
Proposed 10-50 Main St. Redevelopment
Ashland, MA

Site Traffic - Vehicle Trip Analysis

January 31, 2020

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EXECUTIVE SUMMARY

This report presents our findings regarding existing traffic and estimated new site generated traffic and minor impacts at each of the four (4) proposed site driveways where labeled on the Figure 1 LOCUS aerial photo. They include the existing south driveway on Main Street which will be limited to enter only, a new 2-way driveway #2 as an added fourth leg at the Pleasant Street signalized intersection. Additionally the two other existing driveways, #3 along Main Street slightly north of the signal to access the frontage off-street parking aisle plus the existing Myrtle Street driveway #4. The future number of vehicles entering and exiting the site was estimated for the peak morning and evening travel hours during weekdays and also the Saturday midday peak hour site traffic. These estimated vehicle trips are based on the Institute of Transportation Engineers(ITE) trip generation statistics for a variety of potential Business/Office/Commercial and Apartment tenants. Any commercial uses will be on the first floor. Residential rental apartments will occupy the remaining areas of the first floor and all of the second through fourth floors, when the redevelopment is fully occupied.

It should be noted that driveway #1 and #2 will access parking areas level with Main Street on raised, decked parking. The entire site will provide customer and mostly apartment tenant parking on ground level, under the buildings and under the deck parking areas with a 2-way ramp at the southeast limit of the site, allowing access between the decked area and ground level parking. The full parking and site driveway locations and design are shown on the full architecture plan set. An aerial view of the driveways and parking are included on the architectural drawing included in the full report following Page 5 and Figure 1, the Locus aerial.

The ITE Trip Generation Manual, 10th Edition, contains peak hour trip data for both entering and exiting various types of existing facilities, where actual counts were conducted and summarized in the ITE Manual. This resource document is the traffic industry standard publication for estimating vehicle trips from future businesses and residential structures. Each ITE data graph and average trip counts used to estimate future traffic for this site are included in the main report as Attachment G.

The ITE data was used to calculate this site's total peak hour trips entering and exiting the site, then the total site vehicle count was assigned a percentage that will use each of the four (4) proposed driveways. These assignments to the driveways is based on our judgment from reviewing 2017 peak hour traffic counts that were collected for Main Street/Pleasant Street and Myrtle Street/Driveway #4 intersections, for a site development previously proposed for this site. Those counts indicate a large percentage of Main Street traffic turns to or from Pleasant Street at the traffic signal. (A summary of those traffic counts can be reviewed in the main report Attachment C).

The majority of existing traffic traveling north on Main Street turn west on Pleasant Street in the morning peak and return eastbound turning south onto Main Street during the evening peak hours. This travel pattern is significantly increased by area employees heading to the train station and to Routes 9, 90 and 495 along the signed truck route. Thus the majority of Main Street traffic does not continue onto Myrtle Street. The developer will help reduce new trips from the 222 proposed apartments to the busy Pleasant Street intersection by providing a shuttle bus during peak travel hours for tenants traveling both to and from the train station. Refer to the main report Attachment D for the calculated shuttle bus and existing site use trip reduction of site trips at the Pleasant Street intersection.

The Town is moving forward with a Main Street improvement project with the BSC Group engineering firm working on the road design and streetscape improvements, as well conducting an analysis and improvements to the existing three coordinated traffic signals on Main Street. Therefore we supply the future site traffic estimates at each site driveway so the BSC Group will be able to incorporate the site traffic into the final signal system design, making any signal timing and phasing adjustments deemed appropriate. The estimated new site driveway traffic volumes provided are during the peak weekday and Saturday travel periods in Attachment C. We also include a layout plan of the architects building concept and parking drawing for ease of understanding the site circulation and driveway usage (Following page 5 and Figure 1).

We measured the safe stopping sight distance at each driveway and find that driveways 1, 2 and 3 have ample stopping and intersection sight distances available to drivers. The driveway at Myrtle Street does provide the minimum safe stopping and intersection sight distances for safety, as shown on the sight distance sketch in Attachment E. We discuss that in more detail in the main report and list the main items this report focused on regarding the Myrtle Street Driveway #4 sight distance improvements.

I note that the BSC Group summary of findings memorandum (Pages 15-17) in their analysis memorandum (see Attachment B) indicates that the Pleasant Street signal currently and through year 2027, operates at very good levels of service for the various turning movements. The site development plan has a main driveway onto Main Street within the signalized intersection, so the proposed signal timings and phases will need to be reanalyzed to include the new site traffic. The adjustments will need to include the new development site driveway #2 as labeled on Figure 1 and shown in detail on the Architects Site Plan included following Figure 1. Since the intersection operates at an overall very good Level of Service B, as shown in the BSC table of signal operating results (Page 17 of 17), the intersection should be able to easily accommodate the site traffic added via #2 driveway. Our calculations for #2 driveway, included in the lower table found in Attachment C, indicates during the highest PM peak travel hour on weekdays approximately 82 vehicles will exit and 64 vehicles will enter the site through the signalized intersection. That is an average of less than 2 exiting vehicles per minute and approximately 1 entering vehicle per minute. The signal likely runs

a longer cycle length than one minute so even if it runs at a 120 second cycle period, the averages are still very low at an average of less than 3 exiting and about 2 vehicles entering per average cycle of the signal timing.

In summary: this traffic and driveway safety report has been prepared for submission to the Town of Ashland as an informational source to aid in their approval process. The traffic safety related issues addressed in this report include:

- ◆ Measurements of available stopping sight distances at the Myrtle Street/Driveway #4 location to assure safe operation of the intersection when the site is developed are shown on the Myrtle St. sketch plan in the Attachment E to this report. Only minor corner vegetation is to be removed for site vehicles exiting Driveway #4 looking to the right. Additionally as part of the Main Street streetscape project the large utility pole #29/1 shown on Attachment F, the Eversource Energy graphic, is to be removed by others and the wires placed in buried conduits. This will allow the guardrail along the corner of Main Street extending onto the south side of Myrtle Street to be moved 6 to 10 feet from the edge of Myrtle Street if it is still felt necessary to have a guardrail. The shift or removal of the guardrail will improve the sight distance views looking left from site driveway #4. Also removal of the solid wooden fence in front of the diagonal parked cars along the building front on Main Street is to be replaced with a decorative see-thru type of fence to allow the Intersection Sight Distance to be improved at driveway #4.
- ◆ Estimating the future site generated traffic volumes and their anticipated distribution and safety while entering/exiting onto nearby streets via the proposed four driveways, including the new driveway #2 at the signal will assist BSC in reanalyzing the signal timings and phases for Main Street to easily accommodate the new site traffic.

1. INTRODUCTION

This report presents our findings regarding existing traffic and estimated new site generated traffic at each of the four proposed site driveways where labeled on the Figure 1 LOCUS (follows page 5). The future numbers of trips to and from the site were estimated for the peak morning and peak evening travel periods during weekdays and also midday peak hour estimated site traffic on Saturdays. The analysis is based on current Institute of Transportation Engineers (ITE) trip generation statistics for a variety of potential Business/Office/Commercial tenants that will occupy portions of the proposed buildings on the first floor. Residential apartments will occupy the remaining area of the first floor and all of the second through fourth floors, when the facilities are fully occupied. The ITE Trip Generation Manual, 10th Edition, contains peak period trips for both entering and exiting various types of existing facilities, where actual counts were conducted and summarized in the ITE Manual. This resource document is the traffic industry standard publication for estimating vehicle trips from future businesses and residential structures.

The apartments to be included in this Nos. 10 to 50 Main Street facility are tabulated and the ITE data formula results are plotted on graphs under Code #221, titled Multifamily Housing (Mid/Rise). This category is further described as: "Mid-rise multifamily housing including apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have between three and 10 levels (floors). There is another category Code #231 that was considered, however the description is given as Mid-rise with 1st-floor commercial and multifamily housing buildings that have between 3 and 10 levels and include retail space on the first level. However this category is described as being within dense multi-use urban and center city core settings. Although this category may seem similar to the surrounding area, the local buildings are not as dense as typical City Core settings with 3 to 10 story buildings where most buildings are more densely placed as continuous blocks of buildings. Furthermore, review of the trip data, the Code #221 category actually has slightly higher rates of trips per housing unit during weekday 24 hour totals, also between 7-9 AM weekday peak hours and between 4-6 PM peak hours.

Based on the above, we estimate site generated trips for the apartments under Code #221 and separately for the first floor businesses using the gross square foot floor areas for each anticipated typical business use. Examples are listed later in the report and the ITE data graphs with calculated average number of trips generated by the commercial/business/office uses based on their size per 1,000 square foot increments are included in Attachment G. This yields a slightly larger estimate of total peak period trips than we would calculate under use of the Code #231 category.

The existing traffic traveling west on Pleasant Street in the morning peak and returning eastbound during the evening peak hours is significantly increased by employees heading to the train station parking lots to ride the train into the

Boston area. The developer will help reduce those trips from the apartments within this development by providing a shuttle bus for tenants both to and from the train station, thus carrying multiple tenants rather than each tenant driving personal vehicles and parking at the station. The shuttle bus will run during morning and evening hours that commuters typically ride the train that stops in Ashland. Later in this report in Attachment D, we include a summary description of the anticipated apartment tenants use of the shuttle bus and list the reduction in vehicles traveling through the busy Pleasant Street intersection to individually park at the station.

Not knowing the exact commercial clients that will occupy this facility, we used an array of different uses and an estimated size of each use for the calculations of trips per business occupant as tabulated and included in Attachment C. The total site trips per peak period include both the residential and commercial trips anticipated for the overall proposed site redevelopment.

The Town is moving forward with a Main Street improvement project with the BSC Group engineering firm working on the road design and streetscape improvements. Also BSC Group is conducting an analysis and improvements to the existing three traffic signals on Main Street. We are supplying the future site traffic estimates at each site driveway so BSC Group will be able to incorporate the site traffic into the final signal system design and make any signal timing and phasing adjustments deemed appropriate. This report includes each of the estimated new traffic volumes at the four site driveways during the peak weekday AM and PM periods and Saturday midday peak time period in Attachment C and we also include a layout plan of the architects building concept and parking drawing for ease of understanding the site circulation and driveway usage (follows Figure 1). We also measured the stopping sight distance at each driveway and find that driveways 1, 2 and 3 have ample stopping and intersection sight distances available to drivers. The driveway at Myrtle Street does provide the minimum adequate stopping sight distance and the acceptable minimum distances needed for safety, as shown on the sight distance sketch in the Attachment E and we will discuss that in more detail later in the report.

The BTTC engineering firm has a history with this site's past proposals for a similar development plan and for the past somewhat different development scenarios, we conducted the traffic analysis of the Pleasant Street intersection, similar to the BSC Group traffic analysis for the initial redevelopment proposal. I note that the BSC Group summary of findings memorandum (Pages 15-17) of their analysis memorandum, included here in Attachment B, indicates that the Pleasant Street signal, now and through year 2027, still operates at a very good Level of Service B for the overall intersection operation at Pleasant Street (LOS rankings span from A thru F). The current development plan has a main driveway onto Main Street within the signalized intersection, so the proposed signal timings and phases will need to be adjusted to provide adequate green times for all of the future intersection movements, including the new

developments driveway #2 labeled on Figure 1 and shown in detail on the Architects Site Plan that follows Figure 1 herein.

Once we calculated the combined use peak period trips for this multi-use site, we split the total trips and assigned what we anticipate the percentage of overall traffic will be at each of the four driveways. As shown on Figure 1, the Locus aerial photo and on the included architects site plan, and as the architectural plan attached to this report shows, parking for the apartments is on the lower ground level below Main Street level. The commercial customers and residential tenants can enter the decked parking between the two south end building sections by way of a proposed traffic signal controlled entrance/exit #2 at the Pleasant Street intersection. They also can enter via the restricted enter-only driveway #1 south of the building, entering from Main Street at street level onto decked parking, where additional proposed offices are to be located at Main Street level.

Apartment tenants will be able to enter the lower parking by way of any of the driveways labeled 1, 2 or 4 on the Locus. Driveway #4 on Myrtle Street leads directly under the building to the tenant parking spaces. The Main Street deck parking entrances 1 & 2 have a ramp down one level at the rear of the site, sloping down from the Main Street level to the lower ground level parking area under both the building and decked parking.

Driveway 3 on the Locus and architects site plan is intended for business/commercial customers to park during business hours along the building frontage near its north end, functioning similarly to the current one-way diagonal parking aisle usage.

This traffic report has been prepared for submission to the Town of Ashland as an informational source to aid in their approval process. The traffic related issues addressed in this report include:

- ◆ Review of traffic impacts at the existing adjacent signalized intersection, as well as at the Myrtle Street north site driveway #4 during weekday AM and PM Peak Hours, and during Saturday Midday peak hour traffic.
- ◆ Measurements of available stopping sight distances at the Myrtle Street/Driveway #4 location to assure safe operation of the intersection when the site is developed are shown on the Myrtle St. sketch plan in Attachment E to this report. Only minor corner vegetation is to be removed for the benefit of site vehicles exiting Driveway #4 looking to the right. Additionally as part of the Main Street streetscape project the large utility pole #29/1 shown on the Attachment F, Eversource Energy graphic, is to be removed by others and the wires placed in buried conduits. This will allow the guardrail between the corner of Main Street on the south side of Myrtle Street to be moved 6 to 10 feet from the edge of Myrtle Street to improve sight distance views looking left from the site driveway

- #4. Also removal of the solid wooden fence between driveway #4 and in front of the diagonal parked cars along the building and Main Street is to be replaced with a decorative see-thru type of fence to allow the Intersection Sight Distance to be improved at driveway #4.
- ◆ Estimating the future site generated traffic volumes and their anticipated distribution and safety while entering/exiting onto nearby streets via the proposed four driveways.

1.1 *Scope and Method of Study*

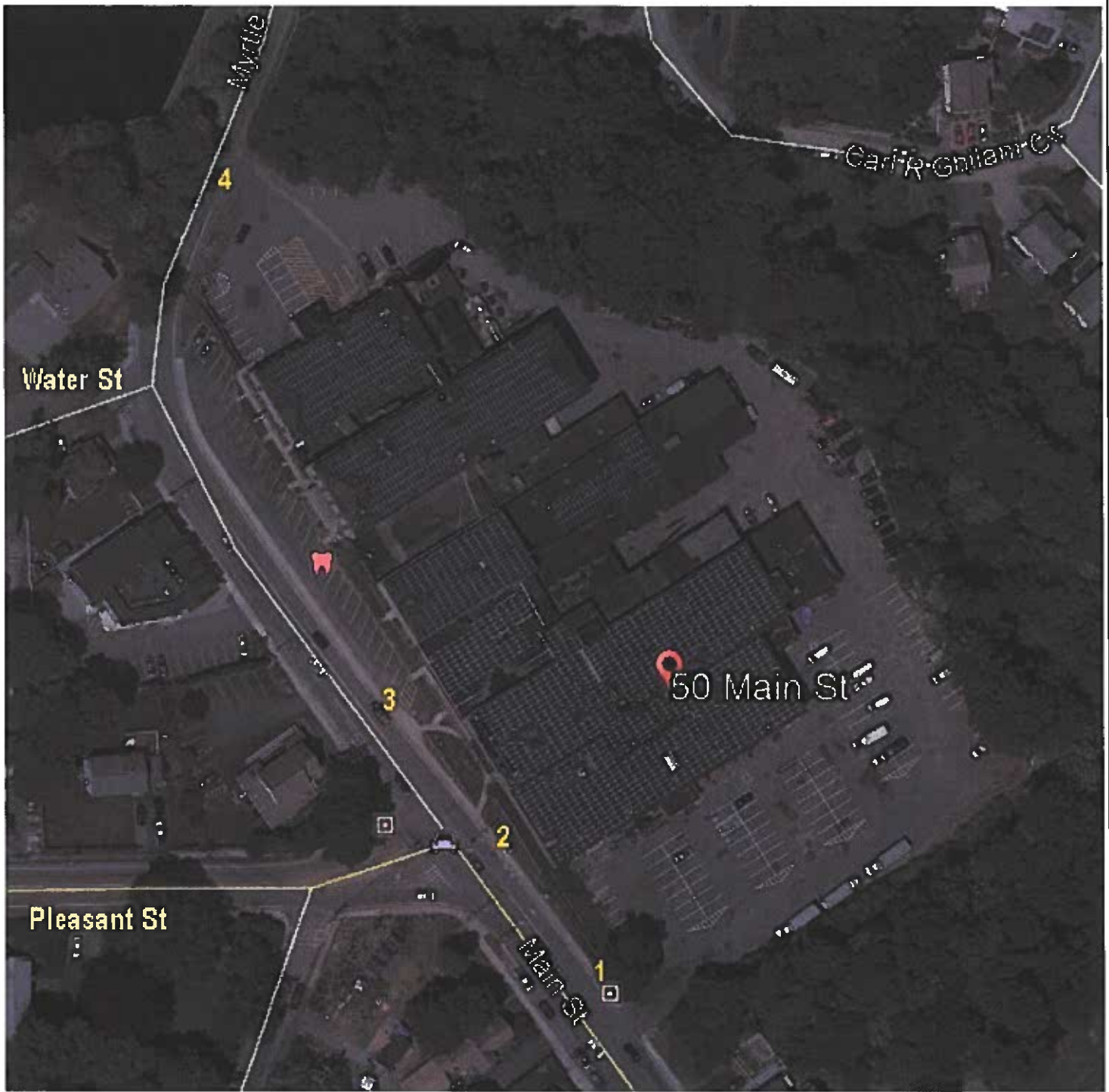
Evaluation and analysis for this project included a field review of existing conditions along the site frontage on Main Street and Myrtle Street and the proposed design changes to Main Street, i.e. Proposed Streetscape Project lane configurations, crosswalk locations, signal changes, etc. Since the Town has recently contracted with the BSC Group engineering firm for roadway, streetscape and signal improvements along Main Street, this traffic report concentrates on the adjacent intersection that potentially might be impacted by this proposed development. That location being the signalized Main Street at Pleasant Street intersection where the proposed site driveway #2 (see Figure 1 and the proposed architectural plan view of the proposed building, parking and driveway layouts following Fig. 1), showing driveway #2 is to become a 4th leg to this signalized intersection. Also reviewing for safety issues, the intersection of Myrtle Street and the north driveway labeled #4 on Figure 1 with each of the site driveways numbered for report references.

To determine the levels of future site related traffic to and from this site redevelopment at each of the proposed four driveways, we first assumed typical site commercial/retail or office uses that may locate in this mixed use site development. Calculating and tabulating each uses trip generation, we then added trip calculations for the proposed 222, one or two bedroom rental apartments, proposed to be above and adjacent to the commercial uses.

Once a reasonable list of typical uses for the mixed use site redevelopment were established, we determined potential traffic peak hour volumes that may be generated by those uses, based on the size of each use and adding typical peak hour trip generation statistics for the apartments. The accepted source of the trip generation estimates is the industry standard Institute of Transportation Engineers (ITE) 10th Edition of the Trip Generation Manual. This source was used to calculate and tabulate the future trip estimates shown in the tables in Attachment C. The ITE document provides peak hour traffic count data from many prior studies compiled into graphical and average trips per use. Commercial/Business trips are based on the use size in 1,000 square feet increments and for apartments the trips are based on the number of apartments. Keeping in mind that the proposed apartments are one or two bedroom rental units, with typical tenants not raising large families here, thus keeping the trip generation on the lower side for the 222 rental units.

