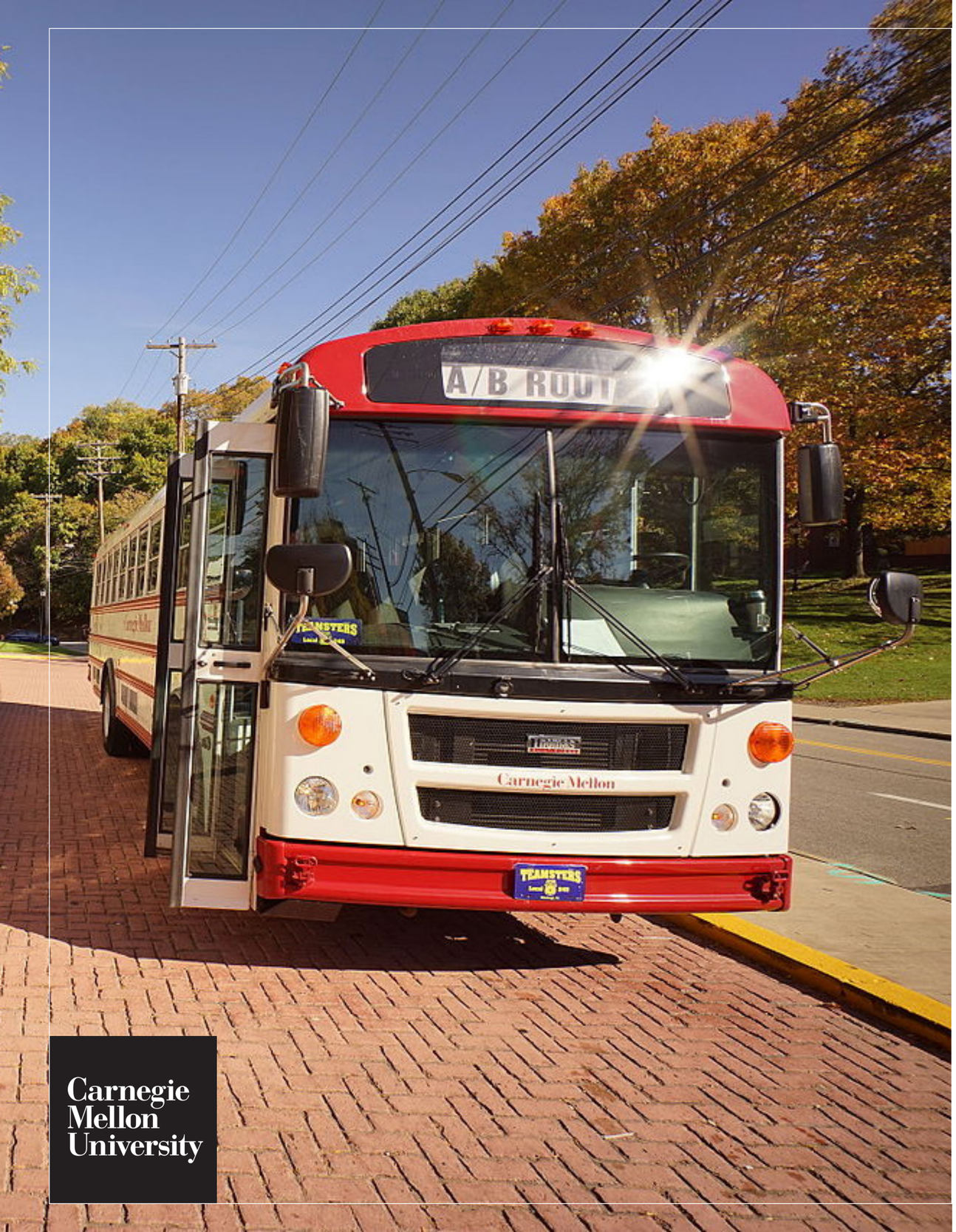
Carnegie Mellon University

INSTITUTIONAL MASTER PLAN 2022

June 2022
Traffic Impact Study ONLY

SUBMISSION FOR PLANNING COMMISSION REVIEW



Carnegie Mellon University

TRAFFIC IMPACT STUDY

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Carnegie Mellon University

2022-2032 Institutional Master Plan

Traffic Impact Study

Carnegie Mellon University
City of Pittsburgh, Allegheny County, Pennsylvania

GAI Project Number: R200398.00

May 2022

Prepared by: GAI Consultants, Inc.
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Prepared for: Carnegie Mellon University
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1.0 Introduction / Project Summary

Carnegie Mellon University, a world class global research university, through its 2022-2032 Institutional Master Plan (IMP), aims to further their vision of having transformative impact on society through continual innovation in education, research, creativity, and entrepreneurship. In supporting that aim and recognizing the university's setting—between neighborhoods and adjacent to a city park—the Master Plan is intended to align university growth with City of Pittsburgh and neighborhood planning goals. Refer to **Figure 1.0** for a location map showing Carnegie Mellon University and its EMI District.

The Master Plan contains 20 proposed development projects within the university's EMI District. Refer to **Figure 2.0** for a site plan showing these development projects and **Table 1.1** for a description of these development projects. These projects have the potential to add up to 2,632,300 square feet of space and 1,955 undergraduate beds. Master planning projects are intended to represent the maximum use of each site, though the actual development sites and schedule of development will likely be less. For example, only 31 percent of the proposed square footage in the 2012-2022 Master Plan was realized, shown in **Table 1.2.** Therefore, anticipated future conditions will assume a conservative 50 percent of proposed square footage within this study. Trip generation is provided for both conditions, though all traffic analysis is based on the 50 percent build condition.

While these projects will allow for expansion, they are also intended to alleviate the overcrowding of existing space that has been occurring over the past several decades. Shown in **Appendix A**, in 2000, Carnegie Mellon's Pittsburgh Campus enrolled 5,105 undergraduate students, 3,185 graduate students, 1,243 faculty, and 2,407 staff, with a total campus footprint of approximately 2,750,000 net assignable square feet (nasf). By 2019, the campus has grown to 6,517 undergraduate students, 6,613 graduate students, 1,374 faculty, and 4,377 staff, with a total campus footprint of approximately 4,250,000 nasf. While the campus headcount grew by 58 percent, the campus footprint grew by closer to 55 percent. This densification resulted in a reduction of net assignable square footage from 250 nasf/person to just 211 nasf/person. While the campus is planning more modest student and faculty growth during the 2022-2032 master planning horizon period, the university aims to grow its facilities at a greater rate than its student and employee headcount to return to the less dense configuration of 250 nasf/person. Likewise, IMP projects are intended to address some of the undergraduate housing that is currently leased in off-campus buildings. By building more on-campus housing, Carnegie Mellon can shift those students onto campus to house almost all undergraduate students on site.

With its membership in the Pittsburgh 2030 District, and through its master plan, the university has been striving to achieve a more sustainable pattern of multimodal traffic growth that requires no net new parking. Landlocked between Oakland, Squirrel Hill, and Shadyside, simply adding lanes and widening streets is not feasible throughout the campus area. Building wider and higher capacity streets may degrade safety and convenience of multimodal alternatives. Building on the previous master plan, in which multi-lane Forbes Avenue was converted to a complete street with bicycle lanes, buffered sidewalks, pedestrian signals, and fewer lanes, this master plan continues prioritizing investing in sustainable transportation alternatives. Complimenting the City of Pittsburgh's Best Practices for Institutional Master Plans, this Traffic Impact Study provides the supporting framework to support the university's mobility goals:

- Meet or exceed the Pittsburgh District 2030 performance targets and the IMP mode share targets to reduce reliance on single occupant vehicle commuting.
- Implement Transportation Demand Management (TDM) to achieve mode share targets.
- Provide no net new parking, with parking demand mitigated through appropriate multimodal projects within the 10-year master planning horizon.

The following sections detail the traffic impact study, parking study, and TDM plan for the ten-year Master Planning Horizon Year, 2032. This study was performed to meet the requirements established by the City of Pittsburgh Departments of Mobility and Infrastructure (DOMI), Department of Public Works (DPW), and Department of City Planning (DCP), fulfilling the traffic impact study scoping form, approved on April 26, 2022. Refer to **Appendix B** for the approved form. Proposed future conditions analyzed assume 50% of full buildout development, a target space allocation of 250 nasf/person, and successful TDM. As individual traffic studies will be required for each development component during the master planning horizon, those studies will verify that these targets are being met and will investigate if any further mitigation is needed.

2.0 Site Plan and Access

Within the Master Plan, Carnegie Mellon is proposing 20 potential projects within its EMI District. Refer to **Figure 2.0** for the Site Plan and **Table 1.1** for a description of these development projects.

2.1 Vehicular Site Access

Carnegie Mellon University is bisected along Forbes Avenue, which is a state route (SR 2108) west of the Beeler Street / East Campus Garage signalized intersection. SR 2108 continues along Beeler Street to the east, while Forbes Avenue becomes a city-owned street to the southeast. All other roads in the campus area are City-owned.

The campus has three distinct neighborhoods: The historic core, which is south of Forbes Avenue, the north campus which is north of Forbes Avenue and east of Junction Hollow (Neville Street), and the Craig Street area which is west of Junction Hollow (Neville Street). The historic core is bounded by Forbes Avenue to the north, Margaret Morrison and Tech Street to the east, Frew Street to the south, and Boundary Street to the west. All are two-lane roadways. There is parallel parking along Margaret Morrison and Tech streets and perpendicular parking along Frew Street. In the north campus, Morewood Avenue bisects the neighborhood, running north from Forbes Avenue. Fifth Avenue bisects the neighborhood running east and west. Residential buildings are also along Clyde Street which runs north from Fifth Avenue. The Craig Street area takes on a more urban feel, as university-owned buildings are interspersed with other commercial, residential, and institutional properties. The north/south streets include Bellefield Avenue (the western border), Dithridge Street, Craig Street, and Neville Street (the eastern border). The east/west streets include Forbes Avenue (the southern border), Filmore Street, Winthrop Street, Henry Street, and Fifth Avenue (the northern border). All streets allow limited on-street parking, either permit or metered. Fifth Avenue is two lanes in each direction and Bellefield Avenue is a one-way street with two lanes in the northbound direction. The other streets are generally one lane in each direction.

Carnegie Mellon has several access driveways along these study roadways. Refer to **Table 2.1** summarizing all existing and proposed site access points from public streets, with **Figure 2.1** showing existing and proposed access control. Throughout the master plan's proposed projects, most driveways will be maintained in their existing configuration. Signalization is not proposed to be added at any location. Depending on which master plan projects are built, a summary of driveways that may require geometric modifications is as follows:

- The shared Donner and Margaret Morrison Hall driveway will be modified as needed to accommodate Margaret Morrison Hall expansion and/or Donner Hall replacement.
- A new driveway is proposed for the South of Forbes Development to connect to Boundary Street (the only all new driveway location proposed).
- The Greek Quad driveways may be reconfigured as part of the Greek Quad redevelopment.

- The Filmore Street and Zebina Way surface lot may be replaced with underground facilities as part of redevelopment, potentially necessitating a change in driveway access.
- The Whitfield Hall driveway may be adjusted as part of redevelopment.

The following existing vehicular driveways will become limited to pedestrians, bicycles, authorized vehicles, and service vehicles for typical use within the master planning horizon timeframe:

- Hamerschlag Drive at Frew Street
- College of Fine Arts Drive at Tech Street and Margaret Morrison Street
- Cyert Hall Drive at Forbes Avenue (Existing lot to be reduced in size or eliminated)

Additionally, new parking facilities may be proposed to connect to existing facilities that use the following driveways:

- Carnegie Museum Driveway at Forbes Avenue and Craig Street
- Tepper School of Business Driveway at Forbes Avenue
- Morewood Place at Morewood Avenue

2.2 Loading

No campus-wide changes are proposed to on-site loading, which be analyzed through the design review process for each individual development as required.

3.0 Multimodal Analysis

Carnegie Mellon University encourages multimodal site access, having invested in bicycle, pedestrian, and transit alternatives. The following section details the bicycle and pedestrian network (**Figures 3.0 and 3.1**) and the public transportation and university shuttle network (**Figures 3.2 and 3.3**).

3.1 Bicycle and Scooter Parking

Carnegie Mellon maintains bicycle racks throughout campus, as well as covered bicycle parking in the East Campus Garage, which is gated. Bicycle parking is located across from the security office. The university supplies bicycle racks based on demand to ensure adequate bicycle parking throughout campus. Carnegie Mellon's transportation website provides a map of campus bike rack locations, shown in **Figure 3.0**, as well as information about local bicycle shops and easy bicycle loops near campus. There are bicycle end-of-trip facilities on campus, including showers, changing rooms, and repair stations. The League of American Bicyclists' Bicycle Friendly University program intends to help guide universities to provide a bikeable campus for students, staff, and visitors. Universities are scored based on their activities in engineering, education, encouragement, enforcement, and evaluation. In 2014, Carnegie Mellon was recognized by the League of American Bicyclists as Bicycle Friendly University, earning the silver level award. Carnegie Mellon continues to invest in its bicycle infrastructure, in eventual pursuit of a gold level award.

For proposed projects within this master plan, Carnegie Mellon maintains its commitment to provide bicycle parking for new developments. The number and configuration of new bicycle parking spaces per development will be determined in the site development process for each master plan project. The university is currently coordinating with the new bikeshare operator POGOH, formerly Healthy Ride, to help identify potential expansion areas. The previous existing Healthy Ride bikeshare stations are shown in **Figure 3.1**. One was located immediately south of campus at the intersection of Frew Street and Schenley Drive, one was located west of campus at the intersection of Craig Street and Fifth

Avenue, and one was located north of campus at the intersection of Neville Street and Ellsworth Avenue. POGOH and Carnegie Mellon are looking to expand the program.

The university is also committed to ensure the safe operation of personal wheeled mobility vehicles such as e-scooters by campus users, including safe parking locations. Announced in 2021, the new Personal Wheeled Transportation Policy is under development with a goal "to provide a safe environment for all members of the campus community, while allowing for the convenient use of personal wheeled vehicles." It should be finalized in 2022 or 2023. The university is continuing to coordinate with the e-scooter operator (Spin). A Spin electric scooter station is just south of campus along Schenley Drive opposite the entrance to Phipps Conservatory. Proposed scooter parking locations are shown in **Figure 3.1**.

3.2 Bicycle Routes to or Near Site

Carnegie Mellon is between two east and west bicycle routes along Schenley Drive and Forbes Avenue. Schenley Drive has a cycle track from Oakland to the Panther Hollow Road intersection. The cycle track turns to onto Panther Hollow Road into Schenley Park, while Schenley Drive continues towards Squirrel Hill with shoulders that bicyclists can use. Forbes Avenue has directional bicycle lanes through campus from Oakland to Squirrel Hill, which was implemented as a project presented in the 2012 master plan. Morewood Avenue, running north from Forbes Avenue, and Neville Street, running north from Fifth Avenue, are marked on-street bicycle routes with sharrows. Boundary Street, Frew Street, Tech Street, Margaret Morrison Street, Craig Street, Bellefield Avenue, and Fifth Avenue west of Craig Street are all considered cautionary on-street bicycle routes, as they do not have bicycle markings but provide important connections to other streets within the bicycle network. The POGOH (Healthy Ride) bike share stations are located between the southern border of campus and the Schenley Park cycle track on Frew Street, in the western part of the Craig Street area of campus near Fifth Avenue, and north of campus at the intersection of Ellsworth Avenue and Neville Street which are both marked on-street bike routes. Refer to **Figure 3.1** for a map of the Pedestrian and Bicycle Network.

The following master plan projects are proposed to enhance the bicycle network:

- Install a cycle track along Morewood Avenue from Forbes Avenue to Fifth Avenue.
- Construct a cycle track through campus from Morewood Avenue to Frew Street.
- Provide a shared use path marked for bicycles in the uphill direction along Frew Street.
- Incorporate Frew Street, Tech Street, and Margaret Morrison Street into a City of Pittsburgh Neighborway.
- Designate Hamerschlag Drive from Frew Street to Boundary Street as a bicycle boulevard, with vehicular traffic prohibited between Wean Hall and Frew Street.
- Reserve space in the Neville Parking Lot to connect to an eventual bicycle trail (by others) parallel to Boundary Street.

3.3 Pedestrian Access, Circulation and Safety

Refer to **Figure 3.1** for the pedestrian network through campus. Carnegie Mellon has a maintenance program for sidewalks, so they are kept in a state of good repair. Recent projects along Forbes Avenue and at the intersection of Fifth Avenue and Clyde Street installed new signalized crosswalks. Portions of sidewalks along Forbes Avenue, Fifth Avenue, and Morewood Avenue lack buffers between the sidewalk and the travel lanes. As Carnegie Mellon redevelops building sites, landscaped buffers are being installed between the sidewalk and travel lanes. Additionally, a shared use path is proposed along the Schenley Park side of Frew Street through these master plan projects.

3.4 Transit Routes to or Near Site

Carnegie Mellon is well served by transit. The campus is accessed by several Port Authority and university-run shuttle routes, listed in **Table 3.1**. Service will be increased in the master planning horizon as the Port Authority is planning bus rapid transit (BRT) along Forbes and Fifth avenues which will improve transit convenience and accessibility. Carnegie Mellon is committed to partnering with the Port Authority to help integrate the planned stops within campus, with proposed BRT stations along Forbes Avenue at Craig Street, Morewood Avenue, and Margaret Morrison Street, and along Fifth Avenue at Craig Street and Morewood Avenue. Refer to **Figure 3.2** for a map of proposed stations.

The university has an agreement with the Port Authority in which the university funds systemwide transit passes to all students, faculty, and staff. This results in high ridership levels. The university is committed to keeping this program throughout the master planning horizon, as it has been in place for decades. Refer to **Figure 3.3** for a map of transit routes and headways in the campus area, as well as the university's shuttle routes. Discussed in Section 6.5, the university is looking to expand shuttle routes to consolidate with other Oakland area operators (University of Pittsburgh and Carlow University) and is currently working on a combined feasibility study.

4.0 Trip Generation

Trip generation has been performed for the proposed master planning projects listed in **Table 1.1** using *ITE Trip Generation Manual, 10th Edition*. Trips were estimated using Land Use 550, University/College; Land Use 170, Utility; and Land Use 225, Off-Campus Student Apartment. The independent variable selected was 1,000 Sq. Ft., GFA for Land Use 550 and 170, and Residents for Land Use 225. Refer to **Appendix C** for trip generation calculations.

Refer to **Table 4.1** for the maximum trip generation for the master planning horizon for full buildout of all potential master plan projects without TDM. Refer to **Table 4.2** for trip generation without TDM if 50 percent of full buildout is realized. Refer to **Table 4.3** for trip generation for the master planning horizon for full buildout of all potential master plan projects assuming TDM will be successfully implemented. Refer to **Table 4.4** for trip generation for the master planning horizon for 50 percent of full buildout is realized, assuming TDM measures are successful and mode share targets are met. As the university is intending to create and implement TDM measures to further their mobility targets and goals, including no net new parking, and 50 percent of full buildout is conservative, trip generation is anticipated to correspond to **Table 4.4** target forecasts.

4.1 Trip Removals

Shown in **Appendix D**, the results of Carnegie Mellon University's 2018 parking study by Ayers Saint Gross, Brailsford & Dunlavey (survey data collected by Fehr & Peers) for faculty and staff, 38 percent parked, 29 percent took transit (22 percent by bus and seven percent by university shuttle), 19 percent walked, seven percent biked, five percent were dropped-off (including rideshare), and two percent other. Results are summarized in **Figure 4.0**. These mode shares were used to calculate trip removals for conditions without TDM. Mode share targets to be achieved through TDM are detailed in the Mobility Master Plan and in Section 6.3 Transportation Demand Management and are as follows: 30 percent single occupant vehicle use (driving alone and parking), seven percent multi occupant vehicle use (carpooling, being dropped off and ridesharing), 30 percent taking transit, nine percent biking, 19 percent walking, and five percent other. These targets are used for conditions with TDM.

The existing student mode share was reported to be two percent driving, 45 percent taking transit (35 percent bus and 10 percent shuttle), 29 percent walking, 12 percent biking, six percent being dropped off (including rideshare), and six percent other. These mode share splits are assumed to be maintained, though they are assumed for student housing land uses only.

4.2 Trip Adjustment Factors

No additional trip adjustment factors for internal trips, shared trips, and pass-by-trips are assumed, as mode share reductions take these into account.

5.0 Roadway Network and Operations Analysis

5.1 Area of Impact – Required Data Collection

Due to ongoing Covid-19 pandemic impacts, regular traffic patterns have not been observed during the 2020-2022 timeframe when this traffic study was prepared. Instead, historical turning movement counts adjusted from 2010 to 2015 are used for the following intersections within the area of impact (**Figure 5.0**), all of which are signalized:

- Fifth Avenue at Bellefield Street, Dithridge Street, Craig Street, Neville Street, Clyde Street, and Morewood Avenue
- Forbes Avenue at Craig Street, CIC/Tepper Drive, Morewood Avenue, Beeler Street, and Margaret Morrison Street

Peak period (7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM) turning movement counts were conducted along Forbes Avenue in 2015 for the Forbes Avenue Reconfiguration traffic study and along Fifth Avenue at Neville Street and Clyde Street for the Dearden Hall Renovation and North of Fifth Residence Hall Traffic Impact Study. Turning movement counts were conducted along the other Fifth Avenue intersections for the 2010 PCTI study. Since the approved Forbes Avenue Reconfiguration Study's background traffic growth rate was 0.25% per year linear, and the background traffic growth rate is not anticipated to grow more steeply during or after the Covid-19 pandemic, 0.25% per year linear was used to adjust all background traffic volumes except at driveways to the 2022 existing year and 2032 master planning horizon year. Please refer to **Figure 5.1** for a summary of turning movement counts from previous studies in **Appendix E:** Figure 14 "Design Year (2021) Peak Hour Volumes" from the Forbes Avenue Reconfiguration Study, Figure 16 "Forecasted Opening Year (2018) Full Buildout with Development Peak Hour Volumes" from the Dearden Center/North of Fifth Traffic Impact Study, and Figure 2 "September 2010 AM Peak Intersection Operations" and Figure 3 "September 2010 PM Peak Intersection Operations" from the Oakland/CMU Pedestrian Safety Mobility (PCTI) Study. Refer to **Figure 5.2** for the turning movement counts all adjusted to the 2022 current year.

5.2 ATR

Due to the inability to count typical traffic volumes, automated traffic recorder (ATR) counts were not performed. Instead, shown in **Figure 5.3**, average daily traffic volumes from PennDOT's Traffic Information Repository (TIRe) are shown, ranging from 2015 to 2020.

5.3 Study Periods

Traffic volumes used in the capacity analysis represent the individual peak hours within the typical AM peak hour (7:00 AM to 9:00 AM) and PM peak hour (4:00 PM to 6:00 PM) period.

5.4 Trip Distribution and Assignment

Trip distribution and assignment for vehicles entering the study area is based on existing traffic data. Refer to **Figure 5.4.1** for a summary of existing traffic distribution.

Parking is a system on the Carnegie Mellon campus, with parking rates and locations organized into five different parking tiers based on demand and proximity to campus. Parking locations are spread throughout the various campus areas, generally with larger facilities in structured locations and smaller facilities in surface lots. Detailed in Section 6.0, the university's parking master plan includes the goal

of removing the remaining surface lots and replacing them with new underground parking as part of each applicable development project. However, pursuant to the university's mobility goal of mitigating demand to provide no net new parking, TDM will be used to help reduce demand from the current parking supply. Therefore, parking reassignment trips will impact future trip distribution, especially in cases where TDM mitigates any trip increases. Entering parking trip reassignments are shown in **Figure 5.4.2** and exiting parking trip reassignments in **Figure 5.4.3** based on full (100 percent) lot occupancy changes, with trips rerouted using the distribution in **Figure 5.4.1** and the assumption that users will typically park at locations convenient to their commuting direction.

5.5 Background Traffic / Future Conditions

5.5.1 Future Year Conditions

Adjusted current year (2022) background traffic volumes from **Figure 5.2** were grown to Master Plan Horizon Year (2032) volumes in **Figure 5.5** using a linear growth rate of 0.25% per year linear.

5.5.2 Trip Removals

Noted in Section 5.4, anticipated parking lot changes will result in trip removals, as vehicles will be reassigned from one parking facility to another. Refer to **Figure 5.4.2** and **Figure 5.4.3** for anticipated parking trip changes based on full lot occupancy.

To meet the university's mobility goals discussed in Section 4.1, TDM will be used to reduce existing parking demand by a target eight percent reduction. With a current parking supply of 2,972 spaces, this corresponds to a demand reduction of 238 spaces. These spaces are anticipated to be backfilled by new parking demand with proposed IMP projects.

5.5.3 New Projects to be Added to Base Traffic

No new projects were determined to be applicable to be added to base traffic.

5.6 Capacity Analysis

Based on coordination with DOMI and DCP staff, and as approved in the scoping meeting application, network-wide capacity analysis cannot be reliably performed due to Covid-19 impacts. Due to Carnegie Mellon's commitment to mitigating trip increases through multimodal TDM strategies, overall university trips are not significantly anticipated to grow in the master-planning horizon. However, more localized impacts may occur as parking facilities shift from one neighborhood of campus to another. Two critical intersections most subject to localized impacts, which were not part of upgrades from the Forbes Avenue Reconfiguration (recommended in the 2012-2022 master plan), are the intersections of Fifth Avenue and Neville Street and Fifth Avenue and Morewood Avenue, shown in **Figure 5.0**. Both intersections are planned for signalization upgrades as part of the Port Authority's BRT project and the City's Smart Spines initiative. However, neither have capacity improvement projects planned. As a result, this study's detailed capacity analysis is limited to these two intersections.

Capacity analyses for the study intersections were performed using Trafficware's Synchro Version 10 analysis software, which performed capacity analyses based on methodologies published in the *2000 Highway Capacity Manual* by the Transportation Research Board. This methodology determines how well an intersection, approach to an intersection, or movement at an intersection operates, and assigns to it a level of service (LOS) A through F, with LOS A representing the best operating conditions and LOS F, the worst. The minimum satisfactory overall intersection LOS for urban conditions is considered LOS D. Detailed definitions of LOS are included in **Appendix F**. While the Transportation Research Board has updated its methodology in 2010, there are limitations to this update. Intersections with shared left/through movements with protected-permitted phasing cannot be analyzed, as is the case with both study intersections. As a result, 2000 methodology was used in this analysis.

5.6.1 Existing Conditions

A capacity analysis for adjusted current year (2022) background traffic volumes from **Figure 5.2** was performed. Intersections were modeled based on the existing traffic signal plans included in **Appendix G**, with intersection descriptions below. Based on the results of the capacity analysis, the intersection of Fifth Avenue and Neville Street currently operates at LOS C overall during the AM and PM peak hours, and the intersection of Fifth Avenue and Morewood Avenue currently operates at LOS B overall during the AM peak hour and at LOS C during the PM peak hour. All movements operate at LOS D or better, except during the AM peak hour when the Neville Street southbound approach operates at LOS E, and during the PM peak hour when the Neville Street southbound approach operates at LOS E (the left/through lane operates at LOS F). The Morewood Avenue northbound right turn operates at LOS E. Refer to **Table 5.1** for a summary of intersection capacity and **Appendix H** for capacity calculations.

Descriptions of study intersections' existing conditions are as follows:

5.6.1.1 Fifth Avenue and Neville Street

The intersection of Fifth Avenue and Neville Street is controlled by a coordinated pretimed traffic signal with an 80 second peak hour cycle length. Fifth Avenue is posted at 35 mph and Neville Street at 25 mph. The Fifth Avenue eastbound approach consists of a shared left/through lane and a shared through/right lane. The left lane has an advance protected permitted left turn phase which creates a southbound right turn overlap. Cartway width approaching the intersection is 56 feet, though the eastbound lanes narrow to two 11-foot lanes approaching the intersection. The Fifth Avenue westbound approach also consists of a shared left/through lane and a shared through/right lane, with all turns permitted only. Cartway width is 44 feet, with two 11-foot lanes in each direction. Northbound Neville Street has a cartway width of 30 feet, with a single 11-foot northbound lane, an 11-foot southbound lane, and an 8-foot southbound parking lane. Southbound Neville Street has a cartway width of 36 feet, with an 11-foot southbound shared left/through lane and an 11-foot exclusive right turn lane, channelized by a painted island. All turn movements are permitted, except for the southbound right-turn that is signal-controlled with an exclusive right turn overlap. Turns on red are prohibited at all movements. There are crosswalks with pedestrian signals across each quadrant, though they lack countdown timers. Refer to **Appendix G** for the existing traffic signal plan.

5.6.1.2 Fifth Avenue and Morewood Avenue

The intersection of Fifth Avenue and Morewood Street is controlled by a coordinated pretimed traffic signal with an 80 second peak hour cycle length. Fifth Avenue is posted at 35 mph and has a cartway width of 44 feet (11-foot lanes) and Morewood Avenue is posted at 25 mph and has a cartway width of 30 feet (10-foot lanes). The Fifth Avenue eastbound approach consists of a shared left/through lane and a shared through/right lane. All turns are permitted. The Fifth Avenue westbound approach also consists of a shared left/through lane and a shared through/right lane, though left turns have an advance protected-permitted left turn phase. Northbound Morewood Avenue has a shared left/through lane and an exclusive right turn lane. Southbound Morewood Avenue has an exclusive left turn lane and a shared through/right lane. The Morewood Avenue approaches are offset from each other by approximately 10 feet, so the northbound left lane lines up with the curb lane trailing the intersection. Southbound traffic must shift a lane through the intersection. Turns on red are prohibited from Morewood Avenue. There are crosswalks with pedestrian signals across each quadrant, though they lack countdown timers. Refer to **Appendix G** for the existing traffic signal plan.

5.6.2 Analysis Year without IMP Projects

A capacity analysis for analysis year (2032) background traffic volumes from **Figure 5.5** was performed. Since the BRT and the City of Pittsburgh's Smart Spines signalization project is anticipated

to be completed by 2032, the analysis assumed fully actuated and coordinated signals with optimized cycle lengths (80 seconds) and optimized timings. This results in improved intersection capacities. Additional phasing changes were not assumed, as the improvement project has not been finalized yet. Refer to **Appendix I** for anticipated intersection plans after BRT construction.

Based on the results of the capacity analysis, the intersection of Fifth Avenue and Neville Street will still operate at LOS C overall during the AM and PM peak hours, and the intersection of Fifth Avenue and Morewood Avenue will still operate at LOS B during the AM peak hour and at LOS C during the PM peak hour. All movements will operate at LOS D or better, except during the PM peak hour when the Neville Street southbound approach is anticipated to operate at LOS E (the left/through lane is anticipated to operate at LOS E) and the Morewood Avenue northbound exclusive right turn lane is anticipated to operate at LOS E. Refer to **Table 5.1** for a summary of intersection capacity. Complete capacity calculations are located in **Appendix J**.

5.6.3 Analysis Year with IMP Projects without TDM

Carnegie Mellon anticipates up to 50 percent of the maximum buildout of IMP projects to be completed through the 10-year master planning horizon. Discussed in Section 5.4, parking trip reassignment will impact forecasted volumes in the 2032 master-planning year, as various parking locations will be relocated during that timeframe so users will have different paths to reach their parking destination. Applying the **Figure 5.4.2** entering parking trip reassignments, **Figure 5.6.1** assumes all entering trip changes will occur in the AM peak hour and conservatively assumes half of those reassigned vehicles entering will also exit during the peak hour. Noted within **Figure 5.6.2**, the eight percent mode share target would reduce parking trips by up to 238 entering vehicles, which balances with the projected 174 new AM entering parking trips and 64 entering drop-off or rideshare trips. However, if TDM is not implemented, there would be an overage of 269 entering trips and 135 exiting trips. Therefore, **Figure 5.6.2** shows these additional AM peak hour trips without TDM.

Applying the **Figure 5.4.3** exiting parking trip reassignments, **Figure 5.6.3** assumes all exiting trip changes will occur in the PM peak hour and conservatively assumes half of those reassigned vehicles exiting will also enter during the PM peak hour. Noted with **Figure 5.6.4**, the eight percent mode share target would reduce parking trips by up to 238 exiting vehicles, which exceeds the projected 163 new PM exiting parking trips and 63 exiting drop-off or rideshare trips. However, if TDM is not implemented, there would be an overage of 255 exiting trips and 128 entering trips. Therefore, **Figure 5.6.4** shows these additional PM peak hour trips without TDM.

A capacity analysis was performed for the IMP horizon year (2032) assuming 50 percent maximum buildout and no TDM using the volumes shown in **Figure 5.6.5**. The analysis assumes the same fully actuated and coordinated signals as in the no-build condition, keeping 80-second cycle lengths and optimized timings.

Based on the results of the capacity analysis, the intersection of Fifth Avenue and Neville Street is still anticipated to operate at LOS C overall during the AM peak hour but degrade to LOS D overall during the PM peak hour. Most individual movements are still anticipated to operate at LOS D or better, except during the AM peak hour where the Neville Street southbound shared left/through lane degrades to LOS E, and during the PM peak hour where the Neville Street southbound shared left/through degrades to LOS F (the approach degrades to LOS E overall). The Neville Street northbound approach also degrades to LOS E.

The intersection of Fifth Avenue and Morewood Avenue is anticipated to degrade to LOS C overall during the AM peak hour and degrade to LOS D overall during the PM peak hour. Most individual movements are still anticipated to operate at LOS D or better, except during the PM peak hour where

the northbound approach is anticipated to degrade to LOS E. Refer to **Table 5.1** for a summary of intersection capacity. Complete capacity calculations are located in **Appendix K**.

5.6.4 Analysis Year with IMP Projects and TDM

To mitigate overall trip and parking increases, Carnegie Mellon is pursuing a TDM program to allow the university to achieve its mobility goals. As noted, this will result in AM entering trips and PM exiting trips balancing with parking facility reassignment trips, avoiding new peak hour trips. As drivers are anticipated to divert to new parking facilities, localized impacts are analyzed. To achieve no net new parking, a number of multimodal projects are proposed as mitigation. Refer to **Table 5.2** for a summary of these multimodal projects. The only proposed project that may impact vehicular travel lanes is the Morewood Avenue improvement project, as eliminating the intersection offset will help make the intersection safer for all users. This project requires Carnegie Mellon-owned right-of-way takes, and it could be achieved with or without lane reconfiguration. This Analysis Year with IMP Projects and TDM study condition assumes no lane changes or capacity improvements. Any additional widening or lane reconfiguration will be studied in Section 5.6.5 as additional capacity mitigation.

A capacity analysis was performed for the IMP horizon year (2032) assuming 50 percent maximum buildout and TDM using the volumes shown in **Figure 5.6.6**. The analysis assumes the same fully actuated and coordinated signals as in the 2032 no-build condition, keeping 80-second cycles and optimized timings.

Based on the results of the capacity analysis, the intersection of Fifth Avenue and Neville Street is still anticipated to operate at LOS C overall during the AM peak hour but degrade to LOS D overall during the PM peak hour. Most individual movements are still anticipated to operate at LOS D or better, except during the AM peak hour where the Neville Street southbound shared left/through lane degrades to LOS E, and during the PM peak hour where the Neville Street shared southbound left/through lane degrades to LOS E (the approach degrades to LOS E overall). The Neville Street northbound approach also degrades to LOS E. Additional capacity mitigation will be needed to mitigate the overall intersection delay increase, as it increases by over ten seconds, though the overall level of service will still be LOS D or better.

The intersection of Fifth Avenue and Morewood Avenue is anticipated to maintain the same levels of service as without development, operating at LOS B overall during the AM peak hour and at LOS C overall during the PM peak hour. Individual movements are anticipated to operate at LOS D or better. Therefore, additional roadway capacity mitigation is not required. Refer to **Table 5.1** for a summary of intersection capacity. Complete capacity calculations are located in **Appendix L**.

5.6.5 Analysis Year with New Project, TDM, and Mitigation

At the intersection of Fifth Avenue and Neville Street, even with TDM mitigation, the overall level of service is anticipated to degrade from LOS C to LOS D during the PM peak hour, with average delay increasing by 17.7 seconds. The Neville Street northbound approach is anticipated to drop from LOS D to LOS E. To mitigate this capacity degradation, given limited ability to make capacity improvements in a constrained urban setting, this study proposes reconfiguring the Neville Street northbound approach. Since the cartway width is 30 feet, prohibiting parking in the block between Henry Street and Fifth Avenue and using the existing parking lane as a proposed travel lane would allow room for three 10-foot lanes. Therefore, the northbound approach could be restriped to a shared left/through lane and an exclusive right turn lane. There is 160 feet between the existing stop bar and the Henry Street intersection, representing the maximum length for an exclusive right turn lane. No other changes to signalization are proposed, as adding advance left turn phases or split phases would increase the

existing 80-second cycle length, leading to more queuing and longer pedestrian wait times. This change would resolve traffic delay increases.

The northbound and southbound approaches of Morewood Avenue at Fifth Avenue are offset from each other, causing southbound traffic to shift a lane through the intersection while avoiding the sidewalk radius. This corner is well used by pedestrians since a busy transit stop is located there. As part of IMP Mobility Plan improvements proposed in **Table 5.2**, the first project listed involves widening Morewood Avenue onto Carnegie Mellon property at the intersection's southwest quadrant, with the lane shift starting 250 feet in advance of Fifth Avenue to eliminate the offset. The project will require a lateral width of up to 12 additional feet for the lane and cycle track, and considering sidewalk widening at the corner, a total right-of-way take of approximately 3,000 square feet. (Required right-of-way is exclusive of the "Morewood Avenue Cycle Track" project that proposes a new sidewalk on university-owned property).

Implementing this project could give space to add a northbound exclusive left turn lane, though due to space constraints with access to Mudge House and the need for the stop bar to be placed far back for turning vehicles, the length would be limited to 50 feet. Therefore, this project proposes reconfiguring the northbound approach to have an exclusive left turn lane, a through lane, and an exclusive right turn lane. The existing geometry of the through and right lanes would not be impacted. Since few vehicles make the northbound left turn, conflict factor analysis recommends a permissive left turn phase. Refer to **Figure 5.7** for a conceptual design for this intersection improvement.

A capacity analysis was performed for these conditions in the IMP horizon year (2032) assuming 50 percent maximum buildout, TDM, and this additional vehicular mitigation using the volumes shown in **Figure 5.6.6**. The analysis assumes 80-second cycles and optimized timings.

Based on the results of the capacity analysis, the intersection of Fifth Avenue and Neville Street is anticipated to operate at LOS C overall during both peak hours. All intersection approaches are still anticipated to operate at LOS D or better overall, though the Neville Street southbound left/through lane is anticipated to operate at LOS E during the AM and PM peak hours.

The Fifth Avenue and Morewood Avenue intersection is anticipated to maintain without development levels of service, operating at LOS B overall during the AM peak hour and at LOS C overall during the PM peak hour. Individual movements are anticipated to operate at LOS D or better. Refer to **Table 5.1** for a summary of intersection capacity. Complete capacity calculations are located in **Appendix M**.

5.7 Queuing Analysis

95th percentile queue length analysis was performed for all study movements for all conditions identified in Section 5.6. Analysis was performed using both Synchro methodology and SimTraffic simulations averaging five runs with 10 minutes of seeding. Refer to **Table 5.3** for queue length summaries, **Appendix M** for Synchro output, and **Appendix N** for SimTraffic output. Results of the queuing analysis indicate that some 95th percentile queues currently spill back beyond left and right turn lanes, but only by a few vehicles which is typical for urban conditions. During the 2032 without development scenario, the 95th percentile queue in the Neville Street southbound right turn lane will exceed its storage bay during the AM peak hour. During the PM peak hour, the 95th percentile queue in the Morewood Avenue right turn lane will also exceed its storage bay.

Additional with development traffic would create queue length increases especially in the PM peak hour, most notably along eastbound Fifth Avenue approaching Neville Street and westbound Fifth Avenue approaching Morewood Avenue. Performing the proposed TDM and capacity mitigation would limit these increases, with the eastbound Synchro-calculated queues increasing by about two car lengths (42 feet) and the westbound Synchro-calculated queues increasing by about five car lengths

(95 feet). At left and right turn lanes, this proposed mitigation will mitigate queue length increases, with any additional spillback limited to a single vehicle.

5.8 Traffic Signal Warrant Analysis

IMP projects are not anticipated to require a new signalized intersection, so traffic signal warrant analysis was not performed.

5.9 Crash History/Analysis

Five-year crash experience was reviewed for the study area delineated in **Figure 5.0**. Reportable crashes were obtained from the Pennsylvania Crash Information Tool (PCIT) from January 2016 through December 2020 and summarized in **Table 5.4** and **Figure 5.8**. Refer to **Appendix O** for the boundary of the crash query area, specific crash locations, and a detailed summary of the findings. Reportable and nonreportable crashes were obtained from the Carnegie Mellon University Police Department (CMUPD) from January 2018 through June 2021 and reported in **Table 5.5**, though only general locations were given.

Crashes were reviewed to identify crash clusters (a minimum of five crashes with similar causation factors occurring in a one-year period), pedestrian collisions, bicycle crashes, and fatalities. PCIT reported 169 crashes within the study area including 26 pedestrian crashes. The pedestrian crash at Fifth Avenue and Dithridge Street was the one reported fatality. Only the intersection of Fifth Avenue and Morewood Avenue had more than five crashes of the same type within a year, experiencing six angle crashes both in 2017 and 2018. However, crashes occurred in varying directions of travel.

According to the PCIT reports, only two intersections experienced more than an average of two crashes per year: Fifth Avenue and Morewood Avenue with 44 crashes and Fifth Avenue and Neville Street with 21 crashes. These are the two intersections modeled in the capacity analysis. In addition to having the highest total number of crashes (44), the intersection of Fifth Avenue and Morewood Avenue had the highest number of pedestrian crashes with seven. One possible causation factor is that the Morewood Avenue intersection approaches are offset from each other. Northbound movements have a shared left/through lane and an exclusive right turn lane. This configuration is difficult for bicycles to maneuver and challenging for left turning vehicles without a dedicated turn lane. Southbound movements have the more typical exclusive left turn lane and shared through/right lane arrangement, though drivers shift over a lane in the middle of the intersection, as the sidewalk lines up with approaching southbound vehicles. All turns are permissive to oncoming vehicular and pedestrian traffic. Left turn lanes are not present along Fifth Avenue, though this is consistent with most Fifth Avenue intersections. This study proposes improving the Fifth Avenue and Morewood Avenue intersection as part as an IMP Mobility Plan project to eliminate the Morewood Avenue intersection offset and to add a 50-foot northbound exclusive left turn lane. Refer to **Figure 5.7** for a conceptual intersection reconfiguration design drawing.

At Fifth Avenue and Neville Street, this study's capacity analysis mitigation proposes delineating a northbound exclusive right turn lane. This improvement would help make traffic flow more orderly and could also help improve driver compliance yielding to conflicting pedestrians.

Upgrades are planned by other agencies at all Fifth Avenue intersections, including at Dithridge Street, Neville Street, and Morewood Avenue. Improvements are to be included within DOMI's Smart Spines project and Port Authority's BRT project. Existing pretimed traffic signals will be replaced with ones that are actuated and coordinated, and they will include modern accessible pedestrian signals. Upgrades will add highly visible crosswalks and update all curb ramps to be ADA compliant.

CMUPD reported 215 crashes, including one involving a bicycle, though its location on Forbes Avenue was not specified. According to the CMUPD, other than incidents reported at the police station or

within parking facilities, Frew Street experiences the highest number of vehicular incidents throughout the campus roadway network. There were 21 collision or vehicular damage reports along Frew Street between Schenley Drive and Tech Street, as the perpendicular parking configuration lacks a maneuvering area to buffer the parking spaces with through traffic. The IMP proposes improving this roadway within the Mobility Plan by converting two-way Frew Street to a one-way facility with parallel parking and a shared use path. Tech Street and Margaret Morrison Street also have parallel parking.

6.0 Parking

6.1 Existing Conditions

Shown in **Figure 6.0** and summarized in **Table 6.1**, Carnegie Mellon University has 34 parking facilities for a total existing parking inventory of 2,972 spaces. Of these parking spaces, 1,093 are in surface lots, 1,795 are in garages, and 84 are in remote lots served by university shuttle routes.

In 2017 and 2018, Carnegie Mellon consulted with Chance Parking Advisors and Ayers Saint Gross to create a Parking Master Plan. Parking surveys conducted in 2017 recorded an overall lot occupancy of 88 percent, with larger facilities filling to capacity and smaller facilities underutilized. Individual lot capacities are shown in **Figure 6.1** occupancies are shown in **Appendix P**. New parking surveys for this master plan are not feasible due to working from home programs during the pandemic. When parking utilization counts were performed, they included 20 spaces at the former Doherty Apartments residence hall. Upon its demolition in 2020 to build the Forbes Beeler project, these spaces were removed. However, the Forbes Beeler project is to include 20 new spaces to come online when the project is completed in 2023. Factoring in those spaces, and not considering some of the remote lots, the 2017 report showed a parking supply of 2,908 spaces. That study also included the 144 city-owned metered parking spaces on Frew Street for a total parking supply of 3,081 spaces. Proposed changes to parking along Frew Street may occur through the IMP mobility project, though that project will require a separate study that will look to reaccommodate parking elsewhere on Schenley Drive.

Based on data provided by the university's Parking and Transportation Services in February 2020 (the last month before pandemic impacts reduced demand), there were 2,267 five-day permits and 95 three-day permits offered. There were also 56 permits reserved for university-owned vehicles and four for zip cars. Therefore, about 82 percent of total lot occupancy was reserved for permit holders. Non-permit holders typically park in the East Campus garage, along the Frew/Tech/Margaret Morrison Street or Circuit Drive metered spaces, or in various free parking locations in Schenley Park. Parking along almost all other on-street spaces on streets bordering or otherwise near campus require parking permits through the city's Residential Parking Program. Refer to **Figure 6.1** for a map of permit parking areas.

6.2 Proposed Parking

Carnegie Mellon is an urban campus surrounded by residential areas with a supply of rental apartments. First-year undergraduates are required to live on or near campus in university-provided housing. While the university does not provide graduate student housing, almost all graduate students live in nearby apartments. Few parking passes are made available to undergraduate or graduate students. Instead, the university provides transit passes and has invested in bicycle infrastructure to provide auto alternatives. Employees can take advantage of car-free commuting options as they also receive transit passes. As a result, parking demand has been determined based on survey data from Carnegie Mellon's parking master plan and from historical parking trend data.

Through the institutional master planning process and Carnegie Mellon's commitment to the Pittsburgh 2030 district, the university is committed to their mobility goal of providing no net new parking, using

TDM to mitigate future parking increases. The IMP's mobility plan presents the goal that "Existing Parking - Removals + Replacement + Leased + TDM = 0 at 90 percent efficiency." Master planning projects also aim to eliminate surface lots, consolidating parking in underground facilities beneath future development sites. Therefore, Carnegie Mellon proposes to maintain the existing 2,972-space parking supply and use TDM to mitigate demand for new parking. Refer to **Figure 6.2** for anticipated parking reassignment due to master planning projects and **Table 6.2** for a summary proposed parking for each IMP development project.

6.3 Transportation Demand Management

The goal of transportation demand management (TDM) is to provide an implementable plan to provide alternatives to single-occupant vehicles that are tied to realistic targets and to monitor the plan to ensure its success. As it will reduce vehicular use, TDM will also reduce parking demand. TDM at Carnegie Mellon will be administered and monitored by the university's Parking and Transportation Services. Discussed in Section 4.1, TDM mode share goals have been proposed through correspondence with DCP and DOMI and based on the results of Carnegie Mellon University's Parking Master Plan. That plan, completed in 2018 by Ayers Saint Gross, Brailsford & Dunlavey, with survey data collected by Fehr & Peers, (**Appendix D**), included an employee commuter survey conducted from March through May of 2018. The employee survey had 2,263 participants, though responses to individual questions varied. From coordination with DCP and DOMI, Carnegie Mellon's TDM mode share targets for faculty and staff are proposed as follows:

- 30 percent mode share for driving alone and parking (decrease of eight percent)
- 7 percent mode share for carpooling and ride sharing (increase of two percent)
- 30 percent transit (increase of one percent)
- 9 percent biking (increase of two percent)
- 19 percent walking (no change)
- 5 percent other, such as working from home (increase of four percent)

Of note, Question 36 of the employee survey asked participants (1,949 respondents) if they would consider alternative modes of transportation if parking rates continued to rise. Six percent indicated a willingness to switch to walking, six percent to switch to biking, three percent to start carpooling, six percent to start getting dropped off, 23 percent switching transit, three percent switching to a university shuttle, and two percent starting to use rideshare. 44 percent of respondents indicated that they would continue to drive. While these percentages are assumedly from the existing auto commuters, the responses show employees do have some willingness to switch modes, indicating that a TDM program that aims to reduce driving alone by eight percent can realistically be implemented.

The survey concluded with an open-ended question, which 824 participants used to discuss their thoughts on commuting. Common themes emerged, and these responses formed the basis of the study's TDM recommendations. Key findings to be implemented are as follows:

- Expanding transit passes to employees of contracted services, such as dining and janitorial services.
- Expanding transit passes beyond Allegheny County to include transit operators in surrounding counties.
- Coordinating with other Oakland area shuttle operators to improve and expand shared shuttle routes and frequencies.

- Building additional bicycle infrastructure.
- Improving on-campus bicycle amenities.
- Developing a carpool/vanpool program.
- Improving sidewalk accessibility, connectivity, and safety.
- Providing three-day or flexible parking passes.
- Coordinating with the Port Authority to improve transit route coverage and efficiency.
- Implementing work from home programs.

Refer to **Table 6.3** for a summary of survey results, possible implementation timeframes, and their potential single occupant vehicle commuting reduction and associated parking reduction. Based on these strategies, at least two percent of commuters may switch to carpooling and ride sharing, six percent to transit, two percent to biking, one percent to walking, and five percent to working from home. Parking demand is also anticipated to decrease by eight percent. Since the survey was conducted before the pandemic, virtual and hybrid commuting options have become more commonplace and acceptable, so survey results may underreport their future mode share. The proposed five percent mode share target may underestimate demand, though it is a more conservative assumption.

As part of a Traffic Impact Study, DOMI includes TDM Checklist items and Site Plan strategies. Refer to **Tables 6.4** and **6.5** respectively for a summary of these strategies, their ongoing incorporation into TDM planning at the university, and additional comments. As a TDM plan includes ongoing monitoring and tweaking these strategies, blank fields for strategy results and strategy revisions are also included in these tables for future updates. Refer to **Table 5.2** for a summary of the multimodal projects included in Carnegie Mellon's mobility section of the master plan to help achieve these TDM targets.

6.4 Parking Demand Analysis

Refer to **Table 6.2** for a summary of parking demand analysis for each proposed development project. This table is supported by the calculation in **Appendix Q** which estimates new parking demand based on net assignable square footage (nasf). As shown, Carnegie Mellon's population has grown from 12,058 students and employees in the fall of 2000 to 19,029 students and employees in the fall of 2019. During that same time, net assignable square footage declined from 249 nasf/person to 211 nasf/person. Part of the campus growth goal for projects proposed in this master plan is to provide space to return to the previous target of 250 nasf/person. Therefore, a portion of each development project will be filled by existing demand, estimated at 742,131 nasf of space to be shifted from existing university buildings to proposed university buildings. Assuming 50 percent of full buildout from the master plan projects, parking demand calculations are based on 456,169 nasf of new space. Detailed in the next section, TDM is planned to reduce parking demand by eight percent. With an existing parking occupancy of 88 percent, TDM would free 210 spaces. With the drive alone mode share target of 30 percent, master plan projects will result 262 new parking spaces demanded. Backfilling parking spaces made available by TDM is anticipated to achieve an overall parking occupancy of 90 percent, which is the target utilization for campus. Therefore, this parking demand analysis justifies the IMP mobility goal, "Existing – Removals + Replacement + Leased + TDM = 0 at 90 percent efficiency."

6.5 Other Transportation

Carnegie Mellon's Parking and Transportation Services offers shuttle and escort services. Shuttle service operates on fixed routes with specific stops. Escort Service helps to fill gaps in transit services

by operating in evening and overnight hours to provide on-demand transportation. Refer to **Table 3.1** and **Figure 3.3** for routes, stop locations, and operational frequency.

Per the TDM proposal, Carnegie Mellon is looking to coordinate with other Oakland-area shuttle operators (University of Pittsburgh and Carlow University) to combine and consolidate routes. This would allow the universities to expand shuttle service coverage and decrease headways, allowing riders with their college IDs to use each other's shuttles. The universities are currently partnering on an ongoing study, with a pilot program expected to start in the next few years.

7.0 Recommendations/Conclusion

This traffic impact study demonstrates Carnegie Mellon's commitment to sustainable growth by proposing multimodal capacity upgrades to support its 2022-2032 Institutional Master Plan projects. As each individual development site included in the IMP represents the largest possible massing on each site, 50 percent of the total development square footage has been evaluated within this study. Conducted from 2020 through 2022 during the years most impacted by the pandemic, this report's analysis reflects pre-pandemic conditions. Though pandemic modal shifts suggest increased post-pandemic workplace flexibility will become typical, this study conservatively limits working from home programs to five percent of commuters. Findings are anticipated to be conservative. Since the land development project has not been completed or the exact size or configuration of any of the IMP development projects known, each development may require a separate traffic impact assessment or comparison with its expectations within this study. Deviations from assumptions presented in this study may also result in the need for future studies and amendments.

Final recommendations proposed by this traffic impact study are as follows:

- Implement a Transportation Demand Management Program that invests in multimodal programs to achieve the following mode share targets:
    - 30 percent mode share for driving alone and parking (decrease of eight percent)
    - 7 percent mode share for carpooling and ride sharing (increase of two percent)
    - 30 percent transit (increase of one percent)
    - 9 percent biking (increase of two percent)
    - 19 percent walking (no change)
    - 5 percent other, such as working from home (increase of four percent)
- Use Transportation Demand Management to successfully mitigate parking demand increases so the existing 2,972-space parking supply is maintained at 90 percent capacity.
- Perform the projects identified in the master plan's mobility proposal (**Table 5.2**) and strategies identified through the Transportation Demand Management study (**Table 6.3**) to achieve the master plan's mobility goals.
- Maintain existing vehicular levels of service through the following two capacity improvement projects:
    - Restripe the northbound Neville Street approach to Fifth Avenue from Henry Street to have a shared left/through lane and an exclusive right turn lane.
    - Reconfigure the northbound Morewood Avenue approach to Fifth Avenue to eliminate the intersection offset by adding a 50-foot (minimum) left turn lane alongside the existing through lane and exclusive right turn lane.

- Partner with the City of Pittsburgh and the Port Authority to implement these mobility projects along with their roadway improvement projects (including Oakland Neighborhood Plan implementation) and BRT projects.

Enacting these mitigative strategies will improve the safety and mobility for all users while allowing Carnegie Mellon to sustainability grow throughout the ten-year master planning horizon.

TABLES

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Table 1.1
Development Description
Carnegie Mellon University 2022-2032 Institutional Master Plan Traffic Impact Study
City of Pittsburgh, Pennsylvania

Project Component				Existing On-Site Conditions			Maximum Future On-Site Conditions			Net Difference (Max.)		
Number	Type	Description	Proposed Use	Size (Sq. Ft.)	# of Beds	# of Parking	Size (Sq. Ft.)	# of Beds	# of Parking	Size (Sq. Ft.)	# of Beds	# of Parking
1	Facilities Operations Center	S Neville along Railroad	Parking, Utility, Office			96	40,000 sf		135	40,000 sf		39
2	New Academic Building	FMS Building	Education, Laboratory / Research, Office, Restaurant, Utility	48,000 sf			300,000 sf			252,000 sf		0
3	Academic Building Expansion	Hamburg & Smith Halls	Education, Laboratory / Research, Office, Restaurant	22,000 sf			100,000 sf			78,000 sf		0
4	New Academic Building	Cyert & Warner Halls	Education, Laboratory / Research, Office, Parking, Restaurant	110,000 sf			250,000 sf			140,000 sf		0
5	Academic Building Expansion	Purnell Center for the Arts	Education, Laboratory / Research, Office, Public Assembly			16	30,000 sf			30,000 sf		-16
6	Student Support Expansion	West Wing Addition	Education, Laboratory / Research, Office, Restaurant				5,000 sf			5,000 sf		0
7	Academic Building Expansion	Margaret Morrison Carnegie Hall	Education, Laboratory / Research, Office			14	110,000 sf			110,000 sf		-14
8	New Mixed Use Building	Donner Hall	Education, Laboratory / Research, Office, Parking, Restaurant / Student Housing		241	23	266,000 sf	735	200	266,000 sf	494	177
9	Student Support Expansion	Hamerschlag House	Office, Restaurant				6,000 sf			6,000 sf		0
10	New Academic Building	Tepper School Expansion Site	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant				180,000 sf		400	180,000 sf		400
11	New Mixed Use Building	Morewood Lot	Laboratory / Research, Office, Restaurant / Student Housing			285	220,000 sf	500	200	220,000 sf	500	-85
12	E Tower Commons	Morewood E Tower	Office, Restaurant				6,000 sf			6,000 sf		0
13	New Mixed Use Building	Capstone site at Forbes & Morewood	Education, Laboratory / Research, Office, Parking, Student Housing, Restaurant			69	200,000 sf	300	150	200,000 sf	300	81
14	New Residential Building(s)	Greek Quad	Office, Parking, Student Housing		384		250,000 sf	720		250,000 sf	336	0
15	New Residential Building	Forbes & Devon	Office, Student Housing				40,000 sf	180		40,000 sf	180	0
16	Shirley Apartments	Shirley Apartments	Office, Parking, Student Housing		20		20,000 sf			20,000 sf	-20	0
17	New Residential Building	Whitfield Hall	Office, Parking, Student Housing	4,000 sf		61	160,000 sf	165	55	156,000 sf	165	-6
18	Academic Building Expansion	Mellon Institute	Education, Laboratory / Research				30,000 sf			30,000 sf		0
19	New Academic Building	North of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Restaurant, Retail	49,000 sf		72	230,000 sf		200	181,000 sf		128
20	New Academic Building	South of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant, Retail	2,700 sf		126	425,000 sf		500	422,300 sf		374
Total				**235,700 sf**	**645**	**762**	**2,868,000 sf**	**2600**	**1840**	**2,632,300 sf ***	**1955 ***	**1078****

* Size reflects maximum buildout. Approximately 1/3 of development square footage realized from 2012-2022 master plan; 1/3 to 1/2 expected to be realized for the 2022-2032 master plan, so 1/2 used in TIS calculations.

** Additional campus surface lots will be removed and replaced with green space, and new parking spaces, which are based on maximum building massing in this table, will be reduced. The University is pursuing a goal of no net new parking so the final number of new proposed parking spaces will be less. Refer to Table 6.2.

Table 1.2
Status of 2012-2022 IMP Projects
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Number	Name	Proposed Size	Constructed Size	Completed?
1	Scott Hall	120,000	105,000	Yes
2	South Wing Wean Hall	10,000		No
3	New Scaife Hall	120,000	85,000	Ongoing
4	ANSYS Hall	50,000	36,000	Yes
5	New Academic Building (Beach)	125,000		No
6	Below-Grade Academic Facility	40,000		No
7	Margaret Morrison Extension	110,000		No
8	Skibo Gym	200,000	165,000	Ongoing
9	Cohon University Center Addition	75,000	68,000	Yes
10	West Wing Addition	7,500		No
11	South of Forbes Site	425,000		No
12	FMS Expansion/Addition	100,000		No
13	Hamburg Hall Addition	60,000	6,000	Yes
14	Warner Hall & Loggia Expansion	70,000		No
15	Below Ground Purnell Expansion	100,000		No
16	Capstone Building	200,000		No
17	Relocation of Greek House	25,000		No
18	Garage Relocations	10,000		No
19	Doherty Apartments Site	120,000	118,000	Ongoing
20	Morewood Gardens Addition	80,000		No
21	North of Forbes (TCS)	385,000	75,000	Yes
22	Tepper School of Business	400,000	315,000	Yes
23	New Academic Building (Tepper 2)	180,000		No
24	New Adacemic Building South	200,000		No
25	New Academic Building North	200,000		No
26	S Neville Support Facility & Parking	50,000	8,000	Yes
27	Mellon Institute Entry & Infills	30,000		No
28	The Residence on Fifth	70,000	65,000	Yes
29	North of Fifth Multi-Use Renovation	25,000	22,000	Yes
30	North of Fifth Multi-Use Building	120,000	98,000	Yes
Total		**3,707,500**	**1,166,000**	**31%**

Table 2.1
Vehicular Site Access
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Proposed Conditions (Project Entry/Exit Points)	Signalized	Unsignalized	Proposed Access (Full or Restricted)	Notes
Frew Street and Hamerschlag Drive		X	Full Access (to be Restricted to Service Vehicles, Bicycles, and Pedestrians)	Hamerschlag Drive entrance permanently closed to all but service vehicles, bicycles, and pedestrians as part of Scaife Hall project
Tech Street, Margaret Morrison Street, and Fine Arts Lot Driveway		X	Full Access (Parking use to be restricted to event-only parking)	Fine Arts Lot to become special event parking only
Margaret Morrison Street and Donner/Margaret Morrison Driveway		X	Full Access	Donner Driveway will be modified as part of Donner Site or Margaret Morrison Expansion projects with existing surface parking replaced with underground parking
Margaret Morrison Street and Hill Dorms Driveway		X	Full Access	No changes anticipated to existing
Forbes Avenue at Beeler Street & East Campus Garage	X		Full Access	No changes anticipated to existing; garage capacity to be maintained
Forbes Avenue & Forbes-Beeler Driveway		X	Full Access	Forbes-Beeler residence hall project to be completed in 2023. Existing driveway will be reopened to serve 20 parking spaces
Forbes Avenue & Devon Rd / East Campus Garage		X	Restricted (No cross traffic, existing)	No changes anticipated to existing; garage capacity to be maintained in long-term condition
Forbes Avenue & Morewood Place / Greek Quad Driveway		X	Restricted (Entering only, existing)	Greek Quad redevelopment project may result in parking and circulation changes, though entry-only configuration from Forbes anticipated
Morewood Avenue & Morewood Place		X	Full Access	Reconfiguration of Morewood Lot; exit-only driveway assumed from Greek Quad redevelopment to match existing but full access may be considered
Forbes Avenue & Cyert Driveway		X	Full Access (to be Restricted to Service Vehicles, Bicycles, and Pedestrians)	Warner Hall Lot to be eliminated, driveway to be restricted to service vehicles
Forbes Avenue & Tepper Driveway	X		Full Access	Capacity of Tepper parking facilities to be increased with IMP project, driveway changes not anticipated
Forbes Avenue & Craig Street / Museum Driveway	X		Full Access	Planned redevelopment of CMU-owned Carnegie Museum and III lots as part of South of Forbes project
Neville Street, South Neville, and South of Forbes Proposed Driveway		X	Full Access	Proposed new driveway from Neville Street to future South of Forbes Garage; location to be determined but likely opposite South Neville Lot driveway. South Neville Lot to be reduced in capacity for FMS project.
Neville Street, Boundary Street, CIC Driveway		X	Full Access	Parking may be eliminated from Hamerschlag Drive (West Campus parking); railroad crossing improvements proposed
Filmore Street and Zebina Way		X	Full Access	Surface lot to be replaced with lower level structured parking in proposed academic building
Clyde Street at Fifth Clyde Residence Hall Driveway		X	Restricted (Left in Left Out)	Previous parking lot reduced to 20 spaces
Clyde Street at Clyde and Highlands Apartments Driveway		X	Restricted (Left in Left Out)	No changes proposed to existing
Craig Street & Whitfield Hall Driveway		X	Full Access	Potential driveway updates when existing building is to be updated or replaced

Table 3.1
Transit Routes
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Route	Operator	Peak Headway	Notes
P3	Port Authority	15 minutes	
28X	Port Authority	30 minutes	
58	Port Authority	1 hour	
61A, B, C, D	Port Authority	15 minutes	
71B, D	Port Authority	15 minutes	
75	Port Authority	25 minutes	
A	CMU	45 minutes	Morning hours
B	CMU	1 hour	Morning hours
AB	CMU	45 minutes	Afternoon hours
C	CMU	45 minutes	
PTC/MILL 19	CMU	1 hour	Mill 19 Shuttle does not run on weekends
Escort (On Demand)	CMU	45 minutes	Replaces shuttle routes for late night hours

Table 4.1
Trip Generation without TDM Mitigation (Full Buildout, 100% of Master Plan)
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Project Component				Trip Generation[3]			Existing On-Site Conditions		Future On-Site Conditions			Anticipated Trip Generation without TDM Mitigation, Maximum Buildout[1 2]														
												Total Trips		Entering Trips							Exiting Trips					
Number	Type	Description	Proposed Use	Land Use Code	Land Use Description	Independent Variable	Size (Sq. Ft.)	# of Beds	Max. Size (Sq. Ft.)	Max. # of Beds	Max Size, Net (Sq. Ft.) or Residents	Trip Type	Total (ITE)	Drive and Park 38% Academic 2% Residential	Drop-off & Rideshare 5% Academic 6% Residential	Transit 29% Academic 45% Residential	Walk 19% Academic 29% Residential	Bike 7% Academic 12% Residential	Other 2% Academic 6% Residential	Total Entering	Drive and Park 38% Academic 2% Residential	Drop-off & Rideshare 5% Academic 6% Residential	Transit 29% Academic 45% Residential	Walk 19% Academic 29% Residential	Bike 7% Academic 12% Residential	Other 2% Academic 6% Residential	Total Exiting
1	Facilities Operations Center	S Neville along Railroad	Parking, Utility, Office	170	Utility	1000 Sq. Ft. GFA			40,000 sf		40,000 sf	Weekday[4]	277	52	7	40	26	10	3	138	53	7	40	26	10	3	139
												AM Peak Hour	92	28	4	21	14	5	2	74	7	1	5	3	1	1	18
												PM Peak Hour	53	4	0	3	2	1	0	10	16	2	12	8	3	2	43
2	New Academic Building	FMS Building	Education, Laboratory / Research, Office, Restaurant, Utility	550	University/College	1000 Sq. Ft. GFA	48,000 sf		300,000 sf		252,000 sf	Weekday[4]	6,562	1,247	164	951	623	230	66	3,281	1,247	164	951	623	230	66	3,281
												AM Peak Hour	275	81	11	61	40	15	4	212	24	3	18	12	4	2	63
												PM Peak Hour	295	36	5	27	18	7	1	94	76	10	58	38	14	5	201
3	Academic Building Expansion	Hamburg & Smith Halls	Education, Laboratory / Research, Office, Restaurant	550	University/College	1000 Sq. Ft. GFA	22,000 sf		100,000 sf		78,000 sf	Weekday[4]	2,031	386	51	294	193	71	20	1,015	386	51	295	193	71	20	1,016
												AM Peak Hour	85	25	3	19	12	5	1	65	8	1	6	4	1	0	20
												PM Peak Hour	91	11	1	8	6	2	1	29	24	3	18	12	4	1	62
4	New Academic Building	Cyert & Warner Halls	Education, Laboratory / Research, Office, Parking, Restaurant	550	University/College	1000 Sq. Ft. GFA	110,000 sf		250,000 sf		140,000 sf	Weekday[4]	3,646	693	91	529	346	128	36	1,823	693	91	529	346	128	36	1,823
												AM Peak Hour	153	45	6	34	22	8	3	118	13	2	10	7	2	1	35
												PM Peak Hour	164	20	3	15	10	4	0	52	43	6	32	21	8	2	112
5	Academic Building Expansion	Purnell Center for the Arts	Education, Laboratory / Research, Office, Public Assembly	550	University/College	1000 Sq. Ft. GFA			30,000 sf		30,000 sf	Weekday[4]	781	148	20	113	74	27	8	390	149	20	113	74	27	8	391
												AM Peak Hour	33	10	1	7	5	2	0	25	3	0	2	2	1	0	8
												PM Peak Hour	35	4	1	3	2	1	0	11	9	1	7	5	2	0	24
6	Student Support Expansion	West Wing Addition	Education, Laboratory / Research, Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			5,000 sf		5,000 sf	Weekday[4]	130	25	3	19	12	5	1	65	25	3	19	12	5	1	65
												AM Peak Hour	5	2	0	1	1	0	0	4	0	0	0	0	0	1	1
												PM Peak Hour	6	1	0	1	0	0	0	2	2	0	1	1	0	0	4
7	Academic Building Expansion	Margaret Morrison Carnegie Hall	Education, Laboratory / Research, Office	550	University/College	1000 Sq. Ft. GFA			110,000 sf		110,000 sf	Weekday[4]	2,864	544	72	415	272	100	29	1,432	544	72	415	272	100	29	1,432
												AM Peak Hour	120	35	5	27	17	6	2	92	11	1	8	5	2	1	28
												PM Peak Hour	129	16	2	12	8	3	0	41	33	4	26	17	6	2	88
8	New Mixed Use Building	Donner Hall	Education, Laboratory / Research, Office, Parking, Restaurant / Student Housing	550	University/College	1000 Sq. Ft. GFA		241	266,000 sf	735	266,000 sf	Weekday[4]	6,927	69	208	1,558	1,004	416	208	3,463	69	208	1,559	1,005	416	207	3,464
												AM Peak Hour	290	4	13	100	65	27	14	223	1	4	30	19	8	5	67
												PM Peak Hour	311	2	6	45	29	12	5	99	4	13	95	61	25	14	212
9	Student Support Expansion	Hamerschlag House	Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			6,000 sf		6,000 sf	Weekday[4]	156	30	4	23	15	5	1	78	30	4	23	15	5	1	78
												AM Peak Hour	7	2	0	1	1	0	1	5	1	0	1	0	0	0	2
												PM Peak Hour	7	1	0	1	0	0	0	2	2	0	1	1	0	1	5
10	New Academic Building	Tepper School Expansion Site	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant	550	University/College	1000 Sq. Ft. GFA			180,000 sf		180,000 sf	Weekday[4]	4,687	890	117	679	445	164	48	2,343	891	117	680	445	164	47	2,344
												AM Peak Hour	196	57	8	44	29	11	2	151	17	2	13	9	3	1	45
												PM Peak Hour	211	25	3	19	13	5	2	67	55	7	42	27	10	3	144
11	New Mixed Use Building	Morewood Lot	Laboratory / Research, Office, Restaurant / Student Housing	550	University/College	1000 Sq. Ft. GFA			220,000 sf	500	220,000 sf	Weekday[4]	5,729	57	172	1,289	831	344	171	2,864	57	172	1,289	831	344	172	2,865
												AM Peak Hour	240	4	11	83	54	22	11	185	1	3	25	16	7	3	55
												PM Peak Hour	257	2	5	37	24	10	4	82	4	11	79	51	21	9	175
12	E Tower Commons	Morewood E Tower	Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			6,000 sf		6,000 sf	Weekday[4]	156	30	4	23	15	5	1	78	30	4	23	15	5	1	78
												AM Peak Hour	7	2	0	1	1	0	1	5	1	0	1	0	0	0	2
												PM Peak Hour	7	1	0	1	0	0	0	2	2	0	1	1	0	1	5
13	New Mixed Use Building	Capstone site at Forbes & Morewood	Education, Laboratory / Research, Office, Parking, Student Housing, Restaurant	550	University/College	1000 Sq. Ft. GFA			200,000 sf	300	200,000 sf	Weekday[4]	5,208	52	156	1,172	755	312	157	2,604	52	156	1,172	755	312	157	2,604
												AM Peak Hour	218	3	10	76	49	20	10	168	1	3	23	15	6	2	50
												PM Peak Hour	234	2	5	34	22	9	3	75	3	10	72	46	19	9	159
14	New Residential Building(s)	Greek Quad	Office, Parking, Student Housing	550	University/College	1000 Sq. Ft. GFA		384	250,000 sf	720	250,000 sf	Weekday[4]	6,510	65	195	1,465	944	391	195	3,255	65	195	1,465	944	391	195	3,255
												AM Peak Hour	273	4	13	95	61	25	12	210	1	4	28	18	8	4	63
												PM Peak Hour	293	2	6	42	27	11	6	94	4	12	90	58	24	11	199
15	New Residential Building	Forbes & Devon	Office, Student Housing	550	University/College	1000 Sq. Ft. GFA			40,000 sf	180	40,000 sf	Weekday[4]	1,042	10	31	234	151	63	32	521	10	31	234	151	63	32	521
												AM Peak Hour	44	1	2	15	10	4	2	34	0	1	5	3	1	0	10
												PM Peak Hour	47	0	1	7	4	2	1	15	1	2	14	9	4	2	32
16	Shirley Apartments	Shirley Apartments	Office, Parking, Student Housing	225	Off-Campus Student Apartment	Residents		20	20,000 sf	20	20	Weekday[4]	221	2	7	50	32	13	6	110	2	7	50	32	13	7	111
												AM Peak Hour	6	0	0	1	1	0	0	2	0	0	2	1	0	1	4
												PM Peak Hour	31	0	1	7	4	2	1	15	0	1	7	5	2	1	16
17	New Residential Building	Whitfield Hall	Office, Parking, Student Housing	225	Off-Campus Student Apartment	Residents	4,000 sf		160,000 sf	165	165	Weekday[4]	857	9	26	193	124	51	25	428	9	26	193	124	51	26	429
												AM Peak Hour	28	0	1	5	3	1	1	11	0	1	8	5	2	1	17
												PM Peak Hour	63	1	2	14	9	4	1	31	1	2	14	9	4	2	32
18	Academic Building Expansion	Mellon Institute	Education, Laboratory / Research	550	University/College	1000 Sq. Ft. GFA			30,000 sf		30,000 sf	Weekday[4]	781	148	20	113	74	27	8	390	149	20	113	74	27	8	391
												AM Peak Hour	33	10	1	7	5	2	0	25	3	0	2	2	1	0	8
												PM Peak Hour	35	4	1	3	2	1	0	11	9	1	7	5	2	0	24
19	New Academic Building	North of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Restaurant, Retail	550	University/College	1000 Sq. Ft. GFA	49,000 sf		230,000 sf		181,000 sf	Weekday[4]	4,713	895	118	683	448	165	47	2,356	896	118	684	448	165	46	2,357
												AM Peak Hour	197	58	8	44	29	11	2	152	17	2	13	9	3	1	45
												PM Peak Hour	212	26	3	20	13	5	1	68	55	7	42	27	10	3	144
20	New Academic Building	South of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant, Retail	550	University/College	1000 Sq. Ft. GFA	2,700 sf		425,000 sf		422,300 sf	Weekday[4]	10,997	2,089	275	1,594	1,045	385	110	5,498	2,090	275	1,595	1,045	385	109	5,499
												AM Peak Hour	460	135	18	103	67	25	6	354	40	5	31	20	7	3	106
												PM Peak Hour	494	60	8	46	30	11	3	158	128	17	97	64	24	6	336
Total							**235,700 sf**	**645**	**2,868,000 sf**	**2620**	**2,456,485 sf**	**Total Weekday[4]**	**64275**	**7,441**	**1,741**	**11,437**	**7,429**	**2,912**	**1,172**	**32,132**	**7,447**	**1,741**	**11,442**	**7,430**	**2,912**	**1,171**	**32,143**
												Total AM	**2,762**	**506**	**115**	**745**	**486**	**189**	**74**	**2,115**	**149**	**33**	**231**	**150**	**57**	**27**	**647**
												Total PM	**2,975**	**218**	**53**	**345**	**223**	**90**	**29**	**958**	**471**	**109**	**715**	**466**	**182**	**74**	**2,017**

1. Trip generation based on maximum buildout of all projects proposed in the 2022-2032 Institutional Master Plan.
2. Mode share based on 2018 Parking Master Plan survey results for Employee and Student trips. Residence hall trips are based on student mode share and all other mode share based on employee trips.
3. All on-campus buildings estimated with the University/College ITE land use code, except for the Facilities Operation Center and the campus-owned apartments beyond the contiguous EMI District.
4. ITE-calculated weekday trip generation numbers are not representative of anticipated conditions, since ITE data was based on only one data collection sample.

Table 4.2
Trip Generation without TDM Mitigation (Anticipated Buildout, 50% of Master Plan)
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Project Component				Trip Generation[3]			Existing On-Site Conditions		Future On-Site Conditions				Anticipated Trip Generation without TDM Mitigation, 50% Buildout[1 2]															
													Total Trips		Entering Trips							Exiting Trips						
Number	Type	Description	Proposed Use	Land Use Code	Land Use Description	Independent Variable	Size (Sq. Ft.)	# of Beds	Max. Size (Sq. Ft.)	50% Size (Sq. Ft.)	Max. # of Beds	Max Size, Net (Sq. Ft.) or Residents	Trip Type	Total (ITE)	Drive and Park 38% Academic 2% Residential	Drop-off & Rideshare 5% Academic 6% Residential	Transit 29% Academic 45% Residential	Walk 19% Academic 29% Residential	Bike 7% Academic 12% Residential	Other 2% Academic 6% Residential	Total Entering	Drive and Park 38% Academic 2% Residential	Drop-off & Rideshare 5% Academic 6% Residential	Transit 29% Academic 45% Residential	Walk 19% Academic 29% Residential	Bike 7% Academic 12% Residential	Other 2% Academic 6% Residential	Total Exiting
1	Facilities Operations Center	S Neville along Railroad	Parking, Utility, Office	170	Utility	1000 Sq. Ft. GFA			40,000 sf	20,000 sf		20,000 sf	Weekday[4]	160	30	4	23	15	6	2	80	30	4	23	15	6	2	80
													AM Peak Hour	46	14	2	11	7	3	0	37	3	0	3	2	1	0	9
													PM Peak Hour	30	2	0	2	1	0	1	6	9	1	7	5	2	0	24
2	New Academic Building	FMS Building	Education, Laboratory / Research, Office, Restaurant, Utility	550	University/College	1000 Sq. Ft. GFA	48,000 sf		300,000 sf	150,000 sf		102,000 sf	Weekday[4]	2,656	505	66	385	252	93	27	1,328	505	66	385	252	93	27	1,328
													AM Peak Hour	111	32	4	25	16	6	2	85	10	1	8	5	2	0	26
													PM Peak Hour	119	14	2	11	7	3	1	38	31	4	23	15	6	2	81
3	Academic Building Expansion	Hamburg & Smith Halls	Education, Laboratory / Research, Office, Restaurant	550	University/College	1000 Sq. Ft. GFA	22,000 sf		100,000 sf	50,000 sf		28,000 sf	Weekday[4]	729	138	18	106	69	25	8	364	139	18	106	69	26	7	365
													AM Peak Hour	31	9	1	7	5	2	0	24	3	0	2	1	0	1	7
													PM Peak Hour	33	4	0	3	2	1	0	10	9	1	7	4	2	0	23
4	New Academic Building	Cyert & Warner Halls	Education, Laboratory / Research, Office, Parking, Restaurant	550	University/College	1000 Sq. Ft. GFA	110,000 sf		250,000 sf	125,000 sf		15,000 sf	Weekday[4]	391	74	10	57	37	14	3	195	74	10	57	37	14	4	196
													AM Peak Hour	16	5	1	3	2	1	0	12	2	0	1	1	0	0	4
													PM Peak Hour	18	2	0	2	1	0	1	6	5	1	3	2	1	0	12
5	Academic Building Expansion	Purnell Center for the Arts	Education, Laboratory / Research, Office, Public Assembly	550	University/College	1000 Sq. Ft. GFA			30,000 sf	15,000 sf		15,000 sf	Weekday[4]	391	74	10	57	37	14	3	195	74	10	57	37	14	4	196
													AM Peak Hour	16	5	1	3	2	1	0	12	2	0	1	1	0	0	4
													PM Peak Hour	18	2	0	2	1	0	1	6	5	1	3	2	1	0	12
6	Student Support Expansion	West Wing Addition	Education, Laboratory / Research, Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			5,000 sf	2,500 sf		2,500 sf	Weekday[4]	65	12	2	9	6	2	1	32	13	2	10	6	2	0	33
													AM Peak Hour	3	1	0	1	0	0	0	2	0	0	0	0	0	1	1
													PM Peak Hour	3	0	0	0	0	0	1	1	1	0	1	0	0	0	2
7	Academic Building Expansion	Margaret Morrison Carnegie Hall	Education, Laboratory / Research, Office	550	University/College	1000 Sq. Ft. GFA			110,000 sf	55,000 sf		55,000 sf	Weekday[4]	1,432	272	36	208	136	50	14	716	272	36	208	136	50	14	716
													AM Peak Hour	60	17	2	13	9	3	2	46	5	1	4	3	1	0	14
													PM Peak Hour	64	8	1	6	4	1	0	20	17	2	13	8	3	1	44
8	New Mixed Use Building	Donner Hall	Education, Laboratory / Research, Office, Parking, Restaurant / Student Housing	550	University/College	1000 Sq. Ft. GFA		241	266,000 sf	133,000 sf	735	133,000 sf	Weekday[4]	3,463	35	104	779	502	208	103	1,731	35	104	779	502	208	104	1,732
													AM Peak Hour	145	2	7	50	32	13	8	112	1	2	15	10	4	1	33
													PM Peak Hour	156	1	3	23	15	6	2	50	2	6	48	31	13	6	106
9	Student Support Expansion	Hamerschlag House	Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			6,000 sf	3,000 sf		3,000 sf	Weekday[4]	78	15	2	11	7	3	1	39	15	2	11	7	3	1	39
													AM Peak Hour	3	1	0	1	0	0	0	2	0	0	0	0	0	1	1
													PM Peak Hour	4	0	0	0	0	0	1	1	1	0	1	1	0	0	3
10	New Academic Building	Tepper School Expansion Site	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant	550	University/College	1000 Sq. Ft. GFA			180,000 sf	90,000 sf		90,000 sf	Weekday[4]	2,344	445	59	340	223	82	23	1,172	445	59	340	223	82	23	1,172
													AM Peak Hour	98	29	4	22	14	5	1	75	9	1	7	4	2	0	23
													PM Peak Hour	105	13	2	10	6	2	0	33	27	4	21	14	5	1	72
11	New Mixed Use Building	Morewood Lot	Laboratory / Research, Office, Restaurant / Student Housing	550	University/College	1000 Sq. Ft. GFA			220,000 sf	110,000 sf	500	110,000 sf	Weekday[4]	2,864	29	86	644	415	172	86	1,432	29	86	644	415	172	86	1,432
													AM Peak Hour	120	2	6	41	27	11	5	92	1	2	13	8	3	1	28
													PM Peak Hour	129	1	2	18	12	5	3	41	2	5	40	26	11	4	88
12	E Tower Commons	Morewood E Tower	Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			6,000 sf	3,000 sf		3,000 sf	Weekday[4]	78	15	2	11	7	3	1	39	15	2	11	7	3	1	39
													AM Peak Hour	3	1	0	1	0	0	0	2	0	0	0	0	0	1	1
													PM Peak Hour	4	0	0	0	0	0	1	1	1	0	1	1	0	0	3
13	New Mixed Use Building	Capstone site at Forbes & Morewood	Education, Laboratory / Research, Office, Parking, Student Housing, Restaurant	550	University/College	1000 Sq. Ft. GFA			200,000 sf	100,000 sf	300	100,000 sf	Weekday[4]	2,604	26	78	586	378	156	78	1,302	26	78	586	378	156	78	1,302
													AM Peak Hour	109	2	5	38	24	10	5	84	1	2	11	7	3	1	25
													PM Peak Hour	117	1	2	17	11	4	2	37	2	5	36	23	10	4	80
14	New Residential Building(s)	Greek Quad	Office, Parking, Student Housing	550	University/College	1000 Sq. Ft. GFA		384	250,000 sf	125,000 sf	720	125,000 sf	Weekday[4]	3,255	33	98	732	472	195	97	1,627	33	98	733	472	195	97	1,628
													AM Peak Hour	136	2	6	47	30	13	7	105	1	2	14	9	4	1	31
													PM Peak Hour	146	1	3	21	14	6	2	47	2	6	45	29	12	5	99
15	New Residential Building	Forbes & Devon	Office, Student Housing	550	University/College	1000 Sq. Ft. GFA			40,000 sf	20,000 sf	180	20,000 sf	Weekday[4]	521	5	16	117	75	31	16	260	5	16	117	76	31	16	261
													AM Peak Hour	22	0	1	8	5	2	1	17	0	0	2	1	1	1	5
													PM Peak Hour	23	0	0	3	2	1	1	7	0	1	7	5	2	1	16
16	Shirley Apartments	Shirley Apartments	Office, Parking, Student Housing	225	Off-Campus Student Apartment	Residents		20	20,000 sf	10,000 sf	20	20	Weekday[4]	221	2	7	50	32	13	6	110	2	7	50	32	13	7	111
													AM Peak Hour	6	0	0	1	1	0	0	2	0	0	2	1	0	1	4
													PM Peak Hour	31	0	1	7	4	2	1	15	0	1	7	5	2	1	16
17	New Residential Building	Whitfield Hall	Office, Parking, Student Housing	225	Off-Campus Student Apartment	Residents	4,000 sf		160,000 sf	80,000 sf	165	165	Weekday[4]	857	9	26	193	124	51	25	428	9	26	193	124	51	26	429
													AM Peak Hour	28	0	1	5	3	1	1	11	0	1	8	5	2	1	17
													PM Peak Hour	63	1	2	14	9	4	1	31	1	2	14	9	4	2	32
18	Academic Building Expansion	Mellon Institute	Education, Laboratory / Research	550	University/College	1000 Sq. Ft. GFA			30,000 sf	15,000 sf		15,000 sf	Weekday[4]	391	74	10	57	37	14	3	195	74	10	57	37	14	4	196
													AM Peak Hour	16	5	1	3	2	1	0	12	2	0	1	1	0	0	4
													PM Peak Hour	18	2	0	2	1	0	1	6	5	1	3	2	1	0	12
19	New Academic Building	North of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Restaurant, Retail	550	University/College	1000 Sq. Ft. GFA	49,000 sf		230,000 sf	115,000 sf		66,000 sf	Weekday[4]	1,719	326	43	249	163	60	18	859	327	43	249	163	60	18	860
													AM Peak Hour	72	21	3	16	10	4	1	55	6	1	5	3	1	1	17
													PM Peak Hour	77	9	1	7	5	2	0	24	20	3	15	10	4	1	53
20	New Academic Building	South of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant, Retail	550	University/College	1000 Sq. Ft. GFA	2,700 sf		425,000 sf	212,500 sf		209,800 sf	Weekday[4]	5,442	1,034	136	789	517	190	55	2,721	1,034	136	789	517	190	55	2,721
													AM Peak Hour	228	67	9	51	33	12	3	175	20	3	15	10	4	1	53
													PM Peak Hour	245	30	4	23	15	5	1	78	63	8	48	32	12	4	167
Total							**235,700 sf**	**645**	**2,868,000 sf**	**1,434,000 sf**	**2620**	**1,112,485 sf**	**Total Weekday[4]**	**29,661**	**3,153**	**813**	**5,403**	**3,504**	**1,382**	**570**	**14,825**	**3,156**	**813**	**5,405**	**3,505**	**1,383**	**574**	**14,836**
													Total AM	**1,269**	**215**	**54**	**347**	**222**	**88**	**36**	**962**	**66**	**16**	**112**	**72**	**28**	**13**	**307**
													Total PM	**1,403**	**91**	**23**	**171**	**110**	**42**	**21**	**458**	**203**	**52**	**343**	**224**	**91**	**32**	**945**

1. Trip generation based on 50% of full buildout as proposed in the 2022-2032 Institutional Master Plan. Under 1/3 of full buildout development square footage was realized from the 2012-2022 master plan, as buildings were built below maximum massing and some projects deferred or cancelled. A 50% assumption is assumed to be a conservative estimate. (Off campus residence halls are excluded from the reduction).
2. Mode share based on 2018 Parking Master Plan survey results for Employee and Student trips. Residence hall trips are based on student mode share and all other mode share based on employee trips.
3. All on-campus buildings estimated with the University/College ITE land use code, except for the Facilities Operation Center and the campus-owned apartments beyond the contiguous EMI District.
4. ITE-calculated weekday trip generation numbers are not representative of anticipated conditions, since ITE data was based on only one data collection sample

Table 4.3
Trip Generation with TDM Mitigation (Full Buildout, 100% of Master Plan)
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Project Component				Trip Generation[3]			Existing On-Site Conditions		Future On-Site Conditions			Anticipated Trip Generation with TDM Mitigation, Maximum Buildout[1 2]															
												Total Trips		Entering Trips							Exiting Trips						
Number	Type	Description	Proposed Use	Land Use Code	Land Use Description	Independent Variable	Size (Sq. Ft.)	# of Beds	Max. Size (Sq. Ft.)	Max. # of Beds	Max Size, Net (Sq. Ft.) or Residents	Trip Type	Total (ITE)	Drive and Park *30% Academic 2% Residential*	Drop-off & Rideshare *7% Academic 6% Residential*	Transit *30% Academic 45% Residential*	Walk *19% Academic 29% Residential*	Bike *9% Academic 12% Residential*	Other *5% Academic 6% Residential*	Total Entering	Drive and Park *30% Academic 2% Residential*	Drop-off & Rideshare *7% Academic 6% Residential*	Transit *30% Academic 45% Residential*	Walk *19% Academic 29% Residential*	Bike *9% Academic 12% Residential*	Other *5% Academic 6% Residential*	Total Exiting
1	Facilities Operations Center	S Neville along Railroad	Parking, Utility, Office	170	Utility	1000 Sq. Ft. GFA			40,000 sf		40,000 sf	Weekday[4]	277	41	10	41	26	12	8	138	42	10	42	26	13	6	139
												AM Peak Hour	92	22	5	22	14	7	4	74	5	1	5	3	2	2	18
												PM Peak Hour	53	3	1	3	2	1	0	10	13	3	13	8	4	2	43
2	New Academic Building	FMS Building	Education, Laboratory / Research, Office, Restaurant, Utility	550	University/College	1000 Sq. Ft. GFA	48,000 sf		300,000 sf		252,000 sf	Weekday[4]	6,562	984	230	984	623	295	165	3,281	984	230	984	623	295	165	3,281
												AM Peak Hour	275	64	15	64	40	19	10	212	19	4	19	12	6	3	63
												PM Peak Hour	295	28	7	28	18	8	5	94	60	14	60	38	18	11	201
3	Academic Building Expansion	Hamburg & Smith Halls	Education, Laboratory / Research, Office, Restaurant	550	University/College	1000 Sq. Ft. GFA	22,000 sf		100,000 sf		78,000 sf	Weekday[4]	2,031	305	71	305	193	91	50	1,015	305	71	305	193	91	51	1,016
												AM Peak Hour	85	20	5	20	12	6	2	65	6	1	6	4	2	1	20
												PM Peak Hour	91	9	2	9	6	3	0	29	19	4	19	12	6	2	62
4	New Academic Building	Cyert & Warner Halls	Education, Laboratory / Research, Office, Parking, Restaurant	550	University/College	1000 Sq. Ft. GFA	110,000 sf		250,000 sf		140,000 sf	Weekday[4]	3,646	547	128	547	346	164	91	1,823	547	128	547	346	164	91	1,823
												AM Peak Hour	153	35	8	35	22	11	7	118	11	2	11	7	3	1	35
												PM Peak Hour	164	16	4	16	10	5	1	52	34	8	34	21	10	5	112
5	Academic Building Expansion	Purnell Center for the Arts	Education, Laboratory / Research, Office, Public Assembly	550	University/College	1000 Sq. Ft. GFA			30,000 sf		30,000 sf	Weekday[4]	781	117	27	117	74	35	20	390	117	27	117	74	35	21	391
												AM Peak Hour	33	8	2	8	5	2	0	25	2	1	2	2	1	0	8
												PM Peak Hour	35	3	1	3	2	1	1	11	7	2	7	5	2	1	24
6	Student Support Expansion	West Wing Addition	Education, Laboratory / Research, Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			5,000 sf		5,000 sf	Weekday[4]	130	20	5	20	12	6	2	65	20	5	20	12	6	2	65
												AM Peak Hour	5	1	0	1	1	0	1	4	0	0	0	0	0	1	1
												PM Peak Hour	6	1	0	1	0	0	0	2	1	0	1	1	0	1	4
7	Academic Building Expansion	Margaret Morrison Carnegie Hall	Education, Laboratory / Research, Office	550	University/College	1000 Sq. Ft. GFA			110,000 sf		110,000 sf	Weekday[4]	2,864	430	100	430	272	129	71	1,432	430	100	430	272	129	71	1,432
												AM Peak Hour	120	28	6	28	17	8	5	92	8	2	8	5	3	2	28
												PM Peak Hour	129	12	3	12	8	4	2	41	26	6	26	17	8	5	88
8	New Mixed Use Building	Donner Hall	Education, Laboratory / Research, Office, Parking, Restaurant / Student Housing	550	University/College	1000 Sq. Ft. GFA		241	266,000 sf	735	266,000 sf	Weekday[4]	6,927	69	208	1,558	1,004	416	208	3,463	69	208	1,559	1,005	416	207	3,464
												AM Peak Hour	290	4	13	100	65	27	14	223	1	4	30	19	8	5	67
												PM Peak Hour	311	2	6	45	29	12	5	99	4	13	95	61	25	14	212
9	Student Support Expansion	Hamerschlag House	Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			6,000 sf		6,000 sf	Weekday[4]	156	23	5	23	15	7	5	78	23	5	23	15	7	5	78
												AM Peak Hour	7	2	0	2	1	0	0	5	1	0	1	0	0	0	2
												PM Peak Hour	7	1	0	1	0	0	0	2	2	0	2	1	0	0	5
10	New Academic Building	Tepper School Expansion Site	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant	550	University/College	1000 Sq. Ft. GFA			180,000 sf		180,000 sf	Weekday[4]	4,687	703	164	703	445	211	117	2,343	703	164	703	445	211	118	2,344
												AM Peak Hour	196	45	11	45	29	14	7	151	14	3	14	9	4	1	45
												PM Peak Hour	211	20	5	20	13	6	3	67	43	10	43	27	13	8	144
11	New Mixed Use Building	Morewood Lot	Laboratory / Research, Office, Restaurant / Student Housing	550	University/College	1000 Sq. Ft. GFA			220,000 sf	500	220,000 sf	Weekday[4]	5,729	57	172	1,289	831	344	171	2,864	57	172	1,289	831	344	172	2,865
												AM Peak Hour	240	4	11	83	54	22	11	185	1	3	25	16	7	3	55
												PM Peak Hour	257	2	5	37	24	10	4	82	4	11	79	51	21	9	175
12	E Tower Commons	Morewood E Tower	Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			6,000 sf		6,000 sf	Weekday[4]	156	23	5	23	15	7	5	78	23	5	23	15	7	5	78
												AM Peak Hour	7	2	0	2	1	0	0	5	1	0	1	0	0	0	2
												PM Peak Hour	7	1	0	1	0	0	0	2	2	0	2	1	0	0	5
13	New Mixed Use Building	Capstone site at Forbes & Morewood	Education, Laboratory / Research, Office, Parking, Student Housing, Restaurant	550	University/College	1000 Sq. Ft. GFA			200,000 sf	300	200,000 sf	Weekday[4]	5,208	52	156	1,172	755	312	157	2,604	52	156	1,172	755	312	157	2,604
												AM Peak Hour	218	3	10	76	49	20	10	168	1	3	23	15	6	2	50
												PM Peak Hour	234	2	5	34	22	9	3	75	3	10	72	46	19	9	159
14	New Residential Building(s)	Greek Quad	Office, Parking, Student Housing	550	University/College	1000 Sq. Ft. GFA		384	250,000 sf	720	250,000 sf	Weekday[4]	6,510	65	195	1,465	944	391	195	3,255	65	195	1,465	944	391	195	3,255
												AM Peak Hour	273	4	13	95	61	25	12	210	1	4	28	18	8	4	63
												PM Peak Hour	293	2	6	42	27	11	6	94	4	12	90	58	24	11	199
15	New Residential Building	Forbes & Devon	Office, Student Housing	550	University/College	1000 Sq. Ft. GFA			40,000 sf	180	40,000 sf	Weekday[4]	1,042	10	31	234	151	63	32	521	10	31	234	151	63	32	521
												AM Peak Hour	44	1	2	15	10	4	2	34	0	1	5	3	1	0	10
												PM Peak Hour	47	0	1	7	4	2	1	15	1	2	14	9	4	2	32
16	Shirley Apartments	Shirley Apartments	Office, Parking, Student Housing	225	Off-Campus Student Apartment	Residents		20	20,000 sf	20	20	Weekday[4]	221	2	7	50	32	13	6	110	2	7	50	32	13	7	111
												AM Peak Hour	6	0	0	1	1	0	0	2	0	0	2	1	0	1	4
												PM Peak Hour	31	0	1	7	4	2	1	15	0	1	7	5	2	1	16
17	New Residential Building	Whitfield Hall	Office, Parking, Student Housing	225	Off-Campus Student Apartment	Residents	4,000 sf		160,000 sf	165	165	Weekday[4]	857	9	26	193	124	51	25	428	9	26	193	124	51	26	429
												AM Peak Hour	28	0	1	5	3	1	1	11	0	1	8	5	2	1	17
												PM Peak Hour	63	1	2	14	9	4	1	31	1	2	14	9	4	2	32
18	Academic Building Expansion	Mellon Institute	Education, Laboratory / Research	550	University/College	1000 Sq. Ft. GFA			30,000 sf		30,000 sf	Weekday[4]	781	117	27	117	74	35	20	390	117	27	117	74	35	21	391
												AM Peak Hour	33	8	2	8	5	2	0	25	2	1	2	2	1	0	8
												PM Peak Hour	35	3	1	3	2	1	1	11	7	2	7	5	2	1	24
19	New Academic Building	North of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Restaurant, Retail	550	University/College	1000 Sq. Ft. GFA	49,000 sf		230,000 sf		181,000 sf	Weekday[4]	4,713	707	165	707	448	212	117	2,356	707	165	707	448	212	118	2,357
												AM Peak Hour	197	46	11	46	29	14	6	152	14	3	14	9	4	1	45
												PM Peak Hour	212	20	5	20	13	6	4	68	43	10	43	27	13	8	144
20	New Academic Building	South of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant, Retail	550	University/College	1000 Sq. Ft. GFA	2,700 sf		425,000 sf		422,300 sf	Weekday[4]	10,997	1,649	385	1,649	1,045	495	275	5,498	1,650	385	1,650	1,045	495	274	5,499
												AM Peak Hour	460	106	25	106	67	32	18	354	32	7	32	20	10	5	106
												PM Peak Hour	494	47	11	47	30	14	9	158	101	24	101	64	30	16	336
Total							**235,700 sf**	**645**	**2,868,000 sf**	**2620**	**2,456,485 sf**	**Total Weekday[4]**	**64275**	**5,930**	**2,117**	**11,627**	**7,429**	**3,289**	**1,740**	**32,132**	**5,932**	**2,117**	**11,630**	**7,430**	**3,290**	**1,744**	**32,143**
												Total AM	**2,762**	**403**	**140**	**762**	**486**	**214**	**110**	**2,115**	**119**	**41**	**236**	**150**	**68**	**33**	**647**
												Total PM	**2,975**	**173**	**66**	**350**	**223**	**99**	**47**	**958**	**375**	**134**	**729**	**466**	**205**	**108**	**2,017**

1. Trip generation based on maximum buildout of all projects proposed in the 2022-2032 Institutional Master Plan.
2. Mode share based on IMP Mobility Goals for Employee trips and 2018 Parking Master Plan survey results for Student trips (On and off-campus residence hall trips).
3. All on-campus buildings estimated with the University/College ITE land use code, except for the Facilities Operation Center and the campus-owned apartments beyond the contiguous EMI District.
4. ITE-calculated weekday trip generation numbers are not representative of anticipated conditions, since ITE data was based on only one data collection sample.

