# 7865 SOUTH HURSTBOURNE DEVELOPMENT

LOUISVILLE, KENTUCKY

## TRAFFIC IMPACT STUDY

JUNE 2019

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# INTRODUCTION

Qk4 was retained to perform a Traffic Impact Study (TIS) for the proposed 7865 South Hurstbourne Development located in east of Fegenbush Lane and west of S. Watterson Trail in Louisville, Kentucky. The approximate location of the proposed development can be seen on Figure 1 below.


**Figure 1: Proposed Development Location**

## PROPOSED DEVELOPMENT

The proposed development will consist of two land uses: 27,500 square feet of commercial buildings and 304 multi-family home units. Note, the square footage of the proposed development has been reduced on the latest site plan; however, this larger development plan was used for analysis as a worst case scenario.

Figure 2 below shows the general layout of the development boundaries and roadway system. The development would provide access to S. Hurstbourne Pkwy via a proposed entrance to the new development as well as a connection to Vassel Rd which also accesses S. Hurstbourne Pkwy.

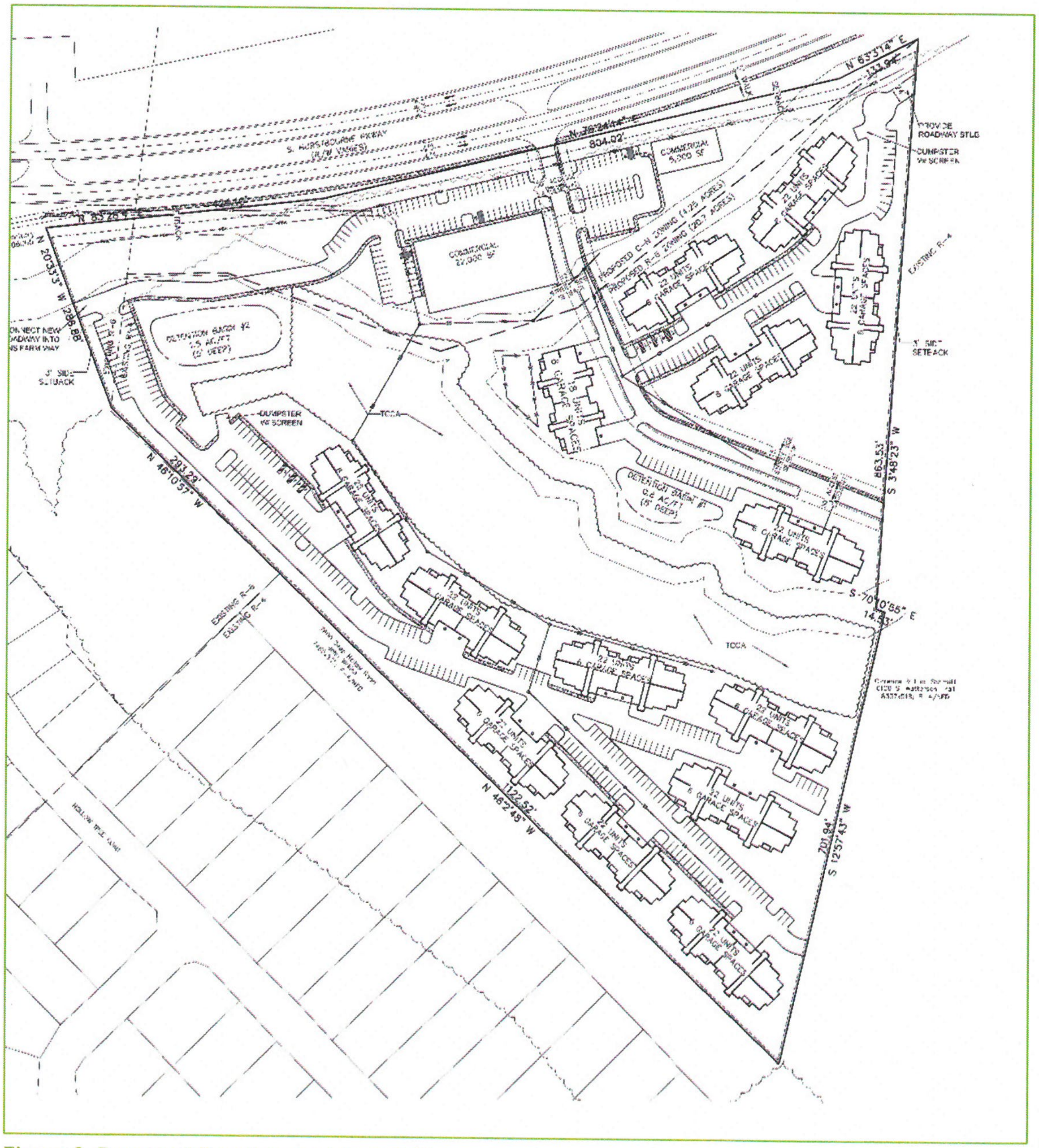


Figure 2: Proposed Development General Layout

# EXISTING CONDITIONS

## STUDY AREA

The study area for this traffic impact study will include the following intersection with S. Hurstbourne Pkwy (1) Vassel Rd, (2) Proposed Site Entrance, and (3) S. Watterson Trail.

The site entrance on S. Hurstbourne Pkwy is approximately 1,300 east of the S. Hurstbourne Pkwy intersection with Vassel Rd and 3,000 feet west of the S. Hurstbourne Pkwy intersection with S. Watterson Trail.


**Figure 3: Study Area Intersections**

### Intersection 1) S. Hurstbourne Pkwy & Vassel Rd

The intersection of S. Hurstbourne Pkwy and Vassel Rd is currently stop controlled with the northbound approach required to stop. The northbound approach to the intersection consists of a shared left/right lane. The westbound approach has a left turn lane and two thru lanes. The eastbound approach has two thru lanes and a right turn lane.


Figure 4: Intersection 1; S. Hurstbourne Pkwy & Vassel Rd

**Intersection 2) S. Hurstbourne Pkwy & Proposed Site Entrance**

There is an existing curb cut where the proposed Site Entrance will be located. The proposed northbound approach with have left and right turn lanes. The configuration of the east and westbound approaches will be determined via this study.


**Figure 5: Intersection 2; S. Hurstbourne Pkwy & Proposed Site Entrance**

**Intersection 3) S. Hurstbourne Pkwy & S. Watterson Trail**

The intersection of S. Hurstbourne Pkwy & S. Watterson Trail is currently signalized. The northbound approach to the intersection consists of a left turn lane, a thru lane and a right turn lane. The westbound approach has a left turn lane, two thru lanes and a right turn lane. The southbound approach has a left turn lane, a thru lane and a right turn lane. The eastbound approach has a left turn lane, two thru lanes and a right turn lane.

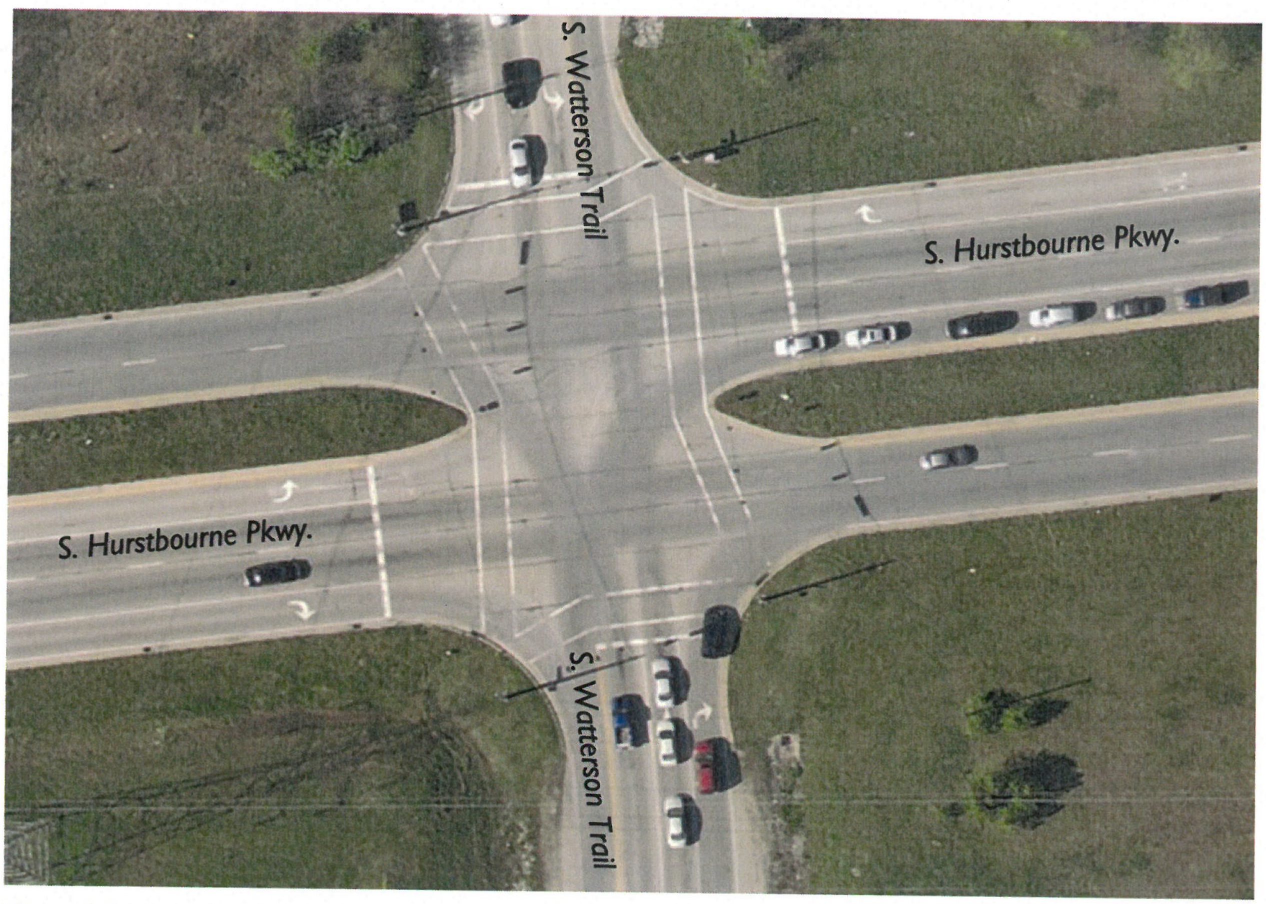



Figure 6: Intersection 3; S. Hurstbourne Pkwy & S. Watterson Trail

## TURNING MOVEMENT COUNTS

Turing movement counts were conducted for S. Hurstbourne Pkwy and Vassel Rd on March 28, 2019 and S. Hurstbourne Pkwy and S. Watterson Trail on April 30, 2019. These counts covered the peak hours of 7AM to 9AM and 4PM to 6PM. All intersections were counted with Miovision data collection units. Truck data was collected independently of passenger car data to determine truck percentages for all intersections. Peak hour summaries for all study area intersections follows. This existing turning movement data is summarized graphically on Figures 8 and 9.

