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Section #7
Traffic Impact Study
Bramhall Street - 22; MMC Congress Street Building
Portland, Maine

PREPARED FOR:
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22 Bramhall Street
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Revised - Traffic Impact Study
Bramhall St. – 22; MMC Congress St. Building
Portland, Maine
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I. Introduction

A Scoping Meeting for this project was held on October 23, 2018 that reviewed Sections 1-6 of the Traffic Movement Permit (TMP) application. This traffic impact study is Section 7 of that application, and examines the potential traffic impact of phase three (3) of the proposed Maine Medical Center expansion in Portland, Maine. The site of the expansion is located at the site of the existing Gilman Garage in the southeast corner of the Congress Street / Gilman Street intersection. The site is identified on City Tax Map 53, Lot D007, and City Tax Map 65 Lots H001, H002, H005, H008, and H009. A proposed site plan is provided with the site plan application under separate cover. The attached Figure 1 in Attachment 7A shows the location of the site.

The existing site is the same location as the Gilman parking garage for the employees of Maine Medical Center. The proposed project consists of razing the existing employee garage and constructing additional hospital space, including new operating rooms and patient rooms, although the total number of beds will remain the same, since the new patient rooms are intended to decompress the existing hospital. A new drop off and pick up loop, with access to the visitor garage is proposed on Congress Street, to the west of the existing visitor garage. Parking will be provided for employees at the recently approved St. John Street employee parking garage and for the patients and visitors in the existing and recently expanded visitor parking garage. The expansion is proposed to be a total of 265,000 sf and is also anticipated to add 200 employees by 2023, the opening year of the project. After opening, MMC is anticipated to add an additional 124 employees, for a total increase of 324 employees.

II. Existing Traffic Volumes

Turning movement counts were completed by Accurate Counts at the following intersections from 5:00AM to 9:00AM and 2:00PM to 8:00 PM on the specified dates:

- St John Street / Valley Street: November 8, 2017
- Valley Street / Commercial Street: November 2, 2017
- Congress Street / St. John Street: November 2, 2017
- St John Street / Park Avenue: November 8, 2017

Accurate Counts also completed turning movement counts at the intersection of Valley Street with Congress Street on June 26, 2018 from 6:00AM – 6:00PM.

Turning movement counts were also completed by Gorrill Palmer at the following intersections:

- St. John Street / D Street: May 30, 2018, 6:00AM – 9:00AM and 3:00PM – 6:00PM
- Congress Street / Bramhall Street: August 23, 2018, 6:00AM – 9:00AM and 3:00PM – 6:00PM
- Congress Street / Visitor Garage: August 29, 2018, 6:00AM – 9:15AM and 3:00PM – 6:00PM
- Visitor Garage / Crescent Street: August 29, 2018, 6:00AM – 9:00 AM and 3:00PM – 6:00PM

In addition, turning movement counts were completed by Gorrill Palmer at the intersection of St. John Street with the Margarita's Driveway on May 17, 18, and 19, 2017 from 6:00AM to 8:00AM, 7:45AM to 9:00AM, 5:00PM to 8:00PM, and 3:00PM to 5:00PM. Those volumes were used as the base raw volumes for St. John Street and for Margaritas during the peak hours of the generator. This evaluation has focused on the peak hour of the adjacent street, which occurs at 7:30AM to 8:30AM and 4:15PM to 5:15PM at the intersection of Congress Street with Bramhall Street.

The results of all counts for the peak hour of the adjacent street are shown on the attached Figure 2 in Attachment 7A.

III. Other Developments in the Vicinity of the Site

Approved projects that are not yet opened as well as projects for which applications have been filed are required to be included in the predevelopment volumes for this project. Based on conversations with City Staff, traffic from the proposed Mercy Hospital expansion, the proposed Dunkin' Donuts on St. John Street, and the Thompson's Point development should be included in the background traffic. It should be noted that although portions of the Thompson's Point development have been constructed, the full build out traffic volumes from the August 2011 Traffic Impact Study have been utilized to be conservative. The traffic from this project that is forecast to impact the Maine Medical Center Expansion study area is shown on the attached Figure 4.

IV. Predevelopment Traffic Volumes

Traffic volumes that are not collected during peak summer months are typically seasonally adjusted to estimate traffic volumes that may be experienced during the peak summer months. Since the traffic counts were not collected during the peak summer months, the raw volumes shown on Figure 2 have been seasonally adjusted based on the weekly group mean factors published by MaineDOT. The following summarizes the adjustment at each intersection:

- Valley Street / Commercial Street: 8.3%
- St. John Street / Valley Street: 8.3%
- D Street / St. John Street: 2.4%
- Margaritas / St. John Street: 3.6%
- Congress Street / St. John Street: 8.3%
- Park Avenue / St. John Street: 8.3%
- Valley Street / Congress Street: 2.4%
- Gilman Street / Congress Street: 15.5% (Congress through traffic only)
- Bramhall Street / Congress Street: 0.0%

In addition to the seasonal adjustment, the adjacent roadway volumes were also increased by an annual growth rate to forecast the traffic volume that may be experienced during the build out year of the project. An annual growth rate of 0.5% per year (approved by the City and consistent with other studies in the area) has been applied to the seasonally adjusted volumes to yield the 2023 Adjusted Volumes shown on the attached Figure 3. The 2023 Adjusted Volumes have been combined with the Other Development Volumes to yield the 2023 Predevelopment traffic volumes shown on the attached Figure 5. It should be noted that the employee growth rate in the IDP is forecast to be approximately 0.63% per year, which is very similar to the growth rate approved by the City for overall on-street traffic and used on other studies in the area.

It should be noted that the traffic volumes into and out of parking areas has not been adjusted because significant seasonal or annual fluctuation is not anticipated.

V. Trip Generation

The trip generation for the Phase 3 Expansion was calculated using the Institute of Transportation Engineers' (ITE) publication, *Trip Generation*, Seventh Edition, Land Use Code (LUC) 610 – Hospital. The Tenth Edition is available, but has not yet been accepted by the MaineDOT. The expansion is proposed to be a total of 265,000 sf and is anticipated to add 200 employees by 2023 and an additional 124 employees after opening for a total of 324 employees. As approved at the October 13, 2017 Pre-Scoping meeting, the trip generation for the expansion has been based on the number of employees, students, and physicians. The following is a summary of the trip generation for the expansion based on an increase of 324 employees:

- AM Peak Hour Adjacent Street: 110 trip ends
- PM Peak Hour Adjacent Street: 107 trip ends
- AM Peak Hour of Generator: 126 trip ends
- PM Peak Hour of Generator: 152 trip ends
- Saturday Peak Hour: 172 trip ends

A trip end is defined as a trip into or out of the site; thus, a round trip is equal to two trip ends. Since the forecast traffic exceeds 99 trip ends during a peak hour, a Traffic Movement Permit is required. The City of Portland has delegated review authority, so the application can be administered by the City. A copy of the trip generation calculations are included as an attachment to this section.

Based on ITE's *Trip Generation*, the following trip distribution is anticipated:

- AM Peak Hour Adjacent Street: 88 in / 22 out
- PM Peak Hour Adjacent Street: 37 in / 70 out
- AM Peak Hour of Generator: 82 in / 44 out
- PM Peak Hour of Generator: 61 in / 91 out
- Saturday Peak Hour: 95 in / 77 out

VI. Trip Composition and Assignment

GP has assumed that all trips are primary in nature and made for the sole purpose of going to and from the site. The forecast trip generation is anticipated to be comprised of patients/visitors and employees. The portion of the trip generation that is forecast to be due to patients/visitors has been based on information provided by MMC in an email dated August 8, 2018.

Table 2.4 on page 41 of the IDP shows the forecast campus weekday volumes for 2026. The patient and visitor volumes from 2026 have been proportionally reduced based on the growth rates to estimate the number of patients and visitors in 2023. Based on the 2026 patient and visitor volumes, an increase of approximately 50 patients and visitors in an average weekday is anticipated by 2023 due to the proposed expansion. The distribution of the patient/visitors has been based on the following assumptions:

- 20% of daily trips occur during the peak hours
- 80% entering during the AM peak hour
- 80% exiting during the PM peak hour

Based on these assumptions, the following trip composition is forecast for the peak hours of the adjacent street:

- AM Peak Hour Adjacent Street (assumed 7:30AM – 8:30AM):
    - Patients/Visitors: 14 trip ends (11 in / 3 out)
    - Employees: 58 trip ends (46 in / 12 out)

- PM Peak Hour Adjacent Street (assumed 4:15PM – 5:15PM):
    - Patients/Visitors: 14 trip ends (3 in / 11 out)
    - Employees: 56 trip ends (21 in / 35 out)

It should be noted that although the patient/visitor trip generation appears to be low, it is a reasonable level of trip generation for the expansion since the expansion is proposed to decompress the existing hospital, and not significantly increase the number of patients at the hospital.

The patient/visitor trip assignment has been based on the proposed driveway locations, information from MMC in an email dated August 8, 2018, and the existing traffic patterns and is shown on Figure 6 in Attachment 7A. The trip assignment for the employees was initially based on the VHB Travelshed for employees, and adjusted per City comments. The trip assignments are shown on Figure 7 in Attachment 7A.

VII. Previously Approved Expansions

Although the currently proposed expansion is for 324 employees, there were previously approved expansions that did not trigger a Traffic Movement Permit. It is required that any development on a property that was completed within the last 10 years be included in the permitted trip generation. Based on information from the City of Portland, there were two previously approved, constructed, and occupied expansions. Based on a review of a traffic impact study completed for the second expansion, dated May 2013, the trip generation for the combined expansions was forecast to be the following:

- AM Peak Hour of the Generator: 77 trip ends
- PM Peak Hour of the Generator: 84 trip ends

It should be noted that the May 2013 traffic impact study included only the peak hours of the generator. Since the expansion projects that were forecast to generate this traffic have been completed and occupied, this traffic is assumed to be included in the existing traffic on the adjacent roadway network. However, it must be included when determining the study area for the currently proposed expansion. The forecast trip generation for the currently proposed expansion has been combined with the previous expansions to yield the following trip generation:

- AM Peak Hour: 187 trip ends
- PM Peak Hour: 191 trip ends

The proposed expansion focuses on the peak hour of the adjacent street traffic, since this is expected to be the most congested time period on the adjacent roadway network. Since the only available information for the previous studies is the peak hour of the generator, those volumes were added to the proposed traffic for the purposes of determining the overall study area. This is a conservative approach, since it overlaps the peak of the hospital that includes primarily employees and occurs off hours, with the peak of the adjacent street traffic.

The distribution between patients and visitors for the previous expansion is assumed to be the same as the currently proposed expansion. The attached Figure 17 shows the estimated trip assignment for the previous expansion and the currently proposed expansion.

VIII. Congress Street Pick-Up / Drop-Off

As part of the proposed expansion, a new patient drop-off / pick-up loop is proposed on Congress Street to the west of the existing visitor garage. The loop is proposed to have a connection to the Visitor Garage, to allow people to drop a patient off then park or pick up a patient after exiting the Visitor Garage. This prevents traffic from recirculating on Congress Street between the loop and the parking garage. There is space for approximately 11 vehicles before backing onto Congress Street, which is anticipated to be adequate based on observations completed at the existing Bramhall Street loop. It is anticipated that the new Congress Street pick-up / drop-off will draw existing traffic from the Bramhall Street drop-off loop. To estimate the traffic that may use the Congress drop-off instead of the Bramhall drop-off, counts and observations were completed by Gorrill Palmer at the Bramhall drop-off on August 28-30, 2018 from 7:00AM – 10:00AM and 3:00PM – 6:00PM. On August 29, 2018 an additional two hours, from 10:00AM – 12:00PM, was also collected. The counts were separated into six types of trips through the loop; pick-up, drop-off, pass-through, parked, valet parking (park), and valet parking (return). Using the counts collected, traffic was reassigned based on existing traffic patterns and the following assumptions:

- Valet parking and return will remain at the Bramhall drop off
- 75% of pick-ups and drop-offs will use the Congress drop off (from MMC in an email dated August 8, 2018)
- 25% of pick-ups and drop-offs will remain at the Bramhall drop off (from MMC in an email dated August 8, 2018)

The reassigned traffic volumes are shown on Figure 8 in Attachment 7A. It should be noted that the initial assumption was that valet parking would remain only at the Bramhall drop-off. Since that time, it has been identified that there will be valet parking at the

Congress Street drop-off as well as the Bramhall drop-off. This may increase traffic volumes using the Congress drop-off and right turning traffic from Congress to Bramhall. The increase in traffic due to valet parking is not forecast to significantly impact the results of this evaluation.

IX. Phase 3 Net Impact

The Phase 3 patient/visitor trip assignment on Figure 6, the Phase 3 employee trip assignment on Figure 7, and the reassigned drop-off traffic on Figure 8 were combined to yield the Phase 3 Net Impact shown on Figure 9 in Attachment 7A.

X. Existing Employee Garage

The proposed Phase 3 expansion will be located at the site of the existing employee garage in the southeast corner of the Congress Street / Gilman Street intersection. The existing employee garage is proposed to be razed and MMC will be constructing a new 2400 space employee parking garage on St. John Street. As a result, the existing employee traffic volumes will be relocated to St. John Street. The existing employee garage traffic volumes have been estimated based on the turning movement counts completed at the garage access on Gilman Street on November 2, 2017, the previously approved proposed employee garage assignment, and existing traffic patterns. Figure 10 in Attachment 7A shows the existing employee garage traffic to be removed from the adjacent roadway network.

XI. Proposed Employee Garage

MMC will construct an approximately 2,400 space employee parking garage with an adjacent surface lot with approximately 50 spaces on St. John Street. The proposed garage and adjacent surface lot are anticipated to initially accommodate the following:

- Gilman Garage: 1,274 spaces
- Sportsman Lot: 60 spaces
- 222 St. John Street Lot: 283 spaces
- Gateway Garage: 100 spaces
- Classic Lot: 97 spaces
- 321 Brackett Street Lot: 9 spaces
- MMC Employee On-Street Parking: 200 spaces (estimated)

Total Parking Spaces = 2,023

The 200 on-street parking spaces are an approximate number of spaces intended to include vehicles that may currently park on neighborhood streets. It should be noted that in the garage and surface lot 50 spaces are proposed to be reserved for the Eagles and approximately 150 are reserved for 222 St. John Street. The 50 parking spaces reserved for the Eagles are not expected to occur on a regular and frequent basis. Additionally, the Eagles and 222 St. John Street peaks are not expected to coincide with the peaks of MMC.

The Institutional Development Plan (IDP) identifies a current total of 2,027 employee parking spaces both on and off campus. The existing employee spaces that are not included in the garage spaces identified above are located in the 7 Bramhall Street lot (26 spaces). This lot is proposed to remain where it is because it serves specific programs at that location.

Existing Parking Area Traffic Volumes

Traffic counts were completed at the existing Gilman Garage access as follows:

- Accurate Counts - November 2, 2017 from 5:00AM to 9:00PM (16 hours) – The counts indicate that the peak hours of traffic entering and exiting the garage occurred from 6:45AM to 7:45AM with 448 trip ends, and 6:00PM to 7:00PM with 326 trip ends.
- GP – January 18, 2018 from 6:30AM to 8:00AM and 5:45PM to 7:15PM - The times were chosen based on the peak hours determined in the November 2, 2017 counts. The counts completed by GP confirmed the original findings from the November 2, 2017 counts.

Traffic counts were also completed at the existing 222 St. John Street surface parking as follows:

- GP - January 18, 2018 from 6:15AM to 7:45AM and from 3:30PM to 5:00PM
- GP - January 23, 2018 from 5:45PM to 7:15PM

The 222 St. John Street parking lot peak hours occurred from 6:15AM to 7:15AM and 3:30PM to 4:30PM. The entering and exiting traffic for each 15 minute period at the 222 St. John Street is shown on the attached "St. John Street Parking Garage Trip Generation" table.

The Gilman Employee Parking Garage and 222 St. John Street surface lot represent approximately 85% of the MMC employee spaces anticipated to be accommodated by the proposed St. John Street garage. As such, it is anticipated that when combined they will

represent the majority of the traffic patterns that can be expected at the new garage. To represent the traffic patterns of the remaining 15% of the satellite lots as well as the on-street parking spaces, the traffic patterns were assumed to be similar to the 222 St. John Street satellite lot. The trip generation for each 15 minute period for each satellite parking area has been estimated based on the trip generation at the 222 St. John Street parking lot and is shown on the attached "St. John Street Parking Garage Trip Generation" table.

Reassigned Parking Area Traffic Volumes

Since the employees that currently park in the Gilman garage will be shifted to the new garage, they will have to take a shuttle in the future rather than have direct access to the hospital as they do currently. Because of this shift, we would expect those employees to arrive approximately 15 minutes earlier than they typically would and that they would end up leaving the new garage approximately 15 minutes later. Therefore, the counted volumes for the Gilman Garage were adjusted by 15 minutes to estimate the traffic that would be experienced when the spaces are relocated to 222 St. John Street. The adjusted Gilman Garage volumes are shown on the attached "St. John Street Parking Garage Trip Generation" table.

The trip generation for the proposed St. John Street garage is based on adding the existing or estimated trip generation of each 15 minute period for each parking location to identify the overall AM & PM peak hours. The AM peak hour of the proposed garage is estimated to occur from 6:00AM to 7:00AM with and the PM peak hour of the garage is estimated to occur 4:15PM to 5:15PM. The peak hours of the garage were evaluated in the St. John Street Garage Memorandum dated June 19, 2018, completed by Gorrill Palmer. This evaluation focuses on the peak hours of the adjacent street which occur from 7:30AM to 8:30AM and 4:15PM to 5:15PM. It should be noted that the PM peak hour of the adjacent street occurs at the same time as the PM peak hour of the proposed garage. The trip generation for the reassigned 2,023 spaces is estimated to be **443 trip ends** during the AM peak hour of the adjacent street and **474 trip ends** during the PM peak hour of the adjacent street. Detailed data is shown on the attached spreadsheet.

Trip Distribution and Assignment

The garage is proposed to be accessed via a full movement driveway directly onto St. John Street as well as indirectly via the Margarita's driveway. During peak hours of the garage, the garage will be set up such that the ground level and first deck will be accessed via the Margarita's driveway and decks 2-8 will be accessed directly via the St. John Street access. All of the 222 St. John Street employees, the 50 Eagles spaces, and some of the MMC Campus employees will use the ground level and first deck parking spaces with decks 2 – 8 used by MMC Campus employees only. It should be noted that at the time this study was prepared, it was estimated that of the approximately All employee shuttles throughout the day (enter and exit) will access the garage via the Margarita's access.

Unused shuttles during non-peak times of the day are expected to be parked on the ground level.

The trip distribution (enter vs. exit) for the proposed St. John Street garage has been based on the counts completed at the existing 222 St. John Street surface lot and the Gilman Garage. Based on the counts, the following trip distribution is anticipated for the proposed 222 St. John Street garage:

- AM Peak Hour: 98% entering, 2% exiting
- PM Peak Hour: 14% entering, 86% exiting

The regional trip assignment has been based primarily on the VHB travelshed completed for the IDP and revised slightly per comments received from the City. For localized assignment, it is based on GP's review of the area as well as numerous discussions with the City of Portland staff and traffic consultant. The trip assignment is shown on the attached Figure 11 in Attachment 7A.

Proposed Parking Garage Trip Generation – Adjacent Street Peak Hour

The proposed St. John Street garage was evaluated for full capacity in a memorandum dated June 19, 2018. To ensure that the proposed garage can accommodate the proposed expansion, the total trip generation for the full capacity garage has been compared to the trip generation for the reassigned existing spaces. The difference between the reassigned existing spaces and the full capacity garage trip generation has been compared to the proposed expansion employee trip generation to determine if the proposed garage can accommodate the proposed expansion.

The total trip generation for the proposed St. John Street garage is based on adding the existing or estimated trip generation of each 15 minute period for each parking location to identify the overall AM & PM peak hours. Then, a ratio of the proposed number of parking spaces (2,450) to the existing combined number of parking spaces to forecast the trip generation for the proposed garage.

Based on the combined volumes for the parking areas and the proportional increase in number of parking spaces, the trip generation of the proposed garage during the peak hours of the adjacent street is forecast to be **537 trip ends** during the AM peak hour and **574 trip ends** during the PM peak hour.

The MMC employee's full garage is 94 trip ends greater than the existing reassigned volumes during the AM peak hour of the adjacent street and 100 trip ends greater than the reassigned volumes during the PM peak hour of the adjacent street. The proposed garage was previously evaluated for full capacity and was forecast to operate at acceptable levels of service. The ITE forecast trip generation for the AM and PM peak hours of the

adjacent street is forecast to be 68 trip ends and 66 trip ends respectively, which is less than the increase from the existing to full build out of the garage. Since the garage is forecast to operate at acceptable levels of service with more trip generation, the garage can accommodate the increase of 200 employees and students.

XII. Shuttle Assignment

MMC will be upgrading their current shuttle service to accommodate the new garage. In addition to employee traffic, shuttles will be used to transport employees between the parking garage and the hospital. There are proposed to be 13 shuttles during the peak hours, each with an approximate 15 minute headway. Based on this information, one shuttle can make approximately four trips to and from the proposed garage during a one hour period. With 13 shuttles, approximately 52 round (52 enter and 52 exit) trips are anticipated at the site during the peak hour. As identified previously, all entering and exiting shuttles will use the Margarita's access. These 104 trips have been added to the employee trips. The shuttle assignment has been based on the shuttle routes provided by MMC. At this time, seven of the shuttles are proposed to use the Congress Street drop off area on Gilman Street and six shuttles are proposed to use the Bramhall Street drop off. It has been assumed that the shuttles will turn right out of the Margarita's access with the Gilman Drop off shuttles entering taking a right in and the Bramhall shuttles entering taking a left in. The shuttle assignment is shown on Figure 12 in Attachment 7A.

XIII. 222 St. John Street MMC Traffic

MMC currently utilizes a satellite parking lot at 222 St. John Street for employees. This traffic currently uses the Margarita's access and will be relocated to the proposed parking garage and is included in the proposed parking garage trip generation. The existing estimated 222 St. John Street MMC traffic is shown on Figure 13 in Attachment 7A.

