



Appendix C

2018 Traffic Impact
Study
&
2019 Traffic Impact
Study Addendum

TRUE NORTH COMMONS TRAFFIC IMPACT STUDY

Prepared for:

City of Colorado Springs, CO

Prepared by:



2435 Research Parkway, Suite 300
Colorado Springs, CO 80920

Contact: Scott Barnhart, PE, PTOE

On Behalf of:

Blue and Silver Development, LLC
2435 Research Parkway, Suite 300
Colorado Springs, CO 8920

November 21, 2018

Table of Contents

| | |
|---|-----------|
| Introduction | 3 |
| Proposed Development | 5 |
| Area Conditions | 7 |
| Study Area Land Use..... | 7 |
| Site Accessibility | 9 |
| Projected Development Traffic | 11 |
| Trip Generation | 11 |
| Trip Distribution | 12 |
| Traffic Analysis | 14 |
| Opening Year (2020)..... | 14 |
| Horizon Year (2040) | 18 |
| Conclusions | 22 |
| Appendix A: Traffic Volumes | |
| Appendix B: Existing Conditions Analysis | |
| Appendix C: Trip Generation Analysis | |
| Appendix D: Opening Year (2020) Analysis | |
| Appendix E: Horizon Year (2040) Analysis | |

List of Figures

| | |
|---|----|
| 1: Vicinity Map | 4 |
| 2: True North Commons Site Plan | 6 |
| 3: Proposed I-25/Powers Boulevard Interchange | 8 |
| 4: Existing Conditions Traffic Volumes..... | 10 |
| 5: Trip Distribution..... | 13 |
| 6: Opening Year (2020) Traffic Volumes..... | 15 |
| 7: Opening Year (2020) With Project Traffic Volumes..... | 17 |
| 8: Horizon Year (2040) Traffic Volumes | 19 |
| 9: Horizon Year (2040) With Project Traffic Volumes | 21 |

List of Tables

| | |
|---|----|
| 1: Existing Conditions Intersection Operations | 11 |
| 2: True North Commons Trip Generation | 12 |
| 3: Opening Year (2020) Intersection Operations..... | 16 |
| 4: Opening Year (2020) With Project Intersection Operations | 18 |
| 5: Horizon Year (2040) Intersection Operations | 20 |
| 6: Horizon Year (2040) With Project Intersection Operations..... | 22 |

Introduction

True North Commons is a 57-acre development that is planned in northwest Colorado Springs. The property is comprised of five parcels that will be developed and a 19-acre parcel that will not be developed at this time. The five parcels consist of the following:

- 8.5-acre retail/commercial parcel
- 1.5-acre I-Fly parcel
- 8.0-acre United States Air Force Academy (USAFA) Visitor Center
- 10.0-acre office parcel
- 10.0-acre hotel parcel

The project lies immediately west of I-25 on both the north and south side of Northgate Boulevard as it approaches the north entrance to USAFA.

The purpose of this study is to assess the effects this proposed development will have on the surrounding transportation system. This report is part of the Master Plan effort and submittal to the City of Colorado Springs.

The report is organized as follows:

Introduction – Describes the purpose and intent of this study.

Area Conditions – Describes the study area land uses as well as the existing and future roadway network.

Proposed Development – Describes the proposed development and the location.

Projected Traffic – Identifies the expected number of daily and peak hour trips that will be generated by True North Commons. The expected external trip distribution is also shown.

Traffic Analysis – Will analyze the existing conditions in the study area as well as opening year (2020) and horizon year (2040) conditions with and without the project.

Findings and Conclusions – Identifies any deficiencies in the study area roadway network with or without the project and mitigation measures that will alleviate any identified deficiencies.

Recommendations – Provides a summary of the study findings.

TRUE NORTH COMMONS
TRAFFIC IMPACT STUDY

Figure 1 – Vicinity Map



Proposed Development

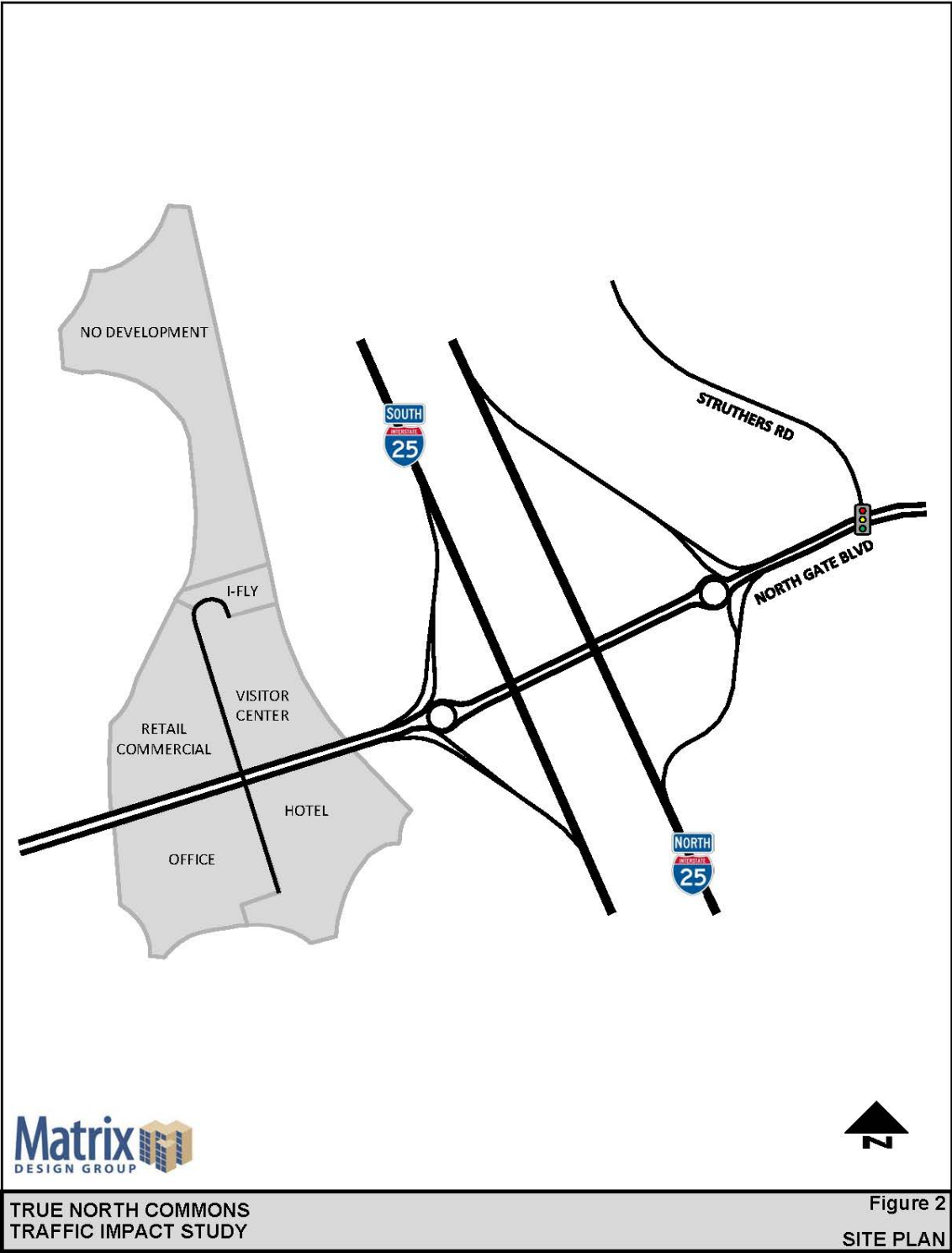
True North Commons consists of the following land uses:

- 37,000 square foot visitors center
- 250-room 4-star hotel
- 150-room 3-star hotel
- 7,500 square foot I-Fly
- 25,000 square foot retail commercial area
- 3,000 square foot gas station with convenience store
- 200,000 square foot office complex

Figure 2 illustrates the True North Commons site plan.

TRUE NORTH COMMONS
TRAFFIC IMPACT STUDY

Figure 2 – True North Commons Site Plan



Area Conditions

This section describes the existing conditions and the planned level of improvements adjacent to True North Commons.

Study Area Land Use

The site where True North Commons will be constructed is currently vacant land on USAFA property and is bound on the east by the Santa Fe Trail. The land sits above Northgate Boulevard at the east end of the property as Northgate Boulevard dips below the Santa Fe Trail and then gradually rises back to grade. There is an existing parking lot on the north side of Northgate Boulevard which serves as a trail-head for the Santa Fe Trail. At the west end of the True North Commons property is the north entrance to the USAFA. No other development is proposed along the west side of I-25 in the study area due the USAFA owning the property. The east side of I-25 has seen significant development in recent years with the construction of the Bass Pro Shops and surrounding retail including the Copper Ridge development. The extension of Powers Boulevard will eventually construct a new interchange with I-25 in the study area. An Interchange Access Request (IAR) was prepared for the Copper Ridge Metropolitan District and submitted to both the Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA) in May of this year (2018). The Copper Ridge Metropolitan District is proposing to construct the Powers Boulevard interchange with I-25 and the Powers Boulevard extension between I-25 on the west and Voyager Parkway on the east as is shown in Figure 3 from the IAR document.

Figure 3 – Proposed I-25/Powers Boulevard Interchange



The IAR documents future development on the east side of I-25 and the future roadway network. This traffic impact study will use the results of the *I-25/Powers Boulevard IAR* as the basis of existing conditions (2015), opening year (2020), and horizon year (2040) traffic projections without the True North Commons development. The IAR assumes that the new Powers interchange has been built by 2020. The interchange diverts traffic away from Northgate Boulevard between Voyager Parkway and I-25. The City of Colorado Springs Traffic Engineering Division has commented that they do not believe that the Powers interchange will be built by 2020 and that this study should not assume the interchange is in place by 2020. Since this study is focusing on the intersections along Northgate Boulevard and the 2020 scenario without a Powers interchange will provide the most conservative background traffic volumes, we will assume that there is no Powers interchange in the 2020 conditions, but that the interchange has been built by 2040.

Site Accessibility

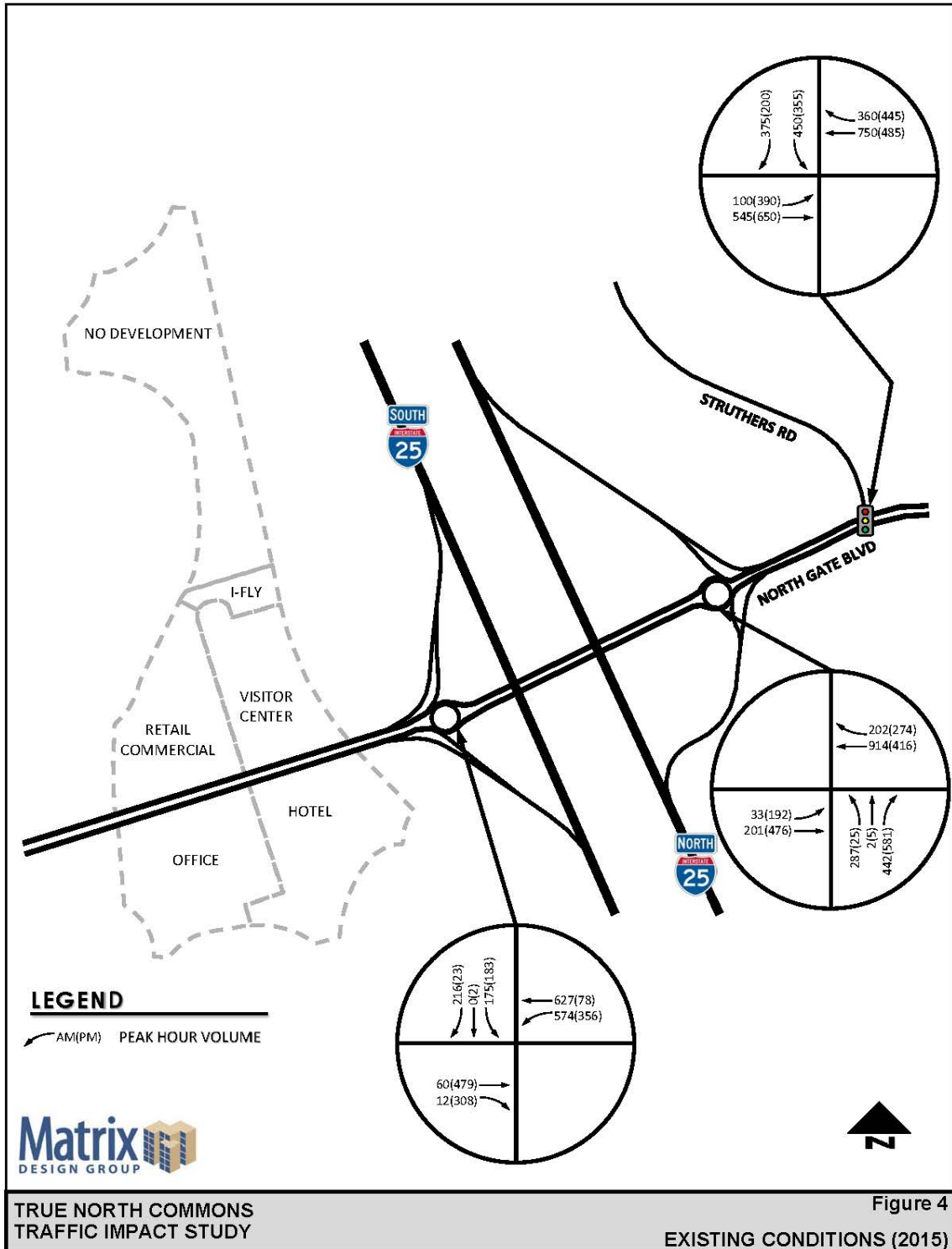
The existing roadway system consists of I-25 as the primary north-south transportation facility and Northgate Boulevard as the east-west transportation facility. I-25 is an interstate freeway maintained by CDOT. Northgate Boulevard is a principal arterial per the City of Colorado Springs Major Thoroughfares Plan. Northgate Boulevard is a divided, 4-lane facility. The daily capacity of a 4-lane principal arterial in the City of Colorado Springs is 25,000 vehicles per day. However, in the area of this development, the two I-25 ramp intersections with Northgate Boulevard as well as the new intersection with the development cross-street will dictate the operations in the study area.

The access control point (North USAFA Gate) is located to the west of the project access roadway. The inbound morning queues from this control point posed a concern. Observations were made to the access control point operations between 6AM and 8:15 AM. The access control point starts with only 1 entrance lane operating. By 6:15, the control point has 3 lanes open. By 8:15 AM, the peak has passed and the access control point returns to 1-lane operation. The longest queue observed was 30 vehicles between the three lanes which did back up past the Santa Fe Trailhead access. This back-up was out of the trailhead access within 5 minutes. We have chosen to use a traffic-signal controlled intersection for project access instead of a roundabout to ensure that the intersection will still function if access control point queues stretch back through the intersection. We also know that the intersection cannot be any closer to the I-25 Southbound Ramps intersection than 550-feet. We optimized the location of the project access intersection between where gate queues are likely to reach and the no access zone from the I-25 ramp.

The existing conditions for the two I-25 ramp intersections as well as the Northgate Boulevard/Struthers Road intersection were taken directly from the *I-25/Powers Boulevard IAR*. The AM and PM peak hour volumes at these intersections is shown in Figure 4.

TRUE NORTH COMMONS
TRAFFIC IMPACT STUDY

Figure 4 – Existing Conditions Traffic Volumes



The analysis used in the *I-25/Powers Boulevard IAR* did not follow traditional *Highway Capacity Manual* methodologies for level of service (LOS). We performed intersection LOS analysis for the two roundabout intersections and the results are shown in Table 1.

Table 1 – Existing Conditions Intersection Operations

| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|------------------------------------|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 6.0 | A | 10.4 | B |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 7.5 | A | 4.9 | A |
| Northgate Boulevard/Struthers Road | Traffic Signal | 14.6 | B | 16.8 | B |

There are no fixed route transit services in the area and there are also no transportation system management or traffic demand management programs in the area.

Projected Development Traffic

This section documents how much traffic the True North Commons development is expected to generate and how the external site trips will be distributed on the adjacent roadway network.

Trip Generation

The vehicle trips associated with True North Commons were calculated using the Institute of Transportation Engineers (ITE) *Trip Generation Manual, Tenth Edition*. This methodology consists of choosing an independent variable for the land use for a particular time of day. The independent variable correlates to the variation in trip ends and is related to the land use. The value of the independent variable is either multiplied by a weighted average or used in a regression equation to calculate the trips generated by the land use. The *ITE Trip Generation Manual* provides guidance on when to use the weighted average versus the regression equation. In most cases, the regression equations are recommended when there are adequate study data points.

Table 2 shows the trips that are expected to be generated by True North Commons at build out. Several of the proposed land uses are unique and do not have an ITE Land Use for trip generation purposes. The proposed Visitors' Center is assumed as a Museum (ITE Land Use Code 580). The 4-star hotel is assumed to be an All Suites Hotel (ITE Land Use Code 311). The 3-star hotel is assumed to be a Business Hotel (ITE Land Use Code 312). The retail land use is assumed to be a Shopping Center (ITE Land Use Code 820). The iFly facility is assumed to be a Rock Climbing Gym (ITE Land Use Code 434). The office and convenience store with gas pumps directly related to ITE land uses (ITE Land Use Code 710 and 853, respectively).

**TRUE NORTH COMMONS
TRAFFIC IMPACT STUDY**

Table 2 – True North Commons Trip Generation

| ITE Code | Land Use | Size | Units | Weekday | | | AM Peak Hour | | | PM Peak Hour | | |
|----------|--------------------------------|---------|---------|--------------|--------------|--------------|--------------|------------|------------|--------------|------------|------------|
| | | | | Total | Entering | Exiting | Total | Entering | Exiting | Total | Entering | Exiting |
| 580 | Visitors' Center | 37,000 | Sq. Ft. | 150 | 90 | 60 | 10 | 9 | 1 | 7 | 1 | 6 |
| 311 | 4-Star Luxury Hotel | 250 | Rooms | 1,115 | 558 | 557 | 85 | 45 | 40 | 90 | 43 | 47 |
| 312 | 3-Star Hotel | 150 | Rooms | 603 | 302 | 301 | 58 | 24 | 34 | 48 | 26 | 22 |
| 820 | Retail | 25,000 | Sq. Ft. | 2,342 | 1,171 | 1,171 | 164 | 102 | 62 | 195 | 94 | 101 |
| 434 | i-Fly | 7,500 | Sq. Ft. | 140 | 70 | 70 | 10 | 3 | 7 | 12 | 7 | 5 |
| 853 | Convenience Market w/Gas Pumps | 3,000 | Sq. Ft. | 1,873 | 937 | 936 | 122 | 61 | 61 | 148 | 74 | 74 |
| 710 | Office Building | 200,000 | Sq. Ft. | 1,873 | 937 | 936 | 214 | 184 | 30 | 220 | 35 | 185 |
| | <i>Sub-total</i> | | | 8,096 | 4,065 | 4,031 | 663 | 428 | 235 | 720 | 280 | 440 |
| | <i>Internal Trip Capture</i> | | | - | - | - | 114 | 57 | 57 | 86 | 43 | 43 |
| | <i>Pass-by Trip Reduction</i> | | | - | - | - | 64 | 30 | 34 | 137 | 68 | 69 |
| | Total | | | 8,096 | 4,065 | 4,031 | 485 | 341 | 144 | 497 | 169 | 328 |

Numbers represent total vehicles

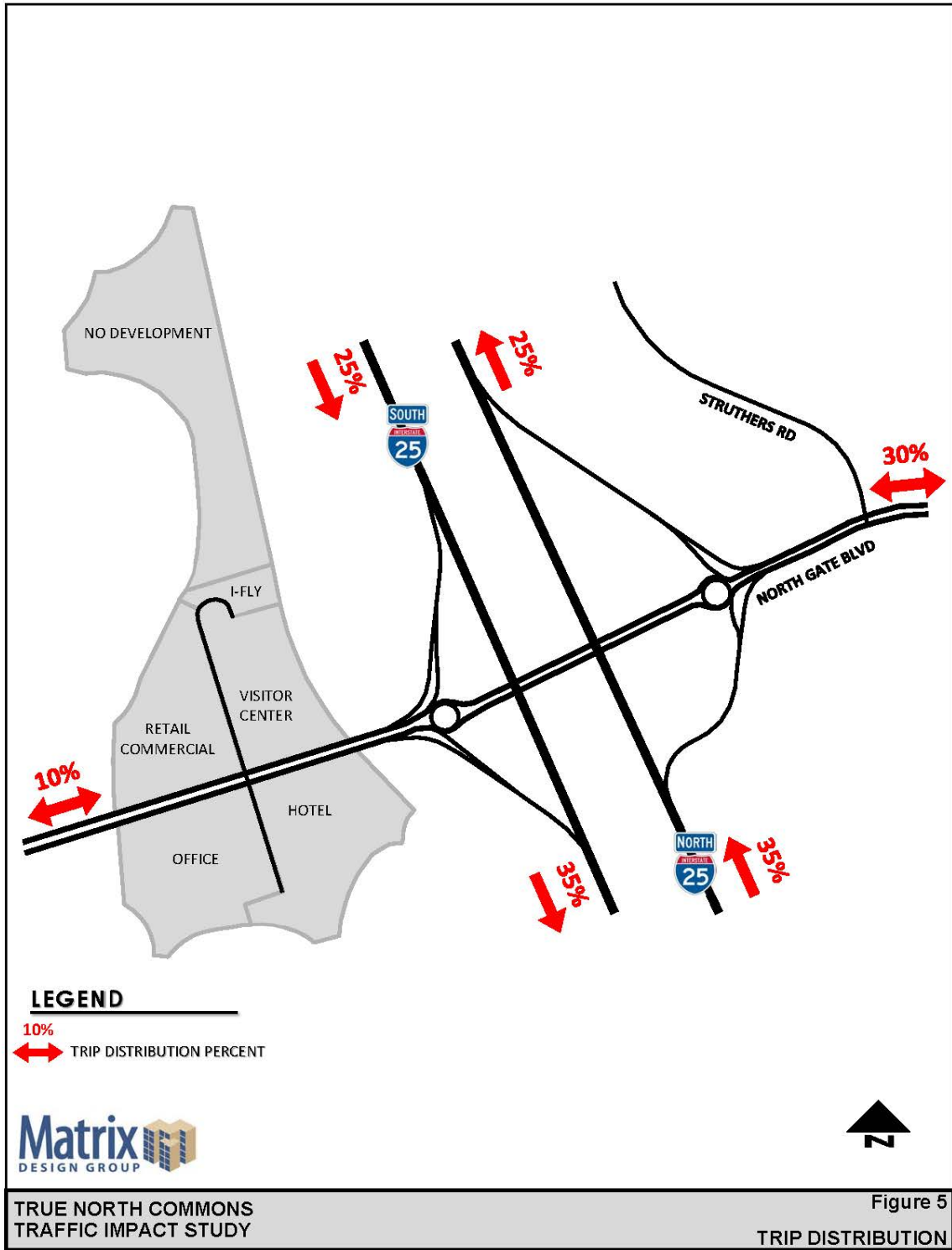
ITE Land Use Codes 580 and 434 do not provide weekday daily trip generation rates. To be conservative, the higher of the AM peak hour or PM peak hour volume for both entering and exiting volumes were assumed to be 10% of the daily total.

The National Cooperative Highway Research Program (NCHRP) Report 684 was used to determine internal trip capture rates during the AM and PM peak hours within the development. Internal trips are trips between the land uses within the develop and do not impact the external roadway network. Additionally, pass-by trip reduction was also applied to some of the land uses. Pass-by trips are trips that will use a land-use because it is on their route, but are not new trips generated just by the new land use. Retail and gas stations are land uses that have pass-by trips. These trips do not get added to the new trips on the external roadway network. During the AM peak hour, 62% of the peak hour trips into and out of the Convenience Market with Gas Pumps were assumed to be pass-by trips per ITE guidelines. A 34% pass-by trip reduction was applied to the retail land use during the PM peak hour and a 61% pass-by trip reduction was applied to the Convenience Market with Gas Pumps during the PM peak hour. The internal trips and pass-by trips are subtracted from the total trips generated to determine the new trips that will impact the external roadway network.

Trip Distribution

Figure 5 illustrates the expected external distribution of travel for the site-generated trips. This distribution was determined by reviewing the total trips on the roadway network in the IAR document.

Figure 5 – Trip Distribution



Traffic Analysis

Traffic conditions both with and without the project have been analyzed for opening year (2020) and horizon year (2040) conditions.

Opening Year (2020)

The True North Commons development will be opened in phases depending on each land use. It is anticipated that the first land uses may open in 2019 with others following. Matrix has chosen 2020 as the analysis year for project opening conditions as all land uses are assumed to be complete by then.

The opening year traffic volumes without the True North Commons project are shown in Figure 6.

**TRUE NORTH COMMONS
TRAFFIC IMPACT STUDY**

Figure 6 – Opening Year (2020) Traffic Volumes

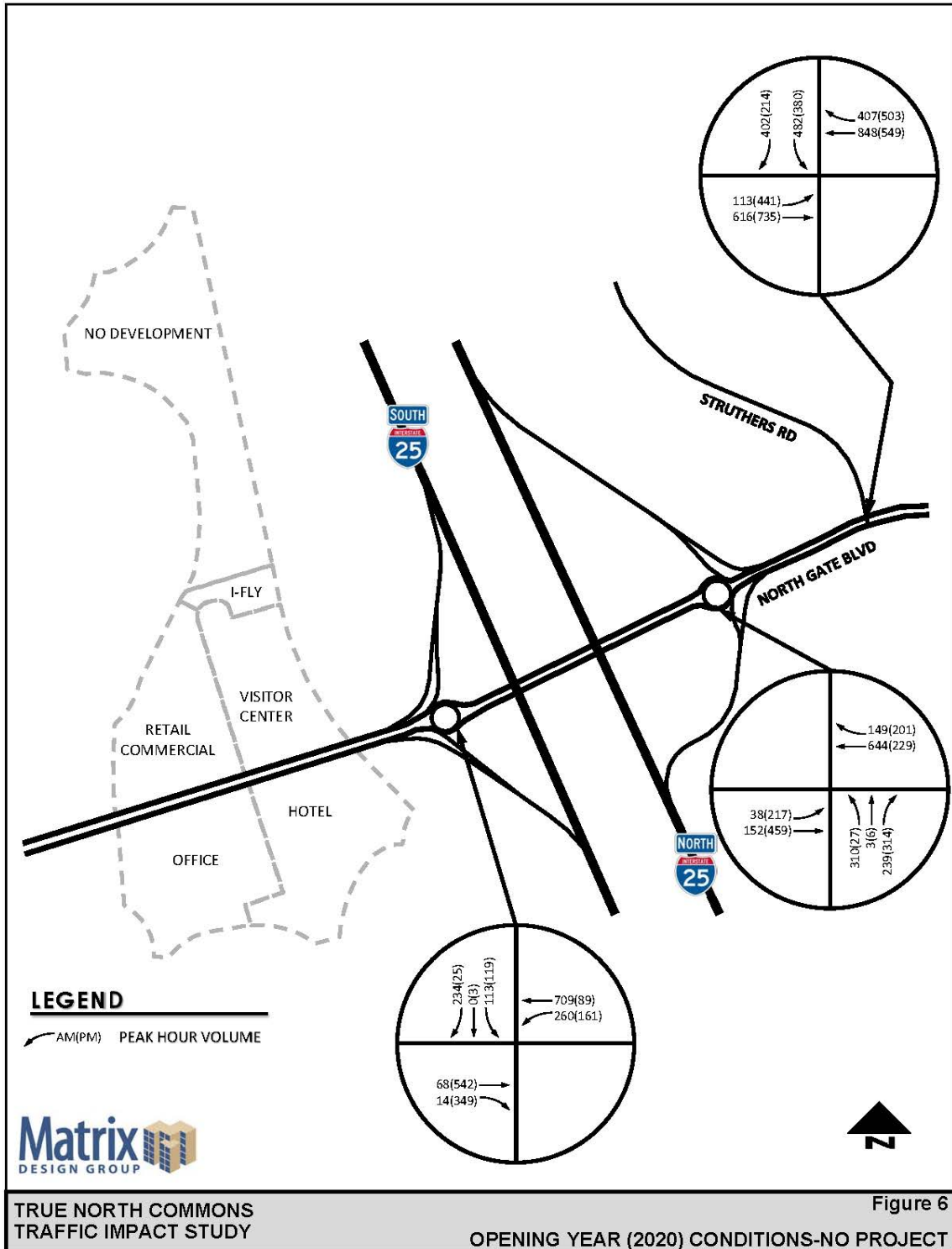


Table 3 shows the LOS of the two I-25 ramp intersections with Northgate Boulevard. As can be seen from Table 3, both intersections will operate well during 2020 without the project.

