Transportation Impact Assessment

The Coolidge at Sudbury Phase 2
Proposed Residential Development Expansion

Sudbury, MA

Prepared for:

B'nai B'rith Housing New England
Brighton, Massachusetts

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TRANSPORTATION IMPACT ASSESSMENT

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July 2016

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EXECUTIVE SUMMARY

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) to determine the potential traffic impacts associated with The Coolidge at Sudbury Phase 2 residential development to be located at 189 Boston Post Road (Route 20) in Sudbury, Massachusetts. The project entails the construction of a residential building that will contain 56 new senior housing units bringing the total unit count to 120. This study identifies and analyzes existing traffic conditions and future traffic conditions both with and without the project and reviews access requirements, potential off-site improvements, and safety considerations.

The project site is situated near the southeast corner of the Route 20 and Landham Road intersection and is bounded by Route 20 to the north, residential properties to the east, railroad tracks and residential properties to the south, and Landham Road to the west. Access to the project will be provided by way of the existing full-access driveway that intersects the south side of Route 20 approximately 350 feet east of Landham Road.

This study was prepared in consultation with the Massachusetts Department of Transportation (MassDOT) and the Town of Sudbury, and was performed in general accordance with the state guidelines for Traffic Impact Assessments (TIAs).

EXISTING CONDITIONS

A comprehensive field inventory of existing conditions within the study area was conducted in June 2016. The field investigation consisted of an inventory of existing roadway geometrics; pedestrian and bicycle facilities; traffic volumes; and operating characteristics; as well as posted speed limits and land use information within the study area. The study area for the project was selected to contain the major roadways providing access to the project, Route 20 and Landham Road, as well as the Route 20 intersections with Landham Road and the site driveway.

Existing Traffic Volumes

In order to determine existing traffic-volume demands and flow patterns within the study area, existing traffic counts were conducted in June 2016 during the weekday morning (7:00 – 9:00 AM) and weekday evening (4:00 – 6:00 PM) periods. Route 20 west of the project site accommodates 1,709 vehicles during the morning peak hour and 1,909 vehicles during the

evening peak hour. The weekday morning peak hour occurs between 7:30 and 8:30 AM and the weekday evening peak hour occurs between 5:00 and 6:00 PM.

Pedestrian and Bicycle Facilities

A comprehensive field inventory of pedestrian and bicycle facilities within the study area was undertaken in June 2016. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadways and at the study intersection, as well as the location of existing and planned future bicycle facilities. In general, sidewalks are provided along the north side of Route 20 and the west side of Landham Road. As part of The Coolidge at Sudbury Phase 1, a sidewalk was constructed connecting the site to Landham Road with a crosswalk at Landham Road.

There are no formal existing bicycle facilities that were identified within the immediate study area.

Motor Vehicle Crash Data

In order to examine motor vehicle crash trends occurring within the study area, motor vehicle crash information for the study area intersection was obtained from the MassDOT Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2009 through 2013). A total of 37 motor vehicle crashes were reported at the intersection of Route 20 at Landham Road over the five-year review period, an average of approximately 7 crashes per year, the majority of which involved property damage only (24 out of 37); and were classified as angle or rear-end-type collisions (28 out of 37). The study intersection was found to have a motor vehicle crash rate above the MassDOT average for an unsignalized intersection for MassDOT Highway Division District 3. One fatal motor vehicle crash was reported at the study area intersection over the five-year review period. Safety improvements including traffic signalization are in the planning storage at this location by MassDOT.

FUTURE CONDITIONS

Traffic volumes in the study area were projected to the year 2023, which reflects a seven-year planning horizon consistent with State traffic study guidelines. Independent of the project, traffic volumes on the roadway network in the year 2023 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated project-generated traffic volumes superimposed upon the 2023 No-Build traffic network reflect the 2023 Build conditions with the project.

Roadway Improvement Projects

The Town of Sudbury and MassDOT are planning improvements at the intersection of Route 20 and Landham Road. The improvements include traffic signalization and widening Route 20 to provide an eastbound right-turn lane and a westbound left-turn lane at Landham Road. These improvements should be implemented within the seven-year study period. The construction cost of these improvements is $1.7 M and there is no set construction date.

Project-Generated Traffic

The Phase 2 project will entail the construction of 56 additional senior housing units. Trip-generation from the existing units at Phase 1 were utilized to project the additional traffic. The project is expected to generate approximately 11 vehicle trips (4 entering and 7 exiting) during the weekday morning peak hour and 15 vehicle trips (9 entering and 6 exiting) during the weekday evening peak hour.

Trip Distribution and Assignment

The directional distribution of generated trips to and from the project was determined based on a review of existing travel patterns at the study roadways and intersection. In general, 30 percent of the project-related traffic was assigned to/from the east on Route 20, with 50 percent assigned to/from the west on Route 20, and 20 percent to/from the south on Landham Road.

Build Condition Traffic-Volume Networks

The 2023 Build condition networks consist of the 2023 No-Build traffic volumes with the anticipated project-generated traffic added to them. Project-related traffic-volume increases external to the site relative to 2023 No-Build conditions are estimated at approximately 0.17-0.43 percent, with vehicle increases ranging from 2 to 8 vehicles during the peak hour periods.

