

ECONOMICS · FINANCE · PLANNING

DATE:June 6, 2023TO:Garth Appanaitis, DKSFROM:Tyler Bump, Scott Goodman, and James Kim, ECONorthwestSUBJECT:Task 3.3 NSHA Economic Analysis

## A. Introduction

The City of Sweet Home is in the process of updating its Transportation System Plan (TSP). As a component of the update, the City is also creating a refinement plan for the North Sweet Home Area (NSHA). The area north of Albany and Eastern Railroad includes over 500 acres of undeveloped land, including natural resources and amenities. The NHSA is largely zoned for Recreational Commercial, which is intended for businesses that cater to tourists and recreational activity. The area also includes some existing residential and industrial uses.

The NSHA project includes a planning component that focuses on identifying and evaluating land use alternatives and zoning options to enable redevelopment opportunities and marketsupported uses in the NSHA. To that end, ECONorthwest conducted an economic analysis of the NSHA by reviewing its previous work for the City's 2017 Economic Opportunities Analysis (EOA), analyzing new employment data, and meeting with property owners and businesses who have an interest in seeing new development in the NSHA. As a result, we identified key areas of economic opportunity and land use alternatives for further evaluation.

## B. Key Takeaways from 2017 EOA

The 2017 EOA includes several key pieces of information, as follows.

"Sweet Home's primary competitive advantages are access to transportation, vacant buildable land, water and wastewater capacity, access to natural resources, relatively affordable housing, and high quality of life. These factors make Sweet Home attractive to residents and businesses that want a high quality of life where they live and work."<sup>1</sup>

### Access

New businesses and households in the NSHA will have access to the state highway system through U.S. Route 20 and State Route 228. U.S. Route 20 is particularly important for growing economic opportunities because it connects larger cities in the Willamette Valley like Albany and Lebanon to cities in Central Oregon like Sisters and Bend. Availability of surface transportation is necessary for connecting people to goods and destinations and connecting businesses to workers.

<sup>&</sup>lt;sup>1</sup> ECONorthwest, Sweet Home Economic Opportunities Analysis, Final Report, April 2017.

### Zoning

Most of the land in the NSHA is zoned for Recreation Commercial (RC) and vacant. The RC zone in the NSHA was originally intended to enable a large tourism-oriented development in the area. The zoning restricts uses to those related to tourist and recreation and does not allow common commercial and industrial uses. Within the current zoning there are opportunities for economic growth through RV parks, resorts, and other recreation retail and services. However, a zoning change to allow new commercial and industrial uses would further enhance economic development opportunities.

In Fall 2022 the City updated the Development Code and added a Mixed Use Employment Zone (MUE) designation. This update was accompanied by an update to the Comprehensive Plan map and all the properties currently zoned RC had the Comprehensive Plan designation changed to MUE. While existing zoning in the area was not changed during this process, the modification enables flexibility by providing the benefits of the existing RC zoning while facilitating future transition to the MUE.

### **Notable Sites**

The NSHA includes a former site of a lumber and plywood mill. The "Old Mill" site requires remediation activities before it can be repurposed for other uses. Linn County sold the site to Sweet Home Real Estate Restorations in 2022.<sup>2</sup>

The NSHA also includes a former gravel mine, now called "Quarry Park." The Quarry Park site is not suitable for new development due to natural constraints (i.e., wetlands and flood plain). The best use of this area may be as open space or an outdoor event venue. The site is now owned by the City of Sweet Home.

### **Target Industries**

Employment growth in the NSHA and the broader city is tied to the location along U.S. Route 20, access to workers and customers from across the mid-Willamette Valley, and availability of land. Target industries for employment growth in the City of Sweet Home per the 2017 EOA are:

- Manufacturing, because of the location along U.S. Route 20,
- Small-scale warehouse, distribution, and wholesale, because of the location along U.S. Route 20,
- **Professional and business services**, because of high quality of life and relatively affordable housing,

<sup>&</sup>lt;sup>2</sup> The New Era, "County commissioners agree to sell Sweet Home mill site to firm owned by Josh Victor," February 9, 2022, https://www.sweethomenews.com/story/2022/02/09/news/county-commissioners-agree-to-sell-sweet-home-mill-site-to-firm-owned-by-josh-victor/25402.html.

- Services for seniors, because of an aging population and attractiveness of Sweet Home for seniors,
- Services for visitors, because of availability of tourist-oriented land, and
- Services for residents, as the population in the city will grow.

To support these areas of employment growth, the NSHA needs to provide more commercial and industrial land with zoning that allows these uses. Broadening the types of uses allowed in the Recreation Commercial zone will attract new businesses and encourage greater development activity. While the City of Sweet Home has sufficient commercial and industrial land to support historical levels of growth, rezoning or changing use allowances of the Recreation Commercial zone in the NSHA is necessary to unlock new potential for growth.

### **Key Conclusions**

The EOA concluded that there is potential for new small-sized and mid-sized businesses to bring commercial and industrial employment to the City of Sweet Home. Though there is sufficient land to accommodate the projected growth, the employment forecast does not include additional potential for development on Recreation Commercial land. The untapped employment potential in the NSHA would be even greater if the City broadens the types of uses allowed in this zone or rezones some portion of the land. Industrial businesses such as food processors or wood product manufacturers could locate in this area with appropriate incentives.

## C. Employment Statistics

### **Employment Growth**

The 2017 EOA included employment data for the City of Sweet Home with the then-current data. ECONorthwest has updated the data for the most recently available year. Both data sets come from Oregon Employment Department<sup>3</sup>.

Comparison of employment data between 2014 and 2021, as shown in Figure 1, revealed noticeable employment growth in 5 industry groups.

- Construction
- Wholesale and Retail Trade<sup>4</sup>
- Transportation and Warehousing
- Health Care and Social Assistance

<sup>&</sup>lt;sup>3</sup> Because the raw data includes confidential information about individual businesses, the reported data is aggregated to ensure there are at least 3 firms in each group and no firm makes up more than 80 percent of total employment in the group.

<sup>&</sup>lt;sup>4</sup> Most of the jobs in this industry groups belong to Retail Trade industry.

Accommodation, Food Services, Arts, Entertainment, and Recreation

These industry groups are directly related to the target industries identified in the EOA. Employment related to transportation and warehousing is supported by the city's location along U.S. Route 20. Services of seniors are reflected in growth in the Health Care and Social Assistance industry group. Similarly, services for visitors are reflected in growth in the Accommodation, Food Services, Arts, Entertainment, and Recreation industry group. Allowing more commercial and industrial uses in the NSHA is critical for supporting the continued growth of these industry groups.

| Source: Oregon Employment Department, data aggregati  | ion and an | alysis by | ECONorthwest |
|---|------------|-----------|--------------|
| Industry  | 2014       | 2021      | Difference   |
| Agriculture, Forestry, Fishing and Hunting  | 94         | 95        | 1            |
| Construction  | 17         | 97        | 80           |
| Manufacturing   | 235        | 230       | (5)          |
| Wholesale and Retail Trade  | 327        | 441       | 114          |
| Transportation and Warehousing  | 23         | 108       | 85           |
| Information   | 20         | 23        | 3            |
| Finance and Insurance   | 34         | 29        | (5)          |
| Real Estate and Rental and Leasing  | 26         | 14        | (12)         |
| Professional, Scientific, and Technicial Services and Management of Companies and Enterprises | 11         | 29        | 18           |
| Administrative and Support and Waste<br>Management and Remediation Services                   | 35         | 27        | (8)          |
| Health Care and Social Assistance   | 201        | 292       | 91           |
| Accommodation, Food Services, Arts,<br>Entertainment, and Recreation                          | 237        | 286       | 49           |
| Other Services (except Public Administration)   | 95         | 52        | (43)         |
| Public Administration   | 529        | 134       | (395)        |
| Total (excluding Public Administration)   | 1,355      | 1,723     | 368          |

| Figure 1. Employment | in Sweet Home in | 2014 and 2021 |
|----------------------|------------------|---------------|
|----------------------|------------------|---------------|

A deeper look at the data revealed that more than half of the growth in the Health Care and Social Assistance industry group was due to reassignment of in-home care businesses from Other Services. About 50 businesses that used to be in the Other Services category are in the Health Care and Social Assistance category in the 2021 data. Even after discounting employment related to this reassignment, employment in the Health Care and Social Assistance industry group grew by about 40 percent between 2014 and 2021.

Notably, the large decrease in employment in the Public Administration industry group is unlikely to be actual employment loss for Sweet Home. It is more likely that some county, state, or federal jobs were counted in Sweet Home in 2014 but outside of Sweet Home in 2021.

Excluding changes in employment from the Public Administration industry group, total employment in Sweet Home increased by 368 jobs between 2014 and 2021. For comparison, data from the U.S. Census Bureau shows that employment increased by 315 jobs from 1,671 in 2014 to 1,986 in 2020.<sup>5</sup>

<sup>&</sup>lt;sup>5</sup> Based on reported from OnTheMap 6.23.1, which uses data from Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics (LODES). The latest year the data was available for was 2020.

### **Employment Distribution**

#### Figure 2. Share of Employment by Industry Group in Sweet Home, 2021

Source: Oregon Employment Department, data aggregation and analysis by ECONorthwest



In terms of concentration of employment in Sweet Home, the Wholesale and Retail Trade industry group makes up the largest (24 percent) portion of all employment. The three next largest are Health Care and Social Assistance (16 percent); Accommodation, Food Services, Arts, Entertainment, and Recreation (15 percent); and Manufacturing (12 percent). All these but Manufacturing are also industry groups that experienced large growths since 2014. Since Manufacturing is the fourth largest industry group by employment and a key industry identified in the EOA that did not experience growth since 2014, there may be untapped potential remaining.

### Average Pay

#### Figure 3. Average Pay per Employee in Sweet Home, 2021

Source: Oregon Employment Department, data aggregation and analysis by ECONorthwest



The City of Sweet Home should also consider the average pay of the industries it wants to grow. Attracting higher paying jobs could lead to faster growth, but they may be more difficult to attract. The average pay per employee of most of the industry groups that grew in recent years or were identified in the EOA is lower than that of other industry groups. Wholesale and Retail Trade; Health Care and Social Assistance; and Accommodation, Food Services, Arts, Entertainment, and Recreation industry groups have relatively low average pay per employee. The two highest paying industry groups in Sweet Home are Agriculture, Forestry, Fishing, and Hunting (\$61,354 per employee) and Finance and Insurance (\$56,442 per employee).

## D. Site Visit and Engagement Summary

The ECONorthwest project team visited the NSHA to observe existing land use conditions and meet with key stakeholders about potential development opportunities. The engagement activity yielded key information about ongoing efforts to redevelop the NSHA.

### Old Mill and Quarry Park Sites

The Old Mill site, located at the southwest end of the NSHA, is expected to be the centerpiece of future developments in the NSHA. A portion of the site is zoned for industrial and commercial uses, and approximately 18 lots are currently platted for residential use. Sweet Home Real Estate Restoration, the new owner of the site, has desires of creating an events center and additional commercial uses, beginning with the Southwest side of the site, east of 18<sup>th</sup> Avenue and south of Tamarack Street. The Sweet Home City Council plans to grow its tourism industry through outdoor events and recreation on the Old Mill site.

Moreover, improvements on the Old Mill site will create new amenities as well as new access points to the City's Quarry Park site. The City plans for the Quarry Park site to host 5 to 6 significant events per year. At the top of the list is creating a permanent site for the annual Oregon Jamboree, which is currently held on public school lands and brings in about 12,000 annual visitors.

A potential land use for the Old Mill site is new lodging space. Currently, accommodations for larger events are primarily limited to camping and RV. There are two small motels in Sweet Home and one hotel in Lebanon, which is about a 15-minute drive away. Additional local lodging would help support the desire for future large events.

To this end, Sweet Home Real Estate Restoration has already started plans for road improvements between 18<sup>th</sup> Avenue and Clark Mill Road. The City also has plans to widen 24<sup>th</sup> Avenue, which is located between 18<sup>th</sup> Avenue and Clark Mill Road, and provides direct access to the Old Mill site. The site has already undergone significant environmental remediation in preparation for development. The final "*No Further Action*" determination from the Department of Environmental Quality is expected for this site towards the end of 2023. There are aims to improve the road system and install stubs for water and wastewater infrastructure.

### **Existing and Planned Developments**

New residential and business locations are possible to the east of the Old Mill and Quarry Park sites. There are currently residential and industrial uses, and the City has approved a 42-lot subdivision for new houses, though recent market trends have made it more difficult to attract homebuilders. The industrial sites can have rail access with minor repairs, and the sites also have access to untreated water from a nearby City diverter. However, depending on the industrial use, the sites may require electrical improvements and significant gas improvements that link as far away as Albany, which is nearly 30 miles away.

The east end of the NSHA connects to Foster Lake, which already is a significant outdoor tourism attraction due to relatively constant water levels that allow for year-round aquatic access. The City hopes to develop a trail system connecting Foster Lake with the Santiam River, a lodge on the east side of Foster Lake, and an improved rail stop for the Lebanon Excursion train. Major property owners within the NSHA expressed interest and have shown initiative for collaborating to bring these visions to fruition.

## E. Identified Land Use Alternatives

Based on the review of the 2017 EOA, new employment data, and input from key stakeholders, ECONorthwest identified areas of economic opportunity for the NSHA and potential land use alternatives that could be considered to advance the community's goals.

Areas of economic opportunity are related to tourism and commercial and industrial activities. Tourism-related employment is currently supported by the Recreation Commercial zone, which makes up a large majority of the NSHA. On the other hand, current zoning is a primary barrier to commercial and industrial development. If allowed by zoning, "the types of large businesses that might consider locating in Sweet Home on Recreation Commercial sites include: general manufacturers, food processors, wood products manufacturers, heavy industrial manufacturers, or regionally scaled clean tech manufacturers. The area that may best support these employment uses is the relatively flat areas along the rail line."<sup>6</sup> If also allowed by-right, new residential uses could come to parts of the NSHA that are further from the rail line and closer to the South Santiam River. Alignment of the City's zoning to the recently updated Comprehensive Plan will support economic growth in the NSHA.

### Land Use Alternative 1

The Old Mill and the Quarry Park sites could be best developed within the current Recreation Commercial zone. There are ongoing plans for tourism-related developments on the sites, and the City supports growing its tourism economy through attractions on these sites. The Old Mill site could develop with new eating and drinking establishments, recreational retail shops, amusement or recreation services, and lodging spaces for people attending large events, like the Oregon Jamboree, which may be hosted at the Quarry Park site in the future. Among sites in the NSHA, the Old Mill site is positioned to have the best access points to U.S. Route 20 due to ongoing plans for road and rail crossing improvements. U.S. Route 20 is likely to bring in visitors from larger cities in the Willamette Valley and cities in Central Oregon. However, for the remainder of the NSHA, maintaining current zoning in this alternative would not leverage market opportunities for residential, commercial, and industrial investments that are best aligned with the site locations and advantages in the NSHA.

### Land Use Alternative 2

The best economic use for the Old Mill and the Quarry Park sites is the same for land use alternatives 1 and 2. The two sites are well-positioned for tourism-related developments. Other

<sup>&</sup>lt;sup>6</sup> ECONorthwest, Sweet Home Economic Opportunities Analysis, Final Report, April 2017.

parts of the NHSA face challenges to development because the current zoning does not support developments for new businesses and residents. However, recent Comprehensive Plan updates and future zoning changes can support greater economic opportunities through development in commercial and industrial industries, as well as new residential development.

New businesses could locate near the railroad to have easier access to rail or road. U.S. Route 20 is accessible via Clark Mill Road, and improvements to Clark Mill Road are under consideration. The new businesses could be related to a few of the target industries for employment growth: manufacturing, small-scale warehousing, distribution and wholesale, and services for seniors, such as medical services. To make the growth of these industries more likely, the City would need to provide more flexibility for employment-oriented uses that are aligned with the City's vision for the NSHA. Allowed uses could include light industrial, heavy industrial, medical offices, and medical supply stores.

For residential use, there already is an approved plan for a 42-lot subdivision. Future residential developments, including small-scale multifamily and senior housing, could cluster around existing and planned residential areas. Vacation homes and more recreation-oriented housing types could be desirable closer to the South Santiam River due to greater accessibility to natural amenities and greater distance apart from commercial and tourism businesses. The City would need to evaluate the types of housing they want to allow by-right by reviewing allowed uses and development standards for residential uses in the NSHA. This could mean either a change to the Recreation Commercial zone or rezoning parts of the NSHA to one of the City's residential zones. These efforts could be concentrated near areas that have existing or planned residential developments.

### **FUTURE FORECASTING - TECHNICAL MEMORANDUM #5**

| DATE:    | October 8, 2024                         |           |
|----------|---|-----------|
| TO:      | Project Management Team                 | - Current |
| FROM:    | Garth Appanaitis   DKS Associates       | 4         |
|          | Eileen Chai I DKS Associates            |           |
|          | Emily D'Antonio   DKS Associates        |           |
| SUBJECT: | Sweet Home TSP and NSHA Refinement Plan |           |
|          | TM#5 Future System Conditions           |           |



#### INTRODUCTION

This memorandum summarizes an assessment of transportation conditions in the Sweet Home Urban Growth Boundary (UGB) under a year 2045 "no-build" scenario. This scenario includes projected development and land use changes through the planning horizon but does not assume any additional improvements to the transportation system beyond those that currently exist. Future phases of analysis will confirm and evaluate potential transportation improvements.

#### FUTURE TRAFFIC FORECASTING PROCESS

Future traffic forecasting is an important step in the transportation planning process and provides estimates of future travel demand. This memorandum documents the traffic forecasting methodology and results associated with the small community model developed for the Sweet Home Transportation System Plan (TSP) Update. The small community modeling approach, in conjunction with post-processing, provides study intersection turn movement forecasts for the 2045 TSP horizon year.

#### METHODOLOGY OVERVIEW

The forecasting methodology associated with the small community model (also referred to as enhanced zonal cumulative analysis or EZCA) expands upon a cumulative analysis approach, as defined in the Oregon Department of Transportation (ODOT) Transportation Planning Analysis Unit's (TPAU's) *Analysis Procedures Manual Version 2 (APM V2)*. In the context of the traditional 4-step travel demand model approach, the typical cumulative analysis is used for trip generation and trip distribution purposes only. The result is a trip table (for growth increment only) that is used as an input into traffic assignment, where analysis is completed by manually assigning the new trips to a street network and then adding them to existing traffic volumes to estimate future volumes.



SWEET HOME TSP . TECHNICAL MEMO #5 . OCTOBER 8, 2024

1

The enhanced zonal cumulative analysis tool uses the same trip generation and trip distribution methodology as the typical cumulative analysis, but it applies the methodology to all land uses within the city (i.e., both existing uses as well as any future development based on a land use inventory). The enhanced tool then uses Visum modeling software and incorporates intersection node delay to complete the equilibrium trip assignment. The result is an improved traffic volume forecasting tool that dynamically assigns both new and existing trips to the transportation network using an equilibrium assignment procedure that represents routing choice more accurately than a manual assignment. It is more accurate due to its responsiveness to varying levels of congestion and delay as traffic patterns change. This tool enables a more comprehensive analysis of future conditions and potential TSP alternatives.

The following sections of this memorandum detail each component of the travel forecast methodology associated with the small community model, including the following:

- The Roadway Network,
- Transportation Analysis Zones (TAZs)
- Land Use
- Travel Demand

The resulting 2045 future projected volumes are also provided.