Table 4.4
Trip Generation with TDM Mitigation (Anticipated Buildout, 50% of Master Plan)
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Project Component				Trip Generation[3]			Existing On-Site Conditions		Future On-Site Conditions				Anticipated Trip Generation with TDM Mitigation, 50% Buildout[1,2]															
													Total Trips		Entering Trips							Exiting Trips						
Number	Type	Description	Proposed Use	Land Use Code	Land Use Description	Independent Variable	Size (Sq. Ft.)	# of Beds	Max. Size (Sq. Ft.)	50% Size (Sq. Ft.)	Max. # of Beds	Max Size, Net (Sq. Ft.) or Residents	Trip Type	Total (ITE)	Drive and Park 30% Academic 2% Residential	Drop-off & Rideshare 7% Academic 6% Residential	Transit 30% Academic 45% Residential	Walk 19% Academic 29% Residential	Bike 9% Academic 12% Residential	Other 5% Academic 6% Residential	Total Entering	Drive and Park 30% Academic 2% Residential	Drop-off & Rideshare 7% Academic 6% Residential	Transit 30% Academic 45% Residential	Walk 19% Academic 29% Residential	Bike 9% Academic 12% Residential	Other 5% Academic 6% Residential	Total Exiting
1	Facilities Operations Center	S Neville along Railroad	Parking, Utility, Office	170	Utility	1000 Sq. Ft. GFA			40,000 sf	20,000 sf		20,000 sf	Weekday[4]	160	24	6	24	15	7	4	80	24	6	24	15	7	4	80
													AM Peak Hour	46	11	3	11	7	3	2	37	3	0	3	2	1	0	9
													PM Peak Hour	30	2	0	2	1	1	0	6	7	2	7	5	2	1	24
2	New Academic Building	FMS Building	Education, Laboratory / Research, Office, Restaurant, Utility	550	University/College	1000 Sq. Ft. GFA	48,000 sf		300,000 sf	150,000 sf		102,000 sf	Weekday[4]	2,656	398	93	398	252	120	67	1,328	398	93	398	252	120	67	1,328
													AM Peak Hour	111	26	6	26	16	8	3	85	8	2	8	5	2	1	26
													PM Peak Hour	119	11	3	11	7	3	3	38	24	6	24	15	7	5	81
3	Academic Building Expansion	Hamburg & Smith Halls	Education, Laboratory / Research, Office, Restaurant	550	University/College	1000 Sq. Ft. GFA	22,000 sf		100,000 sf	50,000 sf		28,000 sf	Weekday[4]	729	109	25	109	69	33	19	364	110	26	110	69	33	17	365
													AM Peak Hour	31	7	2	7	5	2	1	24	2	1	2	1	1	0	7
													PM Peak Hour	33	3	1	3	2	1	0	10	7	2	7	4	2	1	23
4	New Academic Building	Cyert & Warner Halls	Education, Laboratory / Research, Office, Parking, Restaurant	550	University/College	1000 Sq. Ft. GFA	110,000 sf		250,000 sf	125,000 sf		15,000 sf	Weekday[4]	391	59	14	59	37	18	8	195	59	14	59	37	18	9	196
													AM Peak Hour	16	4	1	4	2	1	0	12	1	0	1	1	1	0	4
													PM Peak Hour	18	2	0	2	1	1	0	6	4	1	4	2	1	0	12
5	Academic Building Expansion	Purnell Center for the Arts	Education, Laboratory / Research, Office, Public Assembly	550	University/College	1000 Sq. Ft. GFA			30,000 sf	15,000 sf		15,000 sf	Weekday[4]	391	59	14	59	37	18	8	195	59	14	59	37	18	9	196
													AM Peak Hour	16	4	1	4	2	1	0	12	1	1	1	1	0	0	4
													PM Peak Hour	18	2	0	2	1	1	0	6	4	1	4	2	1	0	12
6	Student Support Expansion	West Wing Addition	Education, Laboratory / Research, Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			5,000 sf	2,500 sf		2,500 sf	Weekday[4]	65	10	2	10	6	3	1	32	10	2	10	6	3	2	33
													AM Peak Hour	3	1	0	1	0	0	0	2	1	0	0	0	0	0	1
													PM Peak Hour	3	1	0	0	0	0	0	1	1	0	1	0	0	0	2
7	Academic Building Expansion	Margaret Morrison Carnegie Hall	Education, Laboratory / Research, Office	550	University/College	1000 Sq. Ft. GFA			110,000 sf	55,000 sf		55,000 sf	Weekday[4]	1,432	215	50	215	136	64	36	716	215	50	215	136	64	36	716
													AM Peak Hour	60	14	3	14	9	4	2	46	4	1	4	3	1	1	14
													PM Peak Hour	64	6	1	6	4	2	1	20	13	3	13	8	4	3	44
8	New Mixed Use Building	Donner Hall	Education, Laboratory / Research, Office, Parking, Restaurant / Student Housing	550	University/College	1000 Sq. Ft. GFA		241	266,000 sf	133,000 sf	735	133,000 sf	Weekday[4]	3,463	35	104	779	502	208	103	1,731	35	104	779	502	208	104	1,732
													AM Peak Hour	145	2	7	50	32	13	8	112	1	2	15	10	4	1	33
													PM Peak Hour	156	1	3	23	15	6	2	50	2	6	48	31	13	6	106
9	Student Support Expansion	Hamerschlag House	Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			6,000 sf	3,000 sf		3,000 sf	Weekday[4]	78	12	3	12	7	4	1	39	12	3	12	7	4	1	39
													AM Peak Hour	3	1	0	1	0	0	0	2	1	0	0	0	0	0	1
													PM Peak Hour	4	1	0	0	0	0	0	1	1	0	1	1	0	0	3
10	New Academic Building	Tepper School Expansion Site	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant	550	University/College	1000 Sq. Ft. GFA			180,000 sf	90,000 sf		90,000 sf	Weekday[4]	2,344	352	82	352	223	105	58	1,172	352	82	352	223	105	58	1,172
													AM Peak Hour	98	23	5	23	14	7	3	75	7	2	7	4	2	1	23
													PM Peak Hour	105	10	2	10	6	3	2	33	22	5	22	14	6	3	72
11	New Mixed Use Building	Morewood Lot	Laboratory / Research, Office, Restaurant / Student Housing	550	University/College	1000 Sq. Ft. GFA			220,000 sf	110,000 sf	500	110,000 sf	Weekday[4]	2,864	29	86	644	415	172	86	1,432	29	86	644	415	172	86	1,432
													AM Peak Hour	120	2	6	41	27	11	5	92	1	2	13	8	3	1	28
													PM Peak Hour	129	1	2	18	12	5	3	41	2	5	40	26	11	4	88
12	E Tower Commons	Morewood E Tower	Office, Restaurant	550	University/College	1000 Sq. Ft. GFA			6,000 sf	3,000 sf		3,000 sf	Weekday[4]	78	12	3	12	7	4	1	39	12	3	12	7	4	1	39
													AM Peak Hour	3	1	0	1	0	0	0	2	1	0	0	0	0	0	1
													PM Peak Hour	4	1	0	0	0	0	0	1	1	0	1	1	0	0	3
13	New Mixed Use Building	Capstone site at Forbes & Morewood	Education, Laboratory / Research, Office, Parking, Student Housing, Restaurant	550	University/College	1000 Sq. Ft. GFA			200,000 sf	100,000 sf	300	100,000 sf	Weekday[4]	2,604	26	78	586	378	156	78	1,302	26	78	586	378	156	78	1,302
													AM Peak Hour	109	2	5	38	24	10	5	84	1	2	11	7	3	1	25
													PM Peak Hour	117	1	2	17	11	4	2	37	2	5	36	23	10	4	80
14	New Residential Building(s)	Greek Quad	Office, Parking, Student Housing	550	University/College	1000 Sq. Ft. GFA		384	250,000 sf	125,000 sf	720	125,000 sf	Weekday[4]	3,255	33	98	732	472	195	97	1,627	33	98	733	472	195	97	1,628
													AM Peak Hour	136	2	6	47	30	13	7	105	1	2	14	9	4	1	31
													PM Peak Hour	146	1	3	21	14	6	2	47	2	6	45	29	12	5	99
15	New Residential Building	Forbes & Devon	Office, Student Housing	550	University/College	1000 Sq. Ft. GFA			40,000 sf	20,000 sf	180	20,000 sf	Weekday[4]	521	5	16	117	75	31	16	260	5	16	117	76	31	16	261
													AM Peak Hour	22	0	1	8	5	2	1	17	0	0	2	1	1	1	5
													PM Peak Hour	23	0	0	3	2	1	1	7	0	1	7	5	2	1	16
16	Shirley Apartments	Shirley Apartments	Office, Parking, Student Housing	225	Off-Campus Student Apartment	Residents		20	20,000 sf	10,000 sf	20	20	Weekday[4]	221	2	7	50	32	13	6	110	2	7	50	32	13	7	111
													AM Peak Hour	6	0	0	1	1	0	0	2	0	0	2	1	0	1	4
													PM Peak Hour	31	0	1	7	4	2	1	15	0	1	7	5	2	1	16
17	New Residential Building	Whitfield Hall	Office, Parking, Student Housing	225	Off-Campus Student Apartment	Residents	4,000 sf		160,000 sf	80,000 sf	165	165	Weekday[4]	857	9	26	193	124	51	25	428	9	26	193	124	51	26	429
													AM Peak Hour	28	0	1	5	3	1	1	11	0	1	8	5	2	1	17
													PM Peak Hour	63	1	2	14	9	4	1	31	1	2	14	9	4	2	32
18	Academic Building Expansion	Mellon Institute	Education, Laboratory / Research	550	University/College	1000 Sq. Ft. GFA			30,000 sf	15,000 sf		15,000 sf	Weekday[4]	391	59	14	59	37	18	8	195	59	14	59	37	18	9	196
													AM Peak Hour	16	4	1	4	2	1	0	12	1	0	1	1	0	1	4
													PM Peak Hour	18	2	0	2	1	1	0	6	4	1	4	2	1	0	12
19	New Academic Building	North of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Restaurant, Retail	550	University/College	1000 Sq. Ft. GFA	49,000 sf		230,000 sf	115,000 sf		66,000 sf	Weekday[4]	1,719	258	60	258	163	77	43	859	258	60	258	163	77	44	860
													AM Peak Hour	72	17	4	17	10	5	2	55	5	1	5	3	2	1	17
													PM Peak Hour	77	7	2	7	5	2	1	24	16	4	16	10	5	2	53
20	New Academic Building	South of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Public Assembly, Restaurant, Retail	550	University/College	1000 Sq. Ft. GFA	2,700 sf		425,000 sf	212,500 sf		209,800 sf	Weekday[4]	5,442	816	190	816	517	245	137	2,721	816	190	816	517	245	137	2,721
													AM Peak Hour	228	53	12	53	33	16	8	175	16	4	16	10	5	2	53
													PM Peak Hour	245	23	5	23	15	7	5	78	50	12	50	32	15	8	167
Total							**235,700 sf**	**645**	**2,868,000 sf**	**1,434,000 sf**	**2620**	**1,112,485 sf**	**Total Weekday[4]**	**29,661**	**2,522**	**971**	**5,484**	**3,504**	**1,542**	**802**	**14,825**	**2,523**	**972**	**5,486**	**3,505**	**1,542**	**808**	**14,836**
													Total AM	**1,269**	**174**	**64**	**356**	**222**	**98**	**48**	**962**	**55**	**21**	**113**	**72**	**32**	**14**	**307**
													Total PM	**1,403**	**76**	**27**	**171**	**110**	**50**	**24**	**458**	**163**	**63**	**351**	**224**	**98**	**46**	**945**

1. Trip generation based on 50% of full buildout as proposed in the 2022-2032 Institutional Master Plan. Under 1/3 of full buildout development square footage was realized from the 2012-2022 master plan, as buildings were built below maximum massing and some projects deferred or cancelled. A 50% assumption is assumed to be a conservative estimate. (Off campus residence halls are excluded from the reduction).
2. Mode share based on IMP Mobility Goals for Employee trips and 2018 Parking Master Plan survey results for Student trips (On and off-campus residence hall trips).
3. All on-campus buildings estimated with the University/College ITE land use code, except for the Facilities Operation Center and the campus-owned apartments beyond the contiguous EMI District.
4. ITE-calculated weekday trip generation numbers are not representative of anticipated conditions, since ITE data was based on only one data collection sample

Table 5.1
Level of Service and Delay
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Intersection/ Approach	Movement	Level of Service (Delay in Seconds) [1]									
		AM Peak Hour					PM Peak Hour				
		2022	2032				2022	2032			
		Existing Conditions	Without Development[2]	With Development	With Development and TDM	With Development TDM and Mitigation	Existing Conditions	Without Development[2]	With Development	With Development and TDM	With Development TDM and Mitigation
Fifth Avenue and Neville Street											
Fifth Avenue Eastbound	Approach	A (7.6)	A (8.0)	A (8.9)	A (8.0)	A (7.1)	B (19.2)	B (18.4)	D (49.6)	D (41.4)	C (21.9)
Fifth Avenue Westbound	Approach	B (10.5)	B (15.6)	C (23.9)	B (18.6)	C (20.5)	B (11.3)	A (7.5)	A (6.8)	A (9.2)	A (8.4)
Neville Street Northbound	Left/Through	N/A	N/A	N/A	N/A	C (25.3)	N/A	N/A	N/A	N/A	C (26.2)
	Right	N/A	N/A	N/A	N/A	C (27.1)	N/A	N/A	N/A	N/A	D (41.7)
	Approach	C (30.7)	C (25.1)	C (21.9)	C (32.2)	C (26.2)	D (54.0)	D (47.3)	E (79.6)	E (79.6)	C (34.5)
Neville Street Southbound	Left/Through	E (66.9)	D (50.0)	E (62.3)	E (58.0)	E (55.7)	F (85.9)	E (72.9)	F (86.2)	E (77.4)	E (61.6)
	Right	E (68.7)	C (33.9)	D (39.2)	D (43.7)	D (43.2)	C (23.3)	C (20.7)	B (18.8)	B (18.4)	C (20.7)
	Approach	E (67.9)	D (40.5)	D (48.6)	D (49.6)	D (48.3)	E (57.7)	D (49.4)	E (59.3)	E (55.1)	D (46.1)
Overall		**C (30.7)**	**C (23.3)**	**C (29.8)**	**C (27.9)**	**C (27.5)**	**C (27.7)**	**C (24.3)**	**D (45.8)**	**D (42.0)**	**C (24.5)**
Fifth Avenue and Morewood Avenue											
Fifth Avenue Eastbound	Approach	A (8.7)	A (6.1)	A (3.8)	A (5.6)	A (5.3)	C (26.4)	B (16.3)	B (17.1)	B (15.9)	B (16.0)
Fifth Avenue Westbound	Approach	B (17.8)	B (12.1)	B (14.9)	B (12.3)	B (12.3)	C (20.4)	B (18.2)	D (53.8)	C (22.7)	C (22.7)
Morewood Avenue Northbound	Left	N/A	N/A	N/A	N/A	C (25.2)	N/A	N/A	N/A	N/A	C (24.0)
	Through	N/A	N/A	N/A	N/A	C (29.3)	N/A	N/A	N/A	N/A	C (25.9)
	Left/Through	C (26.9)	C (33.2)	D (48.2)	D (36.8)	N/A	D (42.5)	D (40.7)	D (45.3)	D (46.3)	N/A
	Right	C (26.4)	C (28.3)	D (35.6)	C (29.9)	C (29.9)	E (58.9)	E (59.3)	E (74.5)	D (48.3)	D (48.3)
	Approach	C (26.8)	C (31.4)	D (43.1)	C (34.2)	C (29.4)	D (50.8)	D (50.1)	E (60.3)	D (47.3)	D (36.8)
Morewood Avenue Southbound	Left	C (25.4)	C (27.4)	C (29.3)	C (28.2)	C (27.5)	C (32.7)	C (25.7)	C (26.5)	C (26.8)	C (25.2)
	Through/Right	C (30.8)	D (40.0)	D (48.5)	D (41.1)	D (41.1)	C (34.1)	C (30.9)	C (33.5)	D (36.0)	D (36.0)
	Approach	C (29.8)	D (37.7)	D (45.1)	D (38.7)	D (38.6)	C (33.8)	C (29.8)	C (32.1)	C (34.1)	C (33.8)
Overall		**B (19.5)**	**B (18.4)**	**C (22.6)**	**B (18.9)**	**B (18.0)**	**C (30.3)**	**C (25.3)**	**D (39.1)**	**C (26.0)**	**C (24.1)**

Notes:
(1) Level of service and vehicular delay calculated using methodologies published in *Highway Capacity Manual 2000* by the Transportation Research Board, 2000 due to shared movements.
(2) Traffic signals anticipated to be upgraded to fully actuated and coordinated as part of the planned BRT project.

Table 5.2
Institutional Master Plan Mobility Projects for Safety and Transportation Demand Management
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Project	Description	Implementation Timeframe	User Improvement
Morewood Avenue at Fifth Avenue Intersection Improvements	Realigning Morewood Avenue to eliminate the intersection offset approaching Fifth Avenue.	Mid-term to long-term	Pedestrians, Transit Users, Bikes, Autos
Morewood Avenue Cycle Track	Constructing a cycle track and installing a buffered sidewalk along Morewood Avenue from Forbes Avenue to Fifth Avenue.	Mid-term to long-term	Pedestrians, Transit Users, Bikes
Forbes Avenue and Margaret Morrison Street Intersection Improvement	Constructing curb extensions across Margaret Morrison Street.	Mid-term to long-term	Pedestrians, Transit Users
Forbes Avenue Bridge Sidewalk Improvement	Widening sidewalks on the Forbes Avenue Bridge over Junction Hollow.	Long-term	Pedestrians
Frew, Tech, and Margaret Morrison Street Neighborway Improvements	Incorporating Frew, Margaret Morrison, and Tech streets into a neighborway, with traffic calming, bicycle enhancements, and pedestrian safety elements like curb extensions and raised crosswalks.	Short-term to long-term	Pedestrians, Bikes
Margaret Morrison Street and Tech Street Intersection Improvements	Providing traffic calming such as a raised intersection or a gateway treatment.	Mid-term to long-term	Pedestrians
Frew Street, Tech Street, and Schenley Drive Intersection Improvements	Adding all-way stop control and improving sidewalks and crosswalks.	Short-term to long-term	Pedestrians, Autos
Cross Campus Cycle Track	Connecting Frew Street and Morewood Avenue with a cycle track through campus to separate bicycles and pedestrians.	Short-term to mid-term	Pedestrians, Bikes
Mid-campus Schenley Park Entrance	Creating a Schenley Park Entrance Opposite the North South Walkway by Hunt Library.	Mid-term to long-term	Pedestrians
Frew Street Reconfiguration	Converting Frew Street to one-way in the downhill direction with a contraflow shared use path in the uphill direction and parallel parking.	Mid-term to long-term	Pedestrians, Bikes
Junction Hollow Pedestrian Bridge	Constructing a pedestrian bridge from the Mall to the Craig Street area.	Long-term	Pedestrians
Hamerschlag Drive Bicycle Boulevard	Converting Hamerschlag Drive to a bicycle boulevard.	Short-term	Bikes
Boundary Street Railroad Crossing	Improving the Boundary Street railroad crossing.	Long-term	Pedestrians, Bikes
Craig Street Improvements	Making Craig Street more pedestrian friendly with safety improvements.	Long-term	Bikes
Fifth Avenue and Neville Street Intersection Improvements	Leverage Oakland Plan, BRT, and City of Pittsburgh Smart Spines projects to improve intersection safety. Reduce pedestrian and vehicular conflicts through designating a northbound exclusive right turn lane alongside a left turn/through lane.	Mid-term to long-term	Pedestrians, Autos
Mellon Institute Connectivity	Improving pedestrian connectivity to Mellon Institute.	Mid-term to long-term	Pedestrians
Fifth Avenue Sidewalk Improvements	Widening sidewalks and installing vegetative buffers alongside travel lanes.	Short-term to long-term	Pedestrians
Enhancing and Adding Bicycle Amenities and Infrastructure	Enhancing bicycle amenities and infrastructure towards the Bicycle Friendly University Gold Level award criteria.	Short-term to long-term	Bikes

Table 5.3
95th Percentile Vehicle Queue Length Summary
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Intersection / Approach	Movement	Available Storage (ft) [2]	95th Percentile Queue Lengths (ft) [1]									
			AM Peak Hour					PM Peak Hour				
			2022	2032				2022	2032			
			Existing Conditions	Without Development[2]	With Development	With Development and TDM	With Development TDM and Mitigation	Existing Conditions	Without Development[2]	With Development	With Development and TDM	With Development TDM and Mitigation
Fifth Avenue and Neville Street												
Fifth Avenue Eastbound	Left/Through	370	63 (129)	72 (151)	75 (160)	70 (147)	65 (132)	253 (316)	276 (325)	427 (399)	398 (416)	318 (351)
	Through/Right	370	63 (82)	72 (99)	75 (98)	70 (97)	65 (76)	253 (271)	276 (280)	427 (359)	398 (359)	318 (304)
Fifth Avenue Westbound	Left/Through	460	118 (150)	313 (165)	354 (194)	334 (187)	343 (175)	95 (115)	88 (95)	66 (122)	90 (127)	94 (106)
	Through/Right	460	118 (128)	313 (151)	354 (165)	334 (169)	343 (159)	95 (112)	88 (85)	66 (95)	90 (106)	94 (86)
Neville Street Northbound	Left/Through	160	N/A	N/A	N/A	N/A	106 (118)	N/A	N/A	N/A	N/A	160 (183)
	Right	570	N/A	N/A	N/A	N/A	115 (140)	N/A	N/A	N/A	N/A	234 (499)
	Left/Through/Right	570	153 (166)	148 (155)	204 (297)	225 (277)	N/A	317 (549)	307 (560)	437 (455)	437 (459)	N/A
Neville Street Southbound	Left/Through	1,130	298 (752)	279 (615)	312 (724)	294 (720)	292 (718)	249 (254)	241 (259)	299 (515)	293 (374)	277 (369)
	Right	160	331 (176)	253 (189)	298 (181)	289 (186)	265 (187)	112 (168)	109 (168)	106 (189)	97 (169)	103 (197)
Fifth Avenue and Morewood Avenue												
Fifth Avenue Eastbound	Left/Through	730	48 (96)	43 (102)	38 (84)	39 (90)	39 (105)	293 (277)	319 (252)	276 (670)	283 (424)	321 (567)
	Through/Right	730	48 (98)	43 (111)	38 (85)	39 (98)	39 (110)	293 (305)	319 (268)	276 (680)	283 (450)	321 (586)
Fifth Avenue Westbound	Left/Through	890	223 (250)	268 (261)	311 (270)	271 (260)	271 (254)	224 (310)	302 (299)	445 (954)	397 (545)	397 (516)
	Through/Right	890	223 (213)	268 (217)	311 (233)	271 (223)	271 (224)	224 (272)	302 (268)	445 (955)	397 (515)	397 (484)
Morewood Avenue Northbound	Left	50	N/A	N/A	N/A	N/A	26 (57)	N/A	N/A	N/A	N/A	41 (74)
	Through	890	N/A	N/A	N/A	N/A	178 (189)	N/A	N/A	N/A	N/A	185 (428)
	Left/Through	890	168 (195)	188 (203)	264 (329)	221 (235)	N/A	288 (348)	290 (355)	309 (339)	277 (334)	N/A
	Right	280	111 (140)	121 (155)	179 (432)	131 (237)	131 (177)	317 (483)	317 (506)	348 (478)	274 (438)	274 (323)
Morewood Avenue Southbound	Left	85	63 (103)	70 (116)	78 (126)	72 (112)	70 (112)	85 (120)	85 (111)	96 (122)	86 (113)	82 (117)
	Through/Right	1,180	217 (274)	263 (324)	301 (477)	266 (295)	266 (314)	266 (309)	266 (297)	302 (377)	289 (306)	289 (337)

Notes:

(1) 95th percentile queue lengths calculated using methodologies published in *Highway Capacity Manual 2000* by the Transportation Research Board, 2000, with an average length of 20 feet per vehicle for unsignalized intersections. 95th percentile queue lengths calculated by SimTraffic are shown in (parentheses) by averaging 5 runs with 10 minutes of seeding.

(2) Reported available storage is the distance to the nearest traffic signal / stop sign or the physical length of the turn bay.

Table 5.4
Reportable Five-Year Crash Experience 2016-2020
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Year	Crash Type	Severity	Number of Occurrences	Year	Crash Type	Severity	Number of Occurrences
Fifth Avenue and Bellefield Avenue (11 Crashes Including 4 Pedestrian Crashes)							
2016	Pedestrian	Injury / Unknown Severity	1	2019	Same Direction Sideswipe	Property Damage Only	1
2018	Rear-End	Unknown	1	2020	Pedestrian	Minor Injury	1
2018	Pedestrian	Injury / Unknown Severity	1	2020	Hit Fixed Object	Unknown or Property Damage Only	2
2018	Pedestrian	Serious Injury	1	2020	Rear-End	Injury / Unknown Severity	1
2018	Same Direction Sideswipe	Property Damage Only	2				
Fifth Avenue and Dithridge Street (5 Crashes including 1 Pedestrian Fatality)							
2016	Angle	Property Damage Only	1	2020	Angle	Property Damage Only	1
2017	Angle	Injury / Unknown Severity	1	2020	Pedestrian	Fatality	1
2019	Rear-End	Injury / Unknown Severity	1				
Fifth Avenue and Craig Street (5 Crashes)							
2017	Same Direction Sideswipe	Possible Injury	1	2020	Same Direction Sideswipe	Property Damage Only	1
2019	Angle	Property Damage Only	1	2020	Angle	Property Damage Only	2
Fifth Avenue and Neville Street (21 Crashes Including 6 Pedestrian Crashes)							
2016	Hit Fixed Object	Injury / Unknown Severity	1	2018	Pedestrian	Injury / Unknown Severity	1
2016	Pedestrian	Injury / Unknown Severity	1	2018	Angle	Injury / Unknown Severity	1
2016	Angle	Injury / Unknown Severity	1	2019	Rear-End	Minor Injury	1
2016	Same Direction Sideswipe	Injury / Unknown Severity	1	2019	Hit Fixed Object	Minor Injury	1
2017	Pedestrian	Unknown or Possible Injury	2	2019	Angle	Property Damage Only	1
2017	Rear-End	Property Damage Only	1	2019	Angle	Possible or Minor Injury	3
2017	Angle	Property Damage Only	2	2019	Pedestrian	Injury / Unknown Severity	1
2017	Opposite Direction Sideswipe	Property Damage Only	1	2019	Pedestrian	Serious Injury	1
				2020	Angle	Property Damage Only	1
Fifth Avenue and Clyde Street (3 Crashes Including 2 Pedestrian Crashes)							
2016	Head-On	Possible Injury	1	2018	Pedestrian	Possible Injury	1
2016	Pedestrian	Minor Injury	1				
Fifth Avenue and Devonshire Street (12 Crashes)							
2016	Opposite Direction Sideswipe	Property Damage Only	1	2018	Rear-End	Property Damage Only	1
2016	Rear-End	Property Damage Only	1	2019	Angle	Property Damage Only	3
2017	Angle	Injury / Unknown Severity	1	2020	Angle	Serious Injury	1
2018	Angle	Property Damage Only	2	2020	Head-On	Property Damage Only	1
2018	Angle	Injury / Unknown Severity	1				
Fifth Avenue and Morewood Avenue (44 Crashes Including 7 Pedestrian Crashes)							
2016	Rear-End	Property Damage Only	1	2018	Rear-to-Rear	Minor Injury	1
2016	Rear-End	Possible Injury or Unknown Severity	2	2018	Angle	Property Damage Only	3
2016	Angle	Possible Injury	1	2018	Angle	Minor Injury or Unknown Severity	3
2016	Angle	Property Damage Only	2	2018	Pedestrian	Minor Injury	1
2016	Same Direction Sideswipe	Property Damage Only	1	2018	Pedestrian	Serious Injury	1
2017	Head-On	Minor Injury	1	2019	Pedestrian	Minor Injury	1
2017	Rear-End	Property Damage Only	2	2019	Pedestrian	Serious Injury	1
2017	Rear-End	Minor Injury	1	2019	Angle	Property Damage Only	3
2017	Hit Fixed Object	Property Damage Only	1	2019	Angle	Minor Injury	1
2017	Pedestrian	Injury / Unknown Severity	1	2019	Rear-End	Property Damage Only	1
2017	Angle	Property Damage Only	5	2020	Angle	Property Damage Only	1
2017	Angle	Injury / Unknown Severity	1	2020	Angle	Possible Injury or Minor Injury	3
2018	Rear-End	Property Damage Only or Possible Injury	2	2020	Pedestrian	Minor Injury or Unknown Severity	2
2018	Hit Fixed Object	Property Damage Only	1				
Forbes Avenue and Bellefield Avenue (5 Crashes)							
2017	Rear-End	Property Damage Only	1	2018	Same Direction Sideswipe	Property Damage Only	1
2017	Angle	Possible Injury	1	2020	Same Direction Sideswipe	Property Damage Only	1
2017	Rear-End	Property Damage Only	1				
Forbes Avenue and Dithridge Street (4 Crashes Including 1 Pedestrian Crash)							
2016	Pedestrian	Possible Injury	1	2019	Same Direction Sideswipe	Property Damage Only	1
2018	Same Direction Sideswipe	Property Damage Only	1	2020	Rear-End	Property Damage Only	1
Forbes Avenue and Craig Street (5 Crashes)							
2016	Rear-End	Property Damage Only	1	2018	Angle	Property Damage Only	1
2017	Rear-End	Possible Injury	1	2018	Hit Fixed Object	Property Damage Only	1
				2019	Same Direction Sideswipe	Possible Injury	1
Forbes Avenue and CIC Drive (2 Crashes Including 1 Pedestrian Crash)							
2018	Angle	Injury / Unknown Severity	1	2019	Pedestrian	Injury / Unknown Severity	1
Forbes Avenue and Morewood Avenue (8 Crashes Including 2 Pedestrian Crashes)							
2017	Same Direction Sideswipe	Minor Injury	1	2019	Head-On	Property Damage Only	1
2018	Pedestrian	Injury / Unknown Severity	1	2019	Head-On	Injury / Unknown Severity	1
2018	Rear-End	Minor Injury	1	2019	Angle	Property Damage Only	1
2019	Pedestrian	Minor Injury	1	2020	Rear-End	Possible Injury	1
Forbes Avenue and Devon Road (3 Crashes Including 1 Pedestrian Crash)							
2017	Rear-End	Property Damage Only	1	2020	Pedestrian	Minor Injury	1
2017	Angle	Minor Injury	1				
Forbes Avenue and Beeler Street (5 Crashes)							
2017	Angle	Minor Injury	1	2020	Rear-End	Property Damage Only	1
2019	Same Direction Sideswipe	Property Damage Only	1	2020	Hit Fixed Object	Property Damage Only	1
				2020	Hit Fixed Object	Injury / Unknown Severity	1
Forbes Avenue and Margaret Morrison Street (4 Crashes)							
2016	Rear-End	Minor Injury or Unknown Severity	2	2020	Angle	Serious Injury	1
2016	Angle	Minor Injury	1				
Frew Street at Schenley Drive (3 Crashes)							
2016	Angle	Injury / Unknown Severity	1	2017	Angle	Minor Injury	1
2016	Head-On	Injury / Unknown Severity	1				
Frew Street Midblock (3 Crashes)							
2016	Rear-to-Rear	Property Damage Only	1	2019	Hit Fixed Object	Minor Injury	1
2018	Angle	Property Damage Only	1				
Tech Street Midblock (1 Crash)							
2020	Rear-End	Property Damage Only	1				
Craig Street North of Fifth Avenue (2 Crashes)							
2018	Rear-End	Property Damage Only	1	2019	Angle	Property Damage Only	1
Craig Street and Winthrop Street (3 Crashes)							
2016	Angle	Property Damage Only	1	2018	Angle	Property Damage Only	1
2016	Same Direction Sideswipe	Property Damage Only	1				
Craig Street and Filmore Street (5 Crashes Including 1 Pedestrian Crash)							
2016	Angle	Injury / Unknown Severity	1	2018	Pedestrian	Injury / Unknown Severity	1
2016	Hit Fixed Object	Property Damage Only	1	2019	Same Direction Sideswipe	Property Damage Only	1
2017	Same Direction Sideswipe	Property Damage Only	1				
Schenley Drive West of Schenley Bridge (2 Crashes)							
2017	Angle	Minor Injury	1	2017	Rear-End	Property Damage Only	1
Schenley Drive West at Phipps Parking (1 Crash)							
2018	Angle	Property Damage Only	1				
Schenley Drive at Tech Street (4 Crashes)							
2016	Hit Fixed Object	Property Damage Only	1	2018	Rear-End	Property Damage Only	1
2018	Hit Fixed Object	Minor Injury	1	2020	Hit Fixed Object	Property Damage Only	1
Neville Street and Ellsworth Avenue (1 Crash)							
2016	Rear-End	Property Damage Only	1				
Neville Street and Henry Street (1 Crash)							
2017	Same Direction Sideswipe	Property Damage Only	1				
Neville Street and Winthrop Street (1 Crash)							
2017	Angle	Property Damage Only	1				
Neville Street and Filmore Street (1 Crash)							
2018	Rear-End	Possible Injury	1				
Boundary Street South of Schenley Bridge (1 Crash)							
2016	Hit Fixed Object	Property Damage Only	1				
Devonshire Road North of Fifth Avenue (1 Crash)							
2018	Hit Fixed Object	Property Damage Only	1				
Ellsworth Avenue and Clyde Street (2 Crashes)							
2018	Hit Fixed Object	Injury / Unknown Severity	1	2020	Head-On	Property Damage Only	1

Table 5.5
Reportable and Non-Reportable Crashes from Campus Police, January 2018 - June 2021
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Location	Crash Type	Number of Occurrences				
		2018	2019	2020	2021	Total
N Dithridge Street between Forbes Ave & Fifth Ave	Vehicle Collision/Damage				1	1
Forbes Avenue (Unspecified Location)	Vehicle Collision/Crash		6			6
	Vehicle Collision/Damage		2			2
	Vehicular and Bicycle Collision			1		1
Forbes Avenue & Schenley Drive Ext	Vehicle Collision/Crash	1				1
	Vehicle Collision/Damage	5				5
	Property Damage by Vehicle	1				1
Forbes Avenue & GATF Lot (Craig Street)	Vehicle Collision/Crash	1	1			2
Forbes Avenue & CIC Drive/Newell-Simon Hall	Vehicle Collision/Crash	1				1
	Vehicle Collision/Damage	1	4			5
	Property Damage by Vehicle	1				1
Forbes Avenue & Gates/Hillman/Cyert	Vehicle Collision/Damage	1		1	1	3
Forbes Avenue & Tepper Quad	Vehicle Collision/Damage	3	2			5
Forbes Avenue & Morewood Avenue	Vehicle Collision/Crash			1		1
Forbes Avenue & Doherty Apartments	Vehicle Collision/Damage		1			1
Forbes Avenue & Intramural Field	Vehicle Collision/Damage		1			1
Beeler Street near Forbes Avenue	Vehicle Collision/Crash			2		2
	Vehicle Collision/Damage				1	1
Fifth Avenue (Unspecified Location)	Vehicle Collision/Crash	2	3	2		7
	Vehicle Collision/Damage	1	1			2
Fifth Avenue at Neville Street / Residence on Fifth	Vehicular Collision	1	1	1		3
	Vehicle Collision/Damage		1			1
Fifth Avenue & Devonshire Road	Vehicle Collision/Crash	1	5	1		7
	Vehicle Collision/Damage	1				1
South Craig Street between Forbes Avenue and Fifth Avenue	Vehicle Collision/Crash		1		1	2
	Vehicle Collision/Damage	2	1			3
Filmore Street at Zebina Way	Vehicle Collision/Crash		1			1
	Vehicle Collision/Damage	1	1			2
Morewood Avenue (Unspecified Location)	Vehicle Collision/Crash	2		2		4
	Vehicle Collision/Damage	2	1			3
Morewood Avenue at Morewood Gardens	Vehicle Collision/Crash	2				2
	Vehicle Collision/Damage		1	1		2
Morewood Avenue at Stever House	Vehicle Collision/Damage			1		1
Morewood Avenue at Mudge House	Vehicle Collision/Damage		1			1
Margaret Morrison Street (Unspecified Location)	Vehicle Collision/Crash	1				1
	Vehicle Collision/Damage	3	1			4
Margaret Morrison Street at Donner House	Vehicle Collision/Damage	1				1
Tech Street	Vehicle Collision/Damage	2				2
Frew Street (Unspecified Location)	Vehicle Collision/Crash	2				2
	Vehicle Collision/Damage	6	3	2		11
Frew Street & Hunt Library	Vehicle Collision/Crash	2				2
	Vehicle Collision/Damage	1				1
Frew Street & Baker Hall	Vehicle Collision/Damage		1			1
Frew Street & Porter Hall	Vehicle Collision/Damage			1	1	2
Frew Street & Scaife Hall	Vehicle Collision/Damage	1		1		2
Schenley Drive (Unspecified Location)	Vehicle Collision/Crash	1				1
Hamerschlag Drive & Roberts Hall	Vehicle Collision/Damage	1				1
Hamerschlag Drive at Wean Hall	Vehicle Collision/Damage	1				1
Hamerschlag Drive at Doherty Hall	Vehicle Collision/Damage		1			1
Hamerschlag Drive at FMS	Vehicle Collision/Damage	4	1	1		6
Neville Street (Unspecified Location)	Vehicle Collision/Damage			1		1
Winthrop Street (Unspecified Location)	Vehicle Collision/Damage		2			2
CMU Police Department	Vehicle Collision/Crash			1		1
	Vehicle Collision/Damage	6	12	4	1	23
	Property Damage by Vehicle				2	2
East Campus Garage Area	Vehicle Collision/Crash	1	2	5	1	9
	Vehicle Collision/Damage	6	12		2	20
	Property Damage by Vehicle	1				1
Dearden Center / North of Fifth Residence Hall	Vehicle Collision/Damage		1			1
CFA Lot	Vehicle Collision/Damage	1				1
SEI / Dithridge Garage	Vehicle Collision/Damage	1	1	1		3
Whitfield Hall Lot	Vehicle Collision/Damage		1	1		2
Donner Hall Lot	Vehicle Collision/Damage	1				1
CIC Garage	Property Damage by Vehicle	1	1			2
Fraternities Lot	Vehicle Collision/Damage	1				1
Information Network Institute	Vehicle Collision/Damage		1			1
Morewood Lot	Vehicle Collision/Damage	6	1		1	8
Warner Hall Lot	Vehicle Collision/Damage		1			1
University Center	Vehicle Collision/Crash	1				1
	Vehicle Collision/Damage	1	1		1	3
Margaret Morrison Hall Lot	Vehicle Collision/Damage			1		1
Fifth Avenue & WQED	Vehicle Collision/Damage	2				2
Mellon Institute & Fifth Avenue	Vehicle Collision/Damage		1			1
Morewood Gardens Circle	Vehicle Collision/Damage	1				1
Unspecified Location	Vehicle Collision/Crash	1				1
	Vehicle Collision/Damage	1	1			2
	Property Damage by Vehicle				2	2
Total		88	80	32	15	215

Table 6.1
Parking Inventory and Anticipated Changes
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

IMP Number	Parking Facility	Existing Parking Capacity	Anticipated Future Parking Capacity	Maximum Future Parking Capacity	Anticipated Change	Notes
1	Zebina Way Lot	32	32	32	0	
2	Henry Street Lot	13	13	13	0	
3	Fairfax Lot	55	55	55	0	
4	Whitfield Hall Lot	61	55	43	-18	Assume 80% of units to have one space
5	300 South Craig Lot	22	22	22	0	
6	Hamburg Hall Lot (CIC Drive)	12	12	12	0	
7	GATF Lot	72	200	100	28	Assume 50% of maximum capacity
8	Frew Street Disabled	10	10	10	0	
9	West Campus Lot	14	0	0	-14	Parking to be removed for bicycle boulevard
10	Morewood Lot	285	200	150	-135	Assume 75% of maximum capacity
11	Warner Hall Lot	16	0	0	-16	
12	Fine Arts Lot	61	0	0	-61	
13	Donner House Lot	23	200	50	27	Assume 25% of maximum capacity
14	Tech Street (Margaret Morrison)	14	0	0	-14	
15	Bramer House Lot	5	5	5	0	
16	Fraternities Lot	69	150	50	-19	Assume 1/3 of capacity; parking under F/M building
17	Fifth and Neville Lot	16	16	16	0	
18	Clyde Street Lot	90	6	15	-75	Parking for Clyde House and Highlands Apartments
19	III Lot	17	0	0	-17	
20	South Neville Lot	96	135	50	-46	FMCS parking only; assume 50% of current capacity
21	Forbes Beeler Lot		20	20	20	
22	Carnegie Museum Lots	110	500	325	215	325 spaces, per CMU
23	5th and Craig Street Garage	40	40	40	0	
24	Dithridge Garage	370	370	370	0	
25	CIC Garage	226	226	226	0	
26	Gates Garage	138	138	138	0	
27	East Campus Garage	780	780	780	0	
28	East Campus Garage Motorcycle	14	14	14	0	
29	Residence at Fifth Garage	37	37	37	0	
30	TCS Garage	35	35	35	0	
31	Tepper Quad	126	126	126	0	
32	Fifth Neville Garage	29	29	29	0	
IMP #10	New Academic Building		400	125	125	Assume similar capacity to Tepper
Shuttle	6555 Penn Ave	54	54	54	0	
Shuttle	Melwood	30	30	30	0	
Total		**2972**	**3910**	**2972**	**0**	**No net change in parking supply anticipated**

Table 6.2
Parking Supply and Demand Analysis
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

Project Component				Existing On-Site Conditions		Anticipated Parking Generation[1]												
						Maximum Buildout Parking Generation							50% of Maximum Size[2]					
Number	Type	Description	Proposed Use	Size (Sq. Ft.)	# of Beds	Max. Size (Total) (Sq. Ft.)	Max. # of Beds	Max Size (Net) (Sq. Ft.)	Proposed Parking Demand (250 nasf/person)	Existing Parking Demand Shifted from Existing to New Building[4]	Net New Parking Demand	Net New Parking Demand and TDM[3]	50% Size (Sq. Ft.)	50% Size (Net) (Sq. Ft.)	Proposed Parking Demand (250 nasf/person)	Parking Demand Shifted from Existing to New Building[4]	Net New Parking Demand	Net New Parking Demand and TDM[3]
1	Facilities Operations Center	S Neville along Railroad	Parking, Utility, Office			40,000 sf		40,000 sf	25	7	18	17	20,000 sf	20,000 sf	12	8	4	4
2	New Academic Building	FMS Building	Education, Laboratory / Research, Office, Restaurant, Utility	48,000 sf		300,000 sf		252,000 sf	157	44	113	104	150,000 sf	102,000 sf	64	39	25	23
3	Academic Building Expansion	Hamburg & Smith Halls	Education, Laboratory / Research, Office, Restaurant	22,000 sf		100,000 sf		78,000 sf	49	14	35	32	50,000 sf	28,000 sf	17	11	6	6
4	New Academic Building	Cyert & Warner Halls	Education, Laboratory / Research, Office, Parking, Restaurant	110,000 sf		250,000 sf		140,000 sf	87	25	62	57	125,000 sf	15,000 sf	9	6	3	3
5	Academic Building Expansion	Purnell Center for the Arts	Education, Laboratory / Research, Office, Public Assembly			30,000 sf		30,000 sf	19	5	14	13	15,000 sf	15,000 sf	9	6	3	3
6	Student Support Expansion	West Wing Addition	Education, Laboratory / Research, Office, Restaurant			5,000 sf		5,000 sf	3	1	2	2	2,500 sf	2,500 sf	2	1	1	1
7	Academic Building Expansion	Margaret Morrison Carnegie Hall	Education, Laboratory / Research, Office			110,000 sf		110,000 sf	69	19	50	46	55,000 sf	55,000 sf	34	21	13	12
8	New Mixed Use Building	Donner Hall	Office, Parking, Restaurant / Student Housing		241	266,000 sf	735	266,000 sf	166	47	119	109	133,000 sf	133,000 sf	83	51	32	29
9	Student Support Expansion	Hamerschlag House	Office, Restaurant			6,000 sf		6,000 sf	4	1	3	3	3,000 sf	3,000 sf	2	1	1	1
10	New Academic Building	Tepper School Expansion Site	Office, Parking, Public Assembly, Restaurant			180,000 sf		180,000 sf	112	32	80	74	90,000 sf	90,000 sf	56	35	21	19
11	New Mixed Use Building	Morewood Lot	Laboratory / Research, Office, Restaurant / Student Housing			220,000 sf	500	220,000 sf	137	39	98	90	110,000 sf	110,000 sf	69	43	26	24
12	E Tower Commons	Morewood E Tower	Office, Restaurant			6,000 sf		6,000 sf	4	1	3	3	3,000 sf	3,000 sf	2	1	1	1
13	New Mixed Use Building	Capstone site at Forbes & Morewood	Office, Parking, Student Housing, Restaurant			200,000 sf	300	200,000 sf	125	35	90	83	100,000 sf	100,000 sf	62	39	23	21
14	New Residential Building(s)	Greek Quad	Office, Parking, Student Housing		384	250,000 sf	720	250,000 sf	156	44	112	103	125,000 sf	125,000 sf	78	48	30	28
15	New Residential Building	Forbes & Devon	Office, Student Housing			40,000 sf	180	40,000 sf	25	7	18	17	20,000 sf	20,000 sf	12	8	4	4
16	Shirley Apartments	Shirley Apartments	Office, Parking, Student Housing		20	20,000 sf		20,000 sf	12	4	8	7	10,000 sf	10,000 sf	6	4	2	2
17	New Residential Building	Whitfield Hall	Office, Parking, Student Housing	4,000 sf		160,000 sf	165	156,000 sf	97	27	70	64	80,000 sf	76,000 sf	47	29	18	17
18	Academic Building Expansion	Mellon Institute	Education, Laboratory / Research			30,000 sf		30,000 sf	19	5	14	13	15,000 sf	15,000 sf	9	6	3	3
19	New Academic Building	North of Forbes @ S Craig	Education, Laboratory / Research, Office, Parking, Restaurant, Retail	49,000 sf		230,000 sf		181,000 sf	113	32	81	75	115,000 sf	66,000 sf	41	25	16	15
20	New Academic Building	South of Forbes @ S Craig	Office, Parking, Public Assembly, Restaurant, Retail	2,700 sf		425,000 sf		422,300 sf	264	74	190	175	212,500 sf	209,800 sf	131	81	50	46
Total				**235,700 sf**	**645**	**2,868,000 sf**	**2600**	**2,632,300 sf**	**1643**	**463**	**1180**	**1087**	**1,434,000 sf**	**1,198,300 sf**	**745**	**463**	**282**	**262**

1. Existing parking supply is 2,972 spaces and existing demand is 2,621 spaces (Source: CMU, February 2020). Existing campus assignable size is 4,015,119 nasf (211 nasf/person for 19,029 total population). Existing parking demand averages 0.074% per NASF. Proposed parking demand is 0.062% per NASF at 250 nasf/persor
2. Under 1/3 of development square footage was realized from the 2012-2022 master plan, as buildings were built below maximum massing and some projects deferred or cancelled. Assume up to 50% of 2022-2032 master plan will be realized.
3. Mobility goal in IMP is to reduce parking by 8 percent.
4. Per CMU's goal of increasing nasf/person from 211 to 250, 250 nasf/person used for future parking demand. 742,131 nasf of space within new development projects will reaccommodate existing users, so the equivalent demand of 463 spaces before TDM will be maintained by existing users shifting to new building

Table 6.3
Transportation Demand Management Reduction Strategies
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

TDM Strategy	Implementation Timeframe	2018 Commuter Survey Response Rate	TDM Max. Anticipated Commuting Reduction
Increasing Transit Pass Program Eligibility	Short-term	2%	2% (Shift to Transit)
Improving and Expanding Shuttle Program	Mid-term	4%	2% (Shift to Transit)
Providing Improved Bicycle Amenities	Short-term	1%	1% (Shift to Biking)
Improving Sidewalk Accessibility, Connectivity, and Safety	Short- to Long-term	1%	1% (Shift to Walking)
Developing a Carpool/Vanpool Program	Mid-term	2%	2% (Shift to Carpooling)
Enhancing Electric Car Charging	Short- to Long-term	1%	0%
Improving Shared Parking Options with Flexible, Limited-use Parking Passes	Mid-term	7%	3% (Shift to Transit, Biking, Walking, Carpooling)
Coordinating with the Port Authority for Improved Transit Routes and Options	Long-term	8%	4% (Shift to Transit)
Implement Work from Home Options	Short- to Long-term	1%	5% (Shift to Other)
Build Bicycle Infrastructure	Mid- to Long-term	N/A	1% (Shift to Biking)

1) Mode share target is to reduce single vehicle commuter use by 8% from 2022 to 2032
2) Survey data based on 824 participant comments from Employee Commuter Survey, 2018

Table 6.4
Transportation Demand Management Checklist
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

TDM Strategy	Status	Results	Revised Strategy	Comments
Meet with the Transportation Management Association (TMA)	Ongoing			Coordination with OTMA is ongoing.
Set mode split goals and commitment to creating a survey. Goals should be consistent with relevant adopted neighborhood master plans	Included in IMP			Surveying is part of CMU's parking master plan. Goals are intended to be compatible with upcoming Oakland and Squirrel Hill neighborhood plans.
Identify responsible party or dedicated staff assigned to administer TDM program and report on this progress	Complete			CMU's Parking and Transportation Services will administer this program.
Payback incentives for using non-motorized and carpool incentives	To be Developed in TDM Plan			A formal carpool incentive program will be included in the University's TDM plan.
Provide transit passes or subsidies to employees or residents	Complete; to be Expanded in TDM			Transit passes are currently provided to employees and students. A TDM plan will consider expanding the program to subcontractors and to transit operators beyond Allegheny County.
Offer employees or residents free or discount bikeshare membership through the Healthy Ride Corporate Membership Program	To be Developed in TDM Plan			A formal incentive program for wheeled mobility programs will be included in the University's TDM plan.
Membership in the 2030 District	Complete			Carnegie Mellon is a member of the 2030 district.
Parking policies that unbundle the cost of parking lease from rent	Complete			Parking is an additional charge for all employees.
Promotion of SPC Commuter Connects programs	To be Developed in TDM Plan			Coordination with SPC programs will be included in the University's TDM plan.
Flexible work hours and/or telecommute program	In Progress			Carnegie Mellon will adopt a formal flexible work location program.
Real time transportation displays internal to development	To be Developed in TDM Plan			Transit information will be included in the University's TDM plan. Options include displays in the Cohon University Center or investing in smartphone apps.

Table 6.5
Site Plan Strategies
Carnegie Mellon University 2022-2032 Institutional Master Plan
City of Pittsburgh, Pennsylvania

TDM Strategy	Status	Results	Revised Strategy	Comments
Adequate sidewalk widths and ADA ramps along all building frontages	Ongoing			Carnegie Mellon continues to invest in widening sidewalks, replacing ADA ramps, and building buffers to vehicular traffic.
Bicycle parking required by code. A mix of bicycle parking should include convenient short-term parking and secure, covered parking accessible from the ground floor for long-term bicycle parking or storage	Ongoing			Covered bicycle parking is provided on the ground floor in the East Campus Garage, and individual bike racks are placed throughout campus at building entrances. Additional bicycle racks are added based on demand.
When impacting a bus stop; work with the city and Port Authority to relocate during construction and restore amenities	Ongoing			Carnegie Mellon has also been working with the Port Authority to integrate planned BRT stations.
When providing public easement or public access to privately owned open space; wayfinding	Complete			Carnegie Mellon has recently installed new campus wayfinding. The general public is welcome to use campus outdoor space.
Upgrades and enhancements for pedestrian safety at site access and intersections	Ongoing			Carnegie Mellon continues to invest in pedestrian safety, as demonstrated by the proposed projects the IMP's mobility plan.
Consistency with improvements identified in City plans or policy	Included in IMP			The IMP mobility plan was prepared in accordance with the City's best practices and includes projects consistent with city improvement strategies.
Identify how existing space can be repurposed as part of reducing SOV trips	Included in IMP			The IMP identifies how existing surface lots will be repurposed to flexible space or replaced with development projects, eliminating on-campus surface parking.
Enhancements to pedestrian facilities that address the last mile problem from transit stops and desired pedestrian paths	Ongoing			The IMP mobility plan includes projects to improve pedestrian paths. Carnegie Mellon is working with the Port Authority to integrate BRT stations.
Bicycle storage that exceed zoning code requirements	In Progress			Carnegie Mellon continues to invest in bicycle amenities to exceed city requirements.
Bikeshare station on site	Complete			Bikeshare stations are located near campus, including along Frew Street, Schenley Drive, and Ellsworth Avenue.
Shower rooms or shower passes for employees who bike to work	Complete			Carnegie Mellon offers shower rooms.
Unbundled parking	Complete			Parking is unbundled for all employees.
Shared parking	Complete			Permit parking is in tiers, not individual reserved spaces.
Priority carpool parking	To be Developed in TDM Plan			Priority carpool parking will be considered for the University's TDM plan.
Dedicated car share parking	Complete			Dedicated car share parking is provided in university-owned parking facilities.
Sponsored car share or bikeshare memberships for employees or residents (annual or intro membership)	To be Developed in TDM Plan			A formal incentive program for wheeled mobility programs will be included in the University's TDM plan.
Real time arrival transit screens in publicly accessible space	To be Developed in TDM Plan			Transit information will be included in the University's TDM plan. Options include displays in the Cohon University Center or investing in smartphone apps.
Transit station enhancements or improvements	Ongoing			Carnegie Mellon is working with the Port Authority to integrate planned BRT stations.
Pedestrian enhancements between proposed buildings and nearby transit stations, such as adding pedestrian scale lighting, emergency call boxes, street trees, and seating	Ongoing			Carnegie Mellon continues to invest in improving the pedestrian experience, including creating vegetated buffers between sidewalks and travel lanes. Emergency call boxes are provided.
Electric vehicle charging	Ongoing			Electric vehicle charging is currently provided on campus. Level one charging spaces will be expanded to all new campus parking facilities.
Tandem parking	Ongoing			Tandem space use will continue to be expanded to reduce the size of parking facilities.
Personal mobility (scooter) parking on campus	To be Developed in TDM Plan			Carnegie Mellon is developing a wheeled mobility plan and will investigate personal mobility parking as part of the TDM plan.

FIGURES

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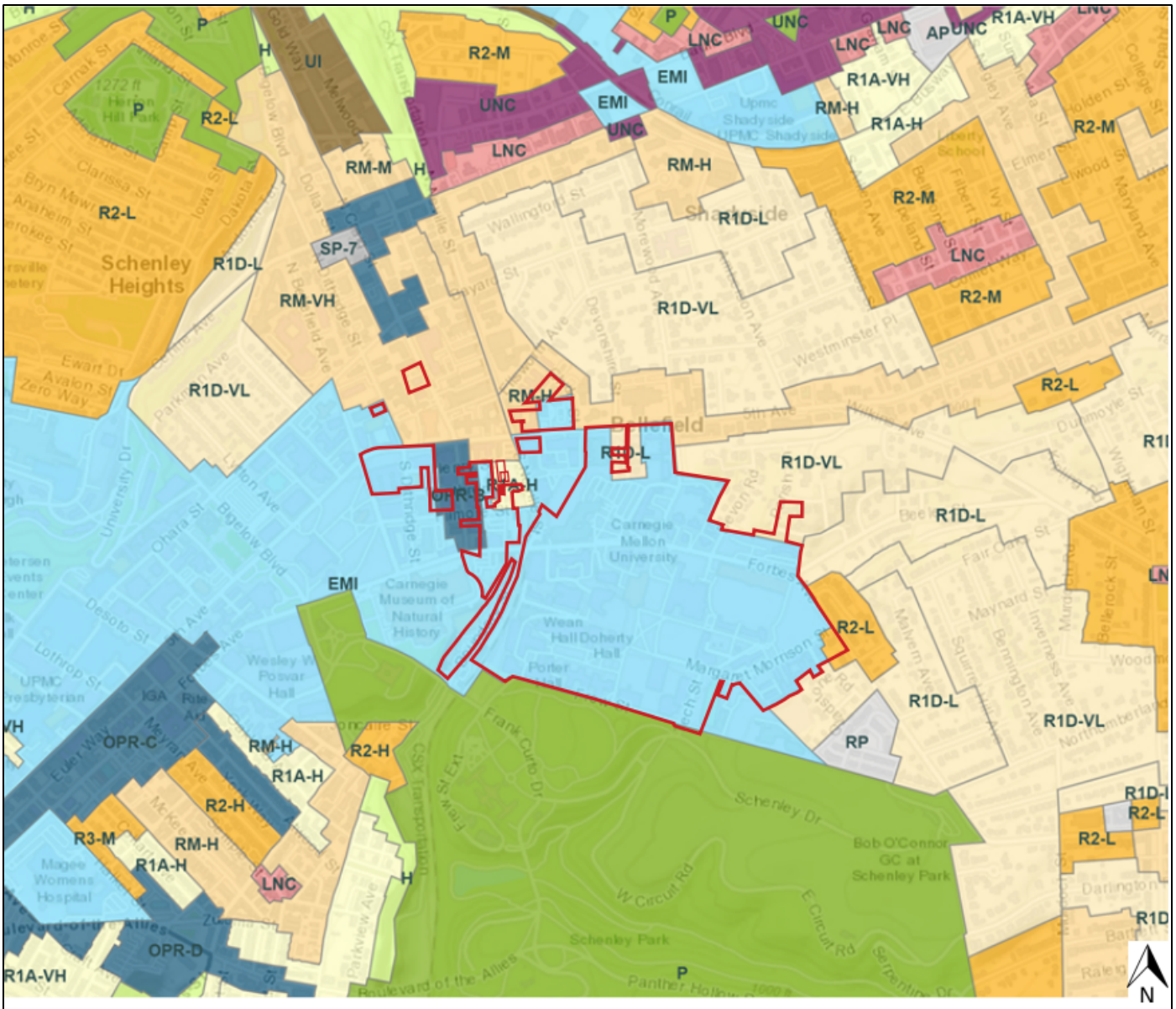

(Map by City of Pittsburgh)

	Carnegie Mellon University Property in 2022 IMP	RM	Residential Multi-Unit
	Planned Development Space	LNC	Local Neighborhood Commercial
EMI	Educational Medical Institutional	UNC	Urban Neighborhood Commercial
OPR	Oakland Public Realm	UI	Urban Industrial
P	Park		
H	Hillside		
R1D	Residential Single-Unit		
R2	Residential Two-Unit		

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PROJECT NO/CLIENT R200398.00 / Carnegie Mellon University

PROJECT
2032 Carnegie Mellon Institutional Master Plan
City of Pittsburgh, Allegheny County

TITLE
Carnegie Mellon EMI District Location

SCALE: N.T.S.

DWN. TMW
CHKD. RAK
FIGURE 1.0

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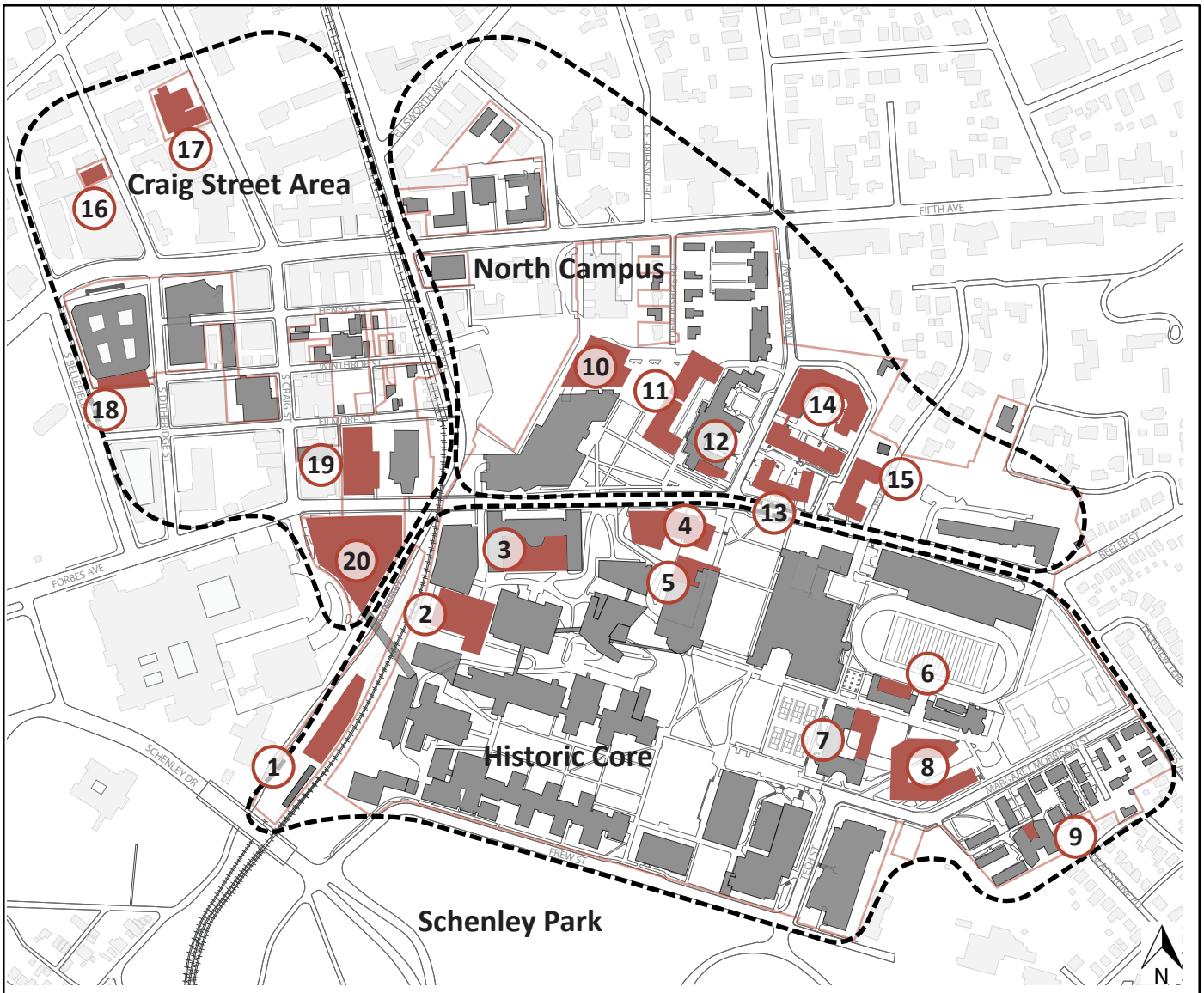

	Carnegie Mellon University Property in 2022 IMP	9	Student Commons
	Carnegie Mellon University Existing Buildings	10	Academic Building
	Campus District Boundaries	11	Mixed Use Building
	Development Sites	12	Student Commons
1	Facilities Operations Center	13	Mixed Use Building
2	Academic Building	14	Student Housing
3	Hamburg Expansion	15	Student Housing
4	Mixed Use	16	Shirley Apartments Renovation
5	Purnell Center Expansion	17	Student Apartments
6	West Wing Addition	18	Mellon Institute Entrance
7	Margaret Morrison Carnegie Hall Expansion	19	Mixed Use Building
8	Academic/Student Housing Complex	20	South of Forbes Site

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PROJECT NO/CLIENT R200398.00 / Carnegie Mellon University

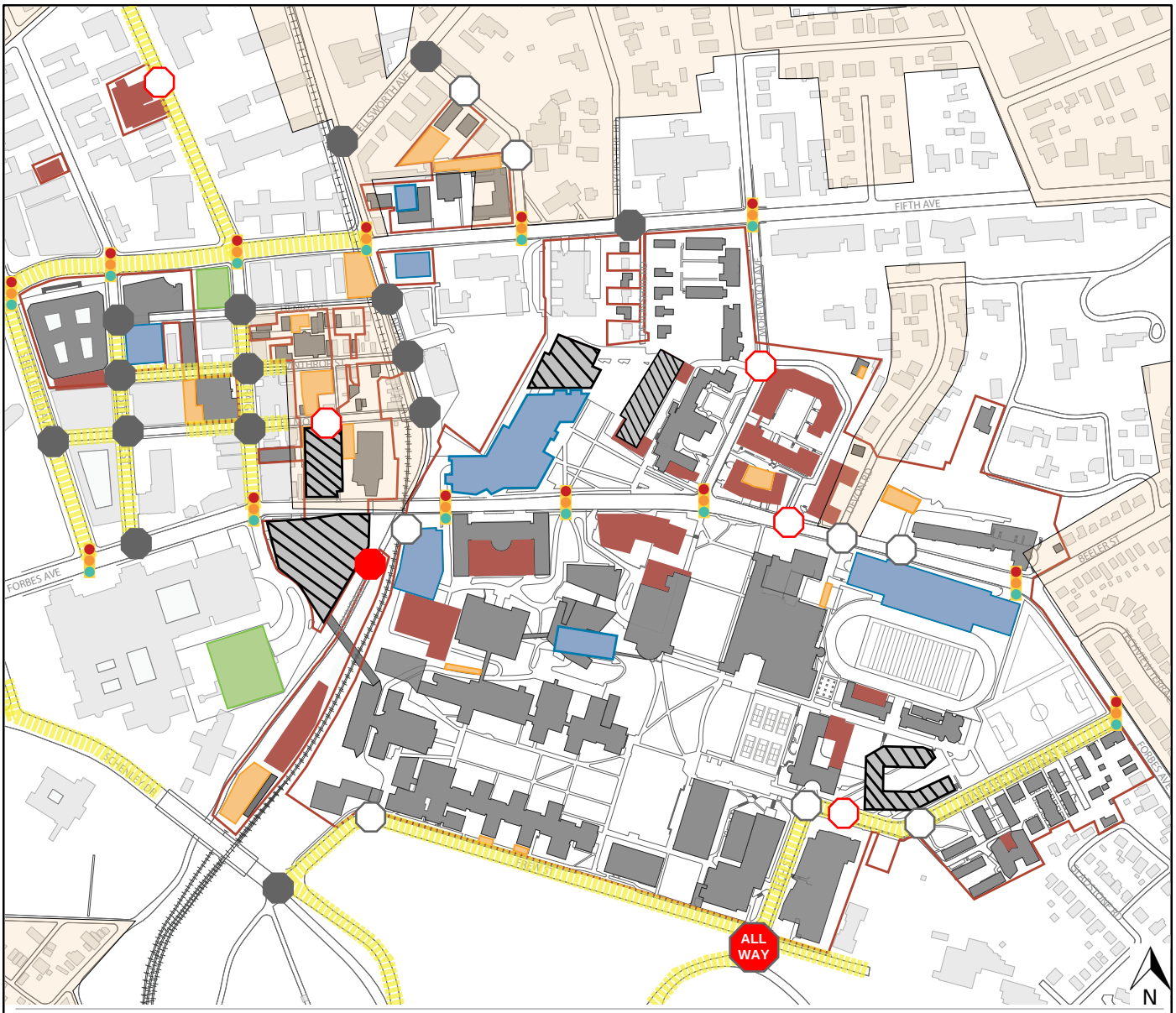
PROJECT
2032 Carnegie Mellon Institutional Master Plan
City of Pittsburgh, Allegheny County

TITLE
Site Plan

SCALE: N.T.S.

DWN. TMW
CHKD. RAK
FIGURE
2.0

FILE NAME: Z:\2020\R200398.00 - CMU-2022 IMP\CAD\TIS Figures\CMU_IMP_Border.dgn
PLOTTED: 2/2/2022



- Carnegie Mellon University Property in 2022 IMP
- Carnegie Mellon University Existing Buildings
- Development Sites
- CMU Structured Parking
- CMU Surface Lot
- New CMU Parking
- CMU Leased Parking
- Metered Street Parking
- Residential Permit Parking
- Unsignalized Driveway to Remain
- Unsignalized Driveway to be Modified
- Unsignalized Driveway to be Added
- Unsignalized Intersection to become All Way Stop
- Existing Unsignalized Intersection
- Existing Signalized Intersection

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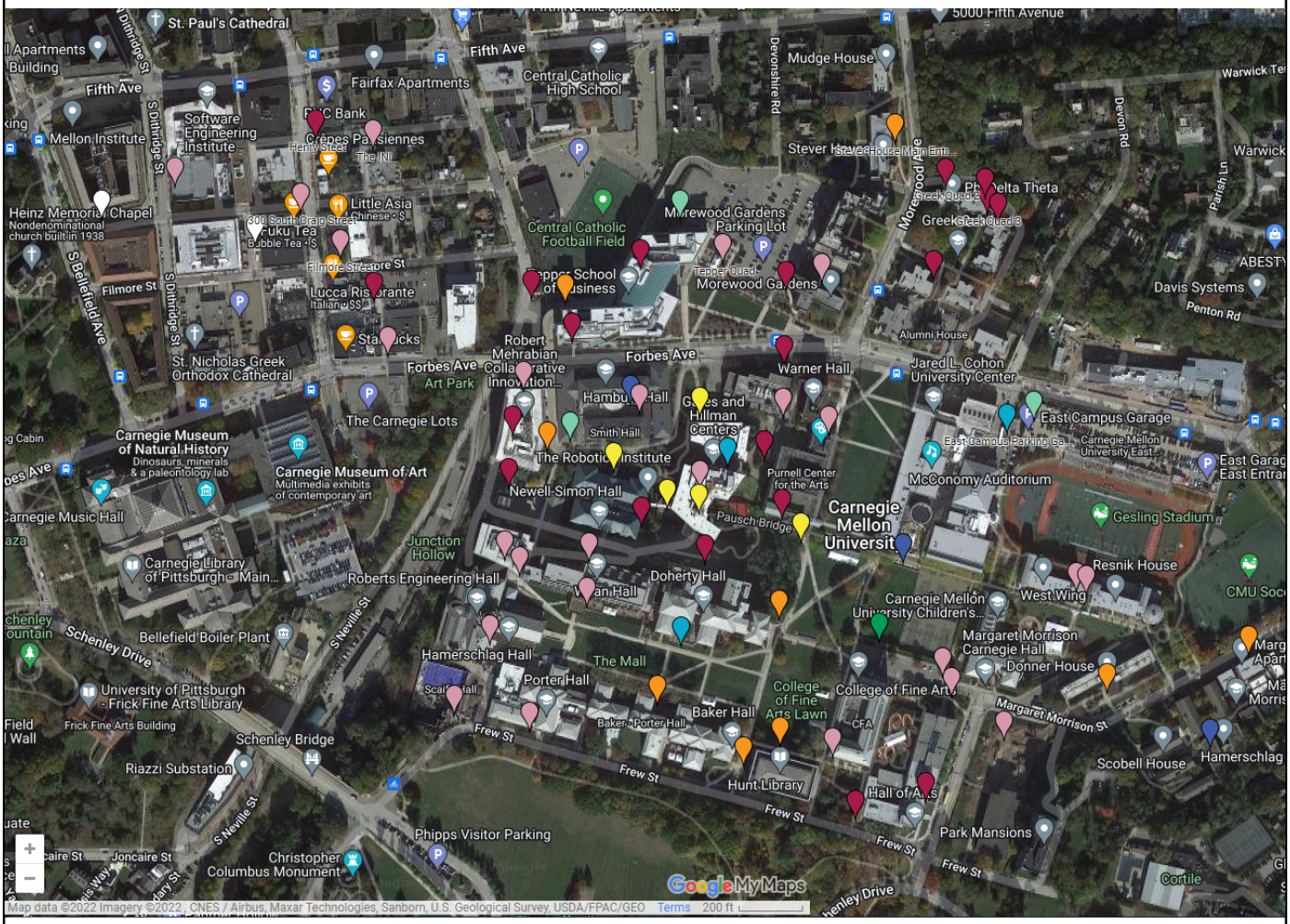
PROJECT NO/CLIENT	R200398.00 / Carnegie Mellon University
PROJECT	2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County
TITLE	Vehicular Site Access
SCALE: N.T.S.	
DWN.	TMW
CHKD.	RAK
FIGURE	2.1

FILE NAME: Z:\2020\R200398.00 - CMU-2022 IMP\CAD\TIS Figures\CMU_IMP_Border.dgn

PLOTTED: 2/2/2022



Source: https://www.cmu.edu/environment/transportation/index.html

Number of Bike Racks in Each Location

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 10
- Other / No data

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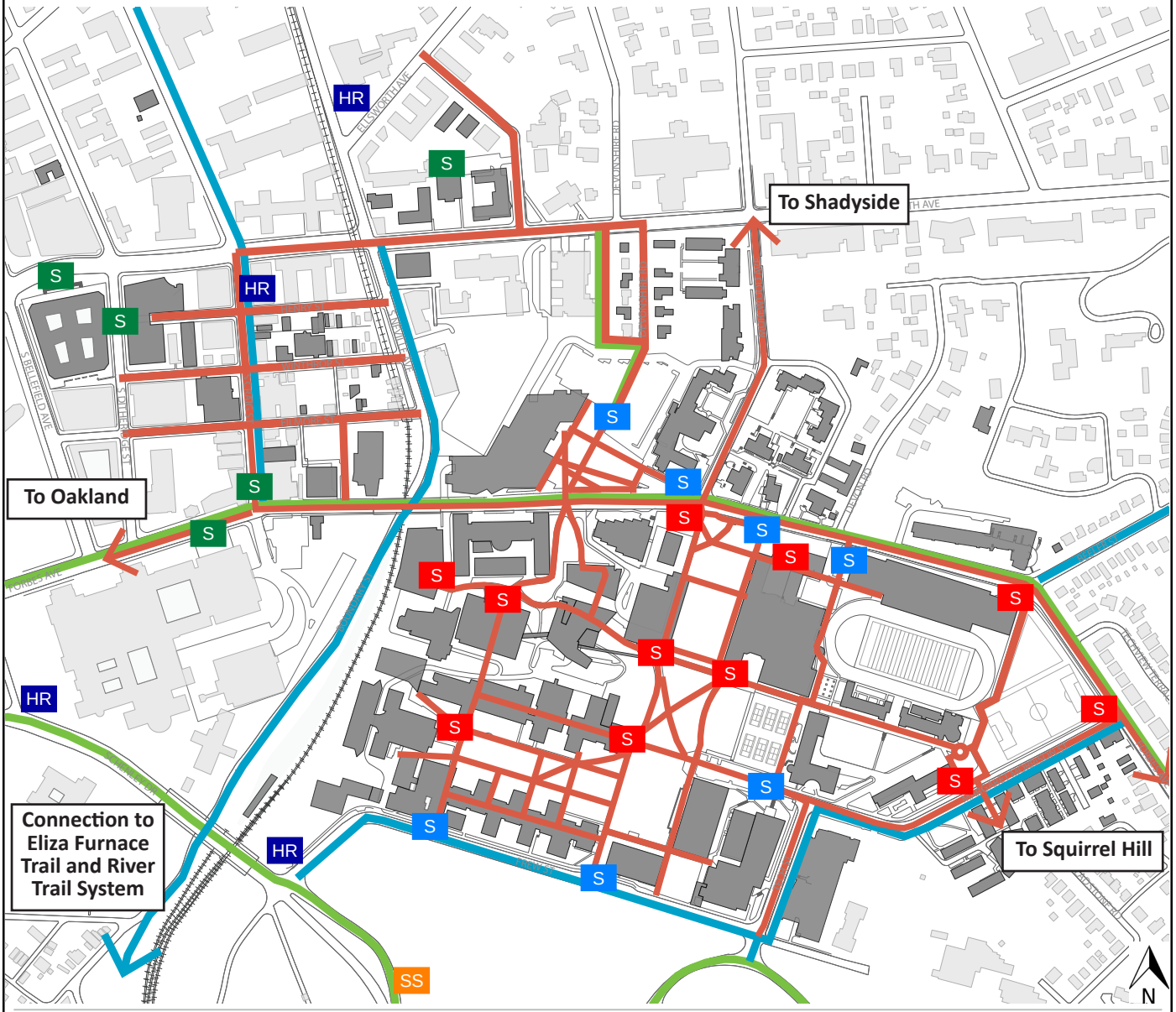
	PROJECT 2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County		CHKD. RAK
	TITLE On-campus Bicycle Parking	SCALE: N.T.S.	FIGURE 3.0

FILE NAME: Z:\2020\R200398.00 - CMU-2022 IMP\CAD\TIS Figures\CMU_IMP_Border.dgn

PLOTTED: 2/2/2022



Carnegie Mellon University Existing Buildings

Major Pedestrian Network

Bike Network

Bike Friendly Streets

HR Healthy Ride (POGOH) Bikeshare Stations (Winter 2022)

SS Existing Spin Scooter Stations (Winter 2022)

S Proposed Scooter Parking (June 2022)

S Proposed Scooter Parking (Fall 2022)

S Proposed Scooter Parking (2023)

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PROJECT NO/CLIENT R200398.00 / Carnegie Mellon University

PROJECT
2032 Carnegie Mellon Institutional Master Plan
City of Pittsburgh, Allegheny County

TITLE
Pedestrian and Bicycle Network

SCALE: N.T.S.

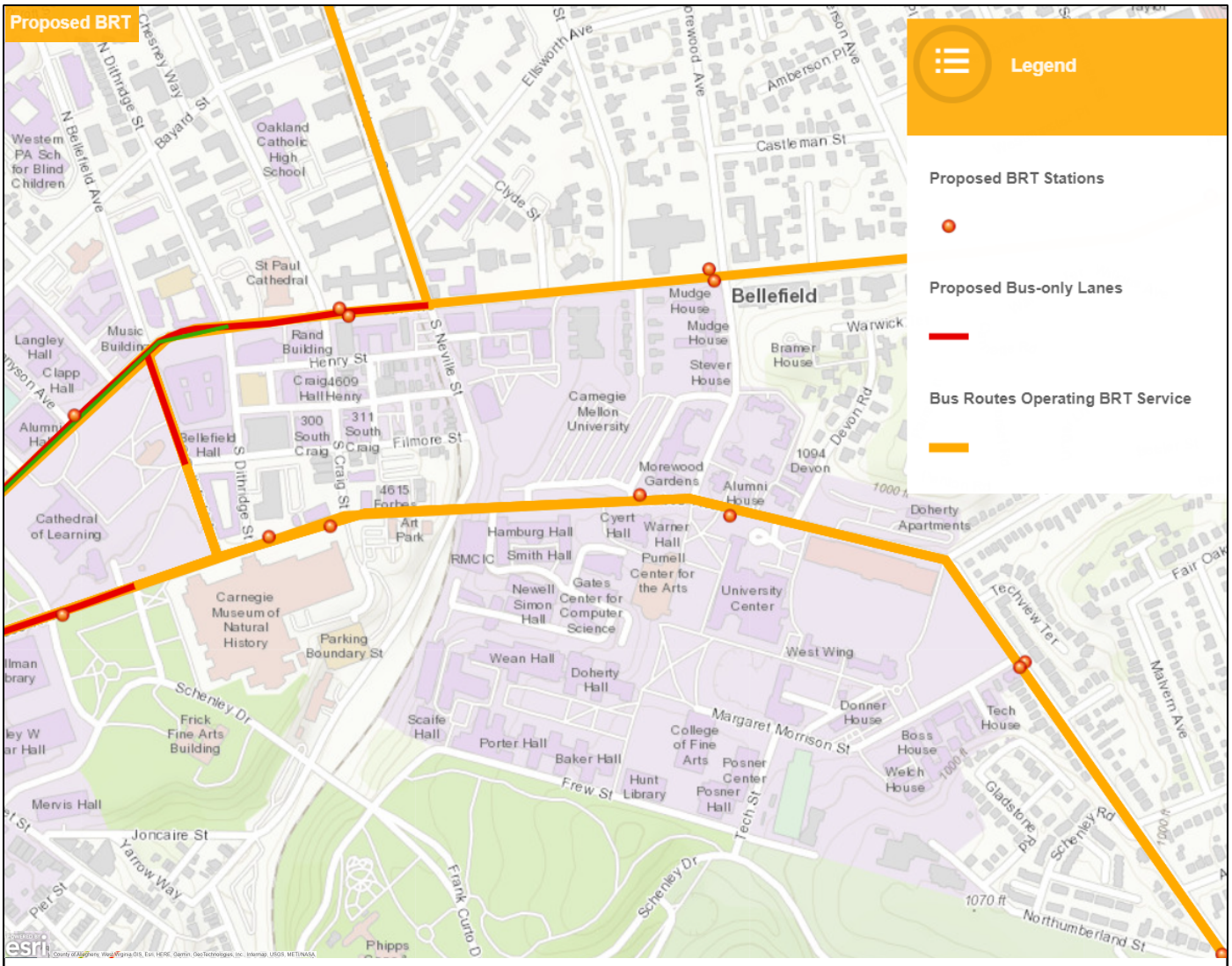
DWN. TMW

CHKD. RAK

FIGURE
3.1

FILE NAME: Z:\2020\R200398.00 - CMU-2022 IMP\CAD\TIS Figures\CMU_IMP_Border.dgn

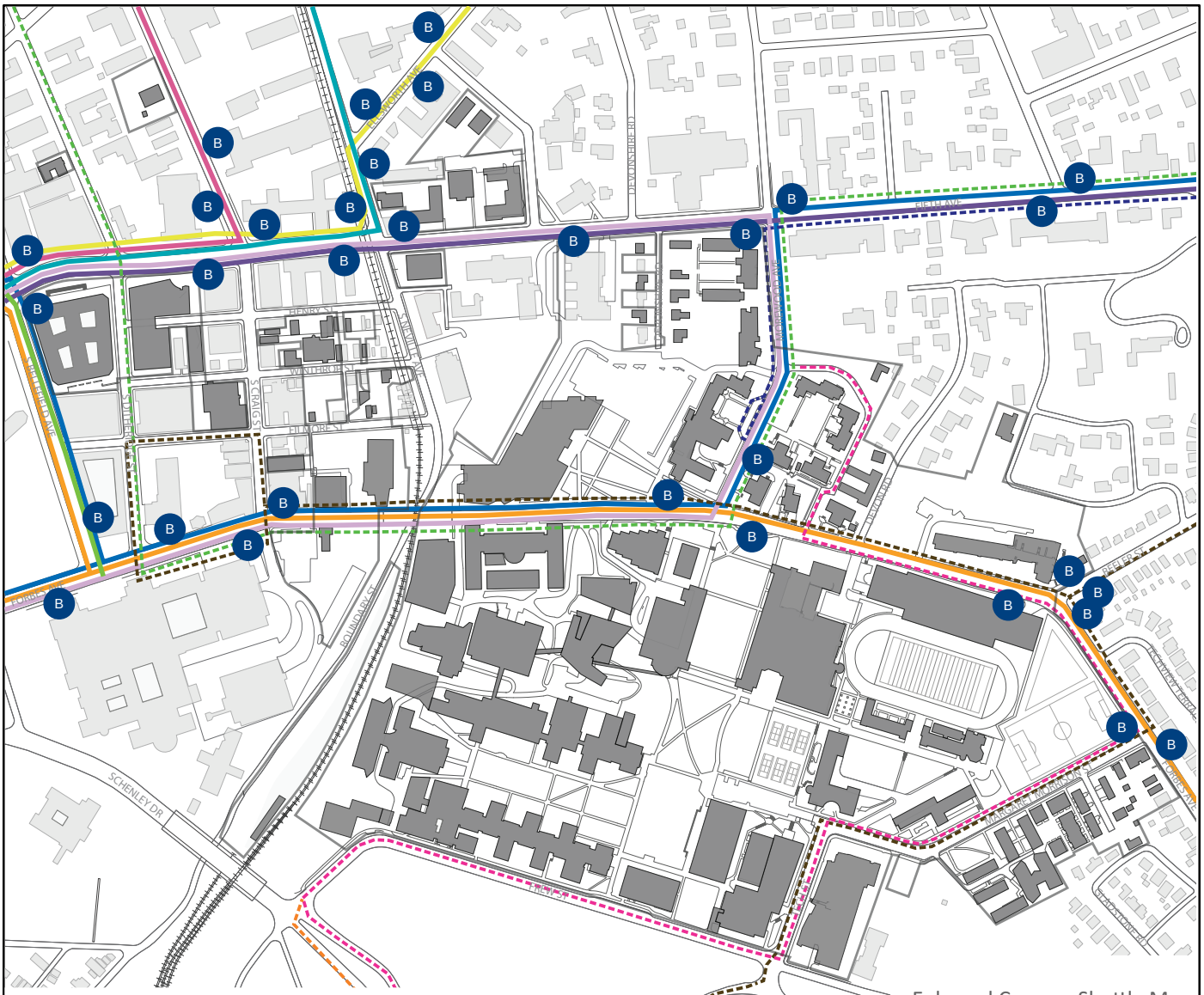
PLOTTED: 2/2/2022



gai consultants	PROJECT NO/CLIENT R200398.00 / Carnegie Mellon University		DWN. TMW
	PROJECT 2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County		CHKD. RAK
	TITLE Planned BRT Service	SCALE: N.T.S.	FIGURE 3.2

FILE NAME: Z:\2020\R200398.00 - CMU-2022 IMP\CAD\TIS Figures\CMU_IMP_Border.dgn

PLOTTED: 2/2/2022



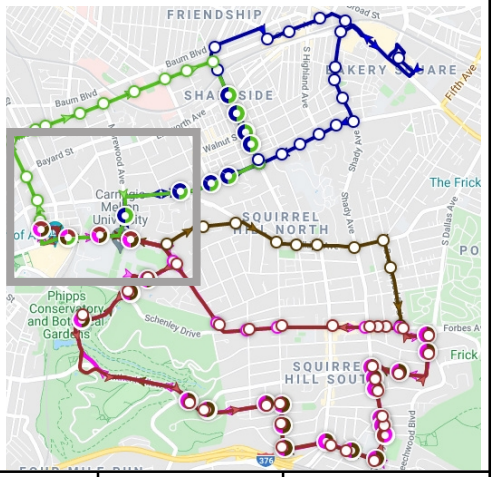
Enlarged Campus Shuttle Map

Port Authority

- P3 (15 min Peak Headway)
- 28X (30 min Peak Headway)
- 58 (1 hr Peak Headway)
- 61A, B, C, D (15 min Pk Hdwy)
- 71B, D (15 min Peak Headway)
- 71A,C/93 (15 min Peak Headway)
- 75 (25 min Peak Headway)
- B Bus Stop

CMU Shuttles

- CMU A (45 min Headway)
- CMU B (1 hr Headway)
- CMU C (45 min Headway)
- PTC/MILL 19 (1 hr Headway)
- Shuttle Stop



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PLOTTED: 2/2/2022

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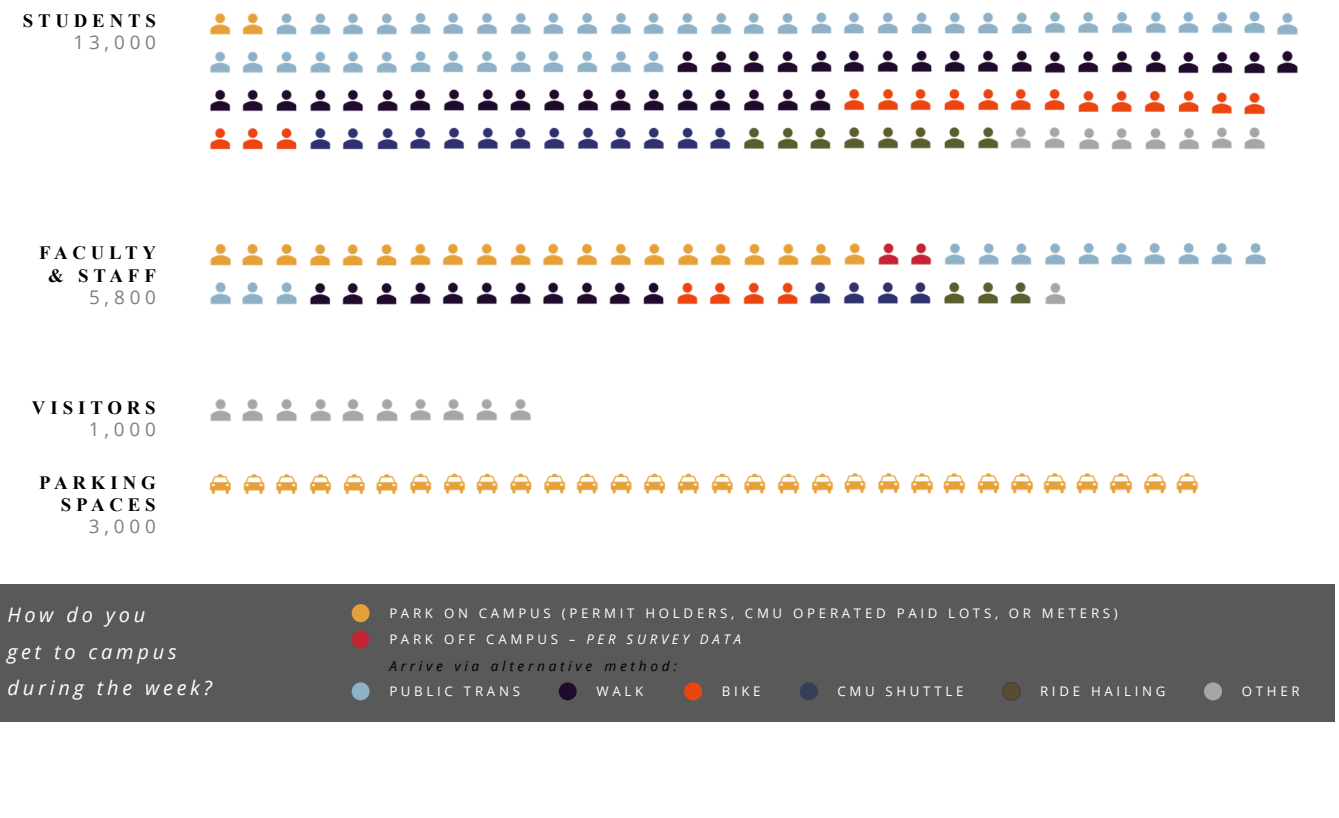
PROJECT NO/CLIENT	R200398.00 / Carnegie Mellon University
PROJECT	2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County
TITLE	Transit and Shuttle Network
SCALE: N.T.S.	
DWN.	TMW
CHKD.	RAK
FIGURE	3.3

Campus Commute Patterns

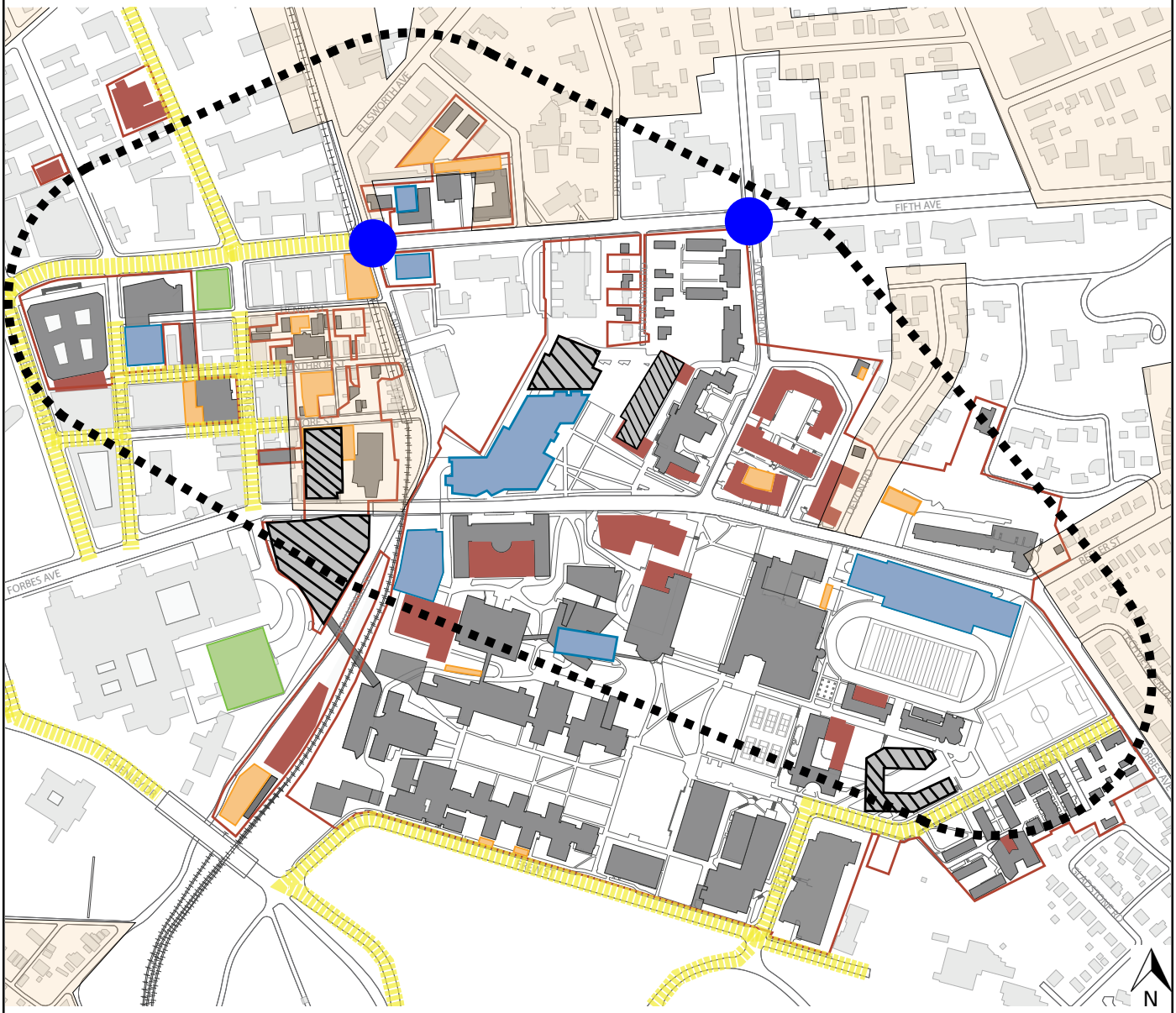
Each icon represents a total of 100 individuals or parking spaces
Demographic Data sourced from www.cmu.edu/ira | Survey Data collected Spring 2018 by Fehr & Peers



gai consultants	PROJECT NO/CLIENT R200398.00 / Carnegie Mellon University		DWN. TMW
	PROJECT 2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County		CHKD. RAK
	TITLE 2018 Parking Survey Mode Shares	SCALE: N.T.S.	FIGURE 4.0

FILE NAME: Z:\2020\R200398.00 - CMU-2022 IMP\CAD\TIS Figures\CMU_IMP_Border.dgn

PLOTTED: 2/2/2022



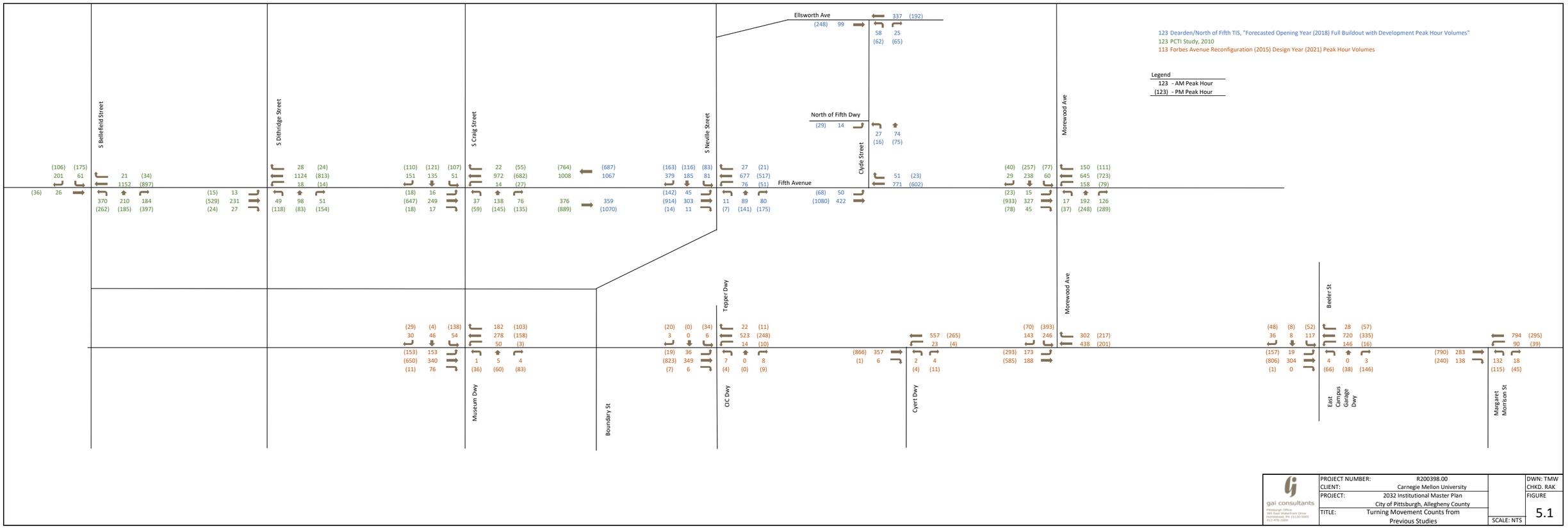
- Area of Influence for Data Collection

- Intersection Selected for Capacity Analysis

gai consultants	PROJECT NO/CLIENT R200398.00 / Carnegie Mellon University		DWN. TMW
	PROJECT 2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County		CHKD. RAK
	TITLE Traffic Study Area of Impact	SCALE: N.T.S.	FIGURE 5.0

FILE NAME: Z:\2020\R200398.00 - CMU-2022 IMP\CAD\TIS Figures\CMU_IMP_Border.dgn

PLOTTED: 2/2/2022



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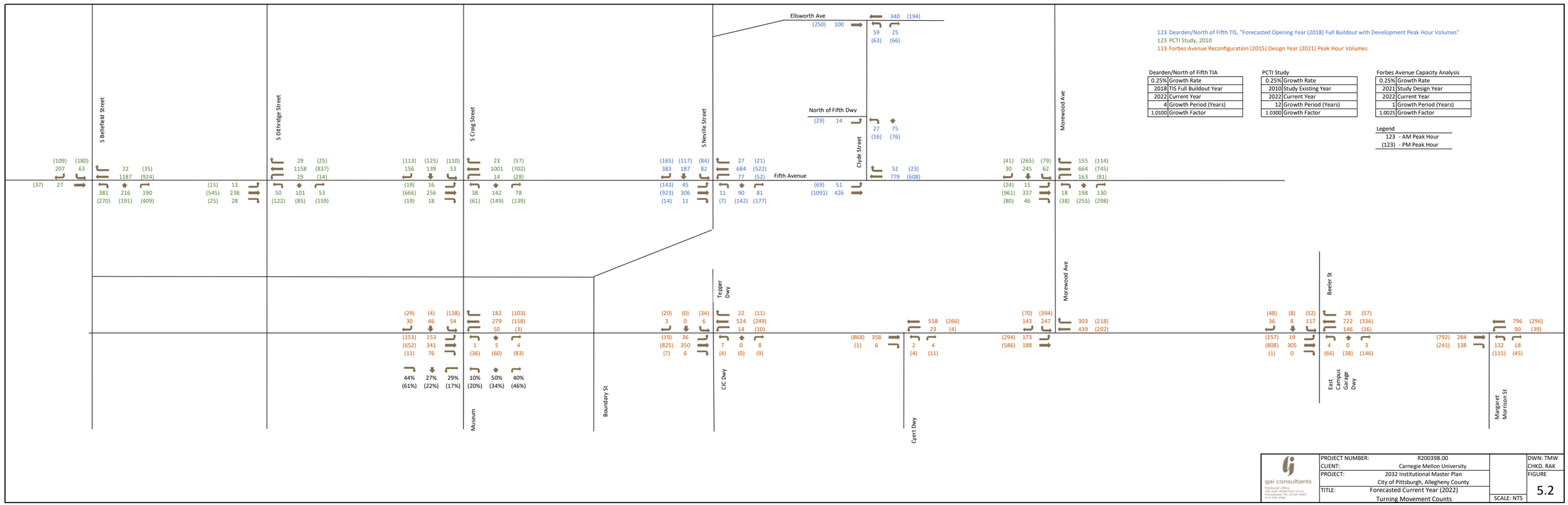
412-476-2000

PROJECT NUMBER:	R200398.00	DWN: TMW
CLIENT:	Carnegie Mellon University	CHKD. RAK
PROJECT:	2032 Institutional Master Plan City of Pittsburgh, Allegheny County	FIGURE
TITLE:	Turning Movement Counts from Previous Studies	5.1
	SCALE: NTS	


S Bellefield Street
S Dithridge Street
S Craig Street
S Neville Street
Clyde Street
Morewood Ave
Ellsworth Ave
North of Fifth Dwy
Fifth Avenue
Tagger Dwy
CIC Dwy
Cyert Dwy
Boundary St
Museum
Beeler St
East Campus Garage Dwy
Margaret Morrison St
123 Dearden/North of Fifth TIS, "Forecasted Opening Year (2018) Full Buildout with Development Peak Hour Volumes"
123 PCTI Study, 2010
113 Forbes Avenue Reconfiguration (2015) Design Year (2021) Peak Hour Volumes
Dearden/North of Fifth TIA
0.25% Growth Rate
2018 TIS Full Buildout Year
2022 Current Year
4 Growth Period (Years)
1.0100 Growth Factor
PCTI Study
0.25% Growth Rate
2010 Study Existing Year
2022 Current Year
12 Growth Period (Years)
1.0300 Growth Factor
Forbes Avenue Capacity Analysis
0.25% Growth Rate
2021 Study Design Year
2022 Current Year
1 Growth Period (Years)
1.0025 Growth Factor
Legend
123 - AM Peak Hour
(123) - PM Peak Hour
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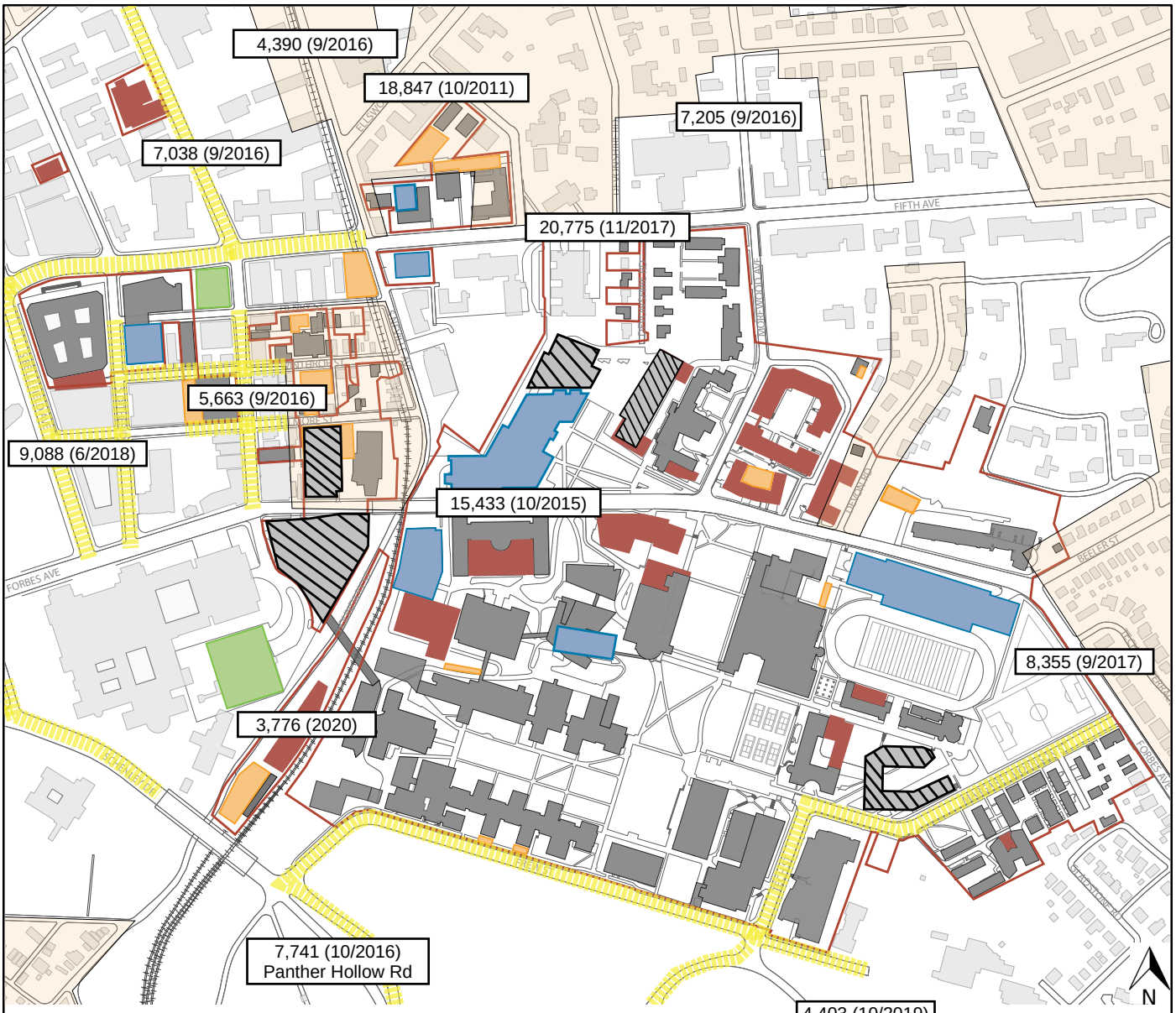
Homestead, PA 15120-5005
412-476-2000
PROJECT NUMBER: R200398.00
CLIENT: Carnegie Mellon University
PROJECT: 2032 Institutional Master Plan
City of Pittsburgh, Allegheny County
TITLE: Forecasted Current Year (2022)
Turning Movement Counts
SCALE: NTS
DWN: TMW
CHKD. RAK
FIGURE
5.2



Source: PennDOT Traffic Information Respository (TIRe)

- Carnegie Mellon University Property in 2022 IMP
- Carnegie Mellon University Existing Buildings
- Development Sites
- CMU Structured Parking
- CMU Surface Lot
- New CMU Parking
- CMU Leased Parking
- Metered Street Parking
- Residential Permit Parking
- ADT (Date) — ADT from TIRe (Date Collected)

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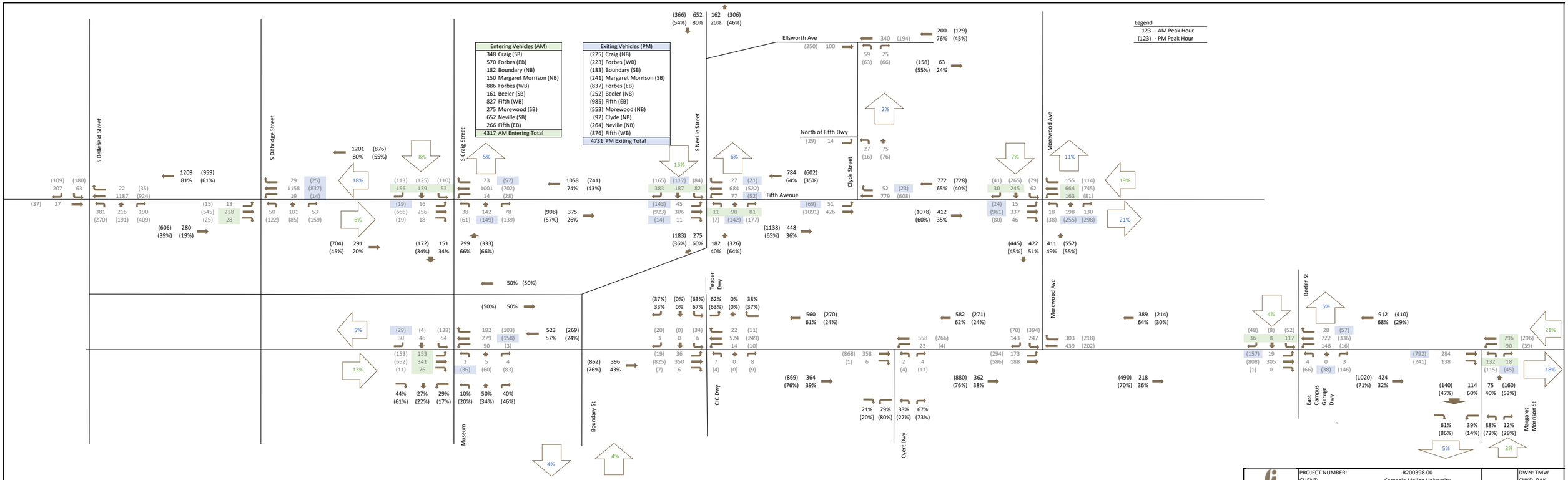
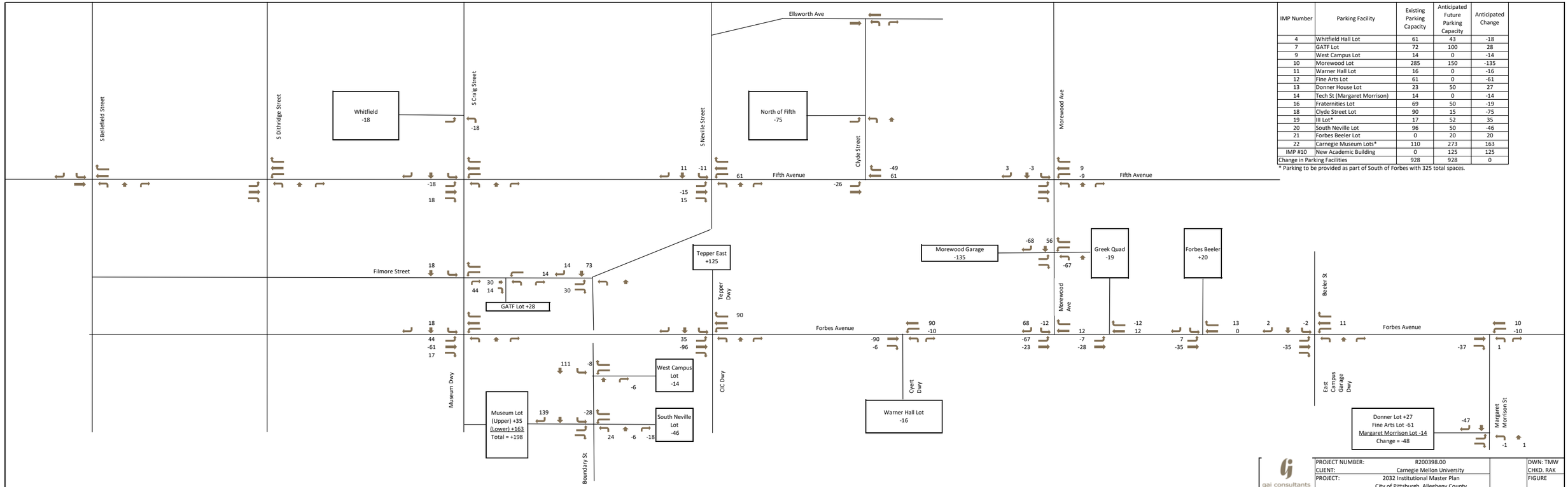
PROJECT NO/CLIENT	R200398.00 / Carnegie Mellon University
PROJECT	2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County
TITLE	Existing ADT Volume
SCALE: N.T.S.	
DWN.	TMW
CHKD.	RAK
FIGURE	5.3

FILE NAME: Z:\2020\R200398.00 - CMU-2022 IMP\CAD\TIS Figures\CMU_IMP_Border.dgn

PLOTTED: 2/2/2022



gai consultants Pittsburgh Office 385 East Waterfront Drive Homestead, PA 15120-5005 412-476-2000	PROJECT NUMBER: R200398.00 CLIENT: Carnegie Mellon University PROJECT: 2032 Institutional Master Plan City of Pittsburgh, Allegheny County TITLE: Existing Traffic Distribution	SCALE: NTS	DWN: TMW CHKD. RAK FIGURE 5.4.1



IMP Number	Parking Facility	Existing Parking Capacity	Anticipated Future Parking Capacity	Anticipated Change
4	Whitfield Hall Lot	61	43	-18
7	GATF Lot	72	100	28
9	West Campus Lot	14	0	-14
10	Morewood Lot	285	150	-135
11	Warner Hall Lot	16	0	-16
12	Fine Arts Lot	61	0	-61
13	Donner House Lot	23	50	27
14	Tech St (Margaret Morrison)	14	0	-14
16	Fraternities Lot	69	50	-19
18	Clyde Street Lot	90	15	-75
19	III Lot*	17	52	35
20	South Neville Lot	96	50	-46
21	Forbes Beeler Lot	0	20	20
22	Carnegie Museum Lots*	110	273	163
IMP #10	New Academic Building	0	125	125
Change in Parking Facilities		928	928	0

* Parking to be provided as part of South of Forbes with 325 total spaces.

