Associates Traffic, Transportation & Civil Engineering
Ali R. Khorasani, P.E. P.O. Box 804, Spencer, MA 01562, Tel: (508) 560-4041

Traffic Impact Study Update

Prepared For

Whitney Street Home Builders

Rice Pond Village

Multifamily Residential Development

Located at

15-17 Rice Road

Millbury, Massachusetts

February 2024

TABLE OF CONTENTS

INTRODUCTION

Whitney Street Home Builders, hereafter referred to as the applicant, is proposing the development of a parcel of land totaling 15.6 acres to construct a multifamily residential development. The proposed development is located on the north side of Rice Road between the Providence & Worcester Railroad Company railroad tracks and power line easement. The applicant is proposing to evaluate the traffic impact of this development on area roadways and consider any improvements that may be necessary to make this development feasible and acceptable. This traffic study is prepared to make this evaluation. The purpose of this traffic study is also to update an earlier traffic study dated September 2022, by collecting new traffic data and to develop an understanding of existing traffic operations and concerns, forecast future site generated traffic, assess the adequacy of the existing roadway system to accommodate the new proposed development into the future, and to identify and recommend appropriate mitigation strategies, should any be deemed necessary.

Project description

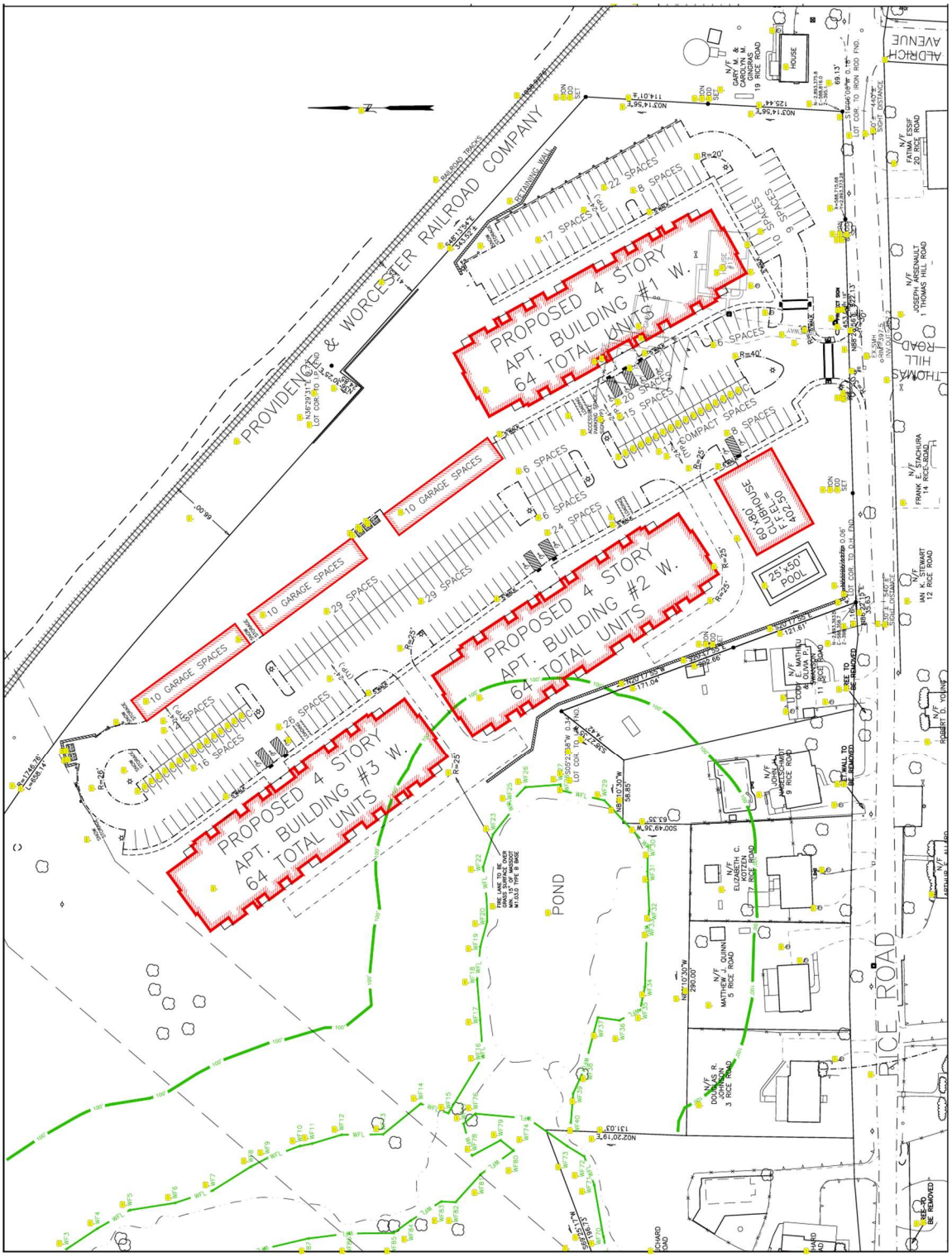
Under the new site plan, the applicant proposes to develop a 15.6-acre parcel of land and build three four story apartment buildings, each floor housing 64 apartment units, for a total of 192 apartment units. Also, the site will include a total of 310 parking spaces, including 30 spaces within garages. Finally, 12 of the parking spaces will be designed and designated as van accessible handicap parking.

The site will be accessed directly from Rice Road via a single driveway that is 33 feet wide and is located approximately 800’ west of the Providence Street intersection, or directly across from Thomas Hill Road, thus creating a four-legged intersection. The site driveway will provide access to all proposed parking spaces that are strategically located in front of the proposed apartment buildings. This entrance driveway has a 33-foot paved surface. The driveway and all parking aisles are proposed to meet or exceed the requirements of the town of Millbury zoning bylaws. The proposed site driveway provides access to all off-street parking spaces for each building as well as each garage space. The proposed site is in an R-1 zoning district and it currently includes one residential property and its approximate location is shown in the aerial photograph in Figure 1.

As stated herein above, the apartment buildings are designed and situated in such a way that they will all have access to off-street parking. This will eliminate the potential for on-street parking activities alongside Rice Road, thus maintaining optimum safety for the neighborhood and for the residents driving through the development. The proposed site plan is shown below in Figure 2.

Figure 1 - Proposed Multi Family Development Site

Figure 2 - Proposed Multi Family Development Site Plan



2

EXISTING CONDITIONS

Evaluation of the transportation impacts associated with the proposed multi-family residential development project requires a thorough understanding of the existing transportation system in the immediate vicinity of the site. Evaluating existing roadway network operating conditions necessitates an examination of existing roadway traffic volumes, geometric features, and local community traffic-related issues. Each of these elements is described below.

Study Area Roadway Network

As in the original report, the study area for this traffic impact report has been defined to include the evaluation of the following intersections located within 1,000 feet of the proposed site driveway.

- Rice Road at Providence Street (Route 122A)
- Rice Road at Thomas Hill Road
- Rice Road at South Main Street

South Main Street is a two-way roadway with one travel lane in each direction. The roadway width is approximately 26' near its intersection with Rice Road. It provides sidewalks on one side of the street north of the Rice Road intersection. South Main Street intersects with Rice Road at a nearly right angle. This intersection has recently been reconfigured to allow for nearly a 90-degree intersection by removing two traffic islands that separated westbound left-turn traffic from right-turn traffic, as well as from eastbound traffic. It is a suburban roadway with predominately residential land use. It traverses in northerly and southerly general directions and provides access to the center of Millbury to the north, and it becomes Dudley Road and connects with Route 146 to the south. South Main Street intersects with Rice Road, Woodland Street, Sycamore Street, Maple Street, and finally, Elm Street in the center of Millbury. Daily traffic volumes in both directions for South Main Street in the vicinity of where its name changes to Dudley Road was obtained from the Massachusetts Department of Transportation (*massDOT*) website. In 2019, the Annual Average Daily Traffic (AADT) on South Main Street from permanent counting station #240695 was 858 vehicles per day at a point approximately a half mile south of the Rice Road intersection. The *massDOT* permanent counting station #240695 shows traffic volumes starting to decrease after the year 2019 due to COVID 19 until the year 2021 when traffic volumes stabilized. Although traffic volumes have stabilized and stayed consistent from 2021 through the year 2022, the volumes may not reach those of periods prior to COVID 19. This may be attributed to the fact that a good portion of the work force has adjusted to working from home/telecommuting.

Rice Road is also a residential street, and it traverses in the easterly and westerly directions. It has recently been improved with a freshly paved surface with a consistent width of 22 feet, except

at/near its intersection with South Main Street, where the roadway width increases to anywhere from 36 feet to 40 feet for approximately 60 feet. The newly configured leg of Rice Road at South Main Street is posted with a new stop sign that controls the westbound traffic at this intersection. Although there is no striping for the westbound approach of Rice Road at this intersection, it is wide enough for a distance of 60 feet so that it could be operating as a two-lane approach; one for left-turn and a second one for right-turn movement. The following photograph depicts this newly configured intersection approach. Rice Road also crosses the Providence & Worcester Railroad Company railroad tracks near its easterly terminus and connects South Main Street to Providence Street (Route 122A) at its easterly terminus. The travel width of Rice Road at the tracks was measured at 19 feet. The railroad crossing is equipped with appropriate crossbuck signs and lights. However, the new pavement lacks appropriate signage and markings that are in compliance with Section 8 of the 11th edition of the Manual on Uniform Traffic Control Devices (MUTCD). Finally, there are no speed limit signs posted on Rice Road. Therefore, the statutory prima facie speed limit of 30 miles per hour applies to Rice Road.

Rice Road approach at South Main Street

Providence Street (Route 122A) is a rural arterial street and is also a state numbered highway. It traverses in the northerly and southerly general directions. It connects to Grafton Street in the center of Millbury to the north, and to Wilkinsonville and Saundersville, and eventually intersecting Providence Road (Route 122) to the south in South Grafton. Its pavement width ranges from 36 feet to 38 feet near its intersection with Rice Road. Providence Street in the area near the Rice Road intersection is posted with 30 mile per hour speed limit signs. In 2022, the

AADT along Providence Street from permanent counting station #240693 was 5,800 vehicles per day at a point approximately a half mile south of the Rice Road intersection. Again, the *massDOT* permanent counting station #240693 shows traffic volumes starting to decrease after the year 2019 due to COVID 19 until the year 2021 when traffic volumes stabilized. Although traffic volumes have stabilized and stayed consistent from 2021 through the year 2022, the volumes may not reach those of pre-COVID 19 levels. As expected, this lower traffic may be attributed to the fact that a substantial portion of the work force has become accustomed to working from home/telecommuting. Finally, land use along Providence Street in this area is primarily commercial/business which also includes the Town of Millbury Department of Public Works facilities.

Intersection of South Main Street and Rice Road, also known as Victor Pelletier Square, is a three-legged "T" intersection with what appears could be a two-lane approach for the westbound traffic. As stated earlier, the Rice Road leg of this intersection was recently reconfigured to eliminate two traffic islands and a utility pole that was in the middle of one of the traffic islands. The new configuration does not have any striping and therefore, it is not clear as to how many lanes will be provided for the westbound approach. Again, due to the wide width of this approach, it is likely that traffic could form two lanes such as a westbound right-turn lane and a left-turn lane. The reconfiguration of the Rice Road leg of this intersection is considered an improvement as it makes the angle of the intersection close to 90 degrees. The South Main Street approaches of this intersection have one lane each. Finally, the westbound approach of this intersection is posted with a stop sign, but no stop bar, centerline or lane lines were observed for this approach.

Intersection of Providence Street and Rice Road is also a three-legged intersection with one lane approaches. The Rice Road approach of this intersection forms a "Y" intersection due to the acute angle of the intersection. There is no stop or yield control sign posted for the eastbound approach of Rice Road at this intersection.

Traffic Volumes

To update the traffic volumes for the intersections in the study area, a new set of traffic counts was collected. It should be noted that although traffic volumes were at historic lows during COVID-19, traffic volumes have finally stabilized. Nevertheless, the new traffic counts may potentially undercount the baseline for which future years are based. Therefore, the peak hour traffic counts were adjusted to pre-COVID-19 conditions using *massDOT* historic traffic data and guidelines.

The new peak hour turning movement counts were obtained to reflect the current traffic conditions in the area. The new counts were collected on Thursday, February 15, 2024, during two-hour periods between the hours of 7-9 AM and 4-6 PM at peak commuter periods, as well as on Saturday, February 17, 2024, during two-hour period between 11 AM and 1 PM.

To establish the present baseline volumes, the intersection turning movement counts were adjusted and normalized into the present year (baseline) utilizing the *massDOT* factor as described below.

The adjusted peak hour turning movement counts are summarized in the following Table 1. They are also depicted in the following Figure 3.

Table 1
Covid Adjusted and Normalized 2024 Peak Hour Turning Movement Counts

Normalized	S Main St at Rice Rd						Rice Rd at Thomas Hill Rd						Providence St at Rice Rd					
	NB T	NB R	SB L	SB T	WB L	WB R	NB L	NB R	EB T	EB R	WB L	WB T	EB L	EB R	NB L	NB T	SB T	SB R
AM Peak	52	8	14	43	7	12	8	6	17	5	3	7	11	8	12	233	155	2
PM Peak	43	7	14	93	5	14	4	3	14	12	5	13	3	4	11	250	291	12
Sat Peak	43	2	12	60	5	5	7	1	14	7	2	7	10	11	8	220	191	9

A more concise method is using the April 2020, revised *massDOT* Guidance on Traffic Count Data. The *massDOT* Yearly Growth Rates data from 2014 -2019 are shown in the Technical Appendix. The growth rates go back to 2014, and therefore, the rates were averaged and then expanded to a five-year period to adjust for the Covid-19 pandemic and then a five-year period to account for the future no-build and build conditions. The average annual growth rate was calculated at 0.0034. This rate was multiplied by five to get the total increased rate of 0.017 for the Covid-19 adjustment (for baseline) and then the resultant was multiplied by another five to get the total increase rate of 0.0175 for future no build conditions. Therefore, the turning movement counts were increased by these factors. Again, as per *massDOT* Guidance on Traffic Count Data, this increase also accounts for all future traffic from any other additional developments that may take place in the general area of the proposed development site between now and the year 2029.

Additionally, the *massDOT* Highway Division provides statewide traffic data collection that includes weekday seasonal factors. To evaluate the potential for seasonal fluctuation of traffic volumes on roadways near the proposed site, weekday seasonal factors were obtained from the *massDOT* Statewide Traffic Data Collection. The data indicated that the seasonal factor for traffic collected during the month of February is 1.09 for R4-7 category roadways. Usually, the TMCs are multiplied by the factor of 1.09 to reflect those of the yearly average. Therefore, the extrapolated data were further adjusted to reflect those of an average year. A copy of adjustment factors is presented in the Technical Appendix section of this report. The seasonally adjusted turning movement counts are shown in Figure 4.

Typically, the PM peak period has the higher volumes, and is considered the critical peak. As is the case here, higher traffic volumes also occur during the PM peak period at these intersections. The percentage of truck traffic at permanent counting station #240695 along South Main Street was recorded by the *massDOT* at 1.3%. This rate includes all vehicles having three axles or more, some of which provide services to the residential properties along South Main Street. This rate is considered below average for roadways having similar characteristics. Again, Figure 4 depicts the base line turning movement counts that were adjusted to reflect an average year for the year 2024.

