Roadway Improvements Concepts

There were two previous concepts provided in the Conceptual Design Report dated December 2018, which can be found in **Appendix G**, along with their analysis and respective figures and cross-sections.

Concept 1 looked into the following improvements:

- Widening Route 20 to provide two lanes in each direction;
- Left-turn pockets at specific sections of Route 20 to provide access to businesses and existing residential developments;
- A 4-foot painted median where no left turn pocket was required;
- Converting Walnut Street South to a right-in/right-out street and diverting left-turns to South Street;
- Reconfiguring the Route 20 intersections with Purinton Street and Clews Street to be traditional T-Intersections (Purinton and Clews Streets intersecting Route 20 at a 90-degree angle);
- Adding turning lanes at existing signalized intersections to accommodate the additional turning volume using those intersections;
- Signal timing and offset updates at other signalized intersections within the study corridor; and
- A two-way, shared-use path on the south side of Route 20 and a five-foot shoulder and sidewalk on the north side.

Concept 2 looked into the following improvements:

- Widening Route 20 to provide two lanes in each direction;
- A Two-Way-Left-Turn-Lane (TWLTL) at specific sections of Route 20 to provide access to businesses and existing residential developments;
- A 4-foot painted median where no TWLTL was required;
- Removing the Walnut Street South connection to Route 20 and moving it to Valente Drive, south of the Valente Drive intersection with Route 20;
- Reconfiguring the Route 20 intersections with Purinton Street and Clews Street to be traditional T-Intersections (Purinton and Clews Streets intersecting Route 20 at a 90-degree angle);
- Adding turning lanes at existing signalized intersections to accommodate the additional turning volume using those intersections;
- Signal timing and offset updates at other signalized intersections within the study corridor; and
- A two-way, shared-use path on both sides of Route 20.

Out of these two concepts, a combined ***Preferred Concept*** was developed, which encompasses pieces from both Concept 1 and Concept 2. What follows is a more detailed description of the Preferred Concept:

- Widening Route 20 to provide two lanes in each direction;
- Left-turn pockets and a TWLTL lane to provide access to businesses and existing residential developments. Location of either depends on access needs and available space to build either improvement;
- A four-foot painted median where no left turn pocket or TWLTL was required. In areas where the Right of Way is constrained, the four-foot painted median becomes a typical double yellow centerline;
- Converting Walnut Street South to a right-in/right-out street and diverting left-turns to South Street;
- Creating a connection between Walnut Street South and Valente Street, thus directing Walnut Street drivers looking to access Route 20 westbound to the proposed signal at Route 20/ Old Shrewsbury Village/Valente Drive intersection;
- Reconfiguring the Route 20 intersections with Purinton Street and Clews Street to be traditional T-Intersections (Purinton and Clews Streets intersecting Route 20 at a 90-degree angle);
- Prohibiting left turns in and out of Purinton Street and diverting them to Grafton Street;
- Adding turning lanes at existing signalized intersections to accommodate the additional turning volume using those intersections;
- Signal timing and offset updates at other signalized intersections within the study corridor;
- A two-way, varying width (eight to ten feet), shared-use path on the south side of Route 20 and a five-foot shoulder and sidewalk on the north side; and
- Providing an exclusive pedestrian phase for shared-use path users to cross Route 20 and the side streets safely and connect to all destinations on either side of Route 20.

The timing changes at the signalized intersections will include updates to signal clearance times to meet standards and address any safety issues with short clearance intervals. Widening Route 20 left-turn pockets and the TWLTL is expected to reduce the possibility of rear-end accidents, especially as drivers slow down to a stop to make a left turn into Purinton Street, Clews Street, Stoney Hill Road (both West and East), South Street, Dunkin Donuts (866 Hartford Turnpike), Avalon Way, and any of the other unsignalized side streets and driveways along the study corridor. Finally, when it comes to speeds along the corridor, speeding countermeasures will be looked in detail during the design phase of the corridor and can include, but are not limited to, speed feedback, advanced curve, intersection signs, optical pavement marking bars, and speed management campaigns.

Conceptual Design Challenges

It should be noted that the widening of the entire Route 20 corridor within the project limits, the widening of specific signalized approaches to add turn lanes, and the addition of sidewalk and a shared-use path will widen the overall cross-section of Route 20 to a point that there will be Right of Way impacts along the whole length of the project corridor. Furthermore, there are portions within the Route 20 study corridor where there is no available Right of Way or actual physical room to be used to provide some of the accommodations proposed in the Preferred Concept, thus requiring modifications to the Preferred Concept cross-sections. The section that follows discusses the design decisions made at key locations and how the preferred cross-sections changed due to constraints.

ROUTE 140 INTERCHANGE VICINITY

There are several factors in the vicinity of the Route 20/Route 140 interchange that require the use of a non-standard cross-section and design in the Preferred Concept. The first factor is the roadway width under the bridge carrying Route 140 over Route 20. The current width appears to be narrow, as it provides three travel lanes and a wide shoulder between the existing bridge piers. This width may not allow a four-foot median or four-foot shoulders to be provided without impact to the bridge abutments. Second, the safety issues caused by the proximity between the Route 20/Grafton Street intersection and the interchange ramps that connect Route 20 and Route 140 require the use of auxiliary lanes in the new design for safer merging activity. However, installing auxiliary lanes and providing two travel lanes in each direction of Route 20 would impact the Route 140 bridge piers Lastly, truck access to the adjacent businesses requires turning lanes and wide curb-cuts for the driveways.

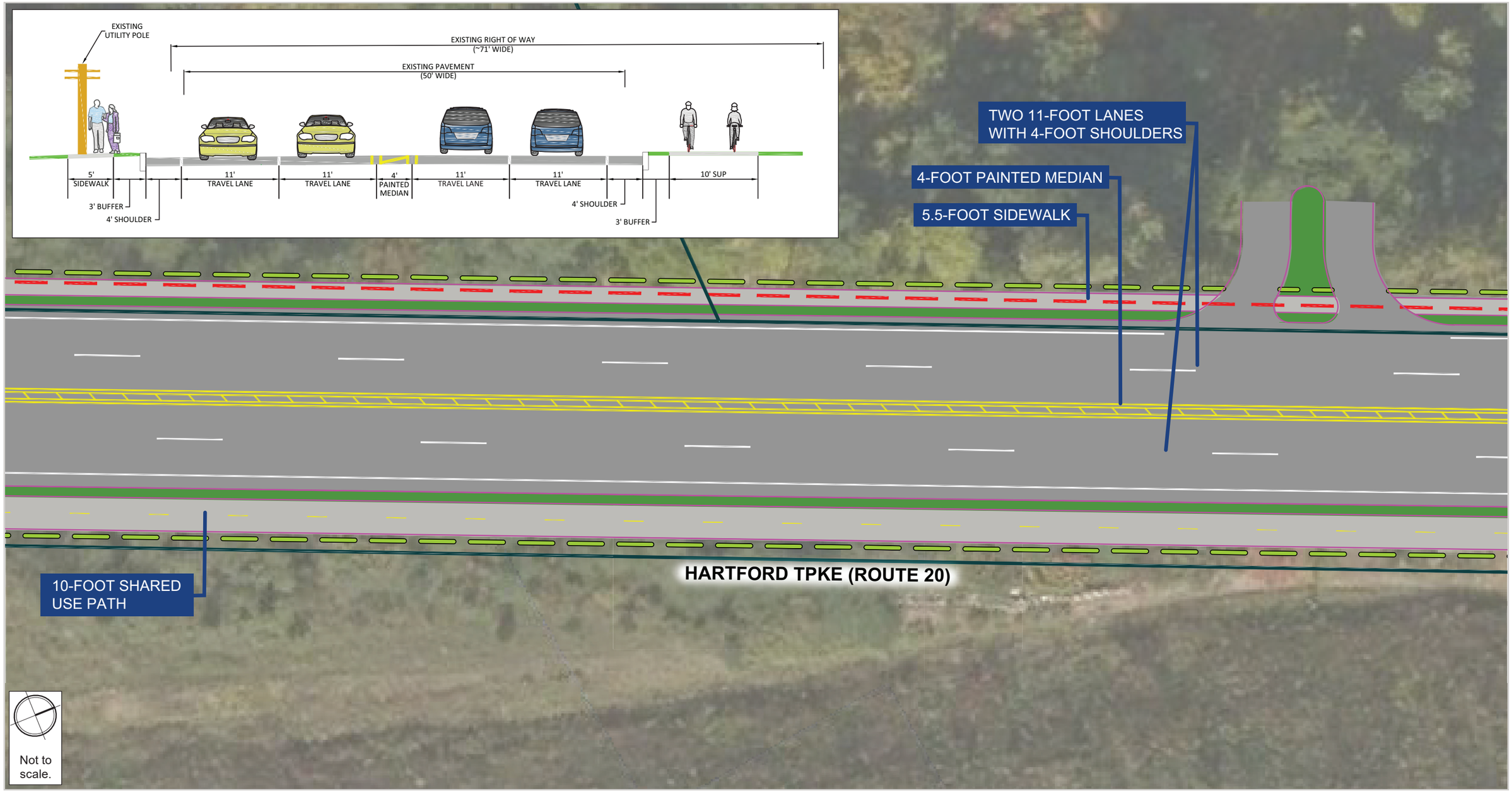
Part of the solution pursued in the Preferred Concept is to divert the shared-use path that runs along the south side of Route 20 onto the parallel corridor available by using Purinton Street, Grafton Street, and Clews Street. A detailed design for this parallel route was not completed as part of the Master Plan, only an initial feasibility assessment. Purinton Street and Clews Street are both generally residential streets that could be converted into "shared streets" where bicycles and pedestrians could operate in the existing travel lanes without separate accommodation if countermeasures are put in place to manage vehicle speeds. Limiting vehicle access from Route 20 to both streets may help create a safer "shared street" environment that could also reduce the volume of cut-through traffic. Bicycle accommodations such as bike lanes would need to be added to Grafton Street and a new shared-use path crossing of Route 140 at Clews Street would need to be installed. Additional planning and design to accommodate feedback from the Town and area residents will be needed.

The Preferred Concept shows sidewalks going between the existing bridge piers and sloped abutment, meaning that some structural work would still be required to build the sidewalks and avoid relocating the bridge piers. However, fitting four, 11-foot lanes with a four-foot median and four-foot shoulders on either side of Route 20, while also providing auxiliary lanes for the Route 140 off-ramps to Route 20 cannot be achieved without impacting the Route 140 bridge piers. For that reason, it was decided to provide four 11-foot lanes under the bridge, separated by a standard double yellow centerline and provided with a minimum one-foot shoulder. This proposed cross-section needs further study to ensure that it won't require relocating the Route 140 bridge piers.

LAKE STREET TO THE WORCESTER CITY LINE

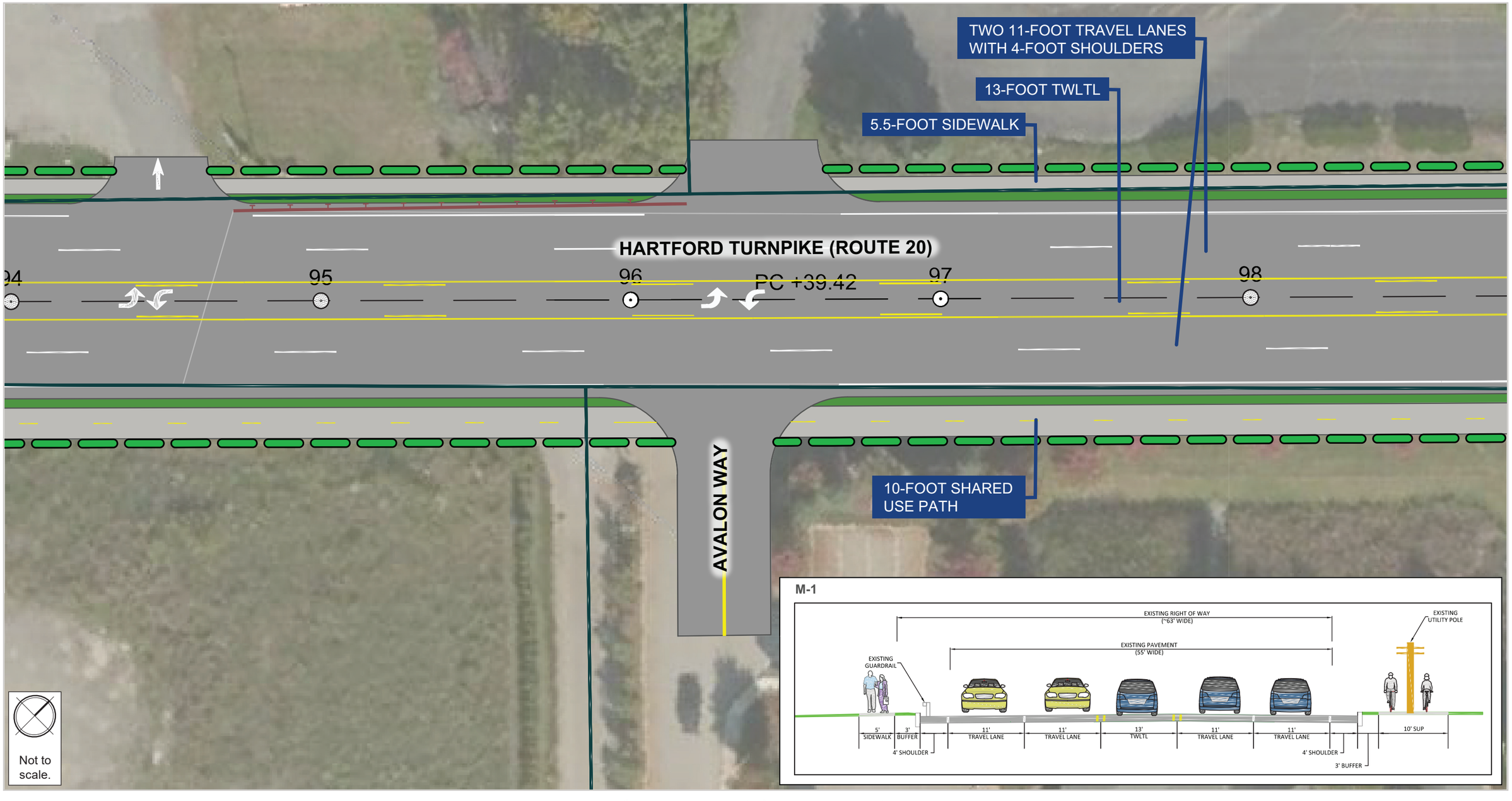
The Route 20 section starting at its intersection with Lake Street and ending at the western end of the study area at the Worcester City line presented some challenges with the Preferred Concept cross-section. This portion of Route 20 goes through Lake Quinsigamond and Flint Pond, which means the roadway is carried over bridges that connect the Edgemere neighborhood and the Worcester portion of Route 20 to the Shrewsbury-portion of Route 20. Furthermore, the existing Route 20 cross-section in the Edgemere neighborhood provides two travel lanes in each direction with shoulders and a sidewalk on the north side of Route 20. Beyond this cross-section there exist private and commercial properties with small setbacks from the Route 20 edge of pavement. The narrow cross-section and available Right of Way make it difficult to provide Preferred Concept cross-section. That is why a modified Preferred Concept is proposed which would provide two 11-foot lanes in each direction with four-foot shoulders, a standard double yellow centerline, a five-foot sidewalk on the north side of Route 20, and an eight-foot shared-use path on the south side. This modified proposed cross-section will still have impacts on private Right of Way, but the goal is to minimize those impacts while still providing the vehicular, pedestrian, and bicycle accommodations needed as there is no alternative route as in the case of Route 140, Purinton Street, and Clews Street. **Figure 35, Figure 36, and Figure 37** show the preferred cross-sections throughout the study corridor.

