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Memorandum

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Project No.: 06971.30

From: Don Cooke, P.E., P.T.O.E.
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Re: Woodland Road
Traffic Safety and Improvements Plan

Vanasse Hangen Brustlin, Inc. (VHB) has conducted an assessment to evaluate the safety and traffic conditions associated with the implementation of the Transportation Safety Improvements Plan ("TSI Plan") (provided under separate cover) along the Woodland Road corridor in Stoneham, Massachusetts, including impacts associated with the construction of the proposed Langwood Commons development. This memorandum presents safety and operational analyses and concludes that the roadway network under future conditions with the TSI plan is able to better accommodate future traffic volumes and operate in a potentially safer and more efficient manner and become a more recreationally-oriented parkway.

STUDY AREA

The study area for the project includes Woodland Road and the following intersections along this roadway:

1. Woodland Road at Pond Street
2. Woodland Road at Ravine Road
3. Woodland Road at the North Site Drive
4. Woodland Road at the South Site Drive
5. Woodland Road at Fulton Street, Elm Street, and Highland Avenue (Molineau Circle)

The study area selected for the analysis presented in this memorandum was determined in consultation with the Department of Conservation and Recreation (DCR), based on the intersections that can be expected to experience a relatively significant increase in traffic volumes due to the proposed Langwood Commons development.

PROJECT DESCRIPTION

The project will consist of the implementation of the TSI Plan along the Woodland Road corridor in Stoneham, Massachusetts. The proponents of the Langwood Commons development and DCR have identified and developed potential roadway improvements for the Woodland Road and Pond Street corridors, between Molineau Circle to the south and a point approximately one-half mile north of the Woodland Road/Pond Street intersection, resulting in the TSI plan.

The analysis provided in this memorandum assumes the full build out of the Langwood Commons project, which is located on the site of the former Boston Regional Medical Center (BRMC) off Woodland Road in Stoneham, Massachusetts. The former BRMC site currently consists of a 300,000 square foot (sf) hospital building and 110,000 sf of medical office space (of which 99,000 sf is currently occupied). There were additional uses previously present on the site which have since been discontinued. An assisted living facility is located to the south of the former BRMC site, with shared access via the former BRMC's site driveways. As part of the Langwood Commons development, the hospital building will be redeveloped to consist of 225,000 sf of general office space, with the 110,000 sf of medical office space being retained. The project will also contain a residential component, consisting of the construction of 261 apartment units, 95 condominium units, and 49 townhouses. Access to the development will continue to be provided by the two existing site driveways (with proposed modifications outlined in the TSI plan) that currently serve the site.

EXISTING TRAFFIC VOLUMES

Automatic traffic recorder (ATR) counts were conducted on Woodland Road between the two driveways to the Langwood Commons site in February, April, and December 2005; July 2007; and February 2009. Manual turning movement counts (TMCs) were collected at the study area intersections in April 2005 and February 2006. Table 1 summarizes the ATR counts. The detailed count data sheets and the weekday morning and evening peak hour existing traffic volume networks are provided in the Appendix.

Table 1
Woodland Road Traffic Volumes

<u>Count Date</u>	<u>Daily Traffic Volume ^a</u>
<i>February 2005</i>	
Tuesday	16,240
Wednesday	16,510
<i>April 2005</i>	
Wednesday	16,490
Thursday	17,390
<i>December 2005</i>	
Wednesday	17,630
<i>July 2007</i>	
Tuesday	17,260
Wednesday	16,690
<i>February 2009</i>	
Thursday	15,590

^a Volumes collected between the driveways to the Langwood Commons site.

As can be seen in Table 1, multiple ATR counts have been conducted on Woodland Road. Although these counts were collected during different months and years, the traffic volumes have been relatively consistent, ranging from approximately 15,590 to 17,630 vehicles per day. Based on these counts, daily traffic volumes along Woodland Road have remained relatively stable over the past several years and have actually declined based on the data collected in 2009. Thus, the turning movement counts originally conducted in 2005 and 2006 were deemed appropriate and even potentially conservative in developing the existing condition traffic volume networks used in the current analysis. The traffic volumes were not seasonally adjusted, since April represents higher traffic volumes than average month conditions based on MassHighway data. Given that the locations with the February counts were adjusted to ensure that traffic volumes leaving an intersection were consistent with those entering an adjacent intersection (many of which had traffic counts conducted in April), the resulting traffic volumes are indicative of average conditions.