#### FORECAST TOOL COMPONENTS

The following sections summarize the forecast tool components that are used to forecast future traffic volumes.

#### **ROADWAY NETWORK**

The roadway network included in the Sweet Home TSP Visum forecast tool consists of the arterial and collector roadways along with most local public streets within the Sweet Home Urban Growth Boundary (UGB). The roadway network is also extended beyond the UGB to capture potential regional routing decisions that could result from future trips to/from Sweet Home and/or conditions in the local street system. These areas outside the UGB included in the model for potential routing purposes include:

- N River Drive (north side of the model area)
- Wiley Creek Road (east side of the model area)
- Shea Hill Drive (east side of the model area)

An existing roadway network was created using centerline data from Open Street Map. Additional roadway attributes were added based on an existing conditions inventory that included posted speeds, traffic control, lane geometries, and the number of travel lanes. The purpose of the existing conditions network was to configure the forecast tool and act as a base for the development of the future tool.

The 2045 future year baseline roadway network was then developed to represent the 2045 No-Build conditions. No committed transportation improvements were identified within the model area that are expected to influence traffic routing. Therefore, the 2045 No Build network is identical to the 2021 network. The 2045 future year network will be further refined as it is used to perform analysis of the various transportation alternatives and improvements to be analyzed for the Sweet Home TSP Update.

#### TRANSPORTATION ANALYSIS ZONES

For transportation forecasting purposes, the Sweet Home UGB was divided into 40 TAZs, which represent the location of various land uses and sources of vehicle trip generation within the city. These TAZ boundaries were determined based on geographical and physical features, allowing the best representation of access for an area, along with maintaining homogenous land use types as much as possible (e.g. residential, commercial, etc.). Centroid connectors were located to best represent access to the street network and major parking facilities. Additionally, 4 rural zones are located to the north of Sweet Home. These rural zones are included to capture land use and trip pattern interactions with areas inside the UGB. The internal TAZs are shown in Figure 1.



FIGURE 1. SWEET HOME TAZ MAP

#### LAND USE

Land use is a key factor affecting travel demands placed on Sweet Home's transportation system. The location, density, type, and mix of land uses have a direct impact on traffic levels and patterns. An existing 2021 land use inventory and future 2045 land use projection were performed for each TAZ in the Sweet Home UGB based on existing uses, zoning, and anticipated development patterns.

The housing and employment forecasts used for this TSP analysis are based on several key sources of data:

- The Coordinated Population Forecast, 2015 through 2065, for Sweet Home County Urban Growth Boundaries (UGB) and Area Outside UGBs, prepared by the Portland State University (PSU) Population Research Center, which provided the population forecast data.
- The 2021 American Community Survey, which provided average persons per household data.
- Oregon Employment Department inventory of Covered Employers and Employment that summarizes the job type and location of employers.
- The 2017 Sweet Home Economic Opportunities Analysis provided future employment projections in the city.

The base 2021 land use inventory approximated the number of households and the amount of retail employment, service employment, educational employment, and other employment that currently exist in each TAZ. Existing employment land uses within Sweet Home were obtained from Oregon Employment Department data and a review of other data sources (tax assessor data, census data, zoning data, and existing aerial photography). The existing land uses correspond to a population of 9,461 residents, which is based on PSU Population Research Center estimates. This corresponds to approximately 3,931 households based on an average household size of 2.46 (US Census data).

The future 2045 land use projection is an estimate of the amount of each land use (household and employment) that the TAZ could reasonably accommodate given market conditions and the current build-out of vacant or underdeveloped lands, assuming Comprehensive Plan zoning. The projected land uses correspond to a year 2045 population projection of approximately 11,246 residents. This corresponds to a 19 percent growth through the planning horizon.

A summary of the existing land use estimates and future projections for the entire Sweet Home UGB is listed in Table 1.

#### TABLE 1. SWEET HOME UGB LAND USE SUMMARY

| LAND USE / GROWTH<br>CATEGORY | EXISTING 2021<br>QUANTITIES | TOTAL GROWTH 2021<br>TO 2045 | FUTURE 2045<br>QUANTITIES |
|-------------------------------|-----------------------------|------------------------------|---------------------------|
| POPULATION                    | 9,461                       | 1,785 (+19%)                 | 11,246                    |
| HOUSEHOLDS                    | 3,986                       | 726 (+18%)                   | 4,712                     |
| EMPLOYEES                     |                             |                              |                           |
| RETAIL                        | 398                         | 75 (+20%)                    | 473                       |
| SERVICE                       | 275                         | 52 (+19%)                    | 327                       |
| INDUSTRIAL                    | 219                         | 41 (+19%)                    | 260                       |
| EDUCATION                     | 357                         | 67 (+19%)                    | 424                       |
| OTHER                         | 996                         | 188 (+18%)                   | 1184                      |
| TOTAL                         | 2245                        | 423 (+19%)                   | 2668                      |

#### TRAVEL DEMANDS

Travel demand on roadways and at intersections in Sweet Home was estimated using the ODOT APM V2 methodology for the EZCA method. This methodology included estimating all vehicle trips (not just growth increments), adjusting the trip distribution to reduce household-to-household trips, and using Visum modeling software to perform the trip assignment. Travel forecasting was performed for the 30<sup>th</sup> highest hour conditions for both 2021 and 2045. The purpose of the 2021 forecast tool was to calibrate the network in preparation for developing the 2045 network, which would then be used for future analysis.

The travel demand analysis includes the translation of City land use information into motor vehicle trips. This was done for each of the TAZs based on the existing and projected land uses described previously in the Land Use section of this memorandum. Trips traveling to and from the external TAZs were also estimated for both the 2021 and 2045 analysis years. The following section describes the methodology used to determine the different trip types and how the trips were distributed and assigned to the roadway network.

#### TRIP TYPES

Travel forecast projections involve the determination of three distinct types of trips, which are categorized based on whether their origin and/or destination (i.e., the trip ends) are internal or external to the Sweet Home UGB. The three trip types and how they apply to Sweet Home are:

• **External-External (E-E) Trips** do not have an origin or destination in Sweet Home and either do not stop or only make a very minor stop while passing through the Sweet Home

UGB. These trips are typically referred to as "through traffic." An example would be a person from Corvallis traveling on US 20 while heading to Bend.

- Internal-External (I-E) Trips originate in Sweet Home and are traveling to a location outside of the Sweet Home UGB (e.g., someone working in Sweet Home that returns north to Lebanon in the evening), while External-Internal (E-I) Trips originate outside of the Sweet Home UGB and are traveling to a location within Sweet Home (e.g., someone from Lebanon traveling into Sweet Home for shopping).
- **Internal-Internal (I-I) Trips** travel from one location within the Sweet Home UGB to another location within the UGB. An example would be a person traveling between their office and home within Sweet Home.

#### EXTERNAL TRIP ENDS

External trip ends are the origin and/or destination of E-E, I-E, or E-I trips and were estimated for the 30<sup>th</sup> highest hour conditions at each of the gateways for both 2021 and 2045.

The number of 2021 external trip ends was based on existing traffic volumes at key gateways:

- North: US 20 north of Osage St
- West: Oregon 228 (Halsey-Sweet Home Highway) west of Fern Ridge Rd/Rowell Hill Rd
- South: Old Holley Road east of Elkhorn St
- South: 21<sup>st</sup> Avenue southwest of Cedar St
- South: Ames Creek Road west of Surrey Ln
- South: 43<sup>rd</sup> Avenue south of Coulter Ln
- South: 50<sup>th</sup> Ave to the south of Airport Rd
- South: Wiley Creek Road east of Riggs Hill Rd
- East: Shea Hill Drive east Riggs Hill Rd
- East: US 20 east of Riggs Hill Rd/Shea Viewpoint
- North: N River Drive east of Foster Dam Rd
- North: Pleasant Valley Road north of Northside Drive

Replica<sup>1</sup>, a web-based data model that includes travel estimation, was used to estimate the portion of through traffic compared to the portion of traffic with either an origin or destination within Sweet Home. The Replica data model is based on "big data" (mobile network) sources and reflects travel trends experienced over a duration of time. The datasets provide an estimate of travel behavior based on sampled conditions. The regional travel patterns are summarized in Table 2.

<sup>&</sup>lt;sup>1</sup> https://www.replicahq.com/

#### TABLE 2. REGIONAL TRAVEL PATTERNS OBSERVED AT EXTERNAL GATEWAYS

|   | PERCENT ENTE                              | RING TRAFFIC  | PERCENT EXITING TRAFFIC |                               |  |
|---|---|---|-------------------------|-------------------------------|--|
| GATEWAY   | WITH A<br>DESTINATION<br>IN SWEET<br>HOME | WITH A WITH AN<br>ESTINATION EXTERNAL<br>IN SWEET DESTINATION<br>HOME |                         | WITH AN<br>EXTERNAL<br>ORIGIN |  |
| NORTH: US 20 NORTH OF<br>OSAGE ST                     | 72%                                       | 28%   | 87%                     | 13%                           |  |
| WEST: OR 228 EAST OF FERN<br>RIDGE RD/ROWELL HILL RD  | 78%                                       | 22%   | 72%                     | 28%                           |  |
| SOUTH: OLD HOLLEY ROAD<br>EAST OF ELKHORN ST          | 63%                                       | 37%   | 83%                     | 17%                           |  |
| SOUTH: 21ST AVENUE<br>SOUTHWEST OF CEDAR ST           | 33%                                       | 67%   | 35%                     | 65%                           |  |
| SOUTH: AMES CREEK ROAD<br>WEST OF SURREY LN           | 42%                                       | 58%   | 40%                     | 60%                           |  |
| SOUTH: 43RD AVENUE SOUTH<br>OF COULTER LN             | 36%                                       | 64%   | 50%                     | 50%                           |  |
| SOUTH: 50TH AVE TO THE<br>SOUTH OF AIRPORT RD         | 60%                                       | 40%   | 55%                     | 45%                           |  |
| SOUTH: WILEY CREEK ROAD<br>EAST OF RIGGS HILL RD      | 33%                                       | 67%   | 52%                     | 48%                           |  |
| EAST: SHEA HILL DRIVE EAST<br>RIGGS HILL RD           | 83%                                       | 17%   | 50%                     | 50%                           |  |
| EAST: US 20 EAST OF RIGGS<br>HILL RD/SHEA VIEWPOINT   | 20%                                       | 80%   | 17%                     | 83%                           |  |
| NORTH: N RIVER DRIVE EAST<br>OF FOSTER DAM RD         | 59%                                       | 41%   | 35%                     | 65%                           |  |
| NORTH: PLEASANT VALLEY RD<br>NORTH OF NORTHSIDE DRIVE | 67%                                       | 33%   | 65%                     | 35%                           |  |
| AVERAGE OF ALL GATEWAYS                               | 54%                                       | 46%   | 53%                     | 47%                           |  |

Source: Replica Trip Count Data taken from 3:00-7:00 pm

Table 2 indicates that most external gateways have a trip end (origin or destination) in Sweet Home. Approximately 20 to 80 percent of external trips (varies by location) are destined for another external location as a "through trip." The east end of US 20 includes the highest portion of external trips – approximately 80 percent of these trips travel through Sweet Home.

The external trip ends that have an internal pair are modeled to pair with the internal trip ends of corresponding land uses within the city (e.g., housing and employment). This modeling process is explained further in the "Trip Distribution" section of this memorandum.

Growth estimates were applied to each gateway to determine 2045 external trip ends for through traffic. The ODOT Future Projected Annual Average Daily Traffic Tables provided data for estimating future growth. The annual growth rates and associated growth factors for each external gateway are shown in Table 3.

| GATEWAY                          | 2021 AADT | 2041 AADT | ANNUAL GROWTH<br>RATE | GROWTH<br>FACTOR (FROM<br>2021 TO 2045) |
|----------------------------------|-----------|-----------|-----------------------|---|
| US 20, EAST OF OSAGE ST          | 10614     | 11000     | 0.18%                 | 1.04                                    |
| OR 228, EAST OF FERN<br>RIDGE RD | 4318      | 4500      | 0.21%                 | 1.05                                    |
| US 20, EAST OF RIGGS HILL<br>RD  | 2262      | 2400      | 0.31%                 | 1.07                                    |

| TABLE 3. | EXTERNAL | GATEWAY | GROWTH | FORECASTS | FOR | SWEET | HOME |
|----------|----------|---------|--------|-----------|-----|-------|------|

Source: ODOT Future Projected Annual Average Daily Traffic Tables, Calculated annual growth forecasts

As listed in Table 3, traffic volumes at external gateways are expected to grow by approximately five percent (four to seven percent) total over the period from 2021 to 2045.

#### **INTERNAL TRIP ENDS**

The number of internal trip ends in Sweet Home was determined using a land use-based trip generation methodology, which translates land use quantities (number of dwelling units or number of employees) into vehicle trip ends (number of vehicles entering or leaving a TAZ) based on empirically derived trip generation rates. These rates were generally developed based on initial values from the Institute of Transportation Engineers (ITE) *Trip Generation Manual* as a starting point that have been further adjusted based on similar local modeling efforts in other Oregon communities.<sup>2</sup> The trip rates that have been developed from experience in other communities were used as a starting point and further calibrated to observed traffic counts in Sweet Home. Local calibration to the trip rates using Sweet Home traffic counts included a combination of strategies that compared observed count data with known land use quantities (e.g., road(s) serving a

<sup>&</sup>lt;sup>2</sup> Trip generation rates for the small community forecast tool have evolved through the development of several small community models in Oregon. Original trip generation estimates were based on ITE Trip Generation rates, however, those rates were consistently determined to be too high relative to observed traffic count data. While ITE trip generation data may accurately reflect driveway counts (or trip ends) for a specific use during that use's peak hour, the small community tool represents trips (including both ends of the trip) during a peak hour common to all the uses, which may have slightly different individual peaking characteristics. The small community tool uses a limited number of trip generation estimates (typically retail, service and other employment) to represent all the various land use types within a community, and one single ITE rate does not reflect the variety of uses, even within a category (e.g. retail). Through the development of small community models in cities including Sisters, Hood River, Canby, Junction City, Tillamook, Scappoose, and Silverton, DKS has observed trip generation rates consistently lower than ITE would indicate. Each of these tools were calibrated to traffic data collected for the respective community. The prior rates were used as a starting point for Sweet Home and calibrated to traffic counts observed in Sweet Home.

residential development of known units, or driveways serving primarily retail uses). Weekday PM peak hour trip generation rates used in the forecast tool are listed in Table 4.

| LAND USE  | TRIPS IN | TRIPS OUT | TOTAL TRIP ENDS |
|---|----------|-----------|-----------------|
| SINGLE-FAMILY HOUSEHOLDS (PER<br>DWELLING UNIT) | 0.50     | 0.30      | 0.80            |
| MULTI-FAMILY HOUSEHOLDS (PER DWELLING<br>UNIT)  | 0.40     | 0.20      | 0.60            |
| RETAIL (PER EMPLOYEE)                           | 1.88     | 2.12      | 4.00            |
| SERVICE (PER EMPLOYEE)                          | 0.73     | 0.92      | 1.65            |
| EDUCATION (PER EMPLOYEE)                        | 0.84     | 0.91      | 1.75            |
| OTHER (PER EMPLOYEE)                            | 0.05     | 0.25      | 0.30            |

TABLE 4. AVERAGE WEEKDAY PM PEAK HOUR TRIP GENERATION RATES BY LAND USE

Source: Institute of Transportation Engineers Trip Generation Manual and local traffic counts

By applying these trip generation rates to the TAZ land uses, the number of trips entering and exiting each TAZ in Sweet Home was estimated. Internal trip estimates were obtained for both the existing 2021 land uses and the projected 2045 land uses.

#### TRIP DISTRIBUTION

Trip distribution was performed to estimate how many trips travel between each of the internal TAZs. Distribution for trips traveling to and from internal zones (i.e., trips having at least one internal trip end) was based on weighting the attractiveness of each zone, as measured by the number of trip ends generated by the zone.

The forecasting model is based on a trip table that describes the internal and external trip ends for each trip within the network. To develop this trip table, External-to-External (E-E) trips are matched based on the external trip probabilities. Next, all remaining external trips (I-E and E-I) are paired with appropriate internal trip ends. These trips represent the inbound and outbound travel for Sweet Home residents and employees, respectively. Finally, the Internal-Internal (I-I) trip pairs are determined based on the land uses within Sweet Home. Note that the rural zones adjacent to Sweet Home, but outside the UGB, were also considered for I-I trip purposes.

#### TRIP ASSIGNMENT

Trip assignment involves the determination of the specific travel routes taken by the trips within the transportation network. This step was performed using Visum modeling software. Forecast tool inputs included the transportation network (i.e., road and intersection locations and characteristics, as determined from maps and field inventories) and a trip distribution table (described in prior sections). Iterated equilibrium assignment was then performed using estimated travel times along roadways and delays at intersection movements. The path choice for each trip was based on minimal travel times between locations. Forecast tool outputs include traffic volumes on roadway segments and at intersections.

#### CALIBRATION

A model calibration was performed on the 2021 base year forecast tools by comparing forecast tool turn volumes at the Sweet Home TSP study intersections with actual counted (measured) 2021 traffic volumes. A plot comparing the measured traffic volumes and the base year forecast tool volumes for all study intersection turn movements was analyzed to evaluate the accuracy of each forecast tool and is shown in Figure 2. As shown in Figure 2, the forecast tool (model) is generally reflective of the traffic counts (R<sup>2</sup> is 0.97 and is very close to the target of 1.0). Further, the y value of 1.048 indicates that the model is only narrowly overestimating traffic counts at 4.8 percent, which is well within the range of daily traffic fluctuations.



## FIGURE 2. COMPARISON OF OBSERVED TURN MOVEMENT COUNTS WITH MODELED TRAFFIC VOLUMES (PM PEAK HOUR)

#### FORECAST TOOL VOLUMES AND POST-PROCESSING

Forecast tool traffic growth plots (2045 minus 2021) for the design hour forecast tool are included in the appendix. While the travel demand forecast tools were calibrated to local conditions and volumes, raw volumes from the tools were not used for capacity analysis. Rather, motor vehicle turn movement volume forecasts will be developed using post-processing methods consistent with the ODOT APM V2. This approach is derived from methodologies outlined in the National Cooperative Highway Research Program (NCHRP) Report 765, *Analytical Travel Forecasting Approaches for Project-Level Planning and Design*.

The post-processing methodology involves estimating trip growth at the intersection approach level (i.e., volume differences between base and future forecast tools), scaling the growth by the number of forecast years (i.e., forecast years divided by the difference in forecast tool years), and adding these volumes to existing traffic counts. Engineering judgment is used as part of the post-processing methodology, with the routing decisions identified by the forecasting tool serving as a reference for making volume adjustments. The results of this process are future-year forecasts derived from the Sweet Home enhanced cumulative analysis forecasting tool that are calibrated to observed data. The year 2045 traffic volume forecasts will serve as a future base volume forecast from which future conditions will be evaluated in subsequent memoranda. The 2045 traffic volume forecasts are included in the appendix.

#### **FUTURE 2045 CONDITIONS**

The future 2045 no-build traffic volumes were evaluated for the study intersections to determine the intersection operating conditions. Under existing conditions, only a single intersection (Main Street / Pleasant Valley Road) exceeds the mobility target. However, the additional growth in traffic volumes, particularly in areas parallel to and crossing the highway adjacent to the growth that is projected to occur in the North Sweet Home Area (NSHA), would cause three more locations to exceed the mobility targets:

- Main Street (US 20) / 22nd Avenue
- Main Street (US 20) / Clark Mill Road
- Main Street (US 20) / 47th Avenue

This increase in delay is due to an increase in vehicle volumes within the NSHA and indicates that additional connectivity within the area, as well as connecting to the rest of the city, will be important in future development.