Figure 35. Route 20 Preferred Concept Cross-Section Type 1 – Four-foot Median



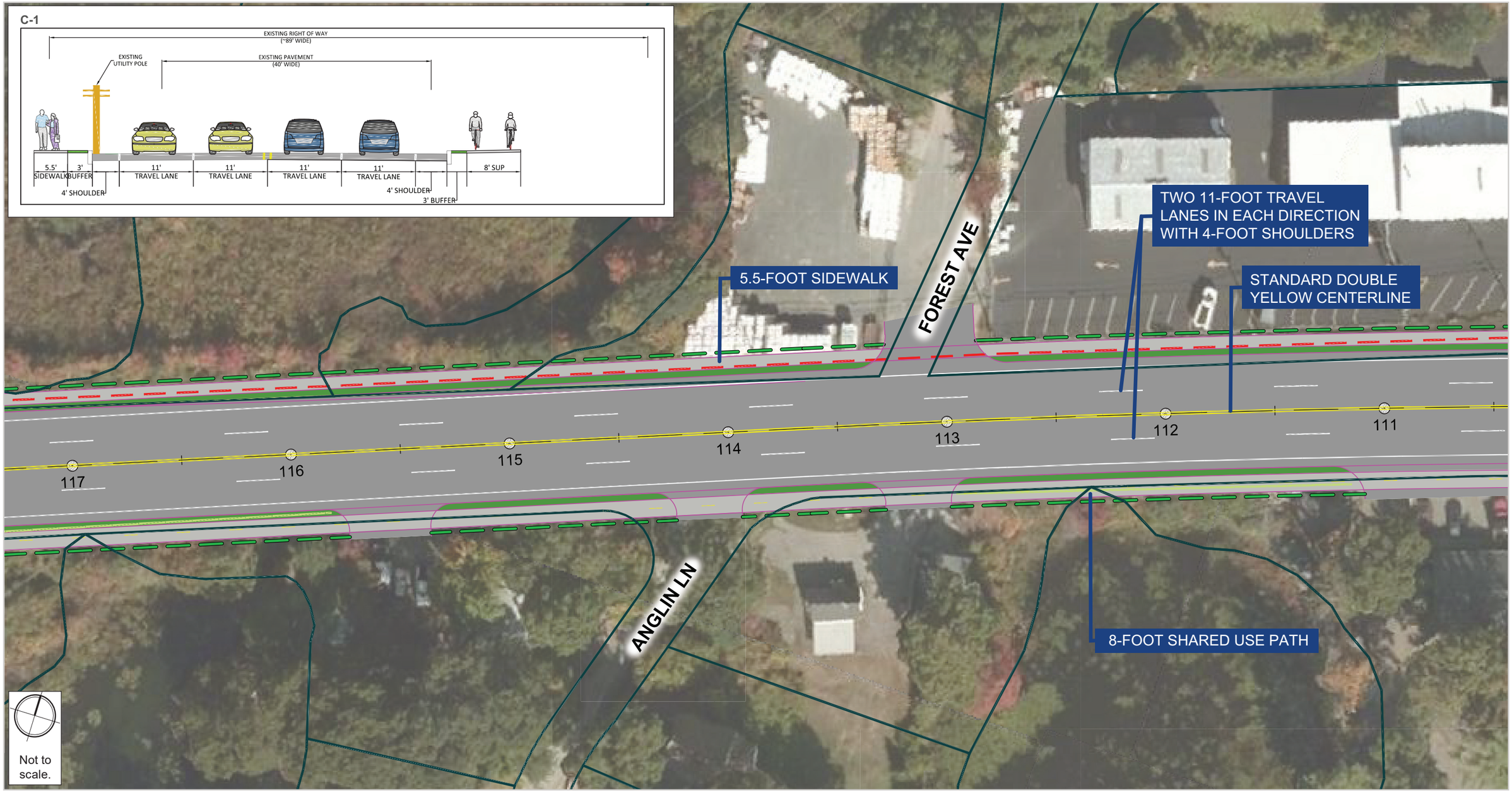
Shrewsbury – Route 20 Corridor Improvements

Figure 36. Route 20 Preferred Concept Cross-Section Type 2 – TWLTL Lane



Shrewsbury – Route 20 Corridor Improvements

Figure 37. Route 20 Preferred Concept Cross-Section Type 3 – Standard Double Yellow Centerline



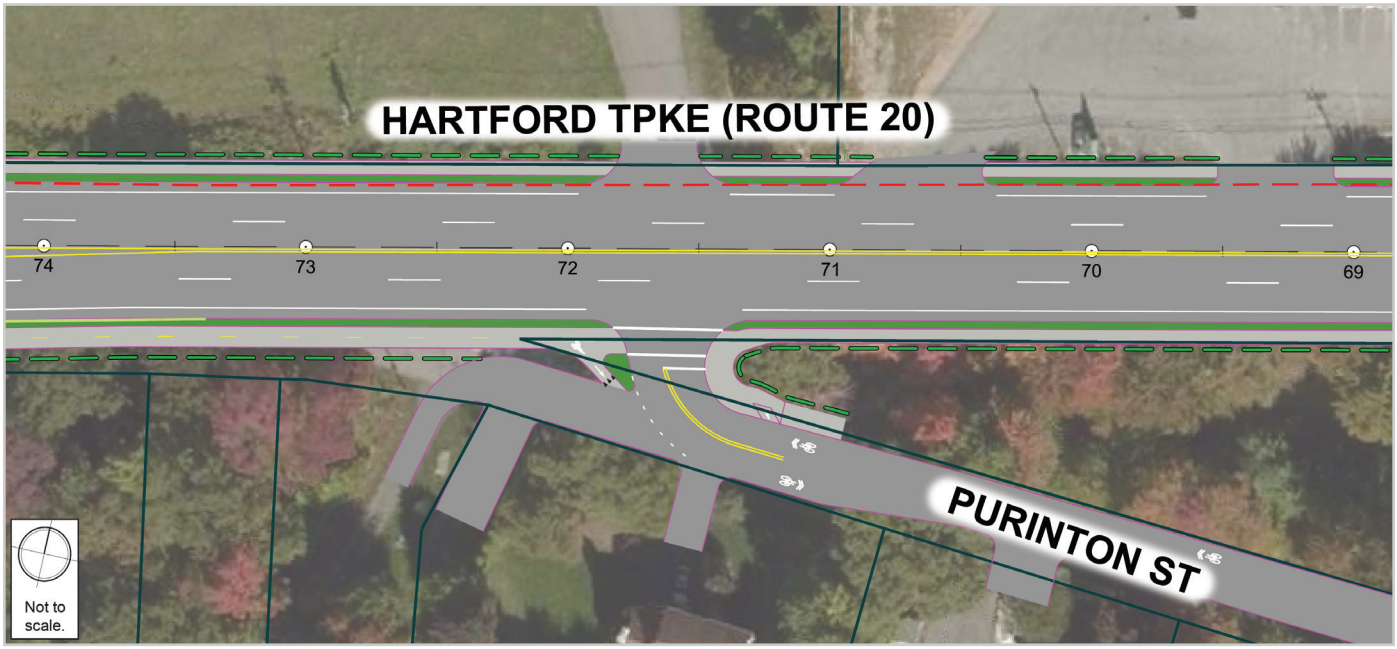
Shrewsbury – Route 20 Corridor Improvements

PREFERRED CONCEPT PLAN AT KEY INTERSECTIONS

PURINTON STREET INTERSECTION

The preferred design concept will add a westbound travel lane on Route 20 to provide a full four-lane cross section. A shared-use path will be added along the south side of Route 20 approaching Purinton Street from the west. Sidewalks will be installed along the north side of Route 20 and along the south side of Route 20 east of the intersection. The shared-use path and the sidewalks will be set back from the Route 20 travel lanes by an asphalt shoulder and grass buffer. The last 100 feet of Purinton Street approaching Route 20 will be realigned so that it intersects the highway at a right angle and the existing concrete island will be removed. All left turns at the intersection will be prohibited. The existing property driveways west of the realigned street will be extended so that their access on to Purinton Street is maintained.

Figure 38. Preferred Concept Plan at Route 20/Purinton Street Intersection



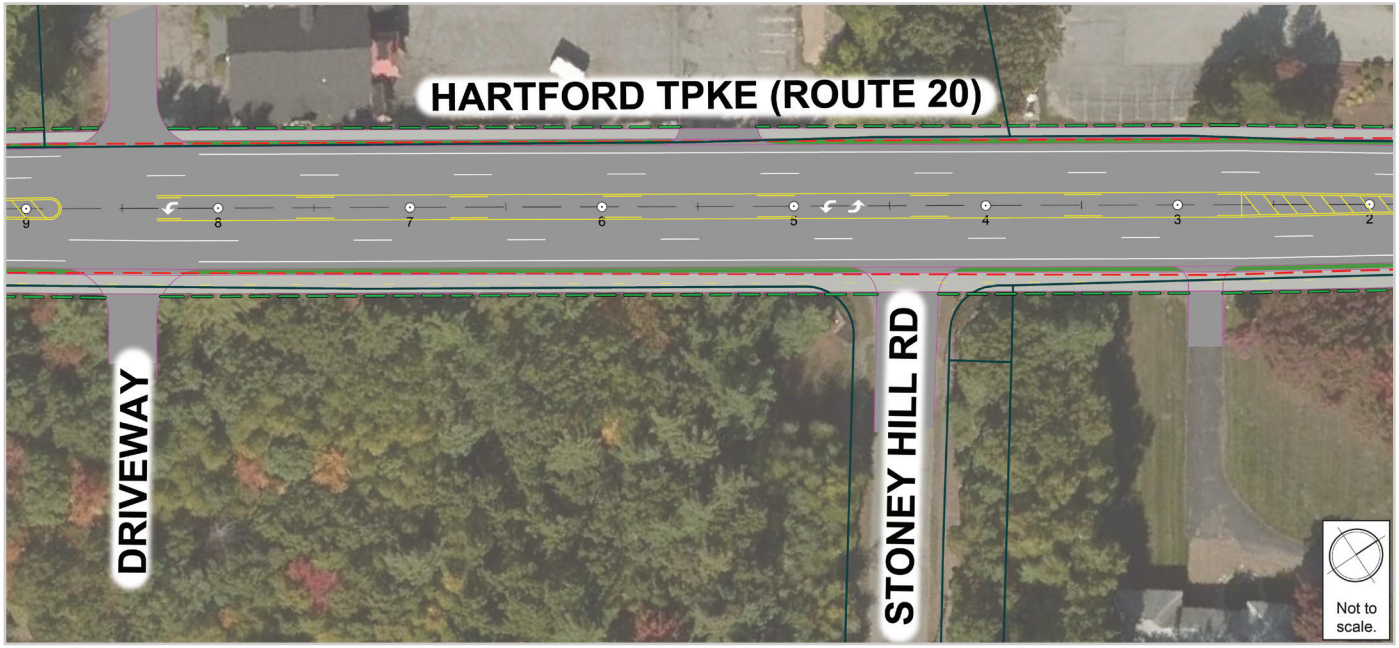
These improvements are needed because the existing intersection alignment is unsafe as it allows vehicles to enter Purinton Street from Route 20 eastbound at high speeds. This new alignment will help reduce the speed of these vehicles and improve driver's ability to see vehicles coming in each direction on Route 20 as they turn right onto Route 20 eastbound.

Although this is currently the preferred design concept, MassDOT and the Town may pursue other options for this intersection as the design process moves forward based on neighborhood feedback. Other options that may be considered include conversion of the Purinton Street approach to allow left turns to and from Route 20 westbound or creation of a cul-de-sac at the end of Purinton Street, which would prevent access to and from Route 20. In that case full access to Purinton Street would be provided via Grafton Street.

STONEY HILL ROAD (EAST) INTERSECTION

The preferred design concept will add a new travel lane in each direction on Route 20 at the eastern intersection with Stoney Hill Road and a new two-way left-turn lane to provide a five-lane cross section. A shared-use path will be added along the south side of Route 20, crossing Stoney Hill Road. Sidewalks will be installed along the north side of Route 20. The shared-use path and the sidewalks will be set back from the Route 20 travel lanes by an asphalt shoulder and grass buffer. In addition to providing space for vehicles to turn left from Route 20, the two-way left-turn lane allows space for vehicles to turn left from Stoney Hill Road (East) in two stages: (1) crossing the eastbound lanes first and (2) then waiting in the center lane for a sufficient gap to merge into Route 20 westbound traffic. Drivers who do not feel safe making the two-stage left turn will be able to turn right and make a U-turn at the Cherry Street/Centech Boulevard intersection approximately 2,000 feet to the east.

