February 25, 2020

Gregory S. Markel, CCIM
Washington Securities & Investment Corporation
8901 Tucannon Avenue, Suite 110
Kennewick, Washington 99336

Via email: wsic@eltopia.com

Regarding: Traffic Engineering Services to Provide Traffic Impact Analysis Letter
Vantage Way Properties
3432 Twin Bridges Road, 3750 State Route 240, and 3801 Horn Rapids Road
Richland, Washington
PBS Project 71517.000

Dear Mr. Markel:

This letter presents a traffic impact analysis (TIA) letter to meet the once-a-year opportunity to submit comprehensive plan updates that are due for submittal in late February. The City of Richland (City) has required a TIA letter to assist in the review of comprehensive plan map and zoning map amendments proposed for the subject property. The TIA letter was scoped based on the comments from the City.

This TIA letter is intended to meet State Environmental Policy Act (SEPA) checklist data requirements for comprehensive plan land use review and is based on a market analysis that estimated the land uses and building sizes/units.

**PROJECT DESCRIPTION**

The 300-acre site is located between State Route 240 (SR 240) and Horn Rapids Road and west of the Horn Rapids Off-Road Vehicle Park. The site is currently designated with a Public Facility (PF) land use designation, and an Agriculture (AG) zoning designation. The proposal is to amend the land use designation to a combination of Commercial and Medium Density Residential land uses; and amend the site zoning from Agriculture (AG) to a mix of C-LB (Limited Business Use District), C-3 (General Business Use District) and R-2 (Medium-Density Residential). The proposed zoning amendment will implement the proposed land use designations.
Figure 1 presents a vicinity map.

The proposed zoning for the site would consist of 177 acres of medium-density residential (R-2 zone), 70 acres of limited business use district (C-LB zone), and 53 acres of general business use district (C-3 zone). The C-3 zone would be in two areas, 45 acres in the southeast end of the site and 8 acres in the northeast end of the site. Figure 2 presents a site plan with the proposed zones. Development would likely proceed in multiple phases according to market demands; for the sake of analysis, this TIA assumes all 300 acres are fully built out by 2040.

This TIA letter analyzes three intersections in the 2040 build-out year:

- New Site Access/SR 240
- Beardsley Road/SR 240
- Beardsley Road/Horn Rapids Road

ATTACHMENT 4

Only the Beardsley Road/SR 240 intersection currently exists; the others are assumed to be created within the study period, likely in conjunction with the Vantage Way Properties development. The new site access on SR 240 and the Beardsley Road/Horn Rapids Road intersection are assumed to have the same lane configuration as the Beardsley Road/SR 240 intersection: two-lane roadways with stop control on the roadway with a lower functional classification.

## TRAFFIC VOLUMES

Existing traffic volumes were obtained from the City of Richland Comprehensive Plan Supporting Analysis document (*City of Richland Comprehensive Plan – Supporting Analysis*, page 56). The "T-5 – 2016 Peak Traffic Volume" diagram provided the PM peak hour volumes (see Appendix A). For the AM peak hour, the same PM peak hour volumes were assumed but the direction of travel was reversed. For example, trips going southeast in the PM peak hour (towards the City of Richland) were assumed to travel northwest in the AM peak hour.

### Background Growth

Background growth is a generic increase in traffic volumes that either is not attributable to specific developments or is attributable to influences outside the study area. A linear background growth rate of 1.0% per year was applied to 2016 peak hour volumes between public roadways at the studied intersections. The background growth volumes are included in the 2040 With Project volumes presented in Figure 4.

### Network Growth

Estimated network growth of 50 trips traveling both southeast and northwest on Horn Rapids Road was assumed with the anticipated future extension of Horn Rapids Road to SR 240.

### Baseline Volumes

The 2040 baseline volumes represent the study area traffic volumes without the Vantage Way Properties project development trips. The baseline volumes are calculated as the sum of existing traffic, background growth, and network growth.

## TRIP GENERATION AND DISTRIBUTION

The following section relies on data provided in the Institute of Transportation Engineers (ITE) *Trip Generation Manual,* 10th Edition (2017). Detailed trip generation calculations are provided in Appendix B.

### Proposed Trip Generation

The City of Richland roadway network would see an increase in traffic volume from the proposed Vantage Way Properties project when site development is proposed. The developed size of each zone was provided by a market analysis study prepared by Leland Consulting Group (Market Analysis and Disposition Strategy, February 10, 2020). A copy of the Leland study is submitted in the application materials. Table 1 presents the preliminary uses and corresponding ITE land use models organized by land zone. The conceptual site plan on Figure 2 provides location references.

**Table 1. Vantage Way Properties Proposed Uses**

| Zone Code | Zone Name | Land Area (acres) | Developed Size[a] | ITE Land Use Code | ITE Land Use Model |
|---|---|---|---|---|---|
| R-2 | Single-Family Residential | 177 | 726 DU | 210 | Single-Family Detached Housing |
| C-LB | Commercial Limited Business | 70 | 1,417 DU | 220 | Multifamily Housing (Low-Rise) |
| C-3 | General Business | 53[b] | 583,000 SF | 820 | Shopping Center |

[a] DU = dwelling units; SF = square feet gross leas area
[b] Combined C-3 zone lots (45 AC + 8 AC)

The total trip generation estimates for the Vantage Way Properties project were calculated using the ITE weighted average trip rates.

With multiple and diverse uses, internal trip capture reductions were estimated for the project following guidance in the ITE *Trip Generation Handbook*, 3rd Edition (2017), specifically using the National Cooperative Highway Research Program (NCHRP) Report 684 method. For the internal trip capture exercise, the single-family and multi-family uses were treated together as residential development types and the shopping center was treated as a retail development type. All internal trips were applied in the 2040 analysis scenario.

Because of the distance between the future commercial properties slated for retail development and high-volume roadways that might support a pass-by trip capture pattern, pass-by trips were not evaluated in this TIA.

Table 2 summarizes the project-generated trips, including the internal and primary trips. Detailed calculations are provided in Appendix B.

**Table 2. Trip Generation Estimates for Vantage Way Properties**

| **Land Use (ITE Code)** | Single-Family Detached Housing (210) | | Multifamily Housing (Low-Rise) (220) | | Shopping Center (820) | | Total | |
|---|---|---|---|---|---|---|---|---|
| **Total Average Weekday Trips (ADT)** | 6,853 | | 10,372 | | 22,008 | | 39,233 | |
| **Peak Hour** | **AM** | **PM** | **AM** | **PM** | **AM** | **PM** | **AM** | **PM** |
| **Total Trips** | 537 | 719 | 652 | 794 | 548 | 2,221 | 1,737 | 3,734 |
| ***Internal Trips*** | *7* | *194* | *8* | *213* | *15* | *407* | *30* | *814* |
| **Primary Trips** | 530 | 525 | 644 | 581 | 533 | 1,814 | 1,707 | 2,920 |

*Findings*: Including all land uses and all development phases, the Vantage Way Properties project would be anticipated to generate 1,707 net new vehicle trips during the AM peak hour and 2,920 net new trips during the PM peak hour. In addition, the Vantage Way Properties project is anticipated to generate 30 internal trips during the AM peak hour and 814 internal trips during the PM peak hour.

**Proposed Trip Distribution**
The proposed distribution of new (primary) trips is based on a review of the land uses within the study area, distribution of existing traffic, and on engineering judgment. The overall distribution pattern is proposed as follows:

- 90% to and from the southeast on SR 240 and/or Horn Rapids Road
- 10% to and from the northwest on SR 240

The distribution pattern above represents an external distribution of the net new trips entering and exiting the study area. The distribution and assignment of the project's net new trips are shown on Figure 3.

As a conservative approach, all single-family trips generated by the R-2 zone are assumed to enter and exit the site at the New Site Access/SR 240 (Intersection 1) only according to the following pattern.

- 90% to and from the southeast on SR 240
- 10% to and from the northwest on SR 240

All multi-family and shopping center trips generated by the C-LB and C-3 zones are assumed to enter and exit the site at Beardsley Road/SR 240 (Intersection 2) and Beardsley Road/Horn Rapids Road (Intersection 3) only according to the following pattern. The distribution is approximately 90% to the southeast and 10% to the northwest as shown in Figure 3, but calculations are based on the following distribution:

- 81% to and from the southeast on SR 240
- 9% to and from the northwest on SR 240, northwest of Beardsley Road
- 9% to and from southeast on Horn Rapids Road, southeast of Beardsley Road
- 1% to and from northwest on Horn Rapids Road, northwest of Beardsley Road

## INTERSECTION OPERATIONS AND ROADWAY CAPACITY ANALYSES

**Operation Standards**
The City's Comprehensive Plan (*City of Richland Comprehensive Plan – Supporting Analysis*, page 44) has adopted a formal level of service (LOS) standard of "D" or better. The Washington State Department of Transportation (WSDOT) requires a level of service "D" or better for Regionally Significant State Highways (non-HSS) in urban areas, including New Site Access/SR 240 and Beardsley Road/SR 240 (WSDOT, "Level of Service Standards for Washington State Highways," January 1, 2010).

**Analysis Methodology**
Traffic impacts were estimated to determine the extent of change in traffic conditions caused by future development. In order to make this determination, the following assumptions were employed:

- The individual peak hour volumes were analyzed for 2040.
- The peak hour factor (PHF) for the overall intersection, as calculated from the count data, was applied for each analysis scenario. The PHF was adjusted to a minimum of 0.92 for future conditions (2040).
- A minimum value of 2.0% was assumed for each movement in the future 2040 conditions for heavy vehicle percentage (HV%).
- As noted previously, trip generation, distribution, and assignment estimates for the project were prepared for the weekday AM and PM peak hours on the surrounding street system.

- Studied intersections were assumed to include a two-lane roadway with stop control on the roadway with a lower functional classification.
- Cumulative traffic impacts of the proposed project were determined by superimposing the project-generated traffic onto the baseline volumes for the weekday AM and PM peak hour at all studied intersections. This sum is termed the 2040 With Project conditions.
- The LOS for each signalized and stop-controlled intersection was calculated with Trafficware's Synchro software, Version 10, based on Highway Capacity Manual (HCM) 6th Edition (2016) methodologies.
- The LOS for each roundabout intersection was calculated with Akcelik Associates' SIDRA Intersection software, Version 8, based on WSDOT-recommended settings.
- Intersection results are reported differently depending on the control type.
    - Two-way stop-controlled intersection results report the critical approach LOS and delay as well as the critical lane v/c ratio within that approach. This methodology also applies to the stop-controlled approach at a T-intersection.
    - Roundabout, and signalized intersection results report the overall intersection LOS and delay as well as the critical lane v/c ratio.
- No internal intersections were evaluated including intersections of driveways on Beardsley Road.

**Level of Service Analyses**

Table 3 presents the key LOS findings for each intersection within the study area for 2040 With Project during the studied peak hours. Detailed LOS calculation reports for the study area intersections are provided in Appendix C.

**Table 3. Estimated Level of Service at Study Area Intersections for 2040 With Project Conditions**

| INT. # | INTERSECTION | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | LOS | Delay (sec/veh) | v/c *(Lane)* | LOS | Delay (sec/veh) | v/c *(Lane)* |
| 1 | New Site Access / SR 240 | **F** | **259.6** | **1.465** ***(SWL)*** | **F** | **163.0** | **1.163** ***(SWL)*** |
| 2 | Beardsley Road / SR 240 | **F** | **2302.9** | **5.955** ***(SWL)*** | **F** | **18346** | **41.137** ***(SWL)*** |
| 3 | Beardsley Road / Horn Rapids Road | A | 9 | 0.078 *(NBL)* | A | 9.7 | 0.56 *(NBL)* |

SWL = Southwest-bound left turn
NBL = Northbound left turn

As shown in Table 3, two out of three studied intersections operate below the acceptable LOS during the AM and PM peak hour for the 2040 With Project conditions. The New Site Access/SR 240 intersection and Beardsley Road/SR 240 intersection operate at LOS F for the southwest-bound left turn.

*Finding:* The New Site Access/SR 240 intersection and Beardsley Road/SR 240 intersection operate below the acceptable LOS in the 2040 with project conditions.

### Signal Warrant Evaluation

The criteria for the analysis of signals at intersections are based on the *Manual on Uniform Traffic Control Devices* (MUTCD), Section 4C.04 Warrant 3, Peak Hour (page 439): The peak hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of one hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. Appendix D presents the studied intersections that met the peak hour signal warrants.

*Findings:* Peak hour signal warrants were met at the following intersections:

- New Site Access/SR 240 during 2040 With Future Project conditions, in the AM and PM peak hour
- Beardsley Road/SR 240 during 2040 With Future Project conditions, in the AM and PM peak hour

## SAFETY EVALUATION

### Left-Turn Lane Evaluation

The criteria for the analysis of left-turn lanes at uncontrolled intersection legs are based on the WSDOT *Design Manual*, Left-Turn Storage Guidelines (Exhibit 1310-7a): Two-Lane, Unsignalized. The exhibit provides guideline curves for posted speeds of 40, 50, and 60 miles per hours (mph). The posted speeds on SR 240 and Horn Rapids Road are 55 mph and 50 mph, respectively. Appendix E presents the left-turn lane evaluations.

*Findings:* Left-turn lanes are recommended for further investigation at the following locations:

- Southeast-bound on SR 240 at the New Site Access intersection during the PM peak hour
- Southeast-bound on SR 240 at the Beardsley Road intersection during the AM and PM peak hours

### Right-Turn Treatment Analysis

The criteria for the analysis of right-turn lanes at uncontrolled intersection legs are based on the *WSDOT Design Manual*, Right-Turn Lane Guidelines (Exhibit 1310-11), which note:

*Right-turn movements influence intersection capacity even though there is not conflict between right-turning vehicles and opposing traffic. Right-turn lanes might be needed to maintain efficient intersection operation. Use the following to determine when to <u>consider</u> right-turn lanes at unsignalized intersections:*

- *For two-lane roadways and for multilane roadways with a posted speed of 45 mph or above, when recommended by Exhibit 1310-11.*

For the intersections likely to be upgraded to traffic signals or roundabouts, the need for right-turn lanes should be evaluated as a LOS improvement. This is considered in the following Mitigation section. Appendix E presents the right-turn treatment evaluations.

*Findings:* A right-turn lane should be considered at the following locations:

- Northwest-bound on SR 240 at the New Site Access intersection during the AM and PM peak hours.
- Northwest-bound on SR 240 at the Beardsley Road intersection during the AM and PM peak hours.

### Safety Evaluation Summary

LOS analysis was prepared at the intersections that met the criteria for turn lanes, as discussed in the previous sections. The added turn lanes at New Site Access/SR 240 and Beardsley Road/SR 240 intersections continue to operate below the acceptable LOS after adding turn lanes to the stop control configuration. Appendix E presents the LOS calculations at the studied intersections after adding the turn lanes.

## MITIGATION

Table 4 presents the possible mitigations for each studied intersection that operates below the acceptable LOS. The shaded cells represent when intersections are operating at an acceptable LOS and do not require mitigation. A summary of mitigations is presented in Table 5, and LOS calculations for mitigated intersections are presented in Appendix F.

**Table 4. Estimated Level of Service at Study Area Intersections for 2040 With Project Conditions**

| INT. # | INTERSECTION | Improvement | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|
| | | | LOS | Delay (sec/veh) | v/c *(Lane)* | LOS | Delay (sec/veh) | v/c *(Lane)* |
| 1 | New Site Access/SR 240 | Signal | A | 10.0 | 0.79 *(SWL)* | B | 10.1 | 0.84 *(NW-TH-RT)* |
| | | Single-lane Roundabout | A | 7.5 | 0.46 *(SEB)* | A | 7.0 | 0.58 *(NWB)* |
| 2 | Beardsley Road/SR 240 | Signal + Turn Lanes | B | 11.7 | 0.76 *(SWL)* | B | 18.6 | 0.91 *(SWL)* |
| | | Multi-lane Roundabout | A | 9.4 | 0.78 *(SEB-TH)* | B | 11.5 | 0.82 *(SWB-LT)* |
| 3 | Beardsley Road/ Horn Rapids Road | | | | | | | |

SWL = southwest-bound left turn
SEB = southeast-bound
SEB-TH = southeast-bound through
NW-TH-RT = northwest-bound shared through and right turn
NWB = northwest-bound
SWB-LT = southwest-bound left turn

As shown in Table 4, LOS at the New Site Access/SR 240 intersection can be mitigated by adding a signal to the assumed lane configuration or with a single-lane roundabout. The intersection is estimated to operate at LOS B or better when mitigated with a signal and at LOS A or better when mitigated with a multi-lane roundabout. *PBS recommends a traffic signal, but a formal WSDOT intersection control evaluation (ICE) will be necessary to finalize the intersection improvements.*

As shown in Table 4, LOS at the Beardsley Road/SR 240 intersection can be mitigated by adding a signal together with left- and right-turn lanes or with a multi-lane roundabout. Appendix F provides a visual representation of the proposed improvements. The intersection is estimated to operate at LOS B or better when mitigated with a signal and at LOS B or better when mitigated with a multi-lane roundabout. *PBS recommends a traffic signal, but a formal WSDOT ICE will be needed to finalize the intersection improvements.*

*Findings:* Intersection upgrades will be needed at the New Site Access/SR 240 and Beardsley Road/SR 240 intersections.

*Recommendations:* PBS recommends a traffic signal at New Site Access/SR 240 and Beardsley Road/SR 240 intersections, but a formal WSDOT ICE will be needed to finalize the intersection improvements.

**Summary and Timing of Mitigations**

To estimate when the intersection starts to operate below the acceptable LOS, the volumes at the intersections were estimated for the years 2025, 2030, and 2035 in the PM peak hour. The volumes were estimated by assuming trips generated are proportional to the buildout year. This assumes linear growth of trips generated over a span of 20 years at a five-year interval, as follows.

- In 2020, 0% of the total trips are generated by the development.
- In 2025, 25% of the total trips are generated.
- In 2030, 50% of the total trips are generated.
- In 2035, 75% of the total trips are generated.
- In 2040, 100% of the total trips are generated.

In addition to the trips generated by the development, a linear 1.0% background growth for each analysis year was added together with the assumed trips from the network growth on Horn Rapids Road.

Table 5 summarizes the possible alternatives that mitigate the intersections that operate below the acceptable LOS. The possible alternatives mitigate the intersections from the scenario when the intersections start to operate below the acceptable LOS in 2040 With Project conditions.

**Table 5. Alternatives that Mitigate Intersections and Recommended Mitigation**

| INT. # | INTERSECTION | Scenario When LOS Drops Below D[a] | TWSC with Turn Lanes[b] | Signal | 1-Lane RAB | 2-Lane RAB | Recommended Mitigation[c] |
|---|---|---|---|---|---|---|---|
| 1 | New Site Access/SR 240 | 2035 With, PM Peak | | ● d | ● | ● | Signal |
| 2 | Beardsley Road/SR 240 | 2025 With, PM Peak | | ● e | | ● | Signal |

RAB = roundabout, TWSC = two-way stop control
[a] Intersection starts to operate below the acceptable LOS from that scenario onward.
[b] Addition of all the turn lanes recommended by the WSDOT criteria discussed in the safety evaluation section did not adequately mitigate the intersection LOS.
[c] PBS recommends the given mitigation but a WSDOT ICE will be necessary to finalize the intersection improvements.
[d] Did not meet peak signal warrant in 2035 but met peak hour signal warrant in 2040.
[e] Add two southwest-bound left-turn lanes (one shared with right turns), a northwest-bound right-turn lane and a southeast-bound left-turn lane with signal. Met peak hour signal warrant.