1,2,4 = Proposed Driveways (#1 is Enter Only) 3= Proposed Off-Street Linear Parking Driveway

Scale: N.T.S.



Aerial Google Earth 6/22/2019

BTTC	<u>10-50 MAIN STREET REDEVELOPMENT</u> ASHLAND, MASSACHUSETTS	<u>FIGURE 1</u> LOCUS & Parking Access
BRISTOL TRAFFIC & TRANSPORTATION CONSULTING, LLC N. BROOKFIELD, MA		



2. EXISTING CONDITIONS

The existing roadways and intersection adjacent to the site were reviewed along with the BSC Group proposed preliminary design plans for the Pleasant Street / Main Street intersection attached following section 2.3 and included at Attachment A.

2.1 *Land Uses*

Located within the vicinity of the proposed development along Main Street there are a mixture of land uses associated with the surrounding area, such as commercial, retail, restaurants, manufacturing, municipal and office space.

2.2 *Existing Roadways*

The roadways serving the study area, which may be impacted by the proposed project, include Main Street, Myrtle Street and Pleasant Street.

Main Street - Myrtle Street

Main Street is classified by MDOT as an Urban Minor Arterial south of Pleasant Street and as an Urban Collector between Pleasant Street and Water Street where Main Street changes to Myrtle Street. It runs generally in a north-south direction with one travel lane for each direction and at its' intersection with Pleasant Street, it has a dedicated northbound left turn lane and a short southbound right turn lane. The posted speed limit on Main Street is 25 mph Northbound to the site driveway on Myrtle Street where it changes to 30 MPH. Main Street carries a significant amount of commuter traffic from the surrounding area and it is lined with commercial and retail businesses that generate local traffic and parking maneuvers. Parking is allowed on the west side north and south of its' intersection with Pleasant Street.

I am aware that there have been some community comments regarding this project possibly further impacting the Main Street southbound queue during train crossings of Main Street, thus adding to the now occurring diversion of southbound Myrtle Street traffic onto Winter Street north of the site. With this site having direct access to the Pleasant Street signal and Pleasant Street across from the site main driveway #2, with signal control of the driveway movements, it is possible that the site traffic be given a green signal to exit westbound crossing Main Street toward the train station and Rte. 9 area destinations during a train crossing Main Street so southbound vehicles cannot move. This would discourage site drivers from trying to exit at the Myrtle Street driveway heading south to Pleasant, adding to the congestion during train crossings. Therefore we do not see any connection of this project with anything that occurs at the intersection of Winter Street and Myrtle Street.

Pleasant Street

Pleasant Street is classified by MDOT as an Urban Minor Arterial for its' full length. Short left and right turn lanes are striped at the Main Street intersection to allow the predominant right turn movement to move during two signal phases. Near the Main Street intersection, Cherry Street intersects with Pleasant Street. Cherry Street is restricted to one-way traffic toward Pleasant Street, which eliminates westbound Pleasant Street vehicles from turning left and blocking Pleasant Street or queuing into the Main Street intersection, when waiting to turn south into Cherry Street. The posted speed limit on Pleasant Street eastbound approaching Main Street is 25 mph while it is signed for 35 mph westbound. On Main Street at the signal, Pleasant Street is also signed as a truck route to Routes 9, 90 and 495.

Water Street connects Pleasant Street to Main Street beginning a short distance from Main Street and ending as a one-way connector traveling to Main Street providing an alternative to turning left at the Main Street signal.

2.3 Existing Study Intersections & Proposed Changes to Intersections

Main Street / Pleasant Street

An Existing Conditions Main Street/Pleasant Street Study Intersection shown with the proposed BSC Group safety improvements at the intersection is found in Attachment A (Page 12). The addition of a proposed site driveway at this intersection will require a modification to the BSC Group completed signal phasing/timing analysis (BSC analysis results are included in Table 8 in Attachment B (Page 13). The signal phasing and timings could be revised to allow independent access to the signal from the site driveway #2 and from Pleasant Street, through a revised setting of the signal phasing and a timing change.

The BSC Group analysis of the signal operation Level of Service and intersection design revisions are excerpted from the BSC Group memorandum to the Town, Pages 15-17 of 17, and inserted in Attachment B to this report. The BSC Level of Service analysis results indicate that the overall intersection signal functions at a very good Level B in Table 8. Indicating green time capacity is available to add a separate, short period signal phase for a fourth leg to the intersection signal operation if it were added directly from the proposed site development as shown as Driveway #2 on the Locus and the Architects plan view. The traffic volume estimates for the site driveways at full occupancy are included in the table included in Attachment C (Page 14) indicate that the volume of traffic during peak hours are not excessive. Since the signal is operating at a reasonably high level of service there is available capacity to handle the site volumes both entering and exiting the site driveway #2 if under the control of the signal. The table with the site trip estimates is titled "Summary of Project Future Peak Hours Trip Generation by Driveway (Mixed Use)". Driveway #2 being the proposed 4th leg to the Main Street/Pleasant Street signalized intersection.

Myrtle Street / Site Drive #4

For the site driveway #4 intersection on Myrtle Street, as labeled on the Figure 1 LOCUS aerial, the existing traffic volumes are significantly lower than the traffic at Pleasant Street, since more than half of the Main Street northbound traffic turns west onto Pleasant Street. Water Street adds some northbound vehicles to Myrtle Street, but not nearly as many as turn left at Pleasant Street. Being much lower than Main Street and being a reasonable volume for a rural road such as Myrtle Street, we do not see a need to study this Driveway #4 for capacity. The prior counts made for the BTTC 2017 year study of this site intersection, are included in Attachment C showing the Myrtle Street peak hour counts collected in 2012 and increased by a growth factor of 3.8% to year 2017.

So we measured both the Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD) for this driveway, each from and to the south and north. SSD is measured for the approaching vehicles ability to view a 2 ft high object in the street ahead (i.e. head or tail lights height 2 ft.), so the approaching vehicle can stop safely if needed. SSD for approaching from the south on Myrtle Street going down a slight grade of 3% requires 158 feet of sight line to avoid an accident with a vehicle exiting the driveway. This approach has a speed limit of 25 mph however the approaching vehicle must turn the corner at Water Street which slows it's approach for part of the travel distance. Available from the north the SSD measured is over 450 ft. so the SSD from the north can see far enough to technically stop in time even if traveling 50 mph. From the south near Water Street the SSD measures to be 200 ft. so both directions satisfy the required safe SSD.

SSD is considered the most important distance requirement to satisfy for safety reasons, since if the exiting vehicle can't be seen from far enough away when it exits and the vehicle doesn't cross the lane in time, there will be an accident with the approaching vehicle. Both directions exceed the SSD requirement of 158 FT. for the south approach and 200 feet for approaching from the north.

The SSD and ISD are calculated based on speed of approaching vehicles. The authority that tests vehicles ability to stop safely and therefore sets these rules for distance needed is the American Association of State Highway and Transportation Officials (AASHTO) and they publish the roadway design criteria and safety requirements in the document titled "A Policy on Geometric Design of Highways and Streets, 2018, 7th Edition."

AASHTO gives the ISD distances with the caveat that ISD is a desirable distance for operational efficiency, not the mandatory safety distance to avoid an accident. However they do require, for safety, that the ISD be equal to or greater than the SSD. ISD is the viewing distance the driver about to exit a side street or driveway, such as our #4 driveway onto Myrtle Street, is able to see oncoming vehicles. The desirable ISD toward the north measured from a height of 42" at a point 14.5 ft from the edge of the through travel way per AASHTO guidelines,

where typical vehicles stop on approaching an intersection, satisfies the 158 ft required SSD looking toward Main Street. By actual measurement ISD is the same 200 ft as the SSD that is available. The ISD from the driver's seat as noted for the north direction, will be double the SSD at 400 ft if a small corner of vegetation at the driveway's northeast corner of Myrtle Street is trimmed back slightly on the site property. This will be done during the site construction period.

The above distances are labeled on the Sight Distance Measurement Myrtle Street Driveway 4 plan in Attachment E (Page 16).

3. STUDY CONCLUSIONS

The proposed mixed use redevelopment complex is anticipated to only moderately increase the weekday Main Street/Pleasant Street intersection traffic volumes. In actuality, this trip generation is assuming full occupancy of the site. The site is partially occupied today and could rent out the remaining space now with no permits regarding traffic or traffic review necessary at this time. An increase in site traffic could occur whether the renovation and change in tenants occurs or not. For this analysis report for the intended site betterment, this report assumes that only the existing partially occupied building site traffic is considered as background traffic that will be eliminated and replaced by the ITE statistics for the new uses. The existing traffic is listed in Attachment D, however no credit has been subtracted from the new use traffic generations for the elimination of existing trips now generated by the sight.

The BSC Group roadway and signal proposed improvements indicate that the Pleasant Street intersection, as it will be modified by the streetscape project, has very good capacity at high Level of Service B through the future year 2027. This report provides the estimated site uses and associated traffic volumes those uses will generate so the BSC Group can recalculate and modify their signal system timings and phasing's to accommodate the proposed site driveway #2, located within the Pleasant Street intersection and provides the overall future site traffic.

To improve sight distances available at the site driveways. Driveway #1 will be restricted to enter only to avoid having exiting traffic attempting to force their way into the long queue that forms for the northbound left turn lane at Pleasant Street or attempt to exit when the signal queues form long lines of through traffic northbound, attempting to turn south causing a traffic jam.

At the Myrtle Street driveway, although the available stopping sight distance to the left exceeds the minimum required length for the 25 MPH approach speed limit. By replacing the solid wood fence along the upper level parking south across from the Water Street intersection with a decorative see-through fence the sight lines are improved. Also when Eversource Energy removes the utility pole #29/1 shown on Attachment F (Page 17) Eversource Energy plan, located on the inside of the corner at the south end of the start of Myrtle Street, the guardrail

can be moved to the Myrtle Street row line or 6 to 10 feet from Myrtle Street pavement edge improving the Driveway #4 already acceptable 200 foot long sight distance to the west. At Driveway #4 northeast corner, a small amount of branches and other vegetation can be trimmed to assure the sight distance is extended to the full 400+ feet to the northeast.

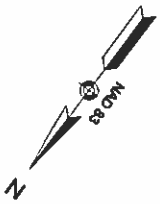
The installed synchronized signal system on Main Street currently runs efficiently with very good Levels of Service at the Pleasant Street signal. Once this site is fully developed as proposed and occupancy is 100%, the modification to the timing and phasing of the Pleasant Street signal can allow the three signal Main Street system to likely continue to operate efficiently at an acceptable level of service.

**A BSC Group preliminary plan for street safety improvement at
Pleasant Street/Main Street**

**ASHLAND
MAIN & FRONT STREET
PAVEMENT MARKING & SIGN PLAN
SHEET 1 OF 5**

DATE	BY	REVISION
10/21/19	JK	ISSUED FOR PERMITS
08/20/19	JK	REVISED
08/14/19	JK	REVISED
08/14/19	JK	REVISED

PROJECT FILE NO. 20190000



#10-60 MAIN STREET
N/F
ASHLAND PROPERTIES
BK 57055 PG 303
PLAN 172 OF 1992

MAIN STREET
(PUBLIC - VARIABLE WIDTH)
1888 COUNTY LAYOUT, PLAN 386 OF 1984

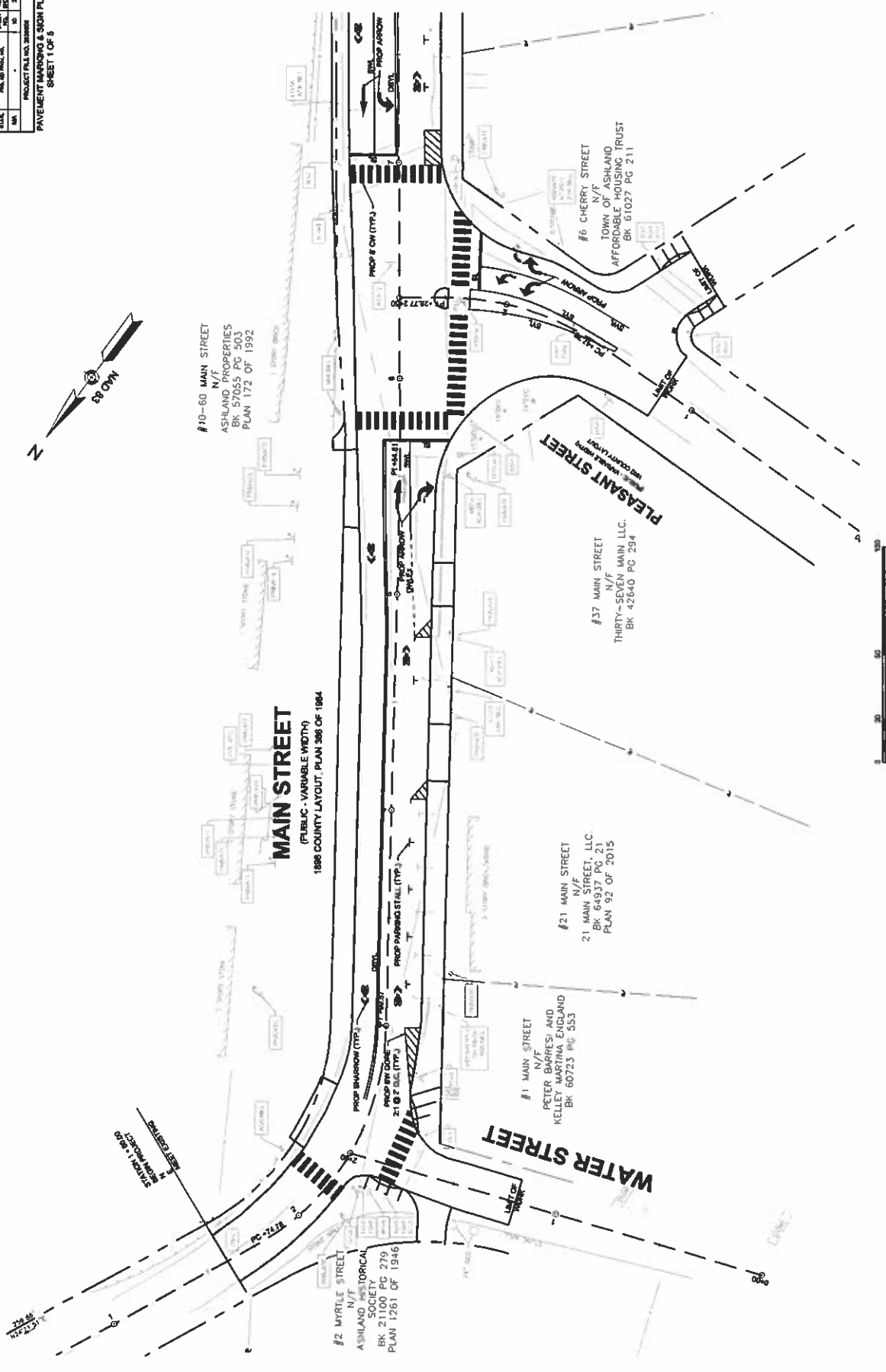
#2 MYRLE STREET
N/F
ASHLAND HISTORICAL
SOCIETY
BK 21100 PG 279
PLAN 1261 OF 1946

#1 MAIN STREET
N/F
PETER BARRETT AND
KELLEY MARINA ENGLAND
BK 60723 PG 353

#21 MAIN STREET
N/F
21 MAIN STREET, LLC
BK 64937 PG 21
PLAN 92 OF 2015

#37 MAIN STREET
N/F
THIRTY-SEVEN MAIN, LLC
BK 42040 PG 294

#6 CHERRY STREET
TOWN OF ASHLAND
AFFORDABLE HOUSING TRUST
BK 61027 PG 211



CONT. ON
SHEET 2



**B Excerpt from BSC Group Memorandum showing Pleasant Street
Improvements and Very Good Traffic Level of Service Analysis
(Pages 15-17 of 17)**

Proposed Intersection Improvements

The three primary intersections within the project corridor were evaluated with respect to geometry, capacity and safety resulting in conceptual layouts summarized as follows:

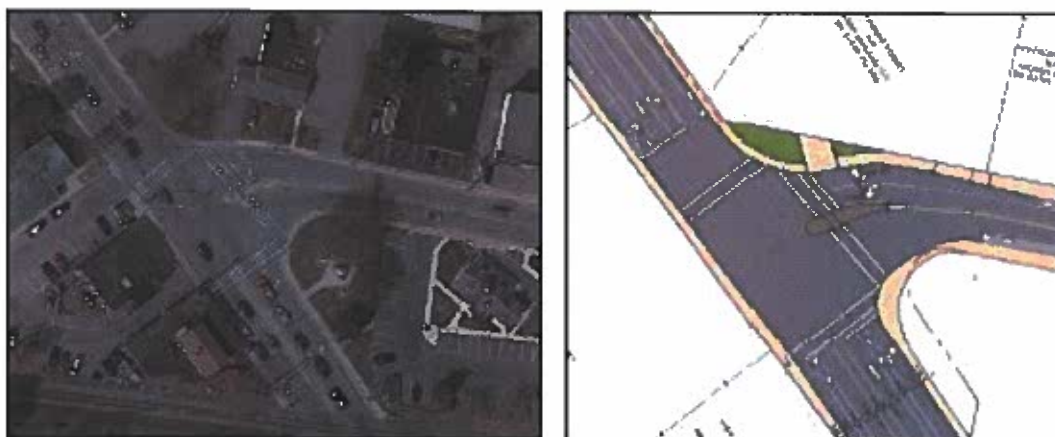
Main Street at Pleasant Street



Main Street at Pleasant Street – Existing Conditions and Proposed Improvements

The proposed improvements at this intersection would reduce the pedestrian crossing distance of Pleasant Street from 109 feet to 101 feet and provide a pedestrian refuge area by extending the existing median through the crosswalk. The proposed improvements would also include a crosswalk across Main Street north of Pleasant Street, reducing the number of pedestrians crossing Pleasant Street. In addition, a reduction in the curb radii will slow vehicles down as they turn, thus improving pedestrian and bicyclist safety.

Main Street at Front Street



Main Street at Front Street – Existing Conditions and Proposed Improvements

The proposed improvements at the intersection of Main Street and Front Street primarily involve decreasing curb radii as much as possible while allowing trucks (WB-50 design vehicle) to safely navigate all turns. Pedestrian crossing

distances will be reduced at this intersection as well while retaining a raised median to provide a refuge and protection for pedestrians crossing Pleasant Street.

Main Street at Summer Street/ Homer Avenue



Main Street at Summer Street/ Homer Avenue – Existing Conditions and Proposed Improvements

A channelizing island is proposed at the intersection of Main Street and Summer Street/ Homer Avenue to address the issues of long pedestrian crossings and wide pavement areas. The existing 83-foot crosswalk across the northern Main Street approach would be broken up into a two-stage crossing consisting of a 48-foot crosswalk and a 22-foot crosswalk. The 85-foot crossing of Homer Avenue would be broken up into a 47-foot crosswalk and a 22-foot crosswalk. The right turn from Homer Avenue onto Main Street would be signalized and prohibited when the railroad gates are down. The crosswalk on the southern approach of Main Street would be reoriented such that the crossing distance would be reduced from 61 feet to 47 feet.