Figure 39. Preferred Concept Plan at Route 20/Stoney Hill Road (East) Intersection

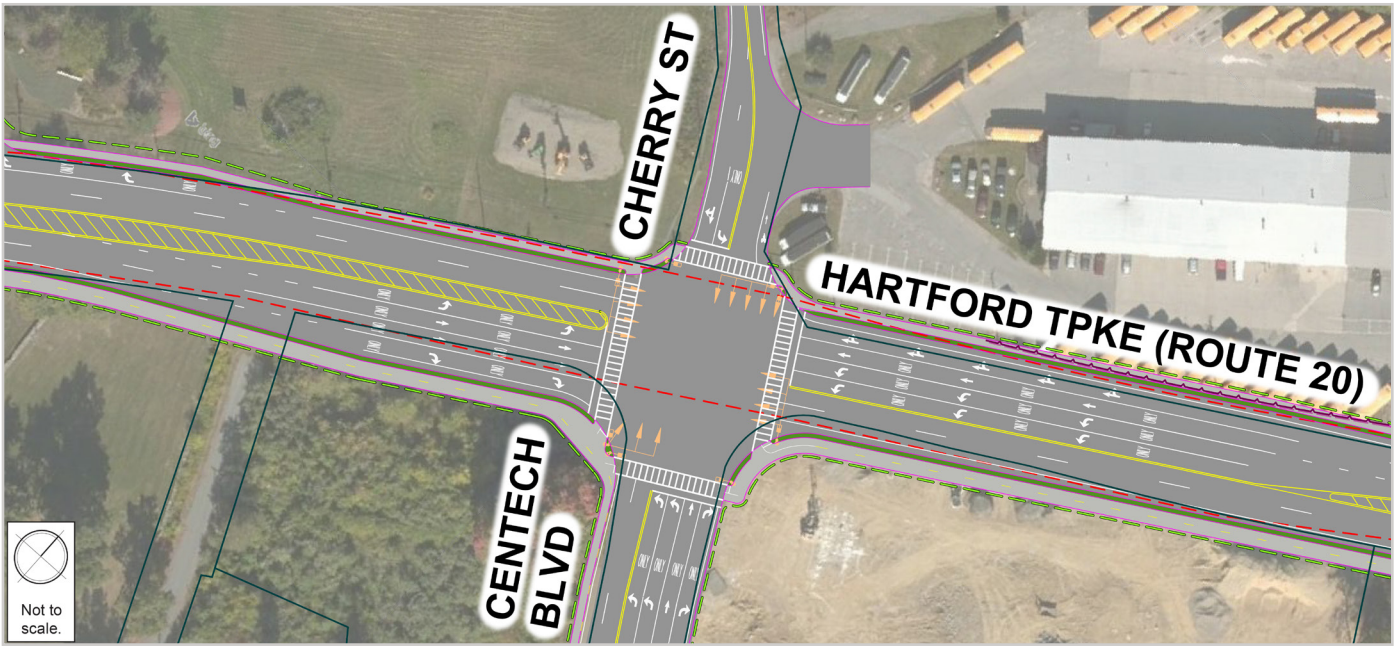


Under existing conditions, Stoney Hill Road drivers attempting to access either direction of Route 20 experience long delays and view left turns out of Stoney Hill Road as dangerous due to the high travel speeds of vehicles on Route 20. Many choose to turn right onto Route 20 and make a U-turn at the Cherry Street/Centech Boulevard intersection instead. Residents of the neighborhood raised these safety concerns at the study public meetings and so a signal warrant analysis was conducted. The signal warrant analysis at the eastern intersection with Stoney Hill Road found that none of the MUTCD signal warrants will be met even with the increase in traffic volumes anticipated from future development projects; therefore, a traffic signal is not recommended. Without a new traffic signal, the creation of a new two-way left-turn lane in the preferred design concept will help address the safety concerns raised by the residents of Stoney Hill Road.

CENTECH BOULEVARD/CHERRY STREET INTERSECTION

The preferred design concept will add multiple new lanes to the streets approaching the intersection from the east, west, and south. The Route 20 eastbound approach will be widened to provide a left-turn lane, two through lanes, and a right-turn lane. The Route 20 westbound approach will be widened to provide two left-turn lanes, a through lane, and a through/right-turn lane. Centech Boulevard northbound will be widened to provide two left-turn lanes, a through lane, and a right-turn lane. Finally, the two lanes on the Cherry Street southbound approach will be maintained but will change assignments to provide a left-turn lane and through/right-turn lane. A shared-use path will be added along the south side of Route 20, crossing Centech Boulevard. Sidewalks will be installed along the north side of Route 20. The shared-use path and the sidewalks will be set back from the Route 20 travel and turning lanes by an asphalt shoulder and grass buffer.

Figure 40. Preferred Concept Plan at Route 20/Centech Boulevard/Cherry Street Intersection

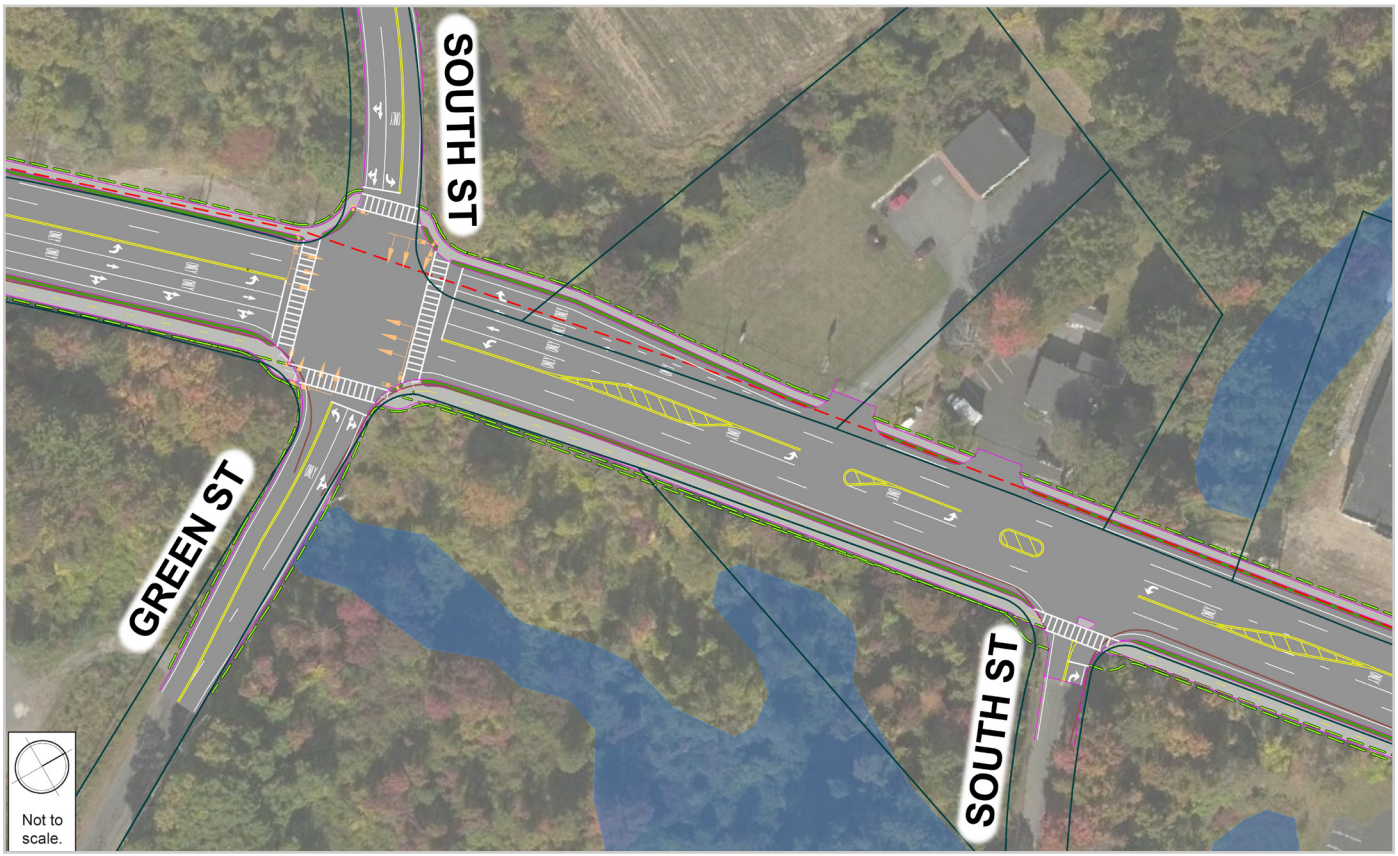


Several new development projects are planned for properties accessed by Centech Boulevard south of Route 20, including a proposed UPS Packaging Facility. Those new developments plus others planned in the Route 20 corridor are estimated to add 1,125 new trips to this intersection in the morning peak hour and 1,445 trips in the afternoon peak hour. The increase in travel and turning lanes is needed to accommodate these new vehicle trips without adding significant delay to vehicles at the intersection. A big part of the increased traffic will be vehicles turning onto or from Route 20, which requires new dedicated signal phases with new dedicated turning lanes for vehicle storage. The new travel and turning lanes at this intersection are likely to be gradually added in parts as new development projects are constructed.

SOUTH STREET (NORTH)/GREEN STREET AND SOUTH STREET (SOUTH) INTERSECTIONS

South Street and Route 20 share a set of off-set intersections approximately 500 feet apart. The intersection of Route 20 with the northern section of South Street is shared with Green Street and is under traffic signal control. The southern section of South Street branches off Route 20 to the east forming a T-intersection where South Street is the stop-controlled side street. The preferred design concept will widen Route 20 through both intersections, add new lanes to the South Street and Green Street approaches at the western intersection, and restrict left turns from South Street onto Route 20 westbound at the eastern intersection. At the intersection of Route 20 with South Street and Green Street, the Route 20 eastbound approach will be widened to provide a through/right-turn lane, a through lane, and a left-turn lane while the Route 20 westbound approach will be widened to provide a right-turn lane, two through lanes, and a left-turn lane. The northern section of South Street and Green Street will be widened as they approach Route 20 to each provide a through/right-turn lane and a left-turn lane. Two short eastbound left-turn pocket lanes will be added between the intersections to serve the two business driveways. A shared-use path will be added along the south side of Route 20. Sidewalks will be installed along the north side of Route 20. The shared-use path and the sidewalks will be set back from the Route 20 travel and turning lanes by an asphalt shoulder and grass buffer.

Figure 41. Preferred Concept Plan at Route 20/South Street/Green Street Intersection

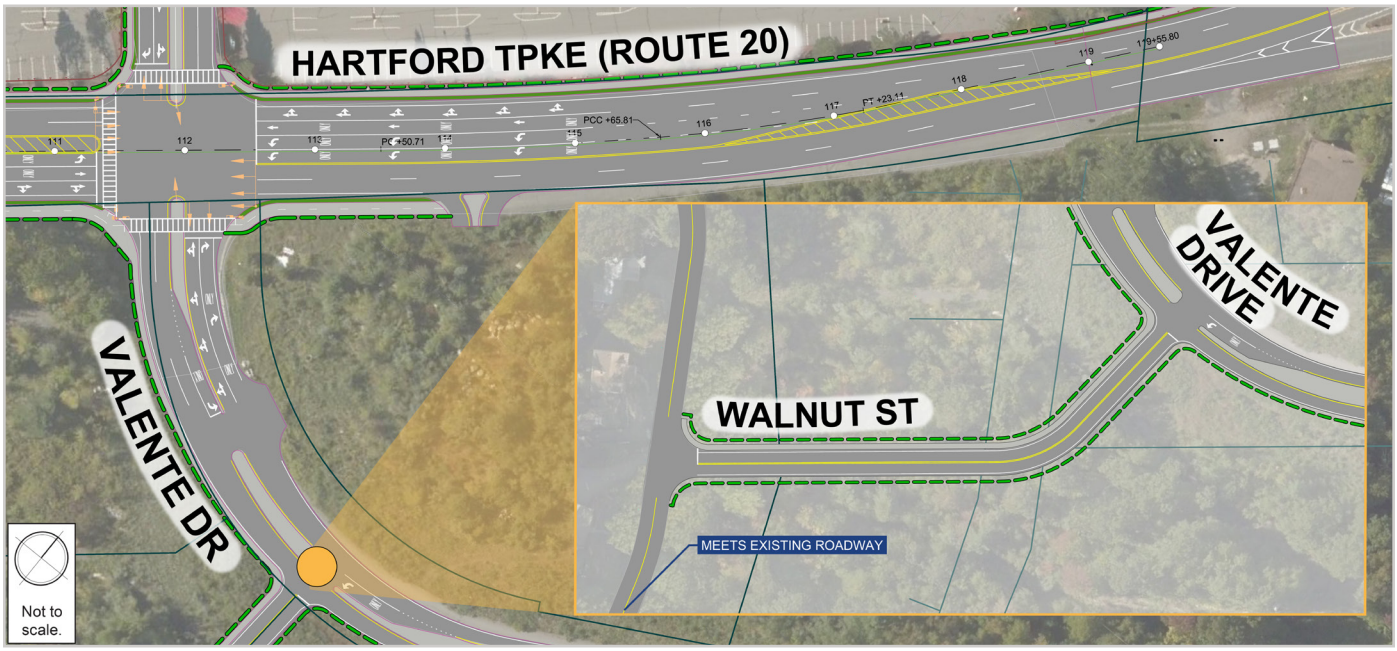


There are existing safety issues at the eastern intersection of Route 20 and South Street. Vehicles turning left from South Street onto Route 20 westbound have been involved in crashes that resulted in injuries. One recent crash involved several young students from the Al-Hamra Academy which is located on South Street just south of Route 20. The feasibility of installing a new traffic signal at this intersection was investigated. The signal warrant analysis found that an insufficient number of the MUTCD signal warrants will be met even with the increase in traffic volumes anticipated from future development projects, therefore a traffic signal cannot be installed. Because of the wetlands located south of Route 20 between South Street and Green Street, it is not possible to build a connecting roadway between them. Without a new traffic signal or connection between the side streets, the best option for addressing the safety issues here is the prohibition of left turns from South Street to Route 20 westbound.

WALNUT STREET/VALENTE DRIVE

The preferred design concept will provide a new traffic signal at the Valente Drive/Old Shrewsbury Drive intersection, provide a new connection between Walnut Street and Valente Drive that allows access to Route 20 via Valente Drive, and the Walnut Street South approach to Route 20 will made into a right-turn-in only approach sending all Route 20-bound vehicles from Walnut Street South through the new signal at Valente Drive. Route 20 westbound vehicles needing to access Walnut Street South will also go through the new signal as left turns onto Valente Drive. A shared-use path will be added along the south side of Route 20. Sidewalks will be installed along the north side of Route 20. The shared-use path and the sidewalks will be set back from the Route 20 travel and turning lanes by an asphalt shoulder and grass buffer.