**TRUE NORTH COMMONS
TRAFFIC IMPACT STUDY**

Table 3 – Opening Year (2020) Intersection Operations

| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|------------------------------------|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 4.9 | A | 6.0 | A |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 6.3 | A | 3.5 | A |
| Northgate Boulevard/Struthers Road | Traffic Signal | 16.5 | B | 23.8 | C |

When the project traffic is distributed and assigned to the roadway network, the resulting traffic volumes are shown in Figure 7.

TRUE NORTH COMMONS
TRAFFIC IMPACT STUDY

Figure 7 – Opening Year (2020) With Project Traffic Volumes

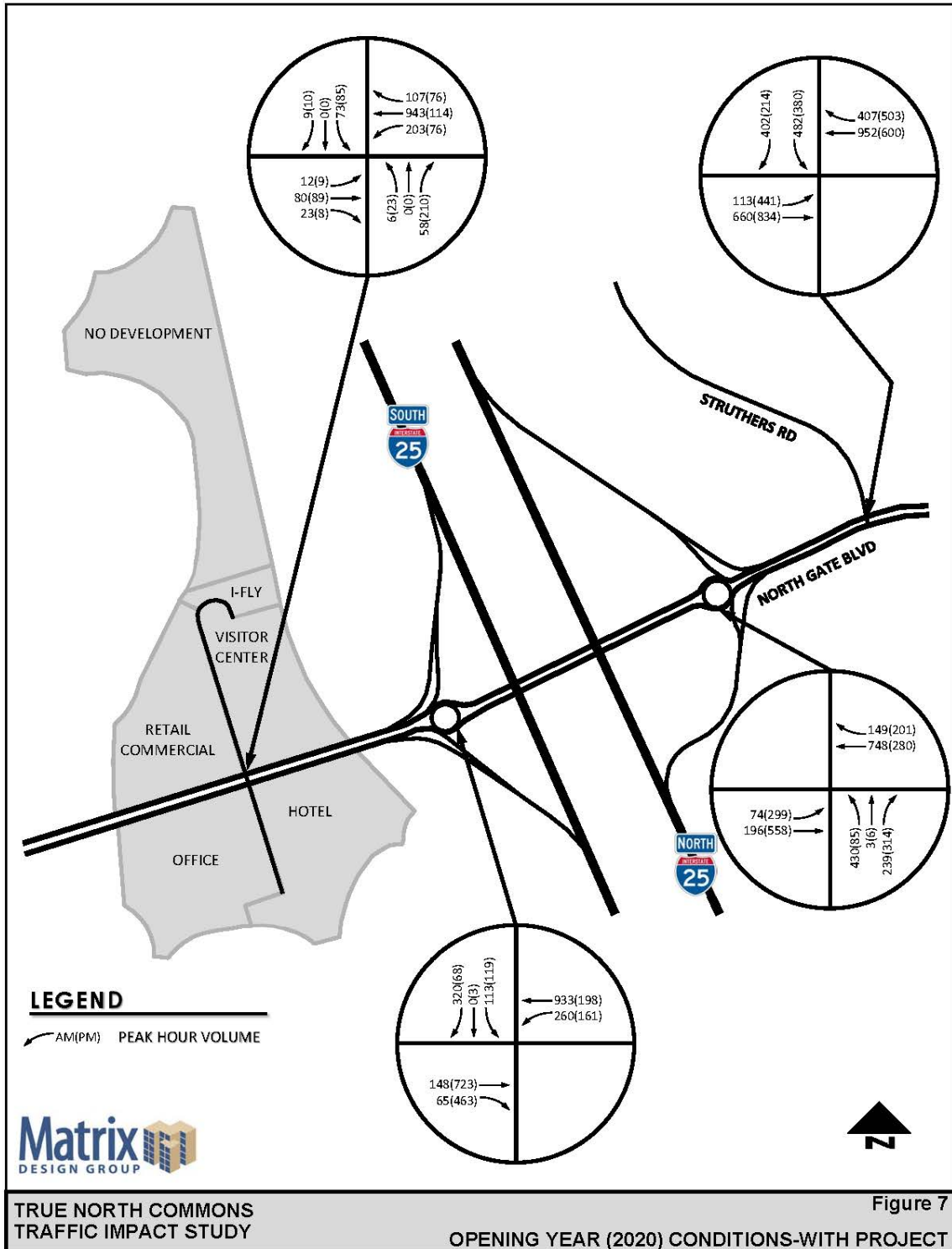


Table 4 shows the LOS of the two I-25 ramp intersections with Northgate Boulevard, the Struthers Road intersection with Northgate Boulevard as well as the new signalized intersection with the roadway that serves the True North Commons development.

Table 4 – Opening Year (2020) With Project Intersection Operations

| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|--|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 6.0 | A | 6.8 | A |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 7.4 | A | 3.8 | A |
| Northgate Boulevard/Struthers Road | Traffic Signal | 16.5 | B | 23.3 | C |
| Northgate Boulevard/True North Commons | Traffic Signal | 7.4 | A | 11.8 | B |

The study area intersections will all operate well in the opening year both with and without the project, so no additional mitigation beyond the assumed design is necessary. Northgate Boulevard is a Principal Arterial and therefore has a design speed of 45 miles-per-hour. With this assumed design speed, right-turn and left-turn lanes will be 200-feet long at intersections based on the City’s *Traffic Criteria Manual*. The projected queue lengths at the new signalized intersection will be contained within the provided left-turn and right-turn storage lengths.

Horizon Year (2040)

The planning horizon year is currently assumed to be 2040. The study area intersections will be analyzed with 2040 projected traffic volumes both with and without the project.

Figure 8 shows the assumed traffic volumes in the study area in 2040 without the project.

TRUE NORTH COMMONS
TRAFFIC IMPACT STUDY

Figure 8 – Horizon Year (2040) Traffic Volumes

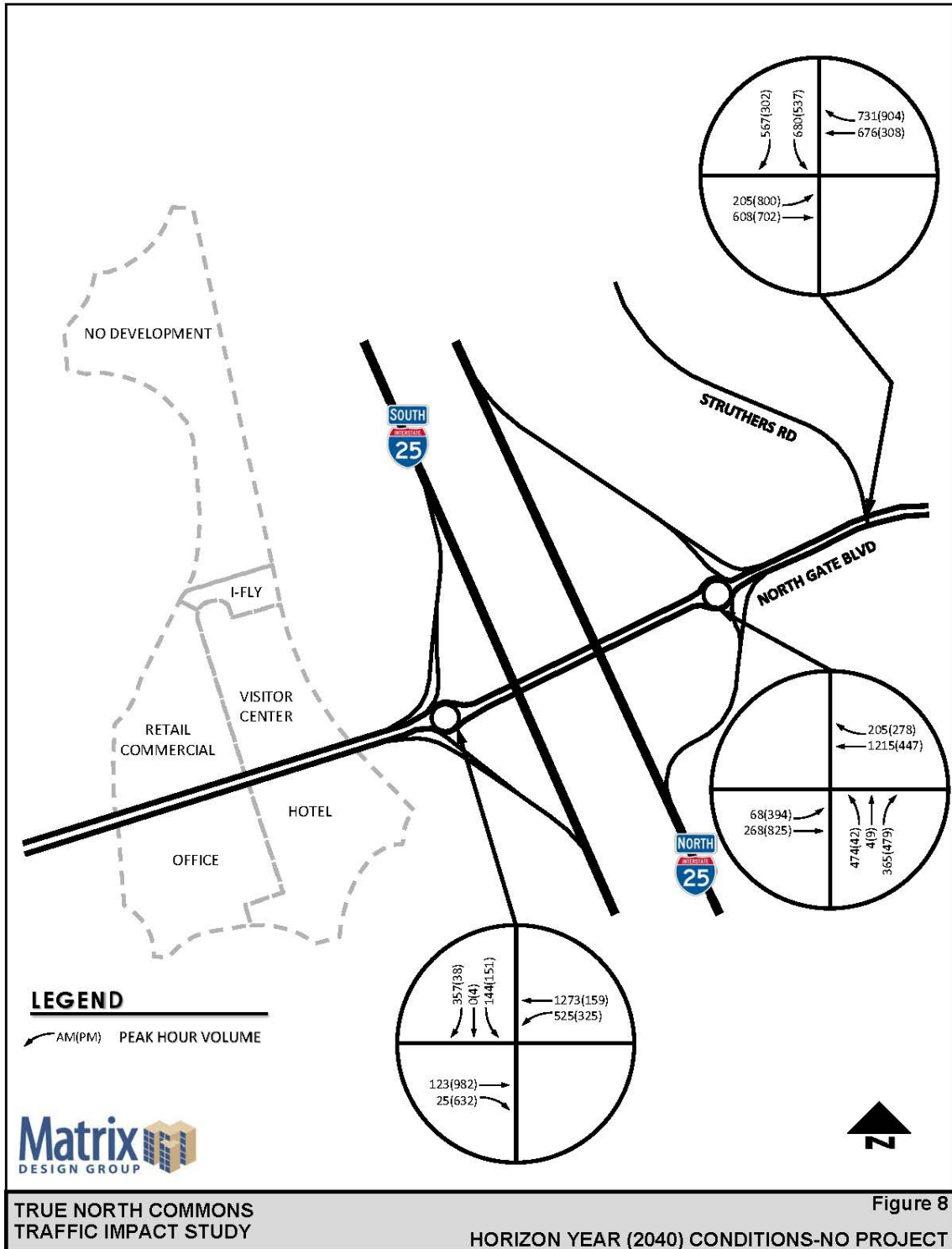


Table 5 shows the LOS of the two I-25 ramp intersections and Struthers Road with Northgate Boulevard. As can be seen from Table 5, all intersections will operate well during 2040 without the project except the Northgate Boulevard/Struthers Road intersection.

Table 5 – Horizon Year (2040) Intersection Operations

| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|------------------------------------|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 7.2 | A | 11.9 | B |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 12.8 | B | 12.4 | B |
| Northgate Boulevard/Struthers Road | Traffic Signal | 79.3 | E | 77.3 | E |

This degradation in operations is due to the high delay experienced by the westbound right-turn movement from Northgate Boulevard onto Struthers Road. This can be solved by adding right-turn overlap traffic signal phasing for the westbound right-turn movement. This would allow a green arrow for right-turn movements to be displayed at the same time as the southbound movements from Struthers Road are timing (non-conflicting movements). This will allow the Northgate Boulevard/Struthers Road intersection to operate with 22.1 seconds of delay and LOS C during the AM peak hour and with 21.5 seconds of delay and LOS C during the PM peak hour. This improvement only requires two new traffic signal vehicle heads and signal phasing/timing changes, but does not require any additional lanes or intersection improvements.

When the project traffic is distributed and assigned to the roadway network, the resulting traffic volumes are shown in Figure 9.

**TRUE NORTH COMMONS
TRAFFIC IMPACT STUDY**

Figure 9 – Horizon Year (2040) With Project Traffic Volumes

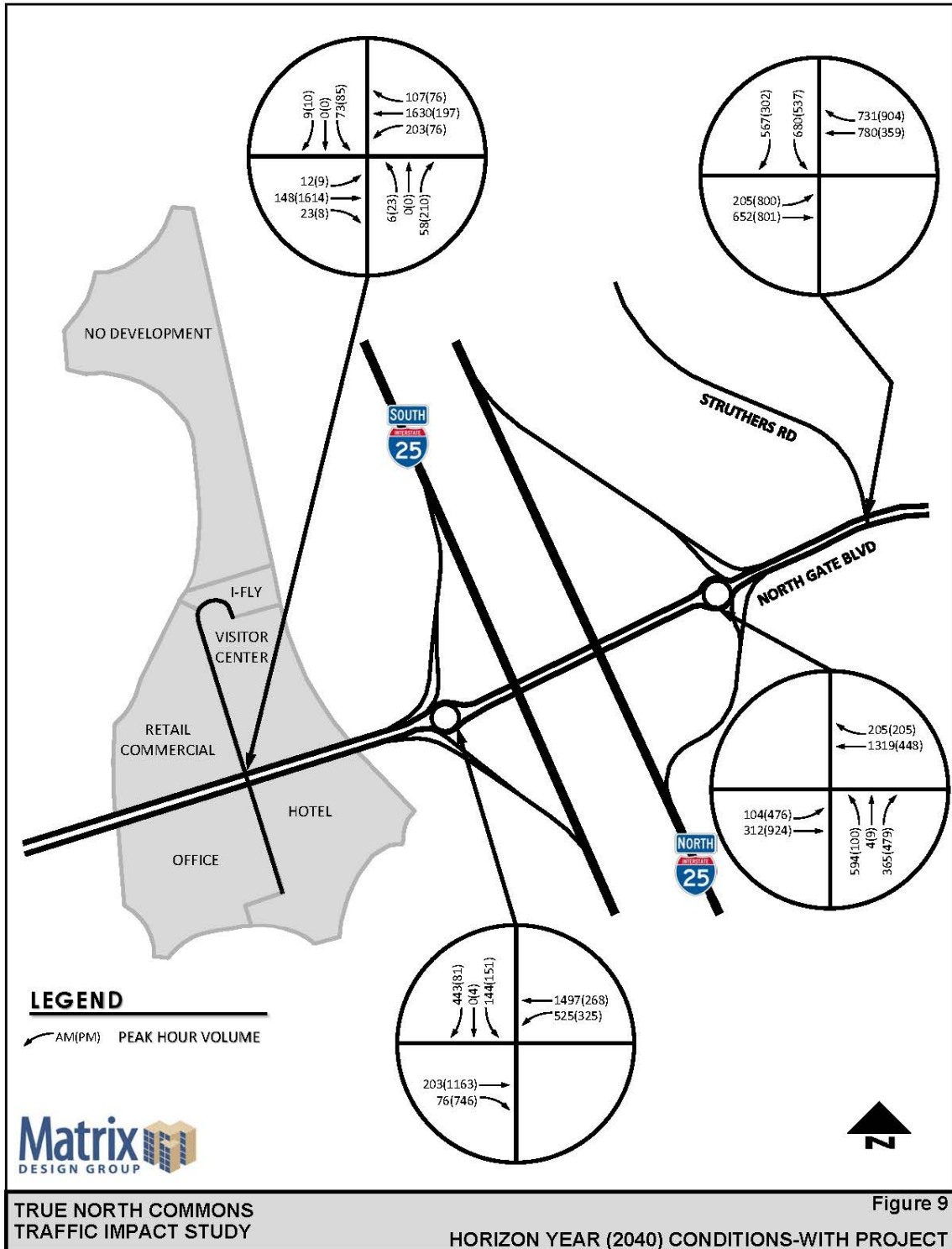


Table 6 shows the LOS of the two I-25 ramp intersections and Struthers Road with Northgate Boulevard as well as the new signalized intersection with the roadway that serves the True North Commons development.

Table 6 – Horizon Year (2040) With Project Intersection Operations

| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|--|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 9.9 | A | 17.2 | C |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 16.9 | C | 4.7 | A |
| Northgate Boulevard/Struthers Road | Traffic Signal | 22.2 | C | 22.2 | C |
| Northgate Boulevard/True North Commons | Traffic Signal | 9.5 | A | 24.3 | C |

The study area intersections will all operate well in the horizon year with the project, so no additional mitigation beyond the assumed design is necessary. It has been assumed that the improvements needed at the Northgate Boulevard/Struthers Road intersection will be implemented since they are needed with or without the project traffic. The projected queue lengths at the new signalized intersection will be contained within the provided left-turn and right-turn storage lengths.

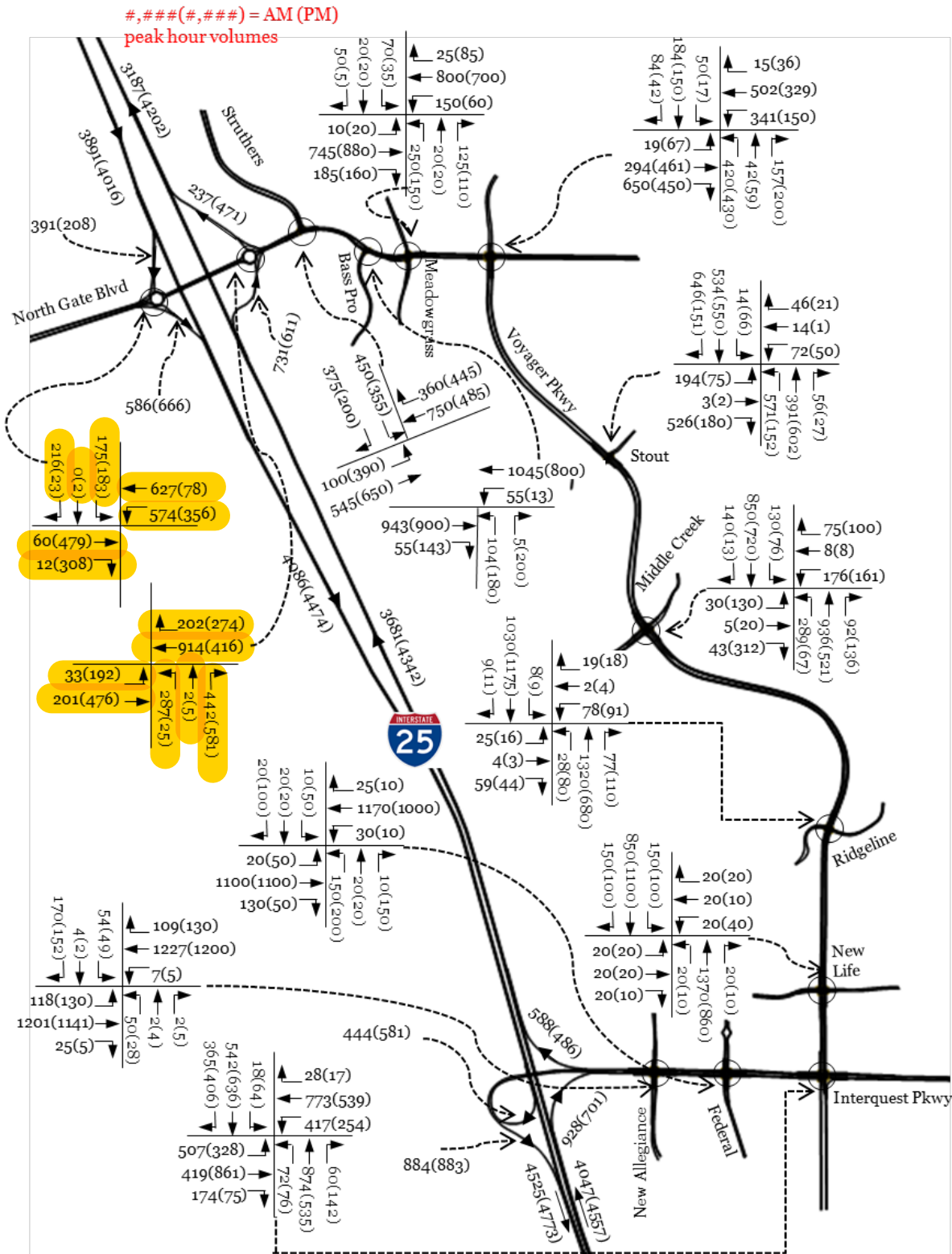
Conclusions

This report has documented how the roadway network in the study area of the True North Commons development currently operates as well as how it is projected to operate both with and without the project during the project’s opening year (2020) and the horizon year of 2040. The study area intersections will operate at acceptable LOS during both the opening year and horizon year with and without the project. The only intersection improvement identified is to add westbound right-turn overlap traffic signal phasing to the Northgate Boulevard/Struthers Road intersection by 2040. This improvement is needed with or without the development traffic and is not caused or worsened by the development traffic.

Appendix A: Traffic Volumes

Existing conditions

Figure 3-1 Existing Traffic Volumes (2015)



I-25/POWERS BOULEVARD IAR

Analysis Results

Figure 5-1 Traffic Volume Forecast – 2020 No-Build

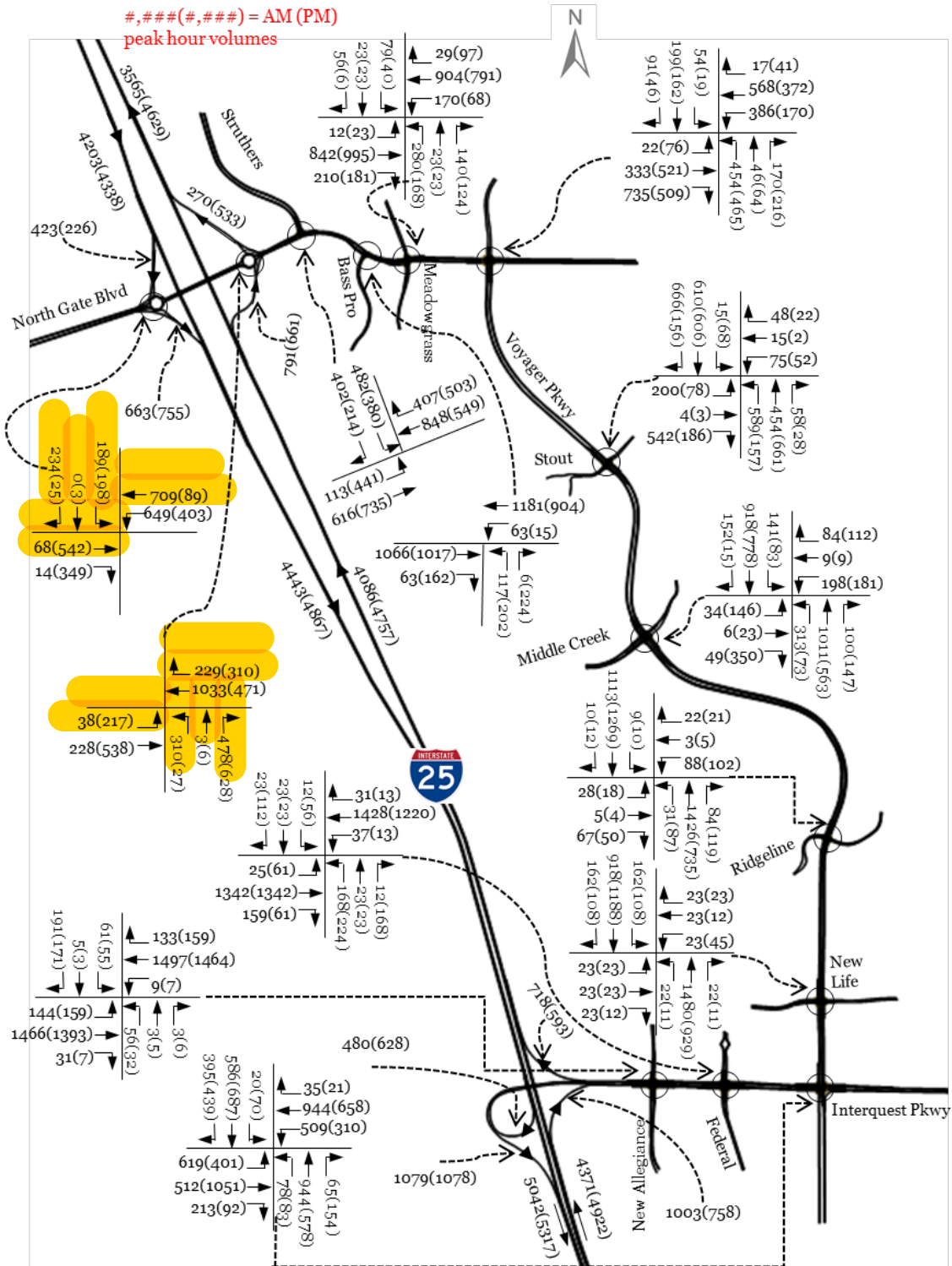
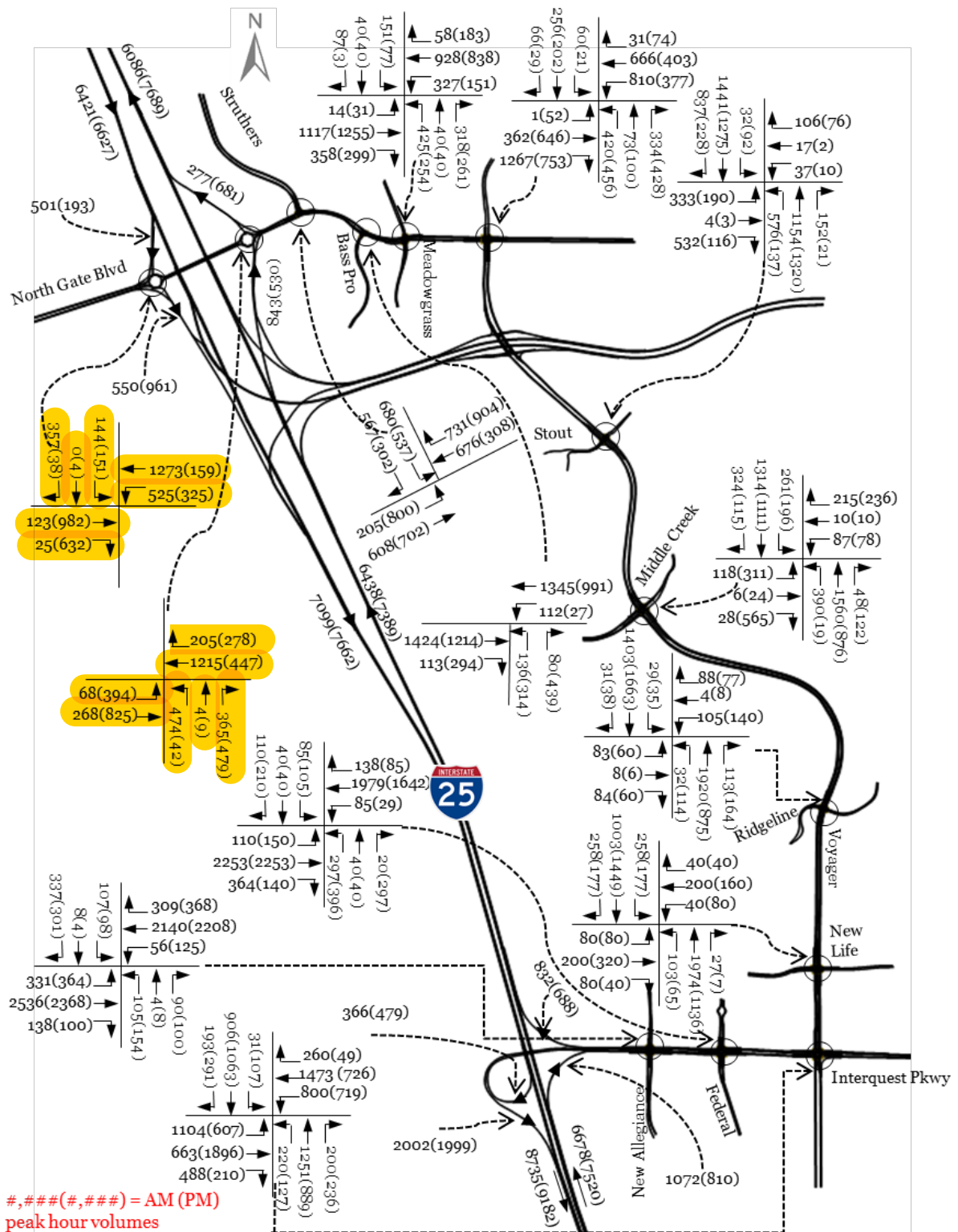


