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# Memorandum

**To:** Adam Bane, El Dorado County

**From:** Stephen Dillon, E.I.T.
Robert Paderna, P.E., $RSP_1$

***Re:*** ***Summer Brook***
*Green Valley Road/Deer Valley Road Intersection Operations Analysis*

**Date:** April 12, 2022

The purpose of this memorandum is to document anticipated intersection operations at Green Valley Road and Deer Valley Road (the "study intersection") under both Near Term (2031) and Cumulative (2041) conditions, with and without the Summer Brook residential development project trips. Kimley-Horn previously conducted an analysis of this intersection as part of the Traffic Impact Analysis prepared for the Summer Brook development in February 2007. This supplemental analysis is intended to inform recent conversations between Blue Mountain Inc., (the "Client") and County regarding current operating conditions of the study intersection and the project's conditions of approval (COA).

## Analysis Background

The project proposes to construct a total of 29 single-family (detached) homes. Access to the site will be provided via two full-access driveways along Green Valley Road, east of the study intersection. As part of the development review process, a traffic impact analysis (TIA) for the proposed project was completed by Kimley-Horn in February 2007. The 2007 TIA established 2025 as the Cumulative condition year for evaluation and concluded the study intersection satisfied California Manual on Uniform Traffic Control Devices (CA MUTCD) peak-hour signal warrants during both the AM and PM peak-hours under both no project and plus project conditions. Contributions to the project's fair share for signalizing the study intersection was established as a Condition of Approval (COA) by the County for the project.

As future year conditions established using El Dorado County's Travel Demand Model (TDM) have been updated since the 2007 TIA, the Client desired to reexamine the previously established signalization COA. As part of the COA, traffic volume-based warrants presented in the CA MUTCD were reviewed by Kimley-Horn utilizing traffic counts from January 2019 and May 2021 for the purpose of comparing results against the Cumulative 2025 peak-hour warrants produced for the 2007 TIA. The updated signal warrant evaluation using January 2019 and May 2021 data concluded that a traffic signal was not warranted for both no project and plus project scenarios at the study intersection under current traffic conditions.

In order to inform conversations with the County regarding consideration of traffic signalization of the study intersection in the future, the Client requested an updated traffic operations analysis be conducted under both no project and plus project conditions for Near Term (2031) and Cumulative (2041) scenarios.

## Analysis Methodology

*Level of Service Definitions*
The level of service (LOS) of a facility is a qualitative measure used to describe operational conditions. LOS ranges from A, which represents minimal delay, to F, which represents heavy delay and a facility that is operating at or near its functional capacity. LOS for this study was determined using methods defined in the *Highway Capacity Manual (HCM) 6th Edition*.

*Intersection Analysis*

The HCM includes procedures for analyzing side-street stop controlled (SSSC) intersections. The SSSC procedure defines LOS as a function of average control delay for each minor street approach movement. **Table 1** presents intersection LOS definitions as defined in the HCM.

**Table 1** - Intersection Level of Service Criteria

| Level of Service (LOS) | Un-Signalized |
|---|---|
| | Average Control Delay* (sec/veh) |
| A | ≤ 10 |
| B | > 10 – 15 |
| C | > 15 – 25 |
| D | > 25 – 35 |
| E | > 35 – 50 |
| F | > 50 |

*Source: Highway Capacity Manual, 6th Edition*

* Applied to the worst lane/lane group(s) for SSSC

LOS for the study intersections was determined using the Synchro® traffic analysis software. Synchro is an interactive computer program that enables planners and engineers to: forecast the traffic impacts of new developments; conduct area-wide traffic forecasting studies; test different mitigation measures and compare different traffic scenarios. Synchro 11 utilizes HCM 6 methodology to analyze intersection delay and LOS. Level of service for the Intersection is evaluated against El Dorado County thresholds of LOS D for Rural Regions[1].

## Analysis Results

Synchro 11 analysis was conducted for the Intersection under Near Term (2031) and Cumulative (2041) no project and plus project conditions using present day intersection geometry. The results of the analysis are reported in **Table 2**.