**Study Name** Hurstbourne Pkwy & Vassel Rd
**Start Date** Thursday, March 28, 2019 7:00 AM
**End Date** Thursday, March 28, 2019 6:00 PM
**Site Code**

### Report Summary

| | | Westbound | | | | | Northbound | | | | | Eastbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time Period | Class. | T | L | U | I | O | R | L | U | I | O | R | T | U | I | O | Total |
| **Peak 1** | Lights | 849 | 6 | 0 | 855 | 563 | 22 | 9 | 0 | 31 | 9 | 3 | 541 | 0 | 544 | 858 | 1430 |
| Specified Period | % | 98% | 100% | 0% | 99% | 96% | 100% | 100% | 0% | 100% | 100% | 100% | 96% | 0% | 96% | 99% | 97% |
| 7:00 AM - 9:15 AM | Other Vehicle: | 13 | 0 | 0 | 13 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 25 | 13 | 38 |
| One Hour Peak | % | 2% | 0% | 0% | 1% | 4% | 0% | 0% | 0% | 0% | 0% | 0% | 4% | 0% | 4% | 1% | 3% |
| 7:00 AM - 8:00 AM | **Total** | **862** | **6** | **0** | **868** | **588** | **22** | **9** | **0** | **31** | **9** | **3** | **566** | **0** | **569** | **871** | **1468** |
| | PHF | 0.86 | 0.75 | 0 | 0.86 | 0.88 | 0.69 | 0.75 | 0 | 0.78 | 0.56 | 0.38 | 0.88 | 0 | 0.88 | 0.86 | 0.9 |
| | Approach % | | | | 59% | 40% | | | | 2% | 1% | | | | 39% | 59% | |
| **Peak 2** | Lights | 774 | 20 | 1 | 795 | 1169 | 11 | 5 | 0 | 16 | 34 | 14 | 1157 | 0 | 1171 | 779 | 1982 |
| Specified Period | % | 98% | 100% | 100% | 98% | 99% | 92% | 83% | 0% | 89% | 100% | 100% | 99% | 0% | 99% | 98% | 99% |
| 4:00 PM - 6:15 PM | Other Vehicle: | 14 | 0 | 0 | 14 | 10 | 1 | 1 | 0 | 2 | 0 | 0 | 9 | 0 | 9 | 15 | 25 |
| One Hour Peak | % | 2% | 0% | 0% | 2% | 1% | 8% | 17% | 0% | 11% | 0% | 0% | 1% | 0% | 1% | 2% | 1% |
| 4:45 PM - 5:45 PM | **Total** | **788** | **20** | **1** | **809** | **1179** | **12** | **6** | **0** | **18** | **34** | **14** | **1166** | **0** | **1180** | **794** | **2007** |
| | PHF | 0.95 | 0.56 | 0.25 | 0.96 | 0.94 | 0.75 | 0.75 | 0 | 0.75 | 0.77 | 0.5 | 0.94 | 0 | 0.93 | 0.95 | 0.97 |
| | Approach % | | | | 40% | 59% | | | | 1% | 2% | | | | 59% | 40% | |

**Study Name** Hurstbourne Pkwy & S Watterson Trail
**Start Date** Tuesday, April 30, 2019 7:00 AM
**End Date** Tuesday, April 30, 2019 6:00 PM
**Site Code**

### Report Summary

| | | Southbound | | | | | | Westbound | | | | | | Northbound | | | | | | Eastbound | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time Period | Class. | R | T | L | U | I | O | R | T | L | U | I | O | R | T | L | U | I | O | R | T | L | U | I | O | Total |
| **Peak 1** | Lights | 39 | 56 | 10 | 0 | 105 | 238 | 9 | 807 | 156 | 0 | 972 | 1093 | 525 | 222 | 278 | 0 | 1025 | 278 | 66 | 558 | 7 | 0 | 631 | 1124 | 2733 |
| Specified Period | % | 95% | 100% | 83% | 0% | 96% | 98% | 90% | 99% | 98% | 0% | 98% | 97% | 99% | 99% | 99% | 0% | 99% | 97% | 92% | 96% | 88% | 0% | 95% | 99% | 98% |
| 7:00 AM - 9:00 AM | Other Vehicle: | 2 | 0 | 2 | 0 | 4 | 5 | 1 | 12 | 3 | 0 | 16 | 31 | 5 | 3 | 3 | 0 | 11 | 9 | 6 | 24 | 1 | 0 | 31 | 17 | 62 |
| One Hour Peak | % | 5% | 0% | 17% | 0% | 4% | 2% | 10% | 1% | 2% | 0% | 2% | 3% | 1% | 1% | 1% | 0% | 1% | 3% | 8% | 4% | 13% | 0% | 5% | 1% | 2% |
| 7:00 AM - 8:00 AM | **Total** | **41** | **56** | **12** | **0** | **109** | **243** | **10** | **819** | **159** | **0** | **988** | **1124** | **530** | **225** | **281** | **0** | **1036** | **287** | **72** | **582** | **8** | **0** | **662** | **1141** | **2795** |
| | PHF | 0.68 | 0.7 | 0.75 | 0 | 0.8 | 0.82 | 0.5 | 0.86 | 0.8 | 0 | 0.85 | 0.93 | 0.97 | 0.82 | 0.66 | 0 | 0.85 | 0.84 | 0.95 | 0.91 | 0.5 | 0 | 0.92 | 0.81 | 0.88 |
| | Approach % | | | | | 4% | 9% | | | | | 35% | 40% | | | | | 37% | 10% | | | | | 24% | 41% | |
| **Peak 2** | Lights | 30 | 218 | 15 | 0 | 263 | 146 | 16 | 697 | 423 | 0 | 1136 | 1202 | 281 | 98 | 65 | 0 | 444 | 882 | 241 | 906 | 32 | 0 | 1179 | 792 | 3022 |
| Specified Period | % | 100% | 100% | 100% | 0% | 100% | 100% | 100% | 99% | 100% | 0% | 99% | 99% | 99% | 100% | 100% | 0% | 100% | 100% | 100% | 99% | 100% | 0% | 99% | 99% | 99% |
| 4:00 PM - 6:00 PM | Other Vehicle: | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 10 | 2 | 0 | 12 | 14 | 2 | 0 | 0 | 0 | 2 | 3 | 0 | 12 | 0 | 0 | 12 | 10 | 27 |
| One Hour Peak | % | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 1% | 1% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 1% | 1% | 1% |
| 5:00 PM - 6:00 PM | **Total** | **30** | **219** | **15** | **0** | **264** | **146** | **16** | **707** | **425** | **0** | **1148** | **1216** | **283** | **98** | **65** | **0** | **446** | **885** | **241** | **918** | **32** | **0** | **1191** | **802** | **3049** |
| | PHF | 0.68 | 0.78 | 0.54 | 0 | 0.77 | 0.89 | 0.67 | 0.95 | 0.92 | 0 | 0.94 | 0.89 | 0.86 | 0.84 | 0.71 | 0 | 0.87 | 0.91 | 0.9 | 0.9 | 0.8 | 0 | 0.95 | 0.95 | 0.95 |
| | Approach % | | | | | 9% | 5% | | | | | 38% | 40% | | | | | 15% | 29% | | | | | 39% | 26% | |

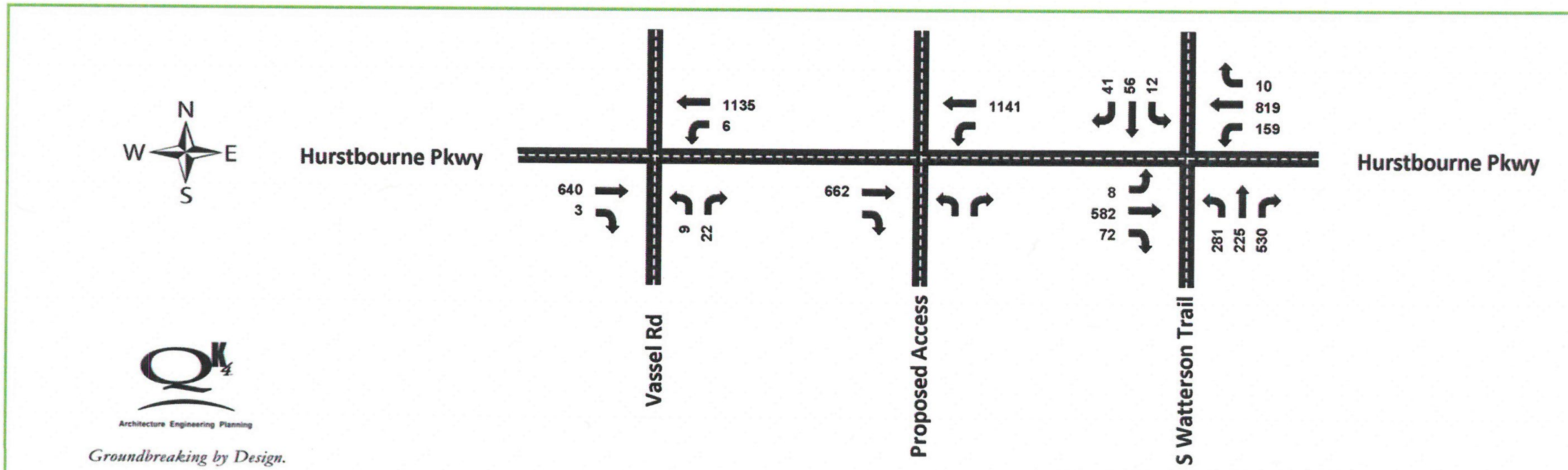



Figure 7: 2019 Existing AM Peak Hour Turing Movements

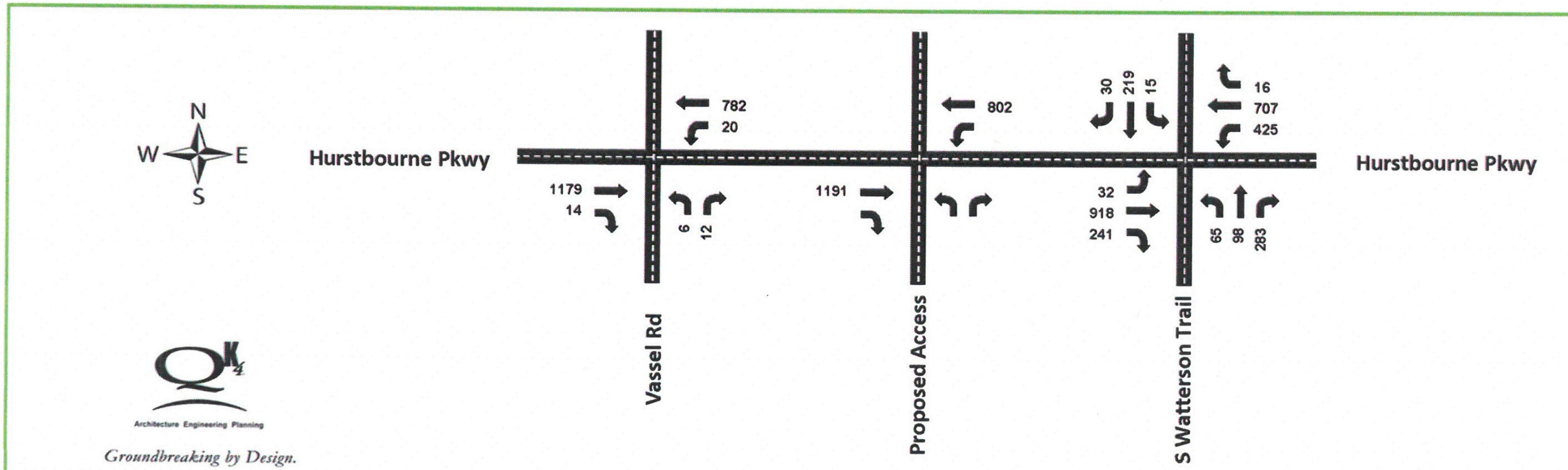


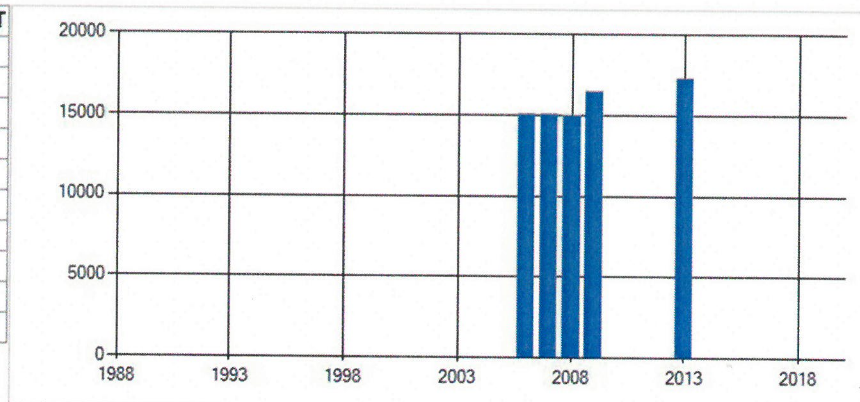

Figure 8: 2019 Existing PM Peak Hour Turing Movements

# PROJECTED TRAFFIC

## BACKGROUND TRAFFIC GROWTH

Existing volumes were grown by 2% to the future years of 2022 and 2032 (build-out of 2022 + 10 years growth). This growth rate was found by analyzing historic counts at KYTC count station Q03 on Hurstbourne Pkwy. The graph below shows this data. 2022 AM and PM no build turning movements can be seen on Figures 9 and 10. 2032 AM and PM no build turning movements can be seen on Figures 11 and 12.