Figure 5-6 Traffic Volume Forecast – 2040 Build



Appendix B: Existing Conditions Analysis

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 6.0 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | NB | SE |
| Entry Lanes | 2 | 0 | 1 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 254 | 0 | 794 | 0 |
| Demand Flow Rate, veh/h | 259 | 0 | 810 | 0 |
| Vehicles Circulating, veh/h | 0 | 357 | 259 | 1331 |
| Vehicles Exiting, veh/h | 1331 | 222 | 0 | 39 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 3.4 | 0.0 | 6.8 | 0.0 |
| Approach LOS | A | - | A | - |
| Lane | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | L | R |
| Assumed Moves | LT | TR | L | R |
| RT Channelized | | | | Yield |
| Lane Util | 0.471 | 0.529 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 4.328 | 490 |
| Entry Flow, veh/h | 122 | 137 | 320 | 1176 |
| Cap Entry Lane, veh/h | 1350 | 1420 | 1139 | 0.980 |
| Entry HV Adj Factor | 0.977 | 0.981 | 0.981 | 480 |
| Flow Entry, veh/h | 119 | 134 | 314 | 1153 |
| Cap Entry, veh/h | 1319 | 1394 | 1117 | 0.416 |
| V/C Ratio | 0.090 | 0.096 | 0.281 | 7.4 |
| Control Delay, s/veh | 3.5 | 3.3 | 5.9 | A |
| LOS | A | A | A | 2 |
| 95th %tile Queue, veh | 0 | 0 | 1 | |

HCM 6th Roundabout
1: Northgate BI & I-25 SB Ramp

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 7.5 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | SB | NW |
| Entry Lanes | 0 | 2 | 0 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 0 | 1306 | 0 | 0 |
| Demand Flow Rate, veh/h | 0 | 1332 | 0 | 0 |
| Vehicles Circulating, veh/h | 830 | 0 | 1332 | 260 |
| Vehicles Exiting, veh/h | 696 | 260 | 0 | 636 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 0.0 | 7.5 | 0.0 | 0.0 |
| Approach LOS | - | A | - | - |
| Lane | Left | Right | | |
| Designated Moves | LT | TR | | |
| Assumed Moves | LT | TR | | |
| RT Channelized | | | | |
| Lane Util | 0.470 | 0.530 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | | |
| Entry Flow, veh/h | 626 | 706 | | |
| Cap Entry Lane, veh/h | 1350 | 1420 | | |
| Entry HV Adj Factor | 0.981 | 0.981 | | |
| Flow Entry, veh/h | 614 | 692 | | |
| Cap Entry, veh/h | 1324 | 1393 | | |
| V/C Ratio | 0.464 | 0.497 | | |
| Control Delay, s/veh | 7.4 | 7.6 | | |
| LOS | A | A | | |
| 95th %tile Queue, veh | 3 | 3 | | |

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018



| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | ↶↶ | ↶↶ | ↶↶ | ↶ | ↶↶ | ↶ | |
| Traffic Volume (veh/h) | 100 | 545 | 750 | 360 | 450 | 375 | |
| Future Volume (veh/h) | 100 | 545 | 750 | 360 | 450 | 375 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 109 | 592 | 815 | 391 | 489 | 408 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 635 | 1673 | 1144 | 510 | 1243 | 570 | |
| Arrive On Green | 0.06 | 0.47 | 0.32 | 0.32 | 0.36 | 0.36 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 109 | 592 | 815 | 391 | 489 | 408 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 0.9 | 5.0 | 9.5 | 10.5 | 5.0 | 10.5 | |
| Cycle Q Clear(g_c), s | 0.9 | 5.0 | 9.5 | 10.5 | 5.0 | 10.5 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 635 | 1673 | 1144 | 510 | 1243 | 570 | |
| V/C Ratio(X) | 0.17 | 0.35 | 0.71 | 0.77 | 0.39 | 0.72 | |
| Avail Cap(c_a), veh/h | 705 | 1880 | 1279 | 570 | 1243 | 570 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 9.6 | 7.9 | 14.1 | 14.4 | 11.3 | 13.0 | |
| Incr Delay (d2), s/veh | 0.1 | 0.1 | 1.7 | 5.6 | 0.9 | 7.5 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 0.3 | 1.5 | 3.4 | 3.9 | 1.7 | 10.0 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 9.7 | 8.1 | 15.8 | 20.0 | 12.2 | 20.5 | |
| LnGrp LOS | A | A | B | B | B | C | |
| Approach Vol, veh/h | | 701 | 1206 | | 897 | | |
| Approach Delay, s/veh | | 8.3 | 17.1 | | 16.0 | | |
| Approach LOS | | A | B | | B | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 26.3 | 21.0 | 7.0 | 19.2 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 25.0 | 17.0 | 4.0 | 17.0 |
| Max Q Clear Time (g_c+I1), s | | | | 7.0 | 12.5 | 2.9 | 12.5 |
| Green Ext Time (p_c), s | | | | 3.8 | 1.6 | 0.0 | 2.7 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 14.6 | | | | |
| HCM 6th LOS | | | B | | | | |

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 10.4 | | | |
| Intersection LOS | B | | | |
| Approach | EB | WB | NB | SE |
| Entry Lanes | 2 | 0 | 1 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 726 | 0 | 664 | 0 |
| Demand Flow Rate, veh/h | 740 | 0 | 678 | 0 |
| Vehicles Circulating, veh/h | 0 | 246 | 740 | 489 |
| Vehicles Exiting, veh/h | 489 | 527 | 0 | 218 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 4.9 | 0.0 | 16.3 | 0.0 |
| Approach LOS | A | - | C | - |
| Lane | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | L | R |
| Assumed Moves | LT | TR | L | R |
| RT Channelized | | | | Yield |
| Lane Util | 0.470 | 0.530 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 4.328 | 645 |
| Entry Flow, veh/h | 348 | 392 | 33 | 907 |
| Cap Entry Lane, veh/h | 1350 | 1420 | 757 | 0.980 |
| Entry HV Adj Factor | 0.980 | 0.981 | 0.983 | 632 |
| Flow Entry, veh/h | 341 | 385 | 32 | 890 |
| Cap Entry, veh/h | 1323 | 1393 | 744 | 0.710 |
| V/C Ratio | 0.258 | 0.276 | 0.044 | 16.9 |
| Control Delay, s/veh | 5.0 | 4.9 | 5.3 | C |
| LOS | A | A | A | 6 |
| 95th %tile Queue, veh | 1 | 1 | 0 | |

HCM 6th Roundabout
 1: Northgate BI & I-25 SB Ramp

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 4.9 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | SB | NW |
| Entry Lanes | 0 | 2 | 0 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 0 | 472 | 0 | 0 |
| Demand Flow Rate, veh/h | 0 | 482 | 0 | 0 |
| Vehicles Circulating, veh/h | 600 | 0 | 482 | 734 |
| Vehicles Exiting, veh/h | 87 | 734 | 0 | 397 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 0.0 | 4.9 | 0.0 | 0.0 |
| Approach LOS | - | A | - | - |
| Lane | Left | Right | | |
| Designated Moves | LT | TR | | |
| Assumed Moves | L | TR | | |
| RT Channelized | | | | |
| Lane Util | 0.820 | 0.180 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | | |
| Entry Flow, veh/h | 395 | 87 | | |
| Cap Entry Lane, veh/h | 1350 | 1420 | | |
| Entry HV Adj Factor | 0.980 | 0.980 | | |
| Flow Entry, veh/h | 387 | 85 | | |
| Cap Entry, veh/h | 1322 | 1392 | | |
| V/C Ratio | 0.293 | 0.061 | | |
| Control Delay, s/veh | 5.3 | 3.1 | | |
| LOS | A | A | | |
| 95th %tile Queue, veh | 1 | 0 | | |

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018



| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | ↖↗ | ↑↑ | ↖↗ | ↗ | ↖↗ | ↗ | |
| Traffic Volume (veh/h) | 390 | 650 | 485 | 445 | 355 | 200 | |
| Future Volume (veh/h) | 390 | 650 | 485 | 445 | 355 | 200 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 424 | 707 | 527 | 484 | 386 | 217 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 906 | 1837 | 1144 | 510 | 1113 | 510 | |
| Arrive On Green | 0.11 | 0.52 | 0.32 | 0.32 | 0.32 | 0.32 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 424 | 707 | 527 | 484 | 386 | 217 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 3.6 | 6.0 | 5.9 | 14.8 | 4.2 | 5.3 | |
| Cycle Q Clear(g_c), s | 3.6 | 6.0 | 5.9 | 14.8 | 4.2 | 5.3 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 906 | 1837 | 1144 | 510 | 1113 | 510 | |
| V/C Ratio(X) | 0.47 | 0.38 | 0.46 | 0.95 | 0.35 | 0.43 | |
| Avail Cap(c_a), veh/h | 928 | 1859 | 1144 | 510 | 1113 | 510 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 8.8 | 7.2 | 13.4 | 16.4 | 12.9 | 13.2 | |
| Incr Delay (d2), s/veh | 0.4 | 0.1 | 0.3 | 27.3 | 0.9 | 2.6 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 1.1 | 1.7 | 2.0 | 8.4 | 1.5 | 5.4 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 9.2 | 7.4 | 13.7 | 43.8 | 13.7 | 15.8 | |
| LnGrp LOS | A | A | B | D | B | B | |
| Approach Vol, veh/h | | 1131 | 1011 | | 603 | | |
| Approach Delay, s/veh | | 8.0 | 28.1 | | 14.5 | | |
| Approach LOS | | A | C | | B | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 29.7 | 20.0 | 9.7 | 20.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 26.0 | 16.0 | 6.0 | 16.0 |
| Max Q Clear Time (g_c+I1), s | | | | 8.0 | 7.3 | 5.6 | 16.8 |
| Green Ext Time (p_c), s | | | | 4.7 | 1.5 | 0.1 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 16.8 | | | | |
| HCM 6th LOS | | | B | | | | |

Appendix C: Trip Generation Analysis

| Project Information | |
|-------------------------|--------------------------------------|
| Project Name: | True North Commons |
| No: | |
| Date: | 9/18/2018 |
| City: | |
| State/Province: | |
| Zip/Postal Code: | |
| Country: | |
| Client Name: | Blue and Silver Development Partners |
| Analyst's Name: | S. Barnhart |
| Edition: | ITE-TGM 10th Edition |

| Land Use | Size | AM Peak Hour | | PM Peak Hour | | Daily | |
|--|----------------------|--------------|------|--------------|------|-------|------|
| | | Entry | Exit | Entry | Exit | Entry | Exit |
| 580 - Museum (General Urban/Suburban) | 37 1000 Sq. Ft. GFA | 9 | 1 | 1 | 6 | 17 | 7 |
| Reduction | | 0 | 0 | 0 | 0 | 0 | 0 |
| Internal | | 0 | 0 | 0 | 2 | 0 | 0 |
| Pass-by | | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-pass-by | | 9 | 1 | 1 | 4 | 17 | 7 |
| 311 - All Suites Hotel (General Urban/Suburban) | 250 Rooms | 45 | 40 | 43 | 47 | 558 | 557 |
| Reduction | | 0 | 0 | 0 | 0 | 0 | 0 |
| Internal | | 0 | 12 | 9 | 3 | 0 | 0 |
| Pass-by | | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-pass-by | | 45 | 28 | 34 | 44 | 558 | 557 |
| 312 - Business Hotel (General Urban/Suburban) | 150 Rooms | 24 | 34 | 26 | 22 | 302 | 301 |
| Reduction | | 0 | 0 | 0 | 0 | 0 | 0 |
| Internal | | 0 | 12 | 8 | 3 | 0 | 0 |
| Pass-by | | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-pass-by | | 24 | 22 | 18 | 19 | 302 | 301 |
| 820 - Shopping Center (General Urban/Suburban) | 25 1000 Sq. Ft. GLA | 102 | 62 | 94 | 101 | 1171 | 1171 |
| Reduction | | 0 | 0 | 0 | 0 | 0 | 0 |
| Internal | | 16 | 7 | 13 | 11 | 0 | 0 |
| Pass-by | | 0 | 0 | 28 | 30 | 0 | 0 |
| Non-pass-by | | 86 | 55 | 53 | 60 | 1171 | 1171 |
| 434 - Rock Climbing Gym (General Urban/Suburban) | 7.5 1000 Sq. Ft. GFA | 3 | 7 | 7 | 5 | 3 | 7 |
| Reduction | | 0 | 0 | 0 | 0 | 0 | 0 |
| Internal | | 1 | 2 | 1 | 0 | 0 | 0 |
| Pass-by | | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-pass-by | | 2 | 5 | 6 | 5 | 3 | 7 |
| 853 - Convenience Market with Gasoline Pumps (General Urban/Suburban) | 3 1000 Sq. Ft. GFA | 61 | 61 | 74 | 74 | 937 | 936 |
| Reduction | | 0 | 0 | 0 | 0 | 0 | 0 |
| Internal | | 12 | 7 | 9 | 9 | 0 | 0 |
| Pass-by | | 30 | 34 | 40 | 39 | 0 | 0 |
| Non-pass-by | | 19 | 20 | 25 | 26 | 937 | 936 |
| 710 - General Office Building (General Urban/Suburban) | 200 1000 Sq. Ft. GFA | 184 | 30 | 35 | 185 | 1039 | 1039 |
| Reduction | | 0 | 0 | 0 | 0 | 0 | 0 |
| Internal | | 28 | 17 | 3 | 15 | 0 | 0 |
| Pass-by | | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-pass-by | | 156 | 13 | 32 | 170 | 1039 | 1039 |
| Total | | 428 | 235 | 280 | 440 | 4027 | 4018 |
| Total Reduction | | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Internal | | 57 | 57 | 43 | 43 | 0 | 0 |
| Total Pass-by | | 30 | 34 | 68 | 69 | 0 | 0 |
| Total Non-pass-by | | 341 | 144 | 169 | 328 | 4027 | 4018 |

PERIOD SETTING

Analysis Name : Daily
Project Name : True North Commons **No :**
Date: 5/7/2018 **City:**
State/Province: **Zip/Postal Code:**
Country: **Client Name:** Blue and Silver Development Partners
Analyst's Name: S. Barnhart **Edition:** ITE-TGM 10th Edition

| Land Use | Independent Variable | Size | Time Period | Method | Entry | Exit | Total |
|---|----------------------|--------------------|------------------------------------|--|--------------------------|-------------------------|-------------------|
| 580 - Museum (General Urban/Suburban) | 1000 Sq. Ft. GFA | 37 ⁽⁰⁾ | Saturday, Peak Hour of Generator | Average 0.66 | 17 ⁽¹⁾ 71% | 7 ⁽¹⁾ 29% | 24 ⁽¹⁾ |
| 311 - All Suites Hotel (General Urban/Suburban) | Rooms | 250 ⁽⁰⁾ | Weekday | Average 4.46 | 558 50% | 557 50% | 1115 |
| 312 - Business Hotel (General Urban/Suburban) | Rooms | 150 | Weekday | Average 4.02 | 302 50% | 301 50% | 603 |
| 820 - Shopping Center (General Urban/Suburban) | 1000 Sq. Ft. GLA | 25 | Weekday | Best Fit (LOG) $\text{Ln}(T) = 0.68\text{Ln}(X) + 5.57$ | 1171 50% | 1171 50% | 2342 |
| 434 - Rock Climbing Gym (General Urban/Suburban) | 1000 Sq. Ft. GFA | 7.5 ⁽⁰⁾ | Weekday, AM Peak Hour of Generator | Average 1.4 | 3 ⁽¹⁾ 30% | 7 ⁽¹⁾ 70% | 10 ⁽¹⁾ |
| 853 - Convenience Market with Gasoline Pumps (General Urban/Suburban) | 1000 Sq. Ft. GFA | 3 | Weekday | Average 624.2 | 937 50% | 936 50% | 1873 |
| 710 - General Office Building (General Urban/Suburban) | 1000 Sq. Ft. GFA | 200 | Weekday | Best Fit (LOG) $\text{Ln}(T) = 0.97\text{Ln}(X) + 2.5$ | 1039 50% | 1039 50% | 2078 |

(0) indicates size out of range.

(1) indicates small sample size, use carefully.

 The time periods do not match.

TRAFFIC REDUCTIONS

| Land Use | Entry Reduction | Adjusted Entry | Exit Reduction | Adjusted Exit |
|--|-----------------|----------------|----------------|---------------|
| 580 - Museum | 0 % | 17 | 0 % | 7 |
| 311 - All Suites Hotel | 0 % | 558 | 0 % | 557 |
| 312 - Business Hotel | 0 % | 302 | 0 % | 301 |
| 820 - Shopping Center | 0 % | 1171 | 0 % | 1171 |
| 434 - Rock Climbing Gym | 0 % | 3 | 0 % | 7 |
| 853 - Convenience Market with Gasoline Pumps | 0 % | 937 | 0 % | 936 |
| 710 - General Office Building | 0 % | 1039 | 0 % | 1039 |

INTERNAL TRIPS

580 - Museum

Exit 7 Demand Exit: 0 % (0)

Entry 17 Demand Entry: 0 % (0)

580 - Museum

Exit 7 Demand Exit: 0 % (0)

Entry 17 Demand Entry: 0 % (0)

580 - Museum

Exit 7 Demand Exit: 0 % (0)

Entry 17 Demand Entry: 0 % (0)

580 - Museum

Exit 7 Demand Exit: 0 % (0)

Entry 17 Demand Entry: 0 % (0)

580 - Museum

Exit 7 Demand Exit: 0 % (0)

Entry 17 Demand Entry: 0 % (0)

580 - Museum

Exit 7 Demand Exit: 0 % (0)

Entry 17 Demand Entry: 0 % (0)

311 - All Suites Hotel

Exit 557 Demand Exit: 0 % (0)

Entry 558 Demand Entry: 0 % (0)

311 - All Suites Hotel

Exit 557 Demand Exit: 0 % (0)

Entry 558 Demand Entry: 0 % (0)

311 - All Suites Hotel

Exit 557 Demand Exit: 0 % (0)

Entry 558 Demand Entry: 0 % (0)

311 - All Suites Hotel

Exit 557 Demand Exit: 0 % (0)

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

Balanced:
0

311 - All Suites Hotel

Demand Entry: 0 % (0) **Entry** 558

Demand Exit: 0 % (0) **Exit** 557

312 - Business Hotel

Demand Entry: 0 % (0) **Entry** 302

Demand Exit: 0 % (0) **Exit** 301

820 - Shopping Center

Demand Entry: 0 % (0) **Entry** 1171

Demand Exit: 0 % (0) **Exit** 1171

434 - Rock Climbing Gym

Demand Entry: 0 % (0) **Entry** 3

Demand Exit: 0 % (0) **Exit** 7

853 - Convenience Market with Gasoline Pumps

Demand Entry: 0 % (0) **Entry** 937

Demand Exit: 0 % (0) **Exit** 936

710 - General Office Building

Demand Entry: 0 % (0) **Entry** 1039

Demand Exit: 0 % (0) **Exit** 1039

312 - Business Hotel

Demand Entry: 0 % (0) **Entry** 302

Demand Exit: 0 % (0) **Exit** 301

820 - Shopping Center

Demand Entry: 0 % (0) **Entry** 1171

Demand Exit: 0 % (0) **Exit** 1171

434 - Rock Climbing Gym

Demand Entry: 0 % (0) **Entry** 3

Demand Exit: 0 % (0) **Exit** 7

853 - Convenience Market with Gasoline Pumps

Demand Entry: 0 % (0) **Entry** 937

| | | | | |
|------------------|-----------------------|----------------|----------------------|-----------------|
| Entry 558 | Demand Entry: 0 % (0) | Balanced: 0 | Demand Exit: 0 % (0) | Exit 936 |
|------------------|-----------------------|----------------|----------------------|-----------------|

311 - All Suites Hotel

| | |
|-----------------|----------------------|
| Exit 557 | Demand Exit: 0 % (0) |
|-----------------|----------------------|

| | |
|------------------|-----------------------|
| Entry 558 | Demand Entry: 0 % (0) |
|------------------|-----------------------|

312 - Business Hotel

| | |
|-----------------|----------------------|
| Exit 301 | Demand Exit: 0 % (0) |
|-----------------|----------------------|

| | |
|------------------|-----------------------|
| Entry 302 | Demand Entry: 0 % (0) |
|------------------|-----------------------|

312 - Business Hotel

| | |
|-----------------|----------------------|
| Exit 301 | Demand Exit: 0 % (0) |
|-----------------|----------------------|

| | |
|------------------|-----------------------|
| Entry 302 | Demand Entry: 0 % (0) |
|------------------|-----------------------|

312 - Business Hotel

| | |
|-----------------|----------------------|
| Exit 301 | Demand Exit: 0 % (0) |
|-----------------|----------------------|

| | |
|------------------|-----------------------|
| Entry 302 | Demand Entry: 0 % (0) |
|------------------|-----------------------|

312 - Business Hotel

| | |
|-----------------|----------------------|
| Exit 301 | Demand Exit: 0 % (0) |
|-----------------|----------------------|

| | |
|------------------|-----------------------|
| Entry 302 | Demand Entry: 0 % (0) |
|------------------|-----------------------|

820 - Shopping Center

| | |
|------------------|----------------------|
| Exit 1171 | Demand Exit: 0 % (0) |
|------------------|----------------------|

| | |
|-------------------|-----------------------|
| Entry 1171 | Demand Entry: 0 % (0) |
|-------------------|-----------------------|

820 - Shopping Center

| | |
|------------------|----------------------|
| Exit 1171 | Demand Exit: 0 % (0) |
|------------------|----------------------|

| | |
|-------------------|-----------------------|
| Entry 1171 | Demand Entry: 0 % (0) |
|-------------------|-----------------------|

820 - Shopping Center

| | |
|------------------|----------------------|
| Exit 1171 | Demand Exit: 0 % (0) |
|------------------|----------------------|

| | |
|-------------------|-----------------------|
| Entry 1171 | Demand Entry: 0 % (0) |
|-------------------|-----------------------|

434 - Rock Climbing Gym

| | |
|---------------|----------------------|
| Exit 7 | Demand Exit: 0 % (0) |
|---------------|----------------------|

| | |
|----------------|-----------------------|
| Entry 3 | Demand Entry: 0 % (0) |
|----------------|-----------------------|

434 - Rock Climbing Gym

710 - General Office Building

| | |
|-----------------------|-------------------|
| Demand Entry: 0 % (0) | Entry 1039 |
|-----------------------|-------------------|

| | |
|----------------------|------------------|
| Demand Exit: 0 % (0) | Exit 1039 |
|----------------------|------------------|

820 - Shopping Center

| | |
|-----------------------|-------------------|
| Demand Entry: 0 % (0) | Entry 1171 |
|-----------------------|-------------------|

| | |
|----------------------|------------------|
| Demand Exit: 0 % (0) | Exit 1171 |
|----------------------|------------------|

434 - Rock Climbing Gym

| | |
|-----------------------|----------------|
| Demand Entry: 0 % (0) | Entry 3 |
|-----------------------|----------------|

| | |
|----------------------|---------------|
| Demand Exit: 0 % (0) | Exit 7 |
|----------------------|---------------|

853 - Convenience Market with Gasoline Pumps

| | |
|-----------------------|------------------|
| Demand Entry: 0 % (0) | Entry 937 |
|-----------------------|------------------|

| | |
|----------------------|-----------------|
| Demand Exit: 0 % (0) | Exit 936 |
|----------------------|-----------------|

710 - General Office Building

| | |
|-----------------------|-------------------|
| Demand Entry: 0 % (0) | Entry 1039 |
|-----------------------|-------------------|

| | |
|----------------------|------------------|
| Demand Exit: 0 % (0) | Exit 1039 |
|----------------------|------------------|

434 - Rock Climbing Gym

| | |
|-----------------------|----------------|
| Demand Entry: 0 % (0) | Entry 3 |
|-----------------------|----------------|

| | |
|----------------------|---------------|
| Demand Exit: 0 % (0) | Exit 7 |
|----------------------|---------------|

853 - Convenience Market with Gasoline Pumps

| | |
|-----------------------|------------------|
| Demand Entry: 0 % (0) | Entry 937 |
|-----------------------|------------------|

| | |
|----------------------|-----------------|
| Demand Exit: 0 % (0) | Exit 936 |
|----------------------|-----------------|

710 - General Office Building

| | |
|-----------------------|-------------------|
| Demand Entry: 0 % (0) | Entry 1039 |
|-----------------------|-------------------|

| | |
|----------------------|------------------|
| Demand Exit: 0 % (0) | Exit 1039 |
|----------------------|------------------|

853 - Convenience Market with Gasoline Pumps

| | |
|-----------------------|------------------|
| Demand Entry: 0 % (0) | Entry 937 |
|-----------------------|------------------|

| | |
|----------------------|-----------------|
| Demand Exit: 0 % (0) | Exit 936 |
|----------------------|-----------------|

710 - General Office Building

Exit 7 Demand Exit: 0 % (0) **Balanced:** 0 **Demand Entry:** 0 % (0) **Entry** 1039

Entry 3 Demand Entry: 0 % (0) **Balanced:** 0 **Demand Exit:** 0 % (0) **Exit** 1039

853 - Convenience Market with Gasoline Pumps

710 - General Office Building

Exit 936 Demand Exit: 0 % (0) **Balanced:** 0 **Demand Entry:** 0 % (0) **Entry** 1039

Entry 937 Demand Entry: 0 % (0) **Balanced:** 0 **Demand Exit:** 0 % (0) **Exit** 1039

580 - Museum

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|------------------------|----------------------|-----------------------|-------------------------|--|-------------------------------|--------|----------------|
| | | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 17 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 17 (100%) |
| Exit | 7 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 7 (100%) |
| Total | 24 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 24 (100%) |

311 - All Suites Hotel

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|----------------------|-----------------------|-------------------------|--|-------------------------------|--------|----------------|
| | | 580 - Museum | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 558 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 558 (100%) |
| Exit | 557 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 557 (100%) |
| Total | 1115 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1115 (100%) |

312 - Business Hotel

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|------------------------|-----------------------|-------------------------|--|-------------------------------|--------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 302 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 302 (100%) |
| Exit | 301 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 301 (100%) |
| Total | 603 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 603 (100%) |

820 - Shopping Center

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-------------------------|--|-------------------------------|--------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 1171 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1171 (100%) |
| Exit | 1171 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1171 (100%) |
| Total | 2342 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 2342 (100%) |

434 - Rock Climbing Gym

| Total Trips | Internal Trips | External |
|-------------|----------------|----------|
|-------------|----------------|----------|

| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | Total | Trips |
|--------------|-----------|--------------|------------------------|----------------------|-----------------------|--|-------------------------------|--------|-----------|
| Entry | 3 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 3 (100%) |
| Exit | 7 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 7 (100%) |
| Total | 10 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 10 (100%) |

853 - Convenience Market with Gasoline Pumps

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-----------------------|-------------------------|-------------------------------|--------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 710 - General Office Building | | |
| Entry | 937 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 937 (100%) |
| Exit | 936 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 936 (100%) |
| Total | 1873 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1873 (100%) |

710 - General Office Building

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-----------------------|-------------------------|--|--------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | | |
| Entry | 1039 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1039 (100%) |
| Exit | 1039 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1039 (100%) |
| Total | 2078 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 2078 (100%) |

EXTERNAL TRIPS

| Land Use | External Trips | Pass-by% | Pass-by Trips | Non-pass-by Trips |
|--|----------------|----------|---------------|-------------------|
| 580 - Museum | 24 | 0 | 0 | 24 |
| 311 - All Suites Hotel | 1115 | 0 | 0 | 1115 |
| 312 - Business Hotel | 603 | 0 | 0 | 603 |
| 820 - Shopping Center | 2342 | 0 | 0 | 2342 |
| 434 - Rock Climbing Gym | 10 | 0 | 0 | 10 |
| 853 - Convenience Market with Gasoline Pumps | 1873 | 0 | 0 | 1873 |
| 710 - General Office Building | 2078 | 0 | 0 | 2078 |

ITE DEVIATION DETAILS

Saturday, Peak Hour of Generator

Landuse No deviations from ITE.