XIV. 222 St. John Street Cut-Through (Non-MMC Traffic)

The existing turning movement counts indicate that some traffic uses the existing Union Station access from Congress Street to the site. For the purposes of this assessment, to be conservative, it has been assumed that this cut-through will not be available and that traffic has been reassigned to the adjacent street. The attached Figure 14 shows the reassignment of the cut-through traffic (not including MMC traffic).

XV. Proposed Garage Net Impact

The net impact of the proposed St. John Street garage has been calculated by combining the Proposed Garage Reassignment on Figure 11 with the Shuttle Assignment on Figure 12 and the 222 St. John Street Cut-Through traffic on Figure 14, then subtracting the existing Gilman garage traffic on Figure 10 and the existing 222 St. John Street MMC traffic on Figure 13. This yields the Proposed Garage Net Impact traffic volumes on Figure 15 included in Attachment 7A.

XVI. Postdevelopment Traffic Volumes

The predevelopment traffic volumes shown in Figure 5 have been combined with the Phase 3 Net Impact on Figure 9 and the Proposed Employee Garage Net Impact on Figure 15 to yield the 2023 Postdevelopment volumes shown on the attached Figure 16 in Attachment 7A.

XVII. Capacity Analysis

GP completed capacity analyses for the intersections discussed above using the Synchro/SimTraffic computer analysis software (Version 10). Level of service rankings are similar to the academic ranking system where an 'A' is good with little control delay and an 'F' represents poor conditions. At an unsignalized intersection, if the level of service falls below a 'D', an evaluation should be made to determine if mitigation is warranted. The following tables summarize the relationship between control delay per vehicle and level of service:

Level of Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (s)
A	Less than 10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	Greater than 80.0

Level of Service Criteria for Unsignalized Intersections

Level of Service	Control Delay per Vehicle (s)
A	Less than 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	Greater than 50.0

The analysis has been completed assuming that the signal at the intersection of Valley Street with Congress is removed and will be unsignalized (based on a study completed by Sebago Technics, Inc.). This change is supported by the City and MaineDOT. Additionally, the intersection of St. John Street with the proposed Garage access is unsignalized in the predevelopment conditions and signalized in the postdevelopment conditions. The predevelopment conditions include timing and phasing that was provided by the City. The postdevelopment has been evaluated based on optimized signal timing. This includes converting the intersection of St. John Street / Congress Street from exclusive pedestrian phasing to concurrent pedestrian phasing. The following table summarizes the capacity analysis results. The detailed analyses are included in Attachment 7C.

Level of Service Summary

Approach	Level of Service			
	AM Pre	AM Post	PM Pre	PM Post
Park / St John (S)				
Park WB	C	C	D	D
St. John NB	C	B	D	C
St. John SB	E	C	D	C
Overall	**D**	**C**	**D**	**C**
Congress / St John (S)				
Congress EB	B	C	B	C
Congress WB	B	B	B	B
St. John NB	C	C	C	C
St. John SB	C	C	C	C
Overall	**B**	**C**	**B**	**C**
Margarita's / St. John (U)				
Margarita's EB	A	A	A	A
St. John NB	A	A	A	A
St. John SB	A	A	A	A
Garage / D / St. John (U/S)				
Garage EB	A	B	A	B
D WB	A	A	A	A
St. John NB	A	A	A	A
St. John SB	A	A	A	B
Overall	**N/A**	**A**	**N/A**	**B**

Approach	Level of Service			
	AM Pre	AM Post	PM Pre	PM Post
Valley / St. John (S)				
St. John EB	B	B	B	B
St. John WB	B	B	B	B
Valley NB	B	B	B	B
Valley SB	B	B	B	B
Overall	**B**	**B**	**B**	**B**
Commercial / Valley (S)				
Fore River Pkwy EB	E	C	E	D
Commercial WB	B	B	B	B
Valley SB	B	B	B	B
Overall	**D**	**C**	**D**	**C**
Valley / Congress (U)				
Congress EB	A	A	A	A
Congress WB	A	A	A	A
Valley NB	B	B	B	B
Gilman / Congress (U)				
Congress EB	A	A	A	A
Congress WB	A	A	A	A
Gilman NB	C	B	D	D
Gilman SB	A	B	B	B
Proposed Drop-Off / Congress (U)				
Congress EB	N/A	A	N/A	A
Congress WB	N/A	A	N/A	A
Drop-Off NB	N/A	C	N/A	C
Visitor Garage / Congress (U)				
Congress EB	A	A	A	A
Congress WB	A	A	A	A
Visitor Garage NB	C	C	B	C
MOB Garage SB	A	A	A	A
Bramhall / Congress (S)				
Congress EB	A	A	B	B
Congress WB	B	B	C	C
Bramhall NE	B	B	B	B
Deering SW	B	B	B	B
Overall	**B**	**B**	**B**	**B**

S=Signalized, U=Unsignalized

As shown in the table, all approaches to the study area intersections are forecast to operate at acceptable levels of service ('D' or better) during the AM and PM peak hours. Additionally, the operation of most intersection approaches is forecast to be maintained, while some are forecast to improve from the predevelopment conditions due to adjustments to signal timing. Any intersection approaches that are forecast to decrease in operation are forecast to decrease by one level of service (e.g. 'B' to 'C').

It should be noted that the intersection of Valley Street with A Street was not included in the capacity analysis. However, the removal of the existing employee garage is anticipated to **reduce** the traffic volumes at this intersection by 132 trip ends during the AM peak hour and 102 trip ends during the PM peak hour, which will improve its operation.

XVIII. Queue Analysis

GP completed a queue analysis using the same Synchro/SimTraffic computer analysis software that was used for the capacity analysis. The queuing analysis involves comparing the postdevelopment 95th percentile queue lengths of the site driveway and turn lanes to the available storage lengths. The queue lengths have been rounded up to the nearest five feet. The following table summarizes the postdevelopment 95th percentile queue lengths based on SimTraffic analyses. The detailed reports are included in Attachment 7C.

Queue Analysis Summary

Approach	Storage Length (ft)	95th Percentile Queue Length (ft)			
		AM Pre	AM Post	PM Pre	PM Post
Park / St John					
Park WB L	95	125	140	185	195
Park WB T	95	200	200	275	280
Park WB TR		225	230	410	525
St. John NB L		160	175	405	335
St. John NB LT		275	290	510	475
St. John NB R	110	165	165	185	175
St. John SB LT		740	330	340	260
St. John SB R	55	105	105	105	105
Congress / St John					
Congress EB L		200	245	195	230
Congress EB T		335	405	315	365
Congress EB R	290	165	295	140	205
Congress WB L	80	65	80	80	95
Congress WB R		100	95	135	140
St. John NB T		90	175	160	345
St. John NB TR	265	115	175	165	220
St. John SB L		135	110	110	110
St. John SB T		170	220	205	210
Margarita's / St. John					
Margarita's EB L		35	40	85	60
Margarita's EB R	125	30	55	60	60
St. John NB LT		30	100	40	100
St. John SB T		--	15	5	10

Approach	Storage Length (ft)	95th Percentile Queue Length (ft)			
		AM Pre	AM Post	PM Pre	PM Post
Garage / D / St. John					
Garage EB LTR		15	N/A	20	N/A
Garage EB LT		N/A	145	N/A	165
Garage EB R	150	N/A	80	N/A	100
D WB LTR		40	35	45	35
St. John NB LTR		10	N/A	20	N/A
St. John NB L	100	N/A	55	N/A	50
St. John NB TR		N/A	120	N/A	165
St. John SB LTR		20	N/A	25	N/A
St. John SB L	75	N/A	60	N/A	85
St. John SB TR		N/A	160	N/A	220
Valley / St. John					
St. John EB LT		90	120	90	140
St. John EB R	110	100	120	125	140
St. John WB L	335	245	215	25	250
St. John WB TR		50	50	60	60
Valley NB L		135	160	115	120
Valley NB TR		245	225	145	165
Valley SB LT		55	50	85	40
Valley SB TR	265	70	45	130	30
Commercial / Valley					
Fore River Pkwy EB L	430	630	395	625	465
Fore River Pkwy EB L	430	640	435	640	505
Fore River Pkwy EB T		1525	330	1225	650
Fore River Pkwy EB T		1420	265	1130	570
Commercial WB T		190	195	225	215
Commercial WB T		190	185	220	205
Commercial WB R	415	80	85	60	60
Valley SB L		105	115	115	115
Valley SB R		115	120	140	145
Valley SB R		120	130	140	155
Valley / Congress					
Congress EB L	50	10	15	15	20
Congress EB TR		5	10	10	15
Congress WB L	50	20	45	35	50
Congress WB TR		5	5	15	5
Valley NB LT		60	55	80	70
Valley NB R	170	55	60	65	55
Gilman / Congress					
Congress EB TR		45	30	30	30
Congress WB T		25	--	30	40
Congress WB L	65	65	45	75	65
Gilman NB LTR		100	70	200	105
Gilman SB LTR		45	50	55	60

Approach	Storage Length (ft)	95th Percentile Queue Length (ft)			
		AM Pre	AM Post	PM Pre	PM Post
Proposed Drop-Off / Congress					
Congress EB TR		N/A	20	N/A	--
Congress WB LT		N/A	85	N/A	115
Drop-Off NB LR		N/A	55	N/A	75
Visitor Garage / Congress					
Congress EB		100	110	30	45
Congress WB		30	35	40	55
Visitor Garage NB		55	50	70	65
MOB Garage SB		25	25	70	70
Bramhall / Congress					
Congress EB L		50	50	120	140
Congress EB TR	400	190	200	215	265
Congress WB L		135	135	180	160
Congress WB TR	65	105	105	105	105
Congress WB L		100	100	105	85
Bramhall NE TR	135	125	125	150	145
Deering SW L		105	120	235	230
Deering SW TR	50	85	85	85	90

As shown in the table, the 95th percentile queue lengths can be accommodated by the storage lengths for most approaches. Some queue lengths exceed the available storage lengths in both the predevelopment and postdevelopment conditions. The 95th percentiles are not forecast to increase by more than three vehicles for most approaches, assuming the length of a vehicle and the associated gap between vehicles is equal to 25 feet. In addition, there are several lanes which are forecast to have improved queue lengths, likely due to the redistribution of traffic in the study area and the modifications to signal timing. The 95th percentile queue length of the proposed Congress Street drop off is not forecast to exceed four vehicles during the AM or PM peak hours.

XIX. Sight Line Evaluation

As discussed in Sections 1-6, the existing sight distances at the proposed drop-off appears to meet City and MaineDOT criteria for 25 mph. The sight distances should continue to be evaluated through the design process to ensure no signs, landscaping or structures will create sight distance deficiencies.

XX. Crash Summary Data

Gorrill Palmer obtained the crash data from MaineDOT for the period of 2015-2017, the most recent period available (See Section 2 of Sections 1-6, Attachment 2A).

In order to evaluate whether a location has a crash problem, MaineDOT uses two criteria to define a High Crash Location (HCL). Both criteria must be met in order to be classified as an HCL.

1. A critical rate factor (CRF) of 1.00 or more for a three year period. A CRF compares the actual crash rate to the rate for similar intersections in the state. A CRF of less than 1.00 indicates a rate of less than average **and**:

2. A minimum of eight crashes over the same three year period.

Based on the crash data provided by MaineDOT, there are seven high crash locations in the vicinity of the study area:

- Intersection of Park Avenue with Valley Street
- Intersection of Congress Street with Gilman Street
- Intersection of St. John Street with A Street
- Intersection of Park Avenue with St. John Street
- Valley Street from A Street to C Street
- Congress Street from Forest Street to Weymouth Street
- St. John Street from Congress Street to Non-Intersection (just south of Park Avenue)

To better evaluate the high crash locations and identify correctable crash patterns, the police reports for these locations were provided by MaineDOT and used to create collision diagrams, included as an attachment to this section. The following discusses the high crash locations as well as pedestrian and bicycle crashes in more detail.

Park Avenue / Valley Street

This intersection has a CRF of 1.80 and experienced 10 collisions during the most recent three-year period. It is an unsignalized intersection that is STOP controlled on Valley Street with free flowing traffic on Park Avenue. The northbound Valley Street approach is one-way into the intersection.

There is one crash pattern at this intersection involving vehicles turning left from northbound Valley Street onto westbound Park Avenue and colliding with vehicles

traveling westbound on Park Avenue. Potential mitigation for this crash pattern may include restricting left turns out of Valley Street.

Additionally, one collision that occurred at this intersection involved a pedestrian and one involved a bicyclist. The traffic from the proposed MMC expansion is not expected to exacerbate this pattern.

Congress Street / Gilman Street

This intersection has a CRF of 3.26 and experienced 20 collisions during the most recent three-year period. It is an unsignalized intersection that is STOP controlled on the Gilman Street approaches with free flowing traffic on Congress Street. The southbound Gilman Street approach is one-way into the intersection. Based on a review of the collision diagram there are three crash patterns at this intersection; southbound through traffic on Gilman Street failing to yield to eastbound through traffic on Congress Street, southbound through traffic on Gilman Street failing to yield to westbound through traffic on Congress Street, and rear end collisions involving eastbound Congress Street traffic.

There were four collisions that involved southbound through traffic on Gilman Street failing to yield the right of way to the eastbound through traffic on Congress Street and three collisions that involved vehicles coming from the same direction failing to yield the right of way to westbound through traffic on Congress Street. These types of collisions may be due to the buildings along Congress Street blocking the sight distance of the southbound traffic. Because the MMC employee parking is being relocated to St. John Street, both the AM and PM total entering traffic volume for this intersection will be decreased from the Predevelopment condition to the Postdevelopment condition.

There were three rear end collisions on Congress Street eastbound. All three were caused by drivers following too closely and/or driver inattention. Additionally, all three collisions involved vehicles stopping for pedestrians in the crosswalk. It is possible that the removal of the traffic signal at the intersection of Congress Street with Valley Street may improve this crash pattern. The crosswalk is located close to the currently signalized intersection. After a vehicle passes through a signalized intersection, they do not anticipate stopping again immediately, which could be a contributing factor of the rear end collisions. If the signal is removed, drivers may be more likely to anticipate stopping. Additionally, if the signal is removed, it may reduce the time that vehicles are queued over the crosswalk, which reduces the time that pedestrians may walk between queued vehicles or be blocked from view by the queue.

St. John Street / A Street

This intersection has a CRF of 1.82 and experienced 8 collisions during the most recent three-year period. It is an unsignalized four-leg intersection with two-way traffic on all

approaches. Based on a review of the collision diagram, there were no correctable crash patterns identified at this intersection. It should be noted that with the removal of the existing employee garage and the construction of the proposed employee garage, the traffic patterns at the intersection are forecast to change (decrease in traffic volume), which may reduce crashes.

Park Avenue / St. John Street

This intersection has a CRF of 1.63 and experienced 36 collisions during the most recent three-year period. It is a signalized four-leg intersection with two-way traffic on all approaches, with the exception of Park Avenue to the east of St. John Street, which is one way away from the intersection. Based on a review of the collision diagram, there are four crash patterns at this intersection.

One crash pattern involved vehicles in the northbound St. John Street left turn lane attempting to go straight through the intersection from the left-most lane and colliding with left turning vehicles in the adjacent left-through lane. There were 13 such crashes at this intersection during the most recent three year period. Most of the drivers that incorrectly attempted to travel through the intersection claimed that they believed they could travel through the intersection from that lane. Overhead lane use signing for the northbound approach mounted next to the traffic signal heads similar to the existing signs facing the westbound and southbound approaches to this intersection may help reduce driver lane confusion.

Another crash pattern was northbound left turning vehicles sideswiping one another while traveling in the left turn lane and left-through lane from the northbound St. John Street approach to the intersection. Six of these crashes occurred at this intersection during the most recent three year period. There is already a skip line striping between the left turn lane and the left-through lane through the intersection. Many of the crashes involved in the two crash patterns discussed at this intersection so far occurred either during the winter or in the spring when the striping of the skip line may have faded away. Re-striping the skip line more frequently may help left turning vehicles stay in their own lane while completing the turn and it also may help vehicles in the left turn lane realize that they cannot travel through the intersection.

A third crash pattern at this intersection involves right angle collisions between westbound through vehicles on Park Avenue failing to yield to northbound through vehicles on St. John Street. Three of these crashes occurred at this intersection during the most recent three year period. All three collisions involved the westbound Park Avenue vehicle running the red light. Additional signage on Park Avenue may improve this pattern.

The fourth crash pattern at this intersection involved rear-end collisions involving vehicles at the northbound approach to this intersection. One potential contributing factor to rear end collisions at signalized intersections is inadequate signal clearance times. This crash pattern may be mitigated by reviewing the signal timings of this intersection to assure that adequate signal clearance times are provided for this approach.

Valley Street from A Street to C Street

This roadway link has a CRF of 2.89 and experienced 8 collisions during the most recent three-year period. There were no correctable crash patterns identified, however there were five crashes involving parked vehicles. Of the five crashes involving parked vehicles, three crashes involved vehicles that were parked illegally. Stricter enforcement of the parking regulations may help reduce the number of crashes along this segment of Valley Street. It should also be noted that there was one crash involving a pedestrian at this location during the most recent three year period.

Congress Street from Forest Street to Weymouth Street

This section of Congress Street has a CRF of 1.45 and experienced 10 collisions during the most recent three-year period. Based on a review of the collision diagram there is one crash pattern of rear end collisions in the eastbound direction. Of the 10 collisions, five were rear end collisions on Congress Street eastbound. The five collisions were caused by drivers following too closely. There are multiple driveways in this roadway segment, including an entrance to the Maine Medical Center visitor parking garage.

An overall review of the collisions showed that there were 9 collisions that occurred on a weekday and of those, 2 occurred during the AM peak commuter hour and 4 occurred during the PM peak commuter hour, when traffic volumes are heaviest. Additionally, one of the collisions that occurred in this area involved a bicyclist.

Restriping of this section of Congress Street to include a center turn lane may be an alternative to be pursued to improve this section of Congress Street.

St. John Street from Congress Street to Non-Intersection (just south of Park Avenue)

This section of St. John Street has a CRF of 3.00 and experienced 30 collisions during the most recent three-year period. Based on a review of the collision diagram, there are two crash patterns.

The first crash pattern involves sideswipe crashes involving vehicles traveling northbound on St. John Street, which are caused by vehicles making lane changes.

Of the 30 collisions, 17 involved vehicles attempting to turn left onto St. John Street from various driveways. There are many driveways on this link of St. John Street including McDonald's, Amato's, Sullivan Tire, Dunkin' Donuts, Lang's Express, Salty Sally's Bare and Grille and Portland Physical Therapy. Of the 30 crashes in this roadway segment, two involved left turns into driveways from St. John Street.

In a recent Traffic Impact Study completed by Maine Traffic Resources for a Dunkin Donuts relocation project in this section of St. John Street, a "road diet" was recommended that would include a single travel lane in each direction with a center turn lane. Gorrill Palmer supports that recommendation.

Pedestrian Collisions

There were 22 collisions involving pedestrians throughout the study area. Of those, 15 occurred when the pedestrian was within the marked crosswalk, seven of which involved one vehicle rear ending another that was yielding to the pedestrian. Several of the collisions involved pedestrians crossing without the walk sign at a signalized intersection, or abruptly entering the intersection. Others involved vehicles failing to yield to the pedestrians in the crosswalks. The attached Figure A in Attachment 7D shows the locations of the pedestrian collisions. Several of the pedestrian involved collisions appear to be located at or near the intersection of Congress Street with Bramhall Street. Most of these collisions occurred after dark. Although there is lighting at the intersection, additional lighting may improve pedestrian visibility. Additionally, three of the rear end collisions due to vehicles yielding to pedestrians in the crosswalk occurred on Congress Street at Gilman Street, discussed above.

Bicycle Collisions

There were 9 collisions involving bicyclists throughout the study area. One collision involved a bicyclist riding in a bike lane being struck by a turning vehicle on Park Avenue. Several of the collisions involved bicyclists riding in the roadway, but not following traffic rules. The bicycle crashes are also shown on the attached Figure A.

XXI. Left Turn Lane Evaluation

The need for a left turn lane on Congress Street at the proposed drop-off has been evaluated using two different sources. The first was Figure 8-19 from the MaineDOT Highway Design Guide, "Volume Warrants for Left-Turn Lanes at Unsignalized Intersections on 2-Lane Highways (40 mph)." Although the speed limit on Congress Street is unposted and assumed to be 25 mph, the 40 mph warrant is the lowest speed chart available for reviewing left turn lanes. This yields a conservative lane warrant evaluation. Based on a review of the evaluation, a left turn lane is warranted during the

AM peak hour and is not warranted in the PM peak hour. The detailed evaluation is included in Attachment 7D.

The second source was the National Cooperative Highway Research Program (NCHRP) 457, Figure 2-5 "Guideline for determining the need for a major-road left-turn bay at a two-way stop controlled intersection." This figure allows for the use of the assumed 25 mph speed limit. This evaluation supported the MaineDOT evaluation and indicated that the warrant is met in the AM peak hour but is not warranted in the PM peak hour. The detailed evaluation is included in Attachment 7D.

In addition to the two formal left turn lane warrant evaluations, the turning movements and crash history on the corridor were also considered in determining if left turn treatment should be considered. As discussed in the previous section, Congress Street in front of the proposed drop-off is a high crash location, with a crash pattern of rear end collisions. Additionally, the left turn volumes within this segment of Congress Street are shown on Figure 18 in Attachment 7A. Based on the left turn lane evaluation the crash history, and the left turn volumes, a center two way left turn lane is recommended on Congress Street from Forest Street to Weymouth Street.

XXII. Executive Summary

1. The proposed development is forecast to generate 126 trip ends during the AM peak hour of the generator, 152 trip ends during the PM peak hour of the generator, and 172 trip ends during the Saturday peak hour of the generator. This level of trip generation requires a MaineDOT traffic movement permit.

2. All study area intersection approaches are forecast to operate at acceptable levels of service in the Postdevelopment conditions. Additionally, for signalized intersections, we recommend that timing and phasing of the study area intersections be adjusted as needed upon completion of the MMC expansion.