The Intersection operates a satisfactory level for the El Dorado County Rural Region under all no project and plus project Near Term scenarios. While the Intersection operates at a deficient level for side street stop control under plus project Cumulative conditions, the Intersection is shown to be deficient under no project conditions as well. The project is shown to add a nominal level to delay to the intersection.

[1] *Transportation Impact Study Guidelines,* El Dorado County Community Development Agency, November 2014.

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**Table 2** – Intersection Levels of Service (Green Valley Rd/Deer Valley Rd)

| Scenario | | LOS Threshold | Peak Hour | Delay (s) | LOS |
|---|---|---|---|---|---|
| Near Term (2031) | No Project | D | AM | 4.7(29.3) | A(D) |
| | | | PM | 2.8(31.3) | A(D) |
| | Plus Project | | AM | 4.7(30.1) | A(D) |
| | | | PM | 2.8(32.1) | A(D) |
| Cumulative (2041) | No Project | | AM | 7.2(44.0) | A**(E)** |
| | | | PM | 4.3(45.0) | A**(E)** |
| | Plus Project | | AM | 7.3(45.2) | A**(E)** |
| | | | PM | 4.4(46.3) | A**(E)** |

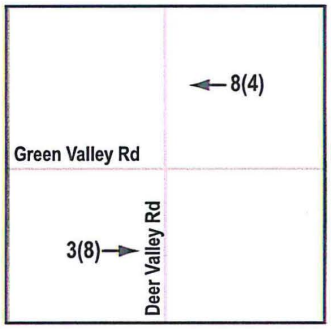
Note: **Bold** represents deficient operations.
Side Street Stop Control (SSSC) reported as intersection delay followed by worst approach's delay

## Attachments:

**Exhibit 1** – Project Vicinity Diagram

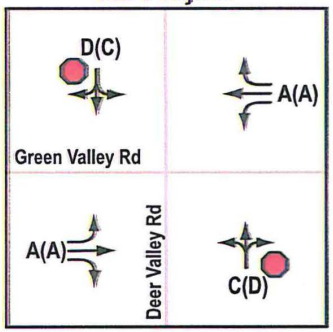
**Attachment 1** – Analysis Worksheets for Near Term Conditions
**Attachment 2** – Analysis Worksheets for Near Term plus Project Conditions
**Attachment 3** – Analysis Worksheets for Cumulative Conditions
**Attachment 4** – Analysis Worksheets for Cumulative plus Project Conditions

## Project Trip Assignment

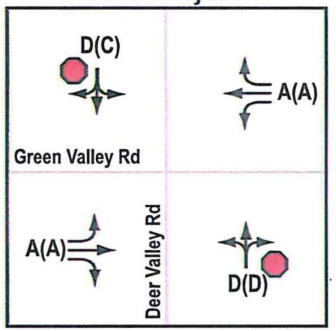



## Near Term (2031) Level of Service

### No Project

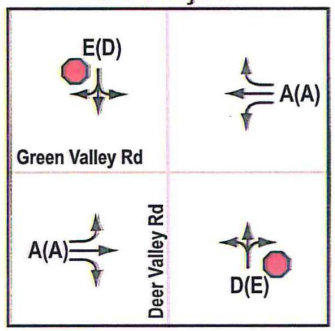



### Plus Project

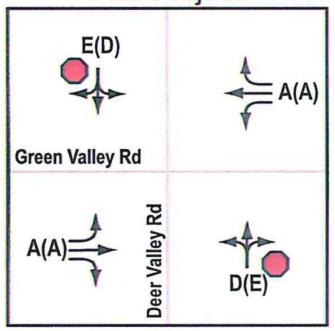



## Cumulative (2041) Level of Service

### No Project




### Plus Project




Intersection LOS threshold for Rural Regions is LOS D per El Dorado County *Transportation Impact Study Guidelines*

