Chapter 3: HIGHWAYS

Chapter Overview

Highways play a critical role in providing both regional and local accessibility to communities in the CYCCS study area. On the regional scale, state highways connect the towns of central York County with the rest of Maine, New England, and points beyond. They provide access to the Interstate Highway system (Maine Turnpike), the Amtrak passenger rail network (in Wells and Saco), and commercial airline service at the Portland Jetport, Sanford Seacoast Regional Airport, and intercity bus service. At the local level, highways provide access between and within the central York County communities.

Automobiles are the predominate means of travel within the CYCCS study area, but highways also facilitate the movement of goods by truck, provide routes for local and regional bus services, are used by bicyclists, and accommodate pedestrians in towns and villages.

This chapter focuses on the CYCCS's assessment of highways within the study area, and is organized as follows:

The Regional Highway Network

The first section of this chapter examines the existing characteristics and operating conditions of highways within the CYCCS study area, followed by a review of future traffic conditions given projected changes in regional population and employment by the year 2035. An overview of how the highway network affects bicycling and walking is provided as well.

Considering Regional Highway System Expansion

Early in the study process, the possibility of expanding the existing highway network by constructing new corridors or increasing the capacity and travel speeds on existing highways was considered. The purpose behind this exercise was threefold:

- To determine how new or expanded highway facilities could change travel patterns and the extent to which such changes would improve mobility in the region;
- To consider how large-scale transportation investments might affect the regional economy over the long-term; and
- To consider the potential adverse effects of highway expansion, such as impacts to natural resources and community character.

Following discussion of the evaluation results with the public, the study Steering and Advisory Committees decided to eliminate large-scale highway expansion strategies from further consideration.

Recommendations - Improving the Current Highway System

During the latter portion of the study, the focus shifted to investigating smaller-scale improvements to address identified issues on the current highway network. These are the basis for the highway-related recommendations of the study.

The Regional Highway Network

Coastal Routes

The regional highway network (Figure 3-1) is anchored by the Maine Turnpike (I-95), which links the state's most populous areas and is the primary transportation corridor connecting Maine with neighboring New Hampshire and other New England states beyond. The Turnpike runs roughly parallel to the coastline in the CYCCS study area, passing through Ogunquit, Wells, Kennebunk, Arundel and Biddeford. Access to the Turnpike is provided at interchanges in Wells (Exit 19), Kennebunk (Exit 25) and Biddeford (Exit 32). Originally two lanes in each direction, the Turnpike was modernized and expanded in the late 1990s to provide a third travel lane in both directions.

Route 1 runs roughly parallel to the Maine Turnpike and is the original Post Road in Maine. Route 1 is the historic commercial "Main" street in Ogunquit, Wells, Kennebunk, and Arundel, passing through the town centers of each community. The highway is named Main Street in Ogunquit, Post Road in Wells, York Street in southern Kennebunk, Main Street in downtown Kennebunk, Portland Road in northern Kennebunk and Arundel, and Elm Street in Biddeford. Route 1 is a two-lane highway, with a two-way left turn lane provided throughout most of Ogunquit and Wells. Elsewhere, left turn pockets are commonly provided at major intersections. In Biddeford, the roadway expands to four travel lanes with left turn pockets approaching the intersection with Precourt Street and expands to four travel lanes approaching the intersection with Route 111 (Alfred Road).

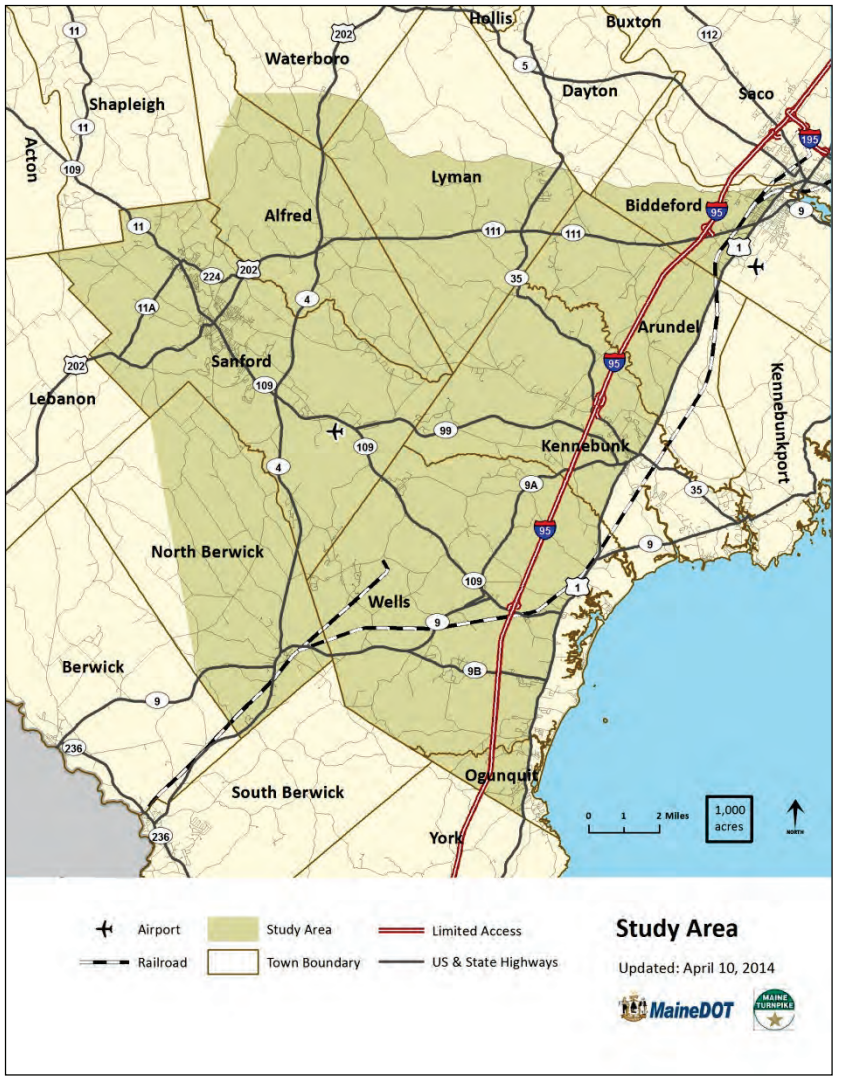


Figure 3-1: CYCCS Study Area and Highway Network

Central York County Connecting Routes

Sanford is the primary employment and residential center in central York County. Several state highways connect Sanford and the other interior communities of central York County—North Berwick, Alfred, Lyman and Waterboro—with the rest of the region and beyond. For purposes of the CYCCS, these highways are consolidated into continuous corridors linking central York County with the rest of the region:

- Routes 111/202, connecting Sanford to Biddeford
- Routes 4/202, connecting Alfred, South Sanford and North Berwick
- Route 109, connecting Sanford with Wells
- Route 9, connecting North Berwick with Wells
- Route 99, connecting South Sanford with Kennebunk

These corridors are the primary focus of the evaluations in this chapter.

Route 111/202 Corridor

Route 111 and Route 202 together comprise a key east-west highway corridor connecting Sanford, Alfred, Lyman and Arundel with the Maine Turnpike in Biddeford (Exit 32). The corridor is the primary route for traffic traveling from central York County to the Portland metropolitan area and points beyond. The corridor comprises Route 111 between Biddeford and Alfred, and Route 202 from Alfred through Sanford (Figure 3-2). Route 202 also travels west from Sanford, through Lebanon to Rochester, New Hampshire where it connects to the Spaulding Turnpike (NH Route 16). The section of Route 202 extending north from Alfred into Waterboro is described later as part of the combined Route 4/202 corridor.

Figure 3-2: Route 111/202 Corridor

The Route 111/202 corridor is classified as a principal arterial. Travel lanes with wide shoulders (typically 8 feet) are provided on rural segments (Figure 3-4), though shoulder width on Route 202 in Sanford varies. Left turn pockets are provided at Route 109 in Sanford (westbound only), Route 224, Route 4/202 in Alfred, and Route 35 in Lyman, all of which are signalized.

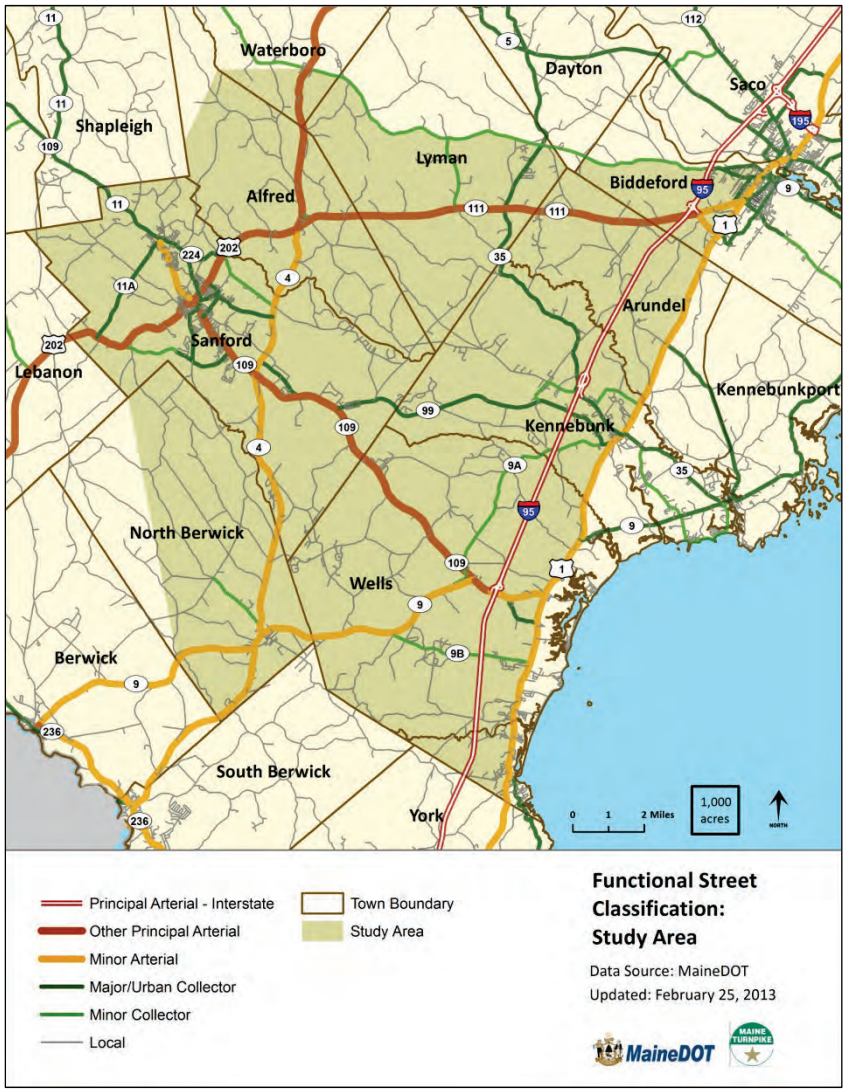


Figure 3-3: CYCCS Functional Street Classification

Figure 3-4: Route 111 Typical Rural Segment

Figure 3-5: Route 111 Entering Biddeford (looking east)

In Biddeford, the corridor expands to a four-lane, divided highway lined with commercial shopping centers just east of the Arundel town line (Figure 3-5). Four signalized intersections provide access to adjacent commercial uses, the Biddeford Park and Ride lot, and the Maine Turnpike entrance at Exit 32. The corridor continues east to Route 1 and into downtown Biddeford.

The speed limit (Figure 3-6) on the corridor is 55 mph between Route 4/202 in Alfred and Route 35 in Lyman, with slower speed zones approaching these major crossroads. East of Lyman, the speed limit is 50 mph, eventually transitioning to 35 mph on the multilane section in Biddeford. West of Alfred, the speed limit is initially 50 mph, but slows to 25 mph through downtown Sanford.

Route 109 Corridor

Route 109 is a principal arterial connecting the Sanford region to the Maine Turnpike (Exit 19) and Route 1 in Wells (Figure 3-7). Route 109 is the most direct route to southbound I-95 for traffic from Sanford, including trips destined for Portsmouth, New Hampshire or the Boston, MA metropolitan area. Alternatively, some westbound/southbound travelers use Route 202 to Rochester, NH or Route 4 to Dover, NH.

Route 109 functions as Sanford's main street (Figure 3-8). It is a two-lane highway in downtown Sanford and further north in Springvale, with turn lanes at major intersections. The speed limit in downtown is 30 mph. In South Sanford, the cross section varies from two to as many as five lanes (including intermittent left turn lanes). The speed limit increases to 35 mph near Old Mill Road, and eventually 45 mph approaching Route 99. Segments with wider cross sections were developed concurrent with major developments, such as Wal-Mart and the Center for Shopping.

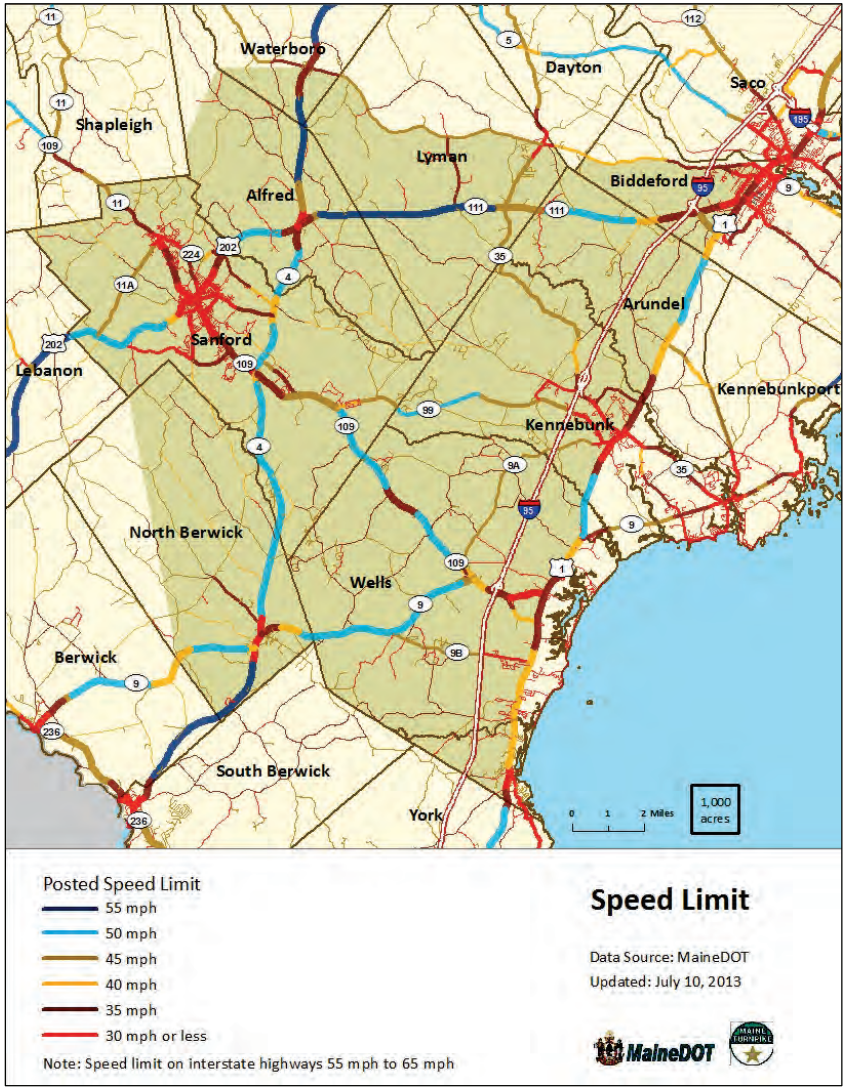


Figure 3-6: CYCCS Speed Limits

Figure 3-7: Route 109 Corridor

East/south of Route 99, Route 109 is a two-lane highway. Route 109 passes through the High Pine neighborhood of Wells, but otherwise the segment is predominately rural with scattered residential development. The speed limit is 50 mph between Route 99 and Route 9B, except for a 35 mph speed zone in High Pine. MaineDOT is completing reconstruction of the highway from the Maine Turnpike to the Sanford Town line, which will widen the paved surface cross section to provide 12-foot travel lanes with 8-foot shoulders (Figure 3-9).

Figure 3-8: Route 109 in Downtown Sanford

Figure 3-9: Recently Improved Section of Route 109 in Wells

Route 4/202 Corridor

Traveling generally north-south through the CYCCS study area, the Route 4/202 corridor links Waterboro, Alfred, South Sanford and North Berwick with South Berwick and Dover, NH to the west (connecting to Route 16, the Spaulding Turnpike in New Hampshire) (Figure 3-10). North of Alfred, the corridor is a principal arterial and is jointly designated Route 4/Route 202. This segment of the Route 4/202 corridor has a 55 mph speed limit in rural areas, with speed zones in Waterboro and the Alfred village center (Figure 3-11). In Alfred, Route 202 turns west toward Sanford, and that segment is described as part of the Route 111/202 corridor.

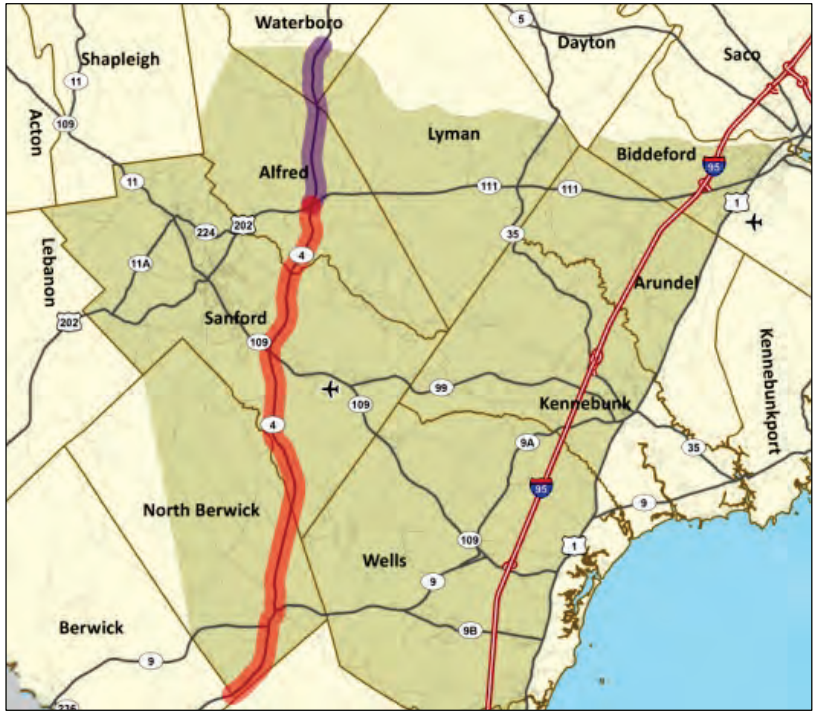


Figure 3-10: Route 4/202 Corridor

South of Route 111/202 in Alfred, the corridor continues as Route 4, a minor arterial that extends to the New Hampshire state line. The corridor is a two-lane highway, with turn lanes provided at major intersections, including right turn lanes at Route 111, and left turn lanes at Grammar Road/New Dam Road, Jagger Mill Road, and Route 9. Route 4 crosses Route 109 at a roundabout, installed in 2007. The speed limit is generally 50 mph, with a 40 mph speed zone in the vicinity of Grammar Road and High Street near the Alfred/Sanford town line, and 25 mph in North Berwick's village center.

Figure 3-11: Route 202 in Alfred Village Center

Route 9 Corridor

Route 9 connects North Berwick with Wells, intersecting Route 109 just north of the Maine Turnpike entrance at Exit 19 (Figure 3-12). The corridor is a two-lane highway generally with 11- to 12-foot travel lanes and wide shoulders, typically 6 to 8 feet. The speed limit is 50 mph along most of the corridor, with reduced speed zones approaching Route 4 in the North Berwick town center, and Route 109 in Wells.

Figure 3-12: Route 9 Corridor

In Wells, the corridor includes two branch routes. Route 9B connects to Route 1 in Ogunquit, while Route 9A extends into Kennebunk (connecting to Route 99 north of Route 1). These roads are both classified as minor collectors with 45 mph speed limits in rural areas, and lower speed limits approaching Route 1 in both Wells and Kennebunk. Travel lanes are 10 to 11 feet with gravel shoulders.

Figure 3-13: Route 9 Connecting North Berwick and Wells

Route 99 Corridor

Route 99 is a two-lane major collector connecting Route 109 in South Sanford with Route 1 in Kennebunk. Route 99 does not directly connect to the Maine Turnpike, though as shown in Figure 3-14, Exit 25 can be accessed by way of a 1.8-mile connecting route following Mill Street and Alfred Street (both minor collectors) and Route 35 (a major collector). Speed limits on these connecting routes are 30 mph or lower.

Figure 3-14: Route 99 Corridor

Travel lanes are approximately 11 feet wide, with gravel shoulders. The speed limit is predominately 45 or 50 mph.

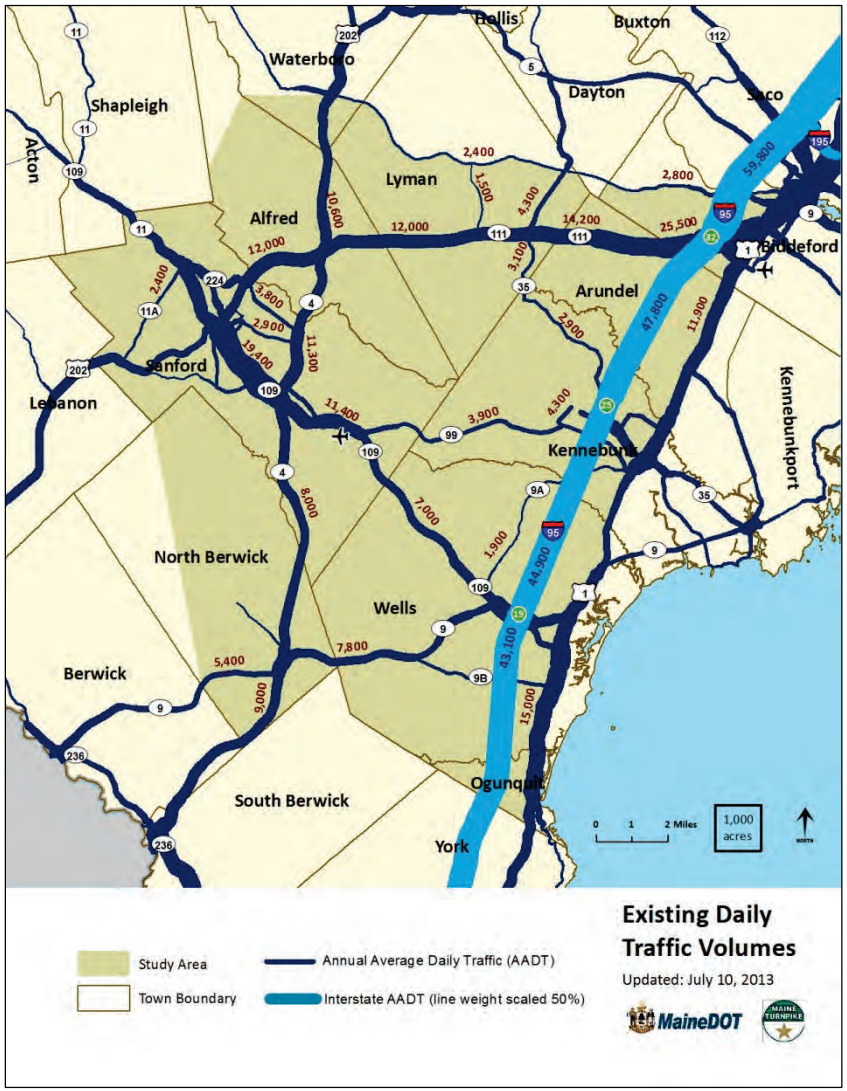
Current and Projected Operating Conditions

Existing Traffic Volumes

Figure 3-15 summarizes current Annual Average Daily Traffic volumes (AADT) for the CYCCS study area highways (AADT is the total volume of vehicle traffic of a highway or road for a year divided by 365 days; it is a useful and simple measurement of how busy the road is). The busiest highways in the CYCCS study are, as expected, the major highway corridors.

Average daily traffic volumes on the Maine Turnpike range from approximately 43,100 vehicles in Ogunquit and Wells to nearly 60,000 vehicles per day north of the Exit 32 interchange in Biddeford. The interchange at Exit 32 (Biddeford) is the busiest in the study area, with a total volume of 22,300 vehicles entering or exiting daily. Exit 25, which connects to Route 35 in Kennebunk, carries 9,000 vehicles daily, while 13,400 vehicles enter or exit the Turnpike at Exit 19, which connects to Route 109 in Wells.

Route 1, which parallels the Maine Turnpike, is busiest in the village center areas of Ogunquit, Wells, and Kennebunk, where AADT ranges from 13,000 to over 16,000 vehicles per day.



Data source: MaineDOT (2010)

Figure 3-15: Existing Annual Average Daily Traffic Volumes

Route 111/202 is the busiest of the highway corridors that connect central York County to the region. Table 3-1 further summarizes daily traffic volumes, showing the range of AADT occurring over major corridor segments. West of Sanford, the corridor volumes are relatively light, ranging from 6,000 vehicles daily near the Lebanon line to 12,100 in downtown Sanford. To the east, the segment between Sanford and Alfred averages between 11,300 and 12,200 vehicles per day. Traffic increases sharply approaching Biddeford, where ultimately a four-lane section carries from 19,100 near the Arundel town line to 29,000 vehicles daily near the Exit 32 interchange with the Maine Turnpike.

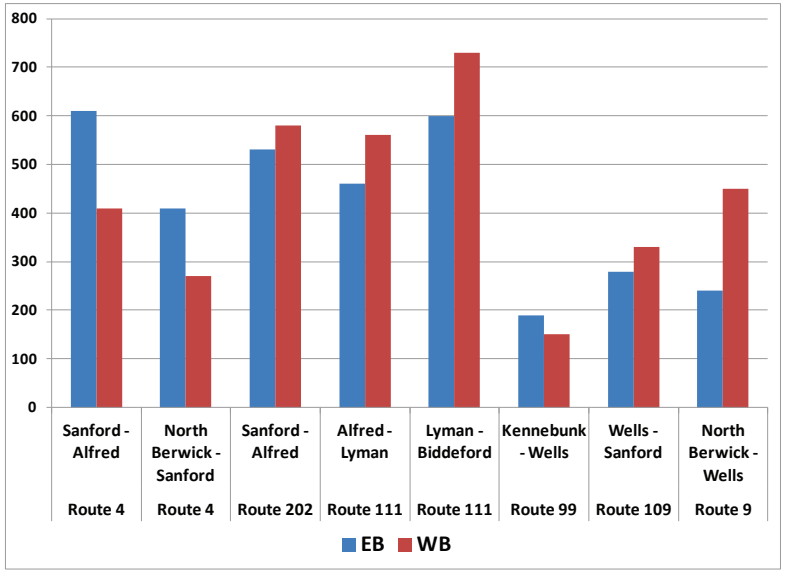
Table 3-1: Route 111/202 Existing Daily Traffic Volume by Segment

Route 111/202 Corridor Segment	Annual Average Daily Traffic (AADT)
Route 202, Sanford *Lebanon/Sanford line to Route 109*	6,000 – 8,700
Route 202, Sanford/Alfred *Route 109 to Route 4/202*	7,800 – 12,100
Route 111, Alfred/Lyman *Route 4/202 to Route 35*	11,300 – 12,200
Route 111, Lyman/Arundel *Route 35 to Arundel/Biddeford line*	13,700 – 18,800
Route 111, Biddeford *Arundel/Biddeford line to Exit 32/ Precourt St.*	19,100 – 29,000

Source: MaineDOT (2010)

Traffic on area corridors reaches its highest concentrations during the afternoon commute, with volumes typically peaking between 4:00 and 6:00 PM. Figure 3-16 compares hourly traffic volumes during the PM peak. Route 111 exhibits strong directionality between Biddeford

and Alfred, with higher traffic volumes westbound than eastbound as a result of commute traffic returning from employment centers in the Portland metropolitan area (including Biddeford, Saco and Scarborough). Westbound and eastbound traffic volumes are more balanced on Route 202 between Sanford and Alfred, reflecting an outbound commute from job sites (as well as shopping and schools) in Sanford as well as the inbound commute of those returning home.



EB = eastbound; WB = Westbound

Figure 3-16: Directional PM Peak Hour Volumes

The Route 109 corridor is busiest in central Sanford, where it carries both longer-distance regional trips and local, in-town trips (Table 3-2). Daily traffic volumes range from 15,500 to 22,500 between Route 4 (the roundabout) and Route 202 in downtown. Traffic volumes between Sanford and Wells are comparatively light, ranging from 6,800 to 8,600 vehicles daily through the High Pine area. Volumes increase again between Route 9 and Route 1, with the highest volumes encountered near Exit 19 of the Maine Turnpike. Route 109 exhibits slightly higher westbound (toward Sanford) volumes during the PM peak, again reflecting a net in-migration of workers returning home to residences in Sanford from jobs elsewhere during the evening (Figure 3-16).

Table 3-2: Route 109 Existing Daily Traffic Volume by Segment

Route 109 Corridor Segment	Annual Average Daily Traffic (AADT)
Route 109, Sanford *Route 224/11A to Route 202*	11,700 – 13,800
Route 109, Sanford (Downtown) *Route 202 to Route 4*	15,500 – 22,500
Route 109, Sanford (South) *Route 4 to Route 99*	10,600 – 13,300
Route 109, Sanford/Wells *Route 99 to Route 9*	6,800 – 8,600
Route 109, Wells *Route 9 to Route 1.*	9,100 – 16,900

Source: MaineDOT (2010)

Traffic volumes on Route 4 between Sanford and North Berwick (Route 109 to Route 9) range from 7,600 to 9,700 vehicles per day (Table 3-3). Higher volumes are present to the north, ranging from 8,700 to 11,600 vehicles daily between Sanford and Alfred (Route 109 to Route 111/202), and 8,300 to 10,100 north to Waterboro. A comparison of afternoon peak volumes on Route 4 shows a strong directional bias in the eastbound direction (towards Alfred/Waterboro), indicative of a large number of commuters from

the Kittery/Portsmouth areas returning home to residences in central York County communities (Figure 3-16).