TRAFFIC OPERATIONS ANALYSIS

In order to assess the impact of the project on the roadway network, traffic operations and vehicle queue analyses were performed at the study intersections under 2016 Existing, 2023 No-Build and 2023 Build conditions. The analysis indicates that the project will have a minimal impact on motorist delays and vehicle queuing over Existing and No-Build conditions.

SUMMARY AND CONCLUSIONS

The proposed additional 56 senior housing units can be accommodated at the existing site driveway intersection with Route 20 and no further improvements are warranted other than a STOP-sign at the site driveway. The level of service will not be affected by the proposed development, which will add only 8 vehicles and hour (one vehicle every 7.5 minutes) during the morning peak hour and only 10 vehicles (one car every 6 minutes) during the evening peak hour at the Route 20/Landham Road intersection. The proposed development will not create any safety hazards at the site driveway or at the Route 20/Landham Road intersection.

INTRODUCTION

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) to determine the potential traffic impacts associated with The Coolidge at Sudbury Phase 2 residential development located at 187-189 Boston Post Road (Route 20) in Sudbury, Massachusetts. The project entails the construction of a residential building that will contain 56 new senior housing units. This study identifies and analyzes existing traffic conditions and future traffic conditions both with and without the project and reviews access requirements, potential off-site improvements, and safety considerations.

PROJECT DESCRIPTION

The project site is situated near the southeast corner of the Route 20 and Landham Road intersection and is bounded by Route 20 to the north, residential properties to the east, railroad tracks and residential properties to the south, and Landham Road to the west. Access to the project will be provided by way of the existing full-access driveway that currently serves The Coolidge at Sudbury Phase 1 intersects the south side of Route 20 approximately 350 feet east of Landham Road. Figure 1 depicts the project location in relation to the existing roadway network.

STUDY METHODOLOGY

This study was prepared in consultation with the Massachusetts Department of Transportation (MassDOT) and the Town of Sudbury, was performed in general accordance with the state guidelines for Traffic Impact Assessments (TIA), and was conducted in three distinct stages.

The first stage involved an assessment of existing conditions in the study area and included an inventory of roadway geometrics; pedestrian and bicycle facilities; observations of traffic flow; and collection of peak period traffic counts. The collection of peak period traffic counts includes data from Phase 1 and the road network.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the project were assessed along with future traffic demands due to expected traffic growth independent of the project. A five-year time horizon was selected for analyses consistent with state guidelines for the preparation of TIAs. The traffic analysis