| Year | AADT | Year | AADT | Year | AADT |
|---|---|---|---|---|---|
| 2019 | | 2009 | 16500 | 1999 | |
| 2018 | | 2008 | 15000 | 1998 | |
| 2017 | | 2007 | 15100 | 1997 | |
| 2016 | | 2006 | 15100 | 1996 | |
| 2015 | | 2005 | | 1995 | |
| 2014 | | 2004 | | 1994 | |
| 2013 | 17276 | 2003 | | 1993 | |
| 2012 | | 2002 | | 1992 | |
| 2011 | | 2001 | | 1991 | |
| 2010 | | 2000 | | 1990 | |



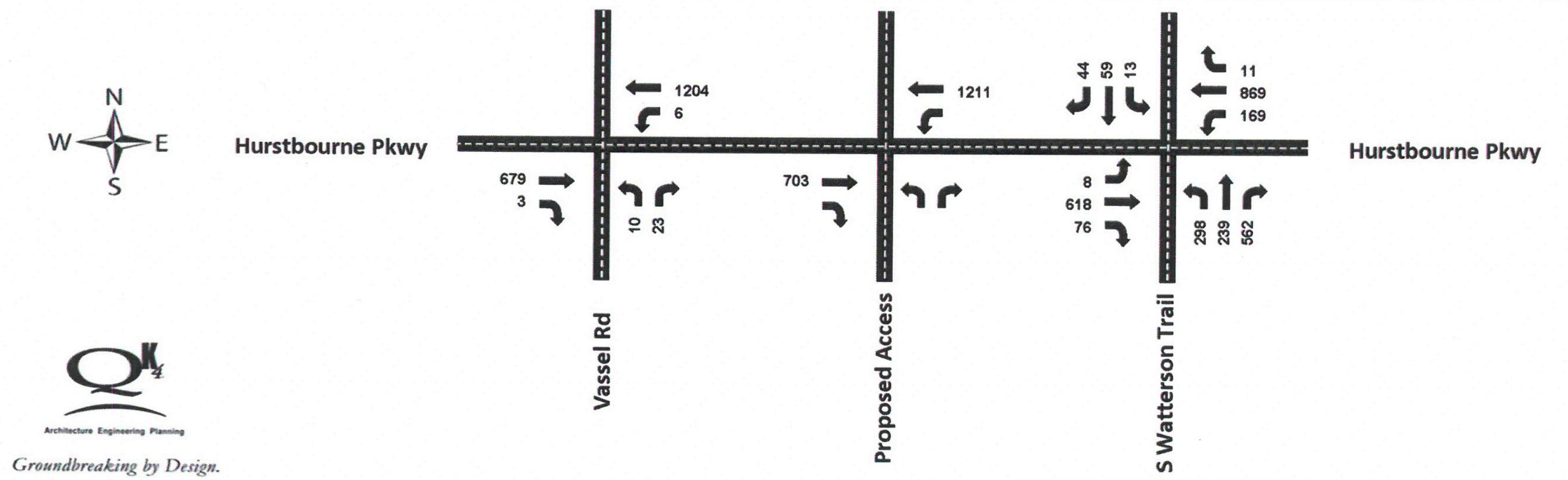



Figure 9: 2022 No Build AM Peak Hour Turing Movements

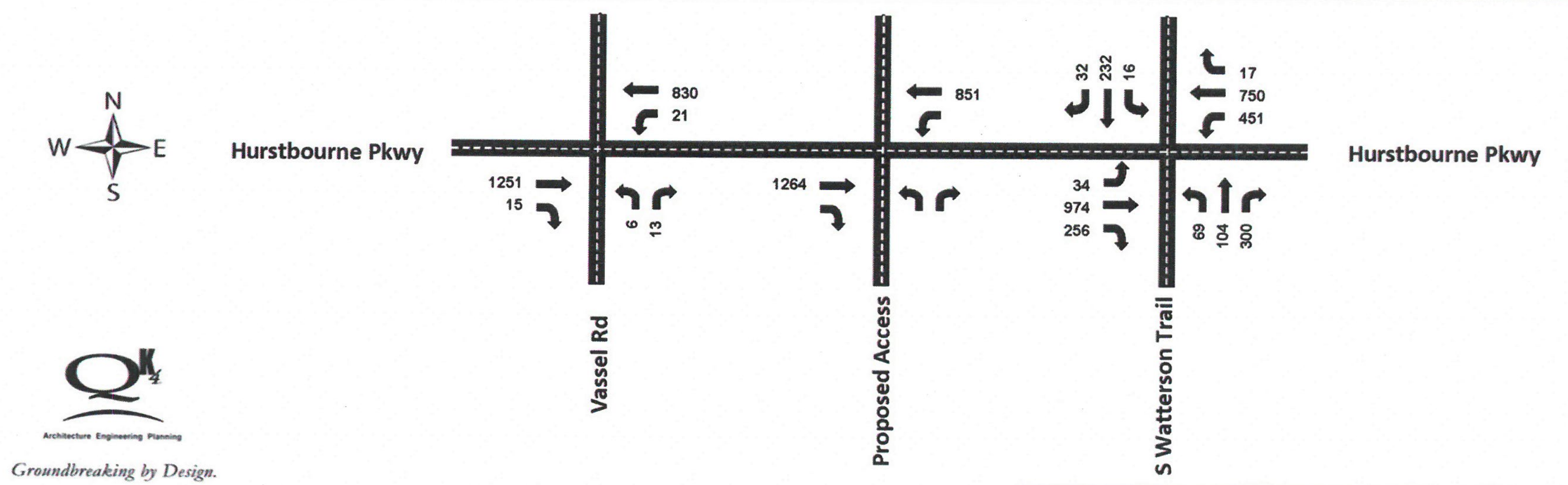



Figure 10: 2032 PM No Build Peak Hour Turing Movements

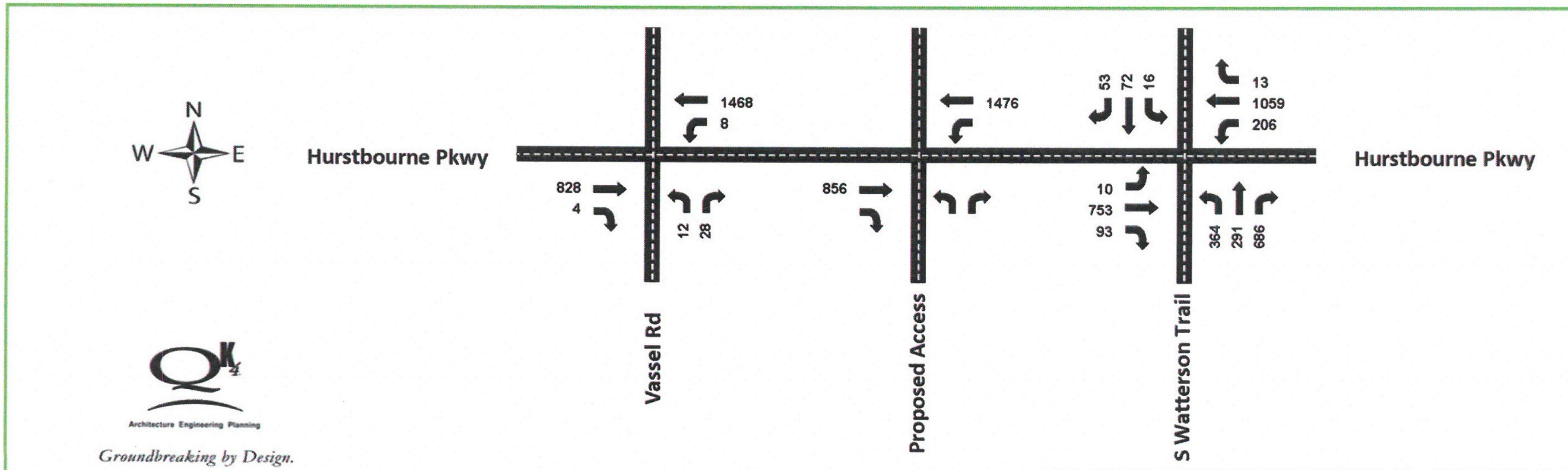



Figure 11: 2032 No Build AM Peak Hour Turing Movements

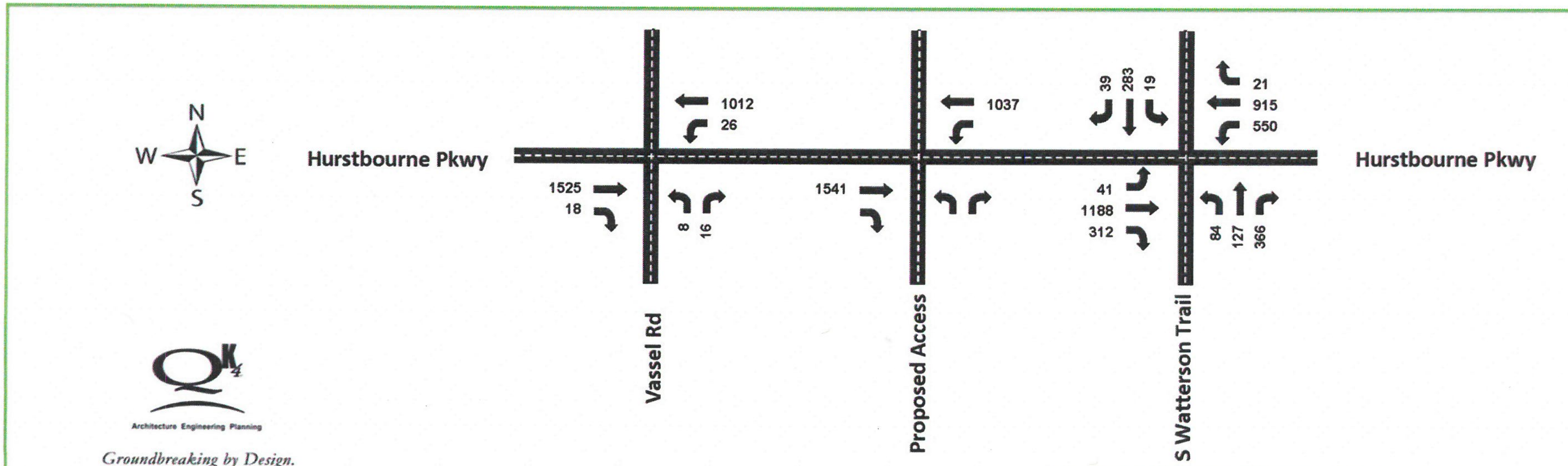



Figure 12: 2032 PM No Build Peak Hour Turing Movements

## TRIP GENERATION

Trips were generated using the latest version of the Trip Generation Manual. Trip generation calculations are summarized below.