Saturday, Peak Hour of Generator

Methods No deviations from ITE.

External Trips 580 - Museum (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

Weekday

Landuse No deviations from ITE.

Methods No deviations from ITE.

External Trips 311 - All Suites Hotel (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

312 - Business Hotel (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

820 - Shopping Center (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

853 - Convenience Market with Gasoline Pumps (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

710 - General Office Building (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

Weekday, AM Peak Hour of Generator

Landuse No deviations from ITE.

Methods No deviations from ITE.

External Trips 434 - Rock Climbing Gym (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

| |
|----------------|
| SUMMARY |
|----------------|

| | |
|--|------|
| Total Entering | 4027 |
| Total Exiting | 4018 |
| Total Entering Reduction | 0 |
| Total Exiting Reduction | 0 |
| Total Entering Internal Capture Reduction | 0 |
| Total Exiting Internal Capture Reduction | 0 |
| Total Entering Pass-by Reduction | 0 |
| Total Exiting Pass-by Reduction | 0 |
| Total Entering Non-Pass-by Trips | 4027 |
| Total Exiting Non-Pass-by Trips | 4018 |

| |
|-----------------------|
| PERIOD SETTING |
|-----------------------|

| | | | |
|------------------------|--------------------|-------------------------|--------------------------------------|
| Analysis Name : | AM Peak Hour | | |
| Project Name : | True North Commons | No : | |
| Date: | 5/7/2018 | City: | |
| State/Province: | | Zip/Postal Code: | |
| Country: | | Client Name: | Blue and Silver Development Partners |
| Analyst's Name: | S. Barnhart | Edition: | ITE-TGM 10th Edition |

| Land Use | Independent Variable | Size | Time Period | Method | Entry | Exit | Total |
|--|----------------------|--------------------|---|--------------------------------------|-------------------------|-------------------------|-------------------|
| 580 - Museum (General Urban/Suburban) | 1000 Sq. Ft. GFA | 37 ⁽⁰⁾ | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m. | Average 0.28 | 9 ⁽¹⁾ 90% | 1 ⁽¹⁾ 10% | 10 ⁽¹⁾ |
| 311 - All Suites Hotel (General Urban/Suburban) | Rooms | 250 ⁽⁰⁾ | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m. | Average 0.34 | 45 53% | 40 47% | 85 |
| 312 - Business Hotel (General Urban/Suburban) | Rooms | 150 | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m. | Average 0.39 | 24 41% | 34 59% | 58 |
| 820 - Shopping Center (General Urban/Suburban) | 1000 Sq. Ft. GLA | 25 | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m. | Best Fit (LIN) T = 0.5 (X)+151.78 | 102 62% | 62 38% | 164 |
| 434 - Rock Climbing Gym (General Urban/Suburban) | 1000 Sq. Ft. GFA | 7.5 ⁽⁰⁾ | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m. | Average 1.4 | 3 ⁽¹⁾ 30% | 7 ⁽¹⁾ 70% | 10 ⁽¹⁾ |
| 853 - Convenience Market with Gasoline Pumps (General Urban/Suburban) | 1000 Sq. Ft. GFA | 3 | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m. | Average 40.59 | 61 50% | 61 50% | 122 |
| 710 - General Office Building (General Urban/Suburban) | 1000 Sq. Ft. GFA | 200 | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m. | Best Fit (LIN) T = 0.94 (X)+26.49 | 184 86% | 30 14% | 214 |

(0) indicates size out of range.

(1) indicates small sample size, use carefully.

TRAFFIC REDUCTIONS

| Land Use | Entry Reduction | Adjusted Entry | Exit Reduction | Adjusted Exit |
|--|-----------------|----------------|----------------|---------------|
| 580 - Museum | 0 % | 9 | 0 % | 1 |
| 311 - All Suites Hotel | 0 % | 45 | 0 % | 40 |
| 312 - Business Hotel | 0 % | 24 | 0 % | 34 |
| 820 - Shopping Center | 0 % | 102 | 0 % | 62 |
| 434 - Rock Climbing Gym | 0 % | 3 | 0 % | 7 |
| 853 - Convenience Market with Gasoline Pumps | 0 % | 61 | 0 % | 61 |
| 710 - General Office Building | 0 % | 184 | 0 % | 30 |

INTERNAL TRIPS

580 - Museum

Exit 1 Demand Exit: 0 % (0)

Entry 9 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

311 - All Suites Hotel

Demand Entry: 0 % (0) **Entry** 45

Demand Exit: 0 % (0) **Exit** 40

580 - Museum

Exit 1 Demand Exit: 0 % (0)

Entry 9 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

312 - Business Hotel

Demand Entry: 0 % (0) **Entry** 24

Demand Exit: 0 % (0) **Exit** 34

580 - Museum

Exit 1 Demand Exit: 0 % (0)

Entry 9 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

820 - Shopping Center

Demand Entry: 0 % (0) **Entry** 102

Demand Exit: 0 % (0) **Exit** 62

580 - Museum

Exit 1 Demand Exit: 0 % (0)

Entry 9 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

434 - Rock Climbing Gym

Demand Entry: 0 % (0) **Entry** 3

Demand Exit: 0 % (0) **Exit** 7

580 - Museum

Exit 1 Demand Exit: 0 % (0)

Entry 9 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

853 - Convenience Market with Gasoline Pumps

Demand Entry: 0 % (0) **Entry** 61

Demand Exit: 0 % (0) **Exit** 61

580 - Museum

Exit 1 Demand Exit: 0 % (0)

Entry 9 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

710 - General Office Building

Demand Entry: 0 % (0) **Entry** 184

Demand Exit: 0 % (0) **Exit** 30

311 - All Suites Hotel

312 - Business Hotel

| | | | | | | | | | |
|-------------------------------|----|---------------|-----------|---|---|---------------|---------|--------------|-----|
| Exit | 40 | Demand Exit: | 0 % (0) | Balanced: | 0 | Demand Entry: | 0 % (0) | Entry | 24 |
| Entry | 45 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 34 |
| 311 - All Suites Hotel | | | | 820 - Shopping Center | | | | | |
| Exit | 40 | Demand Exit: | 14 % (6) | Balanced: | 4 | Demand Entry: | 4 % (4) | Entry | 102 |
| Entry | 45 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 62 |
| 311 - All Suites Hotel | | | | 434 - Rock Climbing Gym | | | | | |
| Exit | 40 | Demand Exit: | 14 % (6) | Balanced: | 0 | Demand Entry: | 4 % (0) | Entry | 3 |
| Entry | 45 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 7 |
| 311 - All Suites Hotel | | | | 853 - Convenience Market with Gasoline Pumps | | | | | |
| Exit | 40 | Demand Exit: | 14 % (6) | Balanced: | 2 | Demand Entry: | 4 % (2) | Entry | 61 |
| Entry | 45 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 61 |
| 311 - All Suites Hotel | | | | 710 - General Office Building | | | | | |
| Exit | 40 | Demand Exit: | 75 % (30) | Balanced: | 6 | Demand Entry: | 3 % (6) | Entry | 184 |
| Entry | 45 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 30 |
| 312 - Business Hotel | | | | 820 - Shopping Center | | | | | |
| Exit | 34 | Demand Exit: | 14 % (5) | Balanced: | 4 | Demand Entry: | 4 % (4) | Entry | 102 |
| Entry | 24 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 62 |
| 312 - Business Hotel | | | | 434 - Rock Climbing Gym | | | | | |
| Exit | 34 | Demand Exit: | 14 % (5) | Balanced: | 0 | Demand Entry: | 4 % (0) | Entry | 3 |
| Entry | 24 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 7 |
| 312 - Business Hotel | | | | 853 - Convenience Market with Gasoline Pumps | | | | | |
| Exit | 34 | Demand Exit: | 14 % (5) | Balanced: | 2 | Demand Entry: | 4 % (2) | Entry | 61 |
| Entry | 24 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 61 |
| 312 - Business Hotel | | | | 710 - General Office Building | | | | | |
| Exit | 34 | Demand Exit: | 75 % (26) | Balanced: | 6 | Demand Entry: | 3 % (6) | Entry | 184 |
| Entry | 24 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 30 |

820 - Shopping Center

Exit 62 Demand Exit: 0 % (0)

Entry 102 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

434 - Rock Climbing Gym

Demand Entry: 0 % (0) **Entry** 3

Demand Exit: 0 % (0) **Exit** 7

820 - Shopping Center

Exit 62 Demand Exit: 0 % (0)

Entry 102 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

853 - Convenience Market with Gasoline Pumps

Demand Entry: 0 % (0) **Entry** 61

Demand Exit: 0 % (0) **Exit** 61

820 - Shopping Center

Exit 62 Demand Exit: 29 % (18)

Entry 102 Demand Entry: 32 % (33)

Balanced:
7

Balanced:
8

710 - General Office Building

Demand Entry: 4 % (7) **Entry** 184

Demand Exit: 28 % (8) **Exit** 30

434 - Rock Climbing Gym

Exit 7 Demand Exit: 0 % (0)

Entry 3 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

853 - Convenience Market with Gasoline Pumps

Demand Entry: 0 % (0) **Entry** 61

Demand Exit: 0 % (0) **Exit** 61

434 - Rock Climbing Gym

Exit 7 Demand Exit: 29 % (2)

Entry 3 Demand Entry: 32 % (1)

Balanced:
2

Balanced:
1

710 - General Office Building

Demand Entry: 4 % (7) **Entry** 184

Demand Exit: 28 % (8) **Exit** 30

853 - Convenience Market with Gasoline Pumps

Exit 61 Demand Exit: 29 % (18)

Entry 61 Demand Entry: 32 % (20)

Balanced:
7

Balanced:
8

710 - General Office Building

Demand Entry: 4 % (7) **Entry** 184

Demand Exit: 28 % (8) **Exit** 30

580 - Museum

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|------------------------|----------------------|-----------------------|-------------------------|--|-------------------------------|--------|----------------|
| | | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 9 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 9 (100%) |
| Exit | 1 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (100%) |
| Total | 10 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 10 (100%) |

311 - All Suites Hotel

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|----------------------|-----------------------|-------------------------|--|-------------------------------|----------|----------------|
| | | 580 - Museum | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 45 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 45 (100%) |
| Exit | 40 (100%) | 0 (0%) | 0 (0%) | 4 (10%) | 0 (0%) | 2 (5%) | 6 (15%) | 12 (30%) | 28 (70%) |

| | | | | | | | | | |
|--------------|-----------|--------|--------|--------|--------|--------|--------|----------|----------|
| Total | 85 (100%) | 0 (0%) | 0 (0%) | 4 (5%) | 0 (0%) | 2 (2%) | 6 (7%) | 12 (14%) | 73 (86%) |
|--------------|-----------|--------|--------|--------|--------|--------|--------|----------|----------|

312 - Business Hotel

| | Total Trips | Internal Trips | | | | | | | External Trips |
|--------------|-------------|----------------|------------------------|-----------------------|-------------------------|--|-------------------------------|----------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | Total | |
| Entry | 24 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 24 (100%) |
| Exit | 34 (100%) | 0 (0%) | 0 (0%) | 4 (12%) | 0 (0%) | 2 (6%) | 6 (18%) | 12 (35%) | 22 (65%) |
| Total | 58 (100%) | 0 (0%) | 0 (0%) | 4 (7%) | 0 (0%) | 2 (3%) | 6 (10%) | 12 (21%) | 46 (79%) |

820 - Shopping Center

| | Total Trips | Internal Trips | | | | | | | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-------------------------|--|-------------------------------|----------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | Total | |
| Entry | 102 (100%) | 0 (0%) | 4 (4%) | 4 (4%) | 0 (0%) | 0 (0%) | 8 (8%) | 16 (16%) | 86 (84%) |
| Exit | 62 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 7 (11%) | 7 (11%) | 55 (89%) |
| Total | 164 (100%) | 0 (0%) | 4 (2%) | 4 (2%) | 0 (0%) | 0 (0%) | 15 (9%) | 23 (14%) | 141 (86%) |

434 - Rock Climbing Gym

| | Total Trips | Internal Trips | | | | | | | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-----------------------|--|-------------------------------|---------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | Total | |
| Entry | 3 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (33%) | 1 (33%) | 2 (67%) |
| Exit | 7 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 2 (29%) | 2 (29%) | 5 (71%) |
| Total | 10 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 3 (30%) | 3 (30%) | 7 (70%) |

853 - Convenience Market with Gasoline Pumps


| | Total Trips | Internal Trips | | | | | | | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-----------------------|-------------------------|-------------------------------|----------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 710 - General Office Building | Total | |
| Entry | 61 (100%) | 0 (0%) | 2 (3%) | 2 (3%) | 0 (0%) | 0 (0%) | 8 (13%) | 12 (20%) | 49 (80%) |
| Exit | 61 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 7 (11%) | 7 (11%) | 54 (89%) |
| Total | 122 (100%) | 0 (0%) | 2 (2%) | 2 (2%) | 0 (0%) | 0 (0%) | 15 (12%) | 19 (16%) | 103 (84%) |

710 - General Office Building

| | Total Trips | Internal Trips | | | | | | | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-----------------------|-------------------------|--|----------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | Total | |
| Entry | 184 (100%) | 0 (0%) | 6 (3%) | 6 (3%) | 7 (4%) | 2 (1%) | 7 (4%) | 28 (15%) | 156 (85%) |
| Exit | 30 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 8 (27%) | 1 (3%) | 8 (27%) | 17 (57%) | 13 (43%) |

| | | | | | | | | | |
|--------------|------------|--------|--------|--------|---------|--------|---------|----------|-----------|
| Total | 214 (100%) | 0 (0%) | 6 (3%) | 6 (3%) | 15 (7%) | 3 (1%) | 15 (7%) | 45 (21%) | 169 (79%) |
|--------------|------------|--------|--------|--------|---------|--------|---------|----------|-----------|

EXTERNAL TRIPS

| Land Use | External Trips | Pass-by% | Pass-by Trips | Non-pass-by Trips |
|--|----------------|--|---------------|-------------------|
| 580 - Museum | 10 | 0 | 0 | 10 |
| 311 - All Suites Hotel | 73 | 0 | 0 | 73 |
| 312 - Business Hotel | 46 | 0 | 0 | 46 |
| 820 - Shopping Center | 141 | 0 | 0 | 141 |
| 434 - Rock Climbing Gym | 7 | 0 | 0 | 7 |
| 853 - Convenience Market with Gasoline Pumps | 103 |  62 | 64 | 39 |
| 710 - General Office Building | 169 | 0 | 0 | 169 |

ITE DEVIATION DETAILS

Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m.

Landuse No deviations from ITE.

Methods No deviations from ITE.

External Trips 580 - Museum (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

311 - All Suites Hotel (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

312 - Business Hotel (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

820 - Shopping Center (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

434 - Rock Climbing Gym (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

710 - General Office Building (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

SUMMARY

| | |
|-----------------------|-----|
| Total Entering | 428 |
| Total Exiting | 235 |

| | |
|--|-----|
| Total Entering Reduction | 0 |
| Total Exiting Reduction | 0 |
| Total Entering Internal Capture Reduction | 57 |
| Total Exiting Internal Capture Reduction | 57 |
| Total Entering Pass-by Reduction | 30 |
| Total Exiting Pass-by Reduction | 34 |
| Total Entering Non-Pass-by Trips | 341 |
| Total Exiting Non-Pass-by Trips | 144 |

| |
|-----------------------|
| PERIOD SETTING |
|-----------------------|

| | | |
|------------------------|--------------------|--|
| Analysis Name : | PM Peak Hour | |
| Project Name : | True North Commons | No : |
| Date: | 5/7/2018 | City: |
| State/Province: | | Zip/Postal Code: |
| Country: | | Client Name: Blue and Silver Development Partners |
| Analyst's Name: | S. Barnhart | Edition: ITE-TGM 10th Edition |

| Land Use | Independent Variable | Size | Time Period | Method | Entry | Exit | Total |
|--|----------------------|--------------------|---|--|-------------------------|-------------------------|-------------------|
| 580 - Museum (General Urban/Suburban) | 1000 Sq. Ft. GFA | 37 ⁽⁰⁾ | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m. | Average 0.18 | 1 ⁽¹⁾ 14% | 6 ⁽¹⁾ 86% | 7 ⁽¹⁾ |
| 311 - All Suites Hotel (General Urban/Suburban) | Rooms | 250 ⁽⁰⁾ | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m. | Average 0.36 | 43 48% | 47 52% | 90 |
| 312 - Business Hotel (General Urban/Suburban) | Rooms | 150 | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m. | Average 0.32 | 26 54% | 22 46% | 48 |
| 820 - Shopping Center (General Urban/Suburban) | 1000 Sq. Ft. GLA | 25 | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m. | Best Fit (LOG) $\ln(T) = 0.74\ln(X)$ +2.89 | 94 48% | 101 52% | 195 |
| 434 - Rock Climbing Gym (General Urban/Suburban) | 1000 Sq. Ft. GFA | 7.5 ⁽⁰⁾ | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m. | Average 1.64 | 7 ⁽¹⁾ 58% | 5 ⁽¹⁾ 42% | 12 ⁽¹⁾ |
| 853 - Convenience Market with Gasoline Pumps (General Urban/Suburban) | 1000 Sq. Ft. GFA | 3 | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m. | Average 49.29 | 74 50% | 74 50% | 148 |
| 710 - General Office Building (General Urban/Suburban) | 1000 Sq. Ft. GFA | 200 | Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m. | Best Fit (LOG) $\ln(T) = 0.95\ln(X)$ +0.36 | 35 16% | 185 84% | 220 |

(0) indicates size out of range.

(1) indicates small sample size, use carefully.

TRAFFIC REDUCTIONS

| Land Use | Entry Reduction | Adjusted Entry | Exit Reduction | Adjusted Exit |
|--|-----------------|----------------|----------------|---------------|
| 580 - Museum | 0 % | 1 | 0 % | 6 |
| 311 - All Suites Hotel | 0 % | 43 | 0 % | 47 |
| 312 - Business Hotel | 0 % | 26 | 0 % | 22 |
| 820 - Shopping Center | 0 % | 94 | 0 % | 101 |
| 434 - Rock Climbing Gym | 0 % | 7 | 0 % | 5 |
| 853 - Convenience Market with Gasoline Pumps | 0 % | 74 | 0 % | 74 |
| 710 - General Office Building | 0 % | 35 | 0 % | 185 |

INTERNAL TRIPS

580 - Museum

Exit 6 Demand Exit: 2 % (0)

Entry 1 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

311 - All Suites Hotel

Demand Entry: 1 % (0) **Entry** 43

Demand Exit: 0 % (0) **Exit** 47

580 - Museum

Exit 6 Demand Exit: 2 % (0)

Entry 1 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

312 - Business Hotel

Demand Entry: 1 % (0) **Entry** 26

Demand Exit: 0 % (0) **Exit** 22

580 - Museum

Exit 6 Demand Exit: 21 % (1)

Entry 1 Demand Entry: 26 % (0)

Balanced:
1

Balanced:
0

820 - Shopping Center

Demand Entry: 4 % (4) **Entry** 94

Demand Exit: 4 % (4) **Exit** 101

580 - Museum

Exit 6 Demand Exit: 21 % (1)

Entry 1 Demand Entry: 26 % (0)

Balanced:
0

Balanced:
0

434 - Rock Climbing Gym

Demand Entry: 4 % (0) **Entry** 7

Demand Exit: 4 % (0) **Exit** 5

580 - Museum

Exit 6 Demand Exit: 21 % (1)

Entry 1 Demand Entry: 26 % (0)

Balanced:
1

Balanced:
0

853 - Convenience Market with Gasoline Pumps

Demand Entry: 4 % (3) **Entry** 74

Demand Exit: 4 % (3) **Exit** 74

580 - Museum

Exit 6 Demand Exit: 2 % (0)

Entry 1 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

710 - General Office Building

Demand Entry: 6 % (2) **Entry** 35

Demand Exit: 1 % (2) **Exit** 185

311 - All Suites Hotel

312 - Business Hotel

| | | | | | | | | | |
|-------------------------------|----|---------------|----------|---|---|---------------|---------|--------------|-----|
| Exit | 47 | Demand Exit: | 0 % (0) | Balanced: | 0 | Demand Entry: | 0 % (0) | Entry | 26 |
| Entry | 43 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 22 |
| 311 - All Suites Hotel | | | | 820 - Shopping Center | | | | | |
| Exit | 47 | Demand Exit: | 16 % (8) | Balanced: | 2 | Demand Entry: | 2 % (2) | Entry | 94 |
| Entry | 43 | Demand Entry: | 17 % (7) | Balanced: | 5 | Demand Exit: | 5 % (5) | Exit | 101 |
| 311 - All Suites Hotel | | | | 434 - Rock Climbing Gym | | | | | |
| Exit | 47 | Demand Exit: | 16 % (8) | Balanced: | 0 | Demand Entry: | 2 % (0) | Entry | 7 |
| Entry | 43 | Demand Entry: | 17 % (7) | Balanced: | 0 | Demand Exit: | 5 % (0) | Exit | 5 |
| 311 - All Suites Hotel | | | | 853 - Convenience Market with Gasoline Pumps | | | | | |
| Exit | 47 | Demand Exit: | 16 % (8) | Balanced: | 1 | Demand Entry: | 2 % (1) | Entry | 74 |
| Entry | 43 | Demand Entry: | 17 % (7) | Balanced: | 4 | Demand Exit: | 5 % (4) | Exit | 74 |
| 311 - All Suites Hotel | | | | 710 - General Office Building | | | | | |
| Exit | 47 | Demand Exit: | 0 % (0) | Balanced: | 0 | Demand Entry: | 0 % (0) | Entry | 35 |
| Entry | 43 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 185 |
| 312 - Business Hotel | | | | 820 - Shopping Center | | | | | |
| Exit | 22 | Demand Exit: | 16 % (4) | Balanced: | 2 | Demand Entry: | 2 % (2) | Entry | 94 |
| Entry | 26 | Demand Entry: | 17 % (4) | Balanced: | 4 | Demand Exit: | 5 % (5) | Exit | 101 |
| 312 - Business Hotel | | | | 434 - Rock Climbing Gym | | | | | |
| Exit | 22 | Demand Exit: | 16 % (4) | Balanced: | 0 | Demand Entry: | 2 % (0) | Entry | 7 |
| Entry | 26 | Demand Entry: | 17 % (4) | Balanced: | 0 | Demand Exit: | 5 % (0) | Exit | 5 |
| 312 - Business Hotel | | | | 853 - Convenience Market with Gasoline Pumps | | | | | |
| Exit | 22 | Demand Exit: | 16 % (4) | Balanced: | 1 | Demand Entry: | 2 % (1) | Entry | 74 |
| Entry | 26 | Demand Entry: | 17 % (4) | Balanced: | 4 | Demand Exit: | 5 % (4) | Exit | 74 |
| 312 - Business Hotel | | | | 710 - General Office Building | | | | | |
| Exit | 22 | Demand Exit: | 0 % (0) | Balanced: | 0 | Demand Entry: | 0 % (0) | Entry | 35 |
| Entry | 26 | Demand Entry: | 0 % (0) | Balanced: | 0 | Demand Exit: | 0 % (0) | Exit | 185 |

820 - Shopping Center

Exit 101 Demand Exit: 0 % (0)

Entry 94 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

434 - Rock Climbing Gym

Demand Entry: 0 % (0) **Entry** 7

Demand Exit: 0 % (0) **Exit** 5

820 - Shopping Center

Exit 101 Demand Exit: 0 % (0)

Entry 94 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

853 - Convenience Market with Gasoline Pumps

Demand Entry: 0 % (0) **Entry** 74

Demand Exit: 0 % (0) **Exit** 74

820 - Shopping Center

Exit 101 Demand Exit: 2 % (2)

Entry 94 Demand Entry: 8 % (8)

Balanced:
2

Balanced:
8

710 - General Office Building

Demand Entry: 31 % (11) **Entry** 35

Demand Exit: 20 % (37) **Exit** 185

434 - Rock Climbing Gym

Exit 5 Demand Exit: 0 % (0)

Entry 7 Demand Entry: 0 % (0)

Balanced:
0

Balanced:
0

853 - Convenience Market with Gasoline Pumps

Demand Entry: 0 % (0) **Entry** 74

Demand Exit: 0 % (0) **Exit** 74

434 - Rock Climbing Gym

Exit 5 Demand Exit: 2 % (0)

Entry 7 Demand Entry: 8 % (1)

Balanced:
0

Balanced:
1

710 - General Office Building

Demand Entry: 31 % (11) **Entry** 35

Demand Exit: 20 % (37) **Exit** 185

853 - Convenience Market with Gasoline Pumps

Exit 74 Demand Exit: 2 % (1)

Entry 74 Demand Entry: 8 % (6)