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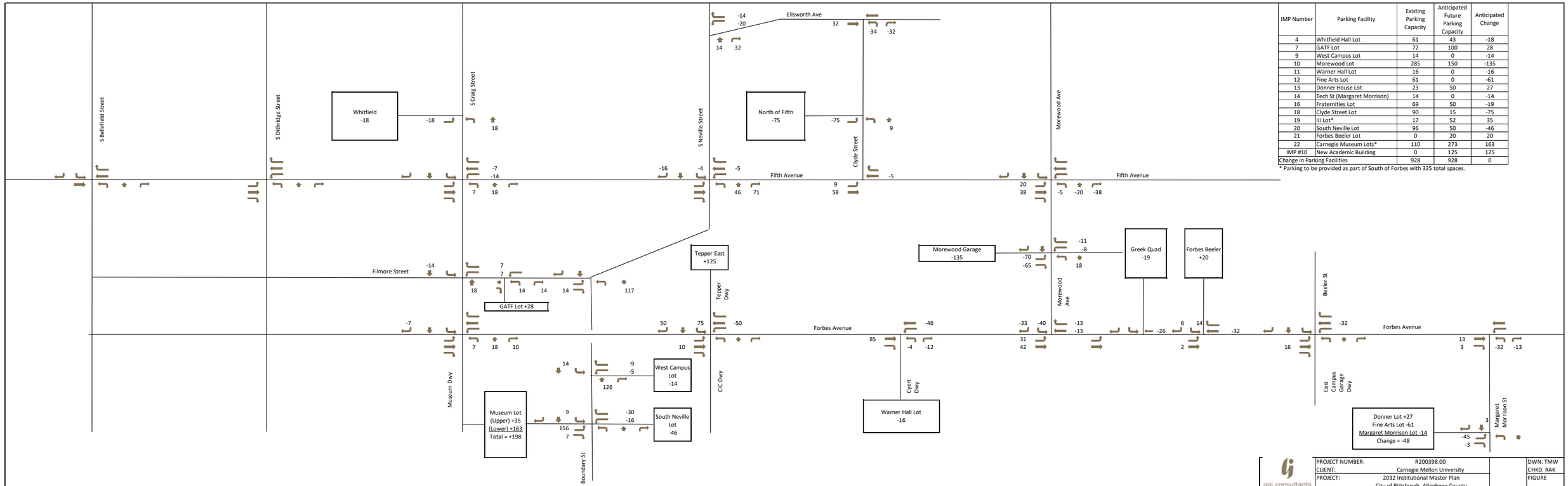
412-476-2000

PROJECT NUMBER:	R200398.00	DWN: TMW
CLIENT:	Carnegie Mellon University	CHKD. RAK
PROJECT:	2032 Institutional Master Plan City of Pittsburgh, Allegheny County	FIGURE
TITLE:	Proposed Master Planning Year (2032) Entering Parking Trip Reassignment	5.4.2
	SCALE: NTS	



IMP Number	Parking Facility	Existing Parking Capacity	Anticipated Future Parking Capacity	Anticipated Change
4	Whitfield Hall Lot	61	43	-18
7	GATF Lot	72	100	28
9	West Campus Lot	14	0	-14
10	Morewood Lot	285	150	-135
11	Warner Hall Lot	16	0	-16
12	Fine Arts Lot	61	0	-61
13	Donner House Lot	23	50	27
14	Tech St (Margaret Morrison)	14	0	-14
16	Fraternities Lot	69	50	-19
18	Clyde Street Lot	90	15	-75
19	III Lot*	17	52	35
20	South Neville Lot	96	50	-46
21	Forbes Beeler Lot	0	20	20
22	Carnegie Museum Lots*	110	273	163
IMP #10	New Academic Building	0	125	125
Change in Parking Facilities		928	928	0

* Parking to be provided as part of South of Forbes with 325 total spaces.

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PROJECT NUMBER:	R200398.00
CLIENT:	Carnegie Mellon University
PROJECT:	2032 Institutional Master Plan City of Pittsburgh, Allegheny County
TITLE:	Proposed Master Planning Year (2032) Exiting Parking Trip Reassignment

SCALE: NTS

DWN: TMW
CHKD. RAK
FIGURE
5.4.3

Forbes Avenue Capacity Analysis

0.25%	Growth Rate
2022	Current Year
2032	Design Year
10	Growth Period (Years)
1.0250	Growth Factor

Legend

123	- AM Peak Hour
(123)	- PM Peak Hour

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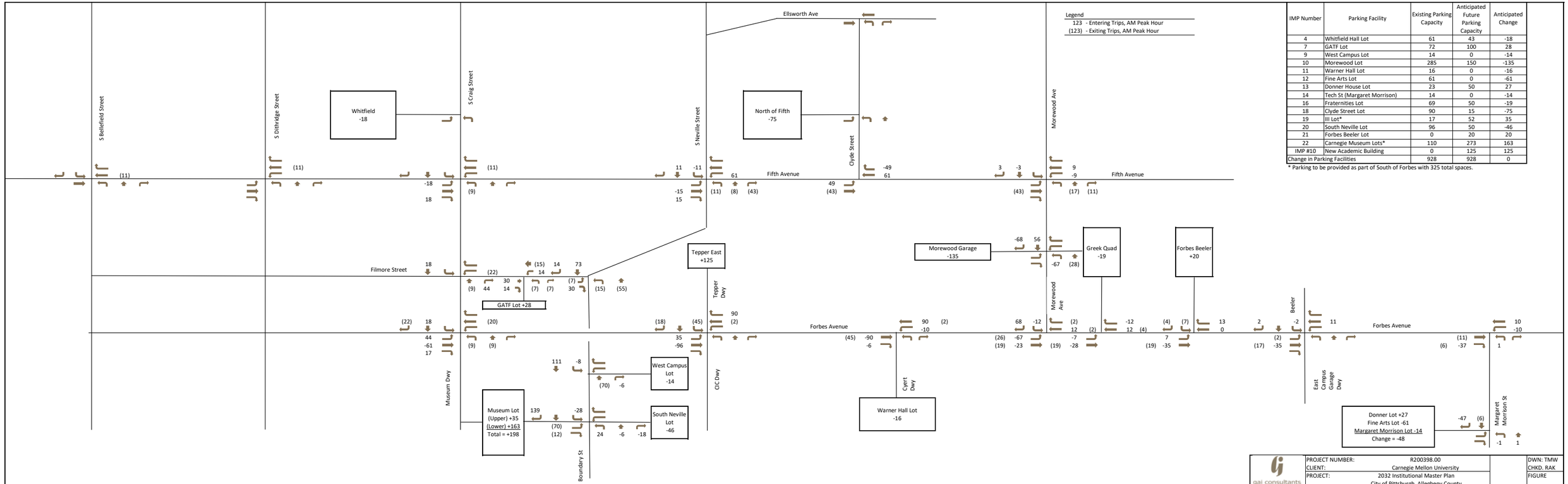
412-476-2000

PROJECT NUMBER:	R200398.00	DWN: TMW
CLIENT:	Carnegie Mellon University	CHKD. RAK
PROJECT:	2032 Institutional Master Plan City of Pittsburgh, Allegheny County	FIGURE
TITLE:	Forecasted Master Planning Year (2032) Turning Movement Counts without Development	5.5
	SCALE: NTS	



IMP Number	Parking Facility	Existing Parking Capacity	Anticipated Future Parking Capacity	Anticipated Change
4	Whitfield Hall Lot	61	43	-18
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12	Fine Arts Lot	61	0	-61
13	Donner House Lot	23	50	27
14	Tech St (Margaret Morrison)	14	0	-14
16	Fraternities Lot	69	50	-19
18	Clyde Street Lot	90	15	-75
19	III Lot*	17	52	35
20	South Neville Lot	96	50	-46
21	Forbes Beeler Lot	0	20	20
22	Carnegie Museum Lots*	110	273	163
IMP #10	New Academic Building	0	125	125
Change in Parking Facilities		928	928	0

* Parking to be provided as part of South of Forbes with 325 total spaces.

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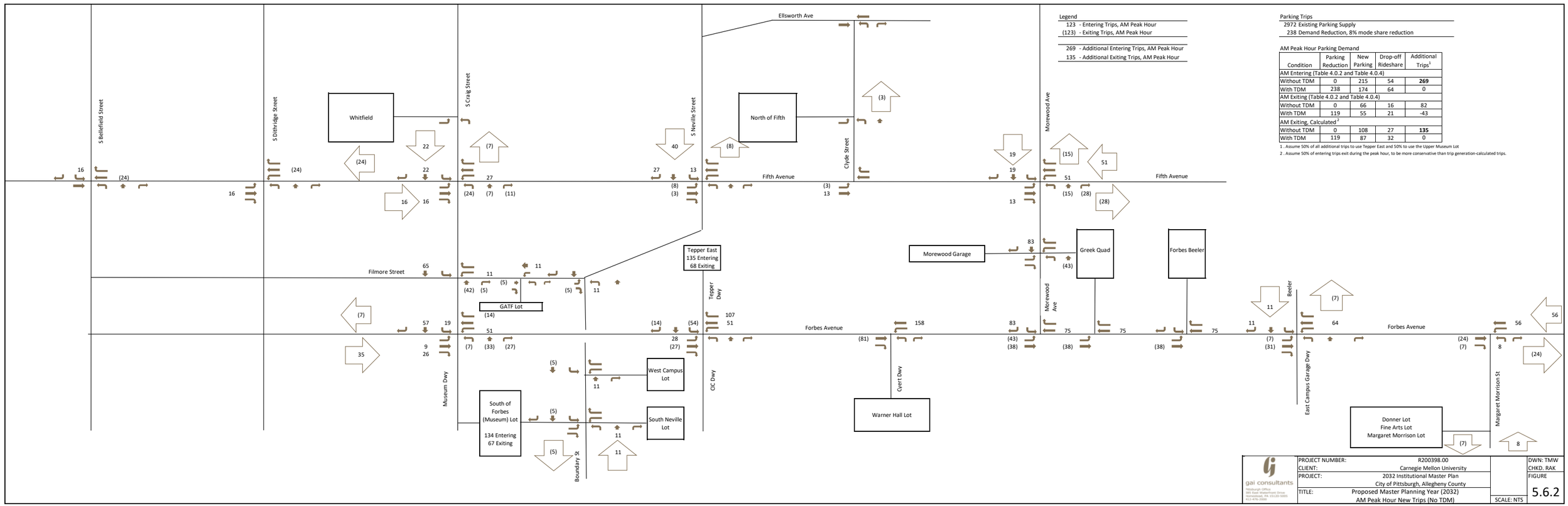
PROJECT NUMBER:	R200398.00
CLIENT:	Carnegie Mellon University
PROJECT:	2032 Institutional Master Plan City of Pittsburgh, Allegheny County
TITLE:	Proposed Master Planning Year (2032) AM Peak Hour Trips with Parking Reassignment

SCALE: NTS

DWN: TMW
CHKD. RAK
FIGURE
5.6.1



Legend

123	- Entering Trips, AM Peak Hour
(123)	- Exiting Trips, AM Peak Hour
269	- Additional Entering Trips, AM Peak Hour
135	- Additional Exiting Trips, AM Peak Hour

Parking Trips

2972	Existing Parking Supply
238	Demand Reduction, 8% mode share reduction

AM Peak Hour Parking Demand

Condition	Parking Reduction	New Parking	Drop-off Rideshare	Additional Trips[1]
AM Entering (Table 4.0.2 and Table 4.0.4)				
Without TDM	0	215	54	**269**
With TDM	238	174	64	0
AM Exiting (Table 4.0.2 and Table 4.0.4)				
Without TDM	0	66	16	82
With TDM	119	55	21	-43
AM Exiting, Calculated[2]				
Without TDM	0	108	27	**135**
With TDM	119	87	32	0

1 . Assume 50% of all additional trips to use Tepper East and 50% to use the Upper Museum Lot

2 . Assume 50% of entering trips exit during the peak hour, to be more conservative than trip generation-calculated trips.

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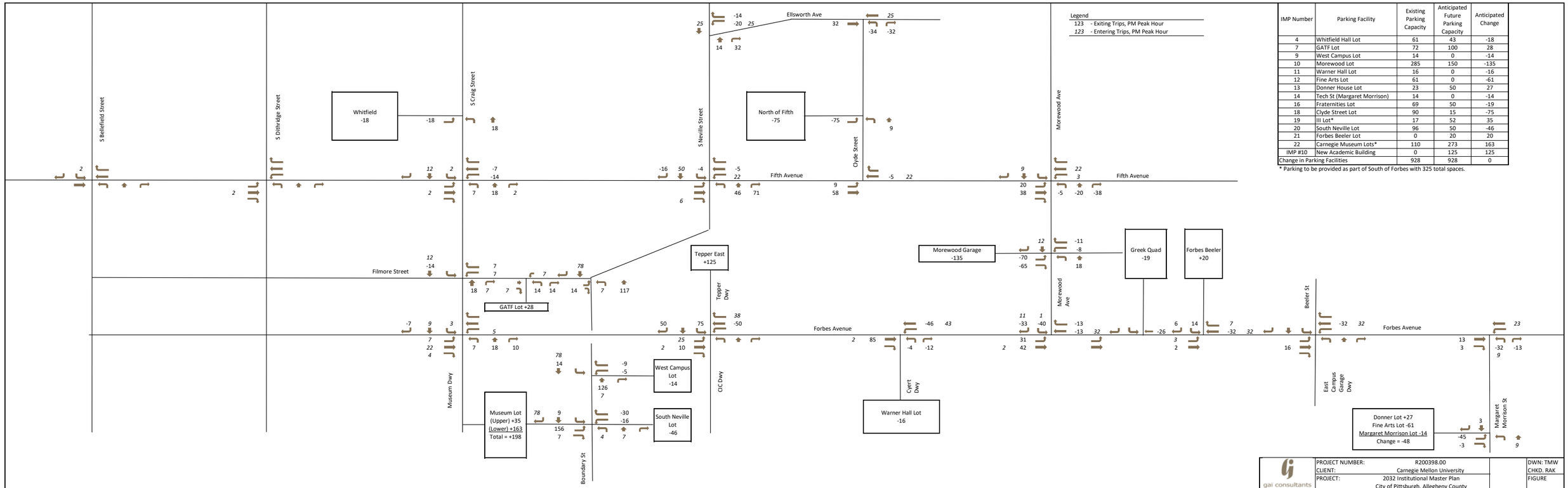
PROJECT NUMBER:	R200398.00		DWN: TMW
CLIENT:	Carnegie Mellon University		CHKD. RAK
PROJECT:	2032 Institutional Master Plan City of Pittsburgh, Allegheny County		FIGURE
TITLE:	Proposed Master Planning Year (2032) AM Peak Hour New Trips (No TDM)	SCALE: NTS	5.6.2



IMP Number	Parking Facility	Existing Parking Capacity	Anticipated Future Parking Capacity	Anticipated Change
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12	Fine Arts Lot	61	0	-61
13	Donner House Lot	23	50	27
14	Tech St (Margaret Morrison)	14	0	-14
16	Fraternities Lot	69	50	-19
18	Clyde Street Lot	90	15	-75
19	III Lot*	17	52	35
20	South Neville Lot	96	50	-46
21	Forbes Beeler Lot	0	20	20
22	Carnegie Museum Lots*	110	273	163
IMP #10	New Academic Building	0	125	125
Change in Parking Facilities		928	928	0

* Parking to be provided as part of South of Forbes with 325 total spaces.

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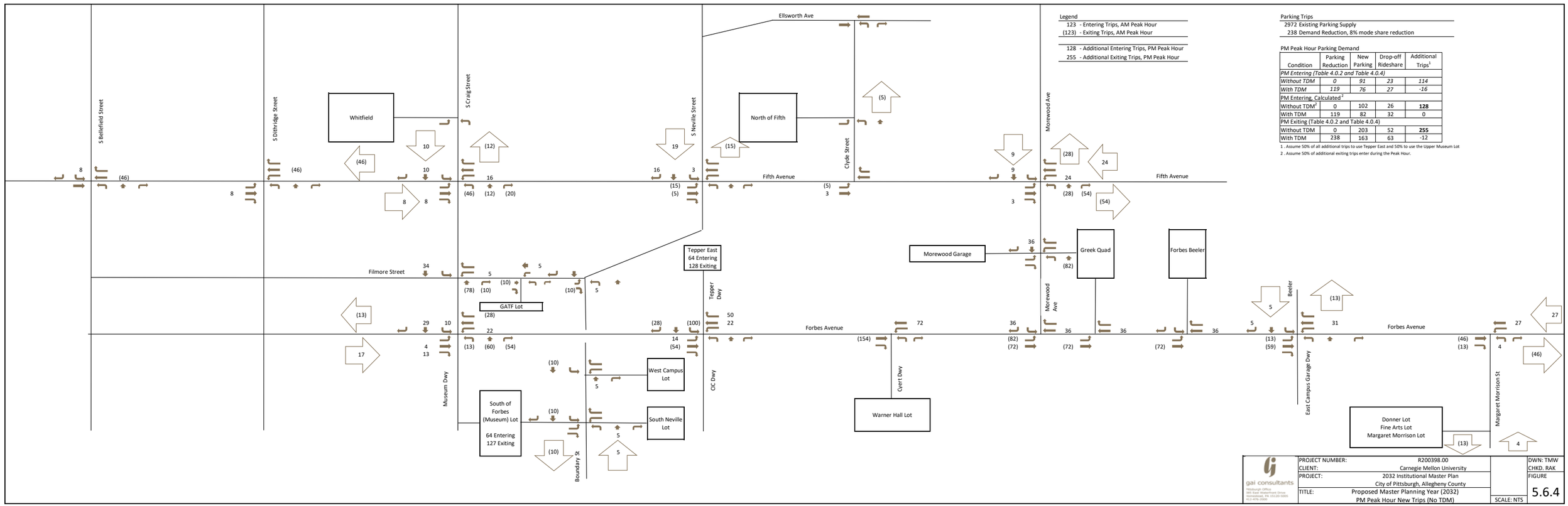
385 East Waterfront Drive
Homestead, PA 15120-5005
412-476-2000

PROJECT NUMBER:	R200398.00
CLIENT:	Carnegie Mellon University
PROJECT:	2032 Institutional Master Plan City of Pittsburgh, Allegheny County
TITLE:	Proposed Master Planning Year (2032) PM Peak Hour Trips with Parking Reassignment

DWN: TMW
CHKD. RAK
FIGURE
5.6.3
SCALE: NTS



Legend

123	- Entering Trips, AM Peak Hour
(123)	- Exiting Trips, AM Peak Hour
128	- Additional Entering Trips, PM Peak Hour
255	- Additional Exiting Trips, PM Peak Hour

Parking Trips

2972	Existing Parking Supply
238	Demand Reduction, 8% mode share reduction

PM Peak Hour Parking Demand

Condition	Parking Reduction	New Parking	Drop-off Rideshare	Additional Trips[1]
PM Entering (Table 4.0.2 and Table 4.0.4)				
Without TDM	*0*	*91*	*23*	*114*
With TDM	*119*	*76*	*27*	*-16*
PM Entering, Calculated[2]				
Without TDM[2]	0	102	26	**128**
With TDM	119	82	32	0
PM Exiting (Table 4.0.2 and Table 4.0.4)				
Without TDM	0	203	52	**255**
With TDM	238	163	63	-12

1 . Assume 50% of all additional trips to use Tepper East and 50% to use the Upper Museum Lot
2 . Assume 50% of additional exiting trips enter during the Peak Hour.

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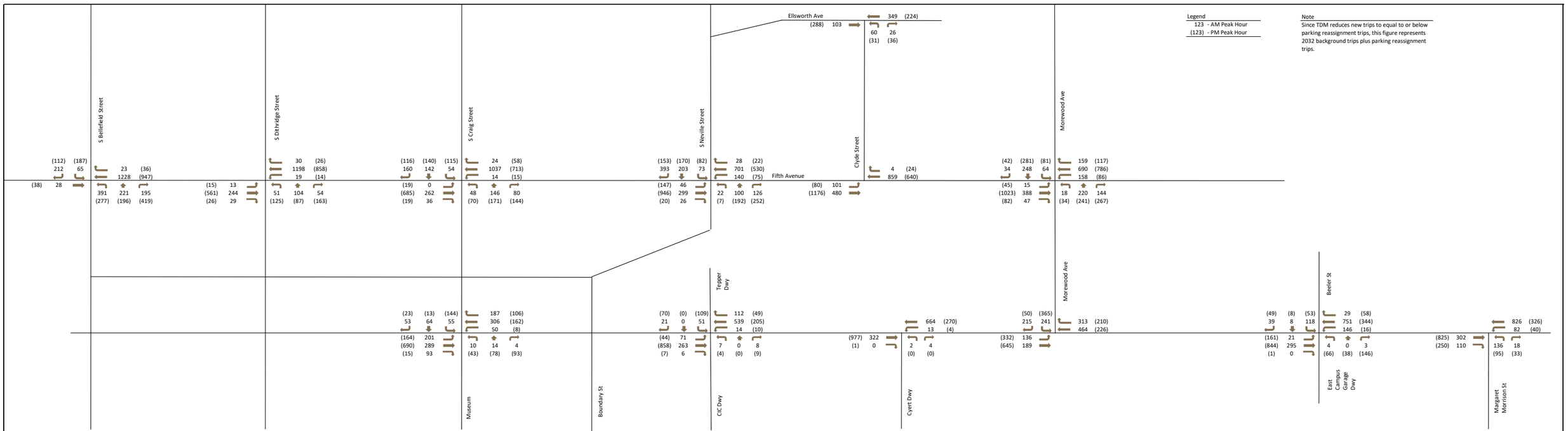
412-476-2000

PROJECT NUMBER:	R200398.00	DWN: TMW
CLIENT:	Carnegie Mellon University	CHKD. RAK
PROJECT:	2032 Institutional Master Plan City of Pittsburgh, Allegheny County	FIGURE
TITLE:	Proposed Master Planning Year (2032) PM Peak Hour New Trips (No TDM)	5.6.4
		SCALE: NTS

gai consultants Pittsburgh Office 305 East Waterfront Drive Homestead, PA 15120-5001 412-476-2000	PROJECT NUMBER: R200398.00 CLIENT: Carnegie Mellon University PROJECT: 2032 Institutional Master Plan City of Pittsburgh, Allegheny County TITLE: Forecasted Master Planning Year (2032) Maximum Trip Conditions (50% Buildout, No TDM)	SCALE: NTS	DWN: TMW CHKD. RAK FIGURE 5.6.5



Legend

123 - AM Peak Hour
(123) - PM Peak Hour

Note

Since TDM reduces new trips to equal to or below parking reassignment trips, this figure represents 2032 background trips plus parking reassignment trips.

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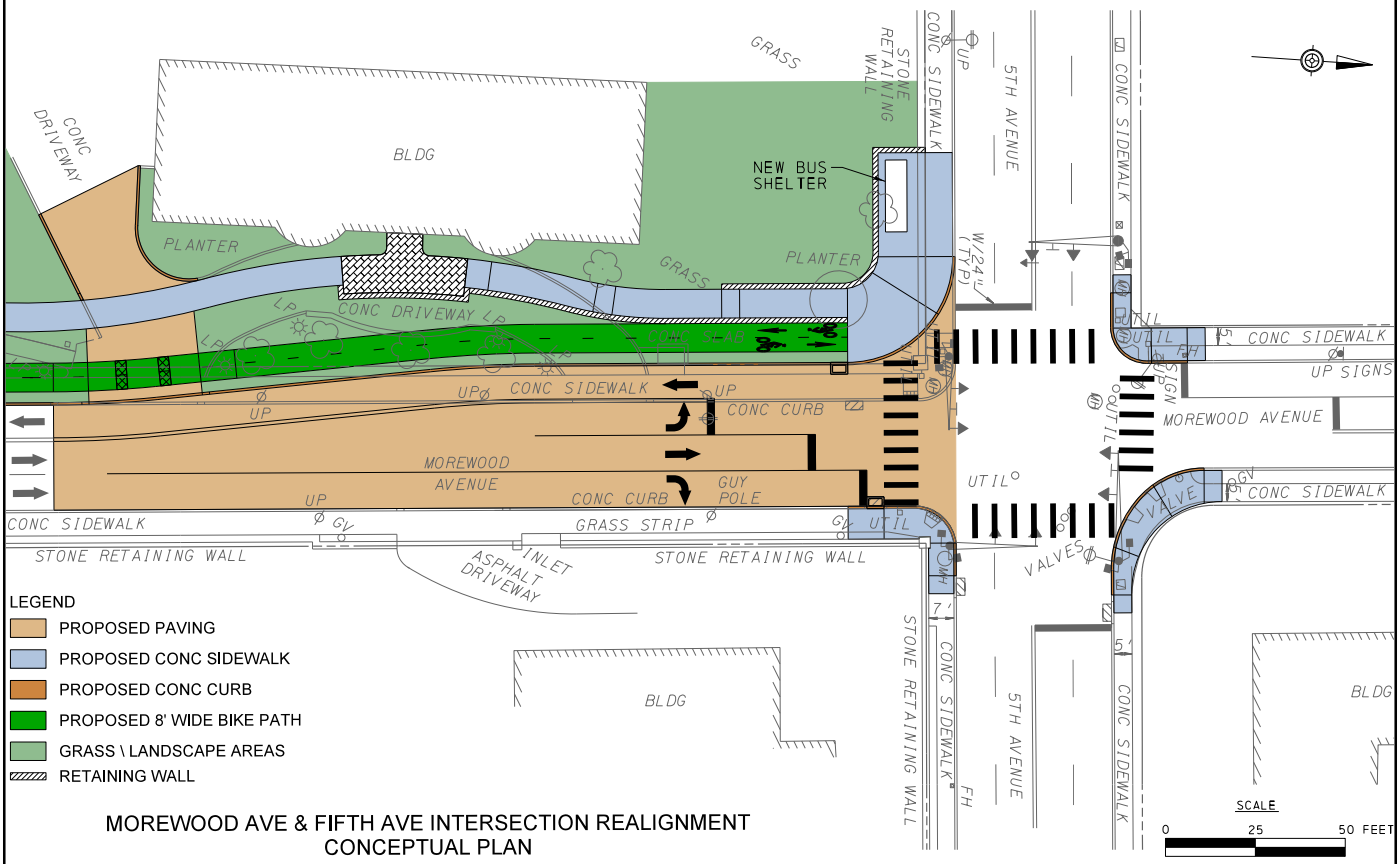
Pittsburgh Office
300 East Waterfront Drive
Homestead, PA 15120-5005
412-476-2000

PROJECT NUMBER:	R200398.00	DWN: TMW
CLIENT:	Carnegie Mellon University	CHKD. RAK
PROJECT:	2032 Institutional Master Plan City of Pittsburgh, Allegheny County	FIGURE
TITLE:	Forecasted Master Planning Year (2032) Anticipated Conditions (50% Buildout & TDM)	5.6.6
	SCALE: NTS	



MOREWOOD AVE & FIFTH AVE INTERSECTION REALIGNMENT
CONCEPTUAL PLAN

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PLOTTED: 2/2/2022

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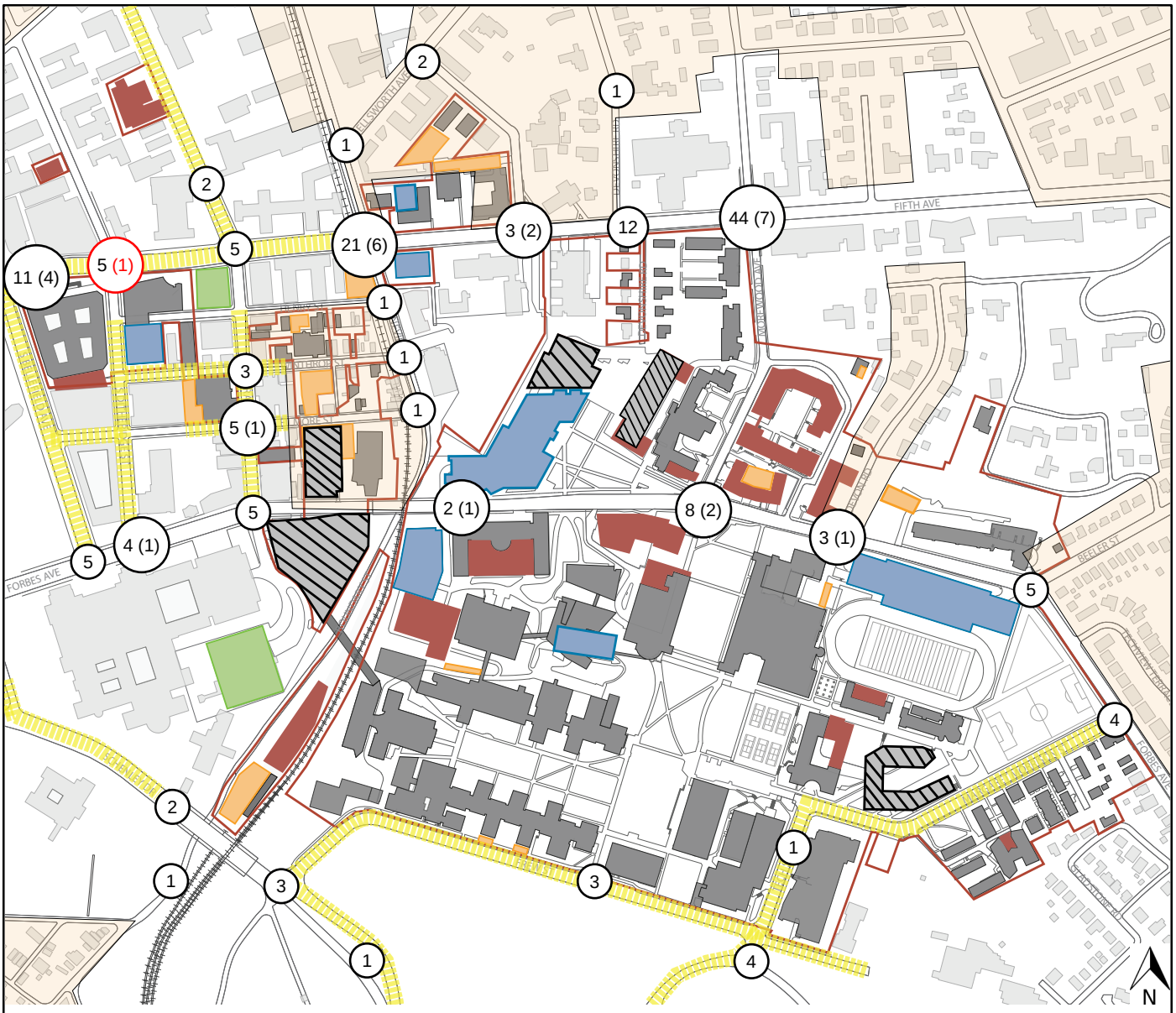
PROJECT NO/CLIENT	R200398.00 / Carnegie Mellon University
PROJECT	2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County
TITLE	Fifth Avenue and Morewood Avenue Northbound Approach Realignment
DWN.	TMW
CHKD.	RAK
FIGURE	5.7



Data represents reportable crashes from January 2016 through December 2020

Source: Pennsylvania Crash Information Tool

Legend

1 (1) - Number of Crashes (Pedestrian Crashes)

- Fatal Crash

gai consultants	PROJECT NO/CLIENT R200398.00 / Carnegie Mellon University		DWN. TMW
	PROJECT 2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County		CHKD. RAK
	TITLE Summary Crash Locations (5 Years)	SCALE: N.T.S.	FIGURE 5.8

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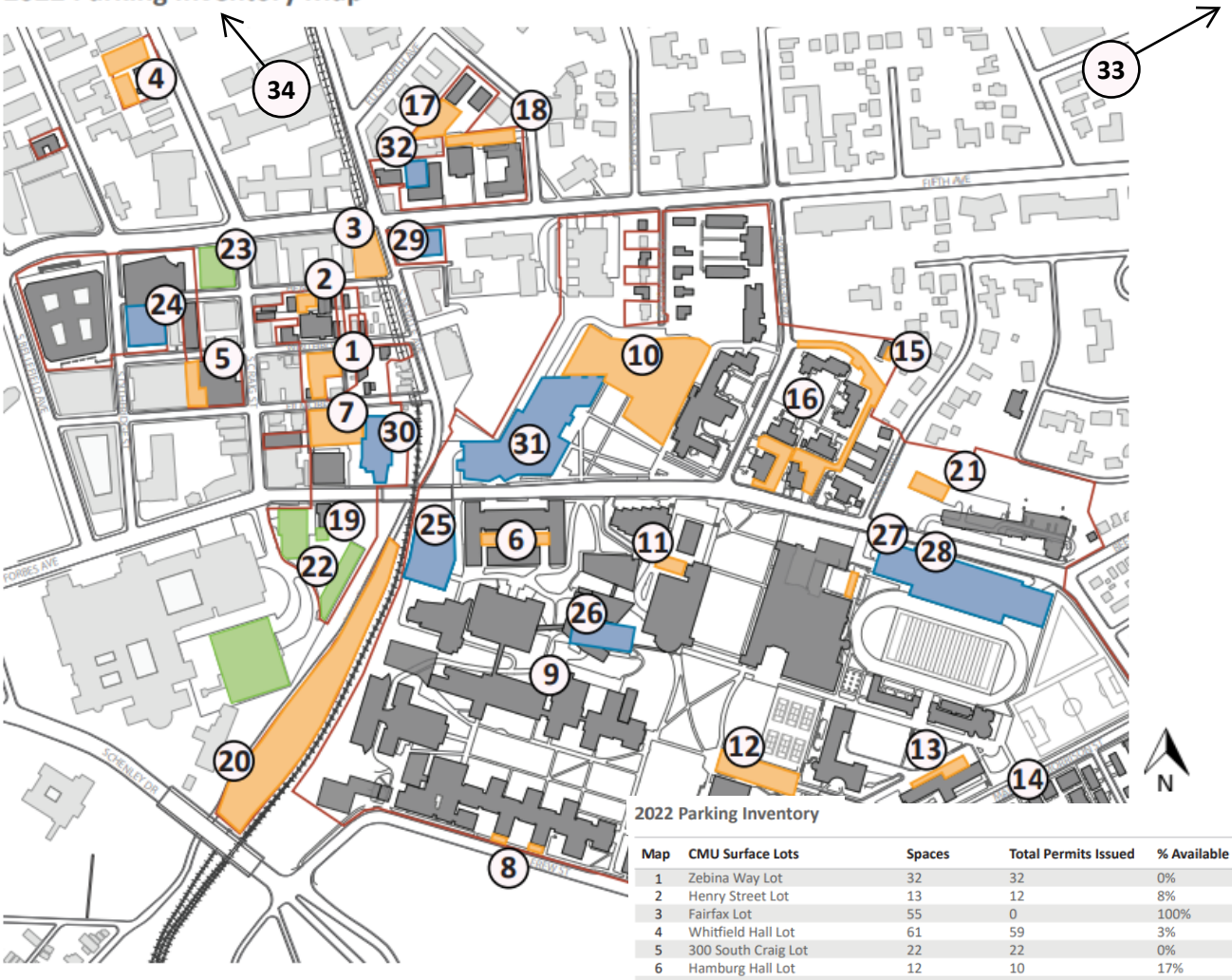
PLOTTED: 2/2/2022

2022 Parking Inventory Map



Parking Options around Carnegie Mellon University

- CMU Garage
- CMU Surface Lot
- CMU Leased Parking

2022 Parking Inventory

Map	CMU Surface Lots	Spaces	Total Permits Issued	% Available
1	Zebina Way Lot	32	32	0%
2	Henry Street Lot	13	12	8%
3	Fairfax Lot	55	0	100%
4	Whitfield Hall Lot	61	59	3%
5	300 South Craig Lot	22	22	0%
6	Hamburg Hall Lot	12	10	17%
7	GATF Lot	72	72	0%
8	Frew Street Meters	10	10	0%
9	West Campus Lot	14	9	36%
10	Morewood Lot	285	288	-1%
11	Warner Hall Lot	16	16	0%
12	Fine Arts Lot	61	54	12%
13	Donner House Lot	23	23	0%
14	Margaret Morrison St	14	7	50%
15	Bramer House Lot	5	5	0%
16	Fraternities Lot	69	71	-3%
17	Fifth and Neville Lot	16	15	6%
18	Clyde Street Lot	90	81	10%
19	III Lot	17	16	6%
20	South Neville	96	95	1%
21	Forbes Beeler Lot		n/a	20 available in 2023
22	Carnegie Museum Lots	110	110	0%

Map	CMU Garages	Spaces	Total Permits Issued	% Available
23	5th and Craig Street Garage	40	5	13%
24	Dithridge Garage	370	388	-5%
25	CIC Garage	226	196	13%
26	Gates Garage	138	142	-3%
27	East Campus Garage	780	633	19%
28	East Campus Garage Motorcycle	14	14	0%
29	Residence at Fifth Garage	37	36	3%
30	TCS Garage	35	0	100%
31	Tepper Quad	126	95	25%
32	Fifth Neville Garage	29	0	100%

Map	CMU Shuttle Lots	Spaces	Total Permits Issued	% Available
33	6555 Penn Ave	54	32	59%
34	Melwood	30	TBD	TBD

Total Existing Parking Inventory: 2,972

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PROJECT NO/CLIENT R200398.00 / Carnegie Mellon University

PROJECT
2032 Carnegie Mellon Institutional Master Plan
City of Pittsburgh, Allegheny County

TITLE
Existing Parking Inventory

SCALE: N.T.S.

DWN. TMW
CHKD. RAK
FIGURE 6.0

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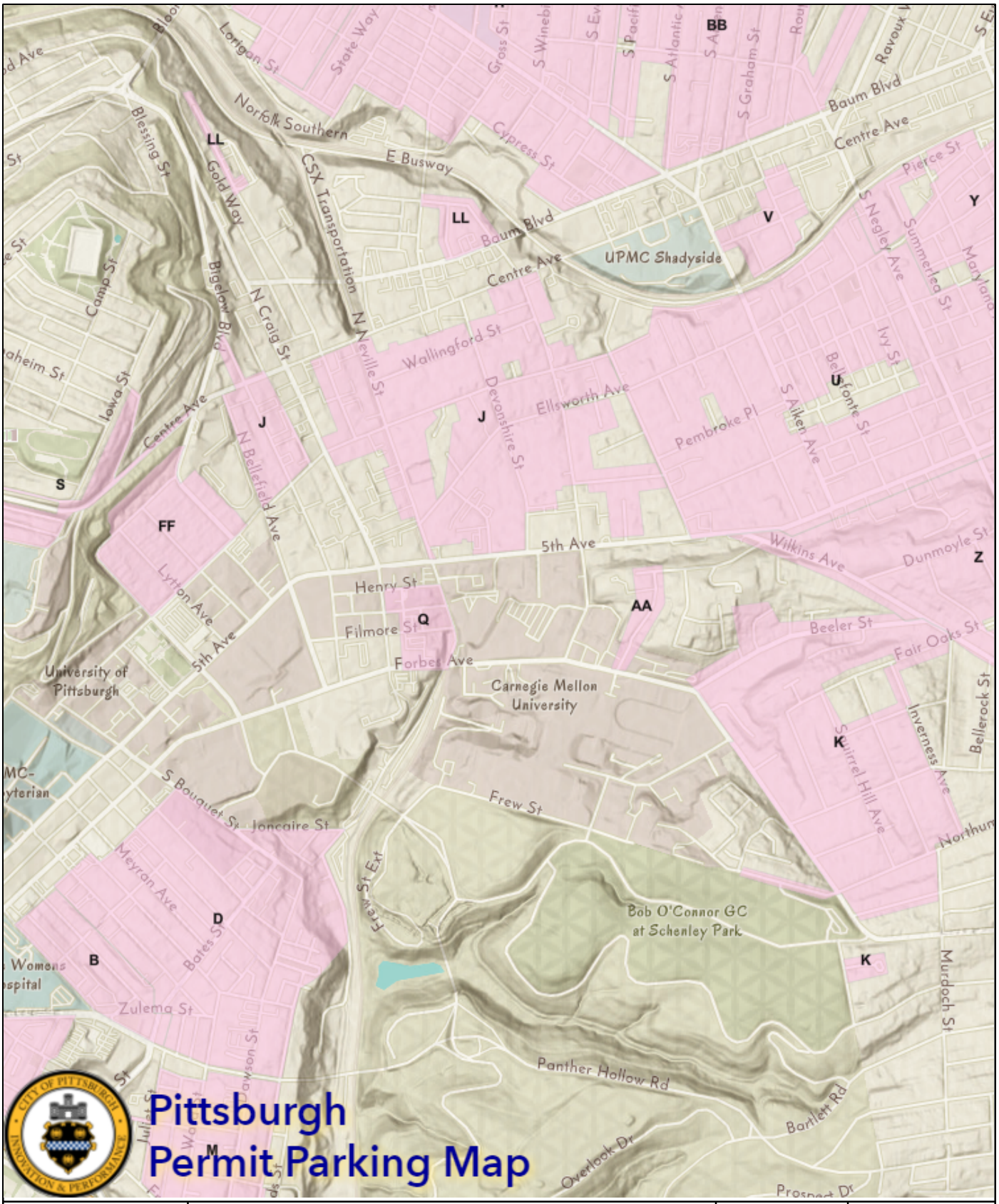
PLOTTED: 2/21/2022



gai consultants	PROJECT NO/CLIENT R200398.00 / Carnegie Mellon University		DWN. TMW
	PROJECT 2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County		CHKD. RAK
	TITLE Existing Residential Permit Parking	SCALE: N.T.S.	FIGURE 6.1

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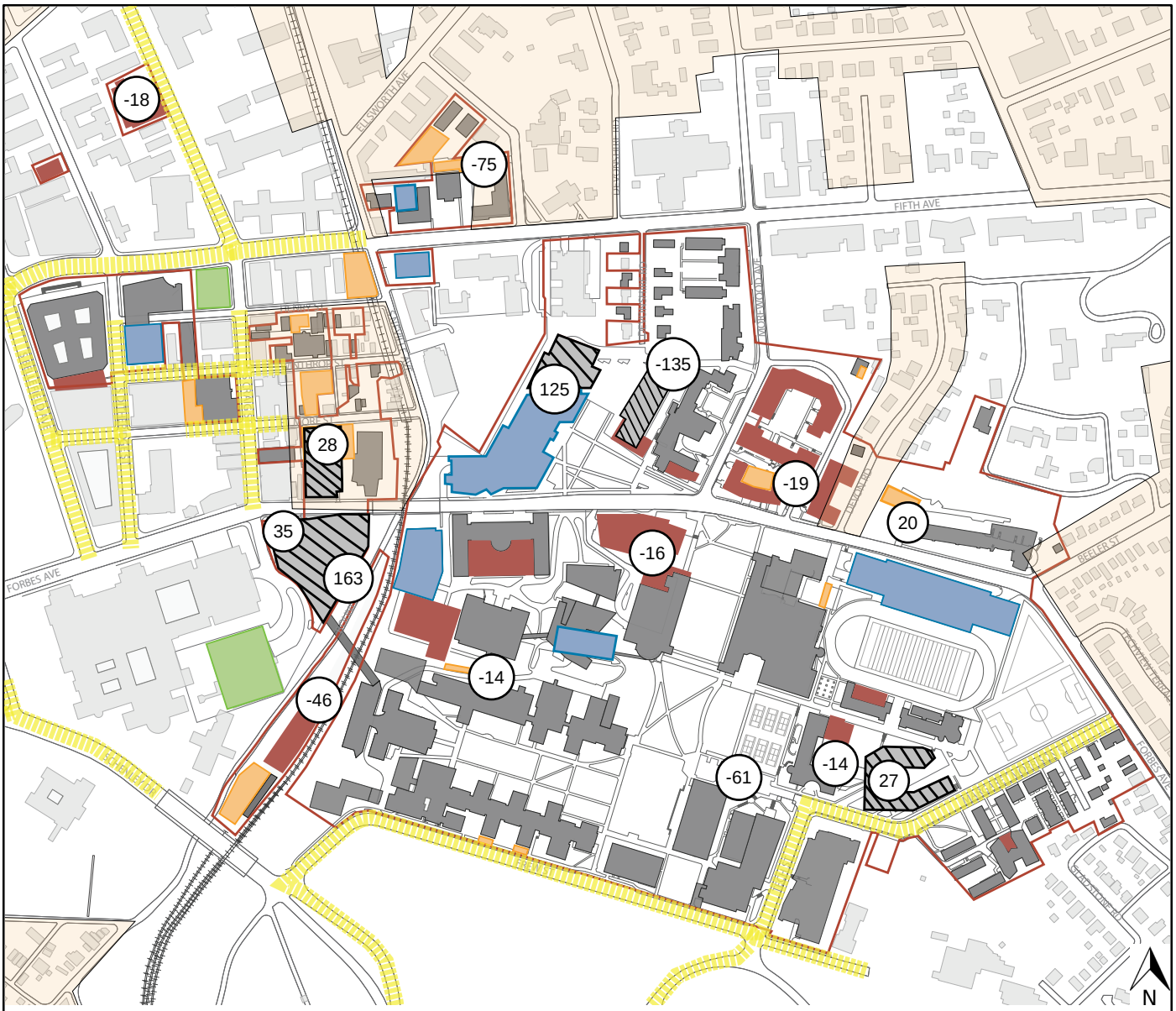
PLOTTED: 2/21/2022



- Carnegie Mellon University Property in 2022 IMP
- Carnegie Mellon University Existing Buildings
- Development Sites
- CMU Structured Parking
- CMU Surface Lot
- New CMU Parking
- CMU Leased Parking
- Metered Street Parking
- Residential Permit Parking

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PROJECT NO/CLIENT	R200398.00 / Carnegie Mellon University
PROJECT	2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County
TITLE	Parking Capacity Changes 2022-2032
SCALE: N.T.S.	
DWN.	TMW
CHKD.	RAK
FIGURE	6.2

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PLOTTED: 2/2/2022

APPENDIX

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APPENDIX A
Carnegie Mellon University Demographics

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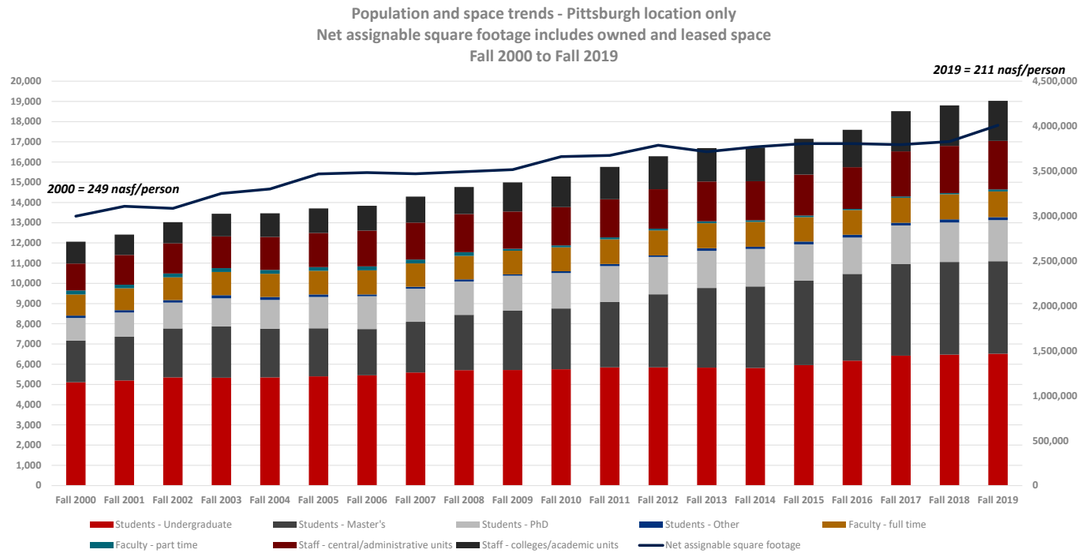
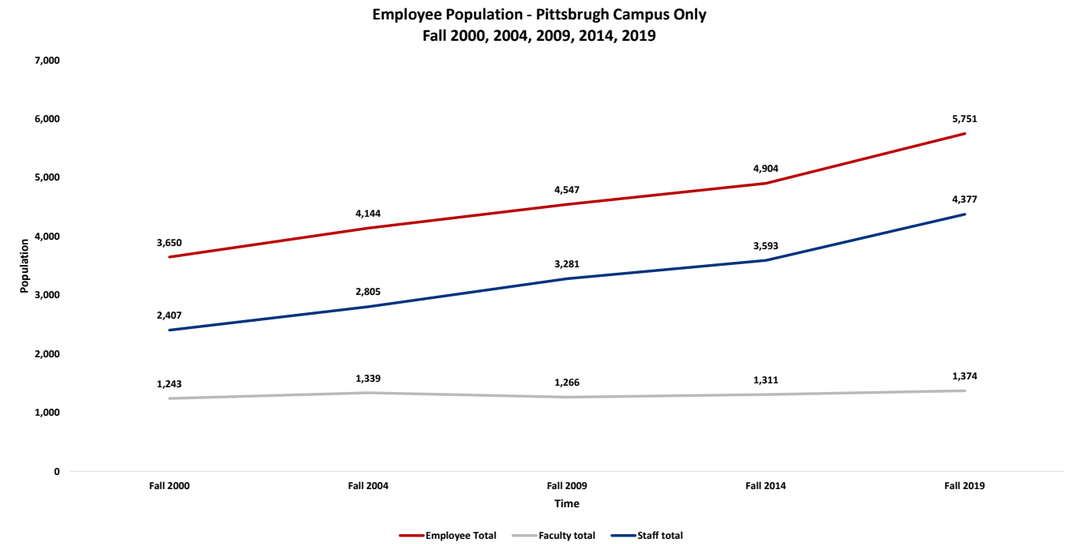
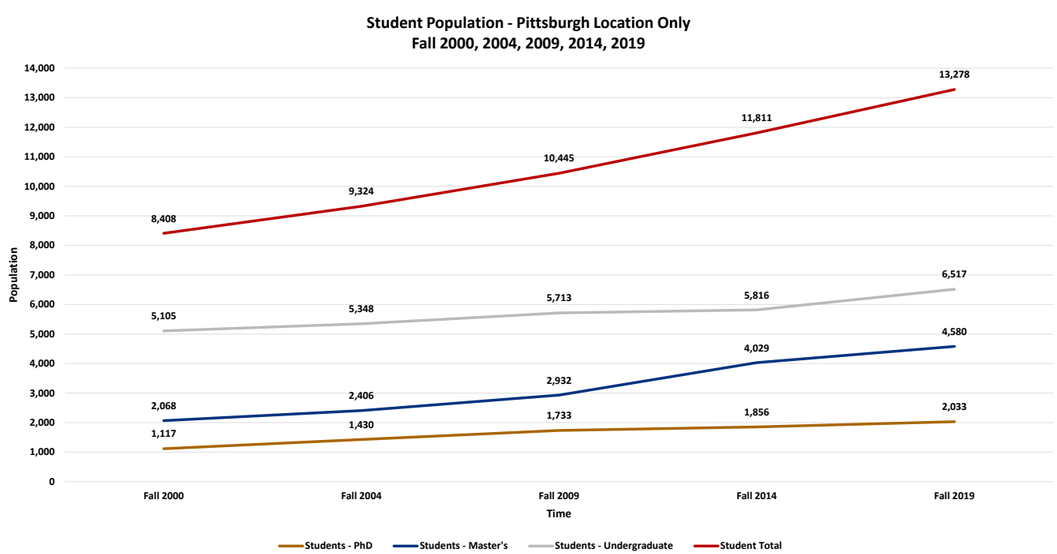
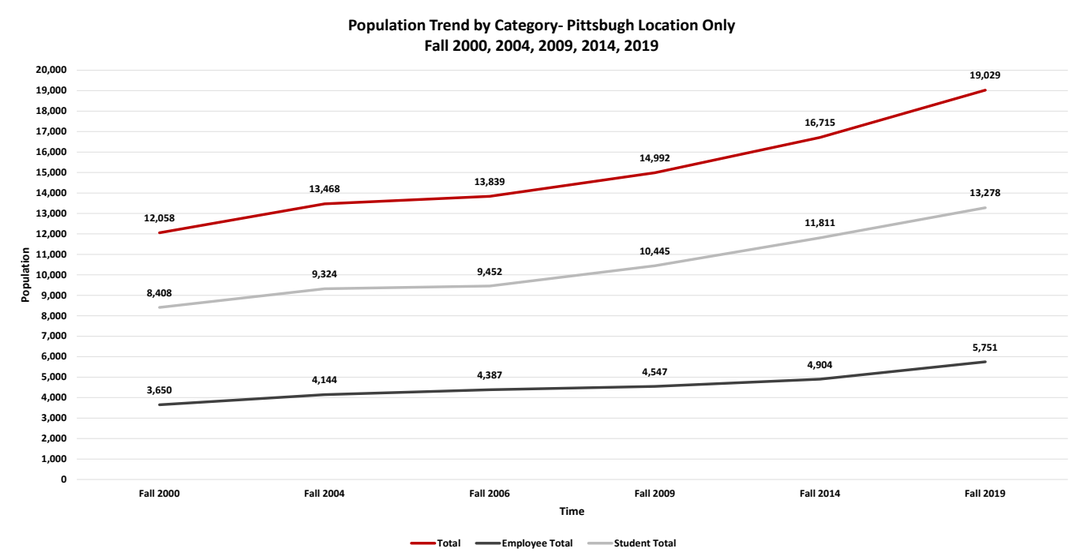
Population Trends









Carnegie Mellon University

cmu.edu/visit #mytartanvisit

One square = approx 425' or 130 m. (Updated 02-03-2020)

Carnegie Mellon University

cmu.edu/visit #mytartanvisit

ACADEMIC/ADMINISTRATIVE

Alumni House	AH	G4
ANSYS Hall	AN	D6
Baker Hall (DC)	BH	E6
Bakery Square	BK	◆
Bramer House	BR	G3
Cohon University Center	CUC	G5
College of Fine Arts (CFA)	CFA	F6
Cyert Hall	CYH	E4
Doherty Hall	DH	E6
Facilities Management Services Building	FM	D5
FMS Roads & Grounds	FR	C6
Gates Center for Computer Science (SCS)	GHC	E5
Hall of the Arts	HOA	F7
Hamburg Hall (HC)	HBH	D4
Hamerschlag Hall	HH	D6
Hillman Center for Future Generation Technologies	GHC	E5
Hunt Library	HL	F7
Integrated Innovation Institute	III	C4
Margaret Morrison Carnegie Hall	MM	G6
Mehrabian Collaborative Innovation Center	CIC	D4
Mellon Institute (MCS)	MI	A3
Mill 19	M19	◆
National Robotics Engineering Center	NR	◆
Newell-Simon Hall	NSH	D5
Pittsburgh Technology Center	PTC	◆
Porter Hall	PH	D6
Posner Center	PC	F6
Posner Hall	POS	G6
PPG 6	PP	◆
Purnell Center for the Arts	PCA	F5
Rand Building	RA	B2
Roberts Engineering Hall	REH	C6
Scaife Hall (E)	SH	C6
Scott Hall	SC	D5
Skibo Gymnasium	GYM	G7
Smith Hall	EDS	D4
Software Engineering Institute	SEI	B2
TCS Hall (2020)	TCS	C4
Tepper Building (TSB)	TEP	E3
Warner Hall	WH	F4
Wean Hall	WEH	D5
West Wing	WWG	G5
Whitfield Hall	WF	B1
WQED Building	WQ	E2
205 S. Craig	2SC	C3
300 S. Craig (Police)	3SC	B3
311 S. Craig	CA	C3
407 S. Craig	4SC	C3
417 S. Craig	CC	C4
4516 Henry	UT	B3
4609 Winthrop	GL	C3
4615 Forbes	FRB	C4
4616 Henry	INI	C3
4620 Henry	PO	C2
4721 Fifth Ave.	MC	D1
477 Melwood Ave.	MEL	◆
6555 Penn	PE	◆

POINTS OF INTEREST

Coulter Welcome Center	WC	D4
Office of Undergraduate Admission	AD	F4
Art Park	AP	C4
Center for Student Diversity & Inclusion	DI	G5
Dining Services	DN	D2
Disability Resources	DR	I6
Entropy+ Convenience Store	EN	G5
The Fence	FE	F6
Housing Services	HO	D2
The Hub	HU	F4
Human Resources	HR	B1
Kraus Campo	KC	F7
Legacy Plaza	LP	G5
Miller ICA	ML	F5
Office of International Education	OIE	E4
Pausch Bridge	PB	E5
Peace Garden	PG	F7
Student Health Services	HS	F3
University Store	US	F5
Walking to the Sky	WS	F4

RESIDENTIAL

Boss House	BOS	H6
Clyde House	CLY	D1
Doherty Apartments	DOH	H4
Donner House	DON	H6
Fairfax Apartments	FAF	C2
Fifth Neville Apartments	FIF	D2
Greek Quad	GQ	G3
Hamerschlag House	HAM	H7
Henderson House	HEN	H7
Highlands Apartments	HIL	D1
Margaret Morrison Apartments Greek Housing	MMA	I6
McGill House	MCG	H6
Morewood E-Tower	MOE	F3
Morewood Gardens	MOR	F3
Mudge House	MUD	F2
Neville Apartments	NVL	D1
Residence on Fifth	ROF	D2
Resnik House	RES	H6
Roselawn Terrace	ROS	I6
Scobell House	SCO	H7
Shady Oak Apartments	SHA	D1
Shirley Apartments	SHI	A1
Spirit House	SPT	I6
Stever House	STE	F2
Webster Hall Apartments	WEB	A2
Welch House	WEL	H7
West Wing	WWG	G5
Woodlawn Apartments	WOO	I6

PARKING

East Campus Garage	ECG	H4
Dithridge St. Garage	DS	B3
Gates Garage	GHC	E5
Mehrabian Collaborative Innovation Center Garage (CIC Garage)	CIC	D4

Alumni House	AH	G4
Bramer House	BR	G3
Carnegie Museum Lot	CM	C5
Children's School	CS	G6
Clyde St. Lot	CLY	D1
Doherty Apartments	DOH	H4
Donner House	DON	H6
Fifth Neville	FIF	D1
Fine Arts Lot	CFA	F6
Frew St.	FS	E7
GATF	FRB	C3
Greek Quad	GQ	G3
Hamburg Hall Lot	HP	D4
Henry St.	HY	C2
Integrated Innovation Institute	III	C4
Melwood Ave.	MEL	◆
Morewood Lot	MOR	E3
Pittsburgh Technology Center	PTC	◆
South Neville Lot	SN	C6
Tepper Quad	TEP	D4
Warner Hall	WH	F4
West Campus	WE	E5
Whitfield Hall	WF	B1
Zebina Way	ZW	C3
300 S. Craig (Police)	3SC	B3
4700 Fifth Ave.	ROF	D2
6555 Penn	PE	◆

KEY

- ◆ Off campus
- University Police
- Student Health Services

COLLEGES AND SCHOOLS (Dean's office locations)

E	College of Engineering
CFA	College of Fine Arts
DC	Dietrich College of Humanities & Social Sciences
HC	Heinz College of Information Systems and Public Policy
MCS	Mellon College of Science
SCS	School of Computer Science
TSB	Tepper School of Business

Visit our on-campus dining locations at cmu.edu/dining-locations

TRANSPORTATION TO CAMPUS

The Pittsburgh International Airport (PIT) is 22 miles from the Carnegie Mellon University campus. Travel time to campus is 45 minutes. Car rentals are available at the airport.

UBER, LYFT OR TAXI: Average taxi fare: $45.00.

HOTEL SHUTTLES: (*Highly encouraged*): Often offered by hotels within a few miles of campus.

BUS: 28X Airport Flyer Bus (Port Authority Transit), stops at the Carnegie Mellon campus. Cost is $2.75 each way (exact change required) but free to students.

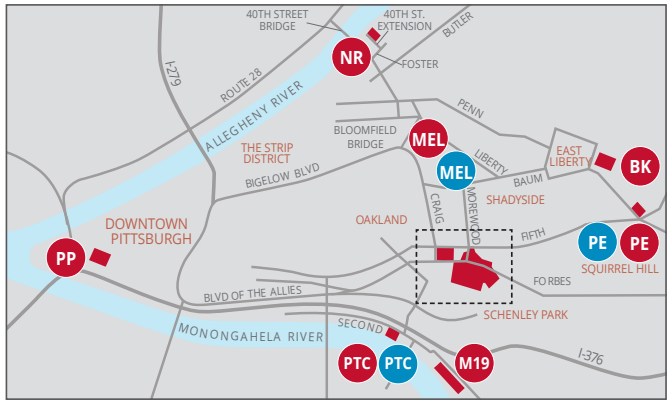
PARKING ON CAMPUS

East Campus Garage
GPS address: 5040 Forbes Ave., Pittsburgh, PA 15213

At times the East Campus Garage does fill. Additional metered parking is available along Frew St., Tech St., S. Craig St., Margaret Morrison St. and near the Schenley Park Visitor Center.

View bicycle parking locations at cmu.edu/bicycle-parking

◆ OFF CAMPUS



APPENDIX B
Approved TIS Scoping Form

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DEPARTMENT OF MOBILITY AND INFRASTRUCTURE
TRANSPORTATION STUDY SCOPING FORM Revised
August 2021

Submit scoping form and trip generation one week prior to scoping meeting or the meeting may need to be rescheduled.

Final scoping form, sign-in sheet and meeting minutes subject to DOMI approval.

For more information, please see DOMI Transportation Review Impact Guidelines.

NAME OF PROJECT Carnegie Mellon University Institutional Master Plan (CMU IMP)

Developer/Applicant: Carnegie Mellon University

Anticipated Development Date: 2022 - 2032 Anticipated Completion Date: 2032

Date Filed:

Prepared by: GAI Consultants

1.0. Project Overview University 10-year Master Plan projects

1.1 Physical Address or Cross Street: 5000 Forbes Ave, Pittsburgh, PA 15213

1.2 ZBA Hearing Required ☐ YES ☐ NO **Notes:**

1.3 Planning Commission Required ☑ YES ☐ NO **Notes:**

1.4 Adopted/Approved Plans ☐ YES ☐ NO **Notes:**

1.5 Impact or access to PennDOT Road ☑ YES ☐ NO **Notes:**

1.6 TDM Plan Required
Complete Checklist for TDM at end of form ☑ YES ☐ NO **Notes:**

1.7 Development Description: For phased developments, description should be provided by phase

	EXISTING ON-SITE CONDITIONS			FUTURE ON-SITE CONDITIONS			NET DIFFERENCE
Project Component	**Size (Sq. Ft.)**	**# of Units**	**# Parking**	**Size (Sq. Ft.)**	**# of Units**	**# Parking**	
List by Type Ex: Office, Residential, Retail, etc.							
TOTAL							

Comments:

Refer to Table 1.7 (attached) for maximum massing for 10-year development components, including maximum parking capacities that could fit on each site. In the 2012-2022 master plan, approximately 1/3 (1,166,000 SF of the proposed 3,707,500 SF) was built and parking supply remained relatively constant. To provide a realistic yet conservative estimate for this TIS, up to 50% of master plan maximum square footage is anticipated to be realized. Should more development be built by 2032, an amended TIS would be required. CMU anticipates no net long-term change in parking supply, with new parking facilities built to replace existing surface lots. Refer to Table 6.2 for anticipated parking facility sizes.

2.0 Site Plan: Attach latest site plan See attached

2.1 Vehicular Site Access See attached

Vehicular Site Access

Proposed Conditions	Signalized	Unsignalized	Proposed Access (Full or Restricted)
Project Entry/Exit Points			

The distance calculation to be provided for all access points

2.2 Loading

		Check
2.2.1	**On-Site** Note: Include Vehicle Class: _____	
2.2.2	**On Street Requested**	
2.2.3	**Loading Demand Analysis** Note: Include timing, type, frequency, and vehicle class: _____	
2.2.4	**Refuse Storage/Pickup**	

3.0 Multi Modal Analysis: Attach map for existing bike, transit or pedestrian facilities

3.1 Bicycle Routes to or Near Site

Bicycle Routes to or Near Site		**Check**
3.1.1	Bicycle Parking Required	X
3.1.2	Bicycle Parking for vehicular parking reduction	X
3.1.3	Additional Bicyclist End-of trip Facilities Provided (Showers, Changing Rooms, etc.) for TDM	X

Comment: CMU will continue meeting criteria from the League of American Bicyclists Silver Level Award as part of their Bicycle Friendly University program and will perform additional improvements and provide additional amenities towards the Gold Level Award. TDM IMP mitigation projects focus on integrating the campus area into the surrounding bicycle network.

3.2 Bicycle Routes to or Near Site (Attach Map)

		Check
3.2.1	Identify existing on-street bike routes or trail connections to the site	X
3.2.2	Identify proposed developer created amenities to attract greater bicyclist use	X
3.2.3	Identify planned new or extended bicycle routes near the site	X
3.2.4	Site is located within .25 miles of a Healthy Ride Station	X
3.2.5	Site is located within .25 miles of trail access	X

Comment: Through IMP process, additional joint bicycle infrastructure projects will be recommended, including a Frew/Tech/Margaret Morrison Street neighborway and a cycle track between Schenley Park at Frew Street and Fifth Avenue along Morewood Avenue and through campus. An additional University-sponsored bike route is planned to connect Frew Street with Boundary/Neville Street along Hamerschlag Drive. Bike trails are existing in Schenley Park and the University has reserved space in their Neville Parking Lot for a bike trail connection through City-owned property in Junction Hollow.

3.3 Pedestrian Access, Circulation and Safety

		Check
3.3.1	On-site Points of Entry and Egress	X
3.3.2	New or Replace sidewalk	X
3.3.3	Crosswalk need and warrants Note pedestrian desire lines	

Comment:

3.4 Transit Routes to or Near the Site (Attach Map)

Transit Routes to or Near the Site (Attach Map)		Check
3.4.1	Identify Peak and Non-Peak Bus Routes At or Near the Site and Frequency	X
3.4.2	Identify Bus Stop and Shelter Locations At or Near the Site	X
3.4.3	Identify developer created amenities to attract greater transit use	X
3.4.4	Site is Located within .25 miles of busway or T station	
3.4.5	Existing stop adjacent to site	X

Comment: BRT stops are planned along Forbes and Fifth avenues.

4.0 Trip Generation: Submit prior to scoping meeting to ensure thorough review, attach to scoping form

Trip Generation Rate	Project Component	Note
ITE General Urban/Suburban	Master Plan	ITE Methodology (LU 550, LU 225, LU 170) with employee and student mode share factors.
ITE Dense Multi-Use Urban		
ITE Rural		
ITE Center City Core		
Independent Survey	Master Plan	CMU data may be used to supplement/replace data as applicable based on employee/student projections.
Other (specify)		

4.1 Trip Removals

Trip Reduction Based on Transportation Demand Analysis				Check: X
Mode Share traffic Adjustment Factors		Percent	***Data Source (Specify)***	
	Auto	30 %	Target mode shares (left) are CMU's IMP/TDM mobility goals based on faculty and staff CMU Campus Commute Patterns, 2018 (Carnegie Mellon University Parking Study | 2018, Ayers Saint Gross, Brailsford & Dunlavey, Fehr & Peers, November 2018), where 38% parked, 29% took transit (22% bus, 7% shuttle), 19% walked, 7% biked, 5% drop-off or rideshare, and 2% other. Existing student mode share to be used for student housing only (Parking Study mode share: 2% drove, 45% took transit (35% bus, 10% shuttle), 29% walked, 12% biked, 6% drop-off/rideshare, and 5% other).	
	Total non-Auto	63 %		
	Transit	30 %		
	Bicycle	9 %		
	Pedestrian	19 %		
	Other	5 %		

4.2 Trip Adjustment Factors

Trip Generation Adjustment Factors (check as applicable and explain)			Check:
Base Traffic Adjustment Factors	Percent	***Comment***	
Internal Trips	TBD %		
Shared Trips	TBD %		
Pass-by Trips	TBD %		

5.0 Roadway Network and Operations Analysis: See section 4.5.0 of Transportation Impact Review Guidelines

5.1 Area of Impact- Required Data Collection

Check

Study Intersections	Unsignalized	Signalized
Fifth Avenue at Craig Street		X
Fifth Avenue at Neville Street		X
Fifth Avenue at Clyde Street		X
Fifth Avenue at Morewood Avenue		X
Forbes Avenue at Craig Street		X
Forbes Avenue at CIC/Tepper Drive		X
Forbes Avenue at Morewood Avenue		X
Forbes Avenue at Beeler Street		X
Forbes Avenue at Margaret Morrison Street		X

Attach map showing project site, nearby critical intersections, study intersections, and proposed project entry/exit points.
Note: Data Collection Must Include: Turning Movement, Transit, Heavy Vehicles, Bicycle, and Pedestrian Counts.

Data collection has been taken from previous studies and grown to 2022 (0.25% per year linear per the Forbes Avenue Capacity Analysis). Due to unknowns from pandemic traffic volumes and from proposed improvements along Fifth Avenue due to the upcoming BRT Project, new data collection cannot be reliably performed. Driveway turning movements and heavy vehicle, bicycle, and pedestrian counts may not be available at all locations. TDM is anticipated to mitigate parking trip increases through the mobility goal of providing no net new parking.

5.2 ATR

5.2.1

Check

Location (Street & Cross Streets)	48-Hour	7-Day	Other	X

Comment: Due to ongoing pandemic impacts, ATR data not proposed. PennDOT Traffic Information Repository (TIRe) summary data is provided in Figure 5.2

5.2.2 Type ATR Count(Please check)

Check

	Check	Comment
Volume Counts		
15-Minute Increments		
1-Hour Increments		
Speed Data		
Vehicle Classification Data		

Comment:

5.3 Study Periods

Study Periods (Please check)

	Check	*Comment-Note Hours*
AM Peak	✔	AM Peak Hour (7:00 AM to 9:00 AM) as required
PM Peak	✔	PM Peak Hour (4:00 PM to 6:00 PM) as required
Saturday Peak		
Custom Design Peak (ex: School, Hospital, Event, Religious, etc.)		
Other		

5.4 Trip Distribution and Assignment

Methodology for Trip Assignment (Please check)	**Check**
Existing Traffic Data	X
Gravity Distribution Model-See TIS Guidelines	
SPC Model	
Market Study	
Other (Specify) Parking is a system on the CMU campus, so trips will be distributed based on changes in parking locations which will represent the main activity of changes in vehicular trips.	X

Comment: TDM is anticipated to mitigate parking increases, resulting in no net new parking demand. Table 4.0.2 Trip Generation and Table 6.2 Parking Supply and Demand Analysis (both assuming 50% of master plan components will be built) show peak hour vehicular trip changes would be less than total parking space relocations. Therefore, trip distribution and assignment based on full capacity (100% occupancy) of AM entering and PM exiting parking space relocations, with AM exiting and PM entering peak hour trips conservatively assumed at 50% of entering and exiting trips.

5.5 Background Traffic/Future Conditions

5.5.1 Future Year Conditions — **Check**

Annual Base Traffic Growth per year (Please indicate date, source and provide comments

Comment: While historical traffic data has declined, the 0.25% per year linear growth rate that was approved for use in the Forbes Avenue Capacity Analysis will be conservative, but appropriate, for this study.

5.5.2 Trip Removals (Please check and comment) — **Check**

Onsite Removals	X
Other (Explain)	

Comment: Removals based on parking lot changes.

5.5.3 New Projects to be added to base traffic (As specified by DCP) — **Check**

Note these are developments which the city has approved but have not been built or occupied and would not otherwise be covered under background trips

Project	Year	Data Source

5.6 Capacity Analysis

Capacity Analysis		**Check**
5.6.1	Existing Conditions	X
5.6.2	Analysis Year Without New Project	
5.6.3	Analysis Year With New Project	
5.6.4	Analysis Year With New Project and Mitigation	

	Check
5 year Horizon	
10 year Master Plan	X
20 Year (federally funded)	
Other Time Frame	

Comment: 10 year Master Plan capacity analysis (50% full buildout) to be performed at two most impacted locations (assumed Fifth at Morewood & Neville as they have the greatest capacity and trip change impacts). Fifth Avenue BRT upgrades and uncertain post-pandemic traffic volumes may impact results. 50% full buildout is greater than the 33% of 2012-22 IMP realized full buildout. Development beyond 50% will require an amended TIS. TDM is anticipated to mitigate new parking demand, so CMU is proposing a number of pedestrian and bicycle alternative improvements for TDM.

5.7 Queuing Analysis

	Check
Queuing Analysis	X
Locations	**Check**
Each Movement of all Study Interactions	X
Queuing Method	**Check**
Synchro	X
HCS	
Other	

Comment: Queuing analysis will be performed for the two analyzed intersections. Tables summarizing 95th percentile Synchro and SimTraffic-calculated queues (5 runs, 10 minutes seeding) will be provided.

5.8 Traffic Signal Warrant Analysis

		Check
	5.8.1 Signal Warrant Analysis	
5.8.1.a	All unsignalized study intersections	
5.8.1.b	All signalized study intersections	
5.8.1.c	All Site Driveways	
5.8.1.d	Signal Deficiency Review (Removal, Phasing or Pedestrian or other Upgrades)	
5.8.1.e	Custom (Specify Locations below)	

		Check
	5.8.2 Signal Warrant Analysis	
5.8.2.a	8-Hour	
5.8.2.b	4-Hour	
5.8.2.c	Peak Hour	
5.8.2.d	Pedestrian Volume	
5.8.2.e	School Crossing	
5.8.2.f	Coordinated Signal System	
5.8.2.g	Crash Experience	
5.8.2.h	Roadway Network	

		Check
	5.8.3 Auxiliary Turn Lane Warrant	
5.8.3.a	Left Turn Lane Warrant	
5.8.3.b	Right Turn Lane Warrant	
5.8.3.c	Recommended Length	

Comment: No new signals are proposed in the IMP. Traffic volumes not anticipated to warrant any new signalization.

5.8 Crash History/ Analysis

5.9.1	Check
Locations Locations around the campus will be reviewed. Both reportable crashes and non-reportable crashes recorded by CMU Police will be reviewed.	X

Contact: penndotcrashhelp@pa.gov

5.9.2	Check
Collision Diagram	
3-Year Data	X
5-Year Data	

Comment:`CMU non-reportable police data to be included, which is available for 2018-2020. Data to be summarized in tabular form only.

6.0 Parking

6.1 Existing Conditions	Check
Existing Parking Management Plan (for Institutional Master Plans)	X
Existing Residential Permit Parking Program (RPPP) Areas (attach map)	

Please refer to: http://www.pittsburghparking.com/rppp

6.2 Proposed Parking

Proposed Parking (Check Source used)

Methodology	Check
ITE Parking Generation Manual	
City of Pittsburgh Zoning Code	
Site specific Parking Study or Market Demand CMU's 2018 Parking Master Plan and supporting data	X
Other Methodology (ex: Urban Land Institute or other, please specify)	

Comment: Proposed parking to be based on IMP Mobility Goals and TDM

Parking Conditions Supply and Demand Analysis	Check
Existing Conditions	X
Phase 1 Year	
Phase 2 Year	
Phase 3 Year	
10-Year Master Plan Year Based on CMU's February 2020 parking data and CMU's 2018 Parking Master Plan with its supporting data. Refer to Table 6.2 attached.	X

Comment:

6.3 Parking Reduction

	Parking Reduction: Check all that apply	Check
6.3.1	Parking Reduction Area	X
6.3.2	Bicycle parking reduction	X
6.3.3	Shared Parking	X
6.3.4	Fee in lieu	

6.4 Parking Demand Analysis

	Check
Parking Demand Analysis	X
On and off street inventory(map)	X

Data Collection(Describe): Due to ongoing Covid-19 impacts, accurate data cannot be collected during the master planning process. Parking will be based on CMU's 2018 Parking Master Plan data and pre-pandemic parking data, as parking demand is not anticipated to recover to normal patterns until fall 2022 or beyond.

6.5 Other Transportation

Other Transportation	Check
Shuttle Bus /Other Private Carrier Service Analysis	
Identify Peak and Non Peak Routes	X
Identify Shuttle Stop Locations At or Near the Site	X
Estimate number of passengers served	X
Time of Day/Frequency of Operations	X
School Buses	
Identify Peak and Non Peak Routes	
Identify School Bus Stop Locations At or Near the Site	
Estimate number of students served	
Time of Day/Frequency of operations	

Comment:

Submission Requirements		Check
Emailed to DOMI	**Digital copy of Final Traffic Impact Study Report**	
Emailed to DOMI	**Executive Summary (include in the beginning of report)**	
Emailed to DOMI	**City Correspondence/Comment Response Letters (Include in beginning of Final Report)**	
Emailed to DOMI	**Approved Scoping Form (Include copy in back of Final Report)**	
Emailed to DOMI	**Raw Data Files**	
Emailed to DOMI	**Digital copy of report, appendices, analysis and data in PDF format (no CD's)**	

Send To:

Name	Department	Mailing Address	
Katie K. Reed, Senior Planner Zoning Case Manager	City of Pittsburgh Dept. of Mobility and Infrastructure	414 Grant St., 2nd Fl, Pittsburgh, PA 15219	katherine.reed@pittsburghpa.gov

DOMI

Department of Mobility and Infrastructure

TDM Checklist

August 2021

There is not a one size fits all strategy for TDM. To assist in the development of a TDM plan, DOMI has prepared a checklist intended to identify expected (pre-checked) and optional aspects of a TDM plan submitted to the City. Applicants should work with a qualified transportation professional and DOMI to identify a mix of strategies which address transportation impacts, provide adequate multimodal transportation facilities and incentives for non-SOV trips appropriate to the context, scale and use of the proposed development.

No TDM Program is expected to incorporate all of the strategies outlined in the checklist. Rather, the checklist provides a framework of options from which developers can identify appropriate actions for their project. The checklist is not exhaustive and does not constitute a full TDM scope.