Figure 42. Preferred Concept Plan at Route 20/Valente Drive/Old Shrewsbury Drive Intersection



The study evaluation identified a safety issue at the Walnut Street South intersection with Route 20 because it is located at the bottom of a crest vertical curve. This means that Walnut Street vehicles waiting to enter traffic cannot see vehicles traveling on Route 20 westbound in time to enter traffic safely. The feasibility of installing a new traffic signal at this intersection was investigated and found that it is justified. However, a new signal here paired with the proposed signal at Route 20/Valente Drive/Old Shrewsbury Drive would create operational and safety issues as these two intersections are so closely spaced that the high speeds on Route 20 may create rear-end crashes when vehicles try to go through one intersection when the light changes from green to yellow, only to have to come to a stop at the next intersection, but cannot stop in time. Travel delays on Route 20 would also be much higher with two signals instead of just one between these two intersections.

The proposed signal phasing for all future signalized intersections can be seen in Appendix J. Figures and cross-sections of the Preferred Concept can be found in Appendix F. For a full picture of the Preferred Concept proposed improvements, please refer to the roll plan titled "Shrewsbury – Route 20 Corridor Conceptual Master Plan." The Preferred Concept (2037) Conditions a.m. and p.m. peak hour Level of Service for each of the nine (9) signalized and the 16 unsignalized intersections within the study area are shown graphically in **Figure 43. Table 20** through **Table 23** show the a.m. and p.m. peak hour capacity analyses in detail.

Figure 43. Preferred Concept (2037) Conditions, Level of Service a.m. and p.m. Peak Hours

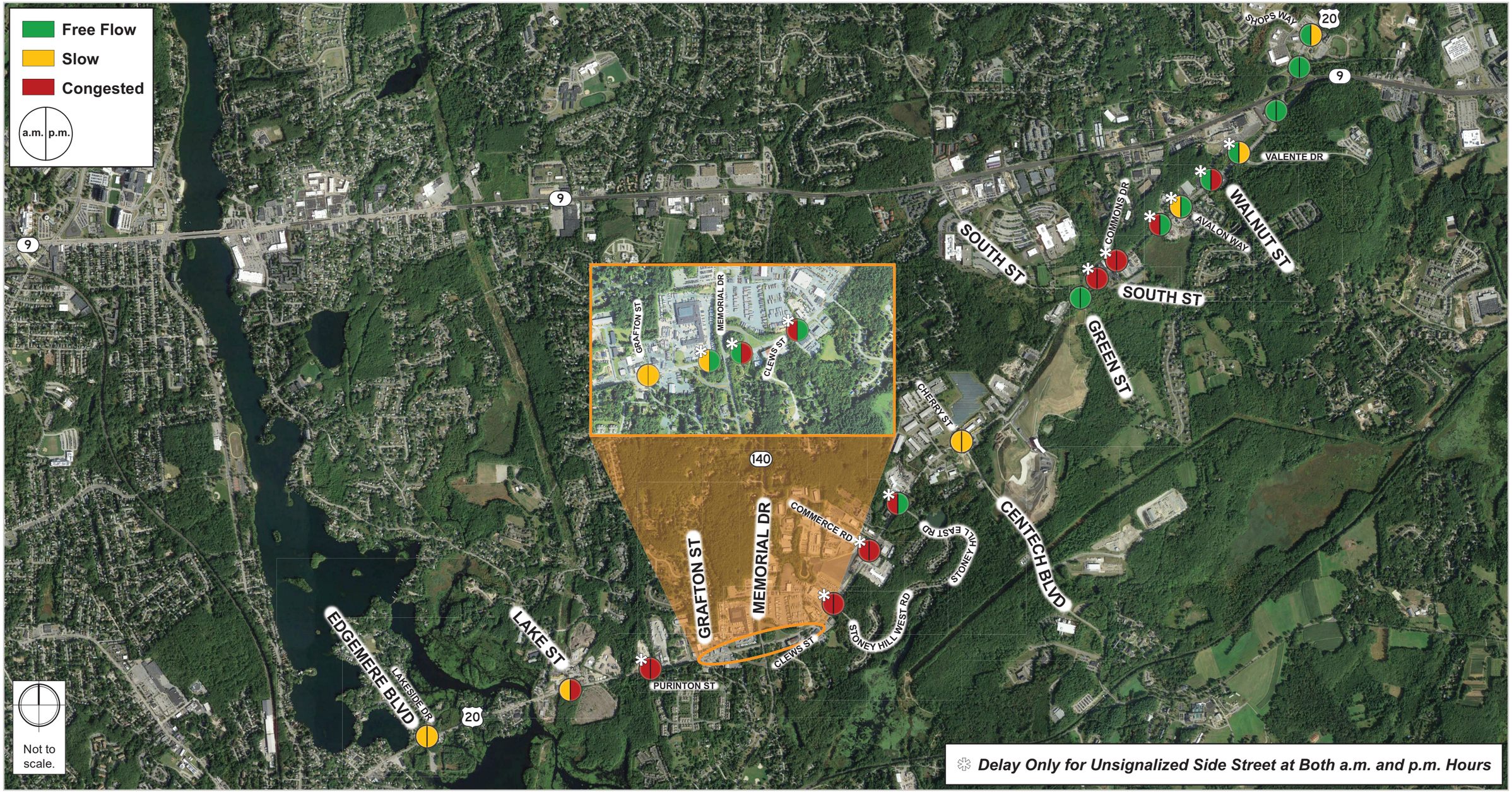


Table 20. Preferred Concept Signalized Intersection Capacity Analysis Summary, a.m. Peak Hour

Intersection/Movement	LOS	Delay (Seconds)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Route 20/Edgemere Boulevard/Oak Island Driveway	D	49.0	-	-	-
Route 20 EB left	B	11.6	0.07	1	13
Route 20 EB thru|thru/right	E	64.2	1.08	262	#995
Route 20 WB left	B	11.0	0.01	0	5
Route 20 WB thru|thru/right	C	27.0	0.90	113	#735
Oak Island NB left/thru/right	D	37.7	0.00	0	159
Edgemere SB left/thru/right	C	34.3	0.06	0	291
Route 20/Lake Street/Edgemere Driveway	D	47.0	-	-	-
Route 20 EB left	D	38.7	0.66	86	#286
Route 20 EB thru|thru/right	D	45.7	0.98	595	#1235
Route 20 WB left	C	31.7	0.50	30	89
Route 20 WB thru|thru/right	D	40.7	0.89	373	#799
Edgemere NB left/left	E	56.8	0.35	28	68
Edgemere NB thru/right	D	54.9	0.05	0	0
Lake SB thru/left	F	>80.0	1.05	86	#278
Lake SB right	D	40.1	0.14	0	47
Route 20/Grafton Street	D	48.6	-	-	-
Route 20 EB left	D	45.5	0.33	36	#131
Route 20 EB thru|thru/right	D	46.1	1.00	543	#1098
Route 20 WB left	F	>80.0	0.68	17	#60
Route 20 WB thru|thru/right	C	33.2	0.84	344	525
Grafton NB left/thru/right	F	>80.0	0.99	147	#400
Grafton SB left/thru/right	F	>80.0	0.93	141	#386
Route 20/Cherry Street/Centech Boulevard	**E**	**55.1**	-	-	-
Route 20 EB left	D	46.0	0.21	36	108
Route 20 EB thru|thru	E	63.4	1.01	582	#1093
Route 20 EB right	B	15.5	0.34	9	41
Route 20 WB left/left	E	67.6	0.75	83	#182
Route 20 WB thru|thru/right	D	39.2	0.68	279	401
Centech NB left|left	F	>80.0	0.96	150	#330
Centech NB thru	D	47.6	0.31	65	148
Centech NB right	D	37.0	0.17	0	71
Cherry SB left	D	47.0	0.36	47	116
Cherry SB thru/right	F	>80.0	0.92	132	#351
Route 20/Green Street/South Street	**C**	**32.2**	-	-	-
Route 20 EB left	C	30.4	0.77	143	#491
Route 20 EB thru|thru/right	C	22.1	0.79	242	#773
Route 20 WB left	D	49.0	0.10	2	12
Route 20 WB thru|thru	D	47.2	0.87	198	#425
Route 20 WB right	C	23.0	0.25	16	101
Green NB left	D	49.4	0.14	5	25
Green NB thru/right	E	73.6	0.73	41	#133
South SB left	D	35.7	0.39	63	153
South SB thru/right	D	40.3	0.27	6	#143
Route 20/Valente Drive/Old Shrewsbury Village	**C**	**29.2**	-	-	-
Route 20 EB left	E	56.1	0.33	10	31
Route 20 EB thru|thru/right	C	29.6	0.87	410	#682
Route 20 WB left|left	D	46.3	0.58	95	126
Route 20 WB thru|thru/right	B	17.9	0.50	155	389
Valente NB left/thru	D	46.9	0.51	61	#187
Valente NB right	D	35.8	0.52	101	196

Table 20. Preferred Concept Signalized Intersection Capacity Analysis Summary, a.m. peak hour (cont'd)

Intersection/Movement	LOS	Delay (Seconds)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Old Shrewsbury Village SB left/thru	**E**	71.9	0.38	3	16
Old Shrewsbury Village SB right	D	50.0	0.01	0	0
Route 20/Route 9 EB on ramp	A	3.6	-	-	-
Route 20 EB thru	A	7.6	0.70	177	271
Route 20 WB left	A	3.9	0.35	0	2
Route 20 WB thru|thru	A	0.3	0.33	0	0
Route 20/Route 9 WB on/off ramp	A	7.4	-	-	-
Route 20 EB left	B	17.9	0.33	31	m63
Route 20 EB thru	A	5.2	0.73	94	25
Route 20 WB thru|thru/right	A	5.2	0.49	78	96
Route 9 off ramp NB right	C	23.5	0.11	0	43
Route 20/Shops Way/Baseball Complex Drive	C	27.2	-	-	-
Route 20 EB left|left	D	42.9	0.65	101	139
Route 20 EB thru/right	B	17.0	0.76	343	541
Route 20 WB left	D	53.5	0.40	24	58
Route 20 WB thru|thru/right	B	17.5	0.41	141	204
Baseball Complex NB left	**E**	58.8	0.47	17	48
Baseball Complex NB left/thru	**E**	58.8	0.47	17	48
Baseball Complex NB right	D	46.2	0.01	0	0
Shops Way SB left/thru	**E**	68.3	0.79	100	#227
Shops Way SB right|right	C	32.7	0.10	0	32

= 95th percentile volume exceeds capacity, queue may be longer.
~=Volume exceeds capacity, queue is theoretically infinite.
m = Volume of 95th percentile queue is metered by upstream signal.

Table 21. Preferred Concept Unsignalized Intersection Capacity Analysis Summary, a.m. Peak Hour

Intersection/Movement	LOS	Delay (Seconds)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Route 20/Purinton Street	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0
Purinton NB right	C	18.4	0.02	-	0
Route 20/Route 140 West Off-Ramp	-	-	-	-	-
Route 20 EB thru/thru	A	0.0	0.00	-	0
Route 20 WB thru/thru	A	0.0	0.00	-	0
Route 140 West NB right	E	43.1	0.73	-	135
Route 20/Route 140 East Off-Ramp	-	-	-	-	-
Route 20 EB thru/thru	A	0.0	0.00	-	0
Route 20 WB thru/thru	A	0.0	0.00	-	0
Route 140 East SB right	C	17.2	0.40	-	48
Route 20/Clews Street	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left	C	17.2	0.08	-	5
Route 20 WB thru|thru	A	0.0	0.00	-	0
Clews NB left/right	F	>50.0	0.88	-	173
Route 20/Stoney Hill Road (West)/Driveway	-	-	-	-	-
Route 20 EB left	B	11.0	0.06	-	5
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left	C	17.7	0.03	-	3
Route 20 WB thru/thru	A	0.0	0.00	-	0
Route 20 WB right	A	0.0	0.00	-	0
Stoney Hill NB left/thru/right	F	>50.0	3.42	-	170
Driveway SB left/thru/right	B	14.2	0.01	-	0
Route 20/Commerce Road	-	-	-	-	-
Route 20 EB left	B	11.7	0.05	-	3
Route 20 EB thru//thru	A	0.0	0.00	-	0
Route 20 WB thru|thru/right	A	0.0	0.00	-	0
Commerce SB left/right	F	>50.0	0.34	-	30
Route 20/Stoney Hill Road (East)	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left	C	21.9	0.03	-	3
Route 20 WB thru|thru	A	0.0	0.00	-	0
Stoney Hill Rd NB left/right	E	45.4	0.43	-	48
Route 20/South Street	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left	C	17.5	0.03	-	3
Route 20 WB thru|thru	A	0.0	0.00	-	0
South St NB left/right	F	>50.0	1.03	-	133
Route 20/Commons Drive/Sunbelt Rentals Driveway	-	-	-	-	-
Route 20 EB left	B	10.2	0.01	-	0
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left/thru|thru/right	A	0.0	0.00	-	0
Sunbelt Rentals NB left/thru/right	F	>50.0	0.42	-	25
Commons SB left/thru/right	C	22.1	0.25	-	25
Route 20/Dunkin Donuts Driveway	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left	B	14.7	0.08	-	7
Route 20 WB thru|thru	A	2.6	0.00	-	0
Dunkin Donuts NB left/right	F	>50.0	0.81	-	150

Table 21. Preferred Concept Unsignalized Intersection Capacity Analysis Summary, a.m. Peak Hour (cont'd)

Intersection/Movement	LOS	Delay (Seconds)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Route 20/Avalon Way	-	-	-	-	-
Route 20 EB thru/thru|right	A	0.00	0.0	-	0
Route 20 WB left	C	17.3	0.02	-	3
Route 20 WB thru|thru	A	0.0	0.00	-	0
Avalon NB left/right	D	30.3	0.34	-	38
Route 20/Walnut Street N	-	-	-	-	-
Route 20 EB left	B	10.3	0.02	-	3
Route 20 EB thru/thru	A	0.0	0.00	-	0
Route 20 WB thru/thru|right	A	0.0	0.00	-	0
Walnut SB left/right	C	21.5	0.19	-	18
Valente Drive/Walnut Street S	-	-	-	-	-
Walnut EB left/right	C	18.8	0.48	-	63
Valente NB left	A	0.0	0.00	-	0
Valente NB thru	A	0.0	0.00	-	0
Valente SB thru|thru/right	A	0.0	0.00	-	0
Route 20/Route 9 EB off ramp	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0
Route 9 EB off ramp SB right	B	14.4	0.20	-	18
Route 20 EB/Route 9 EB off ramp	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0
Route 9 EB off ramp NB right	D	28.9	0.60	-	93
Route 20 WB/Route 9 WB off ramp	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0
Route 9 WB off ramp SB right	E	40.7	0.89	-	265