As shown in Table 5, and based on the assumptions in this TIA, the New Site Access/SR 240 intersection begins to experience LOS failure in 2035, and the recommended mitigation is a traffic signal. The Beardsley Road/SR 240 intersection begins to experience LOS failure in 2025, and the recommended mitigation is a traffic signal.

*Findings:* New Site Access/SR 240 intersection begins to operate below the acceptable LOS in 2035.

*Findings:* Beardsley Road/SR 240 intersection begins to operate below the acceptable LOS in 2025.

## FINDINGS

Including all land uses and all development phases, the Vantage Way Properties project would be anticipated to generate 1,707 net new vehicle trips during the AM peak hour and 2,920 net new trips during the PM peak hour. In addition, the project is anticipated to generate 30 internal trips during the AM peak hour and 814 internal trips during the PM peak hour.

The New Site Access/SR 240 intersection and Beardsley Road/SR 240 intersection will operate below the acceptable LOS in 2040 With Project conditions.

Two intersections meet the peak hour signal warrant during the 2040 with project conditions:

- New Site Access/SR 240
- Beardsley Road/SR 240

Two approaches meet the criteria for further investigation of a left-turn lane:

- Southeast-bound SR 240 at the New Site Access intersection
- Southeast-bound SR 240 at the Beardsley Road intersection

Two approaches meet the criteria for a right-turn lane:

- Northwest-bound SR 240 at the New Site Access intersection
- Northwest-bound SR 240 at the Beardsley Road intersection

Intersection upgrade will be needed at the New Site Access/SR 240 and Beardsley Road/SR 240 intersections.

New Site Access/SR 240 intersection begins to operate below the acceptable LOS in 2035.

Beardsley Road/SR 240 intersection begins to operate below the acceptable LOS in 2025.

## RECOMMENDATIONS

When future development plans are designed, prepare a WSDOT ICE at the New Site Access/SR 240 intersection and Beardsley Road/SR 240 intersection for 2035 and 2025, respectively. The project developers should contribute at least a proportionate share of the cost for the selected intersection improvements.

## CLOSING

Please feel free to contact me at 360.567.2117 or John.Manix@pbsusa.com with any questions or comments.

Sincerely,

John Manix, PE
Senior Traffic Engineer

JOHN ANDREW MANIX
STATE OF WASHINGTON
37225
REGISTERED
PROFESSIONAL ENGINEER

Digitally signed by John Manix
Date: 2020.02.25
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Attachments: Figure 1. Vicinity Map
Figure 2. Site Plan
Figure 3. Trip Distribution and Assignment

Figure 4. 2040 With Project Volumes
Appendix A. Traffic Counts
Appendix B. Trip Generation Calculations
Appendix C. Level of Service Calculations
Appendix D. Peak Hour Signal Warrants
Appendix E. Left and Right Turn Analysis
Appendix F. Mitigated Level of Service Calculations

BJ:DAH,JAM:mo

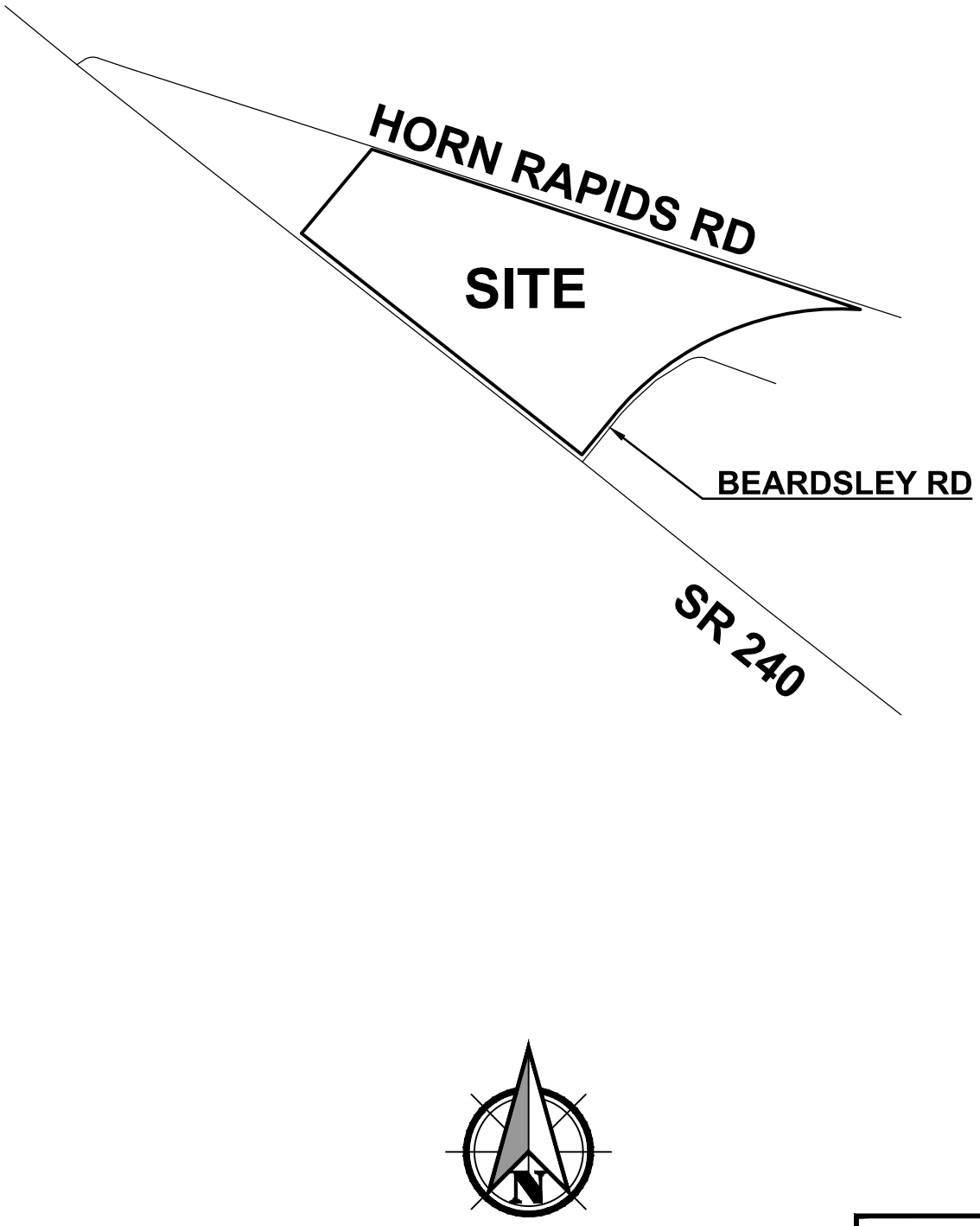



FIGURE 1

# Vicinity Map

## Vantage Way Properties

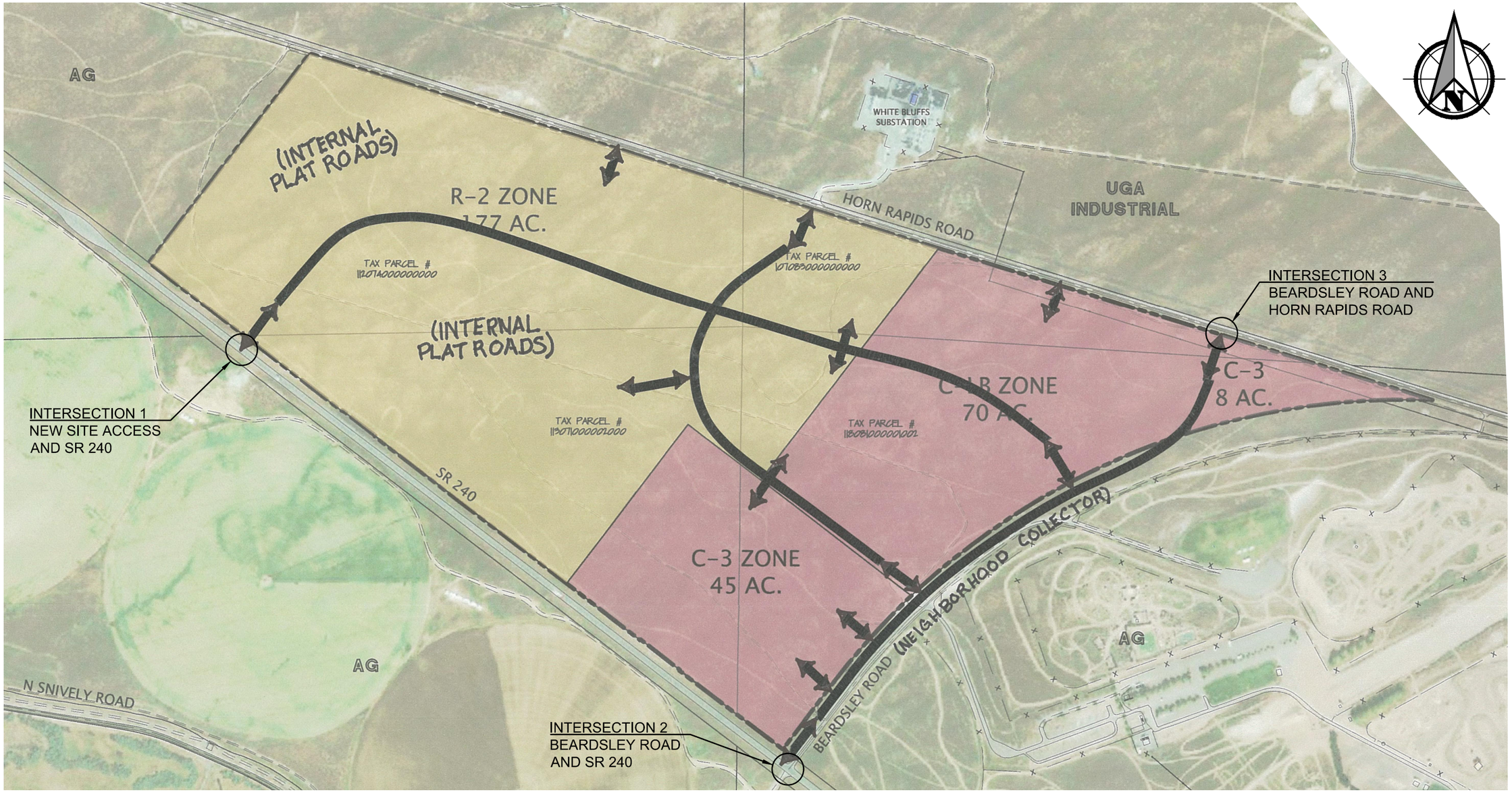
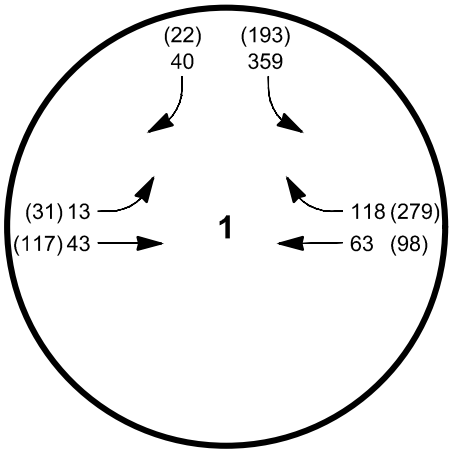


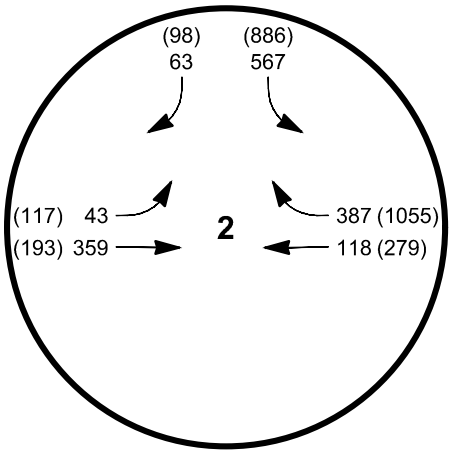

FIGURE 2

# Site Plan

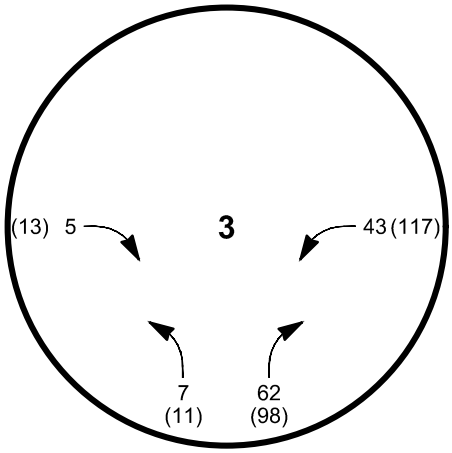
## Vantage Way Properties



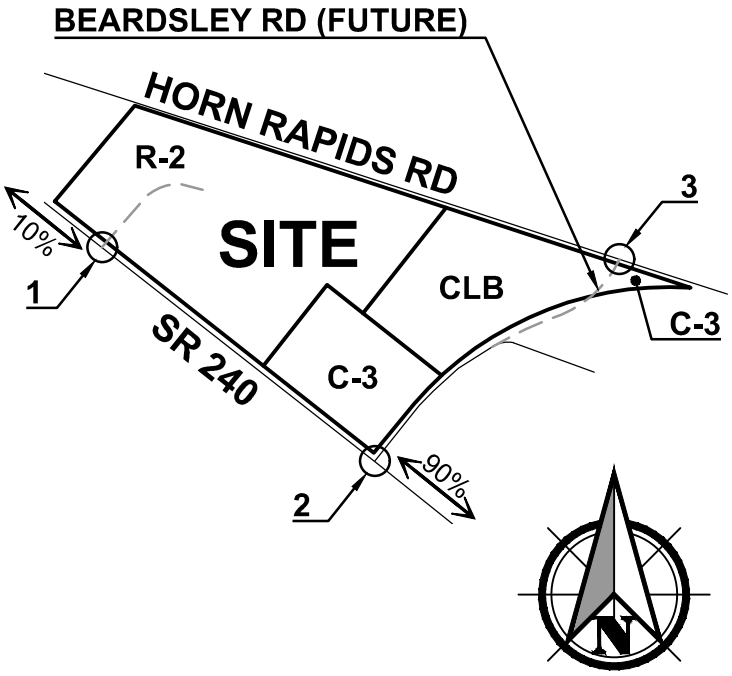

New Site Access / SR 240




Beardsley Road / SR 240




Beardsley Road / Horn Rapids Road



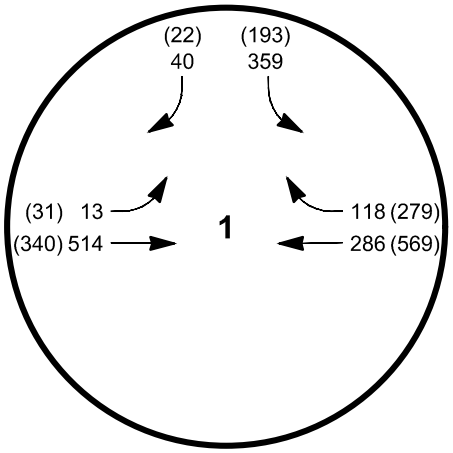

| WEEKDAY PEAK HOUR TRIPS | | |
|---|---|---|
| | AM | PM |
| ENTER | 609 | 1612 |
| EXIT | 1098 | 1308 |
| TOTAL | 1707 | 2920 |

