lane. The drives to the north and south of Route 109 do not meet driveway spacing requirements.

FIGURE 33: ACCESS MANAGEMENT DEFICIENCIES ALONG ROUTES 109 & 9 (SANFORD ROAD) BETWEEN INTERSECTION WITH MTA EXIT 19/WELLS TRANSPORTATION CENTER AND SPENCER DRIVE

Location 6, represented on **Figure 34,** depicts driveways across from the westerly entrance to the Transportation Center. These driveways do not meet spacing requirements.

FIGURE 34: ACCESS MANAGEMENT DEFICIENCIES ALONG ROUTE 109 & 9 (SANFORD ROAD) BETWEEN INTERSECTION WITH SPENCER DRIVE AND CHAPEL ROAD

SECTION 3: FUTURE NO-BUILD CONDITIONS

As part of planning future roadway recommendations, it is common to create a baseline with which to compare. The Future No-Build condition is this baseline. In this case, the future year evaluated is 20 years, or the year 2036. Methods for developing future growth and results of the subsequent analysis follow in this section.

3.1: Future Growth Projections

In order to evaluate the Future No-Build condition, a 20 year growth scenario was established. In this case, traffic was forecasted to the year 2036 and no other changes or improvements were incorporated to the transportation network. Signal timing was optimized for the future analysis, but signal phasing was not changed from existing conditions. This scenario was used as the base line to evaluate various improvement alternatives.

Because of the variety of corridor users ranging from tourists to students to residents and more, a single growth rate was not to be applied to the corridor intersections. The Town Planner, MaineDOT and the MTA were contacted to provide recommendations on corridor growth. Data collected and analyzed included growth methods from the Central York County Connections Study, MaineDOT collected and published historic AADT volumes, and general guidance from MaineDOT and MTA.

For the purposes of this analysis, MaineDOT recommended use of a straight-line method of projecting future traffic volumes rather than using a compounding growth rate. This is because traffic volumes are not on an accelerating long-term growth pattern, such as when volumes were expanding quickly in the 1950s and 1960s. They have identified a slower rate of growth in population, driver's license applications and vehicle registrations in recent years.

The Turnpike Exit 19 Intersection was the focus area for developing growth rates as it has the highest volume in the corridor. According to MaineDOT historical data, volumes from 2002 to 2016 indicate an average straight line annual growth rate of 1.33% per year, or 26.67% over 20 years. Based on this, the Turnpike 20-year growth was set to a conservative 30%. The Route 109 & 9 approaches are estimated to have 10% growth over a 20 year period, resulting in an overall (approximately) 20% growth on Route 109 when combined with Turnpike movements. This is consistent with MaineDOT's statewide travel demand model growth projections that indicate slower growth on Route 109 versus the Turnpike. The Wells Transportation Center has seen large growth due to increased intermodal use. Because most of this traffic is locally driven, Turnpike movements to and from the Wells Transportation Center was estimated to increase by 30% over 20 years, while local growth is expected to increase by 50%. For the remainder of the corridor, in general, the overall growth calculated for the Route 109 and 9 legs of the Turnpike Exit 19 intersection were applied. Deviations from this method are discussed in the sections that follow. **Figure 35** depicts the 20-year growth percentages used for each movement in the corridor.

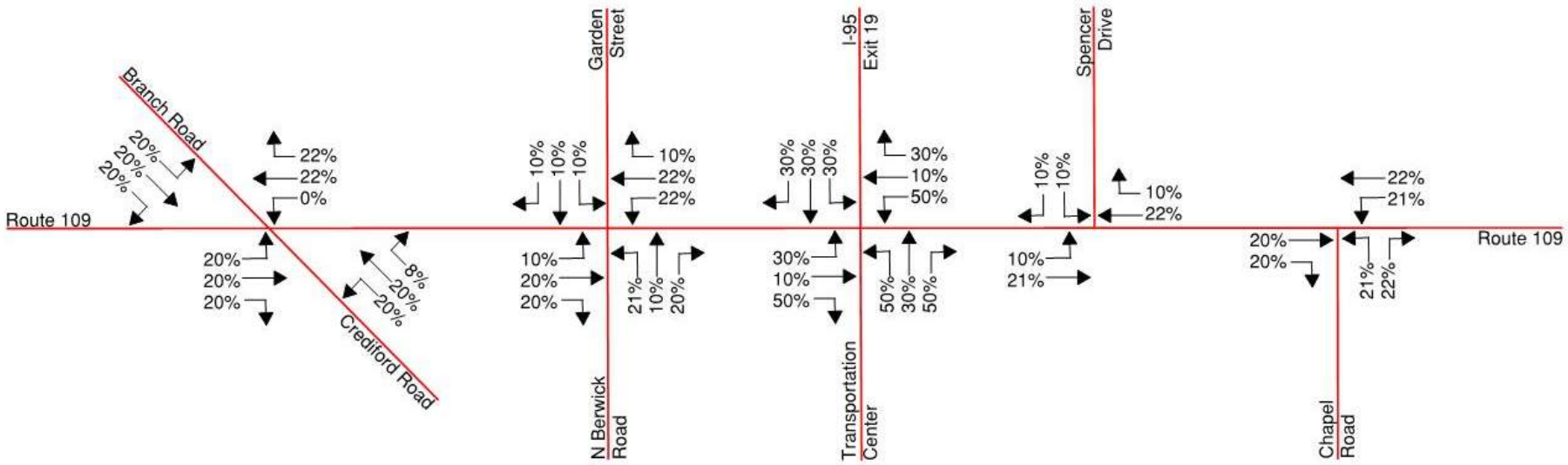


FIGURE 35: FUTURE GROWTH PERCENTAGES

Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road

As previously discussed, at the intersection of Route 109 and Branch Road/Crediford Road, the Route 109 approach growth rate was dictated by growth rates from the Route 109 approaches at the Turnpike Exit 19 intersection. The growth is estimated to be approximately 20%, slightly modified to balance traffic flow throughout the corridor. It should also be noted that reviewing AADT's obtained from the MaineDOT count books from 2010 and 2015, the Route 109 growth rate in this area varies between 0.5% and 1% per year, which is consistent with our approach, and is slightly conservative. Branch Road and Crediford Road were estimated to have similar traffic growth patterns as Route 109 at this location and therefore a 20% overall growth was assumed. During the only two years (2015 and 2016) of available MaineDOT data, Crediford Road increased by 6%. This short-term growth is not anticipated to continue over a long-term period and thus using 20% seems reasonable. Specific volume changes and growth percentages applied are shown in **Table 15.**

Table 15: Future Growth Percentages: Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street												
	Branch Road (SB)			Route 109 (Sanford Rd) WB			Crediford Road (NB)			Route 109 (Sanford Rd) EB		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
AM Peak (2016)	114	63	6	0	166	37	21	85	1	6	513	51
AM Peak (2036)	*137*	*76*	*8*	*0*	*204*	*46*	*26*	*102*	*1*	*8*	*618*	*62*
PM Peak (2016)	65	73	7	2	538	121	63	112	6	4	282	43
PM Peak (2036)	*78*	*88*	*9*	*2*	*653*	*146*	*76*	*135*	*7*	*5*	*338*	*52*
Percentage Recommended	20%	20%	20%	0%	22%	22%	20%	20%	8%	20%	20%	20%

Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street

Similar to the intersection of Route 109 and Branch Road/Crediford Road, the Route 109 intersection with Route 9 (North Berwick Road)/Garden Street is projected to have growth that is generally dictated by the growth rates on Route 109 at the Turnpike Exit 19 intersection. Route 109 movements are expected to increase by approximately 20%, again modified as needed to balance traffic flow throughout the corridor. Garden Street saw an anomaly, similar to growth computed on Crediford Road. From 2010 to 2016, AADT's on this approach grew from 100 to 290 vehicles. This would equate to approximately 10% growth per year. This area is not anticipated to see continued substantial growth and a 10% increase over 20-years was recommended by MaineDOT. Route 9 (North Berwick Road) had four estimated AADT's over a ten year period indicating approximately 1.2% growth per year. MaineDOT recommends an overall growth of 20%. **Table 16** presents the results.