Table 22. Preferred Concept Signalized Intersection Capacity Analysis Summary, p.m. Peak Hour

Intersection/Movement	LOS	Delay (Seconds)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Route 20/Edgemere Boulevard/Oak Island Driveway	**E**	**60.5**	-	-	-
Route 20 EB left	C	31.8	0.44	7	63
Route 20 EB thru|thru/right	B	10.3	0.69	167	698
Route 20 EB left	A	9.2	0.01	0	4
Route 20 WB thru|thru/right	F	>80.0	1.15	~907	#1655
Oak Island NB left/thru/right	E	59.0	0.00	0	0
Edgemere SB left/thru/right	E	55.7	0.05	0	0
Route 20/Lake Street/Edgemere Driveway	F	>80.0	-	-	-
Route 20 EB left	F	>80.0	1.11	~174	#509
Route 20 EB thru|thru/right	C	32.9	0.86	414	#905
Route 20 WB left	D	49.2	0.83	59	#267
Route 20 WB thru|thru/right	F	>80.0	1.30	~913	#1555
Edgemere NB left/left	E	71.4	0.76	63	#163
Edgemere NB thu/right	D	55.0	0.09	0	0
Lake SB left/thru	F	>80.0	1.08	128	#374
Lake SB right	D	44.7	0.45	29	157
Route 20/Grafton Street	E	57.6	-	-	-
Route 20 EB left	E	65.2	0.57	44	#139
Route 20 EB thru|thru/right	B	18.5	0.67	312	626
Route 20 WB left	F	>80.0	0.74	41	#122
Route 20 WB thru|thru/right	E	70.9	1.07	740	#1351
Grafton NB left/thru/right	F	>80.0	1.07	155	#406
Grafton SB left/thru/right	F	>80.0	0.89	139	#356
Route 20/Cherry Street/Centech Boulevard	**D**	**44.5**	-	-	-
Route 20 EB left/left	C	29.1	0.34	11	41
Route 20 EB thru|thru	C	28.2	0.61	258	500
Route 20 EB right	B	13.4	0.26	0	29
Route 20 WB left/left	E	60.1	0.69	98	174
Route 20 WB thru|thru/right	D	46.2	0.97	592	#1149
Centech NB left|left	E	71.5	0.89	163	#342
Centech NB thru	D	49.8	0.38	72	161
Centech NB right	D	36.4	0.13	0	62
Cherry SB left	D	51.3	0.44	52	125
Cherry SB thru/right	F	>80.0	0.96	94	#280
Route 20/Green Street/South Street	**C**	**33.5**	-	-	-
Route 20 EB left	D	51.2	0.75	82	#247
Route 20 EB thru|thru/right	C	29.1	0.74	333	463
Route 20 WB left	C	20.6	0.16	14	52
Route 20 WB thru|thru	C	32.1	0.88	387	#816
Route 20 WB right	B	17.5	0.23	33	121
Green NB left	D	51.5	0.12	4	21
Green NB thru/right	D	52.9	0.38	15	58
South SB left	D	47.1	0.70	121	#310
South SB thru/right	D	44.5	0.37	15	#179
Route 20/Valente Drive/Old Shrewsbury Village	**D**	**46.1**	-	-	-
Route 20 EB left	D	53.3	0.39	23	57
Route 20 EB thru|thru/right	E	58.6	0.99	398	#536
Route 20 WB left|left	D	40.2	0.62	187	255
Route 20 WB thru|thru/right	C	22.7	0.85	255	#814
Valente NB left/thru	D	53.3	0.68	106	#279
Valente NB right	E	74.9	1.03	402	#775

Table 22. Preferred Concept Signalized Intersection Capacity Analysis Summary, p.m. Peak Hour (cont'd)

Intersection/Movement	LOS	Delay (Seconds)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Old Shrewsbury Village SB left/thru	E	59.4	0.40	12	35
Old Shrewsbury Village SB right	D	47.5	0.03	0	0
Route 20/Route 9 EB on ramp	**A**	**6.2**	-	-	-
Route 20 EB thru	B	11.6	0.76	523	m627
Route 20 WB left	C	20.9	0.70	64	m150
Route 20 WB thru|thru	A	0.5	0.54	0	0
Route 20/Route 9 WB on/off ramp	**C**	**22.9**	-	-	-
Route 20 EB left/left	E	63.3	0.82	237	m316
Route 20 EB thru	A	9.3	0.83	110	136
Route 20 WB thru|thru/right	B	12.4	0.77	333	442
Route 9 off ramp NB right	E	73.3	0.92	199	#386
Route 20/Shops Way/Baseball Complex Drive	**D**	**39.2**	-	-	-
Route 20 EB left|left	D	52.7	0.91	234	m#323
Route 20 EB thru/right	B	17.0	0.74	336	m521
Route 20 WB left	C	24.4	0.20	26	54
Route 20 WB thru|thru/right	D	40.4	0.89	400	#537
Baseball Complex NB left	F	>80.0	0.72	35	#94
Baseball Complex NB left/thru	E	79.0	0.70	36	#93
Baseball Complex NB right	D	46.6	0.01	0	0
Shops Way SB left/thru	F	>80.0	0.91	156	#298
Shops Way SB right|right	C	30.5	0.60	164	228

= 95th percentile exceeds capacity, queue may be longer.
~ = Volume exceeds capacity, queue is theoretically infinite.
m = Volume of 95th percentile queue is metered by upstream signal.

Table 23. Preferred Concept Unsignalized Intersection Capacity Analysis Summary, p.m. Peak Hour

Intersection/Movement	LOS	Delay (Seconds)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Route 20/Purinton Street	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left/thru|thru	A	0.0	0.00	-	0
Purinton NB left/right	B	14.3	0.01	-	0
Route 20/Route 140 West Off-Ramp	-	-	-	-	-
Route 20 EB thru/thru	A	0.0	0.00	-	0
Route 20 WB thru/thru	A	0.0	0.00	-	0
Route 140 West NB right	A	0.0	0.00	-	0
Route 20/Route 140 East Off-Ramp	-	-	-	-	-
Route 20 EB thru/thru	A	0.0	0.00	-	0
Route 20 WB thru/thru	A	0.0	0.00	-	0
Route 140 East SB right	F	>50.0	1.16	-	345
Route 20/Clews Street	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left	B	13.9	0.25	-	25
Route 20 WB thru|thru	A	0.0	0.00	-	0
Clews NB left/right	C	17.1	0.29	-	30
Route 20/Stoney Hill Road (West)/Driveway	-	-	-	-	-
Route 20 EB left	D	26.6	0.07	-	5
Route 20 EB left/thru|thru/right	A	0.0	0.00		0
Route 20 WB left	B	12.2	0.02	-	3
Route 20 WB thru/thru	A	0.0	0.00	-	0
Route 20 WB right	A	0.0	0.00	-	0
Stoney Hill NB left/thru/right	F	>50.0	0.85	-	70
Driveway SB left/thru/right	F	>50.0	0.27	-	18
Route 20/Commerce Road	-	-	-	-	-
Route 20 EB left	E	38.7	0.03	-	3
Route 20 EB thru//thru	A	0.0	0.00	-	0
Route 20 WB thru|thru/right-turn	A	0.0	0.00	-	0
Commerce SB left-turn/right-turn	F	>50.0	0.31	-	30
Route 20/Stoney Hill Road East	-	-	-	-	-
Route 20 EB thru|thru/right-turn	A	0.0	0.00	-	0
Route 20 WB thru/left-turn	B	12.4	0.08	-	7
Route 20 WB thru	A	0.0	0.00	-	12
Stoney Hill NB left//right	C	23.2	0.17	-	15
Route 20/South Street	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left	B	12.3	0.09	-	7
Route 20 WB thru|thru	A	0.0	0.00	-	0
South St NB left/right	F	>50.0	0.99	-	115
Route 20/Commons Drive/Sunbelt Rentals Driveway	-	-	-	-	-
Route 20 EB left	C	15.6	0.05	-	5
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left/thru|thru/right	A	0.0	0.00	-	0
Sunbelt Rentals NB left/thru/right	F	>50.0	0.17	-	13
Commons SB left/thru/right	C	19.5	0.13	-	13
Route 20/Dunkin Donuts Driveway	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0
Route 20 WB left	B	11.4	0.03	-	3
Route 20 WB thru|thru	A	5.6	0.00	-	0
Dunkin Donuts NB left/right	B	14.0	0.10	-	15

Table 23. Preferred Concept Unsignalized Intersection Capacity Analysis Summary, p.m. Peak Hour (cont'd)

Intersection/Movement	LOS	Delay (Seconds)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
Route 20/Avalon Way	-	-	-	-	-
Route 20 EB thru/thru|right	A	0.0	0.00	-	0
Route 20 WB left	B	11.7	0.08	-	5
Route 20 WB thru|thru	A	5.6	0.00	-	0
Avalon NB left/right	B	14.1	0.11	-	10
Route 20/Walnut Street N	-	-	-	-	-
Route 20 EB left	B	14.5	0.01	-	0
Route 20 EB thru/thru	A	0.0	0	-	0
Route 20 WB thru/thru|right	A	0.0	0	-	0
Walnut SB left/thru/right	F	>50.0	0.69	-	108
Valente Drive/Walnut Street S	-	-	-	-	-
Valente EB thru|thru/right	A	0.0	0.00	-	0
Valente WB left	A	0.0	0.00	-	0
Valente WB thru	A	0.0	0.00	-	0
Walnut NB left/right	F	>50.0	1.52	-	355
Route 20/Route 9 EB off ramp	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0
Route 9 EB off ramp SB right	F	>50.0	0.84	-	168
Route 20 EB/Route 9 EB off ramp	-	-	-	-	-
Route 20 EB thru		0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0
Route 9 EB off ramp NB right	F	>50.0	1.43	-	518
Route 20 WB/Route 9 WB off ramp	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0
Route 9 WB off ramp SB right	F	>50.0	2.32	-	1702

The Preferred Concept proposed improvements show that, during both the a.m. peak hour, eight of the nine signalized intersections operate at LOS D or better, and only one intersection operates at LOS E. During the p.m. peak hour, six of the nine signalized intersections operate at LOS D or better, and the remaining three intersections operate at LOS E or LOS F. Details of the Synchro analyses are provided in **Appendix B.**

In addition, under the Preferred Concept, the unsignalized side streets and driveways along Route 20 are anticipated to operate in a similar manner to there being no roadway improvements on Route 20. The left-turn pockets and the TWLTL are expected to reduce the impacts at these locations, with the only exception being the Route 20/South Street intersection in the p.m. peak hour, which is anticipated to operate at LOS F under the Preferred Concept.

Recommendations

The anticipated increase in volumes in this portion of the Route 20 corridor, due to background growth rate and the proposed developments, are expected to worsen operations throughout the corridor, and especially at six of the nine signalized intersection within the study area, as is shown in the analysis assuming no roadway improvements.

The Preferred Concept analysis shows that a four-lane cross section is required on Route 20 eastbound, Route 20 westbound, and Centech Boulevard. These improvements are expected to mitigate the impacts from these developments, when compared to the No-Build condition. Any additional lanes on Route 20 or the side streets are not recommended, as the Right of Way impacts will be much greater than the Preferred Concept impacts, and that additional capacity may not be needed outside of the peak morning and evening commuting hours.

Furthermore, the Route 20 unsignalized intersections with Stoney Hill Road (West and East) and with South Street should be monitored for safety moving forward. MassDOT has implemented some short-term improvements at Route 20/South Street to mitigate existing safety issues (clearing and grubbing to increase sight distance, oversized stop sign on South Street to emphasize that South Street traffic has to come to a stop before entering Route 20), whereas the Stoney Hill Road intersections are seeing minor modifications from proposed Pointe at Hill Farms Title 40B developments adjacent to either intersection. The Master Plan proposes additional improvements at these intersections (TWLTL and left-turn pockets) to help alleviate the existing safety issues. As public meeting attendees have requested signals at these intersections, the proposed Master Plan improvements at these intersections don't preclude the ability to install a signal without requiring any additional geometry improvements or Right of Way.

Stoney Hill Road (W) intersection with Route 20.

If the Walnut Street South modification proposed under the Preferred Concept will be pursued, a discussion with the property owner(s) would be required, as the realigned Walnut Street will cut through one or more of their properties. In addition, the new intersection of Walnut Street and Valente Drive should be monitored over time as build-out increases to determine when signal warrants indicate a new signal is necessary.

The Preferred Concept will provide continuous and connected bicycle and pedestrian accommodations with the study area. A continuous sidewalk will be provided along the north side and a shared-use path along the south side of Route 20, as well as crosswalks at all signalized intersections within the study area. Widening Route 20 to provide the additional travel lanes and to provide bicycle and pedestrian accommodations will have Right of Way impacts along the project corridor.

Future traffic operations have shown that the Route 20 at Route 9 Interchange will be impacted heavily by the projected increase in volumes. The Preferred Concept analysis shows queues on Route 9 off-ramps to Route 20 that spill back onto the Route 9 mainline. This project focuses on Route 20 improvements due to projected growth in the area; it does not include mitigation for the interchange and/or its ramps to and from Route 20.

The Preferred Concept shows a four-lane cross-section for the portion of Route 20 going under the Route 140 bridge, with sidewalks going between the existing bridge piers and sloped abutment, meaning that some structural work is required here to build the sidewalks. However, of bigger concern is the ability to fit four 11-foot lanes with appropriate shoulders under the bridge. The existing width under the bridge and between the bridge piers needs to be further evaluated to determine the ability to create four travel lanes. **Table 24 through Table 27** show the capacity analysis summary side-by-side for comparison.

Walnut Street westbound at Route 20.