Table 3-3: Route 4/202 Existing Daily Traffic Volume by Segment

Route 4/202 Corridor Segment	Annual Average Daily Traffic (AADT)
Route 202, Waterboro/Alfred *Route 4/202 to Route 111/202*	8,300 – 10,100
Route 4, Alfred/Sanford *Route 111/202 to Route 109*	8,700 – 11,600
Route 4, Sanford/North Berwick *Route 109 to Route 9*	7,600 – 9,700

Source: MaineDOT (2010)

Route 224, which is a popular route for travels from Springvale avoiding downtown Sanford, carries 6,000 to 10,000 vehicles per day, with higher volumes occurring near the intersection with Route 109 in Springvale. Other area highways carry fewer than 5,000 daily users:

- Route 11A carries 2,400 to 2,800 vehicles per day.
- Route 99 carries 3,600 to 5,300 vehicles per day.
- Route 35 carries 9,000 vehicles per day entering Kennebunk and 2,700 to 3,800 vehicles per day north of the Maine Turnpike.

Seasonal Variation

Annual variation in traffic volumes is influenced by tourism in some areas, particularly along the coast. This is especially true for the Maine Turnpike and Route 1 along the coast, as well as the connecting interchange at Exit 19 in Wells.

Traffic data is collected continuously along the Maine Turnpike, which allows investigation of how traffic volumes change over time. Figure 3-17 illustrates seasonal variation in average daily traffic volumes for the three interchanges located within the CYCCS study area. All three interchanges carry more traffic during summer months when tourist and vacation travel peaks. This is particularly pronounced at Exit 19 in Wells, which provides access to nearby beaches and coastal communities. July and August traffic volumes at Exit 19 are nearly 40 percent higher than the average volume for the entire year. Conversely, daily traffic volumes at Exit 32 vary less over the course of the year, with summer traffic volumes about 10 percent higher than the AADT.

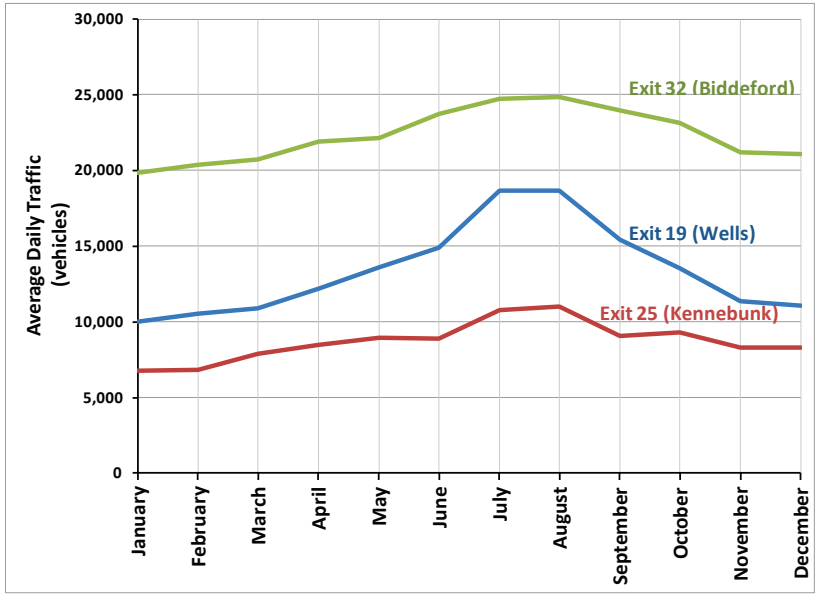


Figure 3-17: Seasonal Variation in Daily Traffic Volumes at Maine Turnpike Interchanges

Inland routes experience less variation in traffic levels over the course of the year, as typified in Figure 3-18 for Route 109 in Sanford, where MaineDOT maintains a permanent count station.

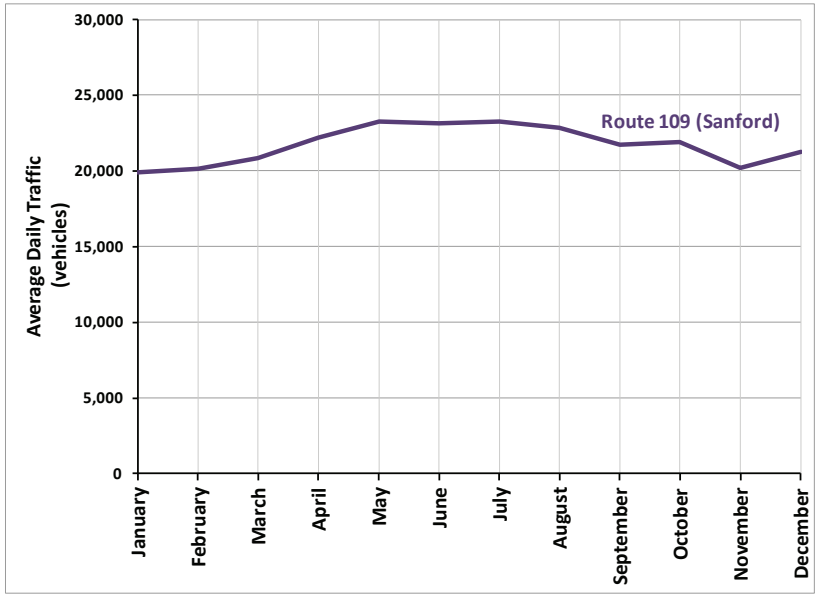


Figure 3-18: Seasonal Variation in Daily Traffic Volumes on Route 109 in Sanford

Route 111 is susceptible to congestion caused by peak hour volumes mixing with seasonal tourist traffic from Maine Turnpike Exit 32 in Biddeford and activity associated with various shopping centers in the vicinity of the interchange. Existing AM and PM peak period level of service along the Route 111 between Sanford and Exit 32 is LOS D/E, which indicates that the segment is experiencing unstable flow. Additional summertime traffic is likely to exacerbate unstable flow on Route 111 during the PM peak.

Projected Future Growth

The study also considered how transportation needs may differ in the future as a result of population and job growth in the region. As described in *Chapter 2: Study Context*, an additional 33,572 people and 20,534 jobs are forecast in York County by 2035.

Growth in population and employment is expected to translate into increased traffic on study area roadways. Traffic modeling conducted for the study forecasts that total vehicle miles traveled in York County will increase by 29.4 percent between 2010 and 2035 (Table 3-4). Larger increases are expected on the Maine Turnpike and collector/local roadways than on the other principal and minor arterials.

Table 3-4: Modeled Vehicle Miles Traveled (VMT)

Roadway Classifications	2010	2035	Net Change	Percent
Maine Turnpike and Other Expressways	2,520,000	3,330,000	810,000	32.0%
Other Principal and Minor Arterials	2,710,000	3,200,000	490,000	18.2%
Collector and Local Roads	3,180,000	4,350,000	1,170,000	36.9%
TOTAL	**8,410,000**	**10,880,000**	**2,470,000**	**29.4%**

Source: MaineDOT (2010)

Figure 3-19 illustrates how the projected increase in travel translates to changes in daily traffic on the corridors in the CYCCS network. Outside of the Maine Turnpike, the major highway corridors are expected to experience the most growth, particularly on rural

segments and near interchanges with the Maine Turnpike. Projected growth relative to existing volumes (shown previously in Figure 3-15) is especially high on the rural segment of Route 109 between Route 99 in Sanford and Route 9A in Wells, as well as on Route 35 and Route 99, which are collector roadways that carry much less traffic than the region's primary corridors (Routes 111, 202, 4 and 109). This may be indicative of both the projected locations of future growth and/or higher proportions of traffic using alternate routes due to peak period congestion on the primary arterial highway corridors.

As with any forecasting process, actual changes in traffic volumes over time could be higher or lower, depending on a wide range of factors or unforeseen trends. For planning purposes, factors such as the real (inflation adjusted) cost of vehicle operation and mode share are presumed to hold steady over the 25 year timeframe.

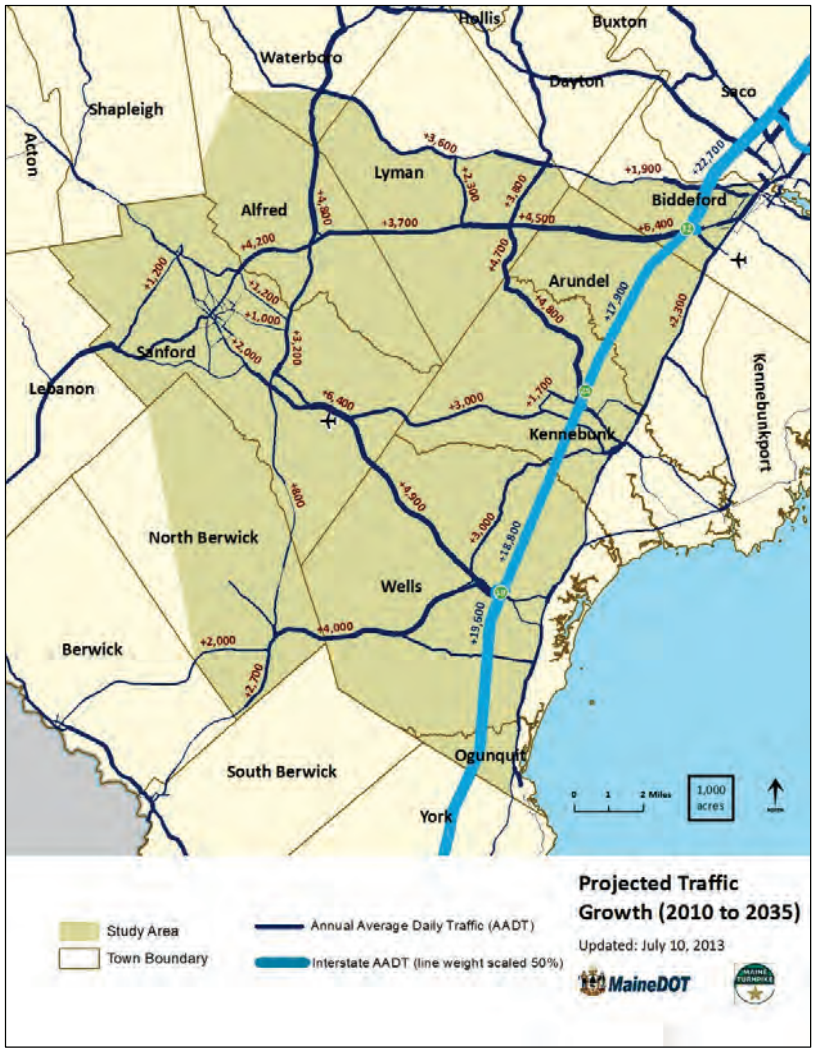


Figure 3-19: Projected Change in Daily Traffic Volumes (2010 to 2035)

Data source: MaineDOT (2010)

Traffic Operating Conditions

Highway connections between central York County and the coastal transportation corridors primarily involve rural highway segments with occasional intersections at major crossroads. To better understand and evaluate travel conditions on these corridors, a detailed Level of Service (LOS) analysis was conducted for the major highway segments and selected intersections identified by the study team (Figure 3-20 and Figure 3-21).

Level of Service (LOS)

LOS is a standard measure of operational effectiveness for transportation facilities defined by the Highway Capacity Manual. LOS is graded from LOS A (best conditions) to LOS F (very poor conditions). LOS A represents little to no delay, or uncongested conditions, whereas LOS F indicates very congested conditions with long delays. LOS conditions of D or better are generally considered satisfactory during peak periods.

Source: Transportation Research Board

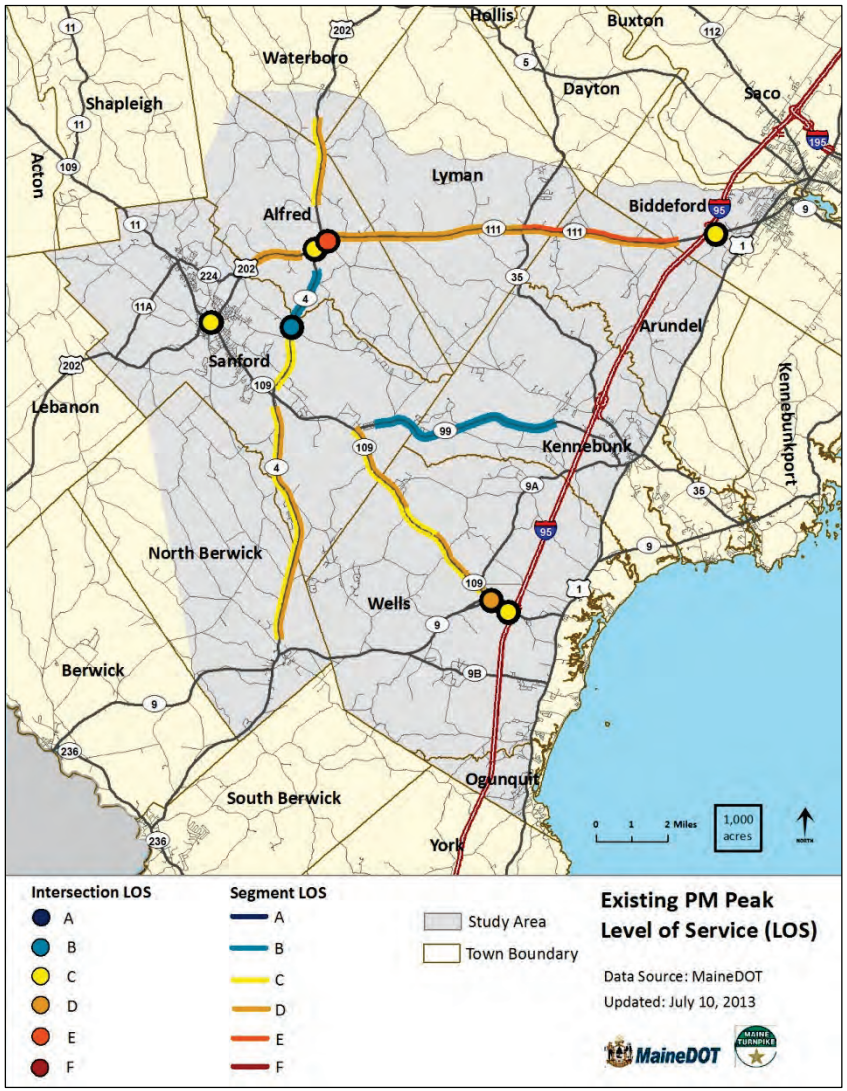


Figure 3-20: Existing PM Peak Level of Service (LOS)

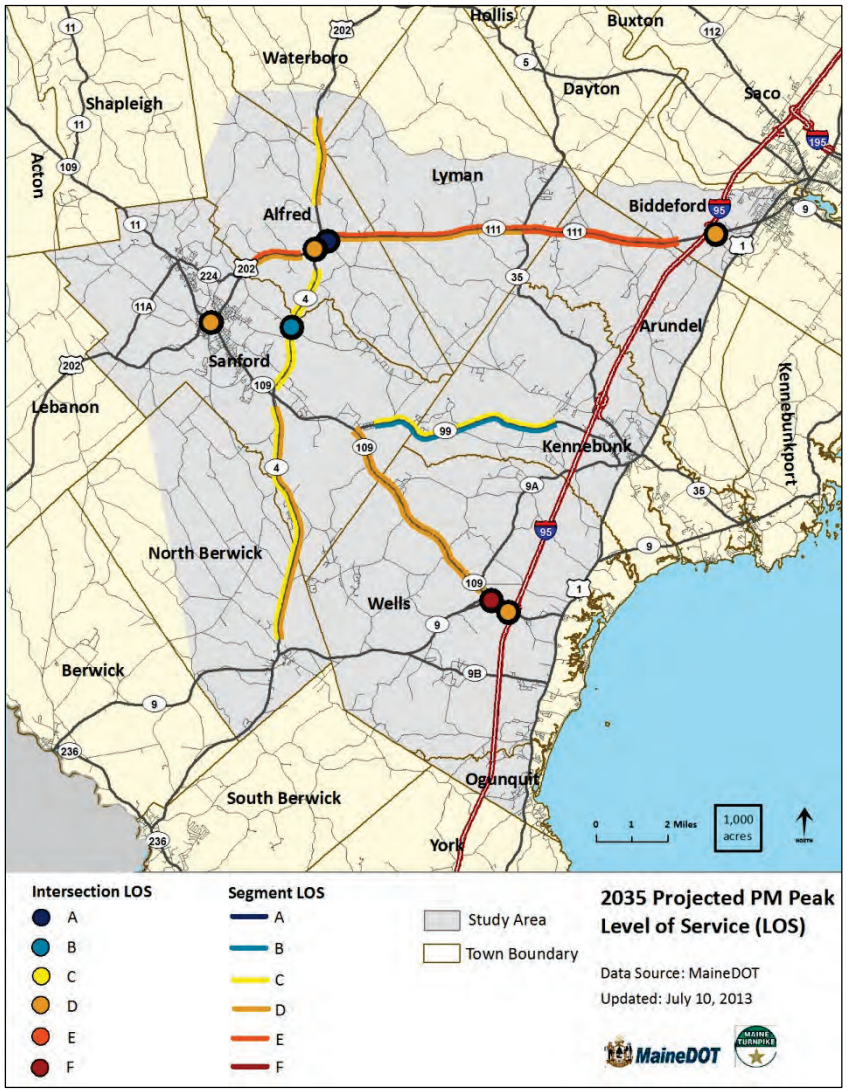


Figure 3-21: Projected 2035 PM Peak Level of Service (LOS)

Rural highway segments on the Route 4/202, Route 99, Route 109, and Route 111/202 corridors were assessed using HCS 2010 software[2], which implements the methodologies described in the Transportation Research Board's *Highway Capacity Manual*, 2010 edition. These are the primary highway corridors linking central York County with the Maine Turnpike and Route 1. Traffic volumes are highest during the afternoon peak, so the PM peak hour was selected as the analysis period.

In addition, LOS was assessed at seven study area intersections using Synchro (v8), a traffic analysis and signal optimization software package developed by Trafficware. Seven intersections were selected for evaluation based on review of traffic volumes, field observation of current operations, and input from the study committees and public:

- Route 111/Exit 32/Precourt Street, Biddeford: The busiest intersection in the study area accommodates heavy traffic volumes on Route 111 as well as all traffic entering or exiting the Maine Turnpike at Exit 32. It is a controlled, signalized intersection.
- Route 111/Kennebunk Road, Alfred: This controlled intersection was newly signalized in 2012.
- Route 4/Route 202/Route 111, Alfred: The major crossroads in Alfred, this controlled, signalized intersection was observed to experience congestion in the northbound direction during the afternoon peak.

[2] HCS 2010 is a product of McTrans, an organization affiliated with the University of Florida that was created by the Federal Highway Administration (FHWA) in 1986 to distribute and support microcomputer software in the highway transportation field.

- Route 109/Route 202, Sanford: This is the major crossroads in downtown Sanford and affects traffic movements both east-west along the Route 202 corridor, as well as north-south along Route 109. It is a controlled, signalized intersection.
- Route 4 at Grammar Road/New Dam Road, Sanford: This signalized intersection is a key access point from the Route 4 corridor into Sanford. It is a controlled, signalized intersection.
- Route 9/Route 109, Wells: A major crossroad in Wells, this controlled, unsignalized intersection provides access to North Berwick.
- Route 109/Exit 19/Wells Transportation Center, Wells: A busy access point to the Maine Turnpike, congestion at this controlled, signalized intersection has been noted westbound turning left onto the Maine Turnpike as well as on the Turnpike off-ramp during peak periods.

The roundabout at Route 4/Route 109 in Sanford and the signalized intersection of Route 35/Route 111 in Lyman are other intersections at major crossroads within central York County. LOS at these intersections was not analyzed because both have been improved in recent years and were confirmed to operate effectively through field observation. Future improvements are not expected to be necessary over the study timeframe.

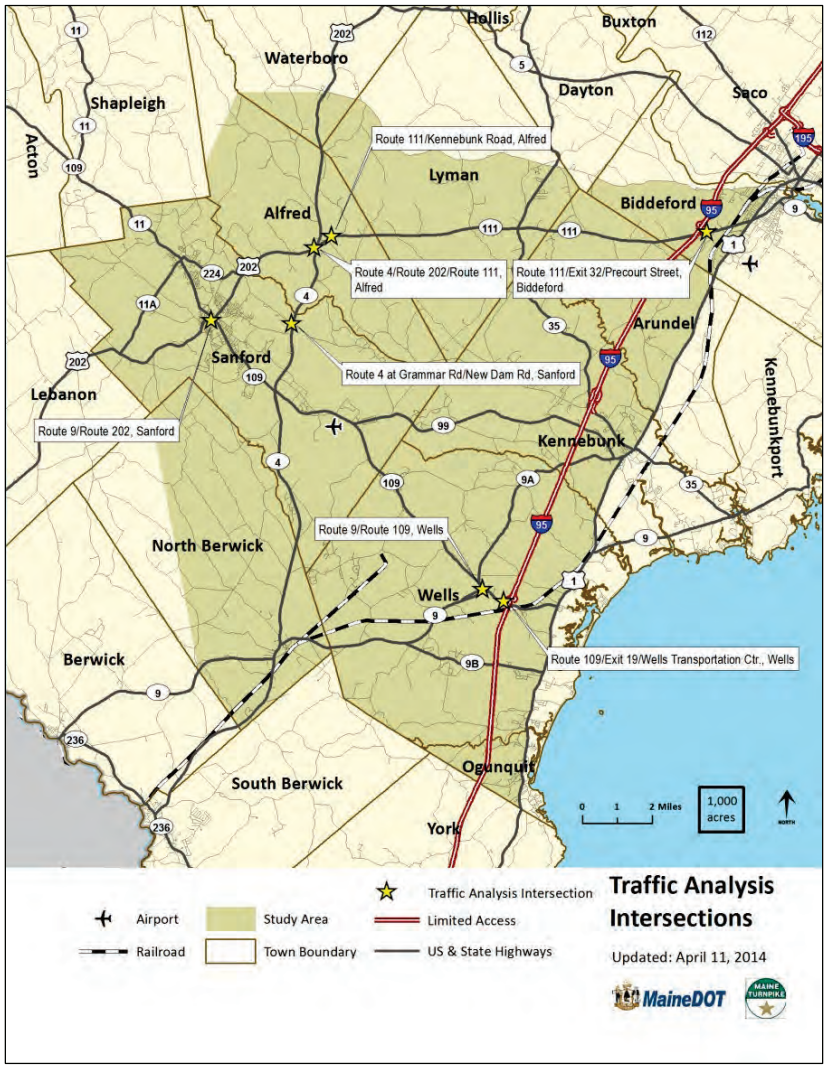


Figure 3-22: Traffic Analysis Intersections

Rural Highway Segments

The Highway Capacity Manual categorizes LOS on two-lane rural highway segments based on travel speeds and the percent of time spent following other vehicles. As traffic volumes increase, average speeds drop and passing opportunities decrease.

Detailed LOS analysis found that the Route 4/202 and Route 109 corridors operate at LOS D or better conditions during the afternoon commute, with many segments operating at LOS B or C conditions (Table 3-5). This indicates that travel speeds are near posted levels, and passing opportunities are generally available.

The Route 111/202 corridor is more congested. Most segments operate at LOS D, but the westbound segment between Biddeford and Lyman is LOS E, reflecting heavy traffic and limited passing opportunities.

In 2035, conditions on the Route 109 and Route 4/202 corridors are expected to remain in the LOS C-D range. All westbound segments of Route 111 are forecast to degrade to LOS E conditions during the afternoon peak by 2035, as is the eastbound segment between Lyman and Biddeford.

Because it provides an alternate route from the South Sanford area to the Maine Turnpike and Route 1, LOS was also assessed on Route 99. Lightly traveled today and in the future, conditions are LOS B today and projected to remain in the LOS B-C range in 2035.

Table 3-5: Level of Service (LOS) – Rural Highway Segments (PM Peak)

Segment	2010 LOS		Projected 2035 LOS	
Route 4/202 Corridor	**NB**	**SB**	**NB**	**SB**
RR Dr (Waterboro) – Gore Rd (Alfred)	D	C	D	C
Rte 111/202 (Alfred) – Grammar Rd (Sanford)	B	B	C	C
Grammar Rd (Sanford) – Rte 109 (Sanford)	C	C	C	C
Rte 109 (Sanford) – Rte 9 (North Berwick)	D	C	D	C
Route 109 Corridor	**NB**	**SB**	**NB**	**SB**
Route 99 (Sanford) – Bald Hill Rd (Wells)	D	C	D	D
Bald Hill Rd (Wells) – Pool Rd (Wells)	C	C	D	D
Pool Rd (Wells) – Route 9 (Wells)	D	C	D	D
Route 111/202 Corridor	**NB**	**SB**	**NB**	**SB**
Biddeford/Arundel line – Rte 35 (Lyman)	**E**	D	**E**	**E**
Rte 35 (Lyman) – Rte 4/202 (Alfred)	D	D	**E**	D
Rte 4/202 (Alfred) – Rte 224 (Sanford)	D	D	**E**	D
Route 99	**NB**	**SB**	**NB**	**SB**
Whitten Rd (Kennebunk) – Rte 109 (Sanford)	B	B	C	B

Major Intersections

Level of Service was assessed for both the morning and evening peak periods for study area intersections, since specific movements may peak at different times of day. Intersections analyzed were those most likely to experience congestion due to high traffic volumes, geometric constraints, or method of traffic control (stop control, traffic signal, etc). The intersections of Route 111 at Route 35 (Lyman) and Route 109 at Route 4 (Sanford) have been upgraded in recent

years and were confirmed to operate effectively through field observation. These were therefore not assessed further.

Five (5) signalized intersections evaluated were found to operate at LOS C or better conditions today. With forecast traffic growth through the year 2035, the intersections of 1) Route 202 & Route 109 in Sanford; 2) Route 111/202 & Route 4/202 in Alfred; 3) Route 111 & Exit 32/Precourt Street in Biddeford and 4) Route 109 & Exit 19/Wells Transit Center in Wells are forecast to degrade to LOS D conditions. The latter two are especially of concern because queuing at these locations can back onto the off-ramps from the Maine Turnpike.

Table 3-6). At the two intersections controlled by stop signs, delay on the stop controlled side street resulted in LOS D or E conditions at times:

- Side street movements on Kennebunk Road onto Route 111 in Alfred, which were formerly controlled by stop signs, were LOS E during the PM peak. This issue was resolved by installation of a traffic signal by MaineDOT in October 2012.
- Eastbound traffic on Route 9, which stops at the intersection of Route 109 in Wells, is subject to LOS D conditions during both the AM and PM peaks.

Specific movements at the signalized intersections were generally found to operate well (LOS D or better) today. The one exception is:

- Westbound through movements on Route 111 at the Maine Turnpike Exit 32/Precourt Street intersection are LOS E during the PM peak.

With forecast traffic growth through the year 2035, the intersections of 1) Route 202 & Route 109 in Sanford; 2) Route 111/202 & Route 4/202 in Alfred; 3) Route 111 & Exit 32/Precourt Street in Biddeford and 4) Route 109 & Exit 19/Wells Transit Center in Wells are forecast to degrade to LOS D conditions. The latter two are especially of concern because queuing at these locations can back onto the off-ramps from the Maine Turnpike.

Table 3-6: Intersection Level of Service (LOS)

Intersection	2010 LOS		Projected 2035 LOS		Issues (see notes)
	AM	PM	AM	PM	
Rte 111 & MTA Exit 32/Precourt St (Biddeford)	C	C	D	D	1, 2
Rte 111 & Kennebunk Rd (Alfred)*	C	E	A	A	2
Rte 111/202 & Rte 4/202 (Alfred)	B	C	C	D	2
Rte 202 & Rte 109 (Sanford)	B	C	C	D	2
Rte 4 & Grammar Rd/New Dam Rd (Sanford)	B	B	B	B	None
Rte 109 & Rte 9 (Wells)**	D	D	F	F	2
Rte 109 & MTA Exit 19/Transit Center (Wells)	B	C	C	D	1, 2

*Unsignalized, two-way stop intersection in 2010. LOS reported for Kennebunk Road stoop controlled movement

** Unsignalized, two-way stop intersection in 2010 and 2035. LOS reported for Route 9 stop controlled movement.

1. Traffic queues are subject to backing up onto Maine Turnpike off-ramps

2 . Specific movements concerns by year 2035

Source: MaineDOT (2010)

Analysis of specific movements indicates the following concerns in 2035:

- Several movements at the Route 111/202 & Route 4/202 intersection are forecast to degrade to LOS E conditions in the future during the PM peak. Depending on how signal timing is allocated, both the westbound through and eastbound left movements on Route 111/202, or the northbound through/left turn movement on Route 4, is expected to degrade to LOS E. The northbound movement is impacted by left turns blocking the higher volume through movement.
- At the intersection of Route 202 and Route 109 in downtown Sanford, the shared eastbound left/through movement on Route 202 is expected to degrade to LOS F during the PM peak by 2035.
- During both the AM and PM peaks, both westbound and eastbound left turning movements on Route 111 at the Maine Turnpike Exit 32/Precourt Street intersection are forecast to degrade to LOS E during the AM peak.
- Several movements at the Route 109 & Exit 32/Wells Transit Center intersection are forecast to degrade to LOS F during the PM peak by 2035: Eastbound left turns from Route 109 onto the Maine Turnpike (LOS F), left turns exiting the Wells Transportation Center, and the shared left/through movement from the Maine Turnpike Exit 19 off-ramp.
- All movements on Route 9 at the unsignalized (stop sign controlled) intersection with Route 109 are forecast to degrade sharply to LOS F conditions during the AM and PM peaks. Left turning traffic from Route 9 onto 109, though a fairly light movement, is expected to block the heavy right turning traffic movement, causing considerable delays for all eastbound traffic on Route 9 at the intersection.

Crash History and Safety

MaineDOT maintains a comprehensive database of information regarding vehicle crashes occurring in Maine. Crashes for the three year period of 2008-2010, the most recently available data, were analyzed to identify locations with higher than expected crash histories.