| LEGEND | |
|---|---|
| ○ | INTERSECTION |
| XXX | AM PEAK HOUR |
| (XXX) | PM PEAK HOUR |

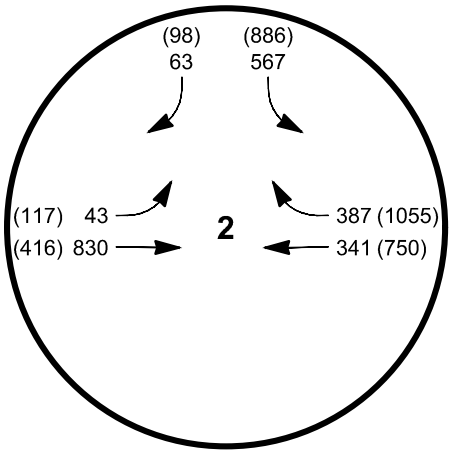
FIGURE 3

# Trip Distribution and Assignment

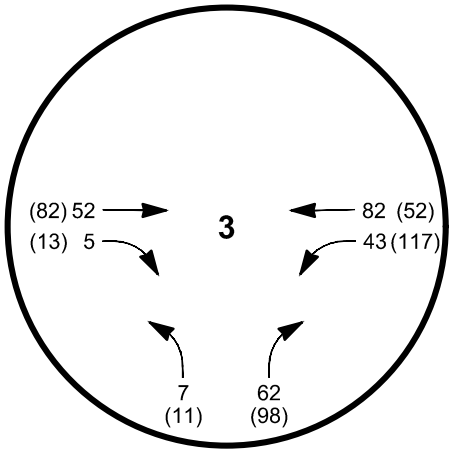
## Vantage Way Properties



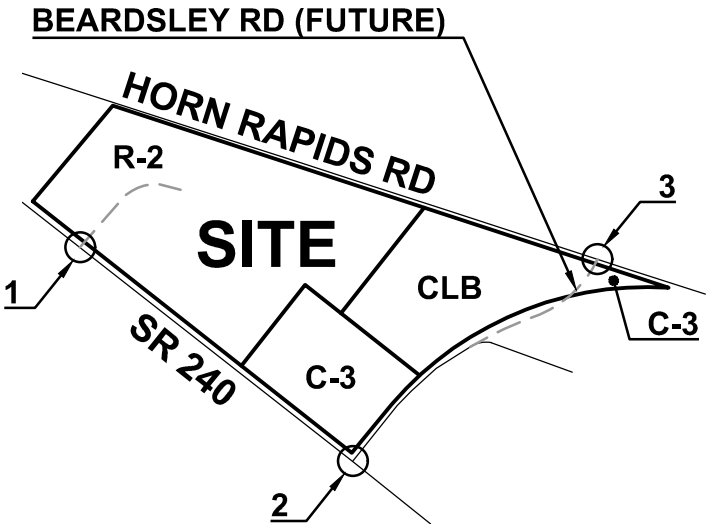

New Site Access / SR 240

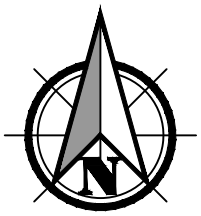



Beardsley Road / SR 240




Beardsley Road / Horn Rapids Road




| LEGEND | |
|---|---|
| ○ | INTERSECTION |
| XXX | AM PEAK HOUR |
| (XXX) | PM PEAK HOUR |

FIGURE 4

# 2040 With Project Volumes

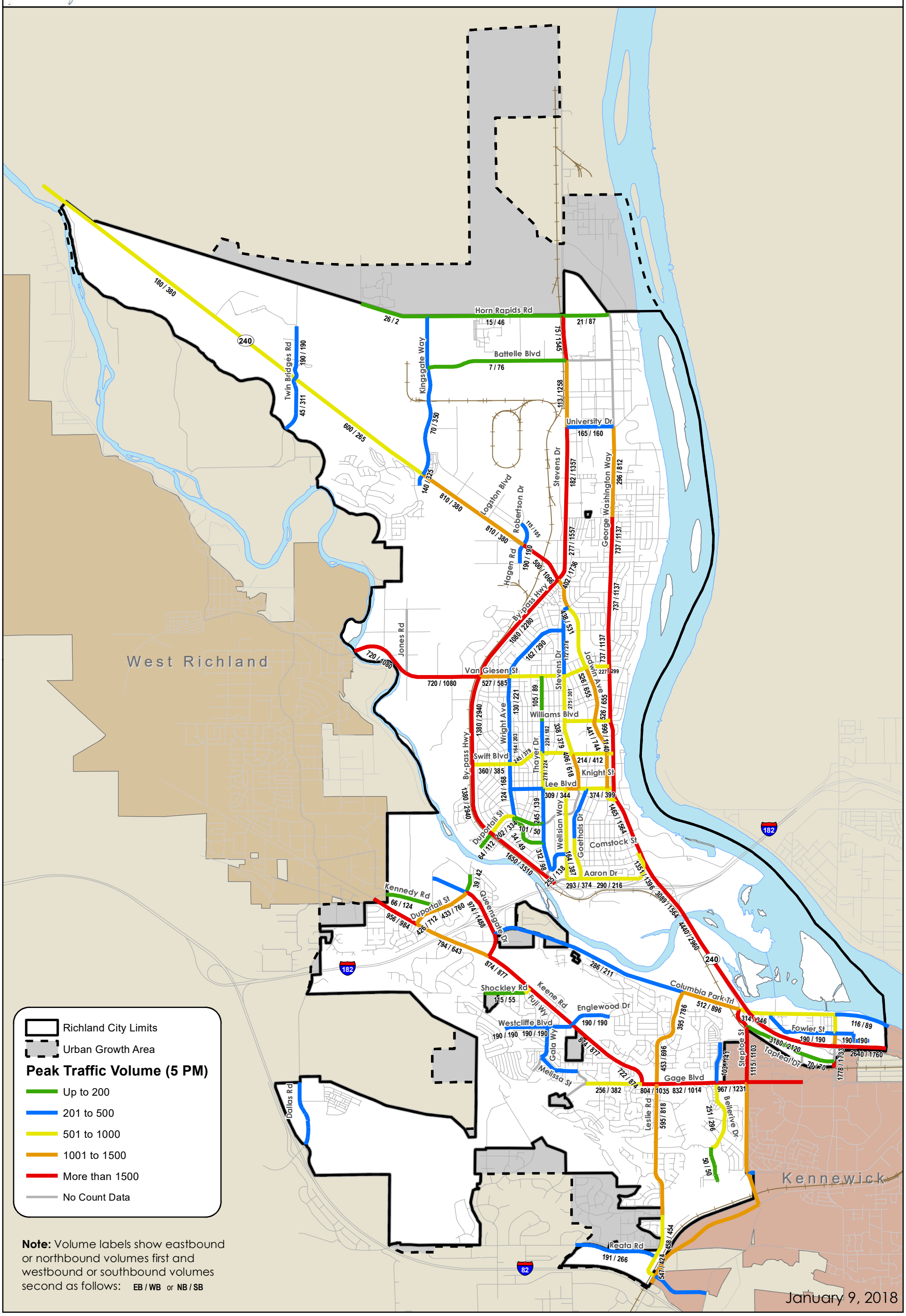
## Vantage Way Properties

# Appendix A

## Traffic Counts

# City of Richland

## T-5 - 2016 Peak Traffic Volumes



# Appendix B

## Trip Generation Calculations

| ITE Code | Zone | Vantage Way Properties - Total<br>Land Use | Total | Unit | AM<br>Enter | AM<br>Exit | AM<br>Total | PM<br>Enter | PM<br>Exit | PM<br>Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 210 | R-2 | Single Family Residential | 726 | dwelling units | 134 | 403 | 537 | 453 | 266 | 719 |
| 220 | C-LB | Apartments | 1417 | dwelling units | 150 | 502 | 652 | 500 | 294 | 794 |
| 820 | C-3 | Shoping Center | 583 | 1,000 sf | 340 | 208 | 548 | 1,066 | 1,155 | 2,221 |
| | | | | | 624 | 1,113 | 1,737 | 2,019 | 1,715 | 3,734 |

| | Vantage Way Properties - by 2040<br>Land Use | Total | Unit | AM<br>Enter | AM<br>Exit | AM<br>Total | PM<br>Enter | PM<br>Exit | PM<br>Total |
|---|---|---|---|---|---|---|---|---|---|
| 2040 | Single Family Residential Phases 6- | 726 | dwelling | 134 | 403 | 537 | 453 | 266 | 719 |
| | *Internal Trips* | | | -3 | -4 | -7 | -143 | -51 | -194 |
| | Primary Trips | | | 131 | 399 | 530 | 310 | 215 | 525 |
| | Multi Family Residential | 1417 | dwelling units | 150 | 502 | 652 | 500 | 294 | 794 |
| | *Internal Trips* | | | -3 | -5 | -8 | -157 | -56 | -213 |
| | Primary Trips | | | 147 | 497 | 644 | 343 | 238 | 581 |
| | Commercial General | 583 | 1,000 sf | 340 | 208 | 548 | 1,066 | 1,155 | 2,221 |
| | *Internal Trips* | | | *-9* | *-6* | *-15* | *-107* | *-300* | *-407* |
| | *Pass-By Trips* | | | *0* | *0* | *0* | *0* | *0* | *0* |
| | Primary Trips | | | 331 | 202 | 533 | 959 | 855 | 1,814 |
| | | | Total Trips Generated | 624 | 1,113 | 1,737 | 2,019 | 1,715 | 3,734 |
| | | | *Internal Trips* | *-15* | *-15* | *-30* | *-407* | *-407* | *-814* |
| | | | *Pass-By Trips* | *0* | *0* | *0* | *0* | *0* | *0* |
| | | | **Total Primary Trips** | 609 | 1,098 | 1,707 | 1,612 | 1,308 | 2,920 |

## Trip Generation Summary

Alternative: Alternative 1
Phase:
Project: Vantage Way Property

Open Date: 2/13/2020
Analysis Date: 2/13/2020

| ITE | Land Use | * | Weekday Average Daily Trips Enter | Exit | Total | * | Weekday AM Peak Hour of Adjacent Street Traffic Enter | Exit | Total | * | Weekday PM Peak Hour of Adjacent Street Traffic Enter | Exit | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 210 | SFHOUSE 1 | | 3427 | 3426 | 6853 | | 134 | 403 | 537 | | 453 | 266 | 719 |
| | 726 Dwelling Units | | | | | | | | | | | | |
| 220 | LOW-RISE 1 | | 5186 | 5186 | 10372 | | 150 | 502 | 652 | | 500 | 294 | 794 |
| | 1417 Dwelling Units | | | | | | | | | | | | |
| 820 | CENTERSHOPPING 1 | | 11004 | 11004 | 22008 | | 340 | 208 | 548 | | 1066 | 1155 | 2221 |
| | 583 1000 Sq. Ft. GLA | | | | | | | | | | | | |
| Unadjusted Volume | | | 19617 | 19616 | 39233 | | 624 | 1113 | 1737 | | 2019 | 1715 | 3734 |
| Internal Capture Trips | | | 0 | 0 | 0 | | 15 | 15 | 30 | | 407 | 407 | 814 |
| Pass-By Trips | | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 |
| Volume Added to Adjacent Streets | | | 19617 | 19616 | 39233 | | 609 | 1098 | 1707 | | 1612 | 1308 | 2920 |

Total Weekday Average Daily Trips Internal Capture = 0 Percent
Total Weekday AM Peak Hour of Adjacent Street Traffic Internal Capture = 2 Percent
Total Weekday PM Peak Hour of Adjacent Street Traffic Internal Capture = 22 Percent

* - Custom rate used for selected time period.

Source: Institute of Transportation Engineers, Trip Generation Manual 10th Edition

**Detailed Land Use Data**

For 726 Dwelling Units of SFHOUSE 1

( 210 ) Single-Family Detached Housing

Open Date: 2/13/2020

Project: Vantage Way Property

Analysis Date: 2/13/2020

| Day / Period | Total Trips | Pass-By Trips | Avg Rate | Min Rate | Max Rate | Std Dev | Avg Size | % Enter | % Exit | Use Eq. | Equation | R2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weekday Average Daily Trips | 6853 | 0 | 9.44 | 4.81 | 19.39 | 2.1 | 264 | 50 | 50 | False | Ln(T) = 0.92 Ln(X) + 2.71 | 0.95 |
| Source : Trip Generation Manual 10th Edition | | | | | | | | | | | | |
| Weekday AM Peak Hour of Adjacent Street Traffic | 537 | 0 | 0.74 | 0.33 | 2.27 | 0.27 | 219 | 25 | 75 | False | T = 0.71(X) + 4.8 | 0.89 |
| Source : Trip Generation Manual 10th Edition | | | | | | | | | | | | |
| Weekday PM Peak Hour of Adjacent Street Traffic | 719 | 0 | 0.99 | 0.44 | 2.98 | 0.31 | 242 | 63 | 37 | False | Ln(T) = 0.96 Ln(X) + 0.2 | 0.92 |
| Source : Trip Generation Manual 10th Edition | | | | | | | | | | | | |

**Detailed Land Use Data**

For 1417 Dwelling Units of LOW-RISE 1

( 220 ) Multifamily Housing (Low-Rise)

Open Date: 2/13/2020

Project: Vantage Way Property

Analysis Date: 2/13/2020

| Day / Period | Total Trips | Pass-By Trips | Avg Rate | Min Rate | Max Rate | Std Dev | Avg Size | % Enter | % Exit | Use Eq. | Equation | R2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weekday Average Daily Trips | 10372 | 0 | 7.32 | 4.45 | 10.97 | 1.31 | 168 | 50 | 50 | False | T = 7.56(X) - 40.86 | 0.96 |
| Source : Trip Generation Manual 10th Edition | | | | | | | | | | | | |
| Weekday AM Peak Hour of Adjacent Street Traffic | 652 | 0 | 0.46 | 0.18 | 0.74 | 0.12 | 199 | 23 | 77 | False | Ln(T) = 0.95 Ln(X) - 0.51 | 0.9 |
| Source : Trip Generation Manual 10th Edition | | | | | | | | | | | | |
| Weekday PM Peak Hour of Adjacent Street Traffic | 794 | 0 | 0.56 | 0.18 | 1.25 | 0.16 | 187 | 63 | 37 | False | Ln(T) = 0.89 Ln(X) - 0.02 | 0.86 |
| Source : Trip Generation Manual 10th Edition | | | | | | | | | | | | |

**Detailed Land Use Data**

For 583 1000 Sq. Ft. GLA of CENTERSHOPPING 1

( 820 ) Shopping Center

Open Date: 2/13/2020

Project: Vantage Way Property

Analysis Date: 2/13/2020

| Day / Period | Total Trips | Pass-By Trips | Avg Rate | Min Rate | Max Rate | Std Dev | Avg Size | % Enter | % Exit | Use Eq. | Equation | R2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weekday Average Daily Trips | 22008 | 0 | 37.75 | 7.42 | 207.98 | 16.41 | 453 | 50 | 50 | False | Ln(T) = 0.68 Ln(X) + 5.57 | 0.76 |
| Source : Trip Generation Manual 10th Edition | | | | | | | | | | | | |
| Weekday AM Peak Hour of Adjacent Street Traffic | 548 | 0 | 0.94 | 0.18 | 23.74 | 0.87 | 351 | 62 | 38 | False | T = 0.5(X) + 151.78 | 0.5 |
| Source : Trip Generation Manual 10th Edition | | | | | | | | | | | | |
| Weekday PM Peak Hour of Adjacent Street Traffic | 2221 | 0 | 3.81 | 0.74 | 18.69 | 2.04 | 327 | 48 | 52 | False | Ln(T) = 0.74 Ln(X) + 2.89 | 0.82 |
| Source : Trip Generation Manual 10th Edition | | | | | | | | | | | | |

Analyst: Bhaurvesh Jaya
Date: 2/12/2020

# MULTI-USE DEVELOPMENT TRIP GENERATION AND INTERNAL CAPTURE SUMMARY

Name of Dvlpt: Vantage Way Properties
Time Period: AM Peak Hour of Adj. Street Traffic

## LAND USE A: SF & MF

ITE LU Code: 210 & 220
Size: 726 + 1417 DUs

| | Total | Internal | External |
|---|---|---|---|
| Enter | 284 | 6 | 278 |
| Exit | 905 | 9 | 896 |
| Total | 1189 | 15 | 1174 |
| % | 100% | 1% | 99% |

Exit to External: 896
Enter from External: 278

1% 9 Demand
9 Balanced
17% 69 Demand

2% 6 Demand
6 Balanced
14% 29 Demand

% Demand
Balanced
% Demand

% Demand
Balanced
% Demand

## LAND USE B: CG - SH - CTR

ITE LU Code: 820
Size: 583,000 SF

| | Total | Internal | External |
|---|---|---|---|
| Enter | 340 | 9 | 331 |
| Exit | 208 | 6 | 202 |
| Total | 548 | 15 | 533 |
| % | 100 | 3% | 97% |

Exit to External: 202
Enter from External: 331

Demand % Balanced Demand %

% Demand Balanced % Demand

## LAND USE C

ITE LU Code:
Size:

| | Total | Internal | External |
|---|---|---|---|
| Enter | | | |
| Exit | | | |
| Total | | | |
| % | | | |

Enter from External
Exit to External

## Net External Trips for Multi-Use Development

| | LAND USE A | LAND USE B | LAND USE C | TOTAL |
|---|---|---|---|---|
| Enter | 278 | 331 | | 609 |
| Exit | 896 | 202 | | 1098 |
| Total | 1174 | 533 | | 1707 |
| Single-Use Trip Gen. Est. | 1189 | 548 | | 1737 |

INTERNAL CAPTURE: 2%

Source: Kaku Associates, Inc.

Analyst Bhauvesh Jaya
Date 02/11/2020

# MULTI-USE DEVELOPMENT TRIP GENERATION AND INTERNAL CAPTURE SUMMARY

Name of Dvlpt Vantage Way Properties
Time Period PM Peak Hour of Adj. street Traffic

## LAND USE A SF & MF

ITE LU Code 210 & 220
Size 726 + 1417

| | Total | Internal | External |
|---|---|---|---|
| Enter | 953 | 300 | 653 |
| Exit | 560 | 107 | 453 |
| Total | 1513 | 407 | 1106 |
| % | 100 | 27 | 73 |

Exit to External: 453
Enter from External: 653

42% 235 Demand
107 Balanced
10% 107 Demand

46% 438 Demand
300 Balanced
26% 300 Demand

% Demand
Balanced
% Demand

% Demand
Balanced
% Demand

## LAND USE B CG-SH-CTR

ITE LU Code 820
Size 583,000 SF

| | Total | Internal | External |
|---|---|---|---|
| Enter | 1066 | 107 | 959 |
| Exit | 1155 | 300 | 855 |
| Total | 2221 | 407 | 1814 |
| % | 100 | 18 | 82 |

Exit to External: 855
Enter from External: 959

% Demand
Balanced
% Demand

% Demand
Balanced
% Demand

## LAND USE C

ITE LU Code
Size

| | Total | Internal | External |
|---|---|---|---|
| Enter | | | |
| Exit | | | |
| Total | | | |
| % | | | |

Enter from External
Exit to External

## Net External Trips for Multi-Use Development

| | LAND USE A | LAND USE B | LAND USE C | TOTAL |
|---|---|---|---|---|
| Enter | 653 | 959 | | 1612 |
| Exit | 453 | 855 | | 1308 |
| Total | 1106 | 1814 | | 2920 |
| Single-Use Trip Gen. Est. | 1513 | 2221 | | 3734 |

Source: Kaku Associates, Inc.

INTERNAL CAPTURE 22%

# Appendix C

## Level of Service Calculations

| Intersection | |
|---|---|
| Int Delay, s/veh | 78 |

| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 13 | 514 | 286 | 118 | 359 | 40 |
| Future Vol, veh/h | 13 | 514 | 286 | 118 | 359 | 40 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 14 | 559 | 311 | 128 | 390 | 43 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 439 | 0 | - | 0 | 962 | 375 |
| Stage 1 | - | - | - | - | 375 | - |
| Stage 2 | - | - | - | - | 587 | - |
| Critical Hdwy | 4.12 | - | - | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | 2.218 | - | - | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | 1121 | - | - | - | ~ 284 | 671 |
| Stage 1 | - | - | - | - | 695 | - |
| Stage 2 | - | - | - | - | 556 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 1121 | - | - | - | ~ 279 | 671 |
| Mov Cap-2 Maneuver | - | - | - | - | ~ 279 | - |
| Stage 1 | - | - | - | - | 682 | - |
| Stage 2 | - | - | - | - | 556 | - |

| Approach | SE | NW | SW |
|---|---|---|---|
| HCM Control Delay, s | 0.2 | 0 | 259.6 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NWT | NWR | SEL | SET | SWLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 1121 | - | 296 |
| HCM Lane V/C Ratio | - | - | 0.013 | - | 1.465 |
| HCM Control Delay (s) | - | - | 8.3 | 0 | 259.6 |
| HCM Lane LOS | - | - | A | A | F |
| HCM 95th %tile Q(veh) | - | - | 0 | - | 24 |

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

| Intersection | |
|---|---|
| Int Delay, s/veh | 650.5 |

| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 43 | 830 | 341 | 387 | 567 | 63 |
| Future Vol, veh/h | 43 | 830 | 341 | 387 | 567 | 63 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 47 | 902 | 371 | 421 | 616 | 68 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 792 | 0 | - | 0 | 1578 | 582 |
| Stage 1 | - | - | - | - | 582 | - |
| Stage 2 | - | - | - | - | 996 | - |
| Critical Hdwy | 4.12 | - | - | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | 2.218 | - | - | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | 829 | - | - | - | ~ 120 | 513 |
| Stage 1 | - | - | - | - | ~ 559 | - |
| Stage 2 | - | - | - | - | ~ 357 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 829 | - | - | - | ~ 106 | 513 |
| Mov Cap-2 Maneuver | - | - | - | - | ~ 106 | - |
| Stage 1 | - | - | - | - | ~ 495 | - |
| Stage 2 | - | - | - | - | ~ 357 | - |

| Approach | SE | NW | SW |
|---|---|---|---|
| HCM Control Delay, s | 0.5 | 0 | $ 2302.9 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NWT | NWR | SEL | SET | SWLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 829 | - | 115 |
| HCM Lane V/C Ratio | - | - | 0.056 | - | 5.955 |
| HCM Control Delay (s) | - | - | 9.6 | $ | $ 2302.9 |
| HCM Lane LOS | - | - | A | A | F |
| HCM 95th %tile Q(veh) | - | - | 0.2 | - | 74.7 |