#### TABLE 5: EXISTING (2021) AND FUTURE (2045) TRAFFIC OPERATIONS AT STUDY INTERSECTIONS - WEEKDAY PM PEAK HOUR

|  | CONTROL                                   | MOBILITY                                |                       | EXIST                         | ING              |                              | FUTURE 2045       |                      |  |  |
|--|---|---|-----------------------|-------------------------------|------------------|------------------------------|-------------------|----------------------|--|--|
| INTERSECTION   | ΤΥΡΕ <sup>Α</sup>                         | STANDARD                                | LOS                   | DELAY <sup>B</sup><br>(SEC)   | V/C <sup>c</sup> | LOS                          | DELAY<br>(SEC)    | V/C                  |  |  |
| 1. MAIN<br>STREET (U.S.<br>20) AND<br>PLEASANT<br>VALLEY ROAD  | TWSC                                      | v/c≤0.85 A/F 10/97 0.23 <b>/ 0.91</b> , |                       | A/F                           | 10/>100          | 0.25 <b>/</b><br><b>1.05</b> |                   |                      |  |  |
| 2. MAIN<br>STREET (U.S.<br>20) AND<br>HOLLEY ROAD<br>(HWY 228) | Signal                                    | v/c ≤ 0.90                              | c≤0.90 B 12 0.65 B 13 |                               | 13               | 0.70                         |                   |                      |  |  |
| 3. MAIN<br>STREET (U.S.<br>20) AND 12 <sup>TH</sup><br>AVENUE  | Signal                                    | v/c ≤ 0.90                              | A                     | 5                             | 0.64             | A                            | 4                 | 0.70                 |  |  |
| 4. MAIN<br>STREET (U.S.<br>20) AND 15 <sup>TH</sup><br>AVENUE  | Signal v/c ≤ 0.9                          |   | A                     | 5                             | 0.68             | A                            | 8                 | 0.88                 |  |  |
| 5. MAIN<br>STREET (U.S.<br>20) AND 18 <sup>TH</sup><br>AVENUE  | Signal                                    | v/c ≤ 0.90                              | A                     | 6                             | 0.67             | A                            | 7                 | 0.84                 |  |  |
| 6. MAIN<br>STREET (U.S.<br>20) AND 22 <sup>ND</sup><br>AVENUE  | TWSC                                      | v/c ≤ 0.90                              | A/E                   | 10/35                         | 0.20/ 0.34       | B/F                          | 12/>100           | 0.32/<br><b>1.58</b> |  |  |
| 7. MAIN<br>STREET (U.S.<br>20) AND 24 <sup>TH</sup><br>AVENUE  | TWSC                                      | v/c ≤ 0.90                              | A/D                   | 9/27                          | 0.19/ 0.15       | B/F                          | 12/>100           | 0.34/<br>0.58        |  |  |
| 8. MAIN<br>STREET (U.S.<br>20) AND<br>CLARK MILL<br>ROAD       | AIN<br>ET (U.S.<br>AND TWSC v/c<br>K MILL |   | A/C                   | 9/19                          | 0.17/ 0.16       | B/F                          | 13/>100           | 0.36/ <b>3.06</b>    |  |  |
| 9. MAIN<br>STREET (U.S.<br>20) AND 44 <sup>TH</sup><br>AVENUE  | TWSC                                      | v/c ≤ 0.85                              | A/C                   | 9/22                          | 0.15/ 0.18       | B/F                          | 10/>100           | 0.25/<br>0.77        |  |  |
| 10. MAIN<br>STREET (U.S.<br>20) AND 47 <sup>TH</sup><br>AVENUE | TWSC                                      | v/c ≤ 0.85                              | A/C                   | A/C 9/19 0.14/ 0.16 A/F 10/>1 |                  | 10/>100                      | 0.26/ <b>1.67</b> |                      |  |  |

| INTERSECTION   | CONTROL           | MOBILITY                          |   | EXIST                       | ING              | FUTURE 2045   |                |               |  |
|--|-------------------|-----------------------------------|---|-----------------------------|------------------|---------------|----------------|---------------|--|
| INTERSECTION   | ΤΥΡΕ <sup>Δ</sup> | STANDARD                          | LOS                                     | DELAY <sup>B</sup><br>(SEC) | V/C <sup>c</sup> | LOS           | DELAY<br>(SEC) | V/C           |  |
| 11. MAIN<br>STREET (U.S.<br>20) AND 49 <sup>TH</sup><br>AVENUE                         | TWSC              | v/c ≤ 0.85                        | A/B                                     | 9/14                        | 0.12/ 0.13       | A/C           | 9/17           | 0.15/<br>0.24 |  |
| 12. MAIN<br>STREET (U.S.<br>20) AND 53 <sup>RD</sup><br>AVENUE                         | TWSC              | v/c ≤ 0.85                        | v/c ≤ 0.85 A/C 8/20 0.23/ 0.15 A/D 8/28 |                             | 8/28             | 0.26/<br>0.20 |                |               |  |
| 13. MAIN<br>STREET (U.S.<br>20) AND 54 <sup>TH</sup><br>AVENUE                         | TWSC              | v/c ≤ 0.85                        | c≤0.85 A/B 8/13 0.25/0.08 A/B 8/        |                             | 8/11             | 0.28/0.07     |                |               |  |
| 14. MAIN<br>STREET (U.S.<br>20) AND 60 <sup>TH</sup><br>AVENUE<br>(FOSTER DAM<br>ROAD) | TWSC              | VSC v/c≤0.85 A/C 8/19             |   | 8/19                        | 0.18/ 0.09       | A/C           | 8/22           | 0.20/<br>0.05 |  |
| 15. HOLLEY<br>ROAD (HWY<br>228) AND 1 <sup>ST</sup><br>AVENUE                          | TWSC              | v/c ≤ 0.95                        | 95 A/C 8/16 0.25/ 0.29 A/C              |                             | 8/17             | 0.26/<br>0.33 |                |               |  |
| 16. HOLLEY<br>ROAD (HWY<br>228) AND OAK<br>TERRACE                                     | TWSC              | SC v/c ≤ 0.95 A/C 8/16 0.17/ 0.23 |   | 0.17/ 0.23                  | A/C              | 8/18          | 0.20/<br>0.25  |               |  |
| 17. LONG<br>STREET AND<br>18 <sup>™</sup> AVENUE                                       | AWSC              | LOS D                             | В                                       | 10                          | 0.32             | В             | 11             | 0.37          |  |
| 18. LONG<br>STREET AND<br>43 <sup>RD</sup> AVENUE                                      | AWSC              | LOS D                             | А                                       | 8                           | 0.11             | A             | 9              | 0.23          |  |
| 19. ELM<br>STREET AND<br>10 <sup>™</sup> AVENUE  | TWSC              | LOS D                             | S D A/B 7/11 0.06/ 0.08 A,              |                             | A/B              | 7/11          | 0.08/<br>0.08  |               |  |

A. AWSC: All Way Stop Control, TWSC: Two Way Stop Control

B. Overall intersection measures reported for signal and AWSC intersections. The worst approach for major/minor approaches is reported for TWSC intersections.

C. Values in Bold exceed mobility standards.

#### **MULTI-MODAL ASSESSMENT**

#### **PEDESTRIAN NETWORK**

Sidewalks are located in all of the commercial areas along Main Street and are well connected with most streets. Development of the NSHA plan will improve pedestrian connectivity in North Sweet Home through the development of a trail system as well as improvements to the roadway network.

#### **BICYCLE NETWORK**

There are several designated bike routes and lanes within Sweet Home's downtown area, including portions of Main Street and Long Street. There are no separated cycling facilities in Sweet Home, but there are painted bike lanes present along a large portion of Main Street and one segment of Long Street between 22<sup>nd</sup> Avenue and 25<sup>th</sup> Avenue. Like with the pedestrian network, development of the NSHA plan will improve cyclist connectivity in North Sweet Home through the development of a multi-use path and improvements to the roadway network.

#### TRANSIT NETWORK

As noted in Technical Memo #3, transit service is provided in Sweet Home through three main routes:

- The Linn Shuttle
- The Sweet Home Shopper
- Dial-A-Bus Service

#### FUTURE DEFICIENCIES

#### **ROADWAY NETWORK**

As previously noted, projected future vehicle volumes will result in the exceeding of mobility targets at four study intersections. Improving traffic controls and/or adding new routes within the Sweet Home roadway network for traffic using Clark Mill Road, 22<sup>nd</sup> Ave, 47<sup>th</sup> Ave, and Pleasant Valley Road will be necessary to mitigate the delay from these volume increases.

#### **PEDESTRIAN NETWORK**

With increases in vehicle volumes due to the NSHA Plan, sidewalk deficiencies along Clark Mill Road, 47<sup>th</sup> Avenue, and Long Street will be important to fill. Currently, vehicle volumes along Clark Mill Road and 47<sup>th</sup> Avenue are low, but these will be key tie in streets to the new roadway network developed in the area. Completing the sidewalk network along these streets will also provide better pedestrian connections to the newly developed area for those currently living in West Sweet Home. In addition to filling in the sidewalk gaps, there is also a need to provide safer and convenient crossing opportunities on Main Street. Pedestrian Network gaps are shown in Figure 3 below.





#### **BICYCLIST NETWORK**

The bike network within Sweet Home will be improved through the development of the NSHA plan and the addition of a new multi-use path. Improving bicycle facilities along Long Street will improve east west connectivity and better connect West Sweet Home with future NSHA development.

Main Street currently has a high level of stress (LTS) for cyclists even with the current marked bike lane. Long Street, OR 228, and other arterials or collectors with an LTS of 3 or greater are places in need of improved cycling infrastructure. A map of current LTS within Sweet Home is shown in Figure 4 below.



**FIGURE 4. BICYCLE LEVEL OF STRESS** 

#### TRANSIT

The Linn Shuttle and Sweet Home Shopper currently provide most transit connections within Sweet Home as previously noted. These services do not currently provide access to the NSHA. Filling that transit gap will be optimal to provide access to the newly developed area.

### **ATTACHMENTS**

### CONTENTS

ATTACHMENT A: HOUSEHOLD GROWTH BY TAZ ATTACHMENT B: EMPLOYMENT GROWTH BY TAZ ATTACHMENT C: 2045 NO BUILD TRAFFIC VOLUMES ATTACHMENT D: TRAFFIC GROWTH PLOTS ATTACHMENT E: FUTURE CONDITION HCM REPORTS

### ATTACHMENT A: HOUSEHOLD GROWTH BY TAZ



FIGURE 5. 2021-2045 PROJECTED HOUSEHOLD GROWTH BY TAZ

### ATTACHMENT B: EMPLOYMENT GROWTH BY TAZ



FIGURE 6. 2021-2045 PROJECTED EMPLOYMENT GROWTH



### ATTACHMENT C: 2045 NO BUILD TRAFFIC VOLUMES

#### TABLE A1: 2045 PM PEAK HOUR 30 HV TRAFFIC VOLUMES

| N/S                      | E/W                      | NBL | NBT | NBR | SBL | SBT | SBR | EBL | EBT  | EBR | WBL | WBT  | WBR |
|--------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|------|-----|
| Pleasant Valley Rd       | Hwy 20 (Main St)         | 0   | 0   | 5   | 100 | 0   | 50  | 75  | 755  | 0   | 0   | 565  | 110 |
| Hwy 228 (Holley Road)    | Hwy 20 (Main St)         | 125 | 0   | 225 | 0   | 5   | 5   | 5   | 810  | 90  | 195 | 605  | 0   |
| 12th Ave                 | Hwy 20 (Main St)         | 45  | 20  | 20  | 25  | 25  | 35  | 65  | 900  | 75  | 60  | 790  | 20  |
| 15th Ave                 | Hwy 20 (Main St)         | 20  | 40  | 25  | 85  | 30  | 20  | 65  | 895  | 60  | 70  | 890  | 50  |
| 18th Ave                 | Hwy 20 (Main St)         | 95  | 35  | 100 | 65  | 15  | 60  | 50  | 935  | 50  | 50  | 940  | 35  |
| 22nd Ave                 | Hwy 20 (Main St)         | 40  | 5   | 35  | 30  | 10  | 20  | 5   | 1055 | 55  | 15  | 945  | 30  |
| 24th Ave                 | Hwy 20 (Main St)         | 20  | 0   | 5   | 5   | 0   | 35  | 15  | 1055 | 50  | 5   | 1005 | 5   |
| Clark Mill Rd            | Hwy 20 (Main St)         | 15  | 0   | 30  | 45  | 5   | 170 | 230 | 760  | 115 | 65  | 850  | 50  |
| 44th Ave                 | Hwy 20 (Main St)         | 50  | 0   | 20  | 10  | 0   | 20  | 20  | 695  | 105 | 60  | 740  | 0   |
| 47th Ave                 | Hwy 20 (Main St)         | 15  | 10  | 5   | 65  | 5   | 260 | 210 | 495  | 5   | 5   | 460  | 50  |
| 49th Ave                 | Hwy 20 (Main St)         | 35  | 0   | 50  | 0   | 0   | 0   | 0   | 440  | 65  | 35  | 440  | 0   |
| 53rd Ave                 | Hwy 20 (Main St)         | 30  | 0   | 5   | 5   | 10  | 35  | 45  | 390  | 50  | 5   | 395  | 10  |
| 54th Ave                 | Hwy 20 (Main St)         | 0   | 0   | 0   | 0   | 0   | 35  | 15  | 370  | 10  | 0   | 350  | 5   |
| 60th Ave (Foster Dam Rd) | Hwy 20 (Main St)         | 10  | 0   | 0   | 5   | 0   | 60  | 85  | 290  | 5   | 0   | 275  | 10  |
| 1st Ave                  | Hwy 228 (Holley<br>Road) | 0   | 0   | 5   | 35  | 10  | 75  | 40  | 290  | 5   | 0   | 270  | 25  |
|                          | Hwy 228 (Holley          |     |     |     |     |     |     |     |      |     |     |      |     |
| Oak Terrace              | Road)                    | 70  | 0   | 10  | 0   | 0   | 0   | 0   | 265  | 100 | 20  | 270  | 0   |
| 18th Ave                 | Long St                  | 35  | 85  | 15  | 30  | 70  | 25  | 65  | 75   | 35  | 15  | 130  | 75  |
| 43rd Ave                 | Long St                  | 35  | 25  | 5   | 10  | 40  | 65  | 65  | 50   | 50  | 0   | 25   | 10  |

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#### TABLE A2: 30 HV TRAFFIC GROWTH (2021 TO 2045)

| N/S                      | E/W                      | NBL | NBT | NBR | SBL | SBT | SBR | EBL | EBT | EBR | WBL | WBT | WBR |
|--------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pleasant Valley Rd       | Hwy 20 (Main St)         | -1  | 0   | 1   | 4   | 0   | 1   | 0   | 55  | -2  | -2  | 39  | 5   |
| Hwy 228 (Holley Road)    | Hwy 20 (Main St)         | 9   | 0   | 34  | -2  | 1   | 1   | -1  | 76  | 10  | 34  | 68  | -1  |
| 12th Ave                 | Hwy 20 (Main St)         | -2  | 2   | 1   | -2  | -1  | 2   | 2   | 144 | 13  | 18  | 170 | 6   |
| 15th Ave                 | Hwy 20 (Main St)         | 2   | -2  | 7   | 13  | 7   | -1  | 1   | 193 | 16  | 37  | 269 | 19  |
| 18th Ave                 | Hwy 20 (Main St)         | 25  | 13  | 33  | 36  | 6   | 30  | 14  | 243 | 1   | 7   | 325 | 15  |
| 22nd Ave                 | Hwy 20 (Main St)         | 13  | 0   | 14  | 5   | 0   | -1  | -1  | 359 | 10  | 6   | 380 | 4   |
| 24th Ave                 | Hwy 20 (Main St)         | 1   | 0   | 0   | -1  | 0   | 2   | 1   | 443 | 5   | 2   | 451 | 1   |
| Clark Mill Rd            | Hwy 20 (Main St)         | 0   | -1  | 2   | 34  | 4   | 130 | 197 | 207 | 57  | 34  | 346 | 43  |
| 44th Ave                 | Hwy 20 (Main St)         | 21  | -1  | 9   | 6   | 0   | 9   | 10  | 234 | 41  | 25  | 287 | -1  |
| 47th Ave                 | Hwy 20 (Main St)         | 10  | 9   | 2   | 51  | 3   | 211 | 178 | 62  | -2  | 2   | 77  | 41  |
| 49th Ave                 | Hwy 20 (Main St)         | 14  | 0   | 21  | 0   | 0   | 0   | 0   | 55  | 22  | 13  | 77  | 0   |
| 53rd Ave                 | Hwy 20 (Main St)         | 2   | -1  | -2  | 1   | 5   | 15  | 14  | 53  | 3   | 1   | 59  | 4   |
| 54th Ave                 | Hwy 20 (Main St)         | 0   | -1  | -2  | -2  | -1  | 4   | 3   | 44  | 1   | -1  | 45  | 1   |
| 60th Ave (Foster Dam Rd) | Hwy 20 (Main St)         | 1   | 0   | 0   | 1   | 0   | 11  | 14  | 31  | -1  | -2  | 36  | 0   |
| 1st Ave                  | Hwy 228 (Holley<br>Road) | -1  | -1  | 2   | 2   | 2   | 3   | 0   | 13  | 2   | -2  | 29  | 1   |
| Oak Terrace              | Hwy 228 (Holley<br>Road) | -1  | 0   | -1  | 0   | 0   | 0   | 0   | 30  | 2   | 1   | 45  | 0   |
| 18th Ave                 | Long St                  | -1  | 18  | 1   | 4   | 4   | 2   | 21  | 1   | 1   | 1   | 2   | 26  |
| 43rd Ave                 | Long St                  | 18  | 18  | 2   | 6   | 30  | 37  | 41  | 9   | 31  | -1  | -1  | 5   |

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### **ATTACHMENT D: TRAFFIC GROWTH PLOTS**