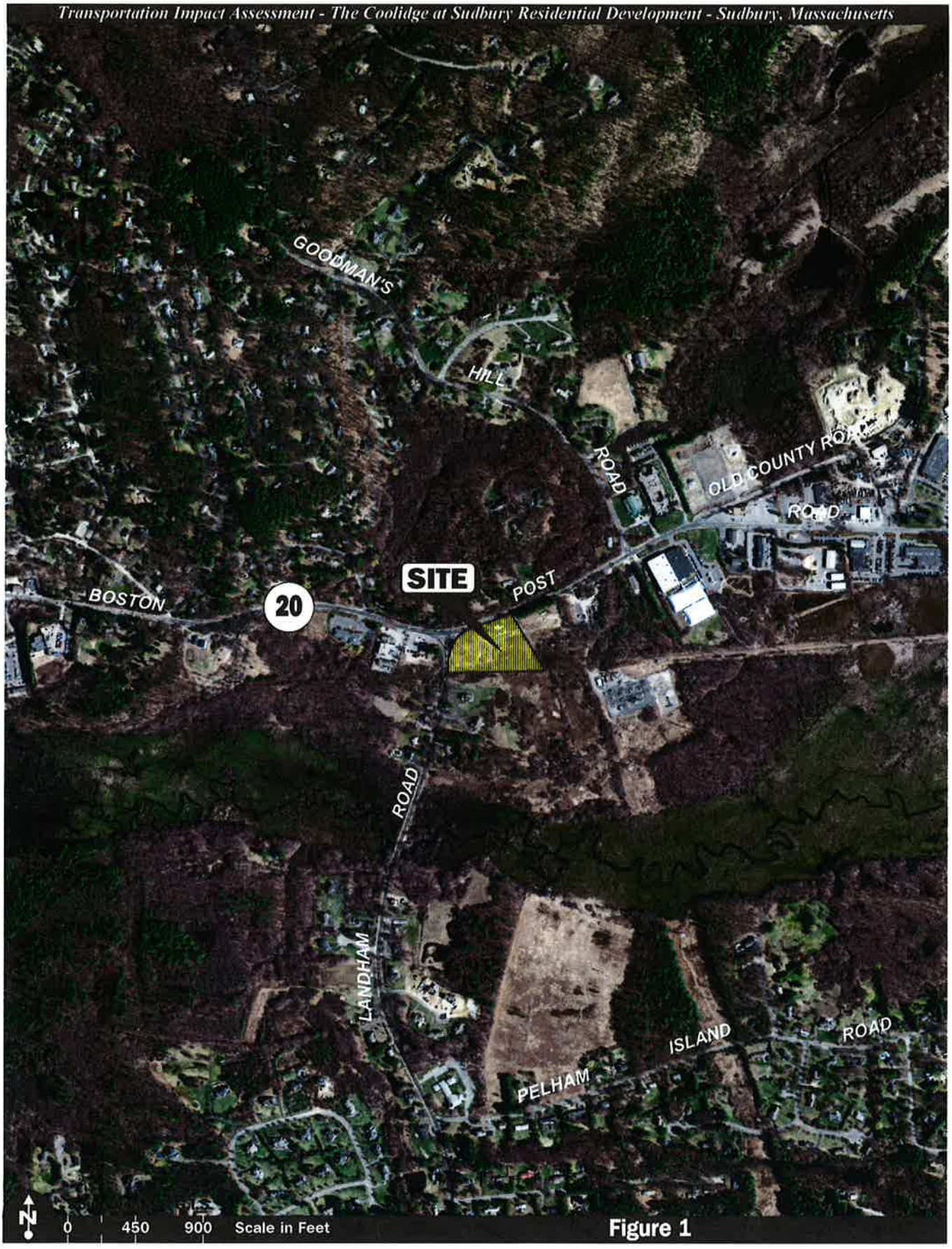

Figure 1

Site Location Map

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conducted in stage two identifies existing or projected future roadway capacity, traffic safety, and site access issues.

The third stage of the study presents and evaluates measures to address traffic and safety issues, if any, identified in stage two of the study.

EXISTING CONDITIONS

A comprehensive field inventory of existing conditions within the study area was conducted in June 2016. The field investigation consisted of an inventory of existing roadway geometrics; pedestrian and bicycle facilities; traffic volumes; and operating characteristics; as well as posted speed limits and land use information within the study area. The study area for the project was selected to contain the major roadways providing access to the project, Route 20 and Landham Road, as well as the Route 20 and Landham Road intersection and the existing site driveway serving The Coolidge at Sudbury Phase 1.

The following describes the study area roadways and intersection.

Roadways

Boston Post Road (Route 20)

Boston Post Road (Route 20) is an urban principle arterial roadway that traverses the study area in a general east-west direction and is under state jurisdiction. Route 20 provides a connection to Interstate 95 (I-95) to the east of the site and to I-495 to the west of the site. Route 20, within the study area, provides one travel lane per direction separated by a double-yellow centerline with 2-foot wide marked shoulders. A sidewalk is provided along the north side of Route 20 within the study area. A sidewalk is under construction along the south side of Route 20 within the study area. Land use along Route 20 within the study area consists of residential and commercial properties. The posted speed limit along Route 20 varies between 30 and 40 miles per hour (mph).

Landham Road

Landham Road is an urban minor arterial roadway that is under town jurisdiction and traverses the study area in a general north-south direction. Within the study area, Landham Road provides one travel lane per direction separated by a double-yellow centerline. A sidewalk is provided along the west side of Landham Road within the study area. Land use along Landham Road consists of residential properties and wetlands. The posted speed limit along Landham Road is 35 mph.

Intersection

Route 20 at Landham Road

Landham Road intersects Route 20 from the south to form this three-legged unsignalized intersection. The Route 20 eastbound and westbound approaches consist of one general-purpose travel lane separated by a double yellow centerline with a 2-foot wide marked shoulder. The Landham Road northbound approach consists of a left-turn lane with vehicles approaching Route 20 under Stop-sign control and a right-turn lane with vehicles approaching Route 20 under Yield-sign control. It should be noted that MassDOT was contacted regarding the Yield-control for right-turns from Landham Road and they do not recommend changing the Yield-sign to a Stop-sign. The directions of travel along Landham Road are separated by a median at the intersection and by a double yellow centerline along the remainder of the roadway. Land use in the vicinity of the intersection consists of residential properties, a gas station, The Coolidge at Sudbury Phase 1, the project site and areas of open and wooded space. It should be noted that improvements are planned at this intersection to include widening Route 20 and installing traffic signal control.

Route 20 at the Site Driveway

The site driveway intersects Route 20 from the south to form a four-way unsignalized intersection under STOP-control. A sidewalk connects the site to Landham Road with a crosswalk at Landham Road.

EXISTING TRAFFIC VOLUMES

In order to determine existing traffic-volume demands and flow patterns within the study area, manual turning movement counts (TMCs) and vehicle classification counts were conducted. The 2016 Existing traffic volumes are graphically depicted on Figure 2 for the weekday morning and evening peak hours.

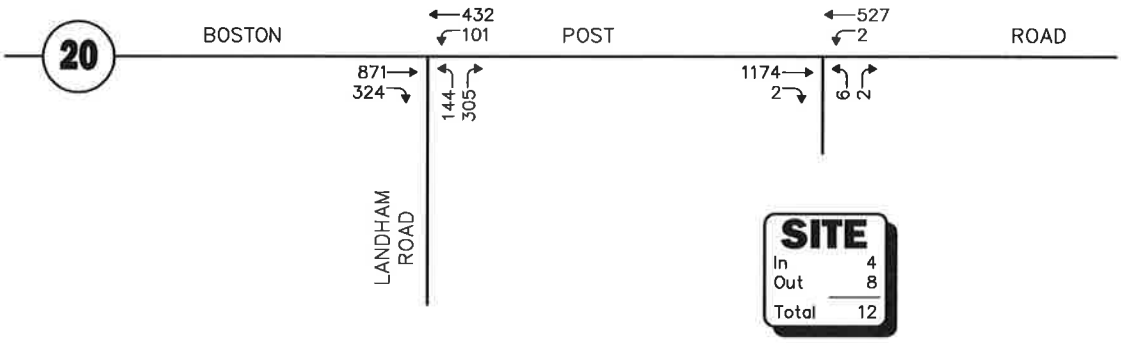
Route 20 in the vicinity of the project site was found to accommodate approximately 1,709 vehicles per hour (vph) during the weekday morning peak hour and 1,909 vph during the weekday evening peak hour.