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

| Intersection | |
|---|---|
| Int Delay, s/veh | 3.7 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 52 | 5 | 43 | 82 | 7 | 62 |
| Future Vol, veh/h | 52 | 5 | 43 | 82 | 7 | 62 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 57 | 5 | 47 | 89 | 8 | 67 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 62 | 0 | 243 | 60 |
| Stage 1 | - | - | - | - | 60 | - |
| Stage 2 | - | - | - | - | 183 | - |
| Critical Hdwy | - | - | 4.12 | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | - | - | 2.218 | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | - | - | 1541 | - | 745 | 1005 |
| Stage 1 | - | - | - | - | 963 | - |
| Stage 2 | - | - | - | - | 848 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1541 | - | 721 | 1005 |
| Mov Cap-2 Maneuver | - | - | - | - | 721 | - |
| Stage 1 | - | - | - | - | 963 | - |
| Stage 2 | - | - | - | - | 821 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 2.5 | 9 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 966 | - | - | 1541 | - |
| HCM Lane V/C Ratio | 0.078 | - | - | 0.03 | - |
| HCM Control Delay (s) | 9 | - | - | 7.4 | 0 |
| HCM Lane LOS | A | - | - | A | A |
| HCM 95th %tile Q(veh) | 0.3 | - | - | 0.1 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 24.6 |

| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 31 | 340 | 569 | 279 | 193 | 22 |
| Future Vol, veh/h | 31 | 340 | 569 | 279 | 193 | 22 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 34 | 370 | 618 | 303 | 210 | 24 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 921 | 0 | - | 0 | 1208 | 770 |
| Stage 1 | - | - | - | - | 770 | - |
| Stage 2 | - | - | - | - | 438 | - |
| Critical Hdwy | 4.12 | - | - | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | 2.218 | - | - | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | 741 | - | - | - | ~ 202 | 401 |
| Stage 1 | - | - | - | - | 457 | - |
| Stage 2 | - | - | - | - | 651 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 741 | - | - | - | ~ 190 | 401 |
| Mov Cap-2 Maneuver | - | - | - | - | ~ 190 | - |
| Stage 1 | - | - | - | - | 430 | - |
| Stage 2 | - | - | - | - | 651 | - |

| Approach | SE | NW | SW |
|---|---|---|---|
| HCM Control Delay, s | 0.8 | 0 | 163 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NWT | NWR | SEL | SET | SWLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 741 | - | 201 |
| HCM Lane V/C Ratio | - | - | 0.045 | - | 1.163 |
| HCM Control Delay (s) | - | - | 10.1 | 0 | 163 |
| HCM Lane LOS | - | - | B | A | F |
| HCM 95th %tile Q(veh) | - | - | 0.1 | - | 11.6 |

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

| Intersection | |
|---|---|
| Int Delay, s/veh | 5435.1 |

| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 117 | 416 | 750 | 1055 | 886 | 98 |
| Future Vol, veh/h | 117 | 416 | 750 | 1055 | 886 | 98 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 127 | 452 | 815 | 1147 | 963 | 107 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 1962 | 0 | - | 0 | 2095 | 1389 |
| Stage 1 | - | - | - | - | 1389 | - |
| Stage 2 | - | - | - | - | 706 | - |
| Critical Hdwy | 4.12 | - | - | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | 2.218 | - | - | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | 296 | - | - | - | ~ 57 | 175 |
| Stage 1 | - | - | - | - | ~ 231 | - |
| Stage 2 | - | - | - | - | ~ 489 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 296 | - | - | - | ~ 24 | 175 |
| Mov Cap-2 Maneuver | - | - | - | - | ~ 24 | - |
| Stage 1 | - | - | - | - | ~ 99 | - |
| Stage 2 | - | - | - | - | ~ 489 | - |

| Approach | SE | NW | SW |
|---|---|---|---|
| HCM Control Delay, s | 5.7 | 0 | $ 18346 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NWT | NWR | SEL | SET | SWLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 296 | - | 26 |
| HCM Lane V/C Ratio | - | - | 0.43 | - | 41.137 |
| HCM Control Delay (s) | - | - | 26 | $ | $ 18346 |
| HCM Lane LOS | - | - | D | A | F |
| HCM 95th %tile Q(veh) | - | - | 2.1 | - | 133.5 |

| Notes | | | |
|---|---|---|---|
| ~: Volume exceeds capacity | $: Delay exceeds 300s | +: Computation Not Defined | *: All major volume in platoon |

| Intersection | |
|---|---|
| Int Delay, s/veh | 5.2 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 82 | 13 | 117 | 52 | 11 | 98 |
| Future Vol, veh/h | 82 | 13 | 117 | 52 | 11 | 98 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 89 | 14 | 127 | 57 | 12 | 107 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 103 | 0 | 407 | 96 |
| Stage 1 | - | - | - | - | 96 | - |
| Stage 2 | - | - | - | - | 311 | - |
| Critical Hdwy | - | - | 4.12 | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | - | - | 2.218 | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | - | - | 1489 | - | 600 | 960 |
| Stage 1 | - | - | - | - | 928 | - |
| Stage 2 | - | - | - | - | 743 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1489 | - | 547 | 960 |
| Mov Cap-2 Maneuver | - | - | - | - | 547 | - |
| Stage 1 | - | - | - | - | 928 | - |
| Stage 2 | - | - | - | - | 678 | - |

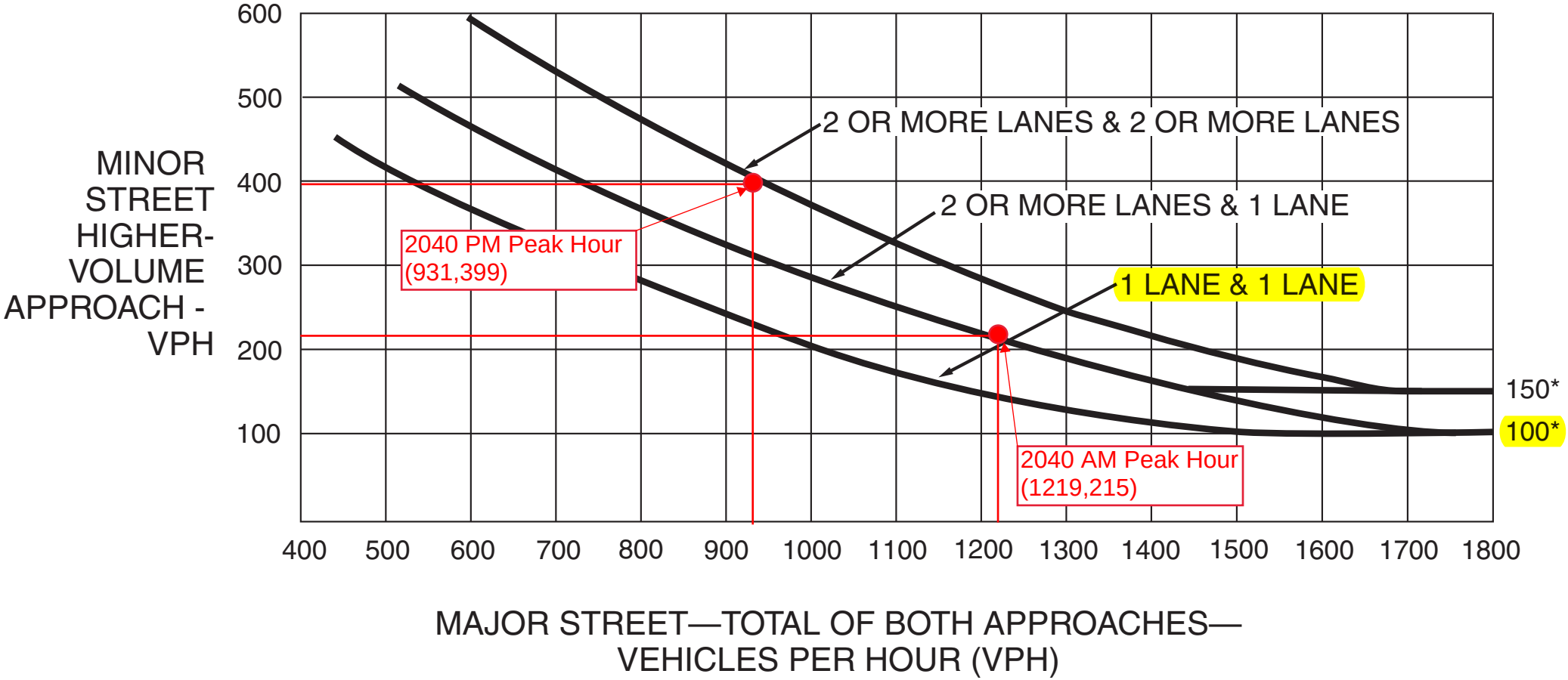
| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 5.3 | 9.7 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 892 | - | - | 1489 | - |
| HCM Lane V/C Ratio | 0.133 | - | - | 0.085 | - |
| HCM Control Delay (s) | 9.7 | - | - | 7.6 | 0 |
| HCM Lane LOS | A | - | - | A | A |
| HCM 95th %tile Q(veh) | 0.5 | - | - | 0.3 | - |

# Appendix D
## Signal Warrants

# New Site Access / SR 240
# 2040 Conditions

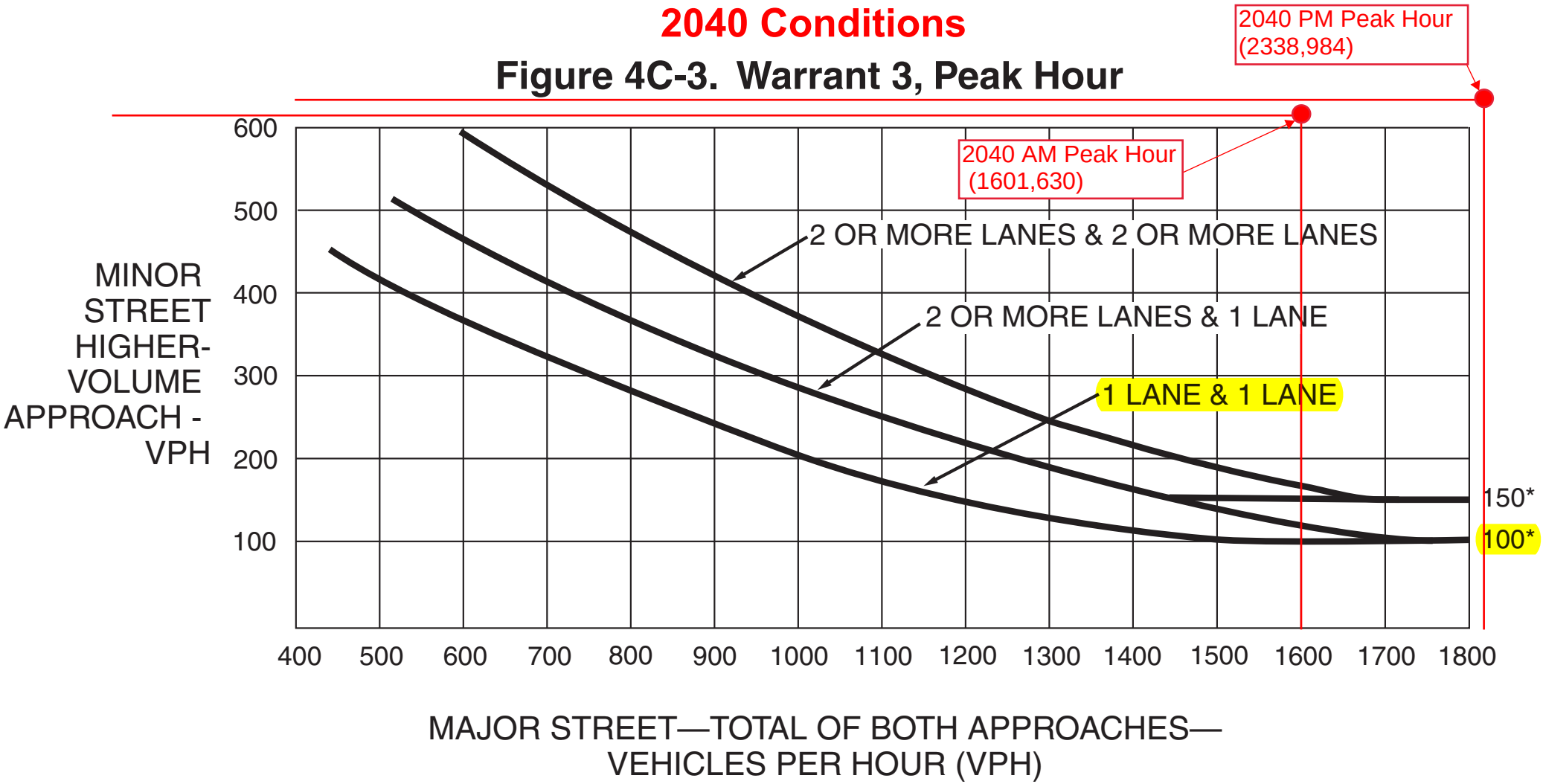
## Figure 4C-3. Warrant 3, Peak Hour




*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Beardsley Road / SR 240
# 2040 Conditions

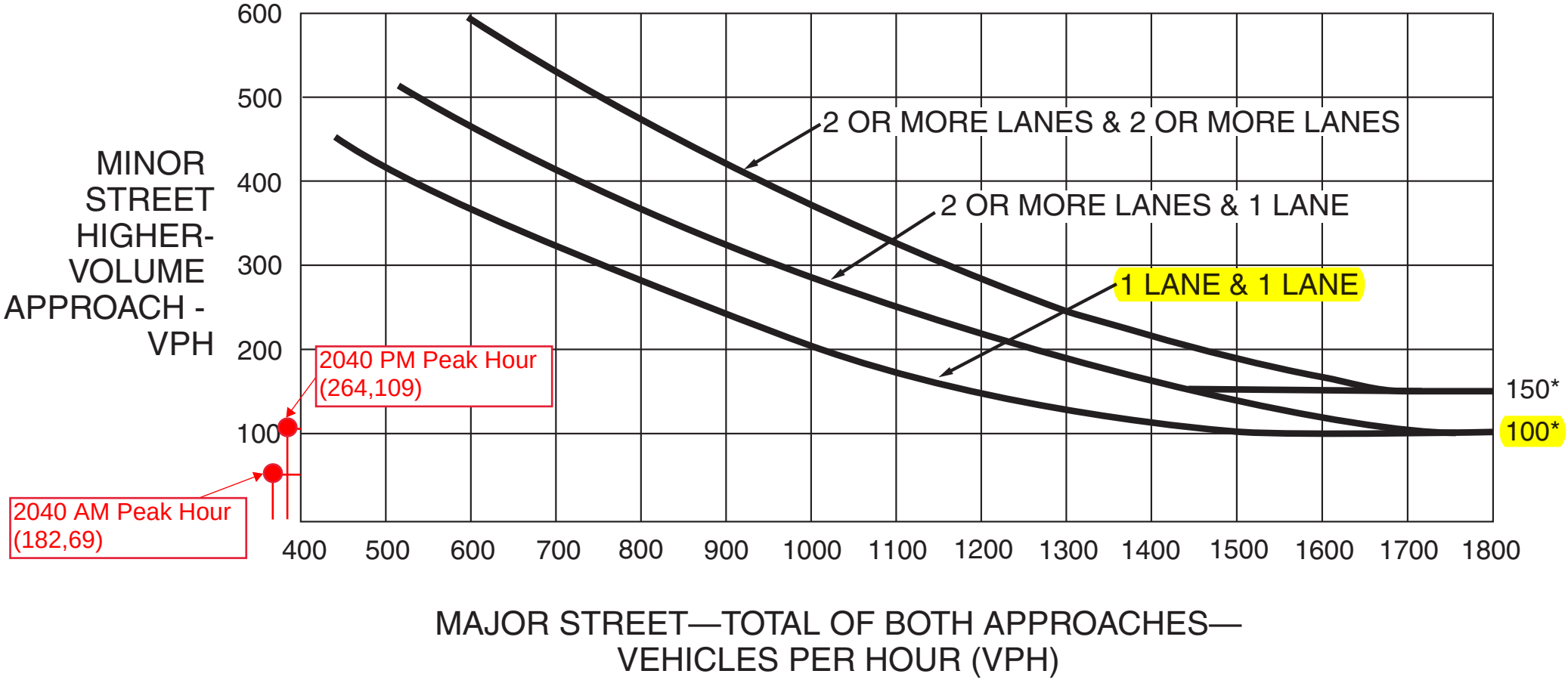
## Figure 4C-3. Warrant 3, Peak Hour




*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Beardsley Road / Horn Rapids Road
# 2040 Conditions