Table 16: 2036 Future Growth Percentages: Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street												
	Garden Street (SB)			Route 109 (Sanford Rd) WB			North Berwick Road (NB)			Route 109 (Sanford Rd) EB		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
AM Peak (2016)	5	3	0	233	199	2	4	0	380	11	603	14
AM Peak (2036)	*6*	*4*	*0*	*286*	*245*	*3*	*5*	*0*	*458*	*13*	*726*	*17*
PM Peak (2016)	6	0	3	380	643	4	15	3	365	4	337	12
PM Peak (2036)	*7*	*0*	*4*	*460*	*778*	*5*	*19*	*4*	*437*	*5*	*403*	*15*
Percentage Recommended	10%	10%	10%	22%	22%	10%	21%	10%	20%	10%	20%	20%

Intersection of Routes 109 & 9 (Sanford Road) and MTA Exit 19/Wells Transportation Center

As previously discussed, the greatest volume growth in the corridor is anticipated to be at the Turnpike Exit 19 intersection. The Turnpike is anticipated to experience a 30% growth over the next 20 years. MaineDOT recommends an overall 20% growth for the approach of Route 109 at the Turnpike Exit 19 intersection. This is consistent with historical AADT information provided by MaineDOT. From 2010 to 2016, both Route 109 approaches experienced a growth rate of approximately 1.2% per year. MaineDOT recommendations can also be compared with the Transportation Center approach. The Transportation Center approach experienced approximately 4.6% growth per year from 2010 to 2016. MaineDOT recommends a 50% growth over 20-years. This approach is anticipated to continue as the Wells Transportation continues to expand. A complete summary can be found in **Table 17**.

TABLE 17: 2036 FUTURE GROWTH PERCENTAGES: INTERSECTION OF ROUTES 109 & 9 (SANFORD ROAD) AND MTA EXIT 19/WELLS TRANSPORTATION CENTER

	Route 109 WB			Transportation Center			Route 109 EB			Turnpike		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
AM Peak (2016)	12	171	298	9	5	4	477	496	15	291	8	254
AM Peak (2036)	*18*	*189*	*388*	*14*	*7*	*6*	*621*	*546*	*23*	*379*	*11*	*331*
PM Peak (2016)	5	486	435	22	18	19	329	376	3	478	20	519
PM Peak (2036)	*8*	*535*	*566*	*33*	*24*	*29*	*428*	*414*	*5*	*622*	*26*	*675*
Percentage Recommended	50%	10%	30%	50%	30%	50%	30%	10%	50%	30%	30%	30%

Intersection of Routes 109 & 9 (Sanford Road) and Spencer Drive

Historical data for Spencer Drive was limited and conclusions regarding growth were not available. Potential Industrial Park expansion appears to be possible, and while growth opportunities may occur, they appear to be minimal. Based on this information all movements related to Spencer Drive were estimated to grow 10% over the next 20 years. Similar to the intersections west of the Turnpike, Route 109 growth near Spencer Drive was dictated by growth rates on the westbound Route 109 approach to the Turnpike Exit 19 intersection. The growth applied to Route 109 movements is approximately 20%, modified as needed to balance the traffic flow throughout the corridor. The volumes are represented in **Table 18.**

Table 18: 2036 Future Growth Percentages: Intersection of Route 109 & 9 and Spencer Drive						
	Spencer Drive (SB)		Route 109 (Sanford Rd) WB		Route 109 (Sanford Rd) EB	
	Left	Right	Through	Right	Left	Through
AM Peak (2016)	17	6	475	15	84	707
AM Peak (2036)	*19*	*7*	*588*	*17*	*93*	*838*
PM Peak (2016)	21	97	829	6	39	834
PM Peak (2036)	*24*	*107*	*1002*	*7*	*43*	*1022*
Percentage Recommended	10%	10%	22%	10%	10%	21%

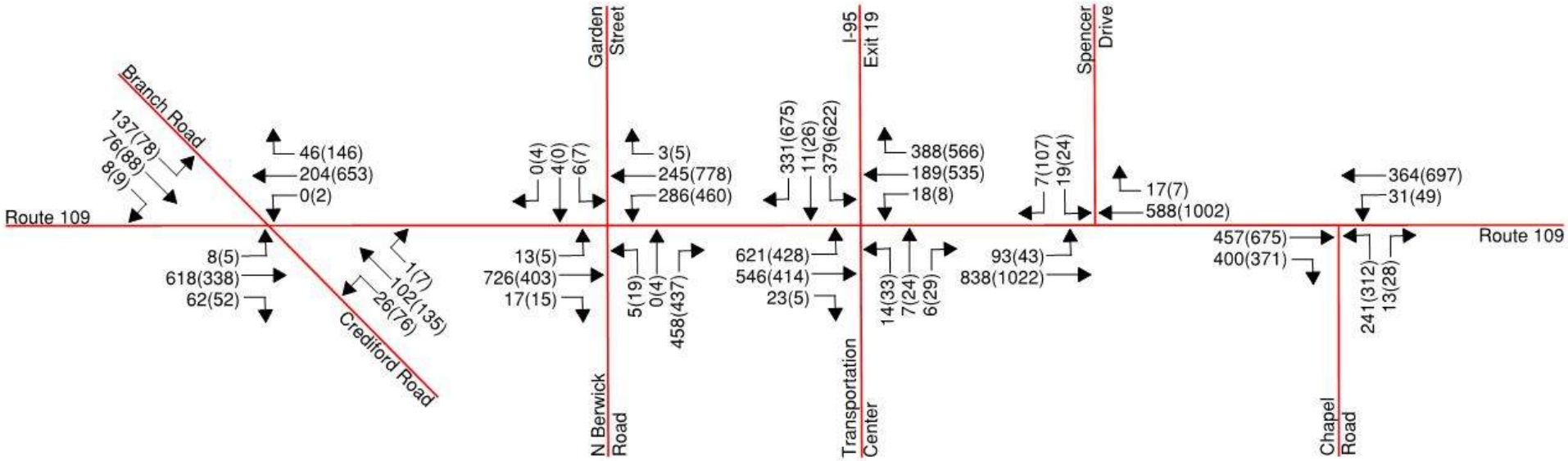
Intersection of Routes 109 & 9 (Sanford Road) and Chapel Road

The intersection of Route 109 and Chapel Road has a similar lack of historical data as the Spencer Drive intersection. MaineDOT counts were conducted in 2013, presumably in association with the traffic signal installation at this location. For all approaches, the growth for the westbound approach on Route 109 at the Turnpike Exit 19 intersection dictated growth – averaging approximately 20%. It is important to note that growth on Chapel Road may be slightly underestimated as York County Community College continues to grow and has been named one of the fastest growing two year institutions in Maine. Volumes and percentages are represented below in **Table 19.**

Table 19: 2036 Future Growth Percentages: Intersection of Route 109 & 9 and Chapel Road						
	Route 109 (Sanford Rd) WB		Chapel Road (NB)		Route 109 (Sanford Rd) EB	
	Left	Through	Left	Right	Through	Right
AM Peak (2016)	25	295	195	10	386	338
AM Peak (2036)	*31*	*364*	*241*	*13*	*457*	*400*
PM Peak (2016)	40	577	258	23	552	303
PM Peak (2036)	*49*	*697*	*312*	*28*	*675*	*371*
Percentage Recommended	21%	22%	22%	21%	20%	20%

Balanced Volumes

The final balanced 2036 peak hour traffic volumes are summarized in **Figure 36.**



XXX – AM Peak Hour

(XXX) – PM Peak Hour

FIGURE 36: 2036 BALANCED VOLUMES

3.2: Future No Build Intersection Level of Service Analysis

The following sections use the 2036 No-Build volume projections to analyze the operations of the corridor intersections to create a baseline for recommendations.