Figure 3
Existing Turning Movement Counts COVID Adjusted

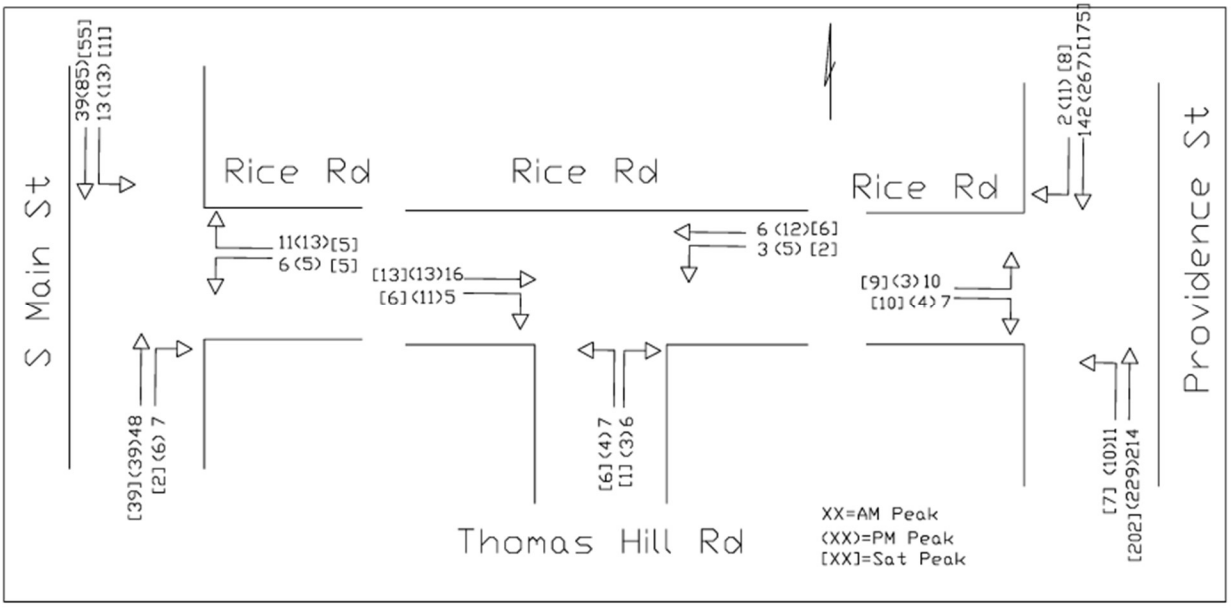
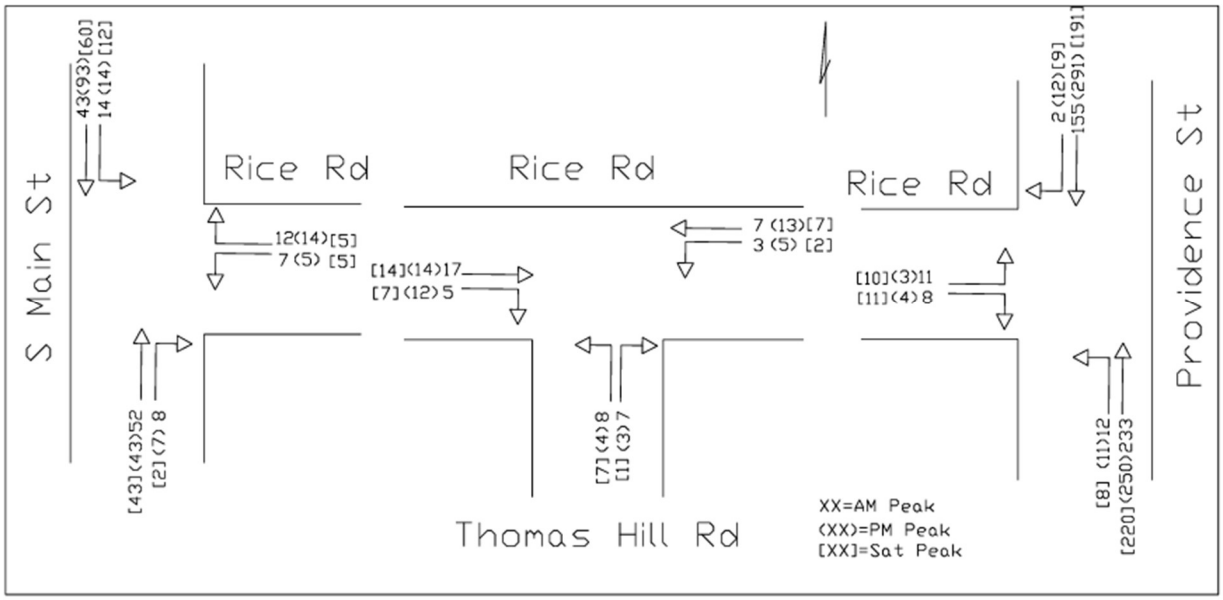


Figure 4
Seasonally Adjusted Baseline Turning Movements



Safety Concerns

Sight Distances: To evaluate the safety of traffic to and from the proposed site via its proposed driveway, sight distances were measured in the field and analyzed.

Sight distance is defined in the *massDOT Project Development and Design Guide* as the length of roadway ahead that is visible to the road users. In most cases, specific sight distance measures apply to motor vehicles and bicyclists. There are two aspects of sight distance that apply to this case. They are:

- Stopping sight distance
- Intersection sight distance

The sight distances are related to the design speed (posted speed) of the roadway and are based on the standards of the American Association of State Highway and Transportation Officials (AASHTO) publication entitled *A Policy on Geometric Design of Highways and Streets* also referred to as the *Green Book.*

Stopping Sight Distance is further described in the *massDOT Project Development and Design Guide* as the distance necessary for a vehicle traveling at the design speed (posted speed) before reaching a stationary object in its path. The sight distance at every point along a roadway should be at least the stopping sight distance.

The sight distances for vehicles leaving the site via the proposed driveway to the right (west) and left (east) of the proposed site driveway were measured in the field. The measured distances are those from a point 5 feet back of a stop bar (approximately 15 feet from the street line) and 3.5 feet above grade to represent drivers' eye height to an object 3.5 feet above roadway grade. The field review of Rice Road showed that the available sight line for the traffic coming out of the proposed site driveway is approximately 500+ feet to the right (west) and 350 feet to the left (east). As stated earlier, no speed limit signs are posted on Rice Road. Therefore, the statutory prima facie speed limit of 30 miles per hour applies.

Based on Basic Design Controls for roadway design, the Stopping Sight Distance is calculated using the formula d=(V*V)/(30*f), plus the time required for perception and reaction by a driver (2.5 seconds). V is approach speed in mph, and f=0.28-0.35. The stopping sight distances are calculated and are provided in Exhibit 3-8 of the 2006 *massDOT Project Development and Design Guide*. A copy of this exhibit is presented in the Technical Appendix section of this report. The required stopping sight distance for 30 miles per hour speed on Rice Road is 200 feet.

Intersection Sight Distance is explained by the *massDOT Project Development and Design Guide* as a sight distance at an intersection to allow drivers to perceive the presence of potentially conflicting vehicles. This should occur in sufficient time for a motorist to stop or adjust their speed, as appropriate, to avoid colliding in the intersection. Intersection sight distance also allows drivers of stopped vehicles with a sufficient view of the intersecting roadway to decide when to enter or cross the intersecting roadway. The AASHTO *Green Book* provides procedures

to determine desirable intersection sight distances at intersections for various cases, one procedure is Intersection Sight Triangle. Exhibit 3-11 of the *massDOT Project Development and Design Guide* that demonstrates the sight distances desired based on Intersection Sight Triangle methodology is included in the Technical Appendix section of this report. As shown in this exhibit, for the posted speed limit of 30 mph on Rice Road, 335 feet should be provided for vehicles turning left from the site driveway, and 290 feet should be provided for vehicles turning right from the site driveway.

Again, as demonstrated herein above, available sight distances are greater than the desired values for intersection sight distances. Therefore, proper intersection sight distances can be provided in both directions for the proposed driveway. The following Table 2 shows the relationship between the available sight distances, required stopping sight distances, and the desired intersection sight distances.

The following photographs illustrate the available sight distances visually for both directions of Rice Road at the proposed site driveway.

The sight distances were examined both horizontally and vertically. The following Google Earth aerials show the general grade profile of Rice Road in respect to the proposed site driveway in both directions. It should be noted that these same sight distances currently provide safe sight lines for traffic in and out of Thomas Hill Road at its intersection with Rice Road, which is located opposite the proposed site driveway.

From proposed Driveway looking to the right (west)

From proposed Driveway looking to the left (east)

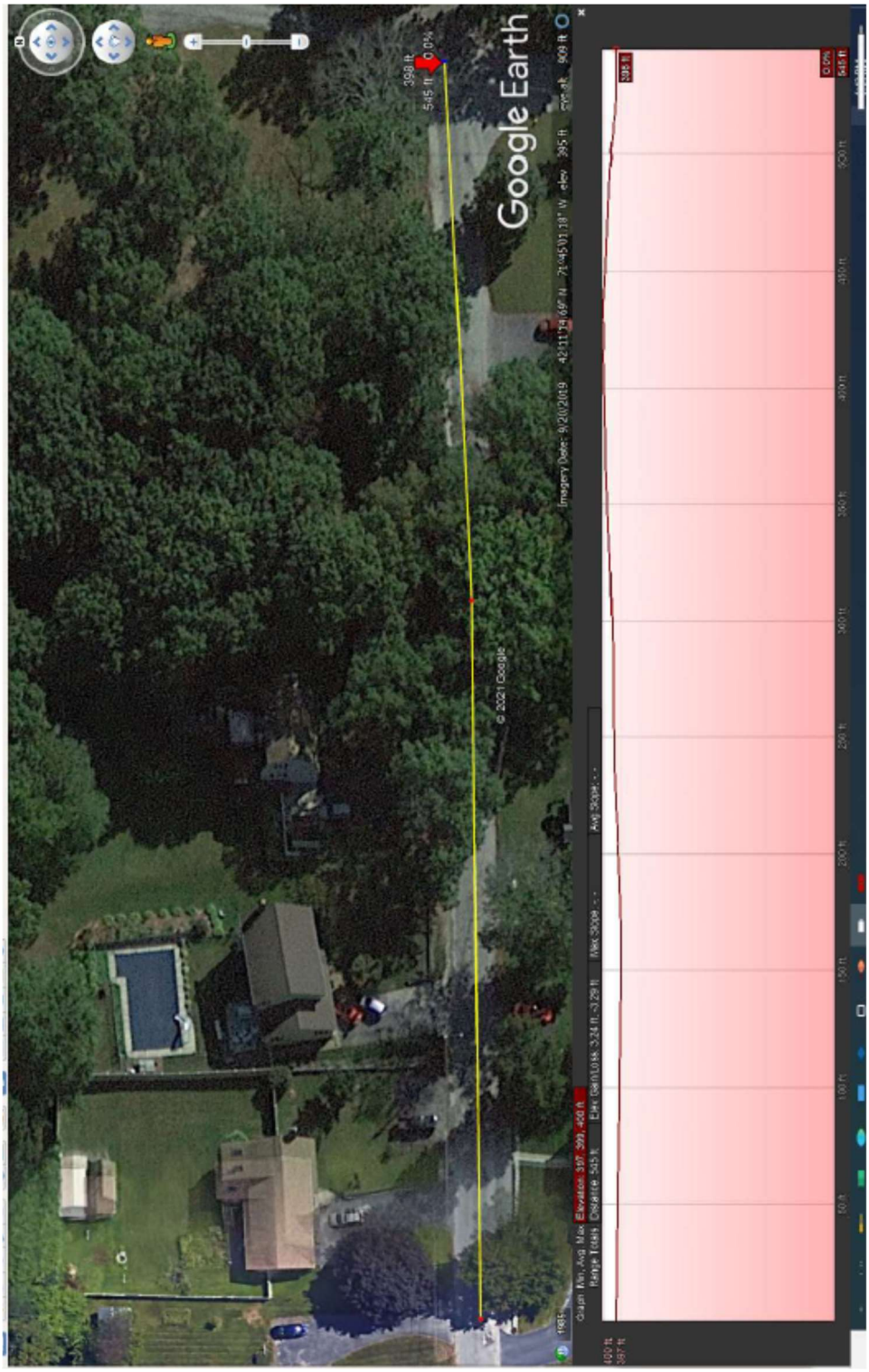
Table 2
Sight Distance Analysis

Direction	Available SD	Required SSD	Desired ISD
Looking to right (west)	500'+	200'	335'(LT), 290'(RT)
Looking to the left (east)	350'	200'	335'(LT), 290'(RT)

As demonstrated herein above, available sight distances are significantly greater than the required values. Therefore, proper sight distances in both directions will be provided along Rice Road for vehicles entering and exiting the proposed site.

Rice Road profile looking to the east (left) from proposed site driveway

Rice Road profile looking to the west (right) from proposed site driveway



Accidents: The latest accident data compiled by the *massDOT* were obtained and reviewed for an eight-year period of January 1, 2016, through January 1, 2024. This review revealed that only one accident was reported at the intersection of Rice Road and Providence Street. It was a rear-end type accident involving a vehicle traveling eastbound waiting to turn right onto Providence Street and was rearended by a second vehicle. It occurred on December 11, 2019, at 7:21 PM, and it was raining. This accident involved property damage only. Using the new turning movement counts compiled during traffic surveys of these intersections, an accident rate was calculated in accidents per million vehicles entering the intersection of Rice Road and Providence Street. Utilizing the *massDOT* prescribed methodology, the accident rate for this intersection was calculated at 0.05, which is significantly lower than the *massDOT*'s latest available rate of 0.61 for unsignalized intersections on roadways in District 3 of the *massDOT* in which the town of Millbury is located. A copy of the accident rate calculation sheet is included in the Technical Appendix section of this report. Also included in the Technical Appendix section of this report is a copy of the *massDOT* Average Crash Rates for signalized and unsignalized intersections throughout the Commonwealth of Massachusetts.

Finally, there was one more accident recorded in front of #9 Rice Road that is approximately 400' west of the proposed site driveway. This accident occurred on March 17, 2019, at 3:00 PM and it involved a single vehicle backing out and hitting a parked car. This accident involved no injuries.

Existing Conditions Summary

Rice Road can be characterized as a two-way roadway with one travel lane in each direction along its length in the vicinity of the proposed multifamily residential development site. However, Rice Road has been improved with a new resurfacing that also includes reconfiguration of its intersection with South Main Street. Rice Road has a uniform width of 22 feet except at South Main Street which has a width that ranges from 36 feet to 40 feet. As stated earlier in this report, Rice Road now intersects South Main Street at nearly 90 degrees. It is approximately 1,700 feet in length, and it connects South Main Street to Providence Street. It is a residential roadway and has a combination of gentle horizontal and vertical curves on either side of the proposed site driveway.

The current land use designation for the proposed multifamily development site is R-1, and the site currently includes one residential property, and its approximate location is shown in the aerial photograph in Figure 1.

3

FUTURE CONDITIONS

Where possible, traffic volumes in the study area are projected to post-development levels. Projected traffic volumes include the existing traffic data obtained from the new turning movement counts, adjusted, and normalized into the year 2024 to account for the COVID-19 pandemic and to represent the post-pandemic baseline, then projected into the future no build (year 2029) to reflect increases due to future area projects, and finally, added to the new traffic expected to be generated by the proposed multifamily residential development to represent future build conditions.

Site-Generated Traffic

The magnitude of traffic volumes that will be generated by the proposed development was projected by using the latest (11th) Edition of *Trip Generation*[1] *Manual* plus its supplement published by the Institute of Transportation Engineers (ITE).

Based on the ITE *Trip Generation Manual*, the rates at which the proposed land use generates traffic vary depending upon the time of day. These rates were used to calculate the number of trips expected to be generated by the proposed multifamily residential development during an average weekday, morning, afternoon, and Saturday peak traffic periods. To obtain the most accurate forecast and to be consistent with the guidelines established by the *massDOT*, when available, the fitted curves in the *Trip Generation Manual* were used to forecast trips to and from the proposed site for daily, AM, PM, and Saturday peak hours. The ITE Trip Generation tabulation pages are presented in the Technical Appendix section ofthis report. The resulting trips and their directional distribution for this site are shown in the following Table 3.