3. Overall, the 95th percentile queue lengths are not forecast to exceed the predevelopment queue lengths by more than three vehicles for most approaches. For many approaches, the 95th percentile queue lengths are forecast to decrease from the predevelopment conditions due to both the redistribution of traffic throughout the study area and the optimization of signal timing.

4. The existing sight distances at the proposed Congress Street drop off appear to meet MaineDOT and City of Portland Standards.

5. The MaineDOT crash data indicates that there are seven high crash locations in the study area:

    - Intersection of Park Avenue with Valley Street
    - Intersection of Congress Street with Gilman Street
    - Intersection of St. John Street with A Street
    - Intersection of Park Avenue with St. John Street
    - Valley Street from A Street to C Street
    - Congress Street from Forest Street to Weymouth Street
    - St. John Street from Congress Street to Non-Intersection (just south of Park Avenue)

6. Based on a review of the MaineDOT and NCHRP left turn lane warrants at the proposed Congress Street drop-off / pick-up loop, as well as the crash history and the left turning volumes at adjacent intersections on Congress Street, a center two way left turn lane is recommended on Congress Street from Forest Street to Weymouth Street.

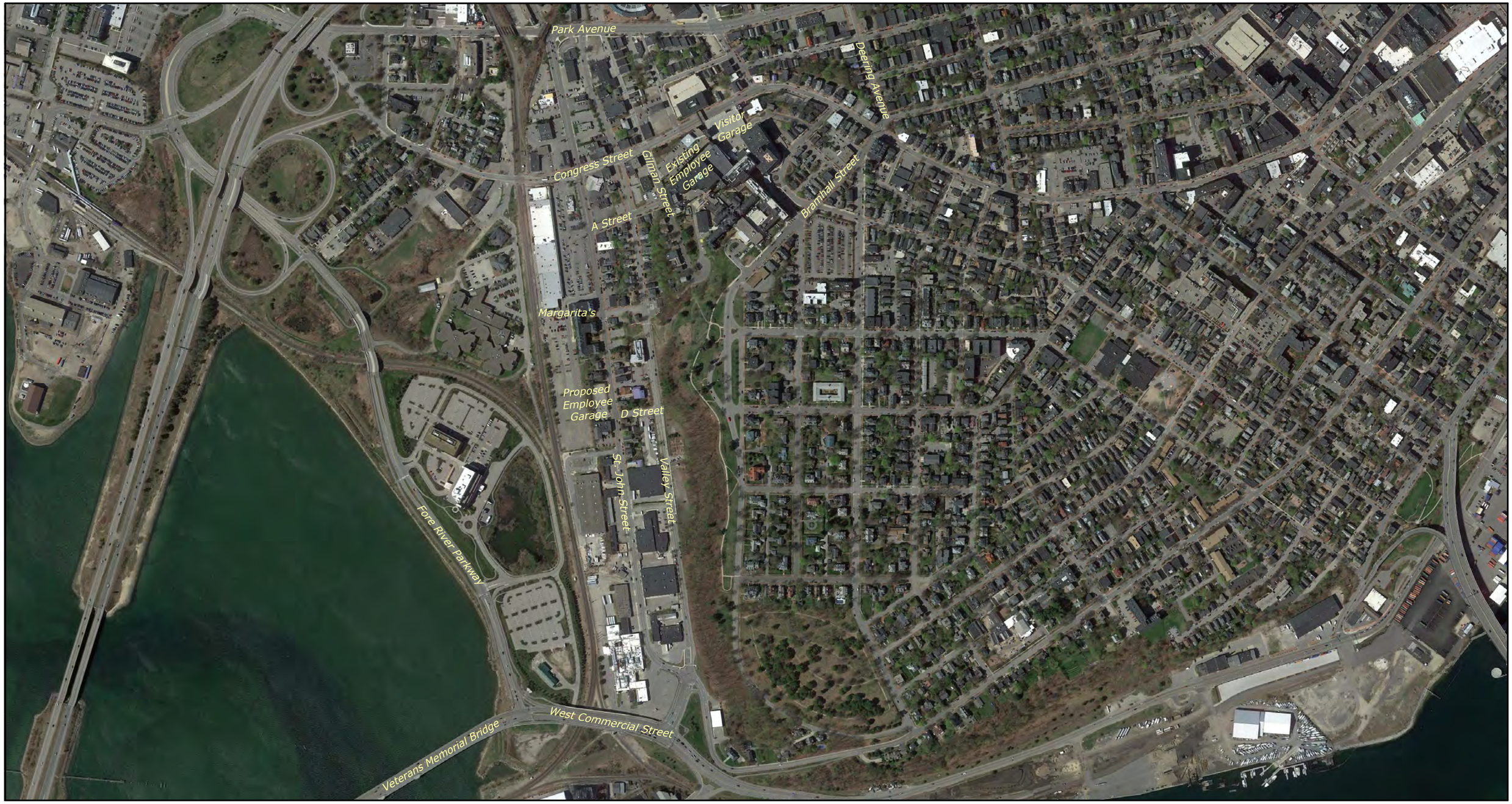
7. Overall, the proposed expansion is forecast to have a moderate impact on the surrounding roadway network; however, the surrounding roadway network has the capacity to accommodate the proposed project.

Attachment 7A

Site Location Map
Turning Movement Figures
VHB Travelshed

Location Map

Figure No. 1



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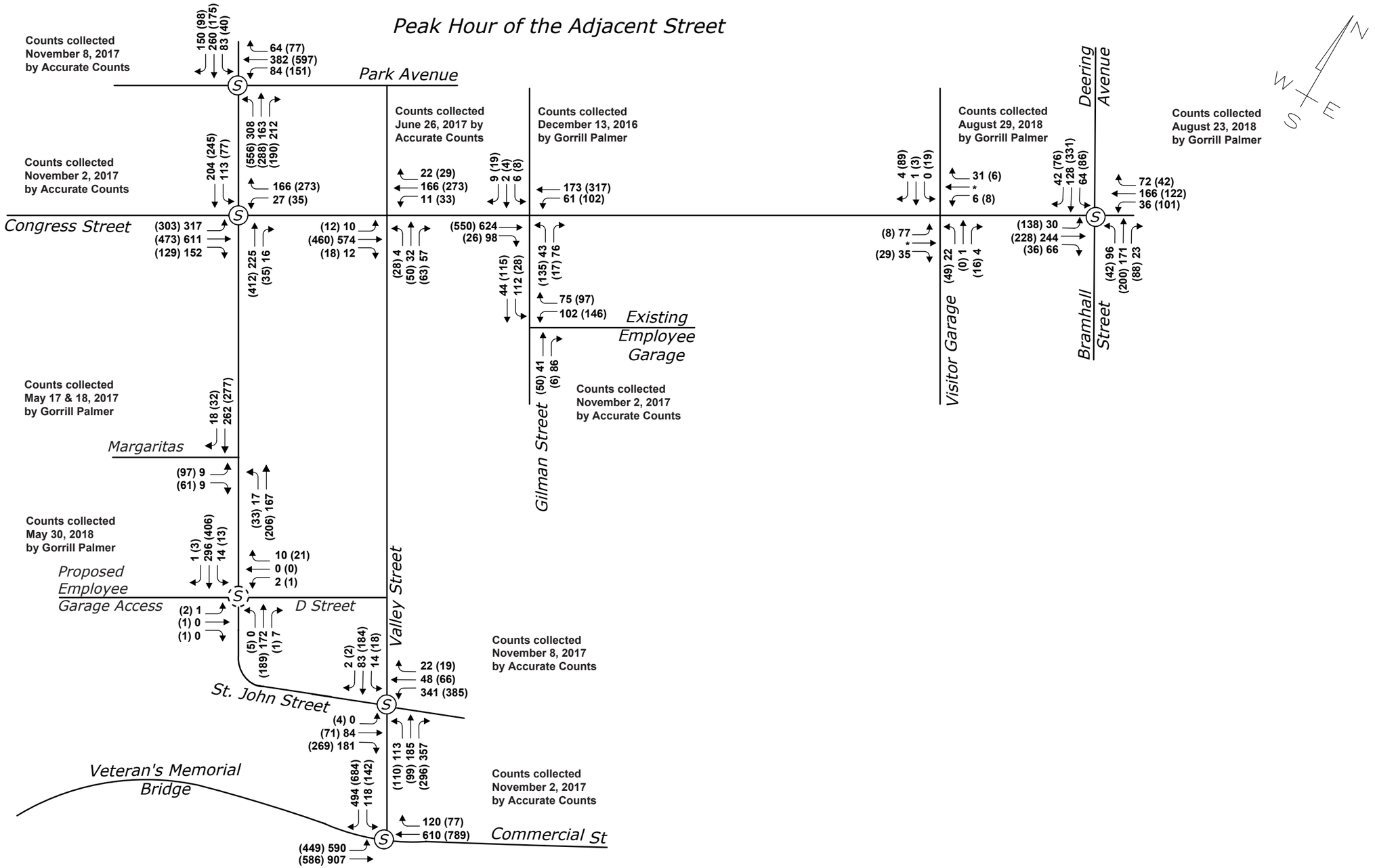

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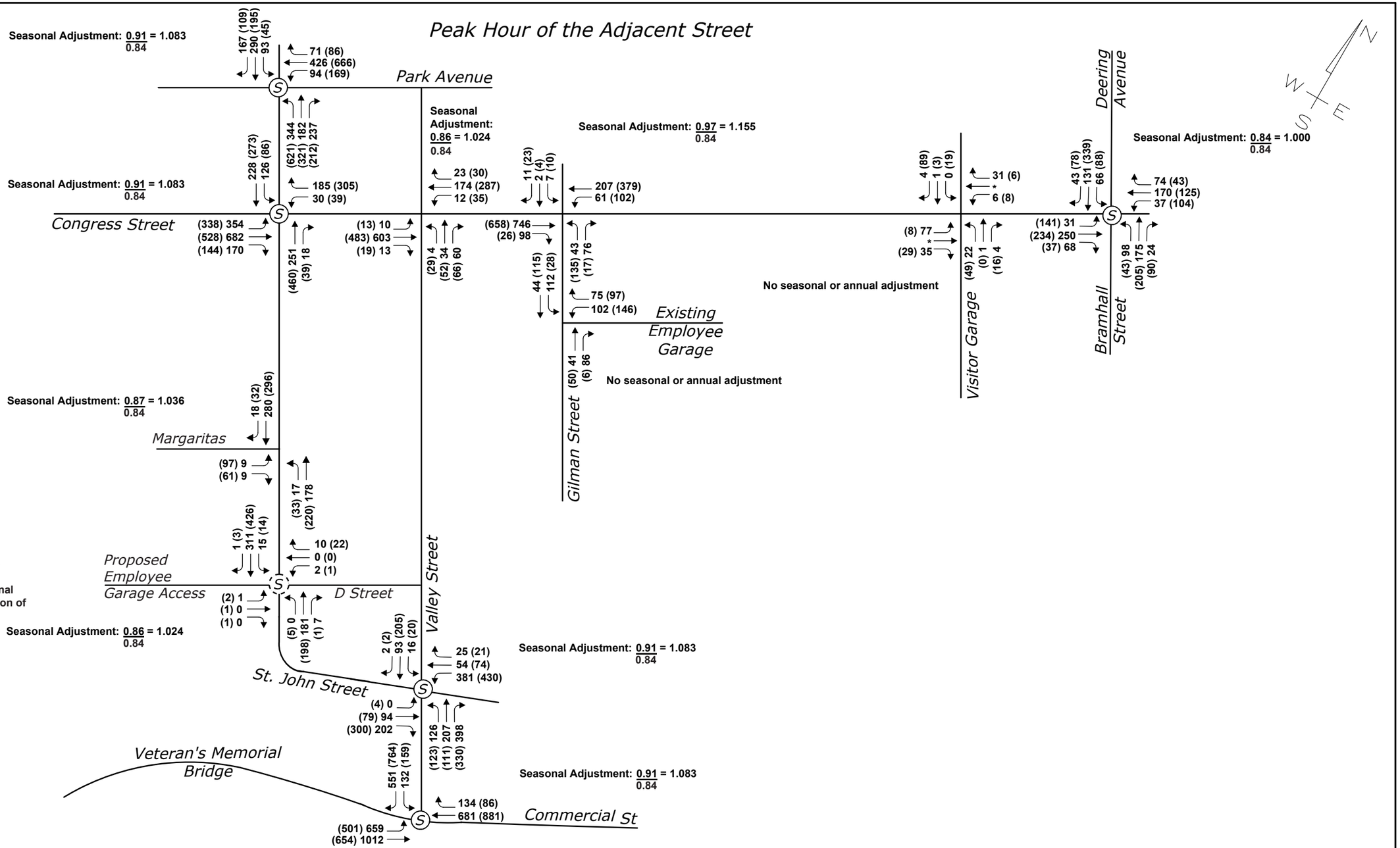
2023 Adjusted Volumes

Figure No. 3



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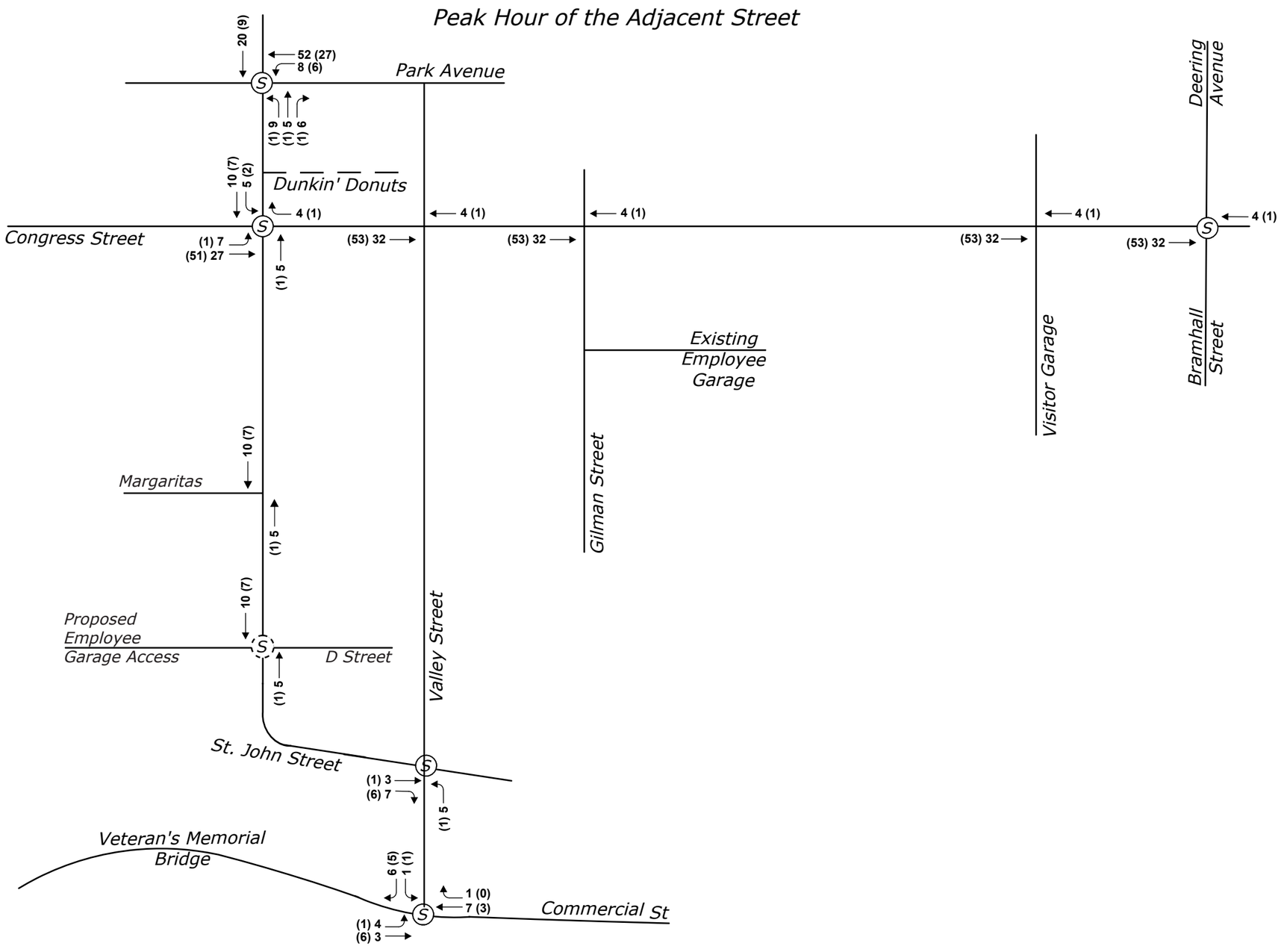
Other Development

Figure No. 4



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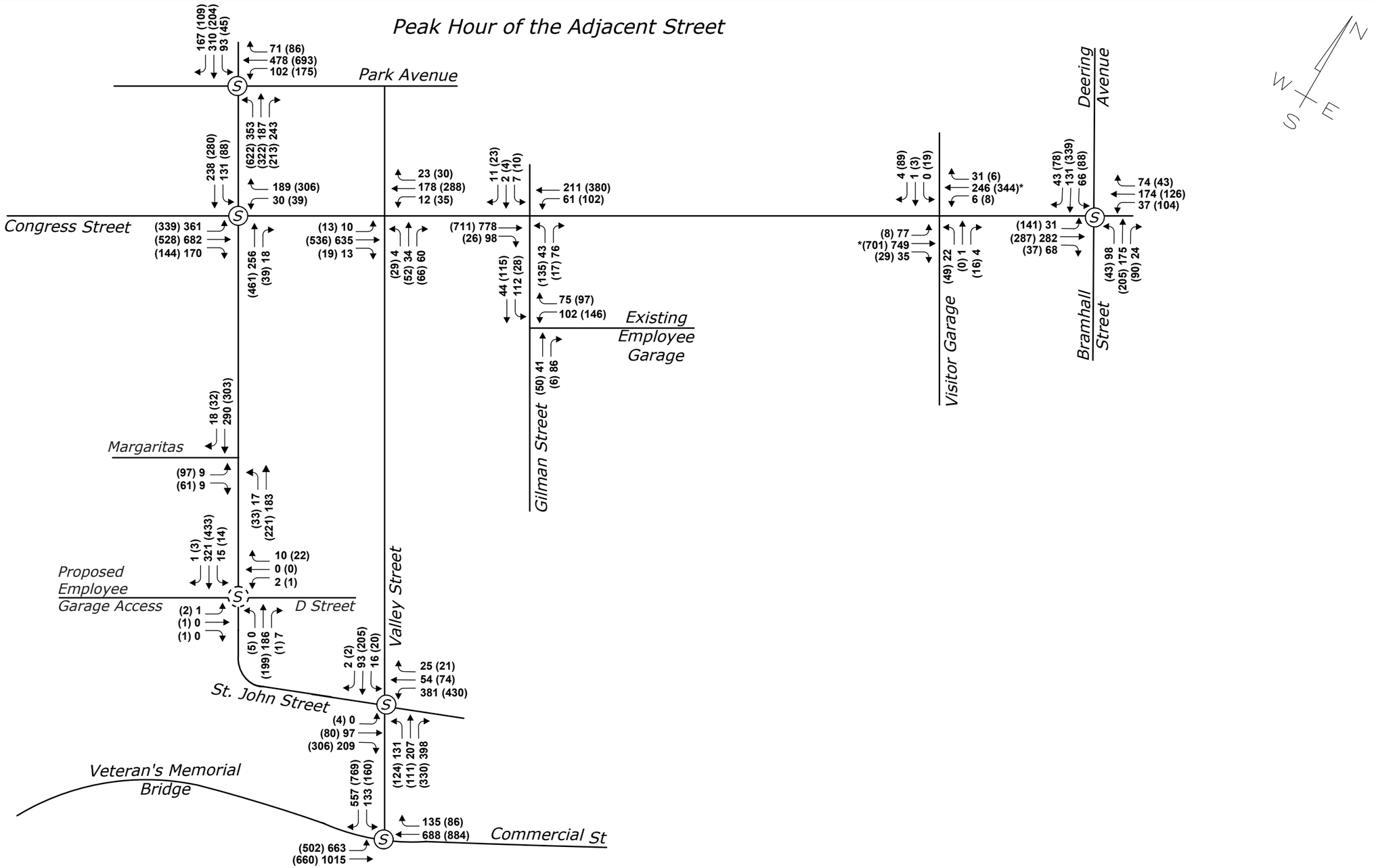
2023 Predevelopment