Intersection Level of Service

As previously mentioned, the standard used to evaluate traffic operating conditions of the transportation system is referred to as the Level of Service (LOS). SimTraffic computer models were used to analyze the study intersections and were simulated in Synchro vs. 9 for 5 runs of 60 minutes. Like the existing conditions analysis, the analysis is based on an optimized signal timing scenario. The report printouts can be found in **Appendix D: 2036 No-Build SimTraffic Reports** and results are in the tables that follow.

Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road

The intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road is a four-leg unsignalized intersection that is STOP controlled on the side roads and free-flow on Route 109. Route 109 experiences little to no queueing and delay, while heavy mainline traffic causes side roads to experience long delays and queues. While these movements on Branch Road and Crediford Road are anticipated to see significant delays, the delays and 95th percentile queues computed are likely overestimated by the simulation program. Full results are shown in **Table 20** and indicate that, with the projected volumes, side roads are anticipated to operate at failing levels of service. Basically the capacity of Route 9A approaches is insufficient resulting in long delays and queues that may back up through the nearest side roads as shown in the available queue of the table below but probably not to the extent shown.

TABLE 20: 2036 NO BUILD LEVEL OF SERVICE RESULTS: ROUTE 109 (SANFORD ROAD) AND BRANCH ROAD/CREDIFORD ROAD

		Route 9A (Branch Road)			Route 109			Route 9A (Crediford Road)			Route 109			Overall
		From North			From East			From South			From West			
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	Volume	137	76	8	0	204	46	26	102	1	8	618	62	
	LOS	F			A			F			A			F
	Delay (sec/veh)	898.9			0			996.5			0.1			204.9
	95th% Queue (feet)	1271			7			1278			68			
PM Peak	Volume	78	88	9	2	653	146	76	135	7	5	338	52	
	LOS	F			A			F			A			F
	Delay (sec/veh)	574.0			0.0			768.8			0.1			162.7
	95th% Queue (feet)	1163			11			1424			20			
	Available Queue (feet)	400 (to Berube)			1865 (to Nella)			800 (to Gregoire)			1750 (to Lindsey)			

Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street

Similar to the intersection of Route 109 with Branch Road/Crediford Road, the intersection of Route 109 with Route 9 (North Berwick Road)/Garden Street is a four leg unsignalized intersection that is STOP controlled on the side roads and free-flow on the mainline. Route 109 traffic is projected to have no delay eastbound, and minor delays westbound caused by traffic turning onto North Berwick Road. The effects of this are reduced by the bypass lane that allows motorists to go around traffic that is waiting to turn. Heavy traffic volumes on Route 109 make it difficult for vehicles on Route 9 or Garden Street to exit the approach and yields poor levels of service at this location (although not as extreme as those noted at Branch and Crediford Roads). It is likely that delays estimated by the simulation program on Route 9 will be less than those shown in Table 19 and that the 95th percentile queues may also be overestimated at this location, especially as the majority of these movements are right-turns that may have the ability to go around vehicles waiting to turn left onto Route 109 westbound. Full results are shown in **Table 21** and indicate that with the projected volumes, side roads are anticipated to operate at failing levels of service. However, even with queues that are thought to be overestimated, there is storage available with the exception of the turn bay onto Route 9.

TABLE 21: 2036 NO-BUILD LEVEL OF SERVICE RESULTS: ROUTE 109 (SANFORD ROAD) AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

		Garden Street			Route 9/109			Route 9			Route 109			Overall
		From North			From East			From South			From West			
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	Volume	6	4	0	286	245	3	5	0	458	13	726	17	
	LOS	F			B		A	F			A			F
	Delay (sec/veh)	52.4			10.1		0.4	284.1			0.1			79.8
	95th% Queue (feet)	38			291		85	2061			78			
PM Peak	Volume	7	0	4	460	778	5	19	4	437	5	403	15	
	LOS	F			A		A	F			A			F
	Delay (sec/veh)	69.3			3.8		1.4	422.7			0.2			107.2
	95th% Queue (feet)	47			342		127	2865			48			
	Available Queue (feet)	425 (to Ember)			150 (turn bay)		660 (to Homestead)	3280 (to Shepard)			110 (to Nella)			

Intersection of Routes 109 and 9 (Sanford Road) and MTA Exit 19/Wells Transportation Center

The intersection of Route 109, Maine Turnpike Exit 19 Ramps, and the Wells Transportation Center is the heart of this corridor. It is a four leg signalized intersection. North and southbound movements (the Turnpike Exit 19 approaches and the Wells Transportation Center) operate in a split signal phase, and left-turning movements from Route 109 operate as a protected phase only. The operation of this intersection, because of heavy volumes of conflicting movements and inefficient signal phasing, is extremely sensitive to signal timing adjustments. For the purposes of this analysis, this location includes optimized signal timing. Under the current configuration the heaviest delays are anticipated to be southbound from the Turnpike Exit 19 Off Ramps. The through and left-turn movements have reached or exceed the intended throughput capacity (in large part because there is not an equal utilization of both through lanes – many do not use the right most through lane because it is a lane drop). Other problematic movements include the westbound Route 109 movements. Despite this, excessively long queues are not anticipated, although the 95th percentile queues for southbound and westbound movements are estimated to exceed capacity under future conditions; eastbound right turn movements are also estimated to exceed capacity slightly. Refer to **Table 22** for a full summary of this information.

TABLE 22: 2036 NO-BUILD LEVEL OF SERVICE RESULTS: ROUTES 109 AND 9 (SANFORD ROAD) AND MTA EXIT 19/WELLS TRANSPORTATION CENTER

		MTA Exit 19			Route 9/109				Wells Trans Center			Route 9/109			Overall
		From North			From East				From South			From West			
		Left	Thru	Right	Left	Thru		Right	Left	Thru	Right	Left	Thru	Right	
AM Peak	Volume	379	11	331	18	189		388	14	7	6	621	546	23	
	LOS	E	F	A	D	D	D	A	D	C		C	B	C	C
	Delay (sec/veh)	53.8	86.0	1.6	45.9	49.6	49.8	8.7	40.0	28.9		26.3	14.3	29.4	25.3
	95th% Queue (feet)	354	350	223	69	198	177	198	53	42		343	376	446	
PM Peak	Volume	622	26	675	8	535		566	33	24	29	428	414	5	
	LOS	F	F	A	D	E	F	A	D	D		D	B	E	D
	Delay (sec/veh)	109.9	209.5	5.5	39.8	65.0	120.9	7.3	52.2	37.5		49.6	12.8	65.0	47.9
	95th% Queue (feet)	387	427	366	106	419	456	288	63	83		364	395	496	
	Available Queue (feet)	185 (after tolls)			150 (turn bay)	1350 (to Spencer)		225 (turn bay)	100 (turn bay)	600 (to parking)		300 (where lanes open) 1120 (to Hubbard)			

Intersection of Routes 109 and 9 (Sanford Road) and Spencer Drive

The intersection of Route 109 (Sanford Road) and Spencer Drive is a three-leg unsignalized intersection, with STOP control on the Spencer Drive approach. Route 109 movements operate in a free-flow condition and experience little to no delay with the exception of minor delays anticipated by vehicles traveling eastbound turning left onto Spencer Drive. Vehicles exiting Spencer Drive are anticipated to see some delay (level of service E in the PM Peak hour). The highest volume movement on Spencer Drive is a right-turn during the PM Peak Hour and it is possible for these vehicles to go around those waiting to turn left onto Route 109. Level of Service E conditions are projected for Spencer Drive during the PM peak hour, and are primarily related to left-turning vehicles having difficulty finding a gap in traffic, available storage is adequate. Results are shown in **Table 23**.