Table 24. Capacity Analysis Summary Comparison, a.m. peak hour – Signalized Intersections

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Edgemere Boulevard/Oak Island Driveway	**C**	**33.2**	-	-	-	**E**	**67.2**	-	-	-	**D**	**49.0**	-	-	-
Route 20 EB left (Preferred only)	-	-	-	-	-	-	-	-	-	-	B	11.6	0.07	1	13
Route 20 EB left/thru|thru/right (thru|thru/right under Preferred)	D	48.5	1.05	221	#659	F	>80.0	1.17	~494	#930	E	64.2	1.08	262	#995
Route 20 WB left (Preferred only)	-	-	-	-	-	-	-	-	-	-	B	11.0	0.01	0	5
Route 20 WB left/thru|thru/right (thru|thru/right under Preferred)	A	5.9	0.58	54	223	C	31.6	0.99	170	#600	C	27.0	0.90	113	#735
Oak Island NB left/thru/right	C	29.6	0.00	0	0	C	29.6	0.00	0	0	D	37.7	0.00	0	159
Edgemere SB left/thru/right	C	30.0	0.06	0	22	C	30.1	0.07	0	43	C	34.3	0.06	0	291
Route 20/Lake Street/Edgemere Driveway	**C**	**25.5**	-	-	-	**B**	**19.9**	-	-	-	**D**	**47.0**	-	-	-
Route 20 EB left (Preferred only)	-	-	-	-	-	B	13.1	0.64	46	114	D	38.7	0.66	86	#286
Route 20 EB left/thru|thru (thru|thru/right under Preferred)	C	25.0	0.97	172	#471	B	16.3	0.79	455	666	D	45.7	0.98	595	#1235
Route 20 WB left (Preferred only)	-	-	-	-	-	B	14.9	0.48	13	45	C	31.7	0.50	30	89
Route 20 WB thru|thru/right	C	20.7	0.71	174	136	B	15.6	0.64	267	462	D	40.7	0.89	373	#799
Edgemere NB left (No-Build, left/left in Preferred)	Doesn't exist under existing conditions					D	45.6	0.58	48	92	E	56.8	0.35	28	68
Edgemere NB thru/right (No-Build and Preferred)						D	37.9	0.05	0	2	D	54.9	0.05	0	0
Lake SB left (left/thru in No-Build and Preferred)	E	63.2	0.75	78	#133	D	49.9	0.54	42	91	F	>80.0	1.05	86	#278
Lake SB right (thru/right in No-Build, right only in Preferred)	C	24.8	0.12	0	38						D	40.1	0.14	0	47
Route 20/Grafton Street	**C**	**24.8**	-	-	-	**D**	**47.2**	-	-	-	**D**	**48.6**	-	-	-
Route 20 EB left (No-Build and Preferred)	-	-	-	-	-	E	65.8	0.72	34	#118	D	45.5	0.33	36	#131
Route 20 EB left/thru|thru/right (thru|thru/right under Preferred)	C	24.0	0.94	223	#405	B	19.0	0.87	316	#877	D	46.1	1.00	543	#1098
Route 20 WB left (Preferred only)	-	-	-	-	-	-	-	-	-	-	F	>80.0	0.68	17	#60
Route 20 WB left/thru|thru/right (thru|thru/right under Preferred)	A	7.8	0.54	66	107	C	31.5	0.91	256	#624	C	33.2	0.84	344	525
Grafton NB left/thru/right	E	60.9	0.86	58	#155	F	>80.0	1.28	~144	#387	F	>80.0	0.99	147	#400
Grafton SB left/thru/right	E	60.7	0.86	56	#135	F	>80.0	1.20	~132	#373	F	>80.0	0.93	141	#386

Table 24. Capacity Analysis Summary Comparison, a.m. peak hour – Signalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Cherry Street/Centech Boulevard	**C**	**28.4**	**-**	**-**	**-**	**F**	**>80.0**	**-**	**-**	**-**	**E**	**55.1**	**-**	**-**	**-**
Route 20 EB left	A	8.5	0.10	5	12	A	9.6	0.19	8	19	D	46.0	0.21	36	108
Route 20 EB thru|thru/right (thru/thru in Preferred)	C	22.1	0.87	287	395	F	>80.0	1.17	~613	#752	E	63.4	1.01	582	#1093
Route 20 EB right (Preferred only)	-	-	-	-	-	-	-	-	-	-	B	15.5	0.34	9	41
Route 20 WB left (left/left in Preferred)	B	12.0	0.40	14	21	D	44.8	0.86	54	#175	E	67.6	0.75	83	#182
Route 20 WB thru/right (thru|thru/right for Preferred)	B	12.7	0.59	166	270	B	19.8	0.81	280	#518	D	39.2	0.68	279	401
Centech NB left/thru (left/left for Preferred)	F	>80.0	1.04	107	114	F	>80.0	2.67	~400	#578	F	>80.0	0.96	150	#330
Centech NB thru (Preferred only)	B	18.3	0.22	29	57	C	22.2	0.47	74	136	D	47.6	0.31	65	148
Centech NB right (Preferred only)											D	37.0	0.17	0	71
Cherry SB left/thru (left for Preferred)	D	48.0	0.85	~125	103	F	>80.0	3.83	~205	#320	D	47.0	0.36	47	116
Cherry SB right (thru/right for Preferred)	B	19.3	0.03	30	58	C	20.3	0.02	0	14	F	>80.0	0.92	132	#351
Route 20/South Street/Green Street	**C**	**21.9**	**-**	**-**	**-**	**F**	**>80.0**	**-**	**-**	**-**	**C**	**32.2**	**-**	**-**	**-**
Route 20 EB left	A	6.4	0.57	48	86	F	>80.0	1.11	~218	#406	C	30.4	0.77	143	#491
Route 20 EB thru/right (thru|thru/right for Preferred)	C	26.6	0.95	485	#908	F	>80.0	1.20	~949	#1199	C	22.1	0.79	242	#773
Route 20 WB left	B	12.2	0.45	97	169	D	41.5	0.96	271	#425	D	49.0	0.10	2	12
Route 20 WB thru|thru/right (thru/thru in Preferred)											D	47.2	0.87	198	#425
Route 20 WB right (Preferred only)	-	-	-	-	-	-	-	-	-	-	C	23.0	0.25	16	101
Green NB left	C	28.4	0.26	36	55	C	27.9	0.24	36	79	D	49.4	0.14	5	25
Green NB thru/right											E	73.6	0.73	41	#133
South SB left	D	46.0	0.79	101	142	F	>80.0	1.16	~252	#442	D	35.7	0.39	63	153
South SB thru/right											D	40.3	0.27	6	#143

Table 24. Capacity Analysis Summary Comparison, a.m. peak hour – Signalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/ Old Shrewsbury Village /Valente Drive	-	-	-	-	-	**C**	**23.5**	-	-	-	**C**	**29.2**	-	-	-
Route 20 EB left	B	10.1	0.04	-	3	D	54.3	0.29	10	30	E	56.1	0.33	10	31
Route 20 EB thru|thru/right	A	0.0	0.00	-	0	B	14.9	0.75	150	#830	C	29.6	0.87	410	#682
Route 20 WB left (left|left for No-Build, Preferred)	B	12.7	0.10	-	8	F	>80.0	1.02	~112	#198	D	46.3	0.58	95	126
Route 20 WB thru|thru/right	A	0.0	0.00	-	0	A	9.5	0.40	46	365	B	17.9	0.50	155	389
Valente NB left/thru (for No-Build, Preferred)	-	-	-	-	-	E	66.1	0.54	15	41	D	46.9	0.51	61	#187
Valente NB right	C	21.9	0.28	-	28	D	46.3	0.10	0	39	D	35.8	0.52	101	196
Old Shrewsbury Village SB left/thru	F	>50.0	0.53	-	45	E	56.4	0.19	3	16	E	71.9	0.38	3	16
Old Shrewsbury Village SB right	B	11.0	0.04	-	3	D	48.3	0.01	0	0	D	50.0	0.01	0	0
Route 20/Route 9 EB on ramp	**A**	**2.6**	-	-	-	**A**	**4.8**	-	-	-	**A**	**3.6**	-	-	-
Route 20 EB thru	A	5.3	0.51	81	148	B	10.5	0.69	162	405	A	7.6	0.70	177	271
Route 20 WB left	A	1.0	0.26	0	1	A	4.5	0.36	0	7	A	3.9	0.35	0	2
Route 20 WB thru|thru	A	0.1	0.18	0	0	A	0.3	0.33	0	0	A	0.3	0.33	0	0
Route 20/Route 9 WB on/off ramp	**A**	**8.7**	-	-	-	**B**	**10.2**	-	-	-	**A**	**7.4**	-	-	-
Route 20 EB left	C	30.0	0.28	25	m49	B	12.8	0.28	33	m46	B	17.9	0.33	31	m63
Route 20 EB thru	A	7.5	0.58	144	286	A	7.1	0.72	187	208	A	5.2	0.73	94	25
Route 20 WB thru|thru/right	A	4.4	0.28	36	63	B	10.5	0.51	152	154	A	5.2	0.49	78	96
Route 9 off ramp NB right	C	22.4	0.09	0	0	C	24.0	0.11	0	42	C	23.5	0.11	0	43

Table 24. Capacity Analysis Summary Comparison, a.m. peak hour – Signalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Shops Way/Baseball Complex Drive	**C**	**27.6**	**-**	**-**	**-**	**C**	**30.4**	**-**	**-**	**-**	**C**	**27.2**	**-**	**-**	**-**
Route 20 EB left|left	D	49.1	0.67	115	139	D	49.0	0.64	118	150	D	42.9	0.65	101	139
Route 20 EB thru/right	B	17.8	0.57	228	372	C	20.1	0.80	274	#627	B	17.0	0.76	343	541
Route 20 WB left	E	78.8	0.55	8	21	D	53.5	0.40	24	58	D	53.5	0.40	24	58
Route 20 WB thru|thru/right	B	18.5	0.29	63	122	C	20.1	0.44	156	226	B	17.5	0.41	141	204
Baseball Complex NB left	E	59.3	0.21	3	8	E	58.8	0.47	17	48	E	58.8	0.47	17	48
Baseball Complex NB left/thru	E	59.3	0.21	3	8	E	58.8	0.47	17	48	E	58.8	0.47	17	48
Baseball Complex NB right	A	0.0	0.00	0	0	D	46.2	0.01	0	0	D	46.2	0.01	0	0
Shops Way SB left/thru	D	50.1	0.67	102	44	E	77.3	0.86	109	#233	E	68.3	0.79	100	#227
Shops Way SB right|right	C	27.8	0.10	0	27	C	30.0	0.11	0	30	C	32.7	0.10	0	32

 # = 95th percentile volume exceeds capacity, queue may be longer.
~=Volume exceeds capacity, queue is theoretically infinite.
m = Volume of 95th percentile queue is metered by upstream signal.

Table 25. Capacity Analysis Summary Comparison, a.m. peak hour – Unsignalized Intersections

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Purinton Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0	A	0.0	0.98	-	0	A	0.0	0.00	-	0
Route 20 WB left/thru (left/thru|thru for No-Build and Preferred)	B	12.2	0.01	-	0	C	15.8	0.01	--	0	C	15.8	0.01	-	0
Purinton NB left/right	A	0.0	0.00	-	0	F	>50.0	0.09	-	6	F	>50.0	0.09	-	7
Route 20/Route 140 West Off-Ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru (thru/thru for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru/thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 140 West NB right	F	>50.0	1.60	-	342	F	>50.0	10.66	-	>2000	E	43.1	0.73	-	135
Route 20/Route 140 East Off-Ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru (thru/thru for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru (thru/thru for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 140 East SB right	B	13.5	0.22	-	20	E	38.3	0.67	-	110	C	17.2	0.40	-	48
Route 20/Clews Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru/right (thru|thru/right for Preferred)	A	0.0	0.00	-	0	A	0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left/thru (left only for Preferred)	B	12.8	0.05	-	5	C	17.2	0.08	-	5	C	17.2	0.08	-	5
Route 20 WB thru/thru (Preferred Only)	-	-	-	-	-	-	-	-	-	-	A	0.0	0.00	-	0
Clews St NB left/right	F	>50.0	0.94	-	178	F	>50.0	2.09	-	405	F	>50.0	0.88	-	173
Route 20/Stoney Hill Road (West)/Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB left (Preferred only)											B	11.0	0.06	-	5
Route 20 EB left/thru|thru/right (thru|thru/right in Preferred	A	9.1	0.07	-	5	B	11	0.06	-	5	A	0.0	0.00	-	0
Route 20 WB left/thru (left only for Preferred)	B	12.6	0.01	-	0	C	17.7	0.03	-	3	C	17.7	0.03	-	3

Table 25. Capacity Analysis Summary Comparison, a.m. peak hour – Unsignalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20 WB thru/thru (Preferred Only)	-	-	-	-	-	-	-	-	-	-	A	0.0	0.00	-	0
Route 20 WB right	A	0.0	0.00	-	0	A	0	0.00	-	0	A	0.0	0.00	-	0
Stoney Hill NB left/thru/right	F	>50.0	1.46	-	125	F	>50.0	6.83	-	188	F	>50.0	3.42	-	170
Driveway SB left/thru/right	B	13.8	0.01	-	0	C	22.2	0.01	-	0	B	14.2	0.01	-	0
Route 20/Commerce Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB left/thru (left only for Preferred)	A	9.2	0.03	-	3	B	11.3	0.04	-	3	B	11.7	0.05	-	3
Route 20 EB thru/thru (Preferred Only)	-	-	-	-	-	-	-	-	-	-	A	0.0	0.00	-	0
Route 20 WB thru/right (thru|thru/right for Preferred)	A	0.0	0.00	-	0	A	0	0.00	-	0	A	0.0	0.00	-	0
Commerce SB left/right	F	>50.0	0.37	-	35	F	>50.0	1.03	-	68	F	>50.0	0.34	-	30
Route 20/Stoney Hill Road (East)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru/right (thru|thru/right for Preferred)	A	0.0	0.00	-	0	A	0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left/thru (left only for Preferred)	B	14.0	0.03	-	3	C	20.0	0.03	-	3	C	21.9	0.03	-	3
Route 20 WB thru/thru (Preferred Only)	-	-	-	-	-	-	-	-	-	-	A	0.0	0.00	-	0
Stoney Hill NB left-turn/right-turn	F	>50.0	0.81	-	105	F	>50.0	1.94	-	180	E	45.4	0.43	-	48
Route 20/South Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru/right (thru|thru/right for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left	B	13.7	0.01	-	0	C	16.6	0.03	-	3	C	17.5	0.03	-	3
Route 20 WB thru/thru											A	0.0	0.00	-	0
South St NB left/right	F	>50.0	0.46	-	50	F	>50.0	1.12	-	143	F	>50.0	1.03	-	133