CRASH DATA

In order to identify motor vehicle crash trends and/or roadway deficiencies in the study area, motor vehicle crash data was obtained from MassHighway for the most recent four-year period available (2004 through 2007).

Crash rates are calculated based on the number of crashes and the traffic volume at an intersection. Crash rates that exceed MassHighway's average crash rate (by District) for signalized and unsignalized intersections (District 4 for the study area intersections) could indicate that safety or geometric deficiencies exist at the intersection. The average crash rate for unsignalized intersections is 0.58 for MassHighway District 4. Table 2 summarizes the motor vehicle crash data for the study area intersections.

As can be seen in Table 2, only the intersection of Woodland Road at Pond Street was shown to have a crash rate higher than the District 4 average for unsignalized intersections. The intersection also experienced the most motor vehicle crashes over the four-year review period. A total of 36 motor vehicle crashes were reported at this intersection, with the majority of the crashes consisting of rear-end type collisions (15 crashes), involving property damage only (24 crashes) and occurring on a dry roadway surface (31 crashes). The clear majority of accidents occurred on a weekday during non-peak hours (22 crashes).

Improvements are proposed in the TSI Plan at the intersection of Woodland Road at Pond Street that could potentially reduce the number of correctable motor vehicle collisions at this location. The specific proposed improvements are discussed in a later section of this memorandum.

There was a fatal motor vehicle crash reported in the vicinity of Molineau Circle on Saturday, June 4, 2005 at approximately 3:40 PM. The crash was an angle-type collision and occurred during daylight and under dry pavement conditions. The specific details of the crash indicate that it occurred at the intersection of the Flynn ice skating rink driveway at Woodland Road, just north of Molineau Circle. Specific improvements have been proposed in the TSI Plan along Woodland Road that will extend to the Flynn ice skating rink that will reduce vehicular speeds and enhance safety along the roadway.

Table 2
Motor Vehicle Crash Data Summary (2004-2007)

	Woodland Road/ Pond Street	Woodland Road/ Ravine Road	Woodland Road/ Site Driveways	Woodland Road/ Elm Street/ Highland Avenue/ Fulton Street (Molineau Circle)
<u>Signalized?</u>	NO	NO	NO	NO
<u>Year</u>				
2004	6	4	1	1
2005	7	0	3	2
2006	9	6	2	3
<u>2007</u>	<u>14</u>	<u>8</u>	<u>0</u>	<u>0</u>
Total	36	18	6	6
<u>Type</u>				
Angle	12	6	3	2
Rear-End	15	5	1	0
Head-On	0	0	0	0
Single Vehicle Crash	4	3	1	2
Sideswipe	3	1	0	2
<u>Unknown</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>0</u>
Total	36	18	6	6
<u>Severity</u>				
Prop. Damage Only	24	11	1	4
Personal Injury	6	6	4	0
Fatality	0	0	0	1
<u>Unknown</u>	<u>6</u>	<u>1</u>	<u>1</u>	<u>1</u>
Total	36	18	6	6
<u>Pavement Condition</u>				
Dry	31	14	4	4
Wet	5	2	1	2
Icy/Snow	0	2	0	0
<u>Unknown</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>
Total	36	18	6	6
<u>Time of Day</u>				
Weekday 7:00-9:00 AM	2	2	0	2
Weekday 4:00-6:00 PM	4	2	1	1
Saturday 11:00 AM-2:00 PM	3	0	0	0
Weekday, other time	22	9	4	2
<u>Weekend, other time</u>	<u>5</u>	<u>5</u>	<u>1</u>	<u>1</u>
Total	36	18	6	6
Crash Rate	0.85	0.53	0.21	0.18

Source: Massachusetts Highway Department.

FUTURE CONDITIONS

To determine the impacts on the surrounding roadway network of traffic volumes generated by the proposed Langwood Commons development, future traffic conditions were modeled. Future traffic projections also include regional background traffic growth, full occupancy of the existing medical office, and implementation of the proposed TSI Plan.

Anticipated Traffic Growth

Traffic growth on area roadways is a function of the expected land development, economic activity, and changes in demographics. Two methods are typically used to determine background traffic growth expected on roadways. The first method involves estimating an annual percentage increase in traffic volumes over the past several years (background growth). The second method involves identifying specific development projects in the vicinity of the project site that would affect traffic on the study area roadways. Since the ATR counts collected along Woodland Road show that the traffic volumes within the study area have remained relatively stable over the past several years, this

analysis assumed no background growth, but did include anticipated traffic from specific known development projects.