TABLE 3
ITE Trip Generation for Multi-Family Development
192 Units Multi-Family Housing (Mid-Rise) ITE LU Code 221

	Daily	%In	%Out	AM Pk	%In	%Out	PM Pk	%In	%Out	Sat Pk	%In	%Out
Trip Rate	4.54	50%	50%	0.37	23%	77%	0.39	61%	39%	0.39	51%	49%
Trips	869*	434*	435*	73*	17*	56*	75*	46*	29*	75*	38*	37*

* *Fitted Curve values were used as they were greater than Average values*

As can be seen in Table 3 above, the total number of new trips expected to be generated by the proposed multifamily residential development results in the highest traffic during PM peak period, thus making the PM peak hour the critical peak. Although Saturday peak traffic is like that of PM peak hour, its directional volumes are lower than those of AM and PM peak hours. In standard

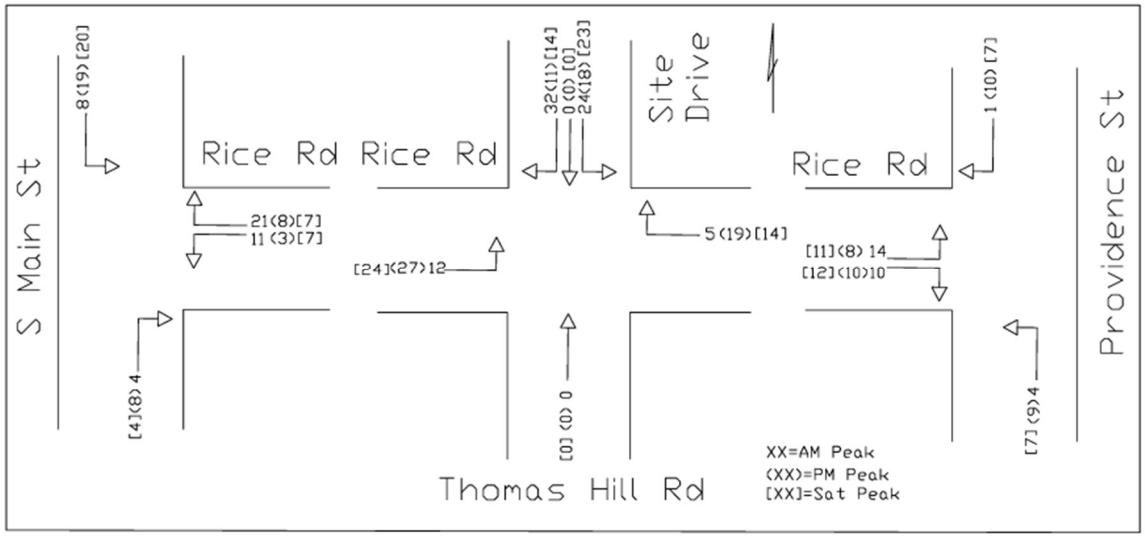
traffic engineering practice, the critical peak period trips are usually used to evaluate the worst-case scenario. However, all three AM, PM and Saturday peak traffic periods were evaluated for all three intersections.

Trip Distribution and Assignment

Because such factors as population density, land use, availability of major highways in the area, and other demographics that make up the traffic patterns within a community, the directional distribution of the projected site-generated trips to and from the proposed multifamily residential development site was based on the existing traffic patterns within the immediate vicinity of the site and based on the knowledge of local traffic patterns. The turning movement traffic counts for the intersection of Rice Road with South Main Street, Thomas Hill Road, and Providence Street are good indicators of the traffic patterns in this area.

Using this information, the projected new site-generated trips from the above Table 3 are proportionally assigned to each approach of these intersections. As shown in Table 3 above and Figure 5 below, during AM peak period, a sum of 17 vehicles would be arriving at the proposed development site and 56 vehicles would be departing from the site in both directions along Rice Road via the proposed site driveway. During PM peak period, a total of 46 vehicles are expected to arrive and 29 vehicles are expected to depart from the proposed site via the proposed site driveway. During a Saturday peak hour, a total of 38 vehicles are expected to arrive and 37 vehicles are expected to exit the site. Finally, a total of 434 vehicles are expected to arrive and 435 vehicles are expected to depart from the proposed site during a 24-hour period on an average day.

Figure 5
Trip Generation and Distribution



[1] *Trip Generation, 11th Edition,* Institute of Transportation Engineers; Washington,

Site Access and Circulation

Site access and internal traffic circulation were evaluated as part of assessing the proposed residential development site. Access to the proposed site is achieved through a driveway located directly opposite Thomas Hill Road, thus forming a four-legged intersection. The proposed site driveway will provide full access to all three apartment buildings. This driveway is intended to accommodate all traffic to and from the proposed development leading up to these buildings and garages in a safe and efficient manner. The site driveway is 33 feet in width with corner radii of 30 feet to accommodate emergency apparatus.

Also, as stated earlier, a total of 310 parking spaces are proposed, 12 of which will be designed and designated as van accessible handicap parking. A total of 30 of the proposed parking spaces will be inside garages. This will eliminate the potential for on-street parking activities alongside Rice Road, thus maintaining optimum safety for residents driving through the area. This translates into 1.61 parking spaces per apartment unit.

The magnitude of parking spaces that will be required by the proposed multifamily residential development was forecasted by using the latest (6th) Edition of *Parking Generation Manual*[1] document also published by the ITE.

Based on the latest ITE *Parking Generation Manual*, the rates at which Residential Low/Mid-Rise Apartments (land use 221) generate demand for parking vary depending upon the location of the project. The demand for off-street parking is greatest for residences located in suburban areas primarily due to the lack of public transportation and long distances from daily conveniences. The average peak period parking demand for apartments located not close to rail transit is 1.23 vehicles for each 2+ bedroom apartment unit, and the 85th percentile demand for apartments located in suburban areas is 1.45 vehicles per unit. This translates into anywhere from 11% to 31% more proposed parking spaces than will be needed during an average weekday or peak period.

[1] *Parking Generation,* Institute of Transportation Engineers; Washington, DC

4

TRAFFIC OPERATIONS

Measuring existing traffic volumes and projecting future traffic volumes quantify traffic flow within the study area. To assess the quality of traffic flow, intersection capacity analyses were performed to measure existing baseline conditions and for projected future design year (2029) conditions with and without the implementation of the proposed multifamily residential development project. Intersection capacity analyses provide an indication of how well roadway facilities and their components serve the traffic demands placed upon them. This section, which updates the original report, includes potential on-site and off-site mitigation improvements should any be deemed necessary to minimize the impact of the proposed multifamily development on the surrounding roadways.

Traffic Operations Measures

Level of service (LOS) is the term used to demonstrate the different operating conditions which occur on a given roadway segment or at an intersection under different traffic volume conditions. LOS is a qualitative measure of the effect of several other factors including roadway geometry, speed, travel delay, signalization timing, freedom to maneuver and safety. The criteria used to analyze the intersections within 1,000 feet of the proposed development site are based on the Highway Capacity Manual and its computer software, Synchro. The computer output sheets are presented in the Technical Appendix section of this report.

The LOS concept is an indicator of the operational qualities of a roadway or an intersection. Six LOSs are defined for each type of facility. They are given letter designations from “A” to “F”. LOS “A” represents the best operating conditions, while LOS “F” represents the worst. Typically, LOS “D” is considered acceptable during peak hour conditions, but LOS ”E” may also be acceptable under some circumstances.

The LOS designation is reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of all traffic entering the intersection, and a LOS designation can be calculated for overall conditions at the intersection. For an unsignalized intersection, however, the analysis assumes that through traffic on major roadways is not affected by traffic on side streets (streets with lower volumes and/or ones under stop sign control). Therefore, a LOS designation is typically calculated for the controlled movements (minor street approaches and major street left-turn movements). As described in the following paragraphs, capacity or LOS analyses were considered for year 2024 existing, year 2029 future no build, and year 2029 future build conditions for morning, evening, and Saturday peak hour periods at the above-mentioned intersections, including the proposed site driveway.

Existing Conditions

Intersection capacity analyses were performed for all three intersections during morning, evening, and Saturday peak traffic periods. These intersections are the only locations within 1,000 feet, or the immediate vicinity of the proposed development site that may be affected by the traffic expected to be generated by the proposed multifamily residential development.

The analysis concluded that LOS "A" is calculated for all approaches of these intersections during all three peak periods, except for the eastbound approach of Rice Road at Providence Street which is operating at LOS "B" during all three peak periods. A summary of intersection analyses results for existing conditions is shown below in Table 4.

Future Conditions

Capacity analyses for the future year peak hour traffic operations were performed for the year 2029 volumes during all three peak periods with and without the proposed multifamily development project in place. A summary of intersection analyses results for both future no-build and future build conditions is also shown below in Table 4.

As noted earlier in this report, in projecting the year 2029 future no-build traffic volumes, the latest *massDOT* available statistics were used. As stated earlier under the Traffic Volumes section, the growth rates that go back to 2014 were averaged and then applied to expand to a five-year period in order to represent the buildout year. The average annual growth rate over the past five-year period was calculated at 0.0034. Therefore, the baseline volumes were increased by that rate over five years. Figure 6 shows the volumes for the future no-build conditions for all three intersections within the study area. The projected future no build year (2029) traffic should also account for any future developments in the general area of the proposed site.

Build traffic volumes were determined by projecting site-generated traffic volumes and distributing those volumes over the intersections within the study area, and finally, adding them to the future no-build conditions volumes. Figure 7 shows future build conditions traffic volumes for all three intersections, including the proposed site driveway that will form the fourth leg of the intersection of Rice Road and Thomas Hill Road.

Figure 6
Turning Movement Counts, Future No Build Conditions

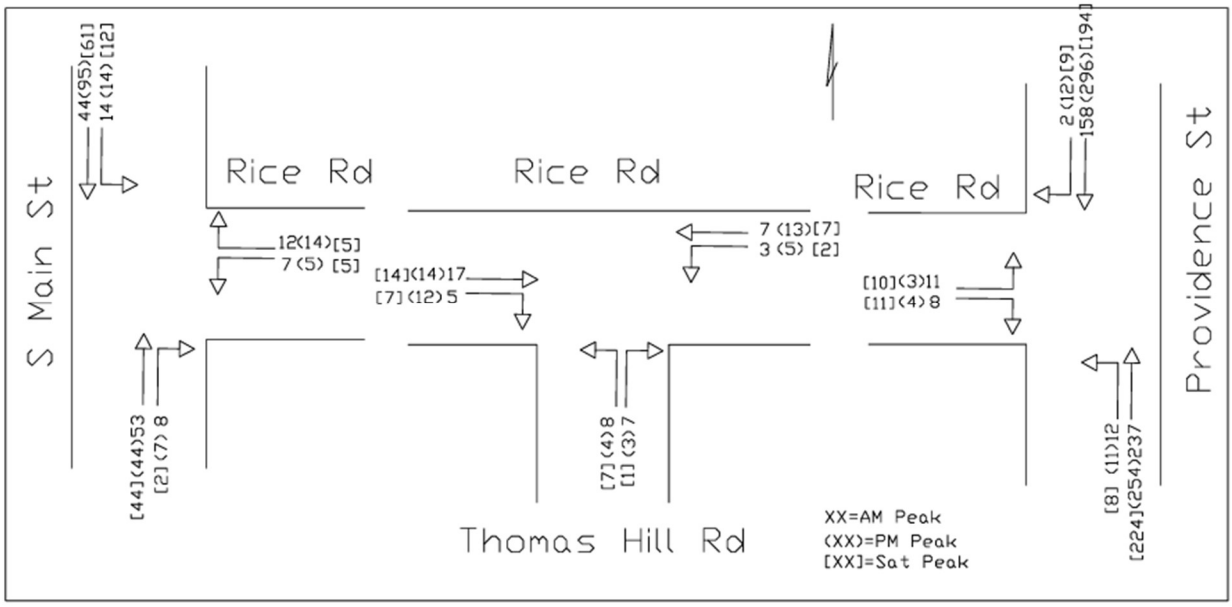
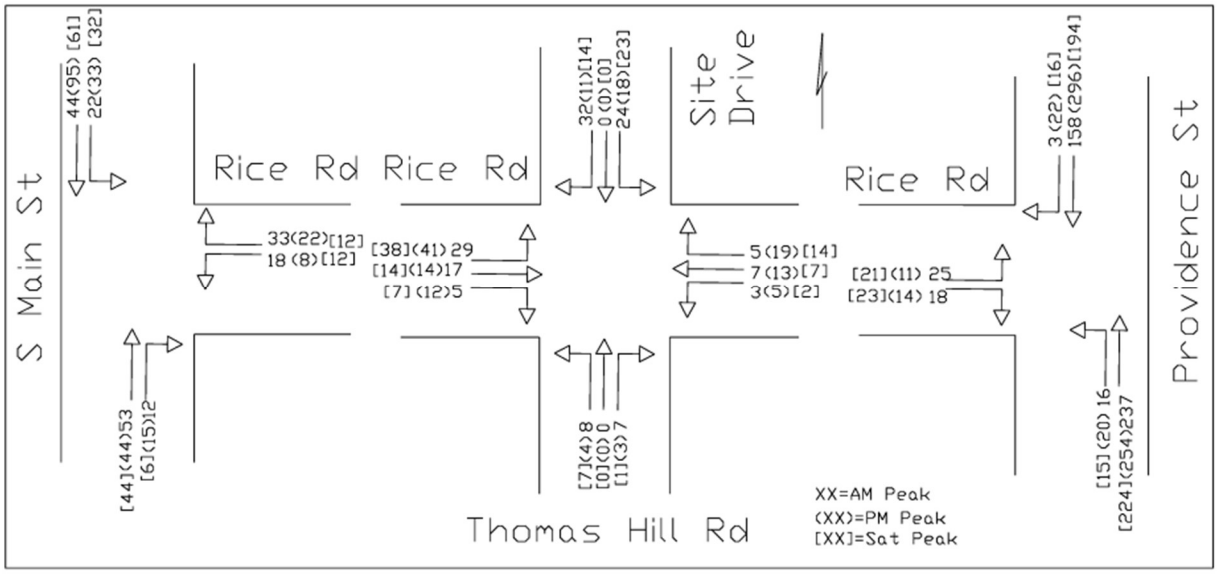


Figure 7
Turning Movement Counts, Future Build Conditions



The intersection LOSs for the year 2029 no-build conditions were calculated for the approaches of these intersections and are expected to be "A" during all three peak periods except the eastbound approach of Rice Road at its intersection with Providence Street which will be operating at LOS "B", signifying no increase in vehicular delays.

To assess the potential traffic impact of the proposed development on these intersections, all traffic from the site was distributed along Rice Road and its three intersections. This will result in the assessment of these intersections under worst-case scenarios. The above Figures 3, 5 and 6 show the traffic volumes at all intersections for the AM, PM, and Saturday peak hours under existing, future no-build, and future build conditions.

The intersection analysis for the year 2029 build conditions were performed for approaches of all three intersections including the site driveway. The analysis revealed that under future build conditions, all three existing intersections will continue to operate at the same LOS as the future no-build with LOS "A" except for the eastbound approach of Rice Road at Providence Street which, again will be operating at LOS "B".

Again, the above-mentioned LOSs "A" and "B" for all three intersections under existing and for future no-build and build conditions are indicative of no impact associated with the development of the proposed multifamily project.

A summary of intersection analyses for all three intersections, including the proposed driveway that forms the fourth leg of the intersection of Rice Road and Thomas Hill Road is also provided herein below in Table 4. Finally, the computer printout of the above-mentioned analysis is presented and included in the Technical Appendix section of this report.