Balanced:
1

Balanced:
6

710 - General Office Building

Demand Entry: 31 % (11) **Entry** 35

Demand Exit: 20 % (37) **Exit** 185

580 - Museum

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|------------------------|----------------------|-----------------------|-------------------------|--|-------------------------------|---------|----------------|
| | | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 1 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (100%) |
| Exit | 6 (100%) | 0 (0%) | 0 (0%) | 1 (17%) | 0 (0%) | 1 (17%) | 0 (0%) | 2 (33%) | 4 (67%) |
| Total | 7 (100%) | 0 (0%) | 0 (0%) | 1 (14%) | 0 (0%) | 1 (14%) | 0 (0%) | 2 (29%) | 5 (71%) |

311 - All Suites Hotel

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|----------------------|-----------------------|-------------------------|--|-------------------------------|---------|----------------|
| | | 580 - Museum | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 43 (100%) | 0 (0%) | 0 (0%) | 5 (12%) | 0 (0%) | 4 (9%) | 0 (0%) | 9 (21%) | 34 (79%) |
| Exit | 47 (100%) | 0 (0%) | 0 (0%) | 2 (4%) | 0 (0%) | 1 (2%) | 0 (0%) | 3 (6%) | 44 (94%) |

| | | | | | | | | | |
|--------------|-----------|--------|--------|--------|--------|--------|--------|----------|----------|
| Total | 90 (100%) | 0 (0%) | 0 (0%) | 7 (8%) | 0 (0%) | 5 (6%) | 0 (0%) | 12 (13%) | 78 (87%) |
|--------------|-----------|--------|--------|--------|--------|--------|--------|----------|----------|

312 - Business Hotel

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|------------------------|-----------------------|-------------------------|--|-------------------------------|----------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 26 (100%) | 0 (0%) | 0 (0%) | 4 (15%) | 0 (0%) | 4 (15%) | 0 (0%) | 8 (31%) | 18 (69%) |
| Exit | 22 (100%) | 0 (0%) | 0 (0%) | 2 (9%) | 0 (0%) | 1 (5%) | 0 (0%) | 3 (14%) | 19 (86%) |
| Total | 48 (100%) | 0 (0%) | 0 (0%) | 6 (13%) | 0 (0%) | 5 (10%) | 0 (0%) | 11 (23%) | 37 (77%) |

820 - Shopping Center

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-------------------------|--|-------------------------------|----------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 94 (100%) | 1 (1%) | 2 (2%) | 2 (2%) | 0 (0%) | 0 (0%) | 8 (9%) | 13 (14%) | 81 (86%) |
| Exit | 101 (100%) | 0 (0%) | 5 (5%) | 4 (4%) | 0 (0%) | 0 (0%) | 2 (2%) | 11 (11%) | 90 (89%) |
| Total | 195 (100%) | 1 (1%) | 7 (4%) | 6 (3%) | 0 (0%) | 0 (0%) | 10 (5%) | 24 (12%) | 171 (88%) |

434 - Rock Climbing Gym

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-----------------------|--|-------------------------------|---------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 853 - Convenience Market with Gasoline Pumps | 710 - General Office Building | | |
| Entry | 7 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (14%) | 1 (14%) | 6 (86%) |
| Exit | 5 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 5 (100%) |
| Total | 12 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (8%) | 1 (8%) | 11 (92%) |

853 - Convenience Market with Gasoline Pumps



| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-----------------------|-------------------------|-------------------------------|----------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 710 - General Office Building | | |
| Entry | 74 (100%) | 1 (1%) | 1 (1%) | 1 (1%) | 0 (0%) | 0 (0%) | 6 (8%) | 9 (12%) | 65 (88%) |
| Exit | 74 (100%) | 0 (0%) | 4 (5%) | 4 (5%) | 0 (0%) | 0 (0%) | 1 (1%) | 9 (12%) | 65 (88%) |
| Total | 148 (100%) | 1 (1%) | 5 (3%) | 5 (3%) | 0 (0%) | 0 (0%) | 7 (5%) | 18 (12%) | 130 (88%) |

710 - General Office Building

| | Total Trips | Internal Trips | | | | | | Total | External Trips |
|--------------|-------------|----------------|------------------------|----------------------|-----------------------|-------------------------|--|---------|----------------|
| | | 580 - Museum | 311 - All Suites Hotel | 312 - Business Hotel | 820 - Shopping Center | 434 - Rock Climbing Gym | 853 - Convenience Market with Gasoline Pumps | | |
| Entry | 35 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 2 (6%) | 0 (0%) | 1 (3%) | 3 (9%) | 32 (91%) |
| Exit | 185 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 8 (4%) | 1 (1%) | 6 (3%) | 15 (8%) | 170 (92%) |

| | | | | | | | | | |
|--------------|------------|--------|--------|--------|---------|--------|--------|---------|-----------|
| Total | 220 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 10 (5%) | 1 (0%) | 7 (3%) | 18 (8%) | 202 (92%) |
|--------------|------------|--------|--------|--------|---------|--------|--------|---------|-----------|

EXTERNAL TRIPS

| Land Use | External Trips | Pass-by% | Pass-by Trips | Non-pass-by Trips |
|--|----------------|--|---------------|-------------------|
| 580 - Museum | 5 | 0 | 0 | 5 |
| 311 - All Suites Hotel | 78 | 0 | 0 | 78 |
| 312 - Business Hotel | 37 | 0 | 0 | 37 |
| 820 - Shopping Center | 171 |  34 | 58 | 113 |
| 434 - Rock Climbing Gym | 11 | 0 | 0 | 11 |
| 853 - Convenience Market with Gasoline Pumps | 130 |  61 | 79 | 51 |
| 710 - General Office Building | 202 | 0 | 0 | 202 |

ITE DEVIATION DETAILS

Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.

Landuse No deviations from ITE.

Methods No deviations from ITE.

External Trips 580 - Museum (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

311 - All Suites Hotel (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

312 - Business Hotel (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

434 - Rock Climbing Gym (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

710 - General Office Building (General Urban/Suburban)
ITE does not recommend a particular pass-by% for this case.

SUMMARY

| | |
|---------------------------------|-----|
| Total Entering | 280 |
| Total Exiting | 440 |
| Total Entering Reduction | 0 |
| Total Exiting Reduction | 0 |

| | |
|--|-----|
| Total Entering Internal Capture Reduction | 43 |
| Total Exiting Internal Capture Reduction | 43 |
| Total Entering Pass-by Reduction | 68 |
| Total Exiting Pass-by Reduction | 69 |
| Total Entering Non-Pass-by Trips | 169 |
| Total Exiting Non-Pass-by Trips | 328 |

Proposed Unconstrained Values for Percent Distribution of Internal Trip Destinations for Exiting Trips and for Internal Trip Origins for Entering Trips

NCHRP Report 684

Table 99. Proposed unconstrained values for percent distribution of internal trip destinations for exiting trips - A.M. peak period.

| Origin Land Use | Destination Land Use | | | | | |
|-----------------|----------------------|--------|------------|-------------|--------|-------|
| | Office | Retail | Restaurant | Residential | Cinema | Hotel |
| Office | N/A | 28% | 63% | 1% | N/A | 0% |
| Retail | 29% | N/A | 13% | 14% | N/A | 0% |
| Restaurant | 31% | 14% | N/A | 4% | N/A | 3% |
| Residential | 2% | 1% | 20% | N/A | N/A | 0% |
| Cinema | N/A | N/A | N/A | N/A | N/A | N/A |
| Hotel | 75% | 14% | 9% | 0% | N/A | N/A |

Note: The values presented in the table above are based on Table 7.1 in ITE Trip Generation Handbook, 2nd Edition.

N/A - Not Available; indicates no data or interaction between the land uses within the same category accounted for within ITE trip generation rates.

Table 100. Proposed unconstrained values for percent distribution of internal trip destinations for exiting trips - P.M. peak period.

| Origin Land Use | Destination Land Use | | | | | |
|-----------------|----------------------|--------|------------|-------------|--------|-------|
| | Office | Retail | Restaurant | Residential | Cinema | Hotel |
| Office | N/A | 20% | 4% | 2% | 0% | 0% |
| Retail | 2% | N/A | 29% | 26% | 4% | 5% |
| Restaurant | 3% | 41% | N/A | 18% | 8% | 7% |
| Residential | 4% | 42% | 21% | N/A | 0% | 3% |
| Cinema | 2% | 21% | 31% | 8% | N/A | 2% |
| Hotel | 0% | 16% | 68% | 2% | 0% | N/A |

Note: The values presented in the table above are based on Table 7.1 in ITE Trip Generation Handbook, 2nd Edition.

N/A - Not Available; indicates no data or interaction between the land uses within the same category accounted for within ITE trip generation rates.

Table 101. Proposed unconstrained values for percent distribution of internal trip origins for entering trips - A.M. peak period.

| Origin Land Use | Destination Land Use | | | | | |
|-----------------|----------------------|--------|------------|-------------|--------|-------|
| | Office | Retail | Restaurant | Residential | Cinema | Hotel |
| Office | N/A | 32% | 23% | 0% | N/A | 0% |
| Retail | 4% | N/A | 50% | 2% | N/A | 0% |
| Restaurant | 14% | 8% | N/A | 5% | N/A | 4% |
| Residential | 3% | 17% | 20% | N/A | N/A | 0% |
| Cinema | N/A | N/A | N/A | N/A | N/A | N/A |
| Hotel | 3% | 4% | 6% | 0% | N/A | N/A |

Note: The values presented in the table above are based on Table 7.2 in ITE Trip Generation Handbook, 2nd Edition.

N/A - Not Available; indicates no data or interaction between the land uses within the same category accounted for within ITE trip generation rates.

Table 102. Proposed unconstrained values for percent distribution of internal trip origins for entering trips - P.M. peak period.

| Origin Land Use | Destination Land Use | | | | | |
|-----------------|----------------------|--------|------------|-------------|--------|-------|
| | Office | Retail | Restaurant | Residential | Cinema | Hotel |

| | | | | | | |
|-------------|-----|-----|-----|-----|-----|-----|
| Office | N/A | 8% | 2% | 4% | 1% | 0% |
| Retail | 31% | N/A | 29% | 46% | 26% | 17% |
| Restaurant | 30% | 50% | N/A | 16% | 32% | 71% |
| Residential | 57% | 10% | 14% | N/A | 0% | 12% |
| Cinema | 6% | 4% | 3% | 4% | N/A | 1% |
| Hotel | 0% | 2% | 5% | 0% | 0% | N/A |

Note: The values presented in the table above are based on Table 7.2 in ITE Trip Generation Handbook, 2nd Edition.

N/A - Not Available; indicates no data or interaction between the land uses within the same category accounted for within ITE trip generation rates.

Appendix D: Opening Year (2020) Analysis

HCM 6th Roundabout
 1: Northgate BI & I-25 SB Ramp

11/21/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 8.5 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | SB | NW |
| Entry Lanes | 0 | 2 | 0 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 0 | 1476 | 0 | 0 |
| Demand Flow Rate, veh/h | 0 | 1505 | 0 | 0 |
| Vehicles Circulating, veh/h | 928 | 0 | 1505 | 284 |
| Vehicles Exiting, veh/h | 786 | 284 | 0 | 719 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 0.0 | 8.5 | 0.0 | 0.0 |
| Approach LOS | - | A | - | - |
| Lane | Left | Right | | |
| Designated Moves | LT | TR | | |
| Assumed Moves | LT | TR | | |
| RT Channelized | | | | |
| Lane Util | 0.470 | 0.530 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | | |
| Entry Flow, veh/h | 707 | 798 | | |
| Cap Entry Lane, veh/h | 1350 | 1420 | | |
| Entry HV Adj Factor | 0.981 | 0.980 | | |
| Flow Entry, veh/h | 694 | 782 | | |
| Cap Entry, veh/h | 1324 | 1392 | | |
| V/C Ratio | 0.524 | 0.562 | | |
| Control Delay, s/veh | 8.3 | 8.7 | | |
| LOS | A | A | | |
| 95th %tile Queue, veh | 3 | 4 | | |

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

11/21/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 6.4 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | NB | SE |
| Entry Lanes | 2 | 0 | 1 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 277 | 0 | 860 | 0 |
| Demand Flow Rate, veh/h | 283 | 0 | 877 | 0 |
| Vehicles Circulating, veh/h | 0 | 389 | 283 | 1489 |
| Vehicles Exiting, veh/h | 1489 | 241 | 0 | 45 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 3.5 | 0.0 | 7.4 | 0.0 |
| Approach LOS | A | - | A | - |
| Lane | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | L | R |
| Assumed Moves | LT | TR | L | R |
| RT Channelized | | | | Yield |
| Lane Util | 0.470 | 0.530 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 4.328 | 530 |
| Entry Flow, veh/h | 133 | 150 | 347 | 1157 |
| Cap Entry Lane, veh/h | 1350 | 1420 | 1116 | 0.980 |
| Entry HV Adj Factor | 0.980 | 0.980 | 0.981 | 520 |
| Flow Entry, veh/h | 130 | 147 | 340 | 1134 |
| Cap Entry, veh/h | 1323 | 1391 | 1095 | 0.458 |
| V/C Ratio | 0.099 | 0.106 | 0.311 | 8.1 |
| Control Delay, s/veh | 3.5 | 3.4 | 6.3 | A |
| LOS | A | A | A | 2 |
| 95th %tile Queue, veh | 0 | 0 | 1 | |

HCM 6th Signalized Intersection Summary

18:

11/21/2018

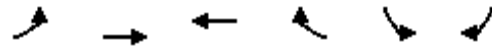


| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | ↖↗ | ↑↑ | ↑↑ | ↖ | ↖↗ | ↖ | |
| Traffic Volume (veh/h) | 113 | 616 | 848 | 407 | 482 | 402 | |
| Future Volume (veh/h) | 113 | 616 | 848 | 407 | 482 | 402 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 123 | 670 | 922 | 442 | 524 | 437 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 607 | 1722 | 1191 | 531 | 1211 | 556 | |
| Arrive On Green | 0.07 | 0.48 | 0.34 | 0.34 | 0.35 | 0.35 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 123 | 670 | 922 | 442 | 524 | 437 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 1.0 | 5.8 | 11.3 | 12.5 | 5.6 | 12.0 | |
| Cycle Q Clear(g_c), s | 1.0 | 5.8 | 11.3 | 12.5 | 5.6 | 12.0 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 607 | 1722 | 1191 | 531 | 1211 | 556 | |
| V/C Ratio(X) | 0.20 | 0.39 | 0.77 | 0.83 | 0.43 | 0.79 | |
| Avail Cap(c_a), veh/h | 661 | 1832 | 1246 | 556 | 1211 | 556 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 10.0 | 7.9 | 14.5 | 14.9 | 12.1 | 14.1 | |
| Incr Delay (d2), s/veh | 0.2 | 0.1 | 3.0 | 10.1 | 1.1 | 10.7 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 0.3 | 1.7 | 4.3 | 5.2 | 2.0 | 11.4 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 10.1 | 8.1 | 17.4 | 24.9 | 13.2 | 24.8 | |
| LnGrp LOS | B | A | B | C | B | C | |
| Approach Vol, veh/h | | 793 | 1364 | | 961 | | |
| Approach Delay, s/veh | | 8.4 | 19.9 | | 18.5 | | |
| Approach LOS | | A | B | | B | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 27.5 | 21.0 | 7.2 | 20.3 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 25.0 | 17.0 | 4.0 | 17.0 |
| Max Q Clear Time (g_c+I1), s | | | | 7.8 | 14.0 | 3.0 | 14.5 |
| Green Ext Time (p_c), s | | | | 4.3 | 1.2 | 0.0 | 1.8 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 16.5 | | | | |
| HCM 6th LOS | | | B | | | | |

Queues

18:

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 123 | 670 | 922 | 442 | 524 | 437 |
| v/c Ratio | 0.22 | 0.40 | 0.76 | 0.53 | 0.43 | 0.61 |
| Control Delay | 7.5 | 8.8 | 19.5 | 4.3 | 13.7 | 10.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 7.5 | 8.8 | 19.5 | 4.3 | 13.7 | 10.9 |
| Queue Length 50th (ft) | 8 | 57 | 123 | 0 | 59 | 45 |
| Queue Length 95th (ft) | 18 | 87 | #183 | 48 | 94 | 120 |
| Internal Link Dist (ft) | | 119 | 372 | | 337 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 563 | 1867 | 1269 | 850 | 1231 | 715 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.22 | 0.36 | 0.73 | 0.52 | 0.43 | 0.61 |

Intersection Summary

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

HCM 6th Roundabout
 1: Northgate BI & I-25 SB Ramp

11/21/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 10.3 | | | |
| Intersection LOS | B | | | |
| Approach | EB | WB | SB | NW |
| Entry Lanes | 0 | 2 | 0 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 0 | 1719 | 0 | 0 |
| Demand Flow Rate, veh/h | 0 | 1753 | 0 | 0 |
| Vehicles Circulating, veh/h | 928 | 0 | 1753 | 373 |
| Vehicles Exiting, veh/h | 1034 | 373 | 0 | 719 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 0.0 | 10.3 | 0.0 | 0.0 |
| Approach LOS | - | B | - | - |
| Lane | Left | Right | | |
| Designated Moves | LT | TR | | |
| Assumed Moves | LT | TR | | |
| RT Channelized | | | | |
| Lane Util | 0.470 | 0.530 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | | |
| Entry Flow, veh/h | 824 | 929 | | |
| Cap Entry Lane, veh/h | 1350 | 1420 | | |
| Entry HV Adj Factor | 0.980 | 0.981 | | |
| Flow Entry, veh/h | 808 | 911 | | |
| Cap Entry, veh/h | 1323 | 1392 | | |
| V/C Ratio | 0.610 | 0.654 | | |
| Control Delay, s/veh | 9.9 | 10.6 | | |
| LOS | A | B | | |
| 95th %tile Queue, veh | 4 | 5 | | |

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

11/21/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 7.5 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | NB | SE |
| Entry Lanes | 2 | 0 | 1 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 376 | 0 | 990 | 0 |
| Demand Flow Rate, veh/h | 384 | 0 | 1009 | 0 |
| Vehicles Circulating, veh/h | 0 | 561 | 384 | 1737 |
| Vehicles Exiting, veh/h | 1737 | 302 | 0 | 85 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 3.8 | 0.0 | 8.9 | 0.0 |
| Approach LOS | A | - | A | - |
| Lane | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | L | R |
| Assumed Moves | LT | TR | L | R |
| RT Channelized | | | | Yield |
| Lane Util | 0.469 | 0.531 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 4.328 | 530 |
| Entry Flow, veh/h | 180 | 204 | 479 | 1099 |
| Cap Entry Lane, veh/h | 1350 | 1420 | 1025 | 0.980 |
| Entry HV Adj Factor | 0.982 | 0.977 | 0.981 | 520 |
| Flow Entry, veh/h | 177 | 199 | 470 | 1077 |
| Cap Entry, veh/h | 1326 | 1388 | 1005 | 0.483 |
| V/C Ratio | 0.133 | 0.144 | 0.468 | 8.8 |
| Control Delay, s/veh | 3.8 | 3.7 | 9.0 | A |
| LOS | A | A | A | 3 |
| 95th %tile Queue, veh | 0 | 1 | 3 | |

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018

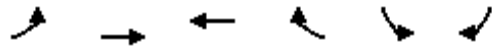


| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | ↖↗ | ↑↑ | ↑↑ | ↖ | ↖↗ | ↖ | |
| Traffic Volume (veh/h) | 113 | 616 | 848 | 407 | 482 | 402 | |
| Future Volume (veh/h) | 113 | 660 | 952 | 407 | 482 | 402 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 123 | 717 | 1035 | 442 | 524 | 437 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 567 | 1800 | 1306 | 582 | 1180 | 541 | |
| Arrive On Green | 0.06 | 0.51 | 0.37 | 0.37 | 0.34 | 0.34 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 123 | 717 | 1035 | 442 | 524 | 437 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 1.0 | 6.6 | 13.7 | 12.9 | 6.2 | 13.2 | |
| Cycle Q Clear(g_c), s | 1.0 | 6.6 | 13.7 | 12.9 | 6.2 | 13.2 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 567 | 1800 | 1306 | 582 | 1180 | 541 | |
| V/C Ratio(X) | 0.22 | 0.40 | 0.79 | 0.76 | 0.44 | 0.81 | |
| Avail Cap(c_a), veh/h | 610 | 1956 | 1416 | 632 | 1180 | 541 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 10.6 | 8.0 | 14.9 | 14.6 | 13.5 | 15.8 | |
| Incr Delay (d2), s/veh | 0.2 | 0.1 | 3.0 | 4.9 | 1.2 | 12.2 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 0.3 | 2.0 | 5.2 | 4.7 | 2.3 | 1.8 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 10.7 | 8.2 | 17.8 | 19.6 | 14.7 | 28.0 | |
| LnGrp LOS | B | A | B | B | B | C | |
| Approach Vol, veh/h | | 840 | 1477 | | 961 | | |
| Approach Delay, s/veh | | 8.6 | 18.3 | | 20.7 | | |
| Approach LOS | | A | B | | C | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 30.7 | 22.0 | 7.3 | 23.4 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 29.0 | 18.0 | 4.0 | 21.0 |
| Max Q Clear Time (g_c+I1), s | | | | 8.6 | 15.2 | 3.0 | 15.7 |
| Green Ext Time (p_c), s | | | | 5.0 | 1.2 | 0.0 | 3.7 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 16.5 | | | | |
| HCM 6th LOS | | | B | | | | |

Queues

18: Northgate Bl & Struthers Rd

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 123 | 717 | 1035 | 442 | 524 | 437 |
| v/c Ratio | 0.24 | 0.41 | 0.76 | 0.50 | 0.44 | 0.65 |
| Control Delay | 7.5 | 8.8 | 19.1 | 3.8 | 15.6 | 13.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 7.5 | 8.8 | 19.1 | 3.8 | 15.6 | 13.8 |
| Queue Length 50th (ft) | 9 | 65 | 150 | 0 | 68 | 61 |
| Queue Length 95th (ft) | 19 | 97 | 214 | 47 | 105 | 148 |
| Internal Link Dist (ft) | | 125 | 405 | | 325 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 517 | 1975 | 1430 | 902 | 1188 | 677 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.24 | 0.36 | 0.72 | 0.49 | 0.44 | 0.65 |

Intersection Summary

HCM 6th Signalized Intersection Summary
 10: EUL Access & Northgate BI

11/21/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↘ | ↑↑ | ↗ | ↘ | ↑↑ | ↗ | | ↕ | | | ↕ | |
| Traffic Volume (veh/h) | 0 | 82 | 0 | 0 | 943 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Future Volume (veh/h) | 12 | 82 | 23 | 203 | 943 | 107 | 6 | 0 | 58 | 73 | 0 | 9 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 13 | 89 | 25 | 221 | 1025 | 116 | 7 | 0 | 63 | 79 | 0 | 10 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 359 | 1205 | 537 | 848 | 1571 | 701 | 451 | 0 | 237 | 397 | 0 | 237 |
| Arrive On Green | 0.01 | 0.34 | 0.34 | 0.12 | 0.44 | 0.44 | 0.16 | 0.00 | 0.16 | 0.16 | 0.00 | 0.16 |
| Sat Flow, veh/h | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 | 1355 | 0 | 1442 | 1028 | 0 | 1442 |
| Grp Volume(v), veh/h | 13 | 89 | 25 | 221 | 1025 | 116 | 7 | 0 | 63 | 79 | 0 | 10 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 | 1355 | 0 | 1442 | 1028 | 0 | 1442 |
| Q Serve(g_s), s | 0.2 | 0.5 | 0.3 | 2.3 | 7.1 | 1.4 | 0.1 | 0.0 | 1.2 | 1.7 | 0.0 | 0.2 |
| Cycle Q Clear(g_c), s | 0.2 | 0.5 | 0.3 | 2.3 | 7.1 | 1.4 | 0.3 | 0.0 | 1.2 | 2.9 | 0.0 | 0.2 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 359 | 1205 | 537 | 848 | 1571 | 701 | 451 | 0 | 237 | 397 | 0 | 237 |
| V/C Ratio(X) | 0.04 | 0.07 | 0.05 | 0.26 | 0.65 | 0.17 | 0.02 | 0.00 | 0.27 | 0.20 | 0.00 | 0.04 |
| Avail Cap(c_a), veh/h | 560 | 1911 | 853 | 921 | 2024 | 903 | 931 | 0 | 730 | 855 | 0 | 730 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 6.9 | 7.1 | 7.0 | 4.7 | 6.9 | 5.3 | 11.2 | 0.0 | 11.5 | 12.8 | 0.0 | 11.1 |
| Incr Delay (d2), s/veh | 0.0 | 0.0 | 0.0 | 0.2 | 0.5 | 0.1 | 0.0 | 0.0 | 0.6 | 0.2 | 0.0 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.0 | 0.1 | 0.1 | 0.4 | 1.6 | 0.3 | 0.0 | 0.0 | 0.3 | 0.4 | 0.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 7.0 | 7.1 | 7.0 | 4.8 | 7.4 | 5.4 | 11.3 | 0.0 | 12.1 | 13.1 | 0.0 | 11.2 |
| LnGrp LOS | A | A | A | A | A | A | B | A | B | B | A | B |
| Approach Vol, veh/h | | 127 | | | 1362 | | | 70 | | | | 89 |
| Approach Delay, s/veh | | 7.1 | | | 6.8 | | | 12.0 | | | | 12.9 |
| Approach LOS | | A | | | A | | | B | | | | B |
| Timer - Assigned Phs | | 2 | 3 | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 9.2 | 7.7 | 14.7 | | 9.2 | 4.4 | 18.0 | | | | |
| Change Period (Y+Rc), s | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | | | | |
| Max Green Setting (Gmax), s | | 16.0 | 5.0 | 17.0 | | 16.0 | 4.0 | 18.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 3.2 | 4.3 | 2.5 | | 4.9 | 2.2 | 9.1 | | | | |
| Green Ext Time (p_c), s | | 0.2 | 0.1 | 0.4 | | 0.3 | 0.0 | 4.8 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 7.4 | | | | | | | | | |
| HCM 6th LOS | | | A | | | | | | | | | |

Queues

10: EUL Access & Northgate BI

11/21/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 13 | 89 | 25 | 221 | 1025 | 116 | 70 | 89 |
| v/c Ratio | 0.03 | 0.06 | 0.04 | 0.31 | 0.56 | 0.13 | 0.11 | 0.13 |
| Control Delay | 3.3 | 7.5 | 0.1 | 4.6 | 7.2 | 2.1 | 2.8 | 3.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 3.3 | 7.5 | 0.1 | 4.6 | 7.2 | 2.1 | 2.8 | 3.9 |
| Queue Length 50th (ft) | 1 | 5 | 0 | 13 | 40 | 0 | 0 | 0 |
| Queue Length 95th (ft) | 4 | 14 | 0 | 31 | 134 | 17 | 7 | 11 |
| Internal Link Dist (ft) | | 2751 | | | 634 | | 378 | 429 |
| Turn Bay Length (ft) | 235 | | 235 | 235 | | 235 | | |
| Base Capacity (vph) | 410 | 1957 | 924 | 711 | 2072 | 975 | 1637 | 1787 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.03 | 0.05 | 0.03 | 0.31 | 0.49 | 0.12 | 0.04 | 0.05 |