PEDESTRIAN AND BICYCLE FACILITIES

A comprehensive field inventory of pedestrian and bicycle facilities within the study area was undertaken. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadways and at the study intersection, as well as the location of existing and planned future bicycle facilities. In general, sidewalks are provided along the north side of Route 20 and the west side of Landham Road. As part of the Phase I development, a sidewalk was constructed connecting the site to Landham Road with a crosswalk at Landham Road. A sidewalk is currently under construction to the south side of Boston Post Road connecting Phase 1 to properties east of the site.

There are no formal existing bicycle facilities that were identified within the immediate study area.

WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR

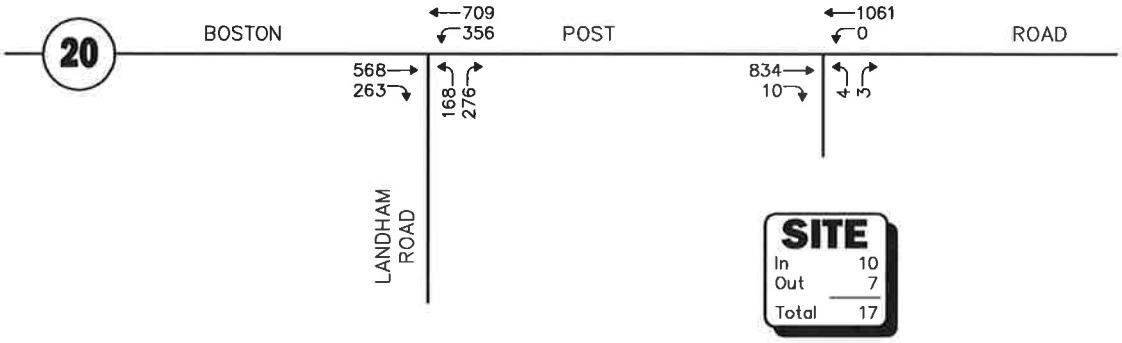


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Figure 2

2016 Existing
Peak Hour Traffic Volumes

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MOTOR VEHICLE CRASH DATA

In order to examine motor vehicle crash trends occurring within the study area, motor vehicle crash information for the study area intersection was obtained from the MassDOT Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2009 through 2013). The data is summarized by intersection, type, severity, and day of occurrence, and presented in Table 1.

Table 1
MOTOR VEHICLE CRASH DATA SUMMARY[a]

	Route 20/ Landham Road
Year:	
2009	4
2010	9
2011	5
2012	9
2013	10
Total	37
Average	7.4
Rate[b]	0.78
Significant?[c]	Yes
Type:	
Angle	15
Rear-End	13
Head-On	1
Sideswipe	4
Single Vehicle	4
Unknown/Other	0
Total	37
Road Surface Conditions:	
Dry	28
Wet	6
Snow/Icy	3
Other	0
Total	37
Severity:	
Property Damage Only	24
Personal Injury	12
Fatality	1
Total	37

[a]Source: MassDOT Safety Management/Traffic Operations Unit records, 2009 through 2013.
[b]Crash rate per million vehicles entering the intersection.
[c]The intersection crash rate is significant if it is found to exceed 0.66 crashes per million vehicles entering an intersection for an unsignalized intersection as defined by MassDOT for District 3).

As can be seen in Table 1, a total of 37 motor vehicle crashes were reported at the intersection of Route 20 at Landham Road over the five-year review period, an average of approximately 7 crashes per year, the majority of which involved property damage only (24 out of 37); and were classified as angle or rear-end-type collisions (28 out of 37). The study intersection was found to have a motor vehicle crash rate above the MassDOT average for an unsignalized intersection for MassDOT Highway Division District 3. One fatal motor vehicle crash was reported at the study area intersection over the five-year review period. It should be noted that safety improvements are proposed at this location by MassDOT.

FUTURE CONDITIONS

Traffic volumes in the study area were projected to the year 2023, which reflects a seven-year planning horizon consistent with State traffic study guidelines. Independent of the Phase 2 project, traffic volumes on the roadway network in the year 2023 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated project-generated traffic volumes superimposed upon this 2023 No-Build traffic network reflect the 2023 Build conditions with the project.

FUTURE TRAFFIC GROWTH

Future traffic growth is a function of the expected land development in the immediate area and the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This procedure produces a more realistic estimate of growth for local traffic. However, the drawback of this procedure is that the potential growth in population and development external to the study area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used, the salient components of which are described below.

Specific Development by Others

Specific development by others that would have an impact on future traffic volumes at the study intersections was researched. This information was obtained from the Meadow Walk Traffic Impact and Access Study prepared by VHB dated February 2016.

General Background Traffic Growth

Consistent with other traffic studies in the area, a 1.0 percent per year compounded annual background traffic growth rate was used in order to account for future traffic growth and presently unforeseen development within the study area.

Roadway Improvement Projects

The Town of Sudbury and MassDOT are planning improvements at the intersection of Route 20 and Landham Road. The improvements include traffic signalization and widening Route 20 to provide an eastbound right-turn lane and a westbound left-turn lane at Landham Road. These improvements should be implemented within the seven-year study period. The construction cost of these improvements is $1.7 million and there is no set construction date.