Table 25. Capacity Analysis Summary Comparison, a.m. peak hour – Unsignalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Commons Drive/Sunbelt Rentals Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB left	A	8.9	0.01	-	0	B	10.2	0.01	-	0	B	10.2	0.01	-	0
Route 20 EB thru/right (thru|thru/right for Preferred)											A	0.0	0.00	-	0
Route 20 WB left	A	0	0.00	-	0	A	0.0	0.00	-	0	B	13.5	0.00	-	0
Route 20 WB thru|thru/right											A	0.0	0.00	-	0
Commons SB left/thru/right	F	>50.0	0.19	-	15	F	>50.0	0.32	-	23	C	22.1	0.25	-	25
Sunbelt Rentals NB left/thru/right	D	31.4	0.38	-	43	F	>50.0	0.59	-	73	F	>50.0	0.42	-	25
Route 20/Dunkin Donuts Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left	B	12.5	0.07	-	5	B	14.7	0.08	-	7	B	14.7	0.08	-	7
Route 20 WB thru|thru											A	2.6	0.00	-	0
Dunkin Donuts NB left/right	F	>50.0	1.11	-	258	F	>50.0	1.77	-	358	F	>50.0	0.81	-	150
Route 20/Avalon Way	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru/thru|right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.00	0.0	-	0
Route 20 WB left	B	14.2	0.03	-	3	C	17.3	0.02	-	3	C	17.3	0.02	-	3
Route 20 WB thru|thru											A	0.0	0.00	-	0
Avalon WB left/right	E	38.2	0.44	-	53	F	>50.0	0.70	-	93	D	30.3	0.34	-	38
Route 20/Walnut Street N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB left	A	8.8	0.01	-	0	B	10.3	0.02	-	3	B	10.3	0.02	-	3
Route 20 EB thru/thru											A	0.0	0.00	-	0
Route 20 WB thru|thru/right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Walnut SB left/right	C	15.4	0.12	-	10	C	23.1	0.20	-	18	C	21.5	0.19	-	18

Table 25. Capacity Analysis Summary Comparison, a.m. peak hour – Unsignalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Walnut Street S	-	-	-	-	-	-	-	-	-	-	Under this concept, Walnut Street South has been realigned to connect to Valente Drive. See analysis results for Valente Drive/ Walnut Street S.				
Route 20 EB thru/thru|right	A	0.0	0.00	-	0	A	0.0	0.00	-	0					
Route 20 WB left (no left in Preferred)	B	11.7	0.04	-	3	B	13.7	0.07	-	5					
Route 20 WB thru/thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0					
Walnut NB left (no left Preferred)	F	>50.0	0.64	-	78	F	>50.0	1.71	-	200					
Walnut NB right (no right in Preferred)	C	16.5	0.28	-	28	C	23.6	0.46	-	58					
Valente Drive/Walnut Street S	Intersection doesn't exist in this condition					Intersection doesn't exist in this condition					-	-	-	-	-
Walnut EB left/right											C	18.8	0.48	-	63
Valente NB left											A	0.0	0.00	-	0
Valente NB thru											A	0.0	0.00	-	0
Valente SB thru|thru/right											A	0.0	0.00	-	0
Route 20 WB/Route 9 EB off ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 9 EB off ramp SB right	B	10.5	0.04	-	3	B	14.4	0.20	-	18	B	14.4	0.20	-	18
Route 20 EB/Route 9 EB off ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 9 EB off ramp NB right	C	17.0	0.37	-	32	D	28.9	0.60	-	93	D	28.9	0.60	-	93

Table 25. Capacity Analysis Summary Comparison, a.m. peak hour – Unsignalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20 WB/Route 9 WB off ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 9 WB off ramp SB right	B	13.5	0.43	-	55	E	40.7	0.89	-	265	E	40.7	0.89	-	265

Table 26. Capacity Analysis Summary Comparison, p.m. peak hour – Signalized Intersections

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Edgemere Boulevard/Oak Island Driveway	**D**	**44.4**	**-**	**-**	**-**	**F**	**>80.0**	**-**	**-**	**-**	**E**	**60.5**	**-**	**-**	**-**
Route 20 EB left (Preferred only)	-	-	-	-	-	-	-	-	-	-	C	31.8	0.44	7	63
Route 20 EB left/thru|thru/right (thru|thru/right under Preferred)	D	38.4	1.00	134	#495	F	>80.0	2.19	~586	#980	B	10.3	0.69	167	698
Route 20 WB left (Preferred only)	-	-	-	-	-	-	-	-	-	-	A	9.2	0.01	0	4
Route 20 WB left/thru|thru/right (thru|thru/right under Preferred)	D	49.5	1.05	221	#691	F	>80.0	1.69	~746	#1248	F	>80.0	1.15	~907	#1655
Oak Island NB left/thru/right	C	29.8	0.01	0	0	C	29.7	0.00	0	0	E	59.0	0.00	0	0
Edgemere SB left/thru/right	C	31.6	0.27	11	38	C	31.7	0.29	12	60	E	55.7	0.05	0	0
Route 20/Lake Street/Edgemere Driveway	**D**	**52.4**	**-**	**-**	**-**	**E**	**69.0**	**-**	**-**	**-**	**F**	**>80.0**	**-**	**-**	**-**
Route 20 EB left (Preferred only)	-	-	-	-	-	F	>80.0	1.15	~206	#383	F	>80.0	1.11	~174	#509
Route 20 EB left/thru|thru (thru|thru/right under Preferred)	E	77.0	1.24dl	~184	#356	B	11.9	0.62	286	351	C	32.9	0.86	414	#905
Route 20 WB left (Preferred only)	-	-	-	-	-	E	78.1	0.94	116	#267	D	49.2	0.83	59	#267
Route 20 WB thru|thru/right	B	17.9	0.87	306	430	E	74.1	1.08	~878	#1018	F	>80.0	1.30	~913	#1555
Edgemere NB left (No-Build, left/left in Preferred)	Doesn't exist under existing conditions					F	>80.0	0.91	108	#213	E	71.4	0.76	63	#163
Edgemere NB thru/right (No-Build and Preferred)						C	34.5	0.15	19	73	D	55.0	0.09	0	0
Lake SB left/thru (No-Build and Preferred)	E	71.1	0.82	113	#219	F	>80.0	1.16	~216	#336	F	>80.0	1.08	128	#374
Lake SB thru/right (No-Build, right only in Preferred)	F	>80.0	0.98	~223	#417						D	44.7	0.45	29	157

Table 26. Capacity Analysis Summary Comparison, p.m. peak hour – Signalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Grafton Street	**B**	**18.7**	-	-	-	**F**	**>80.0**	-	-	-	**E**	**57.6**	-	-	-
Route 20 EB left (No-Build and Preferred)	-	-	-	-	-	D	53.1	0.62	30	#101	E	65.2	0.57	44	#139
Route 20 EB left/thru|thru/right (thru|thru/right under Preferred)	A	9.8	0.74	102	#218	B	12.3	0.66	184	495	B	18.5	0.67	312	626
Route 20 WB left (Preferred only)	-	-	-	-	-	-	-	-	-	-	F	>80.0	0.74	41	#122
Route 20 WB left/thru|thru/right (thru|thru/right under Preferred)	C	21.5	0.93	194	#389	F	>80.0	1.54	~796	#1345	E	70.9	1.07	740	#1351
Grafton NB left/thru/right	D	35.9	0.69	52	83	F	>80.0	1.05	107	#342	F	>80.0	1.07	155	#406
Grafton SB left/thru/right	C	27.4	0.49	35	62	E	70.5	0.89	95	#306	F	>80.0	0.89	139	#356
Route 20/Cherry Street/Centech Boulevard	**D**	**40.5**	-	-	-	**F**	**>80.0**	-	-	-	**D**	**44.5**	-	-	-
Route 20 EB left	B	15.8	0.18	4	6	C	26.0	0.26	5	12	C	29.1	0.34	11	41
Route 20 EB thru|thru/right (thru/thru in Preferred)	A	9.7	0.36	106	144	B	13.0	0.62	245	365	C	28.2	0.61	258	500
Route 20 EB right (Preferred only)	-	-	-	-	-	-	-	-	-	-	B	13.4	0.26	0	29
Route 20 WB left (left/left in Preferred)	A	4.9	0.27	19	28	C	20.4	0.75	39	128	E	60.1	0.69	98	174
Route 20 WB thru/right (thru|thru/right for Preferred)	C	25.1	0.91	554	#958	F	>80.0	1.35	~1564	#1853	D	46.2	0.97	592	#1149
Centech NB left/thru (left/left for Preferred)	F	>80.0	1.17	~152	#203	F	>80.0	4.76	~691	#906	E	71.5	0.89	163	#342
Centech NB thru (Preferred only)	C	30.7	0.02	0	13	C	32.8	0.22	24	77	D	49.8	0.38	72	161
Centech NB right (Preferred only)											D	36.4	0.13	0	62
Cherry SB left/thru (left only in Preferred)	F	>80.0	1.13	~235	#313	F	>80.0	3.82	~240	#386	D	51.3	0.44	52	125
Cherry SB right (thru/right in Preferred)	C	28.4	0.06	0	31	D	35.1	0.02	0	23	F	>80.0	0.96	94	#280

Table 26. Capacity Analysis Summary Comparison, p.m. peak hour – Signalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/South Street/Green Street	**C**	**21.1**	**-**	**-**	**-**	**F**	**>80.0**	**-**	**-**	**-**	**C**	**33.5**	**-**	**-**	**-**
Route 20 EB left	B	11.1	0.51	20	47	C	24.1	0.67	44	110	D	51.2	0.75	82	#247
Route 20 EB thru/right (thru|thru/right for Preferred)	A	8.1	0.61	186	300	C	21.6	0.90	405	#760	C	29.1	0.74	333	463
Route 20 WB left	C	24.0	0.90	323	#509	F	>80.0	1.44	~653	#857	C	20.6	0.16	14	52
Route 20 WB thru|thru/right (thru/thru in Preferred)											C	32.1	0.88	387	#816
Route 20 WB right (Preferred only)	-	-	-	-	-	-	-	-	-	-	B	17.5	0.23	33	121
Green NB left	C	24.3	0.10	11	35	C	25.1	0.10	13	43	D	51.5	0.12	4	21
Green NB thru/right											D	52.9	0.38	15	58
South SB left	D	43.0	0.82	118	#252	F	>80.0	1.55	~418	#646	D	47.1	0.70	121	#310
South SB thru/right											D	44.5	0.37	15	#179
Route 20/Old Shrewsbury Village Valente Drive/ Valente Drive	**-**	**-**	**-**	**-**	**-**	**F**	**>80.0**	**-**	**-**	**-**	**D**	**46.1**	**-**	**-**	**-**
Route 20 EB left	B	11.9	0.07	-	5	D	45.2	0.34	20	51	D	53.3	0.39	23	57
Route 20 EB thru|thru/right	A	0.0	0.00	-	0	F	>80.0	1.39	376	#746	E	58.6	0.99	398	#536
Route 20 WB left (left|left for Preferred)	B	10.0	0.08	-	8	D	35.9	0.53	149	#321	D	40.2	0.62	187	255
Route 20 WB thru|thru/right	A	0.0	0.00	-	0	C	31.2	0.93	246	#897	C	22.7	0.85	255	#814
Valente NB left/thru	D	26.9	0.52	-	70	D	48.2	0.61	54	#149	D	53.3	0.68	106	#279
Valente NB right						C	23.4	0.40	3	#128	E	74.9	1.03	402	#775
Old Shrewsbury Village SB left/thru	F	>50.0	0.69	-	55	D	50.0	0.35	10	31	E	59.4	0.40	12	35
Old Shrewsbury Village SB right	C	15.1	0.16	-	15	D	40.2	0.03	0	0	D	47.5	0.03	0	0

Table 26. Capacity Analysis Summary Comparison, p.m. peak hour – Signalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Route 9 EB on ramp	**A**	**1.2**	-	-	-	**B**	**10.7**	-	-	-	**A**	**6.2**	-	-	-
Route 20 EB thru	A	3.4	0.36	65	135	B	19.1	0.80	317	m535	B	11.6	0.76	523	m627
Route 20 WB left	A	0.9	0.38	0	0	D	42.4	0.71	87	m161	C	20.9	0.70	64	m150
Route 20 WB thru|thru	A	0.3	0.36	0	0	A	0.5	0.54	0	0	A	0.5	0.54	0	0
Route 20/Route 9 WB on/off ramp	**B**	**16.5**	-	-	-	**C**	**22.7**	-	-	-	**C**	**22.9**	-	-	-
Route 20 EB left	D	46.5	0.62	103	141	D	39.7	0.77	186	m195	E	63.3	0.82	237	m316
Route 20 EB thru (thru|thru for Preferred)	A	5.7	0.52	90	337	C	23.3	0.89	517	#889	A	9.3	0.83	110	136
Route 20 WB thru|thru/right	B	10.9	0.53	256	273	B	12.4	0.81	290	m#379	B	12.4	0.77	333	442
Route 9 off ramp NB right	D	44.2	0.66	84	167	D	51.5	0.85	176	#324	E	73.3	0.92	199	#386
Route 20/Shops Way/Baseball Complex Drive	**D**	**37.0**	-	-	-	**D**	**42.3**	-	-	-	**D**	**39.2**	-	-	-
Route 20 EB left|left	D	36.8	0.76	172	206	D	44.5	0.88	205	m240	D	52.7	0.91	234	m#323
Route 20 EB thru/right	B	15.5	0.47	183	158	C	22.1	0.81	290	m438	B	17.0	0.74	336	m521
Route 20 WB left	F	>80.0	0.88	39	49	D	50.0	0.56	34	73	C	24.4	0.20	26	54
Route 20 WB thru|thru/right	C	31.3	0.71	213	283	D	49.6	0.97	347	#492	D	40.4	0.89	400	#537
Baseball Complex NB left	E	56.7	0.61	30	47	E	58.4	0.62	30	#77	F	>80.0	0.72	35	#94
Baseball Complex NB left/thru	D	54.4	0.59	30	65	E	56.4	0.61	31	#77	E	79.0	0.70	36	#93
Baseball Complex NB right	D	39.2	0.01	0	0	D	37.7	0.01	0	0	D	46.6	0.01	0	0
Shops Way SB left/thru	F	>80.0	1.04	~151	#117	F	>80.0	1.02	~172	#316	F	>80.0	0.91	156	#298
Shops Way SB right|right	C	23.3	0.44	86	136	C	26.8	0.60	136	199	C	30.5	0.60	164	228

 # = 95th percentile volume exceeds capacity, queue may be longer.
~=Volume exceeds capacity, queue is theoretically infinite.
m = Volume of 95th percentile queue is metered by upstream signal.