SweetHome Model Connectors



VISUM 2023.01 PTV AG

CommunityModel\_Future\_V1.ver



### ATTACHMENT E: FUTURE CONDITION HCM REPORTS

#### Intersection

Int Delay, s/veh

| Movement EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL S          | BT SBR  |
|---|---------|
| Lane Configurations 🎽 🐴 🎁 👬                                 | ₽.      |
| Traffic Vol, veh/h 75 755 0 0 565 110 0 0 5 100             | 0 50    |
| Future Vol, veh/h 75 755 0 0 565 110 0 0 5 100              | 0 50    |
| Conflicting Peds, #/hr 0 0 0 0 0 0 0 0 0 0 0                | 0 0     |
| Sign Control Free Free Free Free Free Stop Stop Stop Stop S | op Stop |
| RT Channelized None None None -                             | - None  |
| Storage Length 150 100                                      |         |
| Veh in Median Storage, # - 0 0 0                            | 0 -     |
| Grade, % - 0 0 0  | 0 -     |
| Peak Hour Factor 90 90 90 90 90 90 90 90 90 90 90           | 90 90   |
| Heavy Vehicles, % 0 0 0 0 0 0 0 0 0 0 0                     | 0 0     |
| Mvmt Flow 83 839 0 0 628 122 0 0 6 111                      | 0 56    |

| Major/Minor          | Major1 |   | N | lajor2 |   | N | /linor1 |      | ľ   | /linor2 |      |     |  |
|----------------------|--------|---|---|--------|---|---|---------|------|-----|---------|------|-----|--|
| Conflicting Flow All | 750    | 0 | 0 | 839    | 0 | 0 | 1319    | 1755 | 420 | 1275    | 1694 | 375 |  |
| Stage 1              | -      | - | - | -      | - | - | 1005    | 1005 | -   | 689     | 689  | -   |  |
| Stage 2              | -      | - | - | -      | - | - | 314     | 750  | -   | 586     | 1005 | -   |  |
| Critical Hdwy        | 4.1    | - | - | 4.1    | - | - | 7.5     | 6.5  | 6.9 | 7.5     | 6.5  | 6.9 |  |
| Critical Hdwy Stg 1  | -      | - | - | -      | - | - | 6.5     | 5.5  | -   | 6.5     | 5.5  | -   |  |
| Critical Hdwy Stg 2  | -      | - | - | -      | - | - | 6.5     | 5.5  | -   | 6.5     | 5.5  | -   |  |
| Follow-up Hdwy       | 2.2    | - | - | 2.2    | - | - | 3.5     | 4    | 3.3 | 3.5     | 4    | 3.3 |  |
| Pot Cap-1 Maneuver   | 868    | - | - | 804    | - | - | 117     | 86   | 588 | 126     | 94   | 628 |  |
| Stage 1              | -      | - | - | -      | - | - | 263     | 322  | -   | 407     | 450  | -   |  |
| Stage 2              | -      | - | - | -      | - | - | 677     | 422  | -   | 468     | 322  | -   |  |
| Platoon blocked, %   |        | - | - |        | - | - |         |      |     |         |      |     |  |
| Mov Cap-1 Maneuver   | 868    | - | - | 804    | - | - | 99      | 78   | 588 | 116     | 85   | 628 |  |
| Mov Cap-2 Maneuver   | -      | - | - | -      | - | - | 99      | 78   | -   | 116     | 85   | -   |  |
| Stage 1              | -      | - | - | -      | - | - | 238     | 291  | -   | 368     | 450  | -   |  |
| Stage 2              | -      | - | - | -      | - | - | 617     | 422  | -   | 419     | 291  | -   |  |
|                      |        |   |   |        |   |   |         |      |     |         |      |     |  |
| Approach             | EB     |   |   | WB     |   |   | NB      |      |     | SB      |      |     |  |
| HCM Control Delay s  | 0.9    |   |   | 0      |   |   | 11.2    |      |     | 142.4   |      |     |  |
| HCM LOS              | 0.0    |   |   | Ū      |   |   | B       |      |     | F       |      |     |  |

| Minor Lane/Major Mvmt | NBLn1 | EBL   | EBT | EBR | WBL | WBT | WBR S | BLn1  |
|-----------------------|-------|-------|-----|-----|-----|-----|-------|-------|
| Capacity (veh/h)      | 588   | 868   | -   | -   | 804 | -   | -     | 159   |
| HCM Lane V/C Ratio    | 0.009 | 0.096 | -   | -   | -   | -   | -     | 1.048 |
| HCM Control Delay (s) | 11.2  | 9.6   | -   | -   | 0   | -   | -     | 142.4 |
| HCM Lane LOS          | В     | Α     | -   | -   | А   | -   | -     | F     |
| HCM 95th %tile Q(veh) | 0     | 0.3   | -   | -   | 0   | -   | -     | 8.4   |

### HCM 6th Signalized Intersection Summary 2: Holley Rd (OR 228) & Main St (US 20)

05/23/2024

|                              | ≯    | -        | $\mathbf{\hat{z}}$ | 4    | +           | •    | 1    | Ť    | ۲    | 1    | Ļ    | ~    |
|------------------------------|------|----------|--------------------|------|-------------|------|------|------|------|------|------|------|
| Movement                     | EBL  | EBT      | EBR                | WBL  | WBT         | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
| Lane Configurations          | ሻ    | <b>^</b> | 1                  | 5    | <b>4</b> 12 |      |      | र्स  | 1    |      | \$   |      |
| Traffic Volume (veh/h)       | 5    | 810      | 90                 | 195  | 605         | 0    | 125  | Ō    | 225  | 0    | 5    | 5    |
| Future Volume (veh/h)        | 5    | 810      | 90                 | 195  | 605         | 0    | 125  | 0    | 225  | 0    | 5    | 5    |
| 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       | 1750 | 1750     | 1750               | 1750 | 1750        | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |
| Adj Flow Rate, veh/h         | 5    | 890      | 99                 | 214  | 665         | 0    | 137  | 0    | 247  | 0    | 5    | 5    |
| Peak Hour Factor             | 0.91 | 0.91     | 0.91               | 0.91 | 0.91        | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Percent Heavy Veh, %         | 0    | 0        | 0                  | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Cap, veh/h                   | 7    | 1521     | 679                | 273  | 2053        | 0    | 369  | 0    | 511  | 0    | 145  | 145  |
| Arrive On Green              | 0.00 | 0.46     | 0.46               | 0.16 | 0.62        | 0.00 | 0.18 | 0.00 | 0.18 | 0.00 | 0.18 | 0.18 |
| Sat Flow, veh/h              | 1667 | 3325     | 1483               | 1667 | 3413        | 0    | 1387 | 0    | 1483 | 0    | 803  | 803  |
| Grp Volume(v), veh/h         | 5    | 890      | 99                 | 214  | 665         | 0    | 137  | 0    | 247  | 0    | 0    | 10   |
| Grp Sat Flow(s),veh/h/ln     | 1667 | 1663     | 1483               | 1667 | 1663        | 0    | 1387 | 0    | 1483 | 0    | 0    | 1606 |
| Q Serve(g_s), s              | 0.2  | 12.0     | 2.4                | 7.5  | 5.8         | 0.0  | 5.3  | 0.0  | 7.9  | 0.0  | 0.0  | 0.3  |
| Cycle Q Clear(g_c), s        | 0.2  | 12.0     | 2.4                | 7.5  | 5.8         | 0.0  | 5.6  | 0.0  | 7.9  | 0.0  | 0.0  | 0.3  |
| Prop In Lane                 | 1.00 |          | 1.00               | 1.00 |             | 0.00 | 1.00 |      | 1.00 | 0.00 |      | 0.50 |
| Lane Grp Cap(c), veh/h       | 7    | 1521     | 679                | 273  | 2053        | 0    | 369  | 0    | 511  | 0    | 0    | 291  |
| V/C Ratio(X)                 | 0.75 | 0.58     | 0.15               | 0.78 | 0.32        | 0.00 | 0.37 | 0.00 | 0.48 | 0.00 | 0.00 | 0.03 |
| Avail Cap(c_a), veh/h        | 329  | 2218     | 989                | 686  | 2218        | 0    | 699  | 0    | 854  | 0    | 0    | 317  |
| 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        | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 |
| Uniform Delay (d), s/veh     | 30.2 | 12.2     | 9.6                | 24.4 | 5.6         | 0.0  | 22.8 | 0.0  | 15.6 | 0.0  | 0.0  | 20.5 |
| Incr Delay (d2), s/veh       | 46.3 | 0.5      | 0.1                | 3.7  | 0.1         | 0.0  | 0.5  | 0.0  | 0.5  | 0.0  | 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     | 0.2  | 4.1      | 0.7                | 3.1  | 1.6         | 0.0  | 1.8  | 0.0  | 2.6  | 0.0  | 0.0  | 0.1  |
| Unsig. Movement Delay, s/veh |      |          |                    |      |             |      |      |      |      |      |      |      |
| LnGrp Delay(d),s/veh         | 76.5 | 12.7     | 9.7                | 28.0 | 5.7         | 0.0  | 23.3 | 0.0  | 16.2 | 0.0  | 0.0  | 20.5 |
| LnGrp LOS                    | E    | В        | А                  | С    | А           | Α    | С    | Α    | В    | А    | А    | C    |
| Approach Vol, veh/h          |      | 994      |                    |      | 879         |      |      | 384  |      |      | 10   |      |
| Approach Delay, s/veh        |      | 12.7     |                    |      | 11.1        |      |      | 18.7 |      |      | 20.5 |      |
| Approach LOS                 |      | В        |                    |      | В           |      |      | В    |      |      | С    |      |
| Timer - Assigned Phs         | 1    | 2        |                    | 4    | 5           | 6    |      | 8    |      |      |      |      |
| Phs Duration (G+Y+Rc), s     | 13.9 | 31.8     |                    | 15.0 | 4.2         | 41.5 |      | 15.0 |      |      |      |      |
| Change Period (Y+Rc), s      | 4.0  | 4.5      |                    | 4.0  | 4.0         | 4.5  |      | 4.0  |      |      |      |      |
| Max Green Setting (Gmax), s  | 25.0 | 40.0     |                    | 12.0 | 12.0        | 40.0 |      | 25.0 |      |      |      |      |
| Max Q Clear Time (g_c+l1), s | 9.5  | 14.0     |                    | 2.3  | 2.2         | 7.8  |      | 9.9  |      |      |      |      |
| Green Ext Time (p_c), s      | 0.7  | 13.2     |                    | 0.0  | 0.0         | 10.1 |      | 1.1  |      |      |      |      |
| Intersection Summary         |      |          |                    |      |             |      |      |      |      |      |      |      |
| HCM 6th Ctrl Delay           |      |          | 13.2               |      |             |      |      |      |      |      |      |      |
| HCM 6th LOS                  |      |          | В                  |      |             |      |      |      |      |      |      |      |

### HCM 6th Signalized Intersection Summary 3: 12th Ave & Main St (US 20)

05/23/2024

## \* + + + + \* \* \* \* \* + + + + +

| Movement                  | EBL     | EBT      | EBR  | WBL      | WBT         | WBR  | NBL  | NBT       | NBR  | SBL  | SBT       | SBR  |
|---------------------------|---------|----------|------|----------|-------------|------|------|-----------|------|------|-----------|------|
| Lane Configurations       | 7       | A        |      | <u> </u> | <b>≜1</b> } |      |      | \$        |      |      | \$        |      |
| Traffic Volume (veh/h)    | 65      | 900      | 75   | 60       | 790         | 20   | 45   | 20        | 20   | 25   | 25        | 35   |
| Future Volume (veh/h)     | 65      | 900      | 75   | 60       | 790         | 20   | 45   | 20        | 20   | 25   | 25        | 35   |
| 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      | 0.90 | 1.00 | 1.00      | 1.00 |
| Work Zone On Approach     |         | No       |      |          | No          |      |      | No        |      |      | No        |      |
| Adj Sat Flow, veh/h/ln 1  | 1750    | 1750     | 1750 | 1750     | 1750        | 1750 | 1750 | 1750      | 1750 | 1750 | 1750      | 1750 |
| Adj Flow Rate, veh/h      | 72      | 1000     | 83   | 67       | 878         | 22   | 50   | 22        | 22   | 28   | 28        | 39   |
| Peak Hour Factor          | 0.90    | 0.90     | 0.90 | 0.90     | 0.90        | 0.90 | 0.90 | 0.90      | 0.90 | 0.90 | 0.90      | 0.90 |
| Percent Heavy Veh, %      | 0       | 0        | 0    | 0        | 0           | 0    | 0    | 0         | 0    | 0    | 0         | 0    |
| Cap, veh/h                | 551     | 2159     | 179  | 474      | 2302        | 58   | 214  | 38        | 34   | 160  | 56        | 67   |
| Arrive On Green           | 0.69    | 0.69     | 0.68 | 0.69     | 0.69        | 0.68 | 0.10 | 0.10      | 0.10 | 0.10 | 0.10      | 0.10 |
| Sat Flow, veh/h           | 629     | 3108     | 258  | 529      | 3315        | 83   | 719  | 376       | 335  | 402  | 556       | 667  |
| Grp Volume(v), veh/h      | 72      | 535      | 548  | 67       | 440         | 460  | 94   | 0         | 0    | 95   | 0         | 0    |
| Grp Sat Flow(s) veh/h/ln  | 629     | 1663     | 1704 | 529      | 1663        | 1735 | 1430 | 0         | 0    | 1625 | 0         | 0    |
| Q Serve( $q$ s) s         | 21      | 57       | 57   | 2.6      | 43          | 4.3  | 0.2  | 0.0       | 0.0  | 0.0  | 0.0       | 0.0  |
| Cvcle Q Clear(q, c) s     | 6.4     | 57       | 5.7  | 8.3      | 4.3         | 4.3  | 2.3  | 0.0       | 0.0  | 21   | 0.0       | 0.0  |
| Prop In I ane             | 1 00    | 0.1      | 0.15 | 1 00     |             | 0.05 | 0.53 | 0.0       | 0.23 | 0.29 | 0.0       | 0.41 |
| Lane Gro Cap(c) veh/h     | 551     | 1155     | 1183 | 474      | 1155        | 1205 | 285  | 0         | 00   | 283  | 0         | 0    |
| V/C Ratio(X)              | 0.13    | 0.46     | 0.46 | 0.14     | 0.38        | 0.38 | 0.33 | 0.00      | 0 00 | 0.34 | 0 00      | 0.00 |
| Avail Cap(c, a) veh/h     | 765     | 1719     | 1762 | 654      | 1719        | 1794 | 656  | 0.00      | 0.00 | 712  | 0.00      | 0.00 |
| 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      | 0.00 | 1.00 | 0.00      | 0.00 |
| Uniform Delay (d) s/veh   | 3.8     | 27       | 2.7  | 4.6      | 2.5         | 2.5  | 16.9 | 0.0       | 0.0  | 16.8 | 0.0       | 0.00 |
| Incr Delay (d2) s/veh     | 0.0     | 0.4      | 0.4  | 0.2      | 0.3         | 0.3  | 0.5  | 0.0       | 0.0  | 0.5  | 0.0       | 0.0  |
| Initial O Delav(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 BackOfO(50%) veh/    | /Inf) 2 | 0.0      | 0.0  | 0.0      | 0.0         | 0.0  | 0.0  | 0.0       | 0.0  | 0.0  | 0.0       | 0.0  |
| Unsig Movement Delay      | s/veh   | 0.1      | 0.1  | 0.2      | 0.0         | 0.0  | 0.0  | 0.0       | 0.0  | 0.0  | 0.0       | 0.0  |
| I nGrn Delav(d) s/veh     | 4.0     | 31       | 31   | 48       | 28          | 28   | 17 4 | 0.0       | 0.0  | 17.3 | 0.0       | 0.0  |
| InGro LOS                 | 4.0     | Δ        | Δ    | Δ        | Δ           | Δ    | R    | Δ         | Δ    | R    | Δ         | Δ    |
| Annroach Vol. veh/h       | Λ       | 1155     | Л    | Л        | 967         | Π    |      | Q/        | Λ    | U    | 05        | Π    |
| Approach Delay sluch      |         | 20       |      |          | 20          |      |      | 17 /      |      |      | 17 3      |      |
| Approach LOS              |         | J.Z<br>A |      |          | ۲.J         |      |      | 17.4<br>R |      |      | 17.5<br>R |      |
|                           |         | A        |      |          | А           |      |      | D         |      |      | D         |      |
| Timer - Assigned Phs      |         | 2        |      | 4        |             | 6    |      | 8         |      |      |           |      |
| Phs Duration (G+Y+Rc),    | S       | 31.2     |      | 8.0      |             | 31.2 |      | 8.0       |      |      |           |      |
| Change Period (Y+Rc), s   | 6       | 4.5      |      | 4.0      |             | 4.5  |      | 4.0       |      |      |           |      |
| Max Green Setting (Gma    | ix), s  | 40.0     |      | 15.0     |             | 40.0 |      | 15.0      |      |      |           |      |
| Max Q Clear Time (g_c+l   | l1), s  | 8.4      |      | 4.1      |             | 10.3 |      | 4.3       |      |      |           |      |
| Green Ext Time (p_c), s   |         | 18.3     |      | 0.2      |             | 14.6 |      | 0.2       |      |      |           |      |
| Intersection Summary      |         |          |      |          |             |      |      |           |      |      |           |      |
| HCM 6th Ctrl Delay        |         |          | 4.2  |          |             |      |      |           |      |      |           |      |
| HCM 6th LOS               |         |          | А    |          |             |      |      |           |      |      |           |      |

# HCM 6th Signalized Intersection Summary 4: 15th Ave & Main St (US 20)

05/23/2024

## \* + + \* \* \* \* \* \* \* + \*

| Movement                  | EBL     | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |  |
|---------------------------|---------|------|------|------|------|------|------|------|------|------|------|------|--|
| Lane Configurations       | ኘ       | - 11 | 1    | - ሽ  | - 11 | 1    |      | 4    |      |      | 4    |      |  |
| Traffic Volume (veh/h)    | 65      | 895  | 60   | 70   | 890  | 50   | 20   | 40   | 25   | 85   | 30   | 20   |  |
| Future Volume (veh/h)     | 65      | 895  | 60   | 70   | 890  | 50   | 20   | 40   | 25   | 85   | 30   | 20   |  |
| 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 | 0.90 | 1.00 | 1.00 | 0.90 |  |
| Work Zone On Approach     | h       | No   |      |      | No   |      |      | No   |      |      | No   |      |  |
| Adj Sat Flow, veh/h/ln    | 1750    | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |  |
| Adj Flow Rate, veh/h      | 75      | 1029 | 0    | 80   | 1023 | 0    | 23   | 46   | 29   | 98   | 34   | 23   |  |
| Peak Hour Factor          | 0.87    | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 |  |
| Percent Heavy Veh, %      | 0       | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |  |
| Cap, veh/h                | 455     | 2221 |      | 453  | 2221 |      | 134  | 124  | 66   | 254  | 57   | 31   |  |
| Arrive On Green           | 0.67    | 0.67 | 0.00 | 0.67 | 0.67 | 0.00 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |  |
| Sat Flow, veh/h           | 560     | 3325 | 1483 | 557  | 3325 | 1483 | 217  | 830  | 440  | 801  | 380  | 206  |  |
| Grp Volume(v), veh/h      | 75      | 1029 | 0    | 80   | 1023 | 0    | 98   | 0    | 0    | 155  | 0    | 0    |  |
| Grp Sat Flow(s),veh/h/ln  | 560     | 1663 | 1483 | 557  | 1663 | 1483 | 1488 | 0    | 0    | 1387 | 0    | 0    |  |
| Q Serve(g_s), s           | 3.3     | 6.5  | 0.0  | 3.5  | 6.5  | 0.0  | 0.0  | 0.0  | 0.0  | 1.9  | 0.0  | 0.0  |  |
| Cycle Q Clear(g_c), s     | 9.7     | 6.5  | 0.0  | 10.1 | 6.5  | 0.0  | 2.6  | 0.0  | 0.0  | 4.5  | 0.0  | 0.0  |  |
| Prop In Lane              | 1.00    |      | 1.00 | 1.00 |      | 1.00 | 0.23 |      | 0.30 | 0.63 |      | 0.15 |  |
| Lane Grp Cap(c), veh/h    | 455     | 2221 |      | 453  | 2221 |      | 324  | 0    | 0    | 342  | 0    | 0    |  |
| V/C Ratio(X)              | 0.16    | 0.46 |      | 0.18 | 0.46 |      | 0.30 | 0.00 | 0.00 | 0.45 | 0.00 | 0.00 |  |
| Avail Cap(c_a), veh/h     | 598     | 3066 |      | 595  | 3066 |      | 594  | 0    | 0    | 590  | 0    | 0    |  |
| 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 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |  |
| Uniform Delay (d), s/veh  | n 5.8   | 3.5  | 0.0  | 5.9  | 3.5  | 0.0  | 17.0 | 0.0  | 0.0  | 17.7 | 0.0  | 0.0  |  |
| Incr Delay (d2), s/veh    | 0.2     | 0.2  | 0.0  | 0.3  | 0.2  | 0.0  | 0.4  | 0.0  | 0.0  | 0.7  | 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     | n/Ir0.3 | 1.1  | 0.0  | 0.3  | 1.1  | 0.0  | 0.8  | 0.0  | 0.0  | 1.4  | 0.0  | 0.0  |  |
| Unsig. Movement Delay     | , s/veh |      |      |      |      |      |      |      |      |      |      |      |  |
| LnGrp Delay(d),s/veh      | 6.1     | 3.7  | 0.0  | 6.2  | 3.7  | 0.0  | 17.4 | 0.0  | 0.0  | 18.4 | 0.0  | 0.0  |  |
| LnGrp LOS                 | Α       | Α    |      | Α    | Α    |      | В    | Α    | Α    | В    | Α    | Α    |  |
| Approach Vol, veh/h       |         | 1104 |      |      | 1103 |      |      | 98   |      |      | 155  |      |  |
| Approach Delay, s/veh     |         | 3.9  |      |      | 3.9  |      |      | 17.4 |      |      | 18.4 |      |  |
| Approach LOS              |         | А    |      |      | А    |      |      | В    |      |      | В    |      |  |
| Timer - Assigned Phs      |         | 2    |      | 4    |      | 6    |      | 8    |      |      |      |      |  |
| Phs Duration (G+Y+Rc)     | , S     | 33.3 |      | 10.6 |      | 33.3 |      | 10.6 |      |      |      |      |  |
| Change Period (Y+Rc),     | s       | 4.5  |      | 4.0  |      | 4.5  |      | 4.0  |      |      |      |      |  |
| Max Green Setting (Gma    | ax), s  | 40.0 |      | 15.0 |      | 40.0 |      | 15.0 |      |      |      |      |  |
| Max Q Clear Time (g_c+    | ⊦l1), s | 11.7 |      | 6.5  |      | 12.1 |      | 4.6  |      |      |      |      |  |
| Green Ext Time (p_c), s   | ·       | 16.9 |      | 0.3  |      | 16.8 |      | 0.2  |      |      |      |      |  |
| Intersection Summary      |         |      |      |      |      |      |      |      |      |      |      |      |  |
| HCM 6th Ctrl Delay        |         |      | 5.3  |      |      |      |      |      |      |      |      |      |  |
| HCM 6th LOS               |         |      | А    |      |      |      |      |      |      |      |      |      |  |

#### Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

### HCM 6th Signalized Intersection Summary 5: 18th Ave & Main St (US 20)

## ノーン・チャック イントナイ

| Movement   | EBL      | EBT           | EBR  | WBL      | WBT           | WBR  | NBL  | NBT         | NBR  | SBL  | SBT          | SBR  |
|--|----------|---------------|------|----------|---------------|------|------|-------------|------|------|--------------|------|
| Lane Configurations  | <u>۲</u> | - <b>†</b> Ъ  |      | <u>۲</u> | _ <b>≜</b> t≽ |      |      | 4           |      |      | - <b>4</b> > |      |
| Traffic Volume (veh/h)   | 50       | 935           | 50   | 50       | 940           | 35   | 95   | 35          | 100  | 65   | 15           | 60   |
| Future Volume (veh/h)  | 50       | 935           | 50   | 50       | 940           | 35   | 95   | 35          | 100  | 65   | 15           | 60   |
| 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  | ۱        | No            |      |          | No            |      |      | No          |      |      | No           |      |
| Adi Sat Flow, veh/h/ln   | 1750     | 1750          | 1750 | 1750     | 1750          | 1750 | 1750 | 1750        | 1750 | 1750 | 1750         | 1750 |
| Adj Flow Rate, veh/h   | 56       | 1051          | 56   | 56       | 1056          | 39   | 107  | 39          | 112  | 73   | 17           | 67   |
| Peak Hour Factor   | 0.89     | 0.89          | 0.89 | 0.89     | 0.89          | 0.89 | 0.89 | 0.89        | 0.89 | 0.89 | 0.89         | 0.89 |
| Percent Heavy Veh, %   | 0        | 0             | 0    | 0        | 0             | 0    | 0    | 0           | 0    | 0    | 0            | 0    |
| Cap, veh/h   | 367      | 1976          | 105  | 363      | 2012          | 74   | 223  | 75          | 152  | 227  | 71           | 145  |
| Arrive On Green  | 0.62     | 0.62          | 0.61 | 0.62     | 0.62          | 0.61 | 0.22 | 0.23        | 0.22 | 0.22 | 0.23         | 0.22 |
| Sat Flow, veh/h  | 523      | 3211          | 171  | 517      | 3270          | 121  | 541  | 332         | 670  | 543  | 314          | 638  |
| Grp Volume(v), veh/h   | 56       | 544           | 563  | 56       | 537           | 558  | 258  | 0           | 0    | 157  | 0            | 0    |
| Grp Sat Flow(s) veh/h/ln   | 523      | 1663          | 1719 | 517      | 1663          | 1728 | 1542 | Õ           | 0    | 1494 | 0            | 0    |
| Q Serve(q_s), s  | 3.5      | 9.5           | 9.5  | 3.5      | 9.3           | 9.3  | 3.3  | 0.0         | 0.0  | 0.0  | 0.0          | 0.0  |
| Cycle Q Clear(a c), s  | 12.8     | 9.5           | 9.5  | 13.1     | 9.3           | 9.3  | 7.8  | 0.0         | 0.0  | 4.4  | 0.0          | 0.0  |
| Prop In Lane   | 1.00     | 0.0           | 0.10 | 1.00     | 0.0           | 0.07 | 0.41 | 5.0         | 0.43 | 0.46 | 0.0          | 0.43 |
| Lane Grp Cap(c), veh/h   | 367      | 1023          | 1058 | 363      | 1023          | 1064 | 436  | 0           | 0    | 429  | 0            | 0    |
| V/C Ratio(X)   | 0.15     | 0.53          | 0.53 | 0.15     | 0.52          | 0.52 | 0.59 | 0.00        | 0.00 | 0.37 | 0.00         | 0.00 |
| Avail Cap(c, a), veh/h   | 462      | 1324          | 1369 | 456      | 1324          | 1376 | 690  | 0           | 0    | 673  | 0            | 0    |
| 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        | 0.00 | 1.00 | 0.00         | 0.00 |
| Uniform Delay (d), s/veh   | 9.2      | 5.6           | 5.6  | 9.3      | 5.6           | 5.6  | 18.3 | 0.0         | 0.0  | 17.1 | 0.0          | 0.0  |
| Incr Delay (d2), s/veh   | 0.3      | 0.6           | 0.6  | 0.3      | 0.6           | 0.6  | 1.8  | 0.0         | 0.0  | 0.7  | 0.0          | 0.0  |
| Initial Q Delav(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  | /lr0.4   | 2.4           | 2.5  | 0.4      | 2.4           | 2.5  | 2.8  | 0.0         | 0.0  | 1.6  | 0.0          | 0.0  |
| Unsig, Movement Delay.   | s/veh    |               |      |          | _             |      |      | 5.5         |      |      |              |      |
| LnGrp Delav(d).s/veh   | 9.5      | 6.2           | 6.2  | 9.6      | 6.2           | 6.1  | 20.1 | 0.0         | 0.0  | 17.8 | 0.0          | 0.0  |
| LnGrp LOS  | A        | A             | A    | A        | A             | A    | С    | A           | A    | В    | A            | A    |
| Approach Vol. veh/h  |          | 1163          |      |          | 1151          |      | -    | 258         |      |      | 157          |      |
| Approach Delay, s/veh  |          | 6.4           |      |          | 6.3           |      |      | 20.1        |      |      | 17.8         |      |
| Approach LOS   |          | A             |      |          | 0.0<br>A      |      |      | C           |      |      | B            |      |
| Timor Appianod Dha   |          | 0             |      | 4        |               | C    |      | 0           |      |      | 5            |      |
| Physical Prise Prise Prise Physical Prise Physical Physic | 6        | 25.2          |      | 15.6     |               | 35.3 |      | 15.6        |      |      |              |      |
| Change Period (V+Po)   | . Э<br>С | / 5           |      | / 5      |               | / 5  |      | 15.0        |      |      |              |      |
| May Green Setting (Cm  | av) c    | 4.5           |      | 20.0     |               | 4.5  |      | 20.0        |      |      |              |      |
| Max O Clear Time (c. c+  | .11) e   | 40.0<br>1/1 R |      | 6.4      |               | 40.0 |      | 20.0<br>Q R |      |      |              |      |
| Green Ext Time (n. c)  | 11), 5   | 16.0          |      | 0.4      |               | 15.1 |      | 9.0<br>1 2  |      |      |              |      |
|  |          | 10.0          |      | 0.9      |               | 13.7 |      | 1.5         |      |      |              |      |
| Intersection Summary   |          |               | 0.0  |          |               |      |      |             |      |      |              |      |
| HUM 6th Utri Delay   |          |               | 8.3  |          |               |      |      |             |      |      |              |      |
| HUM 6th LUS  |          |               | А    |          |               |      |      |             |      |      |              |      |

#### Intersection

Int Delay, s/veh

| Movement               | EBL  | EBT  | EBR  | WBL  | WBT         | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|-------------|------|------|------|------|------|------|------|
| Lane Configurations    |      | đ þ  |      | ۲    | <b>∱</b> î, |      |      | 4    |      |      | 4    |      |
| Traffic Vol, veh/h     | 5    | 1055 | 55   | 15   | 945         | 30   | 40   | 5    | 35   | 30   | 10   | 20   |
| Future Vol, veh/h      | 5    | 1055 | 55   | 15   | 945         | 30   | 40   | 5    | 35   | 30   | 10   | 20   |
| Conflicting Peds, #/hr | 0    | 0    | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control           | Free | Free | Free | Free | Free        | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized         | -    | -    | None | -    | -           | None | -    | -    | None | -    | -    | None |
| Storage Length         | -    | -    | -    | 100  | -           | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, | # -  | 0    | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %               | -    | 0    | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor       | 89   | 89   | 89   | 89   | 89          | 89   | 89   | 89   | 89   | 89   | 89   | 89   |
| Heavy Vehicles, %      | 0    | 0    | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow              | 6    | 1185 | 62   | 17   | 1062        | 34   | 45   | 6    | 39   | 34   | 11   | 22   |

| Major/Minor          | Major1 |        | N        | /lajor2 |      | 1      | Minor1     |        | I     | Minor2   |         |          |         |  |
|----------------------|--------|--------|----------|---------|------|--------|------------|--------|-------|----------|---------|----------|---------|--|
| Conflicting Flow All | 1096   | 0      | 0        | 1247    | 0    | 0      | 1799       | 2358   | 624   | 1721     | 2372    | 548      |         |  |
| Stage 1              | -      | -      | -        | -       | -    | -      | 1228       | 1228   | -     | 1113     | 1113    | -        |         |  |
| Stage 2              | -      | -      | -        | -       | -    | -      | 571        | 1130   | -     | 608      | 1259    | -        |         |  |
| Critical Hdwy        | 4.1    | -      | -        | 4.1     | -    | -      | 7.5        | 6.5    | 6.9   | 7.5      | 6.5     | 6.9      |         |  |
| Critical Hdwy Stg 1  | -      | -      | -        | -       | -    | -      | 6.5        | 5.5    | -     | 6.5      | 5.5     | -        |         |  |
| Critical Hdwy Stg 2  | -      | -      | -        | -       | -    | -      | 6.5        | 5.5    | -     | 6.5      | 5.5     | -        |         |  |
| Follow-up Hdwy       | 2.2    | -      | -        | 2.2     | -    | -      | 3.5        | 4      | 3.3   | 3.5      | 4       | 3.3      |         |  |
| Pot Cap-1 Maneuver   | 644    | -      | -        | 565     | -    | -      | 51         | 36     | 433   | 59       | 35      | 485      |         |  |
| Stage 1              | -      | -      | -        | -       | -    | -      | 192        | 253    | -     | 226      | 286     | -        |         |  |
| Stage 2              | -      | -      | -        | -       | -    | -      | 478        | 281    | -     | 454      | 244     | -        |         |  |
| Platoon blocked, %   |        | -      | -        |         | -    | -      |            |        |       |          |         |          |         |  |
| Mov Cap-1 Maneuver   | 644    | -      | -        | 565     | -    | -      | ~ 34       | 34     | 433   | 45       | 33      | 485      |         |  |
| Mov Cap-2 Maneuver   | -      | -      | -        | -       | -    | -      | ~ 34       | 34     | -     | 45       | 33      | -        |         |  |
| Stage 1              | -      | -      | -        | -       | -    | -      | 186        | 245    | -     | 219      | 277     | -        |         |  |
| Stage 2              | -      | -      | -        | -       | -    | -      | 424        | 273    | -     | 391      | 236     | -        |         |  |
|                      |        |        |          |         |      |        |            |        |       |          |         |          |         |  |
| Annroach             | ER     |        |          | \//R    |      |        | NR         |        |       | SB       |         |          |         |  |
| HCM Control Dolov o  |        |        |          | 0.2     |      | ¢      | 116.2      |        |       | 270.1    |         |          |         |  |
| HOM CONTO Delay, S   | 0.2    |        |          | U.Z     |      | φ      | 440.3<br>E |        |       | 270.1    |         |          |         |  |
|                      |        |        |          |         |      |        | Г          |        |       | Г        |         |          |         |  |
|                      |        |        |          |         |      |        |            |        |       |          |         |          |         |  |
| Minor Lane/Major Mvn | nt l   | VBLn1  | EBL      | EBT     | EBR  | WBL    | WBT        | WBR \$ | SBLn1 |          |         |          |         |  |
| Capacity (veh/h)     |        | 57     | 644      | -       | -    | 565    | -          | -      | 59    |          |         |          |         |  |
| HCM Lane V/C Ratio   |        | 1.577  | 0.009    | -       | -    | 0.03   | -          | -      | 1.143 |          |         |          |         |  |
| HCM Control Delay (s | ) \$   | 446.3  | 10.6     | 0.2     | -    | 11.6   | -          | -      | 278.1 |          |         |          |         |  |
| HCM Lane LOS         |        | F      | В        | А       | -    | В      | -          | -      | F     |          |         |          |         |  |
| HCM 95th %tile Q(veh | ı)     | 8.2    | 0        | -       | -    | 0.1    | -          | -      | 5.6   |          |         |          |         |  |
| Notes                |        |        |          |         |      |        |            |        |       |          |         |          |         |  |
| ~: Volume exceeds ca | pacity | \$: De | elay exc | eeds 30 | 0s - | +: Com | outation   | Not De | fined | *: All ı | major v | olume in | platoon |  |

| r |   |   |   |    |   |    |     |   |   |  |
|---|---|---|---|----|---|----|-----|---|---|--|
| I | n |   |   | 20 | ~ | 0  |     | 0 | n |  |
| I |   |   |   |    | _ | ι. |     |   |   |  |
| H |   | - | • | •  | • | •  | ••• | - |   |  |
|   |   |   |   |    |   |    |     |   |   |  |

Int Delay, s/veh

| Movement                 | EBL        | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|--------------------------|------------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations      | ٦          | A    |      | ۲.   | A    |      |      | 4    |      |      | 4    |      |
| Traffic Vol, veh/h       | 15         | 1055 | 50   | 5    | 1005 | 5    | 20   | 0    | 5    | 5    | 0    | 35   |
| Future Vol, veh/h        | 15         | 1055 | 50   | 5    | 1005 | 5    | 20   | 0    | 5    | 5    | 0    | 35   |
| Conflicting Peds, #/hr   | 0          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free       | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -          | -    | None | -    | -    | None | -    | -    | None | -    | -    | None |
| Storage Length           | 100        | -    | -    | 100  | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | <b>#</b> - | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %                 | -          | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 87         | 87   | 87   | 87   | 87   | 87   | 87   | 87   | 87   | 87   | 87   | 87   |
| Heavy Vehicles, %        | 0          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 17         | 1213 | 57   | 6    | 1155 | 6    | 23   | 0    | 6    | 6    | 0    | 40   |

| Major/Minor          | Major1 |   | Ν | 1ajor2 |   | N | /linor1 |      | ľ   | Minor2 |      |     |  |
|----------------------|--------|---|---|--------|---|---|---------|------|-----|--------|------|-----|--|
| Conflicting Flow All | 1161   | 0 | 0 | 1270   | 0 | 0 | 1866    | 2449 | 635 | 1811   | 2474 | 581 |  |
| Stage 1              | -      | - | - | -      | - | - | 1276    | 1276 | -   | 1170   | 1170 | -   |  |
| Stage 2              | -      | - | - | -      | - | - | 590     | 1173 | -   | 641    | 1304 | -   |  |
| Critical Hdwy        | 4.1    | - | - | 4.1    | - | - | 7.5     | 6.5  | 6.9 | 7.5    | 6.5  | 6.9 |  |
| Critical Hdwy Stg 1  | -      | - | - | -      | - | - | 6.5     | 5.5  | -   | 6.5    | 5.5  | -   |  |
| Critical Hdwy Stg 2  | -      | - | - | -      | - | - | 6.5     | 5.5  | -   | 6.5    | 5.5  | -   |  |
| Follow-up Hdwy       | 2.2    | - | - | 2.2    | - | - | 3.5     | 4    | 3.3 | 3.5    | 4    | 3.3 |  |
| Pot Cap-1 Maneuver   | 609    | - | - | 554    | - | - | 46      | 31   | 426 | 50     | 30   | 462 |  |
| Stage 1              | -      | - | - | -      | - | - | 179     | 240  | -   | 208    | 269  | -   |  |
| Stage 2              | -      | - | - | -      | - | - | 466     | 268  | -   | 434    | 232  | -   |  |
| Platoon blocked, %   |        | - | - |        | - | - |         |      |     |        |      |     |  |
| Mov Cap-1 Maneuver   | 609    | - | - | 554    | - | - | 41      | 30   | 426 | 48     | 29   | 462 |  |
| Mov Cap-2 Maneuver   | -      | - | - | -      | - | - | 41      | 30   | -   | 48     | 29   | -   |  |
| Stage 1              | -      | - | - | -      | - | - | 174     | 233  | -   | 202    | 266  | -   |  |
| Stage 2              | -      | - | - | -      | - | - | 421     | 265  | -   | 416    | 226  | -   |  |
|                      |        |   |   |        |   |   |         |      |     |        |      |     |  |
| Approach             | EB     |   |   | WB     |   |   | NB      |      |     | SB     |      |     |  |
| HCM Control Delay, s | 0.1    |   |   | 0.1    |   |   | 148     |      |     | 25.4   |      |     |  |
| HCM LOS              |        |   |   |        |   |   | F       |      |     | D      |      |     |  |

| Minor Lane/Major Mvmt | NBLn1 | EBL   | EBT | EBR | WBL  | WBT | WBR | SBLn1 |
|-----------------------|-------|-------|-----|-----|------|-----|-----|-------|
| Capacity (veh/h)      | 50    | 609   | -   | -   | 554  | -   | -   | 222   |
| HCM Lane V/C Ratio    | 0.575 | 0.028 | -   | -   | 0.01 | -   | -   | 0.207 |
| HCM Control Delay (s) | 148   | 11.1  | -   | -   | 11.6 | -   | -   | 25.4  |
| HCM Lane LOS          | F     | В     | -   | -   | В    | -   | -   | D     |
| HCM 95th %tile Q(veh) | 2.2   | 0.1   | -   | -   | 0    | -   | -   | 0.8   |