Figure 3-23 summarizes the crash rates on CYCCS area highways, separating those crashes that occur at intersections from other crashes. Routes through developed areas typically have higher incidence of crashes occurring at intersections. This is somewhat reflected in the data by the higher incidence of intersection crashes on Route 109, much of which travels through urbanized portions of Sanford, compared to Routes 99, 111 or 202. Lightly traveled rural corridors also showed a high number of intersection crashes as well, and closer inspection reveals that these are predominately related to intersection connections at busier, major crossroads (Route 35 at Route 111, and Route 11A at Route 109 are two examples).

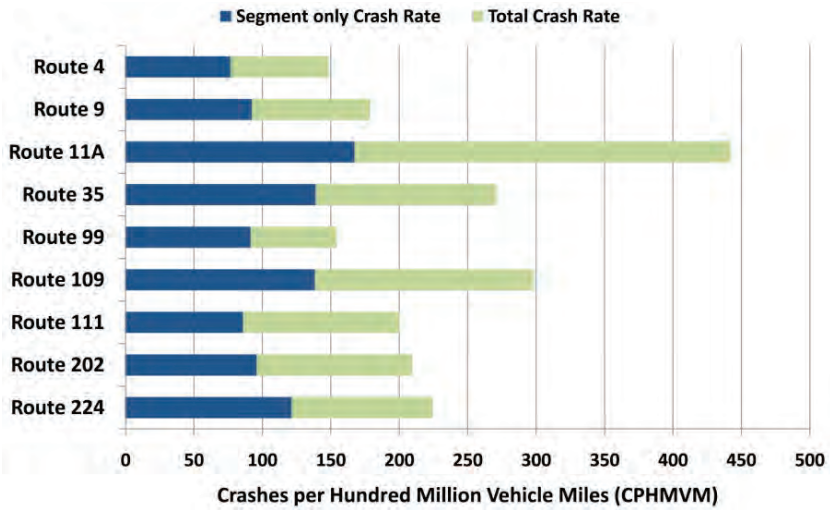


Figure 3-23: Crash Rates for CYCCS Highways (2008-2010)

The expected crash rate for a facility is related to its functional classification (i.e. – the type of roadway), rural/urban area, and traffic characteristics. MaineDOT calculates critical crash rates for specific facility types that allow comparison of crash experience across different facility types. A facility's actual crash rate is compared to the critical rate for facilities with similar urban/rural rating, physical characteristics and traffic, producing a ratio known as the critical rate factor (CRF). CRFs over 1.0 indicate that crashes occur at a higher than expected rate.

Figure 3-24 summarizes total CRF as well as non-intersection (segment only) CRF. Considering only non-intersection crashes, all study area highways exhibit CRFs under 1.0. Some intersection crashes, however, occur at higher frequencies. On a corridor-wide basis, the overall crash rates exceed the corresponding critical rate on Routes 202, 111, 109 and 11A, and the CRF on Route 35 is 1.0. As mentioned previously, the high rate of intersection crashes on Route 35 and Route 11A is mostly related to their intersections with Route 111 and 109, respectively.

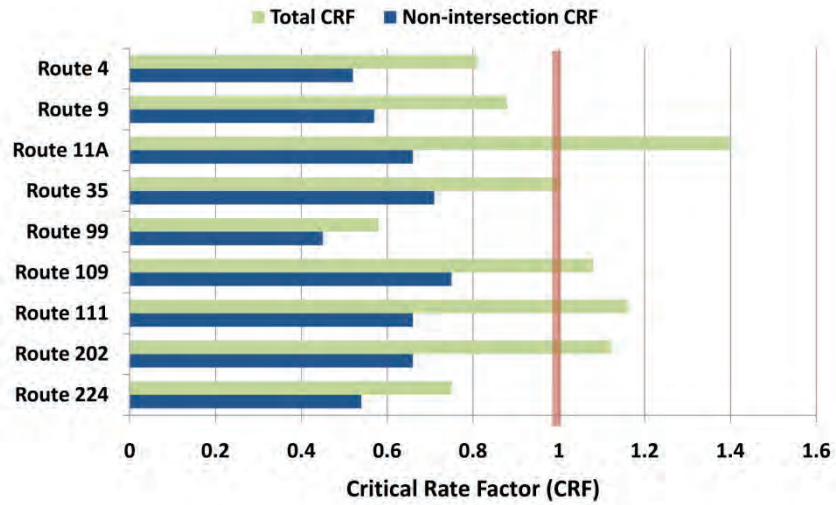


Figure 3-24: Crash Critical Rate Factors for CYCCS Highways (2008-2010)

Table 3-7 identifies the frequency of crashes by type of crash.

Table 3-7: Share of Crashes by Type (2008-10)

	Rear End	Head-on	Intersection	Pedestrian	Bicycle	Went off Road	Animal	Other
Route 4	41%	4%	20%	0%	1%	14%	16%	5%
Route 9	40%	6%	18%	1%	0%	14%	11%	9%
Route 11A	32%	3%	43%	0%	0%	16%	5%	0%
Route 35	50%	2%	18%	0%	0%	23%	6%	2%
Route 99	31%	2%	22%	0%	0%	39%	6%	0%
Route 109	58%	3%	22%	1%	2%	9%	2%	3%
Route 111	55%	5%	17%	0%	0%	13%	4%	6%
Route 202	37%	6%	27%	1%	3%	13%	7%	5%
Route 224	35%	5%	24%	0%	5%	24%	5%	0%

Source: MaineDOT (2010)

Of particular note:

- Rear-end crashes occur most frequently on Route 109 and Route 111, both of which have segments with frequent intersections and/or driveways, where rear-end crashes are more common.
- Head-on crashes, while infrequent, occur more often on the Route 111/202, Route 224 and Route 9 corridors than on other corridors. Head-on crashes are of particular concern due to their severity.
- Crashes involving vehicles running off the road are most common on Route 99, which has narrow shoulders.
- Crashes involving pedestrians and bicycles are infrequent, but occur most frequently on Route 109 and Route 202, which include segments in the built up portions of Sanford where pedestrian and bicycle activity is more prevalent.
- Bike crashes are highest on Route 224, which may be in part caused by a lack of paved shoulders in the eastern section (Shaws Ridge Road), and numerous driveways and street intersections along the Pleasant Street section in Sanford.

To more specifically identify locations with the highest rate of crashes, MaineDOT maintains a list of High Crash Locations (HCLs). HCLs are defined as those locations with CRFs > 1.0 and more than 8 crashes occurring in a 3-year period. Table 3-8 and Table 3-9 identify HCL segments and intersections, respectively. HCLs are also mapped in Figure 3-25, Figure 3-26 and Figure 3-27.

A number of projects have been implemented since 2008 that are expected to improve safety at locations on the 2008-2012 HCL list:

- Route 4/202 Corridor
  - An automated warning system that indicates when vehicles are approaching was installed at Route 4 & High Street (2011).
  - A left turn lane was installed on Route 4 at Jagger Mill Road.
  - The roundabout at the Route 4 & Route 109 intersection in South Sanford was installed in 2009 at the beginning of the analysis period. Crash rates may have been elevated in the months following installation. However, fewer than 20 percent of crashes involved injuries.

- Route 109 Corridor
  - Widened shoulders and improved sight lines along the Route 109 Corridor were constructed in Wells (2012).
  - Intersection improvements and a flashing beacon were installed at the Route 9A intersection in Wells (2012).
- Route 111/202 Corridor
  - A flashing beacon was installed at the Route 202 & Riverside Drive intersection in Sanford.
  - A new traffic signal was installed at Route 111 & Kennebunk Road in Alfred (2012).

Several additional projects that will address current HCLs once constructed are identified in MaineDOT's 2012-13 Capital Work Program:

- Intersection improvements at Route 111 & Hill Road, including a westbound right turn lane from Route 111.
- Intersection improvements at Route 111 & Old Alfred Road/New Road that will realign and consolidate the intersections.
- Route 111 westbound passing lane starting at the New Road/Old Alfred Road intersection and extending west 0.56 miles.
- Intersection improvements and new traffic signal at the Route 109 & Chapel Road intersection.

Table 3-8: High Crash Location (HCL) Segments (2008-2010)

Map ID	Town	Location	Crashes	CRF
Al-s1	Alfred	Gore Rd, west of Federal St	8	1.56
Ar-s1	Arundel	Irving Rd, Brimstone Rd, between Curtis Rd and Limerick Rd	8	3.18
B-s1	Biddeford	MTA Exit 32 at Rte 111 intersection	9	1.70
B-s2	Biddeford	Rte 111, between May St and 5 Points	10	1.15
B-s3	Biddeford	WB cutoff from Rte 1 to Rte 111	22	5.55
B-s4	Biddeford	West Street, between Rte 111/Rte 1 intersection and Burger King	28	3.59
K-s1	Kennebunk	Rte 35, between Perkins Ln and Walker Rd	10	1.18
K-s2	Kennebunk	Rte 35 (Alewive Rd) between I-95 SB off ramp and Fletcher St	9	2.54
K-s3	Kennebunk	Rte 1 between Rte 35 and Dane St	8	1.86
O-s1	Ogunquit	Rte 1, east of Beach St & Shore Rd int	9	2.36
O-s2	Ogunquit	Rte 1, west of Beach St & Shore Rd int	10	1.45
S-s1	Sanford	Rte 109, north of Rte 11A (Oak St)	9	1.39
S-s2	Sanford	Rte 109, south of Rte 11A (Oak St)	9	1.69
S-s3	Sanford	Rte 109, Rte 202 to Twombley Rd	10	3.07
S-s4	Sanford	Rte 109, south of Twombley Rd	9	1.79
S-s5	Sanford	Rte 202 at Welch Ln	8	1.26
S-s6	Sanford	Mt Hope Rd, east of Bauneg Beg Hill Rd	12	1.40
S-s7	Sanford	Rte 109, Gerrish Dr to Old Mill Rd	10	1.76
W-s1	Wells	Rte 109, south of Route 9A*	14	1.80
W-s2	Wells	Rte 1, at Rte 109	11	1.57
W-s3	Wells	Rte 1, south of Chapel Rd	13	1.11

* Denotes location that has since been improved.
Source: MaineDOT (2010)

Table 3-9: High Crash Location (HCL) Intersections (2008–2010)

Map ID	Town	Intersection	Crashes	CRF
Al-i1	Alfred	Rte 111, Kennebunk Rd *	14	3.76
Al-i2	Alfred	Rte 111, Rte 4, Rte 202	25	1.06
Ar-i1	Arundel	Rte 111 (Alfred Rd), Hill Rd	10	2.19
Ar-i2	Arundel	Rte 111, New Rd, Old Alfred Rd	12	2.44
B-i1	Biddeford	Rte 111, entrance to Shaws & Irvings	31	1.10
B-i2	Biddeford	Rte 111, entrance to Five Points Center	13	1.57
B-i3	Biddeford	Rte 111, May St	12	1.52
B-i4	Biddeford	Rte 111, Elm St, entrance to Burger King	17	1.86
B-i5	Biddeford	Rte 111, Alfred St cut-off	11	2.15
B-i6	Biddeford	May St, Dartmouth St	10	1.40
B-i7	Biddeford	South St, May St	11	2.95
L-i1	Lyman	Rte 35, South St	12	5.08
L-i2	Lyman	South St, Hill Rd, Church St	8	2.92
L-i3	Lyman	Rte 111, Rte 35	23	1.13
L-i4	Lyman	Rte 111, Day Rd, Kennebunk Pond Rd	10	2.62
S-i1	Sanford	Rte 202, Brooke St	8	1.86
S-i2	Sanford	Rte 202, Riverside Ave *	8	1.97
S-i3	Sanford	Rte 109, Rte 202	26	1.15
S-i4	Sanford	Washington St & Riverside/Pioneer Ave	8	2.07
S-i5	Sanford	Rte 109, Roberts St	9	1.11
S-i6	Sanford	Rte 109, Old Mill Rd	8	1.12
S-i7	Sanford	Rte 4 (Alfred Rd), School St *	8	1.93
S-i8	Sanford	Rte 4 (Alfred Rd), Jagger Mill Rd *	14	2.64
S-i9	Sanford	Rte 109, Rte 4 roundabout **	60	3.68
W-i1	Wells	Rte 109, Rte 9A *	11	2.61
W-i2	Wells	Rte 109, Chapel Rd	11	1.91
W-i3	Wells	Rte 1, Chapel Rd	27	3.70

* Denotes location that has since been improved.
** MaineDOT reports the HCL for all 4 legs of the roundabout separately. Each leg had the following number of crashes and CRF's between 2008 and 2010: northbound – 19 crashes, CRF 4.22; eastbound – 13 crashes, CRF 2.83; southbound – 18 crashes, CRF 4.56; westbound – 10 crashes, CRF 2.19. The roundabout was completed in 2009, which was during the HCL period. As such, there may have been a temporary increase in crash rates while drivers adjusted to the new roundabout. Source: MaineDOT (2010)

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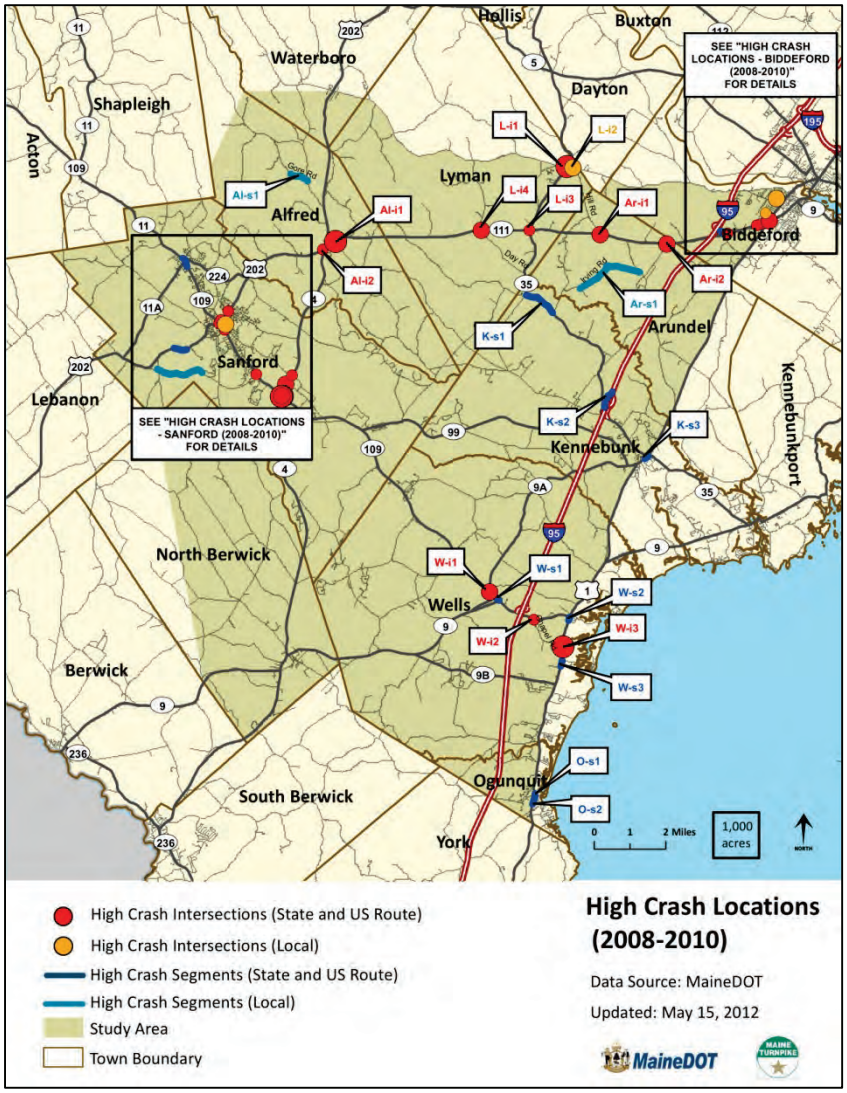

Figure 3-25: High Crash Locations (2008-2010)

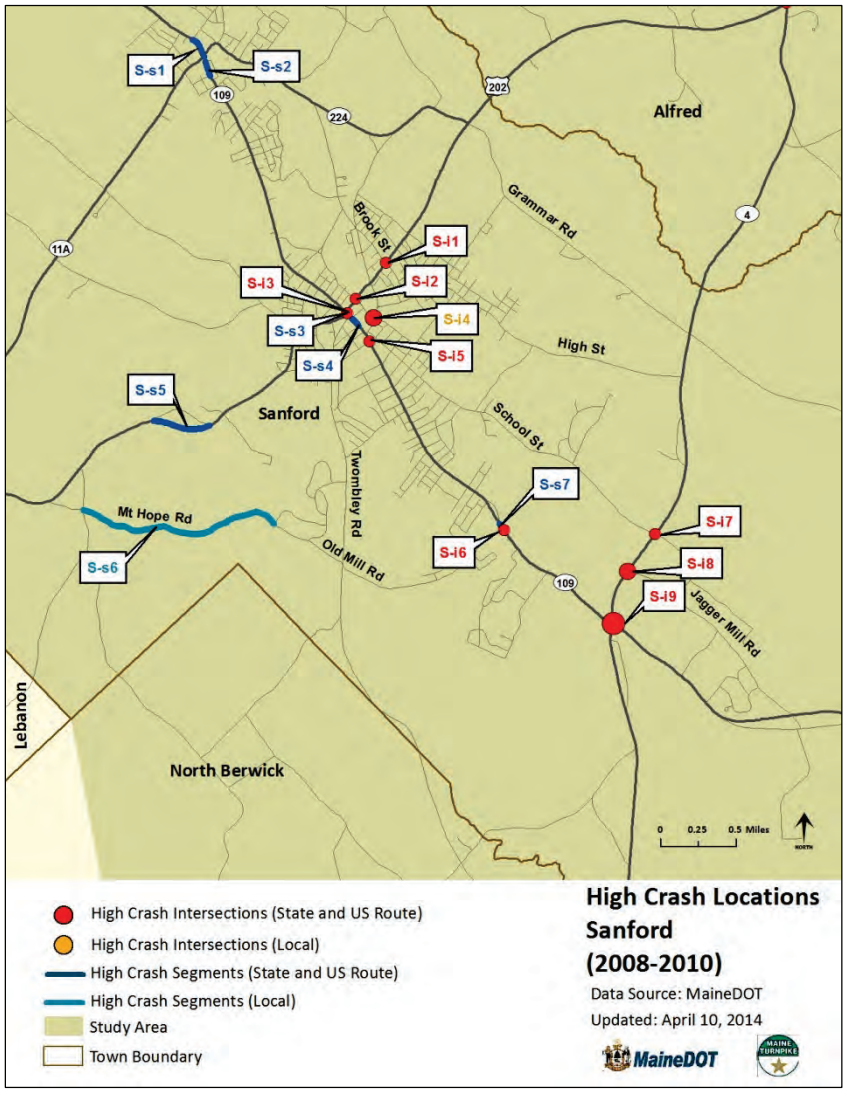

Figure 3-26: High Crash Locations – Sanford (2008-2010)

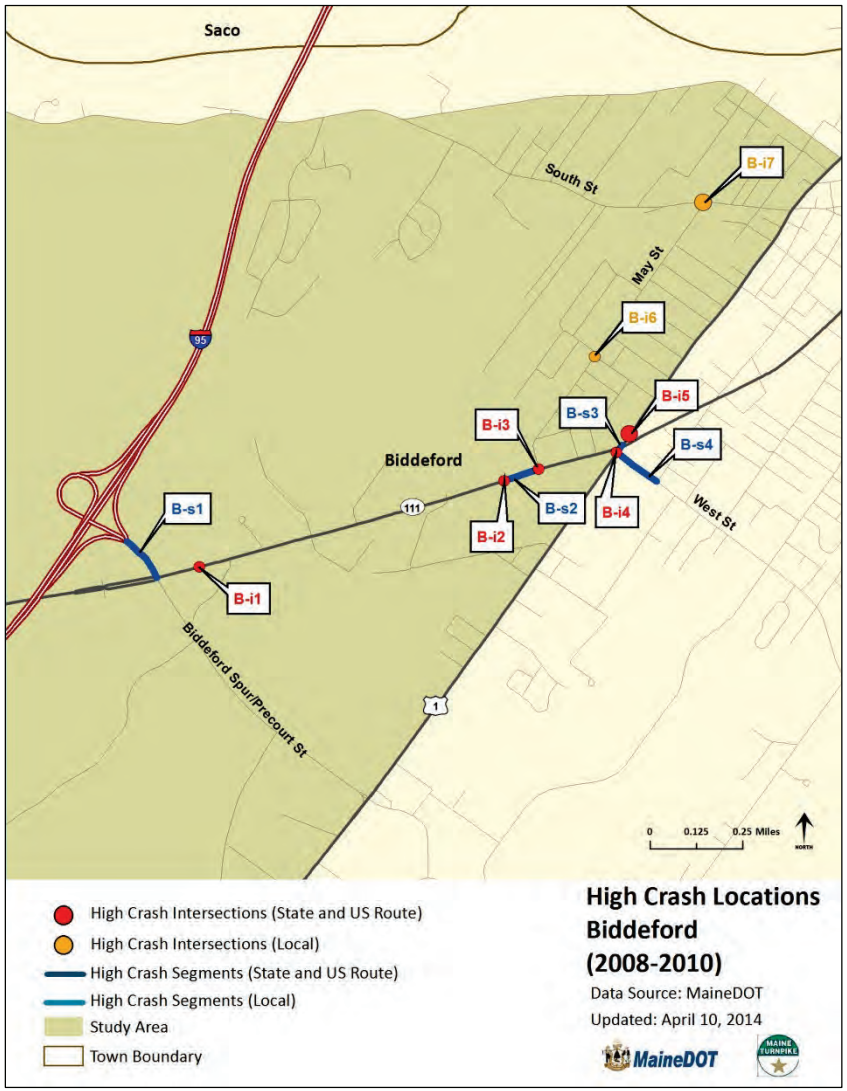

Figure 3-27: High Crash Locations – Biddeford (2008-2010)

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Considering Regional Highway System Expansion

As described in *Chapter 1: Study Overview*, the CYCCS was conducted in four phases:

I. Organization and Background Information
II. Initial Investigations and Analyses
III. Detailed Strategy Development and Assessment
IV. Study Documentation

A central focus of Phase II of the CYCCS was to explore how expansion of the highway network could potentially improve mobility and increase economic productivity in the region, and weigh these benefits relative to potential community or natural resource impacts and costs. Nine conceptual regional highway strategies were developed with the participation of the study committees and by incorporating input from the first public meeting (January 2011). These Phase II highway strategies involved capital-intensive, major improvements to existing highways or construction of new highway corridors with the intent of creating additional capacity and reducing travel times. The strategies considered in Phase II of the study were only conceptual representations. Details such as corridor alignments, interchange locations and other defining features were only roughly defined.

Strategies were organized into three general corridors – Biddeford, Kennebunk/Wells, and North Berwick/Ogunquit – that link the Sanford region of central York County to the major highway corridors along Maine's coast (the Maine Turnpike and Route 1). These strategies are summarized below and are further detailed in the *Phase II Highway Corridor Strategy Descriptions Technical Memorandum* (August 2011), which is incorporated into this report as part of *Appendix F: Phase II Evaluation Summary*.

Interim Strategies for Route 202 Corridor West of Sanford

During discussions with the CYCCS Advisory Committee and Steering Committee, concerns about the CYCSS not evaluating east-west travel along Route 202 between Sanford and New Hampshire were raised. A Bill expanding the CYCCS to include Route 202 to New Hampshire was introduced in the state legislature but tabled with the understating that the SMPDC (then the SMRPC) would conduct a separate corridor study.[3] Noteworthy interim recommendations for the Route 202 corridor west of Sanford (in Lebanon) addressed in the June 2012 *Route 202 Corridor Report* include:[4]

- Possible expansion of WAVE service into Lebanon.
- Possibilities for pedestrian amenities near the intersection of Depot Road.
- Eliminate or reduce passing zone between Maple Street and Spruce Street.
- Review of access management regulations.
- Traffic signal improvements for Route 202 at Hubbard/West Lebanon Road and Depot/Little River Road.
- Possible land use ordinance guidance for Lebanon if desired.
- Development of a Corridor Management Plan with MaineDOT.

[3] A scope of work of the Route 202 corridor study is included in Appendix B of the SMRPC *Route 202 Corridor Report* (June 18, 2012)

[4] SMRPC *Route 202 Corridor Report* (June 18, 2012). pp 27-28.

- Conduct future build-out analysis to assess potential effects of future growth in the corridor.

Biddeford Corridor Strategies

These strategies focus on east-west connections linking Sanford, Alfred, Lyman, Arundel and Biddeford; they are depicted graphically in pairs on the following pages.

- Strategy B-1 is an upgrade to the existing Route 111/202 highway between Sanford and Biddeford to increase speed and capacity.
- Strategy B-2 is a locally focused improvement involving construction of new roads in Biddeford connecting Route 111 south to Route 1 (west of the Biddeford Spur) and north to South Street (South Waterboro Road).
- Strategy B-3 includes the upgrades of B-1, plus additional connections from Route 111 to other highways in the Biddeford area and to the Exit 32 Maine Turnpike interchange.
- Strategy B-4 is a new two-lane roadway connecting Route 202 (west of Sanford), Route 109 in South Sanford, and Route 4 near the Alfred/Sanford town line.
- Strategy B-5 is a new four-lane, access controlled expressway. It would be located south of Route 111, extending from a new interchange with the Maine Turnpike (south of Exit 32), Route 111 and Route 1 in Arundel to Route 4 near the Sanford/Alfred town line. Additional interchanges would provide access to Route 35 near the Arundel/Kennebunk/ Lyman town line and to Route 4 and the local street network near the Alfred/Sanford town line.
- Strategy B-6 is a new four-lane, access controlled expressway. It would run north of Route 111, connecting to Route 202 with a new interchange west of Sanford near the Sanford/Lebanon town line and to the Maine Turnpike north of Exit 32. Additional interchanges would provide connections to Route 109 in Sanford (Springvale), Route 202 in Alfred, Route 35 in Lyman, and Routes 1 and 111 near the Arundel/Biddeford town line.