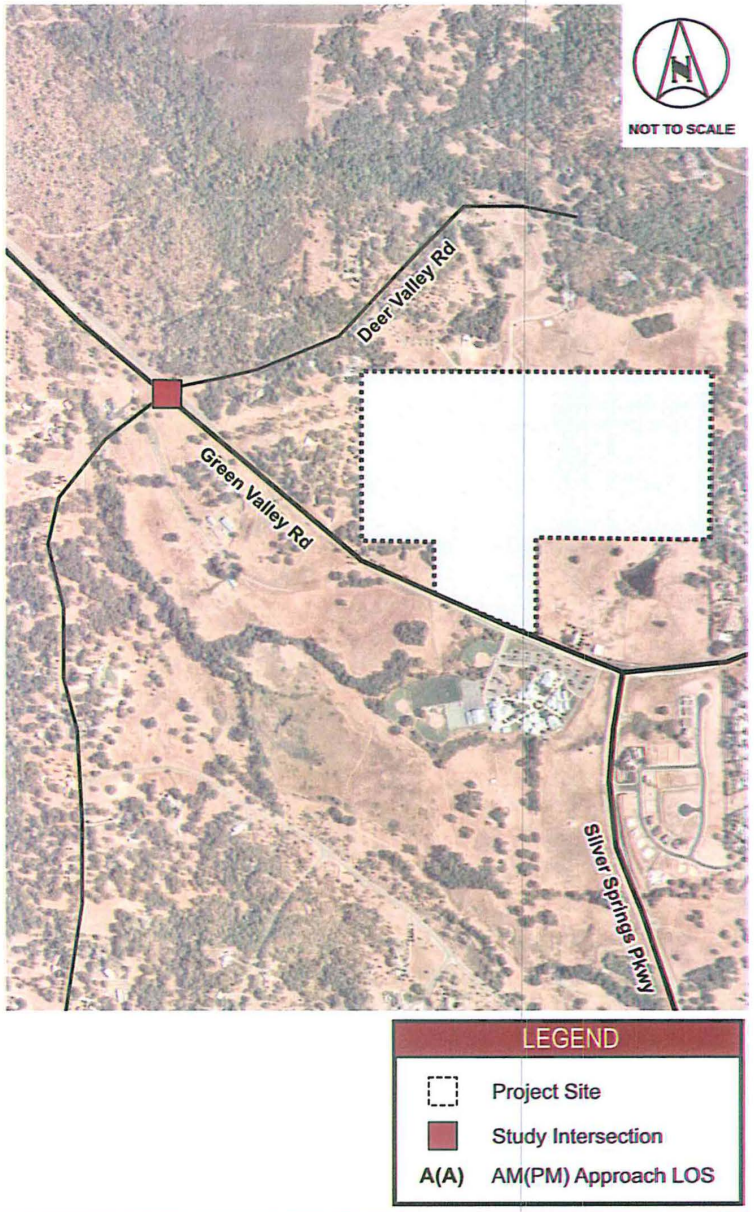



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*Exhibit 1*
*Project Vicinity Diagram*