No-Build Traffic Volumes

The 2023 No-Build peak-hour traffic-volume networks were developed by applying the 1.0 percent per year compounded annual background traffic growth rate to the 2016 Existing peak-hour traffic volumes and then superimposing the peak-hour traffic volumes expected to be generated by the identified specific development projects by others. The resulting 2023 No-Build weekday morning and evening peak-hour traffic volume networks are shown on Figure 3.

PROJECT-GENERATED TRAFFIC

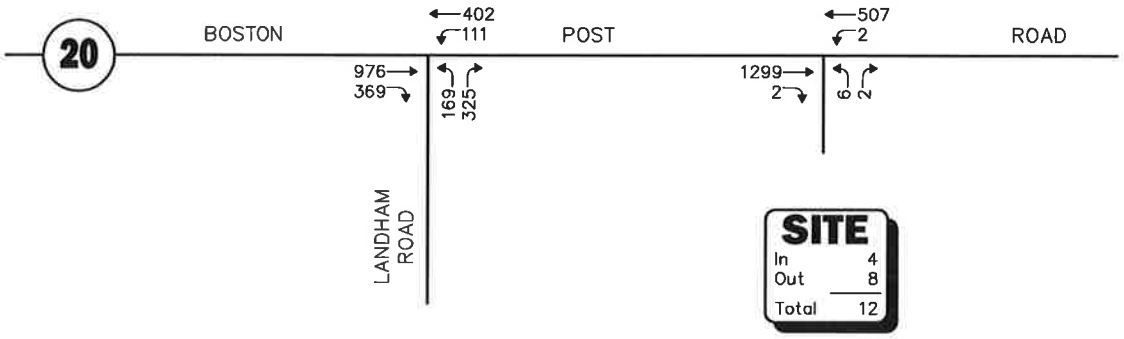
Design year (2023 Build) traffic volumes for the study area roadways were determined by estimating project-generated traffic volumes and assigning those volumes on the study roadways.

The Phase 2 project will entail the construction of 56 senior-housing units. Trip-generation rates from the existing 64 units at Phase 1 were applied to the additional 56 units at Phase 2 as presented in Table 2.

Table 2
TRIP-GENERATION COMPARISON

	Actual Existing The Coolidge on Sudbury (64 Units) Phase 1		Phase 2 Proposed 56 Units		
Time Period/Direction	Trips	Trips/Unit	Trips	Trips/Unit	Total
Weekday Morning Peak Hour:					
Entering	4	0.06	4	0.06	8
Exiting	8	0.13	7	0.13	15
Total	12	0.19	11	0.19	23
Weekday Evening Peak Hour:					
Entering	10	0.16	9	0.16	19
Exiting	7	0.11	6	0.11	13
Total	17	0.27	15	0.27	32

WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR

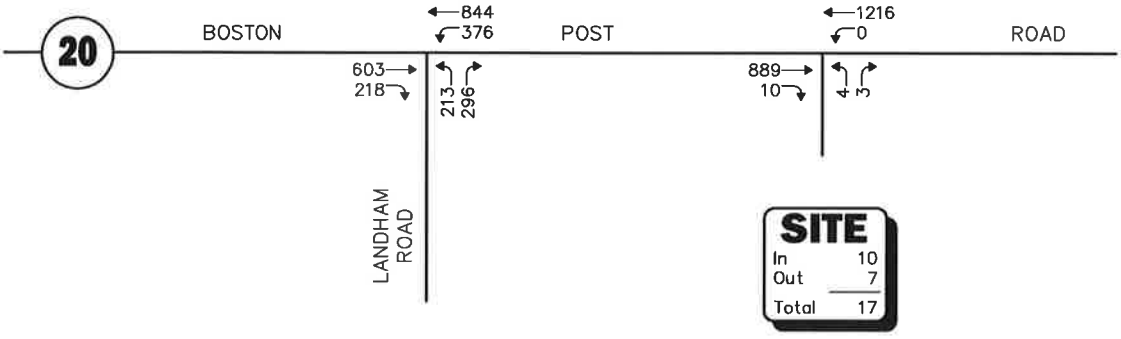


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Figure 3

2023 No-Build
Peak Hour Traffic Volumes

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As can be seen in Table 2, the project is expected to generate approximately 11 vehicle trips (4 entering and 7 exiting) during the weekday morning peak hour approximately just one vehicle every 5.5 minutes and 17 vehicle trips (10 entering and 7 exiting) during the weekday evening peak hour approximately one vehicle every 3.5 minutes.

Trip Distribution and Assignment

The directional distribution of generated trips to and from the project was determined based on a review of existing travel patterns at the study roadways and intersection. The general trip distribution for the project is summarized in Table 3 and graphically depicted on Figure 4. The weekday morning and evening peak-hour traffic volumes expected to be generated by the project were assigned on the study area roadway network as shown on Figure 5.

Table 3
TRIP-DISTRIBUTION SUMMARY

Roadway	Direction (To/From)	Percent
Route 20	East	30
Route 20	West	50
Landham Road	South	20
TOTAL		100

FUTURE TRAFFIC VOLUMES - BUILD CONDITION

The 2023 Build condition networks consist of the 2023 No-Build traffic volumes with the anticipated site-generated traffic added to them. The 2023 Build weekday morning and evening peak-hour traffic-volume networks are graphically depicted on Figure 6.