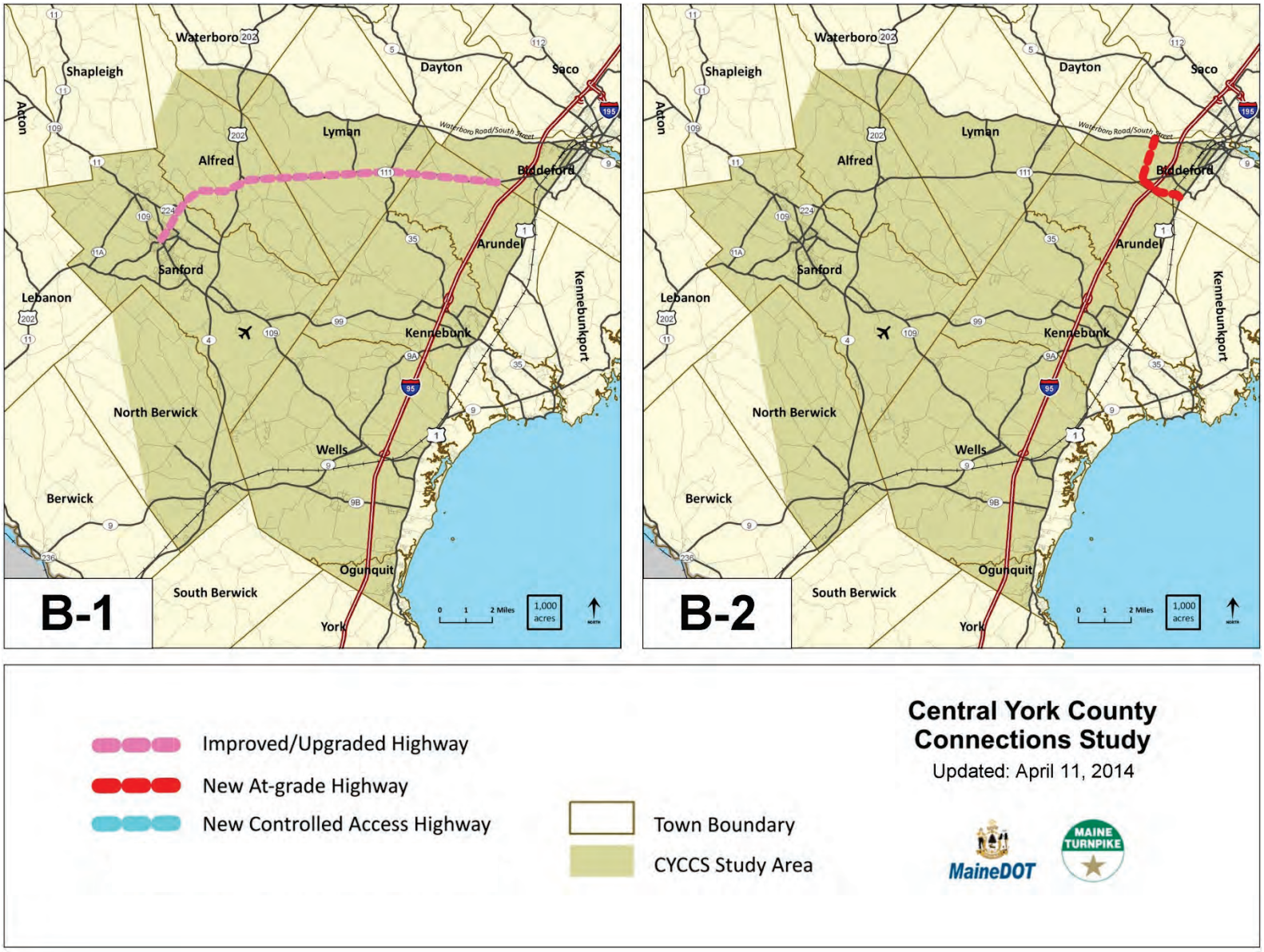


Figure 3-28: Biddeford Conceptual Highway Strategies B-1 and B-2

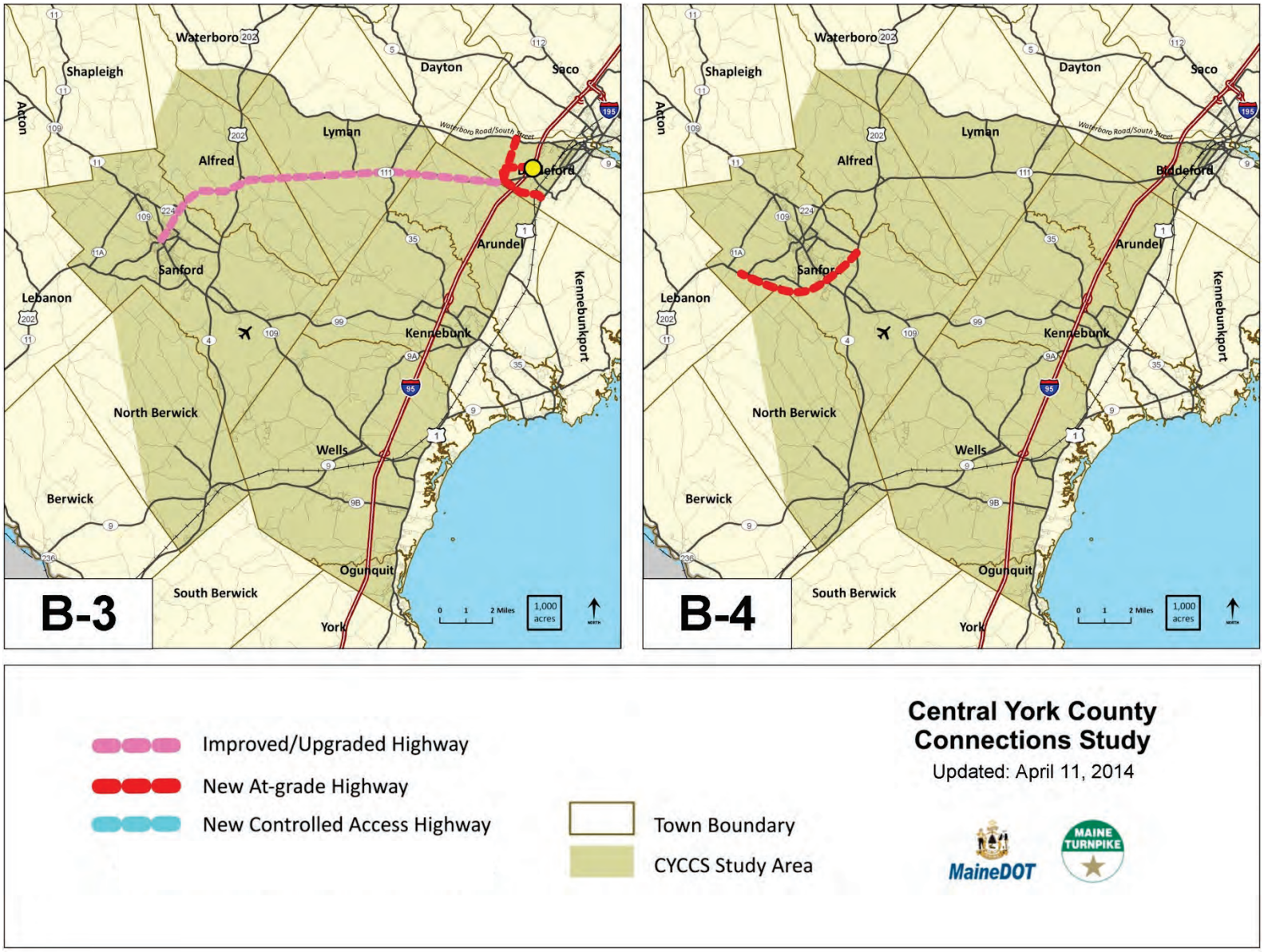


Figure 3-29: Biddeford Conceptual Highway Strategies B-3 and B-4

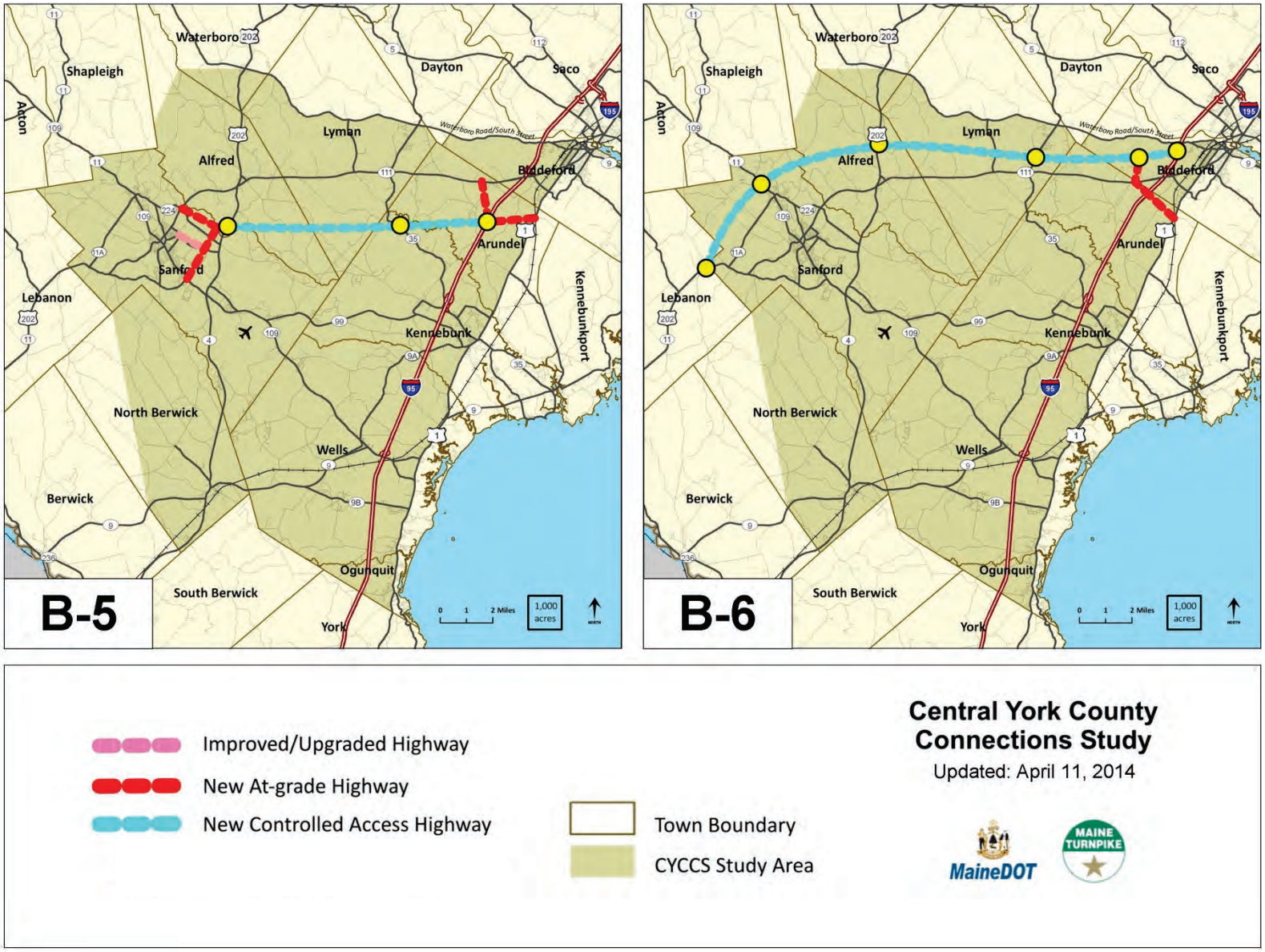


Figure 3-30: Biddeford Conceptual Highway Strategies B-5 and B-6

Kennebunk/Wells Corridor Regional Strategies

These strategies link Sanford with the Maine Turnpike and Route 1 in Kennebunk or Wells.

- Strategy K-1 is a new, more direct two-lane highway connection linking Route 99, Alfred Road, Route 35 and Exit 25 of the Maine Turnpike in Kennebunk. This strategy would involve constructing a new bridge over the Mousam River just north of the Maine Turnpike.
- Strategy K-2 is an upgrade to the existing Route 109 in Sanford and Wells to increase speed and capacity.
- Strategy K-3 is a new four-lane, access-controlled expressway. It would extend from the Maine Turnpike in Kennebunk (south of Exit 25) to Route 4 near the Sanford/Alfred town line, with interchanges providing access to the Maine Turnpike, Route 1 and Route 9A in the vicinity of the Kennebunk/Wells town line; Route 99 in Sanford (east of Route 109); and Route 4 and the local street network in Sanford (east of Route 109 near School Street).

North Berwick/Ogunquit Corridor Strategies

These strategies link Sanford to communities to the southwest, including North Berwick and/or Ogunquit.

- Strategy NB-1 is an upgrade to the existing Route 4 in Alfred, Sanford and North Berwick, including a bypass of North Berwick's town center.
- Strategy NB-2 is a new two-lane highway connecting Route 4 with the Maine Turnpike at a new interchange in Ogunquit, coupled with improvements to Route 4.
- Strategy NB-3 is a new four-lane, access controlled expressway. It would extend from a new interchange with the Maine Turnpike in Ogunquit to Sanford, ending at a new interchange near Route 202 west of downtown. Other interchanges would be provided to Route 9 in Wells (near the South Berwick town line), and to Route 4 near the Sanford Airport.

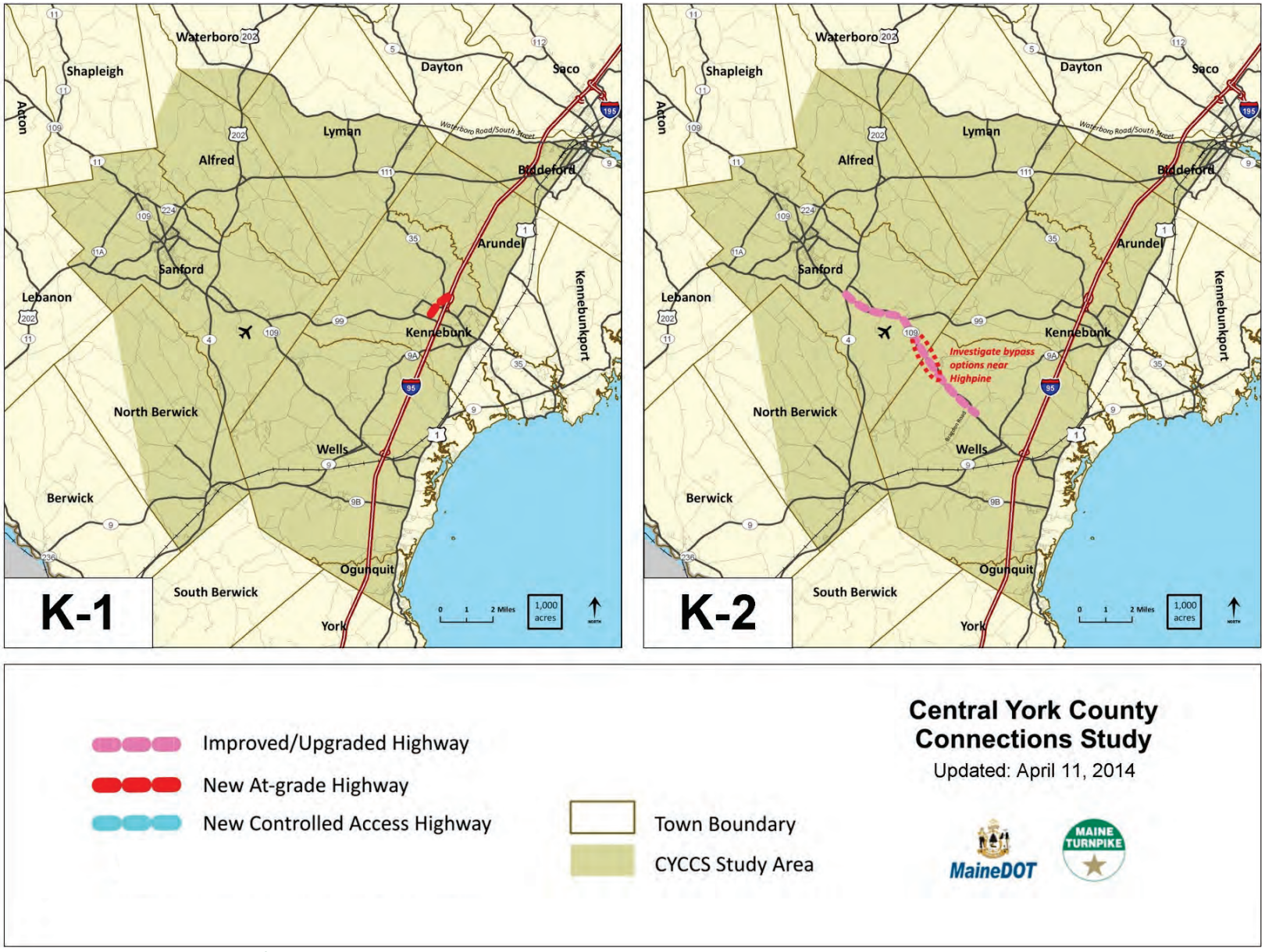


Figure 3-31: Kennebunk/Wells Conceptual Highway Strategies K-1 and K-2

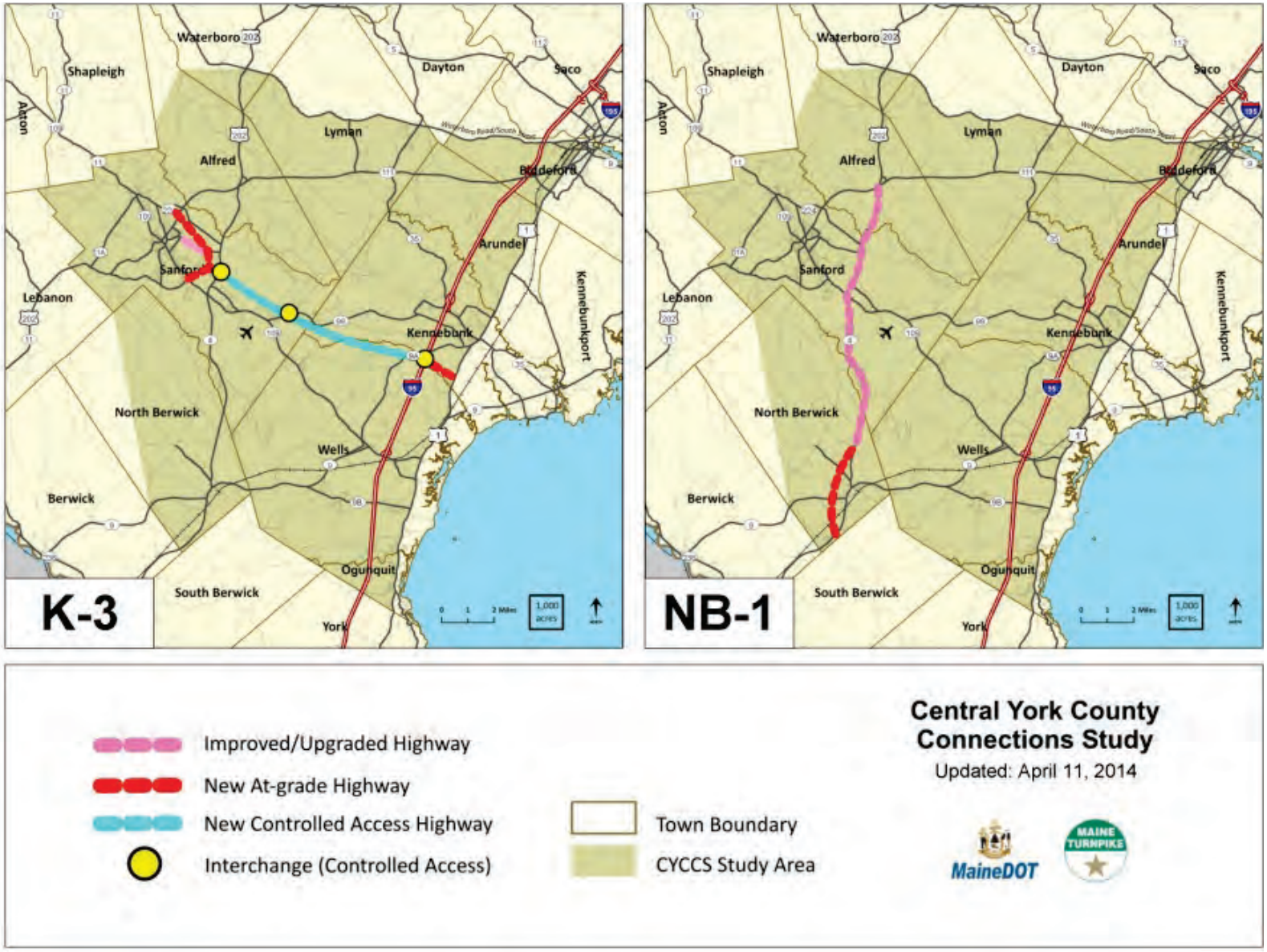


Figure 3-32: Kennebunk/Wells and North Berwick Conceptual Highway Alternatives K-3 and NB-1

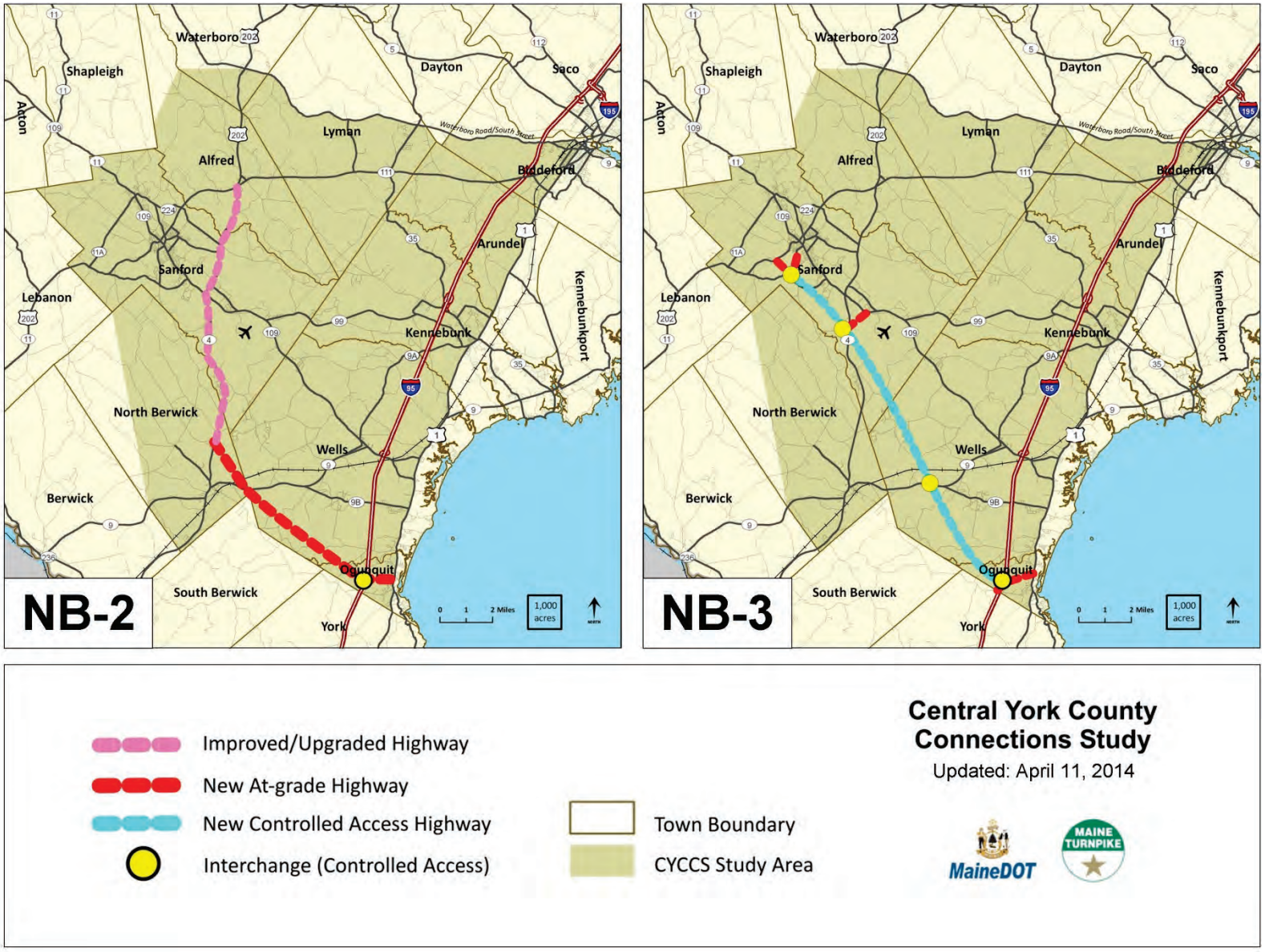


Figure 3-33: North Berwick/Ogunquit Conceptual Highway Alternatives

Evaluation Process

Measures of Effectiveness

The Phase II highway strategies were evaluated based on nine Measures of Effectiveness (MOEs), which were collectively developed by the study team with input from the study's Steering Committee and Advisory Committee. Each MOE is based on the Study Purpose and Need Statement and is comprised of one or more specific measures, as summarized in Table 3-10.

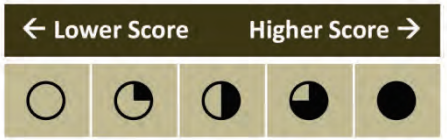
Detailed economic modeling was conducted to support the Phase II evaluation. PRISM, an economic evaluation tool developed by WSP|Parsons Brinckerhoff, was utilized to conduct both a traditional benefit-cost evaluation consistent with FHWA guidelines, as well as an evaluation of the potential for increased economic activity in the region resulting from improved mobility. This latter analysis considered the extent to which improved mobility would be expected to increase employment and the Gross Regional Product (GRP), a measure of economic activity, including effects of monies recirculating in the economy. Economic analyses conducted for the CYCCS are summarized in *Appendix H: Economic Analysis*.

Evaluation Results

A summary of the evaluation results is presented in Figure 3-34. Each strategy received a relative score, ranging from worst to best, for each of the MOEs. The five-tier scoring system is illustrated in a graphical manner, with an empty circle representing the worst possible score and a completely filled circle representing the best possible score. Detailed data and rationale for assigning scores is presented in *Appendix F: Phase II Evaluation Summary*.

Table 3-10: Measures of Effectiveness (MOEs)

MOE Name	Measure
Economic Benefit	Potential job creation Change in regional economic activity (dollars)
Cost	Approximate (planning-level) cost of strategy
Benefit-Cost Ratio	Ratio of projected benefits to costs
Daily Traffic Volumes	Changes in corridor traffic volumes VMT (vehicle miles traveled) Effect on traffic at congested locations
Travel Times and Delay	Projected travel times between key origins and destinations VHT (vehicle hours of travel)
Traffic Safety	High Crash locations addressed Potential change in crash frequency
Transit Operations and Access	Potential to benefit/impact existing transit services
Rural and Urban Character	Rural lands in the corridor Town centers and historic sites in the corridor
Environmental Constraints	Miles of wetlands and environmental features along the corridor



		Capital Cost	Benefit/ Cost	Economic Benefit	Daily Traffic Volumes	Travel Times and Delay	Traffic Safety	Transit	Rural and Urban Character	Environ-mental Constraints
Regional Strategies										
B-1	Upgrade Rte 111/202	◔	●	◑	◔	◑	◑	◔	◔	●
B-3	Upgrade Route 111/202 with add'l Turnpike access and connections	○	●	●	◑	◑	◑	◕	○	◕
B-5	Biddeford Expressway (South)	○	◔	●	●	◕	◕	◕	◔	○
B-6	Biddeford Expressway (North)	○	◔	●	●	●	●	◕	○	○
K-2	Upgrade Rte 109	◕	◔	○	◔	◔	◔	◕	◕	●
K-3	Kennebunk Expressway	○	◕	●	●	◕	●	◕	◑	◑
NB-1	Upgrade Rte 4 and New North Berwick Bypass	◕	○	○	◔	○	○	◑	◑	◕
NB-2	Upgrade Rte 4 and New North Berwick – Maine Tpk/Ogunquit Hwy	○	○	○	◑	◔	◔	◕	◔	◑
NB-3	Ogunquit Expressway	○	○	◑	◕	◔	◑	◕	◔	◔
Local Strategies										
B-2	New Biddeford Highway Connections	●	●	○	◔	◔	◔	◕	●	◕
B-4	Southern Sanford Bypass	◕	●	○	◔	◔	○	◕	●	◕
K-1	Rte 99 – Rte 35 Connection	●	●	○	◔	◔	◔	◑	●	◕

Figure 3-34: Phase II Evaluation Results

Figure 3-35 provides further detail on the benefit-cost evaluation. The primary benefits considered are related to reductions in travel time between York County and other population and employment centers, changes in fuel consumption and operating costs, potential for crash reduction, and environmental factors such as changes in vehicle emissions. In some circumstances, benefits can actually be negative, or "disbenefits." In these cases, costs associated with increased miles traveled outweigh the net value of travel time reductions.

Benefit/Cost Analysis		Total Net Benefits	Total Net Costs (Construction + R&R)	Benefit/Cost Ratio
Regional Corridors				
B-1	Upgrade Rte 111/202	$ 114 M	$83 M	1.4
B-3	Upgrade Route 111/202 with Add'l or Turnpike access and connections	$ 171 M	$135 M	1.3
B-5	Biddeford Expressway (South)	$ 152 M	$256 M	0.6
B-6	Biddeford Expressway (North)	$ 233 M	$365 M	0.6
K-2	Upgrade Rte 109	$ 15 M	$32 M	0.5
K-3	Kennebunk Expressway	$ 206 M	$199 M	1.0
NB-1	Upgrade Rte 4 and New North Berwick Bypass	Negative Net Benefits	$33 M	N/A
NB-2	Upgrade Rte 4 and New North Berwick – Maine Turnpike/Ogunquit Highway	Negative Net Benefits	$97 M	N/A
NB-3	Ogunquit Expressway	Negative Net Benefits	$293 M	N/A
Local Strategies				
B-2	New Biddeford Highway Connections	$ 40 M	$21 M	1.8
B-4	Southern Sanford Bypass	$ 31 M	$26 M	1.3
K-1	Rte 99 – Rte 35 Connection	$ 30 M	$11 M	2.7

Note: "R&R" in this context stands for "rehabilitation and replacement"

Figure 3-35: Phase II Benefit-Cost Details

Expressway strategies (B-5, B-6, K-3 and NB-3) tend to show the greatest regional benefit in terms of economic and traffic related benefits (including travel times and safety). However, these strategies also have greater potential to impact the environment and rural/urban character, and are considerably more expensive to construct and maintain. Of the expressway strategies, only the Kennebunk Expressway (K-3) strategy achieved a benefit-cost ratio of 1.0 or higher.

Corridor upgrades to Route 111 in the Biddeford corridor (B-1, B-3) scored better overall than the other regional highway strategies. They achieved positive economic and traffic-related benefits, and would have fewer environmental impacts. Rural/urban character impacts are of concern for these corridor upgrades, which could potentially impact areas adjacent to the highway. Overall, the benefit-cost ratio of corridor upgrades to Route 111 proved highest of the regional strategies evaluated.

Corridor-wide upgrades in the Route 109 (K-2) and Route 4 (NB-1 and NB-2) corridors were found to have modest benefits as measured by the range of MOEs, which is likely a reflection, in-part, of sufficient capacity and relatively delay-free travel in those corridors today. Specific improvements to address safety issues or spot congestion issues in these corridors were considered during Phase III of the study, though much of Route 109 was upgraded in 2011.

The benefit-cost assessment for the North Berwick/Ogunquit corridor (NB-1, NB-2, NB-3) strategies found that the modest benefits in terms of travel time savings for strategies in this corridor were outweighed by impacts associated with increases in vehicle miles traveled (e.g. – travel costs, safety impacts associated with more

travel, etc.). As a result, the net benefits associated with large-scale improvements in this corridor were negative.

The localized strategies fared relatively well in the Phase II evaluation in terms of benefit-cost ratio, though the methodology used for the Phase II analysis is intended to evaluate larger-scale strategies based on region-wide benefits rather than such local strategies. Further work in Phase III was performed to confirm the benefits for these and other smaller scale strategies, as well as to consider the role these strategies might have in conjunction with other improvements, and is described in detail in the *Recommendations* section of this chapter. Both the benefits and impacts associated with the local strategies tend to be relatively modest and localized.

Study Committee and Public Comments on the Phase II Evaluation

The Advisory and Steering Committees met in September 2011 and March 2012 to review results of the Phase II analysis. The study team subsequently presented Phase II results at a public meeting in Kennebunk on March 27, 2012. Presentation materials and meeting summaries are compiled in *Appendix A: Public Outreach*. An overview of the stakeholder feedback is presented in the following sections.

Advisory Committee

The study's Advisory Committee expressed concern over the magnitude of upgrades (4-lane cross section) proposed under the Biddeford Corridor Upgrade strategies (B-1 and B-3), but supported further study of corridor upgrade strategies on Route 111. Of the Expressway strategies, the Advisory Committee felt that the Kennebunk Expressway (K-3) showed the best potential, but expressed strong concerns about environmental and rural character impacts, as well as costs, associated with any of the new corridors. Several Advisory Committee members noted that the benefits of the Expressway strategies—both travel and economic benefits—were modest. As a result, the group recommended dropping B-5, B-6 and NB-3.

The group also noted that the major corridor upgrades, except those on Route 111, were not expected to greatly change travel conditions, and therefore didn't recommend further study of K-2, NB-1 or NB-2.

The Advisory Committee did express support for further study of the local strategies in Phase III, but with some reservation about potential environmental and community impacts associated with these strategies, especially those around the Route 111/Maine Turnpike intersection.

At the March meeting, the Advisory Committee generally concurred with MaineDOT and MTA's recommendations to drop all the Expressway strategies, including K-3; however it was noted that York County is one of the largest growing workforces in the state and the need to efficiently move people in, out and around the county is key to strong employment.

Steering Committee

The study's Steering Committee responded similarly to the Advisory Committee. They also supported further study of the Biddeford Corridor Upgrade strategies (B-1 and B-3). They noted that these appear to provide travel benefits with lower cost and fewer impacts than the new corridor strategies would. The majority of the group expressed the opinion that the Biddeford Expressway strategies (B-5 and B-6) were too costly, had considerable potential for

environmental and rural character impacts, and would not result in benefits sufficient to justify their considerable cost.