Meet with the Transportation Management Association (TMA): Downtown and Oakland only	✔
Set mode split goals and commitment to survey. Goals should be consistent with relevant adopted neighborhood or master plans.	✔
Identify responsible party or dedicated staff assigned to administer TDM program and report on progress (this can be specific to the tenant or property manager); for speculative developments, this can be a description of how potential tenant will be made aware of TDM requirements and the property owner or tenant requirement to maintain multi-modal facilities.	✔
Hire TDM Coordination opt assign staff responsibility to administer a TDM program	✔
Payback incentives for using non-motorized and carpool commuters	✔
Provide transit passes or subsides to employees or residents	✔
Offer employees or residents free or discount bikeshare membership through the Healthy Ride Corporate Membership Program	✔
Membership in the 2030 District	✔
Parking policies that unbundle the cost of parking lease from rent	✔
Promotion of SPC Commuter Connects programs	✔
Flexible work hours and/or telecommute program	✔
Real time transportation displays internal to the development.	✔
Corporate carpool and/or ride partner programs	✔
Other:	
Other:	
Other:	
Other:	

Site Plan Strategies	
Adequate sidewalk widths and ADA ramps along all building frontages	✔
Bicycle parking required by code. A mix of bicycle parking should include convenient short-term parking and secure, covered parking accessible from the ground floor (not through the driveway of a garage) for long-term bicycle parking or storage.	✔
When impacting a bus stop: work with the City and Port Authority to relocate during construction and restore with amenities	✔
When providing public easement or public access to privately owned open space: wayfinding	✔
Upgrades and enhancements for pedestrian safety at site access and intersections	✔
Consistency with improvements identified in City plans or policy	✔
For master plan areas with very large existing parking structures (i.e., 500 or more parking spaces), identify how existing parking space can be repurposed as part of reducing SOV trips	✔
Enhancements to pedestrian facilities that address the last mile problem from transit stops and desired pedestrian paths	✔
Bicycle storage facilities that exceed Zoning code requirements.	✔
Bikeshare station on site	✔
Shower rooms or shower passes for employees who bike to work (office only)	✔
Unbundled parking	✔
Shared parking	✔
Priority carpool parking	✔
Dedicated car share parking	✔
Sponsored car share or bikeshare memberships for employees or residents (annual or intro membership)	✔
Real time arrival transit screens in publicly accessible space	✔
Transit station enhancements or improvements	✔
Pedestrian enhancements between proposed buildings and nearby transit stations, such as adding pedestrian scale lighting, emergency call boxes, street trees, and seating	✔
Sponsored car share or bikeshare memberships for employees or residents (annual or intro membership)	✔
Real time arrival transit screens in publicly accessible space	✔
Transit station enhancements or improvements	✔
Other: Electric vehicle charging	✔
Other: Tandem parking	✔
Other Personal mobility (scooter) parking on-campus	✔
Other:	

For more information, please see our DOMI TDM Guidelines
For questions, please email katherine.reed@pittsburghpa.gov

APPENDIX C
Trip Generation Calculation Sheets

gai consultants
transforming ideas into reality®

Utility
(170)

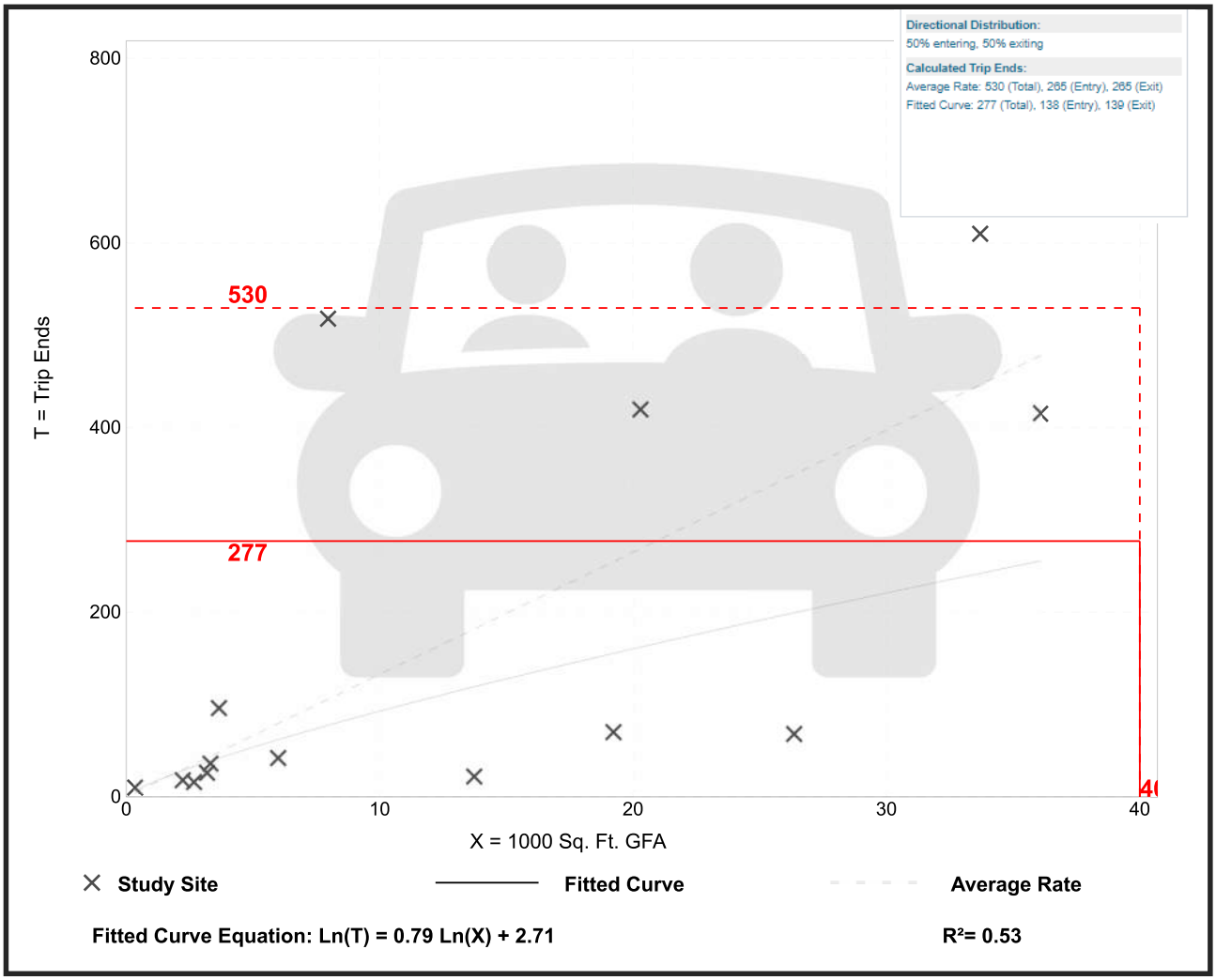
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 14
Avg. 1000 Sq. Ft. GFA: 13
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
13.24	1.60 - 65.03	13.72

Data Plot and Equation



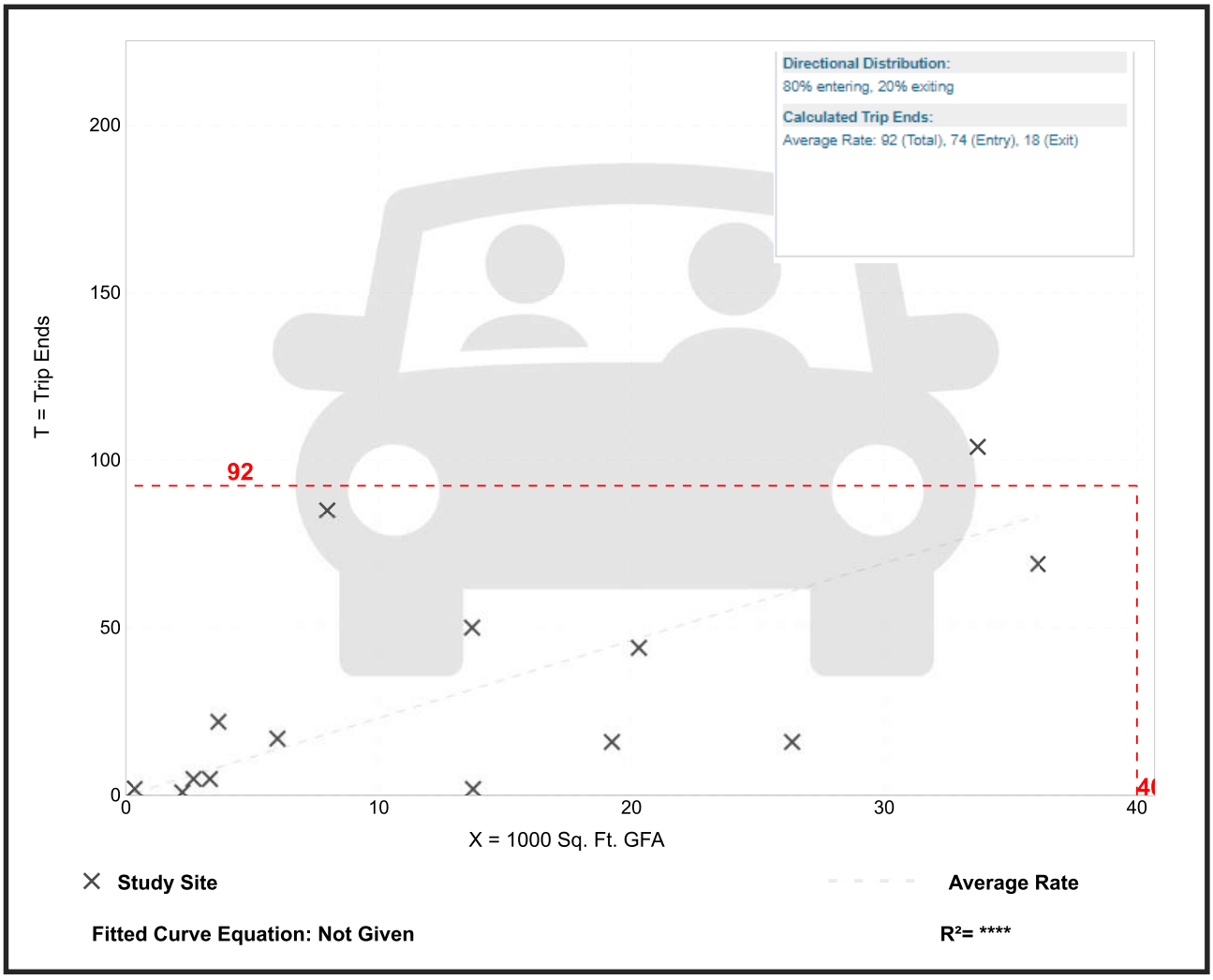
Utility
(170)

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:	14
Avg. 1000 Sq. Ft. GFA:	14
Directional Distribution:	80% entering, 20% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.31	0.15 - 10.67	2.21

Data Plot and Equation



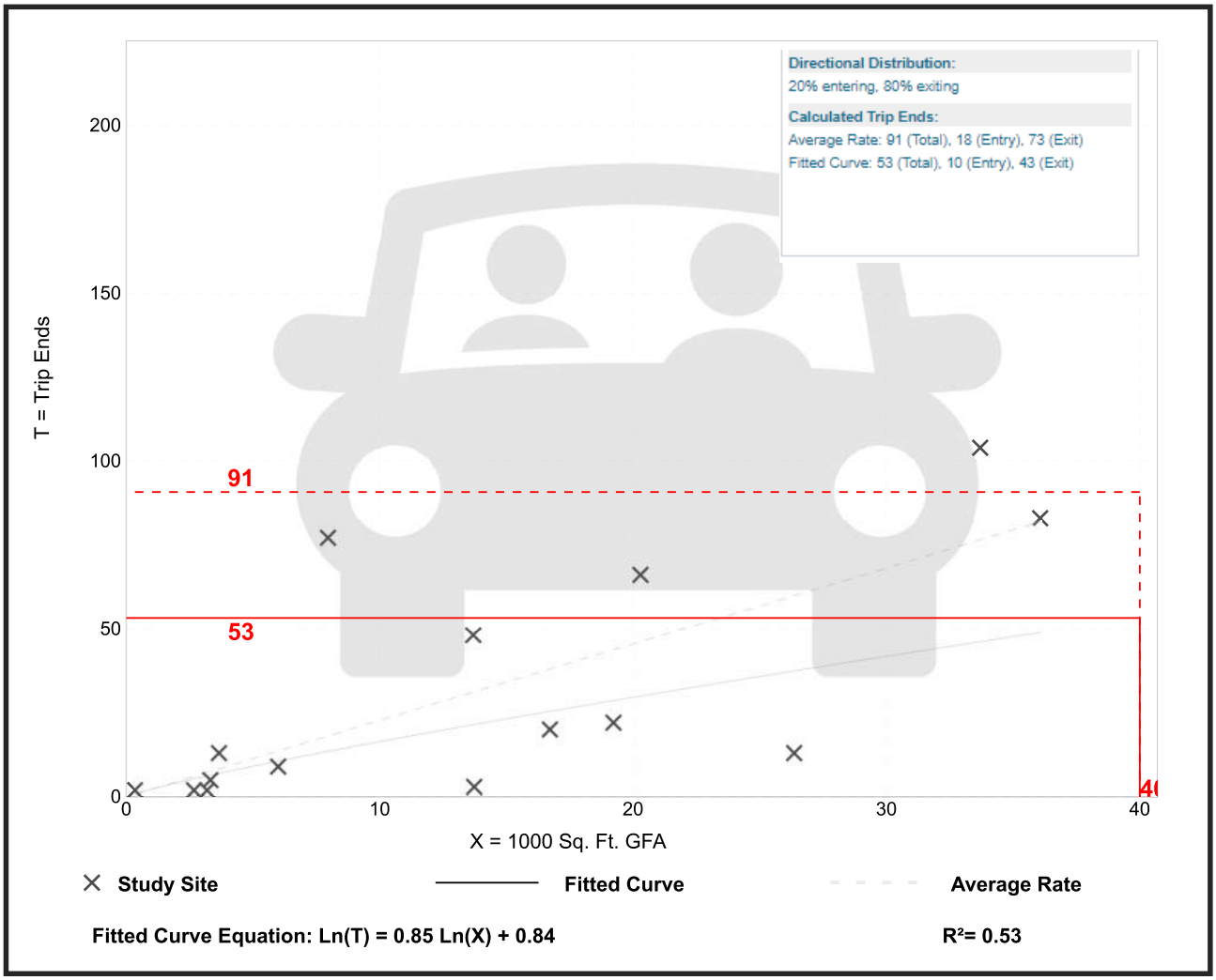
Utility
(170)

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
Avg. 1000 Sq. Ft. GFA:	14
Directional Distribution:	20% entering, 80% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.27	0.22 - 9.67	1.92

Data Plot and Equation



Utility
(170)

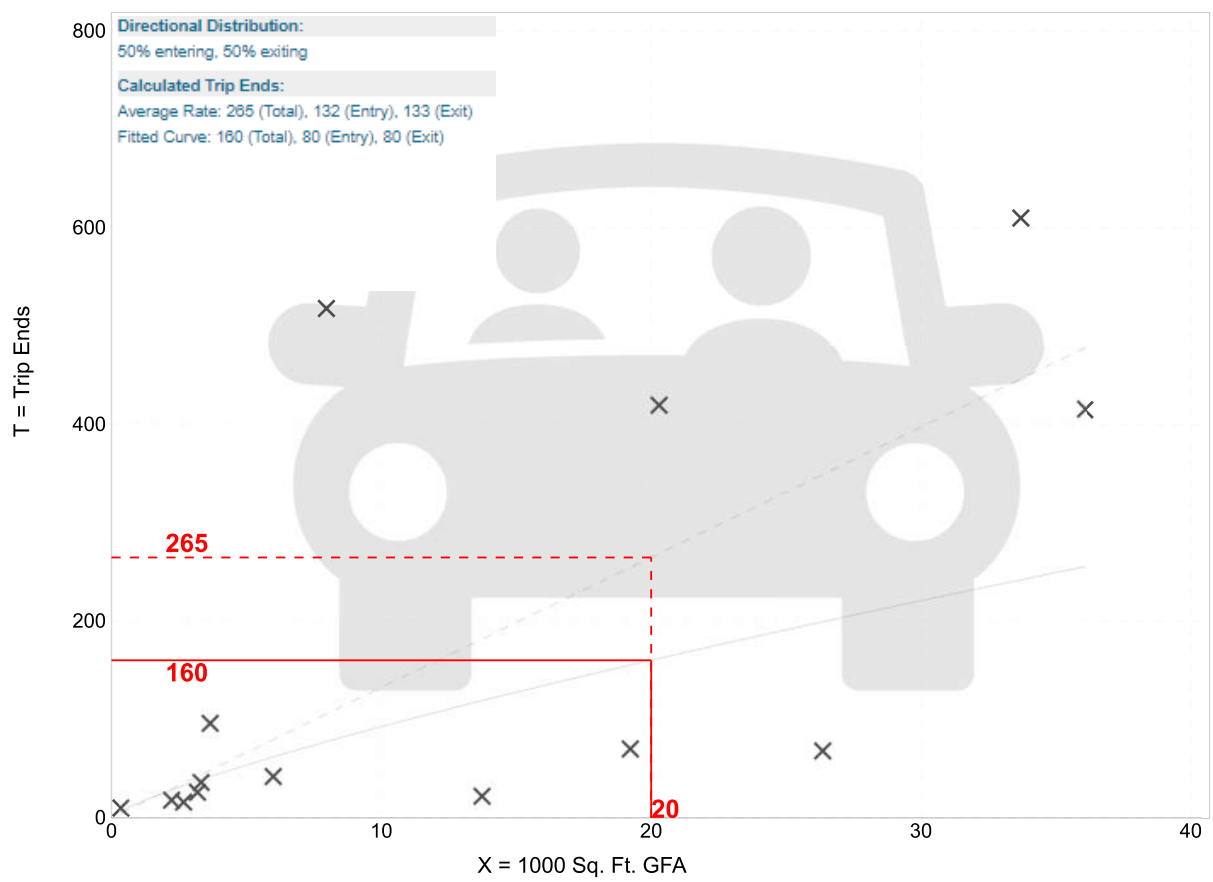
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 14
Avg. 1000 Sq. Ft. GFA: 13
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
13.24	1.60 - 65.03	13.72

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.79 Ln(X) + 2.71 **R^2= 0.53**

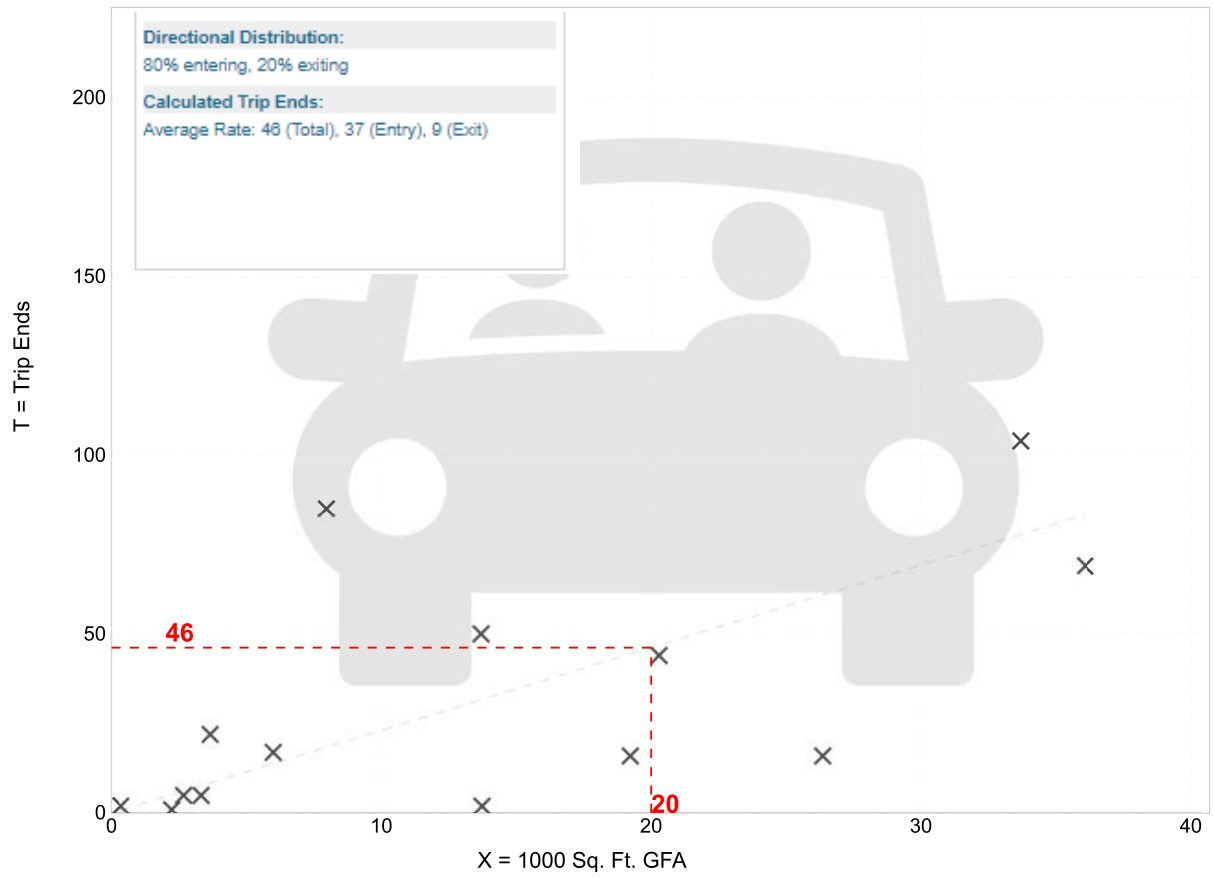
Utility
(170)

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:	14
Avg. 1000 Sq. Ft. GFA:	14
Directional Distribution:	80% entering, 20% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.31	0.15 - 10.67	2.21

Data Plot and Equation



Fitted Curve Equation: Not Given **R^2= ******

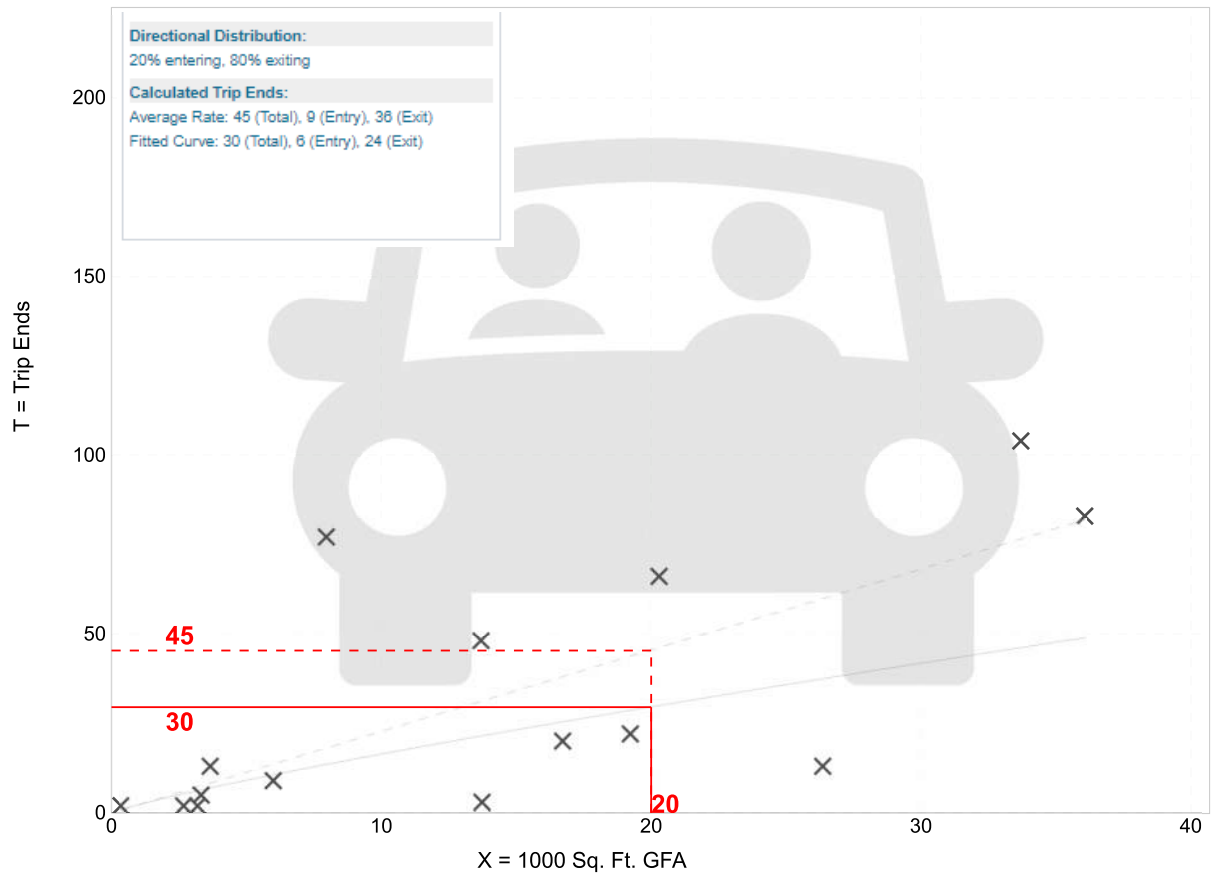
Utility
(170)

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
Avg. 1000 Sq. Ft. GFA:	14
Directional Distribution:	20% entering, 80% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.27	0.22 - 9.67	1.92

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.85 Ln(X) + 0.84 **R^2= 0.53**

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

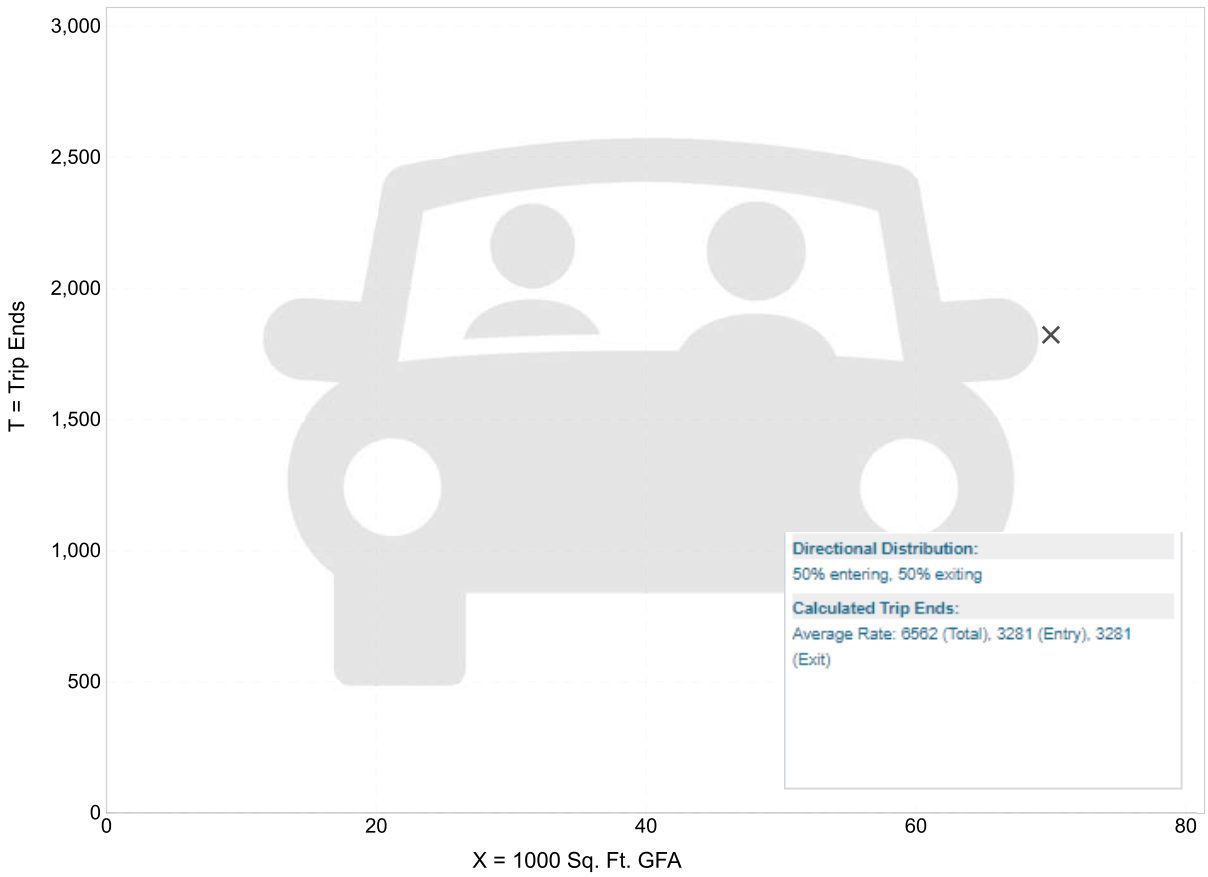
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

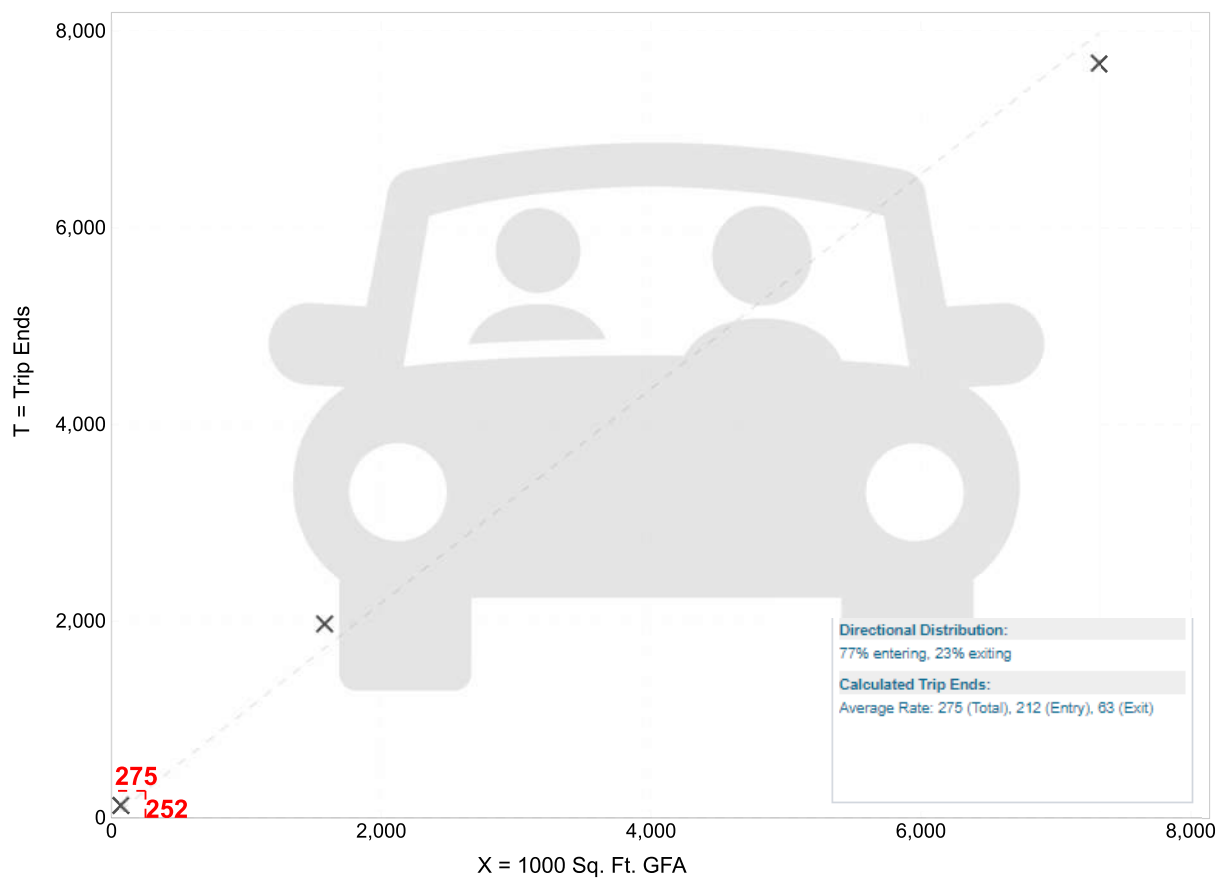
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

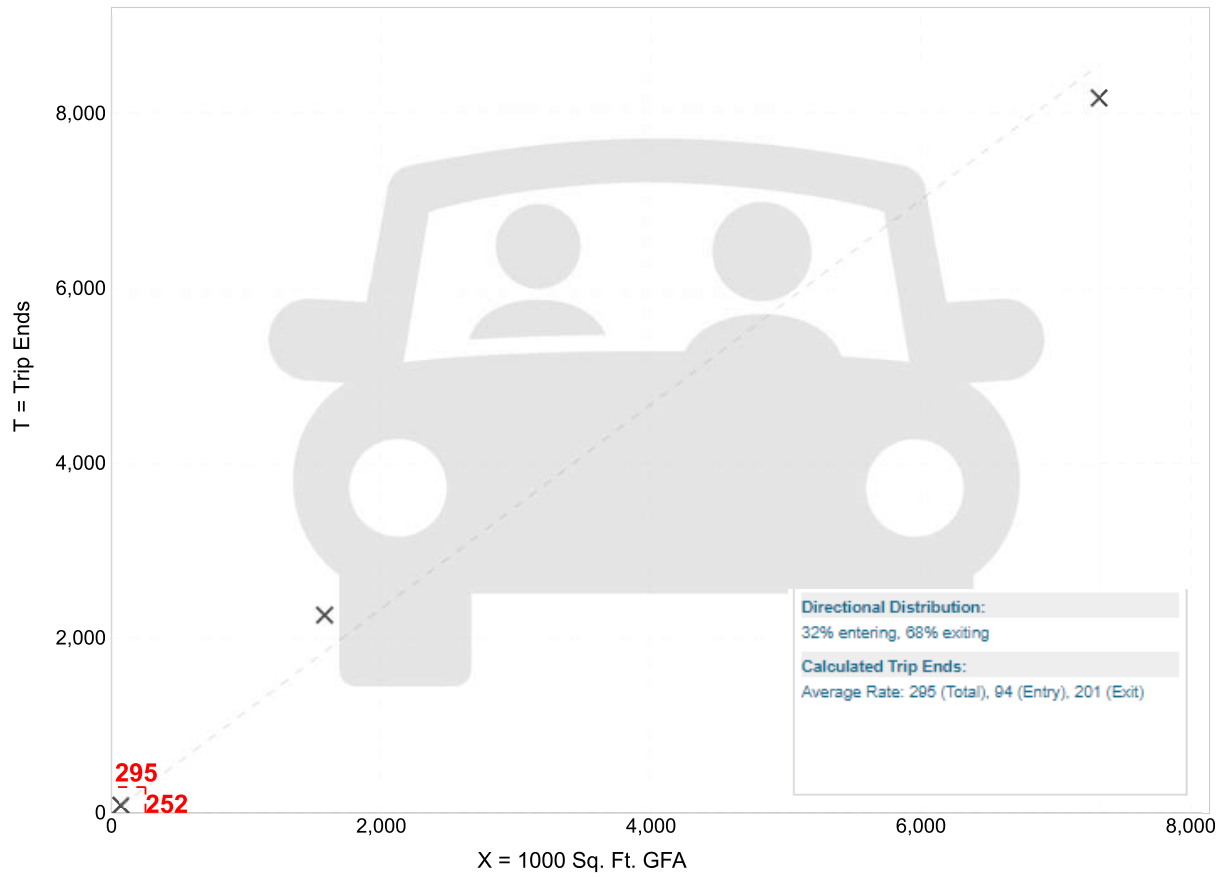
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

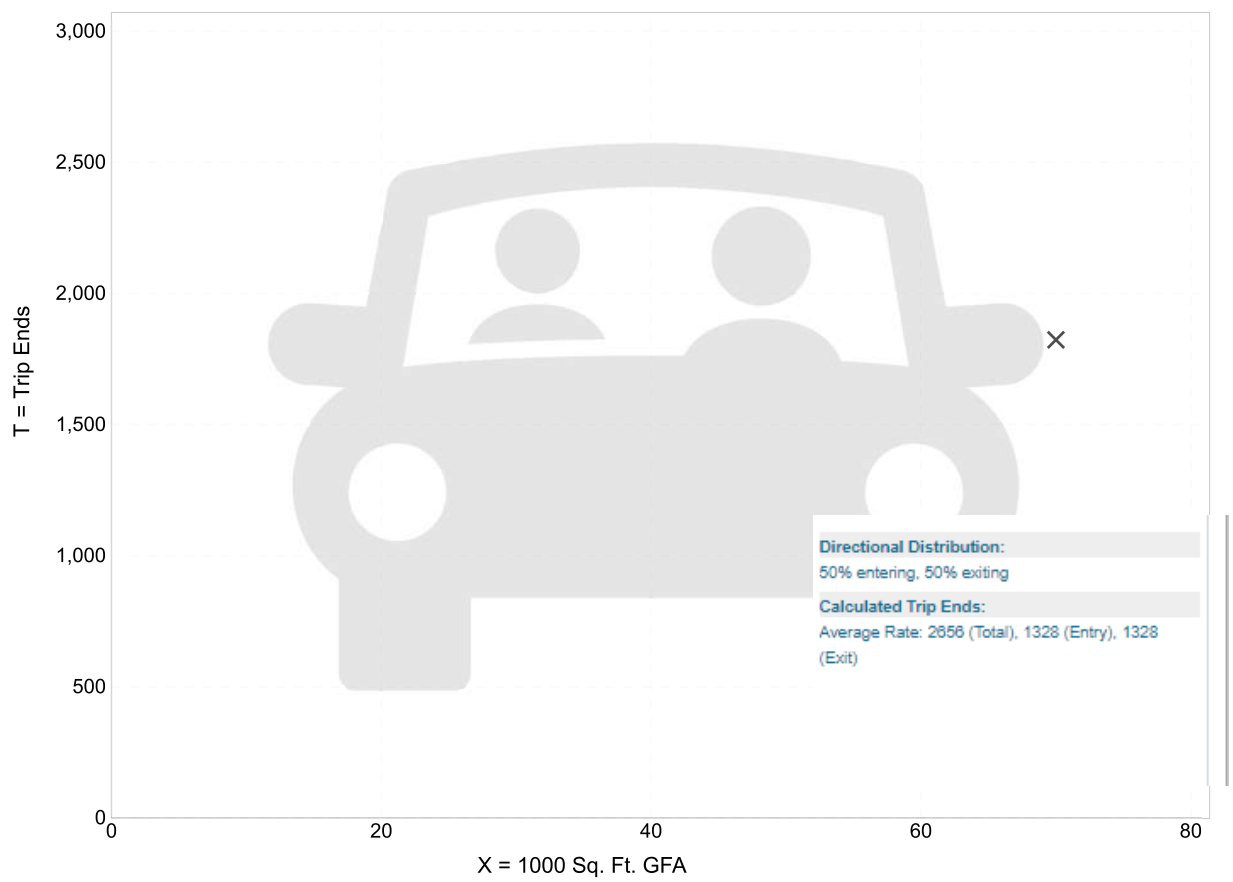
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
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Setting/Location:	**General Urban/Suburban**
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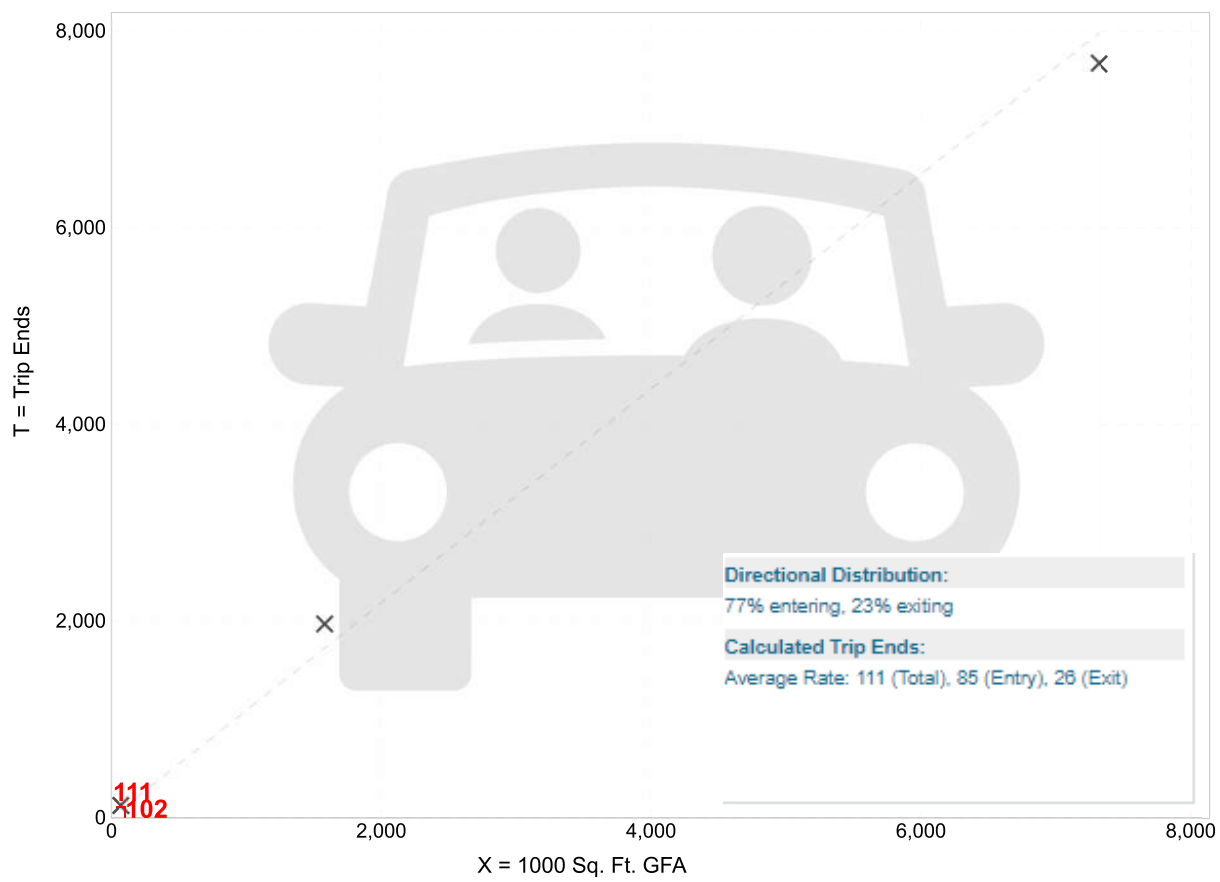

× **Study Site** — — — — **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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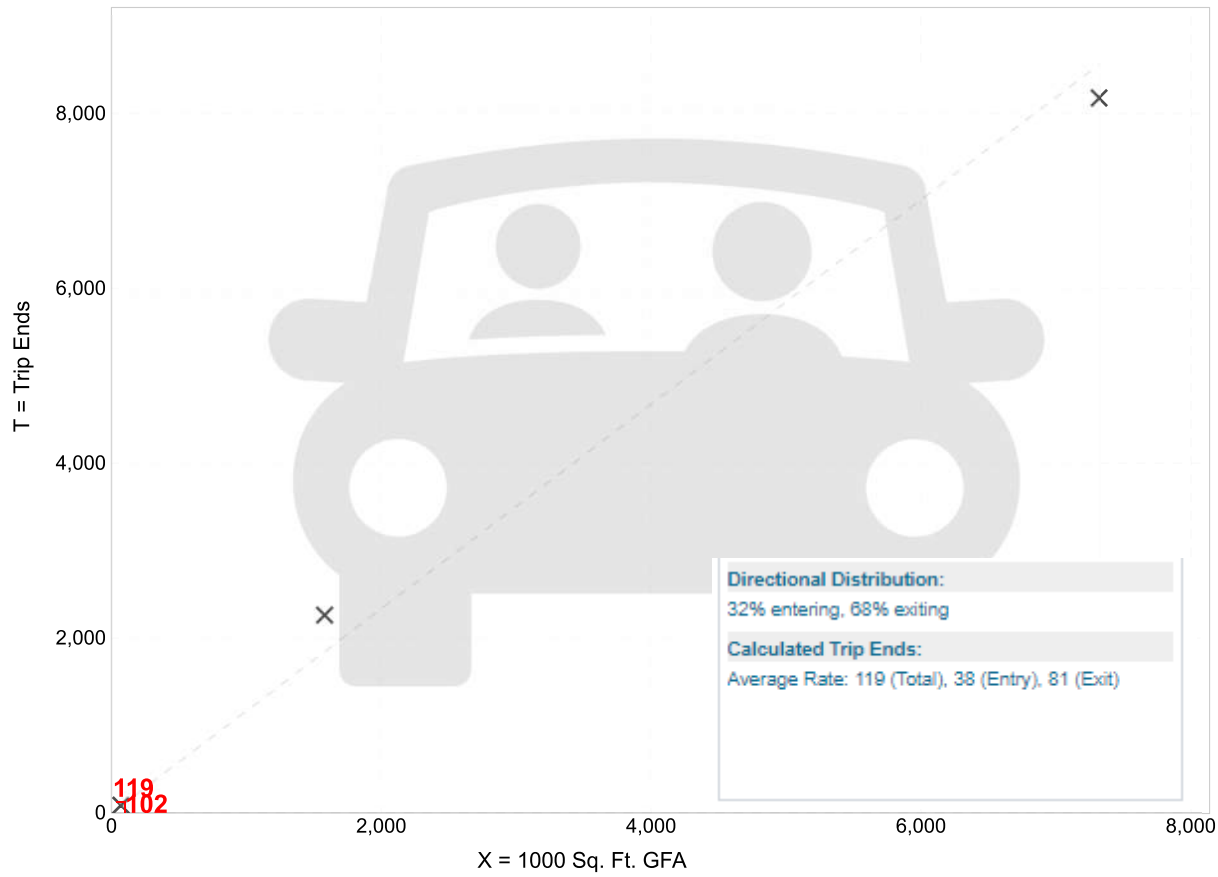

× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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Data Plot and Equation

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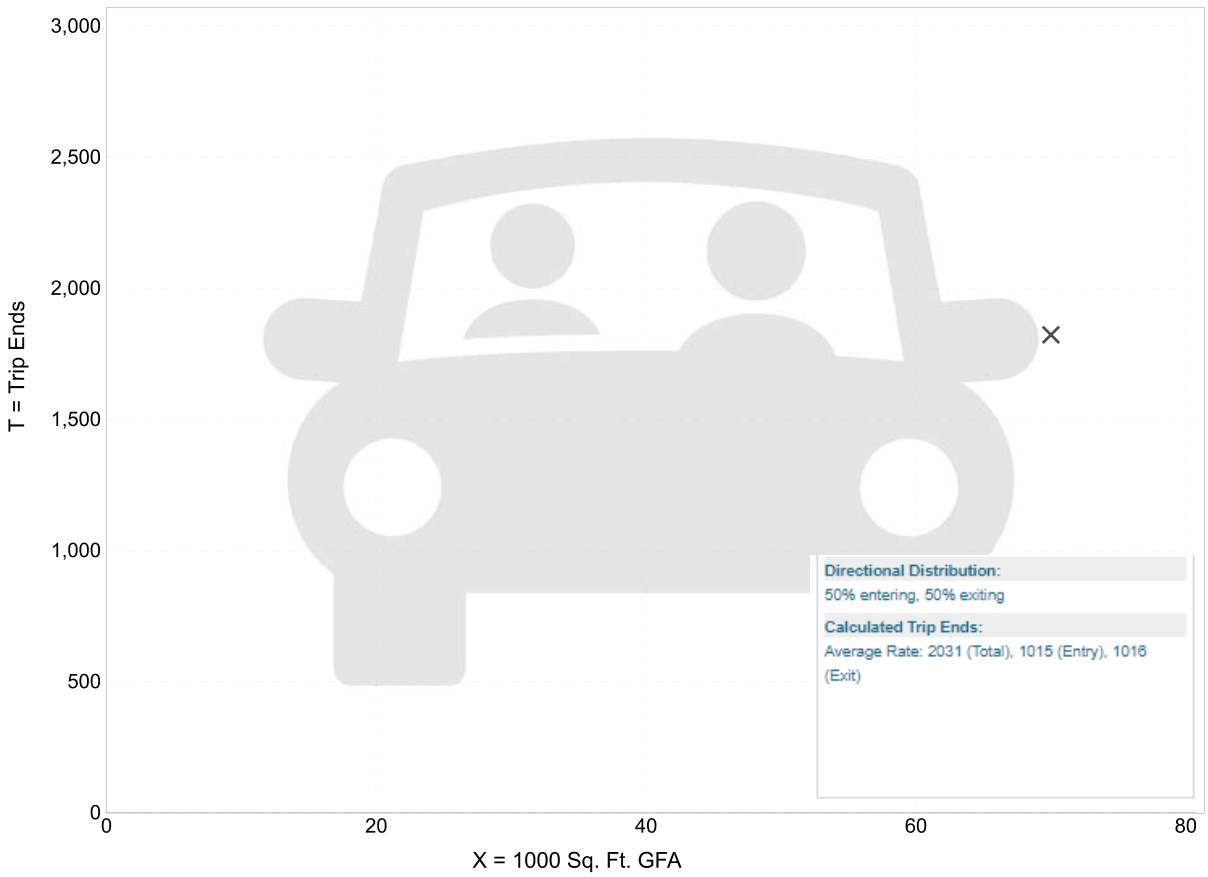

× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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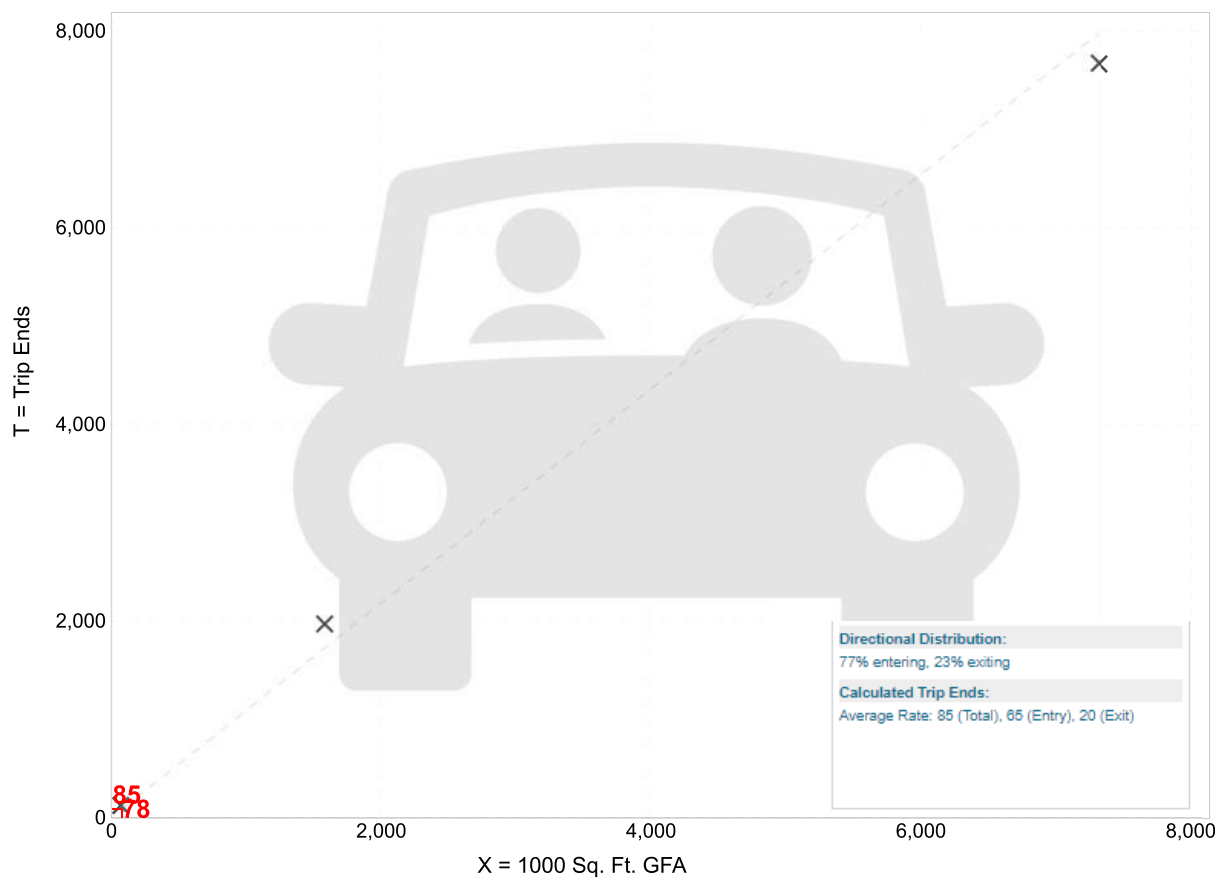

× **Study Site** — — — — **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
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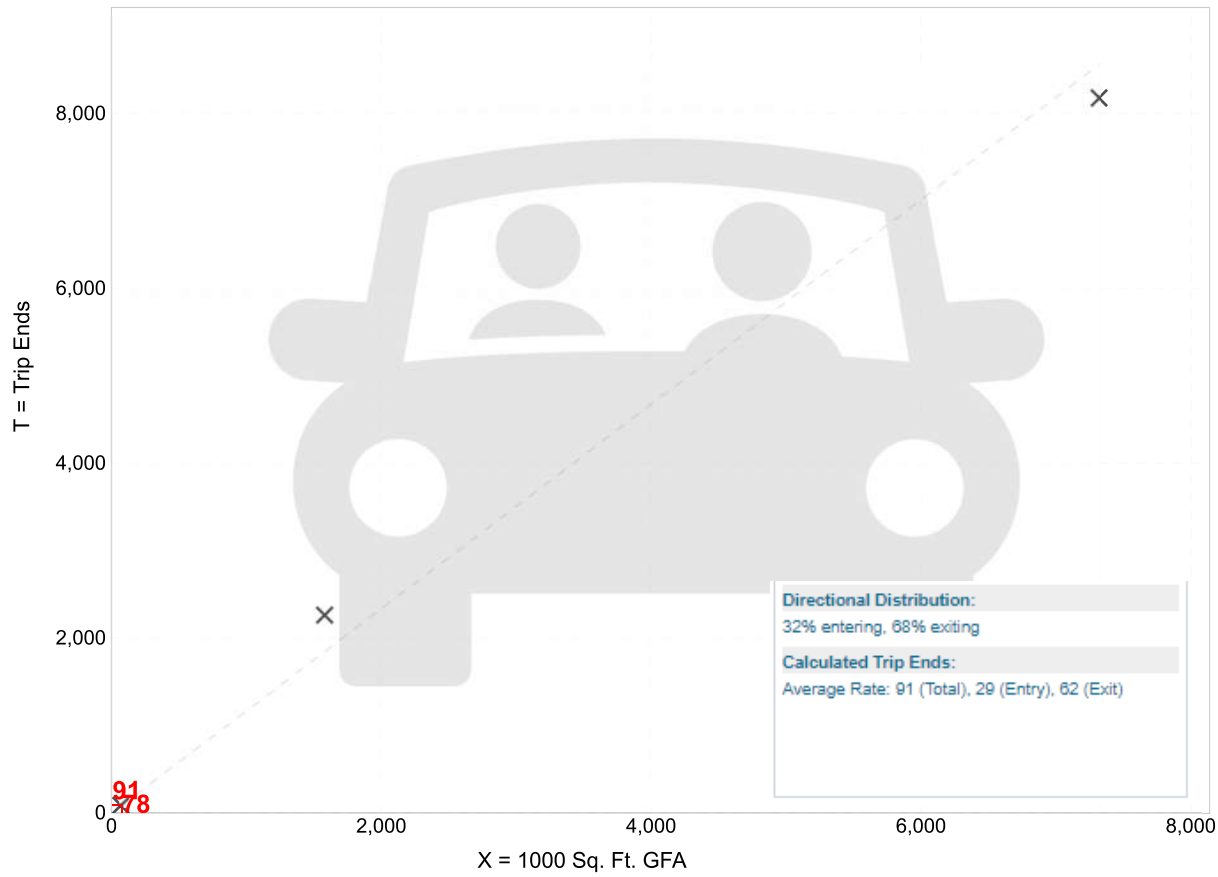

× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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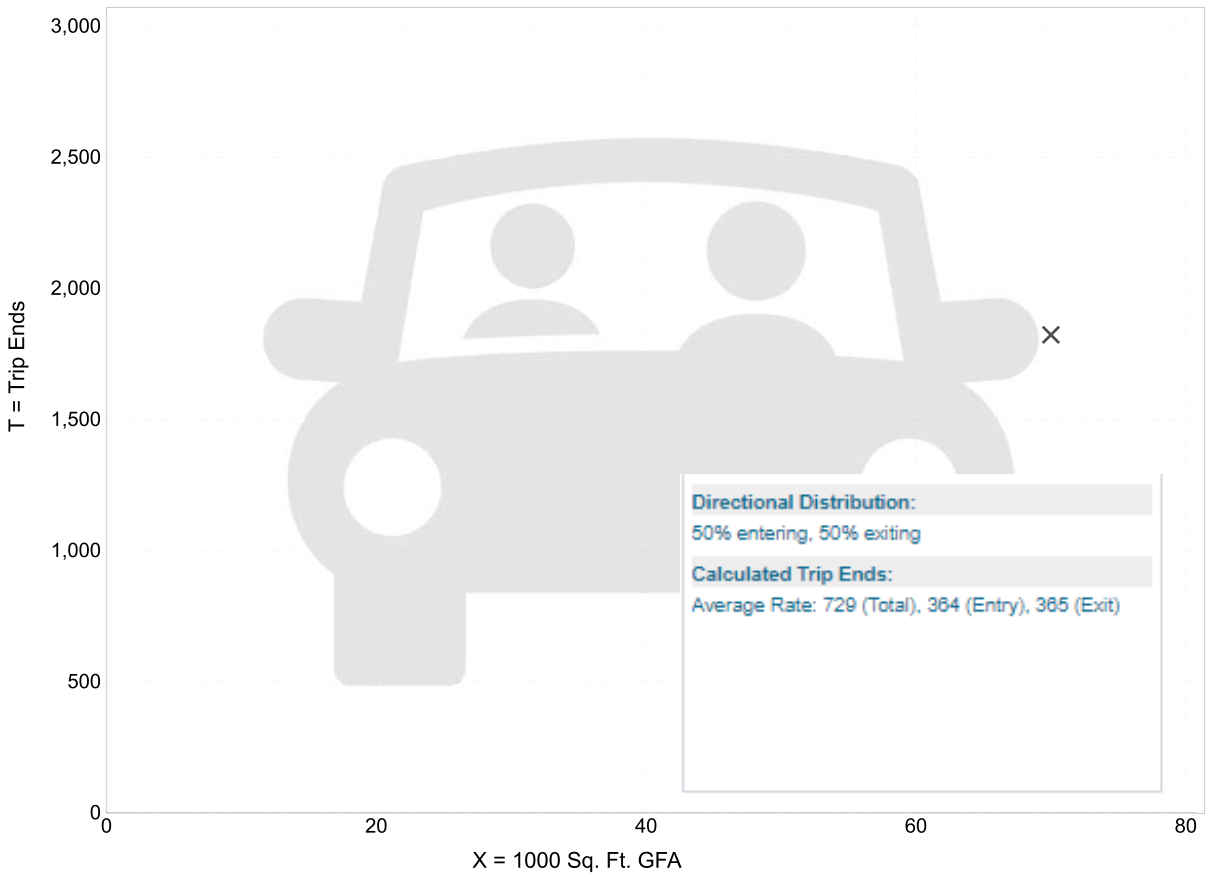
Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

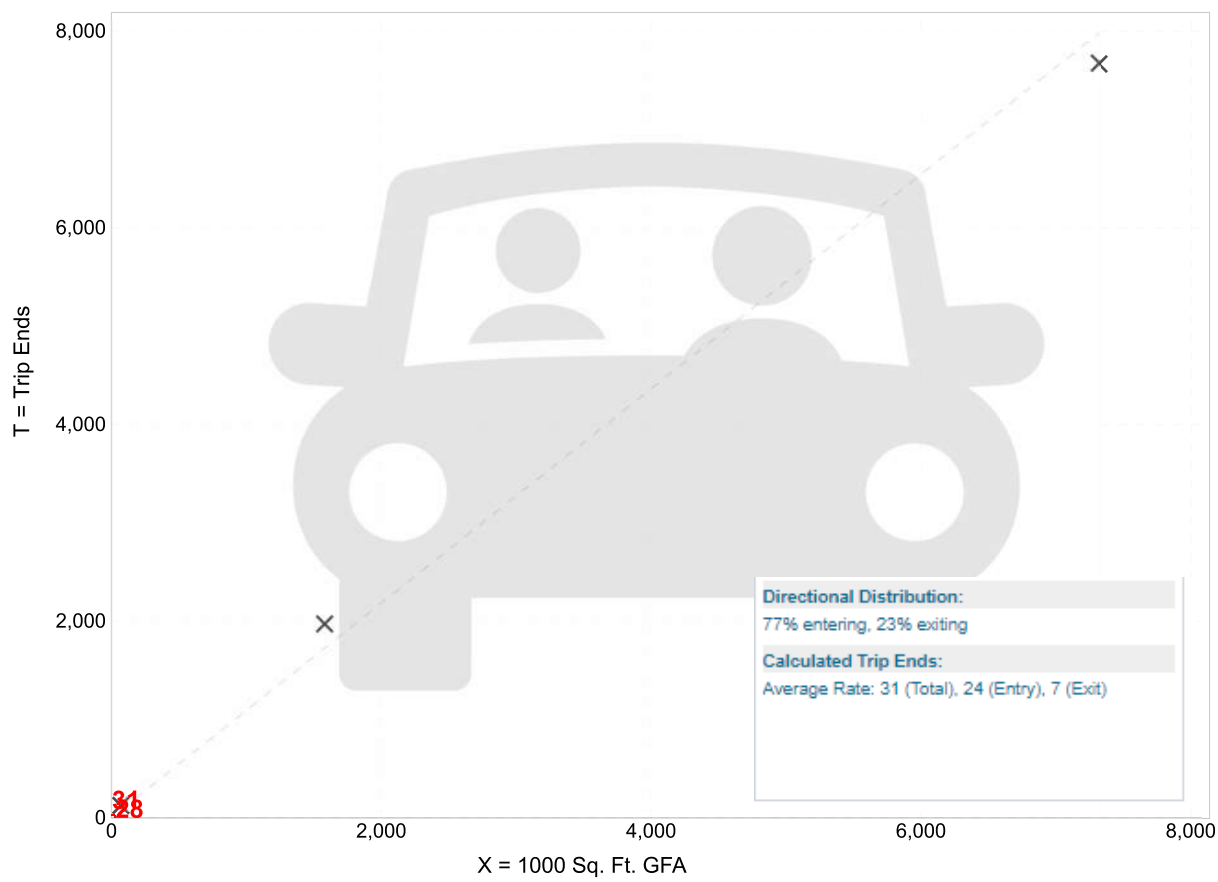
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

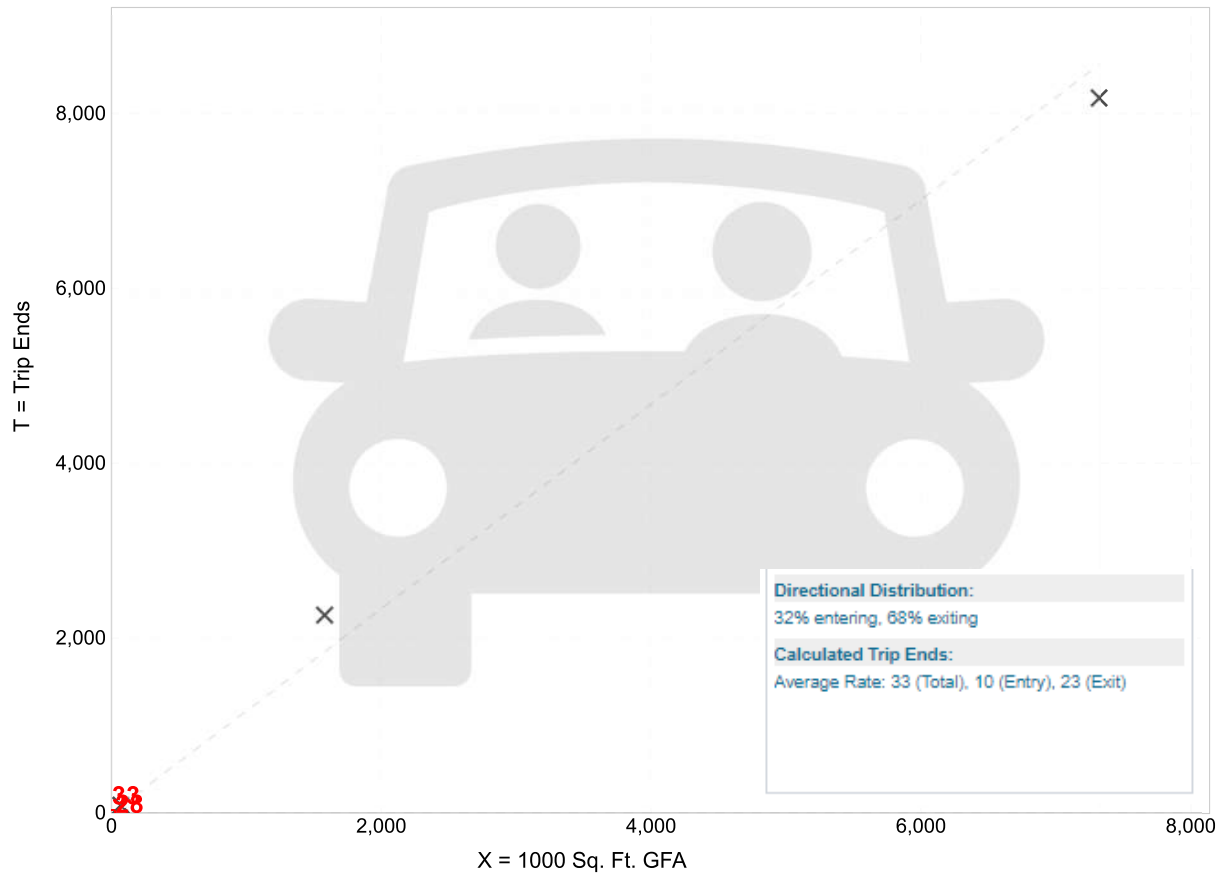
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

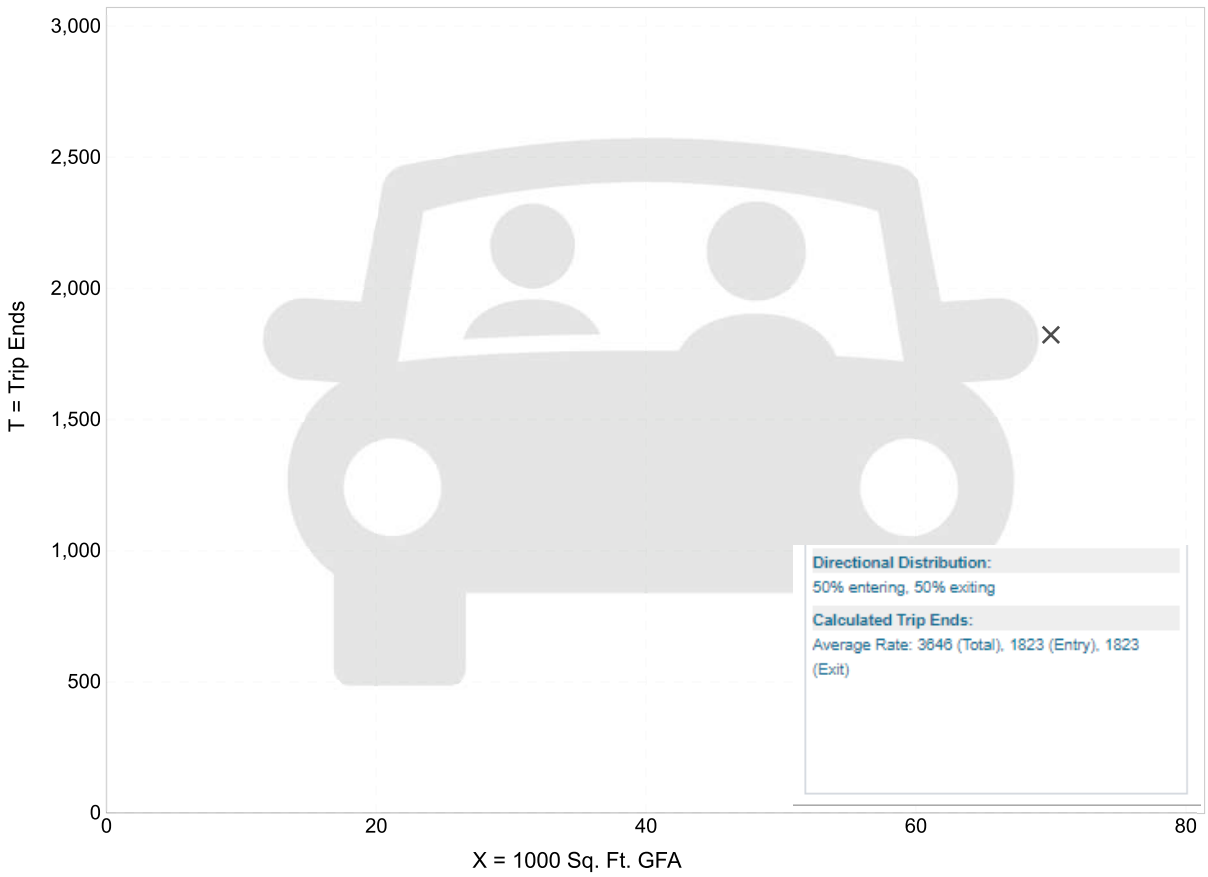
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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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:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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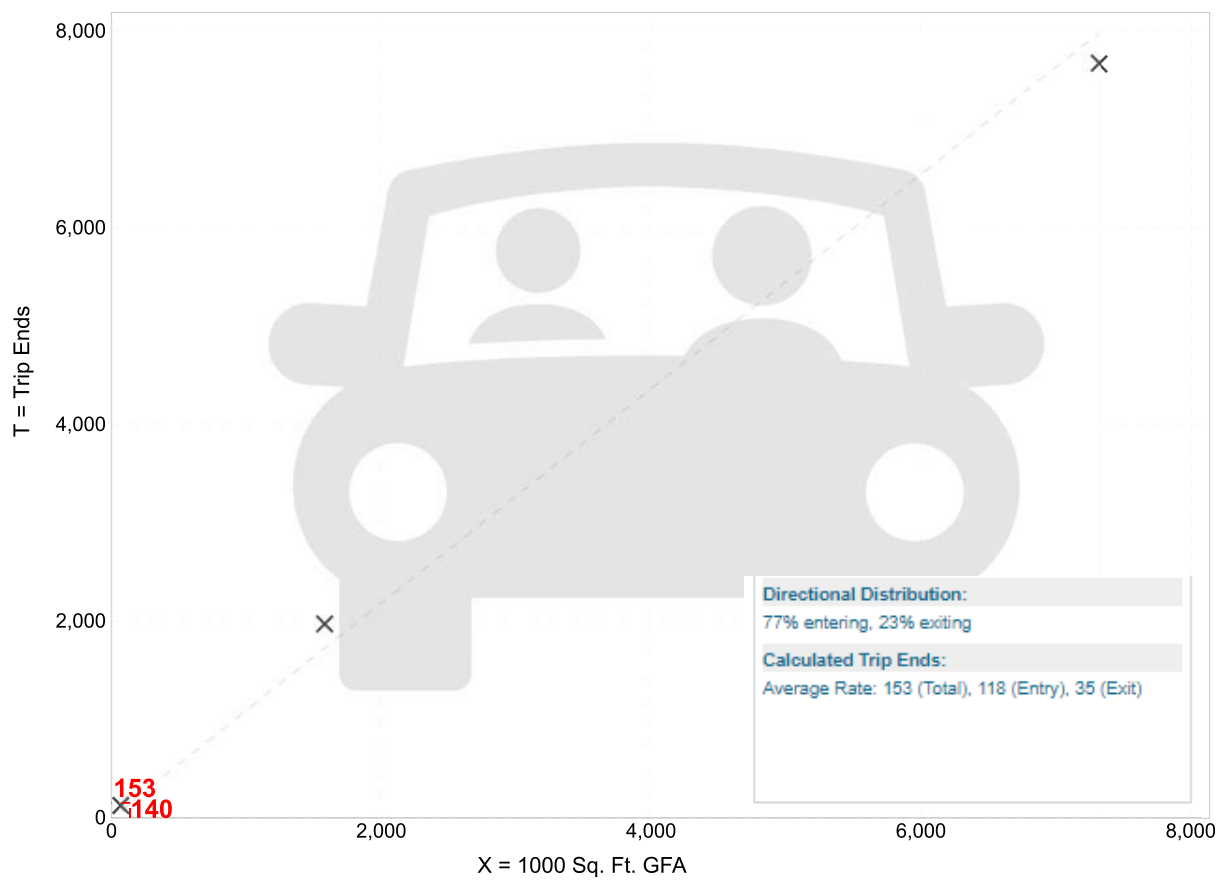

Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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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:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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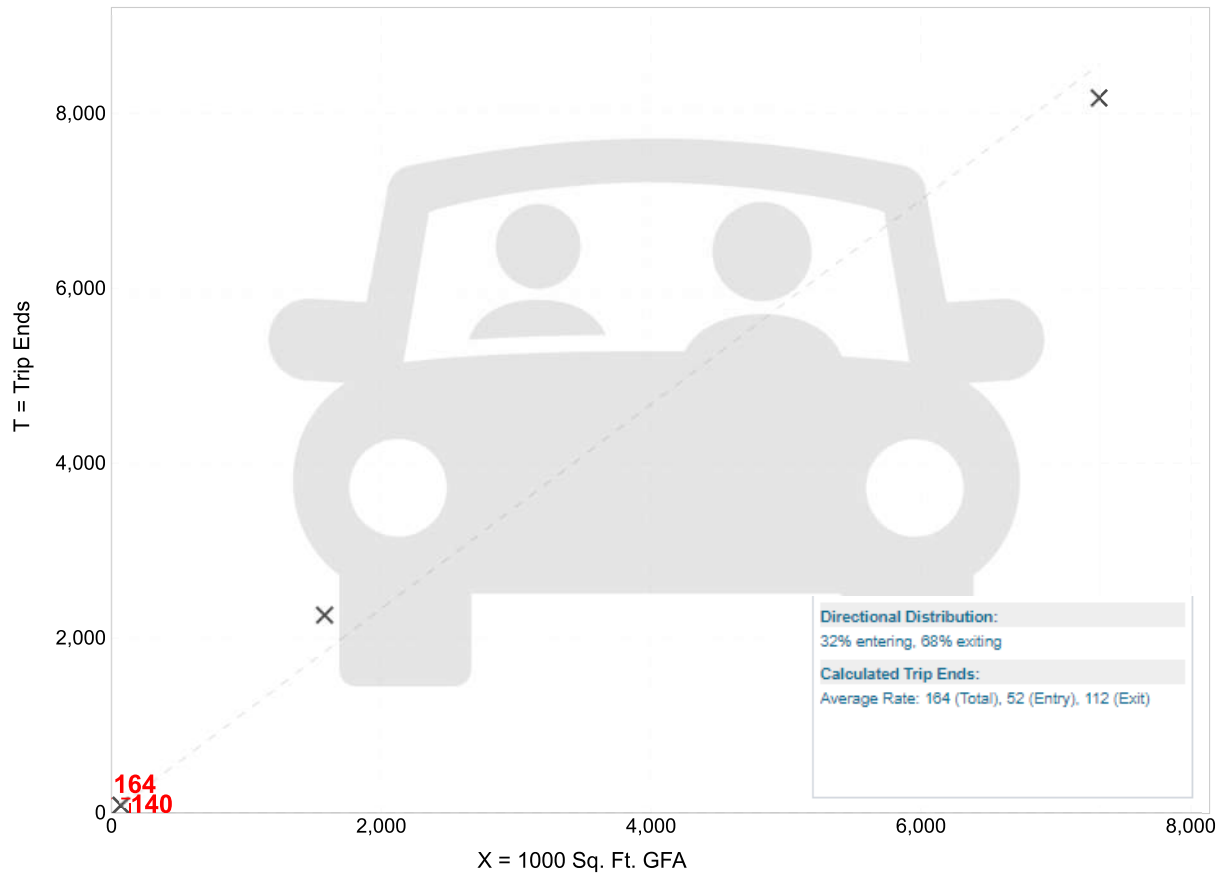
Data Plot and Equation

Caution – Small Sample Size



Study Site — **Average Rate**

Fitted Curve Equation: Not Given — **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size

× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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Setting/Location:	**General Urban/Suburban**
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Avg. 1000 Sq. Ft. GFA:	2990
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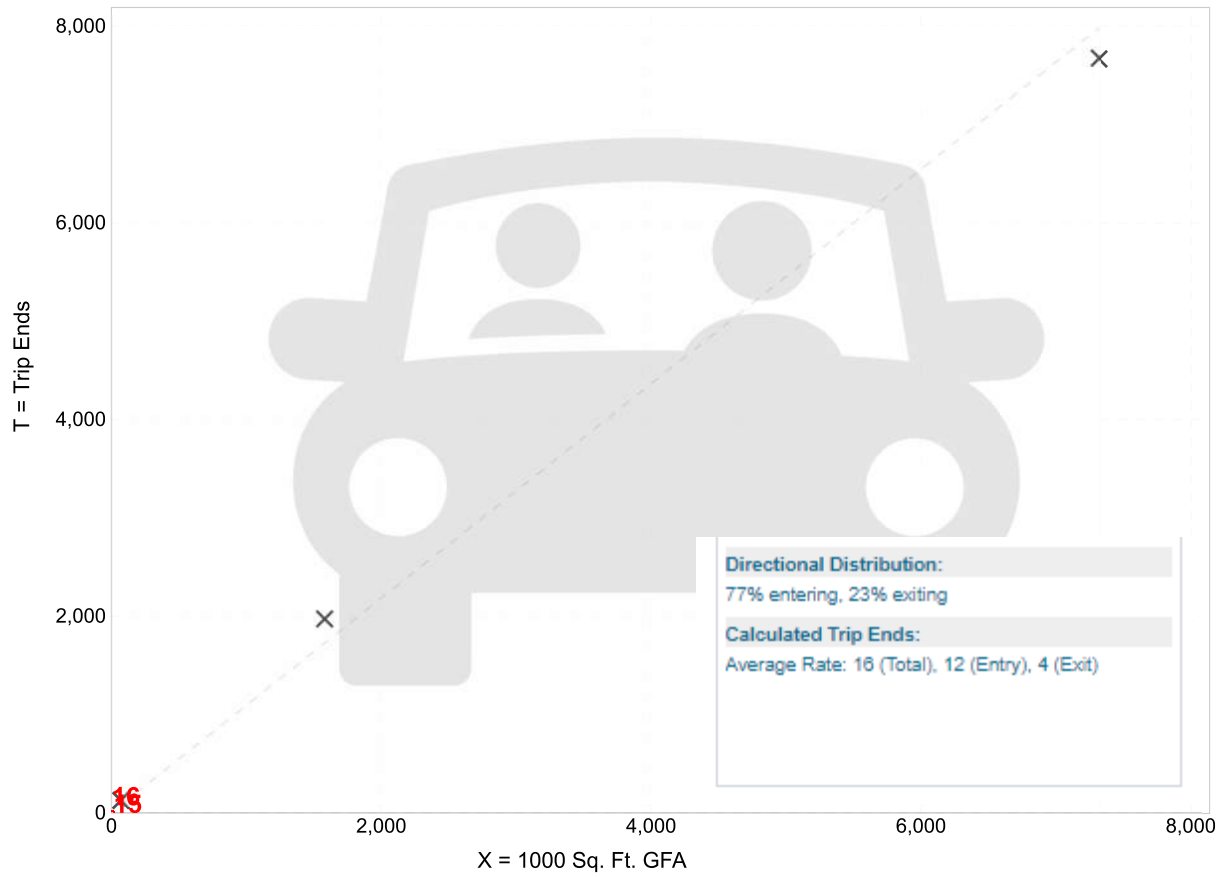
Caution – Small Sample Size



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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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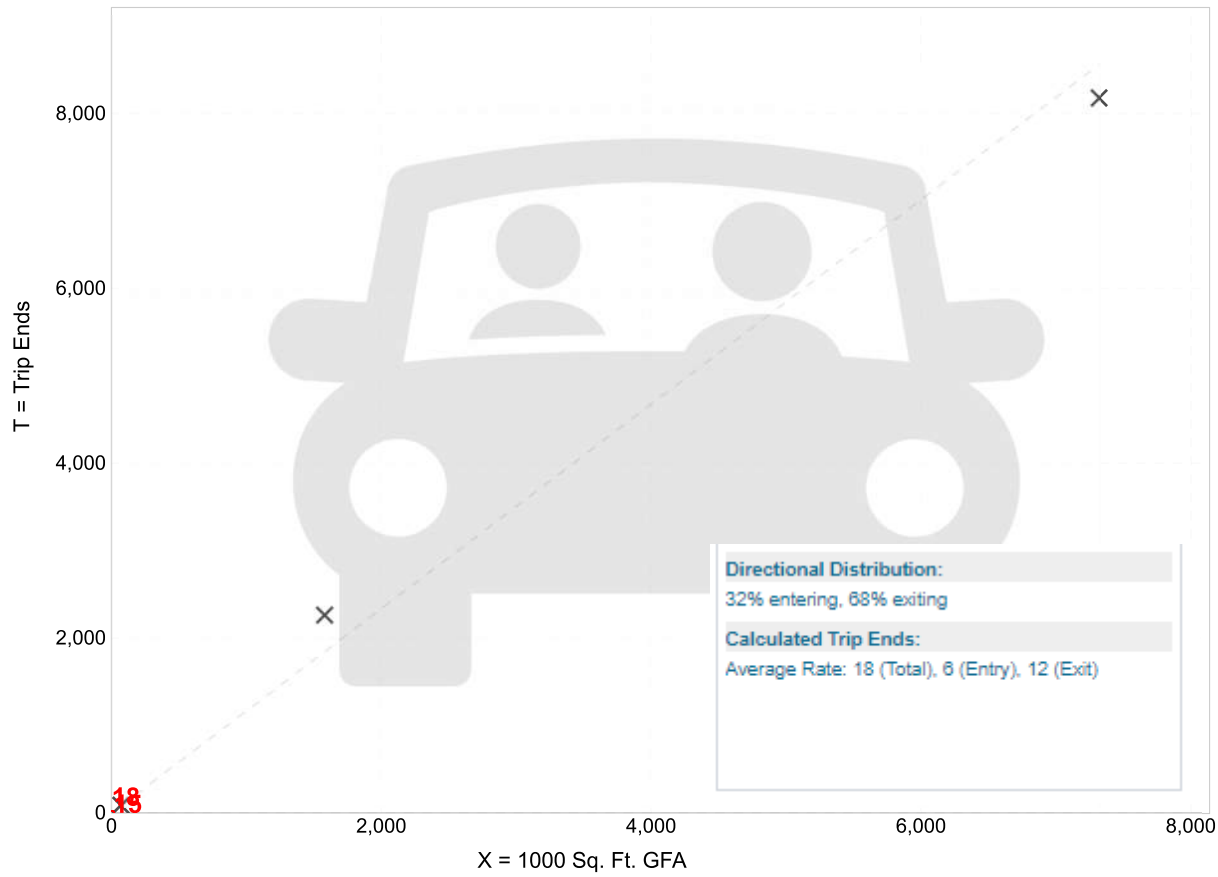

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

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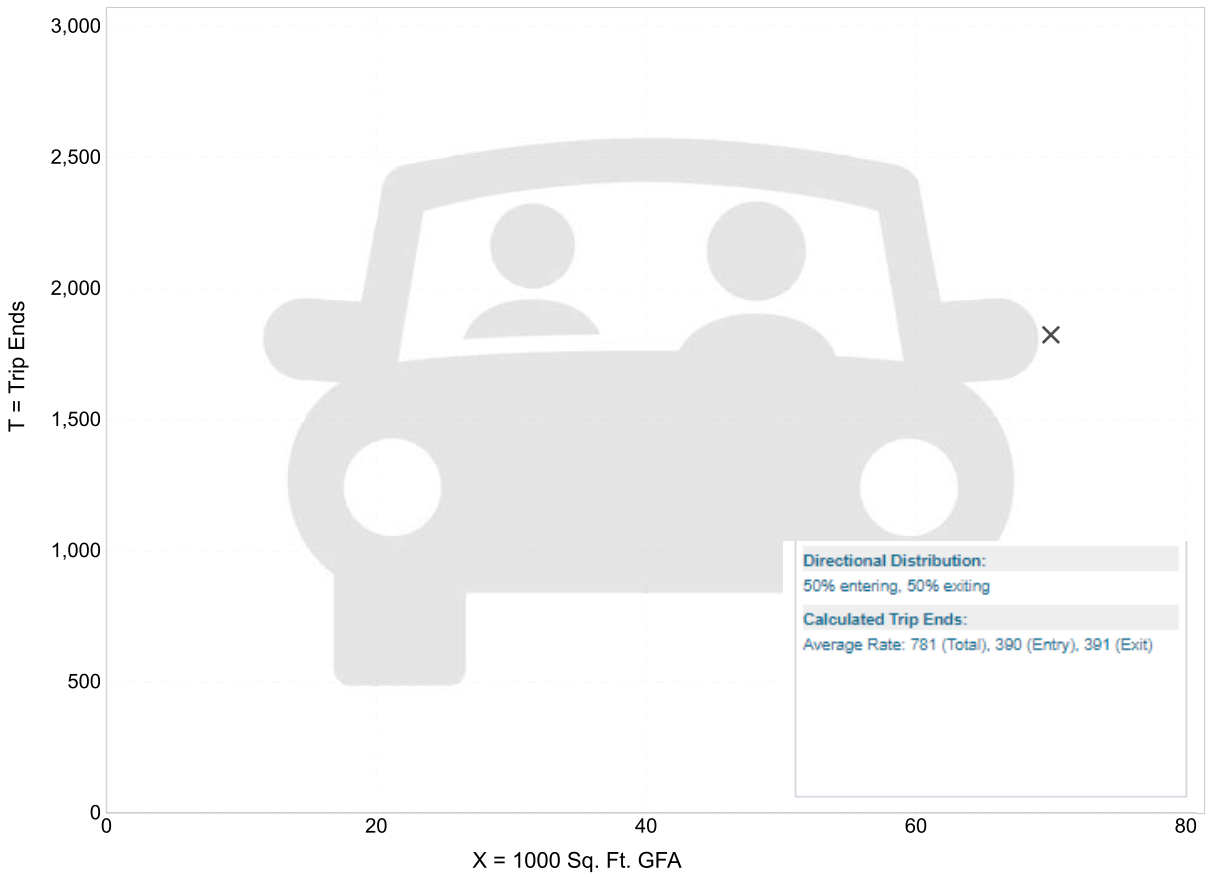

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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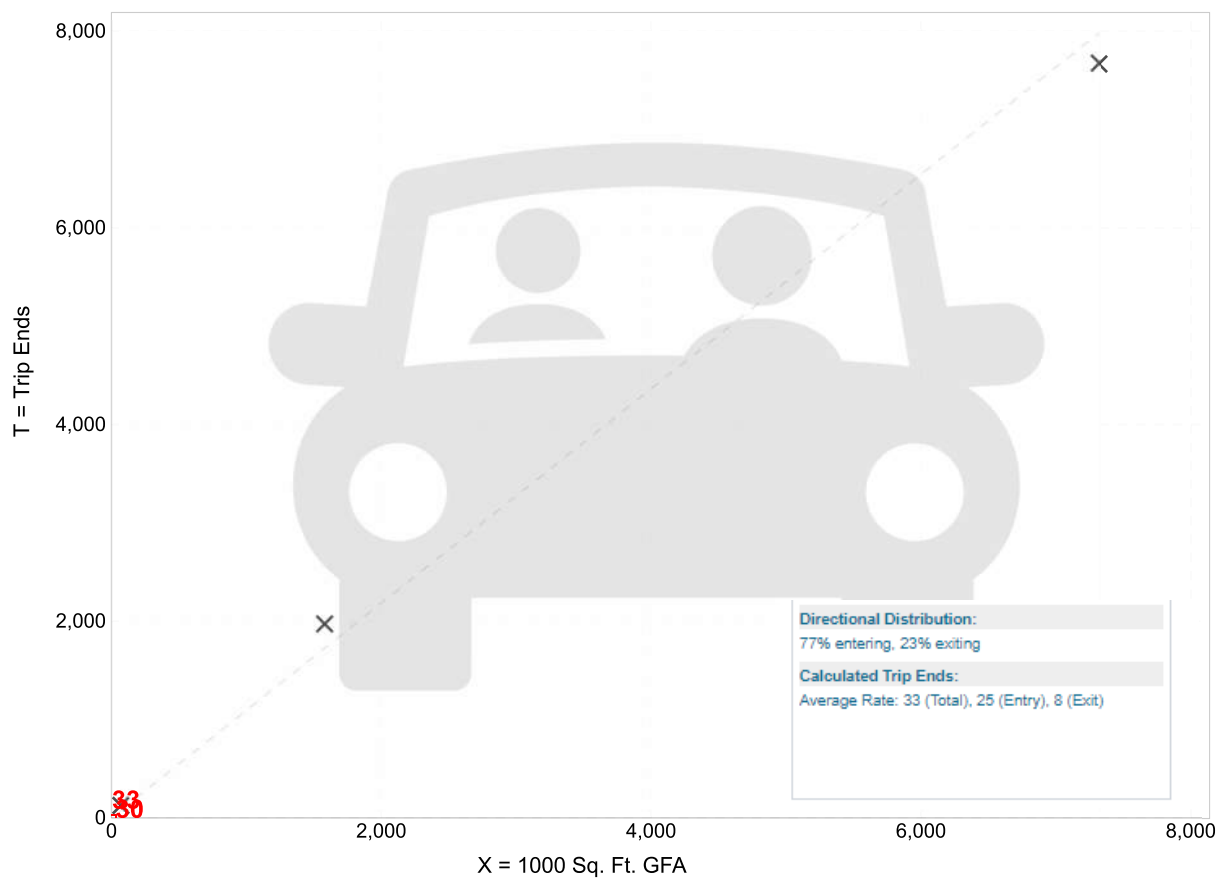

× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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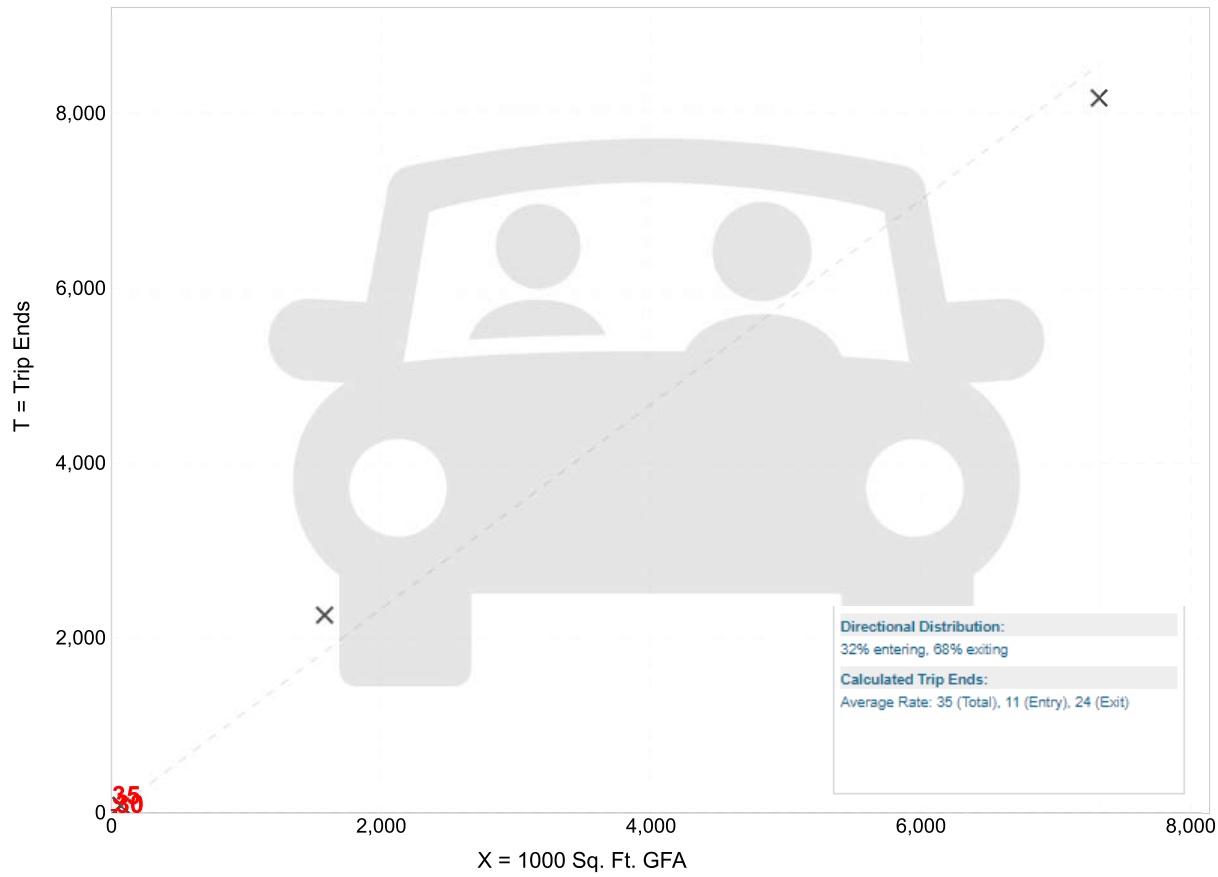

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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Vehicle Trip Generation per 1000 Sq. Ft. GFA

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Data Plot and Equation

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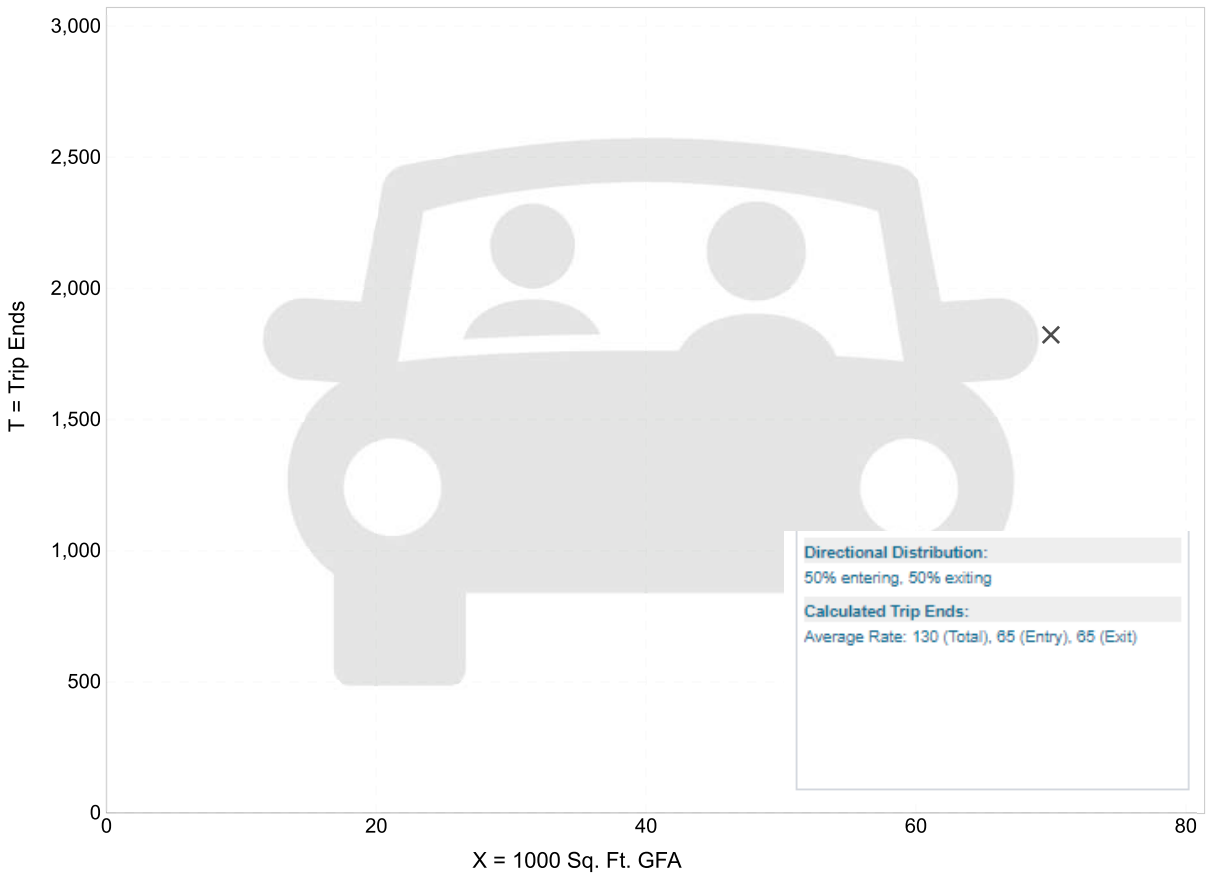

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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Average Rate	Range of Rates	Standard Deviation
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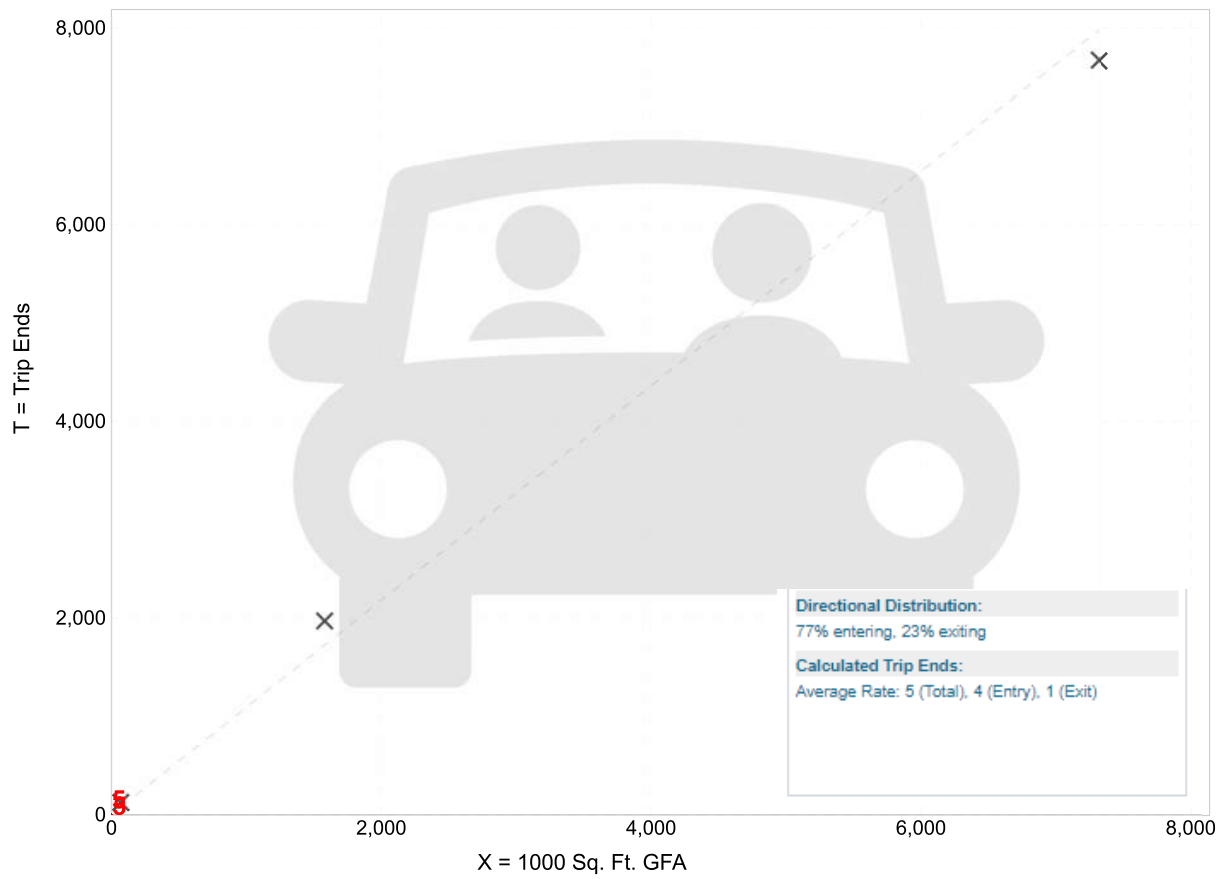

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University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
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Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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Data Plot and Equation

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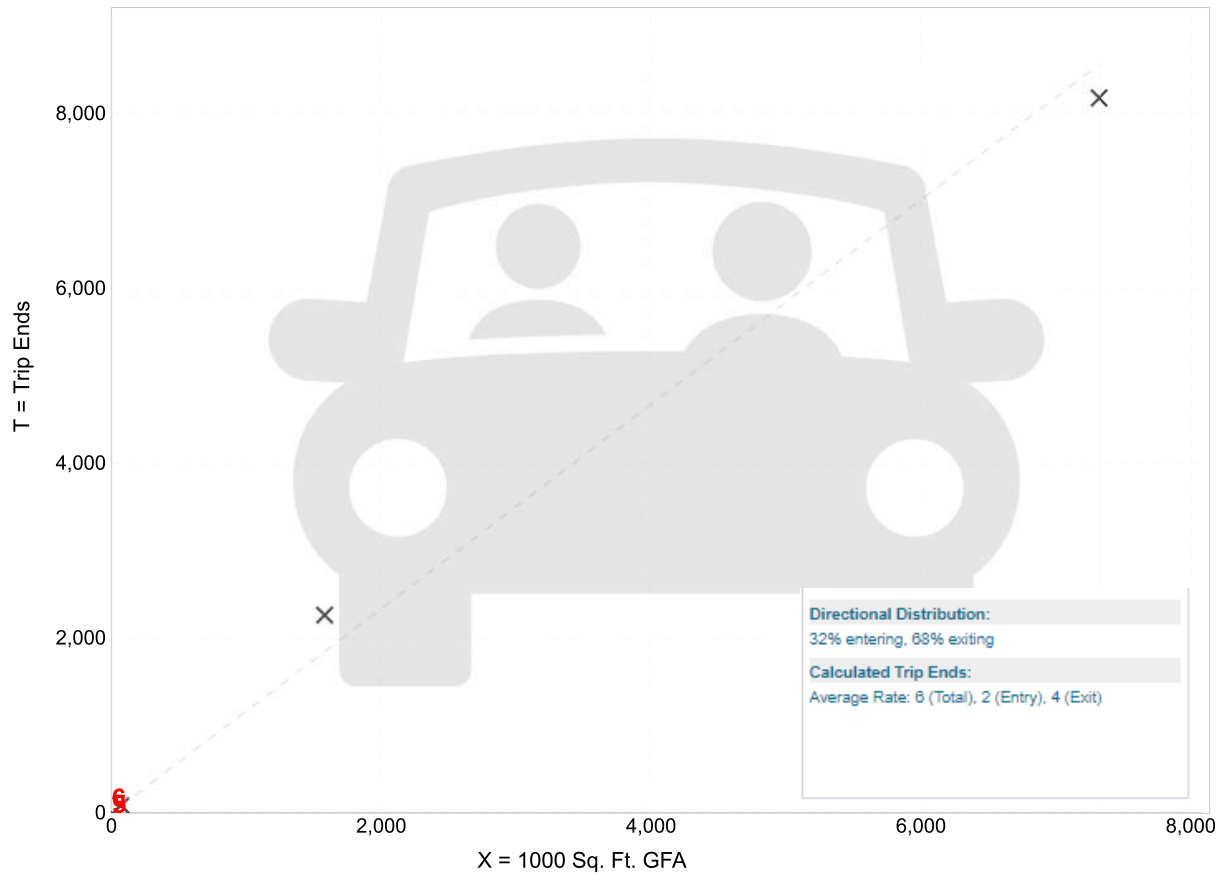

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
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Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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Data Plot and Equation

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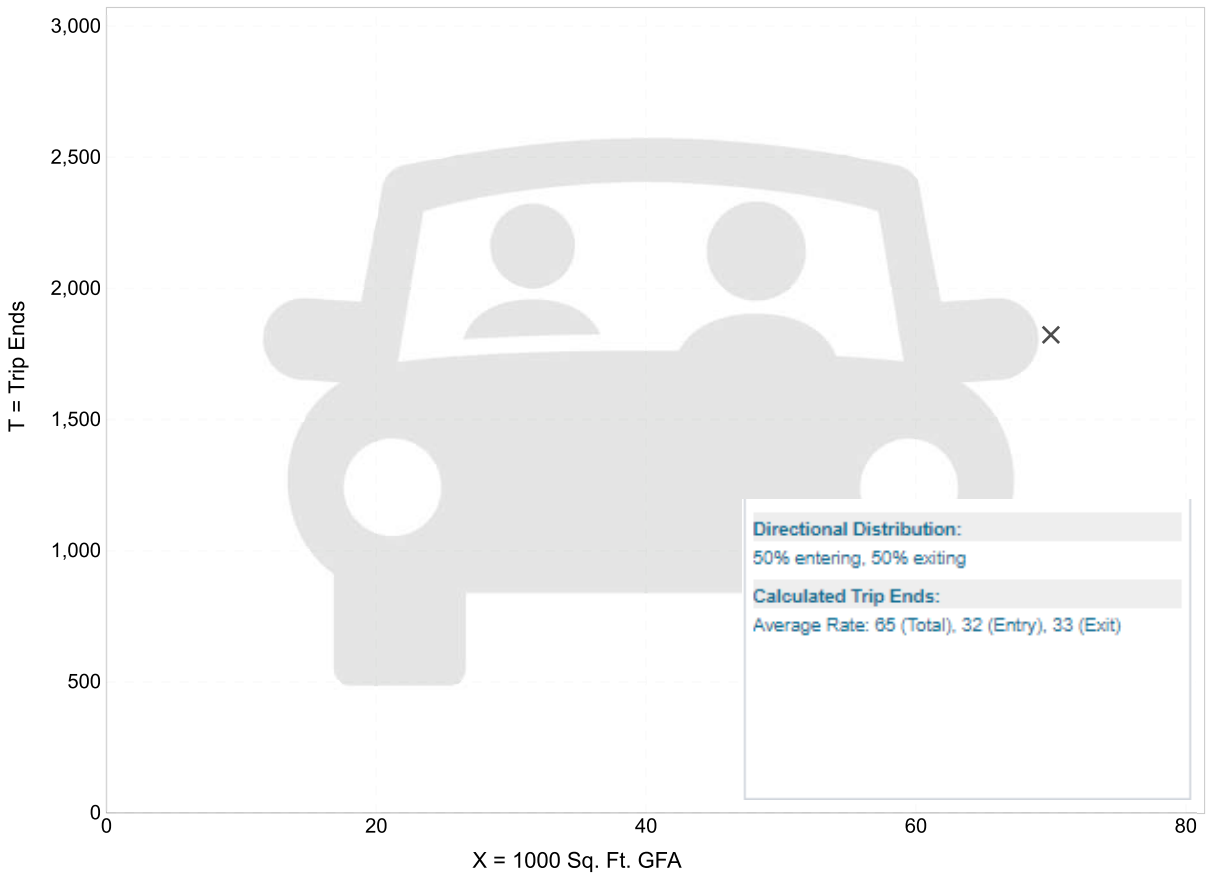

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
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Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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Data Plot and Equation

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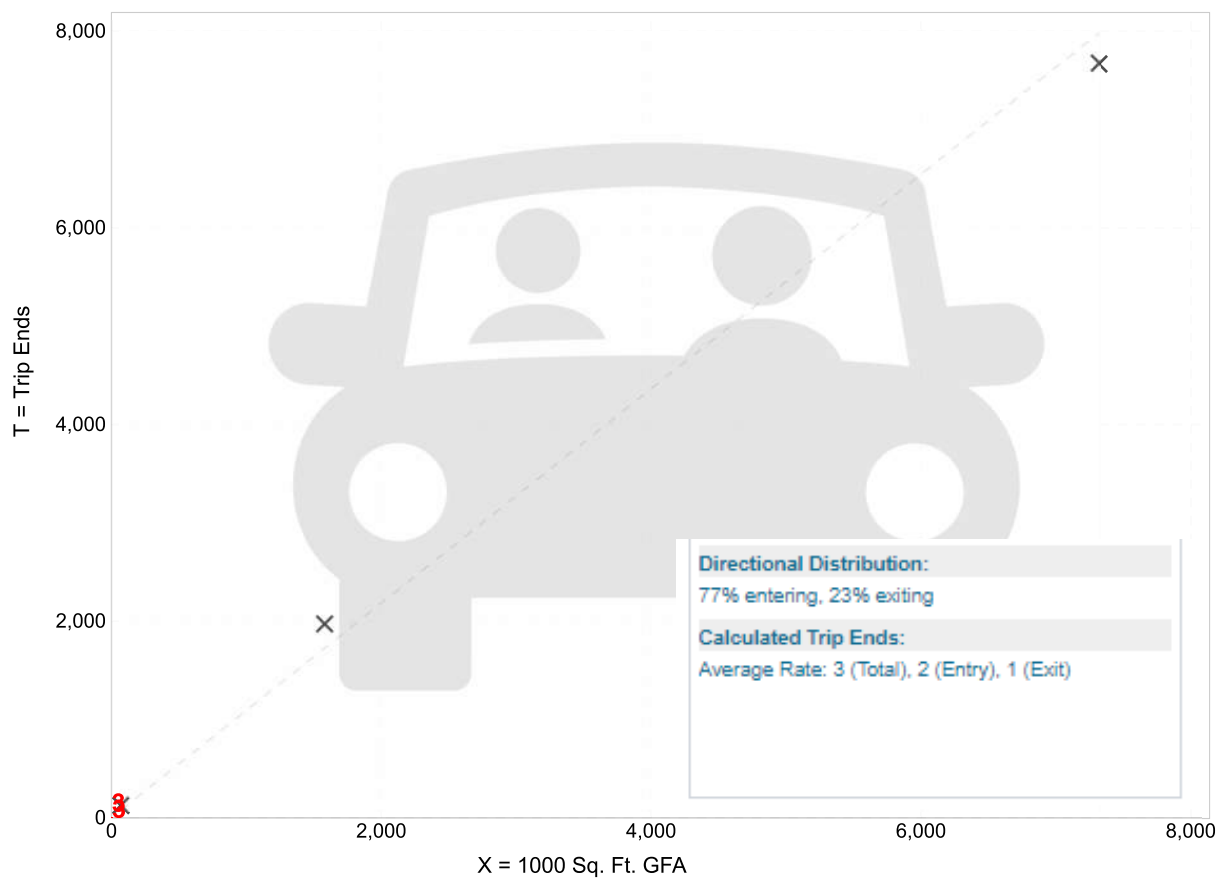