Table 4
Level Of Service Analysis Results Summary

	South Main Street at Rice Road								
AM Peak	Existing 2024			No Build 2029			Build 2029		
Approach	SB L		WB	SB L		WB	SB L		WB
App Delay	1.7		9.1	1.6		9.1	2.3		9.4
v/c	0.01		0.03	0.01		0.03	0.02		0.09
App LOS	A		A	A		A	A		A
Int Av Dela	2			2			3.6		
Int LOS	A			A			A		
PM Peak	Existing 2024			No Build 2029			Build 2029		
Approach	SB L		WB	SB L		WB	SB L		WB
App Delay	1.4		9.1	1.4		9.1	2.7		9.4
v/c	0.02		0.03	0.02		0.03	0.04		0.06
App LOS	A		A	A		A	A		A
Int Sig Dela	2.1			2			3.1		
Int LOS	A			A			A		
Sat Peak	Existing 2024			No Build 2029			Build 2029		
Approach	SB L		WB	SB L		WB	SB L		WB
App Delay	1.6		9.4	1.6		9.3	3.2		9.9
v/c	0.01		0.02	0.01		0.02	0.04		0.05
App LOS	A		A	A		A	A		A
Int Sig Dela	1.3			1.5			3		
Int LOS	A			A			A		

	Providence Street at Rice Road								
AM Peak	Existing 2024			No Build 2029			Build 2029		
Approach	NB L	SB R	EB	NB L	SB R	EB	NB L	SB R	EB
App Delay	0.8	0	13.1	0.7	0	11.1	0.9	0	11.7
v/c	0.02	0.34	0.06	0.02	0	0.05	0.02	0.11	0.11
App LOS	A		B	A		B	A		B
Int Av Dela	0.7			1			1.9		
ICU LOS	A			A			A		
PM Peak	Existing 2024			No Build 2029			Build 2029		
Approach	NB L	SB R	EB	NB L	SB R	EB	NB L	SB R	EB
App Delay	0.06	0	11.4	0.6	0	11.5	1	0	12.1
v/c	0.01	0.2	0.02	0.01	,21	0.02	0.03	0.21	0.07
App LOS	A		B	A		B	A		B
Int Sig Dela	0.5			0.4			1.1		
Int LOS	A			A			A		
Sat Peak	Existing 2024			No Build 2029			Build 2029		
Approach	NB L	SB R	EB	NB L	SB R	EB	NB L	SB R	EB
App Delay	0.6	0	10.8	0.6	0	10.9	1.1	0	11.4
v/c	0.01	0.12	0.04	0.01	0.12	,04	0.03	0.13	0.09
App LOS	A		B	A		B	A		B
Int Sig Dela	0.9			0.9			1.7		
Int LOS	A			A			A		

Table 4 Continued
Level Of Service Analysis Results Summary

	Rice Road at Thomas Hill Road									
AM Peak	Existing 2024			No Build 2029			Build 2029			
Approach	EB	WB	NB	EB	WB	NB	EB	WB	NB	SB
App Delay	0	3.4	8.8	0.0	3.4	8.8	3.6	2.8	9.5	9.1
v/c	0.02	0.01	0.03	.o2	0.01	0.03	0.02	0.01	0.03	0.07
App LOS		A	A		A	A	A	A	A	A
Int Av Dela	3.8			3.8			6.2			
Int LOS	A			A			A			
PM Peak	Existing 2024			No Build 2029			Build 2029			
Approach	EB	WB	NB	EB	WB	NB	EB	WB	NB	SB
App Delay	0	2.4	8.7	0.0	2	8.6	3.8	1.3	9.2	9.4
v/c	0.02	0.01	0.02	0.02	0.00	0.01	0.03	0.01	0.02	0.04
App LOS		A	A		A	A	A	A	A	A
Int Av Dela	2.4			1.9			4.6			
Int LOS	A			A			A			
Sat Peak	Existing 2024			No Build 2029			Build 2029			
Approach	EB	WB	NB	EB	WB	NB	EB	WB	NB	SB
App Delay	0	2.7	8.7	0.0	2.7	8.7	4.3	1.6	9.8	9.3
v/c	0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.01	0.04	0.05
App LOS		A	A		A	A	A	A	A	A
Int Av Dela	2.6			2.6			5.7			
Int LOS	A			A			A			

5
FINDINGS

This updated traffic study has been conducted to evaluate the potential traffic impacts associated with the proposed multifamily residential development site located north of Rice Road in Millbury, Massachusetts utilizing new traffic data that were collected in February of 2024. This study includes the evaluation of three unsignalized intersections within 1,000 feet and in proximity of the proposed site which are likely to be impacted by any traffic from the proposed development project. An evaluation of the area to identify capacity constraints was performed for existing, future no-build, and future build conditions. Future analyses have determined that the site-generated traffic volumes are not significant, and they can safely be accommodated with the existing roadways and the proposed site driveway. These analyses demonstrated that with the additional traffic volumes associated with the proposed multifamily development, the intersection LOSs would not degrade and remain at "B" or better. The analysis showed that the intersection of Rice Road, Thomas Hill Road and the site driveway will be operating at LOS "A" during all three peak periods.

As stated earlier, the percentage of truck traffic at permanent counting station #240695 along South Main Street was recorded by the *massDOT* at 1.3%. This value is considered below average for roadways having similar characteristics.

Conclusion & Recommendations

It is concluded that the area roadways within the vicinity of the proposed development site have enough capacity to safely serve the anticipated additional traffic associated with the proposed multifamily development, particularly since Rice Road has recently been repaved and has been improved. The level of service evaluation presented above is an indicator of the quality of traffic flow through the area. This evaluation indicates that the LOSs are not expected to change and will not fall below "B" at the intersections studied.

It should be noted that the applicant will need to make an effort to trim vegetation along the frontage of the proposed site along Rice Road, particularly to the west, in order to further enhance the sight distances for vehicles leaving the site.

Therefore, to maintain optimum safety and efficiency, the following improvements are recommended.

1. The site frontage on the north side of Rice Road to the west of the intersection of Rice Road and the access driveway should be graded and cleared of tall vegetation to further improve the sight distance to the west (right).
2. Any landscaping along the frontage of the proposed site on Rice Road should be limited to

vegetation varieties that do not grow higher than 2.5 feet to ensure best sight distances are maintained.

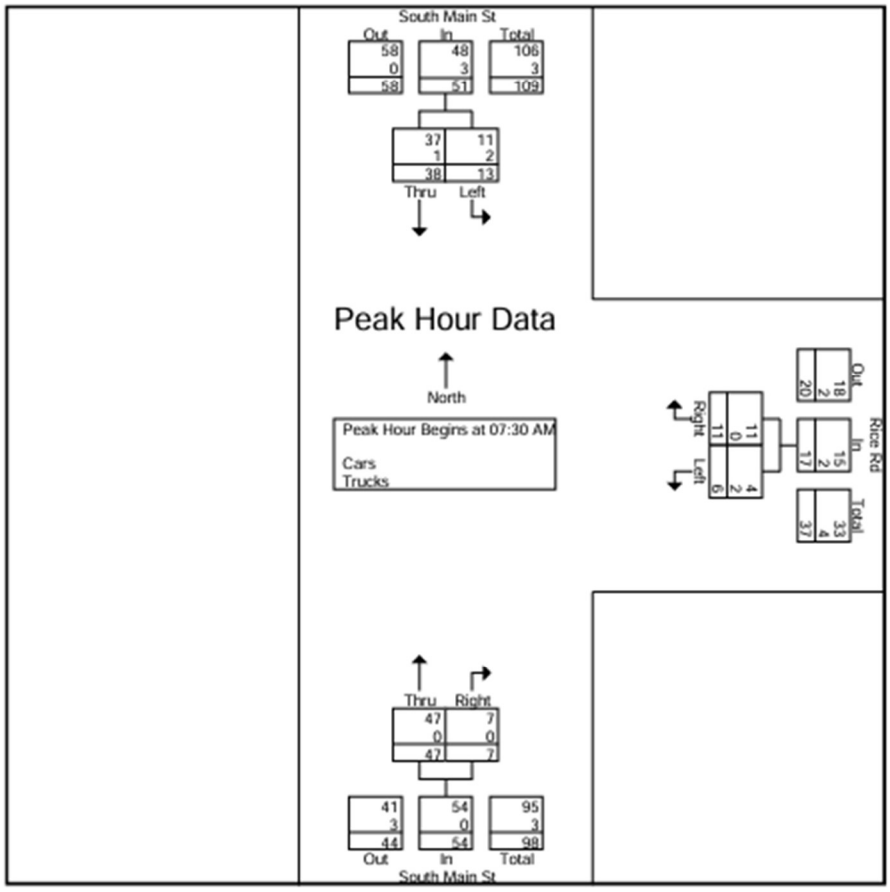
3. It is recommended that stop signs be installed for both the northbound approach of Thomas Hill Road and the southbound approach of the proposed site driveway at Rice Road.
4. Finally, it is recommended that a stop sign be installed for the eastbound approach of Rice Road at its intersection with Providence Street.

Technical Appendix

Accurate Counts
978-664-2565

N/S Street : South Main Street
E/W Street : Rice Road
City/State : Millbury, MA
Weather : Clear

File Name : 20090001
Site Code : 20090001
Start Date : 2/15/2024
Page No : 2



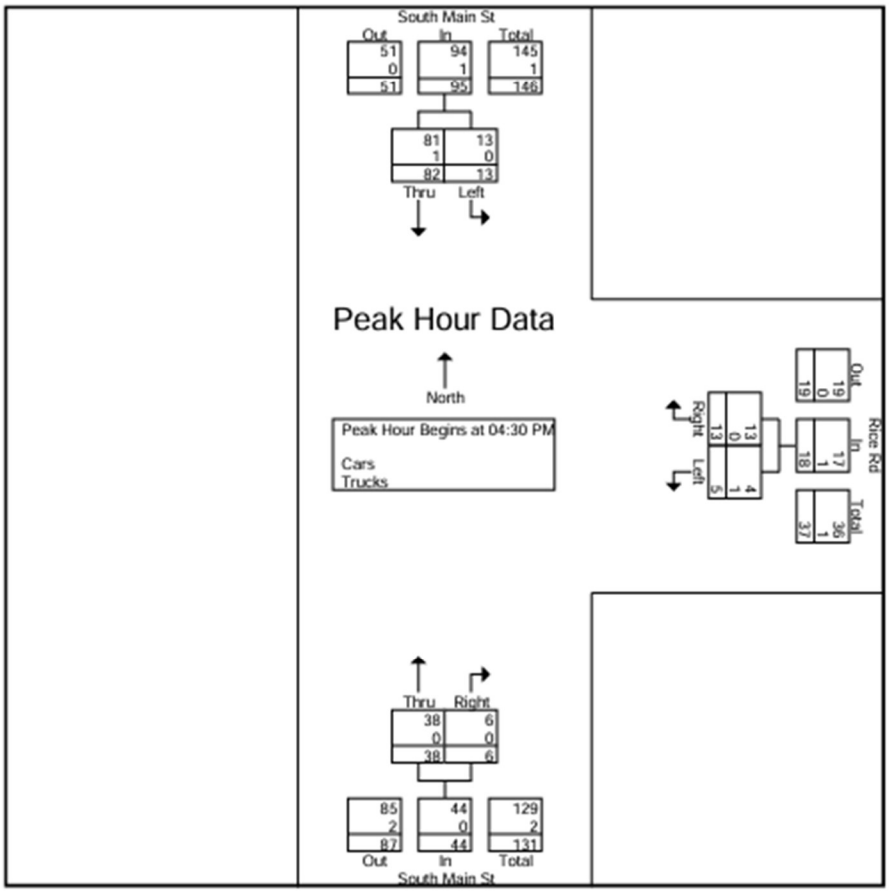
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30 AM			08:00 AM			07:30 AM		
+0 mins.	**4**	7	11	1	1	2	12	2	14
+15 mins.	4	13	**17**	**2**	5	7	10	1	11
+30 mins.	2	4	6	1	2	3	**16**	**4**	**20**
+45 mins.	3	**14**	17	2	**6**	**8**	9	0	9
Total Volume	13	38	51	6	14	20	47	7	54
% App. Total	25.5	74.5		30	70		87	13	
PHF	.813	.679	.750	.750	.583	.625	.734	.438	.675
Cars	11	37	48	5	14	19	47	7	54
% Cars	84.6	97.4	94.1	83.3	100	95	100	100	100
Trucks	2	1	3	1	0	1	0	0	0
% Trucks	15.4	2.6	5.9	16.7	0	5	0	0	0

Accurate Counts
978-664-2565

N/S Street : South Main Street
E/W Street : Rice Road
City/State : Millbury, MA
Weather : Clear

File Name : 20090001
Site Code : 20090001
Start Date : 2/15/2024
Page No : 2



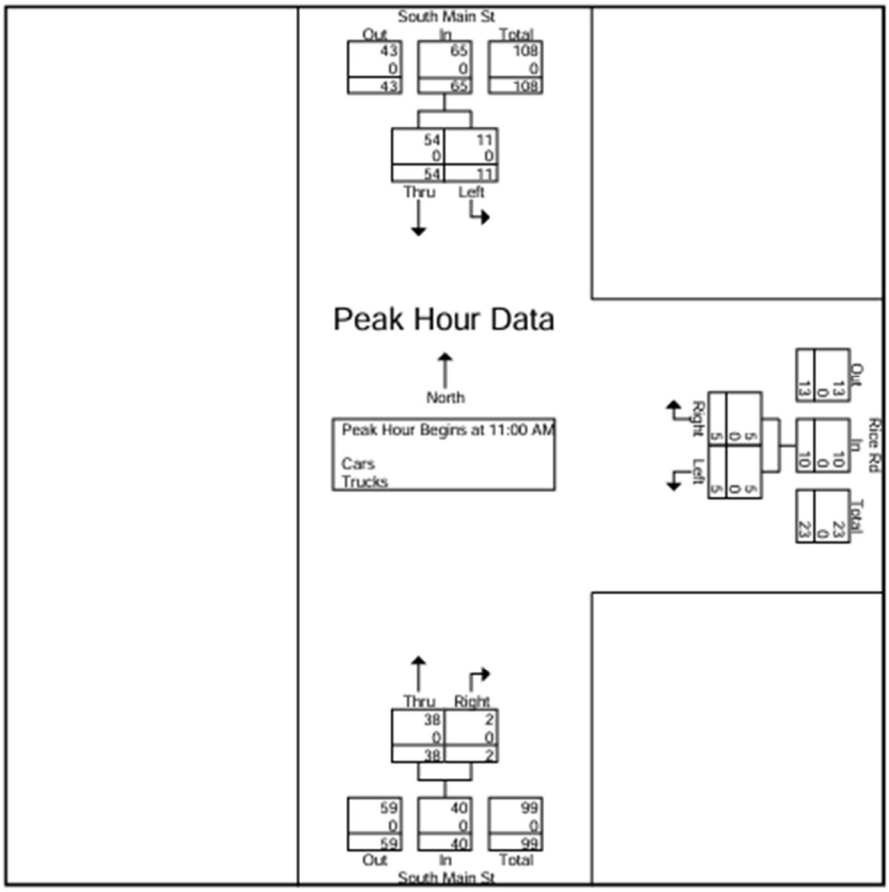
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM			04:00 PM			05:00 PM		
+0 mins.	1	**26**	**27**	3	3	6	9	1	10
+15 mins.	3	16	19	**4**	0	4	**13**	**3**	**16**
+30 mins.	**6**	18	24	1	3	4	13	0	13
+45 mins.	3	22	25	2	**5**	**7**	8	3	11
Total Volume	13	82	95	10	11	21	43	7	50
% App. Total	13.7	86.3		47.6	52.4		86	14	
PHF	.542	.788	.880	.625	.550	.750	.827	.583	.781
Cars	13	81	94	10	11	21	43	7	50
% Cars	100	98.8	98.9	100	100	100	100	100	100
Trucks	0	1	1	0	0	0	0	0	0
% Trucks	0	1.2	1.1	0	0	0	0	0	0

Accurate Counts
978-664-2565

N/S Street : South Main Street
E/W Street : Rice Road
City/State : Millbury, MA
Weather : Cloudy

File Name : 200900S1
Site Code : 20090001
Start Date : 2/17/2024
Page No : 2



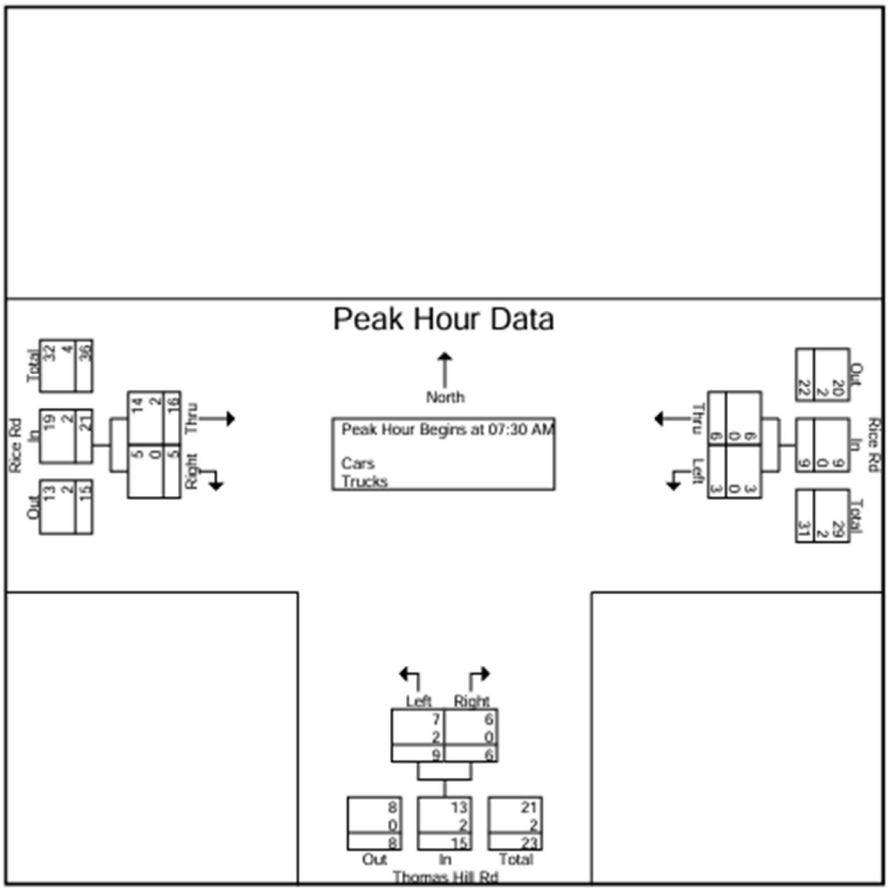
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	11:00 AM			11:30 AM			11:15 AM		
+0 mins.	**5**	**19**	**24**	**2**	1	3	7	0	7
+15 mins.	0	14	14	2	2	4	**17**	0	**17**
+30 mins.	4	14	18	1	3	4	7	**2**	9
+45 mins.	2	7	9	1	**5**	**6**	9	0	9
Total Volume	11	54	65	6	11	17	40	2	42
% App. Total	16.9	83.1		35.3	64.7		95.2	4.8	
PHF	.550	.711	.677	.750	.550	.708	.588	.250	.618
Cars	11	54	65	6	11	17	40	2	42
% Cars	100	100	100	100	100	100	100	100	100
Trucks	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0