#### Intersection

Int Delay, s/veh

| Movement               | EBL  | EBT        | EBR  | WBL  | WBT         | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------------|------|------|-------------|------|------|------|------|------|------|------|
| Lane Configurations    | 1    | <b>∱</b> ₽ |      | 5    | <b>∱î</b> ≽ |      |      | \$   |      |      | \$   |      |
| Traffic Vol, veh/h     | 230  | 760        | 115  | 65   | 850         | 50   | 15   | 0    | 30   | 45   | 5    | 170  |
| Future Vol, veh/h      | 230  | 760        | 115  | 65   | 850         | 50   | 15   | 0    | 30   | 45   | 5    | 170  |
| Conflicting Peds, #/hr | 0    | 0          | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control           | Free | Free       | Free | Free | Free        | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized         | -    | -          | None | -    | -           | None | -    | -    | None | -    | -    | None |
| Storage Length         | 100  | -          | -    | 100  | -           | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage  | ,# - | 0          | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %               | -    | 0          | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor       | 91   | 91         | 91   | 91   | 91          | 91   | 91   | 91   | 91   | 91   | 91   | 91   |
| Heavy Vehicles, %      | 0    | 0          | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow              | 253  | 835        | 126  | 71   | 934         | 55   | 16   | 0    | 33   | 49   | 5    | 187  |

| Major/Minor           | Major1     |                | I         | Major2 |      |           | Minor1 |        | 1         | Minor2  |      |     |  |
|-----------------------|------------|----------------|-----------|--------|------|-----------|--------|--------|-----------|---------|------|-----|--|
| Conflicting Flow All  | 989        | 0              | 0         | 961    | 0    | 0         | 2016   | 2535   | 481       | 2028    | 2571 | 495 |  |
| Stage 1               | -          | -              | -         | -      | -    | -         | 1404   | 1404   | -         | 1104    | 1104 | -   |  |
| Stage 2               | -          | -              | -         | -      | -    | -         | 612    | 1131   | -         | 924     | 1467 | -   |  |
| Critical Hdwy         | 4.1        | -              | -         | 4.1    | -    | -         | 7.5    | 6.5    | 6.9       | 7.5     | 6.5  | 6.9 |  |
| Critical Hdwy Stg 1   | -          | -              | -         | -      | -    | -         | 6.5    | 5.5    | -         | 6.5     | 5.5  | -   |  |
| Critical Hdwy Stg 2   | -          | -              | -         | -      | -    | -         | 6.5    | 5.5    | -         | 6.5     | 5.5  | -   |  |
| Follow-up Hdwy        | 2.2        | -              | -         | 2.2    | -    | -         | 3.5    | 4      | 3.3       | 3.5     | 4    | 3.3 |  |
| Pot Cap-1 Maneuver    | 707        | -              | -         | 724    | -    | -         | 35     | 28     | 537       | ~ 34    | 26   | 525 |  |
| Stage 1               | -          | -              | -         | -      | -    | -         | 149    | 208    | -         | 229     | 289  | -   |  |
| Stage 2               | -          | -              | -         | -      | -    | -         | 452    | 281    | -         | 294     | 194  | -   |  |
| Platoon blocked, %    |            | -              | -         |        | -    | -         |        |        |           |         |      |     |  |
| Mov Cap-1 Maneuver    | 707        | -              | -         | 724    | -    | -         | ~ 11   | 16     | 537       | ~ 21    | 15   | 525 |  |
| Mov Cap-2 Maneuver    | -          | -              | -         | -      | -    | -         | ~ 11   | 16     | -         | ~ 21    | 15   | -   |  |
| Stage 1               | -          | -              | -         | -      | -    | -         | 96     | 134    | -         | 147     | 261  | -   |  |
| Stage 2               | -          | -              | -         | -      | -    | -         | 257    | 253    | -         | 177     | 125  | -   |  |
|                       |            |                |           |        |      |           |        |        |           |         |      |     |  |
| Approach              | EB         |                |           | WB     |      |           | NB     |        |           | SB      |      |     |  |
| HCM Control Delay, s  | 2.7        |                |           | 0.7    |      | \$        | 545.6  |        | g         | \$ 1041 |      |     |  |
| HCM LOS               |            |                |           | -      |      | ,         | F      |        |           | F       |      |     |  |
|                       |            |                |           |        |      |           |        |        |           |         |      |     |  |
| Minor Lane/Maior Mym  | nt N       | IRI n1         | FRI       | FRT    | FRR  | W/RI      | WRT    | W/RR ( | SBI n1    |         |      |     |  |
| Conceity (yeb/b)      | <u>n</u> 1 | 10LIII<br>20   | 707       | LDI    | LDIX | 704       | VUDI   | VUDIX  | 70        |         |      |     |  |
| Capacity (Ven/II)     |            | JZ             | 0 357     | -      | -    | 0.000     | -      | -      | 3.06      |         |      |     |  |
| HCM Control Dolou (a) | ¢          | 1.040<br>5/5 6 | 12.0      | -      | -    | 10 5      | -      | -      | 3.00      |         |      |     |  |
| HCM Lang LOS          | ) Þ        | 545.0<br>E     | 12.9<br>P | -      | -    | 10.5<br>D | -      | - J    | p 1041    |         |      |     |  |
| HCM 05th % tile O(yeh | ۱          | Г<br>5 Б       | 16        | -      | -    | 03        | -      | -      | ⊤<br>2/11 |         |      |     |  |
|                       | )          | 5.5            | 1.0       | -      | -    | 0.5       | -      | -      | 24.1      |         |      |     |  |
| Notes                 |            |                |           |        |      |           |        |        |           |         |      |     |  |

~: Volume exceeds capacity

\$: Delay exceeds 300s +: Computation Not Defined

\*: All major volume in platoon

|   |       |   |   |   | 17 |      |   |  |
|---|-------|---|---|---|----|------|---|--|
| n | <br>^ | 0 | 0 | 0 |    | 5    | n |  |
|   |       |   |   |   |    |      |   |  |
|   | -     | J | c | c | L  | LU I |   |  |
|   |       |   |   |   |    |      |   |  |

Int Delay, s/veh

| Movement               | EBL  | EBT  | EBR  | WBL  | WBT         | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|-------------|------|------|------|------|------|------|------|
| Lane Configurations    | ľ    | î₽   |      | 1    | <b>∱î</b> ≽ |      |      | \$   |      |      | ¢    |      |
| Traffic Vol, veh/h     | 20   | 695  | 105  | 60   | 740         | 0    | 50   | 0    | 20   | 10   | 0    | 20   |
| Future Vol, veh/h      | 20   | 695  | 105  | 60   | 740         | 0    | 50   | 0    | 20   | 10   | 0    | 20   |
| Conflicting Peds, #/hr | 0    | 0    | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control           | Free | Free | Free | Free | Free        | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized         | -    | -    | None | -    | -           | None | -    | -    | None | -    | -    | None |
| Storage Length         | 100  | -    | -    | 100  | -           | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, | # -  | 0    | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %               | -    | 0    | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor       | 87   | 87   | 87   | 87   | 87          | 87   | 87   | 87   | 87   | 87   | 87   | 87   |
| Heavy Vehicles, %      | 0    | 0    | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow              | 23   | 799  | 121  | 69   | 851         | 0    | 57   | 0    | 23   | 11   | 0    | 23   |

| Major/Minor          | Major1 |   | М | ajor2 | 2 Minor1 |   | r1 Minor2 |      |     |      |      |     |  |
|----------------------|--------|---|---|-------|----------|---|-----------|------|-----|------|------|-----|--|
| Conflicting Flow All | 851    | 0 | 0 | 920   | 0        | 0 | 1470      | 1895 | 460 | 1435 | 1955 | 426 |  |
| Stage 1              | -      | - | - | -     | -        | - | 906       | 906  | -   | 989  | 989  | -   |  |
| Stage 2              | -      | - | - | -     | -        | - | 564       | 989  | -   | 446  | 966  | -   |  |
| Critical Hdwy        | 4.1    | - | - | 4.1   | -        | - | 7.5       | 6.5  | 6.9 | 7.5  | 6.5  | 6.9 |  |
| Critical Hdwy Stg 1  | -      | - | - | -     | -        | - | 6.5       | 5.5  | -   | 6.5  | 5.5  | -   |  |
| Critical Hdwy Stg 2  | -      | - | - | -     | -        | - | 6.5       | 5.5  | -   | 6.5  | 5.5  | -   |  |
| Follow-up Hdwy       | 2.2    | - | - | 2.2   | -        | - | 3.5       | 4    | 3.3 | 3.5  | 4    | 3.3 |  |
| Pot Cap-1 Maneuver   | 796    | - | - | 750   | -        | - | 90        | 70   | 554 | 96   | 65   | 582 |  |
| Stage 1              | -      | - | - | -     | -        | - | 301       | 358  | -   | 268  | 327  | -   |  |
| Stage 2              | -      | - | - | -     | -        | - | 483       | 327  | -   | 567  | 336  | -   |  |
| Platoon blocked, %   |        | - | - |       | -        | - |           |      |     |      |      |     |  |
| Mov Cap-1 Maneuver   | 796    | - | - | 750   | -        | - | 79        | 62   | 554 | 84   | 57   | 582 |  |
| Mov Cap-2 Maneuver   | -      | - | - | -     | -        | - | 79        | 62   | -   | 84   | 57   | -   |  |
| Stage 1              | -      | - | - | -     | -        | - | 292       | 348  | -   | 260  | 297  | -   |  |
| Stage 2              | -      | - | - | -     | -        | - | 421       | 297  | -   | 528  | 326  | -   |  |
|                      |        |   |   |       |          |   |           |      |     |      |      |     |  |
| Approach             | EB     |   |   | WB    |          |   | NB        |      |     | SB   |      |     |  |
| HCM Control Delay    | 0.2    |   |   | 0.8   |          |   | 107.5     |      |     | 27.2 |      |     |  |

| HCM Control Delay, s | 0.2 | 0.8 | 107.5 | 27.2 |  |
|----------------------|-----|-----|-------|------|--|
| HCM LOS              |     |     | F     | D    |  |
|                      |     |     |       |      |  |

| Minor Lane/Major Mvmt | NBLn1 | EBL   | EBT | EBR | WBL   | WBT | WBR \$ | SBLn1 |
|-----------------------|-------|-------|-----|-----|-------|-----|--------|-------|
| Capacity (veh/h)      | 105   | 796   | -   | -   | 750   | -   | -      | 196   |
| HCM Lane V/C Ratio    | 0.766 | 0.029 | -   | -   | 0.092 | -   | -      | 0.176 |
| HCM Control Delay (s) | 107.5 | 9.7   | -   | -   | 10.3  | -   | -      | 27.2  |
| HCM Lane LOS          | F     | А     | -   | -   | В     | -   | -      | D     |
| HCM 95th %tile Q(veh) | 4.2   | 0.1   | -   | -   | 0.3   | -   | -      | 0.6   |

| Intersection           |       |             |      |      |             |      |      |      |      |      |      |      |  |
|------------------------|-------|-------------|------|------|-------------|------|------|------|------|------|------|------|--|
| Int Delay, s/veh       | 78.1  |             |      |      |             |      |      |      |      |      |      |      |  |
| Movement               | EBL   | EBT         | EBR  | WBL  | WBT         | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |  |
| Lane Configurations    | ľ     | <b>∱</b> î, |      | 5    | <b>∱</b> î, |      |      | ÷    |      |      | ÷    |      |  |
| Traffic Vol, veh/h     | 210   | 495         | 5    | 5    | 460         | 50   | 15   | 10   | 5    | 65   | 5    | 260  |  |
| Future Vol, veh/h      | 210   | 495         | 5    | 5    | 460         | 50   | 15   | 10   | 5    | 65   | 5    | 260  |  |
| Conflicting Peds, #/hr | 0     | 0           | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |  |
| Sign Control           | Free  | Free        | Free | Free | Free        | Free | Stop | Stop | Stop | Stop | Stop | Stop |  |
| RT Channelized         | -     | -           | None | -    | -           | None | -    | -    | None | -    | -    | None |  |
| Storage Length         | 100   | -           | -    | 100  | -           | -    | -    | -    | -    | -    | -    | -    |  |
| Veh in Median Storage, | , # - | 0           | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |  |
| Grade, %               | -     | 0           | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |  |
| Peak Hour Factor       | 83    | 83          | 83   | 83   | 83          | 83   | 83   | 83   | 83   | 83   | 83   | 83   |  |
| Heavy Vehicles, %      | 0     | 0           | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |  |
| Mvmt Flow              | 253   | 596         | 6    | 6    | 554         | 60   | 18   | 12   | 6    | 78   | 6    | 313  |  |
|                        |       |             |      |      |             |      |      |      |      |      |      |      |  |

| Major/Minor           | Major1 |        | I     | Major2 |     |       | Minor1 |      |        | Minor2 |      |     |  |
|-----------------------|--------|--------|-------|--------|-----|-------|--------|------|--------|--------|------|-----|--|
| Conflicting Flow All  | 614    | 0      | 0     | 602    | 0   | 0     | 1397   | 1731 | 301    | 1406   | 1704 | 307 |  |
| Stage 1               | -      | -      | -     | -      | -   | -     | 1105   | 1105 | -      | 596    | 596  | -   |  |
| Stage 2               | -      | -      | -     | -      | -   | -     | 292    | 626  | -      | 810    | 1108 | -   |  |
| Critical Hdwy         | 4.1    | -      | -     | 4.1    | -   | -     | 7.5    | 6.5  | 6.9    | 7.5    | 6.5  | 6.9 |  |
| Critical Hdwy Stg 1   | -      | -      | -     | -      | -   | -     | 6.5    | 5.5  | -      | 6.5    | 5.5  | -   |  |
| Critical Hdwy Stg 2   | -      | -      | -     | -      | -   | -     | 6.5    | 5.5  | -      | 6.5    | 5.5  | -   |  |
| Follow-up Hdwy        | 2.2    | -      | -     | 2.2    | -   | -     | 3.5    | 4    | 3.3    | 3.5    | 4    | 3.3 |  |
| Pot Cap-1 Maneuver    | 975    | -      | -     | 985    | -   | -     | 102    | 89   | 701    | 101    | 93   | 695 |  |
| Stage 1               | -      | -      | -     | -      | -   | -     | 228    | 289  | -      | 462    | 495  | -   |  |
| Stage 2               | -      | -      | -     | -      | -   | -     | 697    | 480  | -      | 344    | 288  | -   |  |
| Platoon blocked, %    |        | -      | -     |        | -   | -     |        |      |        |        |      |     |  |
| Mov Cap-1 Maneuver    | 975    | -      | -     | 985    | -   | -     | 42     | 66   | 701    | ~ 69   | 69   | 695 |  |
| Mov Cap-2 Maneuver    | -      | -      | -     | -      | -   | -     | 42     | 66   | -      | ~ 69   | 69   | -   |  |
| Stage 1               | -      | -      | -     | -      | -   | -     | 169    | 214  | -      | 342    | 492  | -   |  |
| Stage 2               | -      | -      | -     | -      | -   | -     | 376    | 477  | -      | 238    | 213  | -   |  |
|                       |        |        |       |        |     |       |        |      |        |        |      |     |  |
| Approach              | EB     |        |       | WB     |     |       | NB     |      |        | SB     |      |     |  |
| HCM Control Delay, s  | 3      |        |       | 0.1    |     |       | 139.1  |      | \$     | 355.8  |      |     |  |
| HCM LOS               |        |        |       |        |     |       | F      |      |        | F      |      |     |  |
|                       |        |        |       |        |     |       |        |      |        |        |      |     |  |
| Minor Lane/Maior Mym  | nt     | NBL n1 | EBL   | EBT    | EBR | WBL   | WBT    | WBR  | SBL n1 |        |      |     |  |
| Capacity (veh/h)      |        | 58     | 975   |        | -   | 985   | -      | -    | 238    |        |      |     |  |
| HCM Lane V/C Ratio    |        | 0.623  | 0.259 | _      | -   | 0.006 | _      | -    | 1.671  |        |      |     |  |
| HCM Control Delay (s) |        | 139.1  | 10    | -      | -   | 8.7   | -      | -\$  | 355.8  |        |      |     |  |
| HCM Lane LOS          |        | F      | A     | -      | -   | A     | -      | -    | F      |        |      |     |  |
| HCM 95th %tile Q(veh  | )      | 2.6    | 1     | -      | -   | 0     | -      | -    | 25.7   |        |      |     |  |
|                       | ,      |        |       |        |     |       |        |      |        |        |      |     |  |
| INOTES                |        |        |       |        |     |       |        |      |        |        |      |     |  |