The following specific projects were identified in previous traffic analyses conducted for the Langwood Commons project:

Table 3
Background Development Projects – Previous Analyses

Project Name/Location	Development Program	Peak Hour Trips on Study Area Roadway Network ^a	
		Morning	Evening
Stoneham Crossing – Stoneham	135,000 sf home improvement store; 12,000 office space	9	27
Shannon Estates – Winchester	17 single-family homes	1	0
Outpatient Facility at 620 Washington St. – Winchester	239,000 sf outpatient ambulatory care center	10	12
Avalon Inwood – Woburn	400 apartment units	0	0
Malden Hospital Redevelopment – Malden	300 assisted living units	0	0
154 Pleasant Street – Malden	200 apartment units	0	0
Oak Grove Village – Malden/Melrose	550 apartment units; 16,750 sf retail space	34	55
TOTAL TRIPS		54	94

a Expressed in vehicles per hour.

As shown in Table 3, the specific development projects used in previous analyses are expected to add 54 vehicle trips to the study area roadway network during the weekday morning peak hour and 94 vehicle trips during the weekday evening peak hour. Given the location of the proposed projects, some of them were not expected to have traffic traveling in the study area.

In order to verify the traffic volumes expected to be generated by the anticipated development projects listed in Table 3, the Towns of Stoneham and Winchester and the Cities of Malden, Medford, Melrose, and Woburn were contacted to determine the current status of each project and to determine if there are any additional projects that should be considered to develop future traffic volume networks. Table 4 lists the updated status of the projects above and any additional projects that have been proposed since the previous analysis conducted for the Langwood Commons project.

Table 4
Background Development Projects – 2009 Analysis

Project Name/Location	Development Program	Peak Hour Trips on Study Area Roadway Network ^a	
		Morning	Evening
Stoneham Crossing – Stoneham	87,000 sf self-storage facility ^b	0	0
Shannon Estates – Winchester	17 single-family homes	1	0
Outpatient Facility at 620 Washington St. – Winchester	239,000 sf outpatient ambulatory care center	10	12
Avalon Inwood – Woburn	44 condominium units ^c	0	0
Malden Hospital Redevelopment – Malden	300 assisted living units	0	0
160 Pleasant Street – Malden	200 apartment units ^d	0	0
Oak Grove Village – Malden/Melrose	550 apartment units; 16,750 sf retail space ^e	10	19
27-29 Dartmouth Street – Malden	275 apartment units; 34,000 sf office; 11,500 sf retail	20	26
180 Eastern Avenue – Malden	Wendy's; Bank	0	0
1021 Main Street – Winchester	40 residential units	0	0
Greystone at Winchester – Winchester	50 townhouse units	0	0
Hamilton Farm – Winchester	62 residential units	0	0
Draper Street Warehousing – Woburn	36,000 sf warehouse space	0	0
Stone Place – Melrose	300 apartment units	14	24
TOTAL TRIPS		55	81

- a Expressed in vehicles per hour.
- b The home improvement retail store and office have been removed from the development program.
- c The previously proposed 400 units have been constructed and are substantially occupied. An additional 44 condominium units have been proposed on the project site.
- d This project was formerly known as "154 Pleasant Street".
- e At the time of this memorandum, 350 apartment units were constructed and partially occupied.

As shown in Table 4, the current known development projects are expected to add 55 vehicle trips to the study area roadway network during the weekday morning peak hour and 81 vehicle trips during the weekday evening peak hour. These traffic volumes are generally consistent with what was previously used (with one additional vehicle during the weekday morning peak hour and 13 fewer vehicles during the weekday evening peak hour). Therefore, to maintain consistency with the previous studies, the additional traffic volume growth associated with projects shown in Table 3 was used and result in a somewhat conservative estimate (especially during the PM peak hour) of anticipated traffic volume growth in the study area. In addition to other known projects, additional traffic volume associated with the unoccupied medical office space in Langwood Commons was included to project future conditions. To estimate the trips expected to be generated by the occupancy of the remaining medical office building space, the Institute of Transportation Engineers (ITE) Land Use Code (LUC) 720 – Medical/Dental Office, based on 11,000 sf was used.

Langwood Commons Trip Generation

Trip generation estimates associated with the redevelopment of the Langwood Commons site were determined based on data published by the Institute of Transportation Engineers (ITE)¹.