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## Attachment 1

*Analysis Worksheets for Near Term Conditions*

| Intersection | |
|---|---|
| Int Delay, s/veh | 4.7 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 17 | 320 | 15 | 32 | 545 | 14 | 27 | 1 | 38 | 34 | 1 | 42 |
| Future Vol, veh/h | 17 | 320 | 15 | 32 | 545 | 14 | 27 | 1 | 38 | 34 | 1 | 42 |
| 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 | 415 | - | 415 | 415 | - | 415 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 91 | 91 | 91 | 87 | 87 | 87 | 69 | 69 | 69 | 72 | 72 | 72 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 19 | 352 | 16 | 37 | 626 | 16 | 39 | 1 | 55 | 47 | 1 | 58 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 642 | 0 | 0 | 368 | 0 | 0 | 1128 | 1106 | 352 | 1126 | 1106 | 626 |
| Stage 1 | - | - | - | - | - | - | 390 | 390 | - | 700 | 700 | - |
| Stage 2 | - | - | - | - | - | - | 738 | 716 | - | 426 | 406 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 943 | - | - | 1191 | - | - | 181 | 210 | 692 | 182 | 210 | 484 |
| Stage 1 | - | - | - | - | - | - | 634 | 608 | - | 430 | 441 | - |
| Stage 2 | - | - | - | - | - | - | 410 | 434 | - | 606 | 598 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 943 | - | - | 1191 | - | - | 152 | 200 | 692 | 160 | 200 | 484 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 152 | 200 | - | 160 | 200 | - |
| Stage 1 | - | - | - | - | - | - | 621 | 596 | - | 421 | 427 | - |
| Stage 2 | - | - | - | - | - | - | 348 | 421 | - | 545 | 586 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.4 | 0.4 | 24.6 | 29.3 |
| HCM LOS | | | C | D |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 278 | 943 | - | - | 1191 | - | - | 253 |
| HCM Lane V/C Ratio | 0.344 | 0.02 | - | - | 0.031 | - | - | 0.423 |
| HCM Control Delay (s) | 24.6 | 8.9 | - | - | 8.1 | - | - | 29.3 |
| HCM Lane LOS | C | A | - | - | A | - | - | D |
| HCM 95th %tile Q(veh) | 1.5 | 0.1 | - | - | 0.1 | - | - | 2 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.8 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 34 | 626 | 14 | 33 | 397 | 28 | 18 | 2 | 25 | 11 | 1 | 23 |
| Future Vol, veh/h | 34 | 626 | 14 | 33 | 397 | 28 | 18 | 2 | 25 | 11 | 1 | 23 |
| 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 | 415 | - | 415 | 415 | - | 415 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 91 | 91 | 91 | 87 | 87 | 87 | 69 | 69 | 69 | 72 | 72 | 72 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 37 | 688 | 15 | 38 | 456 | 32 | 26 | 3 | 36 | 15 | 1 | 32 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 488 | 0 | 0 | 703 | 0 | 0 | 1327 | 1326 | 688 | 1321 | 1309 | 456 |
| Stage 1 | - | - | - | - | - | - | 762 | 762 | - | 532 | 532 | - |
| Stage 2 | - | - | - | - | - | - | 565 | 564 | - | 789 | 777 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1075 | - | - | 895 | - | - | 132 | 156 | 446 | 134 | 159 | 604 |
| Stage 1 | - | - | - | - | - | - | 397 | 414 | - | 531 | 526 | - |
| Stage 2 | - | - | - | - | - | - | 510 | 508 | - | 384 | 407 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1075 | - | - | 895 | - | - | 117 | 144 | 446 | 114 | 147 | 604 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 117 | 144 | - | 114 | 147 | - |
| Stage 1 | - | - | - | - | - | - | 384 | 400 | - | 513 | 504 | - |
| Stage 2 | - | - | - | - | - | - | 461 | 487 | - | 338 | 393 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.4 | 0.7 | 31.3 | 23 |
| HCM LOS | | | D | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 201 | 1075 | - | - | 895 | - | - | 248 |
| HCM Lane V/C Ratio | 0.324 | 0.035 | - | - | 0.042 | - | - | 0.196 |
| HCM Control Delay (s) | 31.3 | 8.5 | - | - | 9.2 | - | - | 23 |
| HCM Lane LOS | D | A | - | - | A | - | - | C |
| HCM 95th %tile Q(veh) | 1.3 | 0.1 | - | - | 0.1 | - | - | 0.7 |