Accurate Counts
978-664-2565

N/S Street : Thomas Hill Road
E/W Street : Rice Road
City/State : Millbury, MA
Weather : Clear

File Name : 20090002
Site Code : 20090002
Start Date : 2/15/2024
Page No : 2



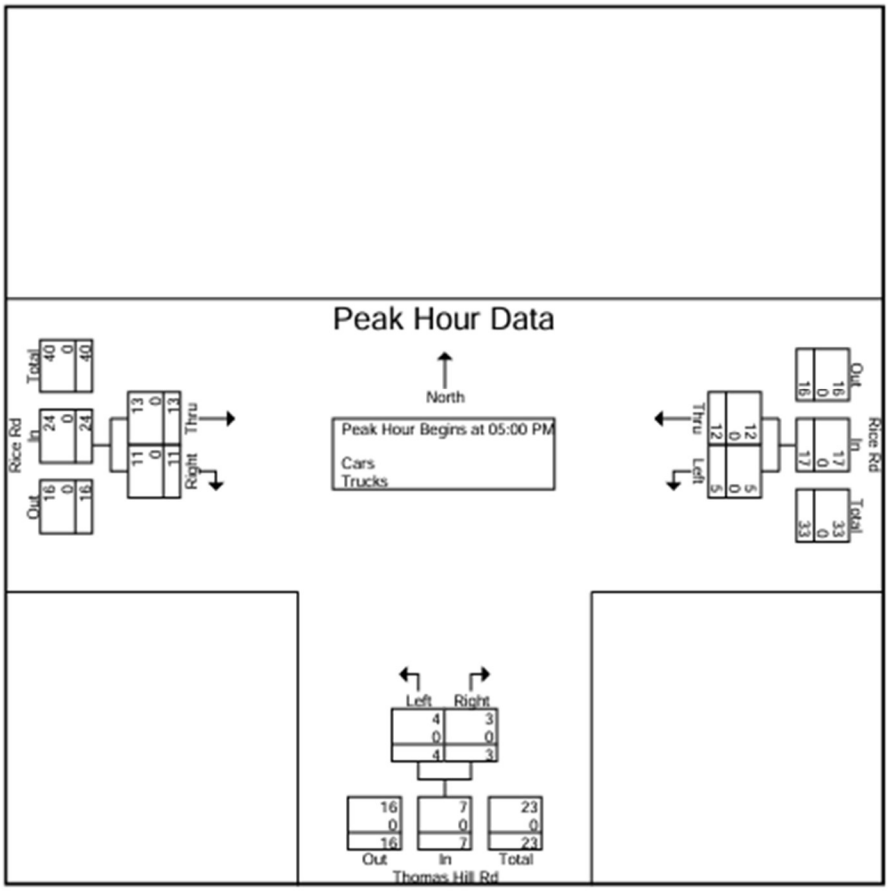
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM			07:30 AM			07:30 AM		
+0 mins.	0	3	3	2	1	3	**6**	0	**6**
+15 mins.	0	**6**	**6**	1	**2**	3	4	1	5
+30 mins.	0	2	2	1	1	2	4	**2**	6
+45 mins.	**2**	1	3	**5**	2	**7**	2	2	4
Total Volume	2	12	14	9	6	15	16	5	21
% App. Total	14.3	85.7		60	40		76.2	23.8	
PHF	.250	.500	.583	.450	.750	.536	.667	.625	.875
Cars	2	12	14	7	6	13	14	5	19
% Cars	100	100	100	77.8	100	86.7	87.5	100	90.5
Trucks	0	0	0	2	0	2	2	0	2
% Trucks	0	0	0	22.2	0	13.3	12.5	0	9.5

Accurate Counts
978-664-2565

N/S Street : Thomas Hill Road
E/W Street : Rice Road
City/State : Millbury, MA
Weather : Clear

File Name : 20090002
Site Code : 20090002
Start Date : 2/15/2024
Page No : 2



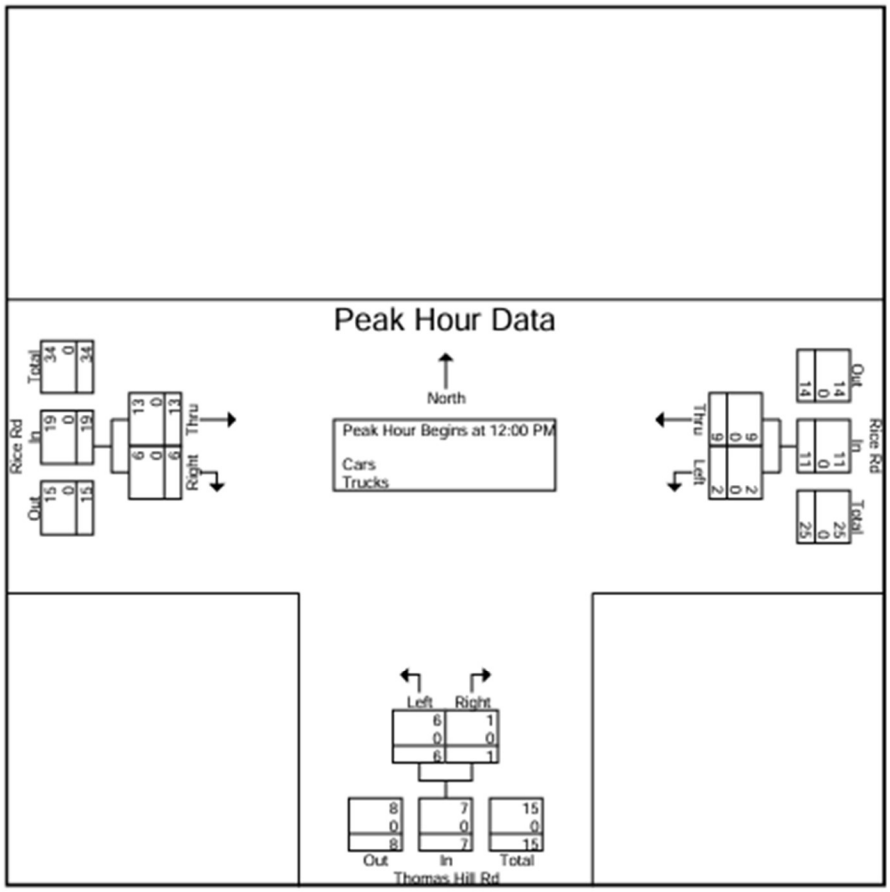
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM			05:00 PM			05:00 PM		
+0 mins.	1	3	4	0	**2**	2	**6**	2	**8**
+15 mins.	1	5	6	0	0	0	1	**4**	5
+30 mins.	**3**	**6**	**9**	**2**	1	**3**	1	2	3
+45 mins.	2	2	4	2	0	2	5	3	8
Total Volume	7	16	23	4	3	7	13	11	24
% App. Total	30.4	69.6		57.1	42.9		54.2	45.8	
PHF	.583	.667	.639	.500	.375	.583	.542	.688	.750
Cars	7	16	23	4	3	7	13	11	24
% Cars	100	100	100	100	100	100	100	100	100
Trucks	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0

Accurate Counts
978-664-2565

N/S Street : Thomas Hill Road
E/W Street : Rice Road
City/State : Millbury, MA
Weather : Cloudy

File Name : 200900S2
Site Code : 20090002
Start Date : 2/17/2024
Page No : 2



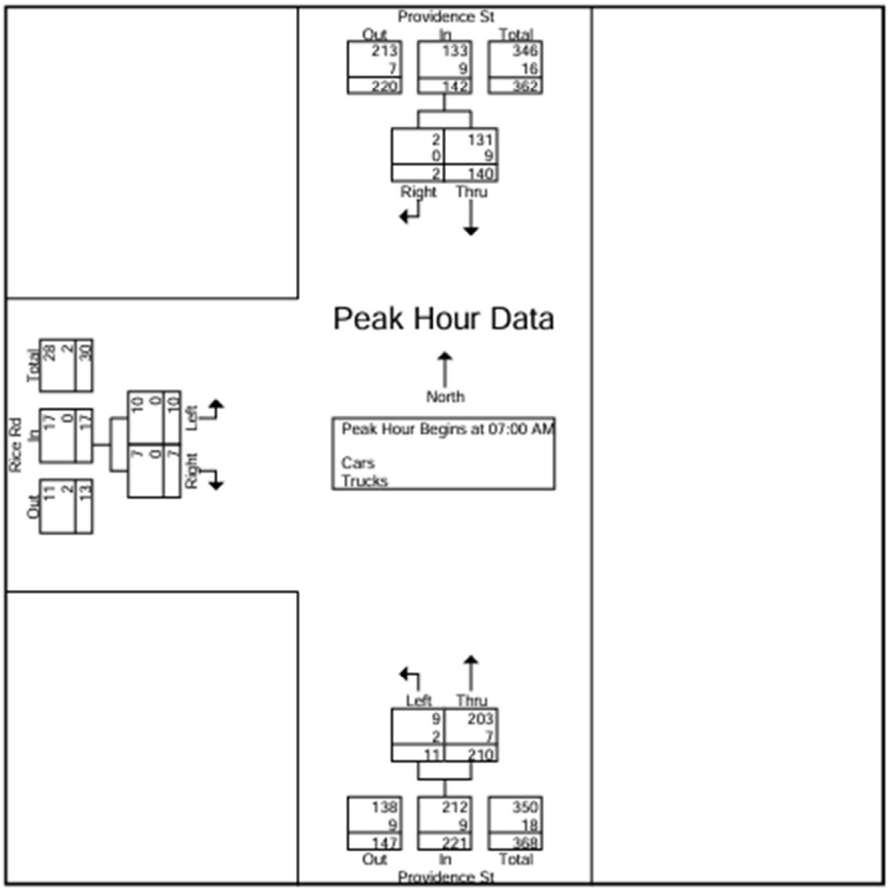
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	11:30 AM			11:45 AM			12:00 PM		
+0 mins.	0	2	2	**2**	0	**2**	2	**2**	4
+15 mins.	0	1	1	1	0	1	**5**	0	**5**
+30 mins.	0	2	2	1	**1**	2	3	2	5
+45 mins.	**1**	**5**	**6**	2	0	2	3	2	5
Total Volume	1	10	11	6	1	7	13	6	19
% App. Total	9.1	90.9		85.7	14.3		68.4	31.6	
PHF	.250	.500	.458	.750	.250	.875	.650	.750	.950
Cars	1	10	11	6	1	7	13	6	19
% Cars	100	100	100	100	100	100	100	100	100
Trucks	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0

Accurate Counts
978-664-2565

N/S Street : Providence Street
E/W Street : Rice Road
City/State : Millbury, MA
Weather : Clear

File Name : 20090003
Site Code : 20090003
Start Date : 2/15/2024
Page No : 2



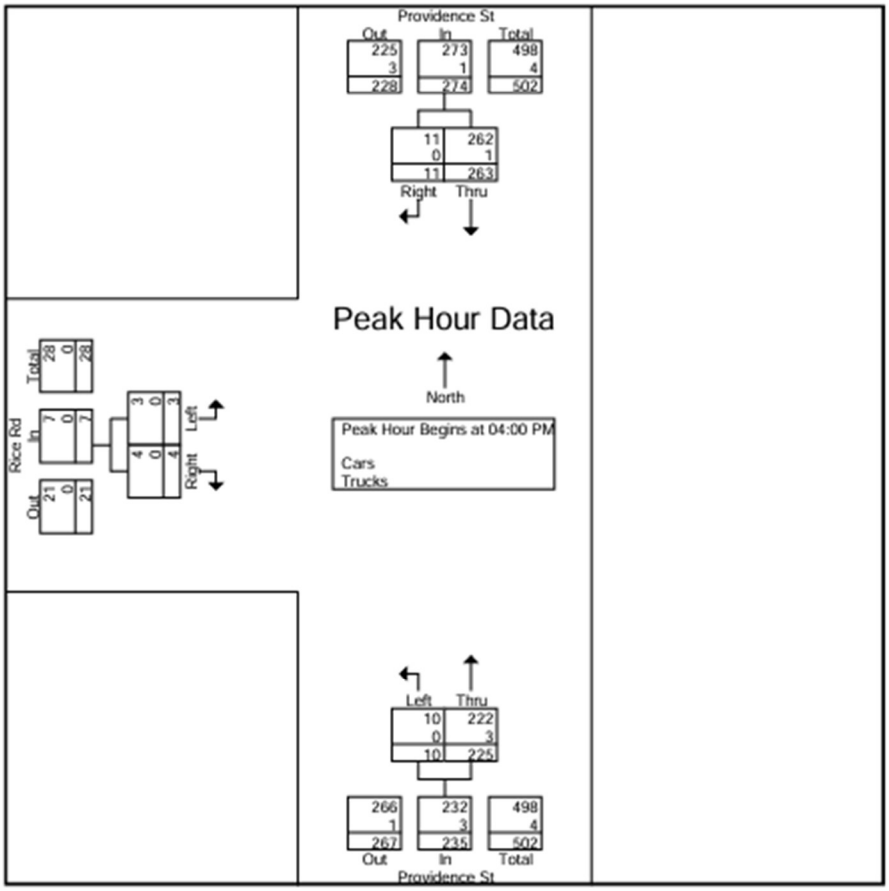
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00 AM			07:00 AM			07:15 AM		
+0 mins.	31	**2**	33	3	58	61	1	**3**	4
+15 mins.	42	1	**43**	2	51	53	**4**	1	**5**
+30 mins.	**43**	0	43	**5**	38	43	2	2	4
+45 mins.	40	0	40	1	**63**	**64**	3	2	5
Total Volume	156	3	159	11	210	221	10	8	18
% App. Total	98.1	1.9		5	95		55.6	44.4	
PHF	.907	.375	.924	.550	.833	.863	.625	.667	.900
Cars	146	3	149	9	203	212	10	8	18
% Cars	93.6	100	93.7	81.8	96.7	95.9	100	100	100
Trucks	10	0	10	2	7	9	0	0	0
% Trucks	6.4	0	6.3	18.2	3.3	4.1	0	0	0

Accurate Counts
978-664-2565

N/S Street : Providence Street
E/W Street : Rice Road
City/State : Millbury, MA
Weather : Clear