TABLE 23: 2036 NO-BUILD LEVEL OF SERVICE RESULTS: ROUTES 109 AND 9 (SANFORD ROAD) AND SPENCER DRIVE

		Spencer Drive		Route 9/109		Route 9/109		Overall
		From North		From East		From West		
		Left	Right	Thru	Right	Left	Thru	
AM Peak	Volume	19	7	588	17	93	838	
	LOS	B		A		A	A	A
	Delay (sec/veh)	18.8		0.2		2.9	0.0	0.6
	95th% Queue (feet)	68		10		68	0	
PM Peak	Volume	24	107	1002	7	43	1022	
	LOS	E		A		A	A	A
	Delay (sec/veh)	36.1		0.1		9.4	0.0	2.6
	95th% Queue (feet)	199		15		75	0	
	Available Queue (feet)	715 (business entrance)		1200 (to Chapel)		110 (turn bay)	1350 (to Turnpike)	

Intersection of Routes 109 & 9 (Sanford Road) and Chapel Road

Similar to the Spencer Drive intersection with Route 109 this is a three leg intersection; however, this intersection is signalized. Although there is a separate left turn lane on the Route 109 westbound approach, it should be noted that all movements at the intersection operate permissively and timings have been optimized for the purposes of this evaluation. This permissive westbound left turn movement is the source of the majority of intersection delay, with minor delays also anticipated on the Chapel Road approach. Overall, the intersection is projected to operate at an acceptable level of service. Results are summarized in **Table 24.**

TABLE 24: 2036 NO-BUILD LEVEL OF SERVICE RESULTS: ROUTES 109 & 9 (SANFORD ROAD) AND CHAPEL ROAD

		Route 109 From East		Chapel Road From South		Route 109 From West		Overall
		Left	Thru	Left	Right	Thru	Right	
AM Peak	Volume	31	364	241	13	457	400	
	LOS	D	A	B		A		A
	Delay (sec/veh)	42.6	5.3	17.0		5.5		8.2
	95th% Queue (feet)	63	229	168		309		
PM Peak	Volume	49	697	312	28	675	371	
	LOS	D	B	C		B		B
	Delay (sec/veh)	43.3	17.0	24.5		7.2		15.0
	95th% Queue (feet)	81	695	260		350		
	Available Queue (feet)	50 (turn bay)	1800 (to Depot)	575 (to Penacook)		1200 (to Spencer)		

SECTION 4: RECOMMENDATIONS

Working with the Steering Group, future recommendations were developed. These recommendations were compared against the No-Build Future Conditions to ensure that improvements mitigate identified deficiencies. Because these improvements are conceptual, the cost estimates provided within this section are planning level estimates.

4.1: Future Build Recommendations

Full corridor graphics of the final recommendations are found in **Appendix E: Conceptual Plans**. Full simulation results for each of these intersections are located in **Appendix F: 2036 Build SimTraffic Reports.**

4.1.1 Route 109 (Sanford Road) and Branch Road/Crediford Road

The current intersection is STOP controlled on the side streets with free movements on Route 109. Due to the difficulty of side street movements being able to exit onto Route 109 and the intersection's status as a high crash location, a signal warrant analysis was conducted to see if the intersection warrants the installation of a traffic signal.

As previously discussed, for the Intersection of Route 109 and Branch Road/Crediford Road there were four warrants met with discounted right turns – the eight, four, and peak hour volume warrants as well as the crash experience warrant. In addition to evaluating the installation of a traffic signal at the intersection from a warrant perspective, a capacity analysis was performed and indicates that acceptable traffic conditions would be expected with traffic signalization. **Table 25** summarizes results of this simulation.

TABLE 25: 2036 BUILD LEVEL OF SERVICE RESULTS: ROUTE 109 (SANFORD ROAD) AND BRANCH ROAD/CREDIFORD ROAD														
			Route 9A (Branch Road)			Route 109			Route 9A (Crediford Road)			Route 109			Overall
			From North			From East			From South			From West			
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
AM Peak Hour	2036 Future No Build	LOS	F			A			F			A			F
		Delay (sec/veh)	898.9			0			996.5			0.1			204.9
		95th% Queue (ft)	1271			7			1278			68			
	2036 Future Build	LOS	C			A			B			B			B
		Delay (sec/veh)	21.1			5.5			13.4			18.4			15.9
		95th% Queue (ft)	168			144			99			479			
PM Peak Hour	2036 Future No Build	LOS	F			A			F			A			F
		Delay (sec/veh)	574			0			768.8			0.1			162.7
		95th% Queue (ft)	1163			11			1424			20			
	2036 Future Build	LOS	B			B			B			B			B
		Delay (sec/veh)	21.6			8.7			19.9			7.3			11.4
		95th% Queue (ft)	139			458			183			379			
		Available Queue (ft)	400 (to Berube)			1865 (to Nella)			800 (to Gregoire)			1750 (to Lindsey)			

Recommendations for the Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road

It is recommended that a traffic signal be installed at the subject intersection. No geometric improvements are recommended. **Figure 37** illustrates the proposed improvements.

Figure 37: Proposed Improvement to the Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road

Planning Level Cost Estimate

As previously discussed, planning level cost estimates were calculated for these conceptual designs. In the estimate found in **Table 26** below, the following assumptions were made:

- Span wire traffic signal system
- Emergency vehicle pre-emption
- Video detection system
- No pavement resurfacing of the road will be required
- No geometric improvements will be made, therefor no widening will be required
- No right-of-way acquisition is necessary

Table 26: Planning Level Cost Estimate for: Route 109 (Sanford Road) and Branch Road/Crediford Road

Improvement	Approximate Cost
Traffic Signal Installation	$100,000
Miscellaneous signing and striping	$10,000
Mobilization and MOT (20%)	$22,000
Contingency (25%)	$27,500
Construction Total	**$159,500**
Design Cost (15%)	$23,925
Construction Engineering (10%)	$15,950
Total Cost	**$200,000**

4.1.2 Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street

The current intersection is STOP controlled on the side streets with free movements on Route 109. Due to the difficulty of side movements being able to exit onto Route 109 and the intersection's status as a high crash location (although the crash pattern is rear-end collisions which may not necessarily be solved by a signal), a signal warrant analysis was conducted to determine if the intersection warrants the installation of a traffic signal. In addition formal left-turn lanes on Route 109 and controlled movements at Nella Street were evaluated. As previously discussed, for the intersection of Route 109 and Route 9/Garden Street there were two warrants met with discounted right turns – the four hour volume and peak hour volume warrants.

Prior to recommending immediate signalization of the intersection, an analysis for the existing volume was run to evaluate if the signal at the Route 9A intersection (with a safety problem correctable by signalization) and geometric improvements would create enough gaps to allow vehicles at the Route 9 (North Berwick Road) and Garden Street approaches to operate acceptably. From this analysis it was clear that although levels of service would not be brought up to acceptable standards, that geometric improvements and the signalization of Branch Road would greatly improve conditions at the intersection.

Acceptable traffic conditions would be expected with future traffic signalization, with the exception of AM Peak Hour delays on the Garden Street approach – which would see approximately 70 seconds of delay, just over the minimum acceptable delay recommended by MaineDOT, however still an improvement over the No-Build future condition.

Possible geometric improvements (included in the following analysis) include removing the island on Route 9 and modifying the approach to be a combined through-left and right lane configuration. In addition, a left-turn lane westbound is also recommended. A complete summary of this analysis is located in **Table 27**.