The Steering Committee was split on the Kennebunk Expressway (K-3) strategy. While expressing strong concerns over environmental impacts, there was general agreement that it was the most promising of the new expressway strategies considered. If any of the expressway strategies were to be carried forward, some Steering Committee members felt K-3 was the best candidate.

The Steering Committee did not express the opinion that the other major highway strategies (K-2, NB-1, NB-2, and NB-3) warranted further consideration due to limited travel and economic benefits. They did concur with further study of the local strategies in Phase III.

At the March meeting, most of the committee members concurred with MaineDOT and MTA's recommendation to drop all the expressway strategies. However, a few committee members did express concerns that economic benefits may not have been fully captured in the analysis. One member also expressed the opinion that strategies should not be eliminated due to current financial constraints, contending that they could at some point become more financially viable.

Public Meeting

Those members of the public who spoke at the meeting expressed a number of concerns regarding the Phase II regional highway strategies; particularly those that involved construction of new corridors. Environmental concerns, costs, and limited benefits were cited by many as reasons to not carry these strategies forward.

Audience members also noted that even the smaller, local strategies that involve new corridors have the potential for impacts to sensitive areas. In Biddeford, the land north of Route 111 and west of the Maine Turnpike includes wetlands and habitats that community members have been working to preserve. They expressed concern that Strategies B-2 and B-3, which include a new connection between Route 111 and South Street (Waterboro Road) would impact these areas.

Some attendees spoke in favor of greater consideration of non-highway strategies, including transit improvements and corridor management strategies, such as interconnecting commercial properties with a central access point. A representative of the Sanford Regional Growth Council expressed support for more detailed study of the existing corridors given the unfavorable findings associated with new corridors.

Phase II Recommendations

Based on the results of Phase II analysis, as well as committee and public feedback, the MaineDOT and MTA decided to eliminate major new corridors (B-5, B-6, K-3, NB-2, and NB-3) or corridor-wide capacity expansion (B-1, B-3, K-2, NB-1 and NB-2) from further consideration. Instead, the study shifted focus to continuing study of targeted, smaller scale highway improvements, as well as non-highway strategies, during Phase III of the CYCCS. Highway-related recommendations are described in the next section, *Recommendations – Improving the Current Highway System*, while non-highway recommendations are presented in other chapters.

Recommendations – Improving the Current Highway System

As a result of the Phase II evaluations, the study during Phase III focused on identifying targeted improvements to existing transportation infrastructure and services. Highway recommendations were developed in response to specific issues identified by the study team with input from the project committees and pubic. **Recommendations** (Table 3-11) were selected based on potential effectiveness, alignment with the study's goals, benefit-to-cost ratios and implementation feasibility. In addition to recommendations, those actions that demonstrated some degree of merit, but are not fully or clearly justified based on existing or projected conditions, or require further deliberation, are also identified as **Other Potential Long-term Actions**.

For recommendations, information presented includes:

- Description: Elements included in the recommendation.
- Location: Town(s) and roadways.
- Benefits: Summary of expected benefits, such as congestion reduction or safety improvements.
- Cost: A planning level estimation of cost to construct or implement the recommendation. Project definitions are at an early stage of development and in many cases will evolve and grow more detailed through subsequent design work. Where costs could not be reasonably estimated, they are instead categorized as low (typically under $50,000), medium ($50,000 to $250,000) or high (over $250,000).
- Benefit/Cost: A benefit-cost assessment (BCA) (separate from the more detailed PRISM regional economic impact analysis for the conceptual highway strategies presented earlier in this chapter) was conducted for cases where cost effectiveness was not known and the proposed action is conceptually developed sufficiently to enable a planning-level BCA.[5] The PRISM tool was also used to calculate BCA, which assigns economic value to benefits associated with a potential strategy (such as travel time savings or reduction in crashed) and compared to the costs to implement the strategy. BCA analysis attempts to determine whether the investment needed to implement a strategy produces direct benefits of equal or greater value. A benefit-cost ratio of 1.0 or higher indicates that the expected benefits outweigh the expected costs. For more details on the BCA methodology

[5] PRISM is a custom economic analysis tool developed by WSP|Parsons Brinckerhoff and applied in many projects throughout the country.

and calculations, see *Appendix H: Economic Assessment*. Many recommendations (e.g., safety and signage improvements, traffic signal upgrades, and streetscape/aesthetic enhancements) were not given benefit-cost assessments because capital costs were less than $50,000, or the benefits were intangible and difficult to quantify. All unassessed recommendations presented in this chapter are assumed to have a positive BCA and are consistent with best practices.

- Potential Impacts: Identified potential impacts to natural or built environment features.
- Timeframe: Indicates when the action could *potentially* be advanced based on the degree of additional design/concept development work needed, funding commitments that would need to be secured, and whether the need is a current or anticipated future need. Actual project timeframes will be subject to further planning and work programming efforts by the MaineDOT and MTA.
  - Near-term recommendations could be implemented relatively quickly and without considerable additional work to develop.
  - Mid-term recommendations require additional design work and/or identification of funding, but could conceivably be implemented within a 5 to 10 year timeframe.
  - Longer-term recommendations would require considerable additional planning, design and coordination before implementing, and are unlikely to more forward to implementation for some time.
- Notes: Highlights any other important aspects of the recommendation.

Table 3-11: CYCCS Recommendations

Recommendation	Jurisdiction(s)	Estimated Cost			Benefit/Cost Ratio (BCR) Assessment*	Implementation Timeframe		
		Low (<$50K)	Medium ($50K - $250K)	High (>250K)		Near-Term (1-2 Years)	Med-Term (2-5 years)	Long-term
H-1: Route 111 Traffic Signal Upgrades	Biddeford		✓		Not assessed	✓	✓	
H-2: Route 111 Lane Choice Sign Improvements	Biddeford	✓			Not assessed	✓		
H-3: Route 111 Passing Lanes (Lyman-Arundel)	Lyman, Arundel			✓	Medium (EB); High (WB)	✓	✓	
H-4: Route 111 Passing Lanes (Alfred-Lyman)	Alfred, Lyman			✓	Medium	✓	✓	
H-5: Route 111 Longitudinal Rumble Strips (40 mph or greater)	Various	✓			Not assessed	✓		
H-6: Improve Lyman Route 111 U-Turn	Lyman		✓		Not assessed	✓		
H-7: Improve Route 111 & Kennebunk Pond Road	Lyman	✓	✓		High	✓		
H-8: Improve Route 111.202 Intersection at Route 4/202	Sanford		✓	✓	Not assessed		✓	✓
H-9: Rehabilitate Route 202 (June St and River St)	Sanford			✓	Not assessed		✓	
H-10: Improve Route 202 & River Street Intersection	Sanford			✓	Medium		✓	✓
H-11: Improve Route 202 & Route 109 Intersection	Sanford			✓	High		✓	✓
H-12: Corridor-wide Signage Improvements	Various	✓			Not assessed	✓		
H-13: Expand the Route 109 & Exit 19 Intersection	Wells			✓	High		✓	
H-14: Traffic Signal Upgrade –Route 109 & Exit 19	Wells	✓			Not assessed		✓	
H-15: Improve Route 109 & Route 9 Intersection	Wells			✓	High		✓	
H-16: Traffic Signal Upgrades –Route 109 in Sanford	Sanford			✓	Not assessed	✓	✓	
H-17: Monitor and Improve School St/Gavel Rd Intersection	Sanford		✓	✓	Not assessed	✓		
H-18: Detailed Study of New Rte 99 to Rte 35 Connection	Kennebunk			✓	High			✓
H-19: Pave Shoulders on Route 224	Sanford			✓	Medium/High	✓		
H-20: Pave Shoulders on Route 35	Kennebunk, Lyman			✓	Medium		✓	✓
H-21: Pave Shoulders on Route 99	Sanford, Kennebunk			✓	Low/Medium		✓	
H-22: Eliminate “Y” Intersections	Various			✓	Not assessed		✓	✓
H-23: Pedestrian and Streetscape Improvements in Villages/Towns	Various		✓	✓	Not assessed	✓	✓	

* High BCR is >1.5; Medium BCR is 1–1.5; Low BCR is <1. Not assessed recommendations are all assumed to be positive.

Route 111/202 Corridor Recommendations

The travel and economic analyses conducted during Phase II highlighted the importance of east-west linkages between central York County and Biddeford, Saco and the Portland metro area. Improving the Route 111/202 corridor, which is the primary corridor linking these areas, is therefore a top priority.

Recommendations for the Route 111/202 Corridor focus on addressing identified safety and mobility issues, as well as improving the pedestrian environment in-town in Sanford, where the corridor travels through established residential and commercial areas. The locations and a summary of the recommendations are provided in Figure 3-36 and Table 3-12, respectively.

In addition to the CYCCS recommendations, those actions currently programmed by MaineDOT in their *Biennial Capital Work Plan (FY 2012-2013)* are also recommended for implementation. These include:

- Improve intersection of Route 111 at Old Alfred Road/New Road in Arundel (WIN# 019002.00).
- Improve intersection of Route 111 at Hill Road in Arundel (WIN# 017239.00).
- Construct westbound 0.56-mile passing lane beginning at Old Alfred Road/New Road in Arundel (WIN# 019007.00). This project is part of the CYCCS recommendation H-3.
- Improve intersection of Route 111 & Route 1 in Biddeford (WIN# 019004.00).

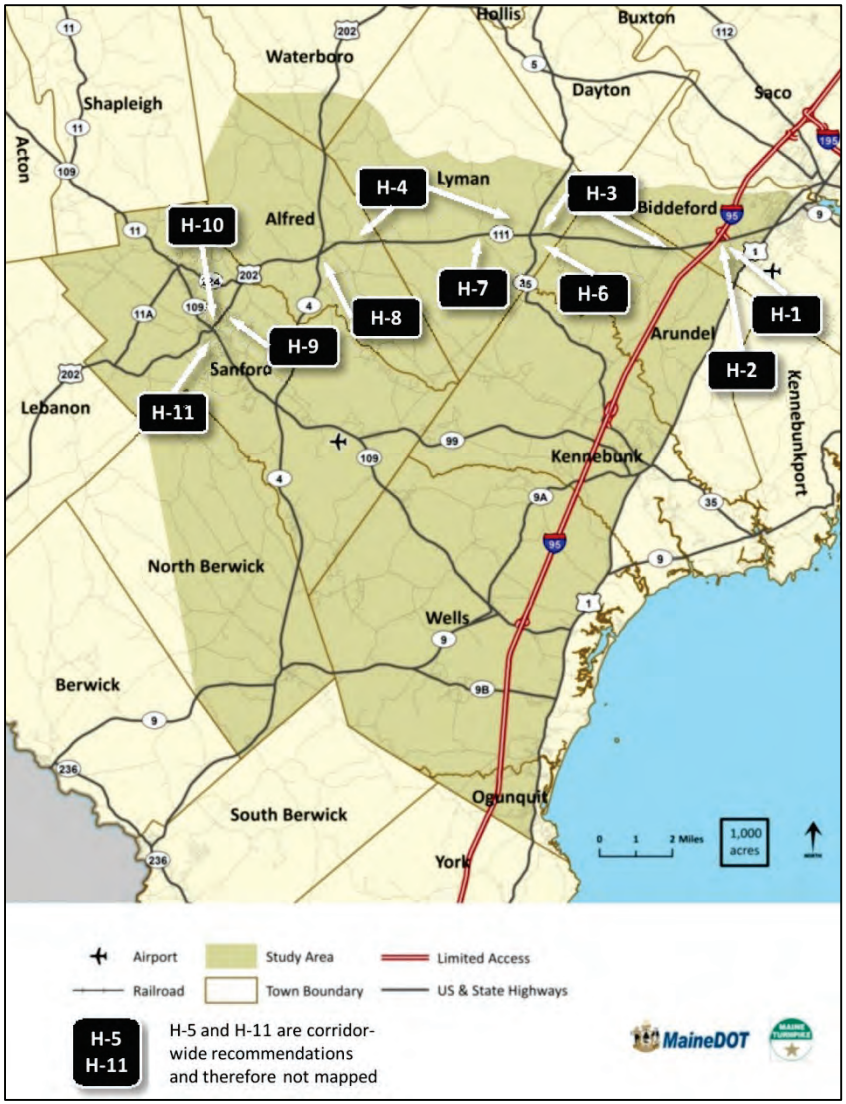


Figure 3-36: Location Map for Route 111/202 Corridor Recommendations

Table 3-12: Route 111/202 Corridor Recommendations

Recommendation		Estimated Cost	Benefit/Cost Ratio (BCR) Assessment	Priority
H-1	Traffic Signal Upgrades – Biddeford Area	$150,000	Assumed to be positive	High
H-2	Lane Choice Sign Improvements	<$20,000	Assumed to be positive	High
H-3	Passing Lanes (Lyman – Arundel Segment)	$1.5 million per mile	1.2 EB; 1.5 WB	High
H-4	Passing Lanes (Alfred – Lyman Segment)	$1.5 million per mile	1.0 EB; 1.2 WB	High
H-5	Longitudinal Rumble Strips	<$3,000 per mile	Assumed to be positive	Low
H-6	Improve Lyman Route 111 U-Turn	$50,000 – $100,000	Assumed to be positive	High
H-7	Improve Route 111 & Kennebunk Pond Rd/Day Rd Intersection	$65,000	16.2	High
H-8	Improve Route 111/202 intersection at Route 4/202	$250,000	Assumed to be positive	Low
H-9	Rehabilitate and Improve Route 202 between June St and River St	$1.25 million	Assumed to be positive	Medium
H-10	Improve Route 202 & River St intersection	$870,000	1.0	Low
H-11	Improve Route 202 & Route 109 intersection	$710,000	3.2	Low
H-12	Corridor-wide Signage Improvements	<$50,000	Assumed to be positive	High

The MaineDOT *Multimodal Six-Year Transportation Capital Plan (2010-2015)* also includes several additional projects, which are incorporated into CYCCS recommendations as noted:

- Westbound passing lane on Route 111, beginning at Route 35 in Lyman (included as part of CYCCS recommendation H-4).
- Eastbound passing lane on Route 111, beginning at Blueberry Road in Alfred and extending to approximately Graves Road in Lyman (included as part of CYCCS recommendation H-4).
- Highway Reconstruction on Route 202 in Sanford (River Street to June Street). This segment corresponds to CYCCS recommendation H-9.

Recommendations presented in the *Recommended Local Jurisdiction Actions* section toward the end of this chapter regarding development of the local street grid would also benefit the Route 111/202 corridor, as would access management and transit improvements described in other chapters. Access management is especially important in preventing degradation of mobility and safety in the Route 111/202 corridor.

H-1: Traffic Signal Upgrades – Biddeford Area

Description	Near- to Mid-term: Upgrade signal controllers and detection to implement Adaptive Signal Control (ASC). On-going: Regular retiming of traffic signals if ASC is not implemented.
Location	Biddeford. Route 111 (Biddeford Crossing to Shaw's Entrance)
Benefits	Maximizes operating efficiency of existing highway capacity, reduces travel delay/congestion, reduces stops at signalized intersections, and responds to changing traffic conditions. Some Adaptive Signal Control (ASC) systems can also positively affect intersection safety by extending green time to avoid changing from green to yellow while a vehicle is entering the intersection.
Cost	Moderate. Varies according to application and system selected, but estimated at around $150,000 for upgrading five intersections (assumes existing signals retained with controller and detection upgrades).
Benefit/Cost	Not assessed; assumed to be positive.
Potential Impacts	None expected.
Timeframe	Near-term to mid-term.
Notes	None.

The Route 111 corridor in Biddeford was previously expanded to four travel lanes with additional turn lanes at intersections. Further capacity expansion is not practical. The busiest location on the corridor—the intersection of Route 111 and Exit 32/Precourt Street—operates at LOS C today and is forecast to operate at LOS D in 2035, which is an acceptable overall LOS. Specific movements are more congested, however, including left turns from Route 111. Further, limiting queue lengths on the north leg of the intersection (Exit 32 off-ramp) is important to prevent traffic from backing into the interchange area.

Intersections west of Precourt Street/Exit 32 have sufficient capacity and operate with relatively little congestion. However, progression of traffic through this segment was noted as a problem by the study committees and public.

Traffic signals on Route 111 in Biddeford (Figure 3-37) have detection, actuation capabilities, and are interconnected, meaning that they already have some ability to respond to traffic conditions and operate in coordination with one another. An option to further improve the operation of signals on this segment is to upgrade to more advanced signal traffic controller equipment in conjunction with expanding vehicle detection capabilities.

MaineDOT is currently considering initial implementation of Adaptive Signal Control (ASC) technologies elsewhere. Should these technologies prove effective, they should be considered for implementation on these Route 111 corridor intersections. An advantage of an ASC system at this location would be that it could quickly adapt to changing traffic conditions throughout the course of

the day/week/year and could be programmed to monitor and aggressively respond to queuing on the Exit 32 off-ramp.

Figure 3-37: Route 111 Traffic Signals near the Exit 32 Interchange

Upgrading to ASC would likely require additional video and loop traffic detection, upgrading traffic signal controllers and software, and developing and testing signal timing parameters.

Short of upgrading to an ASC system, current signal timing plans should be evaluated regularly (every 3 to 5 years is recommended, depending on traffic growth or development in the corridor). This process involves collecting a field inventory of equipment and road geometry, collecting new traffic counts at all intersections in the coordinated system, analyzing traffic signal timing plans, and modifying signal timing. This process would not need to be conducted with most ASC systems, since they monitor and respond to traffic conditions in real-time.

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H-2: Lane Choice Sign Improvements

Description	Supplement current signing on eastbound Route 111 approaching the Exit 32 interchange to clarify lane choice.
Location	Biddeford. Route 111 (West of Exit 32/Precourt St)
Benefits	Reduces driver confusion; potentially reduces collisions approaching the Exit 32/Precourt Street intersection.
Cost	Low. Likely under $20,000 unless a design requiring additional overhead sign supports is selected.
Benefit/Cost	Not assessed; assumed to be positive.
Potential Impacts	None expected.
Timeframe	Near-term.
Notes	Next step would be for MaineDOT to design and implement signing plan.

The left lane on eastbound Route 111 becomes a left-turn only lane at the Exit 32 Maine Turnpike entrance. To help drivers select the appropriate lane while approaching the entrance to the Maine Turnpike at Exit 32, additional signing should be added designating the left lane for Turnpike and Park-and-Ride traffic, and the right lane for Biddeford/Route 111 traffic. Signs to clarify that the Turnpike entrance is the second left, after the Biddeford Park-and-Ride, are recommended as well. A concept plan is illustrated in Figure 3-38.

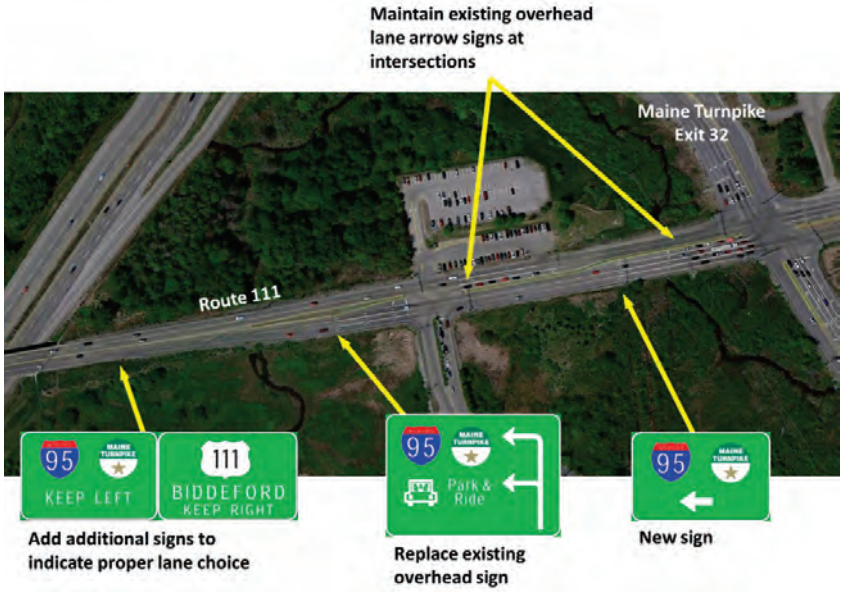

Figure 3-38: Eastbound Route 111 Signage Concept Plan

H-3: Passing Lanes (Lyman – Arundel Segment)

Description	Construct passing lanes.
Location	Arundel, Lyman. Eastbound Route 111 (Route 35 to Thompson Rd/Trout Brook Rd) Westbound Route 111 (New Rd/Old Alfred Rd to Drew's Mill Rd)
Benefits	Allows traffic to pass slower moving vehicles, reduces delay and improves travel reliability; improves peak level of service to LOS C/D (from projected LOS E in 2035); reduces incidence of head-on collisions.
Cost	Typically $1.5 million per mile.
Benefit/Cost	1.2 eastbound 1.5 westbound (1/2 mile) 1.2 westbound (1/2 mile)
Potential Impacts	Could be accommodated within existing right-of-way, but may require modification of access at some locations (e.g. driveway relocations or adjustments).
Timeframe	Near-term to mid-term.
Notes	1-mile long eastbound lane recommended based on traffic volumes. ½-mile westbound passing lane is included in MaineDOT 2012-13 Capital Work Program.

Traffic volumes on the Route 111 corridor are highest to the east in Arundel and Biddeford. In Arundel, the two-lane highway section operates at LOS E conditions in the peak direction of travel (westbound) and LOS D eastbound during the PM peak period today. By 2035, both directions in Arundel are projected to degrade to LOS E conditions. The level of service is largely driven by a lack of passing opportunities during peak periods. Passing lanes provide opportunities to pass slower moving traffic and could maintain LOS C/D conditions through 2035 on the corridor.

A passing lane segment is recommended in each direction between Lyman and Arundel. Preferred passing lane locations have relatively few driveways and cross streets (especially those requiring left turns) and are a minimum of ½-mile in length (one-mile is preferred for busy segments such as this). As practical, they should be located following built up areas or reduced speed zones. AASHTO advises that rural arterials, except freeways, should be designed for speeds of 40 to 75 mph for flat terrain, and 50 to 60 mph for rolling terrain (the terrain along Route 111 in Lyman and Arundel varies between flat and rolling).. Typically, the speed limit is set to the 85th percentile speed (i.e., the speed at which 85 percent of traffic moves) of a sizable

sample of vehicles.[6] To determine the speed limit of the passing lane segment, it will be necessary to conduct an engineering study that accounts for sight distances, roadway geometry, and other factors. Based on the Maine speed laws, the posted speed limit cannot exceed 60 mph for an undivided highway if the engineering study allows an increase in the speed limit.

Prior study of the Route 111 corridor recommended that two 0.5 mile westbound passing lanes be established east of Route 35. One of these would be located between New Road/Old Alfred Road (Arundel) and Drew's Mill Road, and is identified in the MaineDOT *Biennial Capital Work Plan (FY 2012-2013)*, while the other is no longer needed since that segment has since been updated to a four-lane segment. Eastbound, the recommended location remains from Route 35 extending 1-mile to near Thompson/Trout Brook Road, as recommended in the prior Route 111 study. Should any of the segments between Route 35 and Biddeford prove infeasible in the future, other potential viable passing lane options are Thompson/Trout Brook Road to Hill Road and Hill Road to Limerick Road.

While full shoulders (8 feet) do not need to be provided in the direction of the passing lane, adequate paved shoulders should be maintained for safety purposes and to allow for bicycle use. Five-foot minimum shoulders are therefore recommended adjacent to passing lanes.

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[6] Source: AASHTO. *A Policy on Geometric Design of Highways and Streets.* 2001. p. 71.

H-4: Passing Lanes (Alfred – Lyman Segment)

Description	Construct passing lanes.
Location	Alfred, Lyman. Eastbound Route 111 (Either Down/Clark/Blueberry Ln to Graves Rd, or Howitt Rd extending west 1-mile) Westbound Route 111 (Route 35 extending west 1-mile)
Benefits	Allows traffic to pass slower moving vehicles, reduces delay and improves travel reliability; improves peak level of service to LOS C/D (from projected LOS E in 2035); reduces incidence of head-on collisions.
Cost	Typically $1.5 million per mile.
Benefit/Cost	1.0 eastbound 1.2 westbound
Potential Impacts	Could be accommodated within existing right-of-way, but may require modification of access at some locations (e.g. driveway relocations or adjustments).
Timeframe	Near-term to mid-term.
Notes	Eastbound passing lane is included in MaineDOT 2012-13 Capital Work Program. 1-mile long passing lanes recommended based on traffic volumes.

Between Alfred and Lyman, Route 111 operates at LOS D conditions in the peak direction of travel during the PM peak period today, and is expected to degrade to LOS E conditions in 2035. Passing lanes provide opportunities to pass slower moving traffic and could maintain LOS C/D conditions through 2035 on the corridor.

One passing lane is recommended in each direction on this segment:

- Westbound starting at Route 35 (Lyman) and extending 1-mile to the west (currently identified in the MaineDOT 6-Year Plan).
- Eastbound *either* starting near Down/Clark/Blueberry Lane (Alfred) and extending 1-mile east to near Graves Road (Lyman), as recommended in prior Route 111 study, *or* alternatively starting at Howitt Road (Lyman) and extending 1-mile east to beyond Boulder Lane.

H-5: Longitudinal Rumble Strips

Description	Add center and shoulder rumble strips.
Location	Arundel, Lyman, Alfred, Sanford. Route 111, locations posted 40 mph or higher.
Benefits	Reduces incidence of head-on collisions (center rumble strip) and run off the road crashes or crashes related to over-correction (edge line).
Cost	Low.
Benefit/Cost	Not assessed. Known to be cost effective and assumed to be positive.
Potential Impacts	Increased noise for abutters when vehicles cross center or edge line, which can be minimized by temporarily interrupting rumble strips at intersections and in front of residential properties that are located near the roadway.
Timeframe	Near-term.
Notes	Center rumble strips are a higher priority than shoulder rumble strips, but both in combination have proven most effective. Consider an initial pilot program. Work with residents to finalize design details and monitor effectiveness as well as noise complaints.

The share of head-on crashes on the Route 111/202 corridor is 6 percent, which is the highest rate among major highways within the CYCCS study area. Centerline rumble strips are a low cost improvement that has proven very effective at reducing head-on and opposite direction sideswipe crashes.

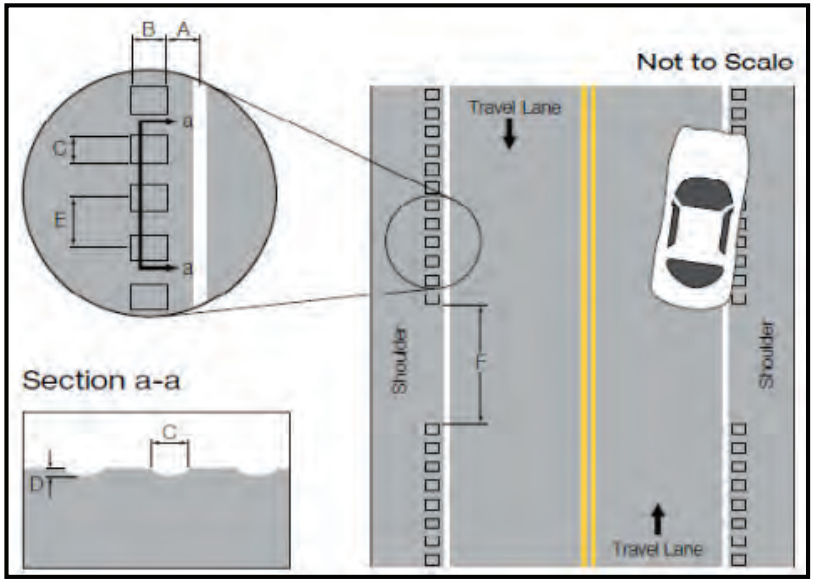
Current FHWA guidance on center line rumble strips (Technical Advisory 5040.40, revision 1) provides guidance on installation details. The FHWA recommends placement on a corridor-wide basis, rather than at selected locations, except for certain design modifications such as breaks for cross streets and driveways. Though initially typically only installed in no passing zones (double yellow lines), the current FHWA guidance notes that the treatment is more effective when continued through passing zones.

Noise to abutters is the primary concern regarding installation of rumble strips. If installed continuously (including in passing zones), the frequency of contact with rumble strips would be higher than if discontinued in passing zones.

Center line rumble strips are recommended for all segments of the Route 111/202 corridor having speed limits of 40 mph or higher, with design provisions to discontinue rumble strips at intersections, driveways or locations where residences closely abut the highway. Given the presence of abutters throughout the corridor, an initial implementation only in no passing zones could be considered and evaluated for effectiveness.

Shoulder rumble strips are effective at reducing run off the road crashes, which constitute 14 percent of crashes on the Route 111/202 corridor. FHWA Technical Advisory 5040.39, revision 1 provides current guidance on implementing shoulder or edge line

rumble strips. Because center line rumble strips will tend to cause vehicles to drive closer to the edge line, placement of shoulder rumble strips to the outside of the edge line is recommended (Figure 3-39). To preserve the shoulder for use by bicyclists, the rumble strip should be placed close to the edge line and periodic breaks should be provided to allow bicyclists to transition from roadway to shoulder riding.



Source: FHWA Technical Advisory 5040.39, revision 1

Figure 3-39: Shoulder Rumble Strip Placement

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H-6: Improve Lyman Route 111 U-Turn

Description	Improve left turn lane and lengthen paved shoulder area to better accommodate U-turns.
Location	Lyman. Route 111 (east of Route 35)
Benefits	Reduces potential for crashes compared to existing configuration. Maintains necessary U-turn route for developments on the corridor where left turn egress is prohibited.
Cost	Approximately $50,000 to $100,000 (depending on extent of widening).
Benefit/Cost	Not assessed; assumed to be positive.
Potential Impacts	None expected.
Timeframe	Near-term.
Notes	Longer-term, replacing the U-turn route with backage roads or interconnected parking lots is preferable.

An informal U-turn space has been constructed for eastbound traffic that wishes to reverse direction east of Route 35 (Figure 3-40). U-turns are currently prohibited at the intersection itself, and traffic exiting adjacent developments is restricted to right-out exit maneuvers today, necessitating a U-turn opportunity.