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
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Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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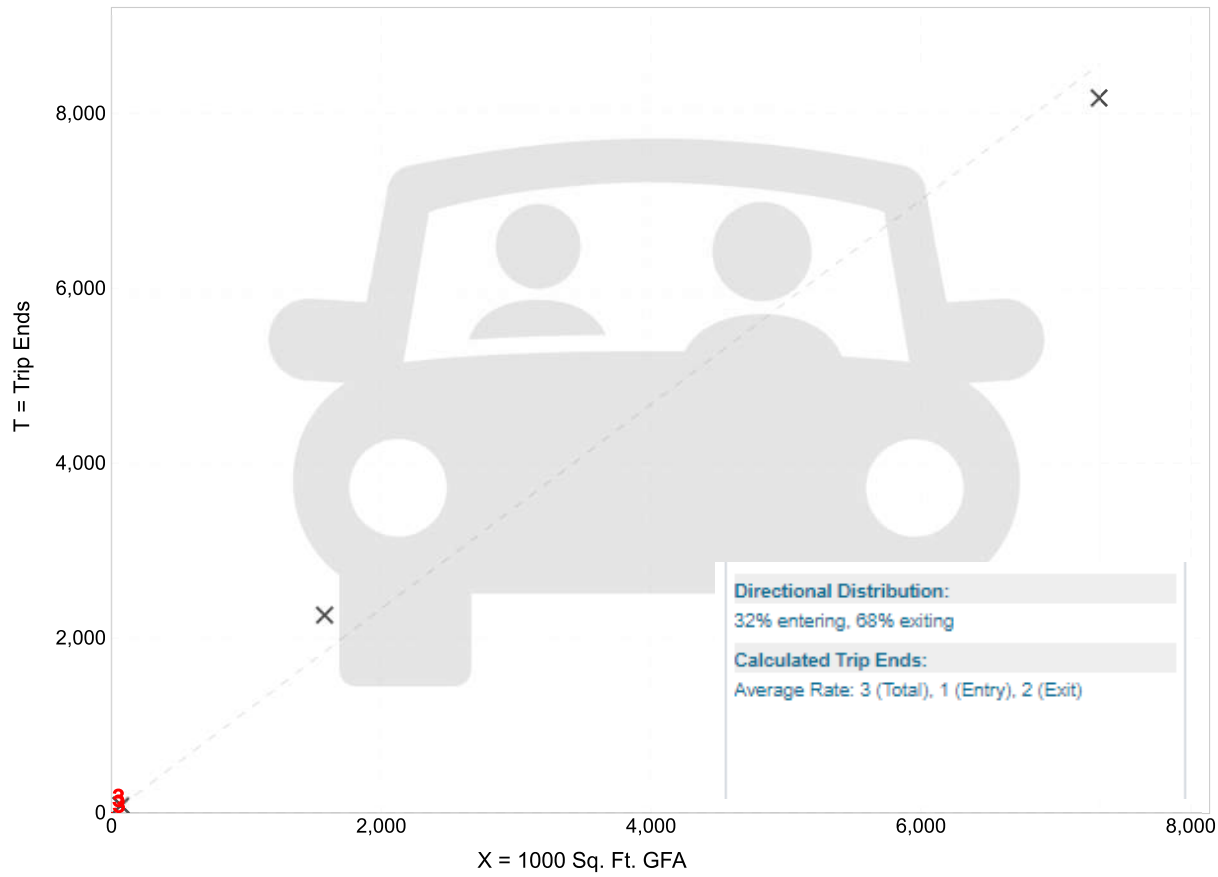

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University/College
(550)

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On a: **Weekday**

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Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
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Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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Data Plot and Equation

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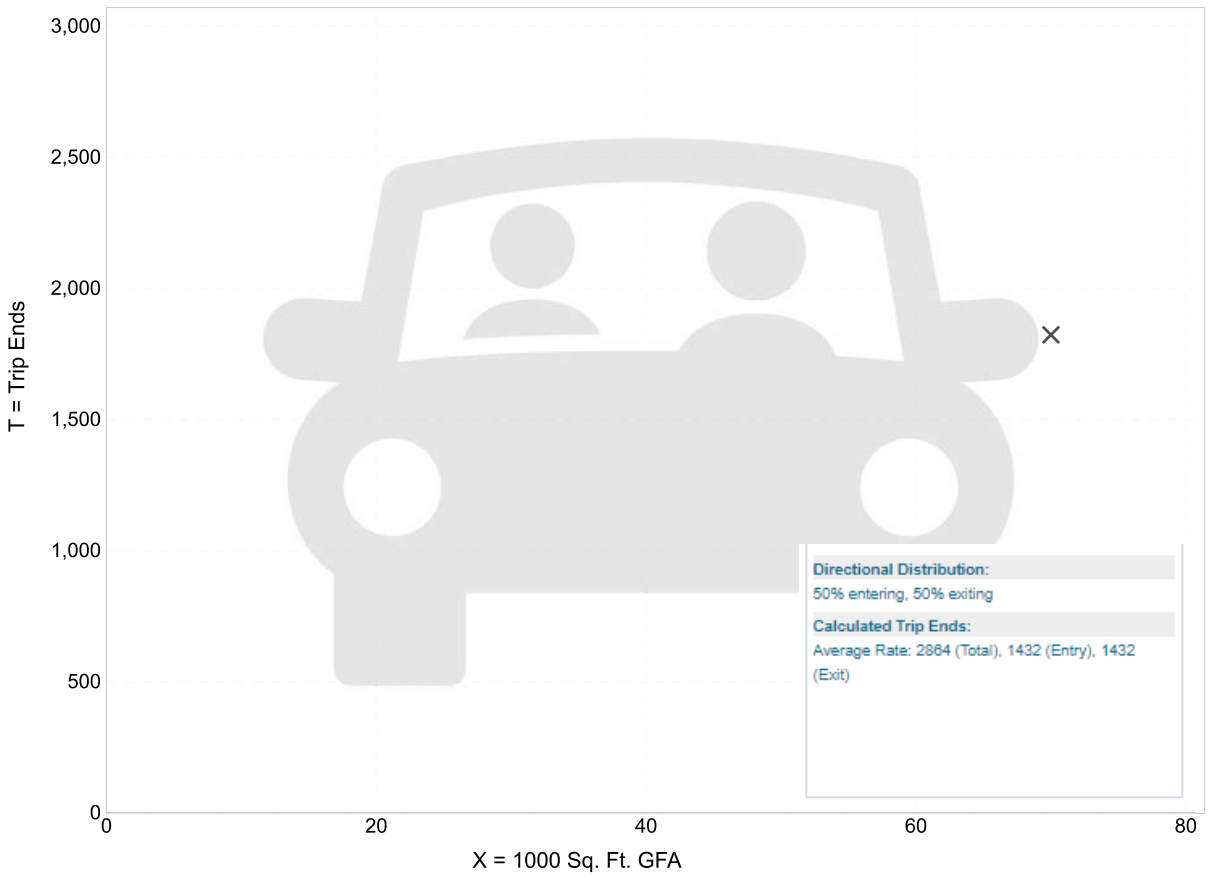

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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Average Rate	Range of Rates	Standard Deviation
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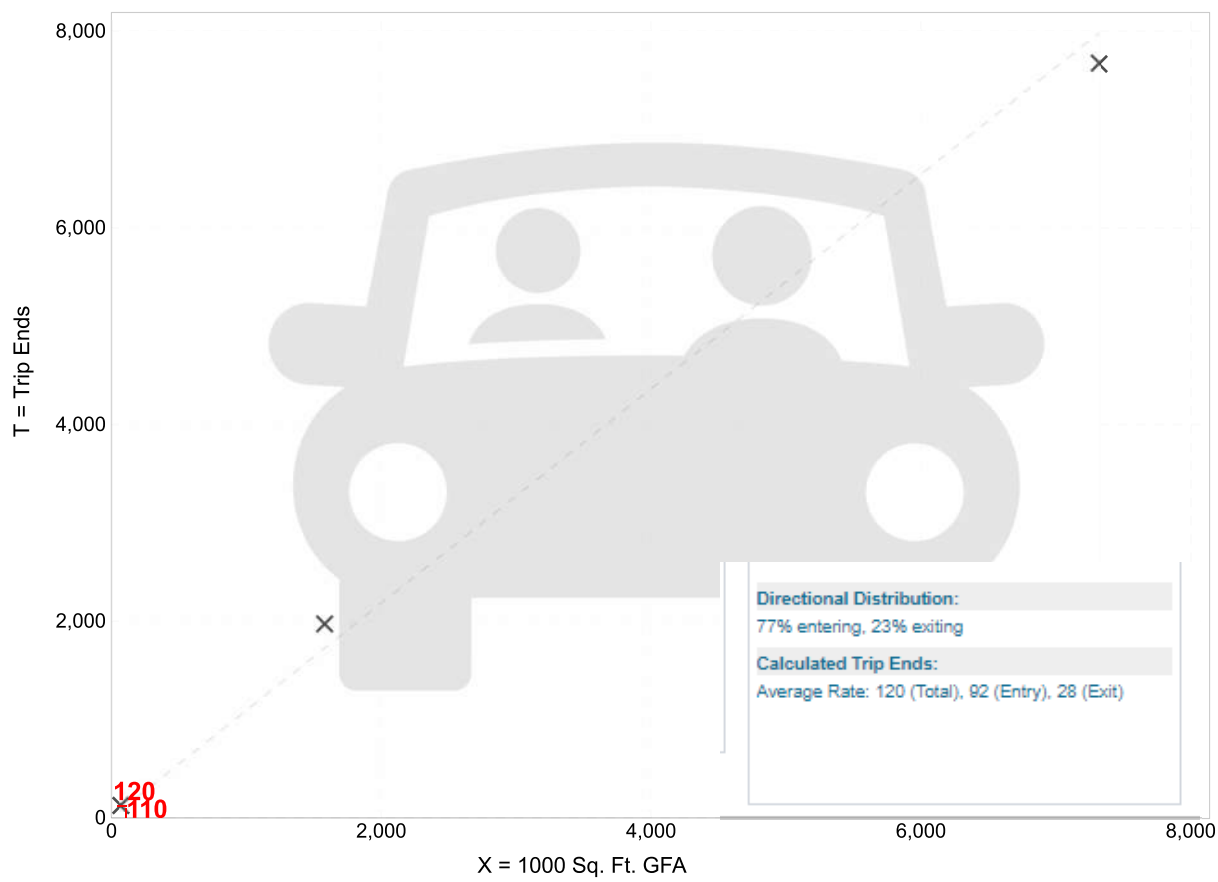

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
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Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

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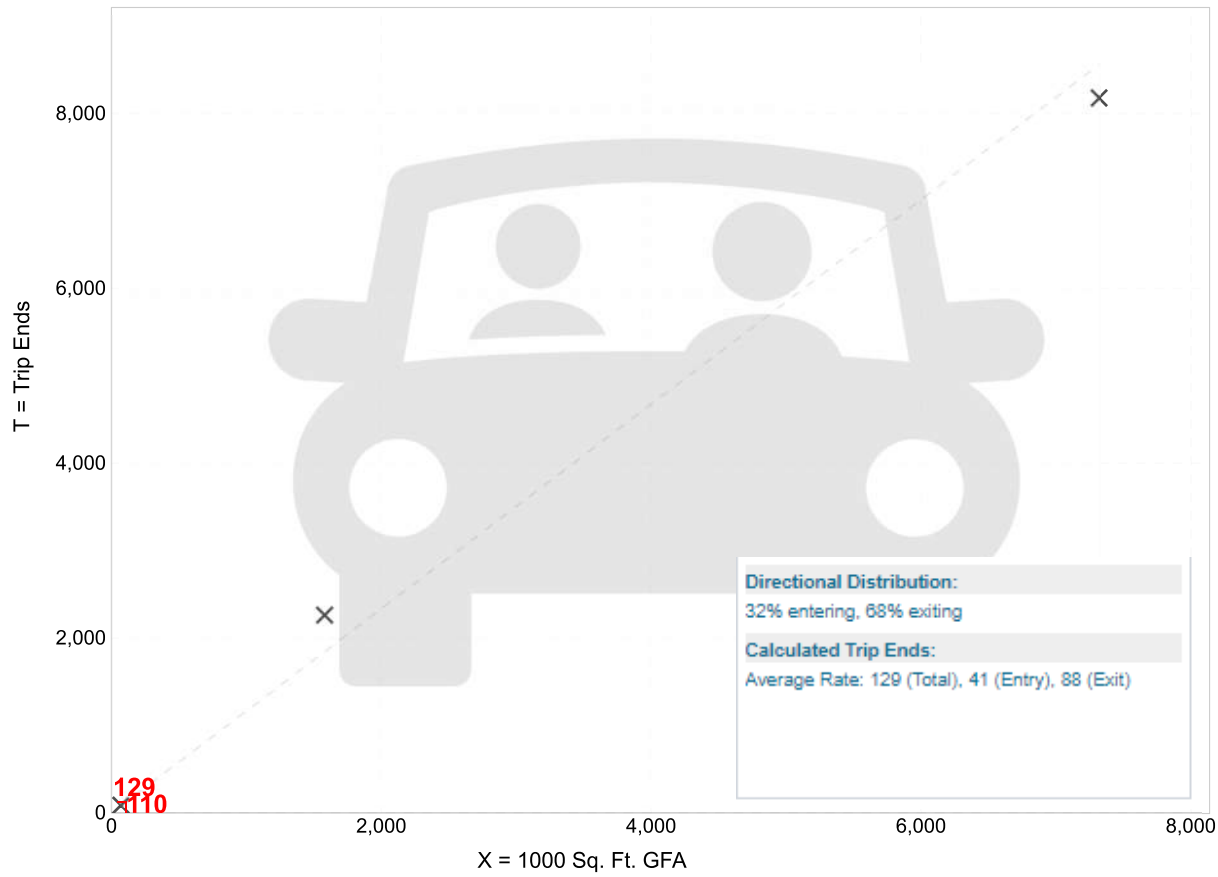

Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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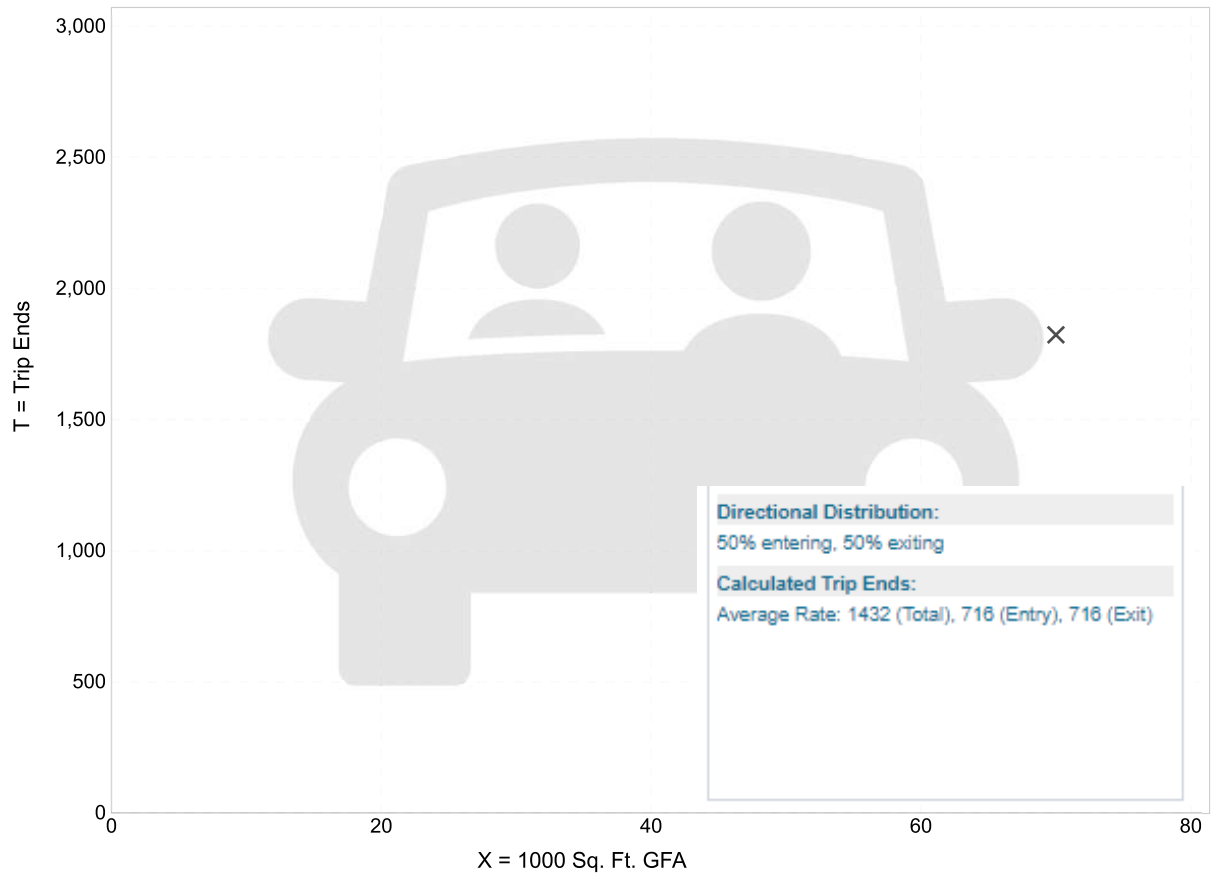

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Fitted Curve Equation: Not Given **R^2= ******

University/College
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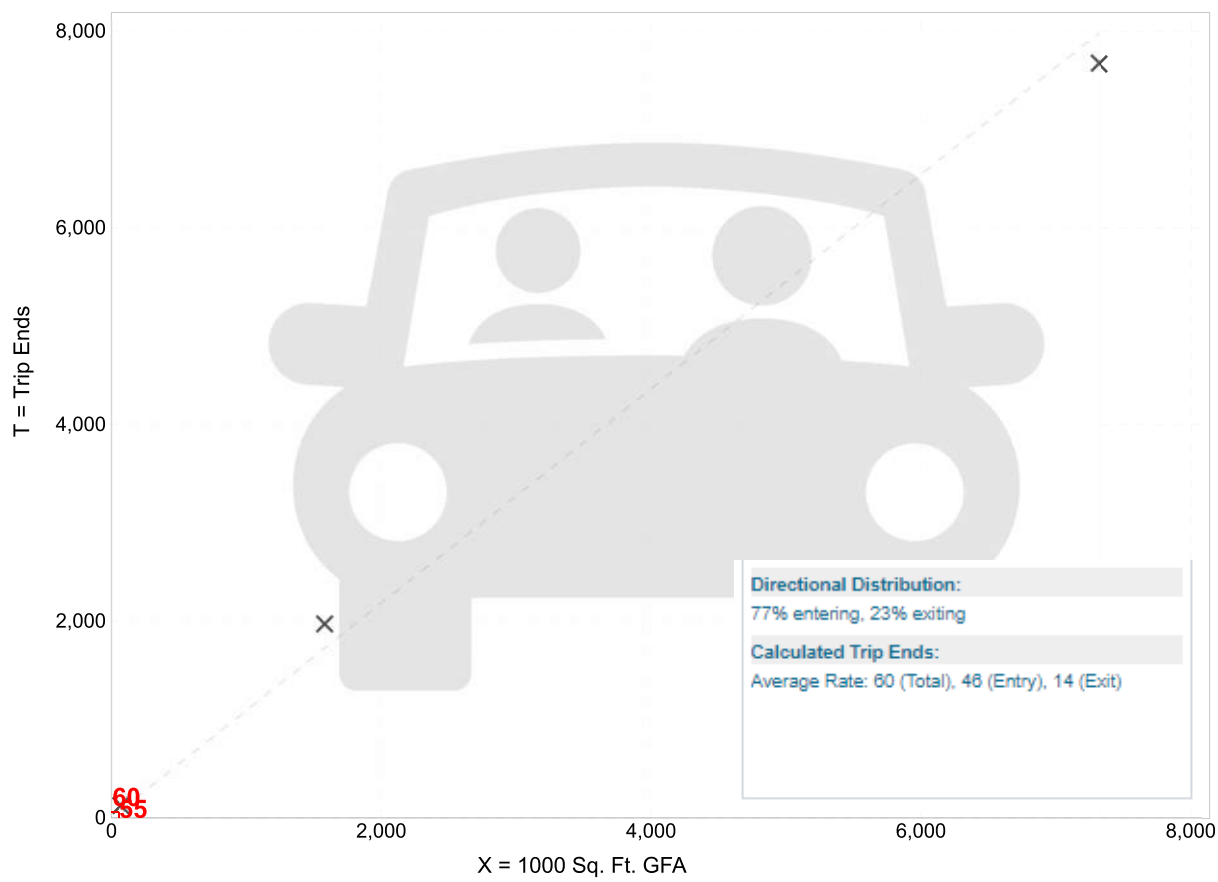

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University/College
(550)

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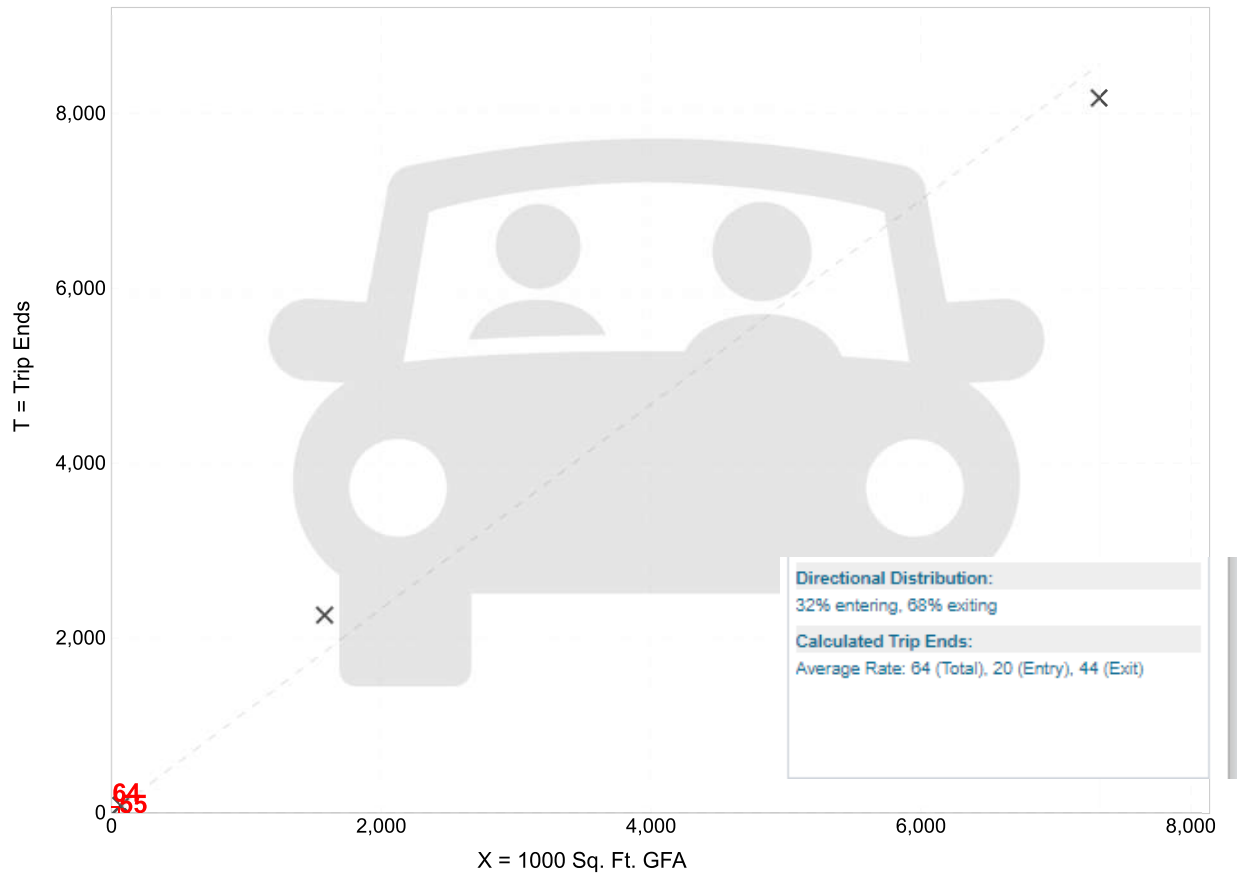

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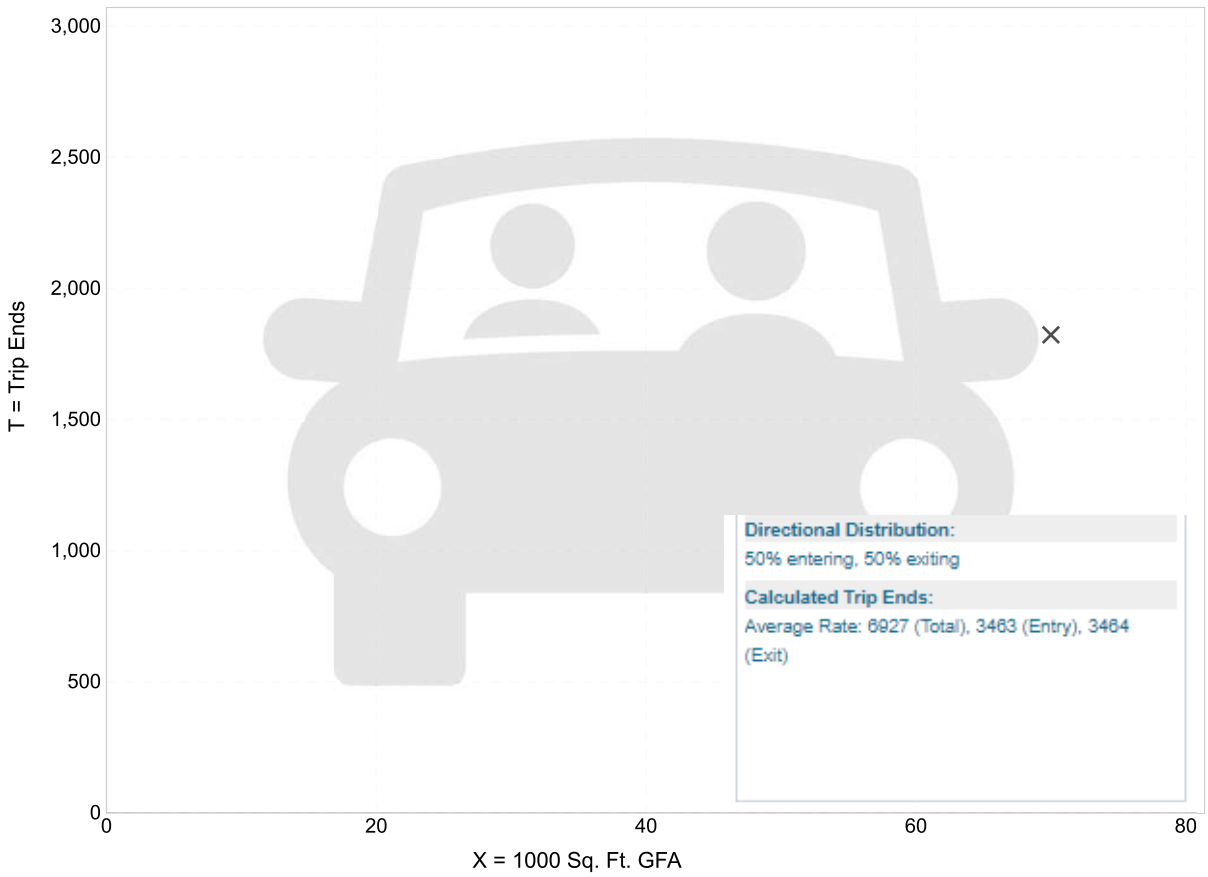
Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

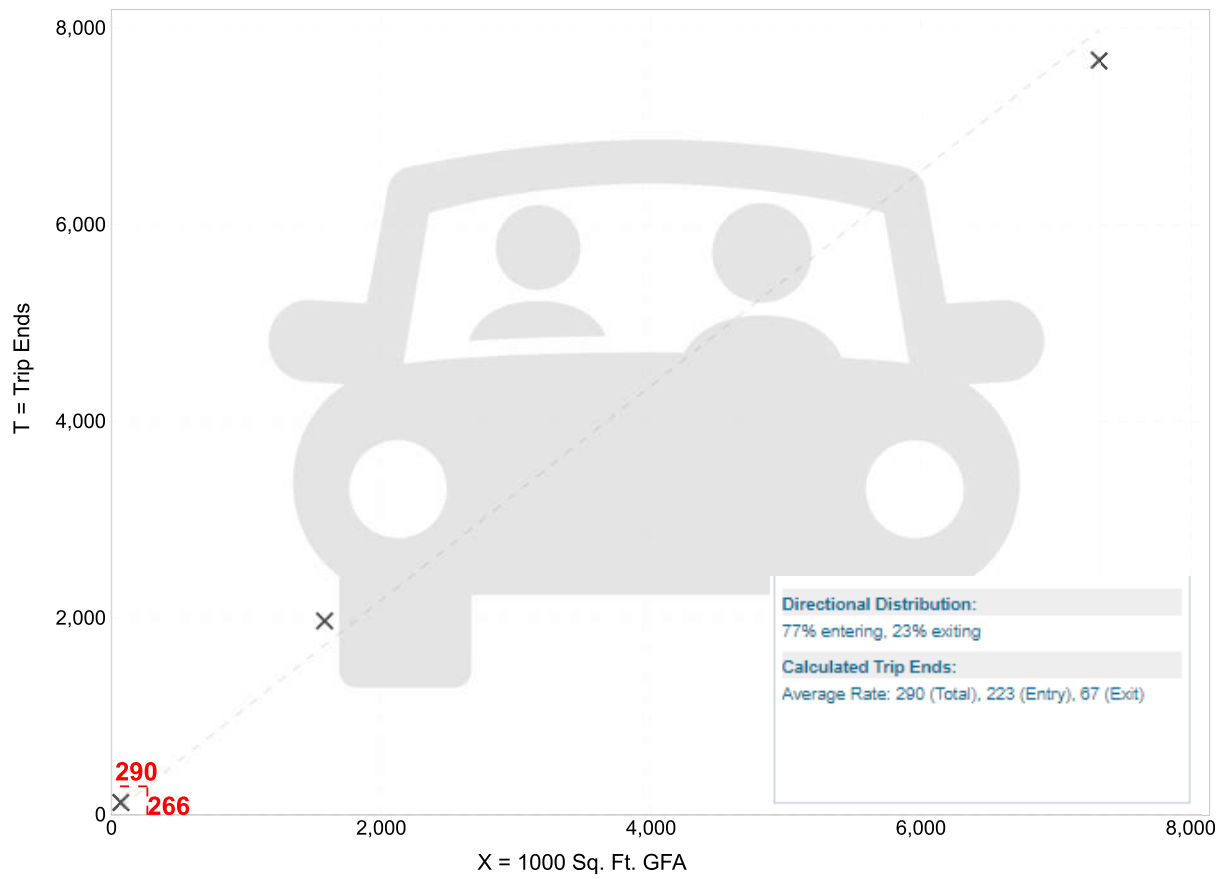
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

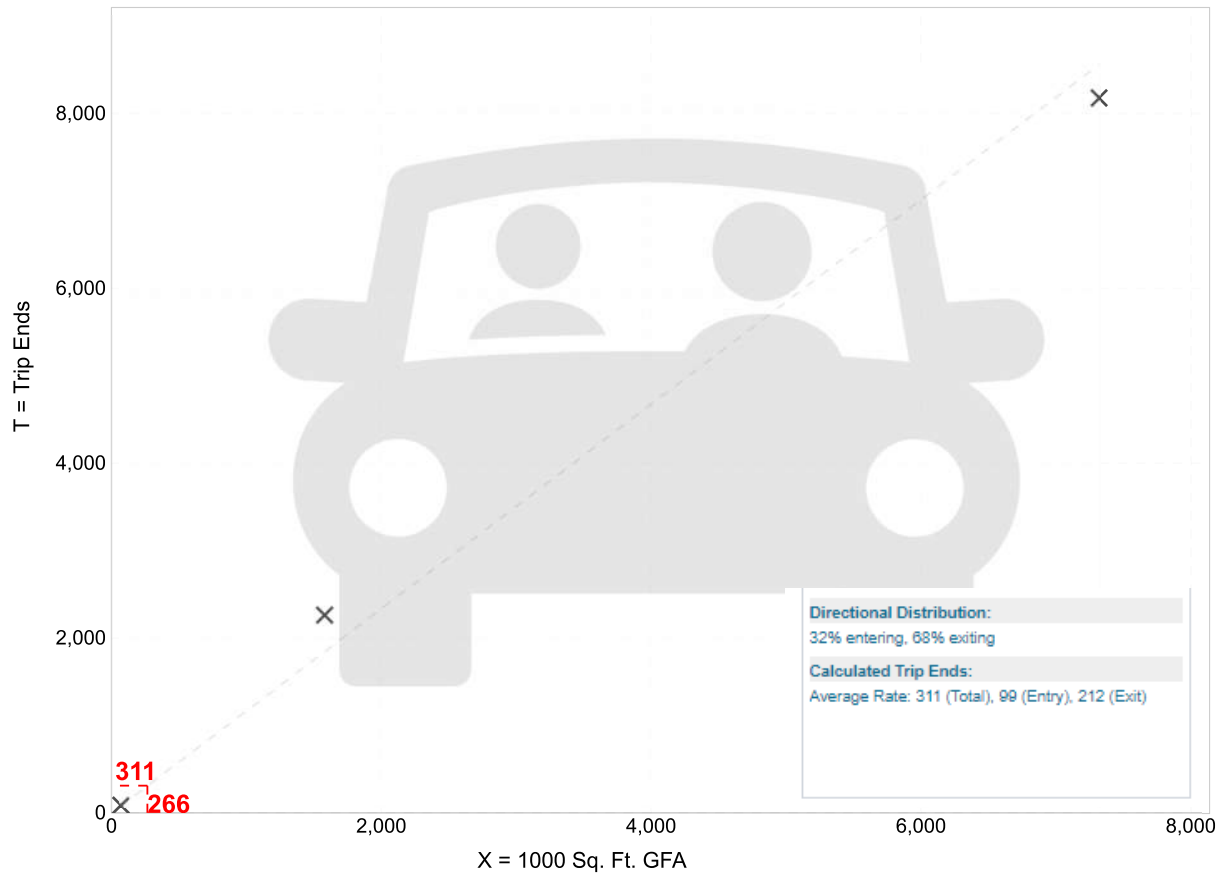
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



Study Site — **Average Rate**

Fitted Curve Equation: Not Given — **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

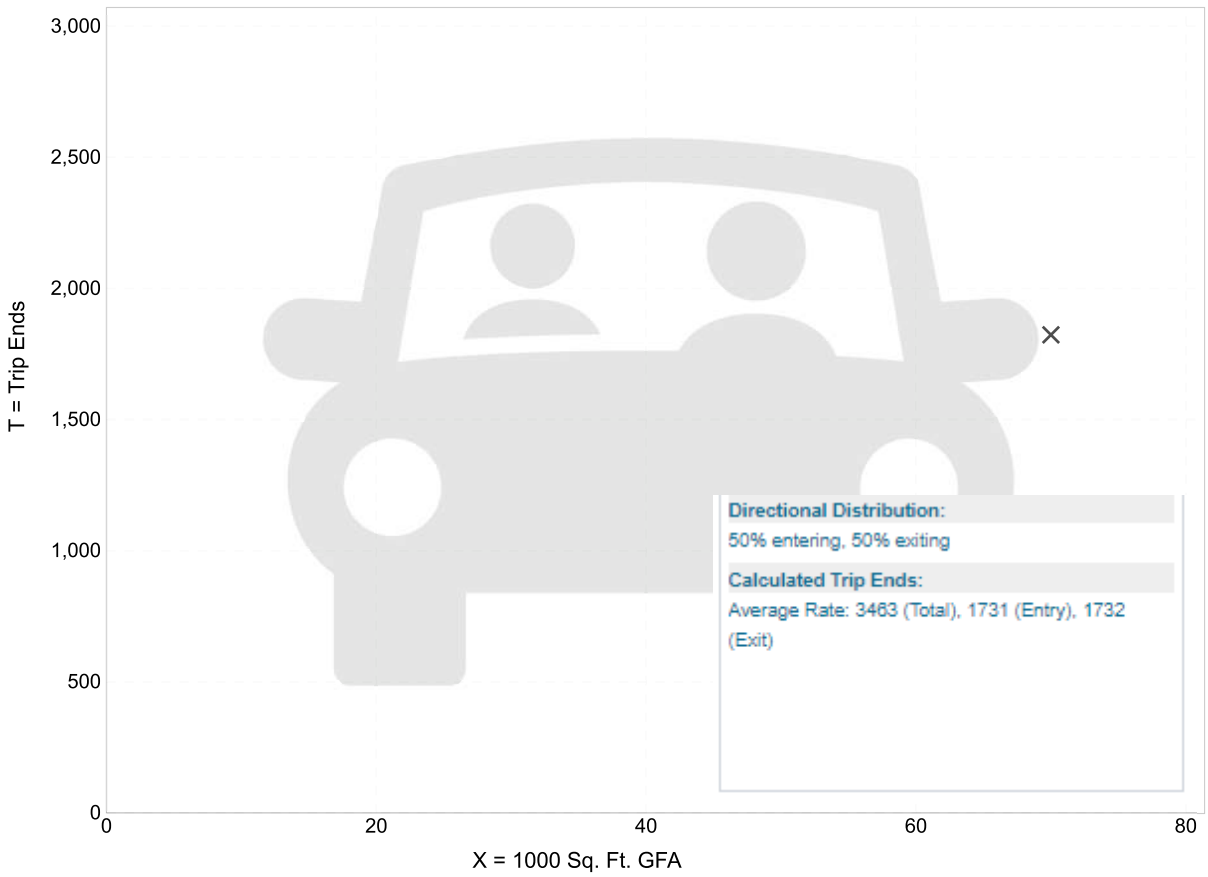
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

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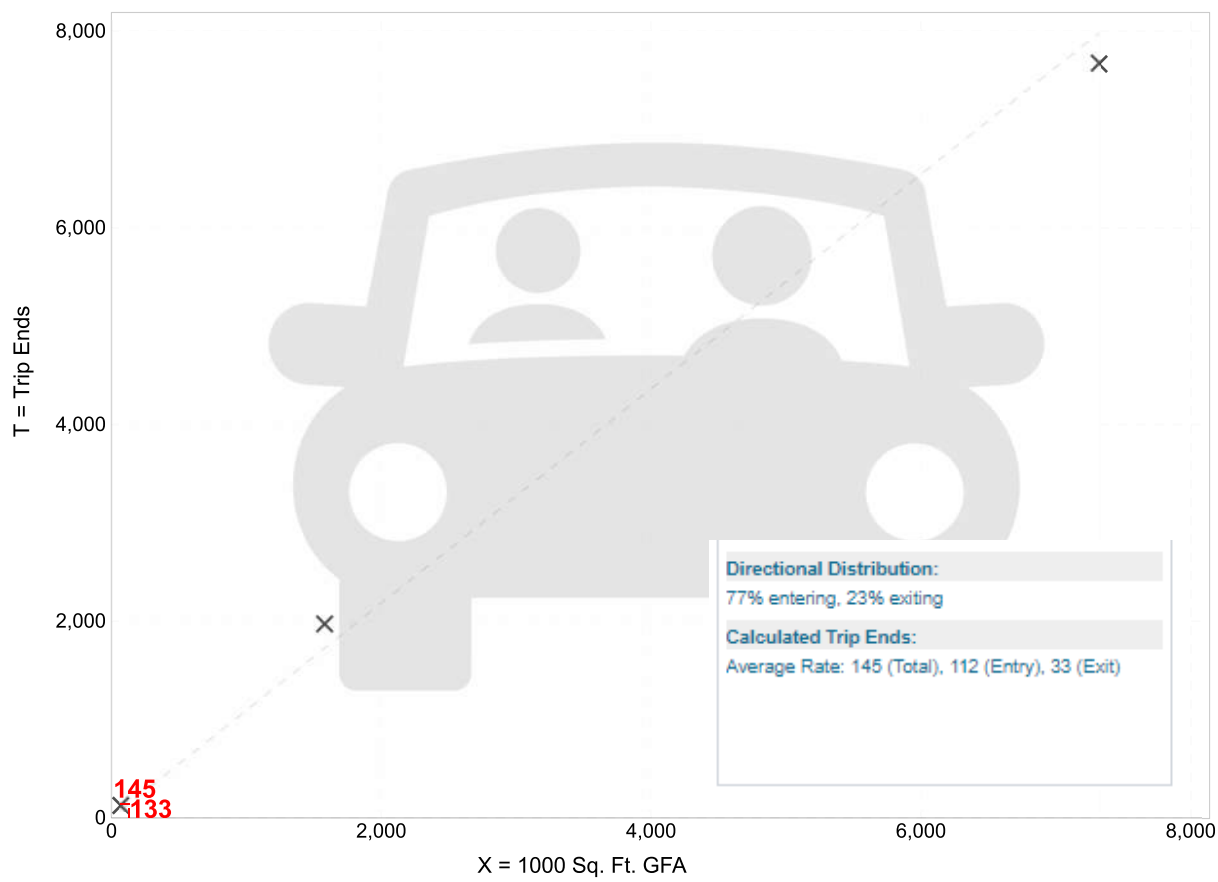
Caution – Small Sample Size



× **Study Site** — — — — **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

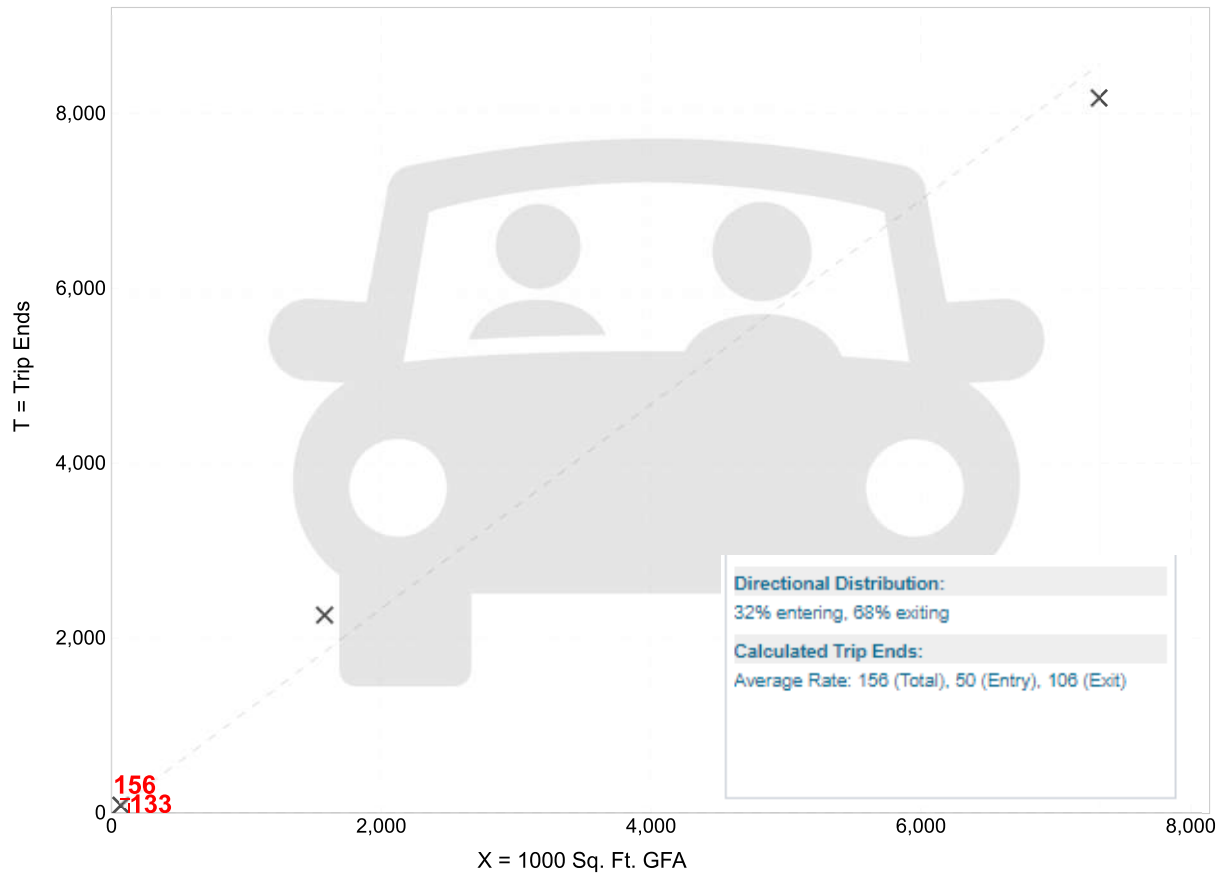
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

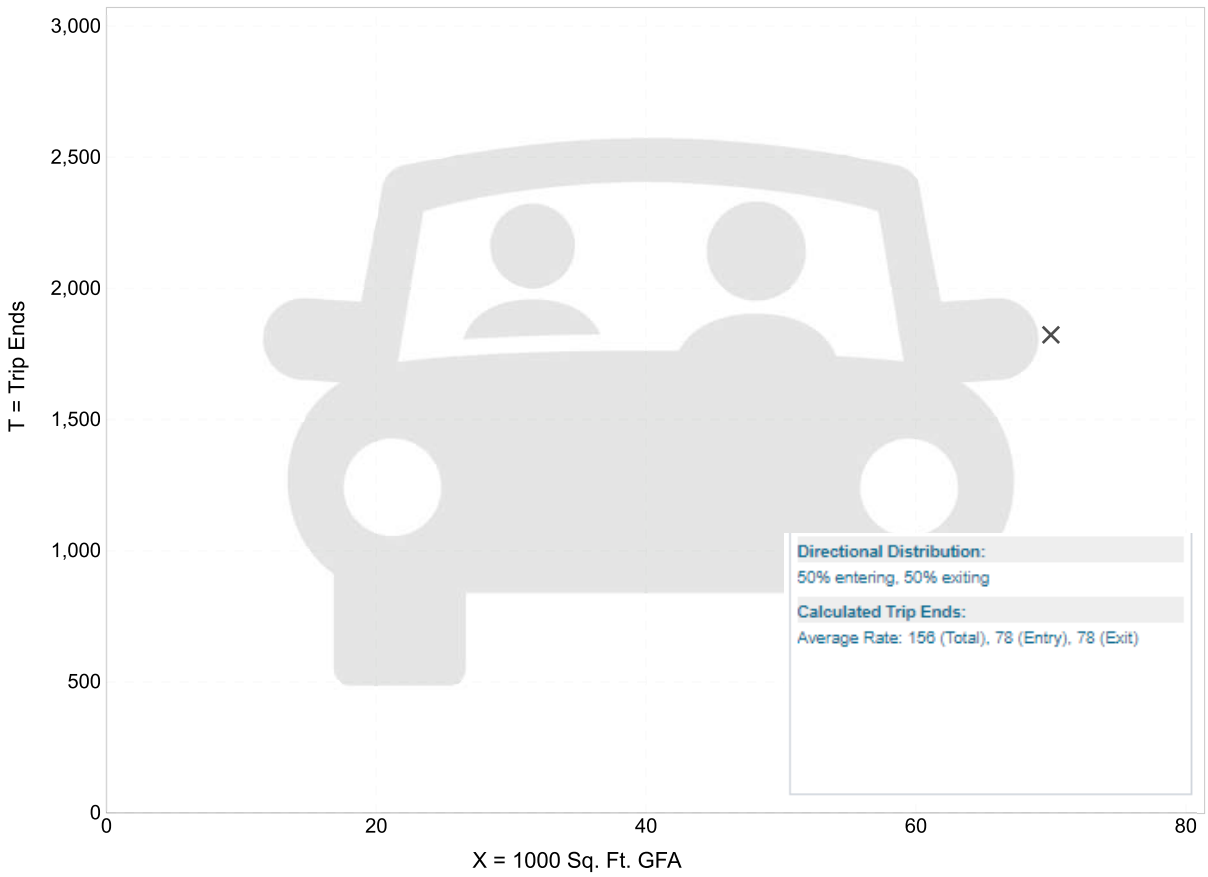
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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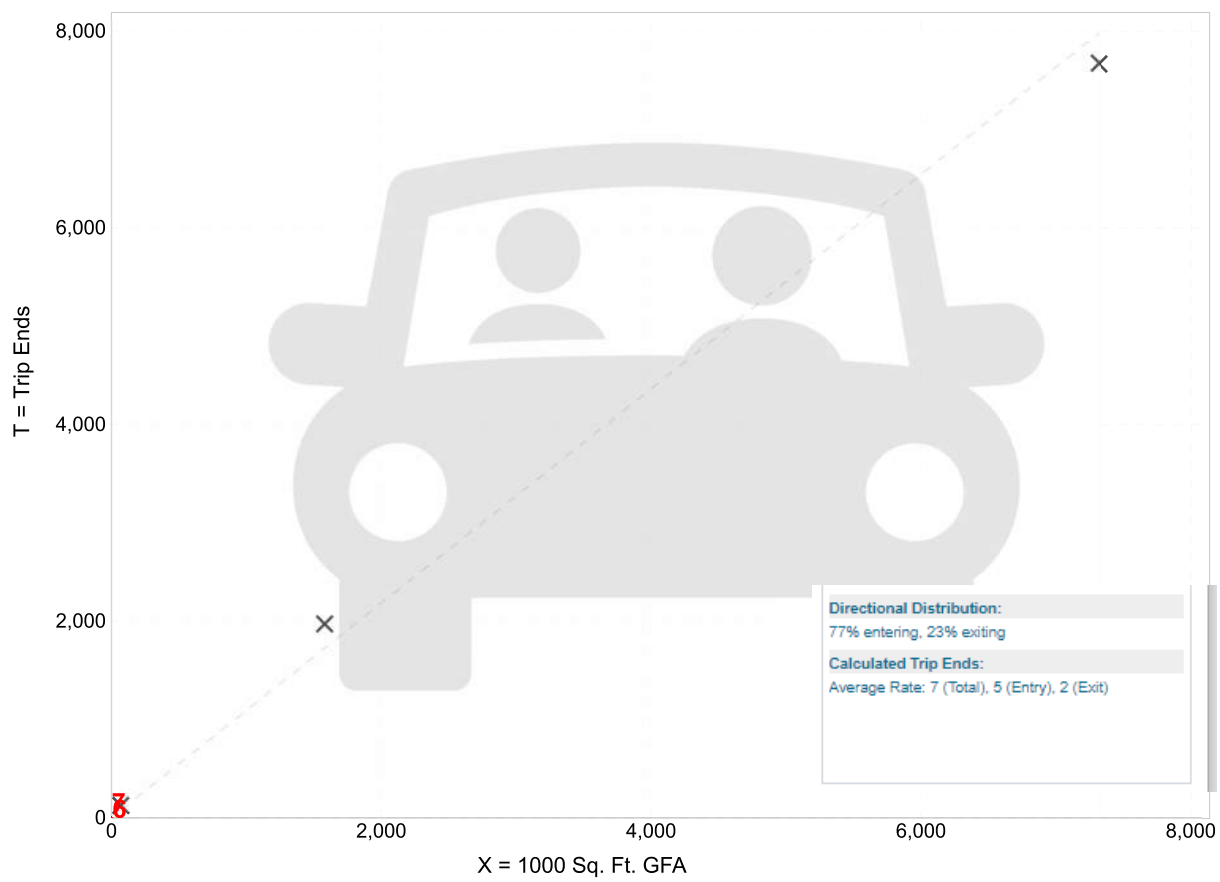
Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Not Given

R^2= ****

University/College
(550)

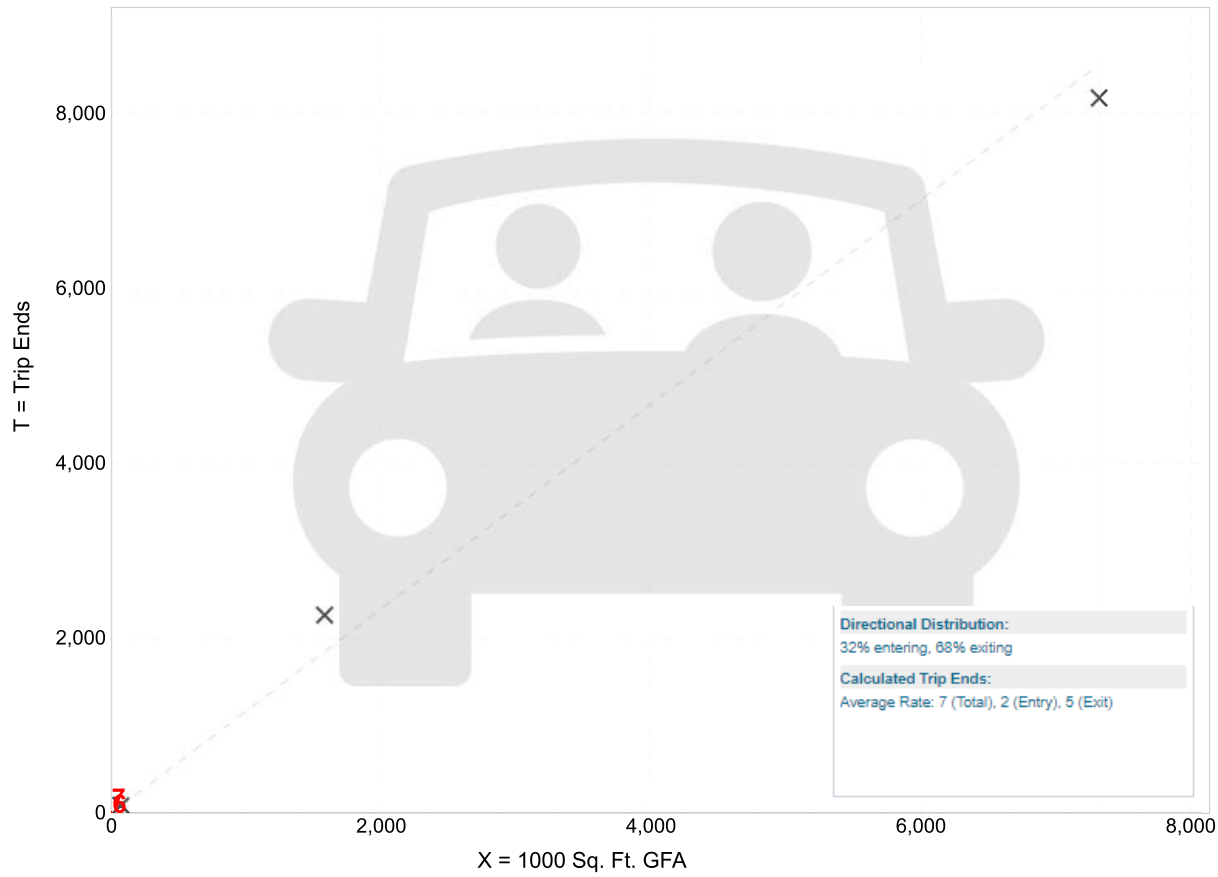
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

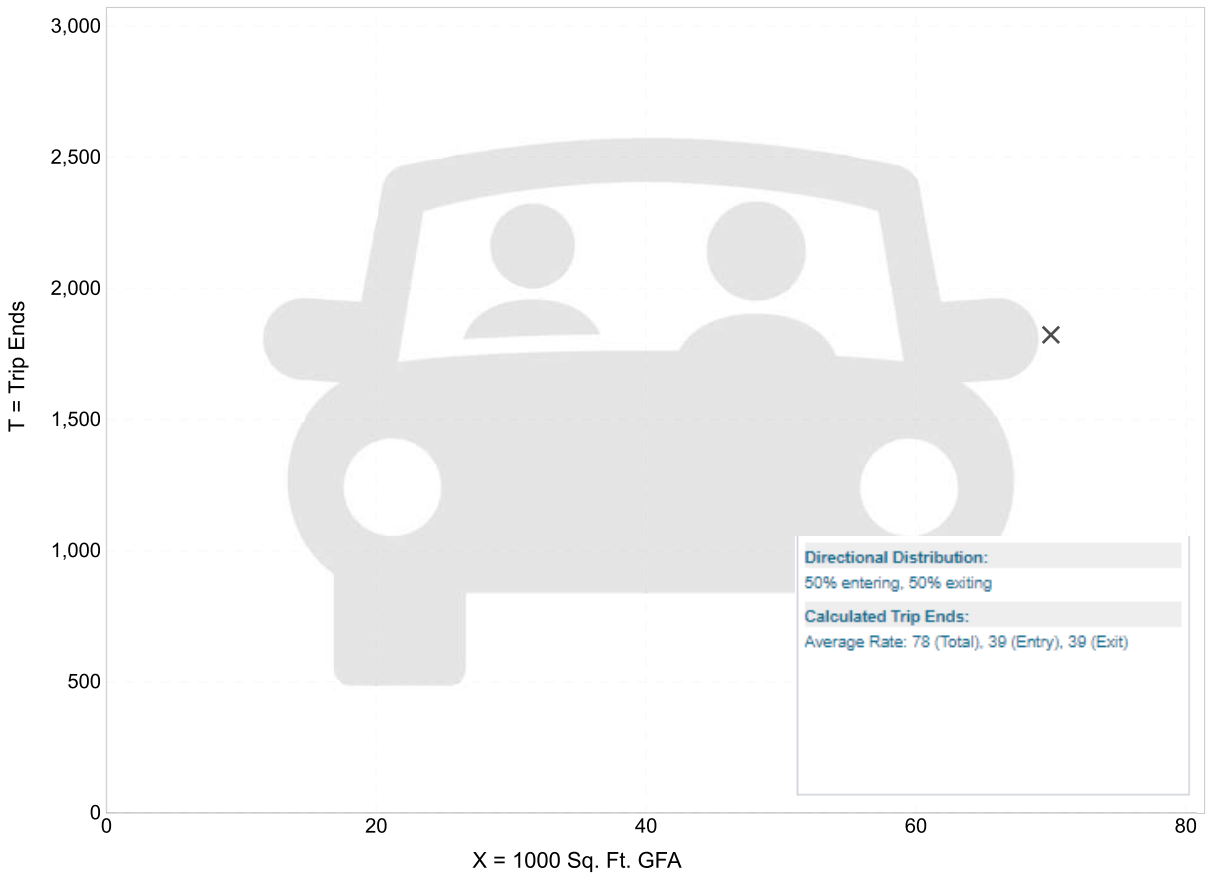
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

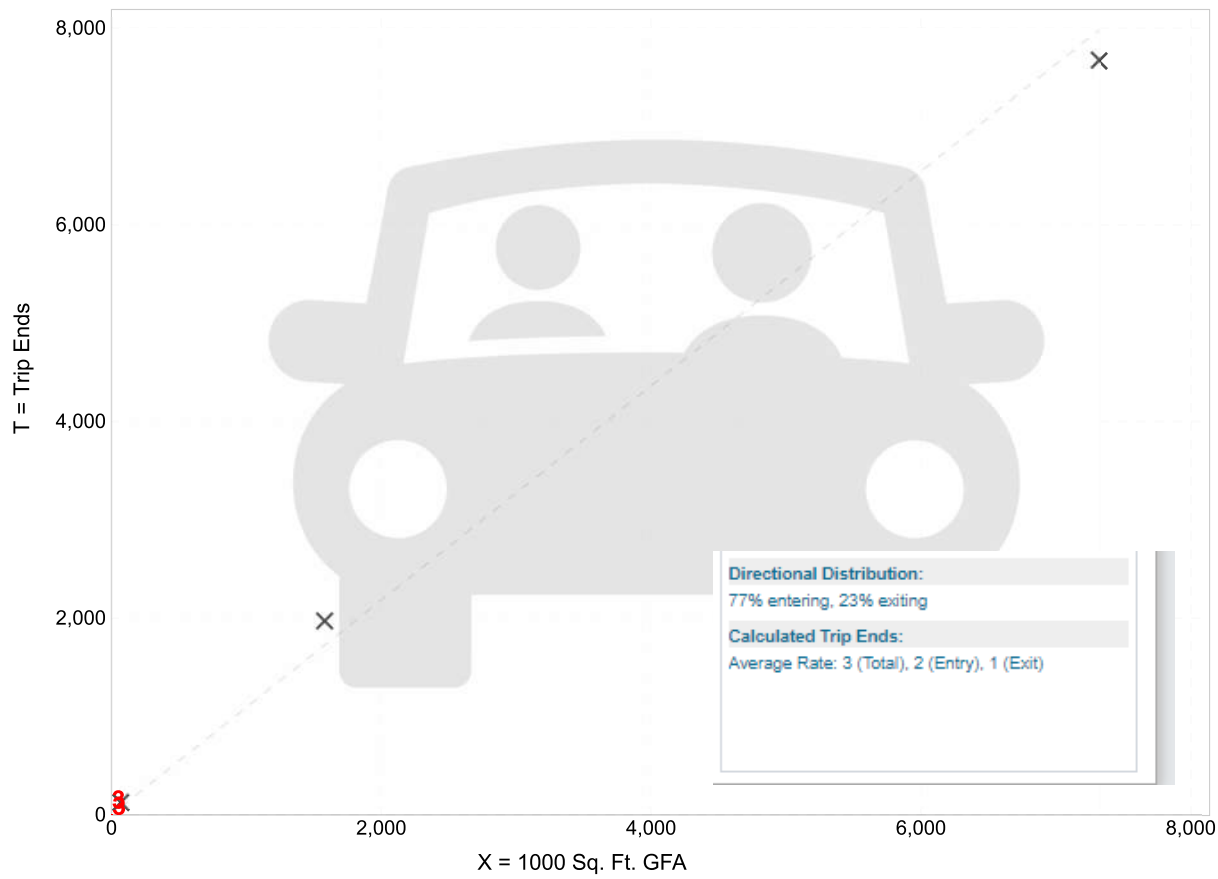
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** — — — — **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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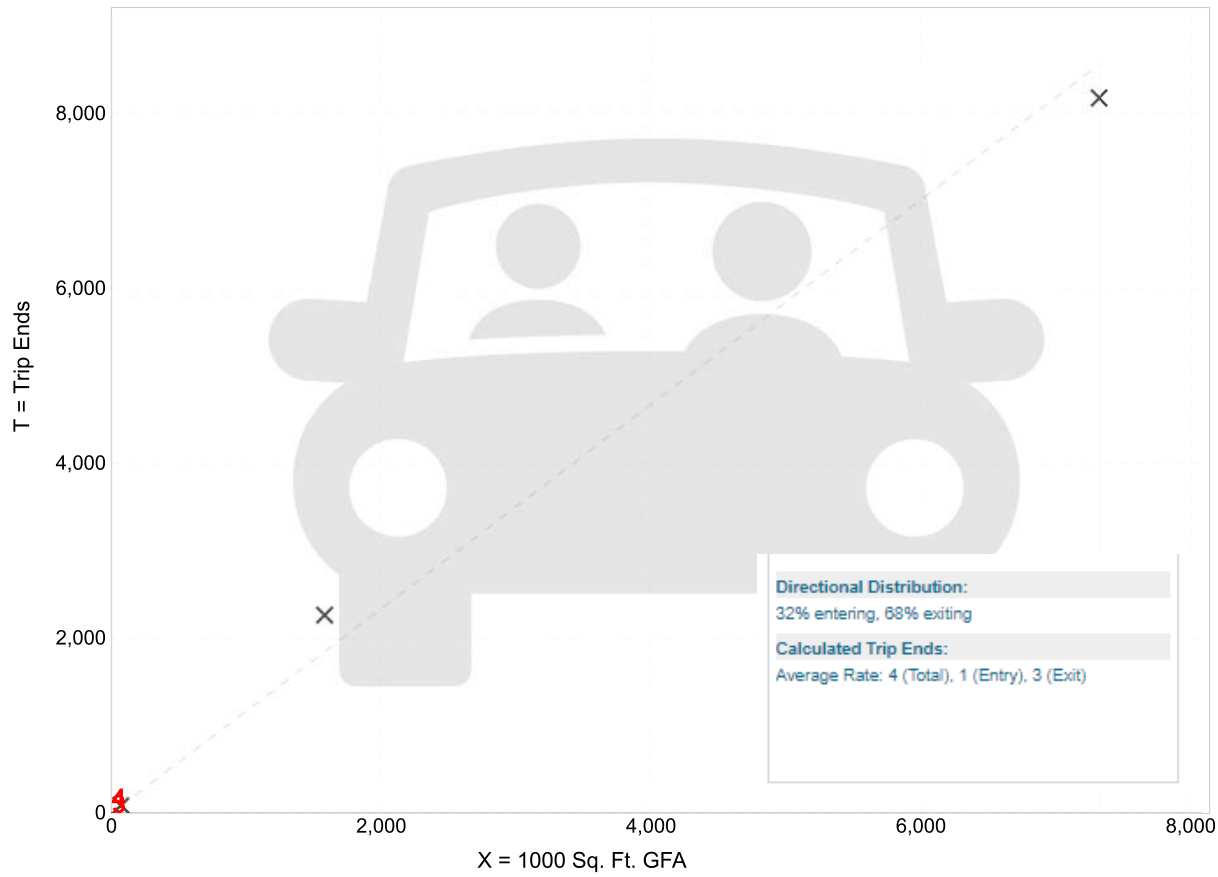
Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

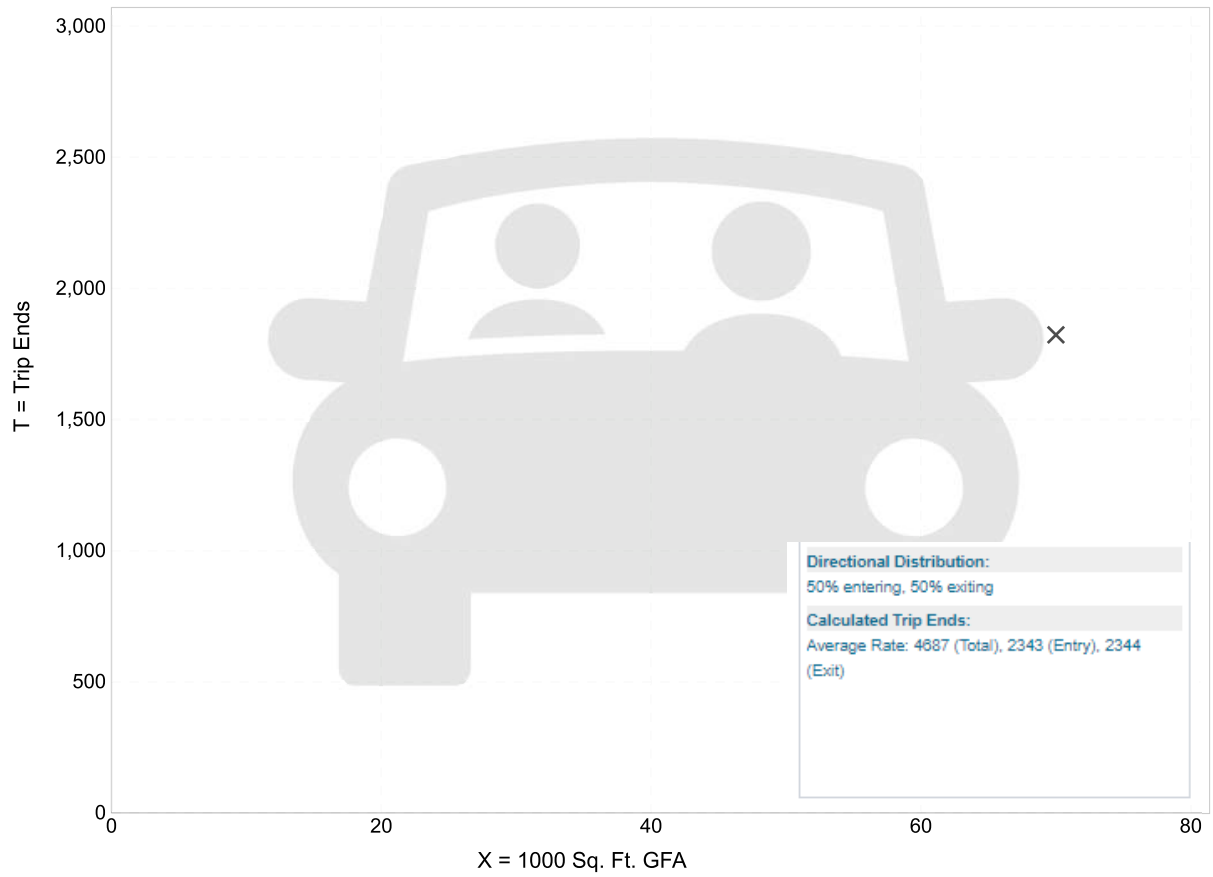
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
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Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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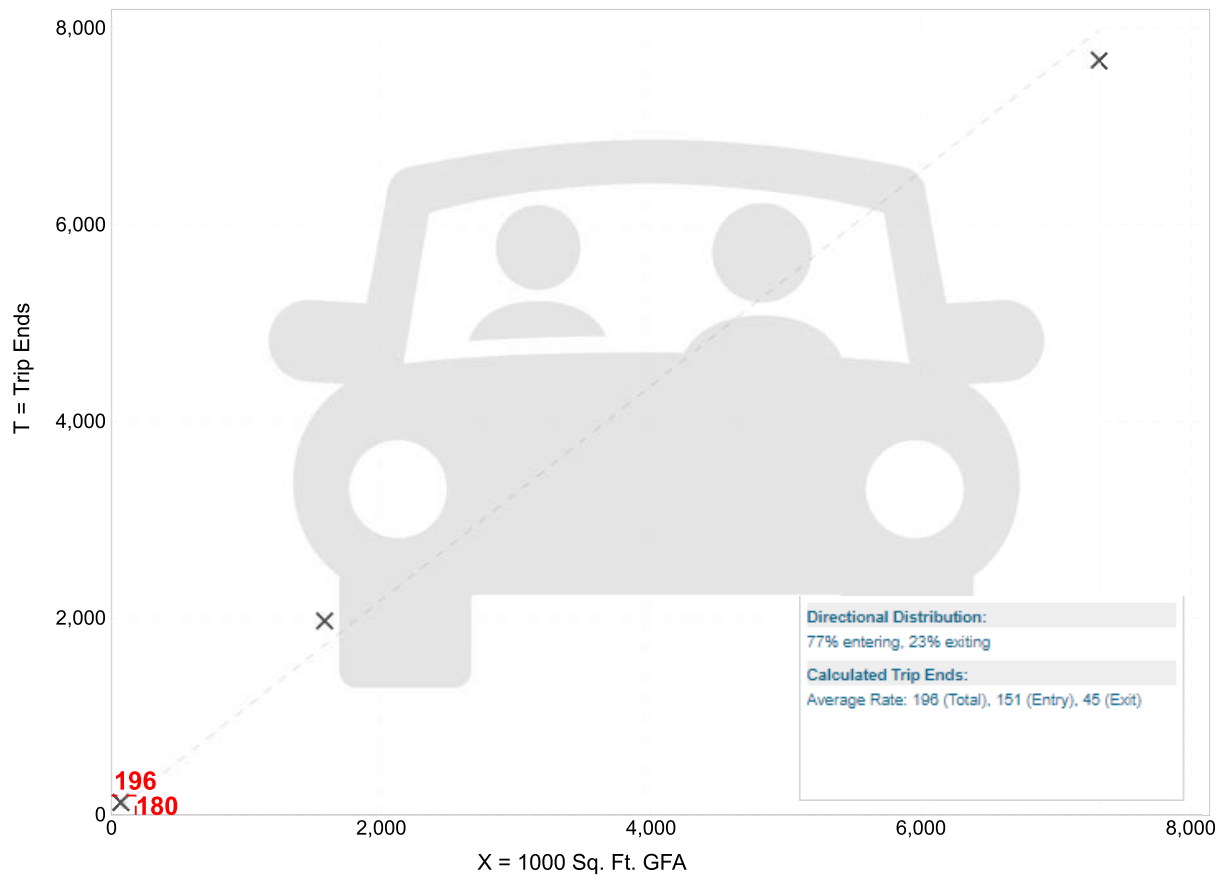
Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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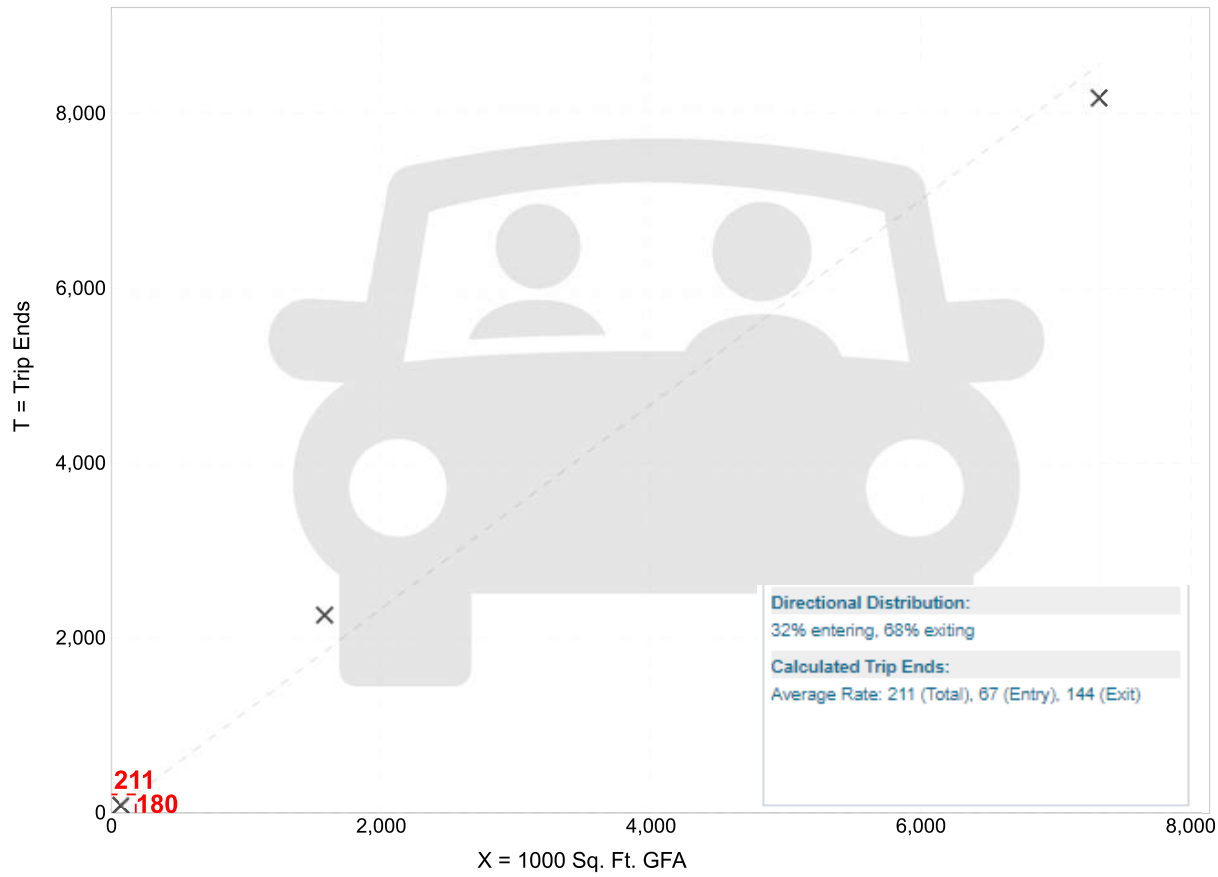


× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

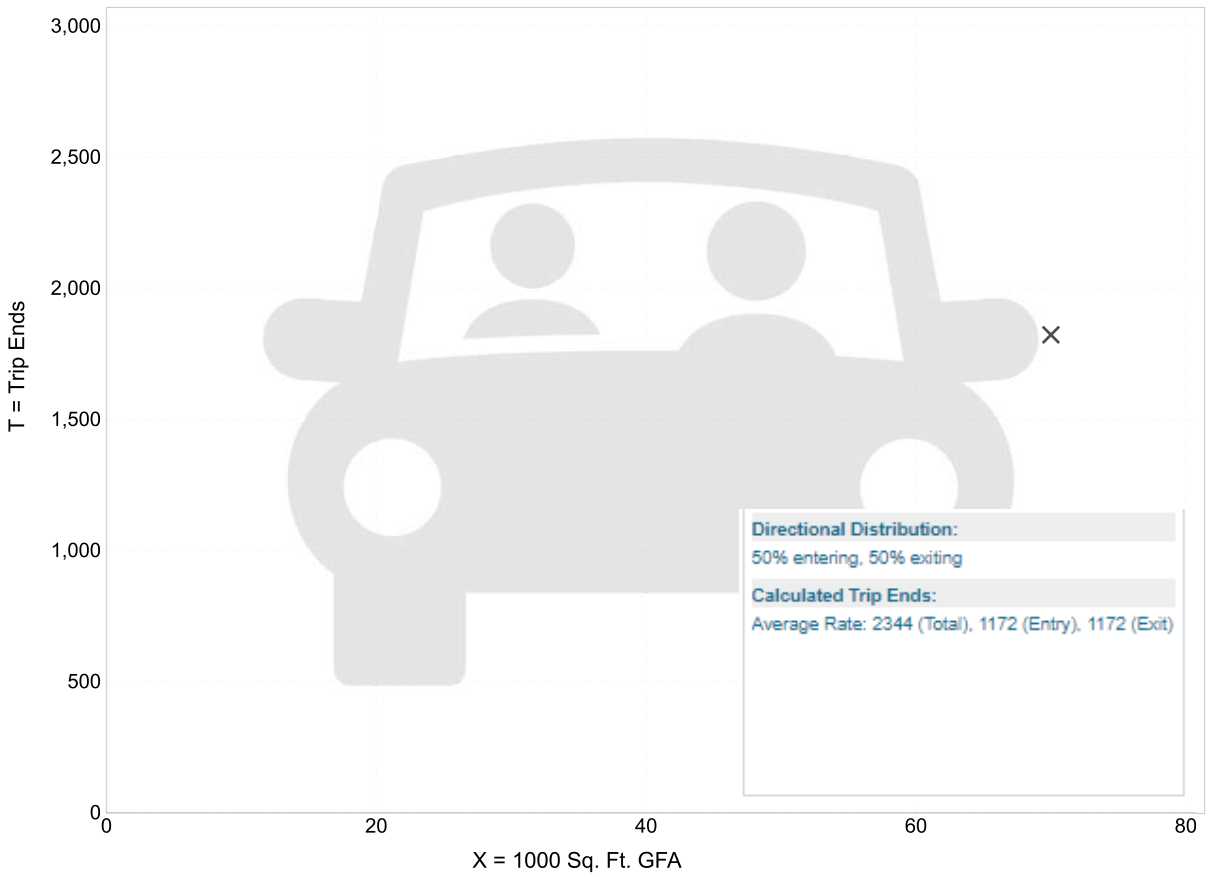
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
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Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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Data Plot and Equation

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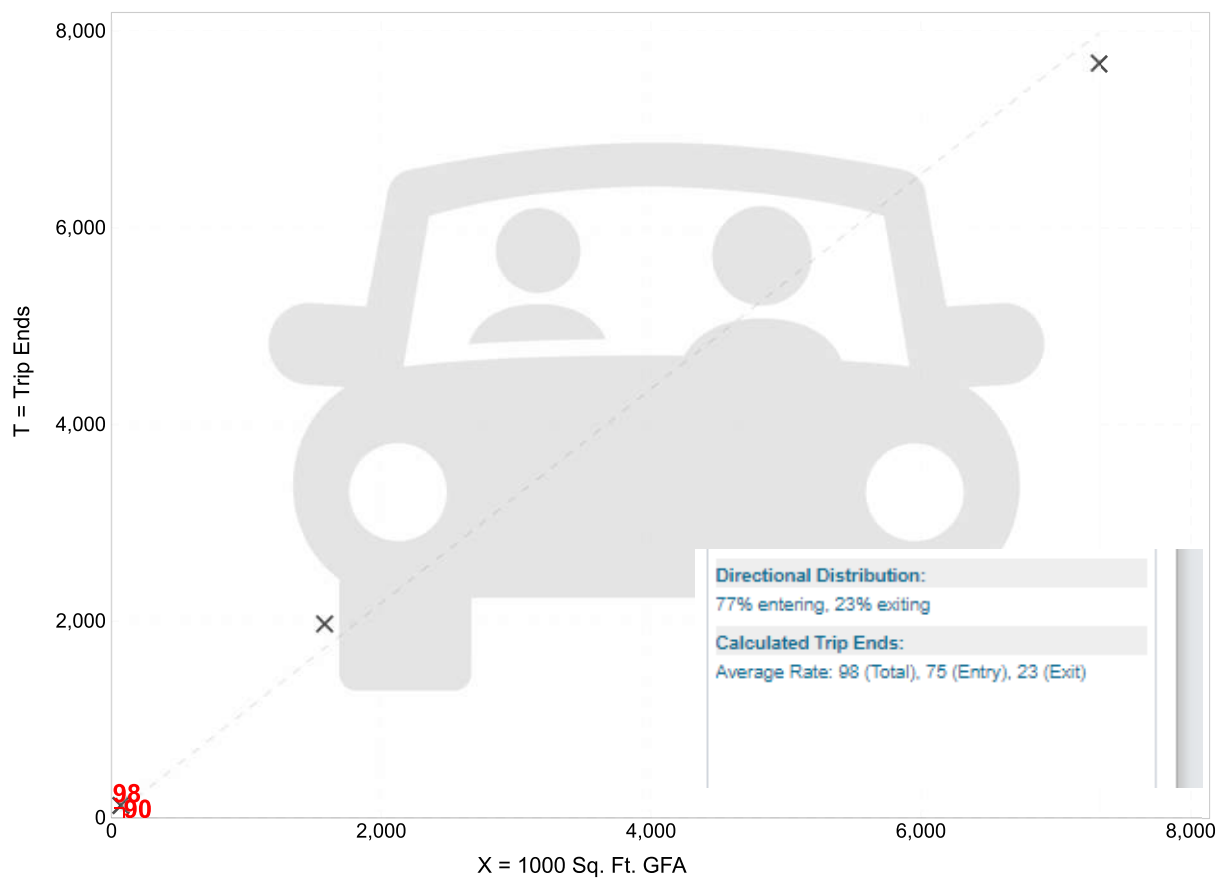

Study Site — **Average Rate**

Fitted Curve Equation: Not Given — **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
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Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

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Average Rate	Range of Rates	Standard Deviation
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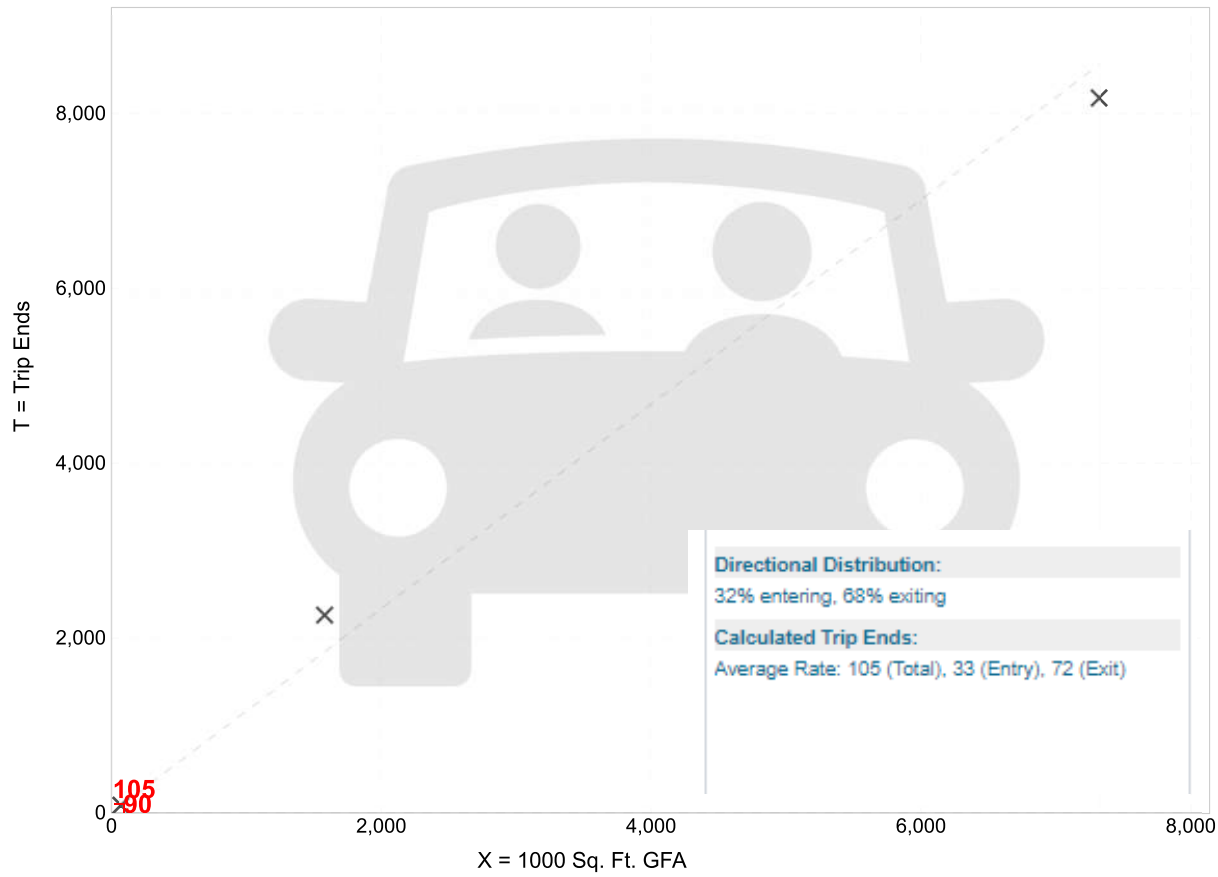

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
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Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

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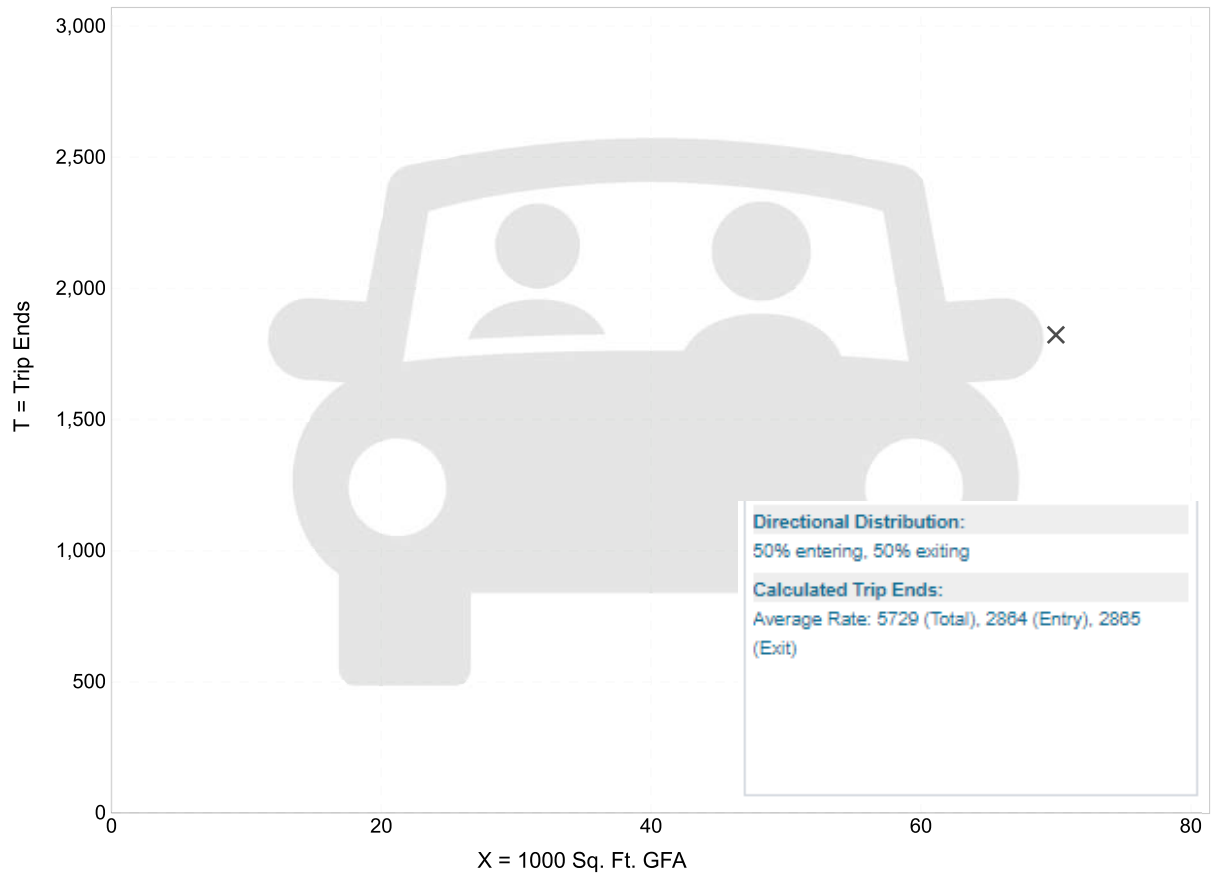

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Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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Avg. 1000 Sq. Ft. GFA:	2990
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Vehicle Trip Generation per 1000 Sq. Ft. GFA

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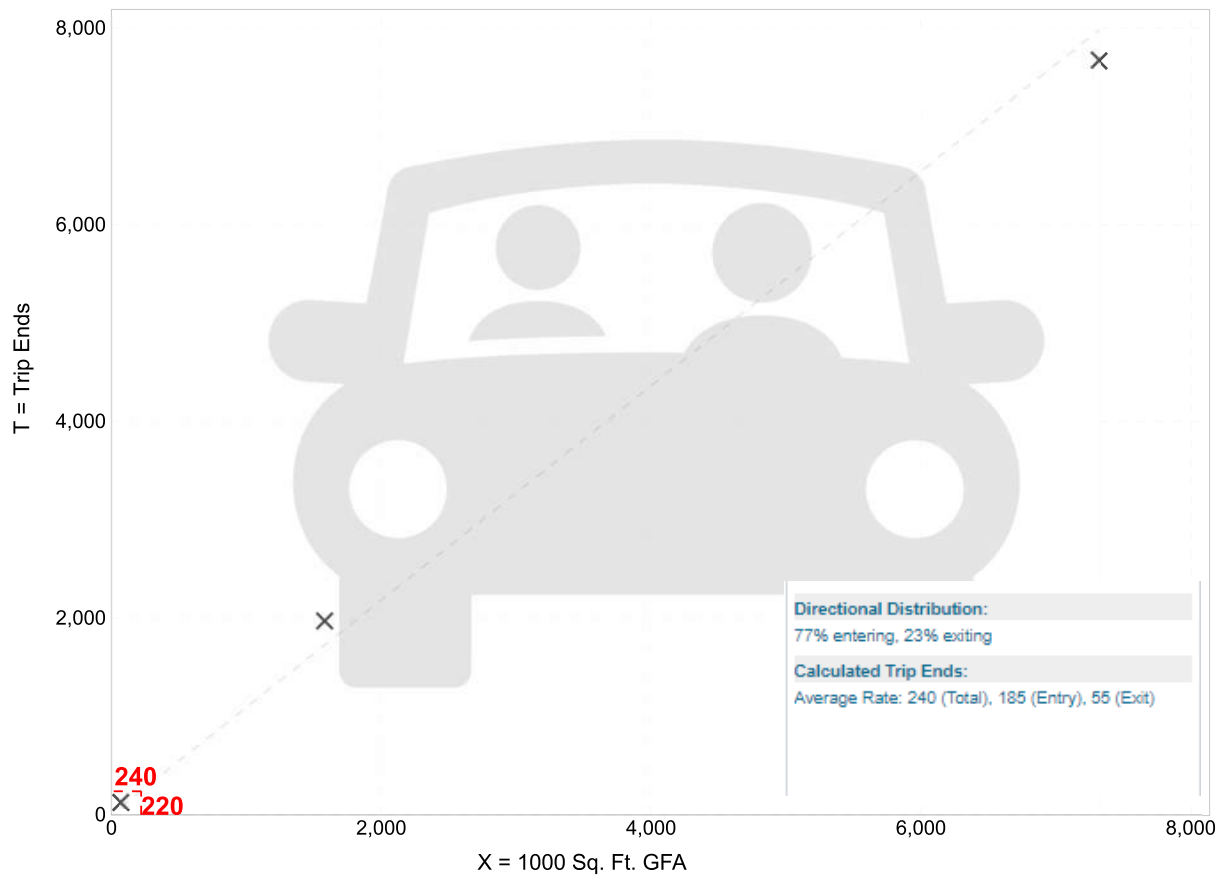

× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
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Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

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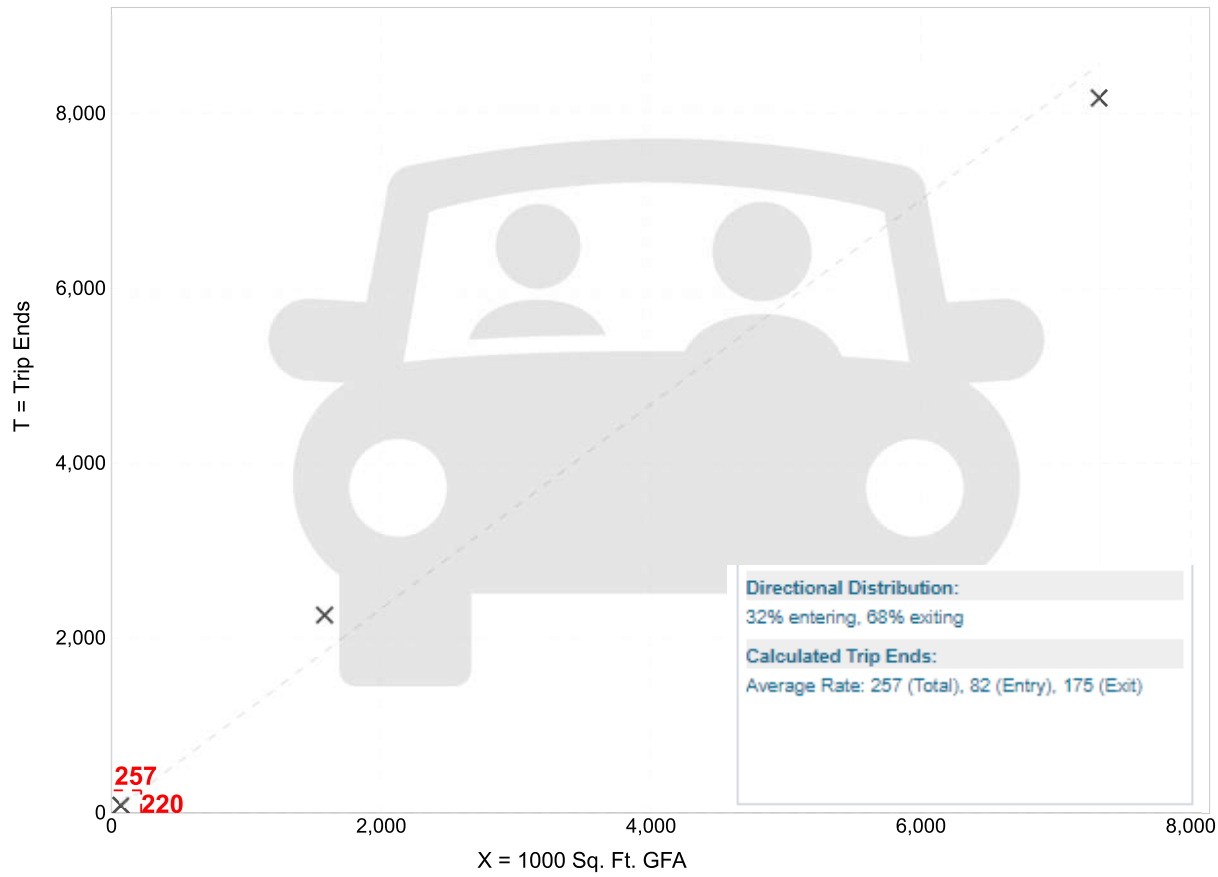

Study Site — **Average Rate**

Fitted Curve Equation: Not Given — **R^2= ******

University/College
(550)

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On a: **Weekday**

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Avg. 1000 Sq. Ft. GFA: 70
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Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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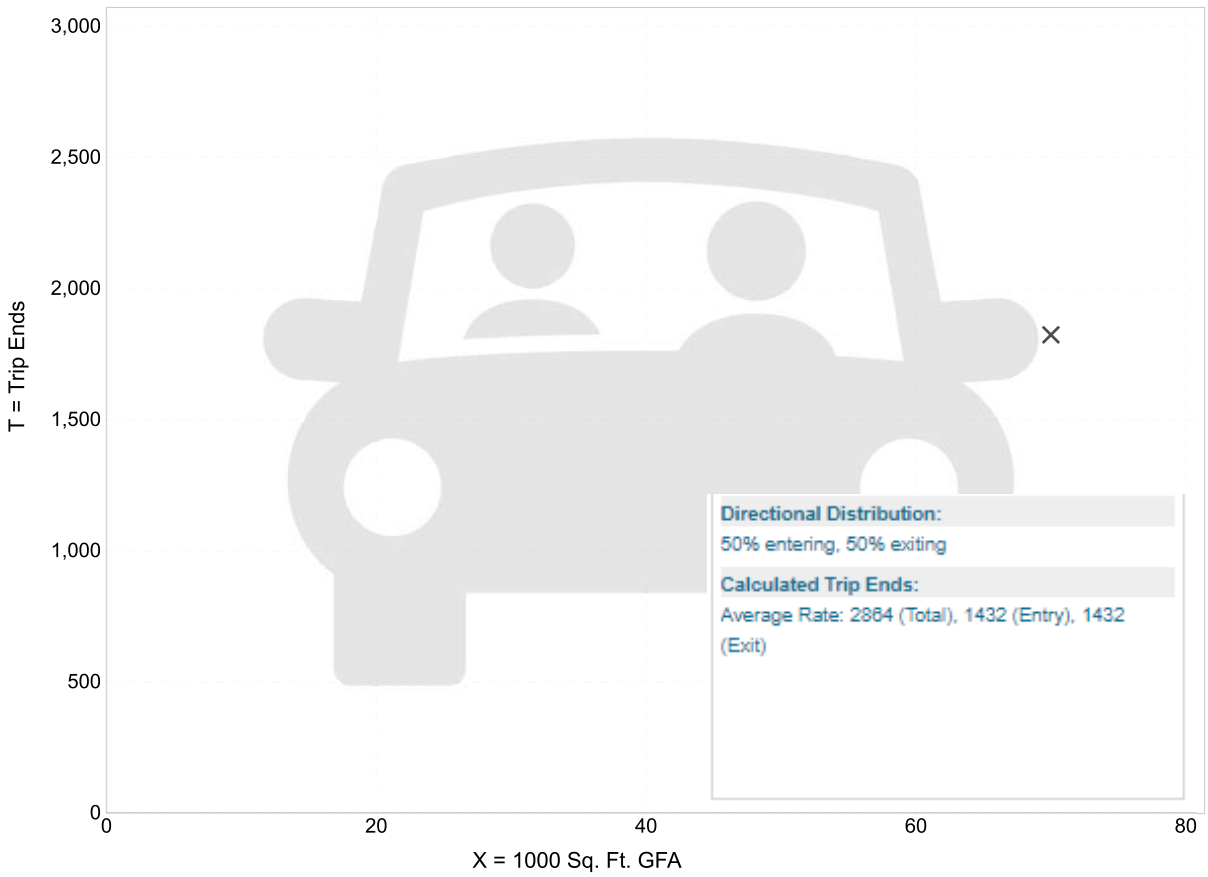
Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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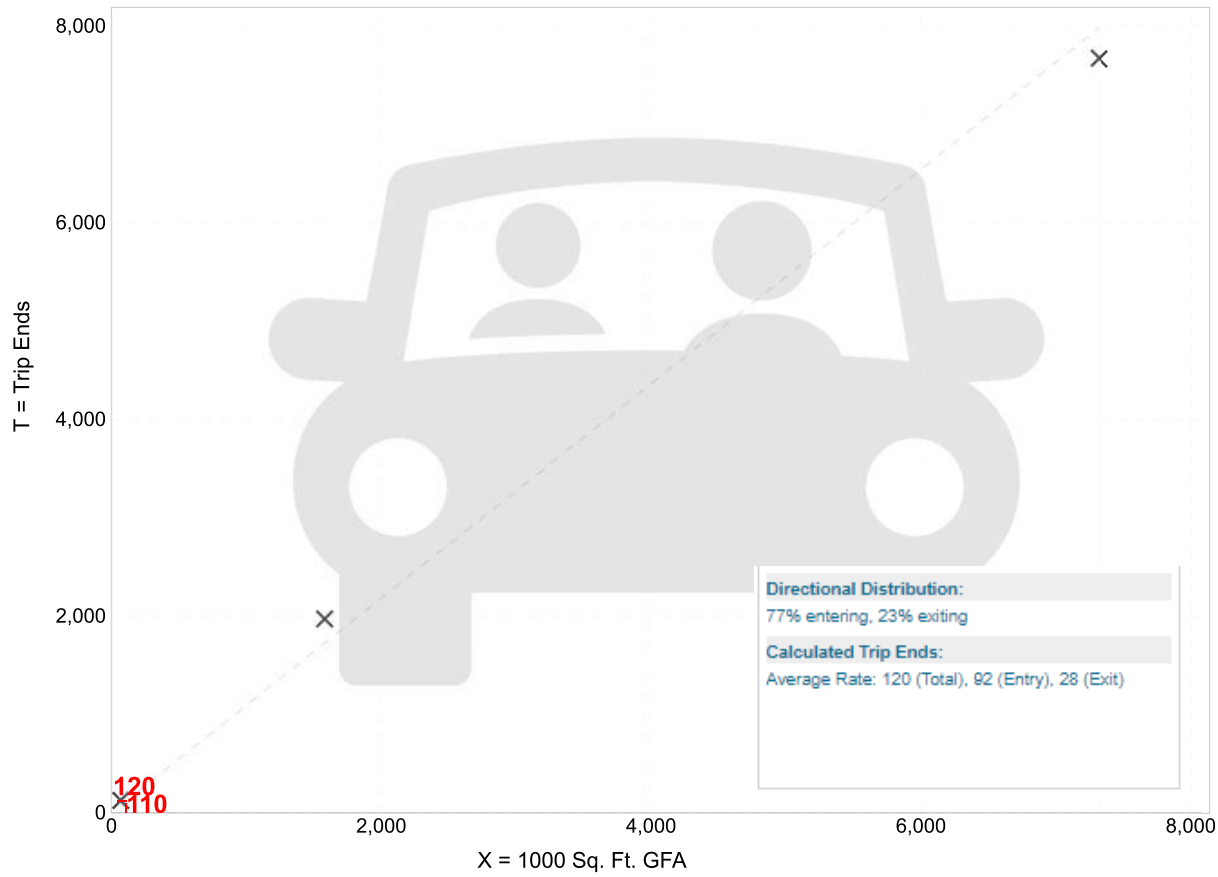
Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
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Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