¹ Trip Generation – 8th Edition; Institute of Transportation Engineers; Washington, D.C.; 2008.

As stated previously, the proposed Langwood Commons will consist of the redevelopment of an existing hospital building to contain 225,000 sf of general office space. In addition, the project will contain a residential component consisting of the construction of 261 apartment units, 95 condominium units, and 49 townhouses. ITE Land Use Code (LUC) 220 – Apartment, based on 261 dwelling units; LUC 230 – Condominium/Townhouse, based on 144 units; and LUC 710 – General Office, based on 225,000 sf were used to estimate the trips expected to be generated by the proposed project. The trip generation for the proposed project is shown in Table 5, with the detailed trip-generation calculations provided in the Appendix.

**Table 5
 Langwood Commons Trip Generation Summary**

Use	Residential Component (261 Apartments; 144 Condominium Units)	Office Component (225,000 sf)	Total Project Generated Trips
Weekday Daily ^a	2,590	2,490	5,080
Weekday AM ^b			
Enter	40	315	355
Exit	<u>160</u>	<u>45</u>	<u>205</u>
Total	200	360	560
Weekday PM ^b			
Enter	160	55	215
Exit	<u>85</u>	<u>275</u>	<u>360</u>
Total	245	330	575

a expressed in vehicles per day.
 b expressed in vehicles per hour.

As shown in Table 5, the Langwood Commons project is expected to generate 5,080 trips on an average weekday, with 560 trips during the weekday morning peak hour and 575 trips during the weekday evening peak hour.

Trip Distribution

Although the Langwood Commons project has been decreased a further 10% since previous studies, the relative office and residential use mix has not changed. Accordingly, the directional distribution of traffic approaching and departing the Langwood Commons site determined in previous studies was used to assign site-generated trips to the study area roadway network. The traffic volumes associated with the Langwood Commons site are shown in figures provided in the Appendix.

Transportation Safety Improvements Plan

The proponent of Langwood Commons and DCR have identified and developed potential roadway improvements for the Woodland Road and Pond Street corridors, between Molineau Circle to the south and a point approximately one-half mile north of the Woodland Road/Pond Street intersection, resulting in the TSI Plan.

The following improvements have been identified in the TSI Plan to enhance safety, improve pedestrian and bicycle accommodations, promote traffic calming measures, and provide for more efficient vehicular operations throughout the Woodland Road corridor:

- Designate most of the extent of the existing Woodland Road southbound lanes for a future two-lane (bi-directional) bicycle and pedestrian path.

- Reconfigure the two remaining northbound Woodland Road lanes to accommodate two-way travel via one southbound travel lane and one northbound travel lane.
- Install a single-lane modern roundabout at the intersection of Woodland Road and the south driveway of Langwood Commons.
- Reconfigure the intersection of Woodland Road and the north driveway of Langwood Commons to provide geometric improvements and prohibit left turns from the driveway.
- Install a double-lane modern roundabout at the intersection of Woodland Road at Ravine Road.
- Reconfigure the intersection of Woodland Road at Pond Street to provide geometric improvements and prohibit left-turns from Pond Street westbound.
- Provide a break in the existing median, approximately one-half mile north of the intersection of Woodland Road at Pond Street, to accommodate u-turning vehicles destined to Woodland Road southbound (those trips restricted from left-turns directly from Pond Street to Woodland Road in the modification detailed above).
- Provide several additional pedestrian crosswalks (signage and striping) and enhanced accommodations at appropriate locations shown on the TSI Plan.

It is anticipated that due to the restriction of left-turning vehicles from the Pond Street westbound approach to Woodland Road, some vehicular traffic will be shifted to Ravine Road and will use the proposed roundabout to travel to Woodland Road southbound. The future conditions associated with this shift are included as a sensitivity analysis.

Build Traffic Volumes

The future Build traffic volumes were developed according to the methodology described above. In order to reflect the proposed roadway and safety improvements in the TSI Plan, two Build scenarios were developed. The first scenario assumes that all left-turning vehicles at Pond Street would be reassigned to the westbound right-turn movement along the Pond Street westbound approach to Woodland Road northbound which would then will make a u-turn maneuver southbound at the proposed median break, approximately one-half mile north of the intersection. The second scenario assumes that this movement will continue to occur, but also assumes that fifty percent of the projected u-turning traffic would divert to Ravine Road and access Woodland Road southbound by way of the proposed roundabout at the intersection of Woodland Road at Ravine Road. Both scenarios reflect the left-turn prohibition for vehicles exiting the north driveway of Langwood Commons. The weekday morning and evening peak hour Build traffic volume networks for the first scenario are shown on Exhibits 1 and 2, respectively. The weekday morning and evening peak hour Build traffic volume networks for the second scenario are shown on Exhibits 3 and 4, respectively.