| ITE SITE CODE 940<br>Bread/Donut/Bagel Shop with Drive-Through Window<br>5,000 Square Feet | |
|---|---|
| Pass-By Percentage | 50% |
| Daily Trips | n/a |
| Daily Trips (in) | n/a |
| Daily Trips (out) | n/a |
| AM Trips | 163 |
| AM Trips (in) | 82 |
| AM Trips (out) | 82 |
| AM Primary Trips (In) | 41 |
| AM Primary Trips (Out) | 41 |
| AM Pass-By Trips (In) | 41 |
| AM Pass-By Trips (Out) | 41 |
| PM Trips | 102 |
| PM Trips (in) | 50 |
| PM Trips (out) | 52 |
| PM Primary Trips (In) | 25 |
| PM Primary Trips (Out) | 26 |
| PM Pass-By Trips (In) | 25 |
| PM Pass-By Trips (Out) | 26 |

| ITE SITE CODE 850<br>Super Market<br>16,500 Square Feet | |
|---|---|
| Pass-By Percentage | 36% |
| Daily Trips | 2382 |
| Daily Trips (in) | 1191 |
| Daily Trips (out) | 1191 |
| AM Trips | 63 |
| AM Trips (in) | 38 |
| AM Trips (out) | 25 |
| AM Primary Trips (In) | 24 |
| AM Primary Trips (Out) | 16 |
| AM Pass-By Trips (In) | 14 |
| AM Pass-By Trips (Out) | 9 |
| PM Trips | 203 |
| PM Trips (in) | 103 |
| PM Trips (out) | 99 |
| PM Primary Trips (In) | 66 |
| PM Primary Trips (Out) | 64 |
| PM Pass-By Trips (In) | 37 |
| PM Pass-By Trips (Out) | 36 |

| ITE SITE CODE 932<br>High Turnover Sit-Down Restaurant<br>6,000 Square Feet | |
|---|---|
| Pass-By Percentage | 43% |
| Daily Trips | 785 |
| Daily Trips (in) | 393 |
| Daily Trips (out) | 393 |
| AM Trips | 60 |
| AM Trips (in) | 33 |
| AM Trips (out) | 27 |
| AM Primary Trips (In) | 19 |
| AM Primary Trips (Out) | 15 |
| AM Pass-By Trips (In) | 14 |
| AM Pass-By Trips (Out) | 12 |
| PM Trips | 59 |
| PM Trips (in) | 36 |
| PM Trips (out) | 22 |
| PM Primary Trips (In) | 21 |
| PM Primary Trips (Out) | 13 |
| PM Pass-By Trips (In) | 16 |
| PM Pass-By Trips (Out) | 10 |

| ITE SITE CODE 221<br>Multifamily Housing (Mid-Rise)<br>304 Dwelling Units | |
|---|---|
| Daily Trips | 1652 |
| Daily Trips (in) | 826 |
| Daily Trips (out) | 826 |
| AM Trips | 102 |
| AM Trips (in) | 26 |
| AM Trips (out) | 75 |
| PM Trips | 129 |
| PM Trips (in) | 79 |
| PM Trips (out) | 50 |

| Trip Generation Site Summary | |
|---|---|
| AM Primary Trips (In) | 110 |
| AM Primary Trips (Out) | 148 |
| PM Primary Trips (In) | 191 |
| PM Primary Trips (Out) | 153 |
| AM Pass-By Trips (In) | 69 |
| AM Pass-By Trips (Out) | 61 |
| PM Pass-By Trips (In) | 78 |
| PM Pass-By Trips (Out) | 71 |

## TRIP DISTRIBUTION / ASSIGNMENT

Traffic was distributed to and from the proposed development based on existing traffic patterns in the study area (specifically the egress/ingress pattern at the Vassel Rd intersection). Figure 13 summarizes trip distributions through the study area. Figures 14 and 15 summarize AM and PM peak hour primary trips generated by the development. Figures 16 and 17 summarize AM and PM peak hour pass-by trips. Figures 18 and 19 summarize 2022 AM and PM peak hour build turning movements. Figures 20 and 21 summarize 2032 AM and PM peak hour build turning movements.