Figure No. 5



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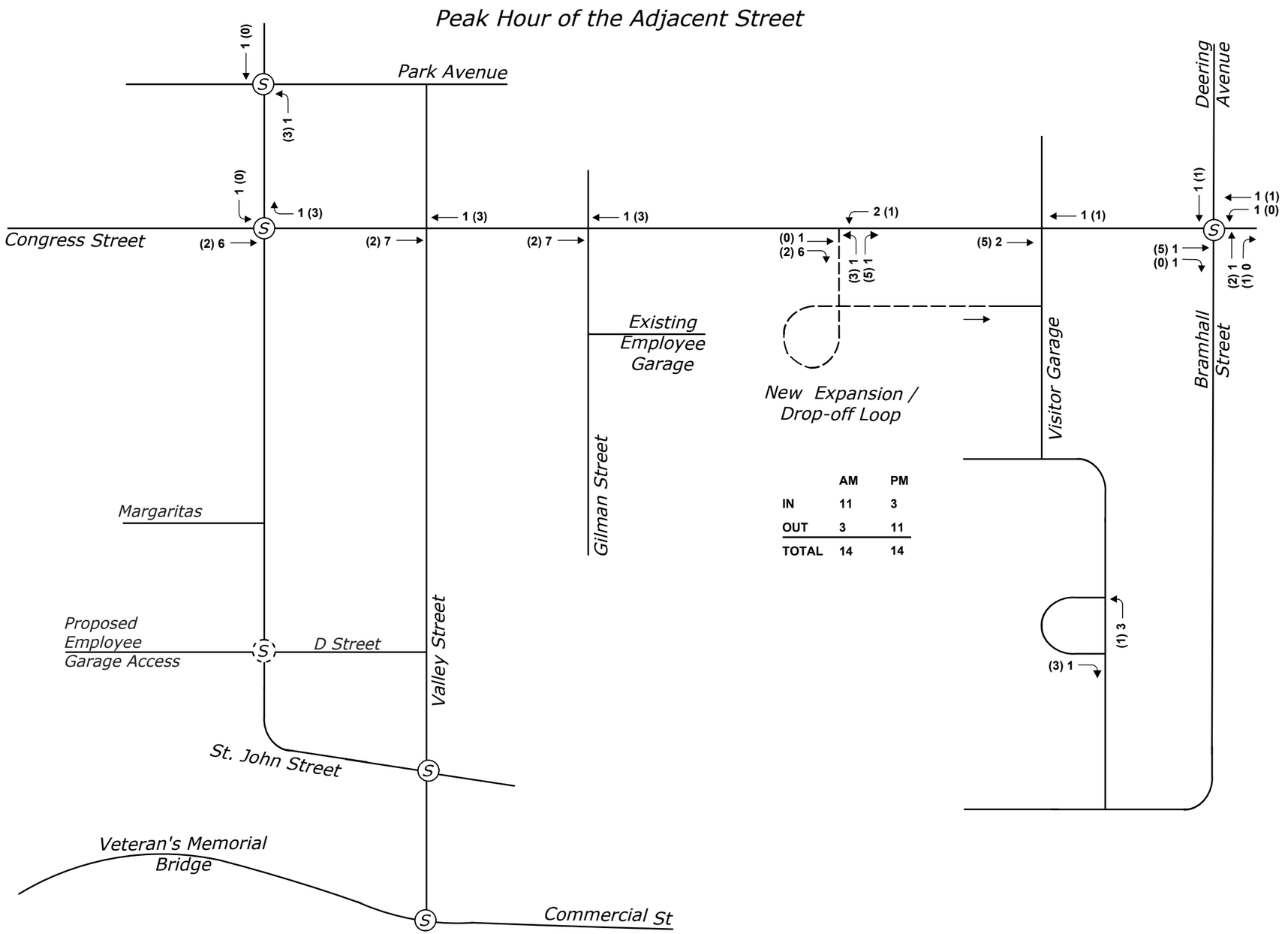
Phase 3 Patient/Visitor Assignment

Figure No. 6



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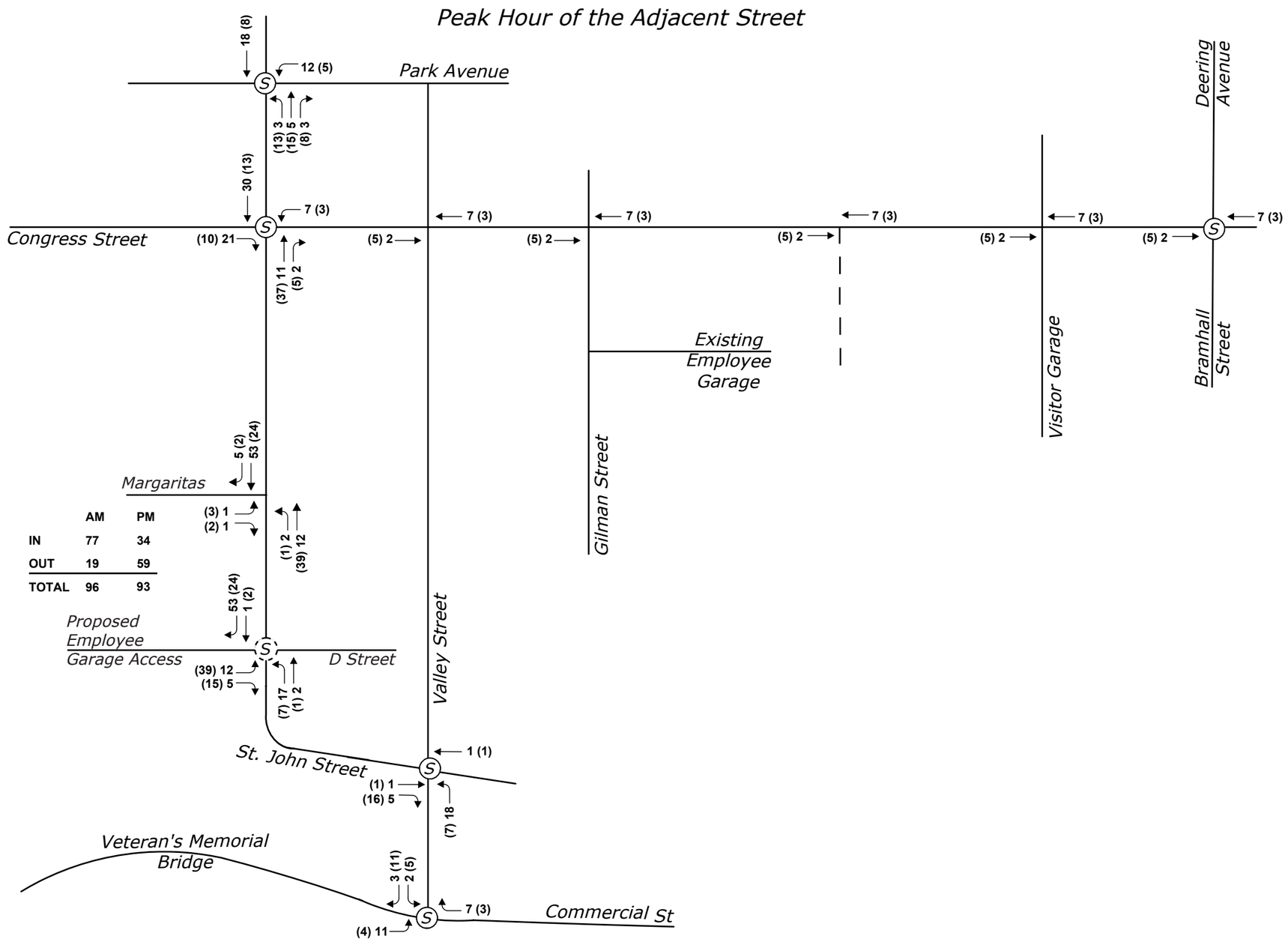
Phase 3 Employee Trip Assignment

Figure No. 7



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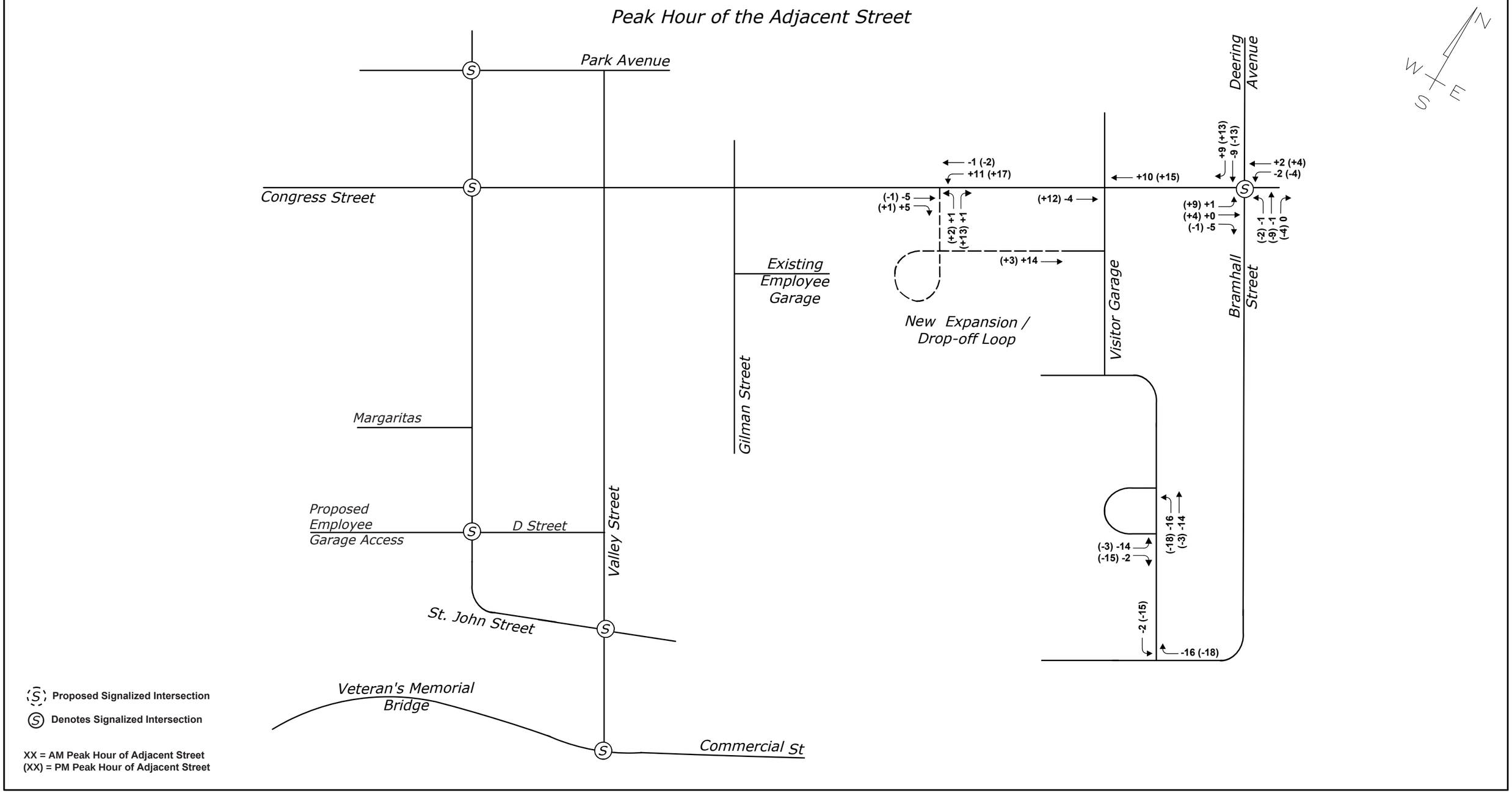
Phase 3 Drop Off Reassignment

Figure No. 8



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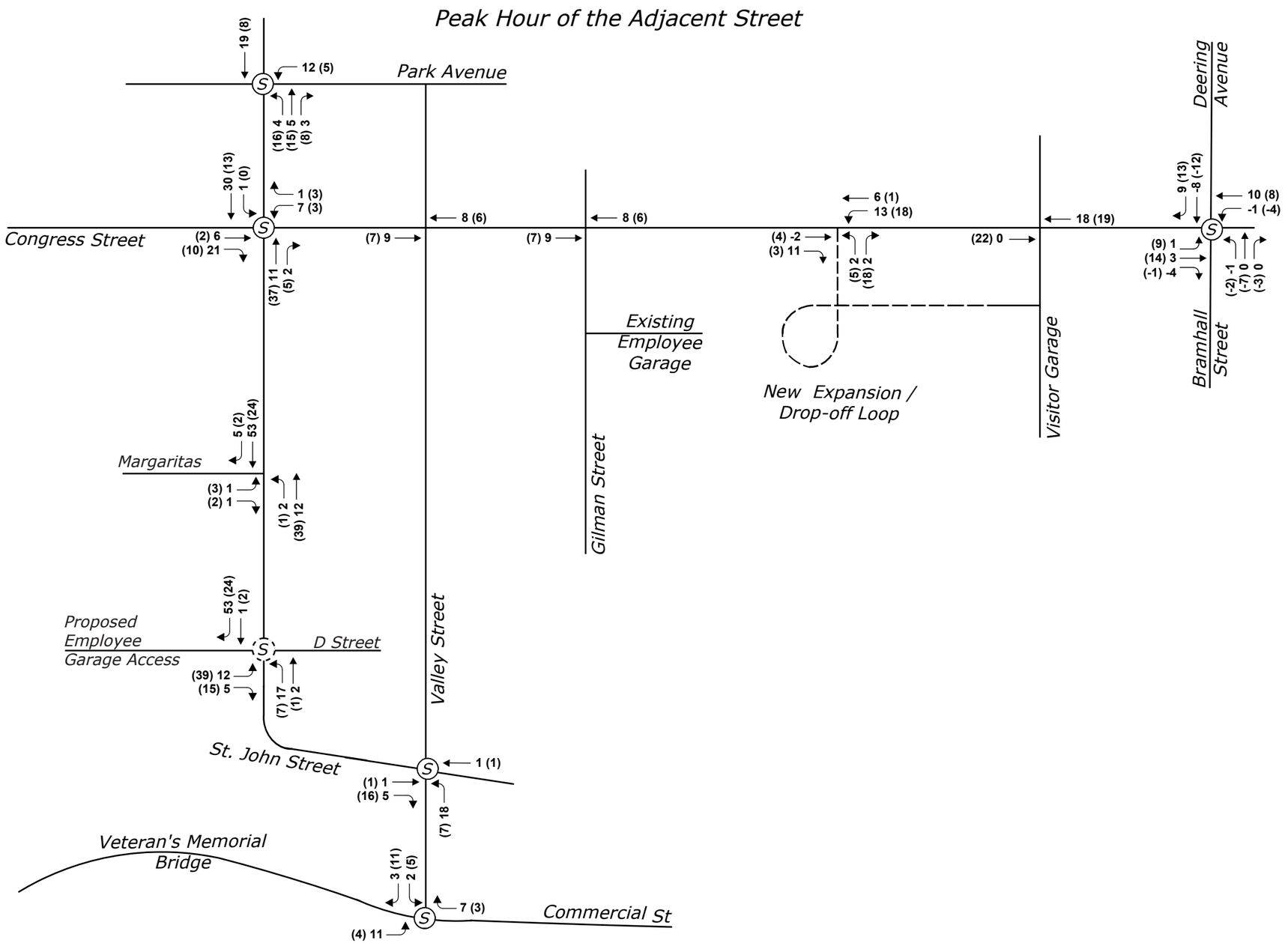

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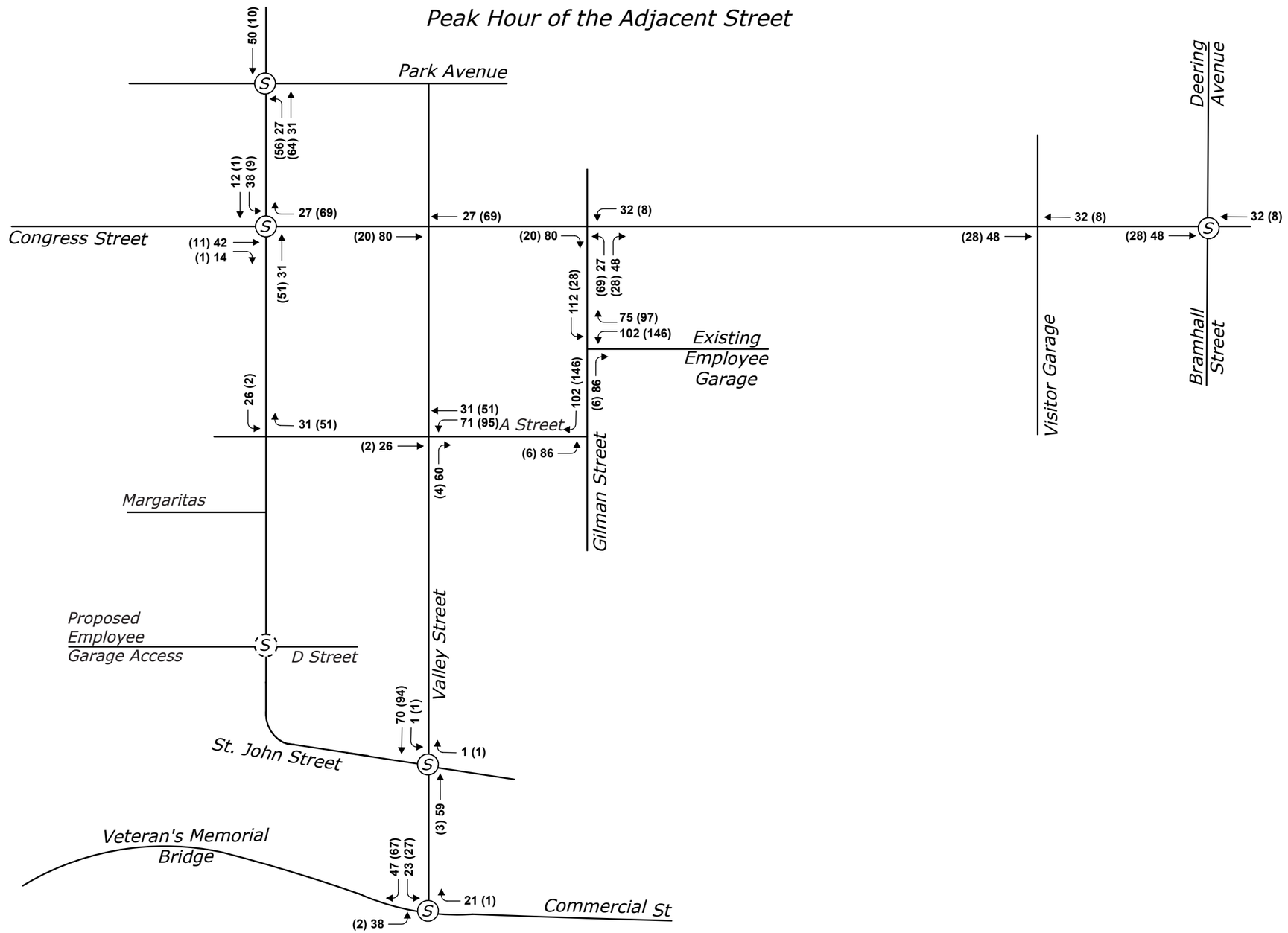
Existing Employee Garage Assignment

Figure No. 10



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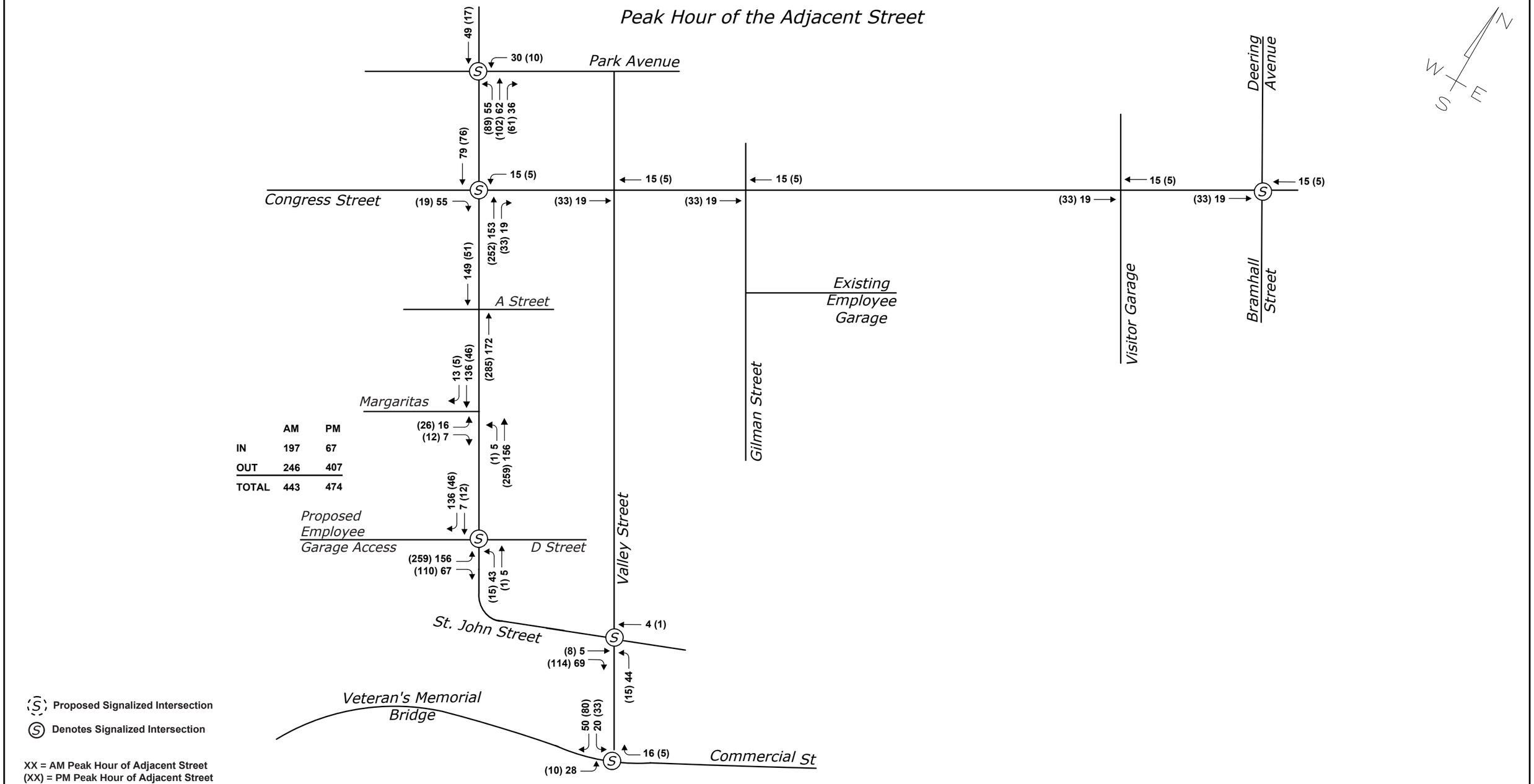
Proposed Garage Reassignment