Intersection Summary

HCM 6th Roundabout
1: Northgate BI & I-25 SB Ramp

11/21/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 5.2 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | SB | NW |
| Entry Lanes | 0 | 2 | 0 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 0 | 535 | 0 | 0 |
| Demand Flow Rate, veh/h | 0 | 546 | 0 | 0 |
| Vehicles Circulating, veh/h | 669 | 0 | 546 | 820 |
| Vehicles Exiting, veh/h | 99 | 820 | 0 | 450 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 0.0 | 5.2 | 0.0 | 0.0 |
| Approach LOS | - | A | - | - |
| Lane | Left | Right | | |
| Designated Moves | LT | TR | | |
| Assumed Moves | L | TR | | |
| RT Channelized | | | | |
| Lane Util | 0.819 | 0.181 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | | |
| Entry Flow, veh/h | 447 | 99 | | |
| Cap Entry Lane, veh/h | 1350 | 1420 | | |
| Entry HV Adj Factor | 0.980 | 0.980 | | |
| Flow Entry, veh/h | 438 | 97 | | |
| Cap Entry, veh/h | 1323 | 1392 | | |
| V/C Ratio | 0.331 | 0.070 | | |
| Control Delay, s/veh | 5.7 | 3.1 | | |
| LOS | A | A | | |
| 95th %tile Queue, veh | 1 | 0 | | |

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

11/21/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 13.7 | | | |
| Intersection LOS | B | | | |
| Approach | EB | WB | NB | SE |
| Entry Lanes | 2 | 0 | 1 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 821 | 0 | 719 | 0 |
| Demand Flow Rate, veh/h | 838 | 0 | 734 | 0 |
| Vehicles Circulating, veh/h | 0 | 278 | 838 | 552 |
| Vehicles Exiting, veh/h | 552 | 597 | 0 | 248 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 5.3 | 0.0 | 23.3 | 0.0 |
| Approach LOS | A | - | C | - |
| Lane | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | L | R |
| Assumed Moves | LT | TR | L | R |
| RT Channelized | | | | Yield |
| Lane Util | 0.470 | 0.530 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 4.328 | 697 |
| Entry Flow, veh/h | 394 | 444 | 37 | 855 |
| Cap Entry Lane, veh/h | 1350 | 1420 | 697 | 0.980 |
| Entry HV Adj Factor | 0.980 | 0.980 | 0.984 | 683 |
| Flow Entry, veh/h | 386 | 435 | 36 | 838 |
| Cap Entry, veh/h | 1322 | 1392 | 685 | 0.815 |
| V/C Ratio | 0.292 | 0.313 | 0.053 | 24.2 |
| Control Delay, s/veh | 5.3 | 5.3 | 5.8 | C |
| LOS | A | A | A | 9 |
| 95th %tile Queue, veh | 1 | 1 | 0 | |

HCM 6th Signalized Intersection Summary

18:

11/21/2018

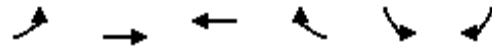


| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | ↖↗ | ↑↑ | ↖↗ | ↗ | ↖↗ | ↗ | |
| Traffic Volume (veh/h) | 441 | 735 | 549 | 503 | 380 | 214 | |
| Future Volume (veh/h) | 441 | 735 | 549 | 503 | 380 | 214 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 479 | 799 | 597 | 547 | 413 | 233 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 808 | 1777 | 1137 | 507 | 1175 | 539 | |
| Arrive On Green | 0.10 | 0.50 | 0.32 | 0.32 | 0.34 | 0.34 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 479 | 799 | 597 | 547 | 413 | 233 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 4.3 | 7.3 | 6.9 | 16.0 | 4.5 | 5.7 | |
| Cycle Q Clear(g_c), s | 4.3 | 7.3 | 6.9 | 16.0 | 4.5 | 5.7 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 808 | 1777 | 1137 | 507 | 1175 | 539 | |
| V/C Ratio(X) | 0.59 | 0.45 | 0.52 | 1.08 | 0.35 | 0.43 | |
| Avail Cap(c_a), veh/h | 808 | 1777 | 1137 | 507 | 1175 | 539 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 10.0 | 8.1 | 13.9 | 17.0 | 12.4 | 12.8 | |
| Incr Delay (d2), s/veh | 1.2 | 0.2 | 0.4 | 62.7 | 0.8 | 2.5 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 1.4 | 2.1 | 2.4 | 13.7 | 1.6 | 5.7 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 11.2 | 8.2 | 14.3 | 79.7 | 13.2 | 15.3 | |
| LnGrp LOS | B | A | B | F | B | B | |
| Approach Vol, veh/h | | 1278 | 1144 | | 646 | | |
| Approach Delay, s/veh | | 9.4 | 45.6 | | 13.9 | | |
| Approach LOS | | A | D | | B | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 29.0 | 21.0 | 9.0 | 20.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 25.0 | 17.0 | 5.0 | 16.0 |
| Max Q Clear Time (g_c+I1), s | | | | 9.3 | 7.7 | 6.3 | 18.0 |
| Green Ext Time (p_c), s | | | | 5.1 | 1.7 | 0.0 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 23.8 | | | | |
| HCM 6th LOS | | | C | | | | |

Queues

18:

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 479 | 799 | 597 | 547 | 413 | 233 |
| v/c Ratio | 0.67 | 0.47 | 0.56 | 0.64 | 0.34 | 0.33 |
| Control Delay | 12.8 | 9.3 | 16.6 | 5.5 | 13.1 | 3.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 12.8 | 9.3 | 16.6 | 5.5 | 13.1 | 3.7 |
| Queue Length 50th (ft) | 37 | 71 | 73 | 0 | 45 | 0 |
| Queue Length 95th (ft) | 60 | 107 | 113 | 55 | 74 | 35 |
| Internal Link Dist (ft) | | 125 | 355 | | 330 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 715 | 1820 | 1165 | 888 | 1201 | 705 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.67 | 0.44 | 0.51 | 0.62 | 0.34 | 0.33 |

Intersection Summary

HCM 6th Roundabout
1: Northgate BI & I-25 SB Ramp

11/21/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 5.1 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | SB | NW |
| Entry Lanes | 0 | 2 | 0 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 0 | 653 | 0 | 0 |
| Demand Flow Rate, veh/h | 0 | 666 | 0 | 0 |
| Vehicles Circulating, veh/h | 669 | 0 | 666 | 1021 |
| Vehicles Exiting, veh/h | 219 | 1021 | 0 | 450 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 0.0 | 5.1 | 0.0 | 0.0 |
| Approach LOS | - | A | - | - |
| Lane | Left | Right | | |
| Designated Moves | LT | TR | | |
| Assumed Moves | L | TR | | |
| RT Channelized | | | | |
| Lane Util | 0.671 | 0.329 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | | |
| Entry Flow, veh/h | 447 | 219 | | |
| Cap Entry Lane, veh/h | 1350 | 1420 | | |
| Entry HV Adj Factor | 0.980 | 0.980 | | |
| Flow Entry, veh/h | 438 | 215 | | |
| Cap Entry, veh/h | 1323 | 1392 | | |
| V/C Ratio | 0.331 | 0.154 | | |
| Control Delay, s/veh | 5.7 | 3.8 | | |
| LOS | A | A | | |
| 95th %tile Queue, veh | 1 | 1 | | |

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

11/21/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 17.2 | | | |
| Intersection LOS | C | | | |
| Approach | EB | WB | NB | SE |
| Entry Lanes | 2 | 0 | 1 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 1017 | 0 | 782 | 0 |
| Demand Flow Rate, veh/h | 1038 | 0 | 798 | 0 |
| Vehicles Circulating, veh/h | 0 | 432 | 1037 | 672 |
| Vehicles Exiting, veh/h | 672 | 706 | 0 | 338 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 6.1 | 0.0 | 31.6 | 0.0 |
| Approach LOS | A | - | D | - |
| Lane | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | L | R |
| Assumed Moves | LT | TR | L | R |
| RT Channelized | | | | Yield |
| Lane Util | 0.470 | 0.530 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 4.328 | 697 |
| Entry Flow, veh/h | 488 | 550 | 101 | 779 |
| Cap Entry Lane, veh/h | 1350 | 1420 | 588 | 0.980 |
| Entry HV Adj Factor | 0.980 | 0.980 | 0.982 | 683 |
| Flow Entry, veh/h | 478 | 539 | 99 | 764 |
| Cap Entry, veh/h | 1322 | 1392 | 577 | 0.894 |
| V/C Ratio | 0.362 | 0.387 | 0.172 | 35.0 |
| Control Delay, s/veh | 6.1 | 6.1 | 8.4 | D |
| LOS | A | A | A | 12 |
| 95th %tile Queue, veh | 2 | 2 | 1 | |

HCM 6th Signalized Intersection Summary

18:

11/21/2018

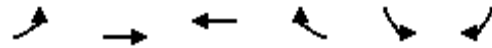


| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | ↖↖ | ↑↑ | ↗↗ | ↖ | ↘↘ | ↘ | |
| Traffic Volume (veh/h) | 441 | 735 | 549 | 503 | 380 | 214 | |
| Future Volume (veh/h) | 441 | 834 | 600 | 503 | 380 | 214 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 479 | 907 | 652 | 547 | 413 | 233 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 854 | 1848 | 1137 | 507 | 1106 | 507 | |
| Arrive On Green | 0.12 | 0.52 | 0.32 | 0.32 | 0.32 | 0.32 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 479 | 907 | 652 | 547 | 413 | 233 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 4.2 | 8.2 | 7.6 | 16.0 | 4.6 | 5.9 | |
| Cycle Q Clear(g_c), s | 4.2 | 8.2 | 7.6 | 16.0 | 4.6 | 5.9 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 854 | 1848 | 1137 | 507 | 1106 | 507 | |
| V/C Ratio(X) | 0.56 | 0.49 | 0.57 | 1.08 | 0.37 | 0.46 | |
| Avail Cap(c_a), veh/h | 854 | 1848 | 1137 | 507 | 1106 | 507 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 9.8 | 7.7 | 14.2 | 17.0 | 13.1 | 13.6 | |
| Incr Delay (d2), s/veh | 0.8 | 0.2 | 0.7 | 62.7 | 1.0 | 3.0 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 1.3 | 2.3 | 2.7 | 13.7 | 1.7 | 5.8 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 10.6 | 7.9 | 14.9 | 79.7 | 14.1 | 16.5 | |
| LnGrp LOS | B | A | B | F | B | B | |
| Approach Vol, veh/h | | 1386 | 1199 | | 646 | | |
| Approach Delay, s/veh | | 8.9 | 44.5 | | 15.0 | | |
| Approach LOS | | A | D | | B | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 30.0 | 20.0 | 10.0 | 20.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 26.0 | 16.0 | 6.0 | 16.0 |
| Max Q Clear Time (g_c+I1), s | | | | 10.2 | 7.9 | 6.2 | 18.0 |
| Green Ext Time (p_c), s | | | | 5.8 | 1.6 | 0.0 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 23.3 | | | | |
| HCM 6th LOS | | | C | | | | |

Queues

18:

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 479 | 907 | 652 | 547 | 413 | 233 |
| v/c Ratio | 0.64 | 0.50 | 0.60 | 0.63 | 0.37 | 0.35 |
| Control Delay | 11.1 | 9.0 | 17.1 | 5.4 | 14.2 | 4.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 11.1 | 9.0 | 17.1 | 5.4 | 14.2 | 4.0 |
| Queue Length 50th (ft) | 36 | 80 | 82 | 0 | 46 | 0 |
| Queue Length 95th (ft) | 57 | 118 | 125 | 55 | 76 | 37 |
| Internal Link Dist (ft) | | 124 | 369 | | 337 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 749 | 1874 | 1153 | 884 | 1118 | 673 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.64 | 0.48 | 0.57 | 0.62 | 0.37 | 0.35 |

Intersection Summary

HCM 6th Signalized Intersection Summary
 10: EUL Access & Northgate BI

11/21/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | | ↖ | | | ↗ | ↘ |
| Traffic Volume (veh/h) | 0 | 891 | 0 | 0 | 114 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Future Volume (veh/h) | 9 | 891 | 8 | 76 | 114 | 76 | 23 | 0 | 210 | 85 | 0 | 10 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 10 | 968 | 9 | 83 | 124 | 83 | 25 | 0 | 228 | 92 | 0 | 11 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 636 | 1323 | 590 | 366 | 1500 | 669 | 548 | 0 | 387 | 330 | 0 | 387 |
| Arrive On Green | 0.01 | 0.37 | 0.37 | 0.06 | 0.42 | 0.42 | 0.27 | 0.00 | 0.27 | 0.27 | 0.00 | 0.27 |
| Sat Flow, veh/h | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 | 1374 | 0 | 1442 | 562 | 0 | 1442 |
| Grp Volume(v), veh/h | 10 | 968 | 9 | 83 | 124 | 83 | 25 | 0 | 228 | 92 | 0 | 11 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 | 1374 | 0 | 1442 | 562 | 0 | 1442 |
| Q Serve(g_s), s | 0.1 | 9.4 | 0.1 | 1.1 | 0.8 | 1.3 | 0.5 | 0.0 | 5.5 | 3.0 | 0.0 | 0.2 |
| Cycle Q Clear(g_c), s | 0.1 | 9.4 | 0.1 | 1.1 | 0.8 | 1.3 | 0.8 | 0.0 | 5.5 | 8.5 | 0.0 | 0.2 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 636 | 1323 | 590 | 366 | 1500 | 669 | 548 | 0 | 387 | 330 | 0 | 387 |
| V/C Ratio(X) | 0.02 | 0.73 | 0.02 | 0.23 | 0.08 | 0.12 | 0.05 | 0.00 | 0.59 | 0.28 | 0.00 | 0.03 |
| Avail Cap(c_a), veh/h | 795 | 1596 | 712 | 437 | 1596 | 712 | 732 | 0 | 576 | 482 | 0 | 576 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 7.7 | 10.8 | 7.9 | 8.1 | 6.9 | 7.1 | 11.1 | 0.0 | 12.7 | 16.5 | 0.0 | 10.8 |
| Incr Delay (d2), s/veh | 0.0 | 1.4 | 0.0 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 1.4 | 0.5 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.0 | 3.0 | 0.0 | 0.3 | 0.2 | 0.3 | 0.1 | 0.0 | 1.6 | 0.7 | 0.0 | 0.1 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 7.7 | 12.3 | 7.9 | 8.4 | 7.0 | 7.1 | 11.1 | 0.0 | 14.2 | 16.9 | 0.0 | 10.8 |
| LnGrp LOS | A | B | A | A | A | A | B | A | B | B | A | B |
| Approach Vol, veh/h | | 987 | | | 290 | | | 253 | | | | 103 |
| Approach Delay, s/veh | | 12.2 | | | 7.4 | | | 13.9 | | | | 16.3 |
| Approach LOS | | B | | | A | | | B | | | | B |
| Timer - Assigned Phs | | 2 | 3 | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 14.7 | 6.4 | 18.9 | | 14.7 | 4.4 | 20.9 | | | | |
| Change Period (Y+Rc), s | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | | | | |
| Max Green Setting (Gmax), s | | 16.0 | 4.0 | 18.0 | | 16.0 | 4.0 | 18.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 7.5 | 3.1 | 11.4 | | 10.5 | 2.1 | 3.3 | | | | |
| Green Ext Time (p_c), s | | 0.9 | 0.0 | 3.5 | | 0.2 | 0.0 | 0.8 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | | 11.8 | | | | | | | | |
| HCM 6th LOS | | | | B | | | | | | | | |

Queues

10: EUL Access & Northgate BI

11/21/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 10 | 968 | 9 | 83 | 124 | 83 | 253 | 103 |
| v/c Ratio | 0.01 | 0.61 | 0.01 | 0.21 | 0.07 | 0.09 | 0.33 | 0.14 |
| Control Delay | 3.2 | 10.0 | 0.0 | 4.5 | 4.8 | 1.7 | 5.4 | 4.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 3.2 | 10.0 | 0.0 | 4.5 | 4.8 | 1.7 | 5.4 | 4.6 |
| Queue Length 50th (ft) | 1 | 77 | 0 | 5 | 3 | 0 | 3 | 0 |
| Queue Length 95th (ft) | 4 | 137 | 0 | 16 | 18 | 12 | 24 | 13 |
| Internal Link Dist (ft) | | 2751 | | | 634 | | 378 | 429 |
| Turn Bay Length (ft) | 235 | | 235 | 235 | | 235 | | |
| Base Capacity (vph) | 699 | 1944 | 918 | 389 | 2225 | 1035 | 1601 | 1683 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.01 | 0.50 | 0.01 | 0.21 | 0.06 | 0.08 | 0.16 | 0.06 |
| Intersection Summary | | | | | | | | |

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018



| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|-------|-------|------|------|------|
| Lane Configurations | | | | | | | |
| Traffic Volume (veh/h) | 205 | 608 | 676 | 731 | 680 | 567 | |
| Future Volume (veh/h) | 205 | 608 | 676 | 731 | 680 | 567 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 223 | 661 | 735 | 795 | 739 | 616 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 649 | 1699 | 1141 | 509 | 1249 | 573 | |
| Arrive On Green | 0.08 | 0.48 | 0.32 | 0.32 | 0.36 | 0.36 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 223 | 661 | 735 | 795 | 739 | 616 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 1.9 | 5.9 | 8.8 | 16.0 | 8.7 | 18.0 | |
| Cycle Q Clear(g_c), s | 1.9 | 5.9 | 8.8 | 16.0 | 8.7 | 18.0 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 649 | 1699 | 1141 | 509 | 1249 | 573 | |
| V/C Ratio(X) | 0.34 | 0.39 | 0.64 | 1.56 | 0.59 | 1.08 | |
| Avail Cap(c_a), veh/h | 662 | 1712 | 1141 | 509 | 1249 | 573 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 10.2 | 8.3 | 14.5 | 16.9 | 12.9 | 15.9 | |
| Incr Delay (d2), s/veh | 0.3 | 0.1 | 1.3 | 262.2 | 2.1 | 59.6 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 0.6 | 1.8 | 3.2 | 42.0 | 3.2 | 9.5 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 10.5 | 8.5 | 15.7 | 279.1 | 15.0 | 75.5 | |
| LnGrp LOS | B | A | B | F | B | F | |
| Approach Vol, veh/h | | 884 | 1530 | | 1355 | | |
| Approach Delay, s/veh | | 9.0 | 152.6 | | 42.5 | | |
| Approach LOS | | A | F | | D | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 27.8 | 22.0 | 7.8 | 20.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 24.0 | 18.0 | 4.0 | 16.0 |
| Max Q Clear Time (g_c+I1), s | | | | 7.9 | 20.0 | 3.9 | 18.0 |
| Green Ext Time (p_c), s | | | | 4.1 | 0.0 | 0.0 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 79.3 | | | | |
| HCM 6th LOS | | | E | | | | |

Queues

18: Northgate BI & Struthers Rd

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 223 | 661 | 735 | 795 | 739 | 616 |
| v/c Ratio | 0.39 | 0.39 | 0.66 | 0.76 | 0.60 | 0.83 |
| Control Delay | 9.4 | 9.2 | 18.0 | 7.6 | 15.4 | 21.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 9.4 | 9.2 | 18.0 | 7.6 | 15.4 | 21.6 |
| Queue Length 50th (ft) | 17 | 59 | 94 | 0 | 87 | 88 |
| Queue Length 95th (ft) | 31 | 91 | 143 | #89 | 132 | #265 |
| Internal Link Dist (ft) | | 127 | 421 | | 345 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 567 | 1708 | 1139 | 1048 | 1242 | 738 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.39 | 0.39 | 0.65 | 0.76 | 0.60 | 0.83 |

Intersection Summary

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

Appendix E: Horizon Year (2040) Analysis

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 7.2 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | NB | SE |
| Entry Lanes | 2 | 0 | 1 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 365 | 0 | 916 | 0 |
| Demand Flow Rate, veh/h | 372 | 0 | 934 | 0 |
| Vehicles Circulating, veh/h | 0 | 604 | 372 | 1872 |
| Vehicles Exiting, veh/h | 1872 | 297 | 0 | 79 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 3.7 | 0.0 | 8.6 | 0.0 |
| Approach LOS | A | - | A | - |
| Lane | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | L | R |
| Assumed Moves | LT | TR | L | R |
| RT Channelized | | | | Yield |
| Lane Util | 0.470 | 0.530 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 4.328 | 405 |
| Entry Flow, veh/h | 175 | 197 | 529 | 1103 |
| Cap Entry Lane, veh/h | 1350 | 1420 | 1035 | 0.980 |
| Entry HV Adj Factor | 0.981 | 0.982 | 0.981 | 397 |
| Flow Entry, veh/h | 172 | 194 | 519 | 1082 |
| Cap Entry, veh/h | 1324 | 1395 | 1015 | 0.367 |
| V/C Ratio | 0.130 | 0.139 | 0.511 | 7.1 |
| Control Delay, s/veh | 3.8 | 3.7 | 9.7 | A |
| LOS | A | A | A | 2 |
| 95th %tile Queue, veh | 0 | 0 | 3 | |

HCM 6th Roundabout
1: Northgate BI & I-25 SB Ramp

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 12.8 | | | |
| Intersection LOS | B | | | |
| Approach | EB | WB | SB | NW |
| Entry Lanes | 0 | 2 | 0 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 0 | 1955 | 0 | 0 |
| Demand Flow Rate, veh/h | 0 | 1994 | 0 | 0 |
| Vehicles Circulating, veh/h | 742 | 0 | 1994 | 297 |
| Vehicles Exiting, veh/h | 1412 | 297 | 0 | 582 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 0.0 | 12.8 | 0.0 | 0.0 |
| Approach LOS | - | B | - | - |
| Lane | Left | Right | | |
| Designated Moves | LT | TR | | |
| Assumed Moves | LT | TR | | |
| RT Channelized | | | | |
| Lane Util | 0.470 | 0.530 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | | |
| Entry Flow, veh/h | 937 | 1057 | | |
| Cap Entry Lane, veh/h | 1350 | 1420 | | |
| Entry HV Adj Factor | 0.981 | 0.980 | | |
| Flow Entry, veh/h | 919 | 1036 | | |
| Cap Entry, veh/h | 1324 | 1392 | | |
| V/C Ratio | 0.694 | 0.744 | | |
| Control Delay, s/veh | 12.1 | 13.4 | | |
| LOS | B | B | | |
| 95th %tile Queue, veh | 6 | 7 | | |

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018



| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|-------|-------|------|------|------|
| Lane Configurations | ↖↗ | ↑↑ | ↖↗ | ↗ | ↖↗ | ↗ | |
| Traffic Volume (veh/h) | 205 | 608 | 676 | 731 | 680 | 567 | |
| Future Volume (veh/h) | 205 | 608 | 676 | 731 | 680 | 567 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 223 | 661 | 735 | 795 | 739 | 616 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 649 | 1699 | 1141 | 509 | 1249 | 573 | |
| Arrive On Green | 0.08 | 0.48 | 0.32 | 0.32 | 0.36 | 0.36 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 223 | 661 | 735 | 795 | 739 | 616 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 1.9 | 5.9 | 8.8 | 16.0 | 8.7 | 18.0 | |
| Cycle Q Clear(g_c), s | 1.9 | 5.9 | 8.8 | 16.0 | 8.7 | 18.0 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 649 | 1699 | 1141 | 509 | 1249 | 573 | |
| V/C Ratio(X) | 0.34 | 0.39 | 0.64 | 1.56 | 0.59 | 1.08 | |
| Avail Cap(c_a), veh/h | 662 | 1712 | 1141 | 509 | 1249 | 573 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 10.2 | 8.3 | 14.5 | 16.9 | 12.9 | 15.9 | |
| Incr Delay (d2), s/veh | 0.3 | 0.1 | 1.3 | 262.2 | 2.1 | 59.6 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 0.6 | 1.8 | 3.2 | 42.0 | 3.2 | 9.5 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 10.5 | 8.5 | 15.7 | 279.1 | 15.0 | 75.5 | |
| LnGrp LOS | B | A | B | F | B | F | |
| Approach Vol, veh/h | | 884 | 1530 | | 1355 | | |
| Approach Delay, s/veh | | 9.0 | 152.6 | | 42.5 | | |
| Approach LOS | | A | F | | D | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 27.8 | 22.0 | 7.8 | 20.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 24.0 | 18.0 | 4.0 | 16.0 |
| Max Q Clear Time (g_c+I1), s | | | | 7.9 | 20.0 | 3.9 | 18.0 |
| Green Ext Time (p_c), s | | | | 4.1 | 0.0 | 0.0 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 79.3 | | | | |
| HCM 6th LOS | | | E | | | | |

Queues

18: Northgate BI & Struthers Rd

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 223 | 661 | 735 | 795 | 739 | 616 |
| v/c Ratio | 0.39 | 0.39 | 0.66 | 0.76 | 0.60 | 0.83 |
| Control Delay | 9.4 | 9.2 | 18.0 | 7.6 | 15.4 | 21.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 9.4 | 9.2 | 18.0 | 7.6 | 15.4 | 21.6 |
| Queue Length 50th (ft) | 17 | 59 | 94 | 0 | 87 | 88 |
| Queue Length 95th (ft) | 31 | 91 | 143 | #89 | 132 | #265 |
| Internal Link Dist (ft) | | 127 | 421 | | 345 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 567 | 1708 | 1139 | 1048 | 1242 | 738 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.39 | 0.39 | 0.65 | 0.76 | 0.60 | 0.83 |

Intersection Summary

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

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018



| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | ↖↗ | ↑↑ | ↖↗ | ↗ | ↖↗ | ↗ | |
| Traffic Volume (veh/h) | 205 | 608 | 676 | 731 | 680 | 567 | |
| Future Volume (veh/h) | 205 | 608 | 676 | 731 | 680 | 567 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 223 | 661 | 735 | 795 | 739 | 616 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 649 | 1699 | 1141 | 1082 | 1249 | 573 | |
| Arrive On Green | 0.08 | 0.48 | 0.32 | 0.32 | 0.36 | 0.36 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 223 | 661 | 735 | 795 | 739 | 616 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 1.9 | 5.9 | 8.8 | 15.9 | 8.7 | 18.0 | |
| Cycle Q Clear(g_c), s | 1.9 | 5.9 | 8.8 | 15.9 | 8.7 | 18.0 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 649 | 1699 | 1141 | 1082 | 1249 | 573 | |
| V/C Ratio(X) | 0.34 | 0.39 | 0.64 | 0.73 | 0.59 | 1.08 | |
| Avail Cap(c_a), veh/h | 662 | 1712 | 1141 | 1082 | 1249 | 573 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 10.2 | 8.3 | 14.5 | 5.0 | 12.9 | 15.9 | |
| Incr Delay (d2), s/veh | 0.3 | 0.1 | 1.3 | 2.6 | 2.1 | 59.6 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 0.6 | 1.8 | 3.2 | 9.5 | 3.2 | 9.5 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 10.5 | 8.5 | 15.7 | 7.7 | 15.0 | 75.5 | |
| LnGrp LOS | B | A | B | A | B | F | |
| Approach Vol, veh/h | | 884 | 1530 | | 1355 | | |
| Approach Delay, s/veh | | 9.0 | 11.5 | | 42.5 | | |
| Approach LOS | | A | B | | D | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 27.8 | 22.0 | 7.8 | 20.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 24.0 | 18.0 | 4.0 | 16.0 |
| Max Q Clear Time (g_c+I1), s | | | | 7.9 | 20.0 | 3.9 | 17.9 |
| Green Ext Time (p_c), s | | | | 4.1 | 0.0 | 0.0 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 22.1 | | | | |
| HCM 6th LOS | | | C | | | | |