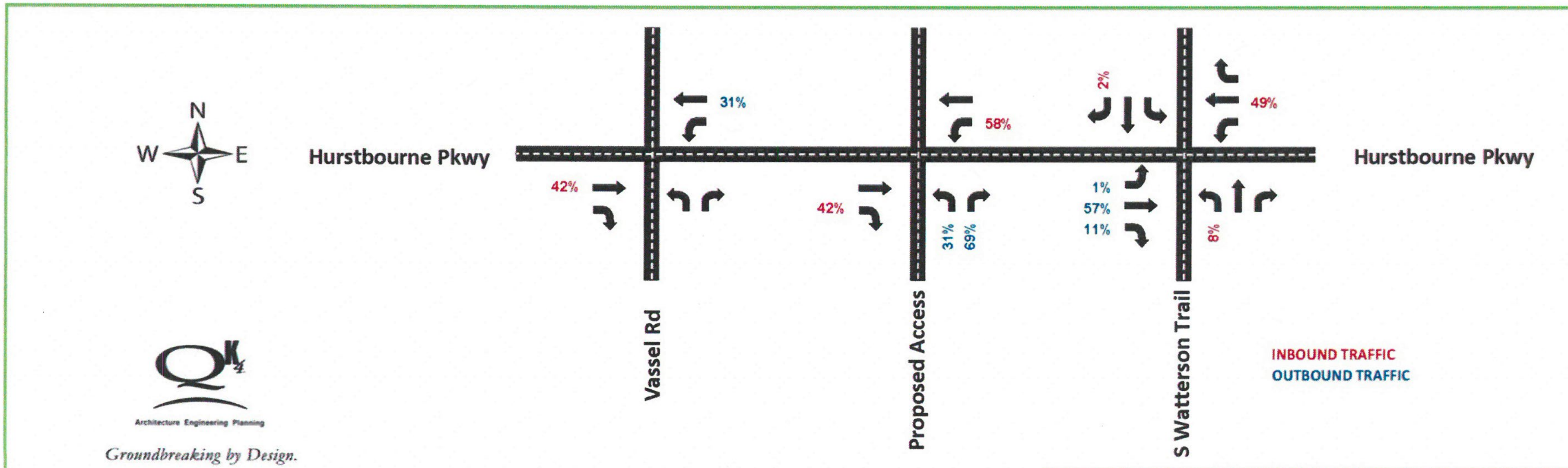



Figure 13: Trip Distributions

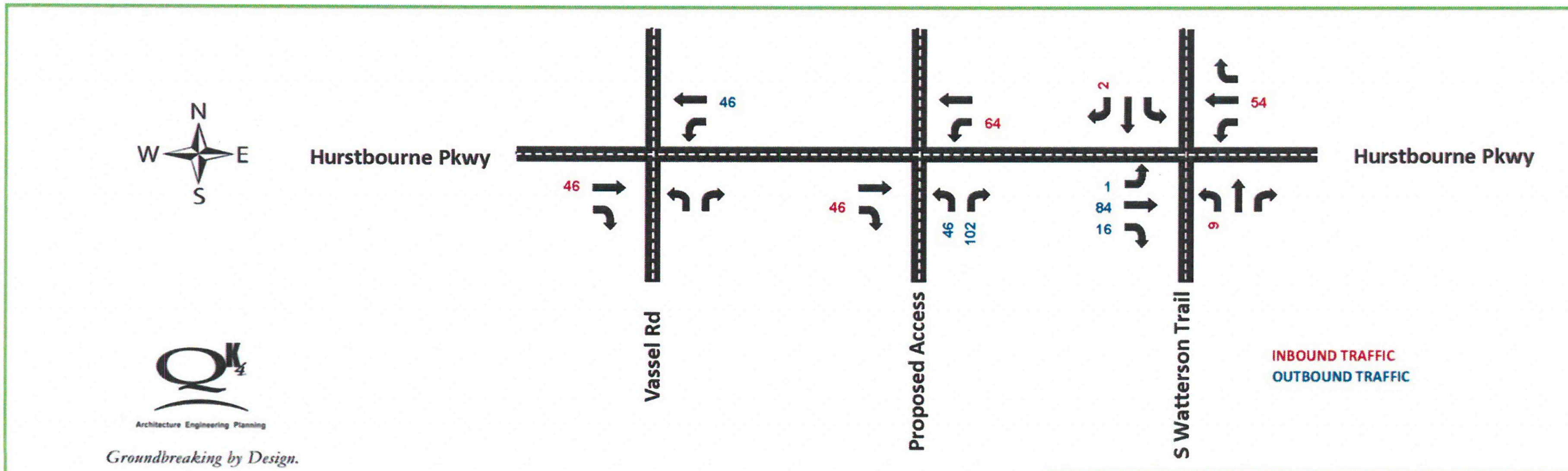



Figure 14: AM Distributed Trips

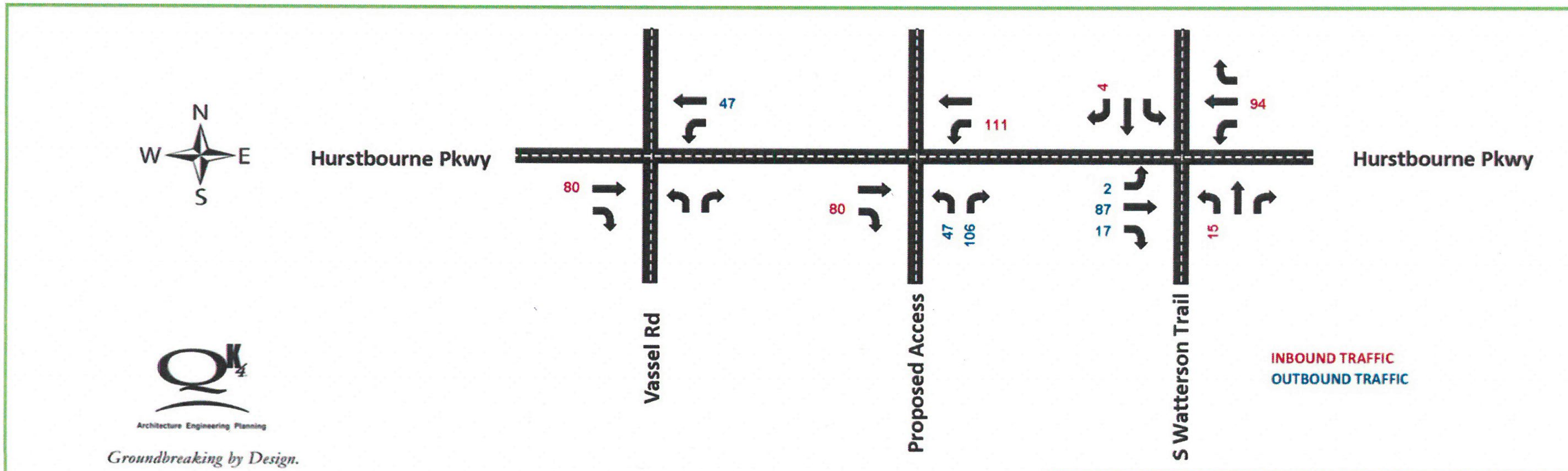



Figure 15: PM Distributed Trips

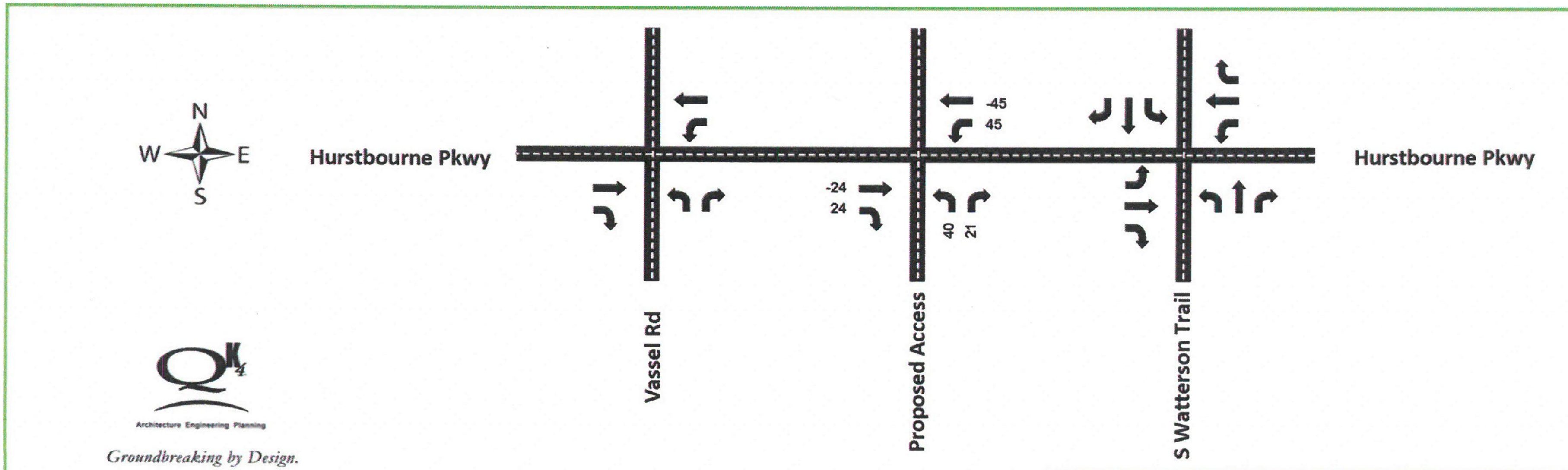



Figure 16: AM Pass-By Trips

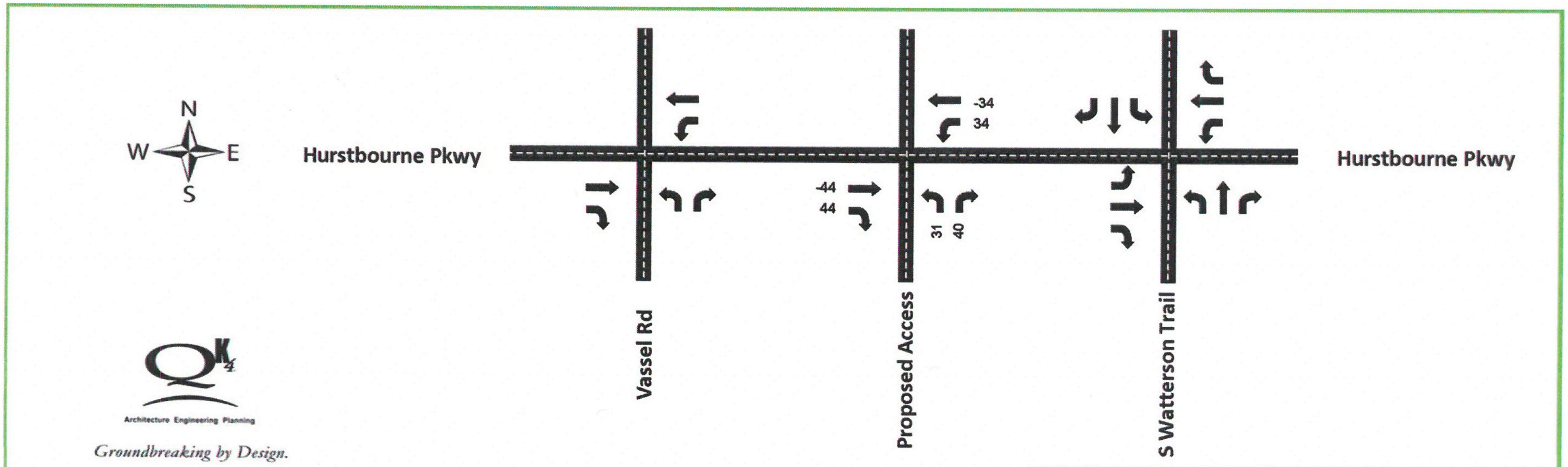



Figure 17: PM Pass-By Trips

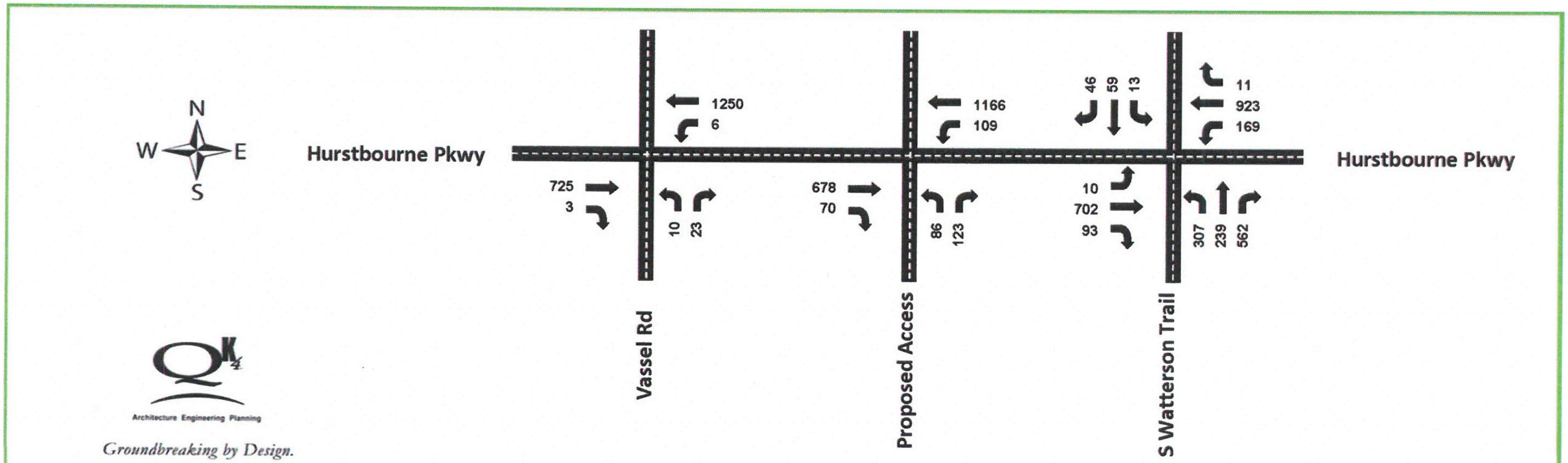



Figure 18 2022 AM Build Traffic

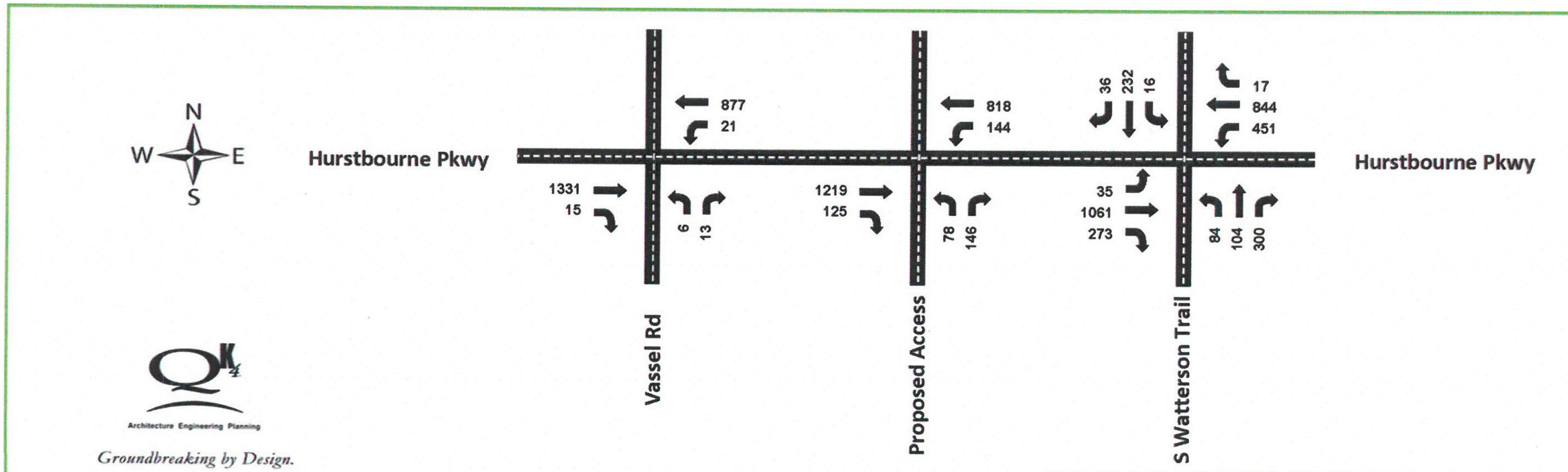



Figure 19: 2022 PM Build Traffic

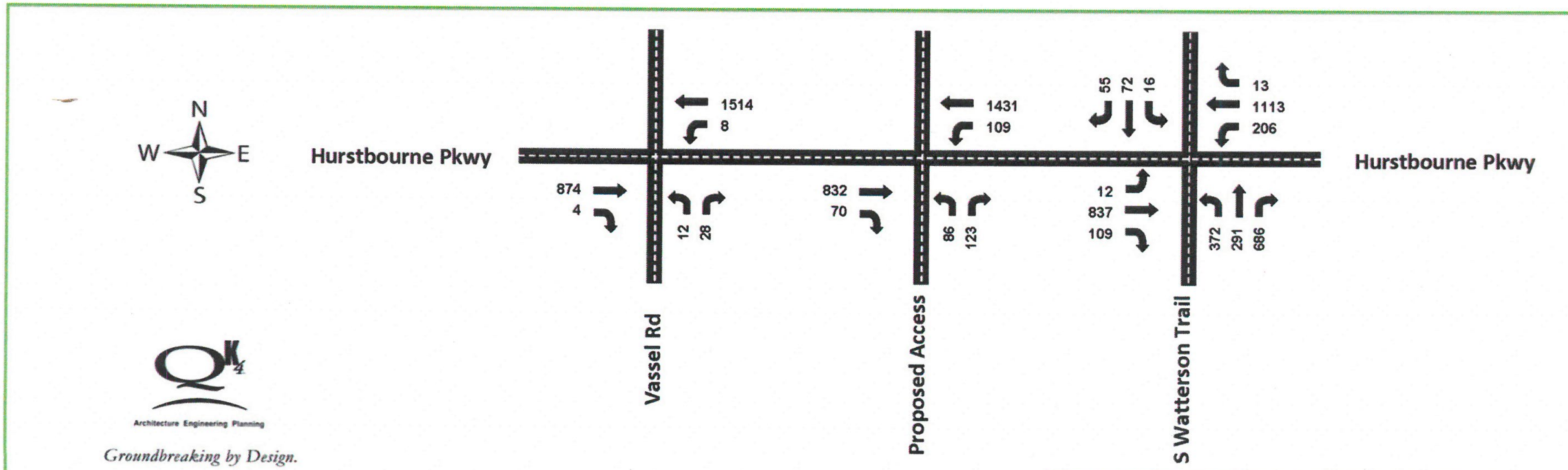



Figure 20 2032 AM Build Traffic

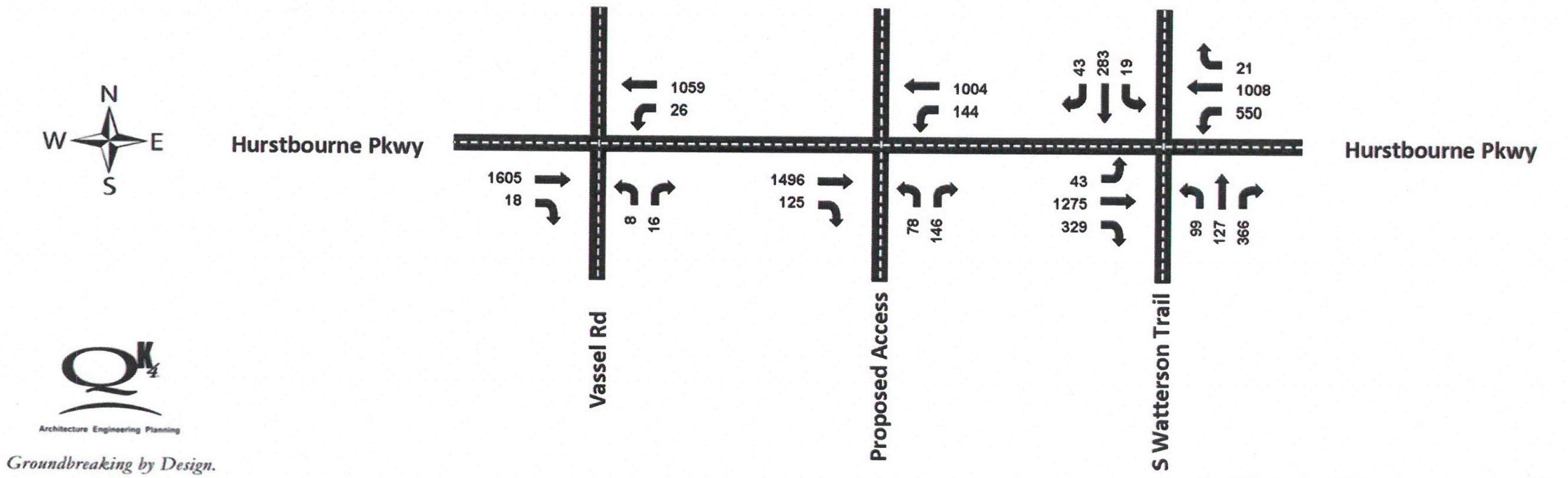



Figure 21: 2032 PM Build Traffic

# ANALYSIS

## TURN LANE ANALYSIS

Turning movements at all study area intersections were compared to KYTC turn lane warrants to determine if right or left turn lanes would be warranted at the proposed entrance.

### RIGHT TURN LANE WARRANTS

Right turn volumes were compared to warrants for the eastbound approach to determine if a right turn lane would be needed. As seen below, this auxiliary lane would be warranted based on projected volumes.

#### *AM PEAK HOUR*

Right Turn Volume: 70

Advancing Volume: 902

Warranted: NO

#### *PM PEAK HOUR*

Right Turn Volume: 125

Advancing Volume: 1621

Warranted: **YES**

### LEFT TURN LANE WARRANTS

Left turn volumes were compared to warrants for the westbound approach to determine if a left turn lane would be needed. As seen below, this auxiliary lane would be warranted based on projected volumes.

#### *AM PEAK HOUR*

Left Turn Volume: 109

Advancing Volume: 1540

Opposing Volume: 902

Warranted: **YES**

#### *PM PEAK HOUR*

Left Turn Volume: 144

Advancing Volume: 1148

Opposing Volume: 1621

Warranted: **YES**

## CAPACITY ANALYSIS

Level of service (LOS) is a term that is commonly used to evaluate roadway functions. Level of service is defined as a qualitative measure of operational conditions and the perception of these conditions by motorists. These conditions are usually defined in terms of factors such as speed and travel time, maneuverability, delay, and safety. There are six levels of service, which are designated by the letters "A" through "F." Level of service "A" represents the best operating conditions, while level of service "F" defines the worst.

The methodology used to analyze the capacity and level of service was based on standard traffic engineering procedures outlined in the *Highway Capacity Manual* (HCM 2010). The analysis was performed using the latest version of the Highway Capacity software. The procedure considers traffic and geometric conditions of the facility, such as traffic volumes, percent of large vehicles, design speed, lane and shoulder widths, grades, and directional distributions to determine the LOS.

Delay is a critical performance measure on interrupted-flow facilities. Delay is measured as the time a vehicle is slowed by a signalized or stop-controlled intersection compared to the average travel time of a vehicle if it were unimpeded by the intersection. Delay includes the time a vehicle decelerates approaching the intersection and accelerating as it leaves the intersection. Although the definition of delay is the same for both signalized and stop-controlled intersections, the thresholds used to determine LOS differ. LOS thresholds for signalized and unsignalized intersections are summarized below.

| LOS Threshold for Signalized Intersections | | |
|---|---|---|
| **Delay (sec)** | **LOS** | **Description** |
| 1-10 | A | Free Flow |
| 10-20 | B | Reasonable Unimpeded Flow |
| 20-35 | C | Stable Operation |