Figure No. 11



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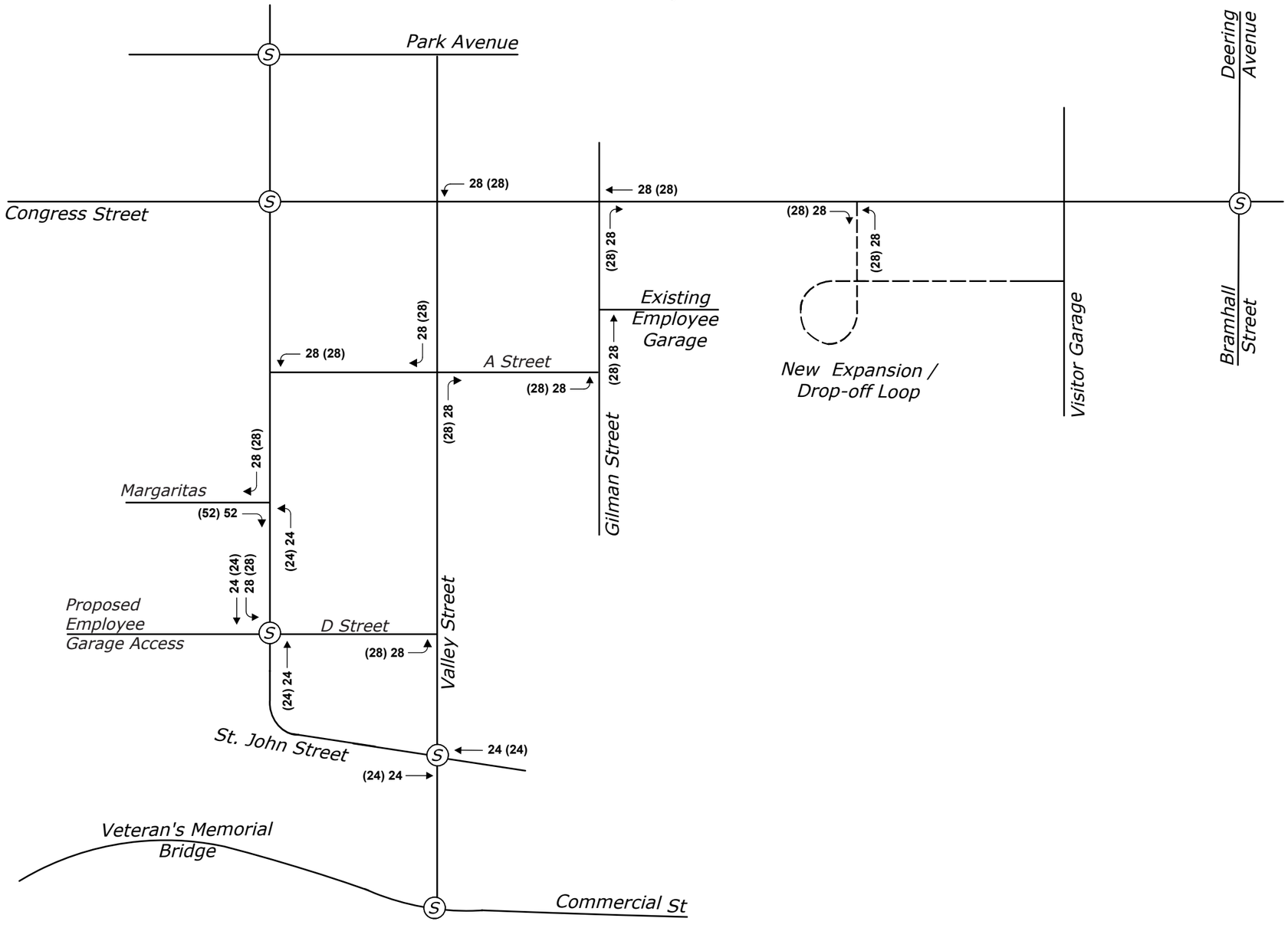
Shuttle Assignment

Figure No. 12

Peak Hour of the Adjacent Street



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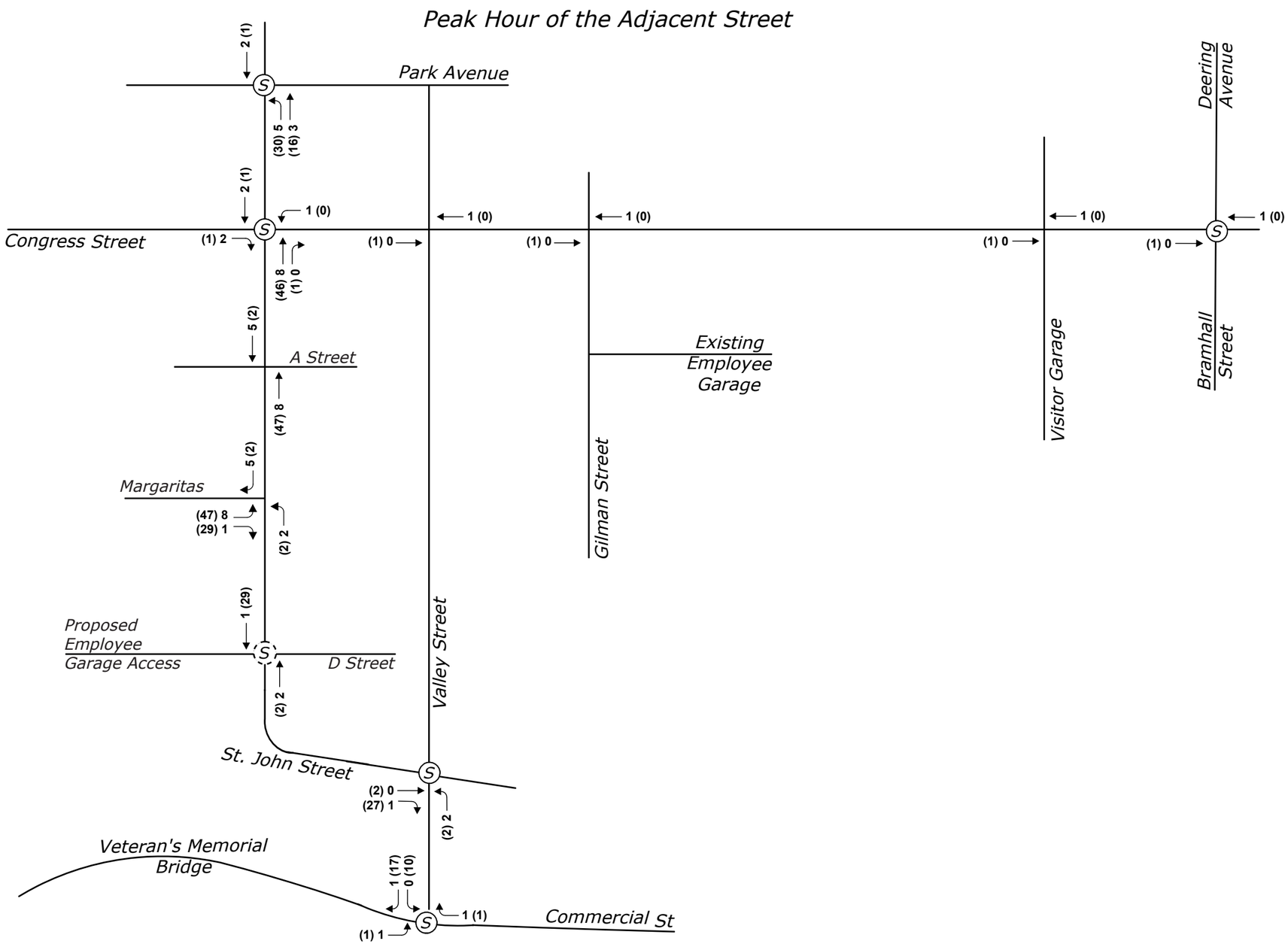
222 St. John Existing MMC Traffic

Figure No. 13



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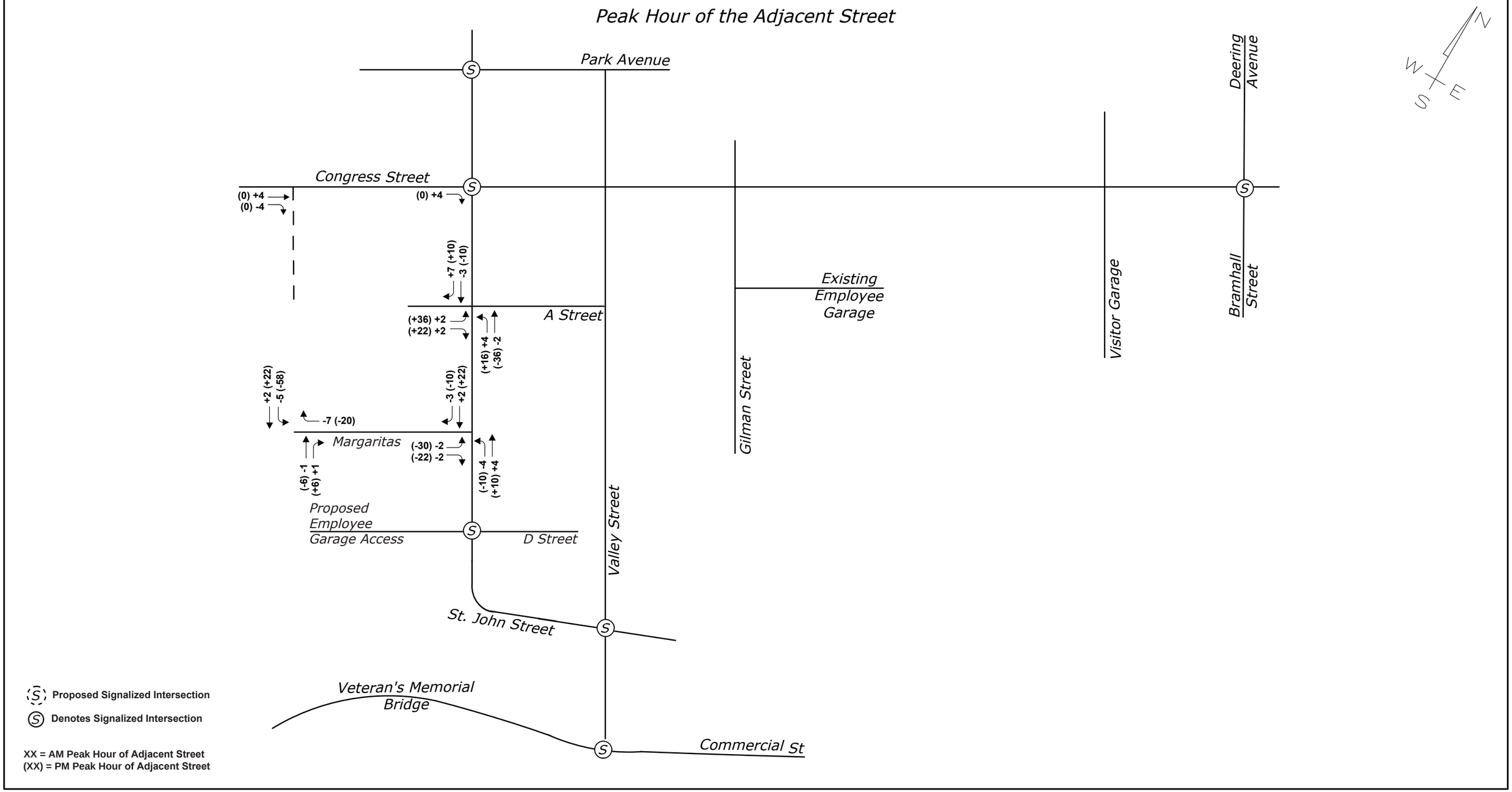
222 St. John Cut-Through (Non-MMC)

Figure No. 14



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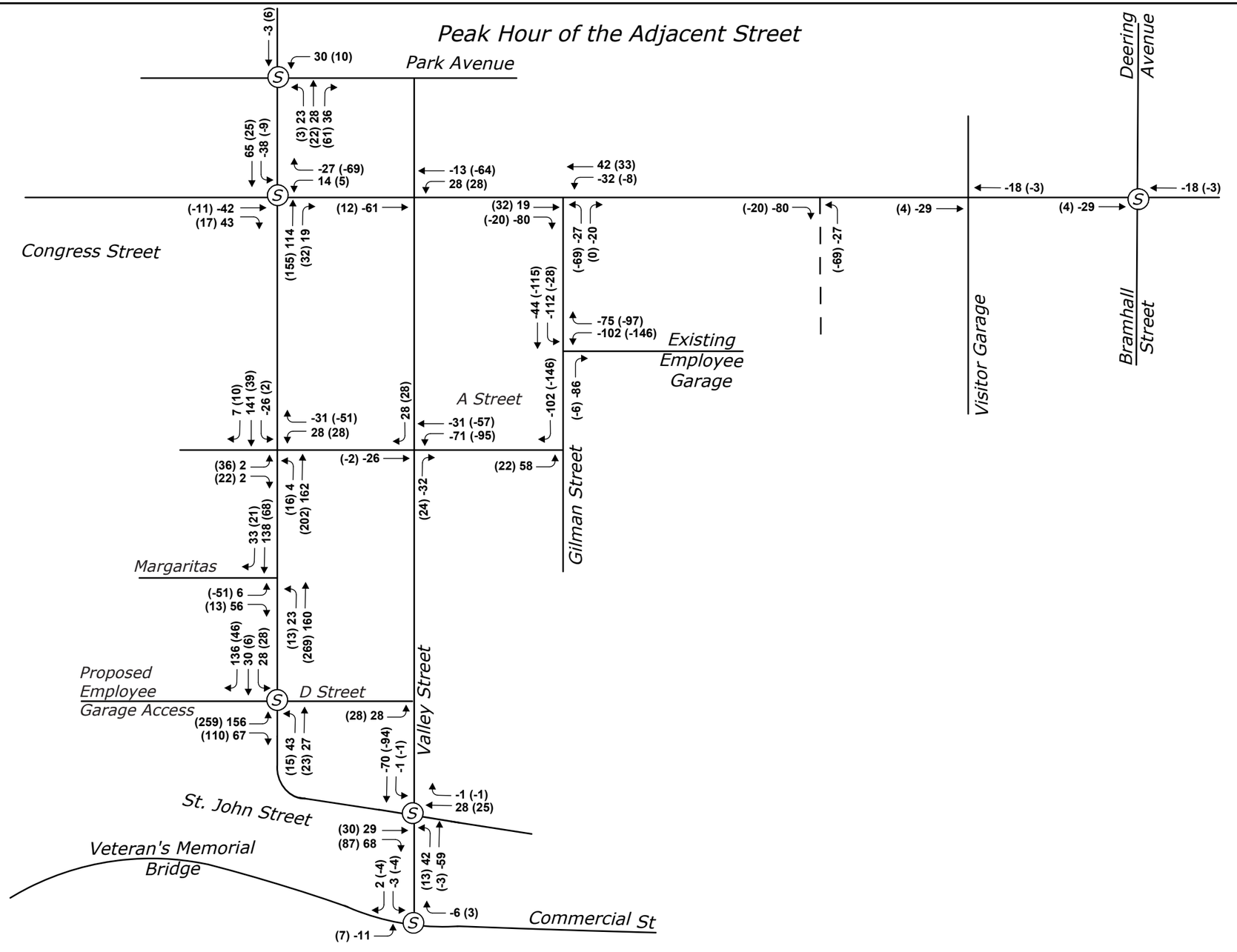
Net Impact Due to Proposed Employee Garage

Figure No. 15



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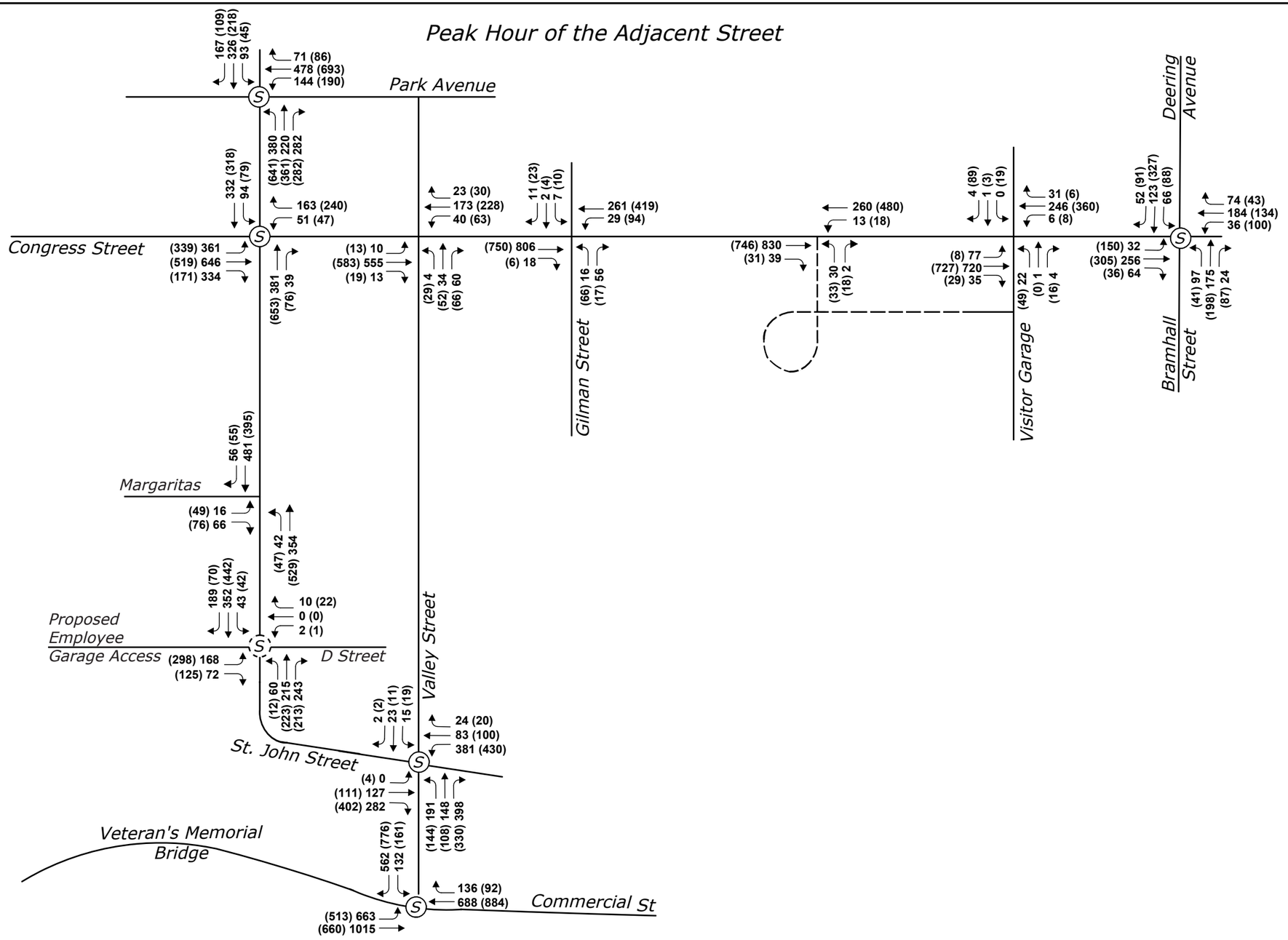
2023 Postdevelopment

Figure No. 16



* Through volumes based on volumes at adjacent intersections.

Proposed Signalized Intersection

Denotes Signalized Intersection

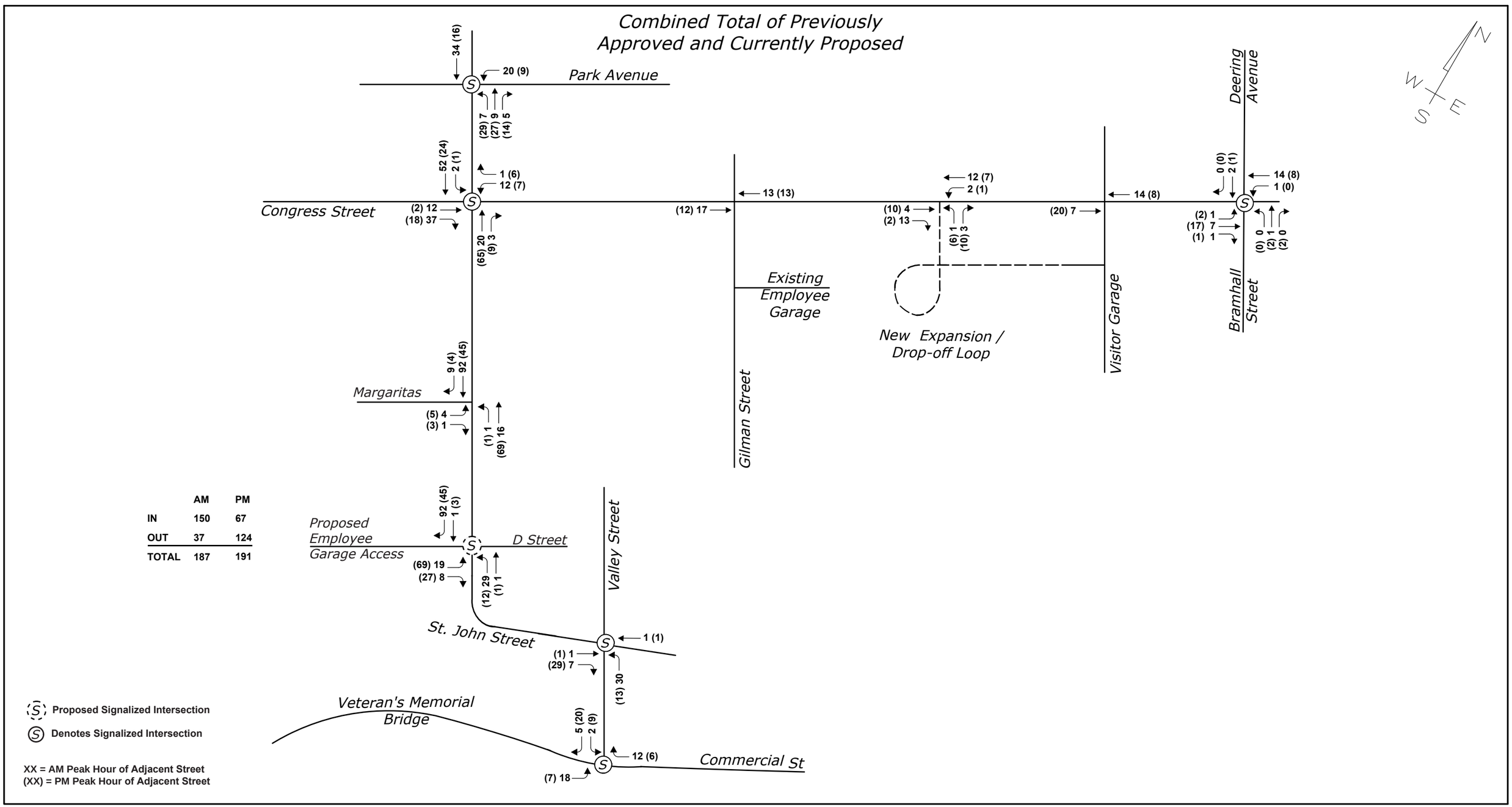
XX = AM Peak Hour of Adjacent Street
(XX) = PM Peak Hour of Adjacent Street