## Figure 4C-3. Warrant 3, Peak Hour




*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

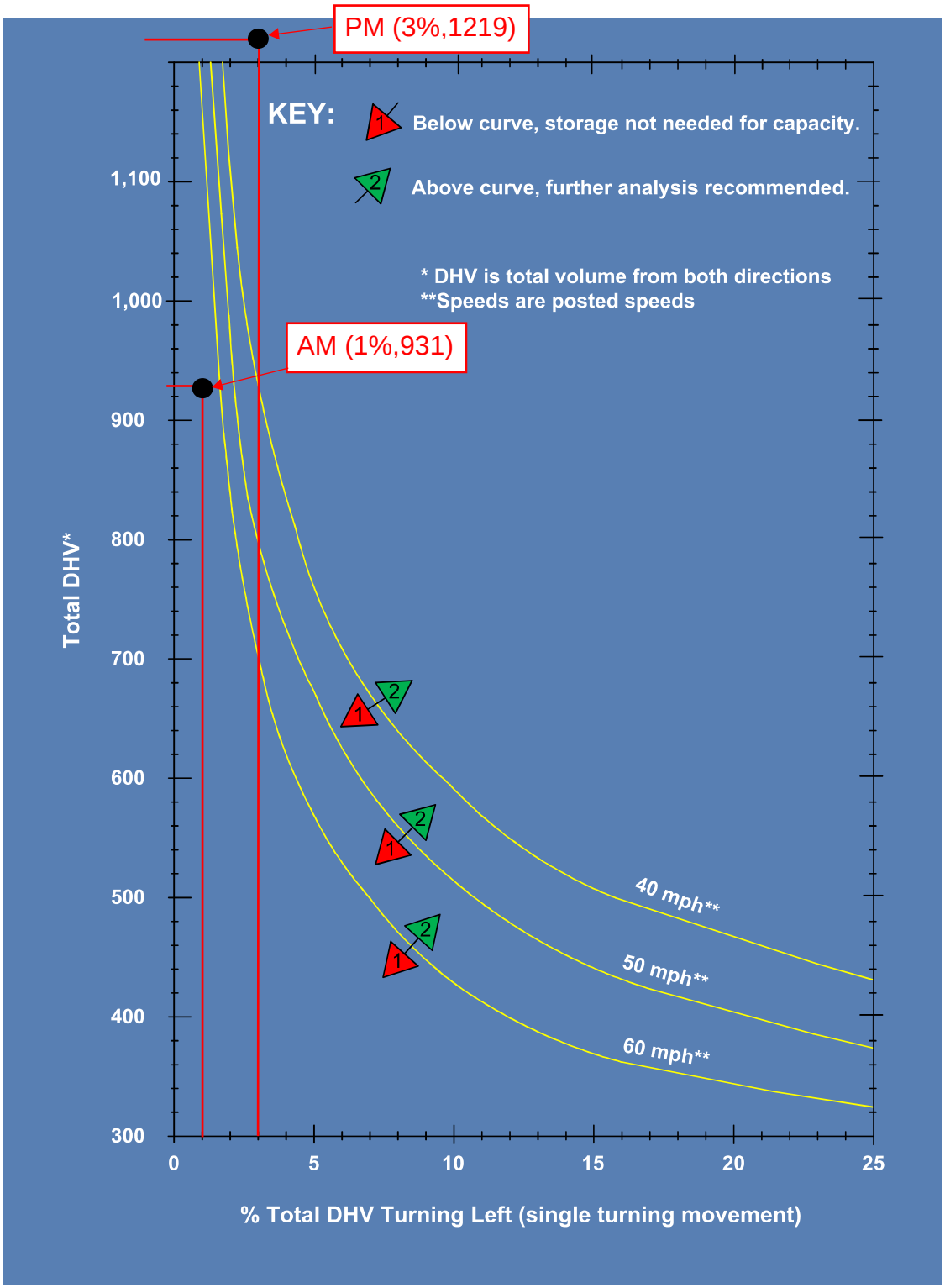
# Appendix E

## Left and Right Turn Analysis

2040 With Project Volumes (SE-bound): New Site Access / SR 240



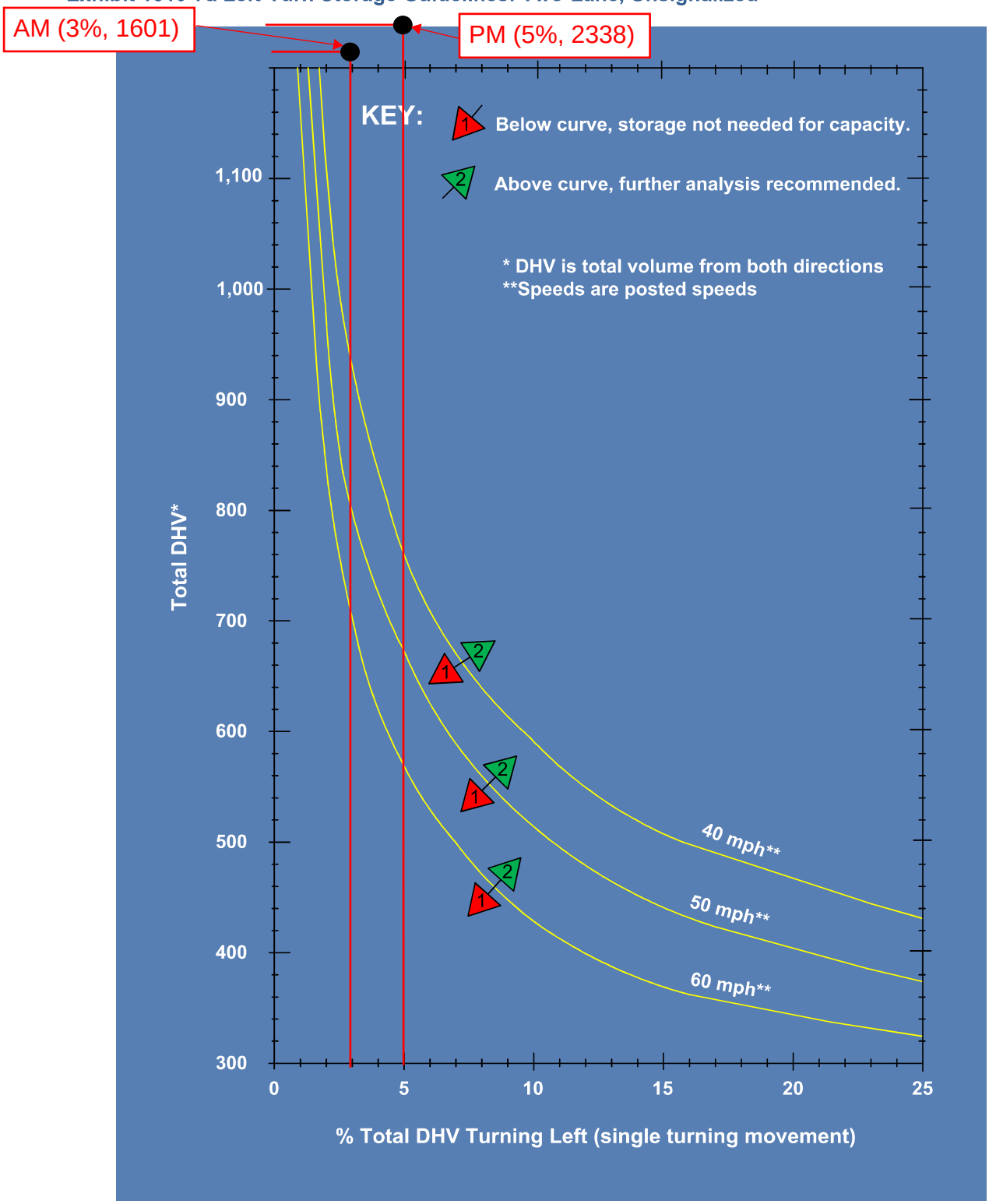
**Exhibit 1310-7a Left-Turn Storage Guidelines: Two-Lane, Unsignalized**



2040 With Project Volumes (SE-bound): Beardsley Road / SR 240



**Exhibit 1310-7a Left-Turn Storage Guidelines: Two-Lane, Unsignalized**



2040 With Project Volumes (NW-bound): Beardsley Road / Horn Rapids Road



**Exhibit 1310-7a Left-Turn Storage Guidelines: Two-Lane, Unsignalized**

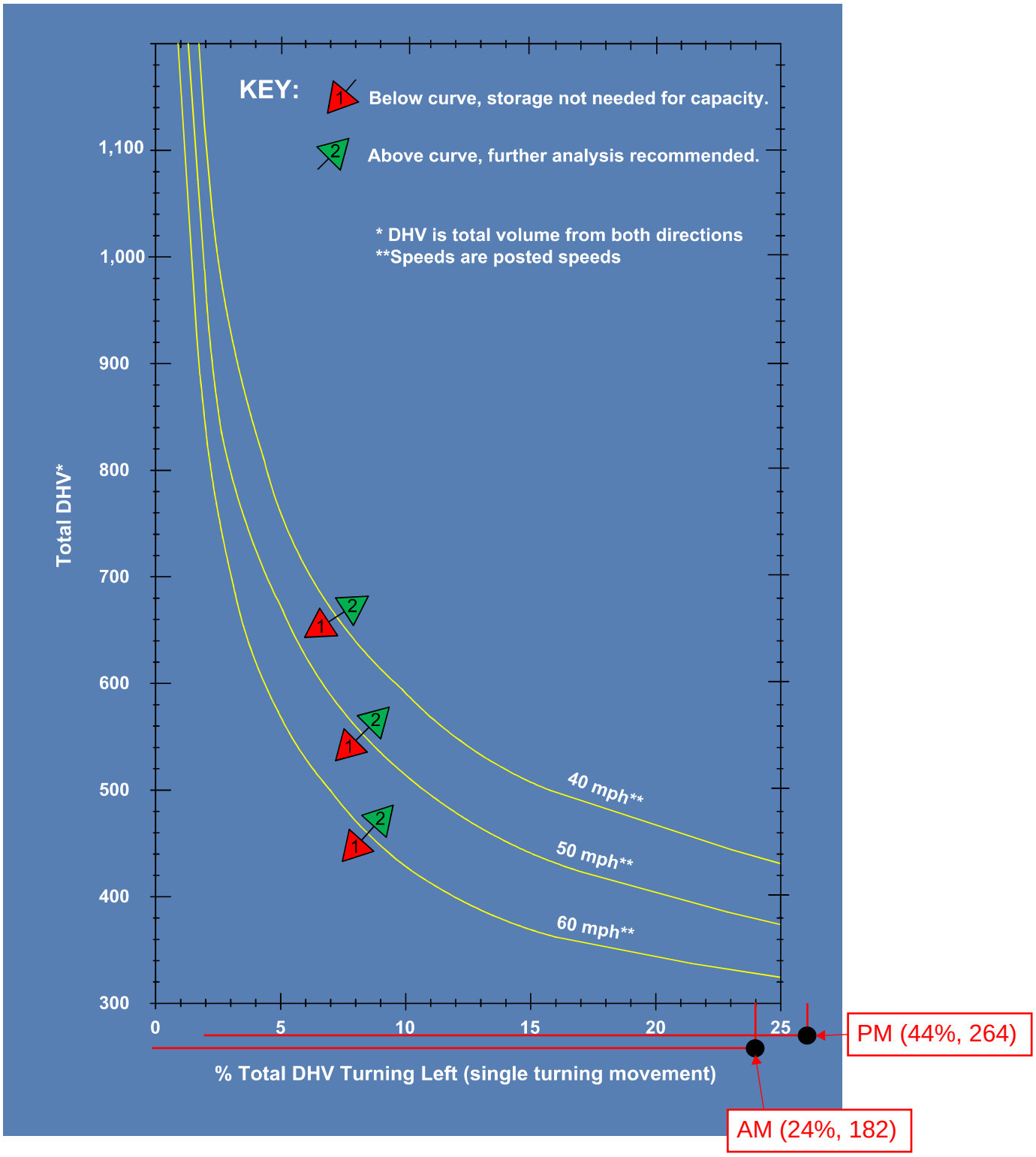
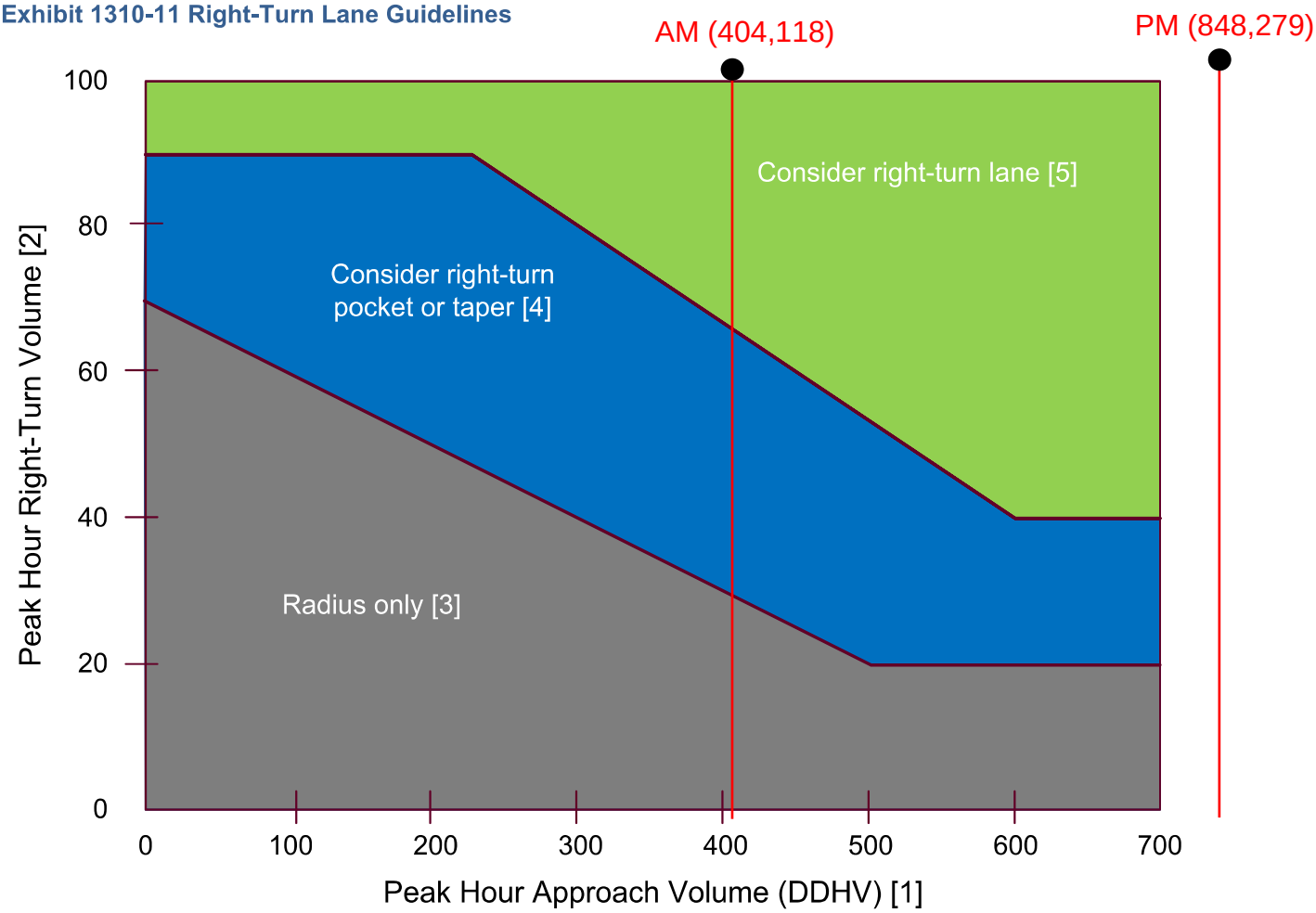


**Exhibit 1310-11 Right-Turn Lane Guidelines**




Notes:

[1] For two-lane highways, use the peak hour DDHV (through + right-turn).
For multilane, high-speed highways (posted speed 45 mph or above), use the right-lane peak hour approach volume (through + right-turn).

[2] When all three of the following conditions are met, reduce the right-turn DDHV by 20:

- The posted speed is 45 mph or below
- The right-turn volume is greater than 40 VPH
- The peak hour approach volume (DDHV) is less than 300 VPH

[3] For right-turn corner design, see Exhibit 1310-6.

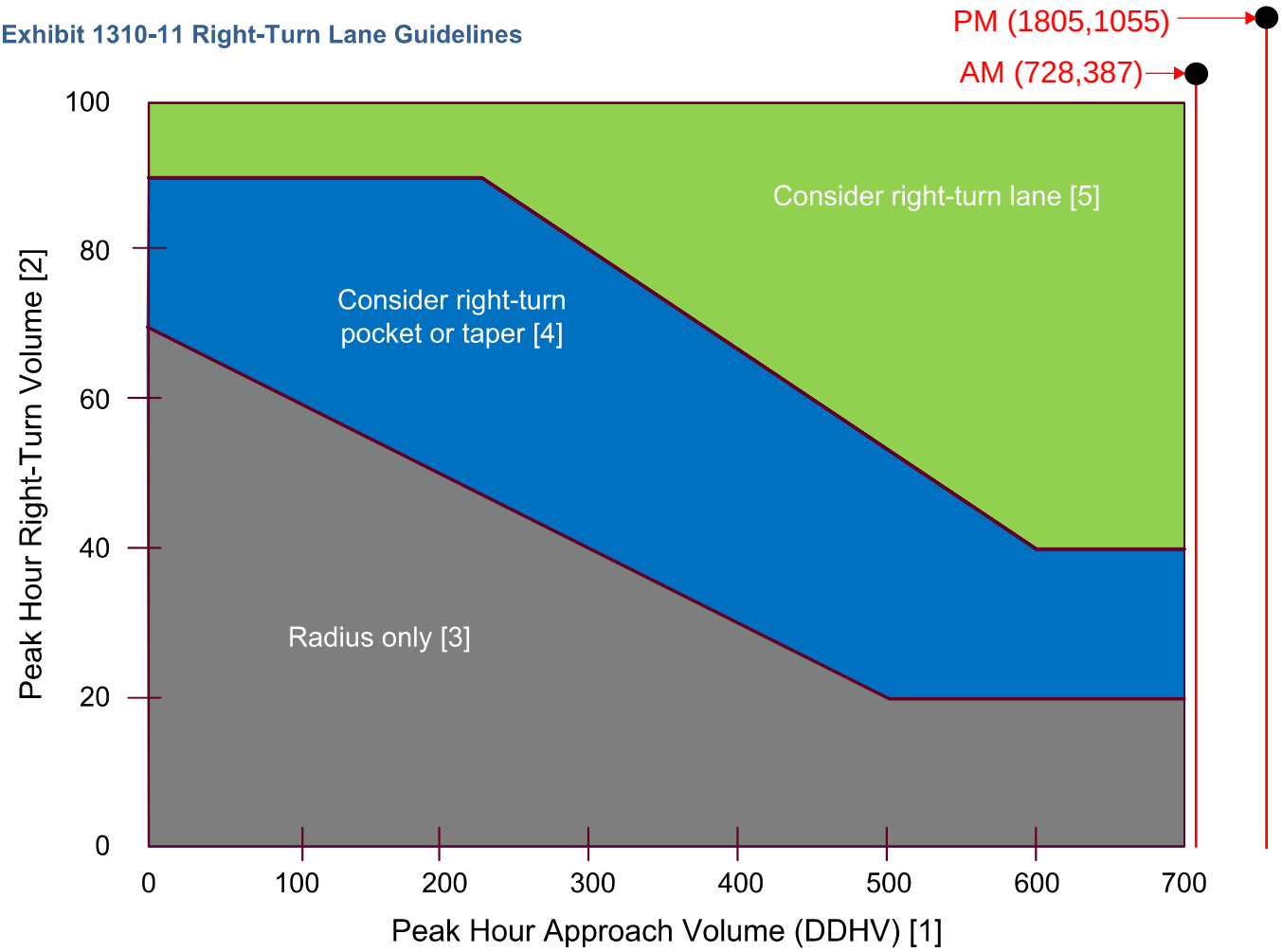
[4] For right-turn pocket or taper design, see Exhibit 1310-12.

[5] For right-turn lane design, see Exhibit 1310-13.

2040 With Project Volumes (NW-bound): Beardsley Road / SR 240



**Exhibit 1310-11 Right-Turn Lane Guidelines**




Notes:

[1] For two-lane highways, use the peak hour DDHV (through + right-turn).
For multilane, high-speed highways (posted speed 45 mph or above), use the right-lane peak hour approach volume (through + right-turn).