| 35-55 | D | *Approaching Unstable Flow |
| 55-80 | E | Unstable Flow |
| >80 | F | Congested Flow |

| LOS Threshold for Unsignalized Intersections | | |
|---|---|---|
| **Delay (sec)** | **LOS** | **Description** |
| 1-10 | A | Free Flow |
| 10-15 | B | Reasonable Unimpeded Flow |
| 15-25 | C | Stable Operation |
| 25-35 | D | *Approaching Unstable Flow |
| 35-50 | E | Unstable Flow |
| >50 | F | Congested Flow |

Capacity analyses were performed for all study area intersections for both the AM and PM peak hours, including the following scenarios: existing, no build and build. Highway Capacity Software 7 was used to analyze all study area intersections. Note that the capacity analyses included a comparison—expressed as a volume to capacity (v/c) ratio—of the traffic volume to the operating capacity of the road based on its characteristics (number of lanes, shoulder width, grades, etc.). The v/c ratio ranges from zero (0) to 1.0, defined as follows:

- **v/c = 0**: the flow rate is zero—this is the starting point for the comparison.
- **v/c = 0– 0.999**: the volume of traffic is less than the road's capacity to handle it.
- **v/c = 1.0**: the flow rate equals the roadway's capacity; i.e., the road is approaching the limits of its ability (capacity) to handle the traffic volume.
- v/c = > 1.0: the traffic volume exceeds the road's capacity, producing unacceptable delays and LOS "F."

95 percentile queue lengths were also report for all intersection movements.

## S. HURSTBOURNE PKWY & VASSEL RD

Level of service changes in 2022 with build traffic added:

- Northbound Left/Right drops from a LOS B to LOS C in AM (+6.7 sec of delay)

Level of service changes in 2032 with build traffic added:

- Westbound Left drops from LOS A to LOS B in AM (+0.2 sec of delay)
- Northbound Left/Right drops from a LOS C to a LOS D in AM (+14.4 sec of delay)

**Capacity Analysis S. Hurstbourne Pkwy & Vassel Road**

| Movement | Time Period | v/c Ratio Existing | v/c Ratio 2022 No Build | v/c Ratio 2022 Build | v/c Ratio 2023 No Build | v/c Ratio 2023 Build | 95% Queue (feet) Existing | 95% Queue (feet) 2022 No Build | 95% Queue (feet) 2022 Build | 95% Queue (feet) 2023 No Build | 95% Queue (feet) 2023 Build | Delay (seconds) Existing | Delay (seconds) 2022 No Build | Delay (seconds) 2022 Build | Delay (seconds) 2023 No Build | Delay (seconds) 2023 Build | Level of Service Existing | Level of Service 2022 No Build | Level of Service 2022 Build | Level of Service 2023 No Build | Level of Service 2023 Build |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Westbound, Left | AM | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 25 | 25 | 25 | 25 | 25 | 9 | 9.1 | 9.3 | 9.8 | 10 | A | A | A | A | B |
| | PM | 0.04 | 0.05 | 0.05 | 0.07 | 0.08 | 25 | 25 | 25 | 25 | 25 | 12 | 12.5 | 13.1 | 15 | 15.9 | B | B | B | C | C |
| Northbound, Left/Right | AM | 0.07 | 0.08 | 0.13 | 0.12 | 0.24 | 25 | 25 | 25 | 25 | 25 | 13.1 | 13.7 | 20.4 | 15.9 | 30.3 | B | B | C | C | D |
| | PM | 0.08 | 0.08 | 0.09 | 0.15 | 0.17 | 25 | 25 | 25 | 25 | 25 | 20.1 | 21.1 | 22.8 | 29.4 | 32.3 | C | C | C | D | D |

## S. HURSTBOURNE PKWY & PROPOSED SITE ENTRANCE

The westbound left movement off out of the development would operate at a LOS E or F during both peak hours for both 2022 and 2032 future years. This movement will also exceed 80 seconds of delay in both years durintg the PM peak hour. Signal warrants would not be met with this development for eight hours of the day. Although this movement would experience delays leaving the development, any queueing would remain on the subject property and no affect operations on S. Hurstbourne Pkwy.