Bramhall St. - 22; MMC Congress Street Building
PORTLAND, MAINE

Design:	EAL	Scale:	NONE
Draft:		Date:	OCT 2018
Checked:	RED	File Name:	2866.01 - Revised

Study Area

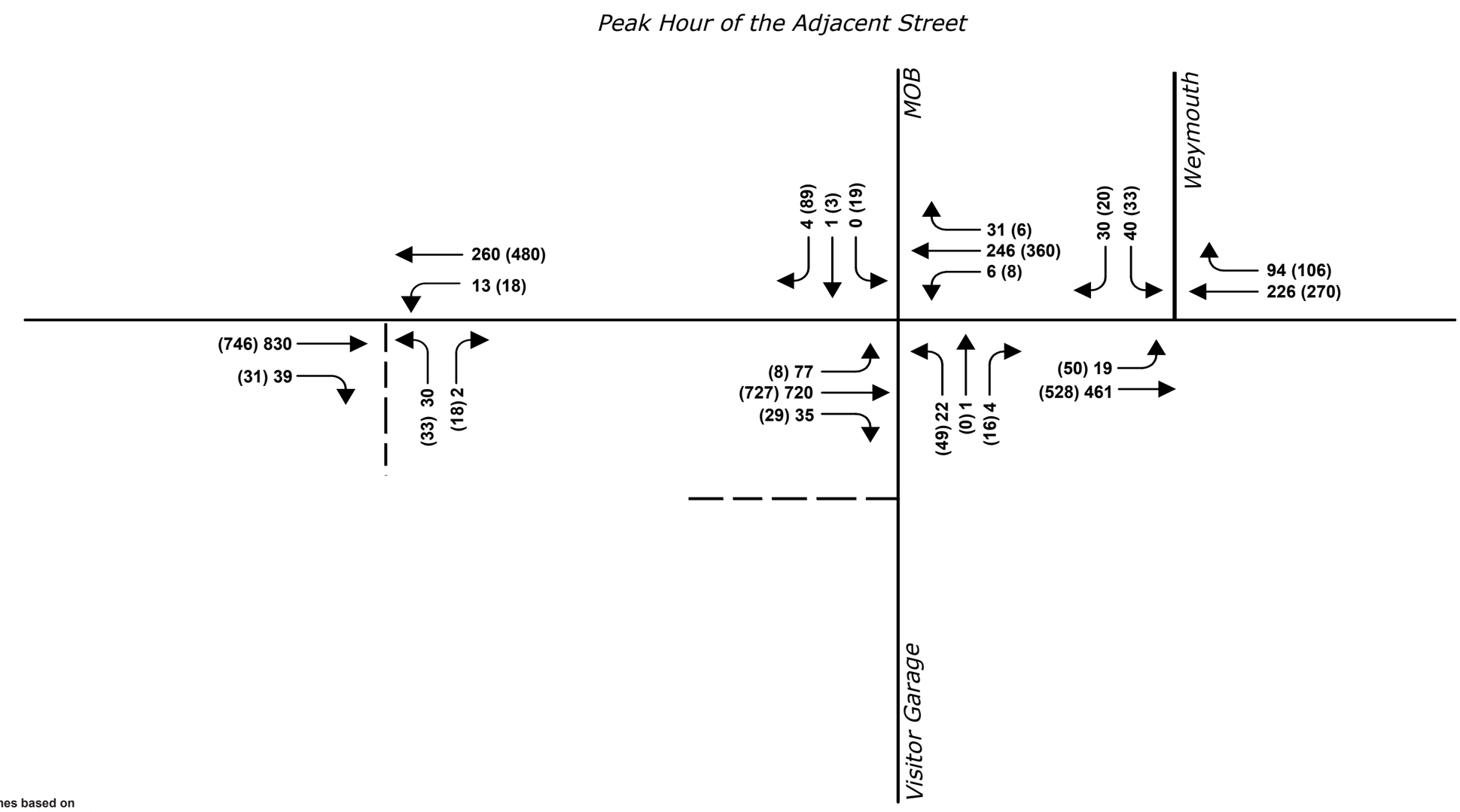
Figure No. 17



Bramhall St. - 22; MMC Congress Street Building
PORTLAND, MAINE

Design: EAL Scale: NONE
Draft: Date: OCT 2018
Checked: RED File Name: 2866.01 - Revised

Peak Hour of the Adjacent Street



* Through volumes based on volumes at adjacent intersections.

(S) Proposed Signalized Intersection

(S) Denotes Signalized Intersection

XX = AM Peak Hour of Adjacent Street
(XX) = PM Peak Hour of Adjacent Street

Bramhall St. - 22; MMC Congress Street Building
PORTLAND, MAINE

Design: EAL Scale: NONE
Draft: Date: OCT 2018
Checked: RED File Name: 2866.01 - Revised

LEGEND

Bramhall Employees	1 mile	Travelshed
<1 mile	3 miles	295 North
1-3 miles	5 miles	35 - 302 - 117 North
3-5 miles	10 miles	95 North
5-10 miles	20 miles	95 South
10-20 miles	30 miles	Ferries
20-30 miles	40 miles	Peninsular Surface Streets
30-40 miles	50 miles	Rt 25 - Brighton Ave
40-50 miles		South Portland Surface Streets
>50 miles		Maine Medical Center

Bramhall Employee Address Locations and Travelsheds
Maine Medical Center

vhb

0 2.5 5 Miles

Attachment 7B

Trip Generation Calculations
May 2013 Traffic Impact Study

JN:	2866.01	Gorrill Palmer
Project Description:	Maine Medical Center Phase 3	707 Sable Oaks Drive
Project Location:	Portland, ME	Suite 30
Date:	08/14/18	South Portland, Maine 04106

Hospital
Land Use Code (LUC) 610

Employees 324

Fitted Curve:

Time Period	ITE Trip Rate	Trip Ends	Directional Split*		Directional Distribution		Sample Size/R2
			IN	OUT	IN	OUT	
Weekday	T =4.40 (X) + 711.46	2137	50%	50%	1069	1068	19/.77
AM Peak Adjacent Street	T =0.32 (X) + 35.15	139	80%	20%	111	28	9/.77
PM Peak Adjacent Street	T =0.28 (X) + 75.75	166	35%	65%	58	108	8/.69
AM Peak of Generator	T = 0.33 (X) +66.57	173	65%	35%	112	61	8/.83
PM Peak of Generator	T = 0..36 (X) + 97.41	214	40%	60%	86	128	15/.73
Saturday	T = 2.95 (X)+ 691.43	1647	50%	50%	824	823	15/.84
Saturday Peak of Generator	Not given	-	55%	45%	-	-	4

* Percentages rounded to nearest 5%

Average Rate:

Time Period	ITE Trip Rate	Trip Ends	Directional Split*		Directional Distribution		Sample Size
			IN	OUT	IN	OUT	
Weekday	**T = 5.2 (X)**	**1685**	**50%**	**50%**	**843**	**842**	**19**
AM Peak Adjacent Street	**T = 0.34 (X)**	**110**	**80%**	**20%**	**88**	**22**	**9**
PM Peak Adjacent Street	**T = 0.33 (X)**	**107**	**35%**	**65%**	**37**	**70**	**8**
AM Peak of Generator	**T = 0.39 (X)**	**126**	**65%**	**35%**	**82**	**44**	**8**
PM Peak of Generator	**T = 0.47 (X)**	**152**	**40%**	**60%**	**61**	**91**	**15**
Saturday	**T = 3.78 (X)**	**1225**	**50%**	**50%**	**613**	**612**	**15**
Saturday Peak of Generator	**T = 0.53 (X)**	**172**	**55%**	**45%**	**95**	**77**	**4**

* Percentages rounded to nearest 5%

Attachment E 1

Traffic Impact Study; Parking Study and Transportation Demand Management Plan
Proposed Bean 2 Roof Addition
Maine Medical Center - Bramhall Campus
Portland, Maine

Prepared for:

Maine Medical Center
22 Bramhall Street
Portland, Maine 04102

May 2013

Prepared by:

Gorrill-Palmer Consulting Engineers, Inc.

Engineering Excellence Since 1998

PO Box 1237
15 Shaker Road
Gray, ME 04039

(207) 657-6910
Fax: (207) 657-6912
E-mail: mailbox@gorrillpalmer.com

E.2

Traffic Impact, Parking Study and Transportation Demand Management Plan
Bean 2 Roof Addition
Maine Medical Center Bramhall Campus
Portland, Maine

Index

Appendix

E.3

Executive Summary

The following Executive Summary is prepared for the reader's convenience, but is not intended to be a substitute for reading the full report.

Gorrill-Palmer Consulting Engineers, Inc. was retained by Maine Medical Center (MMC) to prepare this traffic and parking assessment as well as a Transportation Demand Management Plan Review for the proposed addition to the Bean 2 building at their Bramhall campus in Portland, Maine. Proposed for the site is a 18,758 square foot addition on top of the Bean 2 building. A total of 49 staff will be added as a result of the project. Based on MMC records, a total of 184 staff have been added since the previous expansion of the Bramhall campus. The additional parking demand for the 49 employees is forecast to be 41 spaces and MMC plans to accommodate them at their parking facilities at 887 Congress Street and at 995 Congress Street.

Based on this study, our office has determined the following:

1. The proposed development is forecast to generate 28 and 30 trip ends in the weekday AM and PM peak hours respectively. The increase since the previous project is estimated to be 77 and 84 trip ends in the weekday AM and PM peak hours respectively (Note: A trip end is either a trip in or out of the site. Thus a round trip would equal two trip ends). At this level of trip generation, this project does not require a traffic permit from the Maine Department of Transportation.

2. Gorrill-Palmer Consulting Engineers, Inc. referenced the Maine DOT collision records to determine that are five high crash locations in the vicinity of the project.

3. Gorrill-Palmer Consulting Engineers, Inc. estimates that the additional 49 employees will generate a demand for 41 parking spaces. It is our understanding from MMC that this additional demand can be accommodated at 887 Congress Street and at 995 Congress Street.

4. Maine Medical Center has a comprehensive Demand Management Plan for their Bramhall campus which supports the City's transportation and environmental sustainability goals by encouraging and promoting bicycling, walking, and use of transit. MMC is planning to add two additional bike racks which will accommodate up to 36 bikes as well as a parking space for a U-Share car on the Bramhall campus.

Based on these findings, it is the opinion of Gorrill-Palmer Consulting Engineers, Inc. that the proposed project can be accommodated by the City's transportation system.

E.4

I. *Existing and Proposed Site*

The proposed project consists of an addition to the top of the existing Bean 2 building at Maine Medical Center's (MMC) Bramhall campus in Portland, Maine.

Proposed for the site is a 18,758 sf addition which is forecast by MMC to add 49 employees. MMC estimates that they have added approximately 184 employees since the last major addition to the Bramhall Campus.

II. *Background Conditions*

Gorrill-Palmer Consulting Engineers, Inc. based the study on the following information:

- A site plan, Sheet A01-01 prepared by Perkins + Will dated April 3, 2013.
- Crash data for 2009-2011 provided by the Maine Department of Transportation.

III. *Trip Generation*

Gorrill-Palmer Consulting Engineers, Inc. used the Institute of Transportation Engineers (ITE) publication *Trip Generation*, 7th Edition, to estimate the potential trip generation for the proposed expansion. Based on MMC records, a total of 184 staff have been added since the previous expansion of the Bramhall campus. With the planned staff addition of 49 employees associated with this project, the total additional staff is 233 since the previous expansion resulting in a total staff level of 4,804 following the expansion. Based on Land Use Code (LUC) 610, Hospital, Gorrill-Palmer Consulting Engineers, Inc. has estimated the difference in trip ends using the prior employee level of 4,571 and the post development level of 4804 (Note a trip end is either a trip in or out of the site; thus one round trip is equal to two trip ends):

AM Peak Hour of MMC	77 trip ends
PM Peak Hour of MMC	84 trip ends

Maine Medical received a traffic movement permit for their previous expansion. The level of forecast traffic increase associated with the employee increase since that time does not require a traffic movement permit from the MaineDOT since the peak hour traffic increase is less than 100 trip ends.

IV. *Crash Data*

In order to evaluate whether a location has a crash problem, Maine DOT uses two criteria to define High Crash Locations (HCL). Both criteria must be met in order to be classified as an HCL.

E. 5

1. A critical rate factor of 1.00 or more for a three-year period. (A Critical Rate Factor (CRF) compares the actual accident rate to the rate for similar intersections in the State. A CRF of less than 1.00 indicates a rate less than average) and:

2. A minimum of 8 crashes over a three-year period.

Our office reviewed the 2009-2011 crash data in this area and has summarized the high crash locations or areas which are close to meeting that definition below:

Intersections with Significant Collision History

Location	No. of Collisions	Critical Rate Factor
Congress/Gilman	10	1.89
Bramhall/Congress/Deering	17	0.64
Congress/Valley	28	1.31
Congress/St. John	24	0.75

Roadway Segment with Significant Collision History

Location	No. of Collisions	Critical Rate Factor
Congress between Ellsworth and Weymouth	10	1.52
Congress between Weymouth and Forest St	10	1.50
St. John between C St and A St	11	2.68

This information shows that there are five high crash locations in the vicinity of the site. The MaineDOT furnished the collision reports for these locations and our office is preparing the collision diagrams which will be furnished to the City upon completion.

A copy of the collision history is included in the appendix.

V. *Parking Demand*

Gorrill-Palmer Consulting Engineers, Inc. used the Institute of Transportation Engineers (ITE) publication *Parking Generation*, 3rd Edition, to estimate the potential parking demand for the proposed expansion. Land Use Code 610, Hospital, estimates an average demand of 0.83 spaces per employee. Based on the estimated 49 employees to be added with the planned addition, the project will create a demand for 41 additional parking spaces. It is our understanding from MMC that this additional demand can be accommodated at 887 Cougress Street and at 995 Congress Street.

It is our understanding from John Peverada of the City's parking department staff that, they have done periodic checking of MMC's parking garages at the corner of Gilman Road and Congress Street and has seen vacancies. He also observed that the parking meeting on the Eastern Promenade were underutilized.

Attachment 7C

Capacity and Queuing Analysis Results

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	63	63	63	63	63	63
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	6740	6752	6658	6699	6614	6691
Vehs Exited	6727	6685	6605	6628	6589	6646
Starting Vehs	251	220	223	227	223	224
Ending Vehs	264	287	276	298	248	268
Denied Entry Before	1	2	2	2	2	1
Denied Entry After	3	3	3	3	0	0
Travel Distance (mi)	5093	5125	5012	5064	5000	5059
Travel Time (hr)	259.0	290.9	255.4	264.1	258.5	265.6
Total Delay (hr)	75.8	106.4	75.1	82.0	78.5	83.5
Total Stops	7849	8817	7746	8126	7889	8085
Fuel Used (gal)	182.8	190.0	179.6	182.9	180.3	183.1

Interval #0 Information Seeding

Start Time	6:57
End Time	7:00
Total Time (min)	3

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	6740	6752	6658	6699	6614	6691
Vehs Exited	6727	6685	6605	6628	6589	6646
Starting Vehs	251	220	223	227	223	224
Ending Vehs	264	287	276	298	248	268
Denied Entry Before	1	2	2	2	2	1
Denied Entry After	3	3	3	3	0	0
Travel Distance (mi)	5093	5125	5012	5064	5000	5059
Travel Time (hr)	259.0	290.9	255.4	264.1	258.5	265.6
Total Delay (hr)	75.8	106.4	75.1	82.0	78.5	83.5
Total Stops	7849	8817	7746	8126	7889	8085
Fuel Used (gal)	182.8	190.0	179.6	182.9	180.3	183.1

1: St. John Street & Margaritas Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.4	0.0	0.0	0.1
Total Del/Veh (s)	5.3	1.1	1.6	1.6
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

3: St. John Street & Garage Access/D St Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0
Total Del/Veh (s)	5.2	4.1	1.9	0.9	1.4
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

5: Valley & St. John Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	2.8	0.0	2.3	0.9
Total Del/Veh (s)	12.8	16.6	14.4	15.7	14.7
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

7: St. John Street & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.5	0.0	0.8	0.0	0.4
Total Del/Veh (s)	16.2	9.5	30.1	22.3	18.2
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

13: Fore River Pkwy & Valley Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.4	0.4	0.0	0.3
Total Del/Veh (s)	53.8	18.3	11.6	35.7
Denied Entry Before	0	1	0	1
Denied Entry After	0	0	0	0

19: St. John Street & Park Avenue Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.0	0.0	0.9	0.6
Total Del/Veh (s)	29.1	22.0	54.0	33.2
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

24: Gilman Street & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.3	0.0	0.2	0.1	0.2
Total Del/Veh (s)	3.5	3.1	20.0	9.6	5.1
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

29: Bramhall Street/Deering Avenue & Congress Street Performance by approach

Approach	EB	WB	NE	SW	All
Denied Del/Veh (s)	0.0	1.9	2.2	2.9	1.2
Total Del/Veh (s)	8.3	13.0	13.9	11.3	10.7
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

35: Visitor Garage/Forest Street Garage & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	3.0	2.1	20.6	9.9	3.2
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

Total Network Performance

Denied Del/Veh (s)	1.0
Total Del/Veh (s)	42.5
Denied Entry Before	1
Denied Entry After	0

Intersection: 1: St. John Street & Margaritas

Movement	EB	EB	NB
Directions Served	L	R	LT
Maximum Queue (ft)	30	30	40
Average Queue (ft)	5	7	5
95th Queue (ft)	24	27	25
Link Distance (ft)	626		678
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		125	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: St. John Street & Garage Access/D St

Movement	EB	WB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	31	39	48
Average Queue (ft)	3	11	2
95th Queue (ft)	18	35	22
Link Distance (ft)	570	495	678
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: Valley & St. John Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	L	TR	LT	TR
Maximum Queue (ft)	126	124	292	67	155	274	74	91
Average Queue (ft)	52	62	131	16	57	153	25	35
95th Queue (ft)	97	105	224	45	117	242	60	73
Link Distance (ft)	1618			1012	268	268	937	
Upstream Blk Time (%)						0		
Queuing Penalty (veh)						1		
Storage Bay Dist (ft)		110	335					265
Storage Blk Time (%)	1	1	0					
Queuing Penalty (veh)	1	1	0					

Intersection: 7: St. John Street & Congress Street

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	R	T	TR	L	T
Maximum Queue (ft)	249	380	314	87	129	121	137	159	207
Average Queue (ft)	125	214	57	24	62	50	66	72	93
95th Queue (ft)	206	336	174	63	109	94	119	131	174
Link Distance (ft)	1767	1767			367	670		794	794
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			290	80			175		
Storage Blk Time (%)		2	0	0	4		0		
Queuing Penalty (veh)		3	0	1	1		0		

Intersection: 13: Fore River Pkwy & Valley

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	L	L	T	T	T	T	R	L	R	R
Maximum Queue (ft)	480	527	942	885	196	188	100	137	126	131
Average Queue (ft)	356	420	443	352	132	118	40	64	70	70
95th Queue (ft)	605	620	1249	1122	183	177	82	116	113	111
Link Distance (ft)			2719	2719	1454	1454		268	268	268
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	430	430					415			
Storage Blk Time (%)	7	37	2							
Queuing Penalty (veh)	35	190	14							

Intersection: 19: St. John Street & Park Avenue

Movement	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	LT	R	LT	R
Maximum Queue (ft)	155	219	251	188	353	135	655	80
Average Queue (ft)	52	112	141	108	176	105	325	63
95th Queue (ft)	111	187	207	175	285	172	571	106
Link Distance (ft)			1678	794	794		2255	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	95	95				110		55
Storage Blk Time (%)	2	8	24		21	0	55	7
Queuing Penalty (veh)	6	26	83		52	1	92	27

Intersection: 24: Gilman Street & Congress Street

Movement	EB	WB	NB	SB
Directions Served	TR	L	LTR	LTR
Maximum Queue (ft)	28	68	153	55
Average Queue (ft)	2	30	59	15
95th Queue (ft)	15	64	109	44
Link Distance (ft)	367		1063	624
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		65		
Storage Blk Time (%)		1		
Queuing Penalty (veh)		2		

Intersection: 29: Bramhall Street/Deering Avenue & Congress Street

Movement	EB	EB	WB	WB	NE	NE	SW	SW
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	55	220	176	90	140	142	132	74
Average Queue (ft)	18	116	48	70	54	61	42	47
95th Queue (ft)	47	187	132	101	106	113	97	78
Link Distance (ft)	965		1272		1186		795	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		400		65		135		50
Storage Blk Time (%)			0	11	0	0	3	9
Queuing Penalty (veh)			1	4	1	0	5	6

Intersection: 35: Visitor Garage/Forest Street Garage & Congress Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	163	35	47	30
Average Queue (ft)	30	2	22	5
95th Queue (ft)	100	16	50	23
Link Distance (ft)	425	965	508	434
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 553

Intersection: 5: Valley & St. John Street

Phase	2	3	4	6	8
Movement(s) Served	NBTL	WBL	EBTL	SBTL	WBT
Maximum Green (s)	34.0	23.0	18.0	34.0	46.0
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0
Recall	None	None	None	None	None
Avg. Green (s)	15.3	15.8	10.0	15.3	27.6
g/C Ratio	-0.01	-0.01	-0.01	-0.01	-0.01
Cycles Skipped (%)	6	7	20	6	4
Cycles @ Minimum (%)	0	0	4	0	0
Cycles Maxed Out (%)	1	21	8	1	4
Cycles with Peds (%)	0	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 7: St. John Street & Congress Street