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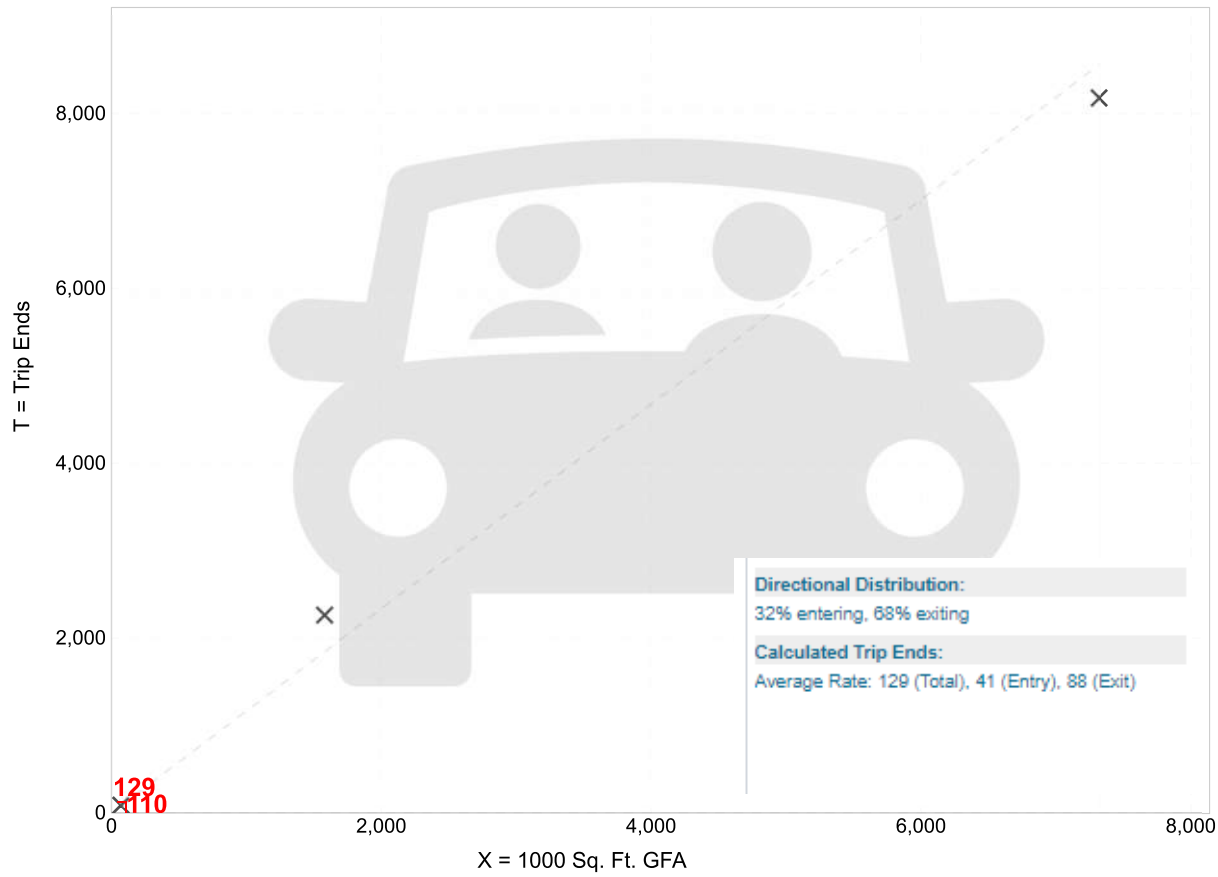

Study Site **Average Rate**

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University/College
(550)

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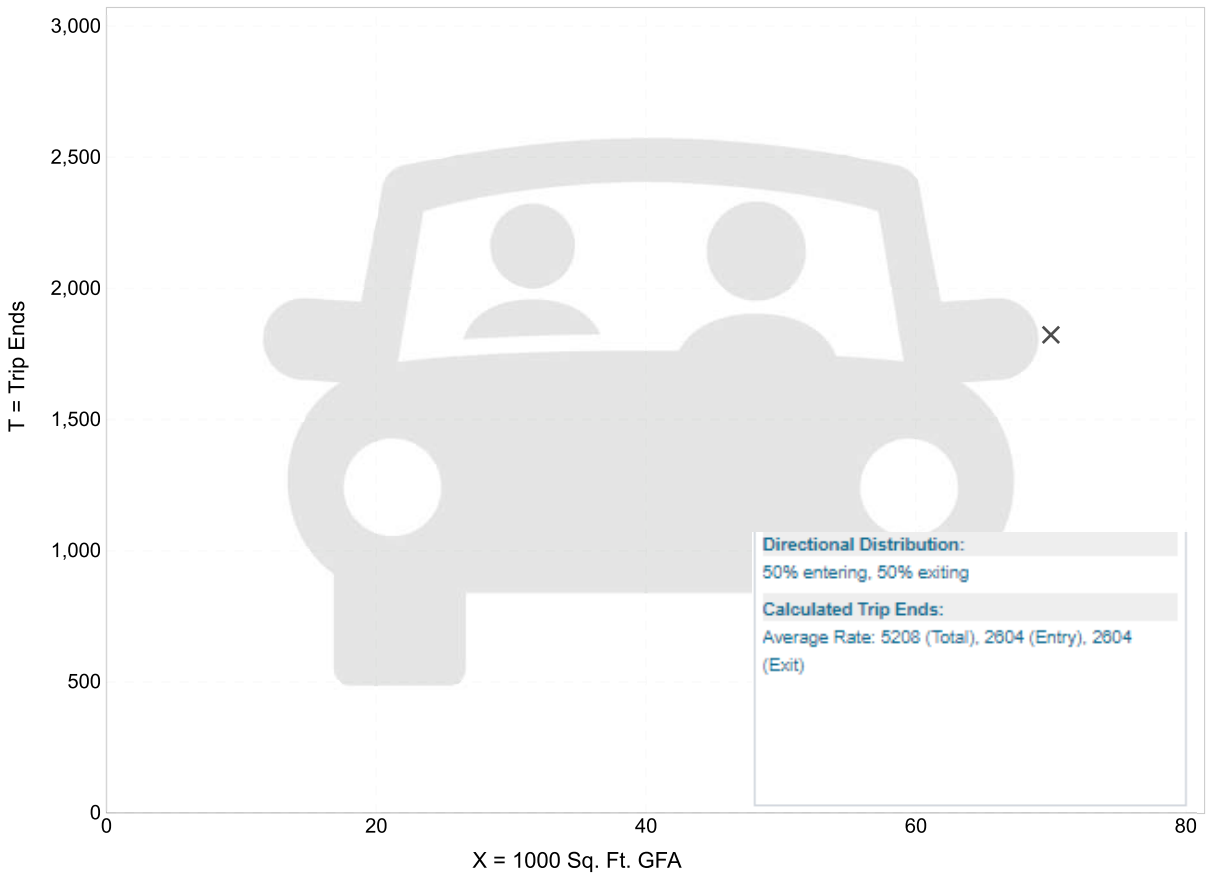
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

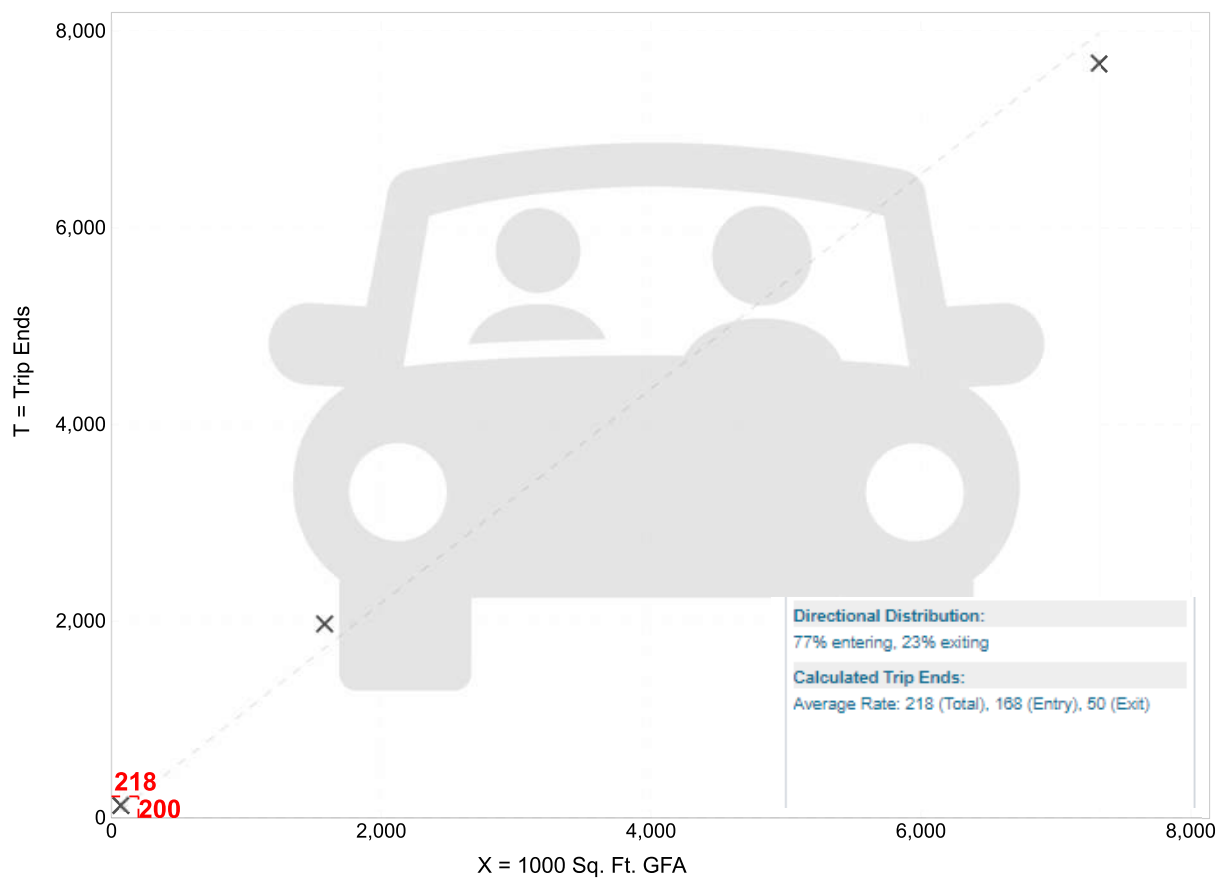
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

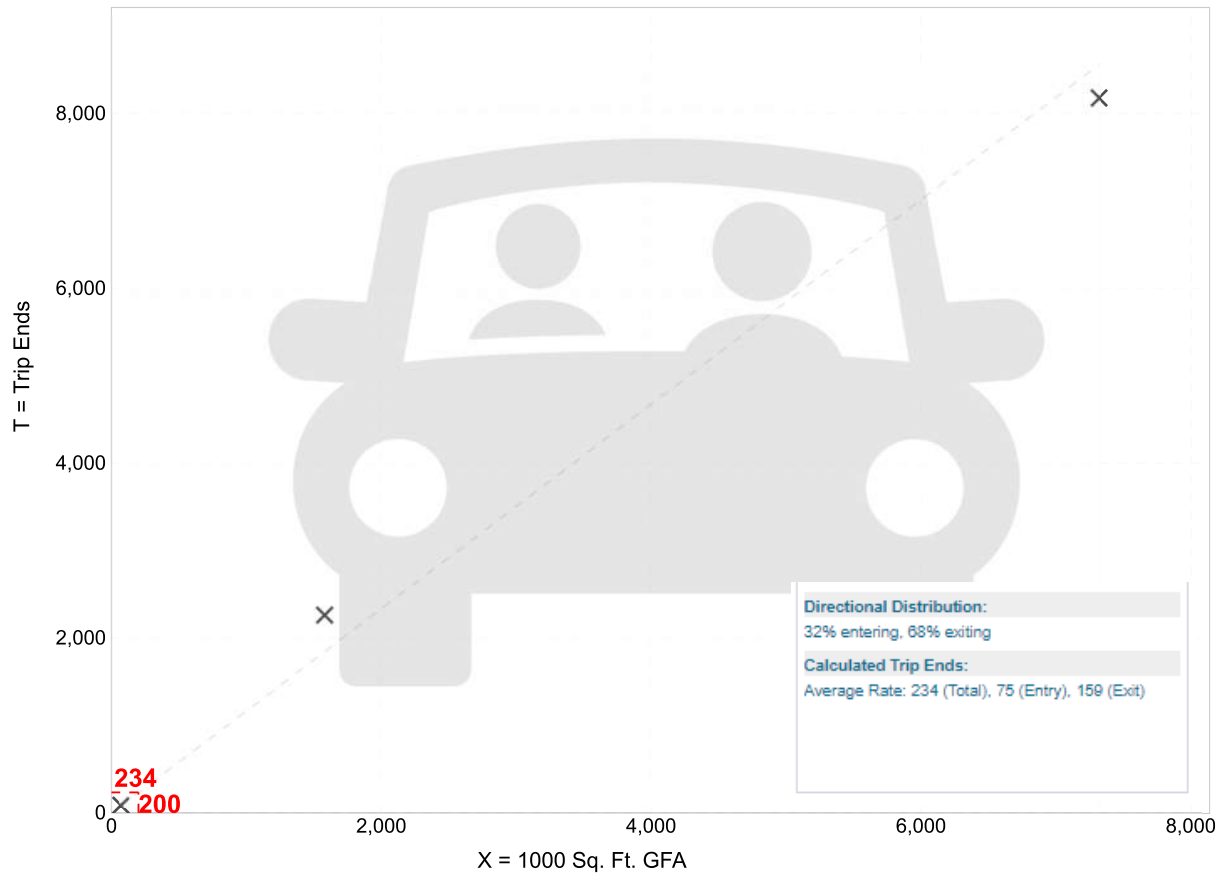
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

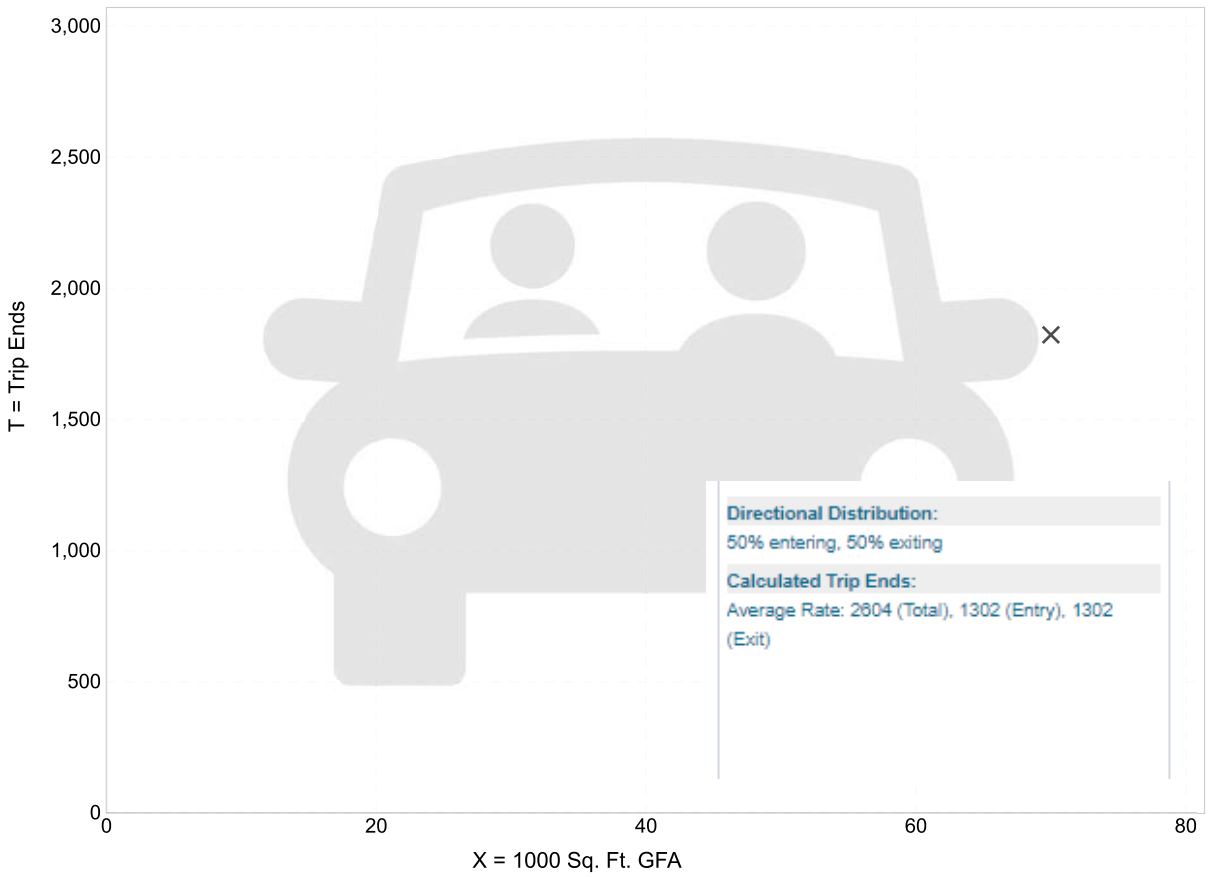
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

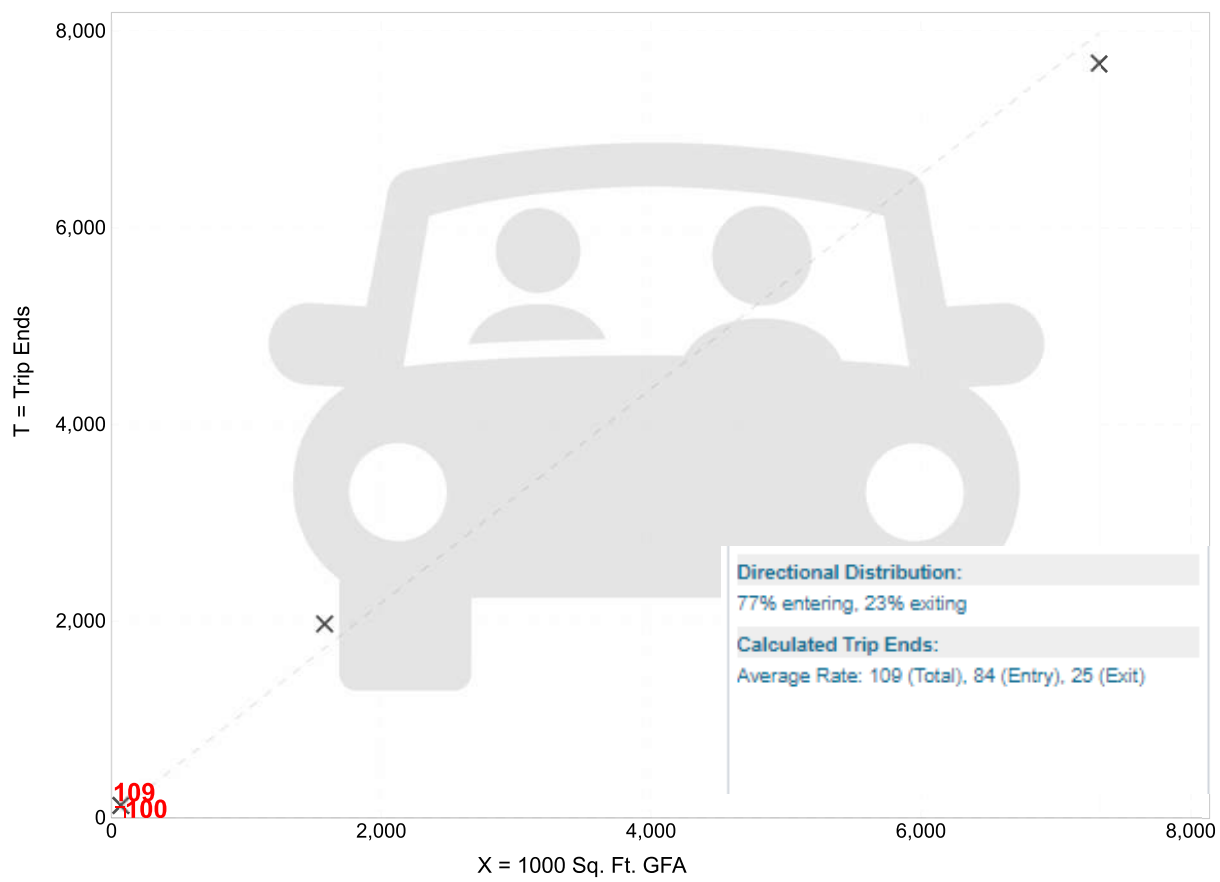
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

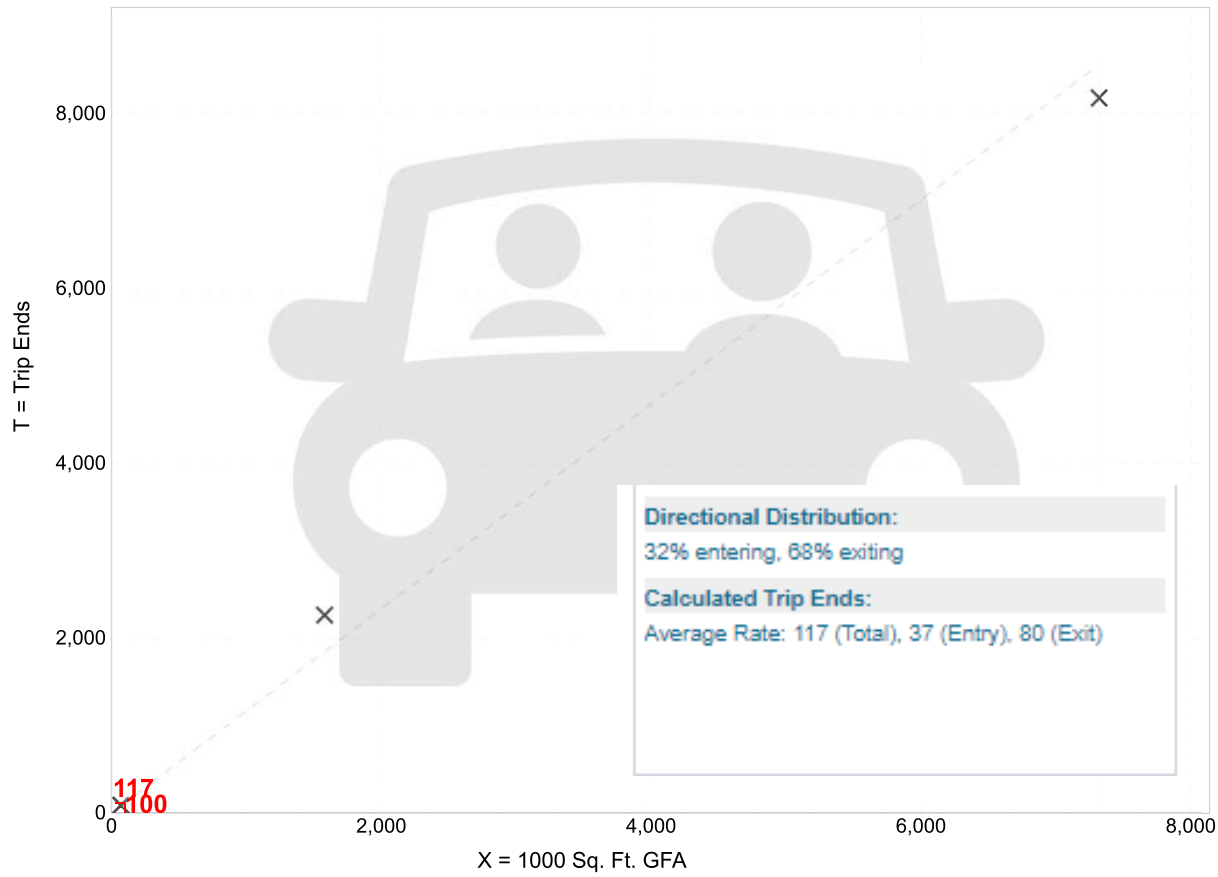
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



Study Site — **Average Rate**

Fitted Curve Equation: Not Given — **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

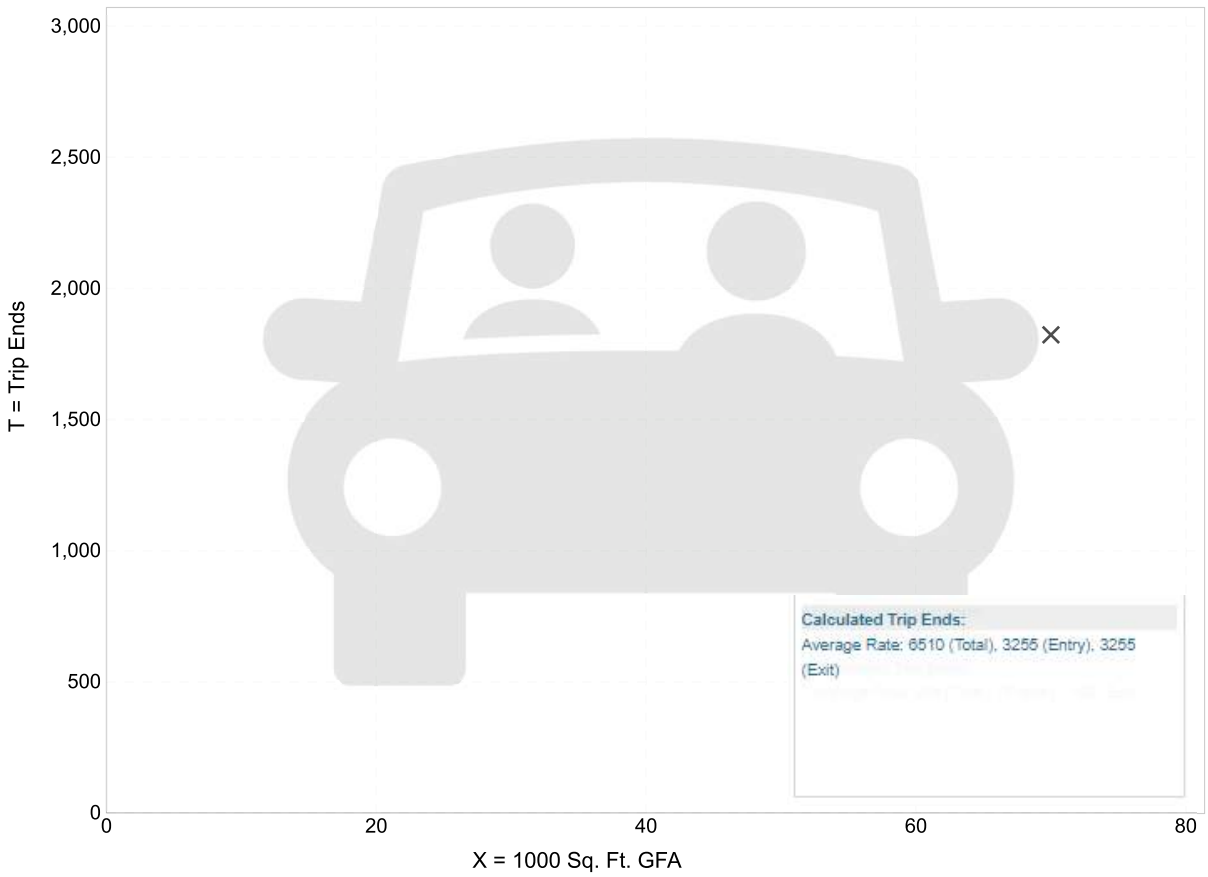
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

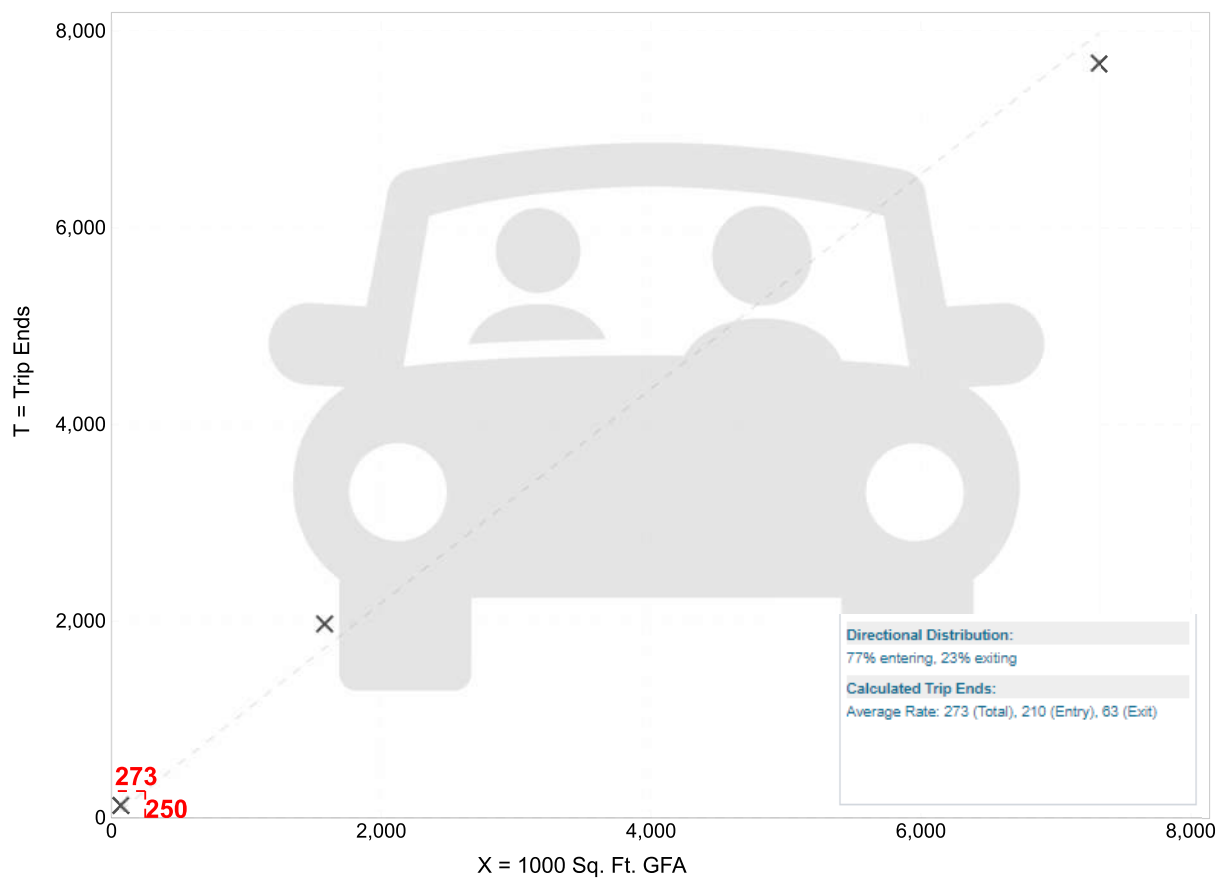
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

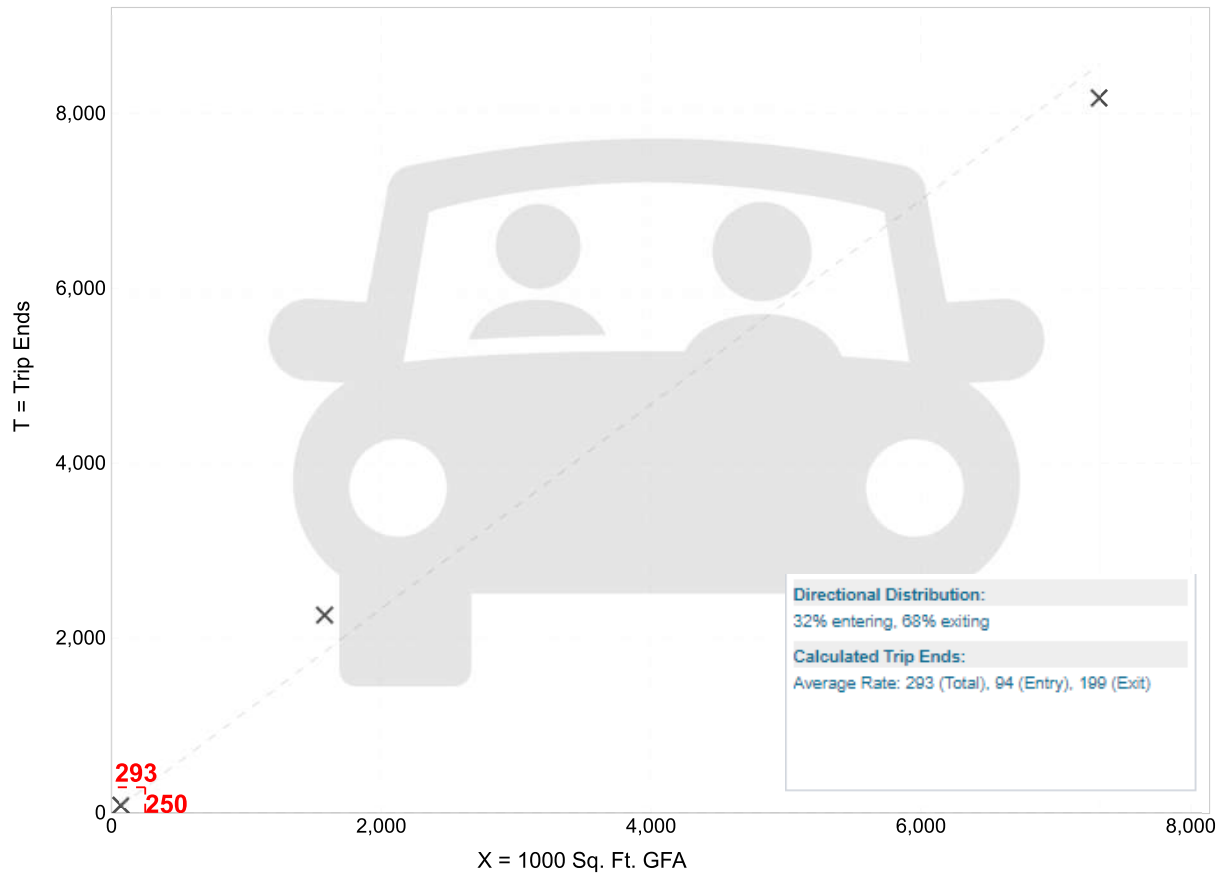
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



Study Site — **Average Rate**

Fitted Curve Equation: Not Given — **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

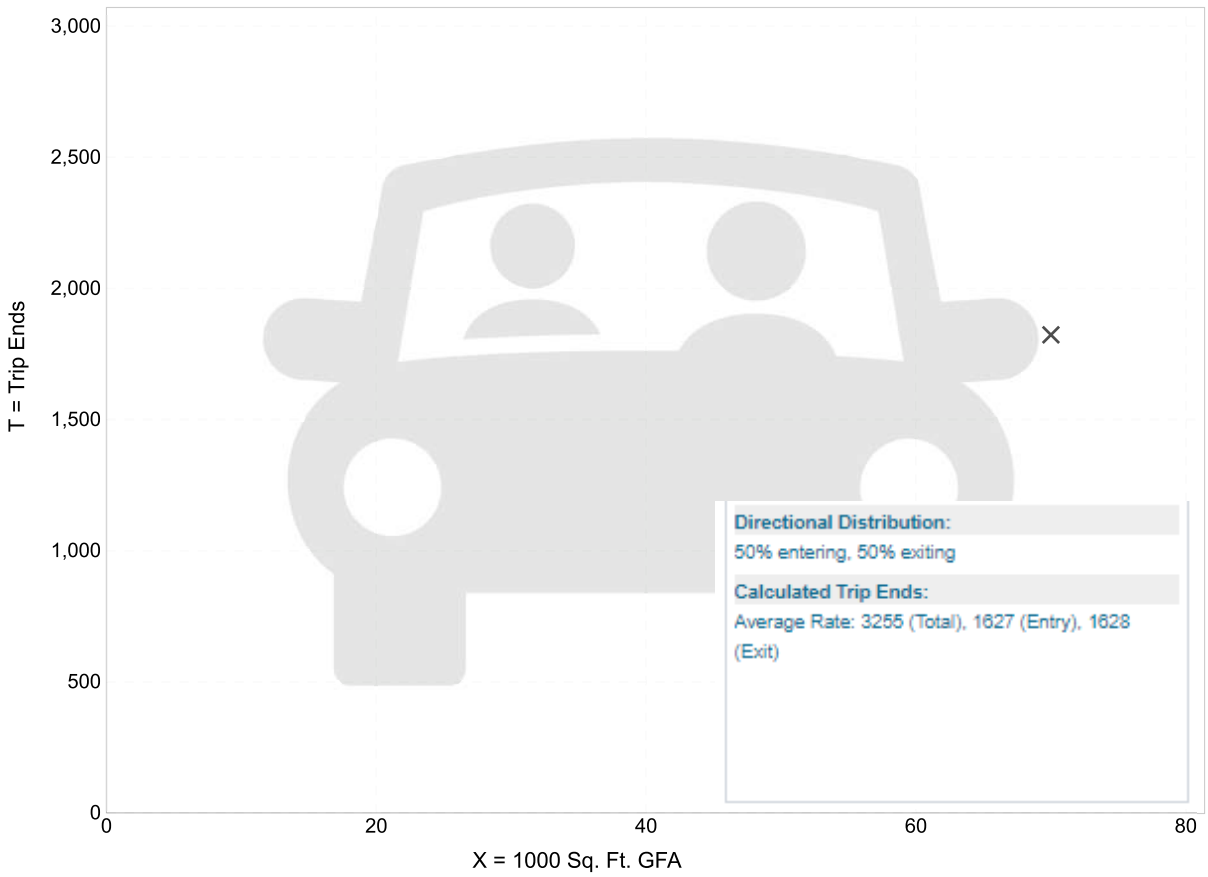
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

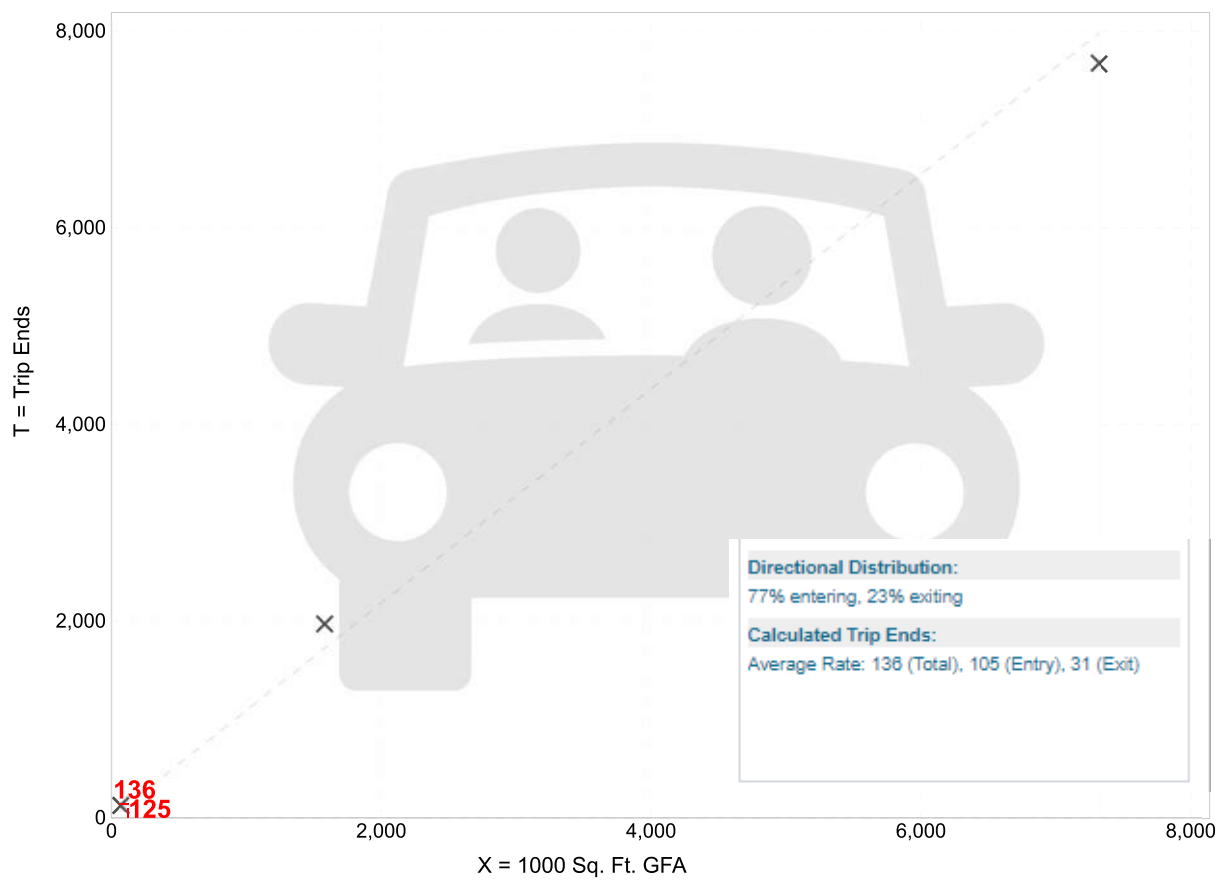
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** — — — — **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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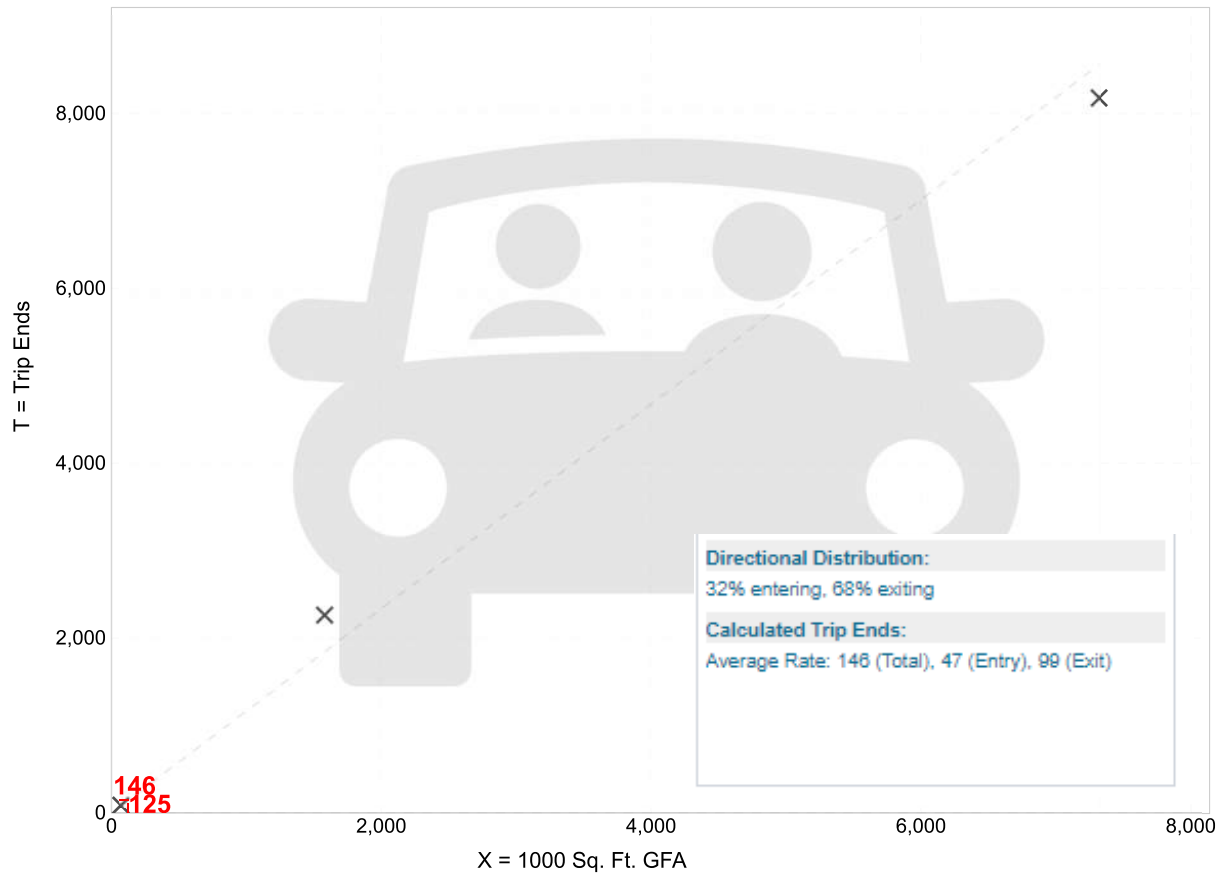
Data Plot and Equation

Caution – Small Sample Size



Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

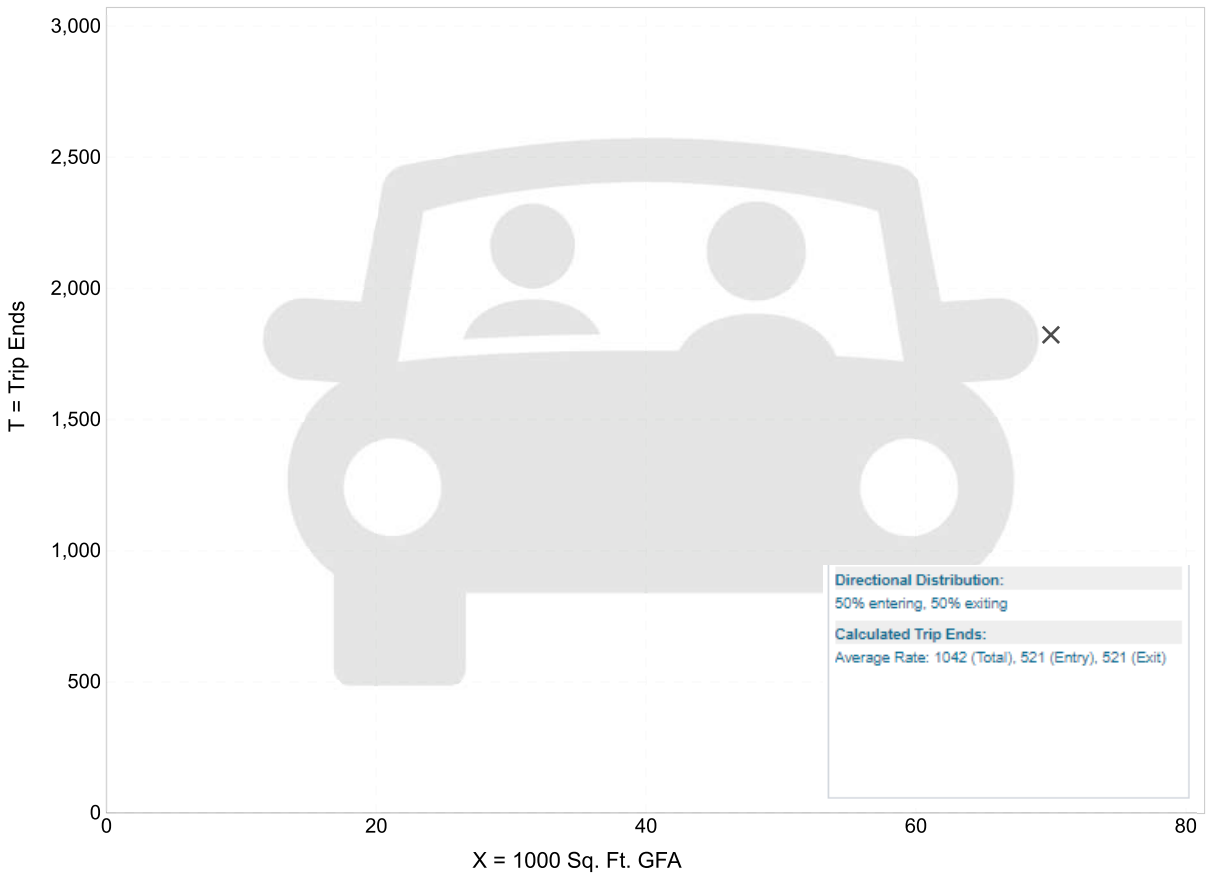
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

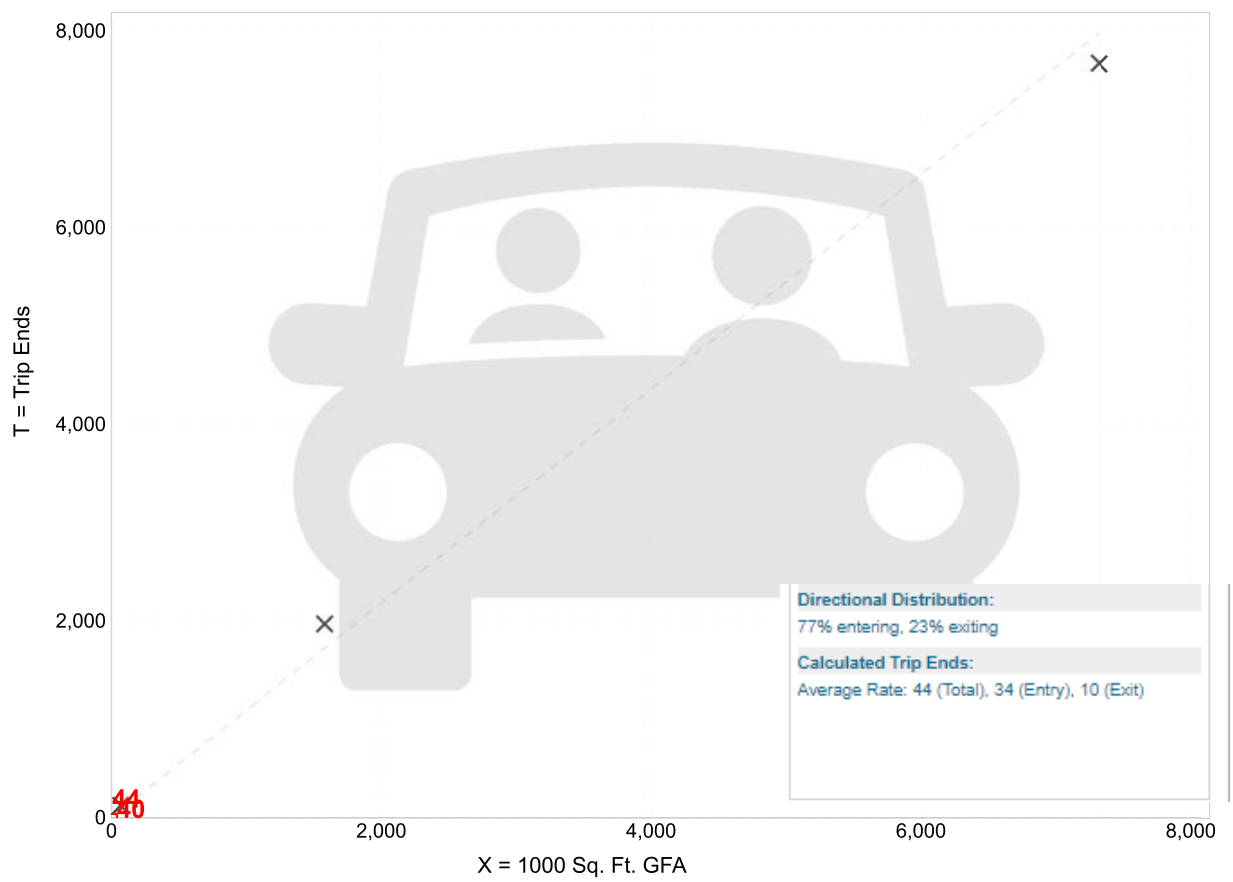
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

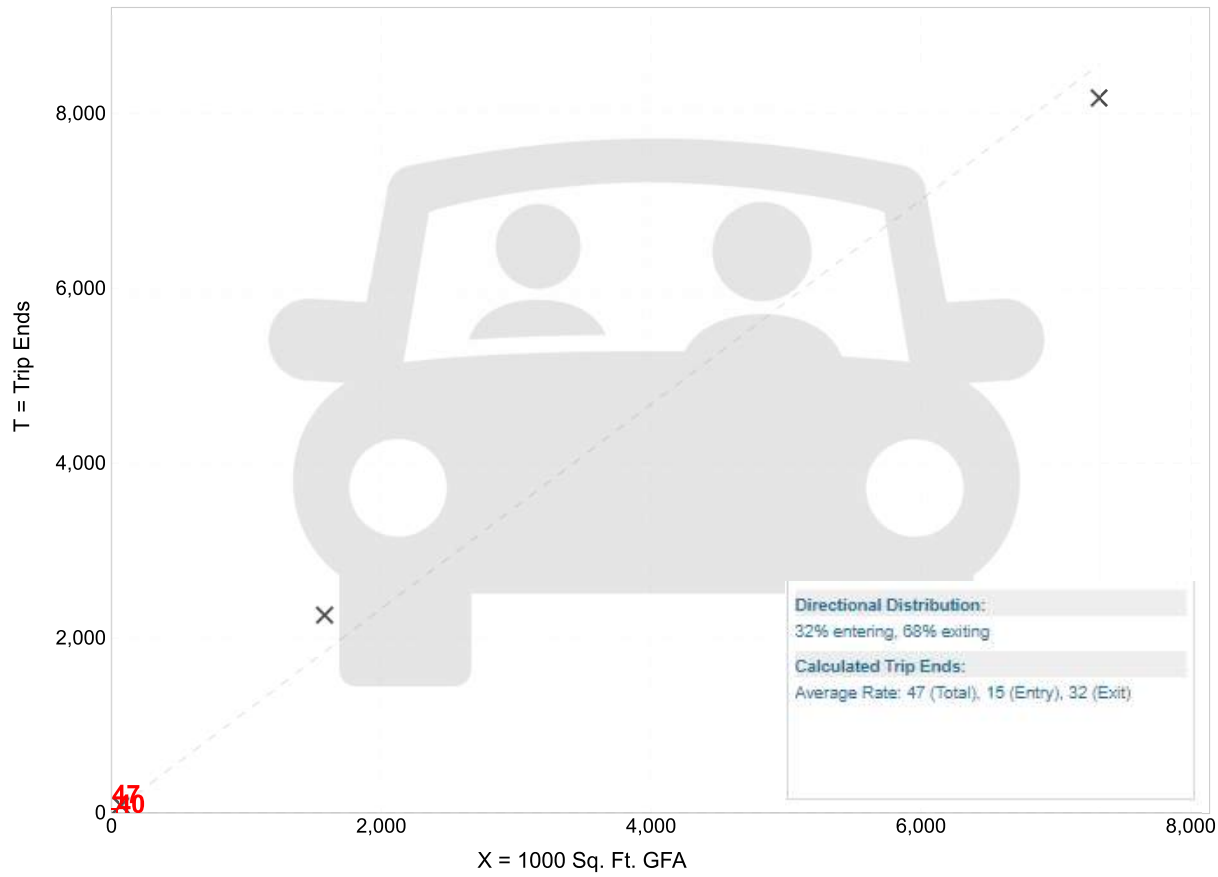
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

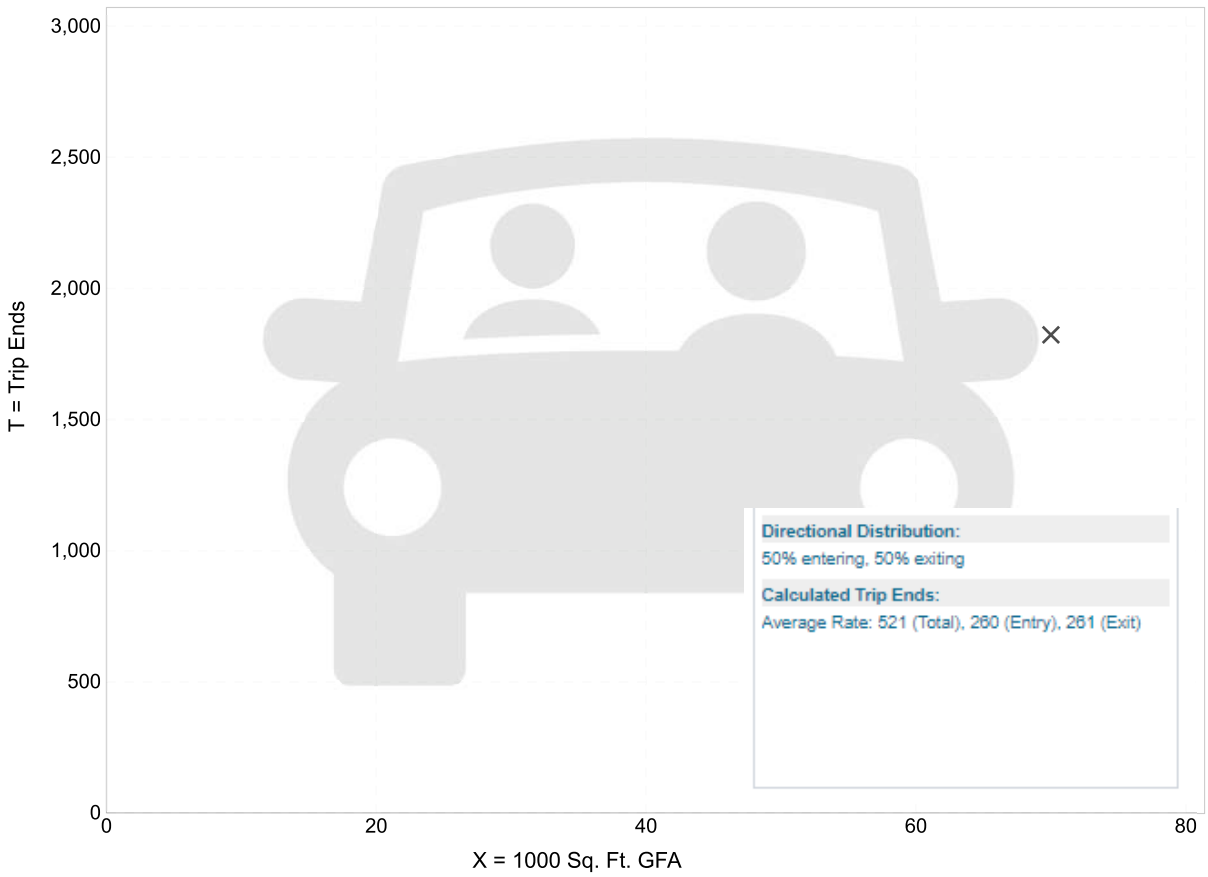
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

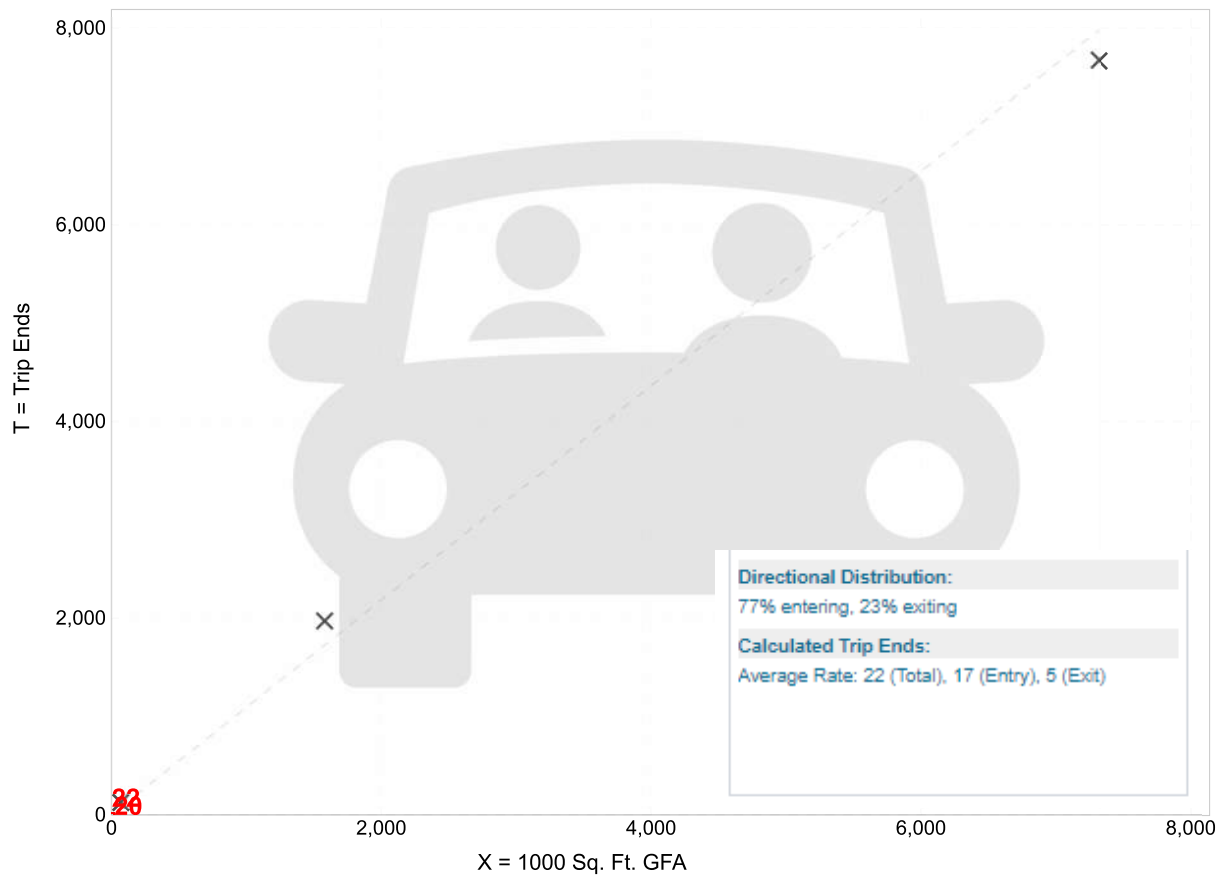
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

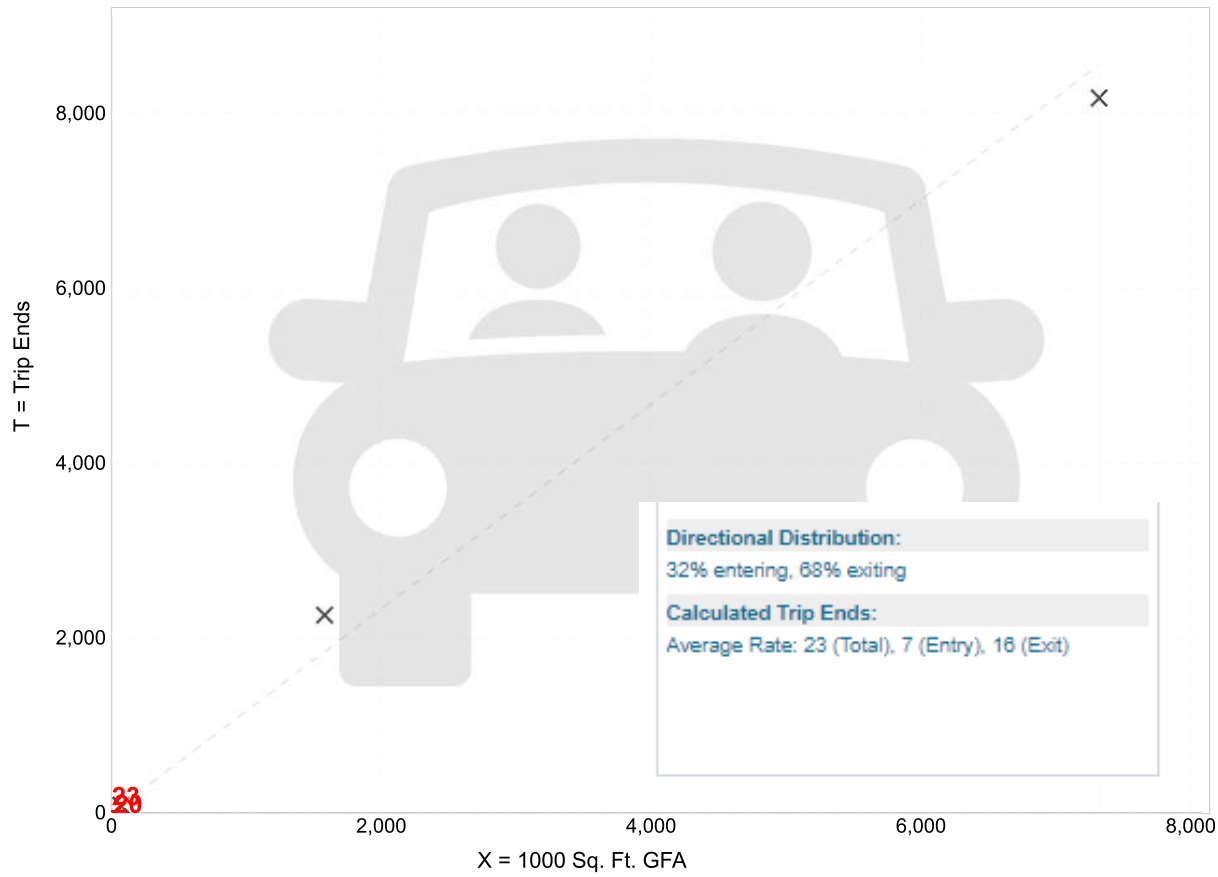
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



Study Site — **Average Rate**

Fitted Curve Equation: Not Given — **R^2= ******

Off-Campus Student Apartment
(225)

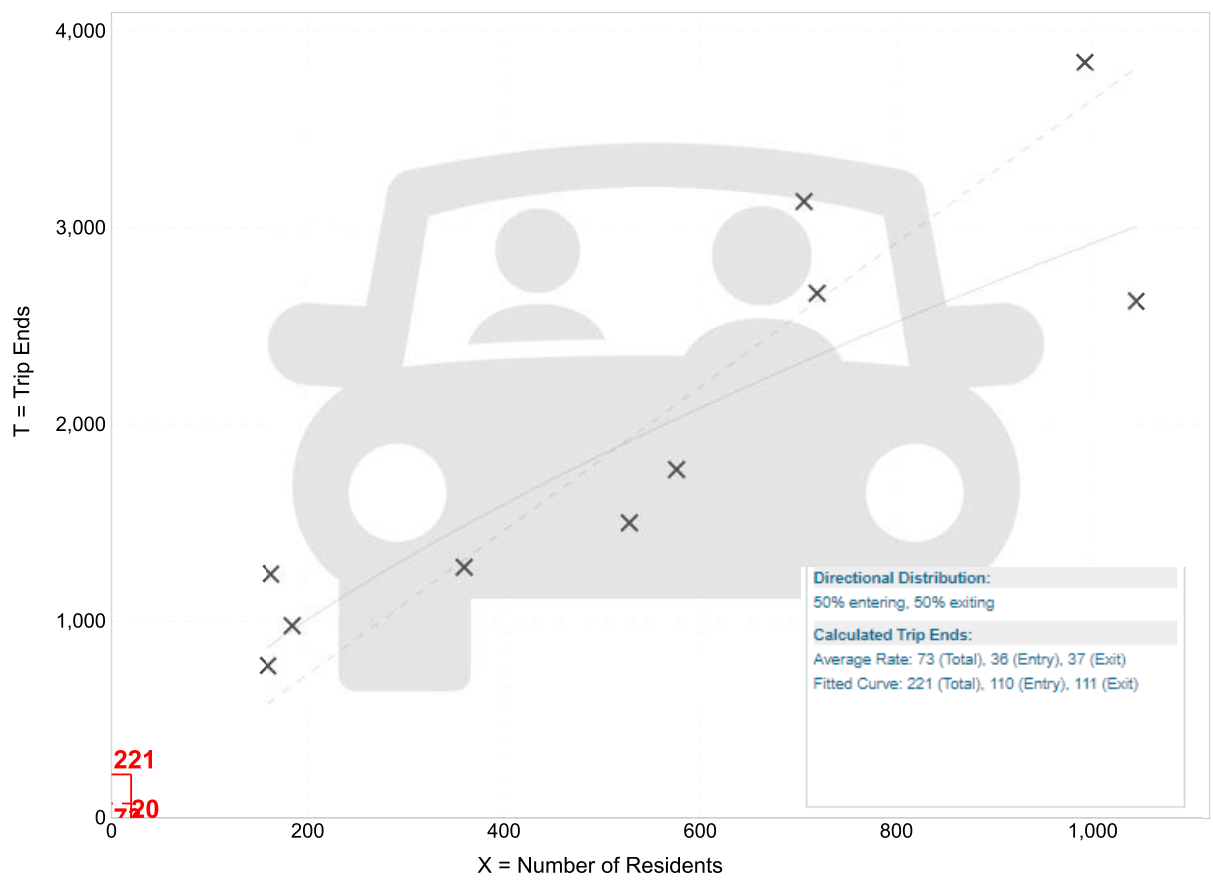
Vehicle Trip Ends vs: **Residents**
On a: **Weekday**

Setting/Location: **Adjacent to Campus**
Number of Studies: 10
Avg. Num. of Residents: 543
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Resident

Average Rate	Range of Rates	Standard Deviation
3.65	2.52 - 7.62	1.08

Data Plot and Equation



Study Site **Fitted Curve** **Average Rate**

Fitted Curve Equation: Ln(T) = 0.66 Ln(X) + 3.42 **R^2= 0.83**

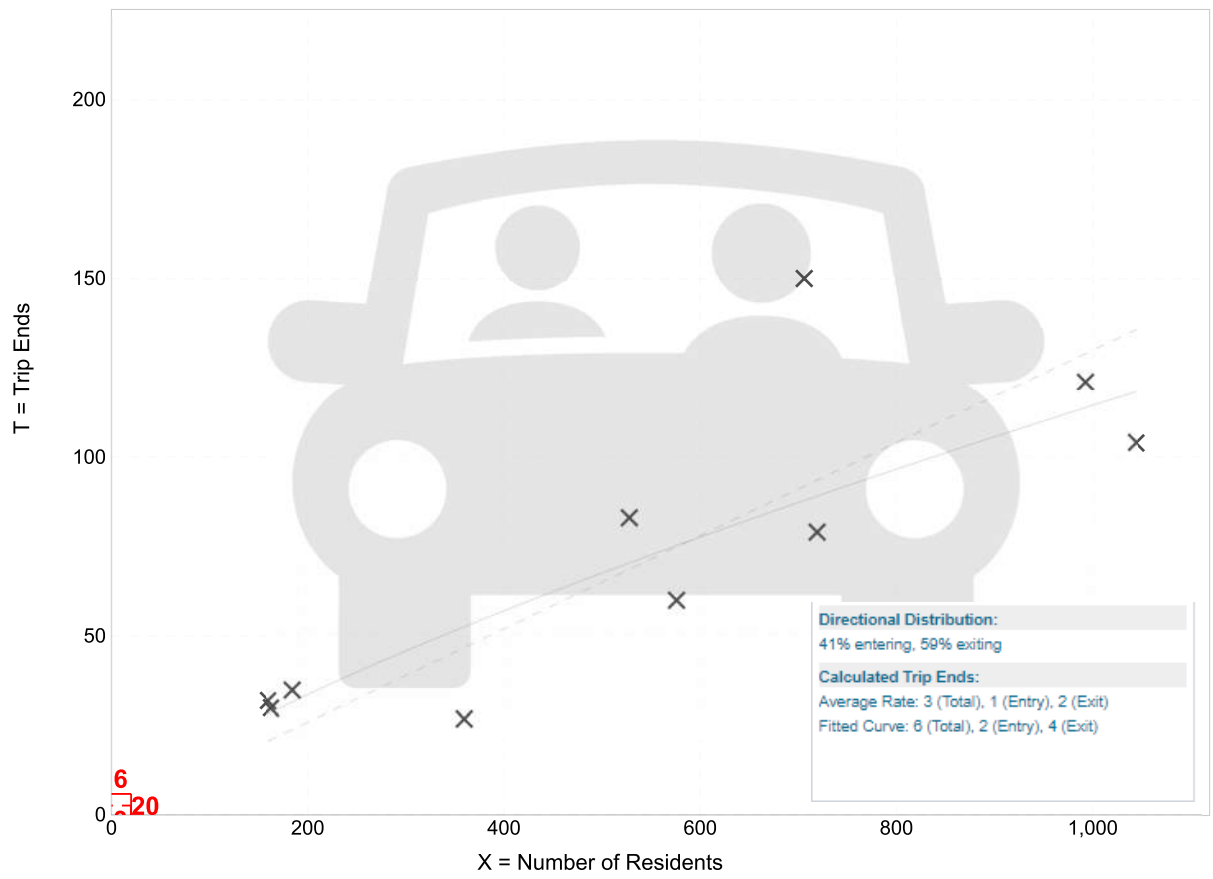
Off-Campus Student Apartment
(225)

Vehicle Trip Ends vs:	**Residents**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**Adjacent to Campus**
Number of Studies:	10
Avg. Num. of Residents:	543
Directional Distribution:	41% entering, 59% exiting

Vehicle Trip Generation per Resident

Average Rate	Range of Rates	Standard Deviation
0.13	0.08 - 0.21	0.04

Data Plot and Equation



Study Site **Fitted Curve** **Average Rate**

Fitted Curve Equation: Ln(T) = 0.76 Ln(X) - 0.51 **R^2= 0.76**

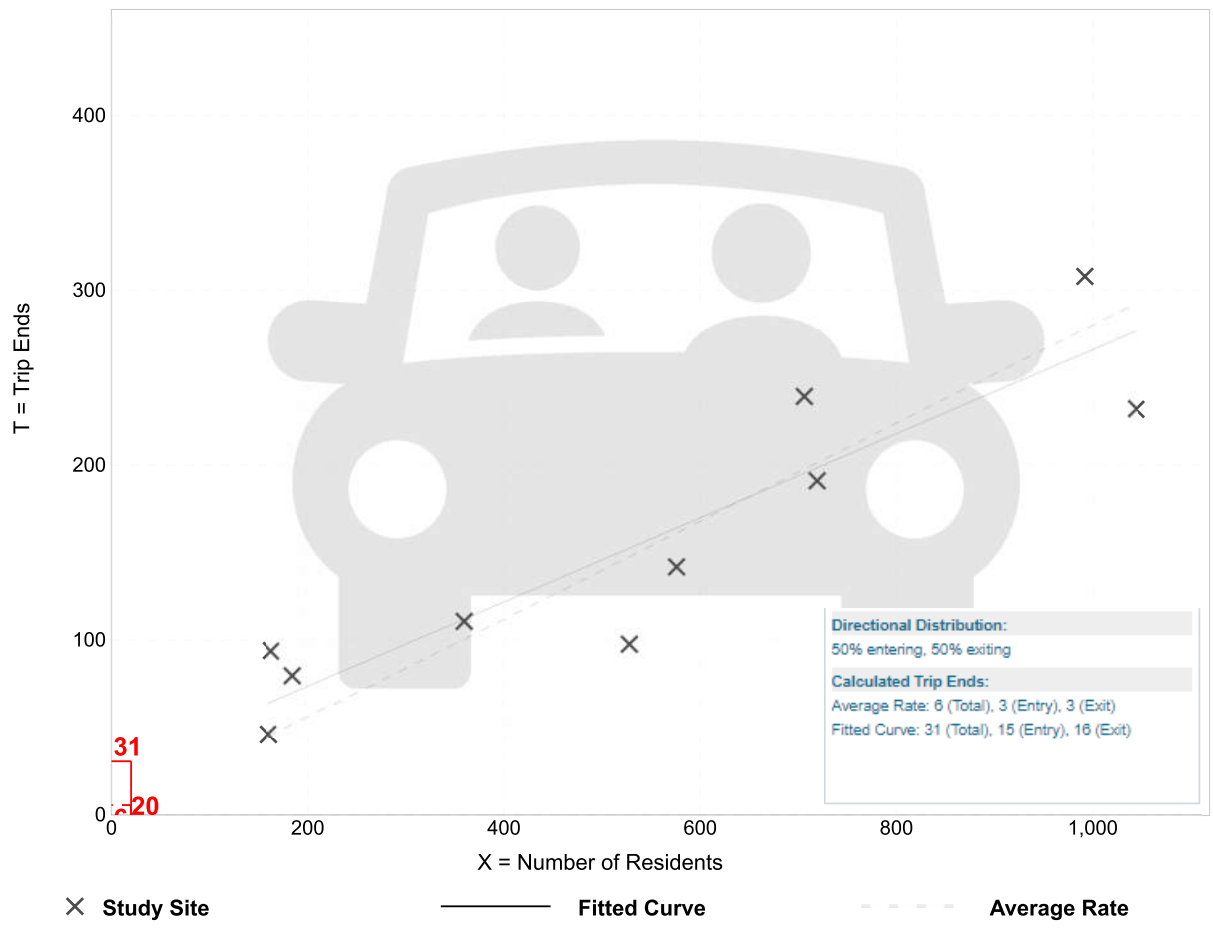
Off-Campus Student Apartment
(225)

Vehicle Trip Ends vs:	**Residents**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**Adjacent to Campus**
Number of Studies:	10
Avg. Num. of Residents:	543
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per Resident

Average Rate	Range of Rates	Standard Deviation
0.28	0.19 - 0.58	0.08

Data Plot and Equation



Study Site **Fitted Curve** **Average Rate**

Fitted Curve Equation: T = 0.24(X) + 25.88 **R^2= 0.84**

Off-Campus Student Apartment
(225)

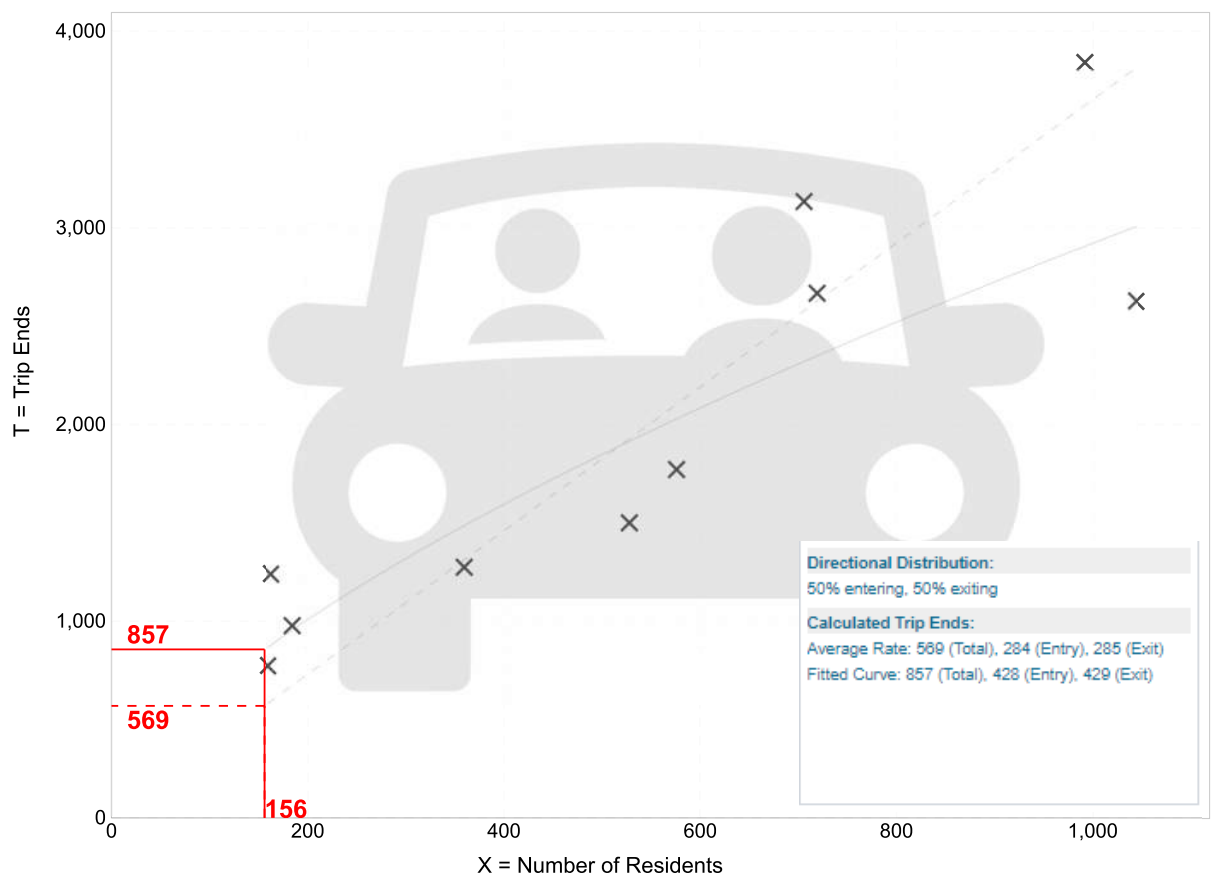
Vehicle Trip Ends vs: **Residents**
On a: **Weekday**

Setting/Location: **Adjacent to Campus**
Number of Studies: 10
Avg. Num. of Residents: 543
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Resident

Average Rate	Range of Rates	Standard Deviation
3.65	2.52 - 7.62	1.08

Data Plot and Equation



× **Study Site** ——— **Fitted Curve** - - - **Average Rate**

Fitted Curve Equation: Ln(T) = 0.66 Ln(X) + 3.42 **R^2= 0.83**

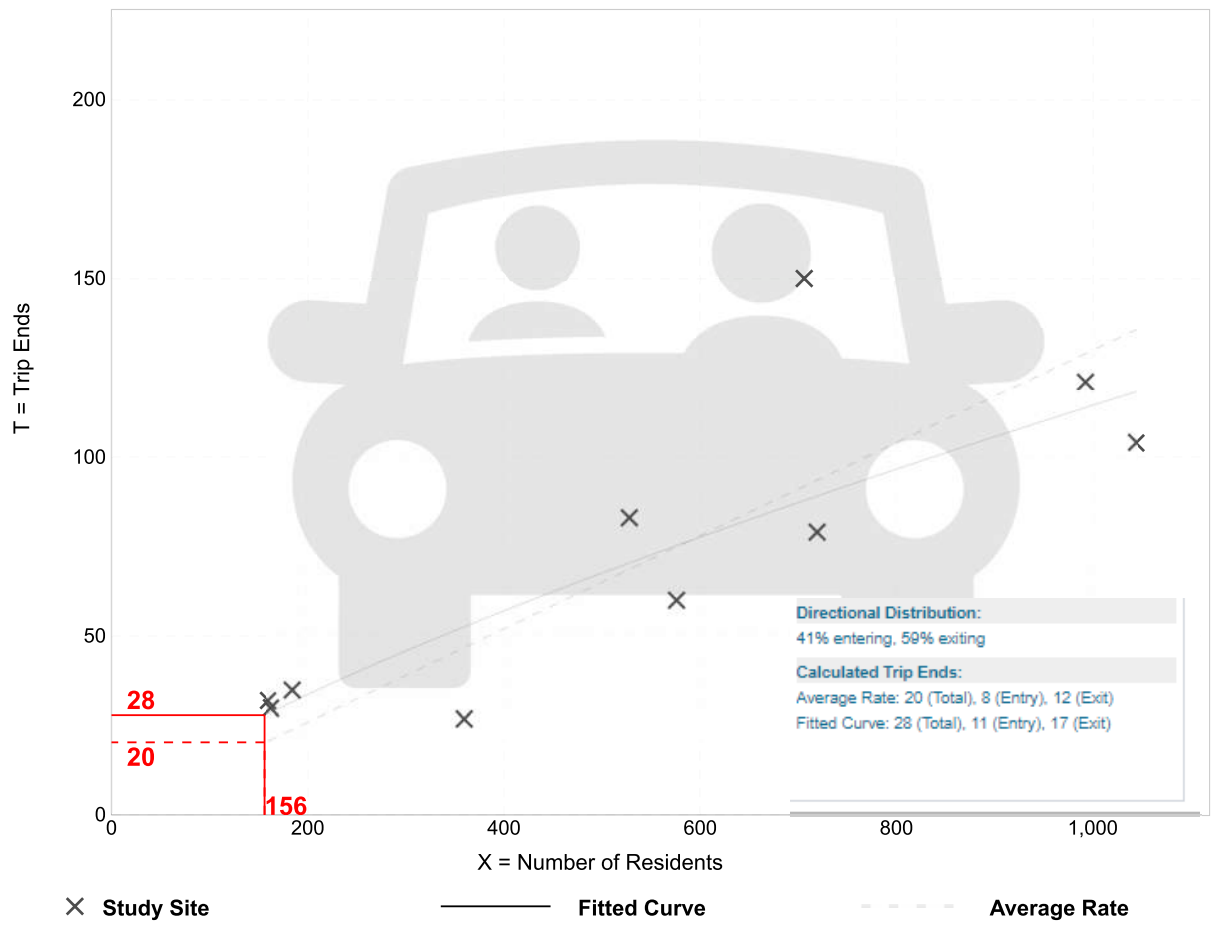
Off-Campus Student Apartment
(225)

Vehicle Trip Ends vs:	**Residents**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**Adjacent to Campus**
Number of Studies:	10
Avg. Num. of Residents:	543
Directional Distribution:	41% entering, 59% exiting

Vehicle Trip Generation per Resident

Average Rate	Range of Rates	Standard Deviation
0.13	0.08 - 0.21	0.04

Data Plot and Equation



× **Study Site** ——— **Fitted Curve** - - - **Average Rate**

Fitted Curve Equation: Ln(T) = 0.76 Ln(X) - 0.51 **R^2= 0.76**

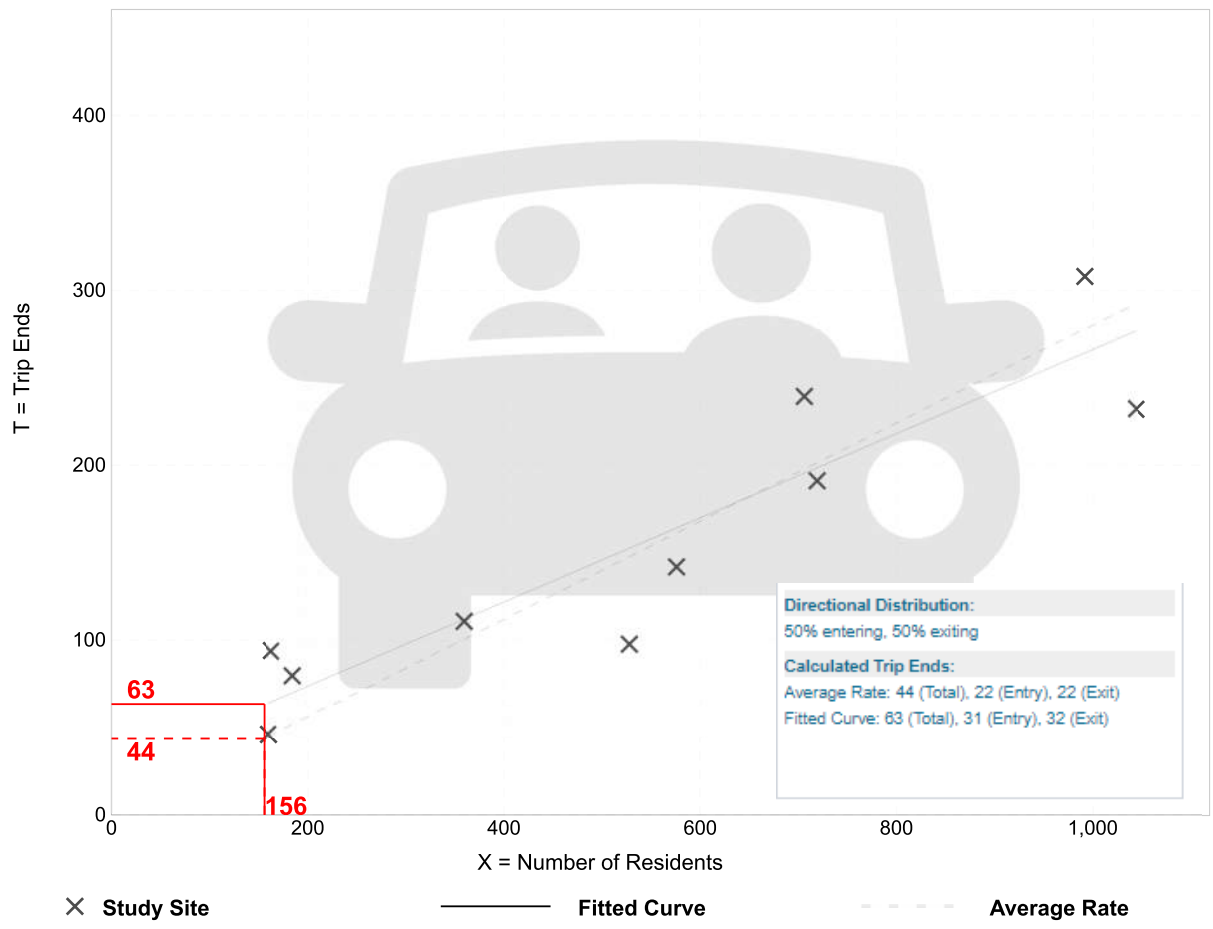
Off-Campus Student Apartment
(225)

Vehicle Trip Ends vs:	**Residents**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**Adjacent to Campus**
Number of Studies:	10
Avg. Num. of Residents:	543
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per Resident

Average Rate	Range of Rates	Standard Deviation
0.28	0.19 - 0.58	0.08

Data Plot and Equation



Study Site **Fitted Curve** **Average Rate**

Fitted Curve Equation: T = 0.24(X) + 25.88 **R^2= 0.84**

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

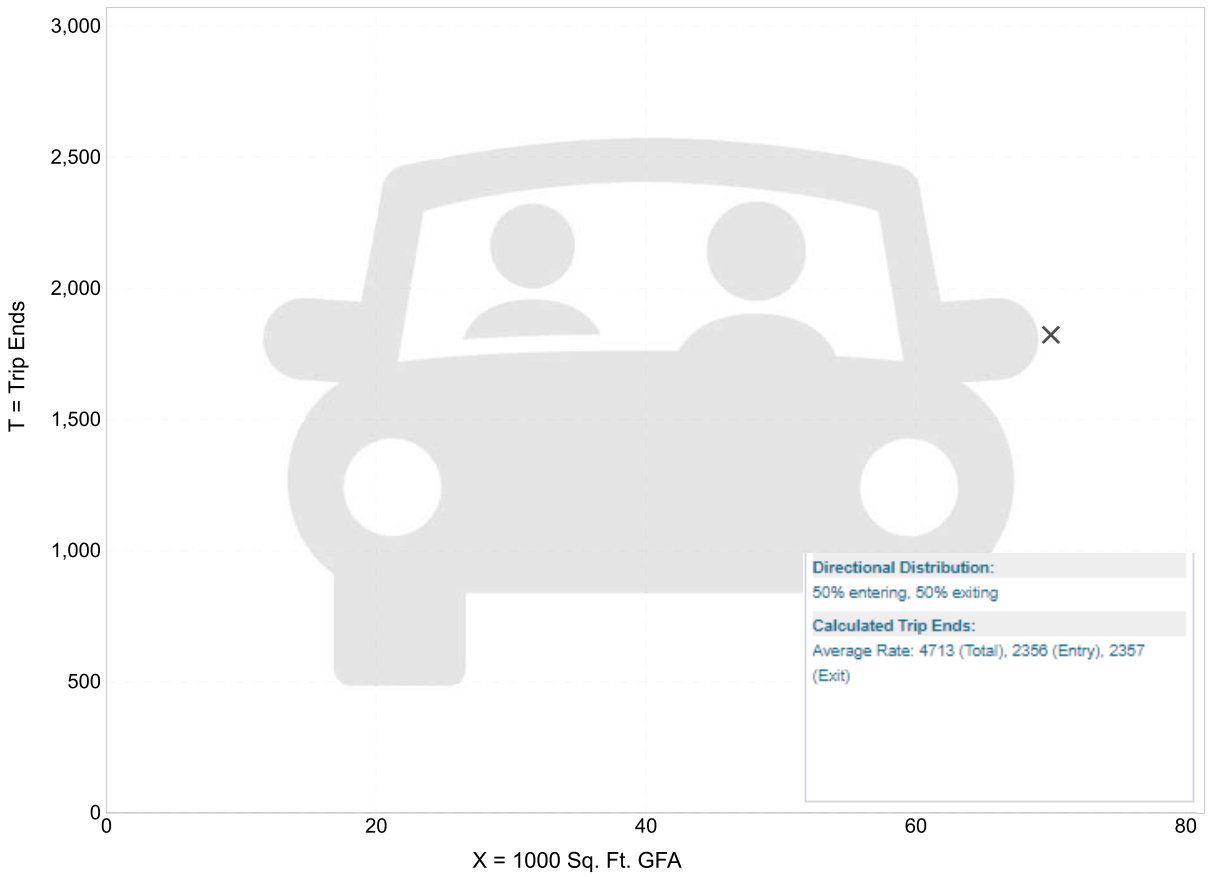
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

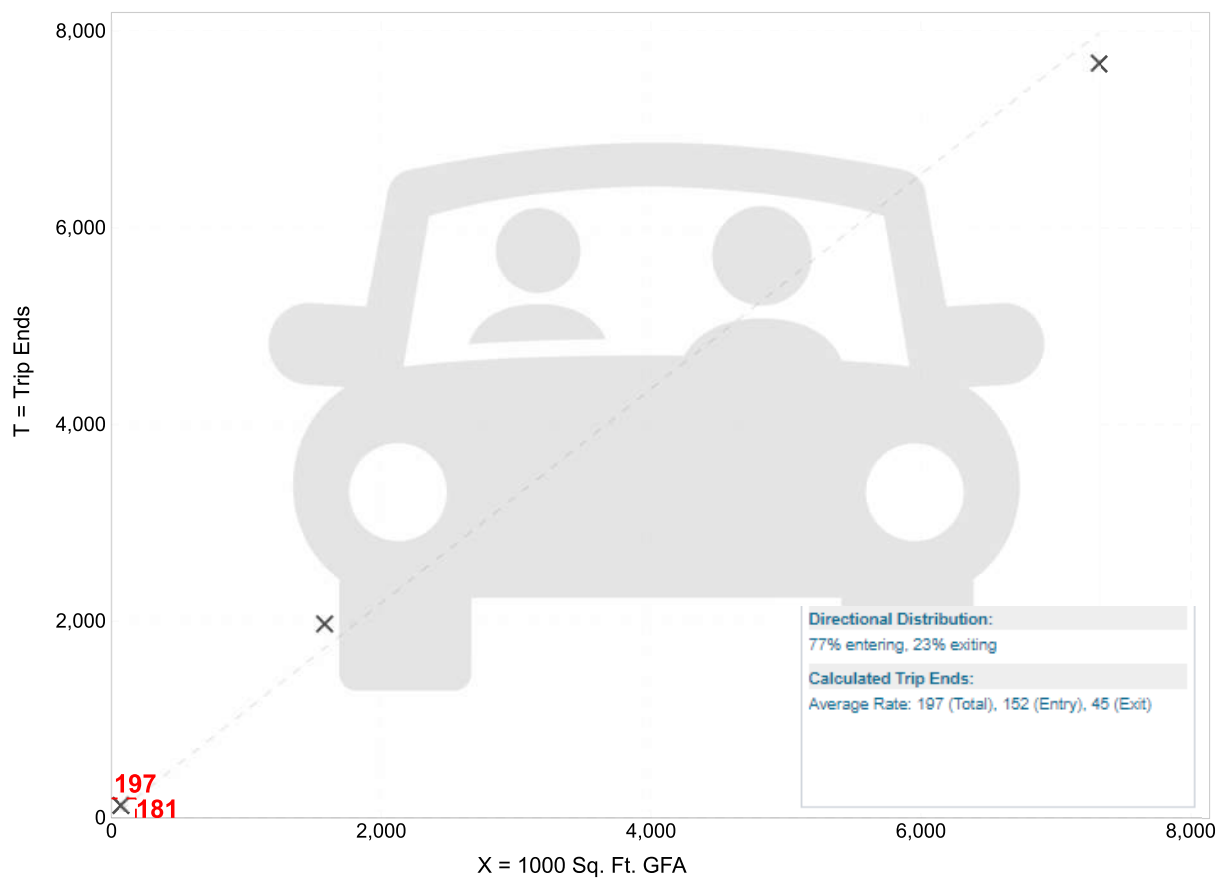
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.09	1.05 - 1.80	0.12

Data Plot and Equation

Caution – Small Sample Size



Study Site — **Average Rate**

Fitted Curve Equation: Not Given — **R^2= ******

University/College
(550)

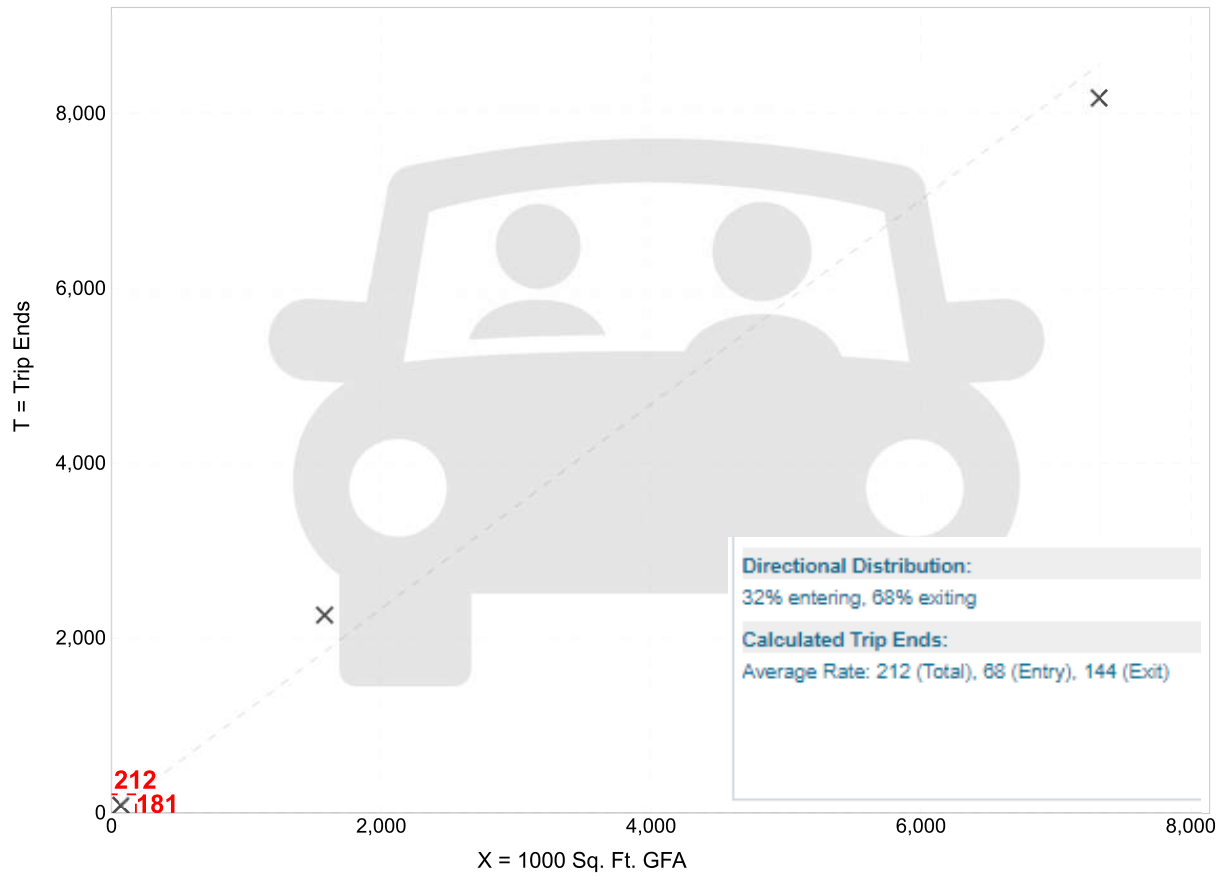
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