**Capacity Analysis S. Hurstbourne Pkwy & Proposed Site Entrance**

| Movement | Time Period | v/c Ratio Existing | v/c Ratio 2022 No Build | v/c Ratio 2022 Build | v/c Ratio 2023 No Build | v/c Ratio 2023 Build | 95% Queue (feet) Existing | 95% Queue (feet) 2022 No Build | 95% Queue (feet) 2022 Build | 95% Queue (feet) 2023 No Build | 95% Queue (feet) 2023 Build | Delay (seconds) Existing | Delay (seconds) 2022 No Build | Delay (seconds) 2022 Build | Delay (seconds) 2023 No Build | Delay (seconds) 2023 Build | Level of Service Existing | Level of Service 2022 No Build | Level of Service 2022 Build | Level of Service 2023 No Build | Level of Service 2023 Build |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Westbound, Left | AM | --- | --- | 0.15 | --- | 0.17 | --- | --- | 25 | --- | 25 | --- | --- | 10.3 | --- | 11.3 | --- | --- | B | --- | B |
| | PM | --- | --- | 0.35 | --- | 0.45 | --- | --- | 50 | --- | 75 | --- | --- | 17.1 | --- | 23.7 | --- | --- | C | --- | C |
| orthbound, Let | AM | --- | --- | 0.46 | --- | 0.6 | --- | --- | 75 | --- | 100 | --- | --- | 37.5 | --- | 57.1 | --- | --- | E | --- | F |
| | PM | --- | --- | 0.69 | --- | 1.02 | --- | --- | 100 | --- | 150 | --- | --- | 83.5 | --- | 194.1 | --- | --- | F | --- | F |
| Northbound, Right | AM | --- | --- | 0.21 | --- | 0.24 | --- | --- | 25 | --- | 25 | --- | --- | 12.3 | --- | 13.6 | --- | --- | B | --- | B |
| | PM | --- | --- | 0.4 | --- | 0.5 | --- | --- | 50 | --- | 75 | --- | --- | 19.7 | --- | 26.9 | --- | --- | C | --- | D |

## S. HURSTBOURNE PKWY & S WATTERSON TRAIL

Level of service changes in 2022 with build traffic added:

- Eastbound Thru drops from LOS D to LOS E in the PM (+5 sec of delay)
- Westbound Thru drops from LOS B to LOS C in the PM (+1 sec of delay

No movement would have a change in LOS with build traffic in 2032.

**Capacity Analysis S. Hurstbourne Pkwy & S. Watterson Trail**

| Movement | Time Period | Existing | 2022 No Build | 2022 Build | 2023 No Build | 2023 Build | Existing | 2022 No Build | 2022 Build | 2023 No Build | 2023 Build | Existing | 2022 No Build | 2022 Build | 2023 No Build | 2023 Build | Existing | 2022 No Build | 2022 Build | 2023 No Build | 2023 Build |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| astbound, Left | AM | 0.381 | 0.381 | 0.395 | 0.397 | 0.411 | 25 | 25 | 25 | 25 | 25 | 73.5 | 74 | 72 | 73.8 | 72.6 | E | E | E | E | E |
| | PM | 0.552 | 0.572 | 0.581 | 0.652 | 0.671 | 75 | 75 | 50 | 75 | 50 | 66.4 | 67..8 | 68 | 74.3 | 75 | E | E | E | E | E |
| Eastbound, Thru | AM | 0.53 | 0.567 | 0.644 | 0.711 | 0.79 | 325 | 350 | 250 | 425 | 350 | 34.4 | 35.7 | 37.5 | 41.2 | 44.3 | C | D | D | D | D |
| | PM | 0.81 | 0.873 | 0.951 | 1.127 | 1.209 | 500 | 550 | 475 | 1000 | 850 | 41.3 | 46.3 | 55.4 | 112.1 | 145.9 | D | D | E | F | F |
| stbound, Right | AM | 0.145 | 0.154 | 0.189 | 0.194 | 0.227 | 75 | 100 | 75 | 125 | 75 | 28.9 | 29.5 | 30 | 31.7 | 32.2 | C | C | C | C | C |
| | PM | 0.478 | 0.515 | 0.55 | 0.665 | 0.701 | 275 | 300 | 200 | 375 | 275 | 33.7 | 35.5 | 36.5 | 44.3 | 46 | C | D | D | D | D |
| estbound, Left | AM | 0.835 | 0.843 | 0.843 | 0.871 | 0.871 | 250 | 275 | 175 | 325 | 200 | 64.2 | 64.2 | 64.2 | 69.9 | 69.9 | E | E | E | E | E |
| | PM | 1.2 | 1.293 | 1.293 | 1.669 | 1.669 | 850 | 1000 | 675 | 1625 | 1075 | 158.9 | 197.5 | 197.5 | 363.9 | 363.9 | F | F | F | F | F |
| Westbound, Thru | AM | 0.567 | 0.596 | 0.637 | 0.71 | 0.751 | 375 | 400 | 300 | 500 | 375 | 27.2 | 27.8 | 28.9 | 30.7 | 32.3 | C | C | C | C | C |
| | PM | 0.413 | 0.446 | 0.502 | 0.581 | 0.64 | 275 | 300 | 225 | 400 | 325 | 18.1 | 19.5 | 20.5 | 25.5 | 26.9 | B | B | C | C | C |
| estbound, Right | AM | 0.015 | 0.017 | 0.017 | 0.019 | 0.02 | 25 | 25 | 25 | 25 | 25 | 19.6 | 19.5 | 19.7 | 19.7 | 19.5 | B | B | B | B | B |
| | PM | 0.019 | 0.022 | 0.022 | 0.029 | 0.3 | 25 | 25 | 25 | 25 | 25 | 13.9 | 14.7 | 14.7 | 17.7 | 17.8 | B | B | B | B | B |
| rthbound, Left | AM | 0.909 | 0.92 | 0.926 | 1.09 | 1.114 | 425 | 450 | 325 | 675 | 500 | 73.1 | 75.7 | 76.7 | 123.8 | 131.9 | E | E | E | F | F |
| | PM | 0.755 | 0.758 | 0.769 | 0.775 | 0.789 | 125 | 125 | 100 | 150 | 100 | 71.3 | 71.3 | 68.9 | 72.6 | 71 | E | E | E | E | E |
| Northbound, Thru | AM | 0.39 | 0.418 | 0.418 | 0.523 | 0.523 | 250 | 250 | 150 | 325 | 200 | 31.5 | 32.4 | 32.4 | 35.8 | 35.8 | C | C | C | D | D |
| | PM | 0.256 | 0.259 | 0.259 | 0.269 | 0.269 | 125 | 125 | 75 | 175 | 100 | 38.6 | 38.3 | 38.3 | 36.9 | 36.9 | D | D | D | D | D |
| rthbound, Right | AM | 1.068 | 1.141 | 1.141 | 1.432 | 1.432 | 850 | 1000 | 700 | 1700 | 1125 | 98.6 | 125 | 125 | 247.7 | 247.7 | F | F | F | F | F |
| | PM | 0.874 | 0.882 | 0.882 | 0.915 | 0.915 | 375 | 400 | 275 | 525 | 375 | 56.2 | 57.8 | 57.8 | 65.3 | 65.3 | E | E | E | E | E |
| outhbound, Left | AM | 0.658 | 0.671 | 0.671 | 0.71 | 0.71 | 50 | 50 | 25 | 50 | 25 | 102 | 101.9 | 101.9 | 103.6 | 103.6 | F | F | F | F | F |
| | PM | 0.64 | 0.652 | 0.652 | 0.697 | 0.697 | 50 | 50 | 25 | 50 | 25 | 90.3 | 91.3 | 91.3 | 96.6 | 96.6 | F | F | F | F | F |
| Southbound, Thru | AM | 0.205 | 0.232 | 0.239 | 0.31 | 0.31 | 75 | 100 | 50 | 125 | 75 | 44.7 | 46.4 | 46.9 | 49.9 | 49.9 | D | D | D | D | D |
| | PM | 0.686 | 0.963 | 0.735 | 0.725 | 0.76 | 275 | 300 | 200 | 375 | 250 | 48.6 | 49 | 51.3 | 51.7 | 54.3 | D | D | D | D | D |
| uthbound, Right | AM | 0.173 | 0.199 | 0.215 | 0.263 | 0.273 | 75 | 75 | 50 | 75 | 50 | 44.4 | 46.1 | 46.8 | 49.5 | 49.6 | D | D | D | D | D |
| | PM | 0.111 | 0.113 | 0.135 | 0.118 | 0.136 | 50 | 50 | 25 | 50 | 50 | 40.6 | 40.4 | 41.7 | 39.7 | 40.9 | D | D | D | D | D |
| **Overall** | **AM** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | **50.4** | **56.2** | **56** | **87.2** | **87.1** | **D** | E | E | F | F |
| | **PM** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | **54.6** | **62.1** | **63.6** | **108.1** | **116.9** | **D** | E | E | F | F |

## TURN LANE LENGTHS

Turning movement volumes at the intersection of S. Hurstbourne Pkwy with the proposed site entrance warranted both an eastbound right turn lane and a westbound left turn lane off of S. Hurstbourne Pkwy into the site.

Using method 1 in the auxiliary turn lane policy for the uncontrolled eastbound right turn lane and a 45 mph speed on S. Hurstbourne Pkwy, 215 feet would be required for this lane including a 100' bay taper.

For the westbound left turn lane methods 1 and 2 were compared to determine the needed length for this lane. Method 1 would require 215 feet for the posted 45 mph speed limit. Method 2 would require 75 feet for the maximum storage length (output from HCS) and an additional 115 feet, for a total of 190 feet. Using the greater of these two methods, 215' (including a 100' bay taper) would be required for the westbound left turn lane.

## CONCLUSIONS

The subject development would cause little impact to S. Hurstbourne Pkwy or nearby intersections.

The northbound left turn movement out of the development would experience significant delay, but this would be internal to the development and would not affect operations on S. Hurstbourne Pkwy. At this time it is not expected that a signal would be warranted at the S. Hurstbourne intersection with the proposed site entrance. The following improvements are recommended for this intersection based on the findings of this study.

- 215' total length eastbound right turn lane (including 100' bay taper)
- 215' total length westbound left turn lane (including 100' bay taper)

# APPENDICES

# Existing Capacity Analysis

# HCS7 Two-Way Stop-Control Report

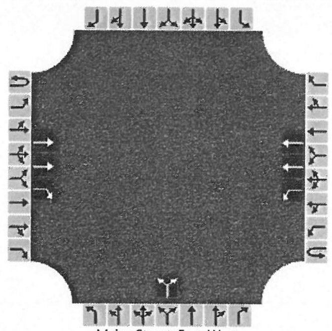
## General Information

| | |
|---|---|
| Analyst | |
| Agency/Co. | |
| Date Performed | 4/2/2019 |
| Analysis Year | 2019 |
| Time Analyzed | AM Peak Hour |
| Intersection Orientation | East-West |
| Project Description | Hurstbourne Development |

## Site Information

| | |
|---|---|
| Intersection | Hurstbourne Pkwy & Vassel |
| Jurisdiction | KYTC |
| East/West Street | Hurstbourne Pkwy |
| North/South Street | Vassel Rd |
| Peak Hour Factor | 0.92 |
| Analysis Time Period (hrs) | 0.25 |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 640 | 3 | 0 | 6 | 1135 | | | 9 | | 22 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 0 | | 0 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

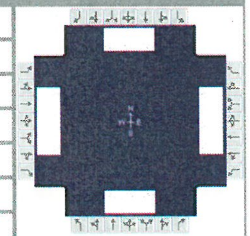
## Critical and Follow-up Headways

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 6.80 | | 6.90 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.50 | | 3.30 | | | | |

## Delay, Queue Length, and Level of Service

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 7 | | | | | 34 | | | | | |
| Capacity, c (veh/h) | | | | | | 907 | | | | | 476 | | | | | |
| v/c Ratio | | | | | | 0.01 | | | | | 0.07 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.0 | | | | | 0.2 | | | | | |
| Control Delay (s/veh) | | | | | | 9.0 | | | | | 13.1 | | | | | |
| Level of Service (LOS) | | | | | | A | | | | | B | | | | | |
| Approach Delay (s/veh) | | | | | 0.0 | | | | 13.1 | | | | | | | |
| Approach LOS | | | | | | | | | B | | | | | | | |