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## Attachment 2

*Analysis Worksheets for Near Term plus Project Conditions*

| Intersection | |
|---|---|
| Int Delay, s/veh | 4.7 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 17 | 323 | 15 | 32 | 553 | 14 | 27 | 1 | 38 | 34 | 1 | 42 |
| Future Vol, veh/h | 17 | 323 | 15 | 32 | 553 | 14 | 27 | 1 | 38 | 34 | 1 | 42 |
| 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 | 415 | - | 415 | 415 | - | 415 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 91 | 91 | 91 | 87 | 87 | 87 | 69 | 69 | 69 | 72 | 72 | 72 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 19 | 355 | 16 | 37 | 636 | 16 | 39 | 1 | 55 | 47 | 1 | 58 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 652 | 0 | 0 | 371 | 0 | 0 | 1141 | 1119 | 355 | 1139 | 1119 | 636 |
| Stage 1 | - | - | - | - | - | - | 393 | 393 | - | 710 | 710 | - |
| Stage 2 | - | - | - | - | - | - | 748 | 726 | - | 429 | 409 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 935 | - | - | 1188 | - | - | 178 | 207 | 689 | 178 | 207 | 478 |
| Stage 1 | - | - | - | - | - | - | 632 | 606 | - | 424 | 437 | - |
| Stage 2 | - | - | - | - | - | - | 404 | 430 | - | 604 | 596 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 935 | - | - | 1188 | - | - | 149 | 197 | 689 | 156 | 197 | 478 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 149 | 197 | - | 156 | 197 | - |
| Stage 1 | - | - | - | - | - | - | 619 | 594 | - | 416 | 423 | - |
| Stage 2 | - | - | - | - | - | - | 343 | 417 | - | 543 | 584 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.4 | 0.4 | 25.1 | 30.1 |
| HCM LOS | | | D | D |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 273 | 935 | - | - | 1188 | - | - | 248 |
| HCM Lane V/C Ratio | 0.35 | 0.02 | - | - | 0.031 | - | - | 0.431 |
| HCM Control Delay (s) | 25.1 | 8.9 | - | - | 8.1 | - | - | 30.1 |
| HCM Lane LOS | D | A | - | - | A | - | - | D |
| HCM 95th %tile Q(veh) | 1.5 | 0.1 | - | - | 0.1 | - | - | 2 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.8 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 34 | 634 | 14 | 33 | 401 | 28 | 18 | 2 | 25 | 11 | 1 | 23 |
| Future Vol, veh/h | 34 | 634 | 14 | 33 | 401 | 28 | 18 | 2 | 25 | 11 | 1 | 23 |
| 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 | 415 | - | 415 | 415 | - | 415 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 91 | 91 | 91 | 87 | 87 | 87 | 69 | 69 | 69 | 72 | 72 | 72 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 37 | 697 | 15 | 38 | 461 | 32 | 26 | 3 | 36 | 15 | 1 | 32 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 493 | 0 | 0 | 712 | 0 | 0 | 1341 | 1340 | 697 | 1335 | 1323 | 461 |
| Stage 1 | - | - | - | - | - | - | 771 | 771 | - | 537 | 537 | - |
| Stage 2 | - | - | - | - | - | - | 570 | 569 | - | 798 | 786 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1071 | - | - | 888 | - | - | 129 | 153 | 441 | 131 | 156 | 600 |
| Stage 1 | - | - | - | - | - | - | 393 | 410 | - | 528 | 523 | - |
| Stage 2 | - | - | - | - | - | - | 506 | 506 | - | 380 | 403 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1071 | - | - | 888 | - | - | 114 | 141 | 441 | 111 | 144 | 600 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 114 | 141 | - | 111 | 144 | - |
| Stage 1 | - | - | - | - | - | - | 379 | 396 | - | 510 | 501 | - |
| Stage 2 | - | - | - | - | - | - | 457 | 484 | - | 334 | 389 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.4 | 0.7 | 32.1 | 23.6 |
| HCM LOS | | | D | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 197 | 1071 | - | - | 888 | - | - | 242 |
| HCM Lane V/C Ratio | 0.331 | 0.035 | - | - | 0.043 | - | - | 0.201 |
| HCM Control Delay (s) | 32.1 | 8.5 | - | - | 9.2 | - | - | 23.6 |
| HCM Lane LOS | D | A | - | - | A | - | - | C |
| HCM 95th %tile Q(veh) | 1.4 | 0.1 | - | - | 0.1 | - | - | 0.7 |