[2] When all three of the following conditions are met, reduce the right-turn DDHV by 20:

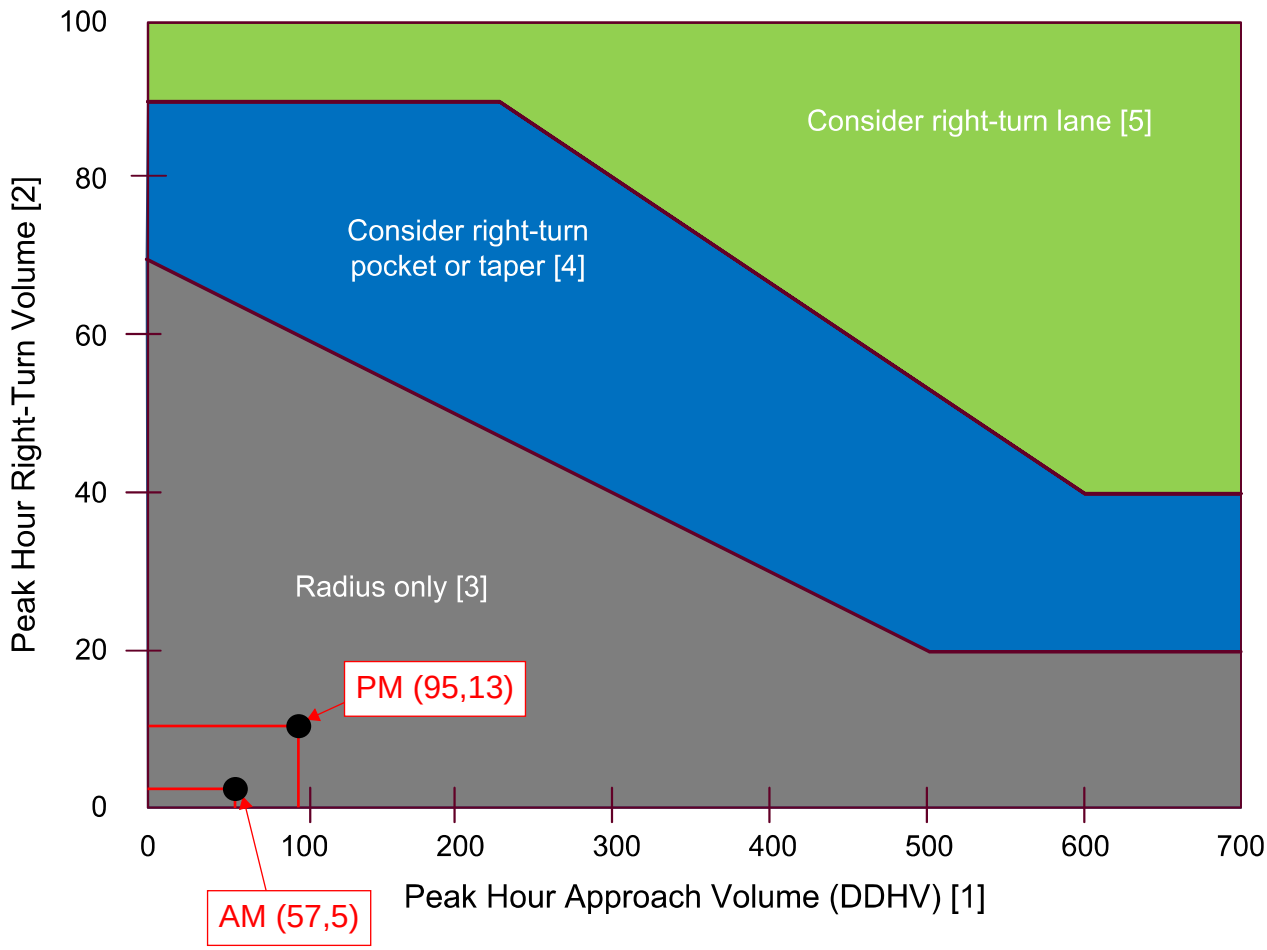
- The posted speed is 45 mph or below
- The right-turn volume is greater than 40 VPH
- The peak hour approach volume (DDHV) is less than 300 VPH

[3] For right-turn corner design, see Exhibit 1310-6.

[4] For right-turn pocket or taper design, see Exhibit 1310-12.

[5] For right-turn lane design, see Exhibit 1310-13.

### Exhibit 1310-11 Right-Turn Lane Guidelines




Notes:

[1] For two-lane highways, use the peak hour DDHV (through + right-turn).
For multilane, high-speed highways (posted speed 45 mph or above), use the right-lane peak hour approach volume (through + right-turn).

[2] When all three of the following conditions are met, reduce the right-turn DDHV by 20:

- The posted speed is 45 mph or below
- The right-turn volume is greater than 40 VPH
- The peak hour approach volume (DDHV) is less than 300 VPH

[3] For right-turn corner design, see Exhibit 1310-6.

[4] For right-turn pocket or taper design, see Exhibit 1310-12.

[5] For right-turn lane design, see Exhibit 1310-13.

| Intersection | |
|---|---|
| Int Delay, s/veh | 12.5 |

| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 31 | 340 | 569 | 279 | 193 | 22 |
| Future Vol, veh/h | 31 | 340 | 569 | 279 | 193 | 22 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | - | - | 0 | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 34 | 370 | 618 | 303 | 210 | 24 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 921 | 0 | - | 0 | 1056 | 618 |
| Stage 1 | - | - | - | - | 618 | - |
| Stage 2 | - | - | - | - | 438 | - |
| Critical Hdwy | 4.12 | - | - | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | 2.218 | - | - | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | 741 | - | - | - | 250 | 489 |
| Stage 1 | - | - | - | - | 538 | - |
| Stage 2 | - | - | - | - | 651 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 741 | - | - | - | 239 | 489 |
| Mov Cap-2 Maneuver | - | - | - | - | 239 | - |
| Stage 1 | - | - | - | - | 513 | - |
| Stage 2 | - | - | - | - | 651 | - |

| Approach | SE | NW | SW |
|---|---|---|---|
| HCM Control Delay, s | 0.8 | 0 | 81.9 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NWT | NWR | SEL | SET | SWLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 741 | - | 252 |
| HCM Lane V/C Ratio | - | - | 0.045 | - | 0.927 |
| HCM Control Delay (s) | - | - | 10.1 | - | 81.9 |
| HCM Lane LOS | - | - | B | - | F |
| HCM 95th %tile Q(veh) | - | - | 0.1 | - | 8.3 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 1678.8 |

| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 117 | 416 | 750 | 1055 | 886 | 98 |
| Future Vol, veh/h | 117 | 416 | 750 | 1055 | 886 | 98 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | - | - | 0 | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 127 | 452 | 815 | 1147 | 963 | 107 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 1962 | 0 | - | 0 | 1521 | 815 |
| Stage 1 | - | - | - | - | 815 | - |
| Stage 2 | - | - | - | - | 706 | - |
| Critical Hdwy | 4.12 | - | - | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | 2.218 | - | - | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | 296 | - | - | - | ~ 130 | 377 |
| Stage 1 | - | - | - | - | ~ 435 | - |
| Stage 2 | - | - | - | - | ~ 489 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 296 | - | - | - | ~ 74 | 377 |
| Mov Cap-2 Maneuver | - | - | - | - | ~ 74 | - |
| Stage 1 | - | - | - | - | ~ 248 | - |
| Stage 2 | - | - | - | - | ~ 489 | - |

| Approach | SE | NW | SW |
|---|---|---|---|
| HCM Control Delay, s | 5.7 | 0 | $ 5664.5 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NWT | NWR | SEL | SET | SWLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 296 | - | 80 |
| HCM Lane V/C Ratio | - | - | 0.43 | - | 13.37 |
| HCM Control Delay (s) | - | - | 26 | | $ 5664.5 |
| HCM Lane LOS | - | - | D | - | F |
| HCM 95th %tile Q(veh) | - | - | 2.1 | - | 126.9 |

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

| Intersection | |
|---|---|
| Int Delay, s/veh | 5.2 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 82 | 13 | 117 | 52 | 11 | 98 |
| Future Vol, veh/h | 82 | 13 | 117 | 52 | 11 | 98 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 89 | 14 | 127 | 57 | 12 | 107 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 103 | 0 | 407 | 96 |
| Stage 1 | - | - | - | - | 96 | - |
| Stage 2 | - | - | - | - | 311 | - |
| Critical Hdwy | - | - | 4.12 | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | - | - | 2.218 | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | - | - | 1489 | - | 600 | 960 |
| Stage 1 | - | - | - | - | 928 | - |
| Stage 2 | - | - | - | - | 743 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1489 | - | 547 | 960 |
| Mov Cap-2 Maneuver | - | - | - | - | 547 | - |
| Stage 1 | - | - | - | - | 928 | - |
| Stage 2 | - | - | - | - | 678 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 5.3 | 9.7 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 892 | - | - | 1489 | - |
| HCM Lane V/C Ratio | 0.133 | - | - | 0.085 | - |
| HCM Control Delay (s) | 9.7 | - | - | 7.6 | 0 |
| HCM Lane LOS | A | - | - | A | A |
| HCM 95th %tile Q(veh) | 0.5 | - | - | 0.3 | - |

# Appendix F

## Mitigated Level of Service Calculations

# HCM 6th Signalized Intersection Summary
## 1: SR 240 & New Site Access

02/21/2020

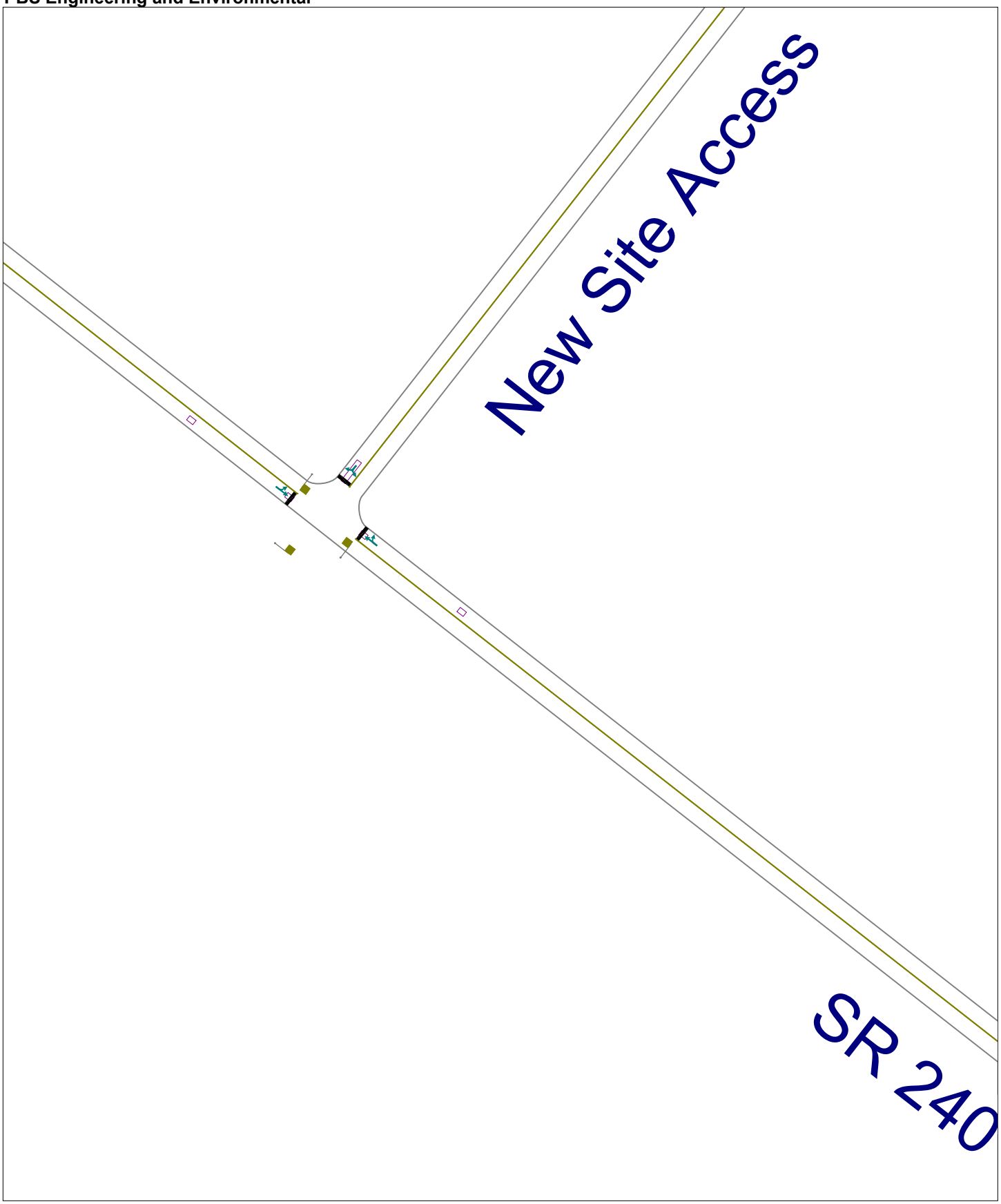
| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 13 | 514 | 286 | 118 | 359 | 40 |
| Future Volume (veh/h) | 13 | 514 | 286 | 118 | 359 | 40 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | No | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1900 | 1900 |
| Adj Flow Rate, veh/h | 14 | 559 | 311 | 128 | 390 | 43 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 0 | 0 |
| Cap, veh/h | 117 | 772 | 529 | 218 | 492 | 54 |
| Arrive On Green | 0.42 | 0.42 | 0.42 | 0.42 | 0.31 | 0.31 |
| Sat Flow, veh/h | 16 | 1839 | 1259 | 518 | 1581 | 174 |
| Grp Volume(v), veh/h | 573 | 0 | 0 | 439 | 434 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1855 | 0 | 0 | 1777 | 1760 | 0 |
| Q Serve(g_s), s | 0.0 | 0.0 | 0.0 | 6.4 | 7.5 | 0.0 |
| Cycle Q Clear(g_c), s | 8.6 | 0.0 | 0.0 | 6.4 | 7.5 | 0.0 |
| Prop In Lane | 0.02 | | | 0.29 | 0.90 | 0.10 |
| Lane Grp Cap(c), veh/h | 889 | 0 | 0 | 746 | 548 | 0 |
| V/C Ratio(X) | 0.64 | 0.00 | 0.00 | 0.59 | 0.79 | 0.00 |
| Avail Cap(c_a), veh/h | 1568 | 0 | 0 | 1407 | 1025 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 8.1 | 0.0 | 0.0 | 7.5 | 10.5 | 0.0 |
| Incr Delay (d2), s/veh | 0.8 | 0.0 | 0.0 | 0.7 | 2.6 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 2.3 | 0.0 | 0.0 | 1.6 | 2.4 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | |
| LnGrp Delay(d),s/veh | 8.9 | 0.0 | 0.0 | 8.2 | 13.2 | 0.0 |
| LnGrp LOS | A | A | A | A | B | A |
| Approach Vol, veh/h | | 573 | 439 | | 434 | |
| Approach Delay, s/veh | | 8.9 | 8.2 | | 13.2 | |
| Approach LOS | | A | A | | B | |

| Timer - Assigned Phs | | 2 | | | | 6 | 8 |
|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | | 18.6 | | | | 18.6 | 14.9 |
| Change Period (Y+Rc), s | | 4.5 | | | | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | | 26.5 | | | | 26.5 | 19.5 |
| Max Q Clear Time (g_c+I1), s | | 8.4 | | | | 10.6 | 9.5 |
| Green Ext Time (p_c), s | | 2.7 | | | | 3.5 | 1.1 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 10.0 |
| HCM 6th LOS | A |

Map - Vantage Way Properties 71517.000
PBS Engineering and Environmental

## New Site Access / SR240




Vantage Way Properties 71517.000
Weekday PM Peak Hour - 2040 With Project Conditions (Mitigated)

02/21/2020

# LANE SUMMARY

## Site: 1 [New Site Access & SR 240 - AM]

2040 AM With Project Volumes + Mitigation
Site Category: (None)
Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SouthEast: SR 240 | | | | | | | | | | | | | |
| Lane 1[d] | 404 | 2.0 | 1476 | 0.274 | 100 | 6.1 | LOS A | 1.7 | 43.8 | Full | 1600 | 0.0 | 0.0 |
| Approach | 404 | 2.0 | | 0.274 | | 6.1 | LOS A | 1.7 | 43.8 | | | | |
| NorthEast: New Site Access | | | | | | | | | | | | | |
| Lane 1[d] | 399 | 2.0 | 1242 | 0.321 | 100 | 7.9 | LOS A | 1.8 | 45.1 | Full | 1600 | 0.0 | 0.0 |
| Approach | 399 | 2.0 | | 0.321 | | 7.9 | LOS A | 1.8 | 45.1 | | | | |
| NorthWest: SR 240 | | | | | | | | | | | | | |
| Lane 1[d] | 527 | 2.0 | 1155 | 0.456 | 100 | 8.2 | LOS A | 3.1 | 79.8 | Full | 1600 | 0.0 | 0.0 |
| Approach | 527 | 2.0 | | 0.456 | | 8.2 | LOS A | 3.1 | 79.8 | | | | |
| Intersection | 1330 | 2.0 | | 0.456 | | 7.5 | LOS A | 3.1 | 79.8 | | | | |

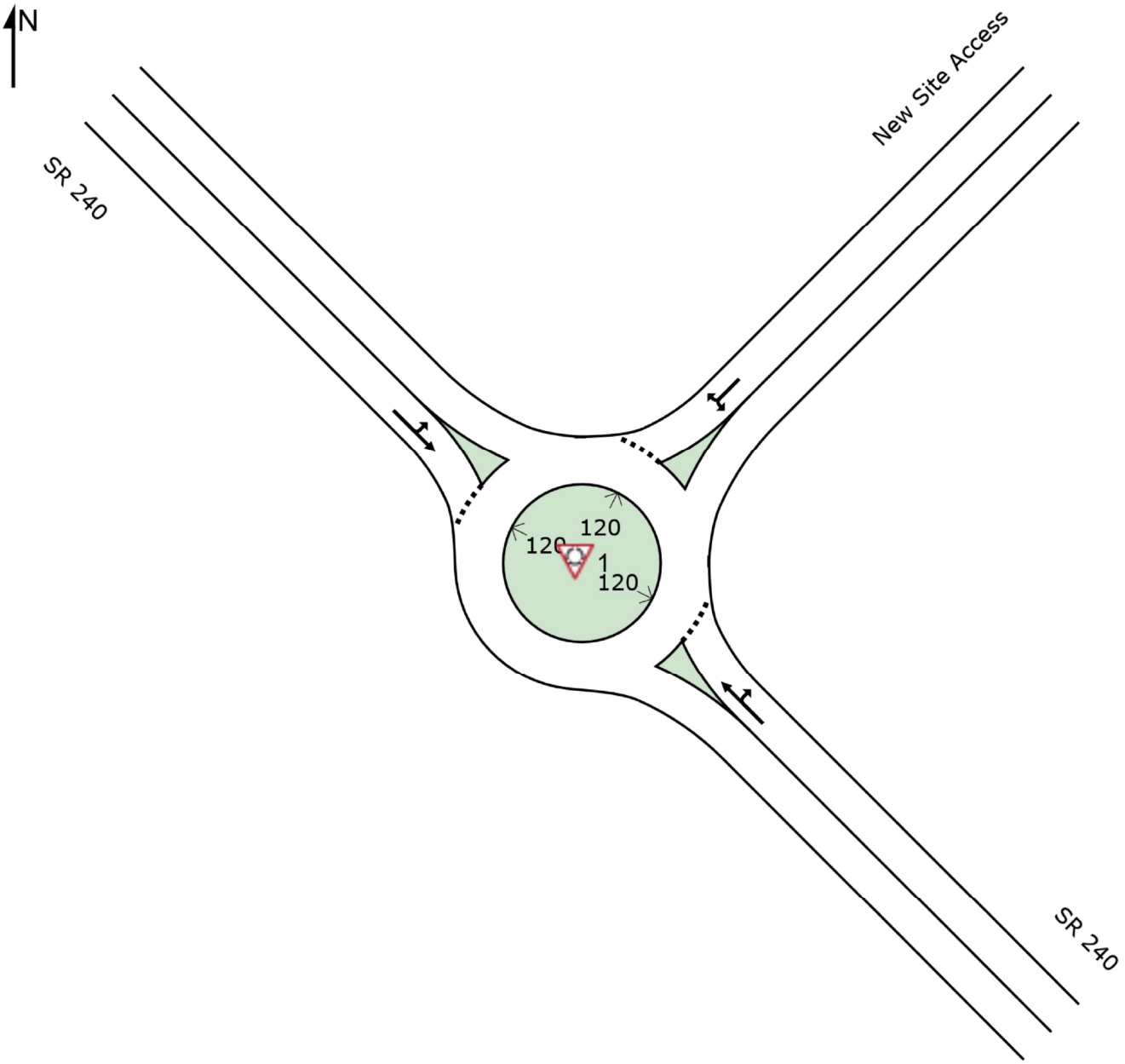
Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