File Name : 20090003
Site Code : 20090003
Start Date : 2/15/2024
Page No : 2



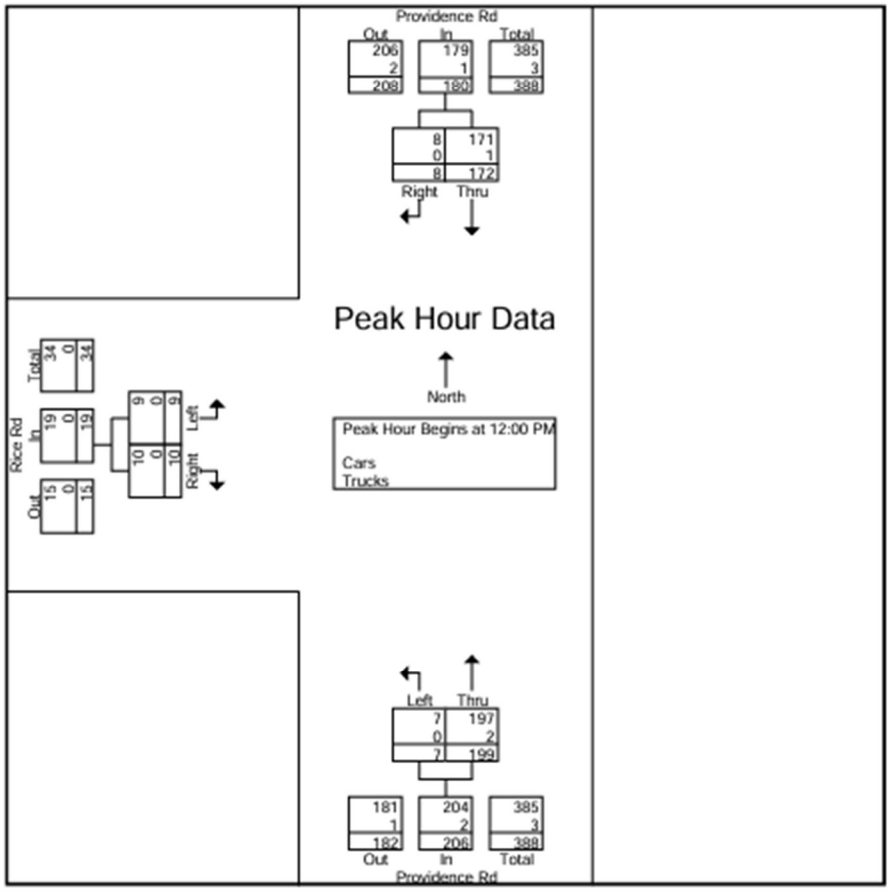
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			05:00 PM		
+0 mins.	72	**4**	**76**	3	**67**	**70**	**3**	**4**	**7**
+15 mins.	66	3	69	0	64	64	2	1	3
+30 mins.	**74**	2	76	3	46	49	2	1	3
+45 mins.	51	2	53	**4**	48	52	3	3	6
Total Volume	263	11	274	10	225	235	10	9	19
% App. Total	96	4		4.3	95.7		52.6	47.4	
PHF	.889	.688	.901	.625	.840	.839	.833	.563	.679
Cars	262	11	273	10	222	232	10	8	18
% Cars	99.6	100	99.6	100	98.7	98.7	100	88.9	94.7
Trucks	1	0	1	0	3	3	0	1	1
% Trucks	0.4	0	0.4	0	1.3	1.3	0	11.1	5.3

Accurate Counts
978-664-2565

N/S Street : Providence Street
E/W Street : Rice Road
City/State : Millbury, MA
Weather : Cloudy

File Name : 200900S3
Site Code : 20090003
Start Date : 2/17/2024
Page No : 2



Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

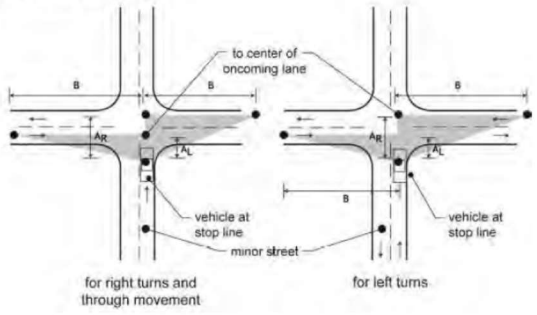
	11:00 AM			12:00 PM			12:00 PM		
+0 mins.	**54**	1	**55**	3	**59**	**62**	1	2	3
+15 mins.	47	**2**	49	**4**	42	46	**3**	**3**	**6**
+30 mins.	47	2	49	0	50	50	3	2	5
+45 mins.	46	2	48	0	48	48	2	3	5
Total Volume	194	7	201	7	199	206	9	10	19
% App. Total	96.5	3.5		3.4	96.6		47.4	52.6	
PHF	.898	.875	.914	.438	.843	.831	.750	.833	.792
Cars	193	7	200	7	197	204	9	10	19
% Cars	99.5	100	99.5	100	99	99	100	100	100
Trucks	1	0	1	0	2	2	0	0	0
% Trucks	0.5	0	0.5	0	1	1	0	0	0

Exhibit 3-8
Motor Vehicle Stopping Sight Distances

	Stopping Sight Distance (ft) by Percent Grade (%)						
		Downgrade			Upgrade		
Design Speed	0	3	6	9	3	6	9
20	115	116	120	126	109	107	104
25	155	158	165	173	147	143	140
30	200	205	215	227	200	184	179
35	250	257	271	287	237	229	222
40	305	315	333	354	289	278	269
45	360	378	400	427	344	331	320
50	425	446	474	507	405	388	375
55	495	520	553	593	469	450	433
60	570	598	638	686	538	515	495
65	645	682	728	785	612	584	561
70	730	771	825	891	690	658	631
75	820	866	927	1003	772	736	704

Source: A Policy on Geometric Design of Streets and Highways, AASHTO, Washington DC, 2004. Chapter 3 Elements of Design

Exhibit 3-11
Sight Triangle Case B
Departure Sight Triangles



Sight Triangle Legs: Case B – Stop Control on Cross Street

	Length of Sight Triangle Legs (feet)			
Major Street Design Speed (mph)	Minor Street for Vehicles Approaching From Right (A_R, feet)	Minor Street for Vehicles Approaching From Left (A_L, feet)	Major Street For Left Turns (B, feet)	Major Street for Right Turns or Through (B, feet)
15	32.5	20.5	170	145
20	32.5	20.5	225	195
25	32.5	20.5	280	240
30	32.5	20.5	335	290
35	32.5	20.5	390	335
40	32.5	20.5	445	385
45	32.5	20.5	500	430
50	32.5	20.5	555	480
55	32.5	20.5	610	530
60	32.5	20.5	665	575
65	32.5	20.5	720	625
70	32.5	20.5	775	670
75	32.5	20.5	830	720

Sight triangle legs shown are for passenger car crossing or turning into a two-lane street, with grades (all approaches) 3 percent or less. For other grades and for other major street widths, recalculate using AASHTO *Green Book* formulas.
Source: *A Policy on Geometric Design of Streets and Highways*, AASHTO, Washington DC, 2004. Chapter 3 Elements of Design

MassDOT Yearly Growth Rates

Data from 2014 to 2018

Growth Factors					
Group	**Grow 2014 to 2015**	**Grow 2015 to 2016**	**Grow 2016 to 2017**	**Grow 2017 to 2018**	**Grow 2018 to 2019**
R1	0	0.023	0.004	0.018	0.016
R2	0.05	0.068	0.004	0.014	0.014
R3	-0.038	0.002	0.008	0.011	0.06
R4-7	-0.01	0.003	0.001	0.011	0.012
Rec - East		0.032	0.02	0.041	0.025
Rec - West		0.051	-0.008	0.029	0
U1-Boston	0.061	0.07	-0.003	0.012	0.006
U1-Essex	0.024	0.025	0.007	0.014	0.011
U1-Southeast	0.05	0.062	0.021	0.014	0
U1-West	0.03	-0.027	0.02	0.028	0.013
U1-Worcester	0.042	0.005	0.018	0.01	0.01
U2	0.04	0.048	0.008	0.01	0.02
U3	0.011	0.013	0.011	0.014	0.004
U4-7	0.023	0.062	0.017	0.003	-0.004

updated
5/1/2020

Massachusetts Highway Department
Statewide Traffic Data Collection
2019 Weekday Seasonal Factors

Factor Group	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Axle Factor
R1	1.22	1.14	1.12	1.06	1.00	0.96	0.87	0.85	0.96	0.99	1.04	1.12	0.85
R2	0.95	0.96	0.98	0.97	0.97	0.93	0.97	0.94	0.96	0.90	0.92	0.93	0.96
R3	1.15	1.06	1.07	1.00	0.89	0.88	0.89	0.89	0.95	0.92	1.02	1.01	0.97
R4-R7	1.09	1.09	1.11	1.02	0.96	0.92	0.89	0.89	0.99	0.98	1.09	1.13	0.98
U1-Boston	1.03	1.01	0.98	0.94	0.94	0.92	0.95	0.93	0.94	0.94	0.97	1.04	0.96
U1-Essex	1.09	1.06	1.03	0.99	0.94	0.90	0.88	0.86	0.93	0.94	0.99	1.06	0.93
U1-Southeast	1.06	1.05	1.01	0.97	0.95	0.93	0.93	0.90	0.94	0.94	0.98	1.04	0.98
U1-West	1.19	1.14	1.09	0.95	0.92	0.89	0.89	0.86	0.91	0.95	0.97	1.07	0.84
U1-Worcester	1.02	1.04	0.97	0.94	0.93	0.91	0.95	0.91	0.93	0.92	0.95	1.10	0.88
U2	1.01	1.00	0.94	0.93	0.91	0.89	0.93	0.90	0.90	0.91	0.94	1.02	0.99
U3	1.06	1.03	0.98	0.94	0.93	0.91	0.95	0.91	0.92	0.93	0.97	1.00	0.98
U4-U7	1.01	1.00	0.95	0.92	0.88	0.86	0.92	0.91	0.92	0.94	0.99	1.04	0.99
Rec - East	1.04	1.16	1.12	0.98	0.92	0.88	0.77	0.81	0.94	1.02	1.08	1.12	0.99
Rec - West	1.30	1.23	1.32	1.18	0.95	0.82	0.70	0.69	0.97	0.96	1.16	1.15	0.98

Round off:
0-999 = 10
>1000 = 100

U = Urban
R = Rural

1 - Interstate
2 - Freeway and Expressway
3 - Other Principal Arterial
4 - Minor Arterial
5 - Major Collector
6 - Minor Collector
7 - Local Road and Street

Recreational - East Group - Cape Cod (all towns) including the town of Plymouth south of Route 3A (stations 7014,7079,7080,7090,7091,7092,7093,7094,7095,7096,7097,7108 and 7178), Martha's Vineyard and Nantucket.
Recreational - West Group - Continuous Stations 2 and 189 including stations 1066,1067,1083,1084,1085,1086,1087,1088,1089,1090,1091,1092,1093,1094,1095,1096,1097,1098,1099,1100,1101,1102,1103,1104,1105,1106,1107,1108,1113,1114, 1116,2196,2197 and 2198.

Moving Massachusetts Forward. massDOT Highway

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Millbury COUNT DATE : 2/15/2024

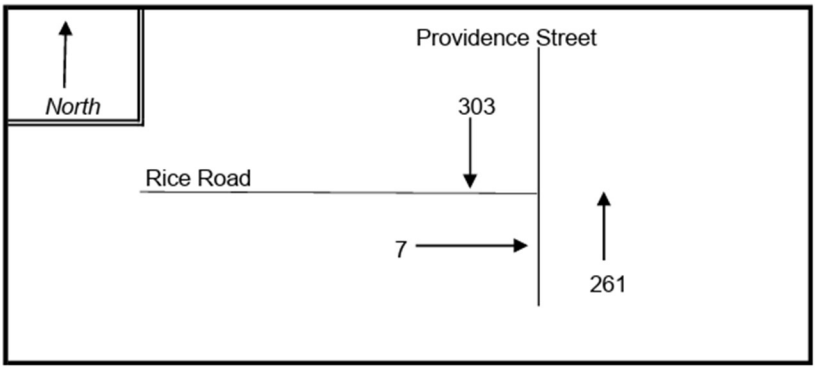
DISTRICT : 3 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Providence Street

MINOR STREET(S) : Rice Road

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	NB	SB			
PEAK HOURLY VOLUMES (AM/PM) :	7	261	303			**571**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **6,344**

TOTAL # OF CRASHES : 1 # OF YEARS : 8 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.13**

CRASH RATE CALCULATION : **0.05** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : Significantly lower than the *massDOT* rate of 0.61 for unsignalized intersections in Dist 3

Project Title & Date: Rice Pond Village, Rice Road, Millbury, MA February 2024

ITE Trip Generation Data

Multifamily Housing (Mid-Rise)
Not Close to Rail Transit (221)

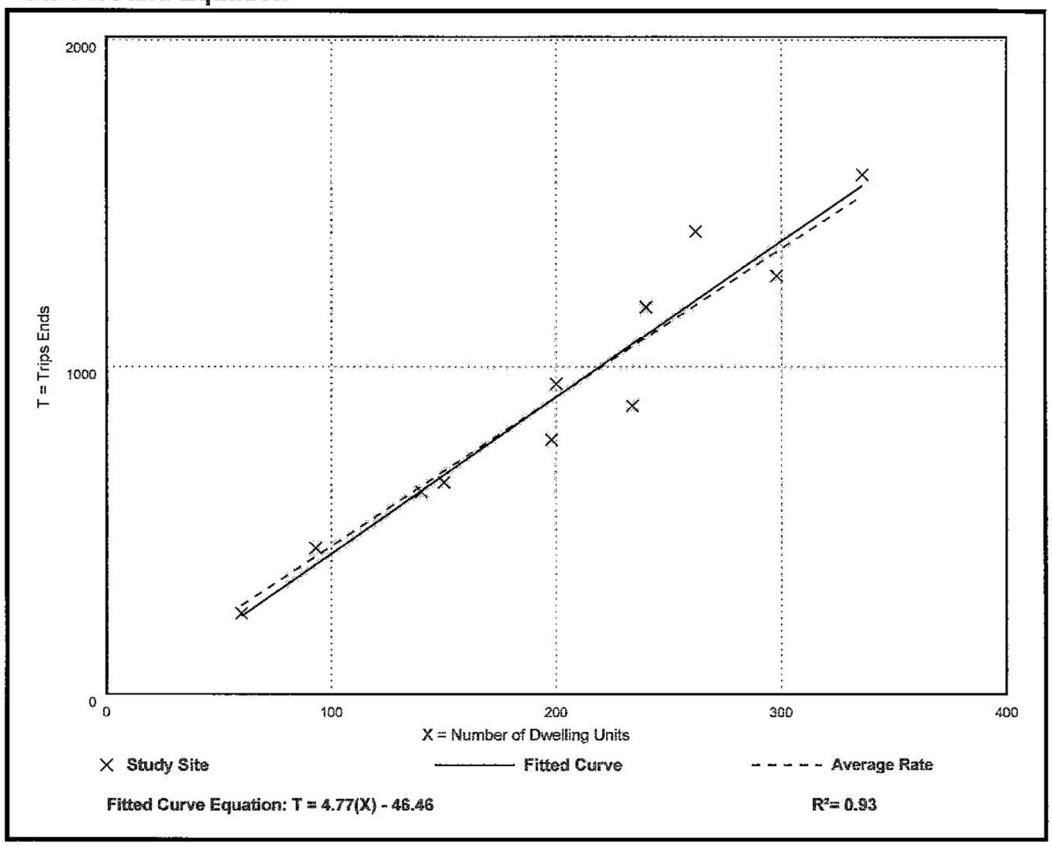
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 11
Avg. Num. of Dwelling Units: 201
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
4.54	3.76 - 5.40	0.51