TRAFFIC OPERATIONS ANALYSIS

To assess the quality of vehicular flow within the study area, intersection capacity analyses were conducted with respect to the projected Build traffic volume conditions, with the implementation of the TSI Plan throughout the Woodland Road corridor. Capacity analyses provide an indication of the adequacy of the roadway facilities to serve the anticipated traffic demands. Roadway operating conditions are classified by calculated "levels-of-service". Level-of-service (LOS) is a qualitative measure that considers a number of factors including roadway geometry, speed, travel delay, and freedom to maneuver and provides an index to the operational qualities of a roadway segment or an intersection. Level-of-service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. Level-of-service analyses were conducted for the future Build conditions for the study area intersections. Table 6 presents a summary of the capacity analyses for the study area intersections under both Build condition scenarios described above. The capacity analysis worksheets are included in the Appendix.

Table 6
Intersection Operations Summary

<i>Intersection/Time Period</i>	Build Conditions				Build Conditions Sensitivity Analysis			
	(assumes all Pond Street traffic uses U-turn for southbound)				(assumes 50% of Pond Street traffic uses U-turn for southbound)			
	v/c ^a	Delay ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue
Pond Street at Pond Street U-Turn								
<i>Weekday Morning Peak Hour</i>								
Pond Street NB U-Turn	>1.20	>120	F	>500	1.03	>120	F	193
Pond Street SB TH	0.86	0	A	0	0.86	0	A	0
<i>Weekday Evening Peak Hour</i>								
Pond Street NB U-Turn	0.70	57	F	108	0.33	32	D	35
Pond Street SB TH	0.73	0	A	0	0.73	0	A	0
Woodland Road at Pond Street								
<i>Weekday Morning Peak Hour</i>								
Pond Street WB RT		Free Movement				Free Movement		
Woodland Road NB TH	0.32	0	A	0	0.32	0	A	0
Woodland Road NB RT	0.08	0	A	0	0.08	0	A	0
Pond Street SB LT	0.38	11	B	45	0.38	11	B	45
Pond Street SB TH	0.80	0	A	0	0.71	0	A	0
<i>Weekday Evening Peak Hour</i>								
Pond Street WB RT		Free Movement				Free Movement		
Woodland Road NB TH	0.66	0	A	0	0.66	0	A	0
Woodland Road NB RT	0.24	0	A	0	0.24	0	A	0
Pond Street SB LT	1.05	88	F	367	1.05	88	F	367
Pond Street SB TH	0.49	0	A	0	0.45	0	A	0
Woodland Road at Ravine Road								
Proposed Roundabout								
<i>Weekday Morning Peak Hour</i>								
Woodland Road NB	0.28	3	A	60	0.28	3	A	62
Woodland Road SB	0.69	6	A	216	0.74	10	A	265
Ravine Road WB	0.71	13	B	190	0.92	22	C	411
Overall	0.75	7	A	--	0.92	11	B	--
<i>Weekday Evening Peak Hour</i>								
Woodland Road NB	0.73	5	A	248	0.74	5	A	255
Woodland Road SB	0.37	4	A	77	0.38	5	A	78
Ravine Road WB	0.83	24	C	210	1.02	53	D	452
Overall	0.86	7	A	--	1.02	12	B	--

See notes at end of table.