# SITE LAYOUT

## Site: 1 [New Site Access & SR 240 - AM]

2040 AM With Project Volumes + Mitigation
Site Category: (None)
Roundabout



| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 43 | 830 | 341 | 387 | 567 | 63 |
| Future Volume (veh/h) | 43 | 830 | 341 | 387 | 567 | 63 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | No | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1900 |
| Adj Flow Rate, veh/h | 47 | 902 | 371 | 421 | 679 | 0 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 0 |
| Cap, veh/h | 459 | 1050 | 1050 | 1290 | 899 | 406 |
| Arrive On Green | 0.56 | 0.56 | 0.56 | 0.56 | 0.25 | 0.00 |
| Sat Flow, veh/h | 685 | 1870 | 1870 | 1585 | 3563 | 1610 |
| Grp Volume(v), veh/h | 47 | 902 | 371 | 421 | 679 | 0 |
| Grp Sat Flow(s),veh/h/ln | 685 | 1870 | 1870 | 1585 | 1781 | 1610 |
| Q Serve(g_s), s | 1.9 | 19.8 | 5.2 | 3.3 | 8.5 | 0.0 |
| Cycle Q Clear(g_c), s | 7.2 | 19.8 | 5.2 | 3.3 | 8.5 | 0.0 |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 |
| Lane Grp Cap(c), veh/h | 459 | 1050 | 1050 | 1290 | 899 | 406 |
| V/C Ratio(X) | 0.10 | 0.86 | 0.35 | 0.33 | 0.76 | 0.00 |
| Avail Cap(c_a), veh/h | 542 | 1276 | 1276 | 1481 | 1326 | 599 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 7.8 | 9.0 | 5.8 | 1.1 | 16.7 | 0.0 |
| Incr Delay (d2), s/veh | 0.1 | 5.2 | 0.2 | 0.1 | 1.4 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.2 | 6.8 | 1.5 | 1.8 | 3.2 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | |
| LnGrp Delay(d),s/veh | 7.9 | 14.2 | 6.0 | 1.3 | 18.1 | 0.0 |
| LnGrp LOS | A | B | A | A | B | A |
| Approach Vol, veh/h | | 949 | 792 | | 679 | |
| Approach Delay, s/veh | | 13.9 | 3.5 | | 18.1 | |
| Approach LOS | | B | A | | B | |

| Timer - Assigned Phs | 2 | | | 6 | 8 |
|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 31.7 | | | 31.7 | 16.7 |
| Change Period (Y+Rc), s | 4.5 | | | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | 33.0 | | | 33.0 | 18.0 |
| Max Q Clear Time (g_c+I1), s | 7.2 | | | 21.8 | 10.5 |
| Green Ext Time (p_c), s | 4.1 | | | 5.4 | 1.7 |

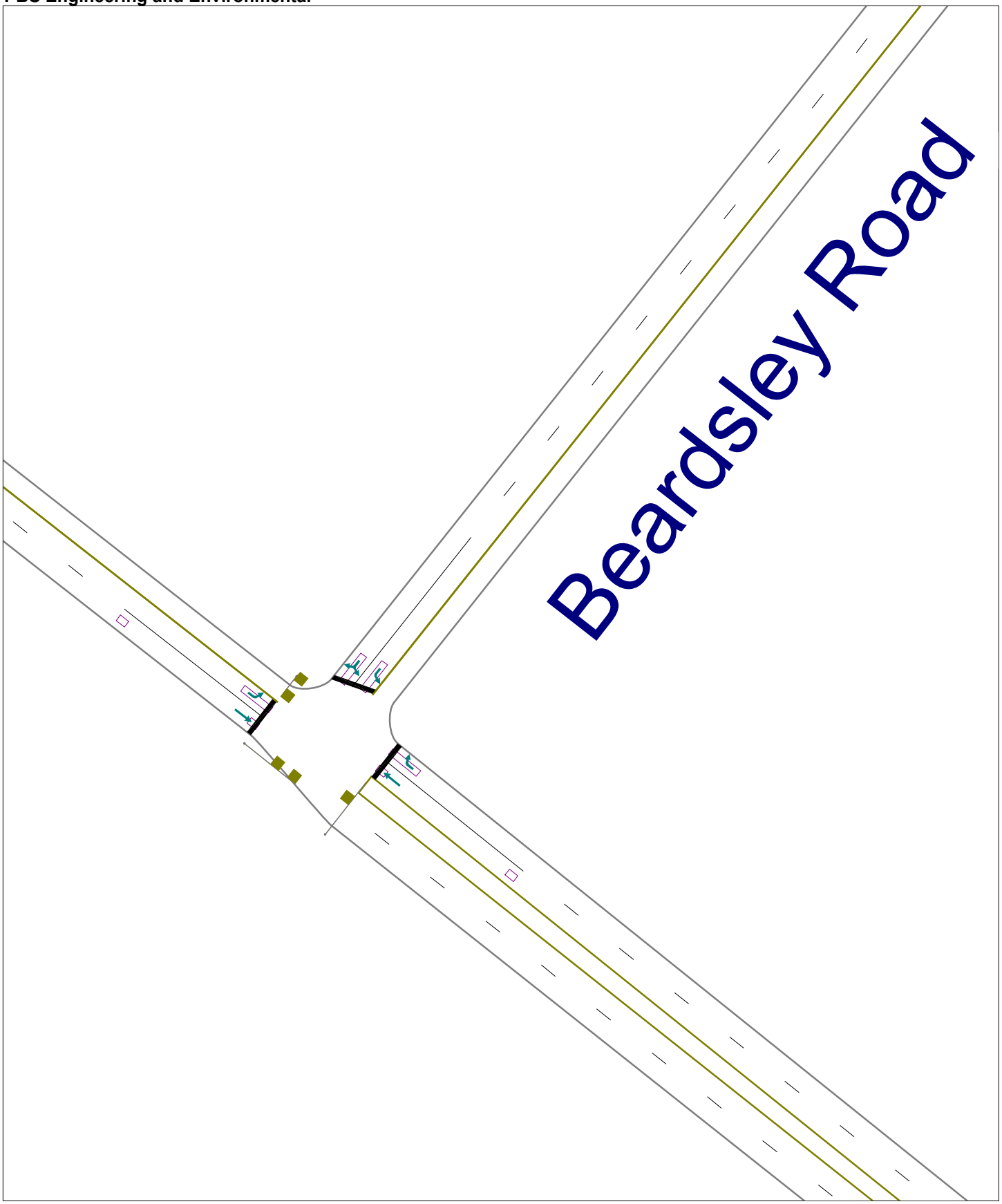
| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 11.7 |
| HCM 6th LOS | B |

Notes

User approved volume balancing among the lanes for turning movement.

Map - Vantage Way Properties 71517.000
PBS Engineering and Environmental

## Beardsley Road / SR240




Vantage Way Properties 71517.000
Weekday PM Peak Hour - 2040 With Project Conditions (Mitigated)

02/21/2020

# LANE SUMMARY

## Site: 2 [Beardsley Road & SR 240 - AM]

2040 AM With Project Volumes + Mitigation
Site Category: (None)
Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SouthEast: SR 240 | | | | | | | | | | | | | |
| Lane 1[d] | 341 | 2.0 | 1463 | 0.233 | 100 | 6.3 | LOS A | 1.1 | 28.5 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 387 | 2.0 | 1642 | 0.236 | 100 | 5.7 | LOS A | 0.0 | 0.0 | Short | 500 | 0.0 | NA |
| Approach | 728 | 2.0 | | 0.236 | | 5.9 | LOS A | 1.1 | 28.5 | | | | |
| NorthEast: Beardsley Road | | | | | | | | | | | | | |
| Lane 1[d] | 567 | 2.0 | 1480 | 0.383 | 100 | 8.4 | LOS A | 2.4 | 60.9 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 63 | 2.0 | 1045 | 0.060 | 100 | 3.5 | LOS A | 0.3 | 6.9 | Full | 1600 | 0.0 | 0.0 |
| Approach | 630 | 2.0 | | 0.383 | | 7.9 | LOS A | 2.4 | 60.9 | | | | |
| NorthWest: SR 240 | | | | | | | | | | | | | |
| Lane 1 | 43 | 2.0 | 683 | 0.063 | 100 | 15.6 | LOS B | 0.3 | 6.9 | Short | 300 | 0.0 | NA |
| Lane 2[d] | 830 | 2.0 | 1064 | 0.780 | 100 | 13.2 | LOS B | 10.2 | 259.0 | Full | 1600 | 0.0 | 0.0 |
| Approach | 873 | 2.0 | | 0.780 | | 13.3 | LOS B | 10.2 | 259.0 | | | | |
| Intersection | 2231 | 2.0 | | 0.780 | | 9.4 | LOS A | 10.2 | 259.0 | | | | |

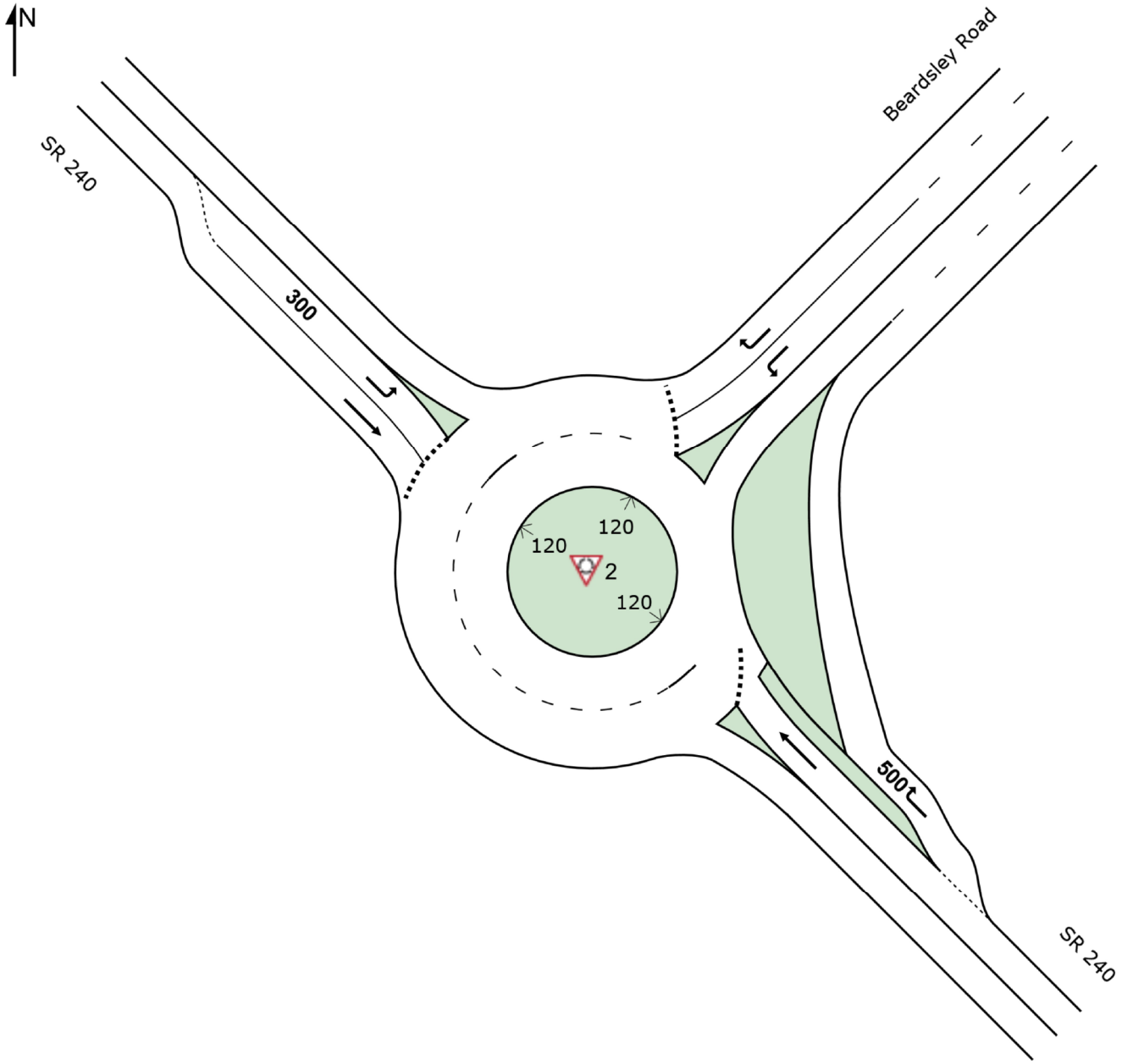
Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

# SITE LAYOUT

## Site: 2 [Beardsley Road & SR 240 - AM]

2040 AM With Project Volumes + Mitigation
Site Category: (None)
Roundabout



# HCM 6th Signalized Intersection Summary
## 1: SR 240 & New Site Access

02/21/2020

| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 31 | 340 | 569 | 279 | 193 | 22 |
| Future Volume (veh/h) | 31 | 340 | 569 | 279 | 193 | 22 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | No | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1900 | 1900 |
| Adj Flow Rate, veh/h | 34 | 370 | 618 | 303 | 210 | 24 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 0 | 0 |
| Cap, veh/h | 117 | 930 | 737 | 361 | 273 | 31 |
| Arrive On Green | 0.62 | 0.62 | 0.62 | 0.62 | 0.17 | 0.17 |
| Sat Flow, veh/h | 45 | 1495 | 1185 | 581 | 1572 | 180 |
| Grp Volume(v), veh/h | 404 | 0 | 0 | 921 | 235 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1540 | 0 | 0 | 1766 | 1759 | 0 |
| Q Serve(g_s), s | 1.2 | 0.0 | 0.0 | 18.1 | 5.6 | 0.0 |
| Cycle Q Clear(g_c), s | 19.3 | 0.0 | 0.0 | 18.1 | 5.6 | 0.0 |
| Prop In Lane | 0.08 | | | 0.33 | 0.89 | 0.10 |
| Lane Grp Cap(c), veh/h | 1047 | 0 | 0 | 1098 | 305 | 0 |
| V/C Ratio(X) | 0.39 | 0.00 | 0.00 | 0.84 | 0.77 | 0.00 |
| Avail Cap(c_a), veh/h | 1431 | 0 | 0 | 1524 | 719 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 4.2 | 0.0 | 0.0 | 6.6 | 17.4 | 0.0 |
| Incr Delay (d2), s/veh | 0.2 | 0.0 | 0.0 | 3.1 | 4.1 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 1.0 | 0.0 | 0.0 | 4.3 | 2.3 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | |
| LnGrp Delay(d),s/veh | 4.4 | 0.0 | 0.0 | 9.7 | 21.4 | 0.0 |
| LnGrp LOS | A | A | A | A | C | A |
| Approach Vol, veh/h | | 404 | 921 | | 235 | |
| Approach Delay, s/veh | | 4.4 | 9.7 | | 21.4 | |
| Approach LOS | | A | A | | C | |

| Timer - Assigned Phs | | 2 | | | | 6 | 8 |
|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | | 31.9 | | | | 31.9 | 12.1 |
| Change Period (Y+Rc), s | | 4.5 | | | | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | | 38.0 | | | | 38.0 | 18.0 |
| Max Q Clear Time (g_c+I1), s | | 20.1 | | | | 21.3 | 7.6 |
| Green Ext Time (p_c), s | | 7.2 | | | | 2.5 | 0.5 |

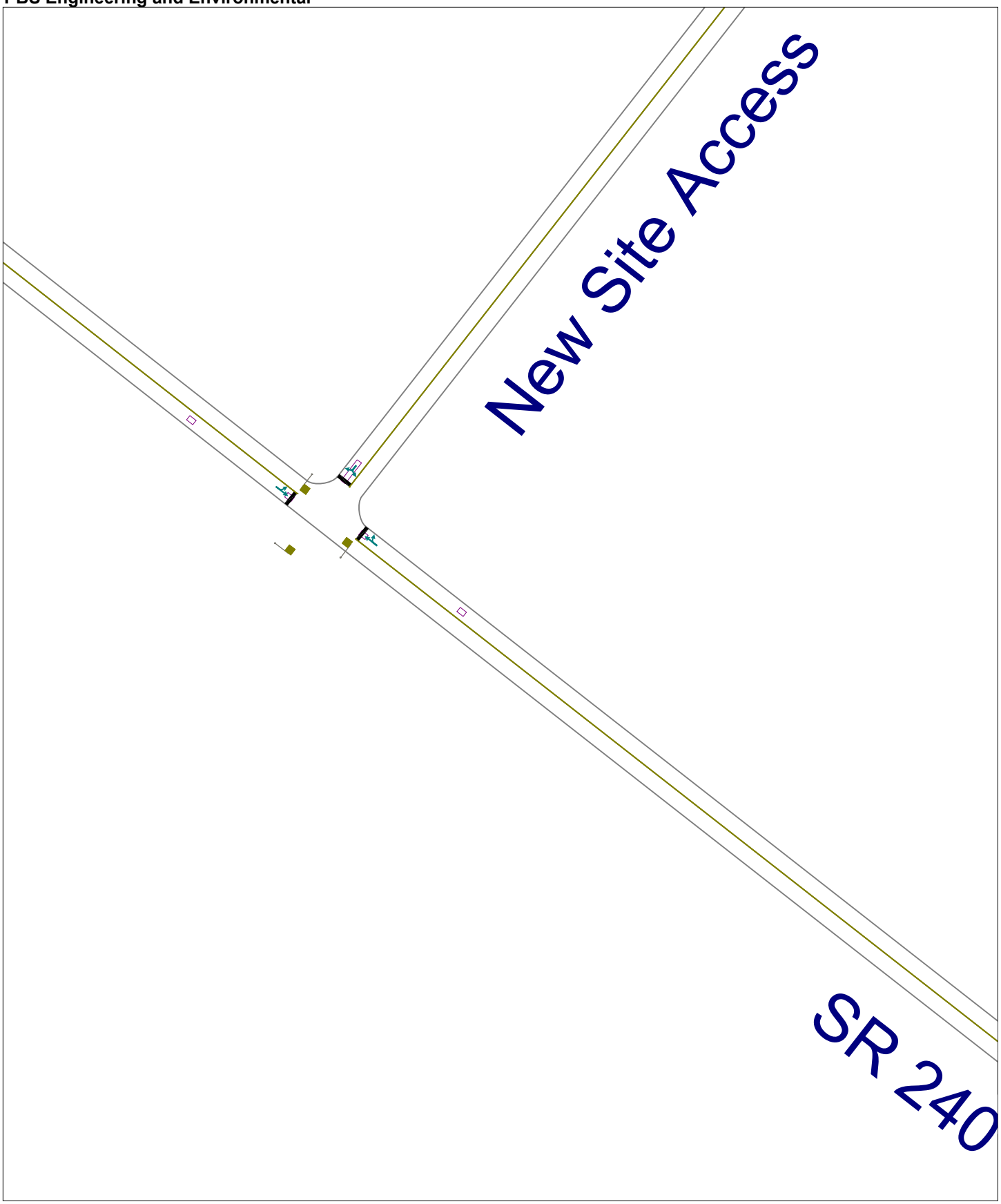
| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 10.1 |
| HCM 6th LOS | B |

**Notes**

User approved volume balancing among the lanes for turning movement.