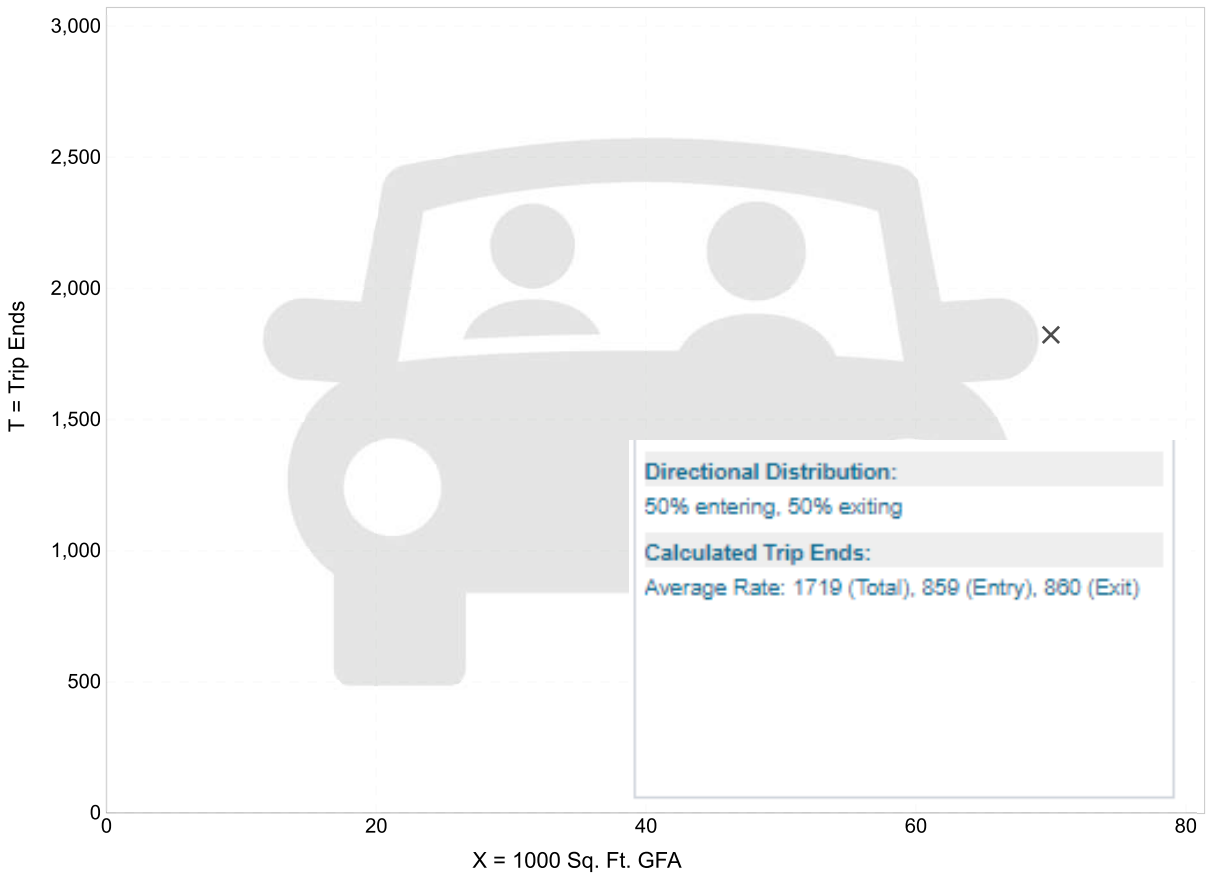
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 70
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.04	26.04 - 26.04	*

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	77% entering, 23% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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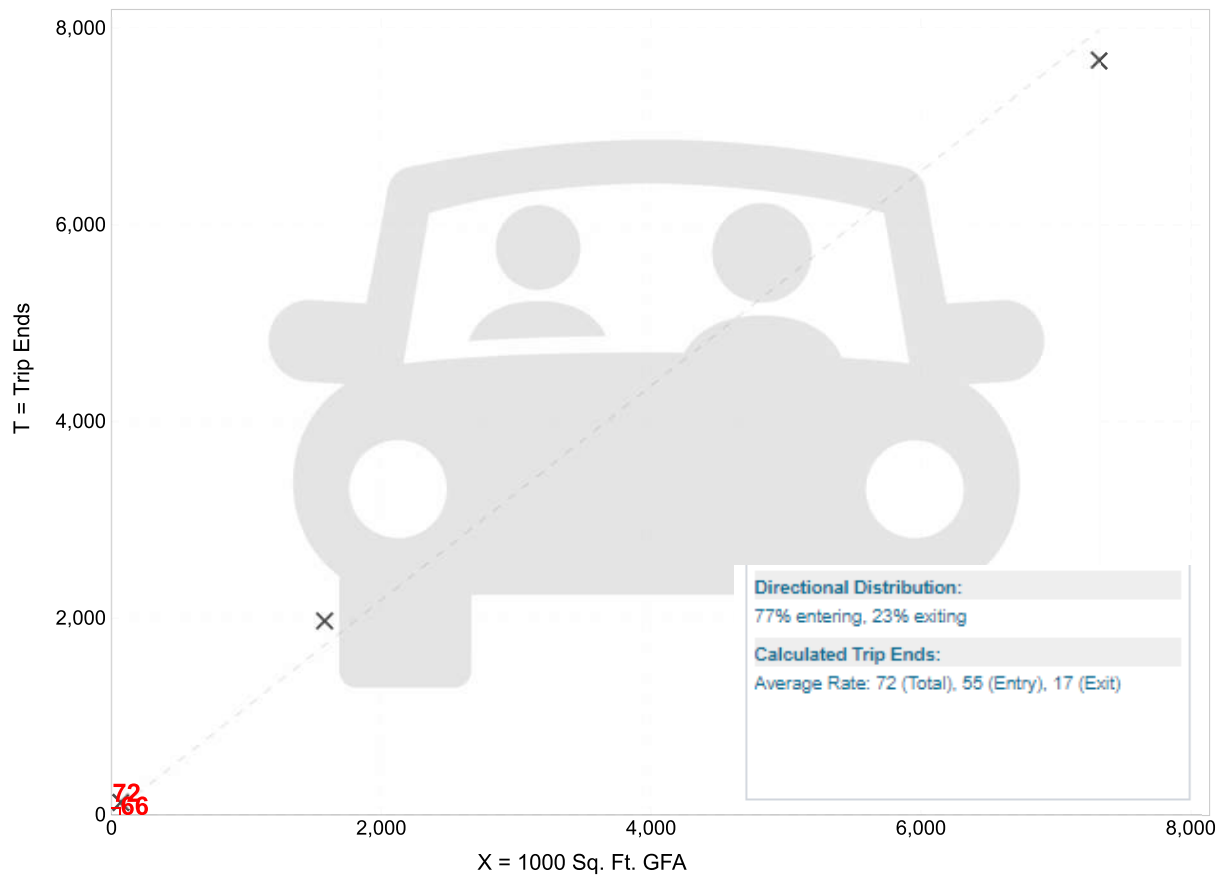
Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

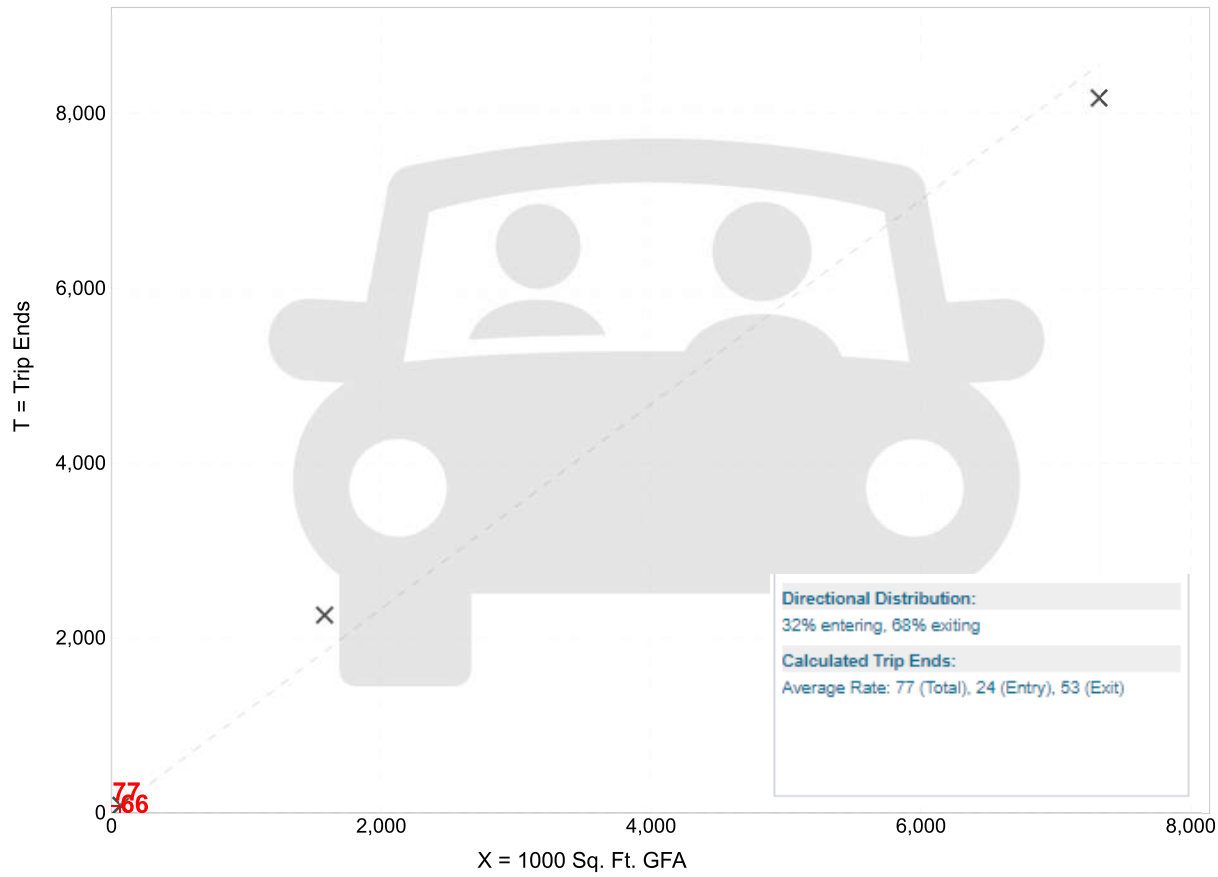
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.17	1.12 - 1.43	0.15

Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
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Number of Studies: 1
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Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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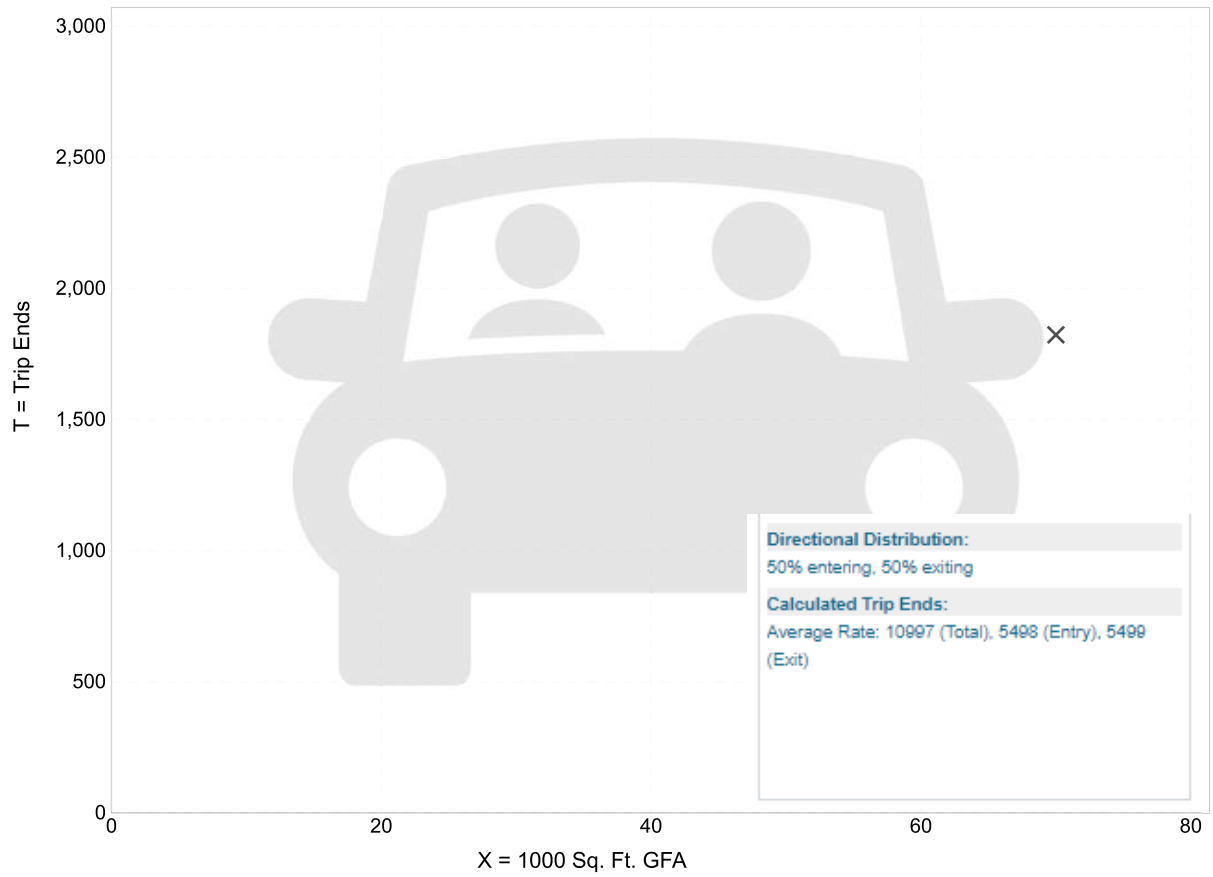
Data Plot and Equation

Caution – Small Sample Size



× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
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Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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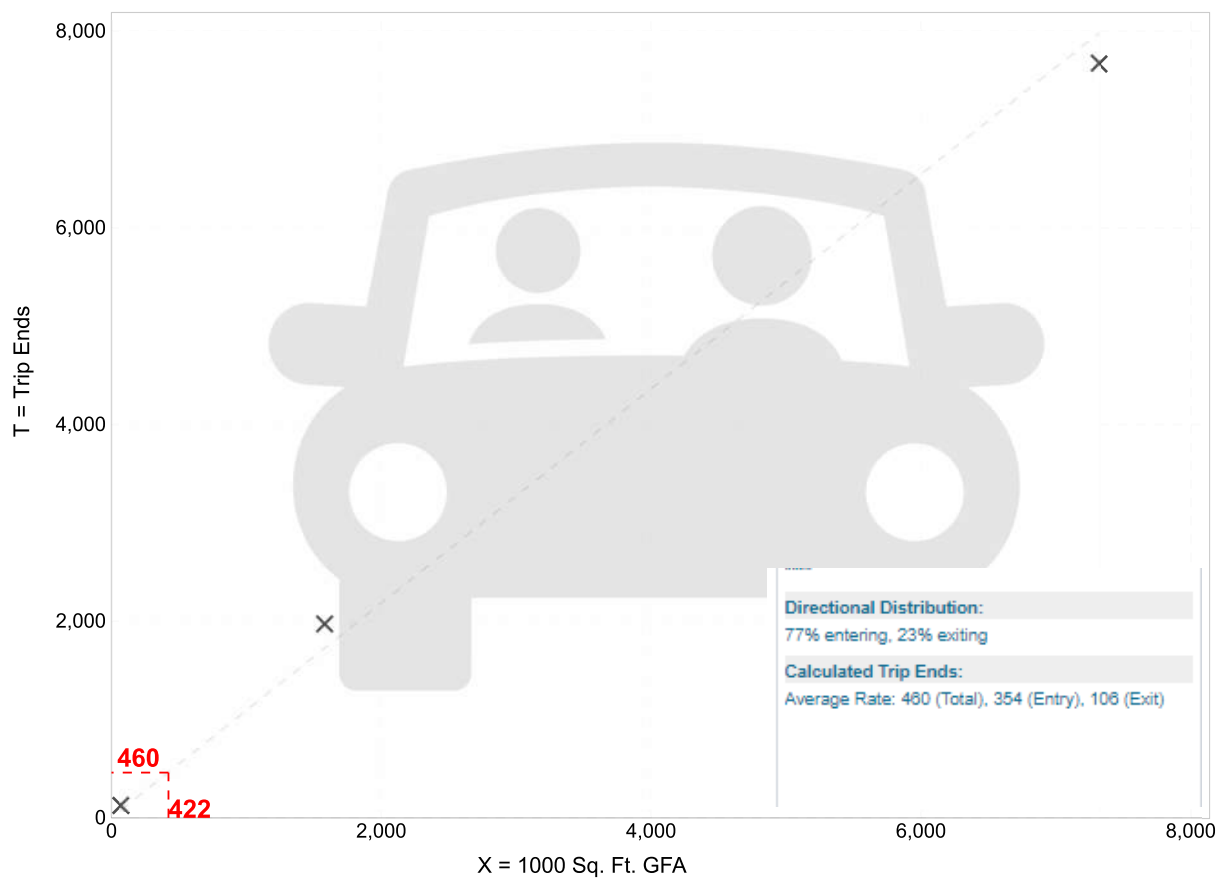
Caution – Small Sample Size



Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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:	3
Avg. 1000 Sq. Ft. GFA:	2990
Directional Distribution:	32% entering, 68% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
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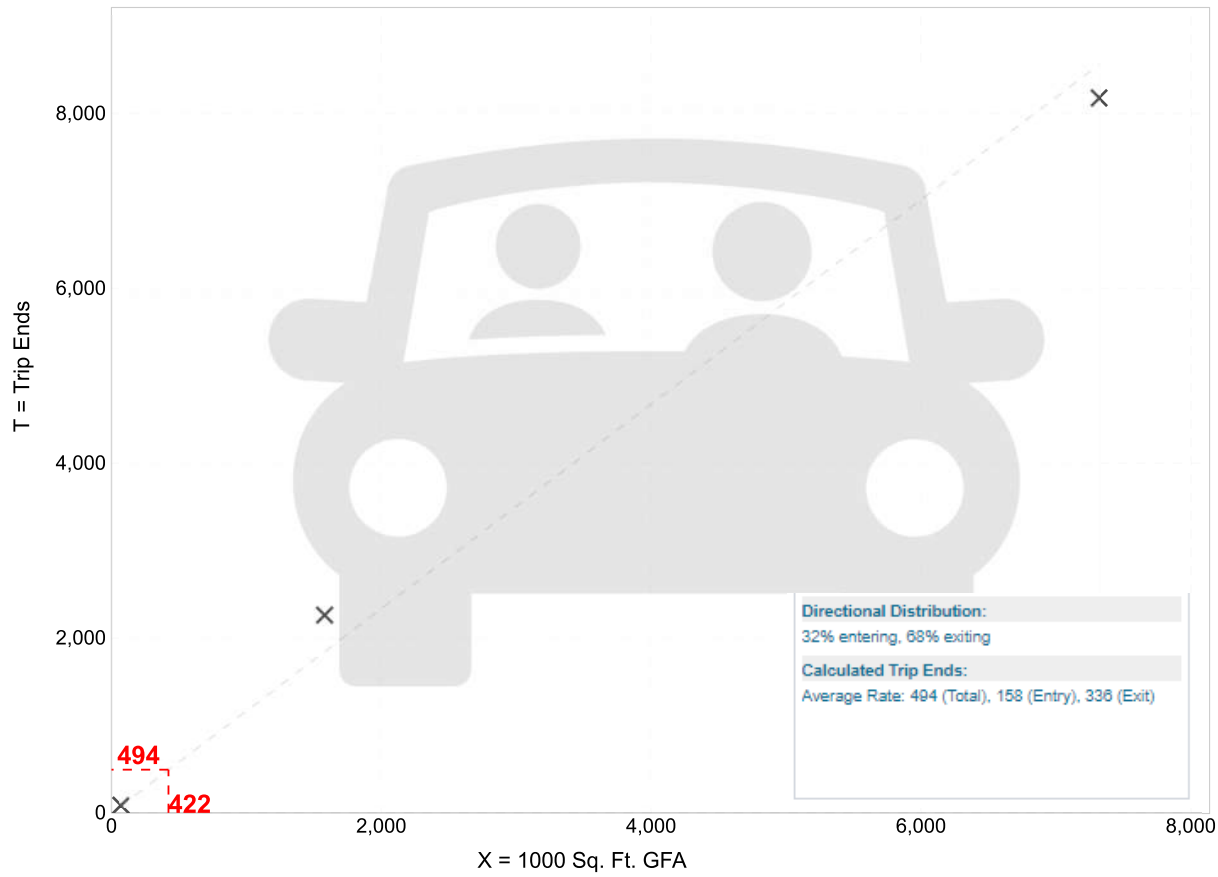
Data Plot and Equation

Caution – Small Sample Size



× **Study Site** — — — — **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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Data Plot and Equation

Caution – Small Sample Size

× **Study Site** - - - - **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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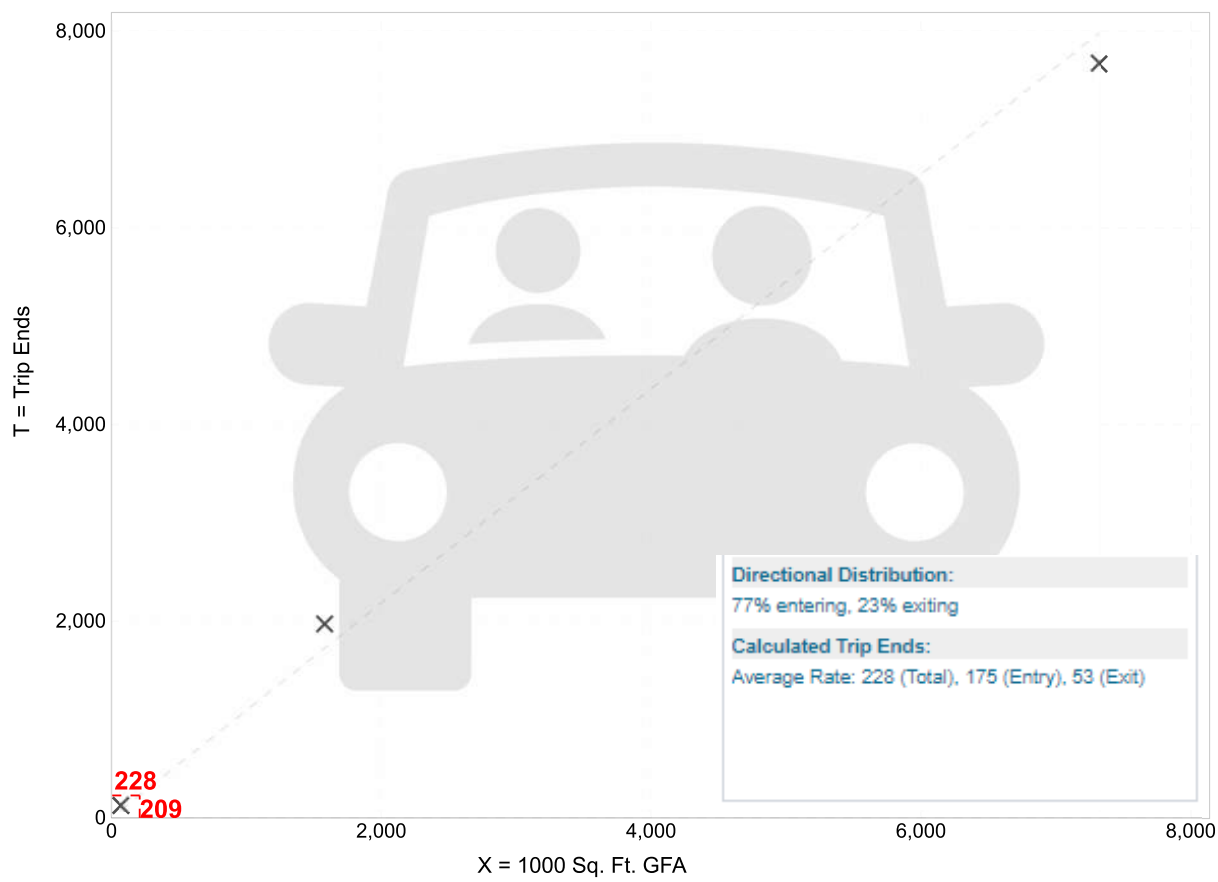

Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

University/College
(550)

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**
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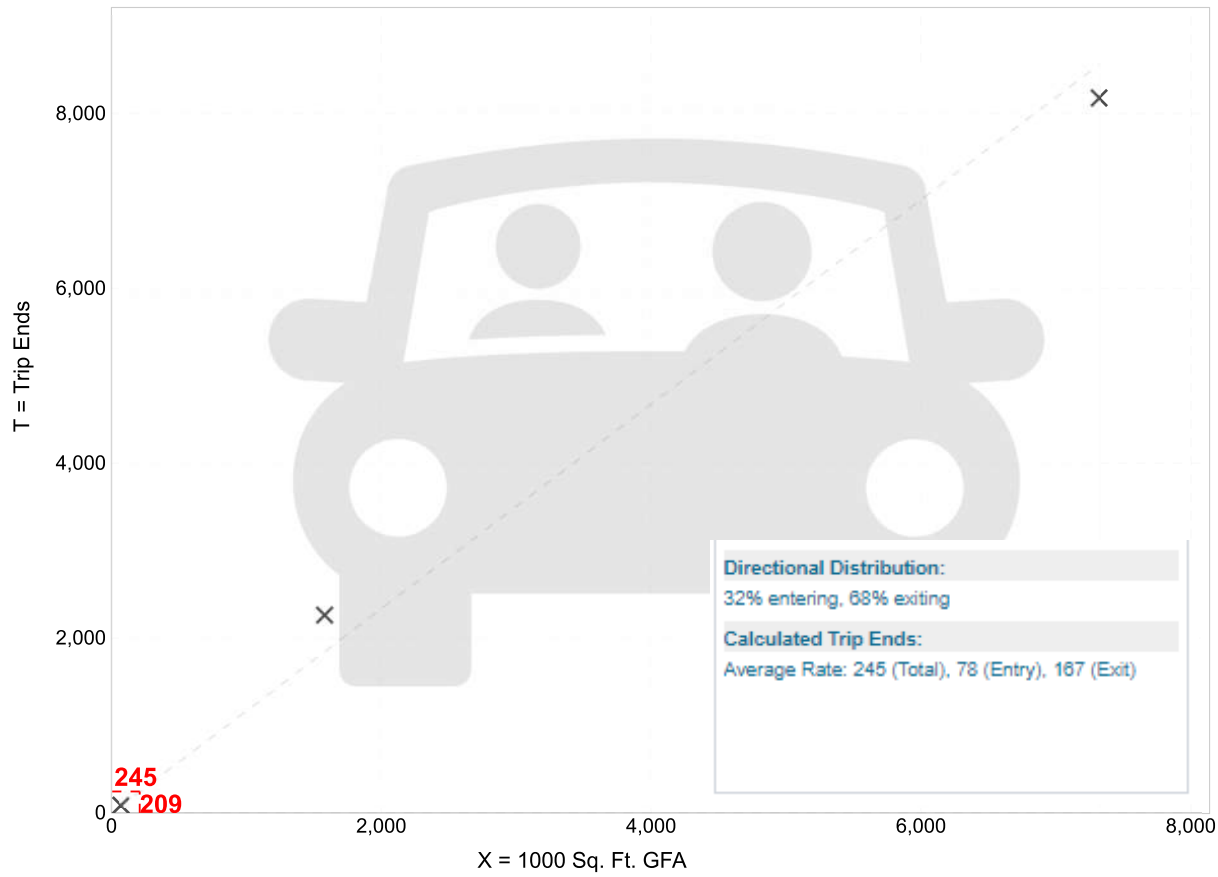

Study Site **Average Rate**

Fitted Curve Equation: Not Given **R^2= ******

APPENDIX D
Carnegie Mellon 2018 Parking Master Plan Highlights

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Carnegie Mellon University

Parking Study | 2018

- Ayers Saint Gross
- Brailsford & Dunlavey
- Fehr & Peers

November 2018

Campus Commute Patterns

Each icon represents a total of 100 individuals or parking spaces
Demographic Data sourced from www.cmu.edu/ira | Survey Data collected Spring 2018 by Fehr & Peers

How do you get to campus during the week?

- PARK ON CAMPUS (PERMIT HOLDERS, CMU OPERATED PAID LOTS, OR METERS)
- PARK OFF CAMPUS – *PER SURVEY DATA*

Arrive via alternative method:

- PUBLIC TRANS
- WALK
- BIKE
- CMU SHUTTLE
- RIDE HAILING
- OTHER

Calculating Parking Demand

Current Supply 3,081

Includes:

- *On-campus parking*
- *Leased spaces*
- *Metered spaces on Frew Street* (144)

2022 parking supply, less 144 metered spaces = 2,908

Demand 2,852

Includes:

- *On-campus observed demand*
- *Documented off-campus parking (from Survey)*
- *Waitlisted permit applications*

Parking Efficiency Rate : 90%

Demand = 90% of Recommended Supply

Recommended Supply 3,169

Current Deficit (88)

1. *Parking occupancy data collected on Monday, April 10th, 2017 and includes student parking and campus managed on-street parking*
2. *Documented off-campus parking calculated based on April 2018 employee survey response data*

APPENDIX E
Turning Movement Counts from Previous Studies

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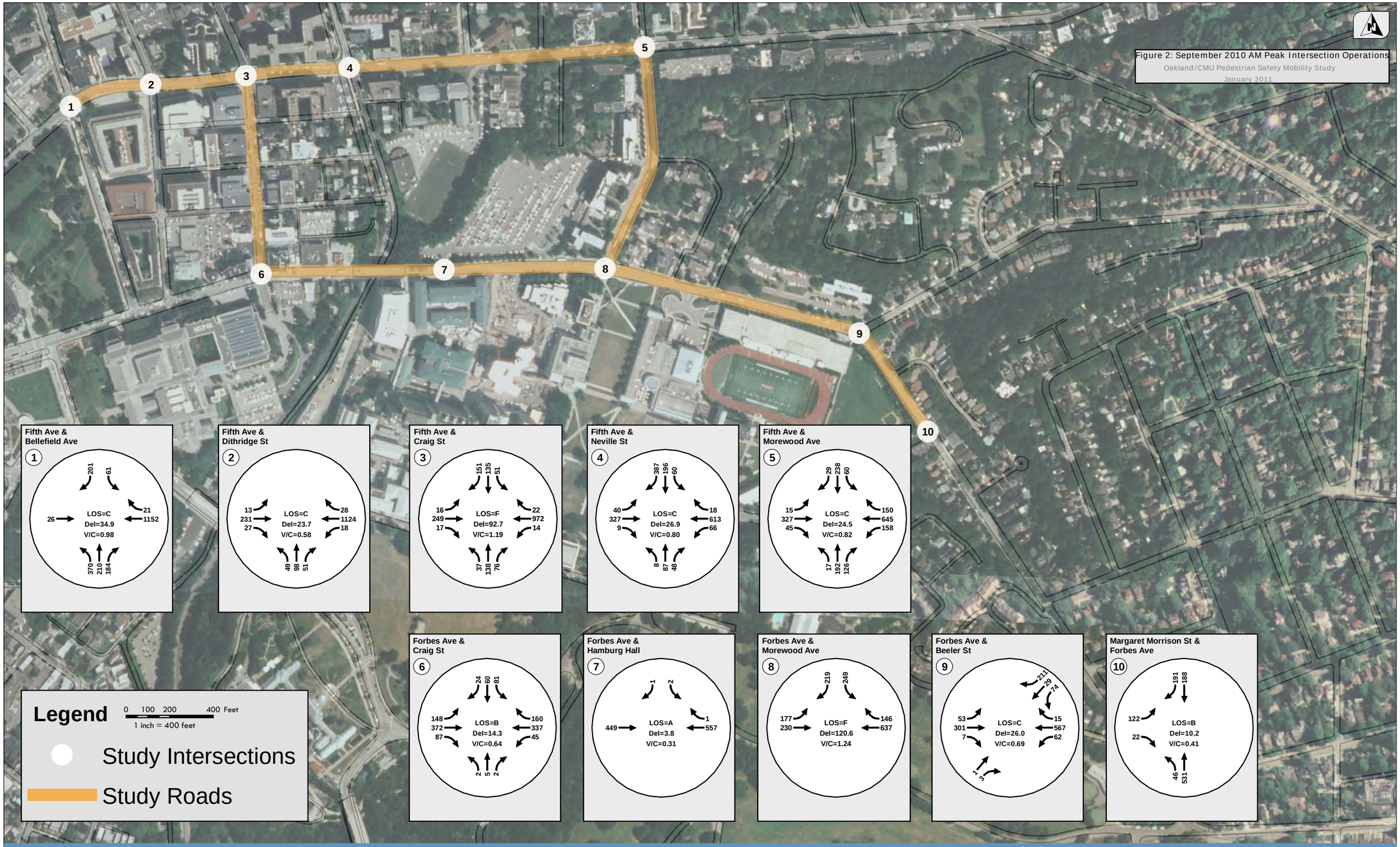


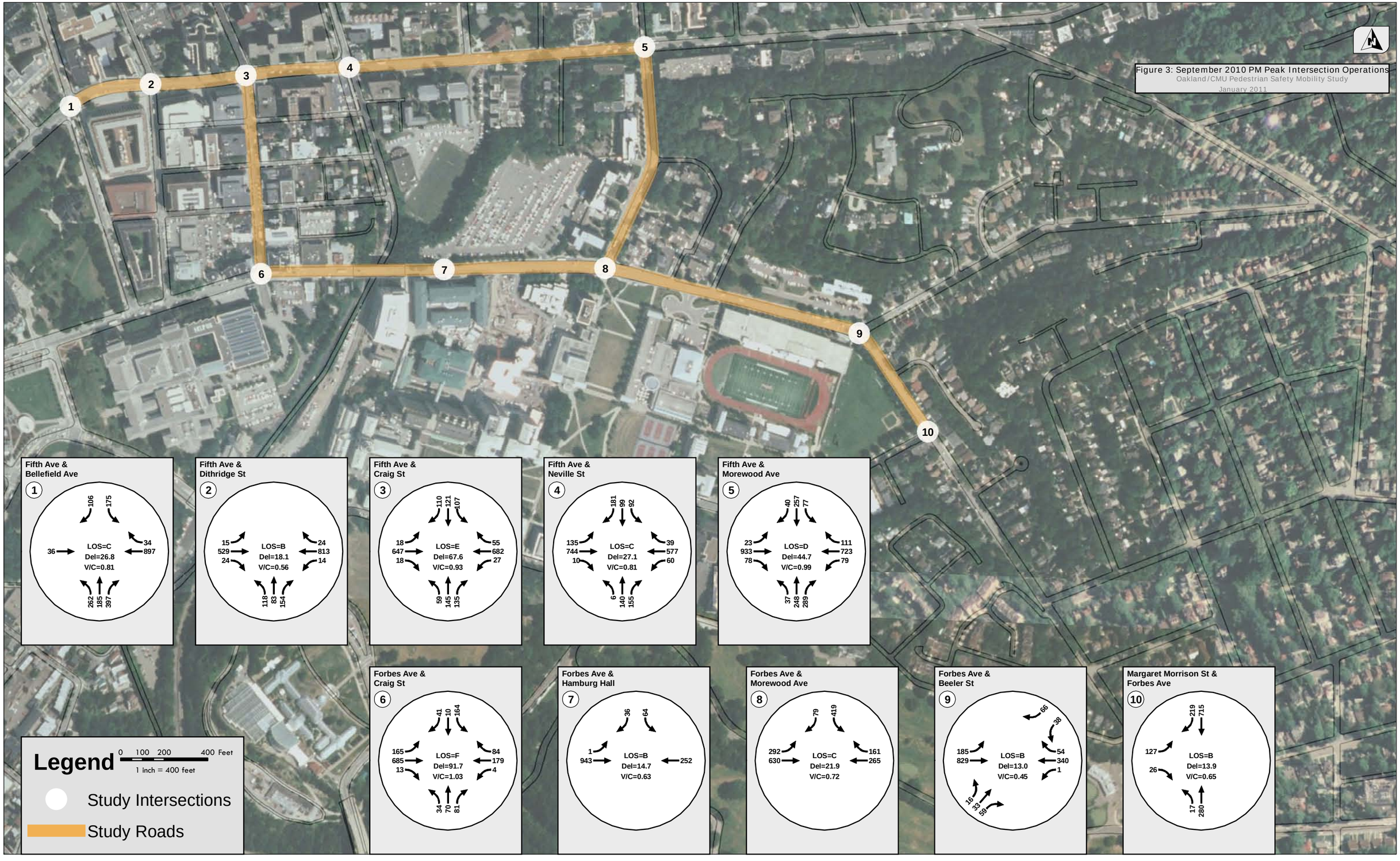
PCTI PENNSYLVANIA COMMUNITY TRANSPORTATION INITIATIVE

Oakland Transportation Management Association

Carnegie Mellon

KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING/PLANNING

gai consultants



PCTI PENNSYLVANIA COMMUNITY TRANSPORTATION INITIATIVE

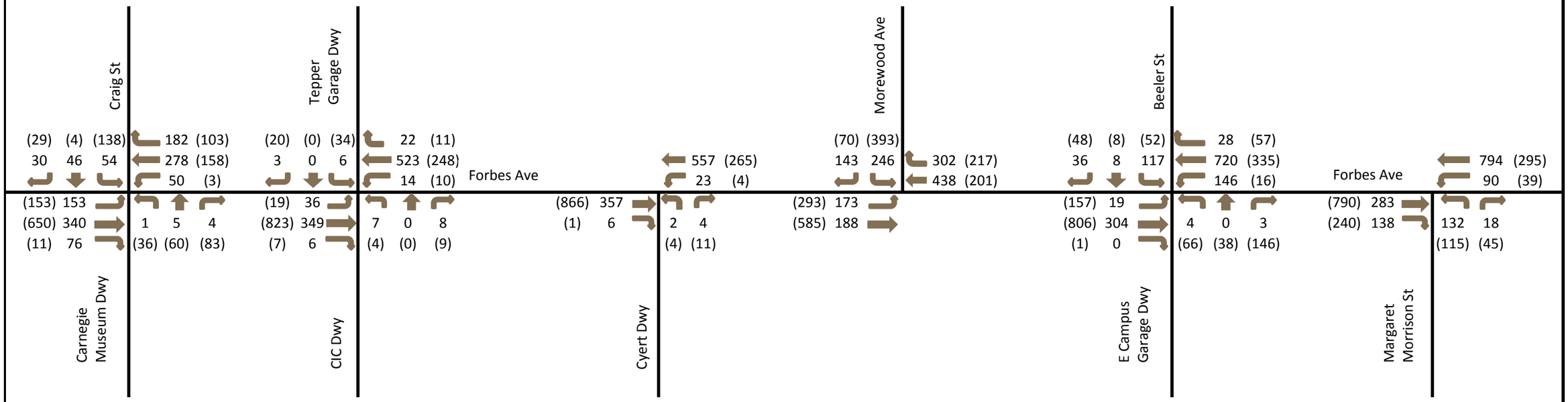
Kittelson & Associates, Inc. Transportation Engineering/Planning

gai consultants

Legend

123	- AM Peak Hour (8:00 AM - 9:00 AM)
(123)	- PM Peak Hour (4:45 PM - 5:45 PM)

0.25%	Growth Rate
2015	Existing Year
2021	Design Year
6	Growth Period (Years)
1.0150	Growth Factor



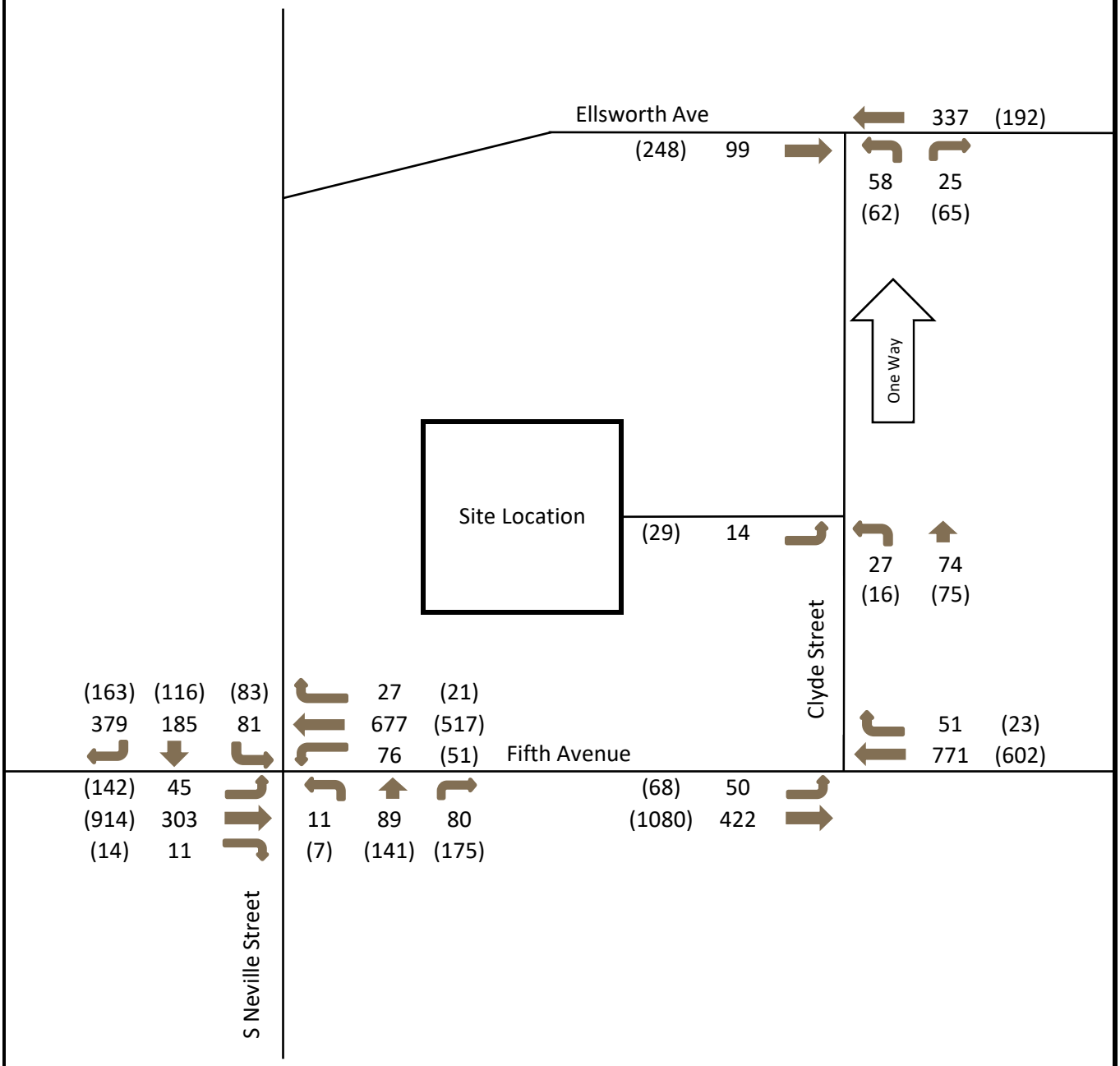
gai consultants
Pittsburgh Office
385 East Waterfront Drive
Homestead, PA 15120-5005
412-476-2000

CLIENT:	C101194.10 Carnegie Mellon University	DWN: TMW CHKD: MSG
PROJECT:	Forbes Avenue Reconfiguration Study City of Pittsburgh, Allegheny County	FIGURE
TITLE:	Design Year (2021) Peak Hour Volumes	14

SCALE: NTS

Legend

123 - AM Peak Hour (7:30 AM - 8:30 AM)
(123) - PM Peak Hour (4:45 PM - 5:45 PM)



gai consultants
Pittsburgh Office
385 East Waterfront Drive
Homestead, PA 15120-5005
412-476-2000

CLIENT:	C151305.00 Carnegie Mellon University	DWN: TMW CHKD. RAK
PROJECT:	Dearden Center / North of Fifth Development City of Pittsburgh, Allegheny County	FIGURE
TITLE:	Forecasted Opening Year (2018) Full Buildout with Development Peak Hour Volumes	16
	SCALE: NTS	

APPENDIX F
Level of Service Definitions

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Level of Service

Intersection levels of service (LOS) were determined through implementation of the methodology presented in the *Highway Capacity Manual* 2000 Edition, published by the Transportation Research Board.

Signalized Intersections

Signalized intersection level of service is described as follows:

"Level of service for signalized intersections is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, geometrics, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions. Specifically, level-of-service (LOS) criteria are stated in terms of the average control delay per vehicle, typically for a 15-minute analysis period. Delay is a complex measure and depends upon a number of variables, including the quality of progression, the cycle length, the green ratio, and the volume to capacity (v/c) ratio for the lane group.

LOS A describes operations with very low control delay, up to 10 seconds per vehicle. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths m ay tend to contribute to low delay values.

LOS B describes operations with control delay greater than 10 and up to 20 seconds per vehicle. This generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

LOS C describes operations with control delay greater than 20 and up to 35 seconds per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with control delay greater than 35 and up to 55 seconds per vehicle. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, and high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with control delay greater than 55 and up to 80 seconds per vehicle. These high delay values generally indicate poor progression, long cycle lengths and high v/c ratios. Individual cycle failures are frequent.

LOS F describes operations with control delay in excess of 80 seconds per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels."

Level of Service Criteria for Signalized Intersections

(Adapted from Figure 16-2, HCS 2000)

Level of Service	Control Delay per Vehicle (Sec)
A	≤ 10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 85
F	> 80

Unsignalized Intersections

Level of service for unsignalized intersections is determined by the computed or measured average control delay and is defined for each minor movement. The delay experienced by a motorist is made up of a number of factors that relate to control, geometrics, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during conditions with ideal geometrics and in the absence of traffic control, incidents, and congestion.

The LOS criteria for unsignalized intersections are somewhat different from the criteria use for signalized intersections primarily because different transportation facilities create different driver perceptions. The expectation is that a signalized intersection is designed to carry higher traffic volumes and experience greater delay than an unsignalized intersection.

Level of Service Criteria for Unsignalized Intersections

(Adapted from Figure 17-2 and 17-22, HCS 2000)

Level of Service	Control Delay per Vehicle (Sec)
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

APPENDIX G
Existing Traffic Signal Plans

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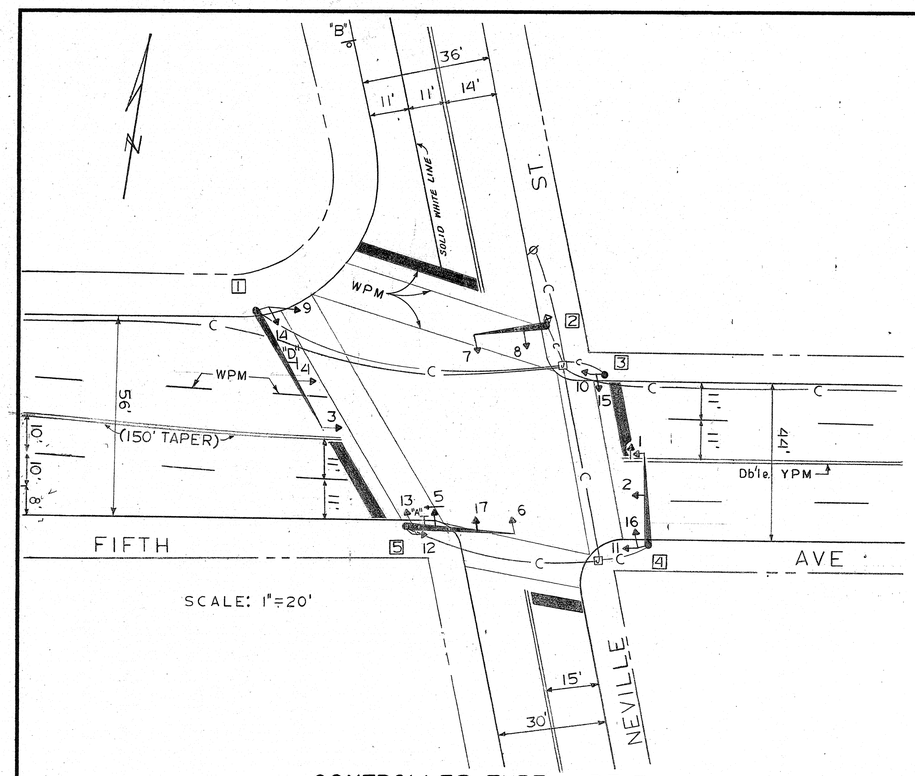
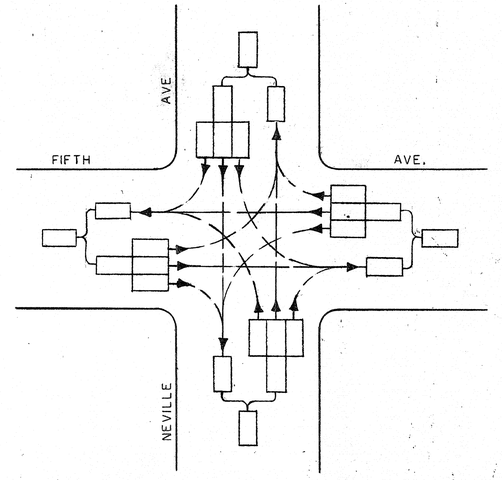


FLOW DIAGRAM



CABLE CHART

	RUN	NO. & SIZE OF CONDUCTORS	FROM	TO	FROM	TO	FROM	TO
1	12C#14	CC	SH1	SH2	SH2	SH11	SH11	SH16
2	12C#14	CC	SH3	SH3	SH4	SH4	SH9	
3		SH9	SH14					
4	12C#14	CC	SH5	SH5	SH17	SH17	SH6	
5		SH6	SH12	SH12	SH13			
6	9C#14	CC	SH7	SH7	SH8			
7	9C#14	CC	SH10	SH10	SH15			
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

MATERIALS LIST

(FOR INFORMATION ONLY)

LUMP SUM ITEM – CS-13

1 EA. CONTROLLER TYPE PT-3 3 DIAL INTERCONNECTED

LUMP SUM ITEM – CS-25
(MAST ARM SIGNAL INST.)

1 EA. SIGNAL UNIT 12" 4 SECTION R-Y-G-G ARROW MAST ARM MTG.

7 EA. SIGNAL UNIT 12" 3 SECTION R-Y-G MAST ARM MTG.

1 EA. SIGNAL UNIT 12" 5 SECTION R-Y-G-G ARROW-Y ARROW MAST ARM MTG.

8 EA. SIGNAL UNIT 12" 2 SECTION WK-DW SIDE OF POST MTG.

4 EA. TYPE I GALV. STEEL MAST ARM POLE - 21'

2 EA. TYPE I-L GALV. STEEL MAST ARM POLE - 32' W/8' LUMINAIRE ARM

1 EA. TYPE X GALV. STEEL POLE 15'

5 EA. POLE FOUNDATION

AS REQUIRED:

12 C #14 AWG. CABLE
2½" STEEL CONDUIT
MISC. HARDWARE
6" PLASTIC PVMT. MARKING (WHITE)
4" PLASTIC PVMT. MARKING (YELLOW/WHITE)

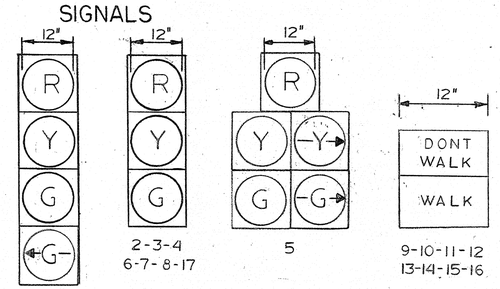
SIGNS:

1 EA. R10-10R 30" X 36"
1 EA. R3-7R 30" X 30"
1 EA. CHANNEL BAR
1 EA. R10-11 30" X 36"

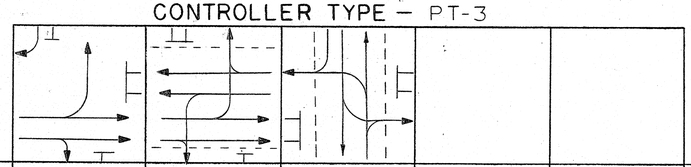
SIGNS

"A" — R10-10R
"B" — R7-R
"D" — R10-11

SIGNALS



CONTROLLER TYPE – PT-3



SIGNALS	PHASE A		PHASE B				PHASE C				PHASE						FLASH
	INTERVAL																
	1	2	3	4	5	6	7	8	9	10							
1	G	G	G	G	Y	R	R	R	R	R							Y
2	G	G	G	G	Y	R	R	R	R	R							Y
3-4	R	R	G	G	Y	R	R	R	R	R							Y
5	R	Y	R	R	R	R	G	G	Y	R							R
6-7-8-17	R	R	R	R	R	R	G	G	Y	R							R
9-10-11-12	DW	DW	FL WK	FL DW	DW	DW	DW	DW	DW	DW							OUT
13-14-15-16	DW	DW	DW	DW	DW	DW	FL WK	FL DW	DW	DW							OUT
DIAL 1 TIME	41.2	3	12.6	12	3.6	1.8	7.2	10.8	3	1.8							60
DIAL 1 DIAL SETT.	0	7	12	33	53	59	62	74	92	97	0						
DIAL 1 %	7	5	21	20	6	3	12	18	5	3							
DIAL 2 TIME	4.8	3.2	30.4	12	4	1.6	7.2	11.2	4	1.6							80
DIAL 2 DIAL SETT.	0	6	10	48	63	68	70	79	93	98	0						
DIAL 2 %	6	4	38	15	5	2	9	14	5	2							
DIAL 3 TIME	12.8	3.2	22.4	12	4	1.6	7.2	11.2	4	1.6							80
DIAL 3 DIAL SETT.	0	16	20	48	63	68	70	79	93	98	0						
DIAL 3 %	16	4	28	15	5	2	9	14	5	2							

LEGEND

- CONTROLLER
- SIGNAL
- MAST ARM
- —C— CONDUIT
- POLE NUMBER
- LOOP DETECTOR
- WOOD POLE
- STEEL POLE
- S SPLICE BOX
- J JUNCTION BOX
- PEDESTRIAN PUSH BUTTON
- YPM YELLOW PAV'T. MKNG.
- WPM WHITE PAV'T. MKNG.

POLE CHART

POLE NO.	POLE: TYPE	HEIGHT	WALL THK.	O.D.	ANCHOR BOLTS	SIGNAL BRACKET ON POLE: DIM "K"	DIM. "L"	MAST ARM: ARM DESIGNATION	DIM. "L"	DIM. "M"	DIM. "N"	DIM. "O"	LOCATION: STATION	OFFSET
1	I-L	32'	7GA	12"	1½" X 60"	10'	33"	A	38'	37.5	22'	17'	‡‡	
2	I	21'	7GA	9"	1¼" X 48"	10'	33"	A	20'	19.5	9'	—	*	
3	X	15'	7GA	7"	1¼" X 48"	10'	33"	—	—	—	—	—	*	
4	I-L	32'	7GA	10"	1½" X 60"	10'	33"	A	22'	21.5	10'	—	‡‡	
5	I	21'	7GA	11"	1½" X 60"	10'	33"	A	30'	29.5	18'	7'	*	
6	I	21'	7GA	9"	1¼" X 48"	—	—	A	16'	15'	—	—	*(140' E. POLE #4)	
7	I	21'	7GA	9"	1¼" X 48"	—	—	A	16	15	—	—	*(FIFTH-DEVONSHIRE)	

* — CONSTRUCT FDN. AT EXISTING INLAY
‡‡ — INSTALL ON EXISTING FDN.

FIELD DATA	DRAWN	SUPERV'SD.
BY		
VOL.		
CHECKED	INSPECT'D	CKD.-CONST.
CALC. BOOK	PG.	

REVISIONS

CHARACTER	DATE

APPROVED	DATE
ENGR.	
ENGR.	
W.J. Rodgers DESIGNER	7/26/77
A. Muscmarra CITY ENGR. D. P. W.	7-26-77
DIRECTOR	

TRAFFIC SIGNAL PLAN

CITY OF PITTSBURGH
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING

— INTERSECTION OF —

FIFTH AVE. — NEVILLE ST.

SCALES AS NOTED
DATE
SHEET NO. 4 OF 16
ACCESSION NO.
CASE NO.
** # 197-B

** THIS DWG. SUPERSEDES B.T.P. PRINT # 197

TS-308

E. DIETZGEN CO. P-3200-57

REFERENCE FOR C100485.00

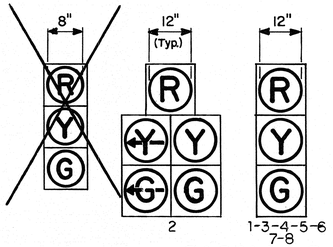
Sent by the City of Pittsburgh on June 11, 2010

PERMIT NO. _____ SHEET 1 OF 1

DATE ISSUED _____

LEGEND

- SIGNAL POLE W/MAST ARM
- SIGNAL STRAIN POLE
- PEDESTAL
- WOOD POLE
- VEHICULAR SIGNAL HEAD
- PEDESTRIAN SIGNAL HEAD
- SIGN
- PEDESTRIAN PUSH BUTTON
- PEDESTRIAN PUSH BUTTON/SIGN
- VEHICLE DETECTOR
- JUNCTION BOX
- SPLICE BOX
- CONTROLLER ASSEMBLY
- C/2½"- - CONDUIT/SIZE (Local Signal)
- W/4" - WHITE (Solid Line)/WIDTH
- BW/4" - BROKEN WHITE (Line)/WIDTH
- DY/4" - DOUBLE YELLOW (Solid Lines)/WIDTH
- C/2½"IC - CONDUIT SIZE (System) INTERCONNECT
- CATCH BASIN/INLET
- LUMINAIRE



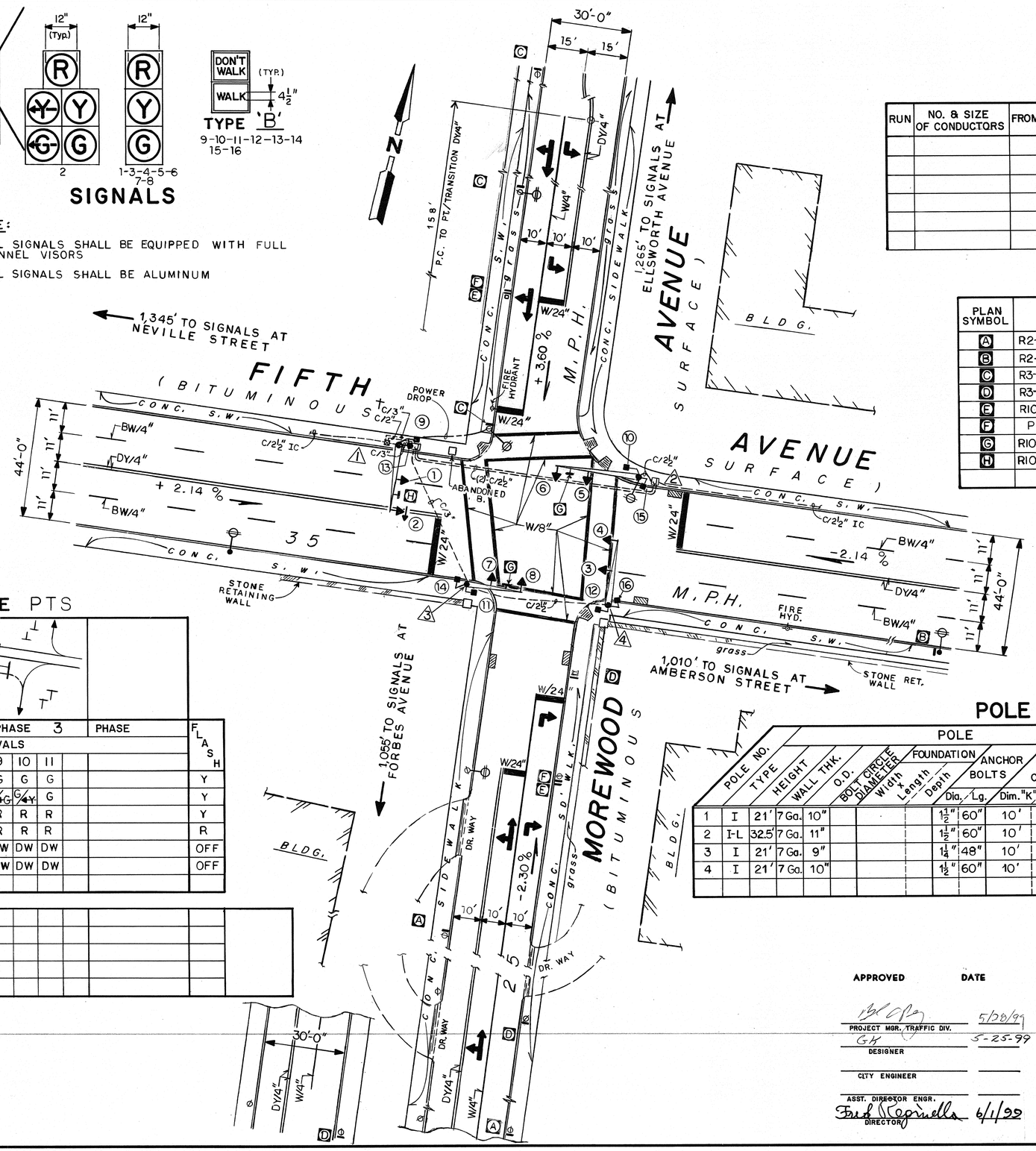
TYPE 'B'
9-10-11-12-13-14
15-16

SIGNALS

NOTE:

1.) ALL SIGNALS SHALL BE EQUIPPED WITH FULL TUNNEL VISORS

2.) ALL SIGNALS SHALL BE ALUMINUM



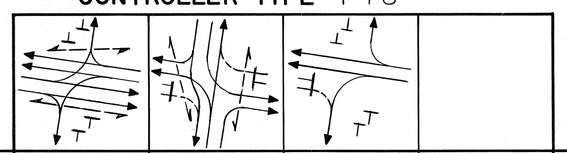
CABLE CHART

RUN	NO. & SIZE OF CONDUCTORS	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO

SIGNS

PLAN SYMBOL	DESCRIPTION	SIZE W x H	QUANTITY
A	R2-1, SPEED LIMIT 25	24"x30"	2
B	R2-1, SPEED LIMIT 35	24"x30"	1
C	R3-8LSR, LANE USE CONTROL	30"x30"	3
D	R3-8LSRB, LANE USE CONTROL	30"x30"	3
E	R10-6L, STOP HERE ON RED	24"x30"	2
F	PLAQUE LEFT LANE	24"x24"	2
G	R10-11, NO TURN ON RED	30"x36"	2
H	R10-12, LEFT TURN YIELD ON GREEN ●	30"x36"	1

CONTROLLER TYPE PTS



SIGNALS	PHASE 1				PHASE 2				PHASE 3			PHASE		FLASH
	INTERVALS													
	1	2	3	4	5	6	7	8	9	10	11			
1	G	G	Y	R	R	R	R	R	G	G	G			Y
2	G	G	Y	R	R	R	R	R	G/4G	G/4Y	G			Y
3-4	G	G	Y	R	R	R	R	R	R	R	R			Y
5-6-7-8	R	R	R	R	G	G	Y	R	R	R	R			R
9-10-11-12	W	FD	DW	DW	DW	DW	DW	DW	DW	DW	DW			OFF
13-14-15-16	DW	DW	DW	DW	W	FD	DW	DW	DW	DW	DW			OFF

POLE CHART

POLE NO.	TYPE	HEIGHT	WALL THK.	O.D.	BOLT CIRCLE DIAMETER	FOUNDATION Width x Length	FOUNDATION Depth	ANCHOR BOLTS Dia.	ANCHOR BOLTS Lg.	SIGNAL BRACKETS ON POLE Dim. "K"	SIGNAL BRACKETS ON POLE Dim. "J"	MAST ARM ARM DESIGNATION	MAST ARM DIM. "L"	MAST ARM DIM. "M"	MAST ARM DIM. "N"	MAST ARM DIM. "O"	LOCATION STATION	LOCATION OFFSET
1	I	21'	7 Ga.	10"				1½"	60"	10'	33"	A	24'	23.5'	12'			
2	I-L	32.5'	7 Ga.	11"				1½"	60"	10'	33"	A	30'	29.5'	18'			
3	I	21'	7 Ga.	9"				1¼"	48"	10'	33"	A	20'	19.5'	8'			
4	I	21'	7 Ga.	10"				1½"	60"	10'	33"	A	24'	23.5'	12'			

FIELD DATA	DRAWN	SUPERV'SD.
BY	C. TAYLOR	
VOL		
CHECKED	INSPECT'D.	CKD-CONST.
CALC. BOOK	PG.	

REVISIONS

CHARACTER	DATE
REMOVE POST MOUNTED CONTROLLER AND INSTALL BASE MOUNTED CONTROLLER INSTALL 2" AND 3" CONDUIT	

APPROVED DATE

PROJECT MGR. TRAFFIC DIV. — 5/28/99

DESIGNER — 5-25-99

CITY ENGINEER

ASST. DIRECTOR ENGR. DIRECTOR — 6/1/99

TRAFFIC SIGNAL PLAN

CITY OF PITTSBURGH
DEPARTMENT OF ENGINEERING AND CONSTRUCTION

— INTERSECTION OF —

FIFTH AVE.-MOREWOOD AVE.

SCALE: 1" = 20 FT.

DATE

TS-306

REFERENCE FOR C100485.00

Sent by the City of Pittsburgh on June 11, 2010

APPENDIX H
Capacity Calculations
2022 Existing Conditions

gai consultants
transforming ideas into reality®

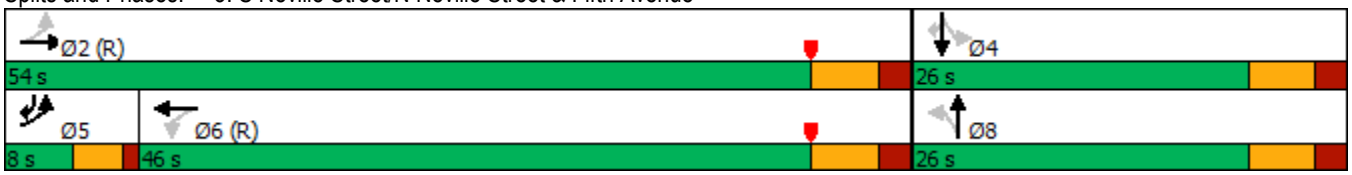
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	306	11	77	684	27	11	90	81	82	187	383
Future Volume (vph)	45	306	11	77	684	27	11	90	81	82	187	383
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	0		0	0		110
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	402	0	0	876	0	0	202	0	0	299	426
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.18	1.18	1.18	1.13	1.13	1.13
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Minimum Split (s)	8.0	54.0		38.0	38.0		26.0	26.0		26.0	26.0	8.0
Total Split (s)	8.0	54.0		46.0	46.0		26.0	26.0		26.0	26.0	8.0
Total Split (%)	10.0%	67.5%		57.5%	57.5%		32.5%	32.5%		32.5%	32.5%	10.0%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0			-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
v/c Ratio		0.27			0.64			0.54			0.94	0.92
Control Delay		7.6			10.7			31.5			70.0	51.7
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		7.6			10.7			31.5			70.0	51.7
Queue Length 50th (ft)		42			68			87			146	184
Queue Length 95th (ft)		63			118			153			#298	#331
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1482			1362			377			317	462
Starvation Cap Reductn		0			0			0			0	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.27			0.64			0.54			0.94	0.92

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow	
Natural Cycle: 80	
Control Type: Pretimed	

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	306	11	77	684	27	11	90	81	82	187	383
Future Volume (vph)	45	306	11	77	684	27	11	90	81	82	187	383
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0			5.0	3.0
Lane Util. Factor		0.95			0.95			1.00			1.00	1.00
Frpb, ped/bikes		1.00			1.00			0.96			1.00	0.96
Flpb, ped/bikes		1.00			0.99			1.00			0.99	1.00
Frt		1.00			0.99			0.94			1.00	0.85
Flt Protected		0.99			1.00			1.00			0.99	1.00
Satd. Flow (prot)		2964			3086			1476			1539	1322
Flt Permitted		0.80			0.86			0.97			0.77	1.00
Satd. Flow (perm)		2385			2658			1438			1210	1322
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	50	340	12	86	760	30	12	100	90	91	208	426
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	402	0	0	876	0	0	202	0	0	299	426
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		48.0			40.0			20.0			20.0	24.0
Effective Green, g (s)		49.0			41.0			21.0			21.0	26.0
Actuated g/C Ratio		0.61			0.51			0.26			0.26	0.32
Clearance Time (s)		6.0			6.0			6.0			6.0	4.0
Lane Grp Cap (vph)		1497			1362			377			317	429
v/s Ratio Prot		0.02										c0.06
v/s Ratio Perm		0.15			c0.33			0.14			0.25	0.26
v/c Ratio		0.27			0.64			0.54			0.94	0.99
Uniform Delay, d1		7.2			14.2			25.3			28.9	26.9
Progression Factor		1.00			0.62			1.00			1.00	1.00
Incremental Delay, d2		0.4			1.6			5.4			38.0	41.8
Delay (s)		7.6			10.5			30.7			66.9	68.7
Level of Service		A			B			C			E	E
Approach Delay (s)		7.6			10.5			30.7			67.9	
Approach LOS		A			B			C			E	

Intersection Summary			
HCM 2000 Control Delay	30.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		

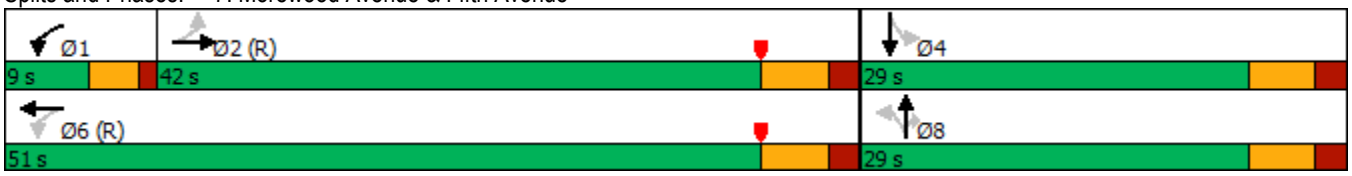
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	337	46	163	664	155	18	198	130	62	245	30
Future Volume (vph)	15	337	46	163	664	155	18	198	130	62	245	30
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	260		0	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	442	0	0	1091	0	0	240	144	69	305	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			10	
Link Offset(ft)		0			0			5			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Minimum Split (s)	26.0	26.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (s)	42.0	42.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (%)	52.5%	52.5%		11.3%	63.8%		36.3%	36.3%	36.3%	36.3%	36.3%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0			-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
v/c Ratio		0.34			0.80			0.51	0.43	0.32	0.64	
Control Delay		8.4			17.9			27.6	27.3	26.6	31.6	
Queue Delay		0.0			0.0			0.0	0.0	0.0	0.0	
Total Delay		8.4			17.9			27.6	27.3	26.6	31.6	
Queue Length 50th (ft)		35			164			98	57	26	131	
Queue Length 95th (ft)		m48			223			168	111	63	217	
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)										75		
Base Capacity (vph)		1287			1363			474	336	219	475	
Starvation Cap Reductn		0			0			0	0	0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn		0			0			0	0	0	0	
Storage Cap Reductn		0			0			0	0	0	0	
Reduced v/c Ratio		0.34			0.80			0.51	0.43	0.32	0.64	

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 68 (85%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow	
Natural Cycle: 80	
Control Type: Pretimed	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 7: Morewood Avenue & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	337	46	163	664	155	18	198	130	62	245	30
Future Volume (vph)	15	337	46	163	664	155	18	198	130	62	245	30
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.97			1.00	0.79	1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00	1.00	0.87	1.00	
Frt		0.98			0.98			1.00	0.85	1.00	0.98	
Flt Protected		1.00			0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3070			3072			1649	1123	1344	1585	
Flt Permitted		0.90			0.73			0.96	1.00	0.52	1.00	
Satd. Flow (perm)		2757			2270			1583	1123	733	1585	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	374	51	181	738	172	20	220	144	69	272	33
RTOR Reduction (vph)	0	12	0	0	19	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	430	0	0	1072	0	0	240	144	69	305	0
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		36.0			45.0			23.0	23.0	23.0	23.0	
Effective Green, g (s)		37.0			46.0			24.0	24.0	24.0	24.0	
Actuated g/C Ratio		0.46			0.58			0.30	0.30	0.30	0.30	
Clearance Time (s)		6.0			6.0			6.0	6.0	6.0	6.0	
Lane Grp Cap (vph)		1275			1365			474	336	219	475	
v/s Ratio Prot					c0.06						c0.19	
v/s Ratio Perm		0.16			c0.39			0.15	0.13	0.09		
v/c Ratio		0.34			0.79			0.51	0.43	0.32	0.64	
Uniform Delay, d1		13.7			13.2			23.1	22.5	21.6	24.3	
Progression Factor		0.59			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.7			4.6			3.8	4.0	3.7	6.5	
Delay (s)		8.7			17.8			26.9	26.4	25.4	30.8	
Level of Service		A			B			C	C	C	C	
Approach Delay (s)		8.7			17.8			26.8			29.8	
Approach LOS		A			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		

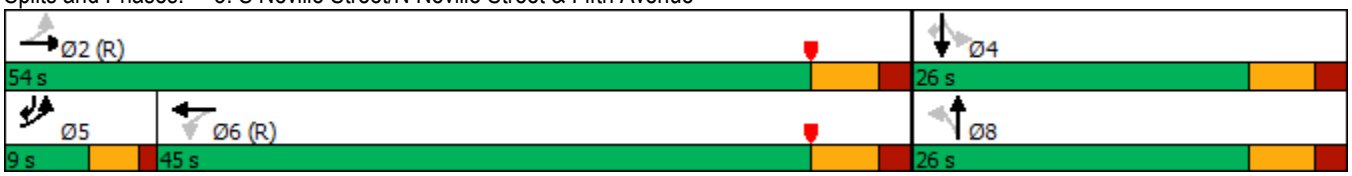
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	143	923	14	52	522	21	7	142	177	84	117	165
Future Volume (vph)	143	923	14	52	522	21	7	142	177	84	117	165
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	0		0	0		110
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1201	0	0	661	0	0	343	0	0	223	183
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.18	1.18	1.18	1.13	1.13	1.13
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Minimum Split (s)	8.0	54.0		38.0	38.0		26.0	26.0		26.0	26.0	8.0
Total Split (s)	9.0	54.0		45.0	45.0		26.0	26.0		26.0	26.0	9.0
Total Split (%)	11.3%	67.5%		56.3%	56.3%		32.5%	32.5%		32.5%	32.5%	11.3%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0			-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
v/c Ratio		0.87			0.56			0.89			0.99	0.39
Control Delay		20.8			11.5			56.4			90.0	19.8
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		20.8			11.5			56.4			90.0	19.8
Queue Length 50th (ft)		176			61			165			111	62
Queue Length 95th (ft)		#253			m95			#317			#249	112
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1385			1189			384			226	473
Starvation Cap Reductn		0			0			0			0	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.87			0.56			0.89			0.99	0.39

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow	
Natural Cycle: 90	
Control Type: Pretimed	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	143	923	14	52	522	21	7	142	177	84	117	165
Future Volume (vph)	143	923	14	52	522	21	7	142	177	84	117	165
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0			5.0	3.0
Lane Util. Factor		0.95			0.95			1.00			1.00	1.00
Frpb, ped/bikes		1.00			0.99			0.95			1.00	0.95
Flpb, ped/bikes		1.00			1.00			1.00			0.99	1.00
Frt		1.00			0.99			0.93			1.00	0.85
Flt Protected		0.99			1.00			1.00			0.98	1.00
Satd. Flow (prot)		3164			3132			1475			1650	1308
Flt Permitted		0.69			0.76			0.99			0.51	1.00
Satd. Flow (perm)		2185			2379			1464			861	1308
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Adj. Flow (vph)	159	1026	16	58	580	23	8	158	177	93	130	183
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1201	0	0	661	0	0	343	0	0	223	183
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		48.0			39.0			20.0			20.0	25.0
Effective Green, g (s)		49.0			40.0			21.0			21.0	27.0
Actuated g/C Ratio		0.61			0.50			0.26			0.26	0.34
Clearance Time (s)		6.0			6.0			6.0			6.0	4.0
Lane Grp Cap (vph)		1411			1189			384			226	441
v/s Ratio Prot		c0.06										0.03
v/s Ratio Perm		c0.46			0.28			0.23			c0.26	0.11
v/c Ratio		0.85			0.56			0.89			0.99	0.41
Uniform Delay, d1		12.5			13.8			28.4			29.4	20.4
Progression Factor		1.00			0.74			1.00			1.00	1.00
Incremental Delay, d2		6.6			1.0			25.6			56.6	2.9
Delay (s)		19.2			11.3			54.0			85.9	23.3
Level of Service		B			B			D			F	C
Approach Delay (s)		19.2			11.3			54.0			57.7	
Approach LOS		B			B			D			E	

Intersection Summary			
HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	104.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

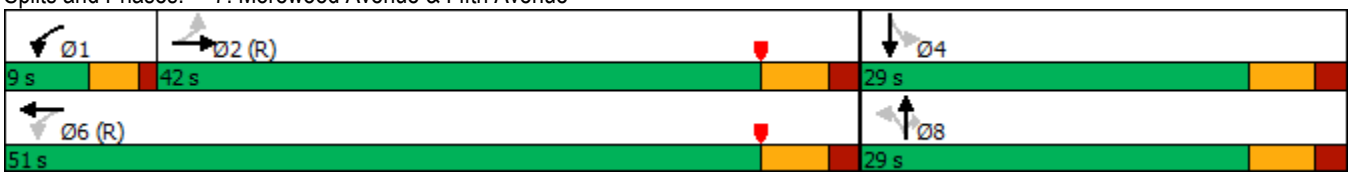
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	961	80	81	745	114	38	255	298	79	265	41
Future Volume (vph)	24	961	80	81	745	114	38	255	298	79	265	41
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	260		0	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1184	0	0	1045	0	0	325	331	88	340	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			10	
Link Offset(ft)		0			0			5			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Minimum Split (s)	26.0	26.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (s)	42.0	42.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (%)	52.5%	52.5%		11.3%	63.8%		36.3%	36.3%	36.3%	36.3%	36.3%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0			-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
v/c Ratio		0.90			0.85			0.81	0.92	0.50	0.72	
Control Delay		27.2			21.5			44.5	61.8	34.6	35.2	
Queue Delay		0.0			0.0			0.0	0.0	0.0	0.0	
Total Delay		27.2			21.5			44.5	61.8	34.6	35.2	
Queue Length 50th (ft)		211			154			150	159	36	151	
Queue Length 95th (ft)		m#293			#224			#288	#317	85	#266	
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)										75		
Base Capacity (vph)		1313			1227			399	358	177	474	
Starvation Cap Reductn		0			0			0	0	0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn		0			0			0	0	0	0	
Storage Cap Reductn		0			0			0	0	0	0	
Reduced v/c Ratio		0.90			0.85			0.81	0.92	0.50	0.72	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 71 (89%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 80
Control Type: Pretimed
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Morewood Avenue & Fifth Avenue



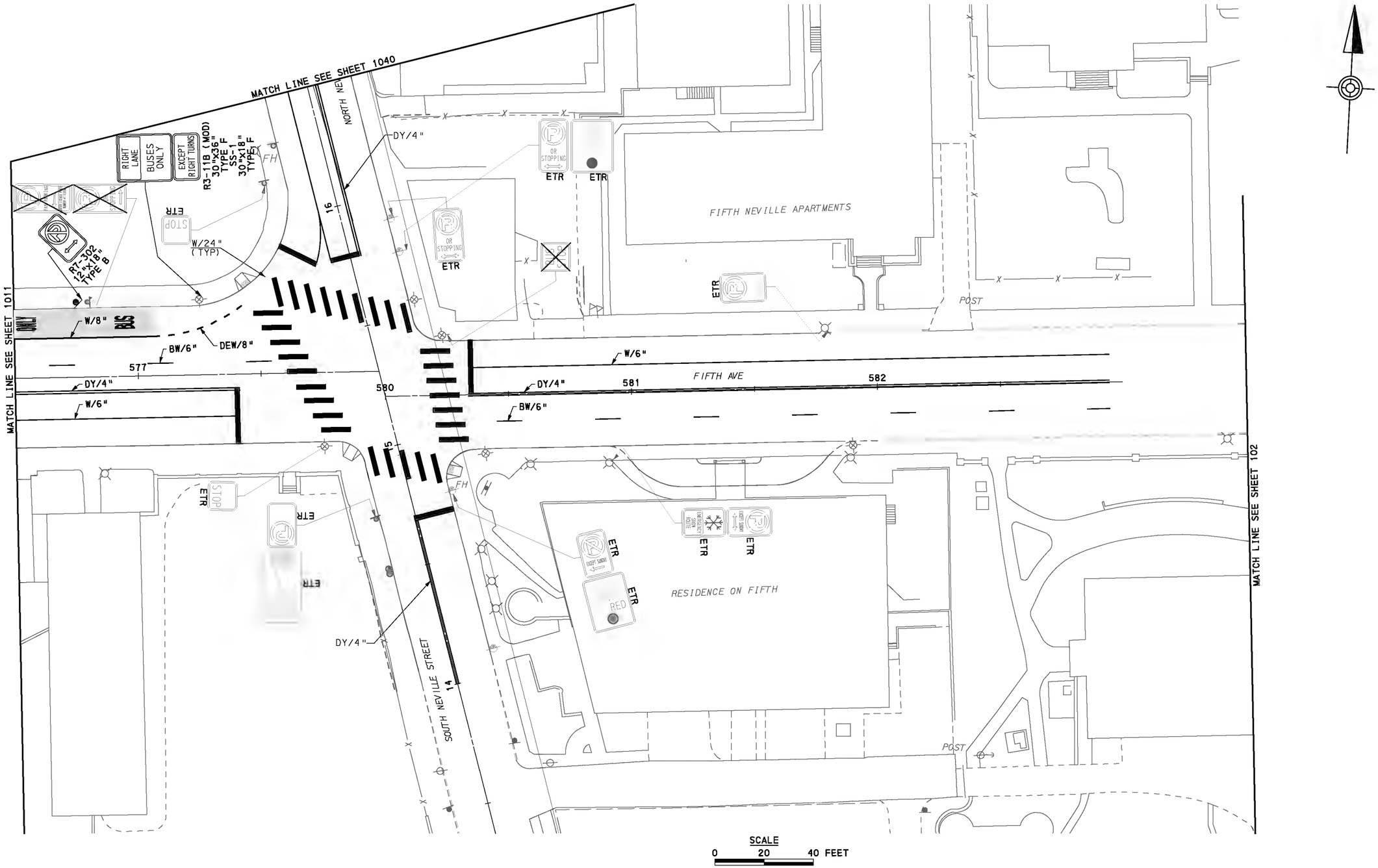
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	961	80	81	745	114	38	255	298	79	265	41
Future Volume (vph)	24	961	80	81	745	114	38	255	298	79	265	41
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.99			1.00	0.84	1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00	1.00	0.93	1.00	
Frt		0.99			0.98			1.00	0.85	1.00	0.98	
Flt Protected		1.00			1.00			0.99	1.00	0.95	1.00	
Satd. Flow (prot)		3102			3167			1645	1194	1433	1579	
Flt Permitted		0.91			0.63			0.80	1.00	0.39	1.00	
Satd. Flow (perm)		2823			2009			1331	1194	591	1579	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	27	1068	89	90	828	127	42	283	331	88	294	46
RTOR Reduction (vph)	0	8	0	0	14	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1176	0	0	1031	0	0	325	331	88	340	0
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		36.0			45.0			23.0	23.0	23.0	23.0	
Effective Green, g (s)		37.0			46.0			24.0	24.0	24.0	24.0	
Actuated g/C Ratio		0.46			0.58			0.30	0.30	0.30	0.30	
Clearance Time (s)		6.0			6.0			6.0	6.0	6.0	6.0	
Lane Grp Cap (vph)		1305			1242			399	358	177	473	
v/s Ratio Prot					c0.06						0.22	
v/s Ratio Perm		c0.42			0.42			0.24	c0.28	0.15		
v/c Ratio		0.90			0.83			0.81	0.92	0.50	0.72	
Uniform Delay, d1		19.8			13.8			25.9	27.1	23.0	25.0	
Progression Factor		1.07			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		5.1			6.5			16.5	31.8	9.6	9.1	
Delay (s)		26.4			20.4			42.5	58.9	32.7	34.1	
Level of Service		C			C			D	E	C	C	
Approach Delay (s)		26.4			20.4			50.8			33.8	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	30.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX I
Proposed Intersection Plans with Bus Rapid Transit

gai consultants
transforming ideas into reality®



FOR CONSTRUCTION PLAN SEE SHEET 588

AECOM
Gulf Tower
707 Grant Street
5th Floor
Pittsburgh, PA 15219

NO.	DATE	DESCRIPTION

REVISIONS

THE PREPARATION OF THIS DOCUMENT HAS BEEN FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL TRANSIT ADMINISTRATION, U.S. DEPARTMENT OF TRANSPORTATION, UNDER THE URBAN MASS TRANSPORTATION ACT OF 1964, AS AMENDED, FOR THE PORT AUTHORITY OF ALLEGHENY COUNTY, PENNSYLVANIA.

100% DESIGN SUBMITTAL

(NOT FOR CONSTRUCTION)

SIGNATURE

APPROVED

DESIGNED	AJR
DRAWN	FJC
CHECKED	BFS
IN CHARGE	JKM
DATE	09/29/20
SCALE	AS SHOWN

PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH PENNSYLVANIA

BUS RAPID TRANSIT ROADWAY
SIGNING & PAVEMENT MARKING PLANS
FIFTH AVE - STA 576+50 TO STA 583+00

Port Authority
connecting people to life

CONTRACT NO. BRT-001

DWG. NO. SN84 SHT. 1012

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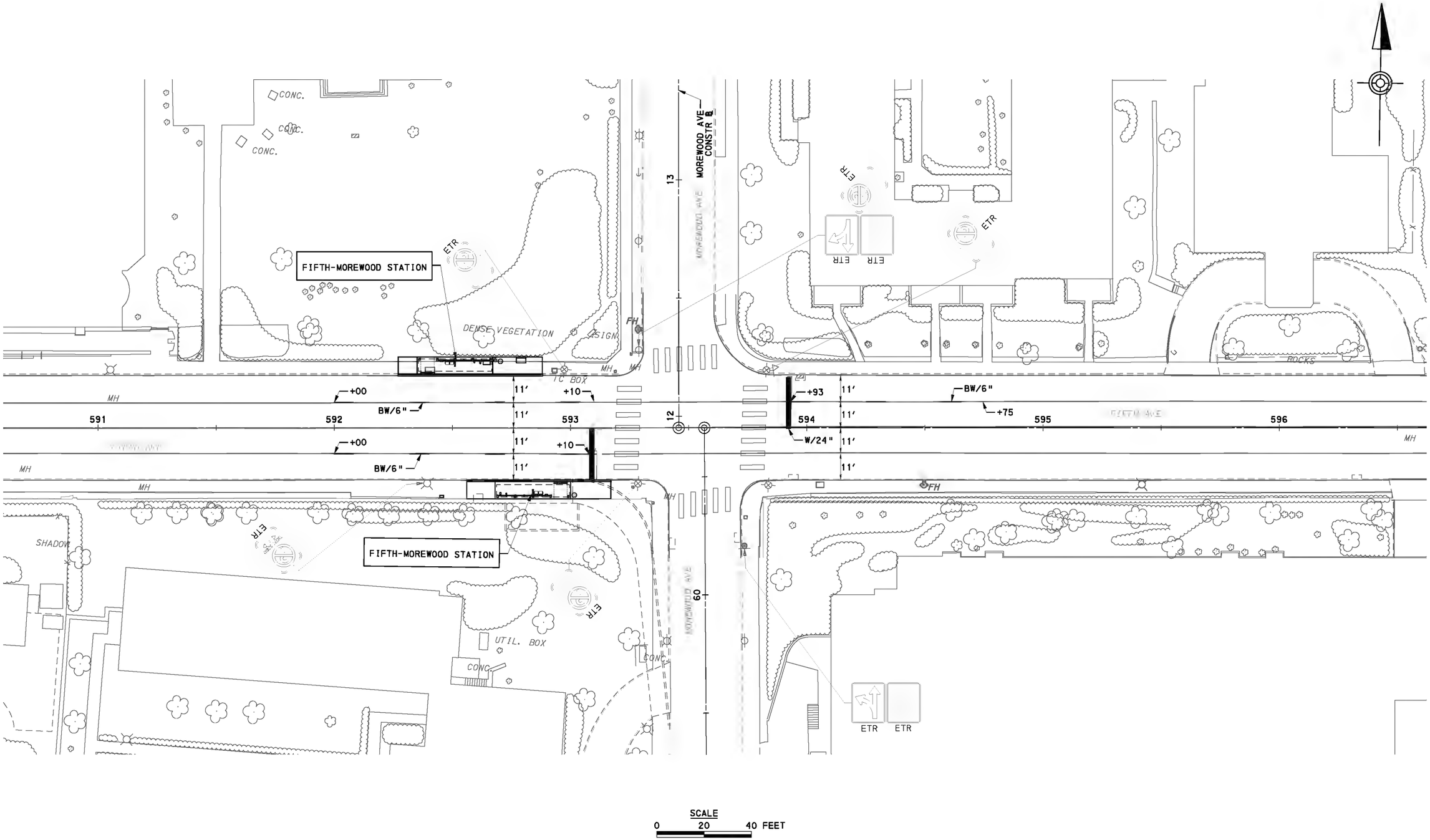

SCALE
0 20 40 FEET

FOR CONSTRUCTION PLAN SEE SHEET 616

AECOM
Gulf Tower
707 Grant Street
5th Floor
Pittsburgh, PA 15219

Prepared by:
MARKOSKY
3689 Route 711
Ligonier, PA 15658
THE MARKOSKY ENGINEERING GROUP, INC.

NO.	DATE	DESCRIPTION

REVISIONS

THE PREPARATION OF THIS DOCUMENT HAS BEEN FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL TRANSIT ADMINISTRATION, U.S. DEPARTMENT OF TRANSPORTATION, UNDER THE URBAN MASS TRANSPORTATION ACT OF 1964, AS AMENDED, FOR THE PORT AUTHORITY OF ALLEGHENY COUNTY, PENNSYLVANIA.