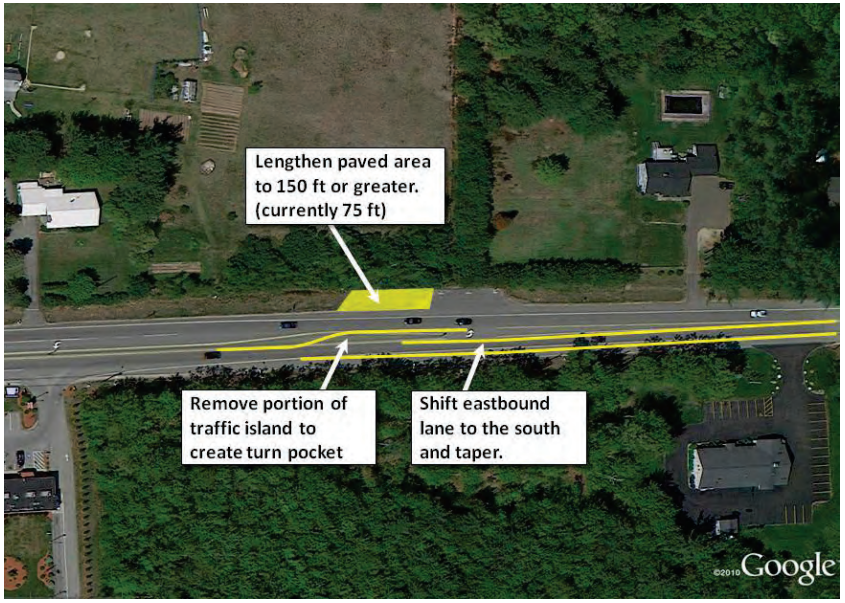
Figure 3-40: Current U-Turn on Route 111 in Lyman

Ideally, backage roads, side streets or interconnected parking lots would provide the necessary additional access to accommodate these movements. Establishment of a local roadway bordering the rear of existing developments and connecting to either Route 35 or Route 111 further from the intersection would provide this access and potentially open other land near the highway to development. The backage road recommendation for this location is specifically called out in the section on *Other Potential Longer-term Route 111/202 Corridor Actions* (page 3-67). Ultimately the responsibility of

the town, this and other access management strategies are also discussed in Chapter 4.

Short of constructing a local backage road to eliminate the need for a U-turn, modification of the existing informal U-turn is recommended. This would involve shifting the eastbound travel lane approximately 4 feet to the south (at the widest point of displacement) to maintain and remove a portion of the existing center island to create space for a standard left turn pocket (see Figure 3-41). The paved receiving area on the north side of the roadway is limited in depth by the highway right-of-way, but could be lengthened to provide more turn around space for vehicles (currently 75 feet, 150 feet or more is recommended). A sign prohibiting trucks from using the U-turn should be included.

The eastbound lane shift could be accommodated without roadway widening by narrowing the shoulder, which currently ranges from approximately 8 to 10 feet in the improvement area. Alternatively, the roadway could be widened by 4 feet to maintain 8 foot minimum shoulders through the improvement area.



Concept Plan Only – Not to Scale

Figure 3-41: Recommended U-Turn Concept

H-7: Improve Route 111 & Kennebunk Pond Road/Day Road Intersection

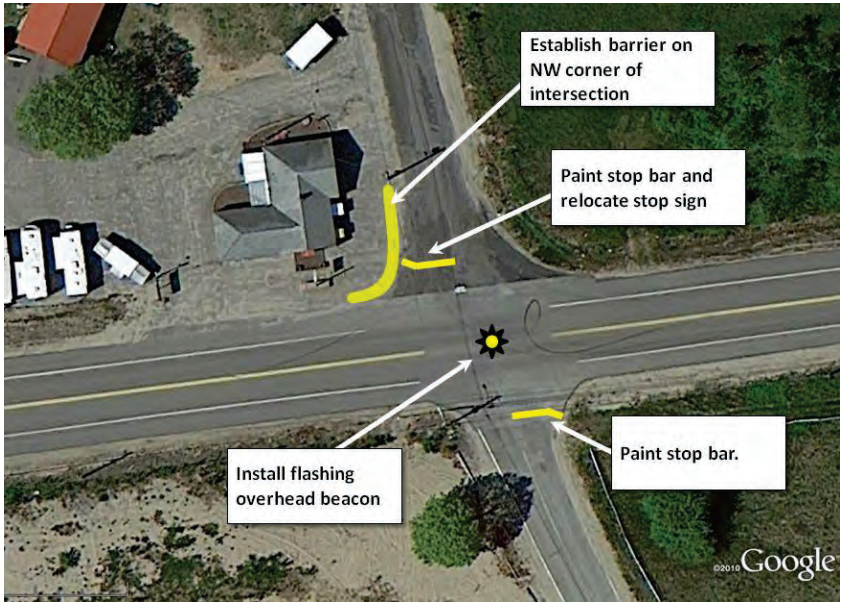
Description	Improve signing, lane markings at intersection. Install overhead flashing beacon. Restrict access from adjacent property in the intersection zone.
Location	Lyman. Route 111 (Kennebunk Pond/Day Rd intersection)
Benefits	Reduces potential for crashes at current HCL.
Cost	Low to moderate. Up to $65,000 depending on selected treatments.
Benefit/Cost	16.3
Potential Impacts	Reconfigures access to parcel on the northeast corner of the intersection.
Timeframe	Near-term.
Notes	Barrier options could include establishing a landscaped area or other barrier on the abutting property, or a guardrail on public right-of-way. Coordinate with property owner to design and implement. Kennebunk Pond Road is an access route to Lyman Elementary School.

The Route 111 intersection with Kennebunk Pond Road/Day Road in Lyman is a high crash location, with a critical rate factor of 2.62. The intersection is poorly defined today, with an adjacent parking area on the northwest corner (Figure 3-42).

Figure 3-42: Current Kennebunk Pond Intersection with Route 111

Recommended improvements include the following (see Figure 3-43):

- Repaint lane striping and add stop bars on Kennebunk Pond Road and Day Road.
- Relocate the stop sign on Kennebunk Road to a more visible location closer to the roadway and intersection.
- Develop a barrier on the northwest side of the intersection to prevent vehicle access to/from the parking area within the intersection. Two potential options are:
  - Work with property owners to construct a landscaped area or other buffer that would restrict vehicle movements at the intersection and formalize entry points away from the intersection.
  - Install a guardrail within the right-of-way.
- Install an overhead flashing beacon (red for side streets, yellow for Route 111) to improve awareness when approaching the intersection. A lower cost alternative would be installation of "stop ahead" signs on the cross street (MUTCD WB-3) in advance of the intersection, but the flashing beacon is preferred in this location given that the intersection is not easily seen when approaching and is fairly dark at night despite the presence of a single streetlight on the southeast corner.



Concept Plan Only – Not to Scale

Figure 3-43: Recommended Kennebunk Pond Intersection Improvements

H-8: Improve Route 111/202 Intersection at Route 4/202

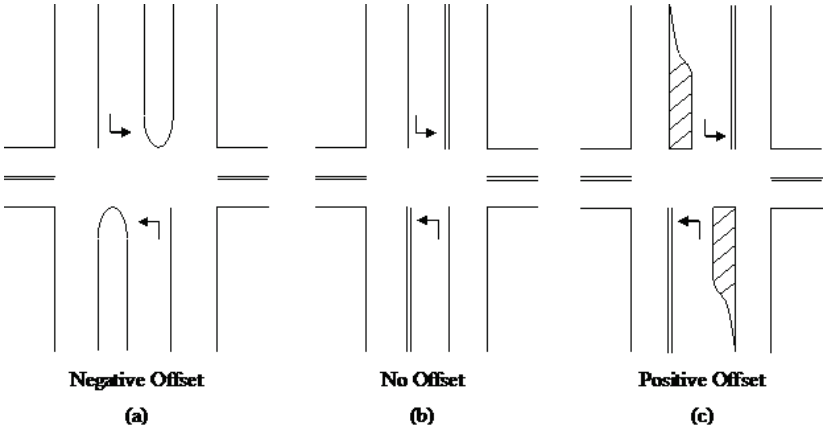
Description	Operational improvements to the Route 4/202 and Route 111/202 intersection. Capacity expansion could be considered over the longer-term should future conditions merit their consideration.
Location	Alfred Route 111/202 intersection with Route 4/202.
Benefits	Congestion reduction. May also have some positive impact on crash rates at current HCL due to congestion reduction.
Cost	Moderate to high, depending on action taken.
Benefit/Cost	Not assessed; assumed to be positive.
Potential Impacts	Protected+permissive phasing could potentially increase crash rates, although this is not always the case with that type of phasing. Capacity expansion options would require small sections of additional right-of-way.
Timeframe	Mid-term to long-term
Notes	Recommend first consideration of protected+permissive phasing and/or Adaptive Signal Control, which are lower cost (<$50,000).

The intersection of Routes 4, 111, and 202 in Alfred is a busy crossroads. Traffic analysis of existing conditions indicates that the intersection operates well today, though occasional occurrences of short-duration congestion northbound on Route 4 during the PM peak were observed by the study team. By 2035, several movements are expected to degrade to LOS E conditions during peak periods as travel demand is expected to approach the capacity of the intersection. One factor affecting operations is that northbound and southbound through movements on the Route 4/202 corridor share a lane with left turns. While left turning volumes are relatively low, they do block through movements when waiting for a gap in oncoming traffic.

Several options have been identified for further consideration at this location, as described below. The first two, which are largely operational improvements and do not involve significant expansion of the intersection, could be considered for implementation in the near- to mid-term, whereas the latter two options are more intensive capacity expansion options that could be considered should future conditions warrant.

- **Implement protected+permissive left turns on Route 111/202**. This option would provide additional opportunities for westbound and eastbound left turns, and with optimization of signal timing could improve all movements to LOS D or better, and overall intersection LOS to C, under projected 2035 conditions. A concern with protected+permissive phasing is safety. In this case, opposing traffic is confined to a single lane and the posted speed limit is 35 mph, which are favorable conditions for protected+permissive phasing. One concern is sight distance, as traffic in the opposing turn lane can limit the ability to see oncoming traffic. Further engineering study of sight distance and vehicle speeds is recommended prior to deciding to

implement protected+permissive phasing. Minor reconstruction of the intersection to provide positive offset left turn lanes could be implemented if sight distance proves to be insufficient given the current turn lane configuration (Figure 3-44).



Source: FHWA

Figure 3-44: Positive Offset Left Turn Lane (Relative to Other Configurations)

- **Upgrade signal controllers to Adaptive Signal Control (ASC)**. ASC would allow signals to respond instantaneously to variations in traffic levels, potentially responding better to brief periods of heavy traffic which have been observed on northbound Route 4. However, its effectiveness during peak periods may decrease in the future without further improvements as the intersection approaches capacity.
- **Add an additional through lane on the east and west legs of the Route 111/202 corridor approaching the intersection**. Sufficient right-of-way exists to create a five-lane section in the vicinity of the intersection (two through lanes in each direction and a center left turn lane). The additional capacity would allow some green time to be reallocated to left turn and/or north-south movements. This would improve the intersection to LOS C, and all movements to LOS D or higher. Allocating green time from the east-west movements to other movements would increase the frequency of stops on east-west movements, however.
- **Add left turn pockets on the north and south legs of the intersection**. Though these are low volume movements, separating left turns from right turns would reduce blocking of the heavier northbound and southbound through movements. Doing so, in conjunction with signal timing optimization, would improve all movements to LOS D or better. The intersection as a whole would continue to operate at LOS D during the PM peak. Neighboring residential developments to the north and the proximity of the Bridge over the Mousam River to the south constrain the ability to widen Route 4, so an alignment study would need to be conducted to determine the viability of adding northbound and southbound turn pockets.

H-9: Rehabilitate and Improve Route 202 between June Street and River Street

Description	Full-depth paving and rehabilitation of highway. Reconstruct and improve pedestrian facilities and streetscaping. Consider relocating utilities underground.
Location	Sanford. Route 202 (June St to River St)
Benefits	Improves condition of road surface and pedestrian facilities. Separates walking surface from roadway. Improves visual character of gateway into downtown.
Cost	High. $1.25 million is a representative cost estimate at this stage of planning. Undergrounding utilities could add up to an additional $500,000, depending on the extent of the installation.
Benefit/Cost	Not assessed; assumed to be positive
Potential Impacts	Construction period impacts to traffic and abutters and potential impacts to historic properties.
Timeframe	Mid-term.
Notes	Ideally conducted in coordination with H-10: Improve Route 202 & River Street Intersection.

This segment of Route 202 is the eastern gateway into Sanford, descending toward the west into downtown (Figure 3-45). The total distance from back-of-sidewalk to back-of-sidewalk (the apparent right-of-way) is approximately 50 feet for the blocks between June Street, North Street and Brook Street. The paved roadway cross section is 40 feet, with on-street parking allowed except in front of Saint Thomas School.

Figure 3-45: Looking West on Route 202 between June Street and River Street

Between Brook Street and River Street, the corridor is particularly constrained. The apparent right-of-way is 40 feet, with two 5-foot sidewalks and two 15-foot lanes (equivalent to two 11-foot lanes with 4-foot shoulders, though a painted edge line is not present). Abutting houses are located close to the roadway, and many are of historical significance.

MaineDOT's current Customer Service Level (CSL) for condition, which factors in pavement condition, ride quality, and roadway strength, is graded "F", or unacceptable for the entire segment. In addition to the road surface condition, sidewalks are in poor

condition, lack curbs and sit nearly flush with the roadway paving. Utility poles are located on the south side of the roadway, within the paved roadway rather than behind a curb. The corridor is an important walking route, providing access to the adjoining residential neighborhoods, Saint Thomas School, Goodall Hospital and nearby Lafayette School. Bicycling is also an important consideration; Route 202 in Sanford has the highest share of bicycle crashes in the study area (3 percent of crashes involved bicyclists).

A full rehabilitation of this segment of the corridor is needed, and the following elements are recommended:

- In general, the existing cross section dimensions are recommended to be retained, with one exception; if overhead utilities are not relocated underground, then widen the south-side sidewalk by one additional foot (6 foot total width) to accommodate utility poles. Other changes to the cross section were considered but deemed too costly and had adverse impacts on abutting residences, as described later.
- Pedestrian accommodations should be improved by reconstructing sidewalks with curbing that provides physical separation from the roadway surface. Curbing would also better channel drainage, though existing storm drainage capabilities will need to be reviewed during the design process to adjust the location of catch basins and drains, and to determine where additional capacity is needed.
- Curb ramps that are compliant with current Americans with Disability Act (ADA) regulations should be constructed at all intersections and crosswalk locations.
- Clarify where on-street parking is allowed through signing and design. Where on-street parking is allowed between Brook Street and June Street, curb extensions (commonly referred to as “bulb outs”) are recommended at crosswalk locations to improve pedestrian safety and to act as a traffic calming element to slow vehicles entering town.
- Consideration should be given to relocating the midblock crossing that provides access to Saint Thomas School to the nearby intersection with Lafayette Street.
- Relocation of overhead utilities is recommended given the limited cross section width and gateway characteristics of the corridor. This is especially applicable for the block between River Street and Brook Street, which has a very constrained cross section.

The study considered the possibility of widening the cross section between River Street and Brook Street to provide additional shoulder width, sidewalk width, and potentially introduce the opportunity for landscaping. Doing so would adversely affect abutting properties, however, which are located close to the roadway. Many of these properties are historically significant, and most have walls, walks, stairs and other structures in their front yards that would be impacted if the cross section were increased. Further, the cost to widen the cross section would be substantial, especially given the potential costs associated with mitigating impacts to abutters.

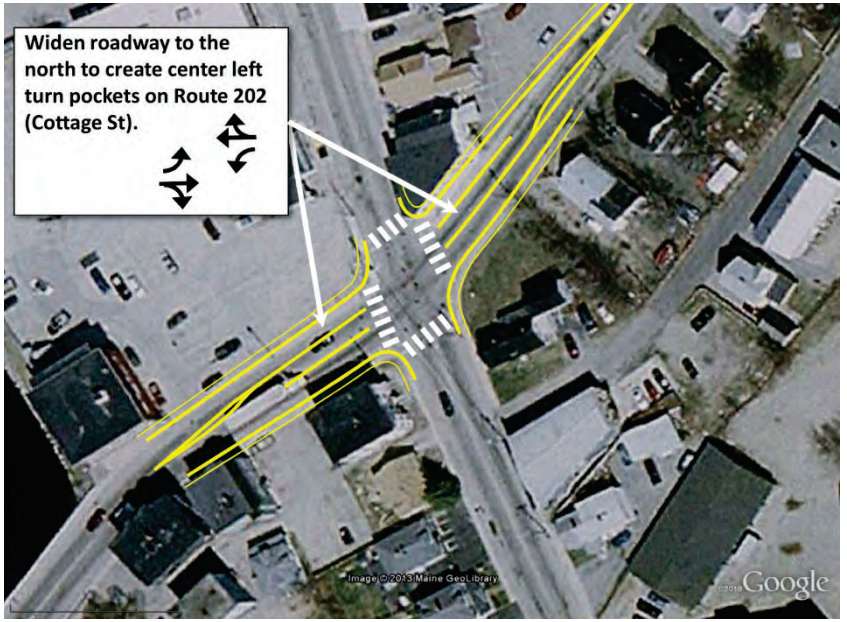
H-10: Improve Route 202 & River Street Intersection

Description	Improve alignment and add left turn lanes on Route 202 at the intersection with River Street.
Location	Sanford. Route 202 (at River St)
Benefits	Eliminates blocking caused by left turning traffic on Route 202 at the River Street intersection. Simplifies traffic movements at the intersection. Reduces potential for crashes by separating left turning traffic and improving alignment. Creates safer, more comfortable pedestrian environment.
Cost	Approximately $870,000 including property acquisition.
Benefit/Cost	1.0
Potential Impacts	Would require 52-foot right-of-way. This would necessitate taking of the property on the northeast corner of the intersection (37 River Street). This building could potentially have characteristics that make it eligible for listing on the National Register of Historic Places. Other minor partial takes of undeveloped parcels (landscaping and/or paved lots) may be necessary too.
Timeframe	Mid-term to long-term.
Notes	Ideally conducted in coordination with reconstruction and streetscape improvements for Route 202 east of River Street (H-9)

The Route 202 intersection with River Street is the second busiest intersection on Route 202 in Sanford, but is physically constrained to a single lane in each direction by adjacent development. The constrained right-of-way also limits pedestrian accommodations, particularly on the north side of the highway where a narrow sidewalk is confined between the highway and the abutting building (Figure 3-46). Route 202 bends at the intersection, which is difficult for traffic traveling westbound to see in advance of the intersection. While not currently a High Crash Location, 10 crashes (including a fatality) have occurred here over the 2008-2010 time period.

Figure 3-46: Route 202 approaching River Street (Looking West)

Recommended improvements are to widen the intersection to create left turn pockets on Route 202, improve intersection alignment, and upgrade sidewalks and crosswalks (Figure 3-47). This would necessitate acquisition and demolition of the building on the northwest corner of the intersection (37 River Street). Constructed during the early 1900's, the building is currently vacant and in disrepair. However, it does maintain some architectural features of distinction, including rusticated concrete block walls (as of May 2013, the building was still standing). MaineDOT and the Maine Historic Preservation Commission would need to make a determination of eligibility for listing on the National Register of Historic places prior to initiating the project. If the property were determined to be eligible for listing, Section 106 and Section 4(f) regulations regarding evaluation, avoidance and minimization of harm to the historic property would apply.



Concept Plan Only – Not to Scale

Figure 3-47: Recommended Intersection Widening to Provide Left Turn Pockets on Route 202 at River Street.

H-11: Improve Route 202 & Route 109 Intersection

Description	Improve alignment and add eastbound left turn lane on Route 202 at the intersection with Route 109. Install center median on Route 109 to prevent left turns from Twombley Rd.
Location	Sanford. Route 202 & Route 109 intersection
Benefits	Reduces congestion and improves LOS. All intersection movements improved to LOS D or better though 2035. Reduces potential for crashes on Route 202 due to separation of left turning traffic. Reduces incidence of collisions on Route 109 near Twombley Road (current high crash location).
Cost	Approximately $710,000, including property acquisition.
Benefit/Cost	3.2
Potential Impacts	Would require acquisition of right-of-way to the south of Route 202. The vacant building at 6 Lebanon Street would need to be demolished. Other partial takes consist of narrow strips of landscaping or paved areas (typically two feet or less). On-street parking (approximately four spaces) on the north side of Route 202 in front of the Sanford Unitarian Universalist Church.
Timeframe	Mid-term to long-term.
Notes	Elimination of the separate short westbound right-turn pocket could be considered during the design process to lessen right-of-way impacts.

The Route 202 intersection with Route 109 is the main crossroads in downtown Sanford (Figure 3-48). The west leg of the intersection on Route 202 is especially constrained by adjacent development. While left turn lanes are provided on all other legs, through traffic and left turns share a lane on eastbound Route 202. As a result, left turning traffic blocks through movements when waiting for opposing traffic before turning. This movement is forecast to degrade to LOS F by 2035. A short right turn pocket is provided in the eastbound direction, but its short length (40 feet) limits its effectiveness. The intersection, as well as the adjacent Route 109 segment and intersection at Twombley Road, are High Crash Locations.

Figure 3-48: Route 202 approaching Route 109 (Looking East)

Recommended improvements are:

- Widen and realign the west leg of Route 202 to improve intersection alignment to add an eastbound left turn pocket.
- Construct a narrow median island on the south leg of the intersection to prevent vehicles from Twombley Road from turning left onto Route 109 (a prohibited movement).
- Provide crosswalks on all sides of the intersection, with ADA compliant curb ramps (Figure 3-49).

Realignment and widening of the west leg of the intersection would require demolition of the former Jerry's Diner building (6 Lebanon Street). This building is currently vacant. It does not appear to have sufficient historical integrity to be considered for eligibility on the National Register of Historic places, though this would need to be verified by MaineDOT and MHPC.

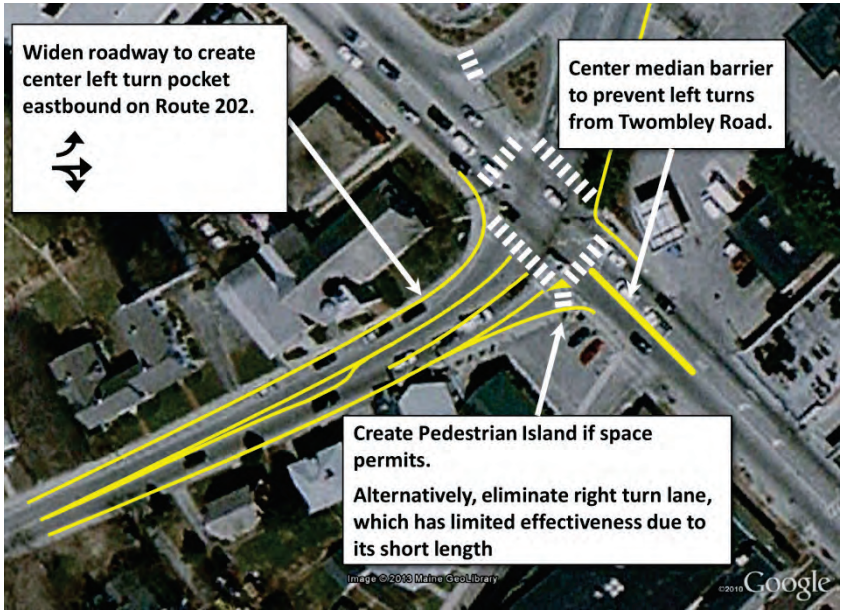


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Figure 3-49: Recommended Intersection Widening to Provide Eastbound Left Turn Pocket on Route 202 at Route 109.

H-12: Corridor-wide Signage Improvements

Description	Inventory and supplement posted speed limit signs. Assess need for "Ice" warning signs.
Location	Biddeford, Arundel, Lyman, Alfred, Sanford. Routes 111 and 202, corridor-wide
Benefits	Improves driver awareness of conditions, potentially improving safety.
Cost	Low.
Benefit/Cost	Not assessed; assumed to be positive
Potential Impacts	No adverse impacts.
Timeframe	Near-term.
Notes	Next step would be MaineDOT inventory and field assessment, followed by placement of signs as appropriate.

Advisory and Steering Committee members noted that speed limits vary on the Route 111/202 corridor, and depending on where one enters the corridor, the applicable speed limit is not always identified (posted). Committee members also noted that some sections of roadway are prone to icing. The bridge near the Biddeford Park-and-Ride was one example noted.

In response, the CYCCS recommends that MaineDOT inventory speed limit signs along the corridor, and supplement as necessary so that signs are present at (1) all locations where speed limits change, and (2) following junctions with arterial or collector roads that provide access to the corridor.

Also recommended is a field assessment of potentially icy locations during a time when conditions are favorable for ice formation on the highway. Potential icy locations include bridges, low areas, hills and shaded curved segments. As necessary, such locations should be identified through placement of MUTDC W8-5 with W8-5aP ("Ice") signs (Figure 3-50).

Figure 3-50: MUTCD W8-5 with W8-5aP

Other Potential Longer-term Route 111/202 Corridor Actions

These approaches demonstrated merit and sufficient feasibility for further consideration, but the projected benefits did not warrant implementation for the given timeframe. They are documented here to serve as a basis for future consideration should conditions change in ways that make their applicability warranted.

Biddeford Route 111 to Exit 32 Interchange Connector

As described earlier, options for expanding the capacity of Route 111 in the Biddeford Crossing to Exit 32 area are limited. The study team therefore looked to the potential for creating new road segments in the interchange area to reduce the amount of traffic on the Route 111 corridor itself, particularly at the intersection with Exit 32/Precourt Street. Expansion of the local street grid, described later under *Recommended Local Jurisdiction Actions (page 3-90)*, is one approach to reduce the concentration of traffic on highway corridors and provide redundant routing options.

Two options were identified for expanding the Exit 32 interchange and constructing a short bypass roadway north of Route 111 connecting directly to the interchange. This would allow traffic destined for Sanford, Alfred, Lyman and other points west of I-95 to avoid the Route 111/Precourt intersection. The *Partial Exit 32 Connection* option would involve construction of the new bypass roadway north of Route 111 in the Biddeford Crossing area, which would have only a connection from the southbound off-ramp at the Exit 32 interchange (Figure 3-51). A second option – *Full Exit 32 Connection* – would reconfigure the interchange to include access from the new connecting highway to the southbound on-ramp and northbound on-ramp as well (Figure 3-52). This second option may not be feasible unless MTA toll collection systems evolve to not require toll booths at ramps (e.g. – all electronic tolling or mainline only tolling). The options could potentially be phased (partially implemented initially, and the full connection at a later time).

Figure 3-51: Partial Exit 32 Connection (southbound off only)

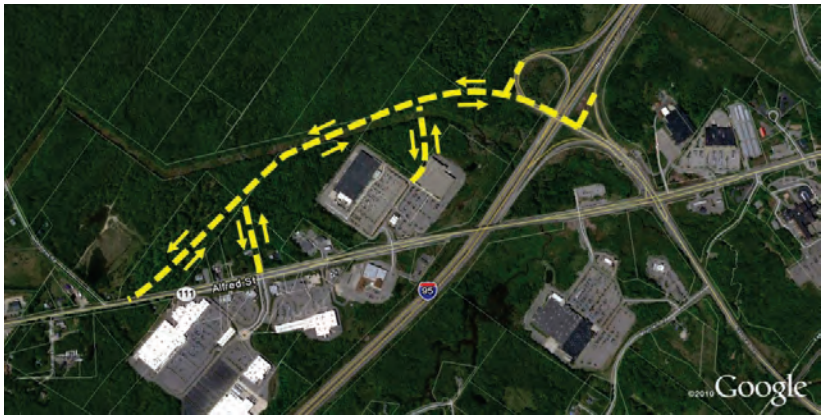

Figure 3-52: Full Exit 32 Connection (southbound off, northbound and southbound on)

The Partial Exit 32 option would primarily divert right-turns from Exit 32 onto westbound Route 111 to the new route. This movement is not a key driver of congestion today, but reducing the volume of traffic making the right turn would allow the Exit 32 leg of the intersection to be restriped to include two dedicated left turn lanes, two through lanes, and a single right turn lane. An estimated 14 percent of daily traffic on Route 111 in the Biddeford Crossing area would shift to the new connecting route. This configuration would reduce overall delay at the Route 111 & Exit 32/Precourt St intersection by about 12 percent during the PM peak period, and allow signal timing to be adjusted to preserve LOS D or better operations for all movements under projected year-2035 demand. Only minor reductions in delay at other times of the day (including the AM peak) are expected.

Under the Full Exit 32 Connection, as much as 28 percent of daily traffic on Route 111 would shift to the new connecting route. Delay at the Route 111 & Exit 32/Precourt Street intersection would decrease by 28 percent and 24 percent during the AM and PM peak periods, respectively. All intersection movements would operate at LOS D throughout the day under projected year-2035 demand.

While effective at reducing congestion, the cost of these improvements is estimated at approximately $8.8 million for the Partial Exit 32 Connector and $10.5 million for the Full Exit 32 Connector, resulting in benefit-cost ratios of 0.4 and 0.7, respectively. As a result, they are not recommended at this time. Instead, approaches to better manage traffic flow on the corridor, as proposed by recommendations H-1 and H-2 should be implemented first. Should traffic conditions worsen beyond projected conditions, the Full Exit 32 Connector could become a more viable strategy.

Reconstruct Route 202 near Goodall Hospital

The existing crest on Route 202 at the “emergency vehicles only” entrance to the Sanford Hospital impacts sight distance for westbound vehicles turning into or exiting the hospital. This is compounded by the lack of a left turn pocket, which means turning traffic must slow or come to a stop in the through travel lane. Reconstruction of the roadway to create a left turn pocket and minor regrading of the vertical profile to improve sight distance and separate turning traffic would address these issues.

MaineDOT has considered improvements at this intersection previously, but they were not implemented due to the high costs associated with regrading the roadway profile. Benefit-cost assessment conducted for this study also did not demonstrate benefits sufficient to justify expected costs, largely because the location has historically had a low rate of crashes and regarding work would be expensive (cost of improvement is estimated at $650,000 or higher, depending on the extent of the vertical profile regarding).

While not justified on a stand-alone basis, some degree of improvement of the intersection is recommended for consideration during the next major overhaul of this section of highway. Widening the roadway to provide a left turn lane (or bypass lane) in the westbound direction would separate turning traffic from through traffic, and should be considered even if major vertical re-profiling is not part of the rehabilitation effort. Widening should occur on the south (hospital) side to the extent possible to limit the need for ledge removal on the north side of the roadway.