~: Volume exceeds capacity

\$: Delay exceeds 300s +: Computation Not Defined

\*: All major volume in platoon

#### Intersection

Int Delay, s/veh

| Movement               | EBL  | EBT         | EBR  | WBL  | WBT         | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|-------------|------|------|-------------|------|------|------|------|------|------|------|
| Lane Configurations    | ľ    | <b>∱</b> î, |      | 1    | <b>∱</b> î≽ |      |      | \$   |      |      | \$   |      |
| Traffic Vol, veh/h     | 0    | 440         | 65   | 35   | 440         | 0    | 35   | 0    | 50   | 0    | 0    | 0    |
| Future Vol, veh/h      | 0    | 440         | 65   | 35   | 440         | 0    | 35   | 0    | 50   | 0    | 0    | 0    |
| Conflicting Peds, #/hr | 0    | 0           | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control           | Free | Free        | Free | Free | Free        | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized         | -    | -           | None | -    | -           | None | -    | -    | None | -    | -    | None |
| Storage Length         | 100  | -           | -    | 100  | -           | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, | # -  | 0           | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %               | -    | 0           | -    | -    | 0           | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor       | 88   | 88          | 88   | 88   | 88          | 88   | 88   | 88   | 88   | 88   | 88   | 88   |
| Heavy Vehicles, %      | 0    | 0           | 0    | 0    | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| M∨mt Flow              | 0    | 500         | 74   | 40   | 500         | 0    | 40   | 0    | 57   | 0    | 0    | 0    |

| Major/Minor          | Major1 |   | Ν | /lajor2 |   | Ν | 1inor1 |      | Ν   | 1inor2 |      |     |  |
|----------------------|--------|---|---|---------|---|---|--------|------|-----|--------|------|-----|--|
| Conflicting Flow All | 500    | 0 | 0 | 574     | 0 | 0 | 867    | 1117 | 287 | 830    | 1154 | 250 |  |
| Stage 1              | -      | - | - | -       | - | - | 537    | 537  | -   | 580    | 580  | -   |  |
| Stage 2              | -      | - | - | -       | - | - | 330    | 580  | -   | 250    | 574  | -   |  |
| Critical Hdwy        | 4.1    | - | - | 4.1     | - | - | 7.5    | 6.5  | 6.9 | 7.5    | 6.5  | 6.9 |  |
| Critical Hdwy Stg 1  | -      | - | - | -       | - | - | 6.5    | 5.5  | -   | 6.5    | 5.5  | -   |  |
| Critical Hdwy Stg 2  | -      | - | - | -       | - | - | 6.5    | 5.5  | -   | 6.5    | 5.5  | -   |  |
| Follow-up Hdwy       | 2.2    | - | - | 2.2     | - | - | 3.5    | 4    | 3.3 | 3.5    | 4    | 3.3 |  |
| Pot Cap-1 Maneuver   | 1075   | - | - | 1009    | - | - | 250    | 209  | 716 | 266    | 199  | 756 |  |
| Stage 1              | -      | - | - | -       | - | - | 501    | 526  | -   | 472    | 503  | -   |  |
| Stage 2              | -      | - | - | -       | - | - | 663    | 503  | -   | 738    | 506  | -   |  |
| Platoon blocked, %   |        | - | - |         | - | - |        |      |     |        |      |     |  |
| Mov Cap-1 Maneuver   | 1075   | - | - | 1009    | - | - | 243    | 201  | 716 | 238    | 191  | 756 |  |
| Mov Cap-2 Maneuver   | -      | - | - | -       | - | - | 243    | 201  | -   | 238    | 191  | -   |  |
| Stage 1              | -      | - | - | -       | - | - | 501    | 526  | -   | 472    | 483  | -   |  |
| Stage 2              | -      | - | - | -       | - | - | 637    | 483  | -   | 679    | 506  | -   |  |
|                      |        |   |   |         |   |   |        |      |     |        |      |     |  |
| Approach             | EB     |   |   | WB      |   |   | NB     |      |     | SB     |      |     |  |
| HCM Control Delay, s | 0      |   |   | 0.6     |   |   | 17     |      |     | 0      |      |     |  |
| HCM LOS              |        |   |   |         |   |   | С      |      |     | А      |      |     |  |

| Minor Lane/Major Mvmt | NBLn1 | EBL  | EBT | EBR | WBL   | WBT | WBR S | SBLn1 |
|-----------------------|-------|------|-----|-----|-------|-----|-------|-------|
| Capacity (veh/h)      | 397   | 1075 | -   | -   | 1009  | -   | -     | -     |
| HCM Lane V/C Ratio    | 0.243 | -    | -   | -   | 0.039 | -   | -     | -     |
| HCM Control Delay (s) | 17    | 0    | -   | -   | 8.7   | -   | -     | 0     |
| HCM Lane LOS          | С     | А    | -   | -   | А     | -   | -     | А     |
| HCM 95th %tile Q(veh) | 0.9   | 0    | -   | -   | 0.1   | -   | -     | -     |

| Intersection           |      |      |      |          |      |      |      |      |      |      |      |      |  |
|------------------------|------|------|------|----------|------|------|------|------|------|------|------|------|--|
| Int Delay, s/veh       | 2.3  |      |      |          |      |      |      |      |      |      |      |      |  |
| Movement               | EBL  | EBT  | EBR  | WBL      | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |  |
| Lane Configurations    | 1    | •    | 1    | <u>ک</u> | el 👘 |      |      | \$   |      |      | 4    |      |  |
| Traffic Vol, veh/h     | 45   | 390  | 50   | 5        | 395  | 10   | 30   | 0    | 5    | 5    | 10   | 35   |  |
| Future Vol, veh/h      | 45   | 390  | 50   | 5        | 395  | 10   | 30   | 0    | 5    | 5    | 10   | 35   |  |
| Conflicting Peds, #/hr | 0    | 0    | 0    | 0        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |  |
| Sign Control           | Free | Free | Free | Free     | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |  |
| RT Channelized         | -    | -    | None | -        | -    | None | -    | -    | None | -    | -    | None |  |
| Storage Length         | 200  | -    | 100  | 100      | -    | -    | -    | -    | -    | -    | -    | -    |  |
| Veh in Median Storage, | # -  | 0    | -    | -        | 0    | -    | -    | 0    | -    | -    | 0    | -    |  |
| Grade, %               | -    | 0    | -    | -        | 0    | -    | -    | 0    | -    | -    | 0    | -    |  |
| Peak Hour Factor       | 87   | 87   | 87   | 87       | 87   | 87   | 87   | 87   | 87   | 87   | 87   | 87   |  |
| Heavy Vehicles, %      | 0    | 0    | 0    | 0        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |  |
| Mvmt Flow              | 52   | 448  | 57   | 6        | 454  | 11   | 34   | 0    | 6    | 6    | 11   | 40   |  |
|                        |      |      |      |          |      |      |      |      |      |      |      |      |  |

| Major/Minor          | Major1 |   | Ν | /lajor2 |   |   | Minor1 |      | ľ   | /linor2 |      |     |  |
|----------------------|--------|---|---|---------|---|---|--------|------|-----|---------|------|-----|--|
| Conflicting Flow All | 465    | 0 | 0 | 505     | 0 | 0 | 1049   | 1029 | 448 | 1056    | 1081 | 460 |  |
| Stage 1              | -      | - | - | -       | - | - | 552    | 552  | -   | 472     | 472  | -   |  |
| Stage 2              | -      | - | - | -       | - | - | 497    | 477  | -   | 584     | 609  | -   |  |
| Critical Hdwy        | 4.1    | - | - | 4.1     | - | - | 7.1    | 6.5  | 6.2 | 7.1     | 6.5  | 6.2 |  |
| Critical Hdwy Stg 1  | -      | - | - | -       | - | - | 6.1    | 5.5  | -   | 6.1     | 5.5  | -   |  |
| Critical Hdwy Stg 2  | -      | - | - | -       | - | - | 6.1    | 5.5  | -   | 6.1     | 5.5  | -   |  |
| Follow-up Hdwy       | 2.2    | - | - | 2.2     | - | - | 3.5    | 4    | 3.3 | 3.5     | 4    | 3.3 |  |
| Pot Cap-1 Maneuver   | 1107   | - | - | 1070    | - | - | 207    | 236  | 615 | 205     | 220  | 605 |  |
| Stage 1              | -      | - | - | -       | - | - | 522    | 518  | -   | 576     | 562  | -   |  |
| Stage 2              | -      | - | - | -       | - | - | 559    | 559  | -   | 501     | 488  | -   |  |
| Platoon blocked, %   |        | - | - |         | - | - |        |      |     |         |      |     |  |
| Mov Cap-1 Maneuver   | 1107   | - | - | 1070    | - | - | 178    | 223  | 615 | 195     | 208  | 605 |  |
| Mov Cap-2 Maneuver   | -      | - | - | -       | - | - | 178    | 223  | -   | 195     | 208  | -   |  |
| Stage 1              | -      | - | - | -       | - | - | 497    | 494  | -   | 549     | 559  | -   |  |
| Stage 2              | -      | - | - | -       | - | - | 508    | 556  | -   | 473     | 465  | -   |  |
|                      |        |   |   |         |   |   |        |      |     |         |      |     |  |
| Approach             | EB     |   |   | WB      |   |   | NB     |      |     | SB      |      |     |  |
| HCM Control Delay, s | 0.8    |   |   | 0.1     |   |   | 27.8   |      |     | 16.2    |      |     |  |
| HCM LOS              |        |   |   |         |   |   | D      |      |     | С       |      |     |  |
|                      |        |   |   |         |   |   |        |      |     |         |      |     |  |
|                      |        |   |   |         |   |   |        |      |     |         |      |     |  |

| Minor Lane/Major Mvmt | NBLn1 | EBL   | EBT | EBR | WBL   | WBT | WBR | SBLn1 |  |
|-----------------------|-------|-------|-----|-----|-------|-----|-----|-------|--|
| Capacity (veh/h)      | 198   | 1107  | -   | -   | 1070  | -   | -   | 380   |  |
| HCM Lane V/C Ratio    | 0.203 | 0.047 | -   | -   | 0.005 | -   | -   | 0.151 |  |
| HCM Control Delay (s) | 27.8  | 8.4   | -   | -   | 8.4   | -   | -   | 16.2  |  |
| HCM Lane LOS          | D     | А     | -   | -   | А     | -   | -   | С     |  |
| HCM 95th %tile Q(veh) | 0.7   | 0.1   | -   | -   | 0     | -   | -   | 0.5   |  |

| Intersection           |      |      |      |      |         |      |      |      |      |      |      |      |  |
|------------------------|------|------|------|------|---------|------|------|------|------|------|------|------|--|
| nt Delay, s/veh        | 0.7  |      |      |      |         |      |      |      |      |      |      |      |  |
| Movement               | EBL  | EBT  | EBR  | WBL  | WBT     | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |  |
| Lane Configurations    | 1    | ef 👘 |      | ۲.   | et<br>P |      |      | \$   |      |      | \$   |      |  |
| Traffic Vol, veh/h     | 15   | 370  | 10   | 0    | 350     | 5    | 0    | 0    | 0    | 0    | 0    | 35   |  |
| Future Vol, veh/h      | 15   | 370  | 10   | 0    | 350     | 5    | 0    | 0    | 0    | 0    | 0    | 35   |  |
| Conflicting Peds, #/hr | 0    | 0    | 0    | 0    | 0       | 0    | 0    | 0    | 0    | 0    | 0    | 0    |  |
| Sign Control           | Free | Free | Free | Free | Free    | Free | Stop | Stop | Stop | Stop | Stop | Stop |  |
| RT Channelized         | -    | -    | None | -    | -       | None | -    | -    | None | -    | -    | None |  |
| Storage Length         | 100  | -    | -    | 100  | -       | -    | -    | -    | -    | -    | -    | -    |  |
| Veh in Median Storage, | # -  | 0    | -    | -    | 0       | -    | -    | 0    | -    | -    | 0    | -    |  |
| Grade, %               | -    | 0    | -    | -    | 0       | -    | -    | 0    | -    | -    | 0    | -    |  |
| Peak Hour Factor       | 80   | 80   | 80   | 80   | 80      | 80   | 80   | 80   | 80   | 80   | 80   | 80   |  |
| Heavy Vehicles, %      | 0    | 0    | 0    | 0    | 0       | 0    | 0    | 0    | 0    | 0    | 0    | 0    |  |
| Nvmt Flow              | 19   | 463  | 13   | 0    | 438     | 6    | 0    | 0    | 0    | 0    | 0    | 44   |  |
|                        |      |      |      |      |         |      |      |      |      |      |      |      |  |

| Major/Minor          | Major1 |        | l   | Major2 |     |     | Minor1 |     | N      | /linor2 |     |     |  |
|----------------------|--------|--------|-----|--------|-----|-----|--------|-----|--------|---------|-----|-----|--|
| Conflicting Flow All | 444    | 0      | 0   | 476    | 0   | 0   | 971    | 952 | 470    | 949     | 955 | 441 |  |
| Stage 1              | -      | -      | -   | -      | -   | -   | 508    | 508 | -      | 441     | 441 | -   |  |
| Stage 2              | -      | -      | -   | -      | -   | -   | 463    | 444 | -      | 508     | 514 | -   |  |
| Critical Hdwy        | 4.1    | -      | -   | 4.1    | -   | -   | 7.1    | 6.5 | 6.2    | 7.1     | 6.5 | 6.2 |  |
| Critical Hdwy Stg 1  | -      | -      | -   | -      | -   | -   | 6.1    | 5.5 | -      | 6.1     | 5.5 | -   |  |
| Critical Hdwy Stg 2  | -      | -      | -   | -      | -   | -   | 6.1    | 5.5 | -      | 6.1     | 5.5 | -   |  |
| Follow-up Hdwy       | 2.2    | -      | -   | 2.2    | -   | -   | 3.5    | 4   | 3.3    | 3.5     | 4   | 3.3 |  |
| Pot Cap-1 Maneuver   | 1127   | -      | -   | 1097   | -   | -   | 234    | 261 | 598    | 242     | 260 | 621 |  |
| Stage 1              | -      | -      | -   | -      | -   | -   | 551    | 542 | -      | 599     | 580 | -   |  |
| Stage 2              | -      | -      | -   | -      | -   | -   | 583    | 579 | -      | 551     | 539 | -   |  |
| Platoon blocked, %   |        | -      | -   |        | -   | -   |        |     |        |         |     |     |  |
| Mov Cap-1 Maneuver   | 1127   | -      | -   | 1097   | -   | -   | 215    | 257 | 598    | 239     | 256 | 621 |  |
| Mov Cap-2 Maneuver   | -      | -      | -   | -      | -   | -   | 215    | 257 | -      | 239     | 256 | -   |  |
| Stage 1              | -      | -      | -   | -      | -   | -   | 542    | 533 | -      | 589     | 580 | -   |  |
| Stage 2              | -      | -      | -   | -      | -   | -   | 542    | 579 | -      | 542     | 530 | -   |  |
|                      |        |        |     |        |     |     |        |     |        |         |     |     |  |
| Approach             | EB     |        |     | WB     |     |     | NB     |     |        | SB      |     |     |  |
| HCM Control Delay, s | 0.3    |        |     | 0      |     |     | 0      |     |        | 11.2    |     |     |  |
| HCM LOS              |        |        |     |        |     |     | A      |     |        | В       |     |     |  |
|                      |        |        |     |        |     |     |        |     |        |         |     |     |  |
| Minor Lane/Maior Mym | nt     | NBI n1 | FBI | FBT    | FRR | WBI | WBT    | WBR | SBI n1 |         |     |     |  |

| Minor Lane/Major Mvmt | NBLn1 | EBL   | EBT | EBR | WBL  | WBT | WBR S | SBLn1 |  |
|-----------------------|-------|-------|-----|-----|------|-----|-------|-------|--|
| Capacity (veh/h)      | -     | 1127  | -   | -   | 1097 | -   | -     | 621   |  |
| HCM Lane V/C Ratio    | -     | 0.017 | -   | -   | -    | -   | -     | 0.07  |  |
| HCM Control Delay (s) | 0     | 8.2   | -   | -   | 0    | -   | -     | 11.2  |  |
| HCM Lane LOS          | A     | А     | -   | -   | А    | -   | -     | В     |  |
| HCM 95th %tile Q(veh) | -     | 0.1   | -   | -   | 0    | -   | -     | 0.2   |  |

#### Intersection

Int Delay, s/veh

| Movement               | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations    | 7    | et 👘 |      | ľ    | •    | 1    |      | \$   |      |      | ÷    |      |
| Traffic Vol, veh/h     | 85   | 290  | 5    | 0    | 275  | 10   | 10   | 0    | 0    | 5    | 0    | 60   |
| Future Vol, veh/h      | 85   | 290  | 5    | 0    | 275  | 10   | 10   | 0    | 0    | 5    | 0    | 60   |
| Conflicting Peds, #/hr | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control           | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized         | -    | -    | None |
| Storage Length         | 150  | -    | -    | 125  | -    | 125  | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage  | ,# - | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %               | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor       | 86   | 86   | 86   | 86   | 86   | 86   | 86   | 86   | 86   | 86   | 86   | 86   |
| Heavy Vehicles, %      | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| M∨mt Flow              | 99   | 337  | 6    | 0    | 320  | 12   | 12   | 0    | 0    | 6    | 0    | 70   |

| Major/Minor          | Major1 |   | Ν | /lajor2 |   | Ν | 1inor1 |     | Ν   | /linor2 |     |     |  |
|----------------------|--------|---|---|---------|---|---|--------|-----|-----|---------|-----|-----|--|
| Conflicting Flow All | 332    | 0 | 0 | 343     | 0 | 0 | 899    | 870 | 340 | 858     | 861 | 320 |  |
| Stage 1              | -      | - | - | -       | - | - | 538    | 538 | -   | 320     | 320 | -   |  |
| Stage 2              | -      | - | - | -       | - | - | 361    | 332 | -   | 538     | 541 | -   |  |
| Critical Hdwy        | 4.1    | - | - | 4.1     | - | - | 7.1    | 6.5 | 6.2 | 7.1     | 6.5 | 6.2 |  |
| Critical Hdwy Stg 1  | -      | - | - | -       | - | - | 6.1    | 5.5 | -   | 6.1     | 5.5 | -   |  |
| Critical Hdwy Stg 2  | -      | - | - | -       | - | - | 6.1    | 5.5 | -   | 6.1     | 5.5 | -   |  |
| Follow-up Hdwy       | 2.2    | - | - | 2.2     | - | - | 3.5    | 4   | 3.3 | 3.5     | 4   | 3.3 |  |
| Pot Cap-1 Maneuver   | 1239   | - | - | 1227    | - | - | 262    | 292 | 707 | 279     | 295 | 725 |  |
| Stage 1              | -      | - | - | -       | - | - | 531    | 526 | -   | 696     | 656 | -   |  |
| Stage 2              | -      | - | - | -       | - | - | 662    | 648 | -   | 531     | 524 | -   |  |
| Platoon blocked, %   |        | - | - |         | - | - |        |     |     |         |     |     |  |
| Mov Cap-1 Maneuver   | 1239   | - | - | 1227    | - | - | 222    | 269 | 707 | 262     | 271 | 725 |  |
| Mov Cap-2 Maneuver   | -      | - | - | -       | - | - | 222    | 269 | -   | 262     | 271 | -   |  |
| Stage 1              | -      | - | - | -       | - | - | 489    | 484 | -   | 640     | 656 | -   |  |
| Stage 2              | -      | - | - | -       | - | - | 598    | 648 | -   | 489     | 482 | -   |  |
|                      |        |   |   |         |   |   |        |     |     |         |     |     |  |
| Approach             | EB     |   |   | WB      |   |   | NB     |     |     | SB      |     |     |  |
| HCM Control Delay, s | 1.8    |   |   | 0       |   |   | 22.1   |     |     | 11.4    |     |     |  |

| HCM LOS               |       |      |     |     |      | С   |         |     | В |  |
|-----------------------|-------|------|-----|-----|------|-----|---------|-----|---|--|
|                       |       |      |     |     |      |     |         |     |   |  |
| Minor Lane/Major Mvmt | NBLn1 | EBL  | EBT | EBR | WBL  | WBT | WBR SBI | _n1 |   |  |
| Capacity (veh/h)      | 222   | 1239 | -   | -   | 1227 | -   | - 6     | 538 |   |  |
| HCM Lane V/C Ratio    | 0.052 | 0.08 | -   | -   | -    | -   | - 0.1   | 118 |   |  |
| HCM Control Delay (s) | 22.1  | 8.2  | -   | -   | 0    | -   | - 1     | 1.4 |   |  |
| HCM Lane LOS          | С     | Α    | -   | -   | Α    | -   | -       | В   |   |  |

0

0.4

0.2

0.3

HCM 95th %tile Q(veh)