TABLE 27: 2036 BUILD LEVEL OF SERVICE: ROUTE 109 (SANFORD ROAD AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

			Garden Street			Route 9/109			Route 9			Route 109			Overall
			From North			From East			From South			From West			
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	2036 Future No Build	LOS	F			B		A	F			A			F
		Delay (sec/veh)	52.4			10.1		0.4	284.1			0.1			79.8
		95th% Queue (feet)	38			291		85	2061			78			
	2016 Interim Build	LOS	C			A		A	C		D	A			B
		Delay (sec/veh)	29.2			7.8		0.0	28.9		33.4	0.2			10.1
		95th% Queue (feet)	36			139		0	45		300	58			
	2036 Future Build	LOS	E			D	D		B		C	B			C
		Delay (sec/veh)	70.8			46.1	45.2		10.3		24.5	18.5			28.2
		95th% Queue (feet)	44			210	678		36		305	544			
PM Peak Hour	2036 Future No Build	LOS	F			A		A	F			A			F
		Delay (sec/veh)	69.3			3.8		1.4	422.7			0.2			107.2
		95th% Queue (feet)	47			342		127	2865			48			
	2016 Interim Build	LOS	E			A		A	F		F	A			C
		Delay (sec/veh)	41.4			6.5		0.0	73.7		80.0	2.4			20.3
		95th% Queue (feet)	36			185		61	125		1222	168			
	2036 Future Build	LOS	D			B	B		B		B	C			B
		Delay (sec/veh)	42.0			17.3	10.8		16.0		11.8	27.5			16.0
		95th% Queue (feet)	36			208	772		46		215	460			
		Available Queue (feet)	425 (to Ember)			150 (turn bay)		660 (to Homestead)	3280 (to Shepard)			110 (to Nella)			

Recommendations

Several recommendations have been made for this intersection, as shown in **Figure 38.** These recommendation include:

- Restrict movements to and from Nella Street to be right-in and right-out only. A flush island on Route 109 shall be installed to accommodate emergency vehicles and will allow as much storage space as possible for vehicles turning left onto Garden Street.
- Remove the island on Route 9 approach and create a separate through-left and right approach. As much storage space as possible without impacting ROW is shown, 90 feet.
- Add left turn on Route 109 westbound onto Route 9 (North Berwick Road) with 200 feet of storage space, the 95th percentile queue required in 2036.
- **Future Evaluation:** Monitor the intersection with improvements and reevaluate traffic signal installation. Although traffic signal warrants are met at this location, it is anticipated that the installation of a new traffic signal at the Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road along with improvements to the Intersection of Routes 9 and 109 (Sanford Road) and MTA Exit 19/Wells Transportation Center will create gaps for vehicles trying to exit side streets. It is also important to be cautious when adding signals so as not to create new safety or vehicular flow concerns.

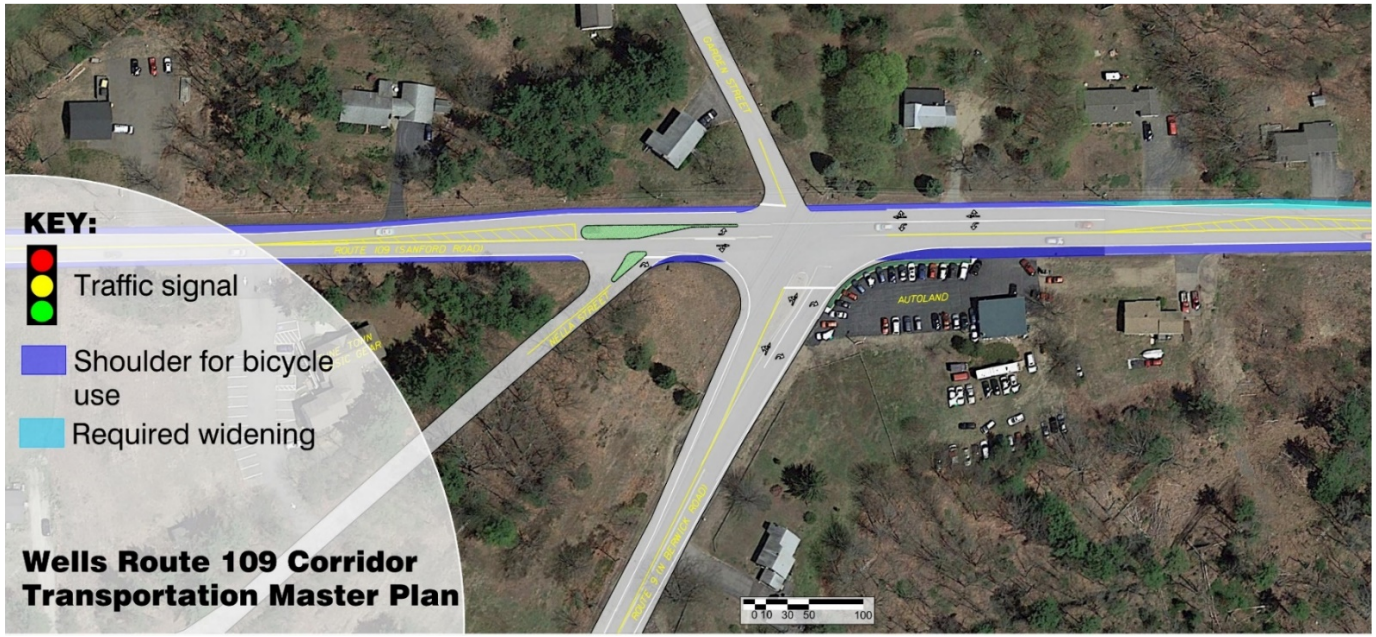


FIGURE 38: RECOMMENDED IMPROVEMENTS FOR THE INTERSECTION OF ROUTE 109 (SANFORD ROAD) AND ROUTE 9 (NORTH BERWICK ROAD)/GARDEN STREET

Planning Level Cost Estimate

As previously discussed, planning level cost estimates were calculated for these conceptual designs. In the estimate in **Table 28**, the following assumptions were made:

- Two drainage structures would require modification
- Widening for bicycle lanes is included in this section
- Right of Way Estimate provided by MaineDOT
- No pavement resurfacing of the road will be required

Table 28: Planning Level Cost Estimate for: Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street

Improvement	Approximate Cost
Flush island at Nella Street	$4,000
Flush island on Sanford Road	$15,000
Removal of raised island on Berwick Road	$15,000
Widening to Homestead	$62,000
Drainage adjustments	$15,000
Miscellaneous signing and striping	$5,000
Mobilization and MOT (20%)	$23,200
Contingency (25%)	$29,000
Construction Total	**$168,200**
Design Cost (15%)	$25,230
Construction Engineering (10%)	$16,820
Right of Way Acquisition	$15,000
Total Cost	**$230,000**

4.1.3 Route 109 and 9 (Sanford Road) and Turnpike Exit 19/Wells Transportation Center

This is the busiest intersection in the study corridor. While several improvements to the intersection have been implemented recently to improve safety and mobility, additional modifications to the intersection are necessary to address future traffic volume growth.

While several alternatives were evaluated for the eastbound Route 109 approach, the most efficient alternative provides a second left-turn lane onto the Turnpike Exit 19 On Ramps from the eastbound approach assuming two exclusive left turn lanes and a through/right approach configuration. This configuration does not require roadway widening. Overhead directional signage will be required under this scenario to direct motorists to the appropriate left-turn lane for northbound and southbound destinations on the Turnpike. A review of traffic volumes indicate close to an equal split and thus close to equal lane distribution is expected.

The two departing lanes on eastbound Route 109, are not seeing equal utilization of both lanes. It is recommended to extend these two departing lanes approximately 250 feet to encourage better utilization.

A capacity analysis was performed and indicates improved traffic conditions would be expected with this new approach lane configuration on eastbound Route 109. There will still be some movements that are anticipated to have a level of service "E", but this is a large improvement over anticipated no build future levels of service. **Table 29** presents the Level of Service results.