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## Attachment 3

*Analysis Worksheets for Cumulative Conditions*

| Intersection | |
|---|---|
| Int Delay, s/veh | 7.2 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 19 | 339 | 20 | 48 | 571 | 16 | 32 | 1 | 51 | 40 | 2 | 46 |
| Future Vol, veh/h | 19 | 339 | 20 | 48 | 571 | 16 | 32 | 1 | 51 | 40 | 2 | 46 |
| 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 | 415 | - | 415 | 415 | - | 415 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 91 | 91 | 91 | 87 | 87 | 87 | 69 | 69 | 69 | 72 | 72 | 72 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 21 | 373 | 22 | 55 | 656 | 18 | 46 | 1 | 74 | 56 | 3 | 64 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 674 | 0 | 0 | 395 | 0 | 0 | 1224 | 1199 | 373 | 1230 | 1203 | 656 |
| Stage 1 | - | - | - | - | - | - | 415 | 415 | - | 766 | 766 | - |
| Stage 2 | - | - | - | - | - | - | 809 | 784 | - | 464 | 437 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 917 | - | - | 1164 | - | - | 156 | 185 | 673 | 154 | 184 | 465 |
| Stage 1 | - | - | - | - | - | - | 615 | 592 | - | 395 | 412 | - |
| Stage 2 | - | - | - | - | - | - | 374 | 404 | - | 578 | 579 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 917 | - | - | 1164 | - | - | 126 | 172 | 673 | 129 | 171 | 465 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 126 | 172 | - | 129 | 171 | - |
| Stage 1 | - | - | - | - | - | - | 601 | 578 | - | 386 | 393 | - |
| Stage 2 | - | - | - | - | - | - | 305 | 385 | - | 501 | 566 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.5 | 0.6 | 32.3 | 44 |
| HCM LOS | | | D | E |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 250 | 917 | - | - | 1164 | - | - | 209 |
| HCM Lane V/C Ratio | 0.487 | 0.023 | - | - | 0.047 | - | - | 0.585 |
| HCM Control Delay (s) | 32.3 | 9 | - | - | 8.2 | - | - | 44 |
| HCM Lane LOS | D | A | - | - | A | - | - | E |
| HCM 95th %tile Q(veh) | 2.5 | 0.1 | - | - | 0.1 | - | - | 3.3 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 4.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 34 | 660 | 14 | 50 | 434 | 41 | 23 | 2 | 37 | 13 | 1 | 25 |
| Future Vol, veh/h | 34 | 660 | 14 | 50 | 434 | 41 | 23 | 2 | 37 | 13 | 1 | 25 |
| 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 | 415 | - | 415 | 415 | - | 415 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 91 | 91 | 91 | 87 | 87 | 87 | 69 | 69 | 69 | 72 | 72 | 72 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 37 | 725 | 15 | 57 | 499 | 47 | 33 | 3 | 54 | 18 | 1 | 35 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 546 | 0 | 0 | 740 | 0 | 0 | 1454 | 1459 | 725 | 1448 | 1427 | 499 |
| Stage 1 | - | - | - | - | - | - | 799 | 799 | - | 613 | 613 | - |
| Stage 2 | - | - | - | - | - | - | 655 | 660 | - | 835 | 814 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1023 | - | - | 867 | - | - | 108 | 129 | 425 | 109 | 135 | 572 |
| Stage 1 | - | - | - | - | - | - | 379 | 398 | - | 480 | 483 | - |
| Stage 2 | - | - | - | - | - | - | 455 | 460 | - | 362 | 391 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1023 | - | - | 867 | - | - | 93 | 116 | 425 | 86 | 122 | 572 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 93 | 116 | - | 86 | 122 | - |
| Stage 1 | - | - | - | - | - | - | 365 | 384 | - | 463 | 451 | - |
| Stage 2 | - | - | - | - | - | - | 398 | 430 | - | 303 | 377 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.4 | 0.9 | 45 | 31 |
| HCM LOS | | | E | D |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 176 | 1023 | - | - | 867 | - | - | 192 |
| HCM Lane V/C Ratio | 0.511 | 0.037 | - | - | 0.066 | - | - | 0.282 |
| HCM Control Delay (s) | 45 | 8.7 | - | - | 9.4 | - | - | 31 |
| HCM Lane LOS | E | A | - | - | A | - | - | D |
| HCM 95th %tile Q(veh) | 2.5 | 0.1 | - | - | 0.2 | - | - | 1.1 |