2027 Build Intersection Capacity Analysis

As previously herein, the Town presented several alternatives to the community that resulted in a preferred alternative for Main Street of no bicycle lanes (i.e. Second Alternative) and for Front Street with bicycle lanes (i.e. First Alternative). Refer to the attached plans and the results of the capacity analysis for the intersections evaluated under the 2027 build conditions are summarized in Table 8. Existing traffic volumes were expanded ten years in the future using an annual growth rate of traffic volumes of 1.0%. The Synchro traffic analysis software package (Version 10) was utilized to evaluate operating conditions for the proposed intersection and the proposed traffic signal alternative.

Under 2027 build conditions the intersection of Main/Pleasant experiences a slight increase in delay and queue length with no change in LOS during the AM & PM peak hour; the intersection of Main/Front experiences a slight increase in delay and queue length with no change in LOS during the AM & PM hour; while the intersection of Main/Summer/Homer experience a slight increase in delay and noticeable increase in queue length that results in a drop in LOS from C to D during the AM peak hour but with no change in LOS during the PM peak hour. It should be noted that although the Main/Summer/Homer intersection experiences an increase in overall delay of approximately 6 seconds and subsequent drop in LOS, this is primarily due to the Summer Street approach and is not considered significant.

In conclusion, the three intersections are able to accommodate future growth with minor or negligible impact to LOS.

Table 8: 2027 Build Conditions Capacity Analysis

	2027 Build AM				2027 Build PM			
	Avg. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)	Avg. Delay (sec)	LOS	V/C Ratio	Queue Length (ft)
SIGNALIZED INTERSECTIONS								
Main Street at Pleasant Street								
Pleasant Street EB L	49.8	D	0.71	178	39.1	D	0.41	76
Pleasant Street EB R	2.3	A	0.46	40	5.7	A	0.59	72
Main Street NB L	6.0	A	0.41	95	15.9	B	0.73	385
Main Street NB R	3.7	A	0.21	31	5.3	A	0.14	47
Main Street SB T	50.1	D	0.74	234	23.5	C	0.53	326
Main Street SB R	12.4	B	0.24	44	9.2	A	0.20	63
Overall	15.5	B	0.74		14.2	B	0.73	
Main Street at Front Street								
Front Street WB L	44.8	D	0.49	100	38.1	D	0.58	137
Front Street WB R	4.6	A	0.31	44	3.9	A	0.37	44
Main Street NB T	18.0	B	0.53	382	19.7	B	0.58	506
Main Street NB R	2.5	A	0.26	44	0.8	A	0.08	2
Main Street SB L	7.3	A	0.44	99	7.0	A	0.39	68
Main Street SB T	6.5	A	0.38	317	10.7	B	0.58	563
Overall	10.9	B	0.53		13.8	B	0.59	
Main Street at Summer Street/ Homer Avenue								
Summer Street EB LTR	62.2	E	0.98	694	47.6	D	0.74	170
Homer Avenue WB LT	20.2	C	0.07	57	27.4	C	0.14	46
Homer Avenue WB R	4.8	A	0.24	53	6.0	A	0.33	36
Main Street NB LTR	23.4	C	0.51	193	10.9	B	0.37	254
Main Street SB LT	36.1	D	0.87	412	16.0	B	0.72	644
Main Street SB R	3.1	A	0.17	6	4.2	A	0.17	36
Overall	35.7	D	0.98		16.3	B	0.74	
UNSIGNALIZED INTERSECTIONS								
Main Street/ Myrtle Street at Water Street/ Driveway								
Water Street EB LTR	20.9	C	0.29	30	19.2	C	0.18	15
Driveway WB LR	16.4	C	0.05	5	16.2	C	0.07	5
Main Street NB TR	0.0	A	0.00	0	0.0	A	0.00	0
Main Street SB LT	8.4	A	0.00	0	0.0	A	0.00	0
Front Street EB LT	8.2	A	0.13	10	8.3	A	0.06	5
Front Street WB T	0.0	A	0.00	0	0.0	A	0.00	0
Front Street WB R	0.0	A	0.00	0	0.0	A	0.00	0
Concord Street SB LR	14.0	B	0.23	23	12.9	B	0.18	15

Abbreviations: NB - Northbound, SB - Southbound, EB - Eastbound, WB - Westbound, L - Left, T - Thru, R - Right

cc: File

**C Mixed Use Summary Table of Project Peak Hour Trip Generation
Volumes at Full Occupancy Assigned to Each Driveway. Also existing
intersection counts for 2017@Main Street / Pleasant Street and
Myrtle Street / Driveway #4**

MIXED USE:

Summary of Project Peak Hour Trip Generation by Use Following Full Occupancy

Building Use	ITE Trip Generation Manual (###) + Title	Size	AM Trips		PM Trips		Sat. MD**		*Driveway # Estimated Usage % Split
			Enter	Exit	Enter	Exit	Enter	Exit	
Apartment	(221) Multi-Family Housing Mid-Rise	222 Units	21	59	60	38	48	50	#1-15% #2-45% #3-5% #4-35%
Mixed Retail	(492) Health/Fitness Club	4,000 SF	3	3	8	6	6	7	#1-25% #2-50% #3-10% #4-15%
& Commercial	(720) Medical-Dental Office	4,000 SF	9	2	4	10	17	17	#1-35% #2-50% #3-0% #4-15%
Potential Uses	(876) Apparel Store	3,000 SF	2	1	6	6	8	8	#1-20% #2-40% #3-20% #4-20%
	(920) Copy, Print, Express Ship Store***	3,000 SF	6	2	10	12	6	6	#1-20% #2-50% #3-10% #4-20%
	(930) Fast Casual Restaurant	4,000 SF	6	3	31	25	75	61	#1-20% #2-50% #3-10% #4-20%
	(936) Coffee/DonutShop NoDriveUp	1,000 SF	52	50	18	18	29	30	#1-5% #2-35% #3-25% #4-35%
	Apartments+Mixed Retail Trips		99	120	137	115	189	179	
Office Use	(710) General Office Building-SF	13,575 SF	14	2	3	13	15	15	#1-25%, #2-50%, #3-5%, #4-20%
	Mixed Use Size (Excluding Apartments)		113	122	140	128	204	194	
	Total ITE Trip Statistics		113	122	140	128	204	194	

*Driveways: #1=South-Enter Only, #2=Pleasant St. 2-way, #3= Bldg Front Enter-Exit pair, #4=Myrtle St. 2-way

**MD=Midday

***SAT MD estimated. ITE lacks data on Saturday for (920) Copy, Print, Express Ship Store

Summary of Project Future Peak Hour Trip Generation by Driveway (Mixed Use).

ITE Trip Generation Volumes	AM Trips		PM Trips		Sat. MD	
	Enter	Exit	Enter	Exit	Enter	Exit
Driveways						
#1 South	16	0	23	0	38	0
#2 Plsnt	47	65	64	82	94	124
#3 Front Pkg	17	17	14	13	21	20
#4 Myrtle	33	41	39	33	51	50
	113	123	140	128	204	194

Exit Vehs. assigned to Drive #2

2017 Peak Hour Turning Movement Count

Ashland, MA Main Street at Pleasant Street
 2012 Turning Movements in One hour adjusted upward by 3.8% Growth Rate
 June 2 MD Sat., June 6 AM PM Weds.
 Counted By: PDI

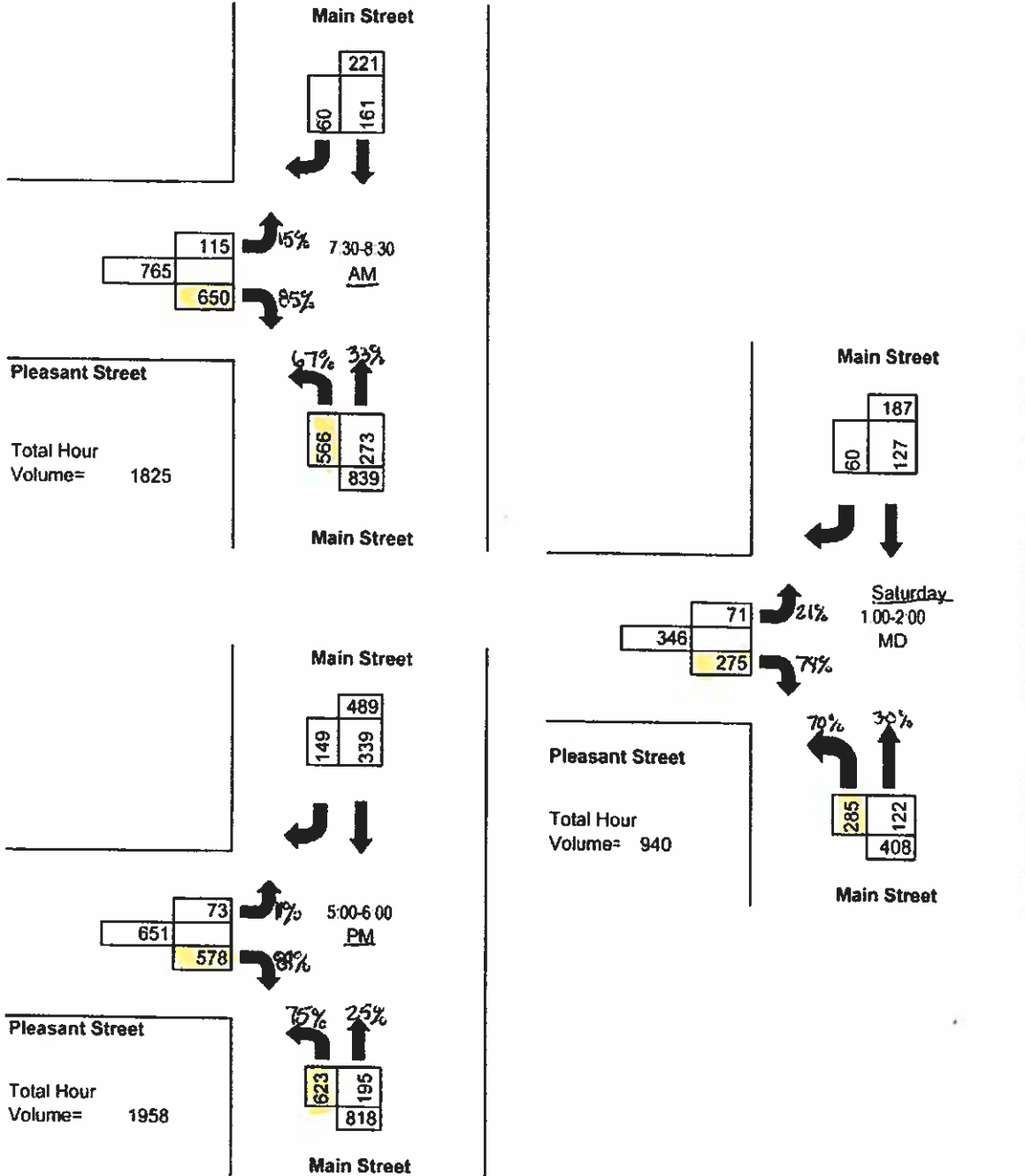


Figure 9
 No-Build

Compiled By: BTTC

2017 Peak Hour Turning Movement Count

Ashland, MA - Myrtle Street at Site North Driveway

2012 Turning Movements in One hour adjusted upward by 3.8% 5 yr Growth Rate

June 2 Sat MD, June 6 Weds AM PM

Counted By: PDI

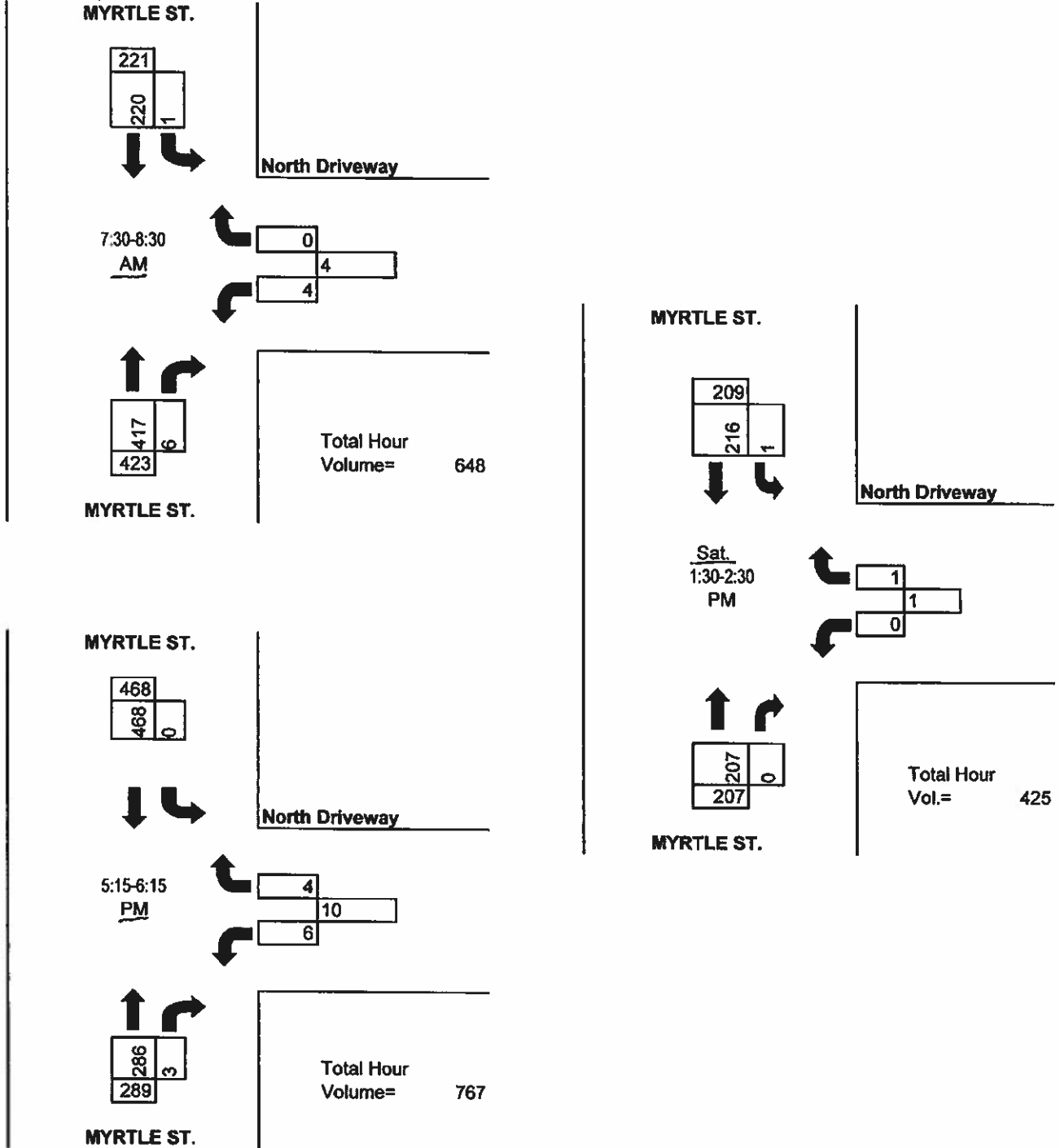


Figure 3
No-Build

**D Potential Existing Site Trip Elimination Credit Table for Driveways,
with Shuttle Bus Operation Description & Framingham/Worcester
MBTA Train Schedule**

Existing Site Trip Elimination Credit.

(These existing counts were collected in 2012 and) (increased to YR 2017@ a 3.8% growth rate.)

Existing Vehicle Trip Reduction Estimates.

These current site trips today will be eliminated from the local driveways and streets thus reducing existing traffic by these amounts at site driveways.

This reduces existing traffic surrounding the site lessening a portion of the future use traffic increase.

± Existing Driveway Site Generated Trips

Driveways	AM Trips		PM Trips		Sat. MD	
	Enter	Exit	Enter	Exit	Enter	Exit
#1 South	9	4	4	10	1	1
#2 Plsnt	(Driveway does not exist)					
#3 Front Pkg	15	2	2	17	8	5
#4 Myrtle	10	2	3	9	5	4
	34	8	9	36	14	10

Shuttle Bus Trip Reduction Estimates.

Site residents will also be provided with Shuttle Bus rides to and from the train station during AM and PM peak periods. According to the train schedule 4 trains stop in Ashland inbound to the Boston area in an extended AM peak period and 4 outbound trains return in the evening extended peak period. The shuttle buses are assumed to carry an average of 8 passengers per trip and will make two trips per train stop, totaling 16 round trips from the site per day to bring residents to the station and back home in the evening. The 8 morning trips carrying 8 passengers will potentially eliminate approximately 64 tenant vehicle trips, while adding only 8 shuttle bus round trips to the Pleasant Street station, repeating this reduction during evening peak traffic hours. Should demand exceed this estimated service, the shuttle will increase either the number of trips or a larger bus will carry more passengers per trip. This shuttle service will reduce the traffic in the project vicinity during peak travel hours.

NOTE:

Although elimination of these existing site trips and the train shuttle bus use will both reduce the projected new site vehicle counts, we have not subtracted them from the site calculated trips as tabulated in the previous "MIXED USE: Summary of Project Peak Hour Trip Generation by Use Following Full Occupancy" table, yielding a conservative estimate of the site vehicle count projections on local streets.

Fall/Winter Schedule Effective November 2, 2020

FRAMINGHAM/WORCESTER LINE

Ride Safer. Wear a face covering.

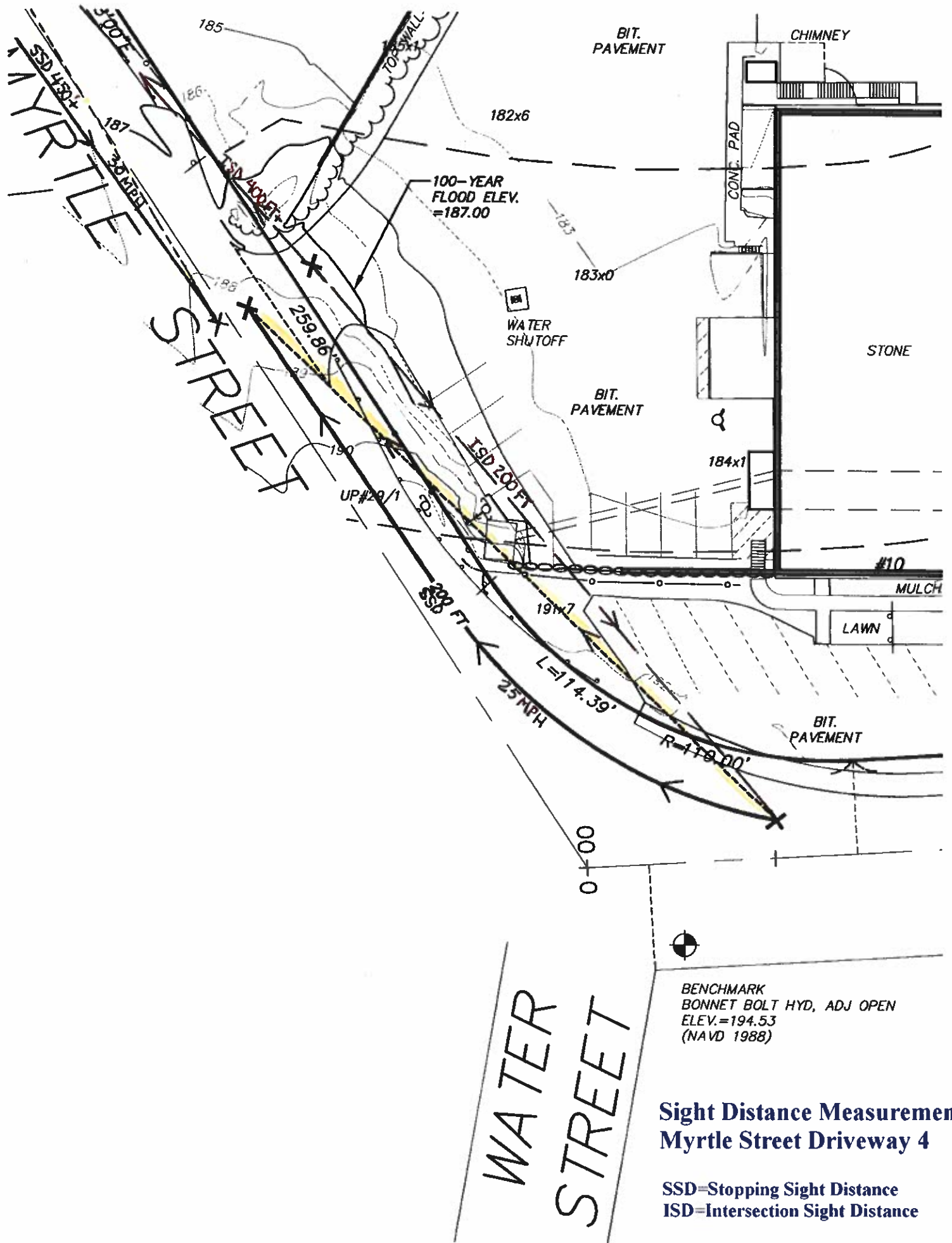
Maintain a healthy distance.