Queues

18: Northgate BI & Struthers Rd

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 223 | 661 | 735 | 795 | 739 | 616 |
| v/c Ratio | 0.38 | 0.40 | 0.70 | 0.64 | 0.58 | 0.82 |
| Control Delay | 9.3 | 9.4 | 19.0 | 4.8 | 14.8 | 20.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 9.3 | 9.4 | 19.0 | 4.8 | 14.8 | 20.5 |
| Queue Length 50th (ft) | 17 | 59 | 94 | 40 | 87 | 88 |
| Queue Length 95th (ft) | 31 | 91 | 143 | 87 | 132 | #265 |
| Internal Link Dist (ft) | | 127 | 421 | | 345 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 581 | 1753 | 1168 | 1239 | 1275 | 750 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.38 | 0.38 | 0.63 | 0.64 | 0.58 | 0.82 |

Intersection Summary

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

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 9.9 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | NB | SE |
| Entry Lanes | 2 | 0 | 1 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 452 | 0 | 1047 | 0 |
| Demand Flow Rate, veh/h | 461 | 0 | 1068 | 0 |
| Vehicles Circulating, veh/h | 0 | 778 | 461 | 2122 |
| Vehicles Exiting, veh/h | 2122 | 346 | 0 | 119 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 4.0 | 0.0 | 12.4 | 0.0 |
| Approach LOS | A | - | B | - |
| Lane | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | L | R |
| Assumed Moves | LT | TR | L | R |
| RT Channelized | | | | Yield |
| Lane Util | 0.471 | 0.529 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 4.328 | 405 |
| Entry Flow, veh/h | 217 | 244 | 663 | 1058 |
| Cap Entry Lane, veh/h | 1350 | 1420 | 960 | 0.980 |
| Entry HV Adj Factor | 0.979 | 0.982 | 0.981 | 397 |
| Flow Entry, veh/h | 213 | 240 | 650 | 1038 |
| Cap Entry, veh/h | 1322 | 1395 | 941 | 0.383 |
| V/C Ratio | 0.161 | 0.172 | 0.691 | 7.5 |
| Control Delay, s/veh | 4.0 | 4.0 | 15.4 | A |
| LOS | A | A | C | 2 |
| 95th %tile Queue, veh | 1 | 1 | 6 | |

HCM 6th Roundabout
 1: Northgate BI & I-25 SB Ramp

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 16.9 | | | |
| Intersection LOS | C | | | |
| Approach | EB | WB | SB | NW |
| Entry Lanes | 0 | 2 | 0 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 0 | 2198 | 0 | 0 |
| Demand Flow Rate, veh/h | 0 | 2242 | 0 | 0 |
| Vehicles Circulating, veh/h | 742 | 0 | 2242 | 385 |
| Vehicles Exiting, veh/h | 1660 | 385 | 0 | 582 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 0.0 | 16.9 | 0.0 | 0.0 |
| Approach LOS | - | C | - | - |
| Lane | Left | Right | | |
| Designated Moves | LT | TR | | |
| Assumed Moves | LT | TR | | |
| RT Channelized | | | | |
| Lane Util | 0.470 | 0.530 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | | |
| Entry Flow, veh/h | 1054 | 1188 | | |
| Cap Entry Lane, veh/h | 1350 | 1420 | | |
| Entry HV Adj Factor | 0.980 | 0.981 | | |
| Flow Entry, veh/h | 1033 | 1165 | | |
| Cap Entry, veh/h | 1323 | 1393 | | |
| V/C Ratio | 0.781 | 0.837 | | |
| Control Delay, s/veh | 15.5 | 18.2 | | |
| LOS | C | C | | |
| 95th %tile Queue, veh | 9 | 11 | | |

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018



| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | ↖↗ | ↑↑ | ↖↗ | ↖ | ↖↗ | ↖ | |
| Traffic Volume (veh/h) | 205 | 608 | 676 | 731 | 680 | 567 | |
| Future Volume (veh/h) | 205 | 652 | 780 | 731 | 680 | 567 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 223 | 709 | 848 | 795 | 739 | 616 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 618 | 1699 | 1141 | 1082 | 1249 | 573 | |
| Arrive On Green | 0.08 | 0.48 | 0.32 | 0.32 | 0.36 | 0.36 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 223 | 709 | 848 | 795 | 739 | 616 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 1.9 | 6.5 | 10.6 | 15.9 | 8.7 | 18.0 | |
| Cycle Q Clear(g_c), s | 1.9 | 6.5 | 10.6 | 15.9 | 8.7 | 18.0 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 618 | 1699 | 1141 | 1082 | 1249 | 573 | |
| V/C Ratio(X) | 0.36 | 0.42 | 0.74 | 0.73 | 0.59 | 1.08 | |
| Avail Cap(c_a), veh/h | 631 | 1712 | 1141 | 1082 | 1249 | 573 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 10.9 | 8.5 | 15.1 | 5.0 | 12.9 | 15.9 | |
| Incr Delay (d2), s/veh | 0.4 | 0.2 | 2.7 | 2.6 | 2.1 | 59.6 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 0.6 | 1.9 | 4.0 | 9.5 | 3.2 | 9.5 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 11.2 | 8.6 | 17.7 | 7.7 | 15.0 | 75.5 | |
| LnGrp LOS | B | A | B | A | B | F | |
| Approach Vol, veh/h | | 932 | 1643 | | 1355 | | |
| Approach Delay, s/veh | | 9.3 | 12.9 | | 42.5 | | |
| Approach LOS | | A | B | | D | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 27.8 | 22.0 | 7.8 | 20.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 24.0 | 18.0 | 4.0 | 16.0 |
| Max Q Clear Time (g_c+I1), s | | | | 8.5 | 20.0 | 3.9 | 17.9 |
| Green Ext Time (p_c), s | | | | 4.4 | 0.0 | 0.0 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 22.2 | | | | |
| HCM 6th LOS | | | C | | | | |

Queues

18: Northgate BI & Struthers Rd

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 223 | 709 | 848 | 795 | 739 | 616 |
| v/c Ratio | 0.39 | 0.42 | 0.77 | 0.64 | 0.59 | 0.84 |
| Control Delay | 9.4 | 9.5 | 21.2 | 4.8 | 15.3 | 22.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 9.4 | 9.5 | 21.2 | 4.8 | 15.3 | 22.8 |
| Queue Length 50th (ft) | 17 | 64 | 114 | 41 | 87 | 94 |
| Queue Length 95th (ft) | 31 | 97 | 170 | 90 | 132 | #272 |
| Internal Link Dist (ft) | | 137 | 378 | | 304 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 570 | 1720 | 1146 | 1244 | 1251 | 730 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.39 | 0.41 | 0.74 | 0.64 | 0.59 | 0.84 |

Intersection Summary

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

HCM 6th Signalized Intersection Summary
 10: EUL Access & Northgate BI

09/18/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | | ↕ | | | ↕ | |
| Traffic Volume (veh/h) | 0 | 148 | 0 | 0 | 1630 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Future Volume (veh/h) | 12 | 148 | 23 | 203 | 1630 | 107 | 6 | 0 | 58 | 73 | 0 | 9 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 13 | 161 | 25 | 221 | 1772 | 116 | 7 | 0 | 63 | 79 | 0 | 10 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 219 | 1902 | 849 | 912 | 2163 | 965 | 331 | 0 | 202 | 278 | 0 | 202 |
| Arrive On Green | 0.01 | 0.54 | 0.54 | 0.09 | 0.61 | 0.61 | 0.14 | 0.00 | 0.14 | 0.14 | 0.00 | 0.14 |
| Sat Flow, veh/h | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 | 1345 | 0 | 1442 | 963 | 0 | 1442 |
| Grp Volume(v), veh/h | 13 | 161 | 25 | 221 | 1772 | 116 | 7 | 0 | 63 | 79 | 0 | 10 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 | 1345 | 0 | 1442 | 963 | 0 | 1442 |
| Q Serve(g_s), s | 0.2 | 1.1 | 0.4 | 2.5 | 19.6 | 1.6 | 0.2 | 0.0 | 2.0 | 2.8 | 0.0 | 0.3 |
| Cycle Q Clear(g_c), s | 0.2 | 1.1 | 0.4 | 2.5 | 19.6 | 1.6 | 0.5 | 0.0 | 2.0 | 4.8 | 0.0 | 0.3 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 219 | 1902 | 849 | 912 | 2163 | 965 | 331 | 0 | 202 | 278 | 0 | 202 |
| V/C Ratio(X) | 0.06 | 0.08 | 0.03 | 0.24 | 0.82 | 0.12 | 0.02 | 0.00 | 0.31 | 0.28 | 0.00 | 0.05 |
| Avail Cap(c_a), veh/h | 337 | 2188 | 976 | 970 | 2329 | 1039 | 581 | 0 | 458 | 516 | 0 | 458 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 7.8 | 5.7 | 5.5 | 3.5 | 7.7 | 4.2 | 19.0 | 0.0 | 19.5 | 21.6 | 0.0 | 18.8 |
| Incr Delay (d2), s/veh | 0.1 | 0.0 | 0.0 | 0.1 | 2.3 | 0.1 | 0.0 | 0.0 | 0.9 | 0.6 | 0.0 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.1 | 0.3 | 0.1 | 0.5 | 5.3 | 0.3 | 0.1 | 0.0 | 0.7 | 0.9 | 0.0 | 0.1 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 7.9 | 5.7 | 5.5 | 3.6 | 10.0 | 4.2 | 19.0 | 0.0 | 20.3 | 22.2 | 0.0 | 18.9 |
| LnGrp LOS | A | A | A | A | A | A | B | A | C | C | A | B |
| Approach Vol, veh/h | | 199 | | | 2109 | | | 70 | | | | 89 |
| Approach Delay, s/veh | | 5.8 | | | 9.0 | | | 20.2 | | | | 21.8 |
| Approach LOS | | A | | | A | | | C | | | | C |
| Timer - Assigned Phs | | 2 | 3 | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 11.0 | 8.4 | 31.0 | | 11.0 | 4.7 | 34.6 | | | | |
| Change Period (Y+Rc), s | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | | | | |
| Max Green Setting (Gmax), s | | 16.0 | 6.0 | 31.0 | | 16.0 | 4.0 | 33.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 4.0 | 4.5 | 3.1 | | 6.8 | 2.2 | 21.6 | | | | |
| Green Ext Time (p_c), s | | 0.2 | 0.1 | 1.1 | | 0.2 | 0.0 | 9.0 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 9.5 | | | | | | | | | |
| HCM 6th LOS | | | A | | | | | | | | | |

Queues

10: EUL Access & Northgate BI

09/18/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 13 | 161 | 25 | 221 | 1772 | 116 | 70 | 89 |
| v/c Ratio | 0.05 | 0.08 | 0.03 | 0.26 | 0.73 | 0.10 | 0.16 | 0.19 |
| Control Delay | 2.8 | 6.2 | 0.0 | 3.2 | 8.4 | 1.4 | 6.3 | 8.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 2.8 | 6.2 | 0.0 | 3.2 | 8.4 | 1.4 | 6.3 | 8.0 |
| Queue Length 50th (ft) | 1 | 11 | 0 | 13 | 97 | 0 | 0 | 0 |
| Queue Length 95th (ft) | 4 | 22 | 0 | 30 | #323 | 15 | 12 | 17 |
| Internal Link Dist (ft) | | 2751 | | | 634 | | 378 | 429 |
| Turn Bay Length (ft) | 235 | | 235 | 235 | | 235 | | |
| Base Capacity (vph) | 282 | 2304 | 1060 | 838 | 2420 | 1119 | 1066 | 1161 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.05 | 0.07 | 0.02 | 0.26 | 0.73 | 0.10 | 0.07 | 0.08 |

Intersection Summary

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

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

09/18/2018

| Intersection | | | | | | | | |
|-----------------------------|-------|-------|-------|-------|--------|-------|--------|--|
| Intersection Delay, s/veh | 11.9 | | | | | | | |
| Intersection LOS | B | | | | | | | |
| Approach | EB | | WB | | NB | | SE | |
| Entry Lanes | 2 | | 2 | | 1 | | 0 | |
| Conflicting Circle Lanes | 2 | | 2 | | 2 | | 2 | |
| Adj Approach Flow, veh/h | 1325 | | 788 | | 577 | | 0 | |
| Demand Flow Rate, veh/h | 1352 | | 804 | | 588 | | 0 | |
| Vehicles Circulating, veh/h | 0 | | 494 | | 1352 | | 543 | |
| Vehicles Exiting, veh/h | 543 | | 915 | | 0 | | 447 | |
| Ped Vol Crossing Leg, #/h | 0 | | 0 | | 0 | | 0 | |
| Ped Cap Adj | 1.000 | | 1.000 | | 1.000 | | 1.000 | |
| Approach Delay, s/veh | 7.6 | | 7.5 | | 27.7 | | 0.0 | |
| Approach LOS | A | | A | | D | | - | |
| Lane | Left | Right | Left | Right | Bypass | Left | Bypass | |
| Designated Moves | LT | TR | LT | TR | R | L | R | |
| Assumed Moves | LT | TR | LT | TR | R | L | R | |
| RT Channelized | | | | | Yield | | Yield | |
| Lane Util | 0.470 | 0.530 | 0.470 | 0.530 | | 1.000 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.667 | 2.535 | | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | 4.645 | 4.328 | 308 | 4.328 | 531 | |
| Entry Flow, veh/h | 635 | 717 | 233 | 263 | 875 | 57 | 653 | |
| Cap Entry Lane, veh/h | 1350 | 1420 | 857 | 933 | 0.980 | 450 | 0.980 | |
| Entry HV Adj Factor | 0.981 | 0.979 | 0.981 | 0.980 | 302 | 0.984 | 521 | |
| Flow Entry, veh/h | 623 | 702 | 229 | 258 | 858 | 56 | 640 | |
| Cap Entry, veh/h | 1324 | 1391 | 841 | 914 | 0.352 | 443 | 0.814 | |
| V/C Ratio | 0.470 | 0.505 | 0.272 | 0.282 | 8.2 | 0.127 | 29.6 | |
| Control Delay, s/veh | 7.5 | 7.7 | 7.2 | 6.9 | A | 9.9 | D | |
| LOS | A | A | A | A | 2 | A | 8 | |
| 95th %tile Queue, veh | 3 | 3 | 1 | 1 | | 0 | | |

HCM 6th Roundabout
1: Northgate BI & I-25 SB Ramp

09/18/2018

| Intersection | | | | | | | |
|-----------------------------|-------|-------|--------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 12.4 | | | | | | |
| Intersection LOS | B | | | | | | |
| Approach | EB | | WB | | SB | | NW |
| Entry Lanes | 2 | | 2 | | 1 | | 0 |
| Conflicting Circle Lanes | 2 | | 2 | | 2 | | 2 |
| Adj Approach Flow, veh/h | 1754 | | 526 | | 209 | | 0 |
| Demand Flow Rate, veh/h | 1789 | | 536 | | 213 | | 0 |
| Vehicles Circulating, veh/h | 531 | | 0 | | 536 | | 1255 |
| Vehicles Exiting, veh/h | 176 | | 1255 | | 0 | | 364 |
| Ped Vol Crossing Leg, #/h | 0 | | 0 | | 0 | | 0 |
| Ped Cap Adj | 1.000 | | 1.000 | | 1.000 | | 1.000 |
| Approach Delay, s/veh | 15.5 | | 4.6 | | 5.4 | | 0.0 |
| Approach LOS | C | | A | | A | | - |
| Lane | Left | Right | Bypass | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | R | LT | TR | L | R |
| Assumed Moves | LT | TR | R | L | TR | L | R |
| RT Channelized | | | Yield | | | | Yield |
| Lane Util | 0.470 | 0.530 | | 0.672 | 0.328 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 701 | 4.645 | 4.328 | 4.328 | 42 |
| Entry Flow, veh/h | 511 | 577 | 952 | 360 | 176 | 171 | 1223 |
| Cap Entry Lane, veh/h | 828 | 904 | 0.980 | 1350 | 1420 | 900 | 0.980 |
| Entry HV Adj Factor | 0.981 | 0.980 | 687 | 0.981 | 0.980 | 0.981 | 41 |
| Flow Entry, veh/h | 501 | 565 | 933 | 353 | 173 | 168 | 1199 |
| Cap Entry, veh/h | 813 | 886 | 0.736 | 1324 | 1392 | 883 | 0.034 |
| V/C Ratio | 0.617 | 0.638 | 17.5 | 0.267 | 0.124 | 0.190 | 3.3 |
| Control Delay, s/veh | 14.4 | 14.1 | C | 5.0 | 3.6 | 6.0 | A |
| LOS | B | B | 7 | A | A | A | 0 |
| 95th %tile Queue, veh | 4 | 5 | | 1 | 0 | 1 | |

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018



| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|-------|-------|------|------|------|
| Lane Configurations | ↖↗ | ↑↑ | ↖↗ | ↖ | ↖↗ | ↖ | |
| Traffic Volume (veh/h) | 800 | 702 | 308 | 904 | 537 | 302 | |
| Future Volume (veh/h) | 800 | 702 | 308 | 904 | 537 | 302 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 870 | 763 | 335 | 983 | 584 | 328 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 931 | 2132 | 1481 | 660 | 922 | 423 | |
| Arrive On Green | 0.12 | 0.60 | 0.42 | 0.42 | 0.27 | 0.27 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 870 | 763 | 335 | 983 | 584 | 328 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 7.0 | 6.6 | 3.6 | 25.0 | 8.9 | 11.5 | |
| Cycle Q Clear(g_c), s | 7.0 | 6.6 | 3.6 | 25.0 | 8.9 | 11.5 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 931 | 2132 | 1481 | 660 | 922 | 423 | |
| V/C Ratio(X) | 0.93 | 0.36 | 0.23 | 1.49 | 0.63 | 0.78 | |
| Avail Cap(c_a), veh/h | 931 | 2132 | 1481 | 660 | 922 | 423 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 12.3 | 6.1 | 11.3 | 17.5 | 19.4 | 20.3 | |
| Incr Delay (d2), s/veh | 16.1 | 0.1 | 0.1 | 227.8 | 3.3 | 13.1 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 4.7 | 1.9 | 1.3 | 49.5 | 3.7 | 11.0 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 28.4 | 6.2 | 11.3 | 245.3 | 22.7 | 33.4 | |
| LnGrp LOS | C | A | B | F | C | C | |
| Approach Vol, veh/h | | 1633 | 1318 | | 912 | | |
| Approach Delay, s/veh | | 18.0 | 185.8 | | 26.6 | | |
| Approach LOS | | B | F | | C | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 40.0 | 20.0 | 11.0 | 29.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 36.0 | 16.0 | 7.0 | 25.0 |
| Max Q Clear Time (g_c+I1), s | | | | 8.6 | 13.5 | 9.0 | 27.0 |
| Green Ext Time (p_c), s | | | | 5.9 | 1.0 | 0.0 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 77.3 | | | | |
| HCM 6th LOS | | | E | | | | |

Queues

18: Northgate BI & Struthers Rd

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 870 | 763 | 335 | 983 | 584 | 328 |
| v/c Ratio | 0.74 | 0.38 | 0.25 | 0.91 | 0.60 | 0.48 |
| Control Delay | 11.5 | 7.0 | 12.2 | 18.6 | 21.5 | 5.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 11.5 | 7.0 | 12.2 | 18.6 | 21.5 | 5.3 |
| Queue Length 50th (ft) | 75 | 64 | 39 | 49 | 95 | 0 |
| Queue Length 95th (ft) | 107 | 92 | 63 | #354 | 142 | 52 |
| Internal Link Dist (ft) | | 118 | 422 | | 342 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 1178 | 2265 | 1572 | 1132 | 976 | 684 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.74 | 0.34 | 0.21 | 0.87 | 0.60 | 0.48 |

Intersection Summary

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

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018



| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | ↶↷ | ↶↷ | ↶↷ | ↶ | ↶↷ | ↶ | |
| Traffic Volume (veh/h) | 800 | 702 | 308 | 904 | 537 | 302 | |
| Future Volume (veh/h) | 800 | 702 | 308 | 904 | 537 | 302 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 870 | 763 | 335 | 983 | 584 | 328 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 904 | 1848 | 1137 | 1014 | 1106 | 507 | |
| Arrive On Green | 0.12 | 0.52 | 0.32 | 0.32 | 0.32 | 0.32 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 870 | 763 | 335 | 983 | 584 | 328 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 6.0 | 6.6 | 3.5 | 16.0 | 6.9 | 8.9 | |
| Cycle Q Clear(g_c), s | 6.0 | 6.6 | 3.5 | 16.0 | 6.9 | 8.9 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 904 | 1848 | 1137 | 1014 | 1106 | 507 | |
| V/C Ratio(X) | 0.96 | 0.41 | 0.29 | 0.97 | 0.53 | 0.65 | |
| Avail Cap(c_a), veh/h | 904 | 1848 | 1137 | 1014 | 1106 | 507 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 13.5 | 7.3 | 12.8 | 6.1 | 13.9 | 14.6 | |
| Incr Delay (d2), s/veh | 21.2 | 0.1 | 0.1 | 21.0 | 1.8 | 6.2 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 5.2 | 1.9 | 1.2 | 16.7 | 2.6 | 8.5 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 34.8 | 7.5 | 12.9 | 27.2 | 15.7 | 20.8 | |
| LnGrp LOS | C | A | B | C | B | C | |
| Approach Vol, veh/h | | 1633 | 1318 | | 912 | | |
| Approach Delay, s/veh | | 22.0 | 23.5 | | 17.6 | | |
| Approach LOS | | C | C | | B | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 30.0 | 20.0 | 10.0 | 20.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 26.0 | 16.0 | 6.0 | 16.0 |
| Max Q Clear Time (g_c+I1), s | | | | 8.6 | 10.9 | 8.0 | 18.0 |
| Green Ext Time (p_c), s | | | | 5.0 | 1.8 | 0.0 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 21.5 | | | | |
| HCM 6th LOS | | | C | | | | |

Queues

18: Northgate BI & Struthers Rd

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 870 | 763 | 335 | 983 | 584 | 328 |
| v/c Ratio | 0.96 | 0.48 | 0.44 | 0.91 | 0.46 | 0.42 |
| Control Delay | 35.0 | 9.6 | 16.5 | 21.8 | 12.4 | 3.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 35.0 | 9.6 | 16.5 | 21.8 | 12.4 | 3.6 |
| Queue Length 50th (ft) | 75 | 64 | 37 | 141 | 53 | 0 |
| Queue Length 95th (ft) | #156 | 97 | 65 | #441 | 98 | 40 |
| Internal Link Dist (ft) | | 118 | 422 | | 342 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 907 | 2117 | 1303 | 1078 | 1264 | 790 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.96 | 0.36 | 0.26 | 0.91 | 0.46 | 0.42 |

Intersection Summary

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

HCM 6th Roundabout
5: I-25 NB Ramp & Northgate BI

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|--------|
| Intersection Delay, s/veh | 17.2 | | | |
| Intersection LOS | C | | | |
| Approach | EB | WB | NB | SE |
| Entry Lanes | 2 | 0 | 1 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 1521 | 0 | 640 | 0 |
| Demand Flow Rate, veh/h | 1551 | 0 | 652 | 0 |
| Vehicles Circulating, veh/h | 0 | 648 | 1551 | 663 |
| Vehicles Exiting, veh/h | 663 | 1024 | 0 | 537 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 8.8 | 0.0 | 37.1 | 0.0 |
| Approach LOS | A | - | E | - |
| Lane | Left | Right | Left | Bypass |
| Designated Moves | LT | TR | L | R |
| Assumed Moves | LT | TR | L | R |
| RT Channelized | | | | Yield |
| Lane Util | 0.470 | 0.530 | 1.000 | |
| Follow-Up Headway, s | 2.667 | 2.535 | 2.535 | |
| Critical Headway, s | 4.645 | 4.328 | 4.328 | 531 |
| Entry Flow, veh/h | 729 | 822 | 121 | 595 |
| Cap Entry Lane, veh/h | 1350 | 1420 | 380 | 0.980 |
| Entry HV Adj Factor | 0.981 | 0.981 | 0.982 | 521 |
| Flow Entry, veh/h | 715 | 806 | 119 | 583 |
| Cap Entry, veh/h | 1324 | 1393 | 373 | 0.893 |
| V/C Ratio | 0.540 | 0.579 | 0.318 | 42.0 |
| Control Delay, s/veh | 8.6 | 9.0 | 15.7 | E |
| LOS | A | A | C | 11 |
| 95th %tile Queue, veh | 3 | 4 | 1 | |

HCM 6th Roundabout
1: Northgate BI & I-25 SB Ramp

09/18/2018

| Intersection | | | | |
|-----------------------------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 4.7 | | | |
| Intersection LOS | A | | | |
| Approach | EB | WB | SB | NW |
| Entry Lanes | 0 | 2 | 0 | 0 |
| Conflicting Circle Lanes | 2 | 2 | 2 | 2 |
| Adj Approach Flow, veh/h | 0 | 644 | 0 | 0 |
| Demand Flow Rate, veh/h | 0 | 657 | 0 | 0 |
| Vehicles Circulating, veh/h | 531 | 0 | 657 | 1456 |
| Vehicles Exiting, veh/h | 297 | 1456 | 0 | 364 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 0.0 | 4.7 | 0.0 | 0.0 |
| Approach LOS | - | A | - | - |
| Lane | Left | Right | | |
| Designated Moves | LT | TR | | |
| Assumed Moves | L | TR | | |
| RT Channelized | | | | |
| Lane Util | 0.548 | 0.452 | | |
| Follow-Up Headway, s | 2.667 | 2.535 | | |
| Critical Headway, s | 4.645 | 4.328 | | |
| Entry Flow, veh/h | 360 | 297 | | |
| Cap Entry Lane, veh/h | 1350 | 1420 | | |
| Entry HV Adj Factor | 0.981 | 0.980 | | |
| Flow Entry, veh/h | 353 | 291 | | |
| Cap Entry, veh/h | 1324 | 1392 | | |
| V/C Ratio | 0.267 | 0.209 | | |
| Control Delay, s/veh | 5.0 | 4.3 | | |
| LOS | A | A | | |
| 95th %tile Queue, veh | 1 | 1 | | |