Kimley»Horn

## Attachment 4

*Analysis Worksheets for Cumulative plus Project Conditions*

| Intersection | |
|---|---|
| Int Delay, s/veh | 7.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 19 | 342 | 20 | 48 | 578 | 16 | 32 | 1 | 51 | 40 | 2 | 46 |
| Future Vol, veh/h | 19 | 342 | 20 | 48 | 578 | 16 | 32 | 1 | 51 | 40 | 2 | 46 |
| 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 | 415 | - | 415 | 415 | - | 415 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 91 | 91 | 91 | 87 | 87 | 87 | 69 | 69 | 69 | 72 | 72 | 72 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 21 | 376 | 22 | 55 | 664 | 18 | 46 | 1 | 74 | 56 | 3 | 64 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 682 | 0 | 0 | 398 | 0 | 0 | 1235 | 1210 | 376 | 1241 | 1214 | 664 |
| Stage 1 | - | - | - | - | - | - | 418 | 418 | - | 774 | 774 | - |
| Stage 2 | - | - | - | - | - | - | 817 | 792 | - | 467 | 440 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 911 | - | - | 1161 | - | - | 153 | 183 | 670 | 152 | 182 | 461 |
| Stage 1 | - | - | - | - | - | - | 612 | 591 | - | 391 | 408 | - |
| Stage 2 | - | - | - | - | - | - | 370 | 401 | - | 576 | 578 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 911 | - | - | 1161 | - | - | 123 | 170 | 670 | 127 | 169 | 461 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 123 | 170 | - | 127 | 169 | - |
| Stage 1 | - | - | - | - | - | - | 598 | 577 | - | 382 | 389 | - |
| Stage 2 | - | - | - | - | - | - | 301 | 382 | - | 499 | 565 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.5 | 0.6 | 33.4 | 45.2 |
| HCM LOS | | | D | E |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 245 | 911 | - | - | 1161 | - | - | 206 |
| HCM Lane V/C Ratio | 0.497 | 0.023 | - | - | 0.048 | - | - | 0.593 |
| HCM Control Delay (s) | 33.4 | 9 | - | - | 8.3 | - | - | 45.2 |
| HCM Lane LOS | D | A | - | - | A | - | - | E |
| HCM 95th %tile Q(veh) | 2.5 | 0.1 | - | - | 0.1 | - | - | 3.3 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 4.4 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 34 | 668 | 14 | 50 | 438 | 41 | 23 | 2 | 37 | 13 | 1 | 25 |
| Future Vol, veh/h | 34 | 668 | 14 | 50 | 438 | 41 | 23 | 2 | 37 | 13 | 1 | 25 |
| 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 | 415 | - | 415 | 415 | - | 415 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 91 | 91 | 91 | 87 | 87 | 87 | 69 | 69 | 69 | 72 | 72 | 72 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 37 | 734 | 15 | 57 | 503 | 47 | 33 | 3 | 54 | 18 | 1 | 35 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 550 | 0 | 0 | 749 | 0 | 0 | 1467 | 1472 | 734 | 1461 | 1440 | 503 |
| Stage 1 | - | - | - | - | - | - | 808 | 808 | - | 617 | 617 | - |
| Stage 2 | - | - | - | - | - | - | 659 | 664 | - | 844 | 823 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1020 | - | - | 860 | - | - | 106 | 127 | 420 | 107 | 133 | 569 |
| Stage 1 | - | - | - | - | - | - | 375 | 394 | - | 477 | 481 | - |
| Stage 2 | - | - | - | - | - | - | 453 | 458 | - | 358 | 388 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1020 | - | - | 860 | - | - | 91 | 114 | 420 | 85 | 120 | 569 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 91 | 114 | - | 85 | 120 | - |
| Stage 1 | - | - | - | - | - | - | 362 | 380 | - | 460 | 449 | - |
| Stage 2 | - | - | - | - | - | - | 396 | 428 | - | 299 | 374 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.4 | 0.9 | 46.3 | 31.3 |
| HCM LOS | | | E | D |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 173 | 1020 | - | - | 860 | - | - | 190 |
| HCM Lane V/C Ratio | 0.519 | 0.037 | - | - | 0.067 | - | - | 0.285 |
| HCM Control Delay (s) | 46.3 | 8.7 | - | - | 9.5 | - | - | 31.3 |
| HCM Lane LOS | E | A | - | - | A | - | - | D |
| HCM 95th %tile Q(veh) | 2.6 | 0.1 | - | - | 0.2 | - | - | 1.1 |