Practice good hygiene.

mbta.com/ride-safer

Monday to Friday		Saturday & Sunday	
Inbound to Boston		Inbound to Boston	
ZONE STATION	TRAM #	AM	PM
8 Worcester	6	6:00	6:22
8 Grafton	6	6:13	6:35
7 Westborough	6	6:17	6:39
6 Southborough	6	6:28	6:50
6 Ashland	6	6:30	6:52
5 Framingham	6	6:40	7:02
4 West Needham	6	6:45	7:07
4 Mattick Center	6	6:50	7:12
3 Wellesley Square	6	6:54	7:16
3 Wellesley Hills	6	6:58	7:20
3 Wellesley Farms	6	7:01	7:23
2 West Newton	6	7:04	7:26
2 West Needham	6	7:08	7:30
1 Newtonville	6	7:11	7:33
1A Boston Landing	6	7:14	7:36
1A Lansdowne	6	7:18	7:40
1A South Station	6	7:21	7:43
1A Back Bay	6	7:25	7:47
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1A			

**E Acceptable Stopping Sight Distance - Sketch for Myrtle Street at
 Driveway #4**

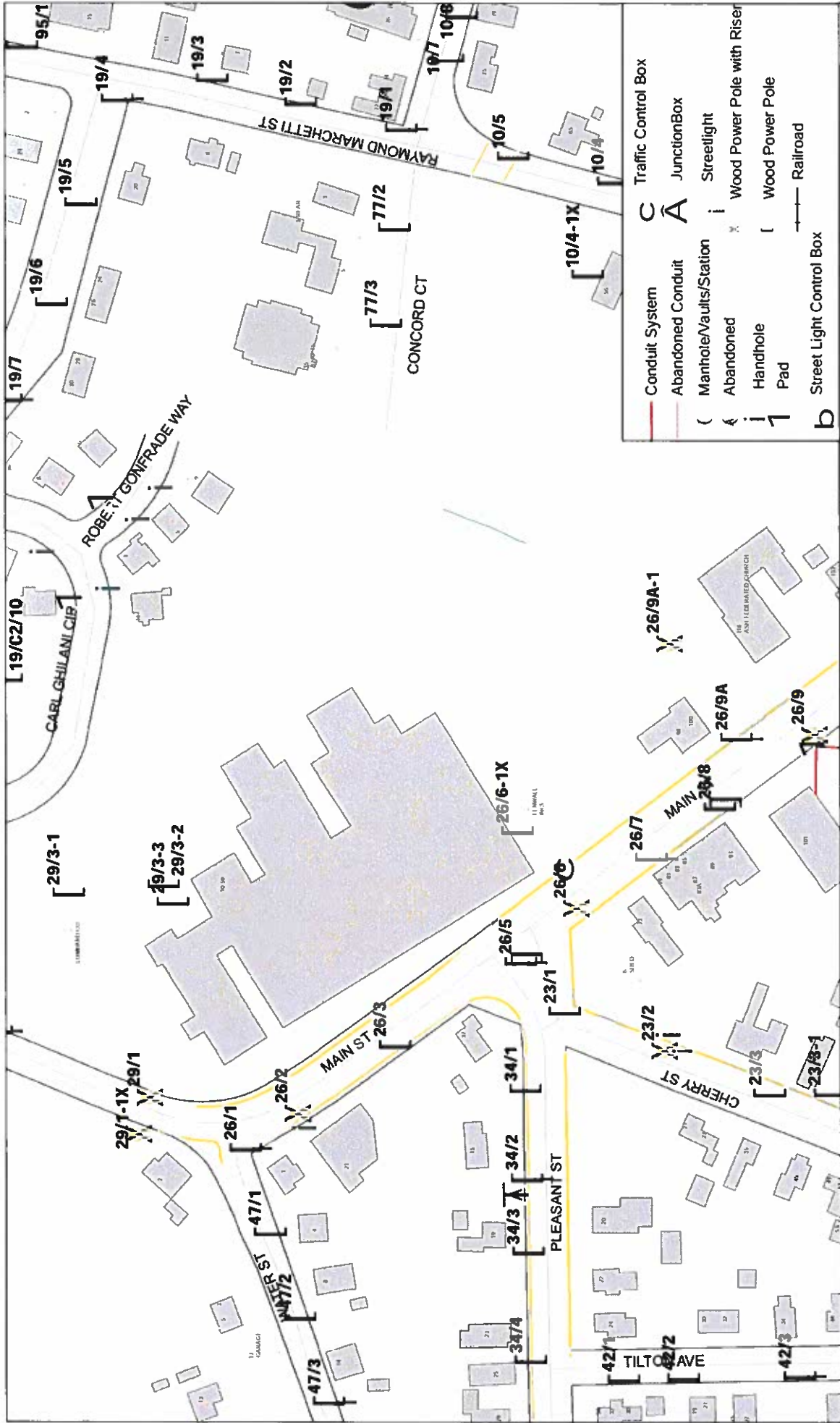


BENCHMARK
 BONNET BOLT HYD, ADJ OPEN
 ELEV.=194.53
 (NAVD 1988)

Sight Distance Measurement Myrtle Street Driveway 4

SSD=Stopping Sight Distance
 ISD=Intersection Sight Distance

**F Eversource Energy plan for Removal of Utility Pole #29/1 on Myrtle
Street corner**



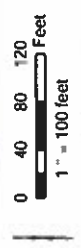
- Conduit System
- Abandoned Conduit
- Manhole/Vaults/Station
- Abandoned
- Handhole
- Pad
- Street Light Control Box
- Traffic Control Box
- Junction Box
- Streetlight
- Wood Power Pole with Riser
- Wood Power Pole
- Railroad

EVERSOURCE T-Plan

Main St
Ashland
Date: 8-25-17

MASS. LAW
REQUIRES 72 HOURS ADVANCE NOTICE TO UTILITY COMPANIES BEFORE DIGGING BY ANYBODY. CALL DIG-SAFE 1-888-344-7233.

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**G ITE Trip Generation Graphs for Determining Site Future Traffic
Volumes (Categories #221 though #710)**

Multifamily Housing (Mid-Rise) (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: 53

Avg. Num. of Dwelling Units: 207

Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate

Range of Rates

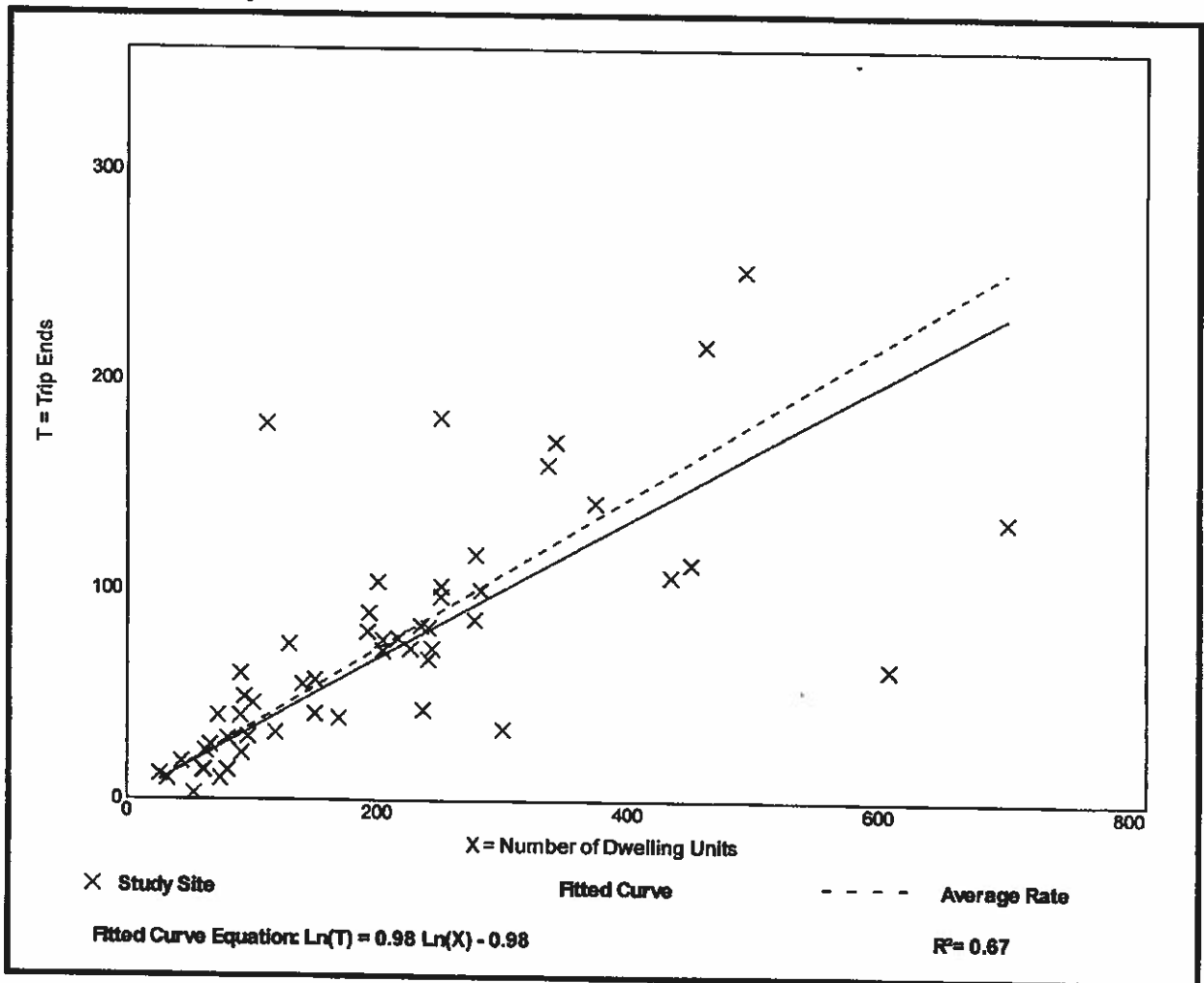
Standard Deviation

0.36

0.06 - 1.61

0.19

Data Plot and Equation



Multifamily Housing (Mid-Rise) (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: 60

Avg. Num. of Dwelling Units: 208

Directional Distribution: 61% entering, 39% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate

0.44

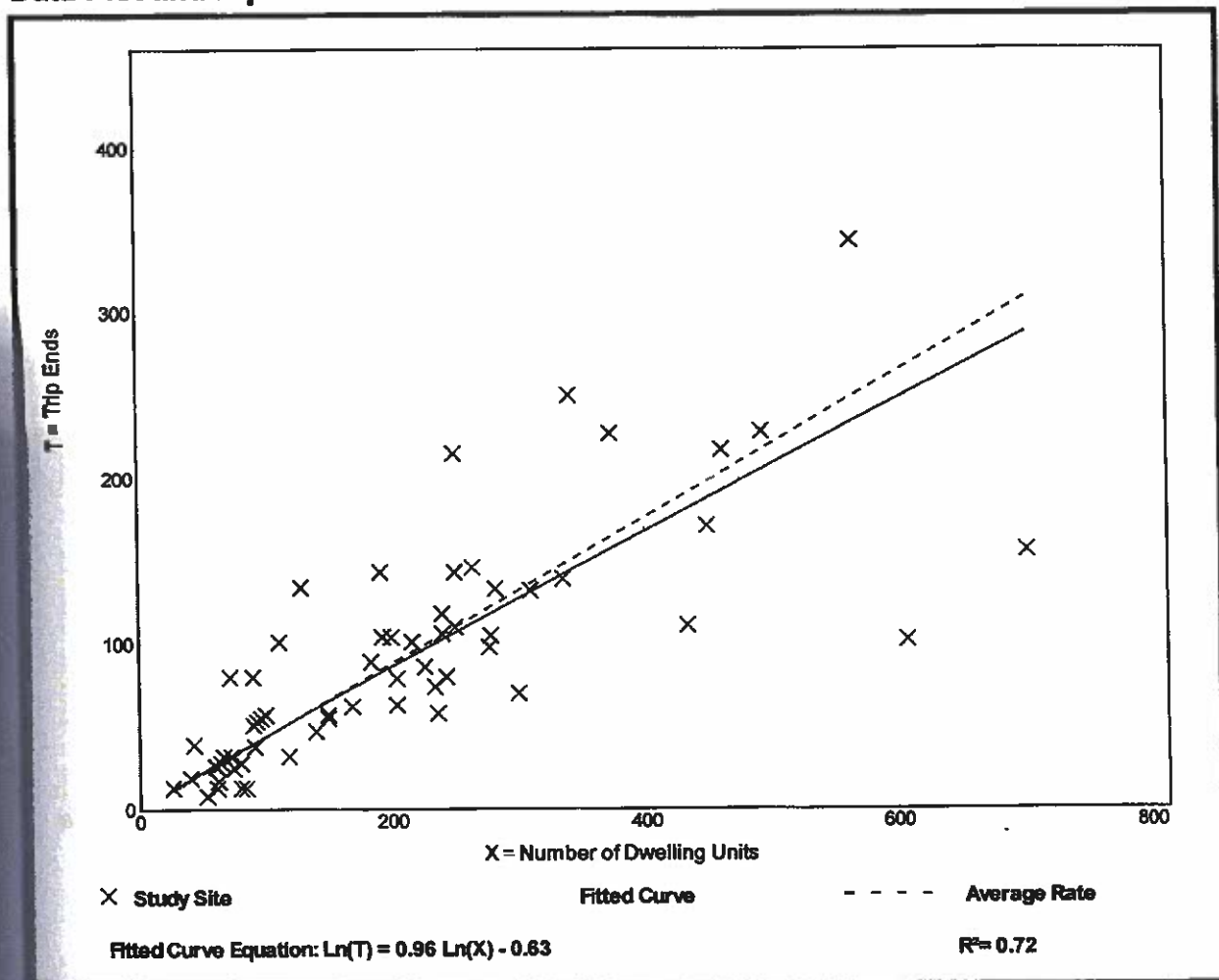
Range of Rates

0.15 - 1.11

Standard Deviation

0.19

Data Plot and Equation



Multifamily Housing (Mid-Rise) (221)

Vehicle Trip Ends vs: Dwelling Units

On a: Saturday, Peak Hour of Generator

Setting/Location: General Urban/Suburban

Number of Studies: 8

Avg. Num. of Dwelling Units: 264

Directional Distribution: 49% entering, 51% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate

0.44

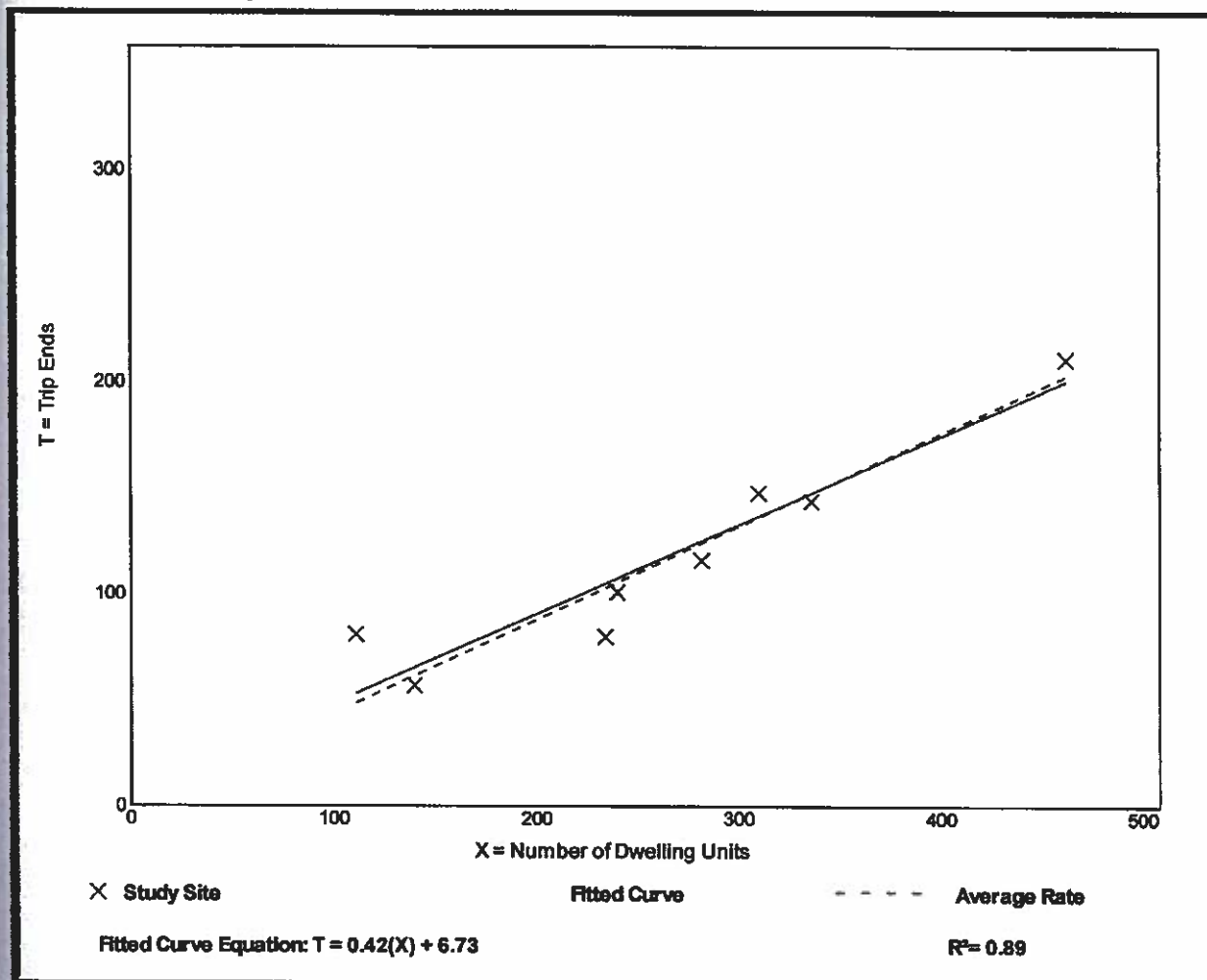
Range of Rates

0.34 - 0.73

Standard Deviation

0.08

Data Plot and Equation



Health/Fitness Club (492)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 6

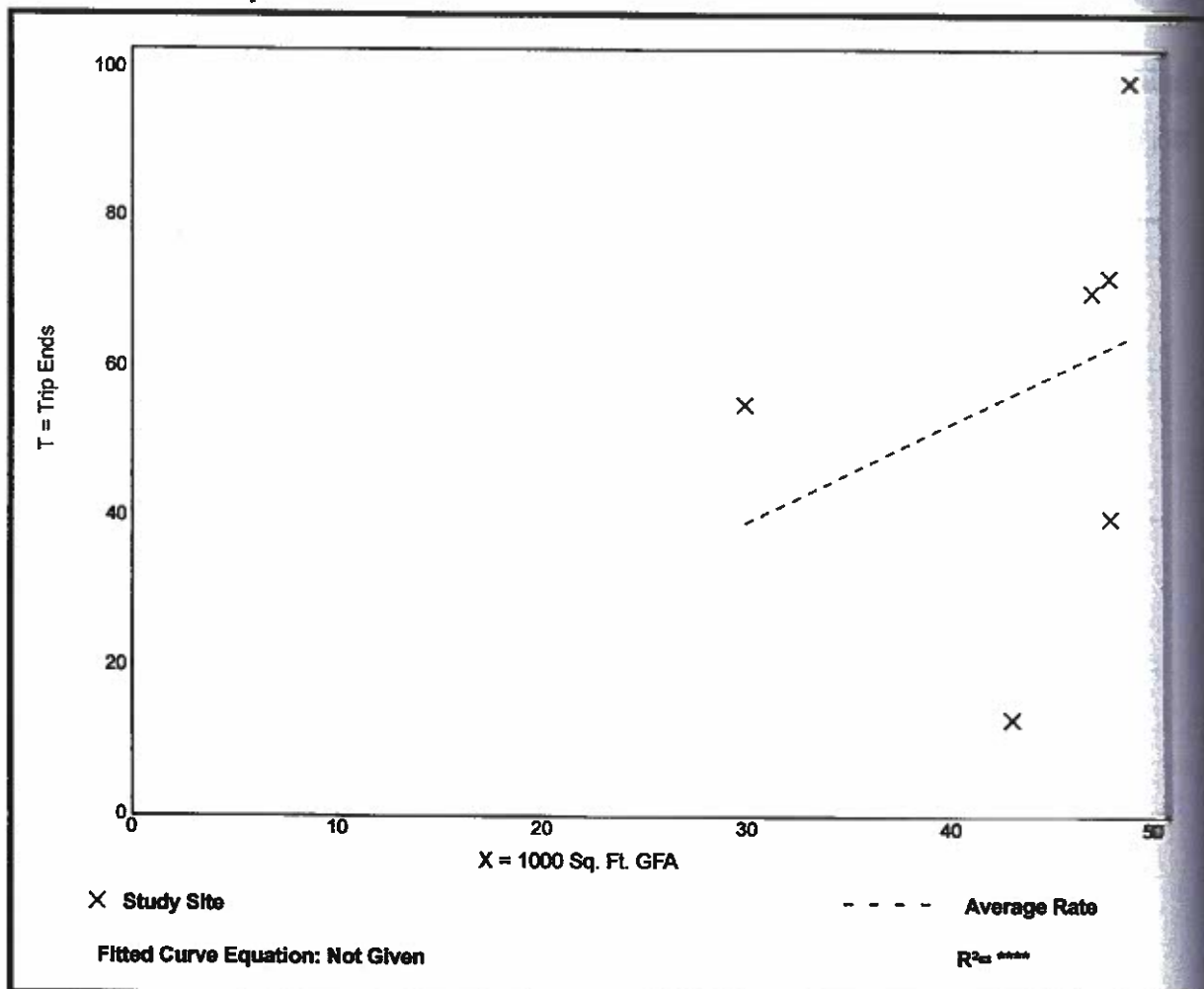
1000 Sq. Ft. GFA: 44

Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

<u>Average Rate</u>	Range of Rates	Standard Deviation
<u>1.31</u>	0.30 - 2.00	0.64

Data Plot and Equation



Health/Fitness Club (492)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 8

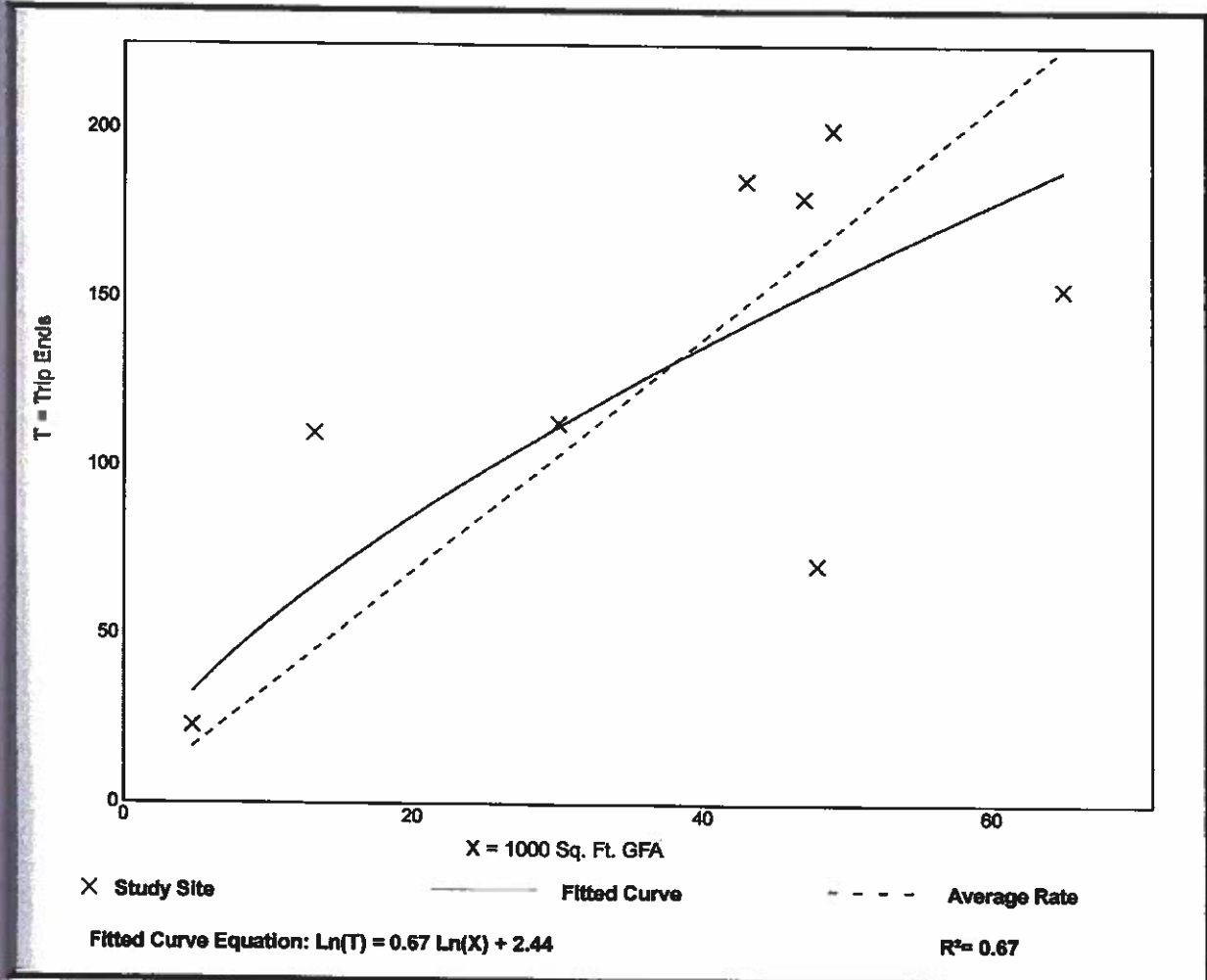
1000 Sq. Ft. GFA: 37

Directional Distribution: 57% entering, 43% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.45	1.48 - 8.37	1.57

Data Plot and Equation



Health/Fitness Club (492)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Saturday, Peak Hour of Generator

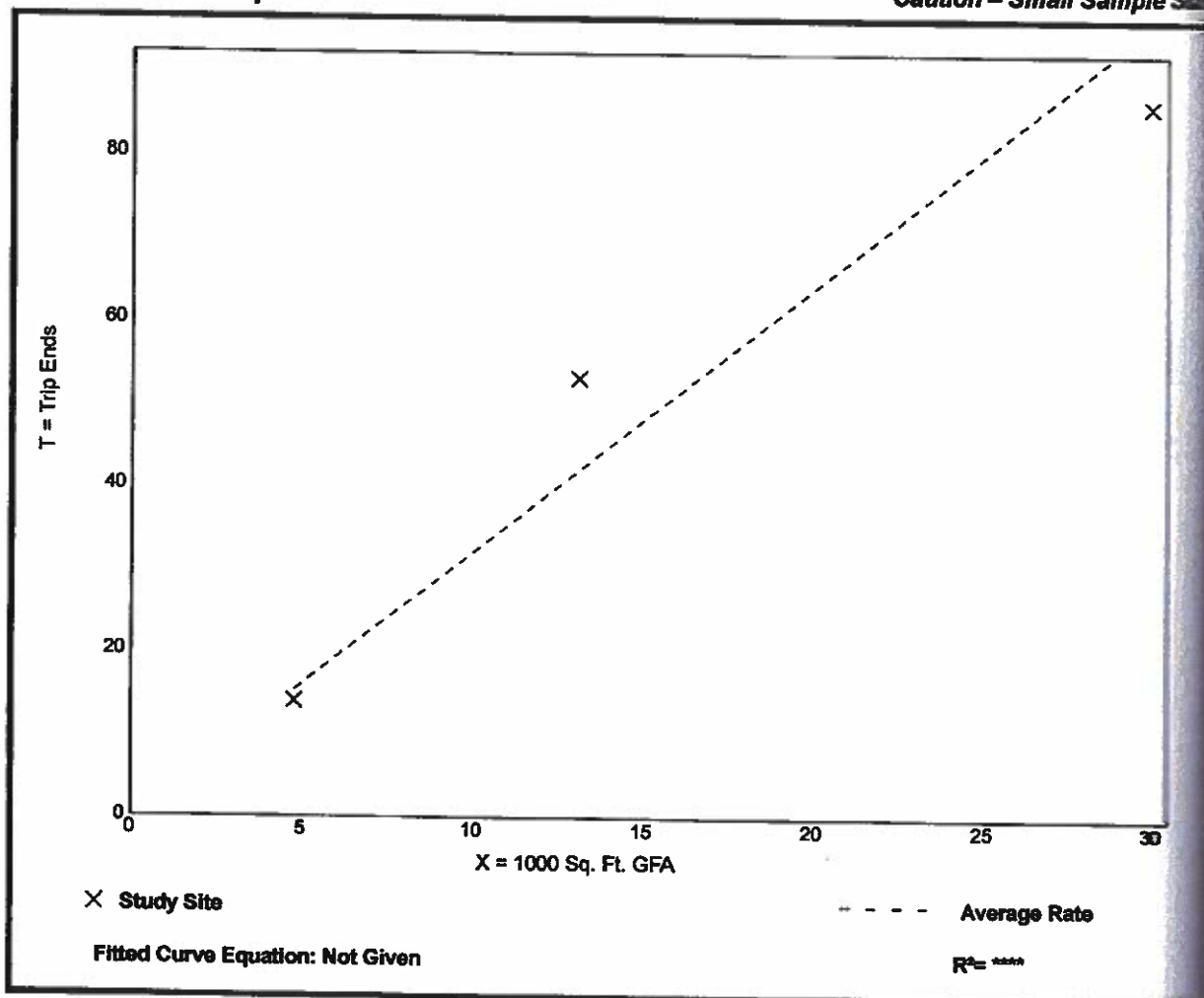
Setting/Location: General Urban/Suburban
Number of Studies: 3
1000 Sq. Ft. GFA: 16
Directional Distribution: 49% entering, 51% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
<u>3.19</u>	2.87 - 4.03	4.06

Data Plot and Equation

Caution – Small Sample Size



Medical-Dental Office Building (720)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 44

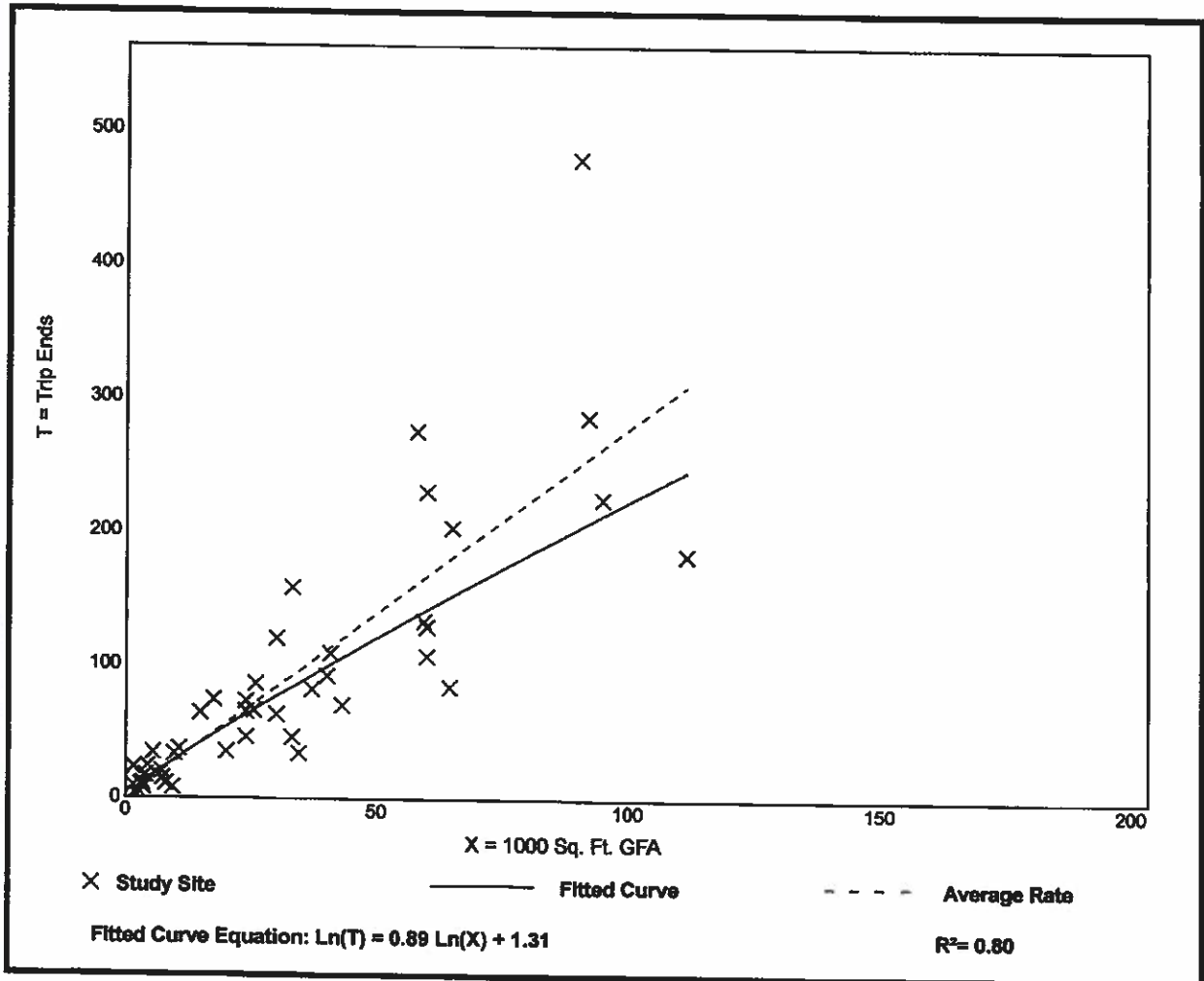
1000 Sq. Ft. GFA: 32

Directional Distribution: **78% entering, 22% exiting**

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.78	0.85 - 14.30	1.28

Data Plot and Equation



Medical-Dental Office Building (720)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 65

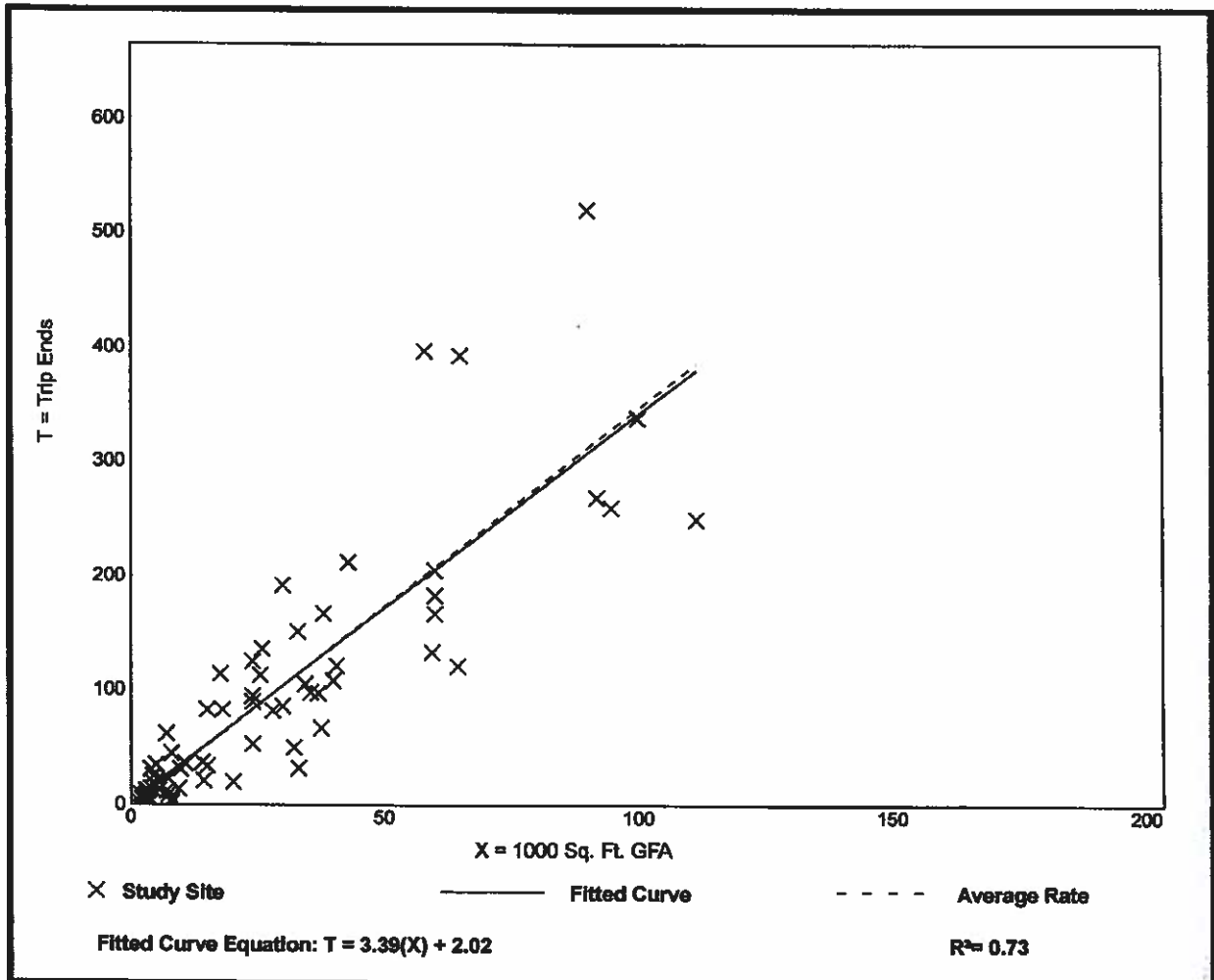
1000 Sq. Ft. GFA: 28

Directional Distribution: 28% entering, 72% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
<u>3.46</u>	0.25 - 8.86	1.58