TABLE 29: 2036 BUILD LEVEL OF SERVICE: ROUTE 109 AND 9 (SANFORD ROAD) AND TURNPIKE EXIT 19/WELLS TRANSPORTATION CENTER

			MTA Exit 19			Route 9/109				Wells Trans Center			Route 9/109			Overall
			From North			From East				From South			From West			
			LT	TH	RT	LT	TH		RT	LT	TH	RT	LT	TH	RT	
2036 AM Peak	Future No Build	LOS	E	F	A	D	D	D	A	D	C		C	B	C	C
		Delay (sec/veh)	53.8	86	1.6	45.9	49.6	49.8	8.7	40	28.9		26.3	14.3	29.4	25.3
		95th% Queue (feet)	354	350	223	69	198	177	198	53	42		343	376	446	
	Future Build	LOS	C	B	A	B	C	B	A	C	B		B	C	B	B
		Delay (sec/veh)	29.3	17.4	1.9	18.7	25.3	22.9	6.9	33.7	17.2		17.7	24.5	11.7	15.5
		95th% Queue (feet)	248	210	117	32	137	93	180	49	47		178	240	282	
2036 PM Peak	Future No Build	LOS	F	F	A	D	E	F	A	D	D		D	B	E	D
		Delay (sec/veh)	109.9	209.5	5.5	39.8	65	120.9	7.3	52.2	37.5		49.6	12.8	65	47.9
		95th% Queue (feet)	387	427	366	106	419	456	288	63	83		364	395	496	
	Future Build	LOS	C	C	A	B	D	D	A	D	C		D	E	A	C
		Delay (sec/veh)	32.7	22.8	4.1	13.1	36.6	39.9	4.1	43.2	28.3		34.8	57.3	8.9	21.5
		95th% Queue (feet)	340	350	261	86	420	473	255	66	97		254	295	306	
		Available Queue (feet)	185 (after tolls)			150 (turn bay)	1350 (to Spencer)		225 (turn bay)	100 (turn bay)	600 (to parking)		300 (where lanes open) 1120 (to Hubbard)			

Recommendations

Several recommendations have been made for this intersection, as shown in **Figure 39.** These recommendations include:

- Modification of the existing signal to adaptive control
- Modification of eastbound Route 109 approach to a double left and through-right approach – turn bays are to remain approximately 300 ft long, which will satisfy 2036 95th percentile queue estimates
- Installation of two overhead lane assignment signage structures
- Extend the two eastbound departure lanes after the intersection by 250 feet before the lane drop occurs. (Approximately at the Turnpike bridges.)

Figure 39: Recommended Improvements for the Intersection of Routes 109 and 9 (Sanford Road) and Turnpike Exit 19/Wells Transportation Center

Planning Level Cost Estimate

As previously discussed, planning level cost estimates were calculated for these conceptual designs. In the estimate below, the following assumptions were made:

- Adaptive Signal Control
- Overhead sign structures
- Signal modification for the new eastbound approach
- Widen Route 109 eastbound under the Turnpike for two departure lanes
- No pavement resurfacing of the road will be required
- No right-of-way acquisition is necessary

TABLE 30:
Planning Level Cost Estimate For: Route 109 (Sanford Road) and Turnpike Exit 19/Wells Transportation Center

Improvement	Approximate Cost
Signal modifications including new signal heads and adaptive signal	$75,000
Two overhead sign structures	$200,000
Widen the road under the bridge for increased merge length	$50,000
Drainage improvements	$10,000
Miscellaneous signing and striping	$5,000
Mobilization and MOT (20%)	$68,000
Contingency (25%)	$85,000
Construction Total	**$493,000**
Design Cost (15%)	$73,950
Construction Engineering (10%)	$49,300
ROW/Survey	$50,000
Total Cost	**$670,000**

4.1.4 Route 109 and 9 (Sanford Road) and Spencer Drive

This intersection is a three leg intersection. Unique to the study area intersections, Spencer Drive is privately owned. Spencer Drive provides access to an industrial park and has high truck volumes. The primary improvement option evaluated was to provide a formal left-turn lane on the eastbound Route 109 approach. Adding separate left and right turn lanes on Spencer Drive and adjusting the island on Spencer Drive was also considered.

A capacity analysis was performed and indicates separating the lanes on Spencer Drive has little effect on the overall level of service. Because the left and right movements are no longer averaged together, higher delays are estimated for vehicles turning from Spencer Drive but a split would allow right turning vehicles to proceed without waiting for vehicles waiting to turn left. **Table 31** presents the Level of Service Results.

TABLE 31: 2036 BUILD LEVEL OF SERVICE: ROUTE 109 AND 9 (SANFORD ROAD) AND SPENCER DRIVE

			Spencer Drive		Route 9/109		Route 9/109		Overall
			From North		From East		From West		
			Left	Right	Thru	Right	Left	Thru	
2036 AM Peak	Future No Build	LOS	B		A		A	A	A
		Delay (sec/veh)	18.8		0.2		2.9	0	0.6
		95th% Queue (feet)	68		10		68	0	
	Future Build	LOS	C	A	A		A	A	A
		Delay (sec/veh)	24.0	4.3	0.1		3.5	0.0	0.6
		95th% Queue (feet)	52	43	12		75	0	
2036 PM Peak	Future No Build	LOS	E		A		A	A	A
		Delay (sec/veh)	36.1		0.1		9.4	0	2.6
		95th% Queue (feet)	199		15		75	0	
	Future Build	LOS	F	A	A		A	B	B
		Delay (sec/veh)	410.8	9.6	5.4		10.0	13.9	12.4
		95th% Queue (feet)	409	119	20		140	655	
		Available Queue (feet)	715		1200		125	1350	

Recommendations

This intersection should be re-evaluated as future development occurs. At that time, several recommendations have been made for potential improvements to this intersection, as shown in **Figure 40.** These recommendations include:

- Formalize left turn bay eastbound (approximately 140 feet would be required to meet 2036 95th percentile queue estimates)
- Separate left and right lanes on Spencer Drive
- Modify island on Spencer Drive

FIGURE 40: RECOMMENDED IMPROVEMENTS FOR THE INTERSECTION OF ROUTE 109 AND 9 AND SPENCER DRIVE

Planning Level Cost Estimate

As previously discussed, planning level cost estimates were calculated for these conceptual designs. In **Table 32** below, the following assumptions were made:

- No pavement resurfacing of the road will be required
- No right-of-way acquisition is necessary

Table 32: Planning Level Cost Estimate for: Routes 109 and 9 (Sanford Road) and Spencer Drive

Improvement	Approximate Cost
Modify median island at Spencer Drive	$3,100
Widen the Spencer Drive approach	$15,000
Drainage improvements	$10,000
Miscellaneous signing and striping	$1,500
Mobilization and MOT (20%)	$5,920
Contingency (25%)	$7,400
Construction Total	**$44,400**
Design Cost (15%)	$6,438
Construction Engineering (10%)	$4,292
Total Cost	**$55,000**

4.1.5 Route 109 and 9 (Sanford Road) and Chapel Road

This three-leg intersection (with a small drive) is under traffic signal control. Two improvements were considered at this location: lengthening the Route 109 westbound left-turn lane for additional storage, and widening the eastbound Route 109 approach to allow right-turns to more easily by-pass through vehicles. A westbound left turn signal phase allowing for protected-permissive phasing was also considered.

A capacity analysis was performed and indicates that acceptable traffic conditions would be expected with the newly proposed traffic signal phasing. The westbound Route 109 turn bay should be increased from 50 feet currently to 100 feet to provide enough storage for estimated queues. Eastbound traffic may see long queues but little delay is projected and it is likely that this length is overestimated. **Table 33** presents the Level of Service results.