HCM 6th Signalized Intersection Summary

18: Northgate BI & Struthers Rd

11/21/2018



| Movement | EBL | EBT | WBT | WBR | SBL | SBR | |
|------------------------------|------|------|------|------|------|------|------|
| Lane Configurations | | | | | | | |
| Traffic Volume (veh/h) | 800 | 702 | 308 | 904 | 537 | 302 | |
| Future Volume (veh/h) | 800 | 801 | 359 | 904 | 537 | 302 | |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Work Zone On Approach | | No | No | | No | | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | |
| Adj Flow Rate, veh/h | 870 | 871 | 390 | 983 | 584 | 328 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | |
| Cap, veh/h | 884 | 1848 | 1137 | 1014 | 1106 | 507 | |
| Arrive On Green | 0.12 | 0.52 | 0.32 | 0.32 | 0.32 | 0.32 | |
| Sat Flow, veh/h | 3456 | 3647 | 3647 | 1585 | 3456 | 1585 | |
| Grp Volume(v), veh/h | 870 | 871 | 390 | 983 | 584 | 328 | |
| Grp Sat Flow(s),veh/h/ln | 1728 | 1777 | 1777 | 1585 | 1728 | 1585 | |
| Q Serve(g_s), s | 6.0 | 7.8 | 4.2 | 16.0 | 6.9 | 8.9 | |
| Cycle Q Clear(g_c), s | 6.0 | 7.8 | 4.2 | 16.0 | 6.9 | 8.9 | |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 | |
| Lane Grp Cap(c), veh/h | 884 | 1848 | 1137 | 1014 | 1106 | 507 | |
| V/C Ratio(X) | 0.98 | 0.47 | 0.34 | 0.97 | 0.53 | 0.65 | |
| Avail Cap(c_a), veh/h | 884 | 1848 | 1137 | 1014 | 1106 | 507 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Uniform Delay (d), s/veh | 13.8 | 7.6 | 13.0 | 6.1 | 13.9 | 14.6 | |
| Incr Delay (d2), s/veh | 26.4 | 0.2 | 0.2 | 21.0 | 1.8 | 6.2 | |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| %ile BackOfQ(50%),veh/ln | 5.7 | 2.2 | 1.5 | 16.7 | 2.6 | 8.5 | |
| Unsig. Movement Delay, s/veh | | | | | | | |
| LnGrp Delay(d),s/veh | 40.1 | 7.8 | 13.2 | 27.2 | 15.7 | 20.8 | |
| LnGrp LOS | D | A | B | C | B | C | |
| Approach Vol, veh/h | | 1741 | 1373 | | 912 | | |
| Approach Delay, s/veh | | 24.0 | 23.2 | | 17.6 | | |
| Approach LOS | | C | C | | B | | |
| Timer - Assigned Phs | | | | 4 | 6 | 7 | 8 |
| Phs Duration (G+Y+Rc), s | | | | 30.0 | 20.0 | 10.0 | 20.0 |
| Change Period (Y+Rc), s | | | | 4.0 | 4.0 | 4.0 | 4.0 |
| Max Green Setting (Gmax), s | | | | 26.0 | 16.0 | 6.0 | 16.0 |
| Max Q Clear Time (g_c+I1), s | | | | 9.8 | 10.9 | 8.0 | 18.0 |
| Green Ext Time (p_c), s | | | | 5.6 | 1.8 | 0.0 | 0.0 |
| Intersection Summary | | | | | | | |
| HCM 6th Ctrl Delay | | | 22.2 | | | | |
| HCM 6th LOS | | | C | | | | |

Queues

18: Northgate BI & Struthers Rd

11/21/2018



| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|-------------------------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 870 | 871 | 390 | 983 | 584 | 328 |
| v/c Ratio | 0.97 | 0.53 | 0.46 | 0.90 | 0.47 | 0.42 |
| Control Delay | 37.3 | 9.8 | 16.2 | 20.0 | 13.4 | 3.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 37.3 | 9.8 | 16.2 | 20.0 | 13.4 | 3.9 |
| Queue Length 50th (ft) | 75 | 76 | 44 | 142 | 55 | 0 |
| Queue Length 95th (ft) | #155 | 113 | 73 | #454 | 109 | 43 |
| Internal Link Dist (ft) | | 121 | 335 | | 336 | |
| Turn Bay Length (ft) | 185 | | | 125 | 330 | |
| Base Capacity (vph) | 895 | 2060 | 1268 | 1090 | 1230 | 777 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.97 | 0.42 | 0.31 | 0.90 | 0.47 | 0.42 |

Intersection Summary

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

HCM 6th Signalized Intersection Summary

10: EUL Access & Northgate BI

09/18/2018



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | ↘ | ↖ | ↗ | ↘ | | ↕ | | | ↕ | |
| Traffic Volume (veh/h) | 0 | 1614 | 0 | 0 | 197 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Future Volume (veh/h) | 9 | 1614 | 8 | 76 | 197 | 76 | 23 | 0 | 210 | 85 | 0 | 10 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 | 1870 |
| Adj Flow Rate, veh/h | 10 | 1754 | 9 | 83 | 214 | 83 | 25 | 0 | 228 | 92 | 0 | 11 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cap, veh/h | 688 | 1829 | 816 | 210 | 1964 | 876 | 455 | 0 | 360 | 238 | 0 | 360 |
| Arrive On Green | 0.01 | 0.51 | 0.51 | 0.05 | 0.55 | 0.55 | 0.25 | 0.00 | 0.25 | 0.25 | 0.00 | 0.25 |
| Sat Flow, veh/h | 1781 | 3554 | 1585 | 1781 | 3554 | 1585 | 1371 | 0 | 1442 | 502 | 0 | 1442 |
| Grp Volume(v), veh/h | 10 | 1754 | 9 | 83 | 214 | 83 | 25 | 0 | 228 | 92 | 0 | 11 |
| Grp Sat Flow(s),veh/h/ln | 1781 | 1777 | 1585 | 1781 | 1777 | 1585 | 1371 | 0 | 1442 | 502 | 0 | 1442 |
| Q Serve(g_s), s | 0.2 | 30.3 | 0.2 | 1.3 | 1.8 | 1.6 | 0.9 | 0.0 | 9.0 | 4.9 | 0.0 | 0.4 |
| Cycle Q Clear(g_c), s | 0.2 | 30.3 | 0.2 | 1.3 | 1.8 | 1.6 | 1.2 | 0.0 | 9.0 | 14.0 | 0.0 | 0.4 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 688 | 1829 | 816 | 210 | 1964 | 876 | 455 | 0 | 360 | 238 | 0 | 360 |
| V/C Ratio(X) | 0.01 | 0.96 | 0.01 | 0.40 | 0.11 | 0.09 | 0.05 | 0.00 | 0.63 | 0.39 | 0.00 | 0.03 |
| Avail Cap(c_a), veh/h | 781 | 1833 | 818 | 235 | 1964 | 876 | 455 | 0 | 361 | 238 | 0 | 361 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh | 7.3 | 14.9 | 7.6 | 14.7 | 6.8 | 6.8 | 18.6 | 0.0 | 21.4 | 27.6 | 0.0 | 18.2 |
| Incr Delay (d2), s/veh | 0.0 | 12.7 | 0.0 | 1.2 | 0.0 | 0.0 | 0.0 | 0.0 | 3.6 | 1.0 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.1 | 13.2 | 0.1 | 0.6 | 0.6 | 0.5 | 0.3 | 0.0 | 3.2 | 1.4 | 0.0 | 0.1 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 7.3 | 27.6 | 7.6 | 15.9 | 6.8 | 6.8 | 18.7 | 0.0 | 25.0 | 28.7 | 0.0 | 18.2 |
| LnGrp LOS | A | C | A | B | A | A | B | A | C | C | A | B |
| Approach Vol, veh/h | | 1773 | | | 380 | | | 253 | | | | 103 |
| Approach Delay, s/veh | | 27.4 | | | 8.8 | | | 24.4 | | | | 27.5 |
| Approach LOS | | C | | | A | | | C | | | | C |
| Timer - Assigned Phs | | 2 | 3 | 4 | | 6 | 7 | 8 | | | | |
| Phs Duration (G+Y+Rc), s | | 20.0 | 7.1 | 36.9 | | 20.0 | 4.7 | 39.4 | | | | |
| Change Period (Y+Rc), s | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | | | | |
| Max Green Setting (Gmax), s | | 16.0 | 4.0 | 33.0 | | 16.0 | 4.0 | 33.0 | | | | |
| Max Q Clear Time (g_c+I1), s | | 11.0 | 3.3 | 32.3 | | 16.0 | 2.2 | 3.8 | | | | |
| Green Ext Time (p_c), s | | 0.6 | 0.0 | 0.7 | | 0.0 | 0.0 | 1.7 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 24.3 | | | | | | | | | |
| HCM 6th LOS | | | C | | | | | | | | | |

Queues

10: EUL Access & Northgate BI

09/18/2018



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBT | SBT |
|-------------------------|------|------|------|------|------|------|------|------|
| Lane Group Flow (vph) | 10 | 1754 | 9 | 83 | 214 | 83 | 253 | 103 |
| v/c Ratio | 0.01 | 0.80 | 0.01 | 0.32 | 0.09 | 0.08 | 0.46 | 0.18 |
| Control Delay | 2.9 | 13.5 | 0.0 | 6.4 | 4.0 | 1.7 | 14.3 | 8.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 2.9 | 13.5 | 0.0 | 6.4 | 4.0 | 1.7 | 14.3 | 8.9 |
| Queue Length 50th (ft) | 1 | 226 | 0 | 6 | 8 | 0 | 21 | 3 |
| Queue Length 95th (ft) | 4 | #443 | 0 | 18 | 30 | 15 | 49 | 20 |
| Internal Link Dist (ft) | | 2751 | | | 634 | | 378 | 429 |
| Turn Bay Length (ft) | 235 | | 235 | 235 | | 235 | | |
| Base Capacity (vph) | 806 | 2215 | 1022 | 261 | 2413 | 1106 | 1012 | 1070 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.01 | 0.79 | 0.01 | 0.32 | 0.09 | 0.08 | 0.25 | 0.10 |

Intersection Summary

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

March 11, 2019

Eric Smith, P.E.
Blue and Silver Development
2435 Research Parkway, Suite 300
Colorado Springs, CO. 80920

RE: True North Commons Traffic Impact Study Addendum

Mr. Smith:

This letter serves as an addendum to the True North Commons Traffic Impact Study (TIS) dated November 21, 2018. The TIS recommends that the primary intersection of Northgate Boulevard and True North Commons be controlled by a traffic signal due to concerns with queues from the adjacent Access Control Point (ACP) backing through the intersection. Several follow-up discussions with United States Air Force Academy (USAFA) Staff has demonstrated that there is more concern with operating and maintaining a traffic signal than queues from the ACP blocking the intersection. Therefore, this letter will analyze how the intersection will operate in Opening Year (2020) and Horizon Year (2040) with the project. This letter will also provide an updated narrative describing the traffic impacts from the development on USAFA in less technical terminology.

Roundabout Intersection Operations

Opening Year (2020) Conditions

The intersection of Northgate Boulevard and True North Commons operates at level-of-service (LOS) A during both the AM and PM peak hours in the opening year (2020). The 95th percentile queue length for westbound (entering) traffic during the AM peak hour is 3 vehicles and the 95th percentile queue length for eastbound (exiting) traffic during the PM peak hour is 2 vehicles. The 95th percentile queue length represents the queue length that will not be exceeded 95 percent of the time during the peak hour. There is a 5 percent chance that these queue lengths could be exceeded.

Horizon Year (2040) Conditions

The intersection of Northgate Boulevard and True North Commons operates at LOS C during both the AM and PM peak hours in the horizon year (2040). The 95th percentile queue length for westbound (entering) traffic during the AM peak hour is 10 vehicles. The 95th percentile queue length for eastbound (exiting) traffic during PM peak hour is 9 vehicles.

Comparison of Roundabout Operations to Traffic Signal Operations

Table 1 compares the overall intersection operation as well as the entering and exiting queue lengths during the AM and PM peak hours respectively.

Table 1 – Comparison of Traffic Signal and Roundabout Operations at TNC

| Scenario | Intersection Control | AM Peak Hour | | | PM Peak Hour | | |
|-------------------------------|----------------------|--------------|-----|-------------------|--------------|-----|------------------|
| | | Delay (sec.) | LOS | Entering Q (veh.) | Delay (sec.) | LOS | Exiting Q (veh.) |
| Opening Year (2020 + Project) | Signal | 7.4 | A | 5 | 11.8 | B | 5 |
| Opening Year (2020 + Project) | Roundabout | 7.7 | A | 3 | 7.4 | A | 2 |
| Horizon Year (2040 + Project) | Signal | 9.5 | A | 11 | 24.3 | C | 15 |
| Horizon Year (2040 + Project) | Roundabout | 15.2 | C | 10 | 17.6 | C | 9 |

Conclusion

Either a roundabout intersection or traffic signal-controlled intersection will operate at an acceptable LOS (LOS A – D) during both the opening year (2020) and horizon year (2040) with the addition of the proposed True North Commons project. Mitigation is required if the resulting LOS of a facility becomes LOS E or LOS F. Therefore, no mitigation is required beyond the assumed roadway and intersection geometry. The entering queue lengths during the AM peak hour and the exiting queue lengths during the PM peak hour are slightly shorter with the roundabout intersection than the traffic signal-controlled intersection. Additional advantages of the roundabout intersection over the traffic signal-controlled intersection are that there are no additional maintenance costs for traffic signal equipment, electrical power, and traffic signal timing maintenance.

Traffic Study Narrative

A Traffic Impact Study (TIS) is used to identify the impacts a proposed land use will have on the surrounding roadway network. If any impacts are identified, the study will also recommend what measures should be used to mitigate the impacts. A TIS is organized into the following sections:

- Existing Conditions – analysis of how the surrounding roadway network currently operates
- Traffic Projections – analysis of how many additional vehicle trips will be added to the surrounding roadway network and how that traffic will be distributed along the roadway network
- Traffic Operations Analysis – analysis of how the surrounding roadway network will operate both with and without the proposed land use during the opening year conditions of the land use and the regionally identified horizon year
- Findings and Conclusion – identifies any deficiencies with the surrounding roadway network and any mitigation measures that are necessary to alleviate the identified deficiencies

This narrative will walk the reader through each of these sections.

Existing Conditions

Typically, traffic counts are conducted at study area intersections and along study area roadways. The roadway and intersection geometry along with traffic volumes are analyzed using the methodologies in the *Highway Capacity Manual (HCM)* to determine how the roadway network operates currently, without the addition of a proposed land-use. Intersection operations are measured in seconds of delay per vehicle and provided with a letter LOS between A and F. A is the best LOS and F is the worst. A depiction of each LOS is shown in Figure 1 below.

In urban and suburban environments, intersection operations have a much higher impact on traffic operations than the roadway segments in between intersections. The study area for the True North Commons development was identified as the new intersection along Northgate Boulevard where True North Commons will gain access to the surrounding roadway network and the two I-25 ramp intersections. The Northgate Boulevard/Struthers Road intersection was later added to the study area based on comments received from El Paso County. The study area is depicted in Figure 2 of the TIS.

The True North Commons study area was included in an Interstate Access Request (IAR) prepared for the Copper Ridge Metropolitan District for the proposed Powers Boulevard Interchange with I-25. This IAR was completed in May 2018. Since the True North Commons study area intersections were included in the IAR and the IAR was completed recently, the traffic volumes used in the IAR were used for the True North Commons TIS. This allowed the TIS to be completed without collecting new traffic counts.

The existing conditions traffic volumes (Figure 4 of the TIS) were analyzed to determine how they currently operate. All three intersections were determined to operate at acceptable levels during both the AM peak hour and PM peak hour.

Table 2 – Existing Conditions Intersection Operations

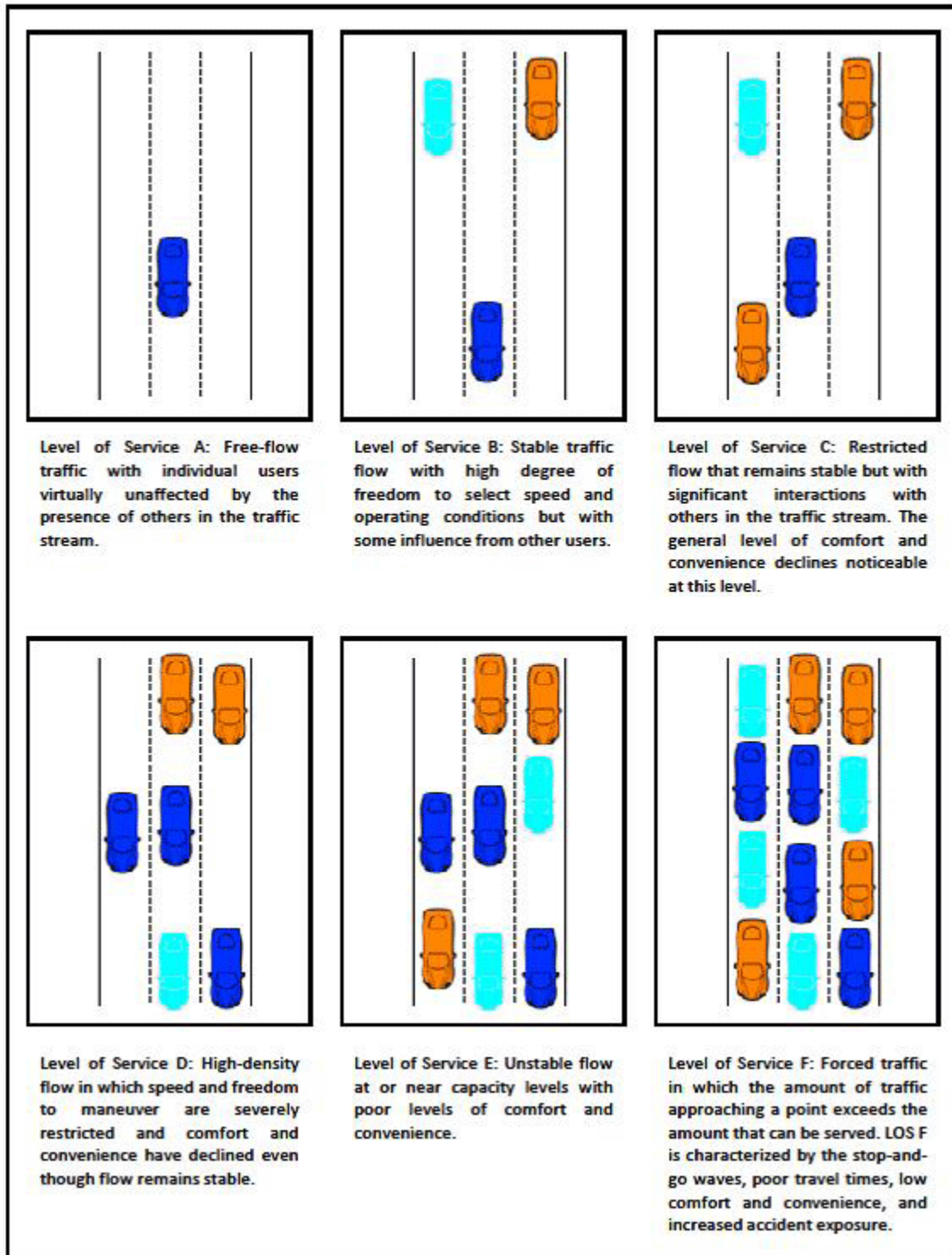
| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|------------------------------------|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 6.0 | A | 10.4 | B |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 7.5 | A | 4.9 | A |
| Northgate Boulevard/Struthers Road | Traffic Signal | 14.6 | B | 16.8 | B |

Traffic Projections

New vehicle trips created by the proposed land use are estimated using the Institute of Transportation Engineers (ITE) *Trip Generation Manual, Tenth Edition*. This manual consists of studies completed all over the United States and allows trip rates and equations to be used to calculate the number of vehicle trips that a specific land use will create based on an independent variable such as the number of hotel rooms or the square feet of an office building. This is the industry standard for projecting traffic created by proposed land uses. The trips from each land use are added together to determine the total traffic that will be created for each weekday, during the AM peak hour and during the PM peak hour.

Denver Colorado Springs Phoenix Anniston Atlanta Omaha Parsons Pueblo Sacramento Washington, D.C.

Figure 1 – Depiction of Level of Service (LOS)



The total trips are reduced for internal trip capture and pass-by trips. Internal trips are trips between the different land uses within the development. Office building workers would likely travel to and from the retail area for shopping and eating. While these trips

Denver Colorado Springs Phoenix Anniston Atlanta Omaha Parsons Pueblo Sacramento Washington, D.C.

will occur within the development, they will not be additional trips onto the roadway network and are therefore subtracted from the total trips that are projected during the AM and PM peak hours. The other phenomenon is pass-by trips. This represents trips that would be on the roadway network anyway and decide to use one of the new land uses. Employees entering USAFA that are on the roadway network anyway may decide to use the retail to grab breakfast or coffee on their way into USAFA. This is not a new trip, but an existing trip that is detouring into the new land use. These trips are also subtracted from the total trips during the AM and PM peak hours. The pass-by and internal trip capture trips are quantified using resources from ITE and other national publications. The resulting vehicle trips generated by the proposed True North Commons development are summarized in Table 3 below.

Table 3 – True North Commons Trip Generation

| ITE Code | Land Use | Size | Units | Weekday | | | AM Peak Hour | | | PM Peak Hour | | |
|----------|--------------------------------|---------|---------|--------------|--------------|--------------|--------------|------------|------------|--------------|------------|------------|
| | | | | Total | Entering | Exiting | Total | Entering | Exiting | Total | Entering | Exiting |
| 580 | Visitors' Center | 37,000 | Sq. Ft. | 150 | 90 | 60 | 10 | 9 | 1 | 7 | 1 | 6 |
| 311 | 4-Star Luxury Hotel | 250 | Rooms | 1,115 | 558 | 557 | 85 | 45 | 40 | 90 | 43 | 47 |
| 312 | 3-Star Hotel | 150 | Rooms | 603 | 302 | 301 | 58 | 24 | 34 | 48 | 26 | 22 |
| 820 | Retail | 25,000 | Sq. Ft. | 2,342 | 1,171 | 1,171 | 164 | 102 | 62 | 195 | 94 | 101 |
| 434 | i-Fly | 7,500 | Sq. Ft. | 140 | 70 | 70 | 10 | 3 | 7 | 12 | 7 | 5 |
| 853 | Convenience Market w/Gas Pumps | 3,000 | Sq. Ft. | 1,873 | 937 | 936 | 122 | 61 | 61 | 148 | 74 | 74 |
| 710 | Office Building | 200,000 | Sq. Ft. | 1,873 | 937 | 936 | 214 | 184 | 30 | 220 | 35 | 185 |
| | <i>Sub-total</i> | | | 8,096 | 4,065 | 4,031 | 663 | 428 | 235 | 720 | 280 | 440 |
| | <i>Internal Trip Capture</i> | | | - | - | - | 114 | 57 | 57 | 86 | 43 | 43 |
| | <i>Pass-by Trip Reduction</i> | | | - | - | - | 64 | 30 | 34 | 137 | 68 | 69 |
| | Total | | | 8,096 | 4,065 | 4,031 | 485 | 341 | 144 | 497 | 169 | 328 |

Numbers represent total vehicles

The development will generate 485 new trips during the AM peak hour and 497 new trips during the PM peak hour with a daily total of 8,096 new trips. During the AM peak hour, 341 trips will enter the new development and 144 trips will exit the new development. During the PM peak hour, 169 new trips will enter the development and 328 trips will exit the development.

Once the number of vehicle trips created by the development are calculated, they must be distributed to the roadway network. Existing turning movement counts at the study area intersections were used to determine where the new trips will enter and exit the roadway network. The resulting distribution pattern is shown in Figure 5 of the TIS. The distribution shows 10% of the trips created by True North Commons going into and coming out of USAFA. 25% of the new trips will enter and exit from I-25 north of Northgate Boulevard. 35% of the new trips will enter and exit from I-25 south of Northgate Boulevard. 30% of new trips will enter and exit along Northgate Boulevard east of Struthers Road.

Traffic Operations Analysis

The study area intersections were analyzed for Opening Year (2020) conditions both with and without the True North Commons development. The 2020 analysis did not assume the completion of the Powers Boulevard/I-25 interchange and therefore has a more conservative (higher volume) estimate of traffic along Northgate Boulevard. The results of the analysis are shown in Tables 4 and 5 below.

Table 4 – Opening Year (2020) Intersection Operations

| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|------------------------------------|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 4.9 | A | 6.0 | A |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 6.3 | A | 3.5 | A |
| Northgate Boulevard/Struthers Road | Traffic Signal | 16.5 | B | 23.8 | C |

Table 5 – Opening Year (2020) With Project Intersection Operations

| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|--|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 6.0 | A | 6.8 | A |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 7.4 | A | 3.8 | A |
| Northgate Boulevard/Struthers Road | Traffic Signal | 16.5 | B | 23.3 | C |
| Northgate Boulevard/True North Commons | Traffic Signal | 7.4 | A | 11.8 | B |

The operations of the Northgate Boulevard/True North Commons intersection with a roundabout are shown in Table 1 of this letter. The results indicate that all study area intersections will operate at an acceptable LOS and no mitigation is required.

The study area intersections were also analyzed for Horizon Year (2040) conditions both with and without the project. The volume of traffic entering USAFA was grown at the assumed regional growth rate. However, if no development occurs on USAFA which would drive an increase in traffic volumes, the volumes analyzed in this TIS are higher than what is anticipated and therefore provide conservative results. The results of the Horizon Year analyses are shown in Tables 6 and 7 below.

Table 6 – Horizon Year (2040) Intersection Operations

| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|------------------------------------|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 7.2 | A | 11.9 | B |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 12.8 | B | 12.4 | B |
| Northgate Boulevard/Struthers Road | Traffic Signal | 79.3 | E | 77.3 | E |

The intersection of Northgate Boulevard/Struthers Road shows an unacceptable LOS in both the AM and PM peak hours in 2040 without the addition of project traffic. Reviewing this in further detail reveals that the issue causing poor LOS is the high volume of westbound to northbound right-turning vehicles. This can be resolved in the addition of a right-turn arrow that comes on at the same time as the non-conflicting southbound left-turns. This is a relatively simple fix that can be achieved with signal timing changes and the addition of two traffic signal vehicle indications.

Table 7 – Horizon Year (2040) With Project Intersection Operations

| Intersection | Intersection Control | AM Peak Hour | | PM Peak Hour | |
|--|----------------------|--------------|-----|--------------|-----|
| | | Delay (sec.) | LOS | Delay (sec.) | LOS |
| I-25 NB Ramps/Northgate Boulevard | Roundabout | 9.9 | A | 17.2 | C |
| I-25 SB Ramps/Northgate Boulevard | Roundabout | 16.9 | C | 4.7 | A |
| Northgate Boulevard/Struthers Road | Traffic Signal | 22.2 | C | 22.2 | C |
| Northgate Boulevard/True North Commons | Traffic Signal | 9.5 | A | 24.3 | C |

The intersection of Northgate Boulevard/Struthers Road was assumed to have been mitigated before the project traffic (which does not impact where the traffic issues was located) was added. All study area intersections will operate at an acceptable LOS in 2040 with the addition of project traffic.

Findings and Conclusion

The TIS has documented that the proposed project can be developed without causing any of the study area intersections to require mitigation. The only intersection that requires mitigation is the Northgate Boulevard/Struthers Road intersection and the mitigation will be required by the horizon year with or without the additional traffic from the development. Therefore, no traffic mitigation measures are required for the proposed development of True North Commons.

If you have any questions, please feel free to contact me at your convenience.

Thank you.

Scott D. Barnhart, P.E., PTOE
Senior Associate of Transportation Services