Data Plot and Equation



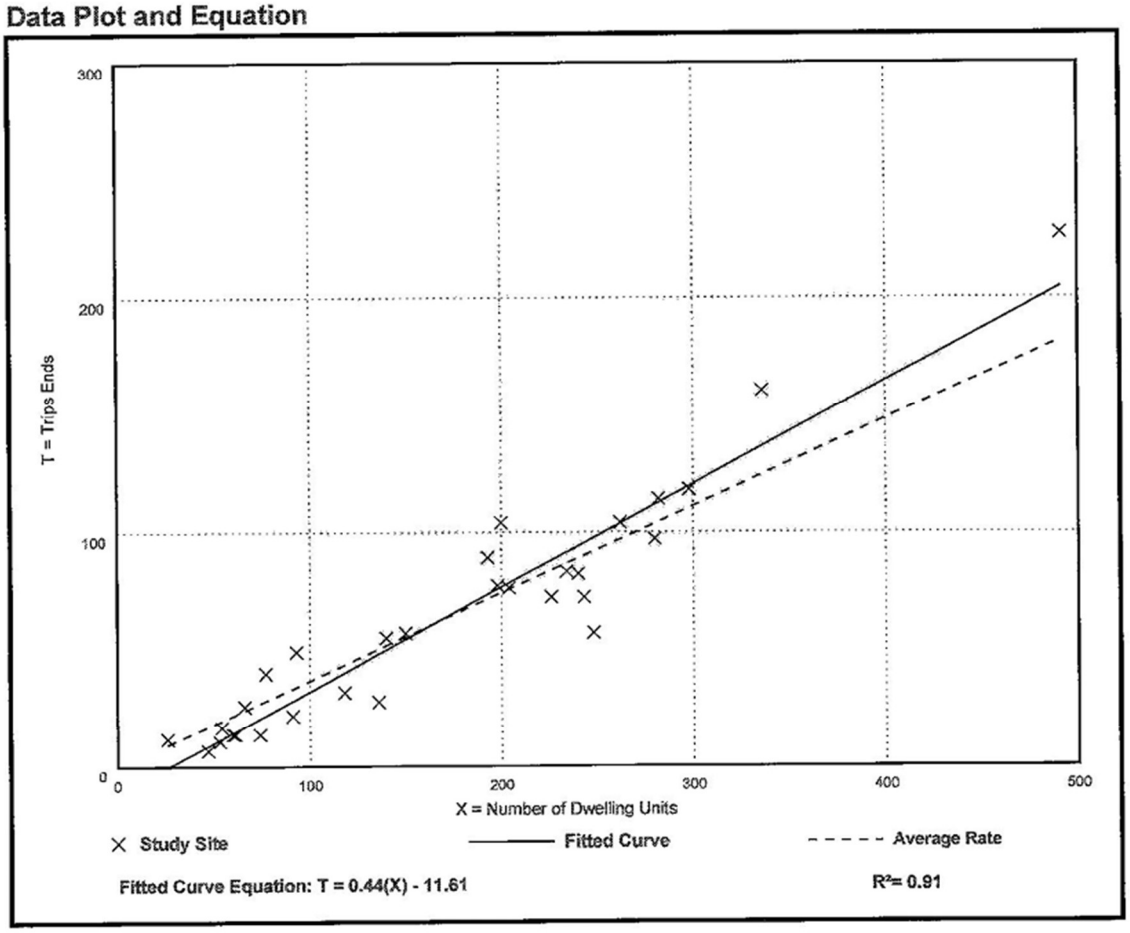
Multifamily Housing (Mid-Rise)
Not Close to Rail Transit (221)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
Number of Studies: 30
Avg. Num. of Dwelling Units: 173
Directional Distribution: 23% entering, 77% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.37	0.15 - 0.53	0.09

Data Plot and Equation



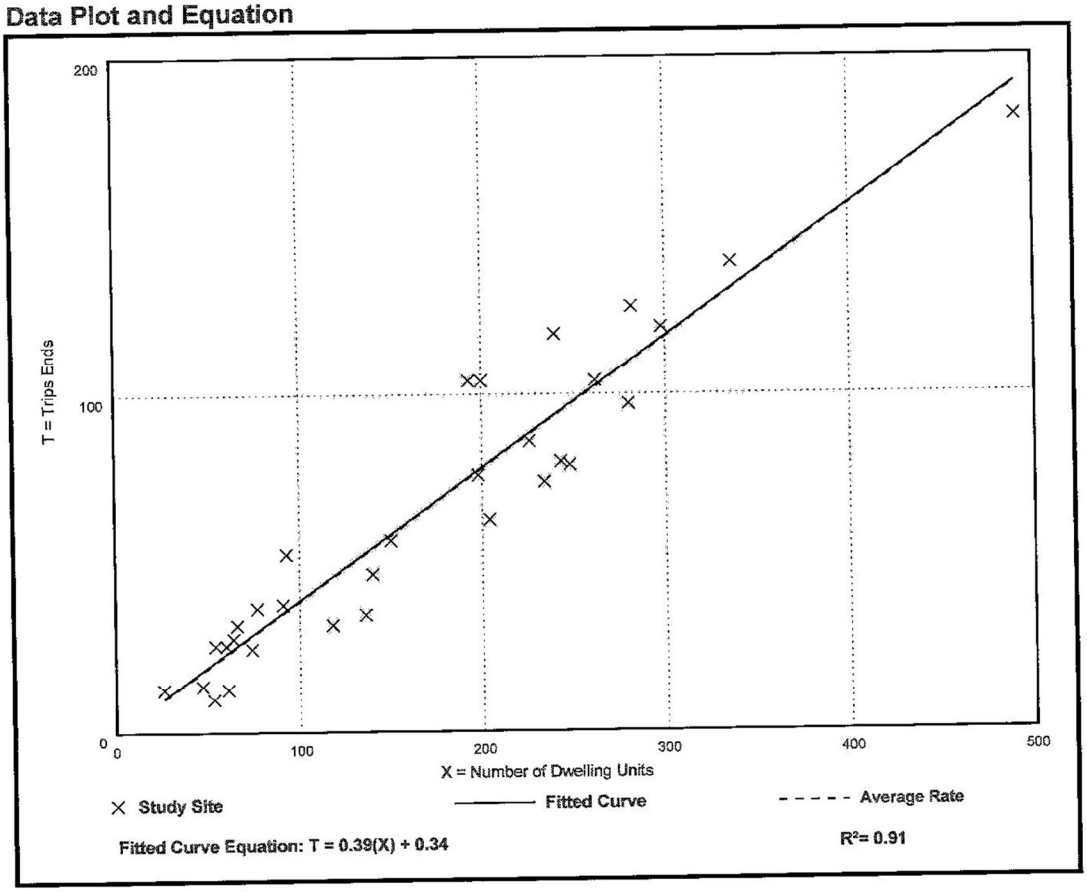
Multifamily Housing (Mid-Rise)
Not Close to Rail Transit (221)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
Number of Studies: 31
Avg. Num. of Dwelling Units: 169
Directional Distribution: 61% entering, 39% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.39	0.19 - 0.57	0.08

Data Plot and Equation



Multifamily Housing (Mid-Rise)
Not Close to Rail Transit (221)

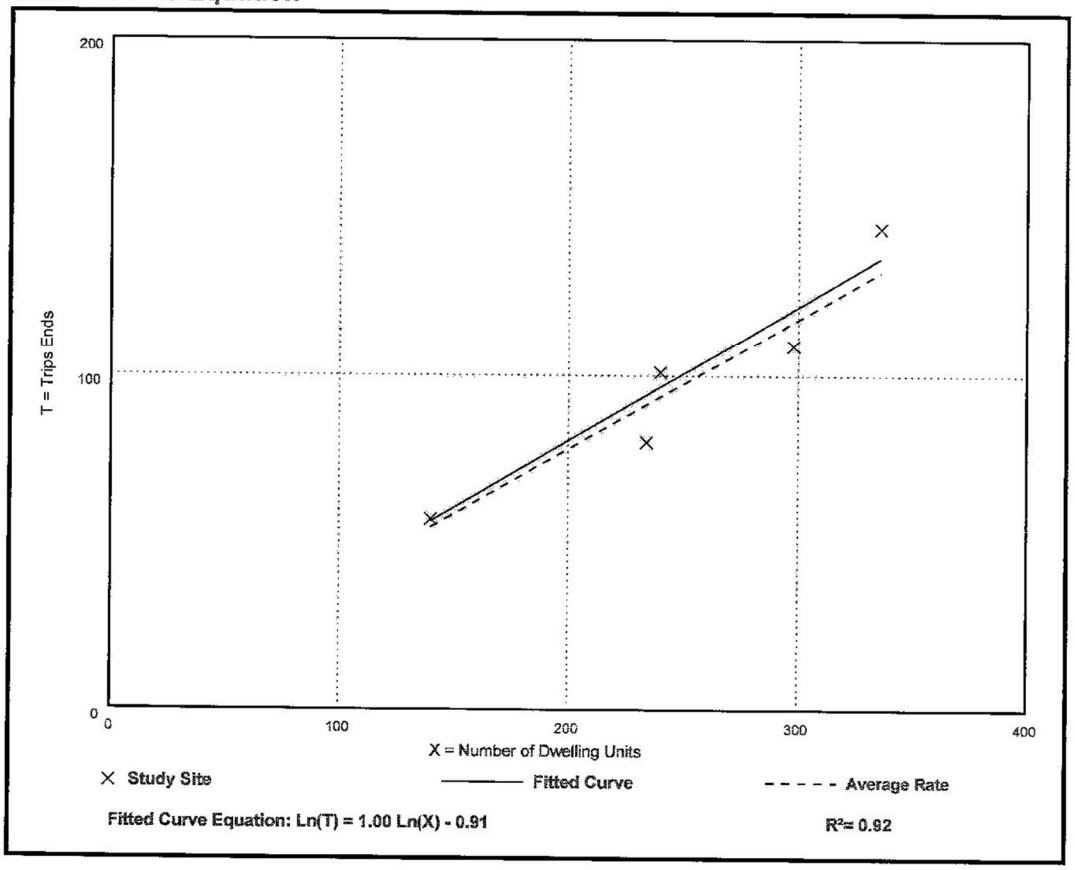
Vehicle Trip Ends vs: Dwelling Units
On a: Saturday, Peak Hour of Generator

Setting/Location: General Urban/Suburban
Number of Studies: 5
Avg. Num. of Dwelling Units: 250
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.39	0.34 - 0.43	0.04

Data Plot and Equation



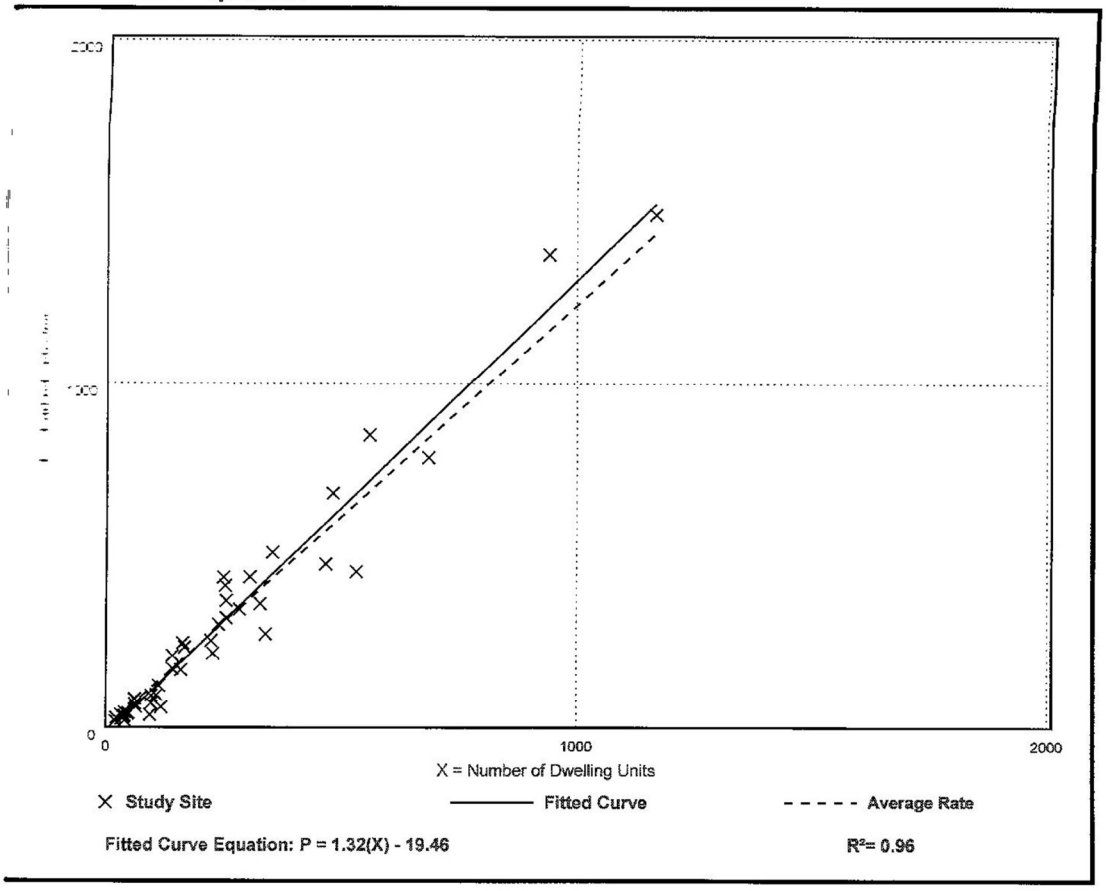
Multifamily Housing - 2+ BR (Mid-Rise)
Not Close to Rail Transit (221)

Peak Period Parking Demand vs: Dwelling Units
On a: Weekday (Monday - Friday)
Setting/Location: General Urban/Suburban
Number of Studies: 44
Avg. Num. of Dwelling Units: 231

Peak Period Parking Demand per Dwelling Unit

Average Rate	Range of Rates	33rd / 85th Percentile	95% Confidence Interval	Standard Deviation (Coeff. of Variation)
1.23	0.39 - 1.75	0.98 / 1.45	1.15 - 1.31	0.27 (22%)

Data Plot and Equation



Providence at Rice AM Peak Existing-R

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	11	8	12	233	161	155
Peak Hour Factor	0.63	0.68	0.55	0.83	0.91	0.38
Hourly flow rate (veh/h)	17	12	22	281	177	408
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	705	381	585			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	98	98			
cM capacity (veh/h)	394	666	990			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	29	303	585
Volume Left	17	22	0
Volume Right	12	0	408
cSH	471	990	1700
Volume to Capacity	0.06	0.02	0.34
Queue Length (ft)	5	2	0
Control Delay (s)	13.1	0.8	0.0
Lane LOS	B	A	
Approach Delay (s)	13.1	0.8	0.0
Approach LOS	B		

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		44.4%	ICU Level of Service A

Providence at Rice PM Peak Existing-R

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	3	4	11	250	291	12
Peak Hour Factor	0.83	0.56	0.63	0.84	0.89	0.69
Hourly flow rate (veh/h)	4	7	17	298	327	17
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	668	336	344			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	99			
cM capacity (veh/h)	417	706	1215			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	315	344
Volume Left	4	17	0
Volume Right	7	0	17
cSH	573	1215	1700
Volume to Capacity	0.02	0.01	0.20
Queue Length (ft)	1	1	0
Control Delay (s)	11.4	0.6	0.0
Lane LOS	B	A	
Approach Delay (s)	11.4	0.6	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	32.1%	ICU Level of Service	A

Providence at Rice Sat Peak Existing-R

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	10	11	8	220	191	9
Peak Hour Factor	0.75	0.83	0.44	0.84	0.89	0.69
Hourly flow rate (veh/h)	13	13	18	262	193	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	497	199	205			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	98	99			
cM capacity (veh/h)	525	842	1367			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	27	280	205
Volume Left	13	18	0
Volume Right	13	0	11
cSH	647	1367	1700
Volume to Capacity	0.04	0.01	0.12
Queue Length (ft)	3	1	0
Control Delay (s)	10.8	0.6	0.0
Lane LOS	B	A	
Approach Delay (s)	10.8	0.6	0.0
Approach LOS	B		

Intersection Summary			
Average Delay		0.9	
Intersection Capacity Utilization		29.8%	ICU Level of Service A

Rice at Thomas Hill AM Peak Existing-R

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	17	5	3	7	8	7
Peak Hour Factor	0.67	0.63	0.25	0.50	0.45	0.75
Hourly flow rate (veh/h)	25	8	12	14	18	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			33		67	29
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		98	99
cM capacity (veh/h)			1578		931	1045

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	33	26	27
Volume Left	0	12	18
Volume Right	8	0	9
cSH	1700	1578	967
Volume to Capacity	0.02	0.01	0.03
Queue Length (ft)	0	1	2
Control Delay (s)	0.0	3.4	8.8
Lane LOS		A	A
Approach Delay (s)	0.0	3.4	8.8
Approach LOS			A

Intersection Summary			
Average Delay		3.8	
Intersection Capacity Utilization		13.3%	ICU Level of Service

Rice at Thomas Hill PM Peak Existing-R

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	14	12	5	13	4	3
Peak Hour Factor	0.58	0.67	0.54	0.69	0.50	0.38
Hourly flow rate (veh/h)	24	18	9	19	8	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			42		70	33
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		99	99
cM capacity (veh/h)			1567		928	1040

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	42	28	16
Volume Left	0	9	8
Volume Right	18	0	8
cSH	1700	1567	981
Volume to Capacity	0.02	0.01	0.02
Queue Length (ft)	0	0	1
Control Delay (s)	0.0	2.4	8.7
Lane LOS		A	A
Approach Delay (s)	0.0	2.4	8.7
Approach LOS			A