Data Plot and Equation



Medical-Dental Office Building (720)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

On a: Saturday

Setting/Location: General Urban/Suburban

Number of Studies: 6

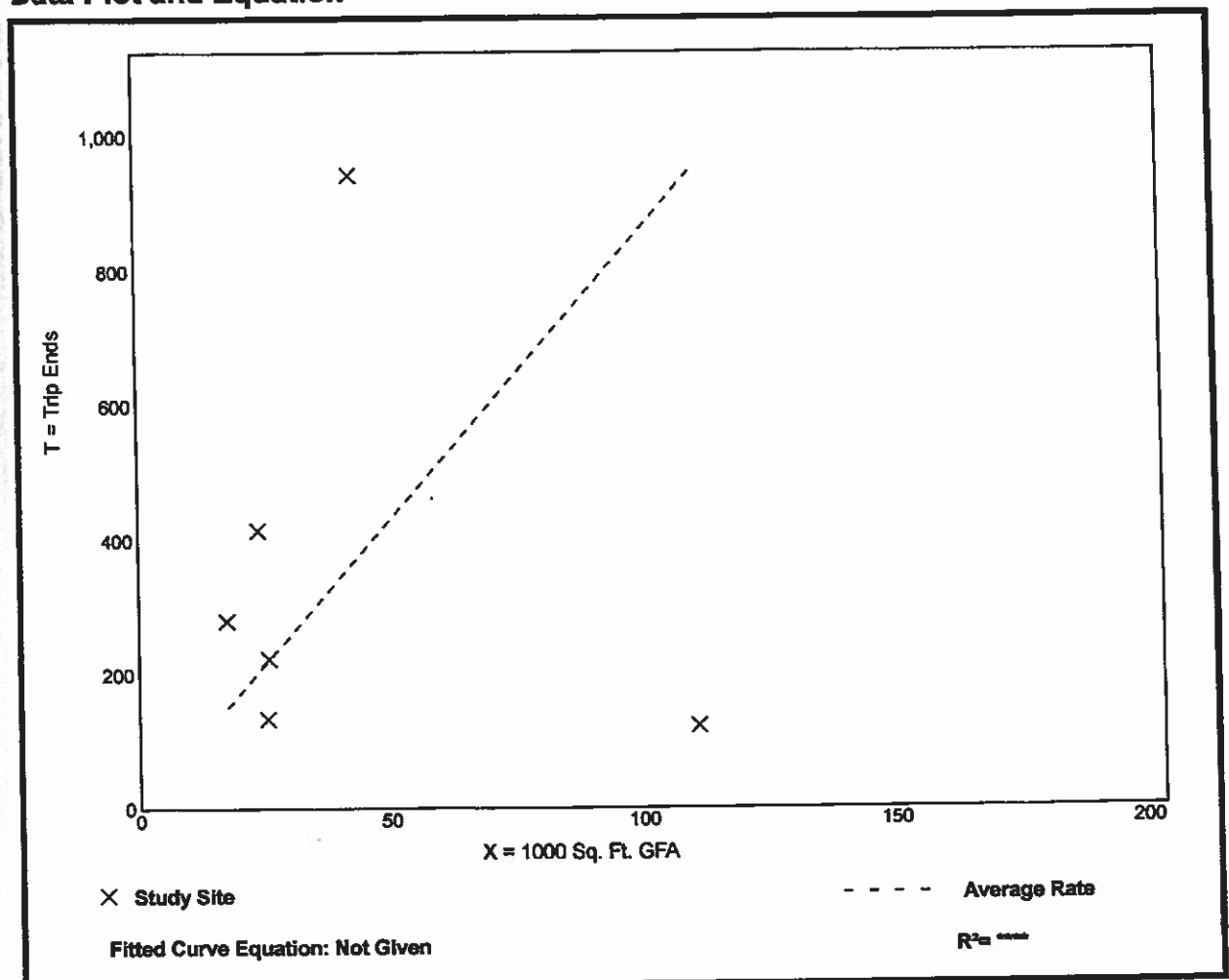
1000 Sq. Ft. GFA: 41

Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
8.57	1.10 - 21.93	9.07

Data Plot and Equation



Apparel Store (876)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 1

1000 Sq. Ft. GFA: 5

Directional Distribution: **80% entering, 20% exiting**

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate

Range of Rates

Standard Deviation

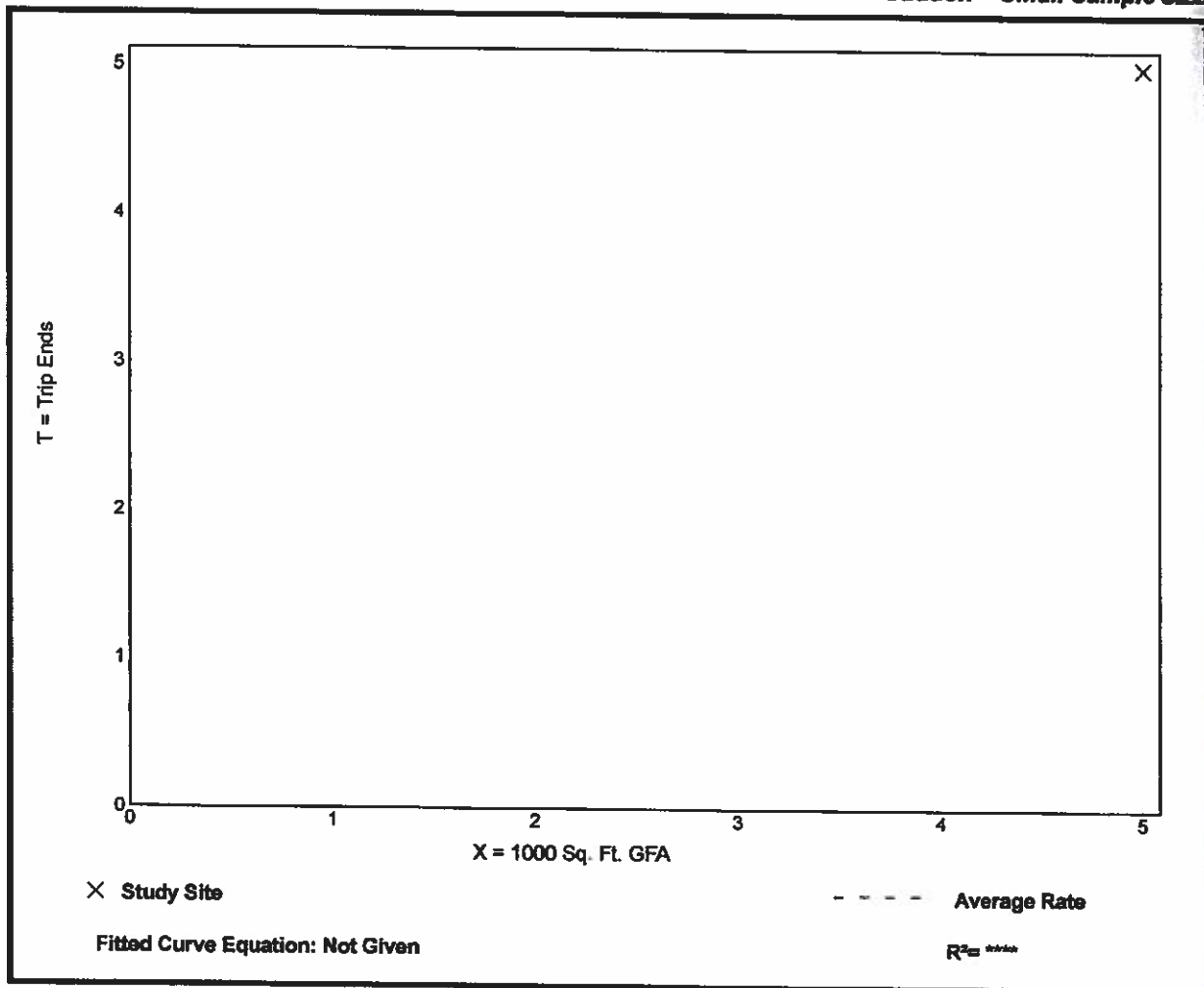
1.00

1.00 - 1.00

*

Data Plot and Equation

Caution – Small Sample Size



Apparel Store (876)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 9

1000 Sq. Ft. GFA: 5

Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate

Range of Rates

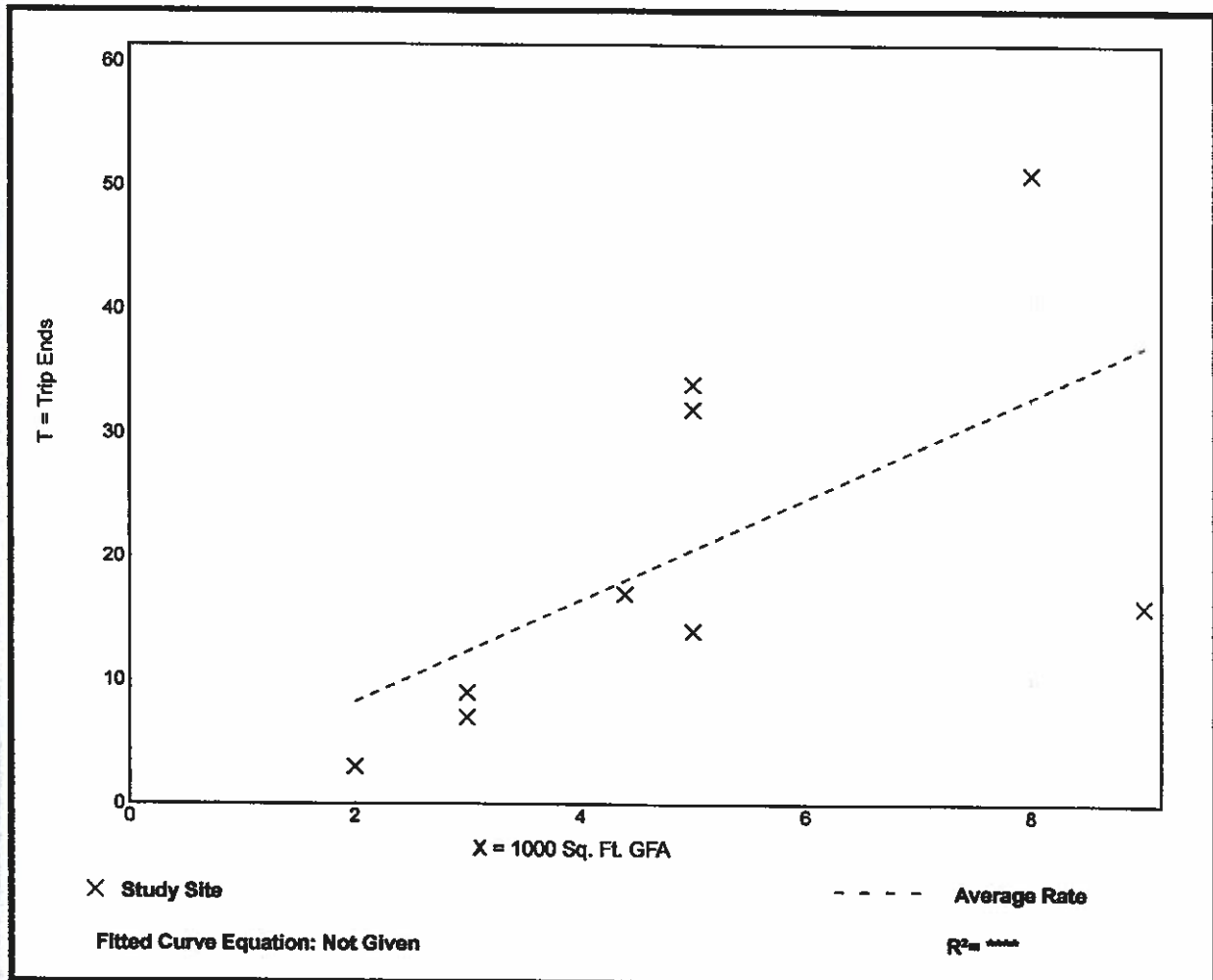
Standard Deviation

4.12

1.50 - 6.80

2.18

Data Plot and Equation



Apparel Store (876)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

On a: Saturday, Peak Hour of Generator

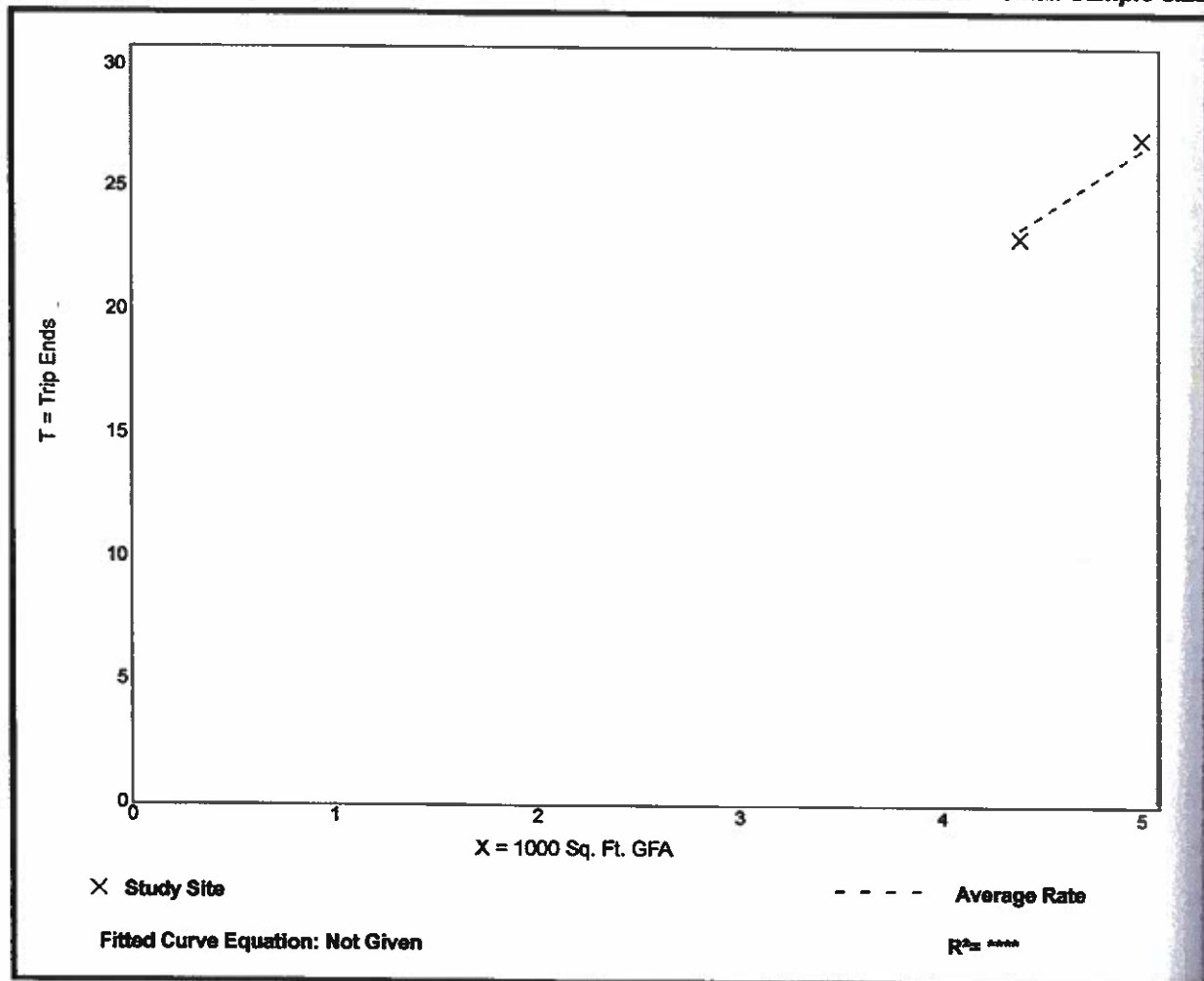
Setting/Location: **General Urban/Suburban**
 Number of Studies: **2**
 1000 Sq. Ft. GFA: **5**
 Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
<u>5.32</u>	5.24 - 5.40	*

Data Plot and Equation

Caution – Small Sample Size



Copy, Print, and Express Ship Store (920)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 1

1000 Sq. Ft. GFA: 4

Directional Distribution: 75% entering, 25% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate

Range of Rates

Standard Deviation

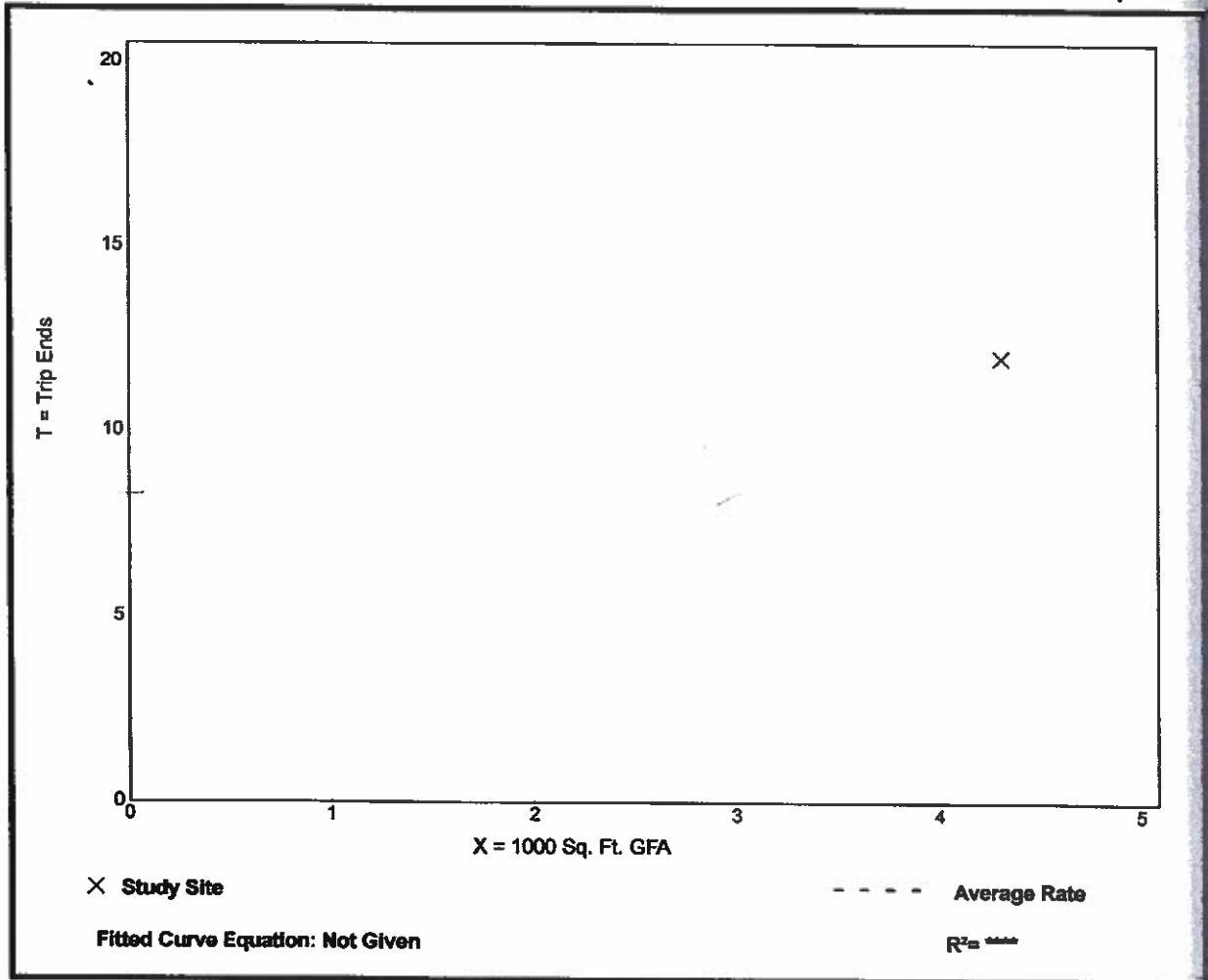
2.78

2.78 - 2.78

*

Data Plot and Equation

Caution - Small Sample Size



Copy, Print, and Express Ship Store (920)

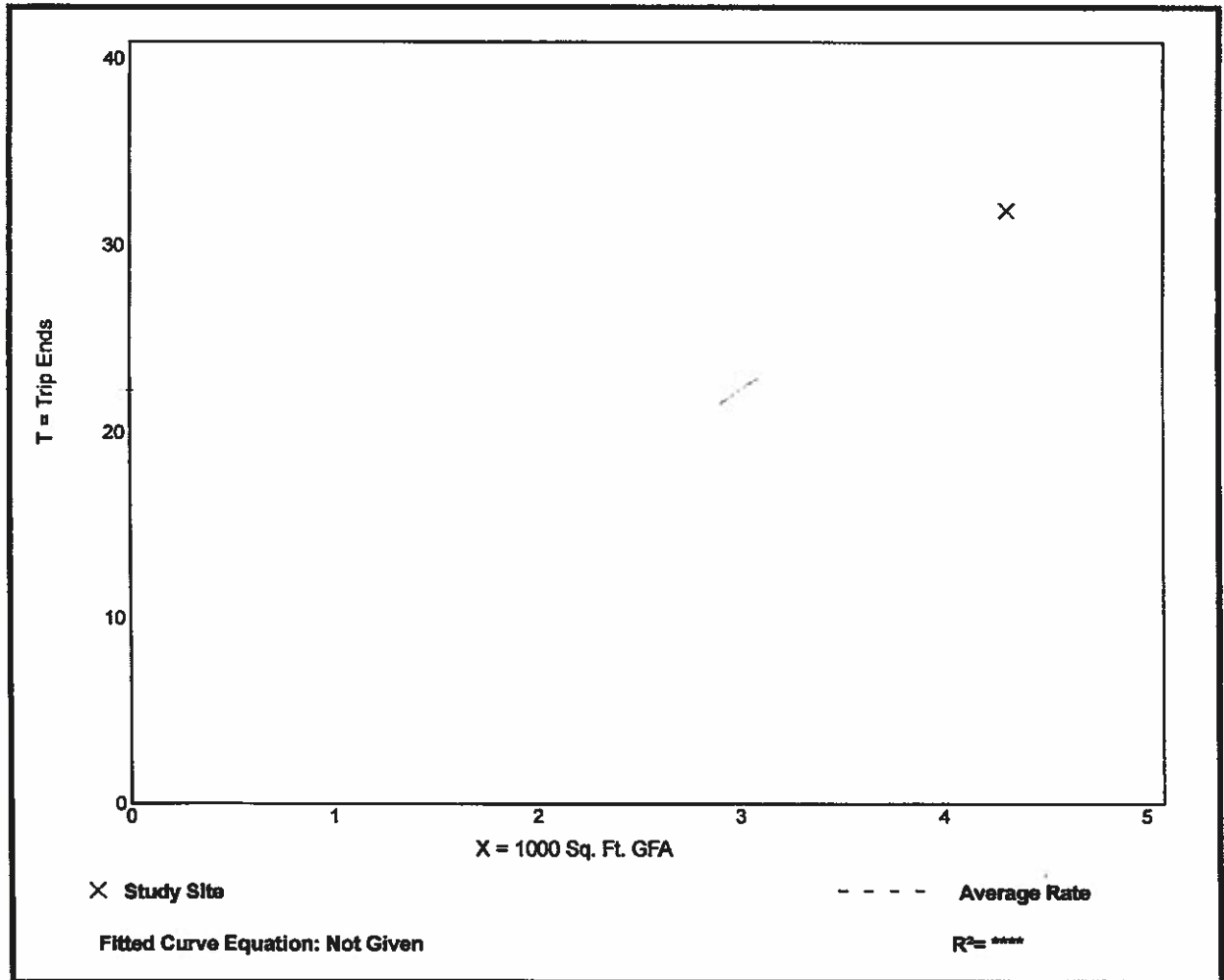
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
 On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
 Setting/Location: General Urban/Suburban
 Number of Studies: 1
 1000 Sq. Ft. GFA: 4
 Directional Distribution: 44% entering, 56% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
<u>7.42</u>	7.42 - 7.42	*

Data Plot and Equation

Caution - Small Sample Size



Fast Casual Restaurant (930)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 1

1000 Sq. Ft. GFA: 3

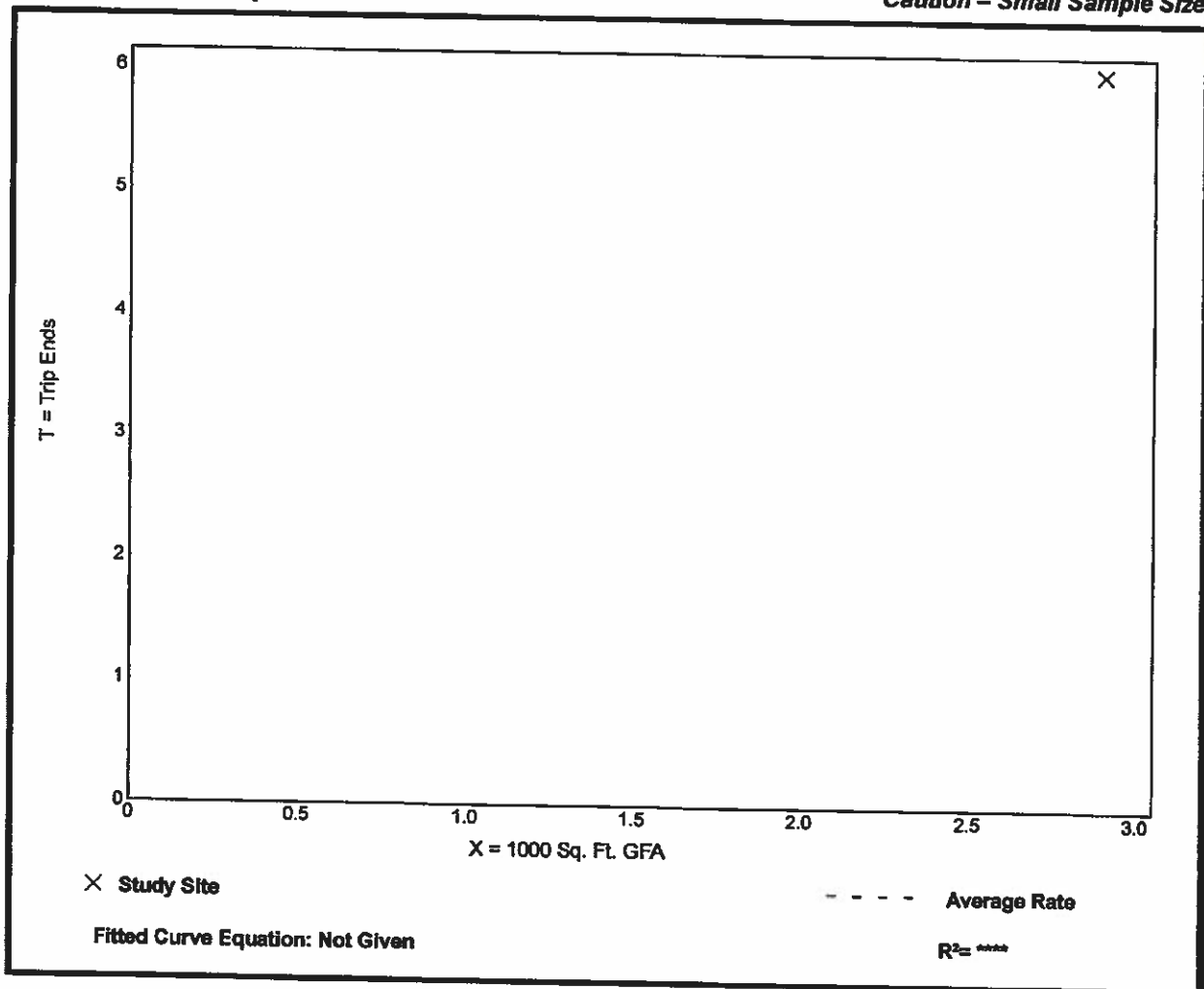
Directional Distribution: 67% entering, 33% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
<u>2.07</u>	2.07 - 2.07	.

Data Plot and Equation

Caution – Small Sample Size



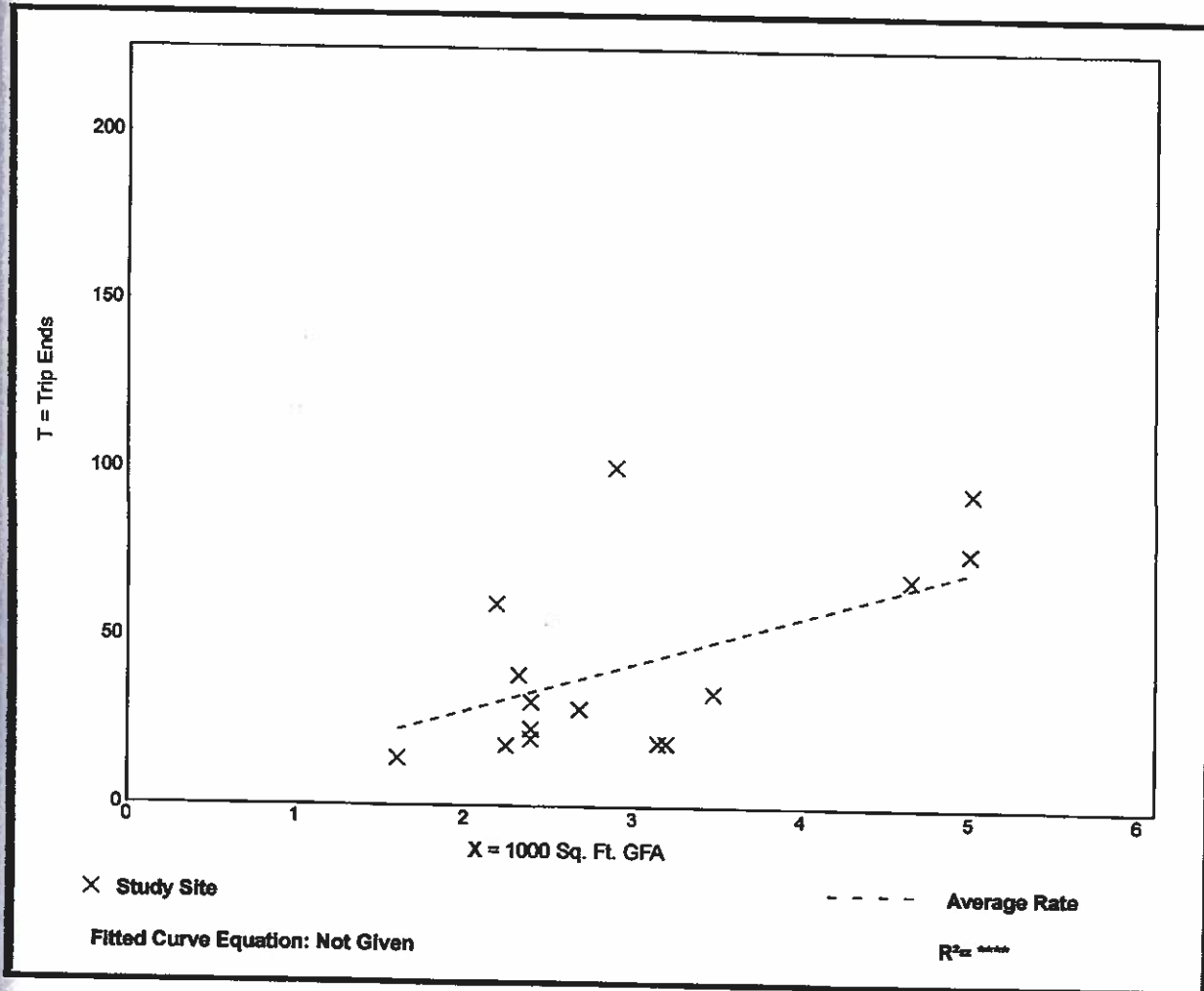
Fast Casual Restaurant (930)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
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: 15
1000 Sq. Ft. GFA: 3
Directional Distribution: 55% entering, 45% exiting.

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
14.13	5.94 - 34.83	7.72

Data Plot and Equation



Fast Casual Restaurant (930)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

On a: Saturday, Peak Hour of Generator

Setting/Location: **General Urban/Suburban**

Number of Studies: 3

1000 Sq. Ft. GFA: 4

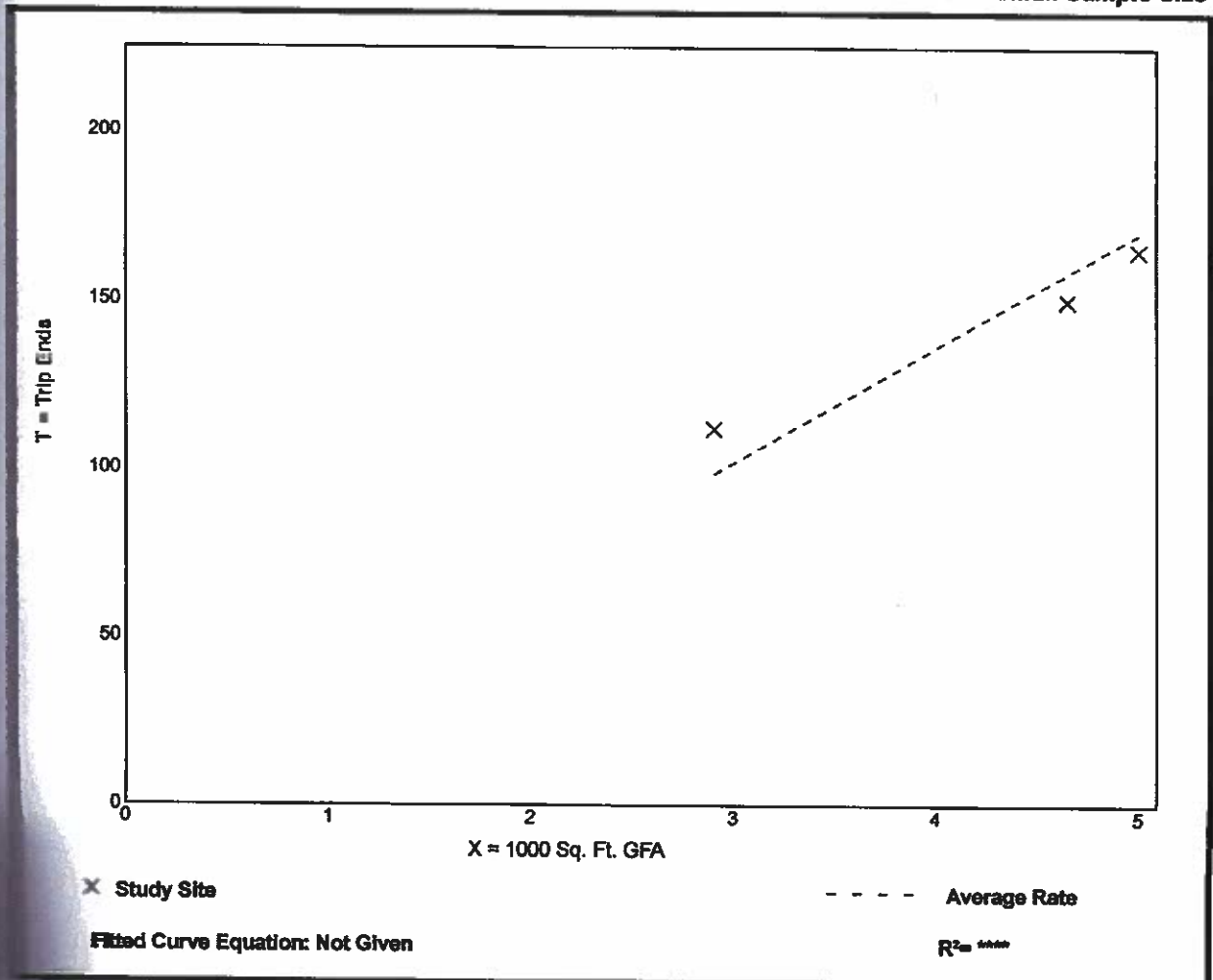
Directional Distribution: 55% entering, 45% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
<u>34.02</u>	32.26 - 38.62	42.55

Data Plot and Equation

Caution – Small Sample Size



Coffee/Donut Shop without Drive-Through Window (936)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 21