A summary of peak-hour projected traffic-volume increases external to the study area is shown in Table 4. These volumes are based on the expected increases from the project.

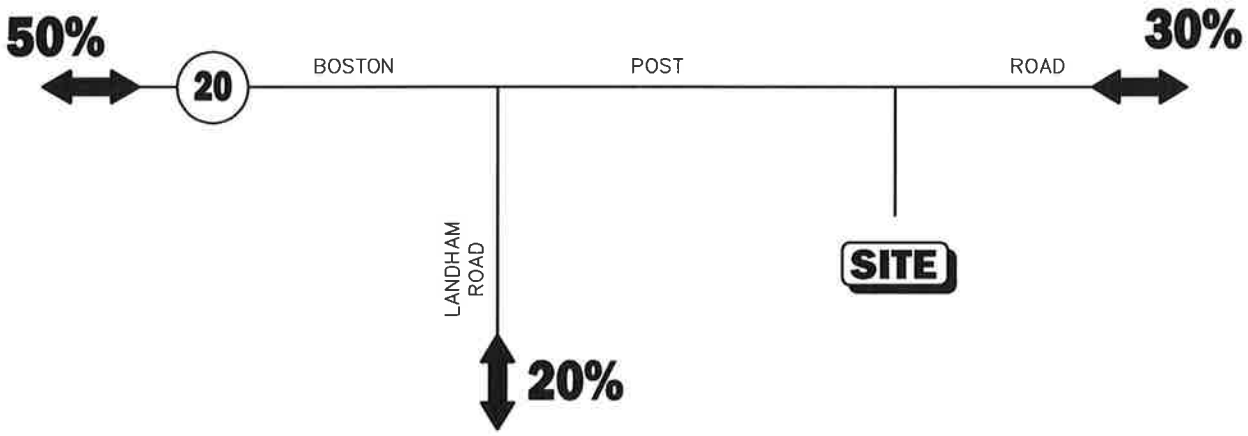

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Figure 4

Trip Distribution Map

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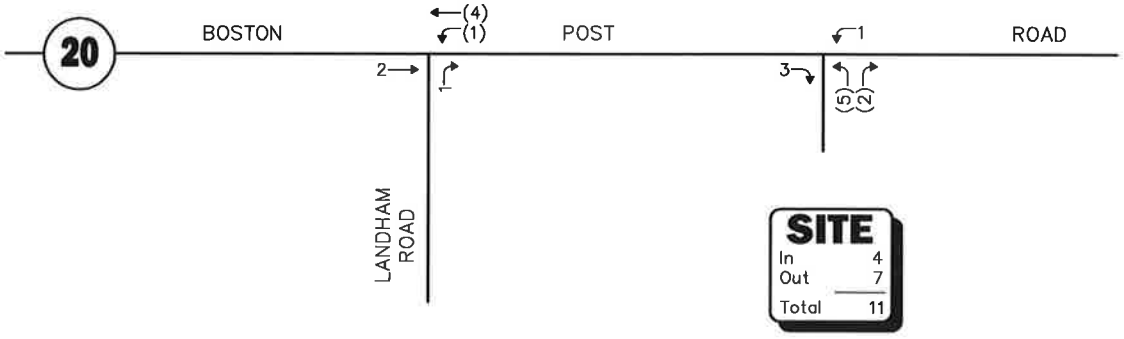
WEEKDAY MORNING PEAK HOUR

Legend:

XX	Entering Trips
(XX)	Exiting Trips



WEEKDAY EVENING PEAK HOUR

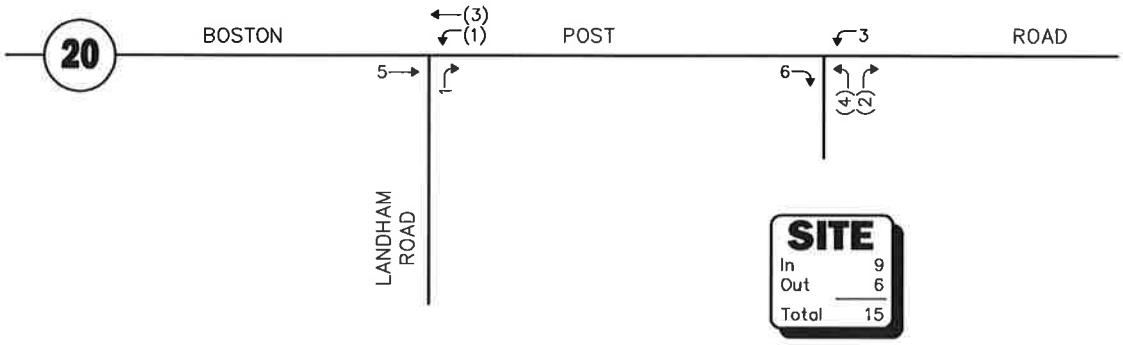


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Figure 5

Site Generated Peak Hour Traffic Volumes

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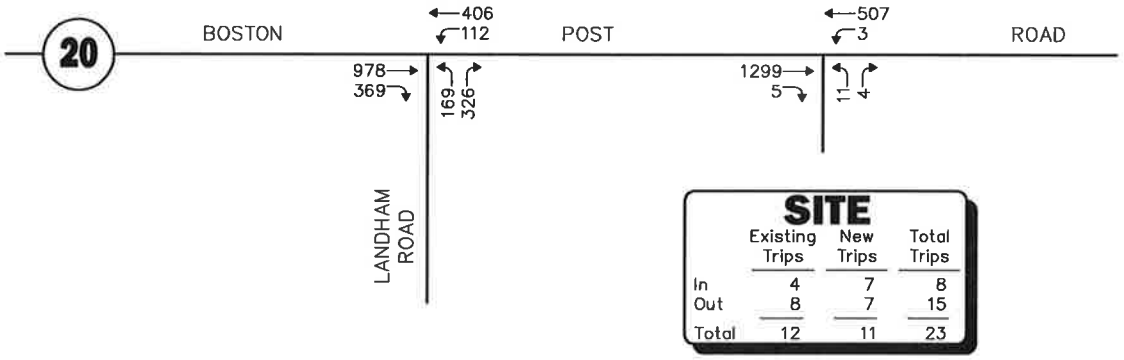
WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR

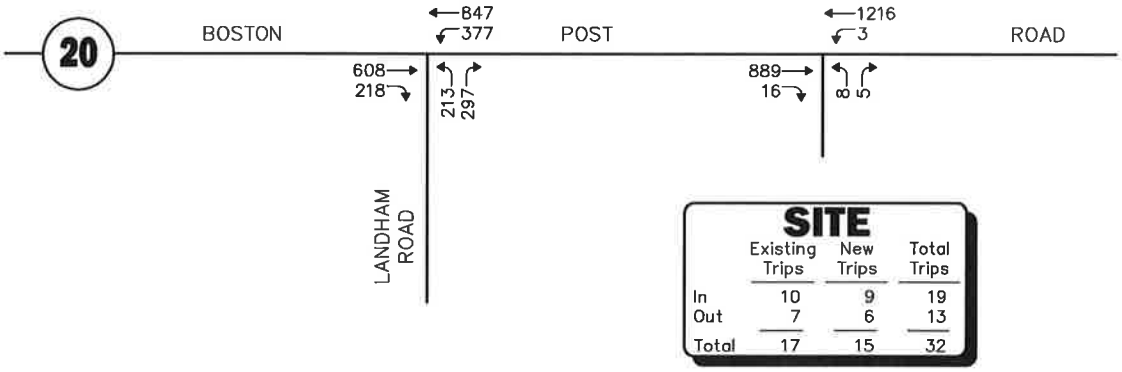


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Figure 6

2023 Build
Peak Hour Traffic Volumes

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Table 4
PEAK-HOUR TRAFFIC-VOLUME INCREASES

Location/Peak Hour	2023 No-Build	2023 Build	Traffic Volume Increase Over No-Build	Percent Increase Over No-Build
Route 20, east of the project site:				
Weekday Morning	1,810	1,813	3	0.17
Weekday Evening	2,108	2,113	5	0.24
Route 20, west of Landham Road:				
Weekday Morning	1,916	1,922	6	0.31
Weekday Evening	1,878	1,886	8	0.43
Landham Road, south of Route 20:				
Weekday Morning	974	976	2	0.21
Weekday Evening	1,103	1,105	2	0.18

As shown in Table 4, project-related traffic-volume increases external to the site relative to 2023 No-Build conditions are estimated at approximately 0.17-0.43 percent, with vehicle increases ranging from 2 to 8 vehicles during the peak hour periods. It is noteworthy that the project adds just 8 vehicles (just one every 7.5 minutes) to the Landham Road/Route 20 intersection during the morning peak hour, and 10 vehicles (one every 6 minutes) to the Landham Road/Route 20 intersection during the evening peak hour.

TRAFFIC OPERATIONS ANALYSIS

Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity and vehicle queue analyses were conducted under Existing, No-Build and Build traffic-volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them.

METHODOLOGY

Levels of Service

A primary result of capacity analyses is the assignment of level of service to traffic facilities under various traffic-flow conditions.[1] The concept of level of service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with level-of-service (LOS) A representing the best operating conditions and LOS F representing congested or constrained operating conditions.

Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year.

[1]The capacity analysis methodology is based on the concepts and procedures presented in the *Highway Capacity Manual;* Transportation Research Board; Washington, DC; 2000.

Unsignalized Intersections

The six levels of service for unsignalized intersections may be described as follows:

- *LOS A* represents a condition with little or no control delay to minor street traffic.
- *LOS B* represents a condition with short control delays to minor street traffic.
- *LOS C* represents a condition with average control delays to minor street traffic.
- *LOS D* represents a condition with long control delays to minor street traffic.
- *LOS E* represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
- *LOS F* represents a condition where minor street demand volume exceeds capacity of an approach lane, with extreme control delays resulting.

The levels of service of unsignalized intersections are determined by application of a procedure described in the 2000 *Highway Capacity Manual.*[2] Level of service is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and STOP signs. Control delay includes the affects of initial deceleration delay approaching a STOP sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. Definitions for level of service at unsignalized intersections are also given in the 2000 *Highway Capacity Manual.* Table 5 summarizes the relationship between level of service and average control delay.

Table 5
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS[a]

Level of Service	Average Control Delay (Seconds Per Vehicle)
A	≤ 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	>50.0

[a]Source: *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2000; page 17-2.

[2] *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2000.