#### Intersection

Int Delay, s/veh

| Movement               | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations    |      | \$   |      |      | \$   |      |      | \$   |      |      | \$   |      |
| Traffic Vol, veh/h     | 40   | 290  | 5    | 0    | 270  | 25   | 0    | 0    | 5    | 35   | 10   | 75   |
| Future Vol, veh/h      | 40   | 290  | 5    | 0    | 270  | 25   | 0    | 0    | 5    | 35   | 10   | 75   |
| Conflicting Peds, #/hr | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control           | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized         | -    | -    | None |
| Storage Length         | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, | # -  | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %               | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor       | 80   | 80   | 80   | 80   | 80   | 80   | 80   | 80   | 80   | 80   | 80   | 80   |
| Heavy Vehicles, %      | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| M∨mt Flow              | 50   | 363  | 6    | 0    | 338  | 31   | 0    | 0    | 6    | 44   | 13   | 94   |

| Major/Minor          | Major1 | Major2 |   |      | Ν | linor1 |     | Ν   | linor2 |     |     |     |  |
|----------------------|--------|--------|---|------|---|--------|-----|-----|--------|-----|-----|-----|--|
| Conflicting Flow All | 369    | 0      | 0 | 369  | 0 | 0      | 873 | 835 | 366    | 823 | 823 | 354 |  |
| Stage 1              | -      | -      | - | -    | - | -      | 466 | 466 | -      | 354 | 354 | -   |  |
| Stage 2              | -      | -      | - | -    | - | -      | 407 | 369 | -      | 469 | 469 | -   |  |
| Critical Hdwy        | 4.1    | -      | - | 4.1  | - | -      | 7.1 | 6.5 | 6.2    | 7.1 | 6.5 | 6.2 |  |
| Critical Hdwy Stg 1  | -      | -      | - | -    | - | -      | 6.1 | 5.5 | -      | 6.1 | 5.5 | -   |  |
| Critical Hdwy Stg 2  | -      | -      | - | -    | - | -      | 6.1 | 5.5 | -      | 6.1 | 5.5 | -   |  |
| Follow-up Hdwy       | 2.2    | -      | - | 2.2  | - | -      | 3.5 | 4   | 3.3    | 3.5 | 4   | 3.3 |  |
| Pot Cap-1 Maneuver   | 1201   | -      | - | 1201 | - | -      | 273 | 306 | 684    | 295 | 311 | 694 |  |
| Stage 1              | -      | -      | - | -    | - | -      | 581 | 566 | -      | 667 | 634 | -   |  |
| Stage 2              | -      | -      | - | -    | - | -      | 625 | 624 | -      | 579 | 564 | -   |  |
| Platoon blocked, %   |        | -      | - |      | - | -      |     |     |        |     |     |     |  |
| Mov Cap-1 Maneuver   | 1201   | -      | - | 1201 | - | -      | 219 | 290 | 684    | 281 | 295 | 694 |  |
| Mov Cap-2 Maneuver   | -      | -      | - | -    | - | -      | 219 | 290 | -      | 281 | 295 | -   |  |
| Stage 1              | -      | -      | - | -    | - | -      | 551 | 537 | -      | 632 | 634 | -   |  |
| Stage 2              | -      | -      | - | -    | - | -      | 530 | 624 | -      | 544 | 535 | -   |  |
|                      |        |        |   |      |   |        |     |     |        |     |     |     |  |
| Approach             | EB     |        |   | WB   |   |        | NB  |     |        | SB  |     |     |  |

| Approach             | ED | VVD | IND  | 30   |  |
|----------------------|----|-----|------|------|--|
| HCM Control Delay, s | 1  | 0   | 10.3 | 16.9 |  |
| HCM LOS              |    |     | В    | С    |  |
|                      |    |     |      |      |  |

| Minor Lane/Major Mvmt | NBLn1 | EBL   | EBT | EBR | WBL  | WBT | WBR | SBLn1 |
|-----------------------|-------|-------|-----|-----|------|-----|-----|-------|
| Capacity (veh/h)      | 684   | 1201  | -   | -   | 1201 | -   | -   | 450   |
| HCM Lane V/C Ratio    | 0.009 | 0.042 | -   | -   | -    | -   | -   | 0.333 |
| HCM Control Delay (s) | 10.3  | 8.1   | 0   | -   | 0    | -   | -   | 16.9  |
| HCM Lane LOS          | В     | Α     | А   | -   | А    | -   | -   | С     |
| HCM 95th %tile Q(veh) | 0     | 0.1   | -   | -   | 0    | -   | -   | 1.4   |

#### Intersection

Int Delay, s/veh

| Movement EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT S                             |
|--|
| Lane Configurations 🚯 📢  |
| Traffic Vol, veh/h 0 265 100 20 270 0 70 0 10 0 0                                  |
| Future Vol, veh/h 0 265 100 20 270 0 70 0 10 0 0                                   |
| Conflicting Peds, #/hr 0 0 0 0 0 0 0 0 0 0 0 0                                     |
| Sign Control Free Free Free Free Free Free Stop Stop Stop Stop Stop Stop Stop Stop |
| RT Channelized None None None No   |
| Storage Length   |
| Veh in Median Storage, # - 0 0 0 0   |
| Grade, % - 0 0 0 0   |
| Peak Hour Factor 87 87 87 87 87 87 87 87 87 87 87 87 87                            |
| Heavy Vehicles, % 0 0 0 0 0 0 0 0 0 0 0 0  |
| Mvmt Flow 0 305 115 23 310 0 80 0 11 0 0   |

| Major/Minor           | Major1 |     | Ν   | /lajor2 |      | Ν     | /linor1 |     | М   | inor2 |   |     |  |
|-----------------------|--------|-----|-----|---------|------|-------|---------|-----|-----|-------|---|-----|--|
| Conflicting Flow All  | -      | 0   | 0   | 420     | 0    | 0     | 719     | 719 | 363 | -     | - | 310 |  |
| Stage 1               | -      | -   | -   | -       | -    | -     | 363     | 363 | -   | -     | - | -   |  |
| Stage 2               | -      | -   | -   | -       | -    | -     | 356     | 356 | -   | -     | - | -   |  |
| Critical Hdwy         | -      | -   | -   | 4.1     | -    | -     | 7.1     | 6.5 | 6.2 | -     | - | 6.2 |  |
| Critical Hdwy Stg 1   | -      | -   | -   | -       | -    | -     | 6.1     | 5.5 | -   | -     | - | -   |  |
| Critical Hdwy Stg 2   | -      | -   | -   | -       | -    | -     | 6.1     | 5.5 | -   | -     | - | -   |  |
| Follow-up Hdwy        | -      | -   | -   | 2.2     | -    | -     | 3.5     | 4   | 3.3 | -     | - | 3.3 |  |
| Pot Cap-1 Maneuver    | 0      | -   | -   | 1150    | -    | 0     | 346     | 357 | 686 | 0     | 0 | 735 |  |
| Stage 1               | 0      | -   | -   | -       | -    | 0     | 660     | 628 | -   | 0     | 0 | -   |  |
| Stage 2               | 0      | -   | -   | -       | -    | 0     | 666     | 633 | -   | 0     | 0 | -   |  |
| Platoon blocked, %    |        | -   | -   |         | -    |       |         |     |     |       |   |     |  |
| Mov Cap-1 Maneuver    | -      | -   | -   | 1150    | -    | -     | 340     | 348 | 686 | -     | - | 735 |  |
| Mov Cap-2 Maneuver    | -      | -   | -   | -       | -    | -     | 340     | 348 | -   | -     | - | -   |  |
| Stage 1               | -      | -   | -   | -       | -    | -     | 660     | 628 | -   | -     | - | -   |  |
| Stage 2               | -      | -   | -   | -       | -    | -     | 650     | 618 | -   | -     | - | -   |  |
|                       |        |     |     |         |      |       |         |     |     |       |   |     |  |
| Approach              | EB     |     |     | WB      |      |       | NB      |     |     | SB    |   |     |  |
| HCM Control Delay, s  | 0      |     |     | 0.6     |      |       | 18.2    |     |     | 0     |   |     |  |
| HCM LOS               | ·      |     |     |         |      |       | C       |     |     | A     |   |     |  |
|                       |        |     |     |         |      |       | 2       |     |     |       |   |     |  |
| Minor Lane/Major Mvm  | t NBL  | _n1 | EBT | EBR     | WBL  | WBT S | BLn1    |     |     |       |   |     |  |
| Capacity (veh/h)      | 3      | 363 | _   | -       | 1150 | -     | -       |     |     |       |   |     |  |
| HCM Lane V/C Ratio    | 0.2    | 253 | -   | -       | 0.02 | -     | -       |     |     |       |   |     |  |
| HCM Control Dolay (c) | 1      | Q 7 |     |         | 8.2  | ٥     | ٥       |     |     |       |   |     |  |

|                       | 10.2 |   |   | 0.2 | U | • |  |
|-----------------------|------|---|---|-----|---|---|--|
| HCM Lane LOS          | С    | - | - | А   | Α | А |  |
| HCM 95th %tile Q(veh) | 1    | - | - | 0.1 | - | - |  |

| Intersection              |      |
|---------------------------|------|
| Intersection Delay, s/veh | 10.5 |
| Intersection LOS          | В    |

| Movement                   | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations        |      | \$   |      |      | \$   |      |      | \$   |      |      | 4    |      |
| Traffic Vol, veh/h         | 65   | 75   | 35   | 15   | 130  | 75   | 35   | 85   | 15   | 30   | 70   | 25   |
| Future Vol, veh/h          | 65   | 75   | 35   | 15   | 130  | 75   | 35   | 85   | 15   | 30   | 70   | 25   |
| Peak Hour Factor           | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Heavy Vehicles, %          | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| M∨mt Flow                  | 80   | 93   | 43   | 19   | 160  | 93   | 43   | 105  | 19   | 37   | 86   | 31   |
| Number of Lanes            | 0    | 1    | 0    | 0    | 1    | 0    | 0    | 1    | 0    | 0    | 1    | 0    |
| Approach                   | EB   |      |      | WB   |      |      | NB   |      |      | SB   |      |      |
| Opposing Approach          | WB   |      |      | EB   |      |      | SB   |      |      | NB   |      |      |
| Opposing Lanes             | 1    |      |      | 1    |      |      | 1    |      |      | 1    |      |      |
| Conflicting Approach Left  | SB   |      |      | NB   |      |      | EB   |      |      | WB   |      |      |
| Conflicting Lanes Left     | 1    |      |      | 1    |      |      | 1    |      |      | 1    |      |      |
| Conflicting Approach Right | NB   |      |      | SB   |      |      | WB   |      |      | EB   |      |      |
| Conflicting Lanes Right    | 1    |      |      | 1    |      |      | 1    |      |      | 1    |      |      |
| HCM Control Delay          | 10.4 |      |      | 10.9 |      |      | 10.2 |      |      | 10   |      |      |
| HCM LOS                    | В    |      |      | В    |      |      | В    |      |      | А    |      |      |

| Lane                   | NBLn1 | EBLn1 | WBLn1 | SBLn1 |
|------------------------|-------|-------|-------|-------|
| Vol Left, %            | 26%   | 37%   | 7%    | 24%   |
| Vol Thru, %            | 63%   | 43%   | 59%   | 56%   |
| Vol Right, %           | 11%   | 20%   | 34%   | 20%   |
| Sign Control           | Stop  | Stop  | Stop  | Stop  |
| Traffic Vol by Lane    | 135   | 175   | 220   | 125   |
| LT Vol                 | 35    | 65    | 15    | 30    |
| Through Vol            | 85    | 75    | 130   | 70    |
| RT Vol                 | 15    | 35    | 75    | 25    |
| Lane Flow Rate         | 167   | 216   | 272   | 154   |
| Geometry Grp           | 1     | 1     | 1     | 1     |
| Degree of Util (X)     | 0.249 | 0.308 | 0.373 | 0.229 |
| Departure Headway (Hd) | 5.386 | 5.129 | 4.942 | 5.352 |
| Convergence, Y/N       | Yes   | Yes   | Yes   | Yes   |
| Сар                    | 667   | 700   | 733   | 670   |
| Service Time           | 3.424 | 3.16  | 2.942 | 3.391 |
| HCM Lane V/C Ratio     | 0.25  | 0.309 | 0.371 | 0.23  |
| HCM Control Delay      | 10.2  | 10.4  | 10.9  | 10    |
| HCM Lane LOS           | В     | В     | В     | А     |
| HCM 95th-tile Q        | 1     | 1.3   | 1.7   | 0.9   |

# Intersection

Intersection Delay, s/veh 8.3 Intersection LOS A

| Movement                       | EBL            | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |  |
|--------------------------------|----------------|------|------|------|------|------|------|------|------|------|------|------|--|
| Lane Configurations            |                | 4    |      |      | 4    |      |      | 4    |      |      | 4    |      |  |
| Traffic Vol, veh/h             | 65             | 50   | 50   | 0    | 25   | 10   | 35   | 25   | 5    | 10   | 40   | 65   |  |
| Future Vol, veh/h              | 65             | 50   | 50   | 0    | 25   | 10   | 35   | 25   | 5    | 10   | 40   | 65   |  |
| Peak Hour Factor               | 0.87           | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 |  |
| Heavy Vehicles, %              | 0              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |  |
| Mvmt Flow                      | 75             | 57   | 57   | 0    | 29   | 11   | 40   | 29   | 6    | 11   | 46   | 75   |  |
| Number of Lanes                | 0              | 1    | 0    | 0    | 1    | 0    | 0    | 1    | 0    | 0    | 1    | 0    |  |
| Approach                       | EB             |      |      |      | WB   |      | NB   |      |      | SB   |      |      |  |
| Opposing Approach              | WB             |      |      |      | EB   |      | SB   |      |      | NB   |      |      |  |
| Opposing Lanes                 | 1              |      |      |      | 1    |      | 1    |      |      | 1    |      |      |  |
| Conflicting Approach Le        | ft SB          |      |      |      | NB   |      | EB   |      |      | WB   |      |      |  |
| Conflicting Lanes Left         | 1              |      |      |      | 1    |      | 1    |      |      | 1    |      |      |  |
| Conflicting Approach Rig       | gh <b>t</b> NB |      |      |      | SB   |      | WB   |      |      | EB   |      |      |  |
| <b>Conflicting Lanes Right</b> | 1              |      |      |      | 1    |      | 1    |      |      | 1    |      |      |  |
| HCM Control Delay              | 8.6            |      |      |      | 7.7  |      | 8.1  |      |      | 8    |      |      |  |
| HCM LOS                        | А              |      |      |      | А    |      | А    |      |      | А    |      |      |  |

| Lane                   | NBLn1 | EBLn1\ | VBLn1 | SBLn1 |
|------------------------|-------|--------|-------|-------|
| Vol Left, %            | 54%   | 39%    | 0%    | 9%    |
| Vol Thru, %            | 38%   | 30%    | 71%   | 35%   |
| Vol Right, %           | 8%    | 30%    | 29%   | 57%   |
| Sign Control           | Stop  | Stop   | Stop  | Stop  |
| Traffic Vol by Lane    | 65    | 165    | 35    | 115   |
| LT Vol                 | 35    | 65     | 0     | 10    |
| Through Vol            | 25    | 50     | 25    | 40    |
| RT Vol                 | 5     | 50     | 10    | 65    |
| Lane Flow Rate         | 75    | 190    | 40    | 132   |
| Geometry Grp           | 1     | 1      | 1     | 1     |
| Degree of Util (X)     | 0.096 | 0.227  | 0.049 | 0.154 |
| Departure Headway (Hd) | 4.62  | 4.304  | 4.4   | 4.182 |
| Convergence, Y/N       | Yes   | Yes    | Yes   | Yes   |
| Сар                    | 776   | 836    | 814   | 859   |
| Service Time           | 2.644 | 2.323  | 2.424 | 2.202 |
| HCM Lane V/C Ratio     | 0.097 | 0.227  | 0.049 | 0.154 |
| HCM Control Delay      | 8.1   | 8.6    | 7.7   | 8     |
| HCM Lane LOS           | А     | А      | А     | А     |
| HCM 95th-tile Q        | 0.3   | 0.9    | 0.2   | 0.5   |

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|----|------------|------------|---|---|--------|---|---|
| н  | ш          | -          | - | - |        |   |   |
|    |            | <b>U</b> 1 | • | • |        | v |   |

Int Delay, s/veh

| Movement                 | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lane Configurations      |      | 4    |      |      | 4    |      |      | 4    |      |      | 4    |      |
| Traffic Vol, veh/h       | 0    | 25   | 0    | 50   | 25   | 10   | 5    | 20   | 40   | 10   | 25   | 0    |
| Future Vol, veh/h        | 0    | 25   | 0    | 50   | 25   | 10   | 5    | 20   | 40   | 10   | 25   | 0    |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -    | -    | None |
| Storage Length           | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | 4 -  | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %                 | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 69   | 69   | 69   | 69   | 69   | 69   | 69   | 69   | 69   | 69   | 69   | 69   |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 0    | 36   | 0    | 72   | 36   | 14   | 7    | 29   | 58   | 14   | 36   | 0    |

| Major/Minor          | Major1 |   | Ν | /lajor2 |   | N | 1inor1   |     | Ν    | linor2 |     |      |  |
|----------------------|--------|---|---|---------|---|---|----------|-----|------|--------|-----|------|--|
| Conflicting Flow All | 50     | 0 | 0 | 36      | 0 | 0 | 241      | 230 | 36   | 267    | 223 | 43   |  |
| Stage 1              | -      | - | - | -       | - | - | 36       | 36  | -    | 187    | 187 | -    |  |
| Stage 2              | -      | - | - | -       | - | - | 205      | 194 | -    | 80     | 36  | -    |  |
| Critical Hdwy        | 4.1    | - | - | 4.1     | - | - | 7.1      | 6.5 | 6.2  | 7.1    | 6.5 | 6.2  |  |
| Critical Hdwy Stg 1  | -      | - | - | -       | - | - | 6.1      | 5.5 | -    | 6.1    | 5.5 | -    |  |
| Critical Hdwy Stg 2  | -      | - | - | -       | - | - | 6.1      | 5.5 | -    | 6.1    | 5.5 | -    |  |
| Follow-up Hdwy       | 2.2    | - | - | 2.2     | - | - | 3.5      | 4   | 3.3  | 3.5    | 4   | 3.3  |  |
| Pot Cap-1 Maneuver   | 1570   | - | - | 1588    | - | - | 717      | 673 | 1042 | 690    | 679 | 1033 |  |
| Stage 1              | -      | - | - | -       | - | - | 985      | 869 | -    | 819    | 749 | -    |  |
| Stage 2              | -      | - | - | -       | - | - | 802      | 744 | -    | 934    | 869 | -    |  |
| Platoon blocked, %   |        | - | - |         | - | - |          |     |      |        |     |      |  |
| Mov Cap-1 Maneuver   | 1570   | - | - | 1588    | - | - | 662      | 641 | 1042 | 607    | 647 | 1033 |  |
| Mov Cap-2 Maneuver   | -      | - | - | -       | - | - | 662      | 641 | -    | 607    | 647 | -    |  |
| Stage 1              | -      | - | - | -       | - | - | 985      | 869 | -    | 819    | 714 | -    |  |
| Stage 2              | -      | - | - | -       | - | - | 726      | 709 | -    | 853    | 869 | -    |  |
|                      |        |   |   |         |   |   |          |     |      |        |     |      |  |
| Approach             | FB     |   |   | WB      |   |   | NB       |     |      | SB     |     |      |  |
| HCM Control Delay s  | 0      |   |   | 43      |   |   | 9.8      |     |      | 11.2   | _   |      |  |
| HCM LOS              | 0      |   |   | 7.0     |   |   | 0.0<br>A |     |      | B      |     |      |  |

| Minor Lane/Major Mvmt | NBLn1 | EBL  | EBT | EBR | WBL   | WBT | WBR S | SBLn1 |
|-----------------------|-------|------|-----|-----|-------|-----|-------|-------|
| Capacity (veh/h)      | 843   | 1570 | -   | -   | 1588  | -   | -     | 635   |
| HCM Lane V/C Ratio    | 0.112 | -    | -   | -   | 0.046 | -   | -     | 0.08  |
| HCM Control Delay (s) | 9.8   | 0    | -   | -   | 7.4   | 0   | -     | 11.2  |
| HCM Lane LOS          | А     | А    | -   | -   | А     | А   | -     | В     |
| HCM 95th %tile Q(veh) | 0.4   | 0    | -   | -   | 0.1   | -   | -     | 0.3   |