Table 27. Capacity Analysis Summary Comparison, p.m. peak hour – Unsignalized Intersections

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Purinton Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0	A	0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left/thru (left/thru|thru for No-Build and Preferred)	A	0.0	0.00	-	0	A	0	0.00	-	0	A	0.0	0.00	-	0
Purinton St NB left/right	E	37.7	0.07	-	5	F	77.4	0.08	-	7	F	>50.0	0.08	-	7
Route 20/Route 140 West Off-Ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru (thru/thru for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru/thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 140 West NB right	C	15.4	0.23	-	22	F	>50.0	0.87	-	154	A	0.0	0.00	-	0
Route 20/Route 140 East Off-Ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru (thru/thru for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru (thru/thru for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 140 East SB right	E	35.1	0.58	-	83	F	>50.0	3.12	-	>2000	F	>50.0	1.16	-	345
Route 20/Clews Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru/right (thru|thru/right for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left/thru (left only for Preferred)	A	9.4	0.13	-	13	B	13.4	0.24	-	23	B	13.9	0.25	-	25
Route 20 WB thru/thru (Preferred Only)	-	-	-	-	-	-	-	-	-	-	A	0.0	0.00	-	0
Clews St NB left/right	B	14.5	0.20	-	20	E	42.6	0.57	-	78	C	17.1	0.29	-	30

Table 27. Capacity Analysis Summary Comparison, p.m. peak hour – Unsignalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Stoney Hill Road (West)/Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB left (Preferred only)	-	-	-	-	-	-	-	-	-	-	D	26.6	0.07	-	5
Route 20 EB left/thru|thru/right (thru|thru/right in Preferred)	B	12.9	0.03	-	3	C	24.7	0.07	-	5	A	0.0	0.00		0
Route 20 WB left/thru (left only for Preferred)	A	9.2	0.02	-	3	B	12.2	0.02	-	3	B	12.2	0.02	-	3
Route 20 WB thru/thru (Preferred Only)	-	-	-	-	-	-	-	-	-	-	A	0.0	0.00	-	0
Route 20 WB right	A	0.0	0.00	-	0	A	0	0.00	-	0	A	0.0	0.00	-	0
Stoney Hill NB left/thru/right	F	>50.0	0.52	-	50	F	>50.0	5.98	-	113	F	>50.0	0.85	-	70
Driveway SB left/thru/right	F	>50.0	0.14	-	13	F	>50.0	0.30	-	18	F	>50.0	0.27	-	18
Route 20/Commerce Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB left/thru (left only for Preferred)	B	13.9	0.01	-	0	D	27.4	0.02	-	3	E	38.7	0.03	-	3
Route 20 EB thru/thru (Preferred Only)											A	0.0	0.00	-	0
Route 20 WB thru/right (thru|thru/right for Preferred)	A	0.0	0.00	-	0	A	0	0.00	-	0	A	0.0	0.00	-	0
Commerce SB left/right	E	35.7	0.19	-	18	F	>50.0	0.82	-	70	F	>50.0	0.31	-	30
Route 20/Stoney Hill Road (East)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru/right (thru|thru/right for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left/thru (left only for Preferred)	A	9.2	0.05	-	3	B	12.4	0.08	-	7	B	12.4	0.08	-	7
Route 20 WB thru/thru (Preferred Only)	-	-	-	-	-	-	-	-	-	-	A	0.0	0.00	-	12
Stoney Hill Rd NB left-turn/right-turn	D	29.9	0.29	-	30	F	>50.0	1.61	-	123	C	23.2	0.17	-	15
Route 20/South Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru/right (thru|thru/right for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left	A	9.9	0.04	-	3	B	12.3	0.09	-	7	B	12.3	0.09	-	7
Route 20 WB thru/thru											A	0.0	0.00	-	0
South St NB left/right	E	48.2	0.37	-	40	D	28.5	0.27	-	28	F	>50.0	0.99	-	115

Table 27. Capacity Analysis Summary Comparison, p.m. peak hour – Unsignalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Commons Drive/Sunbelt Rentals Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB left	B	12.3	0.05	-	5	C	15.6	0.05	-	5	C	15.6	0.05	-	5
Route 20 EB thru/right (thru|thru/right for Preferred)											A	0.0	0.00	-	0
Route 20 WB left	A	0.0	0.00	-	0	A	0.0	0.00	-	0	B	11.2	0.00	-	0
Route 20 WB thru|thru/right											A	0.0	0.00	-	0
Sunbelt Rentals Driveway NB left/thru/right	F	>50.0	0.21	-	20	F	>50.0	0.17	-	13	F	>50.0	0.18	-	13
Commons Drive SB left/right	C	15.0	0.10	-	8	C	19.3	0.13	-	10	C	19.5	0.13	-	13
Route 20/Dunkin Donuts Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru|thru/right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left	A	9.6	0.03	-	3	B	11.4	0.03	-	3	B	11.4	0.03	-	3
Route 20 WB thru|thru (left/ thru|thru for Preferred)											A	5.6	0.00	-	0
Dunkin Donuts Driveway NB left/right	D	27.8	0.33	-	36	B	14.0	0.10	-	7	B	14.0	0.10	-	15
Route 20/Avalon Way	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru/thru|right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB left	A	9.8	0.07	-	5	B	11.7	0.08	-	5	B	11.7	0.08	-	5
Route 20 WB thru|thru											A	5.6	0.00	-	0
Avalon WB left/right	E	43.4	0.40	-	43	B	14.1	0.11	-	10	B	14.1	0.11	-	10
Route 20/Walnut Street N	-	-	-	-	-	--	-	-	-	-	-	-	-	-	-
Route 20 EB left (Preferred Only)	-	-	-	-	-	-	-	-	-	-	B	14.5	0.01	-	0
Route 20 EB left/thru|thru (thru/thru in Preferred)	B	11.5	0.01	-	0	B	14.5	0.01	-	0	A	0.0	0	-	0
Route 20 WB thru|thru/right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0	-	0
Walnut Street SB left/right	C	21.0	0.32	-	35	F	>50.0	0.70	-	108	F	>50.0	0.69	-	108

Table 27. Capacity Analysis Summary Comparison, p.m. peak hour – Unsignalized Intersections (cont'd)

Intersection/Movement	LOS	Delay (sec.)	V/C Ratio	50th Percentile	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)	LOS	Delay (sec.)	V/C Ratio	50th Percentile Queue Length (feet)	95th Percentile Queue Length (feet)
	Existing (2017)					No Build (2037)					Preferred Concept				
Route 20/Walnut Street S	-	-	-	-	-	-	-	-	-	-	Under this concept, Walnut Street South has been realigned to connect to Valente Drive. See analysis results for Valente Drive/ Walnut Street S.				
Route 20 EB thru/thru|right	A	0.0	0.00	-	0	A	0.0	0.00	-	0					
Route 20 WB left (no left in Preferred)	B	10.3	0.14	-	13	B	13.1	0.20	-	18					
Route 20 WB thru/thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0					
Walnut Street NB left (no left in Preferred)	F	>50.0	1.31	-	200	F	>50.0	2.36	-	203					
Walnut Street NB right (no right in Preferred)	B	12.9	0.20	-	20	C	17.4	0.32	-	35					
Valente Drive/Walnut Street S	Intersection doesn't exist in this condition					Intersection doesn't exist in this condition					-	-	-	-	-
Valente Drive NB left											A	0.0	0.00	-	0
Valente Drive NB thru											A	0.0	0.00	-	0
Valente Drive SB thru|thru/right											A	0.0	0.00	-	0
Walnut Street EB left/right											F	>50.0	1.52	-	355
Route 20 WB/Route 9 EB off ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 9 EB off ramp SB right	C	15.7	0.19	-	18	F	>50.0	0.84	-	168	F	>50.0	0.84	-	168
Route 20 EB/Route 9 EB off ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru (thru|thru for Preferred)	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 9 EB off ramp NB right	C	24.8	0.66	-	120	F	>50.0	1.43	-	518	F	>50.0	1.43	-	518
Route 20 WB/Route 9 WB off ramp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Route 20 EB thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 20 WB thru|thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
Route 9 WB off ramp SB right	F	>50.0	1.16	-	528	F	>50.0	2.32	-	1362	F	>50.0	2.32	-	1702

TRANSPORTATION DEMAND MANAGEMENT

As on-going development of the Route 20 corridor continues, it is recommended that the Town develop a set of Travel Demand Management (TDM) strategies with the goal of creating a robust TDM program that will encourage employees and residents to travel via non automobile travel modes. The potential TDM elements include:

ALTERNATIVE MODE BENEFITS/TACTICS

The primary alternative transportation modes to be encouraged will be public transportation, bicycling, and walking.

- Businesses will designate a transportation coordinator to oversee transportation issues, including parking, service and loading, and deliveries;
- On-site management will work with employees/residents as they move in to help facilitate transportation for new arrivals;
- Businesses will provide orientation packets to new employees/residents containing information on available transportation choices, including public transportation routes/schedules, nearby vehicle sharing and bicycle sharing locations, and walking opportunities;
- Provide information on travel alternatives for employees/residents and visitors via the Internet and in the building lobby; and
- Investigate the feasibility of creating a local Transportation Management Association.

BICYCLE/PEDESTRIAN TRIPS

Promotions and incentives to encourage bicycle and pedestrian trips include:

- Providing bike and pedestrian access information on the company website;
- Providing covered, secure bicycle storage for building occupants;
- Providing on-site external bike racks for visitors; and
- Encouraging businesses to provide a "Guaranteed Ride Home" for those commuting on foot or by bike.

ELECTRIC VEHICLES

The goal of the following promotion and incentive measures are to accommodate tenants/residents/guests traveling in an electric vehicle:

- Provide electric vehicle charging stations to accommodate 5 percent of the total parking and sufficient infrastructure capacity for future accommodation of at least 15% of the total parking spaces; and
- Designate up to 5% of the parking spaces as preferred parking for low emission vehicles.

RIDE-SHARING

The goal of the following promotion and incentive measures are to increase ridesharing:

- Encouraging businesses to participate in area airport shuttle services;
- Provide access to information on area carpool and vanpool participants;
- Encouraging businesses to provide on-line registration for a ride-matching program;
- Encouraging businesses to organize an internal ride-matching program for employees who would be more willing to participate in a ride-matching service with fellow employees than with a large regional database; and
- Vehicle Sharing Program: businesses will explore the feasibility of providing spaces on their property for a car sharing service (eg, Zipcar and/or Enterprise CarShare).

Over time, as a culture takes root that encourages employees and residents to travel via non automobile travel modes, MassDOT and the Town should explore strategies for linking people to the nearby public transportation routes. A robust system can be created step by step. As a potential first step to add better public transit access, the Town could explore the introduction of a new bike share system paired with improved bicycle accommodations on roads that connect the MBTA Commuter Rail stations with employers in the study corridor. If shown to be successful, this could be followed by employers in the corridor organizing a shuttle van that transports employees and visitors between their worksites and the MBTA Commuter Rail stations. Incremental improvements can also be made to add fixed route WRTA service in the corridor as development occurs at greater densities. As a potential early example, the Edgemere Crossing at Flint Pond development is proposed to include a Market Basket Supermarket. As resources allow, extending WRTA Route 5 to serve this supermarket may be desirable, especially when paired with potential added development on Route 20 in the City of Worcester. TDM policies that could be linked to public transportation are listed below.

PUBLIC TRANSPORTATION

The goal of the following promotion and incentive measures are to increase public transit use:

- Posting information at worksite locations about public transportation (MBTA Commuter Rail and WRTA Bus Routes);
- Providing transit access information on business websites including information on bus and commuter rail routes and schedules;
- Encourage employers to subsidize on-site full-time employees' purchase of monthly transit passes;
- Promote to commercial businesses that, as employers, they can save on payroll-related taxes and provide employee benefits when they offer transportation benefits such as subsidized public transportation; and
- Promote shared rides or other options for transporting employees/residents from the Route 20 location to the nearby MBTA commuter rail stations.

Order of Implementation

This Master Plan report and related conceptual designs looked into proposed improvements for the entire length of the Route 20 study corridor. MassDOT has asked HSH to assist with planning the implementation of the proposed improvements throughout the Route 20 study corridor in Shrewsbury and Northborough.

The safety issues identified for vehicles turning left from South Street onto Route 20 require immediate attention. The Town should work with MassDOT to install signage and markings to prohibit left turns from South Street onto Route 20.

Improvements at two intersections in the study area have already started design as independent but related efforts to this Master Plan. Due to its classification as one of the top 200 high-crash locations in the Commonwealth, MassDOT is working with another consultant to design improvements at the Route 20/ Grafton Street intersection. The improvements to address the safety issues will be eligible for funding through the federal Highway Safety Improvement Program (HSIP). Separately, the Route 20/Lake Street intersection will also be reconstructed to accommodate the new Edgemere development, with improvements partially funded with the help of a MassWorks grant and partially as mitigation from the private developer. This report, the capacity analyses included in it, and the preferred master plan for this intersection will guide the improvements that will be implemented by MassDOT.

The Route 20/Walnut Street (South) intersection Preferred Concept improvements combined with the signalization of the Valente Drive/Old Shrewsbury Village Driveway intersection should be the first component of this plan to happen next. Walnut Street (South) is an area of concern due to the growth in cut-through traffic coming from the MBTA Westborough Station, delays and crashes that have been experienced at the intersection with Route 20 in the past, and the potential for economic development tied to the Boston Hill Corporate Center development on Valente Drive. The realignment of Walnut Street to create a connection to Valente Drive will require an agreement between the property owners and MassDOT. Fortunately, this can happen concurrently with the design and funding identification process which likely will take four to six years. As this project will likely require federal funding, the next steps needed to implement this project are: (1) the completion of a road safety audit at both intersections, and (2) developing a preliminary cost estimate for construction of the improvements. Depending on the outcome of these two initial steps, MassDOT may consider advancing additional elements of the Preferred Concept design stretching to the adjacent corridor intersection of South Street to the west.

A project area intersection expected to see large traffic impacts due to the planned developments is Route 20 at Centech Boulevard and Cherry Street. At least two large developments are planned on Centech Boulevard (UPS and Centech Park East), and thus will have