Signalized Intersections

The six levels of service for signalized intersections may be described as follows:

- *LOS A* describes operations with very low control delay; most vehicles do not stop at all.
- *LOS B* describes operations with relatively low control delay. However, more vehicles stop than LOS A.
- *LOS C* describes operations with higher control delays. Individual cycle failures may begin to appear. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
- *LOS D* describes operations with control delay in the range where the influence of congestion becomes more noticeable. Many vehicles stop and individual cycle failures are noticeable.
- *LOS E* describes operations with high control delay values. Individual cycle failures are frequent occurrences.
- *LOS F* describes operations with high control delay values that often occur with over-saturation. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Levels of service for signalized intersections are calculated using the operational analysis methodology of the 2000 *Highway Capacity Manual*. This method assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on delay. Level-of-service designations are based on the criterion of control or signal delay per vehicle. Control or signal delay is a measure of driver discomfort, frustration, and fuel consumption, and includes initial deceleration delay approaching the traffic signal, queue move-up time, stopped delay and final acceleration delay. Table 6 summarizes the relationship between level of service and control delay. The tabulated control delay criterion may be applied in assigning level-of-service designations to individual lane groups, to individual intersection approaches, or to entire intersections.

Table 6
LEVEL-OF-SERVICE CRITERIA
FOR SIGNALIZED INTERSECTIONS[a]

Level of Service	Control (Signal) Delay Per Vehicle (Seconds)
A	≤10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

[a]Source: *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2000; page 16-2.

ANALYSIS RESULTS

Level-of-service analyses were conducted for 2016 Existing, 2023 No-Build and 2023 Build conditions for the intersections within the study area. Level-of-service analyses at the intersection of Route 20 at Landham Road were conducted under unsignalized and future signalized conditions. The results of the intersection capacity analyses are summarized for unsignalized and signalized intersections in Tables 7 and 8, respectively, with the detailed analysis results presented in the Appendix.

The following is a summary of the level-of-service analyses for the intersections within the study area.

Route 20 at Landham Road

Under 2016 Existing conditions, the critical movement at this unsignalized intersection (left-turns from Landham Road) were shown to operate at LOS F during both the weekday morning and evening peak hours. Without improvements, this intersection will continue to operate at LOS F during the peak periods under 2023 No-Build and Build conditions. Under 2023 No-Build and Build conditions, with signalization, the overall operations at this intersection were shown to operate at LOS C or better. Thus, development at the project will not affect the Level of Service at this intersection either before or after signalization is added.

Route 20 at the Site Driveway

Under 2016 Existing conditions, the critical movements at the proposed Landham Crossing driveway (left and right-turns from the Landham Crossing driveway) were shown to operate at LOS E during the weekday morning and weekday evening peak hours. Under 2023 No-Build and Build conditions, the critical movements at the proposed Landham Crossing driveway were shown to operate at LOS F during the weekday morning and weekday evening peak hours. This type of traffic operations is expected at unsignalized driveways along this section of Route 20 during the peak periods, but the condition will be improved with the adjacent signalization of Landham Road which will slow traffic and create gaps in the traffic stream.

Table 7
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE SUMMARY

Unsignalized Intersection/Critical Movement/ Peak Hour	2016 Existing			2023 No-Build			2023 Build		
	Demand[a]	Delay[b]	LOS[c]	Demand	Delay	LOS	Demand	Delay	LOS
Route 20 at Landham Road									
Left-turns from Landham Road									
Weekday Morning	144	>50.0	F	169	>50.0	F	169	>50.0	F
Weekday Evening	168	>50.0	F	213	>50.0	F	213	>50.0	F
Route 20 at the Site Driveway									
Left and right-turns from the site driveway									
Weekday Morning	8	45.8	E	8	>50.0	F	15	>50.0	F
Weekday Evening	7	47.8	E	7	>50.0	F	13	>50.0	F

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level-of-Service.

Table 8
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE SUMMARY

Signalized Intersection/Peak Hour	2016 Existing			2023 No-Build			2023 Build		
	V/C[a]	Delay[b]	LOS[c]	V/C	Delay	LOS	V/C	Delay	LOS
Route 20 at Landham Road									
Weekday Morning	--	--	--	0.86	26.5	C	0.87	26.9	C
Weekday Evening	--	--	--	0.78	17.9	B	0.78	18.1	B

[a]Volume-to-capacity ratio.
[b]Control (signal) delay per vehicle in seconds.
[c]Level-of-Service.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The Coolidge at Sudbury Phase 2 development will entail the construction of 56 additional senior housing units. The project is expected to generate with approximately 11 vehicle trips (4 entering and 7 exiting) during the weekday morning peak hour (or about one vehicle every 5.5 minutes) and 15 vehicle trips (9 entering and 6 exiting) during the weekday evening peak hour (or about one vehicle every 4 minutes).

An analysis of traffic operations at the study area intersections indicates that the project will have a minimal impact on motorist delays and vehicle queuing over Existing and No-Build conditions.

SUMMARY

The proposed additional 56 senior housing units can be accommodated at the existing site driveway intersection with Route 20 and no further improvements are warranted other than a STOP-sign at the site driveway. The level of service will not be affected by the proposed development, which will add only 8 vehicles and hour (one vehicle every 7.5 minutes) during the morning peak hour and only 10 vehicles (one car every 6 minutes) during the evening peak hour at the Route 20/Landham Road intersection. The proposed development will not create any safety hazards at the site driveway or at the Route 20/Landham Road intersection.