Map - Vantage Way Properties 71517.000
PBS Engineering and Environmental

## New Site Access / SR240




Vantage Way Properties 71517.000
Weekday PM Peak Hour - 2040 With Project Conditions (Mitigated)

02/21/2020

# LANE SUMMARY

## Site: 1 [New Site Access & SR 240 - PM]

2040 PM With Project Volumes + Mitigation
Site Category: (None)
Roundabout

**Lane Use and Performance**

| | Demand Flows Total veh/h | HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SouthEast: SR 240 | | | | | | | | | | | | | |
| Lane 1[d] | 848 | 2.0 | 1456 | 0.582 | 100 | 6.3 | LOS A | 5.3 | 135.7 | Full | 1600 | 0.0 | 0.0 |
| Approach | 848 | 2.0 | | 0.582 | | 6.3 | LOS A | 5.3 | 135.7 | | | | |
| NorthEast: New Site Access | | | | | | | | | | | | | |
| Lane 1[d] | 215 | 2.0 | 1026 | 0.210 | 100 | 9.2 | LOS A | 1.2 | 30.3 | Full | 1600 | 0.0 | 0.0 |
| Approach | 215 | 2.0 | | 0.210 | | 9.2 | LOS A | 1.2 | 30.3 | | | | |
| NorthWest: SR 240 | | | | | | | | | | | | | |
| Lane 1[d] | 371 | 2.0 | 1284 | 0.289 | 100 | 7.5 | LOS A | 1.8 | 44.6 | Full | 1600 | 0.0 | 0.0 |
| Approach | 371 | 2.0 | | 0.289 | | 7.5 | LOS A | 1.8 | 44.6 | | | | |
| Intersection | 1434 | 2.0 | | 0.582 | | 7.0 | LOS A | 5.3 | 135.7 | | | | |

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

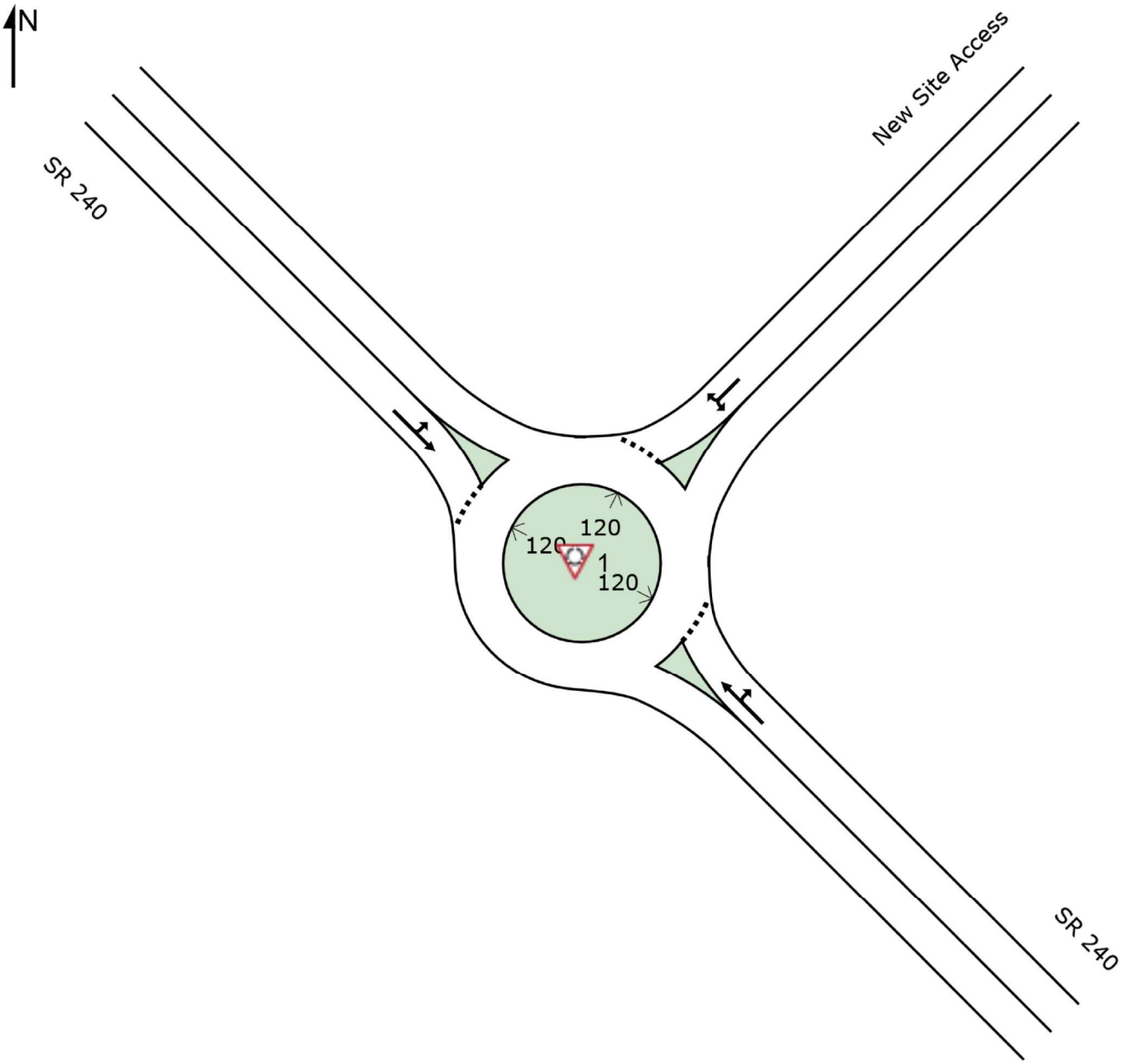
d Dominant lane on roundabout approach

**SIDRA INTERSECTION 8.0 | Copyright © 2000-2019 Akcelik and Associates Pty Ltd | sidrasolutions.com**

# SITE LAYOUT

## Site: 1 [New Site Access & SR 240 - PM]

2040 PM With Project Volumes + Mitigation
Site Category: (None)
Roundabout




**SIDRA INTERSECTION 8.0 | Copyright © 2000-2019 Akcelik and Associates Pty Ltd | sidrasolutions.com**

| Movement | SEL | SET | NWT | NWR | SWL | SWR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 117 | 416 | 750 | 1055 | 886 | 98 |
| Future Volume (veh/h) | 117 | 416 | 750 | 1055 | 886 | 98 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | | 1.00 | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | No | | No | |
| Adj Sat Flow, veh/h/ln | 1870 | 1870 | 1870 | 1870 | 1870 | 1900 |
| Adj Flow Rate, veh/h | 127 | 452 | 815 | 1147 | 1063 | 0 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 2 | 2 | 2 | 2 | 2 | 0 |
| Cap, veh/h | 166 | 916 | 916 | 1299 | 1174 | 531 |
| Arrive On Green | 0.49 | 0.49 | 0.49 | 0.49 | 0.33 | 0.00 |
| Sat Flow, veh/h | 223 | 1870 | 1870 | 1585 | 3563 | 1610 |
| Grp Volume(v), veh/h | 127 | 452 | 815 | 1147 | 1063 | 0 |
| Grp Sat Flow(s),veh/h/ln | 223 | 1870 | 1870 | 1585 | 1781 | 1610 |
| Q Serve(g_s), s | 4.8 | 8.1 | 19.6 | 23.6 | 14.2 | 0.0 |
| Cycle Q Clear(g_c), s | 24.4 | 8.1 | 19.6 | 23.6 | 14.2 | 0.0 |
| Prop In Lane | 1.00 | | | 1.00 | 1.00 | 1.00 |
| Lane Grp Cap(c), veh/h | 166 | 916 | 916 | 1299 | 1174 | 531 |
| V/C Ratio(X) | 0.77 | 0.49 | 0.89 | 0.88 | 0.91 | 0.00 |
| Avail Cap(c_a), veh/h | 166 | 916 | 916 | 1299 | 1187 | 537 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 24.5 | 8.6 | 11.5 | 2.9 | 16.0 | 0.0 |
| Incr Delay (d2), s/veh | 19.0 | 0.4 | 10.8 | 7.5 | 9.9 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 2.3 | 2.6 | 8.8 | 2.7 | 6.4 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | |
| LnGrp Delay(d),s/veh | 43.5 | 9.0 | 22.3 | 10.4 | 25.9 | 0.0 |
| LnGrp LOS | D | A | C | B | C | A |
| Approach Vol, veh/h | | 579 | 1962 | | 1063 | |
| Approach Delay, s/veh | | 16.5 | 15.3 | | 25.9 | |
| Approach LOS | | B | B | | C | |

| Timer - Assigned Phs | 2 | | | 6 | 8 |
|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 28.9 | | | 28.9 | 20.9 |
| Change Period (Y+Rc), s | 4.5 | | | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | 24.4 | | | 24.4 | 16.6 |
| Max Q Clear Time (g_c+I1), s | 25.6 | | | 26.4 | 16.2 |
| Green Ext Time (p_c), s | 0.0 | | | 0.0 | 0.2 |

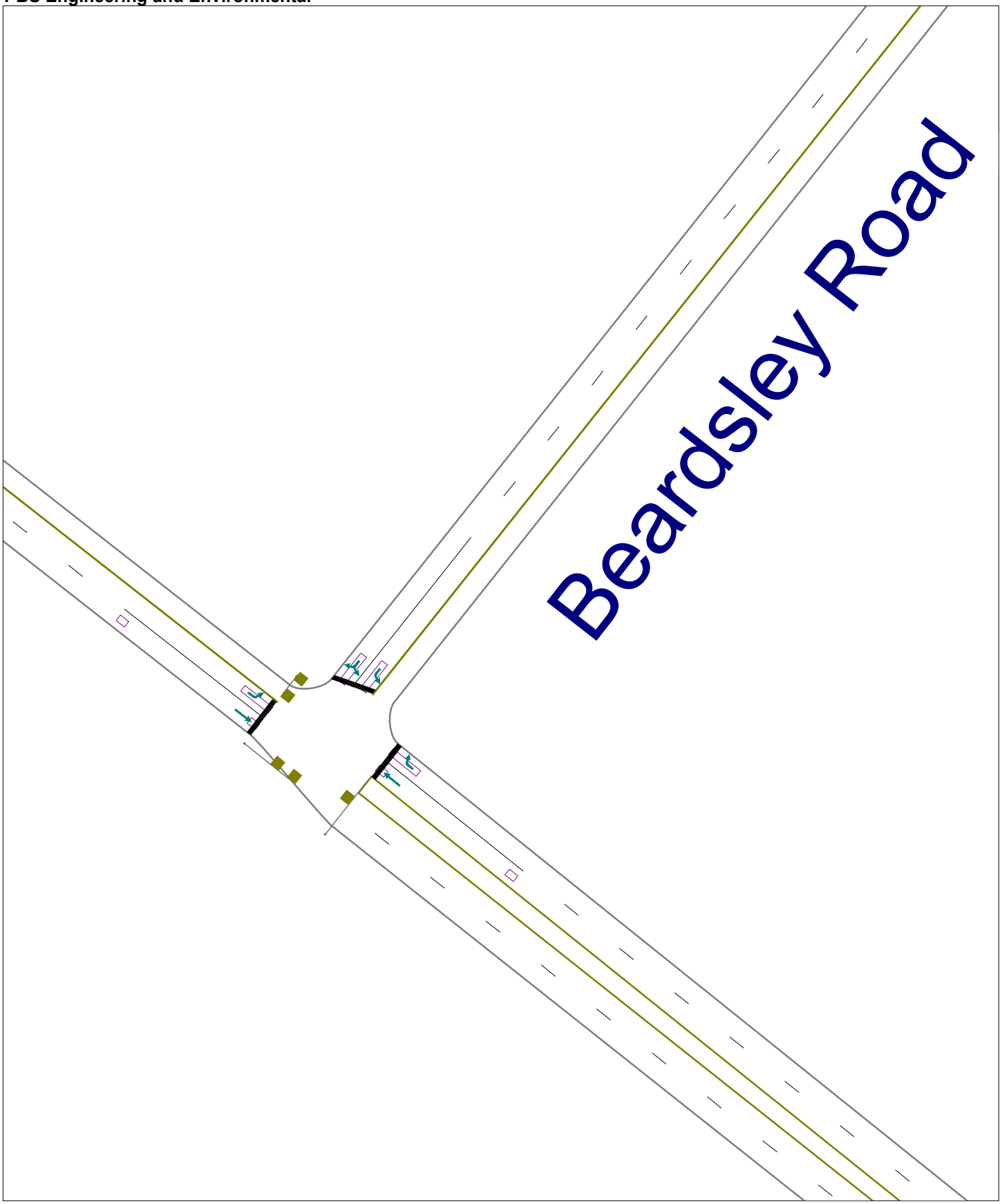
| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 18.6 |
| HCM 6th LOS | B |

Notes

User approved volume balancing among the lanes for turning movement.

Map - Vantage Way Properties 71517.000
PBS Engineering and Environmental

## Beardsley Road / SR240




Vantage Way Properties 71517.000
Weekday PM Peak Hour - 2040 With Project Conditions (Mitigated)

02/21/2020

# LANE SUMMARY

## Site: 2 [Beardsley Road & SR 240 - PM]

2040 PM With Project Volumes + Mitigation
Site Category: (None)
Roundabout

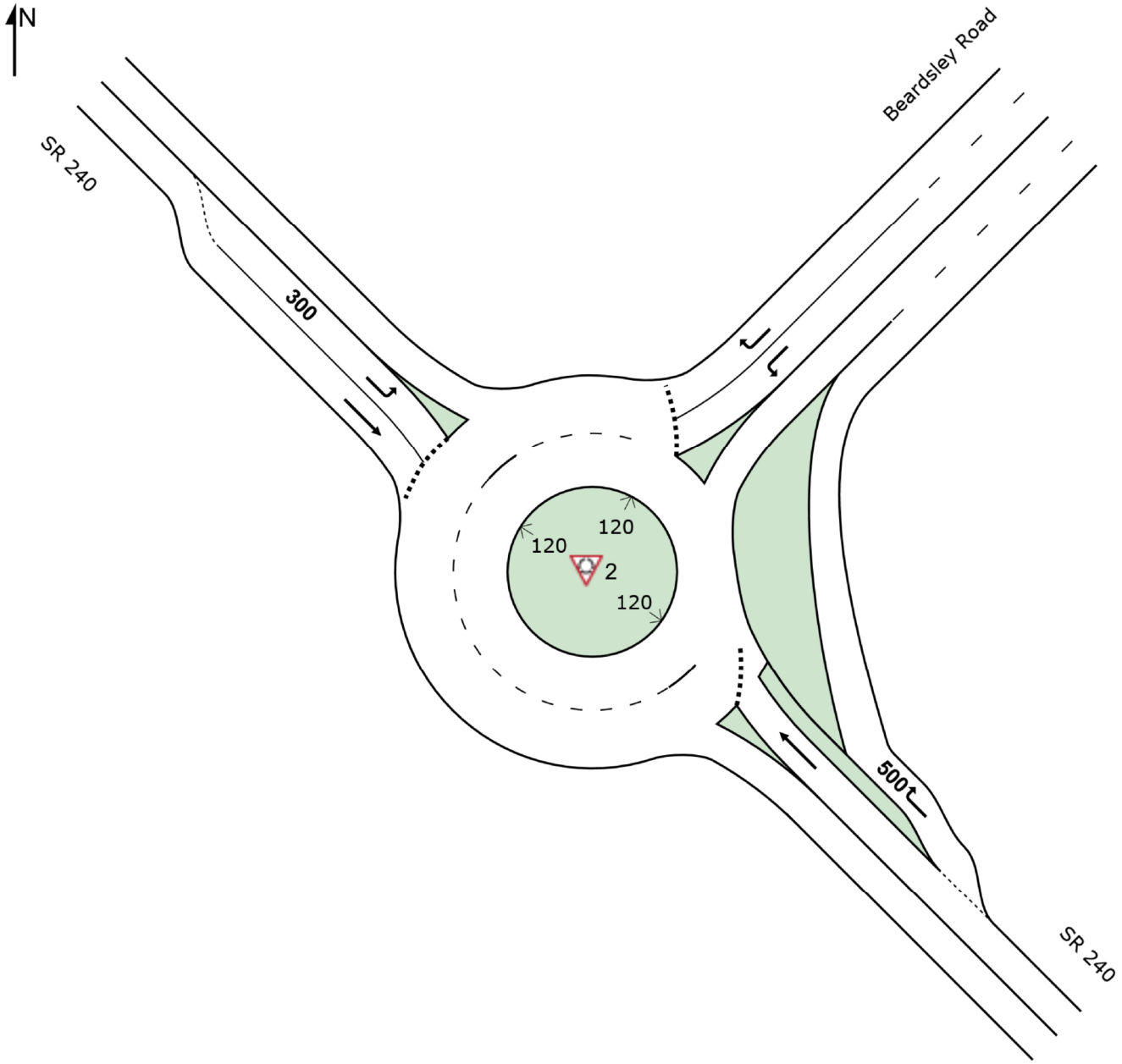
**Lane Use and Performance**

| | Demand Flows Total veh/h | HV % | Cap. veh/h | Deg. Satn v/c | Lane Util. % | Average Delay sec | Level of Service | 95% Back of Queue Veh | Dist ft | Lane Config | Lane Length ft | Cap. Adj. % | Prob. Block. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SouthEast: SR 240 | | | | | | | | | | | | | |
| Lane 1[d] | 750 | 2.0 | 1382 | 0.543 | 100 | 6.7 | LOS A | 4.2 | 106.2 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 1055 | 2.0 | 1642 | 0.643 | 100 | 5.7 | LOS A | 0.0 | 0.0 | Short | 500 | 0.0 | NA |
| Approach | 1805 | 2.0 | | 0.643 | | 6.1 | LOS A | 4.2 | 106.2 | | | | |
| NorthEast: Beardsley Road | | | | | | | | | | | | | |
| Lane 1[d] | 886 | 2.0 | 1087 | 0.815 | 100 | 19.8 | LOS B | 14.8 | 376.5 | Full | 1600 | 0.0 | 0.0 |
| Lane 2 | 98 | 2.0 | 797 | 0.123 | 100 | 5.9 | LOS A | 0.7 | 18.7 | Full | 1600 | 0.0 | 0.0 |
| Approach | 984 | 2.0 | | 0.815 | | 18.4 | LOS B | 14.8 | 376.5 | | | | |
| NorthWest: SR 240 | | | | | | | | | | | | | |
| Lane 1 | 117 | 2.0 | 429 | 0.273 | 100 | 18.8 | LOS B | 1.7 | 43.1 | Short | 300 | 0.0 | NA |
| Lane 2[d] | 416 | 2.0 | 632 | 0.658 | 100 | 16.3 | LOS B | 7.2 | 183.4 | Full | 1600 | 0.0 | 0.0 |
| Approach | 533 | 2.0 | | 0.658 | | 16.8 | LOS B | 7.2 | 183.4 | | | | |
| Intersection | 3322 | 2.0 | | 0.815 | | 11.5 | LOS B | 14.8 | 376.5 | | | | |

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

# SITE LAYOUT

## Site: 2 [Beardsley Road & SR 240 - PM]

2040 PM With Project Volumes + Mitigation
Site Category: (None)
Roundabout