100% DESIGN SUBMITTAL

(NOT FOR CONSTRUCTION)

SIGNATURE

APPROVED

DESIGNED	LMS
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DATE	09/29/20
SCALE	AS SHOWN

PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH PENNSYLVANIA

BUS RAPID TRANSIT ROADWAY
SIGNING & PAVEMENT MARKING PLANS
FIFTH-MOREWOOD STATION

Port Authority
connecting people to life

CONTRACT NO. BRT-001

DWG. NO. SN113 SHT. 1041

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APPENDIX J
Capacity Calculations
2032 Forecasted Master Plan Year without Development

gai consultants
transforming ideas into reality®

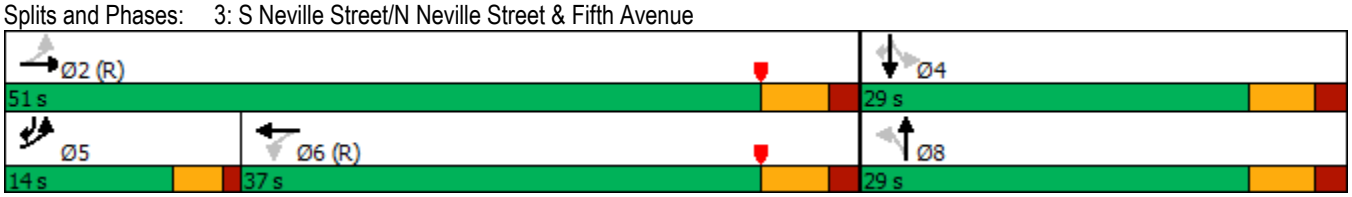
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	314	11	79	701	28	11	92	83	84	192	393
Future Volume (vph)	46	314	11	79	701	28	11	92	83	84	192	393
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	0		0	0		110
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	412	0	0	898	0	0	206	0	0	306	437
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.18	1.18	1.18	1.13	1.13	1.13
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase												
Minimum Initial (s)	4.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	4.0
Minimum Split (s)	8.0	27.0		27.0	27.0		22.0	22.0		22.0	22.0	8.0
Total Split (s)	14.0	51.0		37.0	37.0		29.0	29.0		29.0	29.0	14.0
Total Split (%)	17.5%	63.8%		46.3%	46.3%		36.3%	36.3%		36.3%	36.3%	17.5%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0			-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	C-Min		C-Min	C-Min		None	None		None	None	None
v/c Ratio		0.28			0.76			0.51			0.88	0.79
Control Delay		8.6			17.3			28.7			55.5	29.1
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		8.6			17.3			28.7			55.5	29.1
Queue Length 50th (ft)		48			88			83			141	165
Queue Length 95th (ft)		72			#313			148			#279	253

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1461			1179			431			369	590
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.28			0.76			0.48			0.83	0.74

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 12 (15%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	314	11	79	701	28	11	92	83	84	192	393
Future Volume (vph)	46	314	11	79	701	28	11	92	83	84	192	393
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0			5.0	3.0
Lane Util. Factor		0.95			0.95			1.00			1.00	1.00
Frpb, ped/bikes		1.00			1.00			0.96			1.00	0.97
Flpb, ped/bikes		1.00			0.99			1.00			0.99	1.00
Frt		1.00			0.99			0.94			1.00	0.85
Flt Protected		0.99			1.00			1.00			0.99	1.00
Satd. Flow (prot)		2965			3086			1476			1539	1329
Flt Permitted		0.80			0.85			0.97			0.79	1.00
Satd. Flow (perm)		2375			2645			1439			1232	1329
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	51	349	12	88	779	31	12	102	92	93	213	437
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	412	0	0	898	0	0	206	0	0	306	437
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		46.5			34.7			21.5			21.5	29.3
Effective Green, g (s)		47.5			35.7			22.5			22.5	31.3
Actuated g/C Ratio		0.59			0.45			0.28			0.28	0.39
Clearance Time (s)		6.0			6.0			6.0			6.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0			3.0	3.0
Lane Grp Cap (vph)		1475			1180			404			346	519
v/s Ratio Prot		0.03										c0.09
v/s Ratio Perm		0.14			c0.34			0.14			c0.25	0.24
v/c Ratio		0.28			0.76			0.51			0.88	0.84
Uniform Delay, d1		7.9			18.6			24.1			27.5	22.1
Progression Factor		1.00			0.65			1.00			1.00	1.00
Incremental Delay, d2		0.1			3.5			1.0			22.5	11.8
Delay (s)		8.0			15.6			25.1			50.0	33.9
Level of Service		A			B			C			D	C
Approach Delay (s)		8.0			15.6			25.1			40.5	
Approach LOS		A			B			C			D	

Intersection Summary			
HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	345	47	167	681	159	18	203	133	64	251	31
Future Volume (vph)	15	345	47	167	681	159	18	203	133	64	251	31
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	260		0	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	452	0	0	1120	0	0	246	148	71	313	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			10	
Link Offset(ft)		0			0			5			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		1	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		5.0	14.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	25.0	25.0		9.0	25.0		25.0	25.0	25.0	25.0	25.0	
Total Split (s)	45.0	45.0		9.0	54.0		26.0	26.0	26.0	26.0	26.0	
Total Split (%)	56.3%	56.3%		11.3%	67.5%		32.5%	32.5%	32.5%	32.5%	32.5%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0			-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Min	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio		0.26			0.74			0.69	0.54	0.44	0.80	
Control Delay		6.1			14.0			38.2	33.8	34.4	45.3	
Queue Delay		0.0			0.0			0.0	0.0	0.0	0.0	
Total Delay		6.1			14.0			38.2	33.8	34.4	45.3	
Queue Length 50th (ft)		28			190			107	62	29	141	
Queue Length 95th (ft)		m43			268			188	121	70	#263	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)										75		
Base Capacity (vph)		1753			1518			383	297	174	419	
Starvation Cap Reductn		0			0			0	0	0	0	
Spillback Cap Reductn		0			0			0	0	0	0	
Storage Cap Reductn		0			0			0	0	0	0	
Reduced v/c Ratio		0.26			0.74			0.64	0.50	0.41	0.75	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Morewood Avenue & Fifth Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	345	47	167	681	159	18	203	133	64	251	31
Future Volume (vph)	15	345	47	167	681	159	18	203	133	64	251	31
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.97			1.00	0.79	1.00	0.99	
Flpb, ped/bikes		1.00			0.99			1.00	1.00	0.87	1.00	
Frt		0.98			0.98			1.00	0.85	1.00	0.98	
Flt Protected		1.00			0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3072			3065			1650	1123	1352	1585	
Flt Permitted		0.90			0.77			0.88	1.00	0.47	1.00	
Satd. Flow (perm)		2770			2374			1451	1123	662	1585	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	383	52	186	757	177	20	226	148	71	279	34
RTOR Reduction (vph)	0	9	0	0	19	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	443	0	0	1102	0	0	246	148	71	313	0
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		49.4			49.4			18.6	18.6	18.6	18.6	
Effective Green, g (s)		50.4			50.4			19.6	19.6	19.6	19.6	
Actuated g/C Ratio		0.63			0.63			0.25	0.25	0.25	0.25	
Clearance Time (s)		6.0			6.0			6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1745			1495			355	275	162	388	
v/s Ratio Prot											c0.20	
v/s Ratio Perm		0.16			c0.46			0.17	0.13	0.11		
v/c Ratio		0.25			0.74			0.69	0.54	0.44	0.81	
Uniform Delay, d1		6.5			10.2			27.5	26.3	25.5	28.4	
Progression Factor		0.88			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			1.9			5.8	2.0	1.9	11.6	
Delay (s)		6.1			12.1			33.2	28.3	27.4	40.0	
Level of Service		A			B			C	C	C	D	
Approach Delay (s)		6.1			12.1			31.4			37.7	
Approach LOS		A			B			C			D	

Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

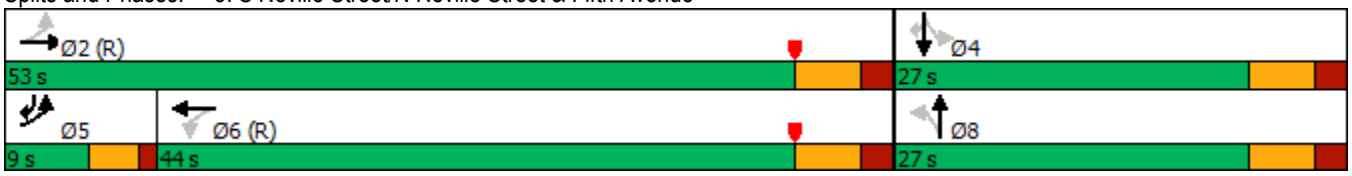
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	143	923	14	52	522	21	7	142	177	84	117	165
Future Volume (vph)	143	923	14	52	522	21	7	142	177	84	117	165
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	0		0	0		110
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1201	0	0	661	0	0	343	0	0	223	183
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.18	1.18	1.18	1.13	1.13	1.13
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase												
Minimum Initial (s)	4.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	4.0
Minimum Split (s)	8.0	27.0		27.0	27.0		25.0	25.0		25.0	25.0	8.0
Total Split (s)	9.0	53.0		44.0	44.0		27.0	27.0		27.0	27.0	9.0
Total Split (%)	11.3%	66.3%		55.0%	55.0%		33.8%	33.8%		33.8%	33.8%	11.3%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0			-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	C-Min		C-Min	C-Min		None	None		None	None	None
v/c Ratio		0.88			0.56			0.88			0.94	0.38
Control Delay		22.1			7.7			52.9			78.3	19.2
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		22.1			7.7			52.9			78.3	19.2
Queue Length 50th (ft)		183			78			162			108	60
Queue Length 95th (ft)		#276			m88			#307			#241	109

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1370			1176			402			242	480
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.88			0.56			0.85			0.92	0.38

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 21 (26%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 70
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	143	923	14	52	522	21	7	142	177	84	117	165
Future Volume (vph)	143	923	14	52	522	21	7	142	177	84	117	165
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0			5.0	3.0
Lane Util. Factor		0.95			0.95			1.00			1.00	1.00
Frpb, ped/bikes		1.00			0.99			0.95			1.00	0.95
Flpb, ped/bikes		1.00			1.00			1.00			0.99	1.00
Frt		1.00			0.99			0.93			1.00	0.85
Flt Protected		0.99			1.00			1.00			0.98	1.00
Satd. Flow (prot)		3164			3132			1475			1650	1308
Flt Permitted		0.68			0.76			0.99			0.52	1.00
Satd. Flow (perm)		2179			2378			1464			881	1308
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Adj. Flow (vph)	159	1026	16	58	580	23	8	158	177	93	130	183
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1201	0	0	661	0	0	343	0	0	223	183
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		47.6			38.6			20.4			20.4	25.4
Effective Green, g (s)		48.6			39.6			21.4			21.4	27.4
Actuated g/C Ratio		0.61			0.50			0.27			0.27	0.34
Clearance Time (s)		6.0			6.0			6.0			6.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0			3.0	3.0
Lane Grp Cap (vph)		1397			1177			391			235	447
v/s Ratio Prot		c0.06										0.03
v/s Ratio Perm		c0.46			0.28			0.23			c0.25	0.11
v/c Ratio		0.86			0.56			0.88			0.95	0.41
Uniform Delay, d1		12.9			14.1			28.0			28.8	20.1
Progression Factor		1.00			0.45			1.00			1.00	1.00
Incremental Delay, d2		5.5			1.1			19.3			44.1	0.6
Delay (s)		18.4			7.5			47.3			72.9	20.7
Level of Service		B			A			D			E	C
Approach Delay (s)		18.4			7.5			47.3			49.4	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	103.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

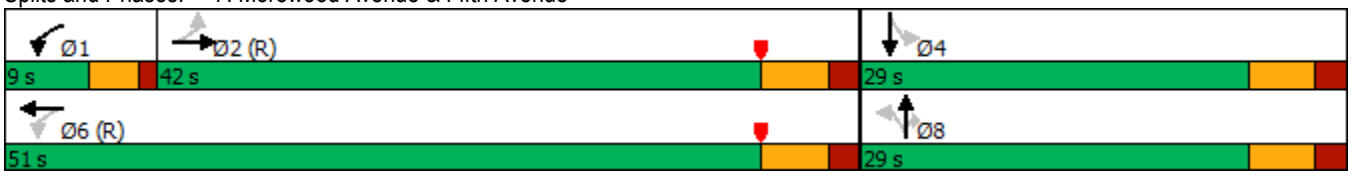
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	961	80	81	745	114	38	255	298	79	265	41
Future Volume (vph)	24	961	80	81	745	114	38	255	298	79	265	41
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	260		0	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1184	0	0	1045	0	0	325	331	88	340	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			10	
Link Offset(ft)		0			0			5			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		1	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		5.0	15.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	26.0	26.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (s)	42.0	42.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (%)	52.5%	52.5%		11.3%	63.8%		36.3%	36.3%	36.3%	36.3%	36.3%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0			-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Min	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio		0.72			0.82			0.84	0.94	0.51	0.73	
Control Delay		16.7			20.4			46.9	64.4	35.4	35.8	
Queue Delay		0.0			0.0			0.0	0.0	0.0	0.0	
Total Delay		16.7			20.4			46.9	64.4	35.4	35.8	
Queue Length 50th (ft)		270			198			150	159	36	151	
Queue Length 95th (ft)		m319			#302			#290	#317	85	#266	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)										75		
Base Capacity (vph)		1644			1267			394	358	175	474	
Starvation Cap Reductn		0			0			0	0	0	0	
Spillback Cap Reductn		0			0			0	0	0	0	
Storage Cap Reductn		0			0			0	0	0	0	
Reduced v/c Ratio		0.72			0.82			0.82	0.92	0.50	0.72	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 72 (90%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Morewood Avenue & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	961	80	81	745	114	38	255	298	79	265	41
Future Volume (vph)	24	961	80	81	745	114	38	255	298	79	265	41
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.99			1.00	0.84	1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00	1.00	0.93	1.00	
Frt		0.99			0.98			1.00	0.85	1.00	0.98	
Flt Protected		1.00			1.00			0.99	1.00	0.95	1.00	
Satd. Flow (prot)		3102			3162			1645	1194	1433	1579	
Flt Permitted		0.91			0.68			0.79	1.00	0.39	1.00	
Satd. Flow (perm)		2830			2161			1316	1194	585	1579	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	27	1068	89	90	828	127	42	283	331	88	294	46
RTOR Reduction (vph)	0	6	0	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1178	0	0	1032	0	0	325	331	88	340	0
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		45.3			45.3			22.7	22.7	22.7	22.7	
Effective Green, g (s)		46.3			46.3			23.7	23.7	23.7	23.7	
Actuated g/C Ratio		0.58			0.58			0.30	0.30	0.30	0.30	
Clearance Time (s)		6.0			6.0			6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1637			1250			389	353	173	467	
v/s Ratio Prot											0.22	
v/s Ratio Perm		0.42			c0.48			0.25	c0.28	0.15		
v/c Ratio		0.72			0.83			0.84	0.94	0.51	0.73	
Uniform Delay, d1		12.2			13.6			26.3	27.4	23.3	25.3	
Progression Factor		1.23			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.3			4.6			14.3	31.9	2.3	5.6	
Delay (s)		16.3			18.2			40.7	59.3	25.7	30.9	
Level of Service		B			B			D	E	C	C	
Approach Delay (s)		16.3			18.2			50.1			29.8	
Approach LOS		B			B			D			C	

Intersection Summary			
HCM 2000 Control Delay	25.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX K
2032 Forecasted Master Plan Year with Development Without Transportation Demand Management Mitigation

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	302	26	140	701	28	22	100	126	86	203	420
Future Volume (vph)	54	302	26	140	701	28	22	100	126	86	203	420
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	0		0	0		110
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	425	0	0	966	0	0	275	0	0	322	467
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.18	1.18	1.18	1.13	1.13	1.13
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase												
Minimum Initial (s)	4.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	4.0
Minimum Split (s)	8.0	27.0		27.0	27.0		22.0	22.0		22.0	22.0	8.0
Total Split (s)	11.0	51.0		40.0	40.0		29.0	29.0		29.0	29.0	11.0
Total Split (%)	13.8%	63.8%		50.0%	50.0%		36.3%	36.3%		36.3%	36.3%	13.8%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0			-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	C-Min		C-Min	C-Min		None	None		None	None	None
v/c Ratio		0.33			0.90			0.67			0.94	0.84
Control Delay		9.2			25.7			34.0			66.7	34.1
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		9.2			25.7			34.0			66.7	34.1
Queue Length 50th (ft)		51			139			119			155	182
Queue Length 95th (ft)		75			m#354			204			#312	#298

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1297			1069			415			345	559
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.33			0.90			0.66			0.93	0.84

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 10 (13%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 75
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	302	26	140	701	28	22	100	126	86	203	420
Future Volume (vph)	54	302	26	140	701	28	22	100	126	86	203	420
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0			5.0	3.0
Lane Util. Factor		0.95			0.95			1.00			1.00	1.00
Frpb, ped/bikes		0.99			1.00			0.96			1.00	0.97
Flpb, ped/bikes		1.00			0.99			1.00			0.99	1.00
Frt		0.99			1.00			0.93			1.00	0.85
Flt Protected		0.99			0.99			1.00			0.99	1.00
Satd. Flow (prot)		2919			3070			1450			1545	1327
Flt Permitted		0.73			0.78			0.95			0.73	1.00
Satd. Flow (perm)		2143			2426			1383			1149	1327
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	60	336	29	156	779	31	24	111	140	96	226	467
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	425	0	0	966	0	0	275	0	0	322	467
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		45.3			34.3			22.7			22.7	29.7
Effective Green, g (s)		46.3			35.3			23.7			23.7	31.7
Actuated g/C Ratio		0.58			0.44			0.30			0.30	0.40
Clearance Time (s)		6.0			6.0			6.0			6.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0			3.0	3.0
Lane Grp Cap (vph)		1317			1070			409			340	525
v/s Ratio Prot		0.03										c0.09
v/s Ratio Perm		0.15			c0.40			0.20			c0.28	0.26
v/c Ratio		0.32			0.90			0.67			0.95	0.89
Uniform Delay, d1		8.7			20.8			24.7			27.5	22.5
Progression Factor		1.00			0.71			1.00			1.00	1.00
Incremental Delay, d2		0.1			9.1			4.3			34.8	16.7
Delay (s)		8.9			23.9			29.1			62.3	39.2
Level of Service		A			C			C			E	D
Approach Delay (s)		8.9			23.9			29.1			48.6	
Approach LOS		A			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	93.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	388	60	209	690	159	18	235	172	64	267	34
Future Volume (vph)	15	388	60	209	690	159	18	235	172	64	267	34
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	260		0	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	515	0	0	1176	0	0	281	191	71	335	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			10	
Link Offset(ft)		0			0			5			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		1	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		5.0	15.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	25.0	25.0		9.0	25.0		25.0	25.0	25.0	25.0	25.0	
Total Split (s)	46.0	46.0		9.0	55.0		25.0	25.0	25.0	25.0	25.0	
Total Split (%)	57.5%	57.5%		11.3%	68.8%		31.3%	31.3%	31.3%	31.3%	31.3%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0			-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Min	C-Min		None	C-Max		None	None	None	None	None	
v/c Ratio		0.29			0.82			0.86	0.70	0.51	0.87	
Control Delay		3.7			17.1			54.9	43.3	40.5	54.1	
Queue Delay		0.0			0.0			0.0	0.0	0.0	0.0	
Total Delay		3.7			17.1			54.9	43.3	40.5	54.1	
Queue Length 50th (ft)		26			206			133	86	30	160	
Queue Length 95th (ft)		m38			311			#264	#179	#78	#301	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)										75		
Base Capacity (vph)		1757			1440			338	280	143	395	
Starvation Cap Reductn		0			0			0	0	0	0	
Spillback Cap Reductn		0			0			0	0	0	0	
Storage Cap Reductn		0			0			0	0	0	0	
Reduced v/c Ratio		0.29			0.82			0.83	0.68	0.50	0.85	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 70
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Morewood Avenue & Fifth Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	388	60	209	690	159	18	235	172	64	267	34
Future Volume (vph)	15	388	60	209	690	159	18	235	172	64	267	34
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.97			1.00	0.79	1.00	0.99	
Flpb, ped/bikes		1.00			0.99			1.00	1.00	0.88	1.00	
Frt		0.98			0.98			1.00	0.85	1.00	0.98	
Flt Protected		1.00			0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3057			3066			1652	1123	1370	1583	
Flt Permitted		0.90			0.73			0.82	1.00	0.40	1.00	
Satd. Flow (perm)		2763			2252			1355	1123	576	1583	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	431	67	232	767	177	20	261	191	71	297	38
RTOR Reduction (vph)	0	11	0	0	16	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	504	0	0	1160	0	0	281	191	71	335	0
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		49.6			49.6			18.4	18.4	18.4	18.4	
Effective Green, g (s)		50.6			50.6			19.4	19.4	19.4	19.4	
Actuated g/C Ratio		0.63			0.63			0.24	0.24	0.24	0.24	
Clearance Time (s)		6.0			6.0			6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1747			1424			328	272	139	383	
v/s Ratio Prot											c0.21	
v/s Ratio Perm		0.18			c0.52			0.21	0.17	0.12		
v/c Ratio		0.29			0.81			0.86	0.70	0.51	0.87	
Uniform Delay, d1		6.6			11.1			29.0	27.7	26.2	29.1	
Progression Factor		0.52			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4			3.7			19.2	8.0	3.1	19.3	
Delay (s)		3.8			14.9			48.2	35.6	29.3	48.5	
Level of Service		A			B			D	D	C	D	
Approach Delay (s)		3.8			14.9			43.1			45.1	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

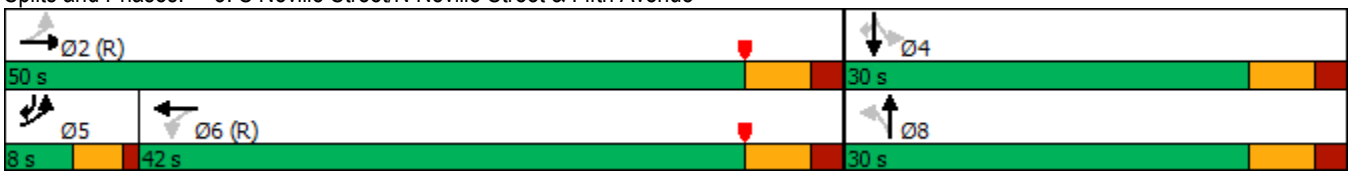
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	162	951	20	75	530	22	7	192	252	85	170	169
Future Volume (vph)	162	951	20	75	530	22	7	192	252	85	170	169
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	0		0	0		110
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1259	0	0	696	0	0	473	0	0	283	188
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.18	1.18	1.18	1.13	1.13	1.13
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase												
Minimum Initial (s)	4.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	4.0
Minimum Split (s)	8.0	27.0		27.0	27.0		25.0	25.0		25.0	25.0	8.0
Total Split (s)	8.0	50.0		42.0	42.0		30.0	30.0		30.0	30.0	8.0
Total Split (%)	10.0%	62.5%		52.5%	52.5%		37.5%	37.5%		37.5%	37.5%	10.0%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0			-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	C-Min		C-Min	C-Min		None	None		None	None	None
v/c Ratio		1.05			0.73			1.04			1.02	0.36
Control Delay		59.4			7.0			82.1			89.7	17.3
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		59.4			7.0			82.1			89.7	17.3
Queue Length 50th (ft)		~245			67			~259			~145	59
Queue Length 95th (ft)		#427			m66			#437			#299	106

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1199			956			456			278	521
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		1.05			0.73			1.04			1.02	0.36

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 26 (33%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 100
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	162	951	20	75	530	22	7	192	252	85	170	169
Future Volume (vph)	162	951	20	75	530	22	7	192	252	85	170	169
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0			5.0	3.0
Lane Util. Factor		0.95			0.95			1.00			1.00	1.00
Frpb, ped/bikes		1.00			0.99			0.95			1.00	0.95
Flpb, ped/bikes		1.00			1.00			1.00			0.99	1.00
Frt		1.00			0.99			0.93			1.00	0.85
Flt Protected		0.99			0.99			1.00			0.98	1.00
Satd. Flow (prot)		3155			3128			1470			1672	1304
Flt Permitted		0.65			0.66			0.99			0.52	1.00
Satd. Flow (perm)		2065			2067			1461			890	1304
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Adj. Flow (vph)	180	1057	22	83	589	24	8	213	252	94	189	188
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1259	0	0	696	0	0	473	0	0	283	188
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		44.0			36.0			24.0			24.0	28.0
Effective Green, g (s)		45.0			37.0			25.0			25.0	30.0
Actuated g/C Ratio		0.56			0.46			0.31			0.31	0.38
Clearance Time (s)		6.0			6.0			6.0			6.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0			3.0	3.0
Lane Grp Cap (vph)		1229			955			456			278	489
v/s Ratio Prot		c0.06										0.02
v/s Ratio Perm		c0.51			0.34			c0.32			0.32	0.12
v/c Ratio		1.02			0.73			1.04			1.02	0.38
Uniform Delay, d1		17.5			17.4			27.5			27.5	18.3
Progression Factor		1.00			0.36			1.00			1.00	1.00
Incremental Delay, d2		32.1			0.5			52.1			58.7	0.5
Delay (s)		49.6			6.8			79.6			86.2	18.8
Level of Service		D			A			E			F	B
Approach Delay (s)		49.6			6.8			79.6			59.3	
Approach LOS		D			A			E			E	

Intersection Summary			
HCM 2000 Control Delay	45.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	114.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

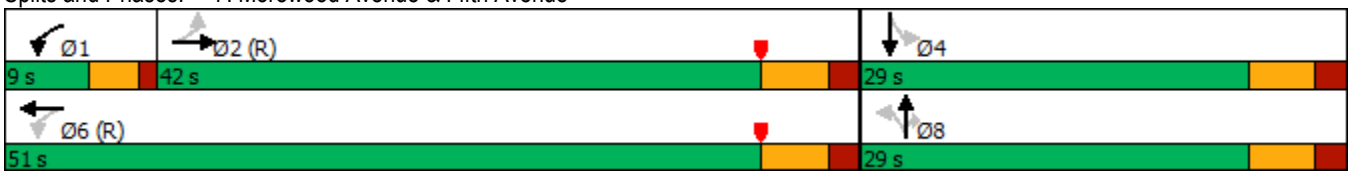
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	1023	85	110	786	117	34	269	321	81	290	42
Future Volume (vph)	45	1023	85	110	786	117	34	269	321	81	290	42
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	260		0	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1281	0	0	1125	0	0	337	357	90	369	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			10	
Link Offset(ft)		0			0			5			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		1	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		5.0	15.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	26.0	26.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (s)	42.0	42.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (%)	52.5%	52.5%		11.3%	63.8%		36.3%	36.3%	36.3%	36.3%	36.3%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0			-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Min	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio		0.84			1.03			0.87	1.00	0.53	0.78	
Control Delay		17.9			54.8			51.9	78.1	37.0	39.0	
Queue Delay		0.0			0.0			0.0	0.0	0.0	0.0	
Total Delay		17.9			54.8			51.9	78.1	37.0	39.0	
Queue Length 50th (ft)		292			~318			159	177	37	167	
Queue Length 95th (ft)		m276			#445			#309	#348	#96	#302	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)										75		
Base Capacity (vph)		1527			1090			386	358	169	474	
Starvation Cap Reductn		0			0			0	0	0	0	
Spillback Cap Reductn		0			0			0	0	0	0	
Storage Cap Reductn		0			0			0	0	0	0	
Reduced v/c Ratio		0.84			1.03			0.87	1.00	0.53	0.78	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 90
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Morewood Avenue & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	1023	85	110	786	117	34	269	321	81	290	42
Future Volume (vph)	45	1023	85	110	786	117	34	269	321	81	290	42
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.99			1.00	0.84	1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00	1.00	0.93	1.00	
Frt		0.99			0.98			1.00	0.85	1.00	0.98	
Flt Protected		1.00			0.99			0.99	1.00	0.95	1.00	
Satd. Flow (prot)		3101			3163			1648	1194	1437	1582	
Flt Permitted		0.85			0.59			0.78	1.00	0.37	1.00	
Satd. Flow (perm)		2649			1870			1290	1194	566	1582	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	50	1137	94	122	873	130	38	299	357	90	322	47
RTOR Reduction (vph)	0	6	0	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1275	0	0	1112	0	0	337	357	90	369	0
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		45.0			45.0			23.0	23.0	23.0	23.0	
Effective Green, g (s)		46.0			46.0			24.0	24.0	24.0	24.0	
Actuated g/C Ratio		0.58			0.58			0.30	0.30	0.30	0.30	
Clearance Time (s)		6.0			6.0			6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1523			1075			387	358	169	474	
v/s Ratio Prot											0.23	
v/s Ratio Perm		0.48			c0.59			0.26	c0.30	0.16		
v/c Ratio		0.84			1.03			0.87	1.00	0.53	0.78	
Uniform Delay, d1		13.9			17.0			26.5	28.0	23.3	25.6	
Progression Factor		1.19			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.5			36.8			18.8	46.5	3.2	7.9	
Delay (s)		17.1			53.8			45.3	74.5	26.5	33.5	
Level of Service		B			D			D	E	C	C	
Approach Delay (s)		17.1			53.8			60.3			32.1	
Approach LOS		B			D			E			C	

Intersection Summary			
HCM 2000 Control Delay	39.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	118.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX L

Capacity Calculations

2032 Forecasted Master Plan Year with Development and Transportation Demand Management Mitigation

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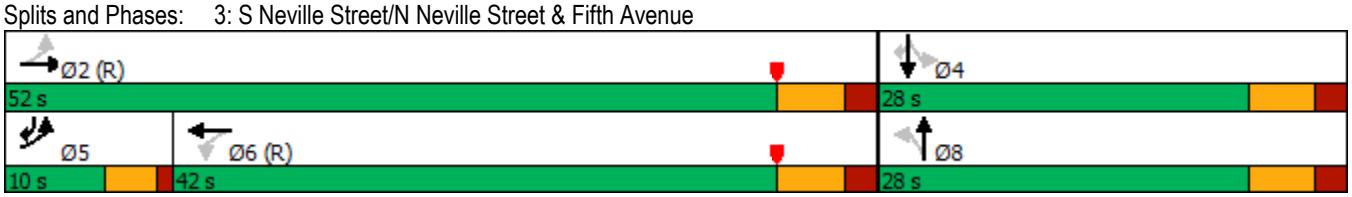
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	299	26	140	701	28	22	100	126	73	203	393
Future Volume (vph)	46	299	26	140	701	28	22	100	126	73	203	393
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	0		0	0		110
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	412	0	0	966	0	0	275	0	0	307	437
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.18	1.18	1.18	1.13	1.13	1.13
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase												
Minimum Initial (s)	4.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	4.0
Minimum Split (s)	8.0	27.0		27.0	27.0		22.0	22.0		22.0	22.0	8.0
Total Split (s)	10.0	52.0		42.0	42.0		28.0	28.0		28.0	28.0	10.0
Total Split (%)	12.5%	65.0%		52.5%	52.5%		35.0%	35.0%		35.0%	35.0%	12.5%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0			-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	C-Min		C-Min	C-Min		None	None		None	None	None
v/c Ratio		0.29			0.84			0.72			0.92	0.84
Control Delay		8.4			19.9			37.8			63.9	37.0
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		8.4			19.9			37.8			63.9	37.0
Queue Length 50th (ft)		47			90			122			146	173
Queue Length 95th (ft)		70			#334			#225			#294	#289

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1406			1147			397			343	518
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.29			0.84			0.69			0.90	0.84

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 10 (13%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	299	26	140	701	28	22	100	126	73	203	393
Future Volume (vph)	46	299	26	140	701	28	22	100	126	73	203	393
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0			5.0	3.0
Lane Util. Factor		0.95			0.95			1.00			1.00	1.00
Frpb, ped/bikes		0.99			1.00			0.96			1.00	0.96
Flpb, ped/bikes		1.00			0.99			1.00			0.99	1.00
Frt		0.99			1.00			0.93			1.00	0.85
Flt Protected		0.99			0.99			1.00			0.99	1.00
Satd. Flow (prot)		2928			3069			1450			1562	1326
Flt Permitted		0.78			0.79			0.95			0.76	1.00
Satd. Flow (perm)		2291			2433			1384			1197	1326
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	51	332	29	156	779	31	24	111	140	81	226	437
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	412	0	0	966	0	0	275	0	0	307	437
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		46.7			36.7			21.3			21.3	27.3
Effective Green, g (s)		47.7			37.7			22.3			22.3	29.3
Actuated g/C Ratio		0.60			0.47			0.28			0.28	0.37
Clearance Time (s)		6.0			6.0			6.0			6.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0			3.0	3.0
Lane Grp Cap (vph)		1421			1146			385			333	485
v/s Ratio Prot		0.03										c0.08
v/s Ratio Perm		0.15			c0.40			0.20			c0.26	0.25
v/c Ratio		0.29			0.84			0.71			0.92	0.90
Uniform Delay, d1		7.9			18.6			26.0			28.0	24.0
Progression Factor		1.00			0.68			1.00			1.00	1.00
Incremental Delay, d2		0.1			6.0			6.2			30.0	19.7
Delay (s)		8.0			18.6			32.2			58.0	43.7
Level of Service		A			B			C			E	D
Approach Delay (s)		8.0			18.6			32.2			49.6	
Approach LOS		A			B			C			D	

Intersection Summary			
HCM 2000 Control Delay	27.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	388	47	158	690	159	18	220	144	64	248	34
Future Volume (vph)	15	388	47	158	690	159	18	220	144	64	248	34
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	260		0	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	500	0	0	1120	0	0	264	160	71	314	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			10	
Link Offset(ft)		0			0			5			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		1	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		5.0	15.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	25.0	25.0		9.0	25.0		25.0	25.0	25.0	25.0	25.0	
Total Split (s)	45.0	45.0		9.0	54.0		26.0	26.0	26.0	26.0	26.0	
Total Split (%)	56.3%	56.3%		11.3%	67.5%		32.5%	32.5%	32.5%	32.5%	32.5%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0			-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Min	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio		0.28			0.75			0.75	0.58	0.47	0.82	
Control Delay		5.7			14.1			42.2	35.7	36.8	46.4	
Queue Delay		0.0			0.0			0.0	0.0	0.0	0.0	
Total Delay		5.7			14.1			42.2	35.7	36.8	46.4	
Queue Length 50th (ft)		28			185			119	69	30	144	
Queue Length 95th (ft)		m39			271			#221	131	72	#266	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)										75		
Base Capacity (vph)		1768			1504			379	294	161	414	
Starvation Cap Reductn		0			0			0	0	0	0	
Spillback Cap Reductn		0			0			0	0	0	0	
Storage Cap Reductn		0			0			0	0	0	0	
Reduced v/c Ratio		0.28			0.74			0.70	0.54	0.44	0.76	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Morewood Avenue & Fifth Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	388	47	158	690	159	18	220	144	64	248	34
Future Volume (vph)	15	388	47	158	690	159	18	220	144	64	248	34
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.97			1.00	0.79	1.00	0.99	
Flpb, ped/bikes		1.00			0.99			1.00	1.00	0.88	1.00	
Frt		0.98			0.98			1.00	0.85	1.00	0.98	
Flt Protected		1.00			0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3085			3069			1650	1123	1361	1580	
Flt Permitted		0.90			0.76			0.87	1.00	0.43	1.00	
Satd. Flow (perm)		2794			2352			1444	1123	618	1580	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	431	52	176	767	177	20	244	160	71	276	38
RTOR Reduction (vph)	0	8	0	0	18	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	492	0	0	1102	0	0	264	160	71	314	0
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		49.5			49.5			18.5	18.5	18.5	18.5	
Effective Green, g (s)		50.5			50.5			19.5	19.5	19.5	19.5	
Actuated g/C Ratio		0.63			0.63			0.24	0.24	0.24	0.24	
Clearance Time (s)		6.0			6.0			6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1763			1484			351	273	150	385	
v/s Ratio Prot											c0.20	
v/s Ratio Perm		0.18			c0.47			0.18	0.14	0.11		
v/c Ratio		0.28			0.74			0.75	0.59	0.47	0.82	
Uniform Delay, d1		6.6			10.2			28.0	26.7	25.9	28.6	
Progression Factor		0.79			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4			2.0			8.8	3.2	2.3	12.5	
Delay (s)		5.6			12.3			36.8	29.9	28.2	41.1	
Level of Service		A			B			D	C	C	D	
Approach Delay (s)		5.6			12.3			34.2			38.7	
Approach LOS		A			B			C			D	

Intersection Summary			
HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

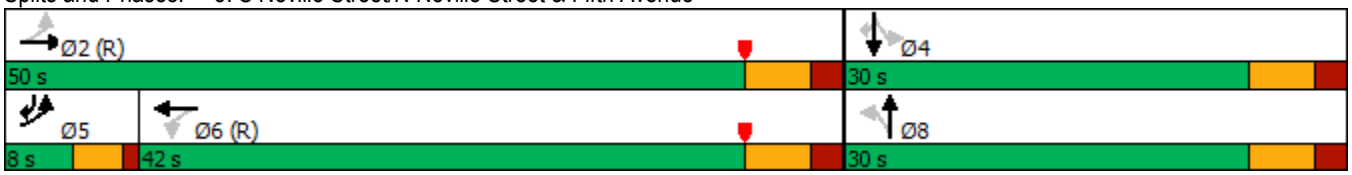
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	147	946	20	75	530	22	7	192	252	82	170	153
Future Volume (vph)	147	946	20	75	530	22	7	192	252	82	170	153
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	0		0	0		110
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1236	0	0	696	0	0	473	0	0	280	170
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.18	1.18	1.18	1.13	1.13	1.13
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase												
Minimum Initial (s)	4.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	4.0
Minimum Split (s)	8.0	27.0		27.0	27.0		25.0	25.0		25.0	25.0	8.0
Total Split (s)	8.0	50.0		42.0	42.0		30.0	30.0		30.0	30.0	8.0
Total Split (%)	10.0%	62.5%		52.5%	52.5%		37.5%	37.5%		37.5%	37.5%	10.0%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0			-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0			5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	C-Min		C-Min	C-Min		None	None		None	None	None
v/c Ratio		1.02			0.72			1.04			0.99	0.33
Control Delay		49.2			9.5			82.1			82.0	16.8
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		49.2			9.5			82.1			82.0	16.8
Queue Length 50th (ft)		~223			76			~259			138	53
Queue Length 95th (ft)		#398			m90			#437			#293	97

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1215			964			456			283	521
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		1.02			0.72			1.04			0.99	0.33

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 26 (33%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	147	946	20	75	530	22	7	192	252	82	170	153
Future Volume (vph)	147	946	20	75	530	22	7	192	252	82	170	153
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	11	11	11	11	11	11
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0			5.0	3.0
Lane Util. Factor		0.95			0.95			1.00			1.00	1.00
Frpb, ped/bikes		1.00			0.99			0.95			1.00	0.95
Flpb, ped/bikes		1.00			1.00			1.00			0.99	1.00
Frt		1.00			0.99			0.93			1.00	0.85
Flt Protected		0.99			0.99			1.00			0.98	1.00
Satd. Flow (prot)		3160			3128			1470			1673	1304
Flt Permitted		0.66			0.66			0.99			0.53	1.00
Satd. Flow (perm)		2092			2088			1461			908	1304
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Adj. Flow (vph)	163	1051	22	83	589	24	8	213	252	91	189	170
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1236	0	0	696	0	0	473	0	0	280	170
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)		44.0			36.0			24.0			24.0	28.0
Effective Green, g (s)		45.0			37.0			25.0			25.0	30.0
Actuated g/C Ratio		0.56			0.46			0.31			0.31	0.38
Clearance Time (s)		6.0			6.0			6.0			6.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0			3.0	3.0
Lane Grp Cap (vph)		1243			965			456			283	489
v/s Ratio Prot		c0.06										0.02
v/s Ratio Perm		c0.50			0.33			c0.32			0.31	0.11
v/c Ratio		0.99			0.72			1.04			0.99	0.35
Uniform Delay, d1		17.4			17.3			27.5			27.4	18.0
Progression Factor		1.00			0.41			1.00			1.00	1.00
Incremental Delay, d2		24.0			2.1			52.1			50.0	0.4
Delay (s)		41.4			9.2			79.6			77.4	18.4
Level of Service		D			A			E			E	B
Approach Delay (s)		41.4			9.2			79.6			55.1	
Approach LOS		D			A			E			E	

Intersection Summary			
HCM 2000 Control Delay	42.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	113.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

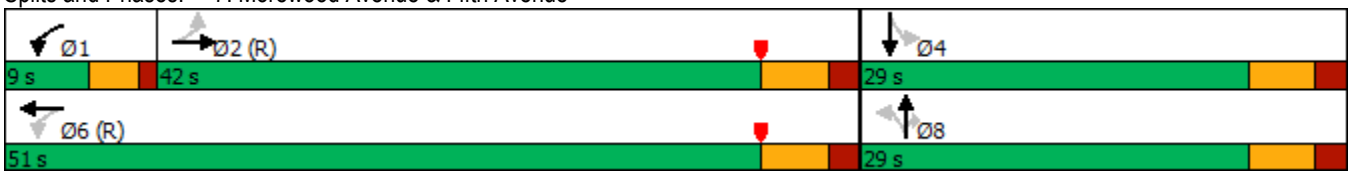
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	1023	82	86	786	117	34	241	267	81	281	42
Future Volume (vph)	45	1023	82	86	786	117	34	241	267	81	281	42
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	260		0	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1278	0	0	1099	0	0	306	297	90	359	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			10	
Link Offset(ft)		0			0			5			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		1	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		5.0	15.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	26.0	26.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (s)	42.0	42.0		9.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (%)	52.5%	52.5%		11.3%	63.8%		36.3%	36.3%	36.3%	36.3%	36.3%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0			-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Min	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio		0.81			0.89			0.86	0.88	0.52	0.80	
Control Delay		17.0			25.8			52.2	54.4	35.8	41.2	
Queue Delay		0.0			0.0			0.0	0.0	0.0	0.0	
Total Delay		17.0			25.8			52.2	54.4	35.8	41.2	
Queue Length 50th (ft)		290			232			141	137	37	161	
Queue Length 95th (ft)		m283			#397			#277	#274	86	#289	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)										75		
Base Capacity (vph)		1576			1232			373	358	182	474	
Starvation Cap Reductn		0			0			0	0	0	0	
Spillback Cap Reductn		0			0			0	0	0	0	
Storage Cap Reductn		0			0			0	0	0	0	
Reduced v/c Ratio		0.81			0.89			0.82	0.83	0.49	0.76	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Morewood Avenue & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	1023	82	86	786	117	34	241	267	81	281	42
Future Volume (vph)	45	1023	82	86	786	117	34	241	267	81	281	42
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95			1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.99			1.00	0.84	1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00	1.00	0.92	1.00	
Frt		0.99			0.98			1.00	0.85	1.00	0.98	
Flt Protected		1.00			1.00			0.99	1.00	0.95	1.00	
Satd. Flow (prot)		3104			3165			1646	1193	1428	1581	
Flt Permitted		0.86			0.65			0.75	1.00	0.40	1.00	
Satd. Flow (perm)		2661			2065			1244	1193	608	1581	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	50	1137	91	96	873	130	38	268	297	90	312	47
RTOR Reduction (vph)	0	5	0	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1273	0	0	1086	0	0	306	297	90	359	0
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		46.2			46.2			21.8	21.8	21.8	21.8	
Effective Green, g (s)		47.2			47.2			22.8	22.8	22.8	22.8	
Actuated g/C Ratio		0.59			0.59			0.29	0.29	0.29	0.29	
Clearance Time (s)		6.0			6.0			6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1569			1218			354	340	173	450	
v/s Ratio Prot											0.23	
v/s Ratio Perm		0.48			c0.53			0.25	c0.25	0.15		
v/c Ratio		0.81			0.89			0.86	0.87	0.52	0.80	
Uniform Delay, d1		12.9			14.2			27.1	27.2	24.0	26.5	
Progression Factor		1.20			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4			8.5			19.1	21.1	2.8	9.5	
Delay (s)		15.9			22.7			46.3	48.3	26.8	36.0	
Level of Service		B			C			D	D	C	D	
Approach Delay (s)		15.9			22.7			47.3			34.1	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	115.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX M

Capacity Calculations

2032 Forecasted Master Plan Year with Development Transportation Demand Management Mitigation Roadway Improvements

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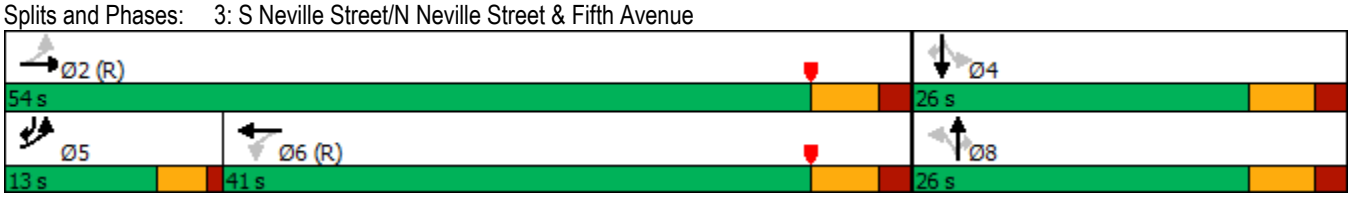
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	299	26	140	701	28	22	100	126	73	203	393
Future Volume (vph)	46	299	26	140	701	28	22	100	126	73	203	393
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	120		0	0		110
Storage Lanes	0		0	0		0	1		1	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	412	0	0	966	0	0	135	140	0	307	437
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.23	1.23	1.23	1.18	1.18	1.18
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8		8	4		4
Detector Phase	5	2		6	6		8	8	8	4	4	5
Switch Phase												
Minimum Initial (s)	4.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	4.0
Minimum Split (s)	9.0	27.0		27.0	27.0		22.0	22.0	22.0	22.0	22.0	9.0
Total Split (s)	13.0	54.0		41.0	41.0		26.0	26.0	26.0	26.0	26.0	13.0
Total Split (%)	16.3%	67.5%		51.3%	51.3%		32.5%	32.5%	32.5%	32.5%	32.5%	16.3%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0	0.0		-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0	6.0		5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?												
Recall Mode	None	C-Min		C-Min	C-Min		None	None	None	None	None	None
v/c Ratio		0.28			0.86			0.39	0.47		0.91	0.85
Control Delay		7.4			21.9			28.3	31.8		61.9	37.0
Queue Delay		0.0			0.0			0.0	0.0		0.0	0.0
Total Delay		7.4			21.9			28.3	31.8		61.9	37.0
Queue Length 50th (ft)		43			168			55	59		147	172
Queue Length 95th (ft)		65			#343			106	115		#292	#265

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1493			1121			354	303		346	521
Starvation Cap Reductn		0			0			0	0		0	0
Spillback Cap Reductn		0			0			0	0		0	0
Storage Cap Reductn		0			0			0	0		0	0
Reduced v/c Ratio		0.28			0.86			0.38	0.46		0.89	0.84

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 23 (29%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 65
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	299	26	140	701	28	22	100	126	73	203	393
Future Volume (vph)	46	299	26	140	701	28	22	100	126	73	203	393
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0	6.0		5.0	3.0
Lane Util. Factor		0.95			0.95			1.00	1.00		1.00	1.00
Frpb, ped/bikes		0.99			1.00			1.00	0.91		1.00	0.97
Flpb, ped/bikes		1.00			0.99			1.00	1.00		0.98	1.00
Frt		0.99			1.00			1.00	0.85		1.00	0.85
Flt Protected		0.99			0.99			0.99	1.00		0.99	1.00
Satd. Flow (prot)		2928			3069			1581	1215		1498	1286
Flt Permitted		0.79			0.79			0.85	1.00		0.87	1.00
Satd. Flow (perm)		2319			2434			1352	1215		1320	1286
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	51	332	29	156	779	31	24	111	140	81	226	437
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	412	0	0	966	0	0	135	140	0	307	437
Confl. Peds. (#/hr)	60		71	71		60	20		50	50		20
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	25%	8%	9%	1%	4%	4%	0%	1%	3%	26%	2%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)		48.5			35.8			19.5	19.5		19.5	28.2
Effective Green, g (s)		49.5			36.8			20.5	19.5		20.5	30.2
Actuated g/C Ratio		0.62			0.46			0.26	0.24		0.26	0.38
Clearance Time (s)		6.0			6.0			6.0	6.0		6.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		1508			1119			346	296		338	485
v/s Ratio Prot		0.03										c0.11
v/s Ratio Perm		0.14			c0.40			0.10	0.12		c0.23	0.23
v/c Ratio		0.27			0.86			0.39	0.47		0.91	0.90
Uniform Delay, d1		7.0			19.3			24.6	25.9		28.8	23.5
Progression Factor		1.00			0.69			1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1			7.1			0.7	1.2		26.8	19.7
Delay (s)		7.1			20.5			25.3	27.1		55.7	43.2
Level of Service		A			C			C	C		E	D
Approach Delay (s)		7.1			20.5			26.2			48.3	
Approach LOS		A			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	27.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	388	47	158	690	159	18	220	144	64	248	34
Future Volume (vph)	15	388	47	158	690	159	18	220	144	64	248	34
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	50		260	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	500	0	0	1120	0	20	244	160	71	314	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			10			10	
Link Offset(ft)		0			0			5			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		1	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		5.0	15.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	25.0	25.0		10.0	25.0		25.0	25.0	25.0	25.0	25.0	
Total Split (s)	44.0	44.0		10.0	54.0		26.0	26.0	26.0	26.0	26.0	
Total Split (%)	55.0%	55.0%		12.5%	67.5%		32.5%	32.5%	32.5%	32.5%	32.5%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0		0.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0		6.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?												
Recall Mode	C-Min	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio		0.28			0.75		0.17	0.60	0.58	0.44	0.82	
Control Delay		5.3			14.1		27.6	33.3	35.7	34.4	46.4	
Queue Delay		0.0			0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay		5.3			14.1		27.6	33.3	35.7	34.4	46.4	
Queue Length 50th (ft)		28			185		8	105	69	29	144	
Queue Length 95th (ft)		m39			271		26	178	131	70	#266	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)							50		260	75		
Base Capacity (vph)		1768			1504		129	436	294	174	414	
Starvation Cap Reductn		0			0		0	0	0	0	0	
Spillback Cap Reductn		0			0		0	0	0	0	0	
Storage Cap Reductn		0			0		0	0	0	0	0	
Reduced v/c Ratio		0.28			0.74		0.16	0.56	0.54	0.41	0.76	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 8 (10%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Morewood Avenue & Fifth Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	388	47	158	690	159	18	220	144	64	248	34
Future Volume (vph)	15	388	47	158	690	159	18	220	144	64	248	34
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0		6.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.97		1.00	1.00	0.79	1.00	0.99	
Flpb, ped/bikes		1.00			0.99		0.95	1.00	1.00	0.87	1.00	
Frt		0.98			0.98		1.00	1.00	0.85	1.00	0.98	
Flt Protected		1.00			0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3085			3069		1495	1664	1123	1351	1580	
Flt Permitted		0.90			0.76		0.33	1.00	1.00	0.47	1.00	
Satd. Flow (perm)		2794			2352		519	1664	1123	665	1580	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	431	52	176	767	177	20	244	160	71	276	38
RTOR Reduction (vph)	0	8	0	0	18	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	492	0	0	1102	0	20	244	160	71	314	0
Confl. Peds. (#/hr)	75		35	35		75	83		161	161		83
Confl. Bikes (#/hr)			1			7			4			3
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		49.5			49.5		18.5	18.5	18.5	18.5	18.5	
Effective Green, g (s)		50.5			50.5		18.5	19.5	19.5	19.5	19.5	
Actuated g/C Ratio		0.63			0.63		0.23	0.24	0.24	0.24	0.24	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1763			1484		120	405	273	162	385	
v/s Ratio Prot								0.15			c0.20	
v/s Ratio Perm		0.18			c0.47		0.04		0.14	0.11		
v/c Ratio		0.28			0.74		0.17	0.60	0.59	0.44	0.82	
Uniform Delay, d1		6.6			10.2		24.6	26.8	26.7	25.6	28.6	
Progression Factor		0.74			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4			2.0		0.7	2.5	3.2	1.9	12.5	
Delay (s)		5.3			12.3		25.2	29.3	29.9	27.5	41.1	
Level of Service		A			B		C	C	C	C	D	
Approach Delay (s)		5.3			12.3			29.4			38.6	
Approach LOS		A			B			C			D	

Intersection Summary			
HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

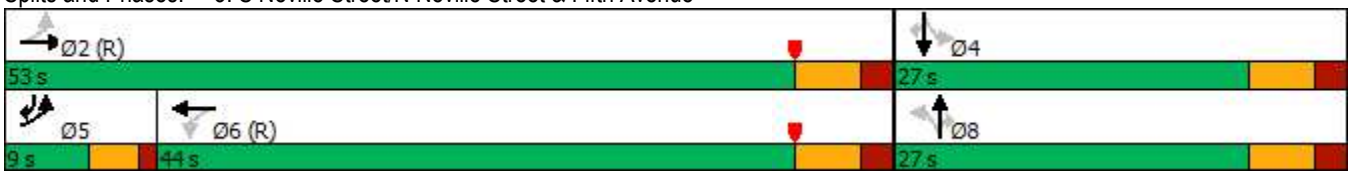
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	147	946	20	75	530	22	7	192	252	82	170	153
Future Volume (vph)	147	946	20	75	530	22	7	192	252	82	170	153
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		-1%			2%			8%			1%	
Storage Length (ft)	0		0	0		0	120		0	0		110
Storage Lanes	0		0	0		0	1		1	0		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		646			1349			479			639	
Travel Time (s)		12.6			26.3			13.1			17.4	
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1236	0	0	696	0	0	221	252	0	280	170
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.11	1.11	1.11	1.13	1.13	1.13	1.23	1.23	1.23	1.18	1.18	1.18
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8		8	4		4
Detector Phase	5	2		6	6		8	8	8	4	4	5
Switch Phase												
Minimum Initial (s)	4.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	4.0
Minimum Split (s)	9.0	27.0		27.0	27.0		25.0	25.0	25.0	25.0	25.0	9.0
Total Split (s)	9.0	53.0		44.0	44.0		27.0	27.0	27.0	27.0	27.0	9.0
Total Split (%)	11.3%	66.3%		55.0%	55.0%		33.8%	33.8%	33.8%	33.8%	33.8%	11.3%
Yellow Time (s)	3.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	3.0
All-Red Time (s)	1.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	1.0
Lost Time Adjust (s)		-1.0			-1.0			-1.0	0.0		-1.0	-1.0
Total Lost Time (s)		5.0			5.0			5.0	6.0		5.0	3.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	C-Min		C-Min	C-Min		None	None	None	None	None	None
v/c Ratio		0.92			0.65			0.52	0.80		0.93	0.37
Control Delay		26.6			8.7			30.0	48.9		67.4	19.0
Queue Delay		0.0			0.0			0.0	0.0		0.0	0.0
Total Delay		26.6			8.7			30.0	48.9		67.4	19.0
Queue Length 50th (ft)		192			82			93	117		134	55
Queue Length 95th (ft)		#318			m94			160	#234		#277	103

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		566			1269			399			559	
Turn Bay Length (ft)												110
Base Capacity (vph)		1344			1064			436	325		312	462
Starvation Cap Reductn		0			0			0	0		0	0
Spillback Cap Reductn		0			0			0	0		0	0
Storage Cap Reductn		0			0			0	0		0	0
Reduced v/c Ratio		0.92			0.65			0.51	0.78		0.90	0.37

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 41 (51%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 75
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: S Neville Street/N Neville Street & Fifth Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	147	946	20	75	530	22	7	192	252	82	170	153
Future Volume (vph)	147	946	20	75	530	22	7	192	252	82	170	153
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		-1%			2%			8%			1%	
Total Lost time (s)		5.0			5.0			5.0	6.0		5.0	3.0
Lane Util. Factor		0.95			0.95			1.00	1.00		1.00	1.00
Frpb, ped/bikes		1.00			0.99			1.00	0.90		1.00	0.95
Flpb, ped/bikes		1.00			1.00			1.00	1.00		0.98	1.00
Frt		1.00			0.99			1.00	0.85		1.00	0.85
Flt Protected		0.99			0.99			1.00	1.00		0.98	1.00
Satd. Flow (prot)		3160			3127			1608	1240		1599	1263
Flt Permitted		0.67			0.68			0.98	1.00		0.70	1.00
Satd. Flow (perm)		2129			2146			1586	1240		1138	1263
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00	0.90	0.90	0.90
Adj. Flow (vph)	163	1051	22	83	589	24	8	213	252	91	189	170
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1236	0	0	696	0	0	221	252	0	280	170
Confl. Peds. (#/hr)	85		120	120		85	36		66	66		36
Confl. Bikes (#/hr)			2			5			2			10
Heavy Vehicles (%)	12%	2%	0%	0%	2%	21%	0%	0%	0%	3%	0%	7%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)		47.7			38.7			20.3	20.3		20.3	25.3
Effective Green, g (s)		48.7			39.7			21.3	20.3		21.3	27.3
Actuated g/C Ratio		0.61			0.50			0.27	0.25		0.27	0.34
Clearance Time (s)		6.0			6.0			6.0	6.0		6.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		1373			1064			422	314		302	430
v/s Ratio Prot		c0.07										0.03
v/s Ratio Perm		c0.48			0.32			0.14	0.20		c0.25	0.11
v/c Ratio		0.90			0.65			0.52	0.80		0.93	0.40
Uniform Delay, d1		13.5			15.0			25.0	28.0		28.6	20.1
Progression Factor		1.00			0.45			1.00	1.00		1.00	1.00
Incremental Delay, d2		8.4			1.5			1.2	13.7		33.0	0.6
Delay (s)		21.9			8.4			26.2	41.7		61.6	20.7
Level of Service		C			A			C	D		E	C
Approach Delay (s)		21.9			8.4			34.5			46.1	
Approach LOS		C			A			C			D	

Intersection Summary			
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	98.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	1023	82	86	786	117	34	241	267	81	281	42
Future Volume (vph)	45	1023	82	86	786	117	34	241	267	81	281	42
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (ft)	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Storage Length (ft)	0		0	0		0	50		260	75		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			No			No
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		1349			803			419			464	
Travel Time (s)		26.3			15.6			11.4			12.7	
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1278	0	0	1099	0	38	268	297	90	359	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.13	1.13	1.13	1.11	1.11	1.11	1.16	1.16	1.16	1.20	1.20	1.20
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		1	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		5.0	15.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	26.0	26.0		10.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (s)	41.0	41.0		10.0	51.0		29.0	29.0	29.0	29.0	29.0	
Total Split (%)	51.3%	51.3%		12.5%	63.8%		36.3%	36.3%	36.3%	36.3%	36.3%	
Yellow Time (s)	4.0	4.0		3.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-1.0			-1.0		0.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		5.0			5.0		6.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Min	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio		0.81			0.89		0.28	0.57	0.88	0.46	0.80	
Control Delay		17.1			25.8		28.4	29.4	54.4	31.7	41.2	
Queue Delay		0.0			0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay		17.1			25.8		28.4	29.4	54.4	31.7	41.2	
Queue Length 50th (ft)		282			232		15	111	137	36	161	
Queue Length 95th (ft)		m321			#397		41	185	#274	82	#289	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1269			723			339			384	
Turn Bay Length (ft)							50		260	75		
Base Capacity (vph)		1576			1232		145	499	358	207	474	
Starvation Cap Reductn		0			0		0	0	0	0	0	
Spillback Cap Reductn		0			0		0	0	0	0	0	
Storage Cap Reductn		0			0		0	0	0	0	0	
Reduced v/c Ratio		0.81			0.89		0.26	0.54	0.83	0.43	0.76	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 12 (15%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Morewood Avenue & Fifth Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	1023	82	86	786	117	34	241	267	81	281	42
Future Volume (vph)	45	1023	82	86	786	117	34	241	267	81	281	42
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	11	11	11	11	11	10	10	10	10	10	10
Grade (%)		2%			-2%			-2%			4%	
Total Lost time (s)		5.0			5.0		6.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		0.95			0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes		0.99			0.99		1.00	1.00	0.84	1.00	0.99	
Flpb, ped/bikes		1.00			1.00		0.97	1.00	1.00	0.91	1.00	
Frt		0.99			0.98		1.00	1.00	0.85	1.00	0.98	
Flt Protected		1.00			1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3104			3165		1526	1664	1193	1414	1581	
Flt Permitted		0.86			0.65		0.31	1.00	1.00	0.46	1.00	
Satd. Flow (perm)		2661			2065		506	1664	1193	690	1581	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	50	1137	91	96	873	130	38	268	297	90	312	47
RTOR Reduction (vph)	0	5	0	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1273	0	0	1086	0	38	268	297	90	359	0
Confl. Peds. (#/hr)	34		72	72		34	59		115	115		59
Confl. Bikes (#/hr)						6			17			10
Heavy Vehicles (%)	3%	2%	13%	2%	2%	1%	2%	2%	1%	1%	1%	0%
Turn Type	Perm	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)		46.2			46.2		21.8	21.8	21.8	21.8	21.8	
Effective Green, g (s)		47.2			47.2		21.8	22.8	22.8	22.8	22.8	
Actuated g/C Ratio		0.59			0.59		0.27	0.29	0.29	0.29	0.29	
Clearance Time (s)		6.0			6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1569			1218		137	474	340	196	450	
v/s Ratio Prot								0.16			0.23	
v/s Ratio Perm		0.48			c0.53		0.08		c0.25	0.13		
v/c Ratio		0.81			0.89		0.28	0.57	0.87	0.46	0.80	
Uniform Delay, d1		12.9			14.2		22.9	24.4	27.2	23.5	26.5	
Progression Factor		1.08			1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.1			8.5		1.1	1.5	21.1	1.7	9.5	
Delay (s)		16.0			22.7		24.0	25.9	48.3	25.2	36.0	
Level of Service		B			C		C	C	D	C	D	
Approach Delay (s)		16.0			22.7			36.8			33.8	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	106.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX N
SimTraffic 95th Percentile Queue Length Summaries

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Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	7:20	7:20	7:20	7:20	7:20	7:20
End Time	8:30	8:30	8:30	8:30	8:30	8:30
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	2937	2953	2889	2917	2961	2931
Vehs Exited	2949	2958	2863	2924	2944	2926
Starting Vehs	70	62	60	81	42	65
Ending Vehs	58	57	86	74	59	66
Travel Distance (mi)	973	962	956	968	965	965
Travel Time (hr)	63.0	72.0	68.6	62.7	71.7	67.6
Total Delay (hr)	30.2	39.4	36.5	30.2	39.2	35.1
Total Stops	2735	3048	2651	2719	2927	2818
Fuel Used (gal)	43.3	45.5	43.9	43.3	45.2	44.2

Interval #0 Information Seeding

Start Time	7:20
End Time	7:30
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:30
End Time	8:30
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	2937	2953	2889	2917	2961	2931
Vehs Exited	2949	2958	2863	2924	2944	2926
Starting Vehs	70	62	60	81	42	65
Ending Vehs	58	57	86	74	59	66
Travel Distance (mi)	973	962	956	968	965	965
Travel Time (hr)	63.0	72.0	68.6	62.7	71.7	67.6
Total Delay (hr)	30.2	39.4	36.5	30.2	39.2	35.1
Total Stops	2735	3048	2651	2719	2927	2818
Fuel Used (gal)	43.3	45.5	43.9	43.3	45.2	44.2

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	154	136	162	152	199	652	160
Average Queue (ft)	71	31	92	69	102	459	156
95th Queue (ft)	129	82	150	128	166	752	176
Link Distance (ft)	618	618	1288	1288	440	602	
Upstream Blk Time (%)						23	
Queuing Penalty (veh)						0	
Storage Bay Dist (ft)							110
Storage Blk Time (%)						44	31
Queuing Penalty (veh)						168	84

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	L	TR
Maximum Queue (ft)	105	118	289	255	227	170	100	318
Average Queue (ft)	56	52	161	118	112	78	50	153
95th Queue (ft)	96	98	250	213	195	140	103	274
Link Distance (ft)	1288	1288	762	762		379		426
Upstream Blk Time (%)								0
Queuing Penalty (veh)								0
Storage Bay Dist (ft)					260		75	
Storage Blk Time (%)					0		4	34
Queuing Penalty (veh)					0		12	21

Network Summary

Network wide Queuing Penalty: 286

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:35	4:35	4:35	4:35	4:35	4:35
End Time	5:45	5:45	5:45	5:45	5:45	5:45
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	3686	3691	3534	3590	3652	3633
Vehs Exited	3679	3660	3527	3598	3641	3622
Starting Vehs	103	102	100	112	100	103
Ending Vehs	110	133	107	104	111	114
Travel Distance (mi)	1303	1292	1251	1266	1270	1276
Travel Time (hr)	174.3	144.7	158.1	178.2	102.9	151.7
Total Delay (hr)	131.8	102.4	117.5	137.0	61.4	110.0
Total Stops	3904	3757	3431	3456	3671	3644
Fuel Used (gal)	79.8	72.9	74.0	79.0	61.8	73.5

Interval #0 Information Seeding

Start Time	4:35
End Time	4:45
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	4:45
End Time	5:45
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3686	3691	3534	3590	3652	3633
Vehs Exited	3679	3660	3527	3598	3641	3622
Starting Vehs	103	102	100	112	100	103
Ending Vehs	110	133	107	104	111	114
Travel Distance (mi)	1303	1292	1251	1266	1270	1276
Travel Time (hr)	174.3	144.7	158.1	178.2	102.9	151.7
Total Delay (hr)	131.8	102.4	117.5	137.0	61.4	110.0
Total Stops	3904	3757	3431	3456	3671	3644
Fuel Used (gal)	79.8	72.9	74.0	79.0	61.8	73.5

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	377	336	123	126	455	311	158
Average Queue (ft)	204	151	64	56	428	128	77
95th Queue (ft)	316	271	115	112	549	254	168
Link Distance (ft)	618	618	1288	1288	440	602	
Upstream Blk Time (%)					73		
Queuing Penalty (veh)					0		
Storage Bay Dist (ft)							110
Storage Blk Time (%)						16	3
Queuing Penalty (veh)						27	6

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	L	TR
Maximum Queue (ft)	305	338	346	312	285	421	100	354
Average Queue (ft)	182	197	198	156	269	374	65	190
95th Queue (ft)	277	305	310	272	348	483	120	309
Link Distance (ft)	1288	1288	762	762		379		426
Upstream Blk Time (%)						64		0
Queuing Penalty (veh)						0		0
Storage Bay Dist (ft)					260		75	
Storage Blk Time (%)					10	63	8	46
Queuing Penalty (veh)					30	186	25	36

Network Summary

Network wide Queuing Penalty: 309

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	7:20	7:20	7:20	7:20	7:20	7:20
End Time	8:30	8:30	8:30	8:30	8:30	8:30
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	3022	3075	3082	3004	2983	3031
Vehs Exited	3018	3074	3070	3014	2983	3033
Starting Vehs	68	64	55	59	56	61
Ending Vehs	72	65	67	49	56	61
Travel Distance (mi)	989	1025	1017	984	975	998
Travel Time (hr)	64.6	62.6	65.6	63.1	62.5	63.7
Total Delay (hr)	31.2	28.4	31.4	29.9	29.5	30.1
Total Stops	2876	2774	2821	2764	2659	2779
Fuel Used (gal)	44.6	45.6	45.6	44.4	43.5	44.7

Interval #0 Information Seeding

Start Time	7:20
End Time	7:30
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:30
End Time	8:30
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3022	3075	3082	3004	2983	3031
Vehs Exited	3018	3074	3070	3014	2983	3033
Starting Vehs	68	64	55	59	56	61
Ending Vehs	72	65	67	49	56	61
Travel Distance (mi)	989	1025	1017	984	975	998
Travel Time (hr)	64.6	62.6	65.6	63.1	62.5	63.7
Total Delay (hr)	31.2	28.4	31.4	29.9	29.5	30.1
Total Stops	2876	2774	2821	2764	2659	2779
Fuel Used (gal)	44.6	45.6	45.6	44.4	43.5	44.7

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	162	135	196	181	181	620	160
Average Queue (ft)	87	39	96	80	89	325	150
95th Queue (ft)	151	99	165	151	155	615	189
Link Distance (ft)	618	618	1288	1288	440	602	
Upstream Blk Time (%)						5	
Queuing Penalty (veh)						0	
Storage Bay Dist (ft)							110
Storage Blk Time (%)						29	21
Queuing Penalty (veh)						114	58

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	L	TR
Maximum Queue (ft)	123	140	275	217	246	230	100	364
Average Queue (ft)	54	52	171	122	122	82	59	182
95th Queue (ft)	102	111	261	217	203	155	116	324
Link Distance (ft)	1288	1288	762	762		379		426
Upstream Blk Time (%)								0
Queuing Penalty (veh)								0
Storage Bay Dist (ft)					260		75	
Storage Blk Time (%)					1		5	43
Queuing Penalty (veh)					2		13	28

Network Summary

Network wide Queuing Penalty: 215

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:35	4:35	4:35	4:35	4:35	4:35
End Time	5:45	5:45	5:45	5:45	5:45	5:45
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	3618	3624	3690	3582	3589	3620
Vehs Exited	3566	3594	3663	3555	3554	3588
Starting Vehs	70	63	94	97	76	78
Ending Vehs	122	93	121	124	111	114
Travel Distance (mi)	1265	1269	1296	1248	1259	1267
Travel Time (hr)	126.7	112.5	119.7	109.8	106.0	114.9
Total Delay (hr)	85.6	71.0	77.5	68.9	64.7	73.5
Total Stops	3453	3634	3916	3592	3576	3636
Fuel Used (gal)	67.9	64.7	67.3	63.3	62.4	65.1

Interval #0 Information Seeding

Start Time	4:35
End Time	4:45
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	4:45
End Time	5:45
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3618	3624	3690	3582	3589	3620
Vehs Exited	3566	3594	3663	3555	3554	3588
Starting Vehs	70	63	94	97	76	78
Ending Vehs	122	93	121	124	111	114
Travel Distance (mi)	1265	1269	1296	1248	1259	1267
Travel Time (hr)	126.7	112.5	119.7	109.8	106.0	114.9
Total Delay (hr)	85.6	71.0	77.5	68.9	64.7	73.5
Total Stops	3453	3634	3916	3592	3576	3636
Fuel Used (gal)	67.9	64.7	67.3	63.3	62.4	65.1

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	387	340	107	106	455	332	160
Average Queue (ft)	216	159	51	35	402	125	87
95th Queue (ft)	325	280	95	85	560	259	168
Link Distance (ft)	618	618	1288	1288	440	602	
Upstream Blk Time (%)					59		
Queuing Penalty (veh)					0		
Storage Bay Dist (ft)							110
Storage Blk Time (%)						14	3
Queuing Penalty (veh)						24	6

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	L	TR
Maximum Queue (ft)	290	304	334	287	285	412	100	370
Average Queue (ft)	166	181	209	168	243	329	58	165
95th Queue (ft)	252	268	299	268	355	506	111	297
Link Distance (ft)	1288	1288	762	762		379		426
Upstream Blk Time (%)						43		1
Queuing Penalty (veh)						0		0
Storage Bay Dist (ft)					260		75	
Storage Blk Time (%)					7	47	5	39
Queuing Penalty (veh)					20	137	14	31

Network Summary

Network wide Queuing Penalty: 233

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	7:20	7:20	7:20	7:20	7:20	7:20
End Time	8:30	8:30	8:30	8:30	8:30	8:30
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	3276	3290	3297	3240	3293	3279
Vehs Exited	3276	3297	3279	3238	3262	3269
Starting Vehs	82	82	85	73	68	77
Ending Vehs	82	75	103	75	99	84
Travel Distance (mi)	1076	1061	1058	1049	1063	1061
Travel Time (hr)	90.5	75.0	88.3	78.3	109.4	88.3
Total Delay (hr)	54.2	38.8	52.3	42.7	73.3	52.3
Total Stops	3252	3251	3368	3339	3235	3291
Fuel Used (gal)	53.5	49.7	52.2	50.0	56.9	52.5

Interval #0 Information Seeding

Start Time	7:20
End Time	7:30
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:30
End Time	8:30
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3276	3290	3297	3240	3293	3279
Vehs Exited	3276	3297	3279	3238	3262	3269
Starting Vehs	82	82	85	73	68	77
Ending Vehs	82	75	103	75	99	84
Travel Distance (mi)	1076	1061	1058	1049	1063	1061
Travel Time (hr)	90.5	75.0	88.3	78.3	109.4	88.3
Total Delay (hr)	54.2	38.8	52.3	42.7	73.3	52.3
Total Stops	3252	3251	3368	3339	3235	3291
Fuel Used (gal)	53.5	49.7	52.2	50.0	56.9	52.5

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	193	136	219	184	351	662	160
Average Queue (ft)	90	41	122	96	160	417	155
95th Queue (ft)	160	98	194	165	297	724	181
Link Distance (ft)	618	618	1288	1288	440	602	
Upstream Blk Time (%)					0	16	
Queuing Penalty (veh)					0	0	
Storage Bay Dist (ft)							110
Storage Blk Time (%)						40	23
Queuing Penalty (veh)						169	67

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	L	TR
Maximum Queue (ft)	96	108	312	273	277	378	100	446
Average Queue (ft)	44	40	187	130	188	222	66	270
95th Queue (ft)	84	85	270	233	329	432	126	477
Link Distance (ft)	1288	1288	762	762		379		426
Upstream Blk Time (%)						20		12
Queuing Penalty (veh)						0		0
Storage Bay Dist (ft)					260		75	
Storage Blk Time (%)					3	24	6	61
Queuing Penalty (veh)					6	62	18	39

Network Summary

Network wide Queuing Penalty: 360

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:35	4:35	4:35	4:35	4:35	4:35
End Time	5:45	5:45	5:45	5:45	5:45	5:45
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	3977	3904	3904	3911	3897	3919
Vehs Exited	3920	3853	3842	3863	3869	3870
Starting Vehs	131	159	113	155	146	141
Ending Vehs	188	210	175	203	174	190
Travel Distance (mi)	1373	1362	1340	1338	1353	1353
Travel Time (hr)	266.1	344.9	244.8	260.1	250.4	273.3
Total Delay (hr)	221.0	300.2	200.9	216.0	206.0	228.8
Total Stops	4606	4879	4630	4465	4694	4654
Fuel Used (gal)	103.9	121.3	97.6	101.0	99.6	104.7

Interval #0 Information Seeding

Start Time	4:35
End Time	4:45
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	4:45
End Time	5:45
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3977	3904	3904	3911	3897	3919
Vehs Exited	3920	3853	3842	3863	3869	3870
Starting Vehs	131	159	113	155	146	141
Ending Vehs	188	210	175	203	174	190
Travel Distance (mi)	1373	1362	1340	1338	1353	1353
Travel Time (hr)	266.1	344.9	244.8	260.1	250.4	273.3
Total Delay (hr)	221.0	300.2	200.9	216.0	206.0	228.8
Total Stops	4606	4879	4630	4465	4694	4654
Fuel Used (gal)	103.9	121.3	97.6	101.0	99.6	104.7

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	441	405	153	130	455	572	160
Average Queue (ft)	276	222	65	42	455	213	97
95th Queue (ft)	399	359	122	95	455	515	189
Link Distance (ft)	618	618	1288	1288	440	602	
Upstream Blk Time (%)					96	9	
Queuing Penalty (veh)					0	0	
Storage Bay Dist (ft)							110
Storage Blk Time (%)						27	4
Queuing Penalty (veh)						45	10

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	L	TR
Maximum Queue (ft)	708	714	799	799	285	414	100	411
Average Queue (ft)	344	364	598	575	273	376	73	210
95th Queue (ft)	670	680	954	955	339	478	122	377
Link Distance (ft)	1288	1288	762	762		379		426
Upstream Blk Time (%)			43	39		65		2
Queuing Penalty (veh)			0	0		0		0
Storage Bay Dist (ft)					260		75	
Storage Blk Time (%)					18	57	9	47
Queuing Penalty (veh)					57	173	31	38

Network Summary

Network wide Queuing Penalty: 354

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	7:20	7:20	7:20	7:20	7:20	7:20
End Time	8:30	8:30	8:30	8:30	8:30	8:30
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	3117	3281	3127	3119	3056	3136
Vehs Exited	3122	3269	3166	3144	3050	3150
Starting Vehs	73	57	89	73	56	68
Ending Vehs	68	69	50	48	62	59
Travel Distance (mi)	1013	1074	1030	1045	1002	1033
Travel Time (hr)	70.9	85.4	78.3	66.5	64.2	73.1
Total Delay (hr)	36.5	49.1	43.6	31.3	30.4	38.2
Total Stops	3093	3396	3119	2894	2859	3073
Fuel Used (gal)	46.9	52.7	49.4	46.9	44.9	48.1

Interval #0 Information Seeding

Start Time	7:20
End Time	7:30
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:30
End Time	8:30
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3117	3281	3127	3119	3056	3136
Vehs Exited	3122	3269	3166	3144	3050	3150
Starting Vehs	73	57	89	73	56	68
Ending Vehs	68	69	50	48	62	59
Travel Distance (mi)	1013	1074	1030	1045	1002	1033
Travel Time (hr)	70.9	85.4	78.3	66.5	64.2	73.1
Total Delay (hr)	36.5	49.1	43.6	31.3	30.4	38.2
Total Stops	3093	3396	3119	2894	2859	3073
Fuel Used (gal)	46.9	52.7	49.4	46.9	44.9	48.1

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	178	133	202	201	333	629	160
Average Queue (ft)	82	41	119	97	158	400	153
95th Queue (ft)	147	97	187	169	277	720	186
Link Distance (ft)	618	618	1288	1288	440	602	
Upstream Blk Time (%)						17	
Queuing Penalty (veh)						0	
Storage Bay Dist (ft)							110
Storage Blk Time (%)						36	25
Queuing Penalty (veh)						142	70

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	L	TR
Maximum Queue (ft)	112	119	284	250	263	317	100	352
Average Queue (ft)	46	42	178	132	137	108	56	169
95th Queue (ft)	90	98	260	223	235	237	112	295
Link Distance (ft)	1288	1288	762	762		379		426
Upstream Blk Time (%)						1		0
Queuing Penalty (veh)						0		0
Storage Bay Dist (ft)					260		75	
Storage Blk Time (%)					2	0	6	42
Queuing Penalty (veh)					3	1	16	27

Network Summary

Network wide Queuing Penalty: 260

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:35	4:35	4:35	4:35	4:35	4:35
End Time	5:45	5:45	5:45	5:45	5:45	5:45
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	3816	3837	3827	3826	3767	3813
Vehs Exited	3814	3868	3833	3789	3740	3809
Starting Vehs	129	131	119	112	86	113
Ending Vehs	131	100	113	149	113	123
Travel Distance (mi)	1349	1351	1344	1346	1332	1344
Travel Time (hr)	190.1	192.2	151.9	197.2	135.7	173.4
Total Delay (hr)	145.9	147.8	107.9	153.1	92.1	129.4
Total Stops	4240	4488	4124	4709	3941	4300
Fuel Used (gal)	85.6	86.1	76.5	86.9	71.9	81.4

Interval #0 Information Seeding

Start Time	4:35
End Time	4:45
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	4:45
End Time	5:45
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3816	3837	3827	3826	3767	3813
Vehs Exited	3814	3868	3833	3789	3740	3809
Starting Vehs	129	131	119	112	86	113
Ending Vehs	131	100	113	149	113	123
Travel Distance (mi)	1349	1351	1344	1346	1332	1344
Travel Time (hr)	190.1	192.2	151.9	197.2	135.7	173.4
Total Delay (hr)	145.9	147.8	107.9	153.1	92.1	129.4
Total Stops	4240	4488	4124	4709	3941	4300
Fuel Used (gal)	85.6	86.1	76.5	86.9	71.9	81.4

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	475	400	144	132	455	478	160
Average Queue (ft)	276	221	73	55	455	163	78
95th Queue (ft)	416	359	127	106	459	374	169
Link Distance (ft)	618	618	1288	1288	440	602	
Upstream Blk Time (%)	0				96	2	
Queuing Penalty (veh)	0				0	0	
Storage Bay Dist (ft)							110
Storage Blk Time (%)						21	3
Queuing Penalty (veh)						32	7

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	L	TR
Maximum Queue (ft)	477	497	556	517	285	411	100	360
Average Queue (ft)	229	245	312	274	198	241	60	175
95th Queue (ft)	424	450	545	515	334	438	113	306
Link Distance (ft)	1288	1288	762	762		379		426
Upstream Blk Time (%)			1	1		12		0
Queuing Penalty (veh)			0	0		0		0
Storage Bay Dist (ft)					260		75	
Storage Blk Time (%)					6	16	4	43
Queuing Penalty (veh)					15	43	14	35

Network Summary

Network wide Queuing Penalty: 147

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	7:20	7:20	7:20	7:20	7:20	7:20
End Time	8:30	8:30	8:30	8:30	8:30	8:30
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	3086	3163	3146	3040	3157	3120
Vehs Exited	3078	3162	3127	3078	3196	3128
Starting Vehs	72	64	58	89	84	72
Ending Vehs	80	65	77	51	45	64
Travel Distance (mi)	1007	1046	1028	1021	1055	1031
Travel Time (hr)	66.2	76.7	65.4	64.5	74.3	69.4
Total Delay (hr)	32.1	41.4	30.7	30.0	38.7	34.6
Total Stops	2885	3090	2810	2758	3198	2948
Fuel Used (gal)	45.2	49.5	45.8	45.6	48.9	47.0

Interval #0 Information Seeding

Start Time	7:20
End Time	7:30
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:30
End Time	8:30
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3086	3163	3146	3040	3157	3120
Vehs Exited	3078	3162	3127	3078	3196	3128
Starting Vehs	72	64	58	89	84	72
Ending Vehs	80	65	77	51	45	64
Travel Distance (mi)	1007	1046	1028	1021	1055	1031
Travel Time (hr)	66.2	76.7	65.4	64.5	74.3	69.4
Total Delay (hr)	32.1	41.4	30.7	30.0	38.7	34.6
Total Stops	2885	3090	2810	2758	3198	2948
Fuel Used (gal)	45.2	49.5	45.8	45.6	48.9	47.0

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	LT	R
Maximum Queue (ft)	157	106	198	201	134	177	646	160
Average Queue (ft)	72	31	109	82	64	74	392	150
95th Queue (ft)	132	76	175	159	118	140	718	187
Link Distance (ft)	620	620	1280	1280		438	602	
Upstream Blk Time (%)							14	
Queuing Penalty (veh)							0	
Storage Bay Dist (ft)					120			110
Storage Blk Time (%)					0	3	40	21
Queuing Penalty (veh)					1	3	156	59

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	L	T	R	L	TR
Maximum Queue (ft)	125	133	292	268	70	233	203	100	366
Average Queue (ft)	61	58	168	120	19	106	99	54	178
95th Queue (ft)	105	110	254	224	57	189	177	112	314
Link Distance (ft)	1280	1280	756	756		379			426
Upstream Blk Time (%)									1
Queuing Penalty (veh)									0
Storage Bay Dist (ft)					50		260	75	
Storage Blk Time (%)					3	34	0	3	45
Queuing Penalty (veh)					12	55	0	7	29

Network Summary

Network wide Queuing Penalty: 322

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:35	4:35	4:35	4:35	4:35	4:35
End Time	5:45	5:45	5:45	5:45	5:45	5:45
Total Time (min)	70	70	70	70	70	70
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	3833	3917	3898	3860	3913	3885
Vehs Exited	3839	3905	3833	3843	3908	3867
Starting Vehs	106	90	112	145	110	111
Ending Vehs	100	102	177	162	115	130
Travel Distance (mi)	1359	1374	1361	1346	1368	1362
Travel Time (hr)	99.6	120.3	135.4	118.5	120.5	118.9
Total Delay (hr)	55.2	75.1	90.8	74.3	75.5	74.2
Total Stops	4375	4876	4965	4869	4866	4791
Fuel Used (gal)	65.1	70.4	72.9	68.8	69.2	69.3

Interval #0 Information Seeding

Start Time	4:35
End Time	4:45
Total Time (min)	10

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	4:45
End Time	5:45
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	3833	3917	3898	3860	3913	3885
Vehs Exited	3839	3905	3833	3843	3908	3867
Starting Vehs	106	90	112	145	110	111
Ending Vehs	100	102	177	162	115	130
Travel Distance (mi)	1359	1374	1361	1346	1368	1362
Travel Time (hr)	99.6	120.3	135.4	118.5	120.5	118.9
Total Delay (hr)	55.2	75.1	90.8	74.3	75.5	74.2
Total Stops	4375	4876	4965	4869	4866	4791
Fuel Used (gal)	65.1	70.4	72.9	68.8	69.2	69.3

Intersection: 3: S Neville Street/N Neville Street & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LT	R	LT	R
Maximum Queue (ft)	391	369	131	124	145	453	438	160
Average Queue (ft)	232	180	54	37	120	268	184	94
95th Queue (ft)	351	304	106	86	183	499	369	197
Link Distance (ft)	620	620	1277	1277		438	602	
Upstream Blk Time (%)						13	1	
Queuing Penalty (veh)						0	0	
Storage Bay Dist (ft)					120			110
Storage Blk Time (%)					11	43	30	2
Queuing Penalty (veh)					27	86	46	5

Intersection: 7: Morewood Avenue & Fifth Avenue

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LT	TR	LT	TR	L	T	R	L	TR
Maximum Queue (ft)	601	615	552	498	75	400	285	100	370
Average Queue (ft)	297	313	336	296	31	221	205	64	197
95th Queue (ft)	567	586	516	484	74	428	323	117	337
Link Distance (ft)	1277	1277	762	762		379			426
Upstream Blk Time (%)			2	1		16			1
Queuing Penalty (veh)			0	0		0			0
Storage Bay Dist (ft)					50		260	75	
Storage Blk Time (%)					6	41	22	7	44
Queuing Penalty (veh)					30	125	61	22	35

Network Summary

Network wide Queuing Penalty: 437

APPENDIX O
Five-year Reportable Crash Summaries

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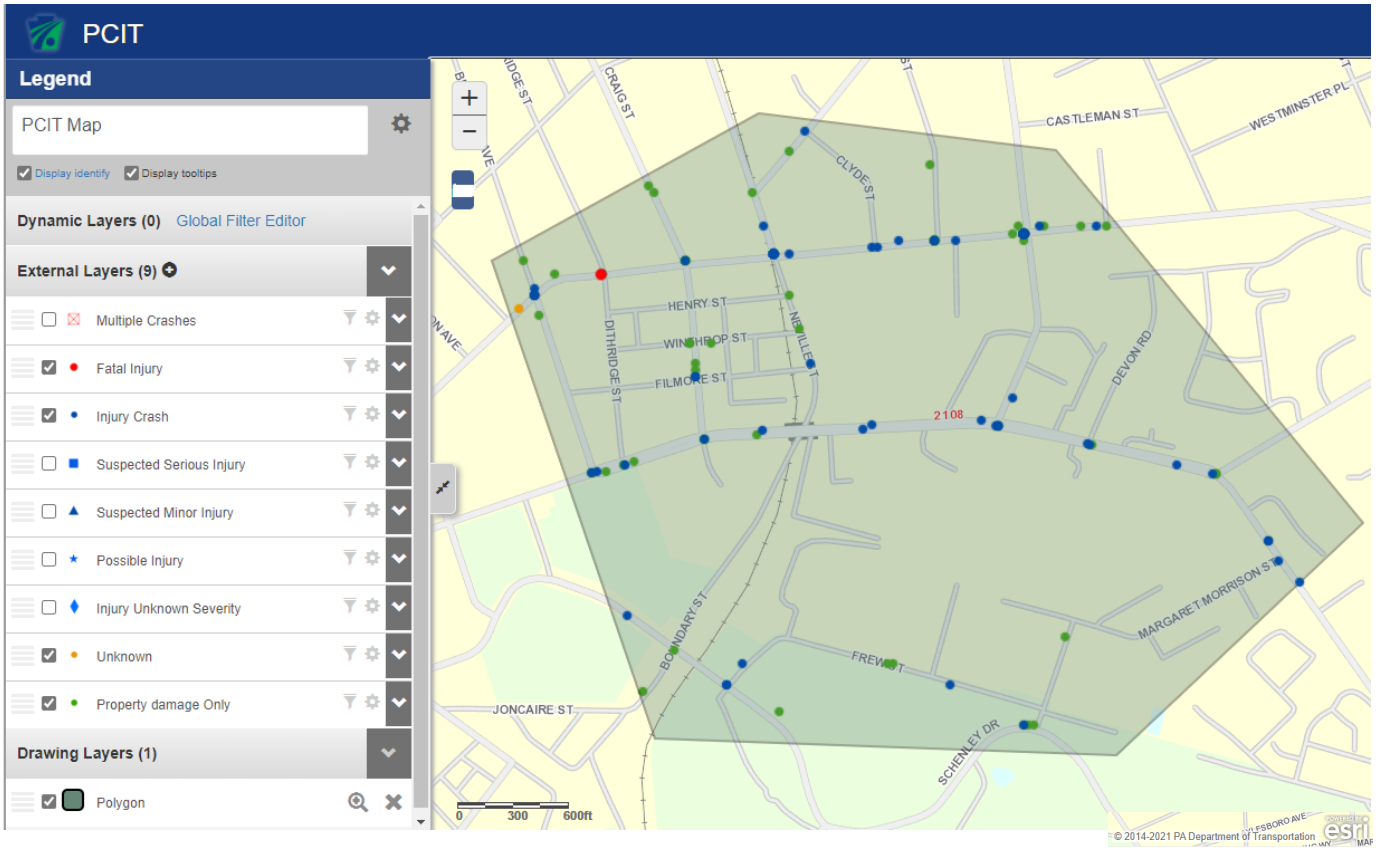

FILE NAME: Z:\2020\R200398.00 - CMU-2022 IMP\CAD\TIS Figures\CMU_IMP_Border.dgn

PLOTTED: 2/2/2022

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PROJECT NO/CLIENT	R200398.00 / Carnegie Mellon University
PROJECT	2032 Carnegie Mellon Institutional Master Plan City of Pittsburgh, Allegheny County
TITLE	Summary Crash Locations (5 Years)
SCALE: N.T.S.	
DWN.	TMW
CHKD.	RAK
APPENDIX	O

Pennsylvania Crash Information Tool

Date Range: 01/01/2016 to 12/31/2020*

CRASH SEVERITY LEVEL BY YEAR

	2016 CRASHES	2017 CRASHES	2018 CRASHES	2019 CRASHES	2020 CRASHES	ALL YEARS CRASHES
FATAL INJURY	0	0	0	0	1	1
SUSPECTED SERIOUS INJURY	0	0	2	2	2	6
SUSPECTED MINOR INJURY	3	7	6	8	6	30
POSSIBLE INJURY	4	4	3	2	2	15
UNKNOWN SEVERITY	10	5	9	4	3	31
UNKNOWN IF INJURED	0	0	1	0	1	2
PROPERTY DMG ONLY	15	19	20	16	14	84
TOTAL	32	35	41	32	29	169

CRASH DESCRIPTION TYPES BY YEAR

	2016 CRASHES	2017 CRASHES	2018 CRASHES	2019 CRASHES	2020 CRASHES	ALL YEARS CRASHES
ANGLE	9	16	15	14	10	64
BACKING	1	0	1	0	0	2
HEAD ON	2	1	0	2	2	7
HIT FIXED OBJECT	4	1	5	2	5	17
OPP DIRECTION SIDESWIPE	1	1	0	0	0	2
PEDESTRIAN	4	3	8	6	5	26
REAR END	8	9	8	3	5	33
SAME DIRECTION SIDESWIPE	3	4	4	5	2	18
TOTAL	32	35	41	32	29	169

PERSON INJURY SUMMARY BY YEAR

	2016 PERSONS	2017 PERSONS	2018 PERSONS	2019 PERSONS	2020 PERSONS	ALL YEARS PERSONS
FATALITIES	0	0	0	0	1	1
SUSPECTED SERIOUS INJURIES	0	0	2	2	2	6
SUSPECTED MINOR INJURIES	3	8	7	9	12	39
POSSIBLE INJURIES	5	6	4	3	3	21
UNKNOWN SEVERITY	11	6	11	4	4	36
UNKNOWN IF INJURED	0	0	5	1	3	9

*** PLEASE NOTE: Years which do not appear in the report contain zero crashes for this request.**

* Complete records of reportable crashes are available in PCIT for the following years: 2001 - 2020

* Crash information for 2021 to 2022 is incomplete at the time of this printing. As such, data for 2021 to 2022 is not included in this report.

IMPORTANT: The information contained in this document is drawn from raw data and should not be interpreted as representing an engineering judgement or determination made by the Department of Transportation as to the type and severity of accidents noted herein.

Print Date: 05/27/2022

Print Date: 05/27/2022

PCIT - PUBLIC REQUEST / PRESS INQUIRY REPORT (01-07)

NOTES:

1 Injury Severity Disclaimer

Please note that beginning January 1, 2016, PennDOT adopted the Federal standard for collecting injury severity data. The field descriptions and definitions changed from the state standard that had been in use for decades. This resulted in a substantial shift in severity levels. Therefore, comparison of the “Suspected Serious Injury”, “Suspected Minor Injury” and “Possible Injury” categories will not be consistent for crashes taking place before versus after the adoption of the new standard.

REPORT PARAMETERS:

Date Range : 01/01/2016 to 12/31/2020

Selected Shapes : Polygon

Filter Characteristics:

This report counts the number of crashes.

APPENDIX P
Existing Parking Lot Inventory and Capacity

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Observed Parking Occupancy

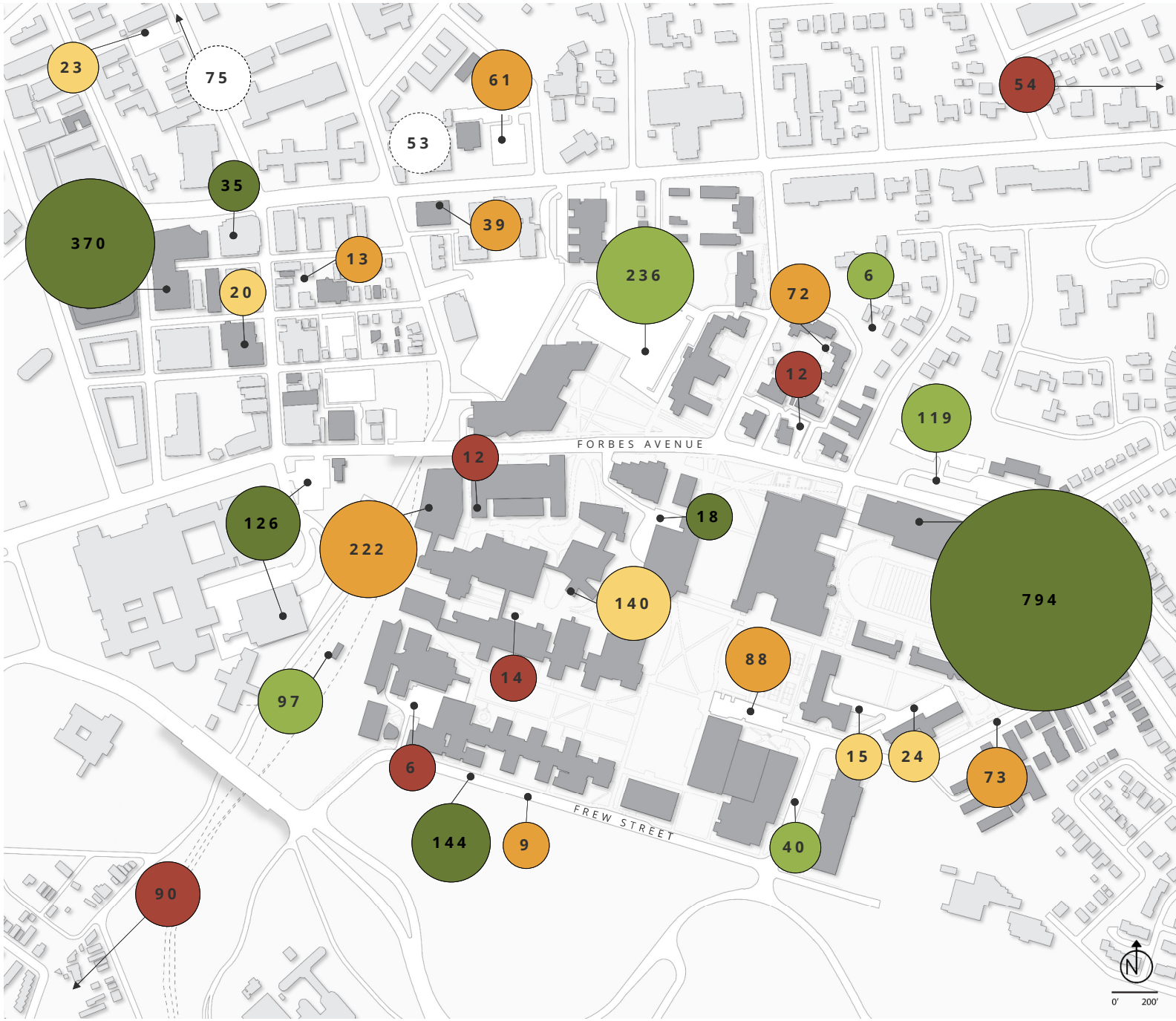
EXISTING SUPPLY

- OCCUPANCY ≤ 55%
- 55% < OCCUPANCY ≤ 65%
- 65% < OCCUPANCY ≤ 75%
- 75% < OCCUPANCY ≤ 85%
- OCCUPANCY > 85%
- NEWLY-ACQUIRED

OBSERVATIONS:

- Parking is distributed across campus
- Large lots are highly utilized
- Many of the small lots are inefficient

➢ *Note: Circles are scaled to represent the total number of parking spaces, which is also indicated by the number noted in the center. Data from TCS Hall Transportation Study, June 2017.*



APPENDIX Q
Parking Demand Analysis Calculation

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Subject:	**Parking Supply and Demand Analysis per Net Assignable Square Footage (NASF)**		
Project No.:	**R200398.00**		
Project Name:	**Carnegie Mellon University 2022-2023 Institutional Master Plan**		
Computed By:	**TMW**	Date:	**2/17/2022**
Checked By:	**RAK**	Date:	**2/17/2022**

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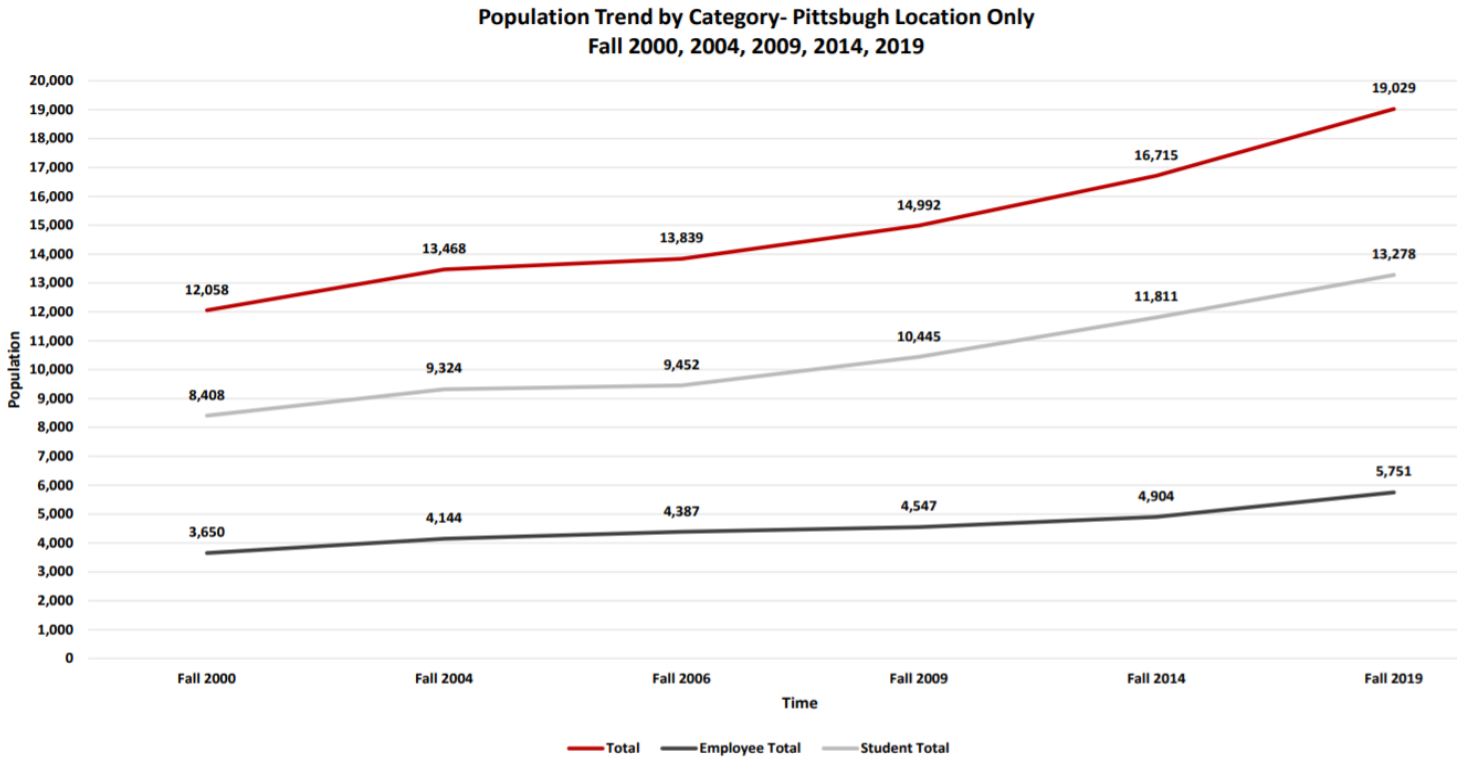
Demographic Data, per 2022-32 IMP, Appendix D

5751 Employees

13278 Students

19029 Total



Subject:	**Parking Supply and Demand Analysis per Net Assignable Square Footage (NASF)**		
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Net Assignable Square Footage, per 2022-32 IMP, Appendix D

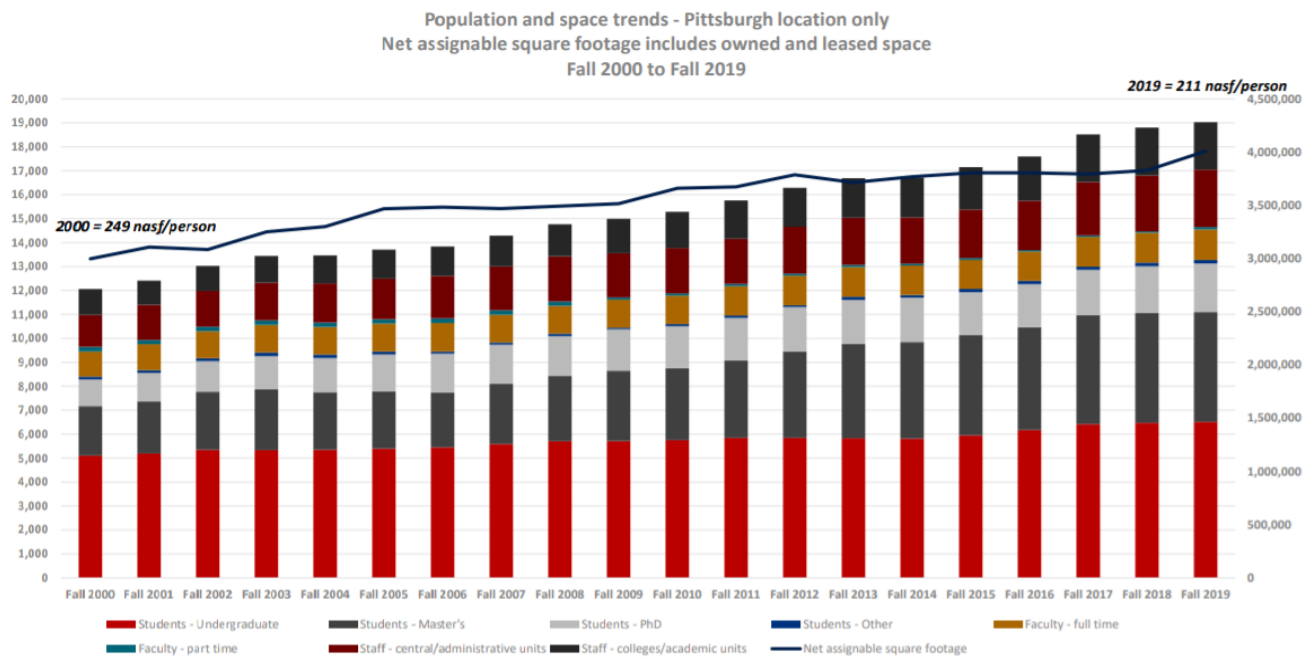
249 nasf/person, 2000

211 nasf/person, 2019

250 nasf/person, 2032 target

4,015,119 total nasf, 2019

Through proposed developments in the IMP, Carnegie Mellon is using expansion projects to return to the year 2000 level of campus density, 250 nasf/person. Work from home policies will also help reduce density. Anticipated trip generation is thus based on 250 nasf/person.



4,757,250 2019 nasf equivalent at 250 nasf/person

742,131 Space from existing buildings to be shifted to take up space in new buildings to achieve 250 nasf/person

1,198,300 Proposed nasf, assuming 50% of the master plan's full buildout is completed (Table 6.2)

456,169 Net new nasf, after existing campus uses shifted to new buildings to achieve 250 nasf/person

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Estimate of Parking Demand per nasf

2972 Existing on-campus parking supply at 4,015,119 nasf (211 nasf/person)

2972 Proposed on-campus parking supply at 4,757,250 nasf (250 nasf/person) to achieve IMP Performance Target goal

38% 2018 Parking Master Plan, mode share of typical employee commuters by automobile

30% TDM mode share target for auto commuters

8% TDM auto mode share target reduction

Parking at 211 nasf/person

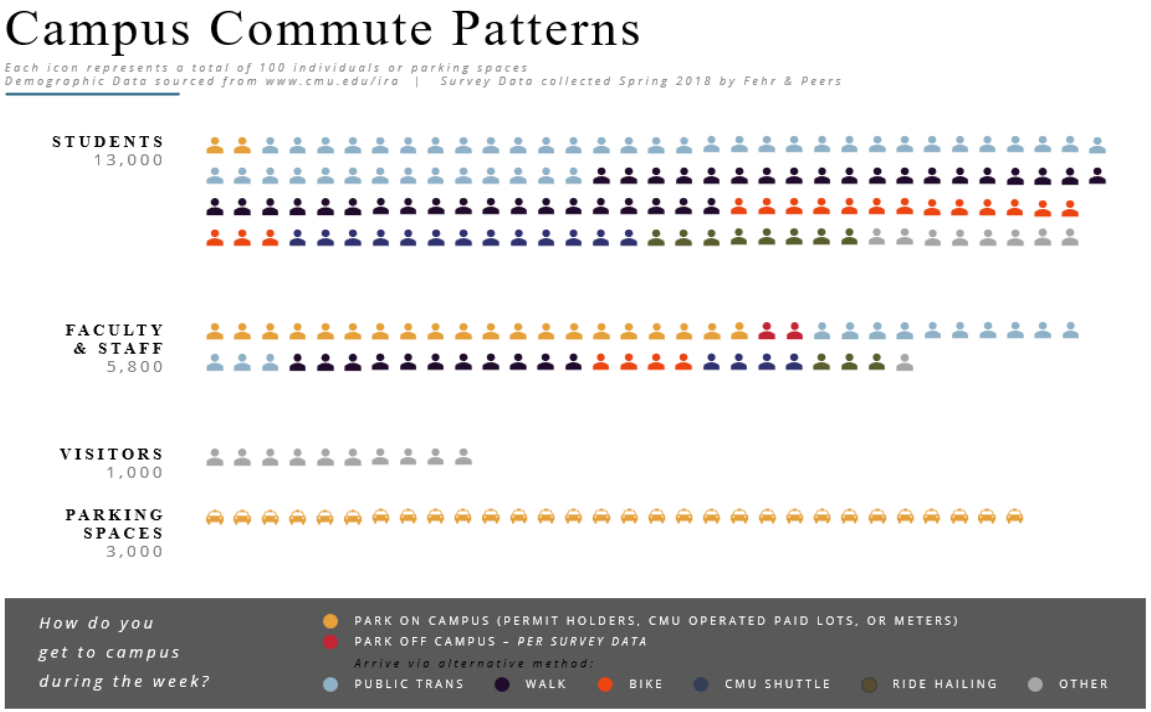
0.000740 Parking per nasf, existing density (211 nasf/person)

0.000681 Parking per nasf, existing density with TDM 8% reduction

Parking at 250 nasf/person

0.000625 Parking per nasf, proposed density (250 nasf/person)

0.000575 Parking per nasf, proposed density (250 nasf/person) with 8% TDM reduction



Subject:	**Parking Supply and Demand Analysis per Net Assignable Square Footage (NASF)**		
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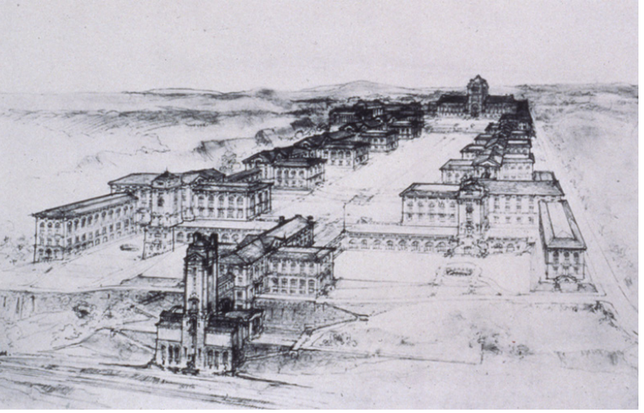
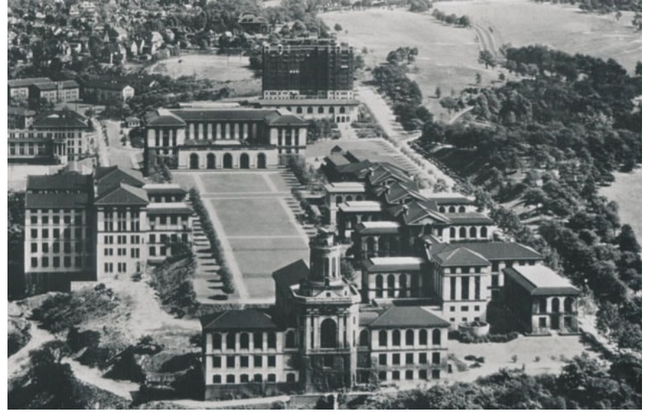
Parking Calculations after TDM

2972	Existing parking supply
2621	Existing parking demand, February 2020 (88%)
2411	Parking demand after 8% TDM reduction
2675	Total parking spaces at 90% capacity
262	Demand for new parking at 250 nasf/person for 456,169 nasf (50% of total)
2673	Total parking demand, 2032, with 50% of IMP projects realized
90%	Anticipated parking occupancy at 50% full buildout in 2032 (2972 spaces)

Conclusion: If campus development from 2022-2032 does not exceed 50% of the maximum potential size of IMP development projects, if Carnegie Mellon is successful in achieving the 250 nasf/person goal, and if the target 8% parking demand reduction is successfully achieved through TDM, Carnegie Mellon can successfully achieve their mobility goal of providing no net new parking for projects within the 2022-2032 IMP. Should any of these conditions not be met, Carnegie Mellon will submit an amended TIS to analyze impacts of overages.