Table 6 (Continued)
Intersection Operations Summary

<i>Intersection/Time Period</i>	Build Conditions (assumes all Pond Street traffic uses U-turn for southbound)				Build Conditions Sensitivity Analysis (assumes 50% of Pond Street traffic uses U-turn for southbound)			
	v/c ^a	Delay ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue
	Woodland Road at north driveway of Langwood Commons							
<i>Weekday Morning Peak Hour</i>								
North driveway WB RT	Free Movement				Free Movement			
Woodland Road NB TH	0.21	0	A	0	0.21	0	A	0
Woodland Road NB TH/RT	0.11	0	A	0	0.11	0	A	0
Woodland Road SB LT/TH	0.31	7	A	34	0.31	7	A	34
Woodland Road SB TH	0.43	0	A	0	0.43	0	A	0
<i>Weekday Evening Peak Hour</i>								
North driveway WB RT	Free Movement				Free Movement			
Woodland Road NB TH	0.50	0	A	0	0.50	0	A	0
Woodland Road NB TH/RT	0.25	0	A	0	0.25	0	A	0
Woodland Road SB LT/TH	0.31	10	A	33	0.31	10	A	33
Woodland Road SB TH	0.20	0	A	0	0.20	0	A	0
Woodland Road at south driveway of Langwood Commons								
Proposed Roundabout								
<i>Weekday Morning Peak Hour</i>								
Woodland Road NB	0.48	2	A	138	0.48	2	A	138
Woodland Road SB	0.91	4	A	>500	0.91	4	A	>500
South driveway WB	0.17	10	A	25	0.17	10	A	25
Overall	0.91	4	A	--	0.91	4	A	--
<i>Weekday Evening Peak Hour</i>								
Woodland Road NB	0.86	2	A	>500	0.86	2	A	>500
Woodland Road SB	0.57	4	A	143	0.57	4	A	143
South driveway WB	0.96	79	E	412	0.96	79	E	412
Overall	0.97	12	B	--	0.97	12	B	--
Molineau Circle								
<i>Weekday Morning Peak Hour</i>								
Elm Street EB	0.30	10	A	50	0.30	10	A	50
Highland Avenue WB	0.49	6	A	120	0.49	6	A	120
Woodland Road SB	0.62	4	A	159	0.62	4	A	159
Overall	0.62	6	A	--	0.62	6	A	--
<i>Weekday Evening Peak Hour</i>								
Elm Street EB	0.68	10	A	199	0.68	10	A	199
Highland Avenue WB	>1.20	>120	F	>500	>1.20	>120	F	>500
Woodland Road SB	0.39	3	A	83	0.39	3	A	83
Overall	>1.20	70	E	--	>1.20	70	E	--

a Volume-to-capacity ratio.
 b Delay, measured in seconds.

c Level-of-service.
 d 95th percentile queue length, measured in feet.

CONCLUSION

The project consists of the implementation of the TSI plan along the Woodland Road corridor in Stoneham, Massachusetts.

A review of existing conditions indicates that there are safety deficiencies within the Woodland Road corridor. The intersection of Woodland Road at Pond Street was found to have a higher crash rate than the MassHighway District 4 average for the most recent four year period for which data is available. There was also one motor vehicle collision related fatality that occurred in the vicinity of

Molineau Circle. Further, there is a lack of pedestrian connectivity throughout the corridor and there are currently no safe pedestrian crossings across Woodland Road.

The analysis presented in this memorandum takes into consideration the impact of the redevelopment of the former Boston Regional Medical Center to encompass 225,000 sf of office space, 261 apartment units, 95 residential condominium units, and 49 townhouses located off Woodland Road in Stoneham, Massachusetts. The full build-out of the project is expected to generate 5,080 vehicle trips to the surrounding roadway network during an average weekday, with 560 trips generated during the weekday morning peak hour and 575 trips generated during the weekday evening peak hour.

To address the current deficiencies and to plan for the future impact of the Langwood Commons project, roadway and safety improvements have been proposed for Woodland Road between Molineau Circle and a point approximately one-half mile north of Pond Street. These improvements are designed to address the existing safety and operational deficiencies of the roadway, as described in previous sections of this memorandum. The improvements along Woodland Road are designed as traffic calming measures that will help reduce vehicular travel speeds and potentially create a safer environment for both motorists and pedestrians. The improvements are also expected to provide more efficient vehicular operations along Woodland Road and at the study area intersections. While certain movements presented in Table 6 reflect less than optimal conditions, most of these movements currently experience similar or worse operations. Further, a number of other current movements that experience poor LOS are significantly improved by the proposed plan.

The recreational aspects of Woodland Road and the Middlesex Fells Reservation will be enhanced by converting the southbound lanes of Woodland Road into a future dedicated bicycle/pedestrian path. Pedestrian safety and mobility will be improved by the addition of several new crosswalks and by the conversion of the southbound lanes into a future recreational path, thereby reducing the total pedestrian crossing width.

A review of operating conditions under future Build conditions with the TSI Plan roadway improvements along Woodland Road indicates that the roadway network should be able to better accommodate future traffic volumes and operate in a potentially safer and efficient way.