1000 Sq. Ft. GFA: 2

Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate

101.14

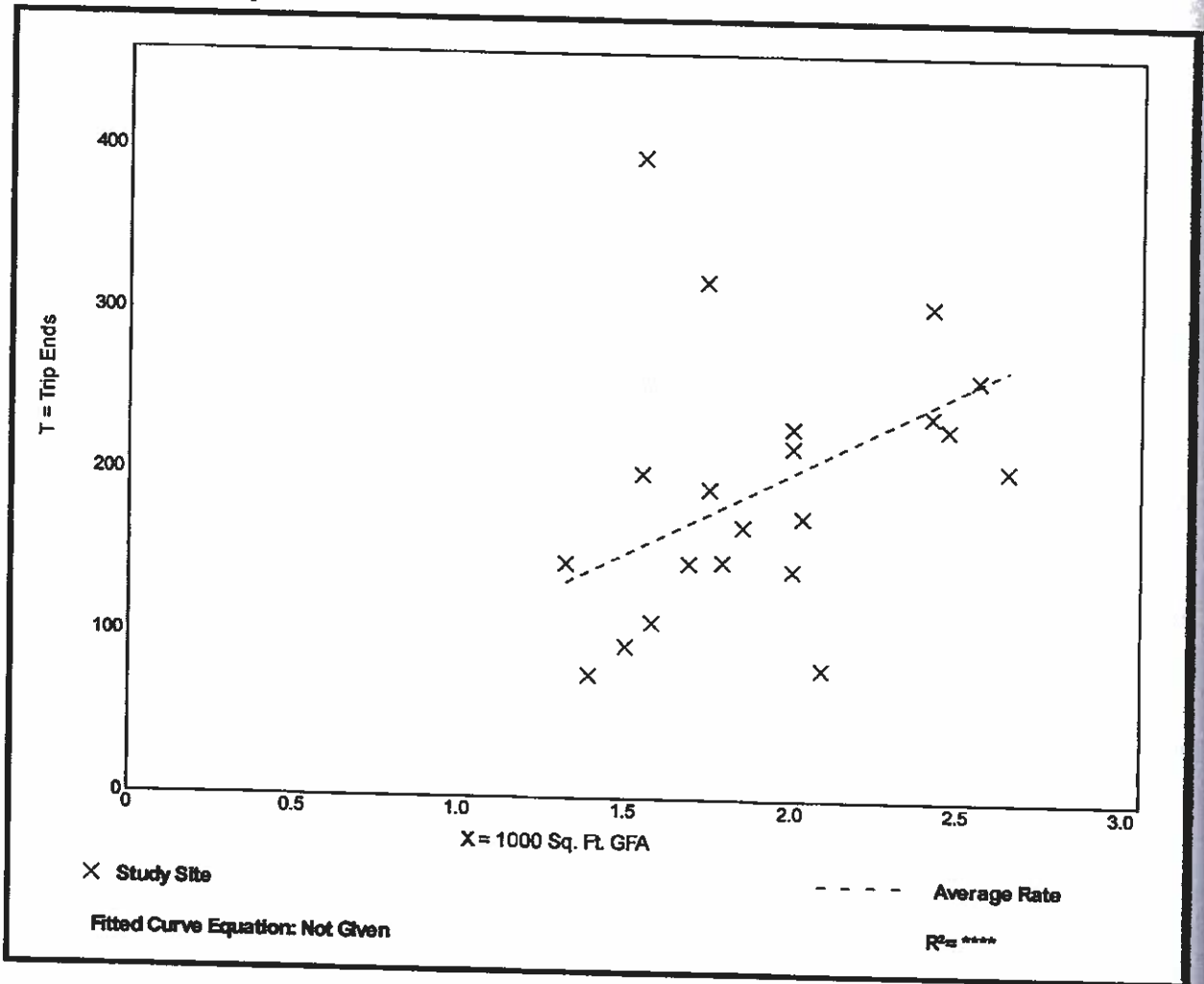
Range of Rates

38.76 - 255.48

Standard Deviation

43.44

Data Plot and Equation



Coffee/Donut Shop without Drive-Through Window (936)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 12

1000 Sq. Ft. GFA: 2

Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate

Range of Rates

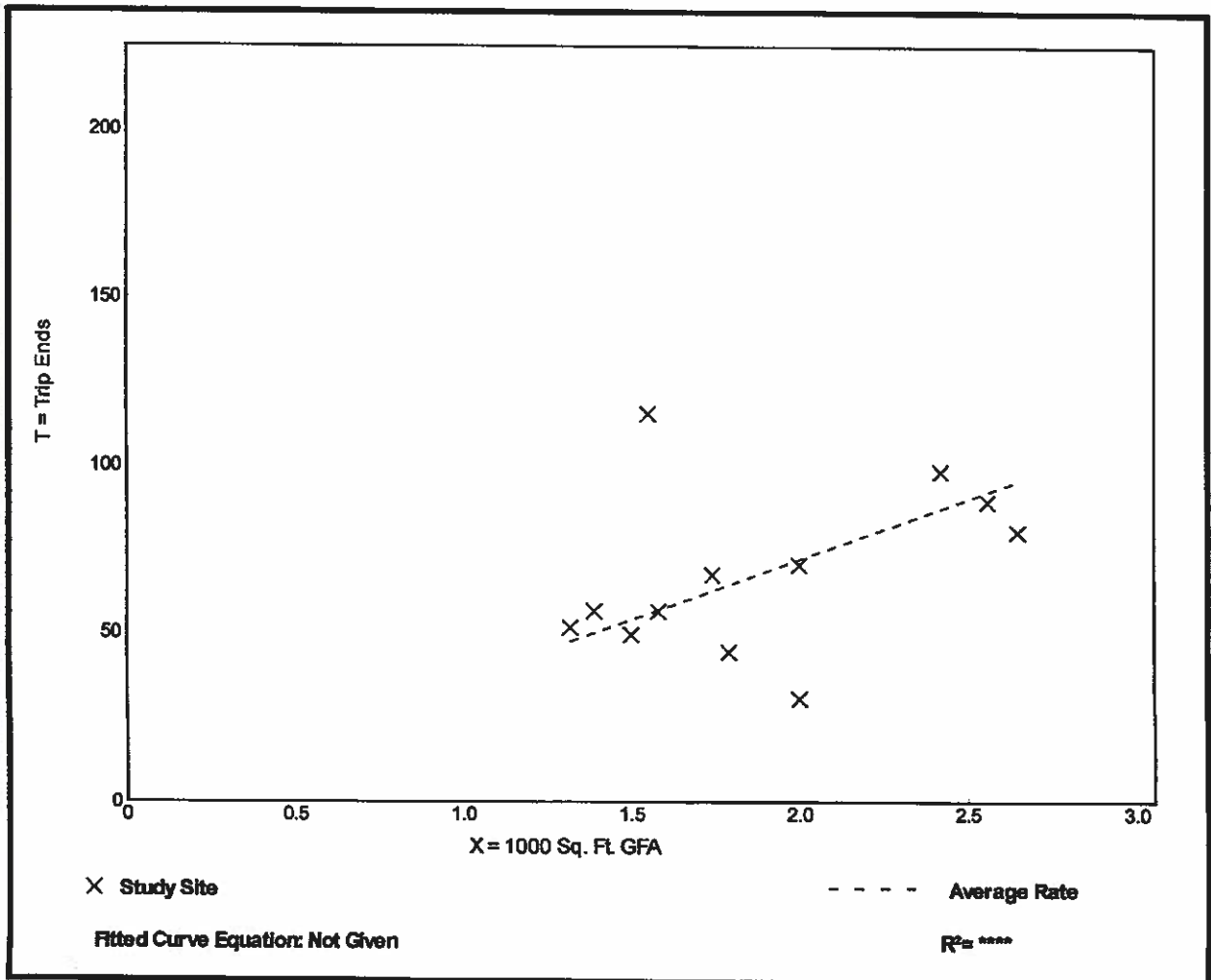
Standard Deviation

36.31

15.50 - 74.84

13.22

Data Plot and Equation



Coffee/Donut Shop without Drive-Through Window (936)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

On a: Saturday, Peak Hour of Generator

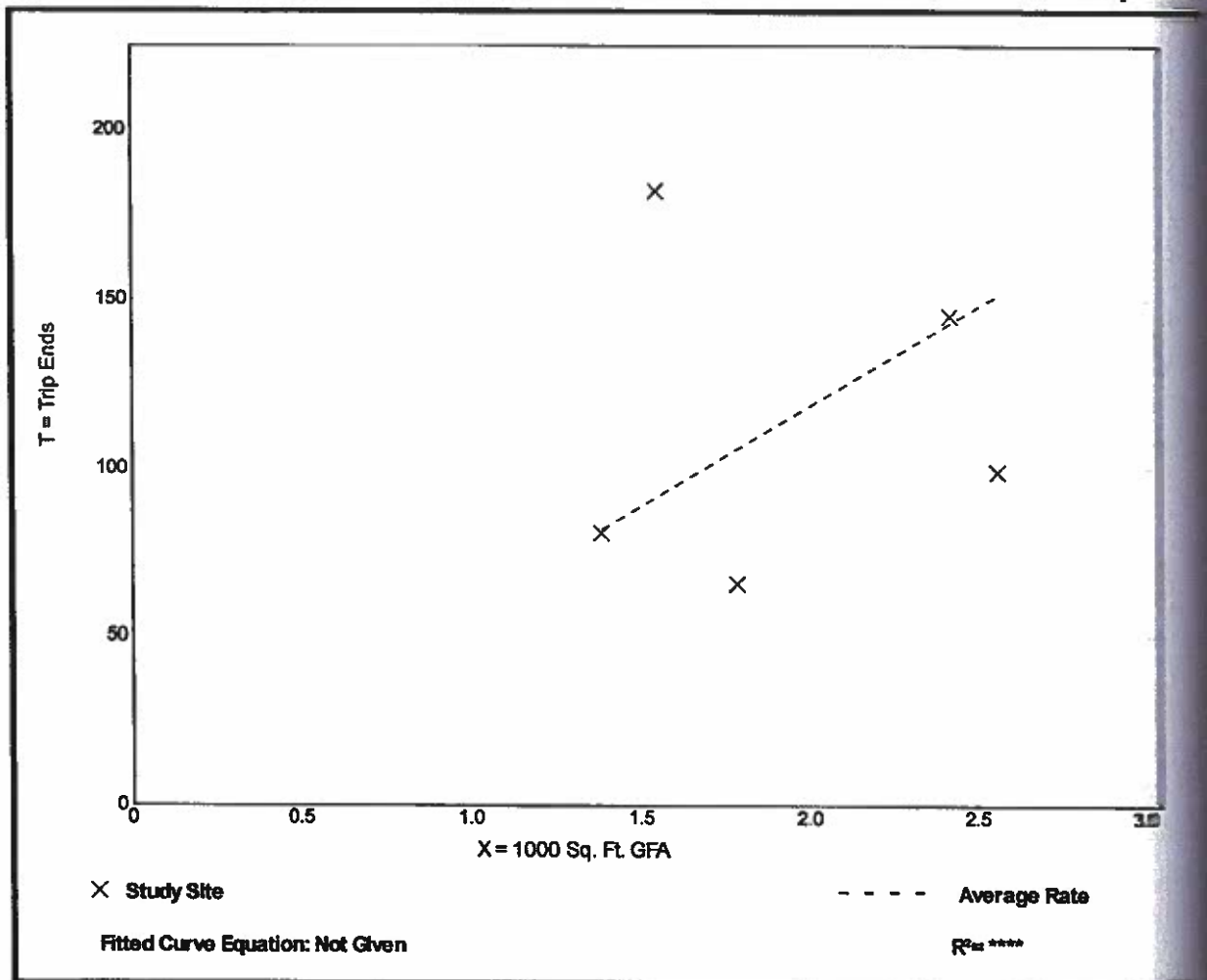
Setting/Location: General Urban/Suburban
 Number of Studies: 5
 1000 Sq. Ft. GFA: 2
 Directional Distribution: 49% entering, 51% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

<u>Average Rate</u>	Range of Rates	Standard Deviation
<u>59.01</u>	36.87 - 117.42	30.50

Data Plot and Equation

Caution – Small Sample



General Office Building (710)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 35

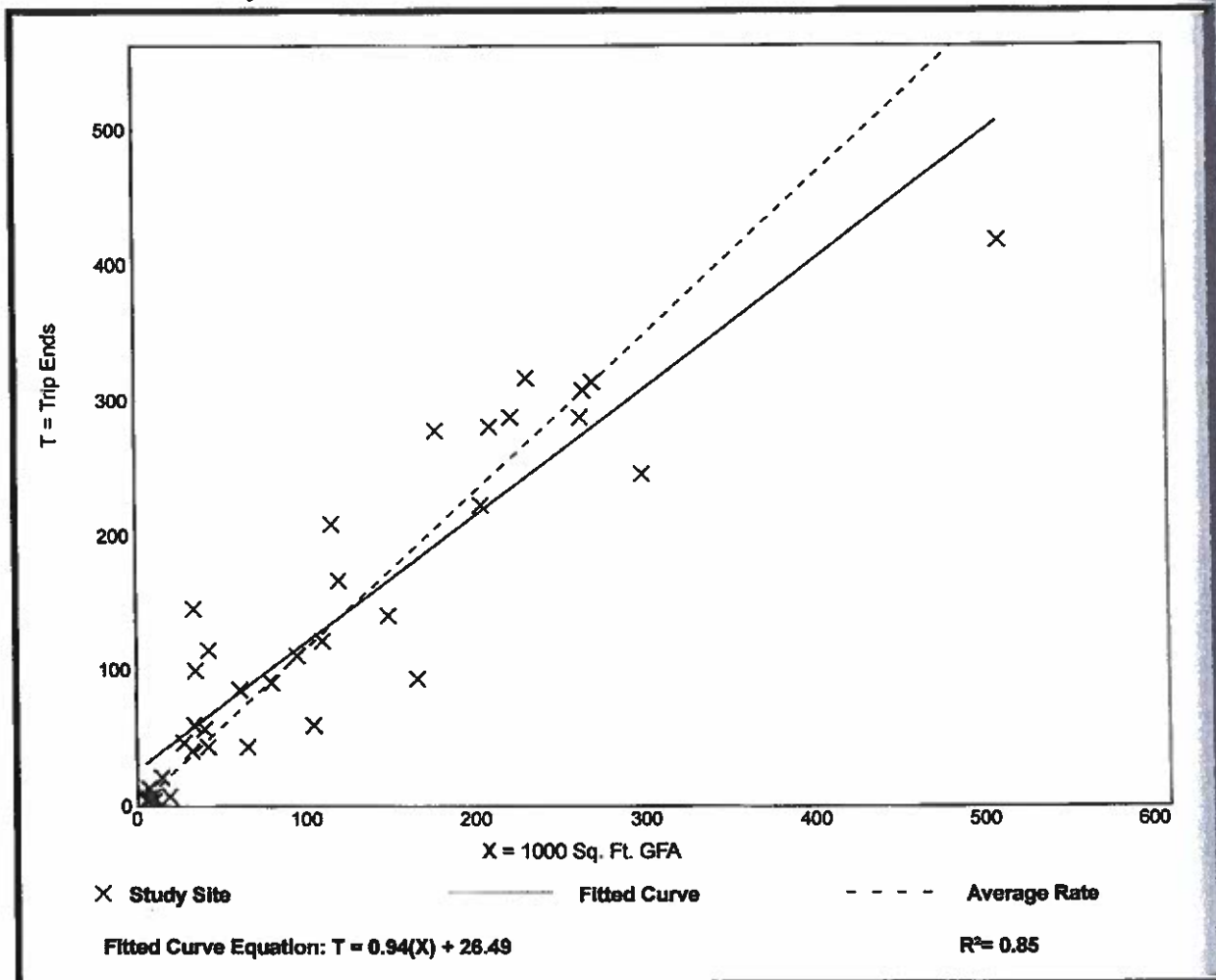
1000 Sq. Ft. GFA: 117

Directional Distribution: **86% entering, 14% exiting**

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
<u>1.16</u>	0.37 - 4.23	0.47

Data Plot and Equation



General Office Building (710)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

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: 32

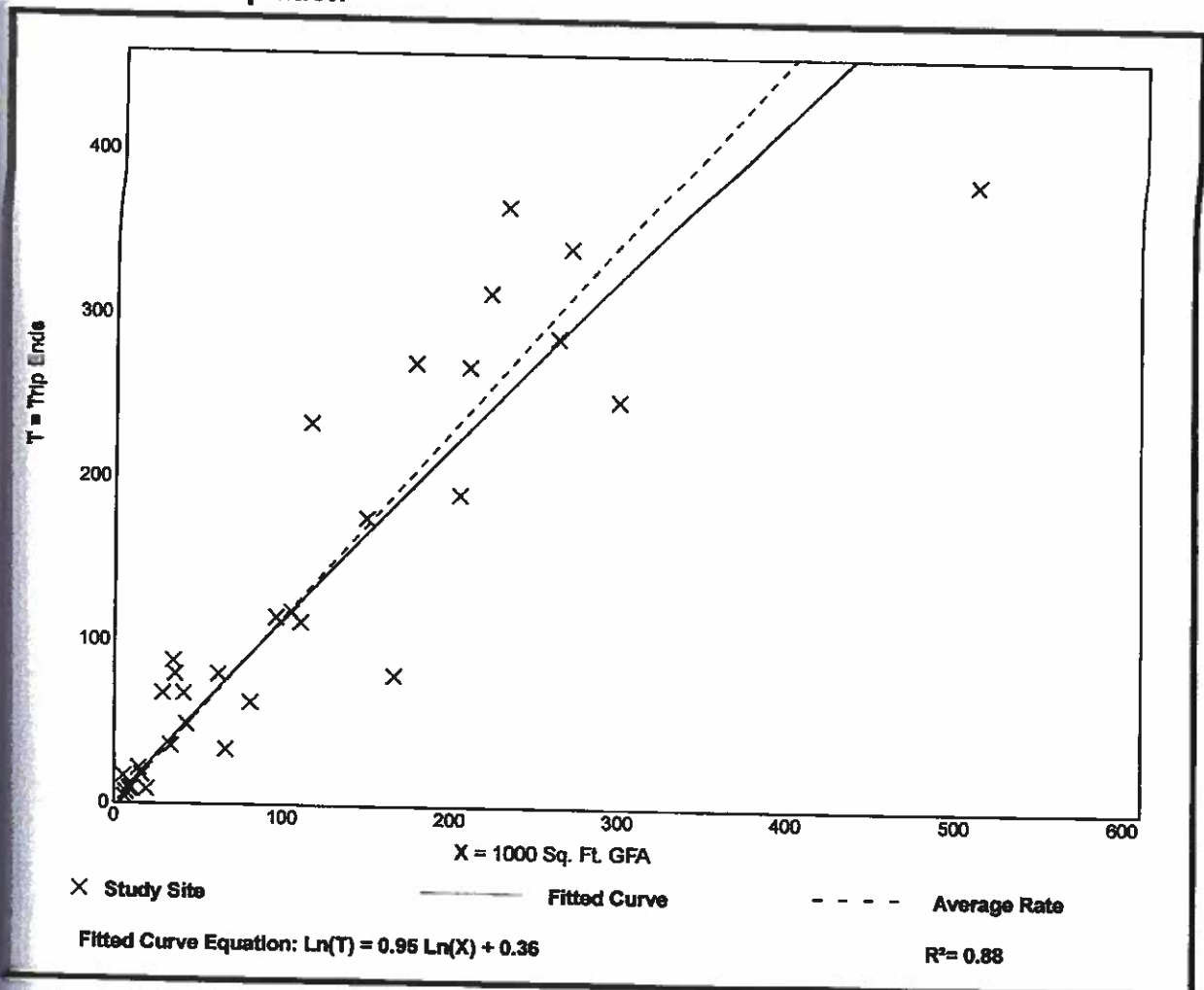
1000 Sq. Ft. GFA: 114

Directional Distribution: **16% entering, 84% exiting.**

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
<u>1.15</u>	0.47 - 3.23	0.42

Data Plot and Equation



General Office Building (710)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA

On a: **Saturday**

Setting/Location: General Urban/Suburban
Number of Studies: 5
1000 Sq. Ft. GFA: 94
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.21	1.24 - 7.46	1.70

Data Plot and Equation

Caution – Small Sample Size