Monitor and Improve Route 111/Limerick Road Intersection

Limerick Road intersects Route 111 at a "T intersection", with a stop sign controlling traffic movements from Limerick Road. Long queues were observed on Limerick Road caused by left turning traffic waiting for gaps in cross traffic sufficient to turn left onto Route 111 during the PM peak. Observed queuing is consistent with LOS E/F conditions for the stopped movement (Limerick Road traffic).

Route 111 is posted at 50 mph at this location, so the potential for severe crashes is of some concern. However, only one crash has occurred at the intersection from 2008-2010, resulting in a critical rate factor of 0.24, which is well below the expected rate for roadways of similar classification, urban/rural setting, and traffic volumes.

Given that Limerick Road is not heavily traveled (1,720 AADT in 2010), and has exhibited low crash rates in recent years, improvements are not a high priority at this time. Conditions at the intersection could deteriorate if traffic volumes increase, however. In particular, traffic growth on Route 111 will reduce the frequency of acceptable gaps for traffic attempting to turn left onto the highway.

The CYCCS recommends that MaineDOT monitor this location periodically and consider improvements should traffic conditions worsen or the occurrence of crashes increase. Installation of a traffic signal is not a preferred option due to the high posted speed limit (50 mph) on Route 111 and distance from other signalized intersections. As such, a new traffic signal would interrupt the flow of traffic on Route 111 and could potentially increase crash rates. Instead, other options that could be considered include:

- A rural high speed roundabout
- Alternative intersection designs:
  - Divided highway with a center acceleration lane to accept left turns
  - Restricted Crossing U-turn
  - Continuous Green T-intersection

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Route 109 Corridor Recommendations

Recommendations for the Route 109 intersection with Route 202 were described previously (Recommendation H-11). Other Route 109 Recommendations are described below.

Recommendations for the Route 109 corridor are summarized in Table 3-13 and Figure 3-53.

Table 3-13: Route 109 Corridor Recommendations

Recommendation		Estimated Cost	Benefit/Cost Ratio (BCR) Assessment	Priority
H-13	Expand the Route 109 & Exit 19 Intersection	$710,000	1.6	Medium
H-14	Traffic Signal Upgrade – Route 109 & Exit 19 Intersection	<$50,000	Assumed to be positive	Medium
H-15	Improve Route 109 & Route 9 Intersection	$300,000	4.8	Medium
H-16	Traffic Signal Upgrades –Route 109 in Sanford	$30,000 – $60,000	Assumed to be positive	High

MaineDOT recently completed a program of upgrades to the Route 109 corridor in Wells that rehabilitated the roadway and added paved shoulders (six to eight feet wide), while also improving the intersection of Route 109 at Route 9A. No additional projects are listed in the *Biennial Capital Work Plan (FY 2012-2013)* or *Multimodal Six-Year Transportation Capital Plan (2010-2015)*.

Recommendations presented in the *Recommended Local Jurisdiction Actions* section toward the end of this chapter (page 3-3-90) regarding development of the local street grid would also benefit the Route 109 corridor, particularly in Sanford, as would access management and transit improvements described in other chapters.

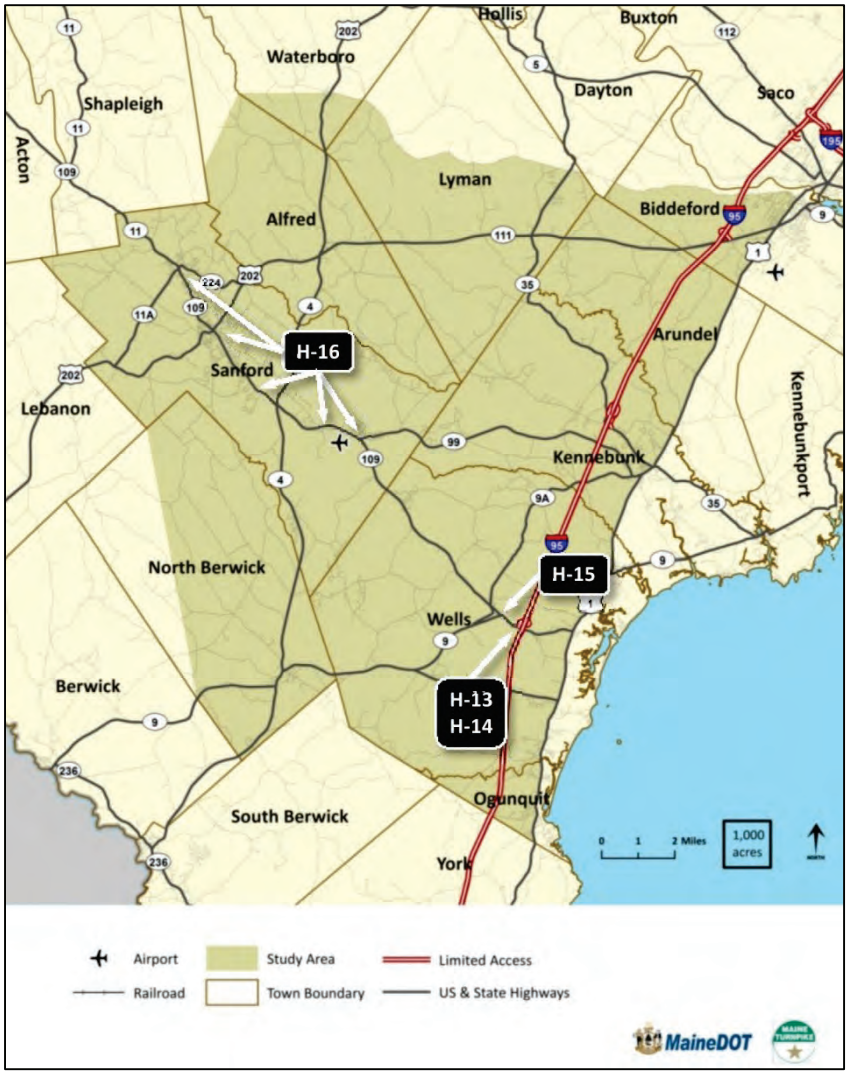
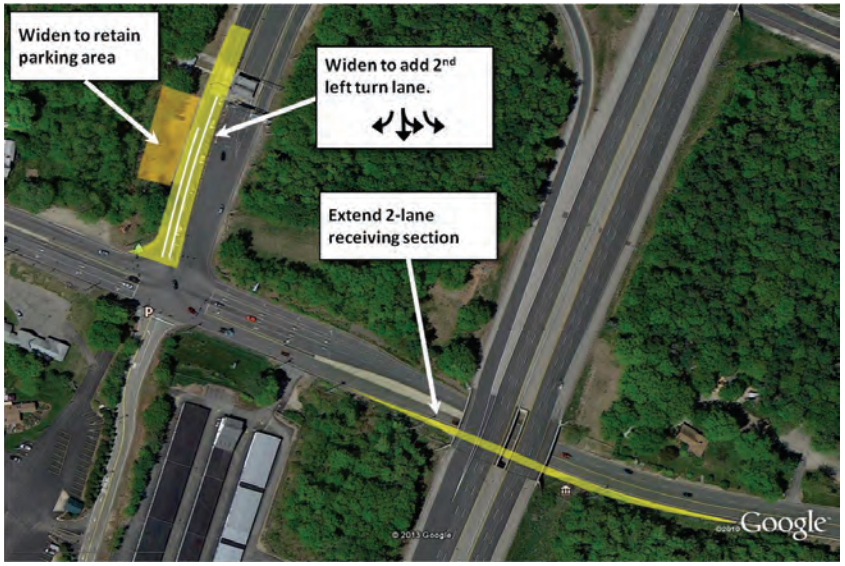


Figure 3-53: Location Map for Route 109 Corridor Recommendations

H-13: Expand the Route 109 & Exit 19 Intersection

Description	Add a second left turn lane from Exit 19 to westbound Route 109. Extend the second westbound lane on Route 109 beyond the Maine Turnpike overpass.
Location	Wells. Route 109 at the Exit 19 interchange/Wells Transportation Center intersection.
Benefits	Reduces congestion and queuing on the exit ramp. Overall intersection LOS improved from LOS D to LOS C. Eliminates projected LOS E and LOS F movements in 2035. Allows some green time to be reallocated to the left turn from Route 109 to the Exit 19 toll booth.
Cost	Approximately $710,000
Benefit/Cost	1.6
Potential Impacts	No adverse impacts other than a minor increase in impervious areas.
Timeframe	Mid-term.
Notes	Consider in conjunction with H-14.

Left turning movements onto and from Exit 19 are problematic at times today, and are expected to degrade to LOS F during peak periods by 2035. The proximity of the toll plaza to the intersection makes the prospect of creating a dual left turn lane from Route 109 to Exit 19 impractical. A second left turn lane for traffic exiting from the Maine Turnpike could be created by widening the roadway by approximately eight to ten feet (Figure 3-54). The adjacent parking area would need to be widened by a corresponding amount as well. Route 109 already has two lanes to receive traffic from the dual left turn lanes, but these should ideally be extended beyond the Maine Turnpike overpass to give traffic ample distance to merge into a single lane. Sufficient room exists to widen Route 109 under the overpass.



Concept Plan Only – Not to Scale

Figure 3-54: Recommended Route 109 & Exit 19 Improvements

H-14: Traffic Signal Upgrade –Route 109 & Exit 19

Description	Near- to Mid-term: Upgrade signal controllers and detection to implement Adaptive Signal Control (ASC). On-going: Regular retiming of traffic signals if ASC is not implemented.
Location	Wells. Route 109 at the Exit 19 interchange/Wells Transportation Center intersection.
Benefits	Maximizes operating efficiency, reduces travel delay/congestion, and responds to changing traffic conditions (including seasonal variability). Some ASC systems can also positively affect intersection safety by extending green time to avoid changing from green to yellow while a vehicle is entering the intersection.
Cost	Less than $50,000, especially if implemented jointly with H-13.
Benefit/Cost	Not assessed; assumed to be positive.
Potential Impacts	None expected.
Timeframe	Mid-term.
Notes	Ideally implemented in conjunction with H-13.

Adaptive Signal Control (ASC), described previously for recommendation H-1 in the Route 111/202 corridor, could also be applied to the Route 109 intersection with Exit 19. In this case, the primary advantage of ASC is that it could respond in real-time to changing traffic conditions throughout the day, as well as to accommodate fluctuation in traffic from day to day and seasonally. As a key access point to coastal areas, Exit 19 experiences considerable variation in demand. The ASC controller could potentially also be programmed to recognize and give some degree of priority to buses entering and departing from the Wells Transportation Center. Because it is not coordinated with other signals, the ASC system would have great flexibility to adjust cycle length and phase timing to adjust to current traffic conditions.

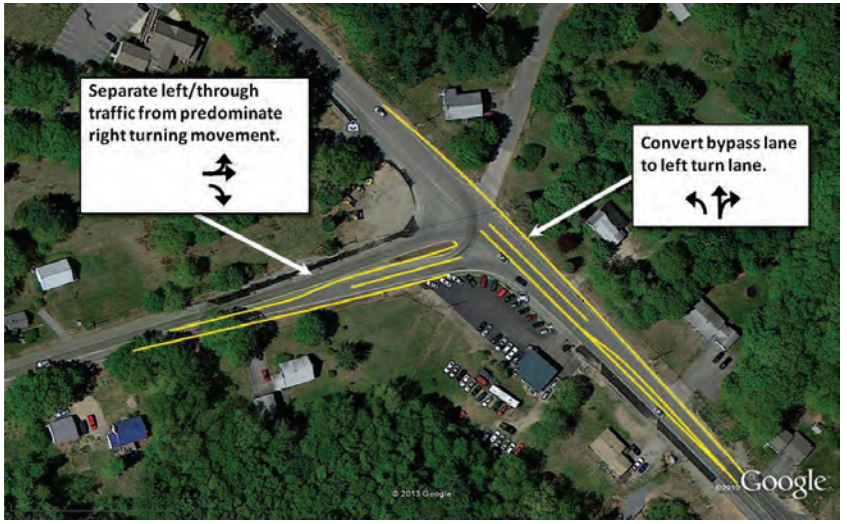
Upgrading to ASC would likely require additional video and loop traffic detection, upgrading traffic signal controllers and software, and developing and testing signal timing parameters.

Short of upgrading to an ASC system, current signal timing plans should be evaluated regularly (every 3 to 5 years is recommended, depending on traffic growth). This process involves field inventory of equipment and road geometry, collecting new traffic counts at all intersections in the coordinated system, analyzing traffic signal timing plans, and modifying signal timing. This process would not need to be conducted with most ASC systems, since they monitor and respond to traffic conditions in real-time.

H-15: Improve Route 109 & Route 9 Intersection

Description	Construct separate left/through and right turn lanes on eastbound Route 9. Convert existing bypass lane to left turn lane on westbound Route 109.
Location	Wells. Route 109 at Route 9 intersection.
Benefits	Improves safety by separating turning traffic from through traffic. Reduces blocking of the predominate eastbound right turn movement by left turning traffic.
Cost	Approximately $300,000.
Benefit/Cost	4.8
Potential Impacts	None expected.
Timeframe	Mid-term.
Notes	—

The intersection of Route 109 and Route 9 is a High Crash Location, with a CRF of 1.04. Eastbound traffic on Route 109 predominately turns right at the intersection with Route 109. While the paved lane width is wide enough to allow right turning vehicles to bypass queued left turning vehicles, the roadway actually consists of a wide, single lane. To better accommodate these turning movements, the CYCCS recommends formalizing separate left/through and right turn lanes. This could be accomplished by reducing the width of the center median island on Route 9 and selectively widening within the existing right-of-way for approximately 400 feet west of the Route 109 intersection (Figure 3-55).



Concept Plan Only – Not to Scale

Figure 3-55: Recommended Route 109 & Exit 19 Improvements

On Route 109, nearly 50 percent of westbound Route 109 traffic turns left onto Route 9 during the AM peak, while nearly 40 percent turns left onto Route 9 during the PM peak. A bypass lane is provided on westbound Route 109, allowing through traffic to pass left turning traffic. Given the very high proportion of left turning traffic, current HCL status, and high volume of traffic on this segment, conversion from the bypass lane configuration on northbound Route 109 to a dedicated left turn lane and separate through lane is recommended. While the bypass lane provides most of the width required, selective additional widening within the right-of-way would be needed to establish appropriate taper and storage length for left turning vehicles.

H-16: Traffic Signal Upgrades –Route 109 in Sanford

Description	Improvements to traffic signal detection, controller and interconnect, to be defined and prioritized through a Systems Engineering process.
Location	Sanford. Signalized intersections on Route 109.
Benefits	Maximizes operating efficiency, reduces travel delay/congestion, and responds to changing traffic conditions (including seasonal variability). Some ASC systems can also positively affect intersection safety by extending green time to avoid changing from green to yellow while a vehicle is entering the intersection.
Cost	Costs depend on system components. Upgrade costs commonly range from $30,000 to $60,000 per intersection, but can vary considerably.
Benefit/Cost	Not assessed; assumed to be positive.
Potential Impacts	None expected.
Timeframe	Near- to Mid-term.
Notes	Completion of a Systems Engineering process recommended to identify, design and procure preferred ITS solutions.

In many cases, implementing Intelligent Transportation Technologies (ITS), such as Adaptive Signal Control (ASC) is a cost effective, low impact way of improving system performance and safety. The FHWA, through its *Everyday Counts* program, is encouraging agencies to adapt innovative technologies – and ASC specifically – to improve system performance and increase the efficiency of the existing transportation network.

Nine intersections on Route 109 in Sanford are controlled by traffic signals. A detailed traffic engineering study will be required to select and design specific improvements that should be implemented.

Systems Engineering is a process defined by the FHWA that provides a structured approach to evaluating, selecting and procuring ITS technologies. A Systems Engineering process is required for ITS projects with federal funding, and is recommended to select and advance improvements to traffic signals on the Route 109 corridor.

Potential ITS improvements for Route 109 intersections in Sanford are summarized in Table 3-14. These options serve as a starting point for more detailed study and consideration of needs following the Systems Engineering process, beginning with development of a *Concept of Operations Plan*. The FHWA's *Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems* (May 2012) provides detailed information on utilizing a Systems Engineering process to implement ITS improvements.

Table 3-14: Route 109 Traffic Signal Upgrade Priorities – Sanford

Intersection	Priority	Options
Rte 11A/ Rte 224	Medium	• Consider protected + permitted phasing • Consider signalizing right turns • Evaluate ASC
Rte 202	High	• Interconnect with Washington St • Evaluate ASC
Washington St	High	• Interconnect with Route 202 • Evaluate ASC
Emery St	Low	• Evaluate ASC
Marden's Plaza (Old Mill Rd)	High	• Relocate signal • Interconnect with Westfield and Center for Shopping • Evaluate ASC
Westview Dr	Medium	• Interconnect with Westfield and Center for Shopping • Evaluate ASC
Center for Shopping	Medium	• Interconnect with Westfield and Center for Shopping • Evaluate ASC
Jagger Mill	Medium	• Evaluate ASC
Wal-Mart	Low	• Evaluate ASC

The Systems Engineering process to develop ITS improvements should consider all signalized intersections in Sanford to ensure compatibility of ITS architectures moving forward. However, system-wide implementation of improvements is unlikely (and may not be warranted); rather, discrete projects that address higher priority locations are expected. The CYCCS has initially identified priorities as follows:

- High priority: Key intersection(s) with identified congestion or safety issues. Initiation of detailed engineering evaluation is recommended in the near-term.
- Medium priority: These are locations with less critical needs, but where ITS enhancements nonetheless could improve traffic conditions.
- Low priority: Intersections that currently operate well, but could potentially realize some modest benefits from ITS improvements. Improvements at these locations are only recommended for consideration after other, higher priority locations have been addressed, unless conditions change markedly from those experienced today.

Other Potential Longer-term Route 109 Corridor Actions

LOS analysis and review of crash records do not indicate a pressing need for improvements to the rural section of Route 109 between Route 99 in Sanford and Route 9A in Wells. This is especially the case given the recent improvements to the corridor, which established paved shoulders and improved sight distance in those areas that were in greatest need of improvement.

In Sanford's downtown core, recommendations regarding long-term planning for the ultimate build out of the corridor are described under *Local Jurisdiction Led Actions* later in this chapter (page 3-90).

Construct passing lanes on Route 109

LOS and crash analyses do not demonstrate a need for passing lanes on Route 109. Despite this, benefit-cost analysis demonstrated cost effectiveness of constructing passing lanes on the corridor (1.4 benefit-cost ratio). Passing lanes may be an effective way to address future crash or travel reliability problems, should they develop. Given current and projected traffic volumes on Route 109, passing lanes approximately 0.75 mile long are recommended. Passing lane placement is complicated by intersections and driveways on the Route 109 corridor, but two segments were identified as being potentially feasible:

- Northbound starting near Route 9A and extending approximately 0.75 mile
- Southbound starting near Route 99 and extending approximately 0.75 mile

The segment between Meetinghouse Road and Bragdon Road is another option for a shorter (0.5 mile) southbound passing lane (benefit-to-cost ratio of <1.0).

Longitudinal Rumble Strips

Given relatively low crash rates along the rural portions of the Route 109 corridor and the recent improvements that established paved shoulders throughout the corridor, neither center line nor shoulder rumble strips are recommended at this time.

Should arterial application of longitudinal rumble strips prove successful elsewhere, such as on the Route 111/202 corridor, and future crash conditions demonstrate a need to reduce head-on or run off the road crashes, application of longitudinal rumble strips could be considered. More heavily populated areas such as Highpine are not well suited for this application, however.

Route 4/Route 202 Corridor Recommendations

The Route 4 corridor is, in many regards, the best performing highway corridor in the CYCCS study area. No traffic operation issues of note were identified, and crash rates are among the lowest in the study area. Access management recommendations described in Chapter 4 are applicable to the corridor, and would help preserve performance and safety over the long term.

The only specific corridor recommendation is to continue to monitor crash occurrences at the Route 4 intersection at School Street/Gavel Road and implement further improvements if necessary (Table 3-15, Figure 3-56).

Route 4 is tied in with the Route 202 corridor to New Hampshire, which will be studied independently. Interim recommendations for Route 202 west of Sanford were presented earlier is this chapter (page 3-27).

Table 3-15: Route 4 Corridor Recommendations

Recommendation		Estimated Cost	Benefit/Cost Ratio (BCR) Assessment	Priority
H-17	Monitor and Improve School Street/Gavel Road Intersection	>$50,000	Assumed to be positive	High

Figure 3-56: Location Map for Route 4 Corridor Recommendations

H-17: Monitor and Improve School Street/Gavel Road Intersection

Benefits	Improve reliability of the current system. Clear vegetation and minor slope flattening to improve sight distance.
Cost	Depends on need for further improvements. Could be substantial if crashes remain a problem.
Benefit/Cost	Not assessed; assumed to be positive.
Potential Impacts	None.
Timeframe	Near-term.
Notes	Continue to monitor crash rates and reevaluate need for more substantial reconstruction.

Sight distance is limited by a crest vertical curve and side embankments at the Route 4 intersection with School Street/Gavel Road. In 2011, MaineDOT installed an automated vehicle detection system that activates to warn vehicles stopped on either School Street or Gavel Road when traffic on Route 4 is approaching the intersection. The system relies on loop detectors on the side streets and additional detection on the mainline to determine when to display the warning.

The intersection is listed on the current HCL list, but the analysis period primarily covers time prior to implementation of the warning system.

Should ongoing monitoring indicate that crashes remain a problem at this location, further improvements may be warranted. Options to be considered include (listed in increasing magnitude of potential costs):

- Expand the coverage of loop detectors on School Street and Gavel Road to ensure that vehicles still activate the system even if they stop in front of, or to the side of, the current loop detectors.
- If left turning crashes from Route 4 occur at higher than expected frequency, a left turn lane on Route 4 could be considered.
- Regrade the side embankments to improve the sight distance triangle for vehicles entering Route 4 from either School Street or Gavel Road. This would necessitate reconfiguring the driveway to the northwest of the intersection.
- If safety or volume warrants are met, a traffic signal could be installed. Sight distance studies would be needed to confirm that the signal would be visible from both approaches of Route 4.
- Undertake major reconstruction of Route 4 to reduce the vertical crest curve.

Other Potential Longer-term Route 4 Corridor Actions

Construct passing lanes on Route 4

As with Route 109, LOS and crash analyses do not demonstrate a need for passing lanes on Route 4. Despite this, benefit-cost analysis demonstrated cost effectiveness of constructing passing lanes on the corridor (2.0 northbound, 1.8 southbound benefit-cost ratio). Passing lanes may be an effective way to address future crash or travel reliability problems, should they develop. Given current and projected traffic volumes on Route 4, passing lanes approximately 0.75 mile long are recommended. Passing lane placement is complicated by intersections, driveways and the signalized intersection at Grammar Road. Two segments were identified as being potentially feasible passing lane locations:

- Northbound starting north of School Street and extending approximately 0.75 mile (benefit-to-cost ratio of 1.0).
- Southbound starting south of Route 111/202 and extending approximately 0.75 mile (benefit-to-cost ratio of 1.0).

Longitudinal Rumble Strips

Given low crash rates along the Route 4 corridor, neither center line nor shoulder rumble strips are recommended at this time. Should arterial application of longitudinal rumble strips prove successful elsewhere, such as on the Route 111/202 corridor, and future crash conditions demonstrate a need to reduce head-on or run off the road crashes, application of longitudinal rumble strips could be considered.

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Other CYCCS Highway Recommendations

This section details highway recommendations that are either regional in nature, or pertain to corridors other than Route 4, Route 109, Route 111 and Route 202 (Table 3-16, Figure 3-57).

Table 3-16: Other Highway Corridor Recommendations

Recommendation		Estimated Cost	Benefit/Cost Ratio (BCR) Assessment	Priority
H-18	Detailed Study of New Rte 99 to Rte 35 Connection	$7.6 – $7.9 million	1.8	Low
H-19	Pave Shoulders on Route 224	$310,000 – $670,000	1.4 – 2.3	High
H-20	Pave Shoulders on Route 35	$780,000	1.4	Low
H-21	Pave Shoulders on Route 99	$2.2 – $5.6 million	0.6 – 1.1	Medium
H-22	Eliminate "Y" Intersections	>$250,000	Assumed to be positive	Low
H-23	Pedestrian and Streetscape Improvements in Villages/Towns	>$50,000	Assumed to be positive	Medium

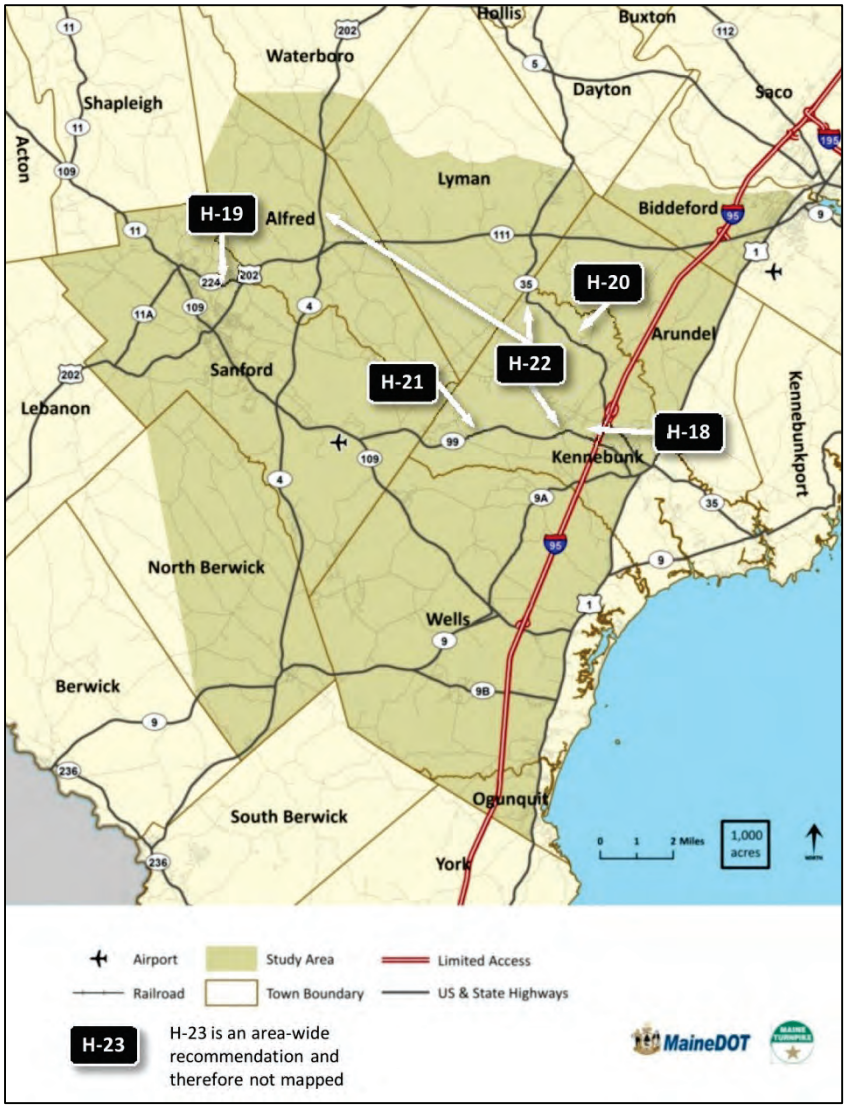


Figure 3-57: Location Map for Highway Other Corridor Recommendations

H-18: Detailed Study of New Connection between Route 99 and Route 35

Benefits	Improves access between South Sanford and the Maine Turnpike. Creates a more direct connection between Rte 99, Rte 35, and Maine Turnpike Exit 25. Reduces traffic through West Kennebunk. Reduces traffic on Route 1 in downtown Kennebunk. Additional river crossing improves local circulation in Kennebunk.
Cost	Construction cost estimated at $7.6M to $7.9M.
Benefit/Cost	1.8
Potential Impacts	Option 1 would require reconfiguration of the access and parking area at Corning. Option 2 passes adjacent to a recreational field. Both options would introduce a new river crossing and pass through undeveloped habitat areas. The improved route would attract an additional 1,100 daily trips from the Sanford area.
Timeframe	Long-term.
Notes	More detailed study and community engagement needed to advance this project.

The CYCCS considered a new corridor connecting Route 99 in Kennebunk with Route 35 in the vicinity of Exit 25 on the Maine Turnpike (Figure 3-58). Two potential alignments were identified:

- Option 1 intersects Route 35 at the current Alewive Rd/Alfred Road intersection and crosses the Mousam River just north of the I-95 bridge. Note that this option is physically constrained due to limited width between the Corning property and Maine Turnpike.
- Option 2 extends Alewive Park Rd to Alfred Road, and continues across the Mousam River to Route 99.

Figure 3-58: New Route Connecting Route 99 and Route 35

The intent of this strategy is to provide a more direct linkage between these two state highways, and in doing so improve the functionality of this route in terms of connecting South Sanford to the Maine Turnpike. Today, this connection is made indirectly by way of Mill Street, which is a local roadway, and Alfred Road, a collector. Both travel through residential areas in the village center of West Kennebunk.

The proposed connector would more directly link Route 99 to Route 35 while avoiding the most populated areas of West Kennebunk. While the Route 111/202 corridor would remain the primary connection to the Maine Turnpike for most trips between the Sanford area and points east, this improved route created by this strategy would be competitive for trips from South Sanford.

Travel forecast modeling comparing projected year-2035 conditions with and without the new connecting roadway estimated that the new road segment would carry 9,200 daily trips. Most of these are trips that would divert from the current Route 99 – Route 35 connecting route – Alfred Road/Mill St (about 4,500) – or from Main Street in downtown Kennebunk (3,600). An estimated 1,100 additionally daily trips are attracted from the Sanford area.

Benefits of the new connection would include:

- Increased utility of the Route 99 corridor as an access route between South Sanford and the Maine Turnpike, increasing accessibility to the area.
- Reduced traffic on Mill Street and Alfred Road in West Kennebunk.
- An additional crossing of the Mousam River in Kennebunk, reducing out of direction travel and decreasing dependence on Main Street.