TABLE 33: 2036 BUILD LEVEL OF SERVICE: ROUTES 109 AND 9 (SANFORD ROAD) AND CHAPEL ROAD

			Route 109 From East		Chapel Road From South		Route 109 From West		Overall
			Left	Thru	Left	Right	Thru	Right	
2036 AM Peak	Future No Build	LOS	D	A	B		A		A
		Delay (sec/veh)	42.6	5.3	17.0		5.5		8.2
		95th% Queue (feet)	63	229	168		309		
	Future Build	LOS	B	A	C		A		A
		Delay (sec/veh)	18.9	4.7	20.8		8.0		9.5
		95th% Queue (feet)	64	164	193		392		
2036 PM Peak	Future No Build	LOS	D	B	C		B		B
		Delay (sec/veh)	43.3	17	24.5		7.2		15
		95th% Queue (feet)	81	695	260		350		
	Future Build	LOS	C	A	C		D		C
		Delay (sec/veh)	25.2	4.9	36.4		51.3		32.6
		95th% Queue (feet)	78	243	306		1486		
		Available Queue (feet)	**50 (turn bay)**	**1800 (to Depot)**	**575 (to Penacook)**		**1200 (to Spencer)**		

Recommendations

Several recommendations have been made for this intersection, as shown in **Figure 41.** These recommendations include:

- Modify the permissive signal phase for westbound left-turn movements to protected-permissive and extend the turn bay 50 feet to meet anticipated 2036 storage requirements. Adjustment to the existing traffic signal will be required.
- Widen the eastbound approach to accommodate a right turn area for vehicles turning onto Chapel Road and bike provisions

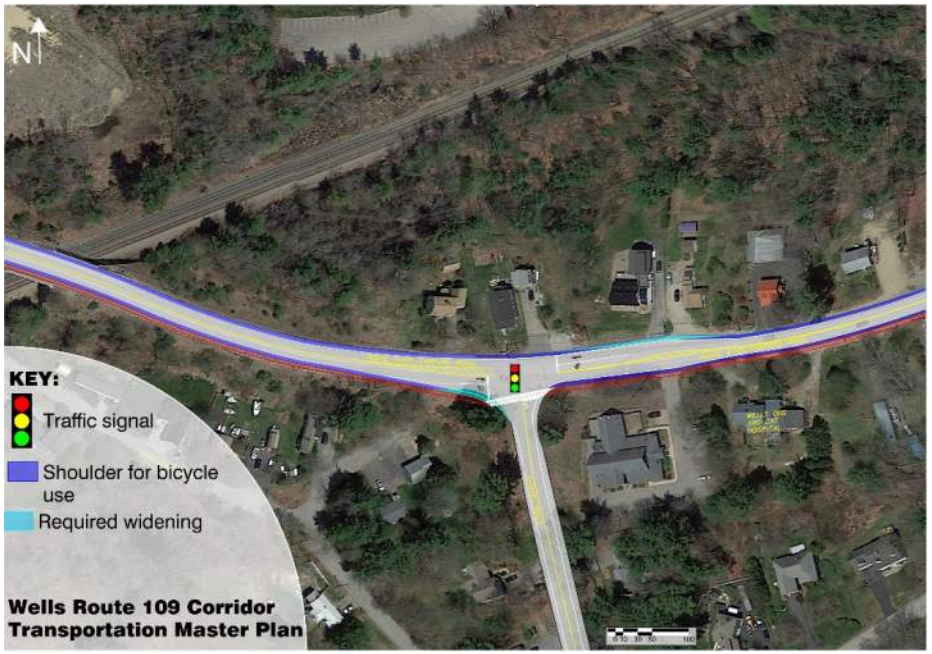


FIGURE 41: RECOMMENDED IMPROVEMENTS FOR THE INTERSECTION OF ROUTES 109 AND 9 AND CHAPEL ROAD

Planning Level Cost Estimate

As previously discussed, planning level cost estimates were calculated for these conceptual designs. In **Table 34** below, the following assumptions were made:

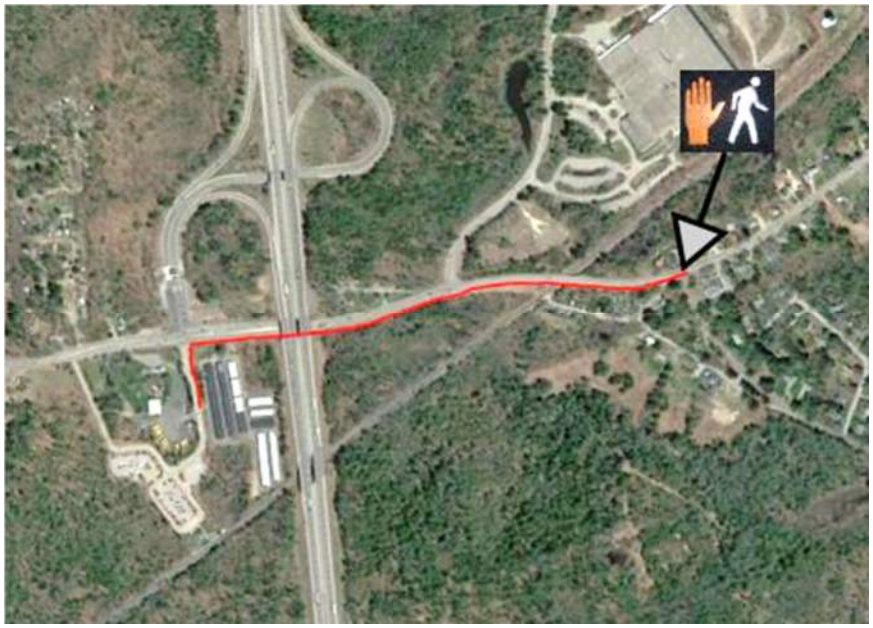
- A retaining wall is likely required for widening and future sidewalk work (estimated to be 8ft high – including buried length by 100ft long). Because the cost of the wall will occur whether or not the sidewalk is placed, the cost of a retaining wall is included in this estimate
- No pavement resurfacing of the road will be required
- No right-of-way acquisition is necessary

Table 34: Planning Level Cost Estimate for: Routes 109 and 9 (Sanford Road) and Chapel Road

Improvement	Approximate Cost
New vehicular signal heads	$5,000
Widen Route 109 for EB Right Turn/Bike	$25,000
Retaining wall	$32,000
Miscellaneous signing and striping	$7,500
Mobilization and MOT (20%)	$13,900
Contingency (25%)	$17,375
Construction Total	**$100,775**
Design Cost (15%)	$15,116
Construction Engineering (10%)	$10,078
Total Cost	**$130,000**

4.1.6 Pedestrian Improvements

There are currently no pedestrian facilities in the corridor. It is suggested that the recommendations contained in the Wells Sidewalk Plan be considered and thus a sidewalk should be constructed on the south side of Route 109 from the terminus of the existing sidewalk (near the elementary school) to the Transportation Center. In conjunction with this, the traffic signal at Chapel Road will need to be upgraded for a new crosswalk with pedestrian heads and push buttons. The railroad bridge will need to be reconfigured roughly to consist of two 12 foot lanes, two 5.5 foot shoulders and a 5 foot sidewalk. According to a review by MaineDOT staff, this bridge can accommodate the additional pedestrian/sidewalk load. Finally, a sidewalk into the Transportation Center will be required. Please see the Appendix for full plans.



Planning Level Cost Estimate

As previously discussed, planning level cost estimates were calculated for these conceptual designs. In **Table 35** the following assumptions were made:

- A retaining wall by Chapel Road will be required and the cost is assumed as part of the road widening
- Sidewalk will extend from the existing sidewalk terminus to the intersection with the Turnpike Exit 19 and into the Wells Transportation Center. Existing curb into the Transportation Center will be reused.
- Signal and other pedestrian upgrades will be required at Chapel Road
- No right-of-way acquisition is necessary

Table 35: Planning Level Cost Estimate for: Corridor Pedestrian Improvements

Improvement	Approximate Cost
Sidewalk into the Wells Transportation Center	$60,000
Sidewalk from the Wells Transportation to Chapel Road, including the bridge improvements	$350,000
Sidewalk from Wells Elementary School to Chapel Road	$125,000
Miscellaneous signing and striping	$1,500
Mobilization and MOT (20%)	$107,300
Contingency (25%)	$134,125
Construction Total	**$777,925**
Design Cost (15%)	$116,689
Construction Engineering (10%)	$77,793
Total Cost	**$975,000**

4.1.7 Bicycle Improvements

The only signed bicycle facility in the corridor exists on the westbound approach to the Turnpike Exit 19 Ramps intersection. To save costs wherever possible, it is recommended to reallocate existing travel lane width and restripe with bicycle lanes.

Specifically, it is proposed to re-allocate lane widths between Branch Road and Chapel Road to provide a minimum shoulder width of 5 feet (restriping) with the exception of the area at Route 9 and widening related to vehicular improvements by the Turnpike bridges. **Table 36** is a planning level estimate for these improvements.