Phase	1	2	3	4	5	6	8
Movement(s) Served	EBL	WBL	SBL	NBT	WBL	EBTL	SBT
Maximum Green (s)	15.3	27.2	6.7	8.0	5.0	37.5	21.5
Minimum Green (s)	8.0	8.0	3.0	8.0	5.0	8.0	5.0
Recall	None	Min	None	None	None	Min	None
Avg. Green (s)	13.0	15.9	6.7	8.4	5.5	31.3	20.1
g/C Ratio	-0.01	NA	-0.01	-0.01	-0.01	NA	NA
Cycles Skipped (%)	2	0	9	4	73	0	0
Cycles @ Minimum (%)	15	34	0	91	24	0	0
Cycles Maxed Out (%)	47	16	78	96	27	36	76
Cycles with Peds (%)	0	0	0	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 13: Fore River Pkwy & Valley

Phase	4	6	7	8
Movement(s) Served	EBT	SBL	EBL	WBT
Maximum Green (s)	39.0	11.0	17.0	17.0
Minimum Green (s)	5.0	5.0	5.0	5.0
Recall	None	None	None	None
Avg. Green (s)	39.0	10.3	17.0	16.1
g/C Ratio	NA	NA	NA	NA
Cycles Skipped (%)	0	0	0	0
Cycles @ Minimum (%)	0	0	0	0
Cycles Maxed Out (%)	68	74	98	69
Cycles with Peds (%)	0	0	0	0

Controller Summary
Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 19: St. John Street & Park Avenue

Phase	2	6	8
Movement(s) Served	NBTL	SBTL	WBTL
Maximum Green (s)	40.0	25.0	40.0
Minimum Green (s)	3.0	3.0	3.0
Recall	Min	Min	Min
Avg. Green (s)	27.2	24.5	24.6
g/C Ratio	NA	NA	NA
Cycles Skipped (%)	0	0	0
Cycles @ Minimum (%)	0	0	0
Cycles Maxed Out (%)	21	82	5
Cycles with Peds (%)	0	0	0

Controller Summary
Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 29: Bramhall Street/Deering Avenue & Congress Street

Phase	1	2	3	4	5	6	7	8
Movement(s) Served	SWL	NETL	WBL	EBTL	NEL	SWTL	EBL	WBTL
Maximum Green (s)	5.5	13.5	5.5	17.5	5.5	13.5	5.5	17.5
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Recall	None	Max	None	None	None	Max	None	None
Avg. Green (s)	5.5	14.9	5.7	14.9	5.5	16.7	7.1	15.2
g/C Ratio	-0.01	NA	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Cycles Skipped (%)	50	0	76	3	65	1	79	4
Cycles @ Minimum (%)	0	0	13	0	9	0	0	0
Cycles Maxed Out (%)	45	100	10	41	25	99	19	38
Cycles with Peds (%)	0	0	0	0	0	0	0	0

Controller Summary
Average Cycle Length (s): NA
Number of Complete Cycles : 0

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	63	63	63	63	63	63
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	7366	7440	7423	7329	7474	7405
Vehs Exited	7310	7424	7376	7305	7450	7372
Starting Vehs	220	237	220	225	249	227
Ending Vehs	276	253	267	249	273	263
Denied Entry Before	3	2	2	1	2	1
Denied Entry After	1	1	0	2	4	0
Travel Distance (mi)	5356	5472	5415	5335	5458	5407
Travel Time (hr)	262.5	270.7	271.1	259.9	269.4	266.7
Total Delay (hr)	69.2	73.4	75.9	67.7	72.1	71.7
Total Stops	8551	8779	8794	8373	8667	8630
Fuel Used (gal)	191.5	196.1	194.8	189.2	194.4	193.2

Interval #0 Information Seeding

Start Time	6:57
End Time	7:00
Total Time (min)	3

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	7366	7440	7423	7329	7474	7405
Vehs Exited	7310	7424	7376	7305	7450	7372
Starting Vehs	220	237	220	225	249	227
Ending Vehs	276	253	267	249	273	263
Denied Entry Before	3	2	2	1	2	1
Denied Entry After	1	1	0	2	4	0
Travel Distance (mi)	5356	5472	5415	5335	5458	5407
Travel Time (hr)	262.5	270.7	271.1	259.9	269.4	266.7
Total Delay (hr)	69.2	73.4	75.9	67.7	72.1	71.7
Total Stops	8551	8779	8794	8373	8667	8630
Fuel Used (gal)	191.5	196.1	194.8	189.2	194.4	193.2

1: St. John Street & Margaritas Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	3.4	0.0	0.0	0.3
Total Del/Veh (s)	5.6	2.3	2.0	2.4
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

3: St. John Street & Garage Access/D St Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	0.1	0.5	0.2	0.5
Total Del/Veh (s)	13.7	5.4	5.8	6.8	7.6
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

5: Valley & St. John Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	2.7	0.0	1.7	0.8
Total Del/Veh (s)	12.9	16.7	13.4	18.1	14.3
Denied Entry Before	0	1	0	0	1
Denied Entry After	0	0	0	0	0

7: St. John Street & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.5	0.0	0.3	0.0	0.3
Total Del/Veh (s)	18.7	9.8	30.6	22.8	20.6
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

12: Congress Street Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	1.3	1.5	19.2	1.8
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

13: Fore River Pkwy & Valley Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.4	0.5	0.0	0.3
Total Del/Veh (s)	25.3	18.7	11.7	20.7
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

19: St. John Street & Park Avenue Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.2	0.0	0.6	0.6
Total Del/Veh (s)	31.5	18.2	22.0	23.5
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

24: Gilman Street & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.1	0.2
Total Del/Veh (s)	2.4	1.2	13.4	8.9	2.9
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

29: Bramhall Street/Deering Avenue & Congress Street Performance by approach

Approach	EB	WB	NE	SW	All
Denied Del/Veh (s)	0.0	1.9	2.2	2.8	1.2
Total Del/Veh (s)	7.3	13.0	13.1	11.1	10.0
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

35: Visitor Garage/Forest Street Garage & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.1	0.1	0.1
Total Del/Veh (s)	2.2	2.1	16.4	8.6	2.5
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

Total Network Performance

Denied Del/Veh (s)	1.0
Total Del/Veh (s)	32.8
Denied Entry Before	1
Denied Entry After	0

Intersection: 1: St. John Street & Margaritas

Movement	EB	EB	NB	SB
Directions Served	L	R	LT	TR
Maximum Queue (ft)	34	64	95	9
Average Queue (ft)	11	29	21	0
95th Queue (ft)	34	49	68	4
Link Distance (ft)	620		678	670
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		125		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: St. John Street & Garage Access/D St

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	L	TR
Maximum Queue (ft)	126	65	39	61	114	91	169
Average Queue (ft)	63	29	11	19	52	24	83
95th Queue (ft)	105	53	36	46	98	63	145
Link Distance (ft)	564		489		1605		678
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		150		100		75	
Storage Blk Time (%)	0				0	0	5
Queuing Penalty (veh)	0				0	1	2

Intersection: 5: Valley & St. John Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	L	TR	LT	TR
Maximum Queue (ft)	164	133	270	70	154	247	40	56
Average Queue (ft)	58	70	138	23	74	141	14	10
95th Queue (ft)	114	118	228	54	131	224	39	37
Link Distance (ft)	1605			1012	268	268	937	
Upstream Blk Time (%)						0		
Queuing Penalty (veh)						0		
Storage Bay Dist (ft)		110	335					265
Storage Blk Time (%)	0	1						
Queuing Penalty (veh)	1	2						

Intersection: 7: St. John Street & Congress Street

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	R	T	TR	L	T
Maximum Queue (ft)	377	552	315	89	106	261	197	146	203
Average Queue (ft)	138	229	82	36	49	92	105	61	109
95th Queue (ft)	266	403	221	76	88	193	174	117	181
Link Distance (ft)	1767	1767			367	670		794	794
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			290	80			175		
Storage Blk Time (%)		3	0	1	1	1	2		
Queuing Penalty (veh)		7	0	1	1	3	3		

Intersection: 12: Congress Street

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (ft)	44	111	71
Average Queue (ft)	2	14	27
95th Queue (ft)	20	62	63
Link Distance (ft)	169	202	174
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 13: Fore River Pkwy & Valley

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	L	L	T	T	T	T	R	L	R	R
Maximum Queue (ft)	377	428	335	325	238	238	98	128	140	148
Average Queue (ft)	177	267	86	98	136	126	40	62	72	73
95th Queue (ft)	372	419	243	199	202	198	79	112	118	120
Link Distance (ft)			2719	2719	1454	1454		268	268	268
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	430	430					415			
Storage Blk Time (%)	0	2								
Queuing Penalty (veh)	2	10								

Intersection: 19: St. John Street & Park Avenue

Movement	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	LT	R	LT	R
Maximum Queue (ft)	162	228	255	194	286	135	326	80
Average Queue (ft)	71	114	139	92	151	100	169	64
95th Queue (ft)	128	197	214	157	253	168	290	102
Link Distance (ft)			1678	794	794		2255	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	95	95				110		55
Storage Blk Time (%)	4	9	29		14	1	33	4
Queuing Penalty (veh)	13	29	108		38	3	55	16

Intersection: 24: Gilman Street & Congress Street

Movement	EB	WB	NB	SB
Directions Served	TR	L	LTR	LTR
Maximum Queue (ft)	10	57	88	68
Average Queue (ft)	1	13	38	17
95th Queue (ft)	8	40	71	49
Link Distance (ft)	367		1063	624
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		65		
Storage Blk Time (%)		0		
Queuing Penalty (veh)		1		

Intersection: 29: Bramhall Street/Deering Avenue & Congress Street

Movement	EB	EB	WB	WB	NE	NE	SW	SW
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	61	213	190	90	140	140	143	75
Average Queue (ft)	18	102	43	68	51	62	39	49
95th Queue (ft)	46	173	122	98	105	116	96	80
Link Distance (ft)	965		1272		1186		795	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		400		65		135		50
Storage Blk Time (%)			1	10	0	0	4	8
Queuing Penalty (veh)			1	4	0	0	6	6

Intersection: 35: Visitor Garage/Forest Street Garage & Congress Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	163	103	58	34
Average Queue (ft)	35	7	21	6
95th Queue (ft)	108	45	49	27
Link Distance (ft)	202	965	508	434
Upstream Blk Time (%)	0			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 314

Intersection: 3: St. John Street & Garage Access/D St

Phase	2	4	5	6	8
Movement(s) Served	NBTL	EBTL	NBL	SBTL	WBTL
Maximum Green (s)	45.0	5.0	6.5	34.0	5.0
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0
Recall	Min	None	None	Min	None
Avg. Green (s)	26.1	5.0	5.7	22.0	5.0
g/C Ratio	-0.01	-0.01	-0.01	NA	-0.01
Cycles Skipped (%)	5	5	76	0	5
Cycles @ Minimum (%)	0	95	5	1	95
Cycles Maxed Out (%)	8	95	4	17	95
Cycles with Peds (%)	0	0	0	0	0

Controller Summary
Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 5: Valley & St. John Street

Phase	2	3	4	6	8
Movement(s) Served	NBTL	WBL	EBTL	SBTL	WBT
Maximum Green (s)	26.0	21.0	18.0	26.0	44.0
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0
Recall	None	None	None	None	None
Avg. Green (s)	13.9	15.7	11.5	13.9	30.6
g/C Ratio	-0.01	-0.01	-0.01	-0.01	-0.01
Cycles Skipped (%)	11	7	14	11	6
Cycles @ Minimum (%)	0	0	1	0	0
Cycles Maxed Out (%)	4	32	17	4	10
Cycles with Peds (%)	0	0	0	0	0

Controller Summary
Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 7: St. John Street & Congress Street

Phase	1	2	3	4	5	6	8
Movement(s) Served	EBL	WBL	SBL	NBT	WBL	EBTL	SBT
Maximum Green (s)	15.6	24.4	5.7	11.5	5.0	35.0	24.0
Minimum Green (s)	8.0	8.0	3.0	8.0	5.0	8.0	5.0
Recall	None	Min	None	None	None	Min	None
Avg. Green (s)	13.7	15.5	5.9	11.9	5.6	29.8	22.6
g/C Ratio	-0.01	NA	-0.01	NA	-0.01	NA	NA
Cycles Skipped (%)	2	0	12	0	54	0	0
Cycles @ Minimum (%)	8	28	0	2	40	0	0
Cycles Maxed Out (%)	57	25	85	85	46	37	68
Cycles with Peds (%)	0	0	0	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 13: Fore River Pkwy & Valley

Phase	4	6	7	8
Movement(s) Served	EBT	SBL	EBL	WBT
Maximum Green (s)	39.0	11.0	17.0	17.0
Minimum Green (s)	5.0	5.0	5.0	5.0
Recall	None	None	None	None
Avg. Green (s)	38.8	10.2	16.9	16.4
g/C Ratio	NA	NA	NA	NA
Cycles Skipped (%)	0	0	0	0
Cycles @ Minimum (%)	0	0	0	0
Cycles Maxed Out (%)	70	70	95	74
Cycles with Peds (%)	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 19: St. John Street & Park Avenue

Phase	2	6	8
Movement(s) Served	NBTL	SBTL	WBTL
Maximum Green (s)	15.0	20.0	10.0
Minimum Green (s)	3.0	3.0	3.0
Recall	Min	Min	Min
Avg. Green (s)	14.5	17.3	10.0
g/C Ratio	NA	NA	NA
Cycles Skipped (%)	0	0	0
Cycles @ Minimum (%)	0	2	0
Cycles Maxed Out (%)	86	59	97
Cycles with Peds (%)	0	0	0

Controller Summary
Average Cycle Length (s): NA
Number of Complete Cycles : 0

Intersection: 29: Bramhall Street/Deering Avenue & Congress Street

Phase	1	2	3	4	5	6	7	8
Movement(s) Served	SWL	NETL	WBL	EBTL	NEL	SWTL	EBL	WBTL
Maximum Green (s)	5.5	13.5	5.5	17.5	5.5	13.5	5.5	17.5
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Recall	None	Max	None	None	None	Max	None	None
Avg. Green (s)	5.6	15.0	6.6	13.9	5.5	16.4	7.6	14.3
g/C Ratio	-0.01	NA	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Cycles Skipped (%)	58	0	74	6	72	1	81	5
Cycles @ Minimum (%)	1	0	12	0	6	0	0	0
Cycles Maxed Out (%)	38	100	11	30	21	99	17	30
Cycles with Peds (%)	0	0	0	0	0	0	0	0

Controller Summary
Average Cycle Length (s): NA
Number of Complete Cycles : 0

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	63	63	63	63	63	63
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	7331	7512	7399	7678	7334	7453
Vehs Exited	7265	7409	7298	7540	7291	7361
Starting Vehs	213	198	216	165	200	193
Ending Vehs	279	301	317	303	243	286
Denied Entry Before	4	2	3	3	0	2
Denied Entry After	2	1	5	1	3	1
Travel Distance (mi)	4625	4680	4600	4791	4585	4656
Travel Time (hr)	253.6	269.0	270.0	266.4	243.9	260.6
Total Delay (hr)	85.3	99.0	102.8	92.3	77.0	91.3
Total Stops	9003	9407	9298	9280	8484	9093
Fuel Used (gal)	173.1	178.4	176.6	180.5	169.3	175.6

Interval #0 Information Seeding

Start Time	6:57
End Time	7:00
Total Time (min)	3

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	7331	7512	7399	7678	7334	7453
Vehs Exited	7265	7409	7298	7540	7291	7361
Starting Vehs	213	198	216	165	200	193
Ending Vehs	279	301	317	303	243	286
Denied Entry Before	4	2	3	3	0	2
Denied Entry After	2	1	5	1	3	1
Travel Distance (mi)	4625	4680	4600	4791	4585	4656
Travel Time (hr)	253.6	269.0	270.0	266.4	243.9	260.6
Total Delay (hr)	85.3	99.0	102.8	92.3	77.0	91.3
Total Stops	9003	9407	9298	9280	8484	9093
Fuel Used (gal)	173.1	178.4	176.6	180.5	169.3	175.6

1: St. John Street & Margaritas Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.7	0.0	0.0	0.3
Total Del/Veh (s)	7.3	1.5	1.9	2.7
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

3: St. John Street & Garage Access/D St Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.1	0.1
Total Del/Veh (s)	7.3	3.3	2.1	0.8	1.3
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

5: Valley & St. John Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	2.8	0.0	2.3	1.1
Total Del/Veh (s)	10.7	19.6	14.0	16.4	15.2
Denied Entry Before	0	1	0	0	1
Denied Entry After	0	0	0	0	0

7: St. John Street & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.4	0.0	0.9	0.0	0.4
Total Del/Veh (s)	16.6	9.0	26.8	21.7	17.8
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

12: Gilman Street & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.3	0.0	0.2	0.1	0.2
Total Del/Veh (s)	2.4	2.4	37.2	12.8	6.5
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

13: Fore River Pkwy & Valley Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.9	0.3	0.0	0.5
Total Del/Veh (s)	53.1	18.4	12.4	29.5
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

18: Bramhall Street/Deering Avenue & Congress Street Performance by approach

Approach	EB	WB	NE	SW	All
Denied Del/Veh (s)	0.0	1.4	2.7	3.0	1.6
Total Del/Veh (s)	16.3	23.5	14.4	16.5	17.1
Denied Entry Before	0	0	0	1	1
Denied Entry After	0	0	0	1	1

19: St. John Street & Park Avenue Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.6	0.1	0.8	0.8
Total Del/Veh (s)	37.4	34.8	39.6	36.5
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

32: Visitor Garage/Forest Street Garage & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.2	0.1
Total Del/Veh (s)	1.8	1.7	17.2	9.0	3.2
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

Total Network Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	41.7
Denied Entry Before	2
Denied Entry After	1

Intersection: 1: St. John Street & Margaritas

Movement	EB	EB	NB
Directions Served	L	R	LT
Maximum Queue (ft)	77	59	80
Average Queue (ft)	37	27	11
95th Queue (ft)	63	50	47
Link Distance (ft)	424		678
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		125	
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Intersection: 3: St. John Street & Garage Access/D St

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	31	36	41	29
Average Queue (ft)	4	15	3	2
95th Queue (ft)	21	40	23	15
Link Distance (ft)	436	550	1618	678
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Valley & St. John Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	L	TR	LT	TR
Maximum Queue (ft)	163	133	274	152	144	175	102	135
Average Queue (ft)	44	76	156	27	58	83	36	62
95th Queue (ft)	106	117	258	100	110	154	77	110
Link Distance (ft)	1618			988	263	263	1083	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		110	335					265
Storage Blk Time (%)	0	1	1					
Queuing Penalty (veh)	0	1	1					

Intersection: 7: St. John Street & Congress Street

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	R	T	TR	L	T
Maximum Queue (ft)	240	339	232	104	166	234	188	121	255
Average Queue (ft)	110	186	59	32	85	98	109	52	120
95th Queue (ft)	192	293	145	81	141	177	177	103	212
Link Distance (ft)	1767	1767			367	671		792	792
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			290	80			175		
Storage Blk Time (%)		1	0	1	9	1	1		
Queuing Penalty (veh)		2	0	2	4	2	3		

Intersection: 12: Gilman Street & Congress Street

Movement	EB	WB	WB	NB	SB
Directions Served	TR	L	T	LTR	LTR
Maximum Queue (ft)	4	73	49	177	76
Average Queue (ft)	0	34	2	83	26
95th Queue (ft)	4	65	29	155	59
Link Distance (ft)	367		425	1063	624
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		65			
Storage Blk Time (%)		1	0		
Queuing Penalty (veh)		5	0		

Intersection: 13: Fore River Pkwy & Valley

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	L	L	T	T	T	T	R	L	R	R
Maximum Queue (ft)	446	491	725	696	229	230	60	146	145	151
Average Queue (ft)	255	323	279	244	153	142	23	64	89	94
95th Queue (ft)	530	561	903	828	216	213	53	116	133	141
Link Distance (ft)			1529	1529	1274	1274		263	263	263
Upstream Blk Time (%)			1	0						
Queuing Penalty (veh)			0	0						
Storage Bay Dist (ft)	430	430					415			
Storage Blk Time (%)	7	23	2							
Queuing Penalty (veh)	22	76	10							

Intersection: 18: Bramhall Street/Deering Avenue & Congress Street

Movement	EB	EB	WB	WB	NE	NE	SW	SW
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	225	285	217	90	140	156	284	75
Average Queue (ft)	75	136	77	68	33	87	119	69
95th Queue (ft)	156	240	167	102	101	147	241	84
Link Distance (ft)	965		1272		1186		795	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		400		65		135		50
Storage Blk Time (%)		0	7	13	0	2	6	29
Queuing Penalty (veh)		0	11	14	0	1	24	25

Intersection: 19: St. John Street & Park Avenue

Movement	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	LT	R	LT	R
Maximum Queue (ft)	164	235	596	406	520	135	365	80
Average Queue (ft)	101	189	262	228	324	106	183	54
95th Queue (ft)	178	269	481	357	492	179	310	105
Link Distance (ft)			1640	792	792		1989	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	95	95				110		55
Storage Blk Time (%)	10	26	42		44	0	47	4
Queuing Penalty (veh)	45	112	217		94	2	51	10

Intersection: 32: Visitor Garage/Forest Street Garage & Congress Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	123	81	82	87
Average Queue (ft)	8	6	37	40
95th Queue (ft)	59	43	69	67
Link Distance (ft)	425	965	508	434
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 734

Intersection: 5: Valley & St. John Street

Phase	2	3	4	6	8
Movement(s) Served	NBTL	WBL	EBTL	SBTL	WBT
Maximum Green (s)	18.0	19.0	18.0	18.0	42.0
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0
Recall	None	None	None	None	None
Avg. Green (s)	14.6	16.3	11.2	14.6	30.4
g/C Ratio	-0.01	-0.01	-0.01	-0.01	-0.01
Cycles Skipped (%)	3	1	16	3	2
Cycles @ Minimum (%)	0	0	4	0	0
Cycles Maxed Out (%)	39	51	12	39	9
Cycles with Peds (%)	0	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 7: St. John Street & Congress Street