Potential Impacts include:

- Increased traffic on Route 99.
- Need for a new traffic signal on Alfred Road (Option 2), or modification of an existing signal (Option 1).
- Property acquisition and need to reconfigure the Corning plant parking lot (Option 1).
- Increased maintenance costs over the long term if both the new route and the current Mill Street bridge are retained (alternatively, Mill Street bridge could be closed at the end of its useful lifespan).
- New roadway corridor crossing the Mousam River.
- New roadway would be adjacent to a recreational field west of Alfred Road (Option 2).

Benefit-cost analysis indicates that travel benefits would outweigh construction and recurring maintenance costs (benefit-cost ratio of 1.8). Travel benefits are in part a result of travel time reductions for trips between Sanford and the Maine Turnpike, as well as for trips diverted from Main Street in downtown Kennebunk. However, the majority of projected travel benefits are associated with longer-term changes in travel patterns; that is, people making different trip choices in the future.

Benefits of the project would be shared by travelers in both Sanford and Kennebunk, though potential impacts would largely occur in Kennebunk. Further public discussion of these trade-offs and detailed investigation of environmental, design and traffic conditions would be necessary before the project could advance. A logical trigger for consideration of the project may be the long term viability of the existing Mill Street bridge. Eventually, this bridge will require costly maintenance or reconstruction. The existing bridge is in fair condition, with an expected rehabilitation cost of approximately $1.5 million. Prior to this occurring, a decision should be made as to whether to instead construct a new route as proposed by this strategy.

H-19: Pave Shoulders on Route 224

Benefits	Improved accommodation of traffic. Improved safety. Shoulders provide space for bicycle use.
Cost	$310,000 (11 ft lanes + 4 ft shoulders) $670,000 (12 ft lanes + 6 ft shoulders)
Benefit/Cost	2.3 (11 ft lanes + 4 ft shoulders) 1.4 (12 ft lanes + 6 ft shoulders)
Potential Impacts	None - work to be conducted in right-of-way.
Timeframe	Near-term
Notes	Pedestrian aspects may be eligible for Safe Routes to Schools funding programs.

Route 224 directly links Routes 11/109 in Springvale with Route 202 east of downtown Sanford, allowing trips to avoid Route 109 and Route 202 in downtown Sanford. The most direct route between Springvale and the Route 111/202 corridor, Route 224 is heavily traveled, carrying between 6,600 to 8,800 vehicles daily. South of River Street, the corridor typically consists of 11-foot lanes and unpaved shoulders. North of River Street, a sidewalk and paved shoulder are provided on the west side of the street only. Carl Lamb Elementary School is located at the intersection with River Street.

The current MaineDOT Customer Service Level (CSL) for condition, which factors in pavement condition, ride quality, and roadway strength, is "D" roughly from River Street to Route 202 and "B" elsewhere (except at the intersection with Route 109 in Springvale, where a short segment is rated "F"). The segment between Route 202 and River Street is included in MaineDOT's *Biennial Capital Work Plan (FY 2012-2013)* as a full depth reclamation (WIN# 019325.00). MaineDOT's shoulder surface policy (updated 2003) recommends paving gravel shoulders for preservation projects when summer ADT exceeds 4000, as is the case with Route 224.

Given high traffic volumes and the importance of the corridor in providing an alternative route to Route 202 in downtown Sanford, improving the roadway to add paved shoulders is recommended. While 12-foot lanes with 6-foot shoulders is preferred given the high traffic volumes served, maintaining the current 11-foot lanes and adding 4-foot paved shoulders may prove more feasible given field conditions, and would still considerably improve current conditions. Extending the shoulder widening to Railroad Avenue (east side of roadway) is recommended.

Expected costs to widen the highway to provide 12-foot lanes with 6-foot shoulders would be approximately $670,000, though the condition of the existing aggregate shoulder could drive costs higher. This would be in addition to costs to rehabilitate the existing roadway. Alternatively, less intensive widening (and lower cost) would be required to instead retain 11-foot lanes and only add 4-foot paved shoulders.

Pedestrian improvements are also recommended for Route 224, extending north from the intersection with River Street to provide better access to the Carl Lamb Elementary School. These are discussed under H-23. While pedestrian improvements could be constructed separately from the recommended shoulder paving, constructing them concurrently would reduce disruption due to construction and potentially result in some cost savings.

H-20: Pave Shoulders on Route 35

Benefits	Improved accommodation of traffic. Improved safety. Shoulders provide space for bicycle use.
Cost	$780,000
Benefit/Cost	1.4
Potential Impacts	None
Timeframe	Mid-term to Longer-term
Notes	Missing gap. Corridor has segment HCL.

The cross section of Route 35 has previously been widened to include paved shoulders north of Bittersweet Drive, and more recently south of Kimball Lane. The southern section includes additional pavement width to accommodate pedestrians since the corridor provides access to the Eastern Trail in Kennebunk.

The segment of Route 35 between Kimball Lane and Bittersweet Drive retains narrow travel lanes (10 to 11 feet) and does not have paved shoulders. An HCL segment is located along this portion of the highway, with a CRF of 1.18. With a current MaineDOT CSL condition rating of "A", pavement maintenance is unlikely for some time. When it is needed, widening the cross section to establish 11-foot lanes and 4-foot shoulders, consistent with the rest of the corridor, is recommended.

The estimated cost to pave shoulders on this segment of Route 35 is $780,000. The benefit-cost ratio for this project is 1.4, and it is consistent with MaineDOT's shoulder surface policy in that it completes gaps in a highway segment where shoulders exist elsewhere. The corridor also provides bicycle access to the Eastern Trail and is expected to cross the 4,000 summer ADT threshold in coming years.

H-21: Pave Shoulders on Route 99

Benefits	Improved accommodation of traffic. Improved safety. Shoulders provide space for bicycle use.
Cost	$2.22 million (11 ft lanes + 4 ft shoulders) $5.60 million (12 ft lanes + 6 ft shoulders)
Benefit/Cost	1.1 (11 ft lanes + 4 ft shoulders) 0.6 (12 ft lanes + 6 ft shoulders)
Potential Impacts	None
Timeframe	Mid-term
Notes	Pedestrian aspects may be eligible for Safe Routes to Schools funding programs.

North of its crossing over the Maine Turnpike, Route 99 generally has 11-foot lanes with gravel aggregate shoulders that vary in width. South toward Route 1, a curbed pedestrian sidewalk is provided on the west side of the road, while a gravel aggregate shoulder is maintained on the east side. While crash rates on Route 99 are low, 39 percent of crashes are classified as "run off the road", the highest share of such crashes in the CYCCS study area. The current MaineDOT CSL condition rating is predominately "D" and "F", with a few sections rated "C".

Adding 4-foot-wide paved shoulders to Route 99 is recommended. South of the Maine Turnpike overcrossing, paved shoulders are needed on the east side of the roadway only. The estimated cost to pave 4-foot shoulders for the entire length of Route 99 is $2.22 million, with a resulting benefit-cost ratio of 1.1. Portions of the corridor exceed MaineDOT's 4,000 summer ADT threshold for paving shoulders during rehabilitation projects, and the entire corridor is expected to exceed 4,000 ADT in the future. Further widening to provide 12-foot lanes with 6-foot shoulders was also considered, but scored poorly in the benefit-cost assessment due to the added cost of further widening the roadway.

H-22: Eliminate "Y" Intersections

Benefits	Improved accommodation of traffic. Improved safety. Shoulders provide space for bicycle use.
Cost	High.
Benefit/Cost	Not assessed; assumed to be positive.
Potential Impacts	None. Work to be conducted in right-of-way.
Timeframe	Mid-term to long-term.
Notes	Pedestrian aspects may be eligible for Safe Routes to Schools funding programs.

Several intersections in the study area are configured as "Y" intersections, which allow vehicles to turn at high speed from either direction of travel. As traffic volumes are not very low, this configuration presents safety challenges because of the speed at which turning traffic negotiates the intersection and the conflict points that occur at the beginning and again at the end of the turn (where the two branches of the Y meet). Three intersections were noted by the study on state highways:

- Route 35 at Walker/Cole Road. Route 35 is an HCL at this location, with a CRF of 1.18. The intersection is also problematic in that the main road, Route 35, sharply curves at the intersection and sight distance is limited by vegetation.
- Route 4 at Gore Road. Gore Road is an HCL with a CRF of 1.56 at this location.
- Route 99 at Whitten Road/Mill St, Kennenbunk. This intersection is part of the current route linking Route 99 to Route 35 via Mill Street. Route 99 curves sharply through the intersection.

These locations should be reconfigured to eliminate the "Y" turn. This would typically involve closing one leg of the "Y" while realigning the second leg to meet the main road as a "T" intersection. Where turning traffic volumes are high, a turn pocket or bypass lane on the main highway may be warranted. Removal of "Y" intersections has been shown to have a crash reduction factor of up to 85 percent.

H-23: Pedestrian and Streetscape Improvements in Villages/Towns

Benefits	Improved accommodation of traffic. Improved safety. Shoulders provide space for bicycle use.
Cost	Moderate to High, depending on improvements.
Benefit/Cost	Not assessed. Creating walkable communities is considered a best practice.
Potential Impacts	None. Work typically conducted in right-of-way.
Timeframe	Near-term to mid-term.
Notes	Some pedestrian improvements may be eligible for Safe Routes to Schools funding programs.

While the CYCCS study focused primarily on regional-scale mobility needs, creating safe and comfortable conditions for pedestrians at the local level is an important aspect of a highly functioning transportation system. Pedestrian networks provide access to businesses, schools, parks and residences. Many transit riders depend on the ability to walk to or from the bus stop. Within towns, an established pedestrian network that allows people to safely travel between nearby origins and destinations can even help reduce short distance vehicular trips.

Current roadway design standards, as well as federal and MaineDOT policies, recommended that when a roadway is improved paved shoulders and sidewalks are considered where warranted. Particularly in rural areas, as roads are brought up to modern day standards, paved shoulders are built to improve vehicular safety, drainage, roadbed stability, and bicycle and pedestrian safety. These shoulders provide space for bicyclists and the occasional walker. A number of the recommendations of the CYCCS involve expanding the prevalence of paved shoulders on the study area's major highways.

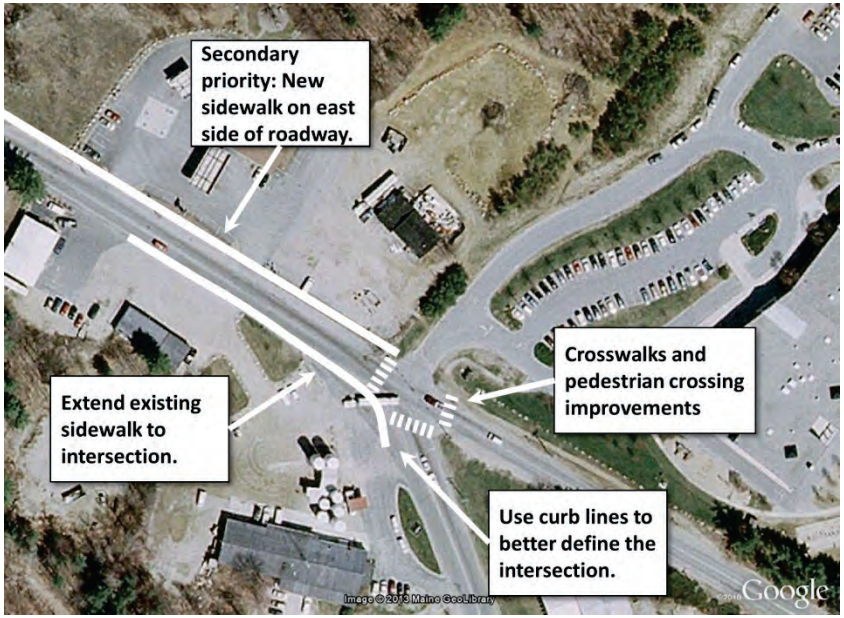
In villages, downtowns, business areas and other higher density locations, sidewalks and walking paths should be considered where warranted as part of roadway reconstruction projects or developed as stand-alone projects.[7] Crossing busy highways is often a challenge in developed areas as well. Well-marked crosswalks, curb extensions, raised center medians, and improved street lighting are features that can be considered to improve the safety of crossing locations.

Towns should evaluate pedestrian and bicycle deficiencies in village areas and work towards improvements in addition to the specific recommendations identified in the CYCCS. There are federally funded sources for standalone bicycle and pedestrian improvements in village areas that communities can apply to the MaineDOT for assistance.

[7] MaineDOT generally shares the cost of sidewalk construction with municipalities. Further discussion of MaineDOT's cost sharing policy is provided in the last section of this chapter.

Some of the areas that could particularly benefit from pedestrian improvements are discussed below.

- The village area of Alfred, including Route 4/202 (Main Street), Kennebunk Road, and Saco Road, lacks pedestrian accommodations. Sidewalks or walking paths appropriate given the village character should be established along these roadways; particularly Main Street. Improvements to facilitate pedestrian crossings of Main Street are needed as well, including crosswalks and street lighting. These should be considered at the intersections with Kennebunk Road, Saco Road and Depot Road.
- In North Berwick, crosswalks and associated crossing improvements should be considered along Route 4 (Elm Street) to provide access to the sidewalk on the southeast side of the highway. Over the longer term, the various disconnected sidewalk segments on the north side of the corridor should be connected to complete a continuous walking route. Similarly, continuous sidewalk should over time be established on both sides of Route 9 (Wells Street) in the developed village area.
- Sidewalks are well established along much of Route 109 (Maine Street) in downtown Sanford, though some segments still need upgrading to provide an elevated curb, wider walking surfaces, ADA accessible accommodation, and attractive streetscaping. Opportunities also exist to shorten pedestrian crossing distances by constructing pedestrian curb extensions at crosswalk locations where on-street parking is provided. In South Sanford, the development pattern is more suburban in nature, but pedestrian pathways and crosswalks at major crossroads should still be provided. Route 109 currently lacks pedestrian accommodation for much of the corridor south of Farview Drive (near the Sanford Plaza Shopping Center), but well worn footpaths along the side of the road demonstrate the need for pedestrian accommodations anywhere there is urban development.
- Route 202 is an important urban corridor where sidewalks are in poor condition. Upgrades to this segment were recommended and discussed earlier as part of H-9.
- Walk access to the Carl J. Lamb Elementary School, located at the Route 224 intersection with River Street, is hampered by a lack of walkway on the west side of the road, the geometric alignment of the intersection, and a lack of crosswalks. A pedestrian improvement program that includes the elements listed below is recommended (Figure 3-59). The resulting project could be a candidate for Safe Routes to Schools funding.
  - Add crosswalks and pedestrian signal heads at the signalized intersection of Route 224 at River Street. Ensure that crosswalks are adequately lit and add additional streetlights if necessary.
  - Extend the sidewalk on the west side of Route 224 to the River Street intersection. Reconfigure the Route 224 intersection at River Street to define the curb line (northwest side), reduce the skew angle of the intersection to slow turning traffic, and reduce the paved width of the roadway through the intersection.
  - Consider establishing a sidewalk on the east side of Route 224 north of River Street as well.



Concept Plan Only – Not to Scale

Figure 3-59: Recommended Pedestrian Improvement Components near Carl J. Lamb Elementary School

Other Potential Longer-term Actions

Paved Shoulder Improvements on Route 11A

Route 11A (Oak Street) connects Route 202 west of downtown Sanford with Routes 11/109 in Springvale, allowing traffic traveling north to bypass downtown Sanford. Average daily traffic on Route 11A is about 2,500 vehicles; it is not as heavily used as the Route 224 connection described earlier. The current paved cross section is relatively narrow, with travel lanes that vary between 10 and 11 feet in width and no paved shoulders. As the highway enters Springvale near Whipple Street, the cross section widens and incorporates sidewalks. The highway has a high rate of crashes, though most of these are intersection related.

The current MaineDOT Customer Service Level (CSL) for condition ranges from "B" to "D". MaineDOT shoulder policy specifies maintaining unpaved shoulders on low volume segments (under 4,000 summer ADT), rather than upgrading to paved shoulders. Benefit-cost assessment yielded a ratio of 0.8, further supporting maintaining the current configuration.

Given the highway's role in complementing Route 202 and relieving traffic at the Route 202/Route 109 intersection, and considering that benefit-cost assessment is highly sensitive to recent crash history, paving shoulders on Route 11A could become warranted in the future. The cost of widening the paved roadway to provide consistent 11-foot travel lanes and 4-foot paved shoulders (4-ft minimum is recommended for bicycling) is estimated to be approximately $750,000 in added cost, if performed as part of a future scheduled rehabilitation of the highway.

Recommended Local Jurisdiction Led Actions

Some potential actions that would help address long-term corridor needs would be the responsibility of local jurisdictions.

Develop Local Street Grid in Biddeford and Arundel

Develop additional local roadways connecting Route 111 to Route 1 to improve local circulation and access, and reduce traffic at key highway intersections (Figure 3-60). These could be developed concurrent with future development, as local roads projects, or some combination of the two. Potential routes would need to be selected and determined by jurisdictions, but could include:

1. Connect West Cole Road to Cole Road (requires grade separated crossing of railroad track). This connection has the potential to greatly improve local circulation and reduce traffic on the heavily traveled portion of Route 111 between Exit 32/Precourt Street and Route 1.
2. Realign Edwards Road to avoid St Demetrios Cemetery and extend to connect to Route 1 or Precourt Street. This would have similar benefits to the Cole Road extension described above.
3. Extend Mariner Way (Biddeford Crossing) to Old Alfred Road to provide additional access to the Shopping centers along Route 111.
4. Connect Old Alfred Road/Mountain Road to Route 1. This would relieve traffic that currently travels circuitously along Route 111 to Precourt Street and on to Route 1.
5. Connect Route 111 with South Street to bypass Route 1 and enhance local connectivity and circulation.

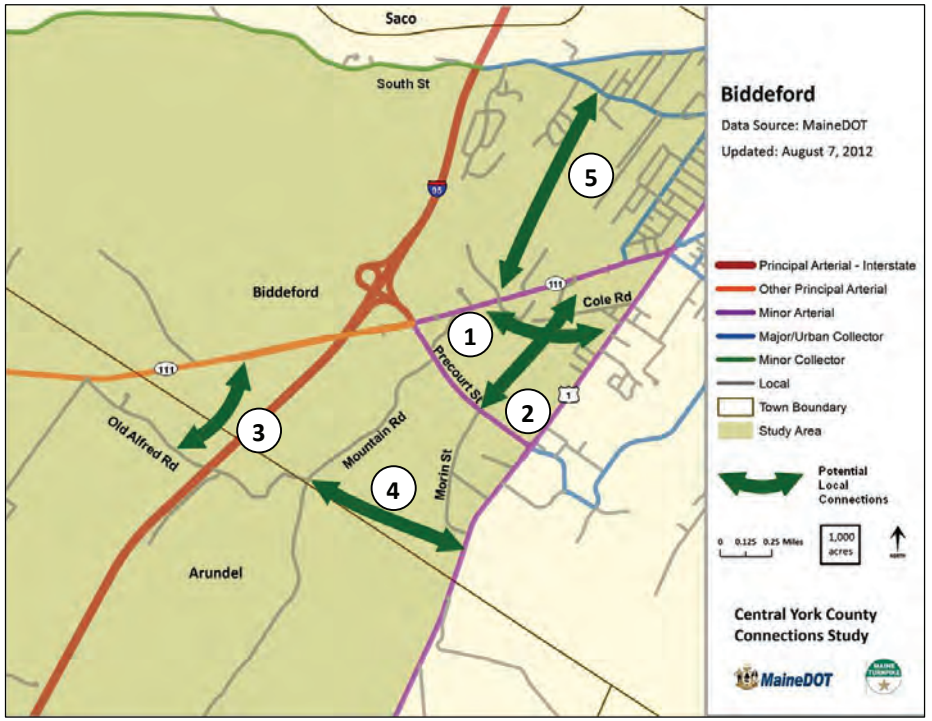


Figure 3-60: Potential New Local Connecting Roadways in Biddeford and Arundel

Develop Local Street Grid in Sanford

The capacity of Route 109 through downtown is constrained by existing development. Therefore, further development of the local street grid is recommended needed to provide additional route choices for local circulation and traffic relief for the Route 109 corridor. Corridor development would be a town-led action; the links shown (Figure 3-61) are suggestions for further consideration by the town. They include:

1. New road linking Jagger Mill Rd to Route 109 at Old Mill Road, possibly extending to School Street.
2. New road linking Route 109/Old Mill Rd to School Street and possibly High Street (access to Route 4).
3. Other new streets parallel to Route 109.
4. Emphasize River Street for access to Route 202 eastbound and eastern areas of the town.

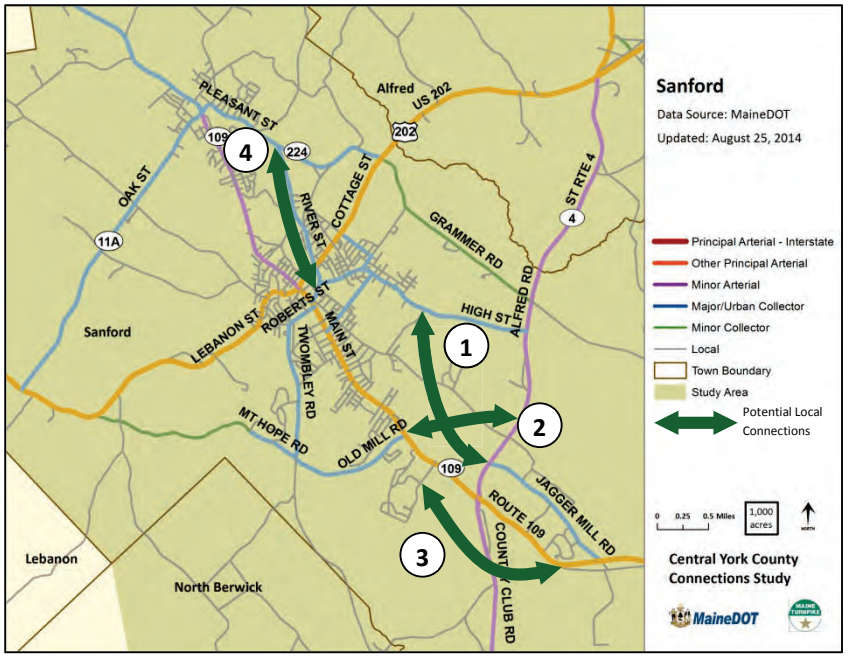


Figure 3-61: Potential New Local Connecting Roadways in Sanford

Pave Shoulder on Old Mill Road

Similar to Route 11A and Route 224, this corridor provides a supplemental route for trips between Route 202 (west of Sanford) and the 109 corridor in South Sanford. The demand for this movement is fairly low, which is reflected in the existing traffic volumes (1,800 to 3,700 vehicles daily, depending on location). Mt Hope Road has a High Crash Location segment east of its intersection with Route 202. These roads were recently repaved. Nonetheless, expanding the existing cross section (generally 20 feet today) to provide 11 foot minimum lanes with 4-foot shoulders (30 foot cross section) is recommended over the longer-term. Additionally, the intersections of these roads with Twombley Road should be realigned to create a four-way intersection.

Plan for Build-out of Route 109 in Sanford

The cross section of Route 109 varies as it travels through Sanford. In downtown, there's little opportunity to consider different cross sections because existing development limits the available right-of-way. Further to the south, however, the highway cross section is less constrained. The Town should establish a plan that defines the ultimate cross section elements for the entire corridor, so that the highway can be improved as developments occur.

1. Downtown Sanford to Old Mill Road (#1 in Figure 3-62)

North of Old Mill Road, existing development essentially constrains the highway to a 2-lane cross section, with turn lanes provided at some intersections and on-street parking allowed in most locations. Sufficient space exists to add additional turn lanes as needed, either at intersections or major driveway entrances. Where left turn lanes are not needed, raised medians could be established at crosswalk locations to provide pedestrians with safe refuge when crossing the highway. Candidate locations include Route 109 intersections with Park St/Jackson St, Avon St/Berwick Rd, Schuler St, and other intersection locations where new crosswalks are merited.

2. Old Mill Road to Route 4 (#2 in Figure 3-62)

Two northbound lanes and one southbound lane are provided from approximately Old Mill Road to Westview Drive, in addition to a left turn lane. Ultimately, a second southbound lane could be constructed to create a continuous 5-lane section between Old Mill Road and Route 4. The existing traffic signal at Marden's may be relocated to the Old Mill Road intersection, and the performance of this intersection over time would determine the need for an additional southbound lane. Should congestion in the future here

warrant a second southbound lane at the Old Mill Road intersection, it should continue to Westview Drive.

The existing cross section between Westview Drive and Route 4 is four lanes, with left turn lanes provided north of the Sanford Center for Shopping. Right-of-way should be preserved to accommodate a left turn lane (5-lane cross section) between the Center for Shopping and Route 4 as well, which could be constructed when needed as adjacent parcels develop. Inclusion of sidewalks and shoulders (or bike lane) is recommended as these segments are improved.

3. Route 4 to Route 99 (#3 in Figure 3-62)

A 3-lane section (with center turn lane) should be developed over time between Route 4 and Airport Road to reduce conflicts with turning vehicles on this segment, and right-of-way preserved to extend to the current 3-lane section near Route 99 should future development warrant it. Roadway widening can be completed concurrent with future development projects, with missing segments ultimately constructed with developer participation to complete a continuous 3-lane segment. Inclusion of sidewalks and shoulders (or bike lanes) is recommended as these segments are improved.

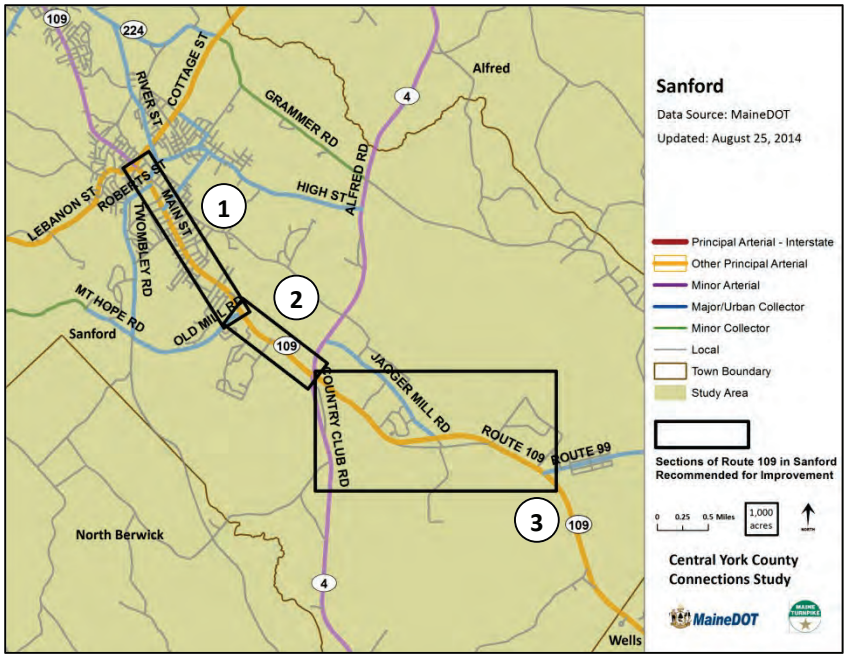


Figure 3-62: Sections of Route 109 in Sanford Recommended for Planned Build-Out

Funding

Improvements to State Highways in Maine are mostly funded by FHWA and MaineDOT, generally at 80 perecent and 20 percent, respectively. For FY2014-FY2015, approximately $700 million, or 61 percent of the MaineDOT budget, is allocated for highway and bridge capital projects and improvements. In addition, modest funding is allocated for the Local Road Assistance Program (LRAP), which aids municipalities in capital improvements to and maintenance of key roads not included in the state highway system. For FY 2014-2015, approximately $43 million, or 4 percent of the overall MaineDOT budget, is allocated for the LRAP. Such funds could be used to undertake smaller scale spot improvements to town roads and intersections in the CYCCS study that are facing capacity constraints.

Generally, State Highways in Maine are maintained by the MaineDOT, with the exception of those located within "compact areas" of "Urban Compact" municipalities, which are maintained by the town. Urban compact municipalities in the CYCC study area include Biddeford, Kennebunk, Sanford, Waterboro, Wells, and Waterboro. Generally, town maintenance responsibilities in Urban Compact municipalities apply to "Compact" or "Built-up sections" of State Highways where buildings are nearer than 200 feet apart for distances of ¼ a mile, unless otherwise defined.[8]

The MaineDOT also provides funding for non-highway projects. The Multimodal Capital Improvements Program could be used to fund many of the projects discussed throughout this chapter and Chapter 5: Transit. The Multimodal Capital Improvements Program, which is budgeted for $99 million of FY 2014-2015 (and receives the majority of its funds from federal sources), could be used to fund critical rail, public transit, and bicycle/pedestrian trail projects in the CYCC study area.

MaineDOT has a systematic approach to prioritizing highway corridors and quantifying their customer service levels. Corridors are ranked according to factors like economic importance, functional classification, truck use, and traffic volume, and assigned a Highway Corridor Priority level (or HCP) of HCP 1 through HCP 6. HCP 1 roads receive greater precedence. Approximately one-third of the HCP ranked roads in York County are designated HCP 1. HCP 1 roads in the study area include Route 4, Route 109, Route 111, and Route 202.

More details on MaineDOT funding can be found in the MaineDOT Work Plan, which is available online at: http://maine.gov/mdot/projects/workplan/docs/WorkPlan2014-2015-2016Final.pdf

Local Cost Sharing Policy

MaineDOT has a local cost-sharing policy whose purpose is to create a consistent and fair policy for sharing the cost of major investments to the state highway system in urban and village areas in all municipalities. According to the policy, MaineDOT will pay for 100 percent of the highway portion of the project as determined by MaineDOT. New sidewalks or replacement/rehabilitation of existing ones requires a 20 percent contribution from municipalities. Municipalities are responsible for year-round maintenance of new and replaced/rehabilitated pedestrian facilities. Sidewalks and multi-use shoulders located on bridges in compact and qualifying

[8] "Urban Compact" sections of State Highway are defined specifically at http://www.maine.gov/mdot/csd/mts/stateurbancompact.htm.

pedestrian areas will be 100 percent funded by MaineDOT using state and/or federal funds.

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