Intersection Summary			
Average Delay		2.4	
Intersection Capacity Utilization		13.3%	ICU Level of Service A

Rice at Thomas Hill Sat Peak Existing-R

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	14	7	2	7	7	1
Peak Hour Factor	0.65	0.75	0.25	0.50	0.75	0.25
Hourly flow rate (veh/h)	22	9	8	14	9	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			31		56	26
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		99	100
cM capacity (veh/h)			1582		947	1050

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	31	22	13
Volume Left	0	8	9
Volume Right	9	0	4
cSH	1700	1582	975
Volume to Capacity	0.02	0.01	0.01
Queue Length (ft)	0	0	1
Control Delay (s)	0.0	2.7	8.7
Lane LOS		A	A
Approach Delay (s)	0.0	2.7	8.7
Approach LOS			A

Intersection Summary			
Average Delay		2.6	
Intersection Capacity Utilization		13.3%	ICU Level of Service

S Main at Rice AM Peak Existing-R

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	7	12	52	8	14	43
Peak Hour Factor	0.75	0.58	0.73	0.44	0.81	0.68
Hourly flow rate (veh/h)	9	21	71	18	17	63
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	178	80			89	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			99	
cM capacity (veh/h)	802	980			1506	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	30	89	81
Volume Left	9	0	17
Volume Right	21	18	0
cSH	917	1700	1506
Volume to Capacity	0.03	0.05	0.01
Queue Length (ft)	3	0	1
Control Delay (s)	9.1	0.0	1.7
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	1.7
Approach LOS	A		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	14.9%	ICU Level of Service	A

S Main at Rice PM Peak Existing_R

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	5	14	43	7	14	93
Peak Hour Factor	0.55	0.63	0.83	0.58	0.54	0.79
Hourly flow rate (veh/h)	9	22	52	12	26	118
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	227	58			64	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			98	
cM capacity (veh/h)	748	1008			1539	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	31	64	144
Volume Left	9	0	26
Volume Right	22	12	0
cSH	916	1700	1539
Volume to Capacity	0.03	0.04	0.02
Queue Length (ft)	3	0	1
Control Delay (s)	9.1	0.0	1.4
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	1.4
Approach LOS	A		

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	20.9%	ICU Level of Service	A

S Main at Rice Sat Peak Existing_R

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	5	5	43	12	12	60
Peak Hour Factor	0.55	0.75	0.59	0.25	0.55	0.71
Hourly flow rate (veh/h)	9	7	73	48	22	85
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	225	97			121	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			99	
cM capacity (veh/h)	752	959			1467	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	16	121	106
Volume Left	9	0	22
Volume Right	7	48	0
cSH	828	1700	1467
Volume to Capacity	0.02	0.07	0.01
Queue Length (ft)	1	0	1
Control Delay (s)	9.4	0.0	1.6
Lane LOS	A		A
Approach Delay (s)	9.4	0.0	1.6
Approach LOS	A		

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	17.0%	ICU Level of Service	A

Providence at Rice AM Peak Future No Build-R

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	11	8	12	237	158	2
Peak Hour Factor	0.63	0.68	0.55	0.83	0.91	0.38
Hourly flow rate (veh/h)	17	12	22	286	174	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	505	176	179			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	99	98			
cM capacity (veh/h)	518	867	1397			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	29	307	179
Volume Left	17	22	0
Volume Right	12	0	5
cSH	618	1397	1700
Volume to Capacity	0.05	0.02	0.11
Queue Length (ft)	4	1	0
Control Delay (s)	11.1	0.7	0.0
Lane LOS	B	A	
Approach Delay (s)	11.1	0.7	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A

Providence at Rice PM Peak Future No Build-R

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	3	4	11	254	296	12
Peak Hour Factor	0.83	0.56	0.63	0.84	0.89	0.69
Hourly flow rate (veh/h)	4	7	17	302	333	17
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	679	341	350			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	99			
cM capacity (veh/h)	411	701	1209			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	320	350
Volume Left	4	17	0
Volume Right	7	0	17
cSH	567	1209	1700
Volume to Capacity	0.02	0.01	0.21
Queue Length (ft)	1	1	0
Control Delay (s)	11.5	0.6	0.0
Lane LOS	B	A	
Approach Delay (s)	11.5	0.6	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	32.4%	ICU Level of Service	A

Providence at Rice Sat Peak Future No Build-R

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	10	11	8	224	194	9
Peak Hour Factor	0.75	0.83	0.44	0.84	0.89	0.69
Hourly flow rate (veh/h)	13	13	18	267	196	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	505	202	208			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	98	99			
cM capacity (veh/h)	520	839	1363			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	27	285	208
Volume Left	13	18	0
Volume Right	13	0	11
cSH	641	1363	1700
Volume to Capacity	0.04	0.01	0.12
Queue Length (ft)	3	1	0
Control Delay (s)	10.9	0.6	0.0
Lane LOS	B	A	
Approach Delay (s)	10.9	0.6	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	30.1%	ICU Level of Service	A

Rice at Thomas Hill AM Peak Future No Build

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	17	5	3	7	8	7
Peak Hour Factor	0.67	0.63	0.25	0.50	0.45	0.75
Hourly flow rate (veh/h)	25	8	12	14	18	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			33		67	29
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		98	99
cM capacity (veh/h)			1578		931	1045

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	33	26	27
Volume Left	0	12	18
Volume Right	8	0	9
cSH	1700	1578	967
Volume to Capacity	0.02	0.01	0.03
Queue Length (ft)	0	1	2
Control Delay (s)	0.0	3.4	8.8
Lane LOS		A	A
Approach Delay (s)	0.0	3.4	8.8
Approach LOS			A

Intersection Summary			
Average Delay		3.8	
Intersection Capacity Utilization		13.3%	ICU Level of Service A

Rice at Thomas Hill PM Peak Future No Build

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	14	12	5	13	4	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	15	13	5	14	4	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			28		47	22
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1585		960	1055

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	28	20	8
Volume Left	0	5	4
Volume Right	13	0	3
cSH	1700	1585	999
Volume to Capacity	0.02	0.00	0.01
Queue Length (ft)	0	0	1
Control Delay (s)	0.0	2.0	8.6
Lane LOS		A	A
Approach Delay (s)	0.0	2.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay		1.9	
Intersection Capacity Utilization		13.3%	ICU Level of Service

Rice at Thomas Hill Sat Peak Future No Build-R

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	14	7	2	7	7	1
Peak Hour Factor	0.65	0.75	0.25	0.50	0.75	0.25
Hourly flow rate (veh/h)	22	9	8	14	9	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
vC, conflicting volume			31		56	26
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		99	100
cM capacity (veh/h)			1582		947	1050

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	31	22	13
Volume Left	0	8	9
Volume Right	9	0	4
cSH	1700	1582	975
Volume to Capacity	0.02	0.01	0.01
Queue Length (ft)	0	0	1
Control Delay (s)	0.0	2.7	8.7
Lane LOS		A	A
Approach Delay (s)	0.0	2.7	8.7
Approach LOS			A

Intersection Summary			
Average Delay		2.6	
Intersection Capacity Utilization		13.3%	ICU Level of Service A

S Main at Rice AM Peak Future No Build-R

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	7	12	53	8	14	44
Peak Hour Factor	0.75	0.58	0.73	0.44	0.81	0.68
Hourly flow rate (veh/h)	9	21	73	18	17	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	181	82			91	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			99	
cM capacity (veh/h)	799	978			1504	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	30	91	82
Volume Left	9	0	17
Volume Right	21	18	0
cSH	914	1700	1504
Volume to Capacity	0.03	0.05	0.01
Queue Length (ft)	3	0	1
Control Delay (s)	9.1	0.0	1.6
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	1.6
Approach LOS	A		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	14.9%	ICU Level of Service	A

S Main at Rice PM Peak Future No Build_R

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	5	14	44	7	14	95
Peak Hour Factor	0.55	0.63	0.83	0.58	0.54	0.79
Hourly flow rate (veh/h)	9	22	53	12	26	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	231	59			65	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			98	
cM capacity (veh/h)	744	1007			1537	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	31	65	146
Volume Left	9	0	26
Volume Right	22	12	0
cSH	913	1700	1537
Volume to Capacity	0.03	0.04	0.02
Queue Length (ft)	3	0	1
Control Delay (s)	9.1	0.0	1.4
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	1.4
Approach LOS	A		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	21.1%	ICU Level of Service	A

S Main at Rice Sat Peak Future No Build_R

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	5	5	44	2	12	61
Peak Hour Factor	0.55	0.75	0.59	0.25	0.55	0.71
Hourly flow rate (veh/h)	9	7	75	8	22	86
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	208	79			83	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			99	
cM capacity (veh/h)	769	982			1515	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	16	83	108
Volume Left	9	0	22
Volume Right	7	8	0
cSH	847	1700	1515
Volume to Capacity	0.02	0.05	0.01
Queue Length (ft)	1	0	1
Control Delay (s)	9.3	0.0	1.6
Lane LOS	A		A
Approach Delay (s)	9.3	0.0	1.6
Approach LOS	A		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	17.1%	ICU Level of Service	A

Providence at Rice AM Peak Future Build-R

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	25	18	16	237	158	3
Peak Hour Factor	0.63	0.68	0.55	0.83	0.91	0.38
Hourly flow rate (veh/h)	40	26	29	286	174	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	521	178	182			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	92	97	98			
cM capacity (veh/h)	505	865	1394			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	66	315	182
Volume Left	40	29	0
Volume Right	26	0	8
cSH	606	1394	1700
Volume to Capacity	0.11	0.02	0.11
Queue Length (ft)	9	2	0
Control Delay (s)	11.7	0.9	0.0
Lane LOS	B	A	
Approach Delay (s)	11.7	0.9	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	39.7%	ICU Level of Service	A

Providence at Rice PM Peak Future Build-R

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	11	14	20	254	296	22
Peak Hour Factor	0.83	0.56	0.63	0.84	0.89	0.69
Hourly flow rate (veh/h)	13	25	32	302	333	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	714	349	364			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	96	97			
cM capacity (veh/h)	387	695	1194			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	38	334	364
Volume Left	13	32	0
Volume Right	25	0	32
cSH	545	1194	1700
Volume to Capacity	0.07	0.03	0.21
Queue Length (ft)	6	2	0
Control Delay (s)	12.1	1.0	0.0
Lane LOS	B	A	
Approach Delay (s)	12.1	1.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	43.8%	ICU Level of Service	A

Providence at Rice Sat Peak Future Build-R

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	21	23	15	224	194	16
Peak Hour Factor	0.75	0.83	0.44	0.84	0.89	0.69
Hourly flow rate (veh/h)	28	28	34	267	196	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	541	206	217			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	97	97			
cM capacity (veh/h)	489	834	1353			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	56	301	217
Volume Left	28	34	0
Volume Right	28	0	20
cSH	616	1353	1700
Volume to Capacity	0.09	0.03	0.13
Queue Length (ft)	7	2	0
Control Delay (s)	11.4	1.1	0.0
Lane LOS	B	A	
Approach Delay (s)	11.4	1.1	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	40.8%	ICU Level of Service	A

Rice at Thomas Hill AM Peak Future Build

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	29	17	5	3	7	5	8	0	7	24	0	32
Peak Hour Factor	0.92	0.67	0.63	0.25	0.50	0.92	0.45	0.92	0.75	0.92	0.92	0.92
Hourly flow rate (veh/h)	32	25	8	12	14	5	18	0	9	26	0	35
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
vC, conflicting volume	19			33			168	136	29	142	137	17
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			99			98	100	99	97	100	97
cM capacity (veh/h)	1597			1578			754	734	1045	803	733	1062

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	65	31	27	61
Volume Left	32	12	18	26
Volume Right	8	5	9	35
cSH	1597	1578	834	933
Volume to Capacity	0.02	0.01	0.03	0.07
Queue Length (ft)	2	1	3	5
Control Delay (s)	3.6	2.8	9.5	9.1
Lane LOS	A	A	A	A
Approach Delay (s)	3.6	2.8	9.5	9.1
Approach LOS			A	A

Intersection Summary				
Average Delay		6.2		
Intersection Capacity Utilization		14.3%	ICU Level of Service	A

Rice at Thomas Hill PM Peak Future Build

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	41	14	12	5	13	19	4	0	3	18	0	11
Peak Hour Factor	0.92	0.54	0.69	0.58	0.67	0.92	0.50	0.92	0.38	0.92	0.92	0.92
Hourly flow rate (veh/h)	45	26	17	9	19	21	8	0	8	20	0	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
vC, conflicting volume	40			43			183	181	35	179	179	30
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			99			99	100	99	97	100	99
cM capacity (veh/h)	1570			1565			750	689	1038	757	690	1045

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	88	49	16	32
Volume Left	45	9	8	20
Volume Right	17	21	8	12
cSH	1570	1565	870	846
Volume to Capacity	0.03	0.01	0.02	0.04
Queue Length (ft)	2	0	1	3
Control Delay (s)	3.8	1.3	9.2	9.4
Lane LOS	A	A	A	A
Approach Delay (s)	3.8	1.3	9.2	9.4
Approach LOS			A	A

Intersection Summary				
Average Delay			4.6	
Intersection Capacity Utilization			19.4%	ICU Level of Service
				A

Rice at Thomas Hill Sat Peak Future Build-R

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	38	14	7	2	7	14	7	0	1	23	0	14
Peak Hour Factor	0.92	0.65	0.75	0.25	0.50	0.92	0.25	0.50	0.92	0.92	0.92	0.92
Hourly flow rate (veh/h)	41	22	9	8	14	15	28	0	1	25	0	15
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
vC, conflicting volume	29			31			162	154	26	148	151	22
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			99			96	100	100	97	100	99
cM capacity (veh/h)	1584			1582			773	715	1050	801	718	1056

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	72	37	29	40
Volume Left	41	8	28	25
Volume Right	9	15	1	15
cSH	1584	1582	781	881
Volume to Capacity	0.03	0.01	0.04	0.05
Queue Length (ft)	2	0	3	4
Control Delay (s)	4.3	1.6	9.8	9.3
Lane LOS	A	A	A	A
Approach Delay (s)	4.3	1.6	9.8	9.3
Approach LOS			A	A

Intersection Summary				
Average Delay			5.7	
Intersection Capacity Utilization			15.5%	ICU Level of Service
				A

S Main at Rice AM Peak Future Build-R

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	18	33	53	12	22	44
Peak Hour Factor	0.75	0.58	0.73	0.44	0.81	0.68
Hourly flow rate (veh/h)	24	57	73	27	27	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	205	86			100	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	94			98	
cM capacity (veh/h)	769	972			1493	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	81	100	92
Volume Left	24	0	27
Volume Right	57	27	0
cSH	902	1700	1493
Volume to Capacity	0.09	0.06	0.02
Queue Length (ft)	7	0	1
Control Delay (s)	9.4	0.0	2.3
Lane LOS	A		A
Approach Delay (s)	9.4	0.0	2.3
Approach LOS	A		

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	17.7%	ICU Level of Service	A

S Main at Rice PM Peak Future Build_R

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	8	22	44	15	33	95
Peak Hour Factor	0.55	0.63	0.83	0.58	0.54	0.79
Hourly flow rate (veh/h)	15	35	53	26	61	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	308	66			79	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	97			96	
cM capacity (veh/h)	656	998			1519	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	49	79	181
Volume Left	15	0	61
Volume Right	35	26	0
cSH	865	1700	1519
Volume to Capacity	0.06	0.05	0.04
Queue Length (ft)	5	0	3
Control Delay (s)	9.4	0.0	2.7
Lane LOS	A		A
Approach Delay (s)	9.4	0.0	2.7
Approach LOS	A		

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	26.4%	ICU Level of Service	A

S Main at Rice Sat Peak Future Build_R

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	12	12	44	6	32	61
Peak Hour Factor	0.55	0.75	0.59	0.25	0.55	0.71
Hourly flow rate (veh/h)	22	16	75	24	58	86
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
vC, conflicting volume	289	87			99	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	98			96	
cM capacity (veh/h)	674	972			1494	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	38	99	144
Volume Left	22	0	58
Volume Right	16	24	0
cSH	775	1700	1494
Volume to Capacity	0.05	0.06	0.04
Queue Length (ft)	4	0	3
Control Delay (s)	9.9	0.0	3.2
Lane LOS	A		A
Approach Delay (s)	9.9	0.0	3.2
Approach LOS	A		

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	24.4%	ICU Level of Service	A