Phase	1	2	3	4	5	6	8
Movement(s) Served	EBL	WBL	SBL	NBT	WBL	EBTL	SBT
Maximum Green (s)	13.7	33.2	5.7	14.6	4.5	42.4	27.1
Minimum Green (s)	8.0	8.0	3.0	8.0	4.5	8.0	5.0
Recall	None	Min	None	None	None	Min	None
Avg. Green (s)	12.3	14.5	5.7	13.8	5.8	27.8	24.5
g/C Ratio	-0.01	NA	-0.01	NA	-0.01	NA	NA
Cycles Skipped (%)	4	0	15	0	66	0	0
Cycles @ Minimum (%)	7	41	0	4	25	0	0
Cycles Maxed Out (%)	56	6	80	64	34	9	55
Cycles with Peds (%)	0	0	0	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 13: Fore River Pkwy & Valley

Phase	4	6	7	8
Movement(s) Served	EBT	SBL	EBL	WBT
Maximum Green (s)	34.0	11.0	11.0	18.0
Minimum Green (s)	5.0	5.0	5.0	5.0
Recall	None	None	None	None
Avg. Green (s)	33.8	11.0	11.0	17.6
g/C Ratio	NA	NA	NA	NA
Cycles Skipped (%)	0	0	0	0
Cycles @ Minimum (%)	0	0	0	0
Cycles Maxed Out (%)	88	94	98	88
Cycles with Peds (%)	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 18: Bramhall Street/Deering Avenue & Congress Street

Phase	1	2	3	4	5	6	7	8
Movement(s) Served	SWL	NETL	WBL	EBTL	NEL	SWTL	EBL	WBTL
Maximum Green (s)	5.5	18.5	5.5	12.5	5.5	18.5	7.5	10.5
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Recall	None	Max	None	None	None	Max	None	None
Avg. Green (s)	5.5	19.5	6.2	13.5	5.5	22.9	9.8	12.1
g/C Ratio	-0.01	NA	-0.01	-0.01	-0.01	NA	-0.01	-0.01
Cycles Skipped (%)	44	0	31	3	78	0	23	17
Cycles @ Minimum (%)	0	0	15	0	3	0	0	0
Cycles Maxed Out (%)	55	100	51	74	17	100	63	61
Cycles with Peds (%)	0	0	0	0	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 19: St. John Street & Park Avenue

Phase	2	6	8
Movement(s) Served	NBTL	SBTL	WBTL
Maximum Green (s)	40.0	25.0	40.0
Minimum Green (s)	3.0	3.0	3.0
Recall	Min	Min	Min
Avg. Green (s)	37.9	21.1	35.2
g/C Ratio	NA	NA	NA
Cycles Skipped (%)	0	0	0
Cycles @ Minimum (%)	0	0	0
Cycles Maxed Out (%)	79	47	48
Cycles with Peds (%)	0	0	0

Controller Summary
Average Cycle Length (s): NA

Number of Complete Cycles : 0

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	6:57	6:57	6:57	6:57	6:57	6:57
End Time	8:00	8:00	8:00	8:00	8:00	8:00
Total Time (min)	63	63	63	63	63	63
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	7831	7966	7847	8076	7814	7904
Vehs Exited	7813	7849	7783	8055	7757	7851
Starting Vehs	252	221	215	251	225	229
Ending Vehs	270	338	279	272	282	281
Denied Entry Before	0	3	2	4	4	1
Denied Entry After	3	3	3	2	5	1
Travel Distance (mi)	4829	4926	4831	4966	4830	4876
Travel Time (hr)	261.7	290.4	275.9	276.3	277.5	276.4
Total Delay (hr)	85.7	110.7	99.9	95.0	101.5	98.6
Total Stops	9846	11329	10407	10601	10702	10579
Fuel Used (gal)	181.4	191.5	185.7	189.1	186.0	186.7

Interval #0 Information Seeding

Start Time	6:57
End Time	7:00
Total Time (min)	3

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	7:00
End Time	8:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	Avg
Vehs Entered	7831	7966	7847	8076	7814	7904
Vehs Exited	7813	7849	7783	8055	7757	7851
Starting Vehs	252	221	215	251	225	229
Ending Vehs	270	338	279	272	282	281
Denied Entry Before	0	3	2	4	4	1
Denied Entry After	3	3	3	2	5	1
Travel Distance (mi)	4829	4926	4831	4966	4830	4876
Travel Time (hr)	261.7	290.4	275.9	276.3	277.5	276.4
Total Delay (hr)	85.7	110.7	99.9	95.0	101.5	98.6
Total Stops	9846	11329	10407	10601	10702	10579
Fuel Used (gal)	181.4	191.5	185.7	189.1	186.0	186.7

1: St. John Street & Margaritas Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.6	0.0	0.0	0.3
Total Del/Veh (s)	10.0	2.9	2.2	3.3
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

3: St. John Street & Garage Access/D St Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	0.1	0.4	0.1	0.6
Total Del/Veh (s)	12.0	4.9	8.9	12.7	11.2
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

5: Valley & St. John Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	2.7	0.0	1.3	0.9
Total Del/Veh (s)	13.3	18.1	14.4	19.2	15.3
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	1	0	0	1

7: St. John Street & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.4	0.0	0.7	0.0	0.4
Total Del/Veh (s)	21.6	9.0	29.1	21.5	21.2
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

12: Gilman Street & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.1	0.1
Total Del/Veh (s)	2.3	1.8	25.4	10.9	3.6
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

13: Fore River Pkwy & Valley Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.9	0.3	0.0	0.4
Total Del/Veh (s)	56.9	18.3	12.8	31.6
Denied Entry Before	1	0	0	1
Denied Entry After	0	0	0	0

18: Bramhall Street/Deering Avenue & Congress Street Performance by approach

Approach	EB	WB	NE	SW	All
Denied Del/Veh (s)	0.0	1.4	2.7	3.1	1.5
Total Del/Veh (s)	16.5	21.5	13.4	15.2	16.4
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

19: St. John Street & Park Avenue Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.6	0.1	1.0	0.8
Total Del/Veh (s)	42.8	23.3	28.5	31.5
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

22: Proposed Drop Off & Congress Street Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	1.0	1.2	16.3	1.6
Denied Entry Before	0	0	0	0
Denied Entry After	0	0	0	0

32: Visitor Garage/Forest Street Garage & Congress Street Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.2	0.1
Total Del/Veh (s)	1.2	1.8	17.3	8.6	2.8
Denied Entry Before	0	0	0	0	0
Denied Entry After	0	0	0	0	0

Total Network Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	42.4
Denied Entry Before	1
Denied Entry After	1

Intersection: 1: St. John Street & Margaritas

Movement	EB	EB	NB	SB
Directions Served	L	R	LT	TR
Maximum Queue (ft)	76	65	158	17
Average Queue (ft)	30	32	31	1
95th Queue (ft)	63	55	98	6
Link Distance (ft)	549		677	671
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		125		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: St. John Street & Garage Access/D St

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	L	TR
Maximum Queue (ft)	168	103	35	73	193	100	293
Average Queue (ft)	89	42	14	13	83	33	133
95th Queue (ft)	147	81	37	44	157	84	239
Link Distance (ft)	559		663		1605		677
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		150		100		75	
Storage Blk Time (%)	0	0			3	0	16
Queuing Penalty (veh)	1	0			1	2	7

Intersection: 5: Valley & St. John Street

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	L	TR	LT	TR
Maximum Queue (ft)	192	135	276	97	146	203	42	50
Average Queue (ft)	66	97	154	24	66	100	13	8
95th Queue (ft)	148	143	240	67	121	167	39	31
Link Distance (ft)	1605			988	270	270	1083	
Upstream Blk Time (%)						0		
Queuing Penalty (veh)						0		
Storage Bay Dist (ft)		110	335					265
Storage Blk Time (%)	1	4						
Queuing Penalty (veh)	3	5						

Intersection: 7: St. John Street & Congress Street

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	R	T	TR	L	T
Maximum Queue (ft)	237	372	313	104	159	439	200	103	240
Average Queue (ft)	136	222	71	40	74	168	156	50	109
95th Queue (ft)	217	340	199	87	130	330	214	93	211
Link Distance (ft)	1767	1767			367	671		792	792
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			290	80			175		
Storage Blk Time (%)		2	0	1	6	3	5		
Queuing Penalty (veh)		4	0	2	3	12	17		

Intersection: 12: Gilman Street & Congress Street

Movement	EB	WB	WB	NB	SB
Directions Served	TR	L	T	LTR	LTR
Maximum Queue (ft)	10	69	20	105	66
Average Queue (ft)	0	30	1	46	27
95th Queue (ft)	7	59	14	81	57
Link Distance (ft)	367		170	1063	624
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		65			
Storage Blk Time (%)		1			
Queuing Penalty (veh)		3			

Intersection: 13: Fore River Pkwy & Valley

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	L	L	T	T	T	T	R	L	R	R
Maximum Queue (ft)	453	500	777	722	227	206	65	123	170	170
Average Queue (ft)	321	372	309	245	151	137	25	65	100	103
95th Queue (ft)	573	595	820	715	207	201	55	106	151	151
Link Distance (ft)			1519	1519	1275	1275		270	270	270
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	430	430					415			
Storage Blk Time (%)	9	28	3							
Queuing Penalty (veh)	29	91	14							

Intersection: 18: Bramhall Street/Deering Avenue & Congress Street

Movement	EB	EB	WB	WB	NE	NE	SW	SW
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	148	273	196	90	114	151	267	75
Average Queue (ft)	69	139	74	69	28	76	117	69
95th Queue (ft)	123	234	153	99	74	130	231	86
Link Distance (ft)	966		1272		1186		795	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		400		65		135		50
Storage Blk Time (%)			5	11		1	5	27
Queuing Penalty (veh)			9	11		0	22	24

Intersection: 19: St. John Street & Park Avenue

Movement	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	LT	R	LT	R
Maximum Queue (ft)	164	235	590	281	447	135	283	80
Average Queue (ft)	115	184	270	157	258	112	137	56
95th Queue (ft)	193	265	581	248	397	175	239	101
Link Distance (ft)			1640	792	792		1376	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	95	95				110		55
Storage Blk Time (%)	10	30	49		31	1	36	3
Queuing Penalty (veh)	44	128	260		87	6	39	8

Intersection: 22: Proposed Drop Off & Congress Street

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (ft)	19	147	74
Average Queue (ft)	1	18	30
95th Queue (ft)	8	79	61
Link Distance (ft)	170	201	194
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		1	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 32: Visitor Garage/Forest Street Garage & Congress Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	72	97	99	83
Average Queue (ft)	5	9	41	41
95th Queue (ft)	35	49	77	69
Link Distance (ft)	201	966	624	434
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 831

Intersection: 3: St. John Street & Garage Access/D St

Phase	2	4	5	6	8
Movement(s) Served	NBTL	EBTL	NBL	SBTL	WBTL
Maximum Green (s)	31.0	19.0	5.5	21.0	19.0
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0
Recall	Min	None	None	Min	None
Avg. Green (s)	21.1	12.6	5.8	19.5	12.6
g/C Ratio	-0.01	-0.01	-0.01	NA	-0.01
Cycles Skipped (%)	1	1	88	0	1
Cycles @ Minimum (%)	0	2	1	0	2
Cycles Maxed Out (%)	16	20	9	53	20
Cycles with Peds (%)	0	0	0	0	0

Controller Summary
Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 5: Valley & St. John Street

Phase	2	3	4	6	8
Movement(s) Served	NBTL	WBL	EBTL	SBTL	WBT
Maximum Green (s)	18.0	19.0	18.0	18.0	42.0
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0
Recall	None	None	None	None	None
Avg. Green (s)	12.1	16.4	13.6	12.1	35.1
g/C Ratio	-0.01	-0.01	-0.01	-0.01	-0.01
Cycles Skipped (%)	8	1	9	8	5
Cycles @ Minimum (%)	0	0	1	0	0
Cycles Maxed Out (%)	20	52	34	20	24
Cycles with Peds (%)	0	0	0	0	0

Controller Summary
Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 7: St. John Street & Congress Street

Phase	1	2	3	4	5	6	8
Movement(s) Served	EBL	WBL	SBL	NBT	WBL	EBTL	SBT
Maximum Green (s)	16.3	22.7	5.7	22.5	4.5	34.5	35.0
Minimum Green (s)	8.0	8.0	3.0	8.0	4.5	8.0	5.0
Recall	None	Min	None	None	None	Min	None
Avg. Green (s)	14.2	15.6	5.7	22.0	5.0	30.0	33.3
g/C Ratio	NA	NA	-0.01	NA	-0.01	NA	NA
Cycles Skipped (%)	0	0	11	0	49	0	0
Cycles @ Minimum (%)	7	24	0	0	44	0	0
Cycles Maxed Out (%)	56	26	82	73	51	36	62
Cycles with Peds (%)	0	0	0	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 13: Fore River Pkwy & Valley

Phase	4	6	7	8
Movement(s) Served	EBT	SBL	EBL	WBT
Maximum Green (s)	34.0	11.0	11.0	18.0
Minimum Green (s)	5.0	5.0	5.0	5.0
Recall	None	None	None	None
Avg. Green (s)	33.8	10.8	11.0	17.5
g/C Ratio	NA	NA	NA	NA
Cycles Skipped (%)	0	0	0	0
Cycles @ Minimum (%)	0	0	0	0
Cycles Maxed Out (%)	89	91	98	89
Cycles with Peds (%)	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 18: Bramhall Street/Deering Avenue & Congress Street

Phase	1	2	3	4	5	6	7	8
Movement(s) Served	SWL	NETL	WBL	EBTL	NEL	SWTL	EBL	WBTL
Maximum Green (s)	5.5	18.5	5.5	12.5	5.5	18.5	5.5	12.5
Minimum Green (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Recall	None	Max	None	None	None	Max	None	None
Avg. Green (s)	5.6	19.4	6.1	12.9	5.7	22.8	8.1	12.8
g/C Ratio	-0.01	NA	-0.01	-0.01	-0.01	NA	-0.01	-0.01
Cycles Skipped (%)	45	0	30	2	80	0	23	15
Cycles @ Minimum (%)	0	0	15	0	5	0	0	0
Cycles Maxed Out (%)	52	100	53	73	14	100	77	48
Cycles with Peds (%)	0	0	0	0	0	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Intersection: 19: St. John Street & Park Avenue

Phase	2	6	8
Movement(s) Served	NBTL	SBTL	WBTL
Maximum Green (s)	29.0	17.0	19.0
Minimum Green (s)	3.0	3.0	3.0
Recall	Min	Min	Min
Avg. Green (s)	28.5	14.8	19.2
g/C Ratio	NA	NA	NA
Cycles Skipped (%)	0	0	0
Cycles @ Minimum (%)	0	0	0
Cycles Maxed Out (%)	89	52	96
Cycles with Peds (%)	0	0	0

Controller Summary

Average Cycle Length (s): NA

Number of Complete Cycles : 0

Attachment 7D

Pedestrian and Bicycle Collision Locations
Left Turn Lane Warrants

Pedestrian and Bicycle Collisions

Figure No. A

Bramhall St. - 22; MMC Congress Street Building
PORTLAND, MAINE

Design: EAL Scale: NONE
Draft: Date: OCT 2018
Checked: RED File Name: 2866.01 - TIS Figures

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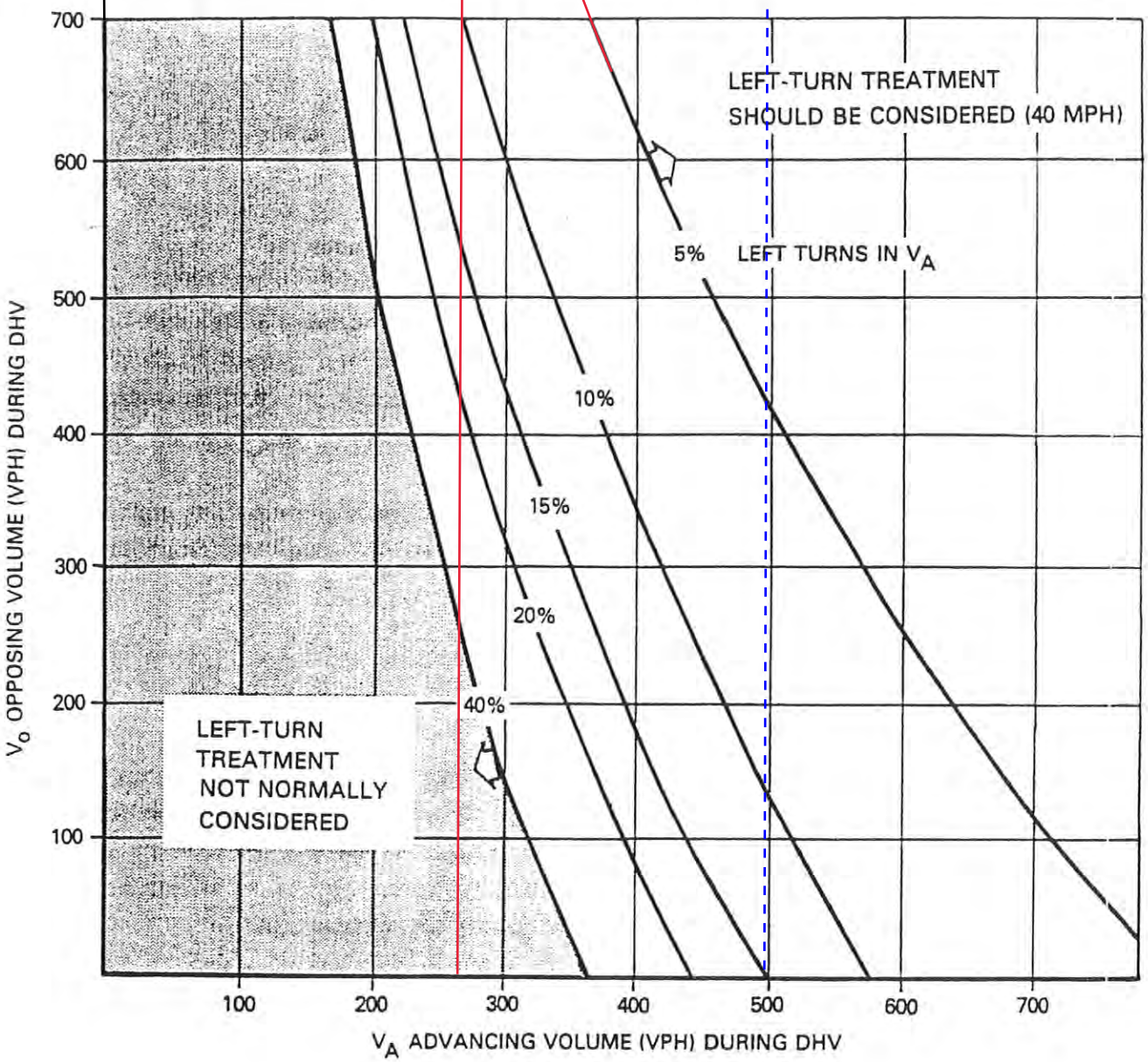
Congress Street Proposed Drop Off Left Turn Lane Warrant

867



Instructions:

1. The family of curves represent the percent of left turns in the advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.

4. Read V_A and V_O into the chart and locate the intersection of the two volumes.

5. Note the location of the point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is warranted. If the point is to the left of the line, then a left-turn lane is not warranted based on traffic volumes.

AM Peak Hour
V_A = 269
V_O = 867
%L = 4.5%

PM Peak Hour
V_A = 496
V_O = 774
%L = 3.4%

VOLUME WARRANTS FOR LEFT-TURN LANES AT UNSIGNALIZED INTERSECTIONS ON 2-LANE HIGHWAYS (40 mph)

Figure 8-19

AM Peak Hour of Adjacent Street

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

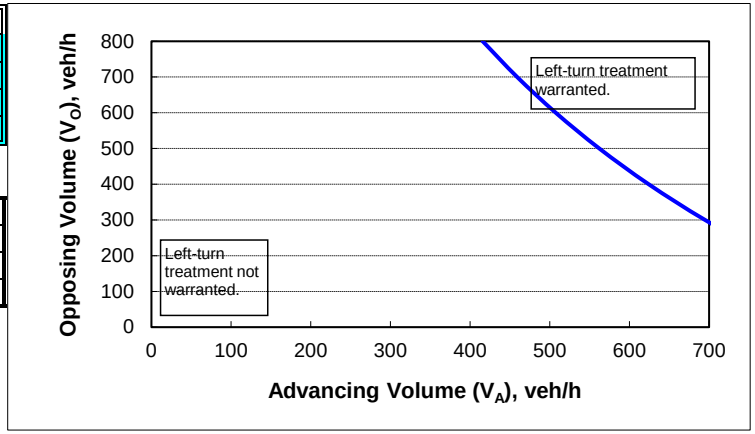
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	25
Percent of left-turns in advancing volume (V_A), %:	5%
Advancing volume (V_A), veh/h:	269
Opposing volume (V_O), veh/h:	867

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	389
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

PM Peak Hour of Adjacent Street

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

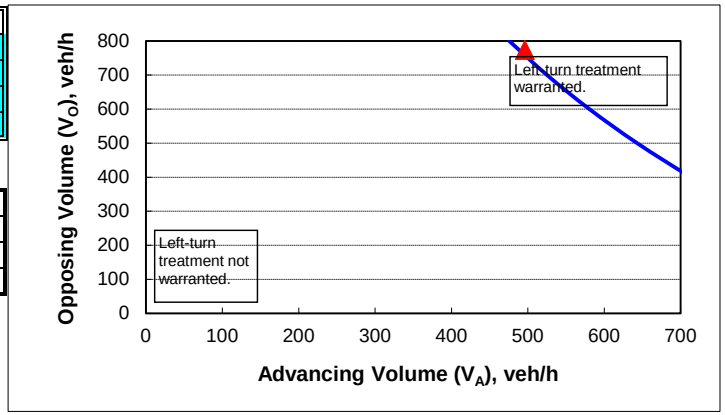
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	25
Percent of left-turns in advancing volume (V_A), %:	3%
Advancing volume (V_A), veh/h:	496
Opposing volume (V_O), veh/h:	774

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	488
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9