- Widening at Route 9
- Widening under the Turnpike bridges is part of the project to widen the road
- No right-of-way acquisition is necessary

Table 36: Planning Level Cost Estimate for: Corridor Bicycle Improvements

Improvement	Approximate Cost
General restriping to achieve 5 foot shoulder	$10,000
Widening from Garden Street to Homestead (northerly side)	$42,000
Mobilization and MOT (20%)	$10,400
Contingency (25%)	$13,000
Construction Total	**$75,400**
Design Cost (15%)	$11,310
Construction Engineering (10%)	$7,540
Total Cost	**$95,000**

4.2 Implementation

Preliminary discussions regarding implementation of various improvements was discussed and a summary of these discussions was as follows.

- **Route 109 (Sanford Road) and Branch Road/Crediford Road with Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street:** Based on proximity, it is anticipated that these two projects will be implemented together, depending on available funding. MaineDOT and the Town of Wells consider these two intersection improvements a priority and intend to work in partnership to identify funding.
- **Route 109/9 (Sanford Road) and Turnpike Exit 19/Wells Transportation Center:** The MTA will seek to perform the roadway work using MTA funds as its capital funding allows. MaineDOT and MTA agree that this work is a department project within the meaning of 23 MRSA 1961(7). Because this intersection was just recently improved, immediate funding is not likely, but the MTA will use good faith efforts to fund this work within a few years.
- **Route 109/9 (Sanford Road) and Spencer Drive:** Improvements to this location are not recommended at this time but should be considered as future development occurs in this area. As Spencer Drive is a private road, any improvements at this location are not eligible for state or federal funding.
- **Route 109/9 (Sanford Road) and Chapel Road:** Because this intersection is currently operating acceptably, without safety concerns, funding for this project is not recommended at this time.
- **Bicycle and Pedestrian Improvements:** Improvements for bicycle and pedestrians, separated out in Sections 4.1.6 and 4.1.7 do not currently have funding sources at this time. The MTA does not anticipate participating in the costs of these improvements.

SECTION 5: PUBLIC INVOLVEMENT AND MEETINGS

An important part of developing concensus on an improvement plan and seeking meaningful feedback, this study involved the Town, MaineDOT, MTA and the general public. To achieve this goal of keeping everyone informed a Steering Group was established that helped guide the study and form initial corridor recommendations. Upon development of Draft recommendations, a public meeting was held for additional thoughts and comments.

5.1: Steering Group

A Steering Group met throughout the duration of the study to provide guidance and feedback as recommendations progressed. The group included the following:

Steering Group	
Affiliation	**Person**
Town of Wells	Jon Carter Terry Oliver Mike Livingston Jo-Ann Putnam
MaineDOT	Nathan Howard Ed Hanscom Tim Soucie
Maine Turnpike Authority	Ralph Norwood Bruce Van Note
T. Y. Lin International	Tom Errico Ariel Greenlaw
State Senator	Ron Collins
State Representative	Bob Foley

5.2: Steering Group Meetings

Project-Kick Off Meeting

On June 16, 2016, the Steering Group met to kick-off the project. Notes of this meeting and all subsequent meetings are including in **Appendix H: Meeting Notes**. Most notably at this meeting, the following specific issues were noted:

- Route 109 eastbound from Exit 19: The lane drop is too short and needs to be reviewed; challenges with this include the B&M Railroad Bridge.
- Traffic: Friday morning commuter traffic is high; there is significant school and private bus activity generated from the bus operator located at the entrance to the Wells Transportation Center; and there is a high volume of trucks especially related to Shaw's and UPS on Spencer Drive.
- Vehicular speeding is perceived to be a problem on Route 109.
- Lane configuration at the Turnpike Exit 19 entrance is anticipated to be evaluated including adding additional capacity for left-turning movements onto the Turnpike Exit 19 Ramps.
- Pedestrian Safety: A sidewalk to the Wells Transportation Center is proposed in the Town's Sidewalk Mast Plan.
- Bicycle Safety: Connectivity should be evaluated, particularly in relation to the Eastern Trail's Off-Road facility and connection to the Transportation Center.
- Future development includes expansion of York County Community College and the development of vacant properties.

Existing Conditions Review

On November 28, 2016, the Steering Group met to review data gathered during the existing conditions review. The draft Existing Conditions Memorandum prepared by TYLI was discussed. At this meeting, the Future No Build draft Memorandum was also examined. Of significance, the growth of the corridor was discussed and areas of concern to be addressed at the recommendations meeting.

Recommendation Review

On December 16, 2016, the Steering Group met to review possible recommendations to improve traffic mobility, safety, and pedestrian/bicycle connectivity. The results of this meeting are discussed in the Recommendations section of the report. Of significance, the cost of improvements were discussed and these costs were to be further refined based on discussion.

5.3: Public Meeting

A public meeting was held February 6, 2017 at Wells Auditorium. The meeting was attended by MaineDOT, Maine Turnpike Authority, TYLin International, and member of the Town of Wells. Many residents also attended the meeting. Planning improvements for the corridor were presented to residents and other interested parties. Residents expressed their corridor concerns. Full minutes including resident concerns and responses by location are located in **Appendix H**.

5.4: Steering Group

A steering committee meeting was held March 27, 2017 at the Wells Town Offices. The most notable issues discussed include:

- Recommendations:
  - Intersection of Route 109 (Sanford Road) and Branch Road/Crediford Road: There was discussion of mast arms vs. strain poles for the proposed signal at this location. Strain poles were agreed on by the steering committee.
  - Intersection of Route 109 (Sanford Road) and Route 9 (North Berwick Road)/Garden Street: A potential signal at this location is to be recommended for future consideration once other improvements have been implemented so as not to possibly disrupt the flow of the corridor and otherwise impair safety. All costs with regards to the signal are not to be included in the report and recommendations without the signal will remove the reference “Interim”. Two lanes from Garden Street was discussed, however this was decided to be re-evaluated if/when more development occurs on this road (a new subdivision is anticipated to nearly double traffic).
  - Intersection of Route 109/9 (Sanford Road) and Turnpike Exit 19/Wells Transportation Center: A few notes were made regarding the plans/locations - overhead sign placement is just a place holder, while two sign structures are needed, locations have not yet been evaluated for clear zone or ROW impacts. It was noted that there is curbing into the Wells Transportation Center – this curbing is in adequate shape to be reused if a sidewalk is placed into the Transportation Center and thus costs will be adjusted accordingly. The question of funding this project came up and MTA stated that because of recent improvements to the intersection it is not known when this work would occur but MTA would likely only fund a portion of this work. There are questions about what people are going to say about giant signs and structures on an otherwise quiet road. There was also discussion about lighting the signs –

this is not necessary because of the new reflective material and relatively low corridor speeds.

- Intersection of Route 109/9 (Sanford Road) and Spencer Drive: There was discussion that because it was private these changes probably would not be made at this time, but could be encouraged if development continues. The possibility of a traffic light here was not warranted at this time and there was discussion over how one could be used to keep traffic moving throughout the corridor.
- Intersection of Route 109/9 (Sanford Road) and Chapel Road: Add the bike improvements to the corner widening of the eastbound approach onto Chapel Road.
- Pedestrian Improvements: There were comments that adding a sidewalk on the bridge would definitely require more preliminary engineering. The bridge was constructed in 1988 and is not on the list for improvements or upgrades at this time. There was also a question regarding a sidewalk into Chapel – a lot of people at the public meeting mentioned this would be nice for those going to the York County Community College. This is not included at this time as the recommendations in that area will follow the previous pedestrian study completed.
- Implementation: There was a lot of talk about implementation, time frames, and who would pay. Essentially the Town and MaineDOT will work together on the Intersections of Route 109 (Sanford Road) and Route 9A/Route 9. MTA will work with the town on the Turnpike Intersection, and the other recommendations will not be funded at this time.