# HCS7 Signalized Intersection Results Summary

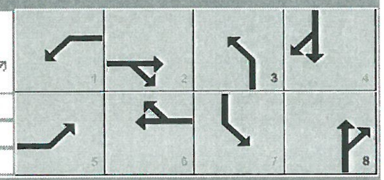


| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | AM S Watterson Trail.xus | | |
| Project Description | AM Peak Hour | | | | |

| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( $v$ ), veh/h | 8 | 582 | 72 | 159 | 819 | 10 | 281 | 225 | 530 | 12 | 56 | 41 |

| Signal Information | | | |
|---|---|---|---|
| Cycle, s | 120.7 | Reference Phase | 2 |
| Offset, s | 0 | Reference Point | End |
| Uncoordinated | Yes | Simult. Gap E/W | Off |
| Force Mode | Fixed | Simult. Gap N/S | Off |

| | | | | | | |
|---|---|---|---|---|---|---|
| Green | 1.5 | 5.8 | 40.0 | 1.4 | 14.4 | 19.1 |
| Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 3.5 | 3.6 |
| Red | 3.0 | 3.0 | 1.8 | 3.0 | 3.0 | 2.8 |



| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 8.0 | 46.1 | 20.3 | 58.4 | 28.8 | 46.4 | 7.9 | 25.5 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( $MAH$ ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.9 |
| Queue Clearance Time ( $g_s$ ), s | 2.6 | 19.2 | 13.3 | 24.2 | 21.9 | 42.0 | 2.9 | 5.4 |
| Green Extension Time ( $g_e$ ), s | 0.0 | 2.5 | 0.6 | 3.2 | 0.4 | 0.0 | 0.0 | 0.4 |
| Phase Call Probability | 0.25 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.35 | 0.97 |
| Max Out Probability | 0.00 | 0.00 | 0.02 | 0.03 | 1.00 | 1.00 | 0.00 | 0.00 |

| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( $v$ ), veh/h | 9 | 626 | 77 | 171 | 881 | 11 | 302 | 242 | 570 | 13 | 60 | 44 |
| Adjusted Saturation Flow Rate ( $s$ ), veh/h/ln | 1810 | 1781 | 1610 | 1795 | 1795 | 1610 | 1795 | 1870 | 1610 | 1682 | 1856 | 1610 |
| Queue Service Time ( $g_s$ ), s | 0.6 | 17.2 | 4.1 | 11.3 | 22.2 | 0.5 | 19.9 | 12.0 | 40.0 | 0.9 | 3.4 | 2.9 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 0.6 | 17.2 | 4.1 | 11.3 | 22.2 | 0.5 | 19.9 | 12.0 | 40.0 | 0.9 | 3.4 | 2.9 |
| Green Ratio ( $g/C$ ) | 0.01 | 0.33 | 0.33 | 0.11 | 0.43 | 0.43 | 0.19 | 0.33 | 0.33 | 0.01 | 0.16 | 0.16 |
| Capacity ( $c$ ), veh/h | 23 | 1180 | 534 | 205 | 1554 | 697 | 332 | 620 | 534 | 20 | 293 | 254 |
| Volume-to-Capacity Ratio ( $X$ ) | 0.381 | 0.530 | 0.145 | 0.835 | 0.567 | 0.015 | 0.909 | 0.390 | 1.068 | 0.658 | 0.205 | 0.173 |
| Back of Queue ( $Q$ ), ft/ln ( 95 th percentile) | 15.5 | 302.1 | 72.8 | 239.3 | 361.6 | 7.9 | 412 | 231.4 | 826.8 | 29.7 | 72.5 | 51.8 |
| Back of Queue ( $Q$ ), veh/ln ( 95 th percentile) | 0.6 | 11.9 | 2.9 | 9.5 | 14.4 | 0.3 | 16.3 | 9.1 | 33.1 | 1.1 | 2.8 | 2.1 |
| Queue Storage Ratio ( $RQ$ ) ( 95 th percentile) | 0.03 | 0.00 | 0.16 | 0.53 | 0.00 | 0.02 | 1.65 | 0.00 | 3.31 | 0.20 | 0.00 | 0.35 |
| Uniform Delay ( $d_1$ ), s/veh | 59.1 | 32.7 | 28.3 | 52.3 | 25.7 | 19.5 | 48.2 | 31.0 | 40.3 | 59.4 | 44.2 | 44.0 |
| Incremental Delay ( $d_2$ ), s/veh | 14.4 | 1.7 | 0.6 | 11.8 | 1.5 | 0.0 | 24.9 | 0.6 | 58.3 | 42.7 | 0.5 | 0.5 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( $d$ ), s/veh | 73.5 | 34.4 | 28.9 | 64.2 | 27.2 | 19.6 | 73.1 | 31.5 | 98.6 | 102.0 | 44.7 | 44.4 |
| Level of Service (LOS) | E | C | C | E | C | B | E | C | F | F | D | D |
| Approach Delay, s/veh / LOS | 34.3 | | C | 33.1 | | C | 77.1 | | E | 50.9 | | D |
| Intersection Delay, s/veh / LOS | 50.4 | | | | | | D | | | | | |

| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.11 | B | 2.44 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.07 | A | 1.36 | A | 2.33 | B | 0.68 | A |

 HCS™ Streets Version 7.5 Generated: 6/5/2019 9:12:41 AM

# HCS7 Two-Way Stop-Control Report

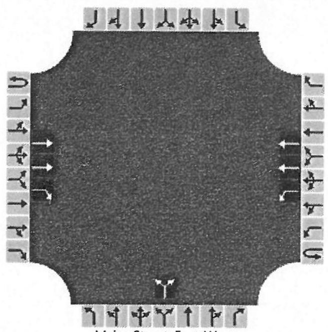
## General Information

| | |
|---|---|
| Analyst | |
| Agency/Co. | |
| Date Performed | 4/2/2019 |
| Analysis Year | 2019 |
| Time Analyzed | PM Peak Hour |
| Intersection Orientation | East-West |
| Project Description | Hurstbourne Development |

## Site Information

| | |
|---|---|
| Intersection | Hurstbourne Pkwy & Vassel |
| Jurisdiction | KYTC |
| East/West Street | Hurstbourne Pkwy |
| North/South Street | Vassel Rd |
| Peak Hour Factor | 0.92 |
| Analysis Time Period (hrs) | 0.25 |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 1191 | 14 | 0 | 20 | 782 | | | 6 | | 12 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 17 | | 8 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

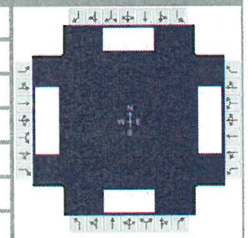
| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 7.14 | | 7.06 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.67 | | 3.38 | | | | |

## Delay, Queue Length, and Level of Service

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 22 | | | | | 20 | | | | | |
| Capacity, c (veh/h) | | | | | | 535 | | | | | 258 | | | | | |
| v/c Ratio | | | | | | 0.04 | | | | | 0.08 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.1 | | | | | 0.2 | | | | | |
| Control Delay (s/veh) | | | | | | 12.0 | | | | | 20.1 | | | | | |
| Level of Service (LOS) | | | | | | B | | | | | C | | | | | |
| Approach Delay (s/veh) | | | | | 0.3 | | | | 20.1 | | | | | | | |
| Approach LOS | | | | | | | | | C | | | | | | | |

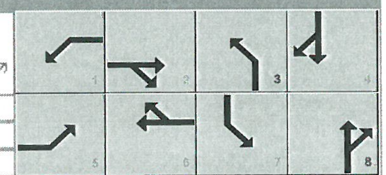
# HCS7 Signalized Intersection Results Summary

| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | PM S Watterson Trail.xus | | |
| Project Description | PM Peak Hour | | | | |



| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( $v$ ), veh/h | 32 | 918 | 241 | 425 | 707 | 15 | 65 | 98 | 283 | 15 | 219 | 30 |

| Signal Information | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cycle, s | 117.8 | Reference Phase | 2 | | | | | | | |
| Offset, s | 0 | Reference Point | End | Green | 4.1 | 14.4 | 40.0 | 1.6 | 4.4 | 21.3 |
| Uncoordinated | Yes | Simult. Gap E/W | Off | Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 0.0 | 3.6 |
| Force Mode | Fixed | Simult. Gap N/S | Off | Red | 3.0 | 3.0 | 1.8 | 3.0 | 0.0 | 2.8 |



| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 10.6 | 46.1 | 31.5 | 67.0 | 12.5 | 32.1 | 8.1 | 27.7 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( *MAH* ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.8 |
| Queue Clearance Time ( $g_s$ ), s | 4.2 | 31.5 | 27.0 | 17.4 | 6.5 | 23.7 | 3.0 | 15.7 |
| Green Extension Time ( $g_e$ ), s | 0.1 | 3.4 | 0.0 | 3.0 | 0.2 | 2.0 | 0.0 | 1.1 |
| Phase Call Probability | 0.68 | 1.00 | 1.00 | 1.00 | 0.90 | 1.00 | 0.41 | 1.00 |
| Max Out Probability | 0.00 | 0.43 | 1.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 |

| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( $v$ ), veh/h | 34 | 987 | 259 | 457 | 760 | 16 | 70 | 105 | 304 | 16 | 235 | 32 |
| Adjusted Saturation Flow Rate ( $s$ ), veh/h/ln | 1810 | 1795 | 1598 | 1795 | 1781 | 1610 | 1810 | 1885 | 1598 | 1810 | 1900 | 1610 |
| Queue Service Time ( $g_s$ ), s | 2.2 | 29.5 | 15.1 | 25.0 | 15.4 | 0.6 | 4.5 | 5.5 | 21.7 | 1.0 | 13.7 | 2.0 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 2.2 | 29.5 | 15.1 | 25.0 | 15.4 | 0.6 | 4.5 | 5.5 | 21.7 | 1.0 | 13.7 | 2.0 |
| Green Ratio ( *g/C* ) | 0.03 | 0.34 | 0.34 | 0.21 | 0.52 | 0.52 | 0.05 | 0.22 | 0.22 | 0.01 | 0.18 | 0.18 |
| Capacity ( $c$ ), veh/h | 62 | 1219 | 542 | 381 | 1842 | 833 | 93 | 411 | 348 | 25 | 343 | 291 |
| Volume-to-Capacity Ratio ( $X$ ) | 0.552 | 0.810 | 0.478 | 1.200 | 0.413 | 0.019 | 0.755 | 0.256 | 0.874 | 0.640 | 0.686 | 0.111 |
| Back of Queue ( $Q$ ), ft/ln ( 95 th percentile) | 52.3 | 485.3 | 253.5 | 843.4 | 257.1 | 9.4 | 108.4 | 113.9 | 363.8 | 31.3 | 269.5 | 35.3 |
| Back of Queue ( $Q$ ), veh/ln ( 95 th percentile) | 2.1 | 19.3 | 10.1 | 33.5 | 10.1 | 0.4 | 4.3 | 4.5 | 14.4 | 1.3 | 10.8 | 1.4 |
| Queue Storage Ratio ( *RQ* ) ( 95 th percentile) | 0.12 | 0.00 | 0.56 | 1.87 | 0.00 | 0.02 | 0.43 | 0.00 | 1.46 | 0.21 | 0.00 | 0.24 |
| Uniform Delay ( $d_1$ ), s/veh | 56.0 | 35.5 | 30.7 | 46.4 | 17.5 | 13.9 | 55.2 | 38.2 | 44.5 | 57.8 | 45.1 | 40.3 |
| Incremental Delay ( $d_2$ ), s/veh | 10.4 | 5.9 | 3.0 | 112.5 | 0.7 | 0.0 | 16.1 | 0.5 | 11.7 | 32.5 | 3.4 | 0.2 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( $d$ ), s/veh | 66.4 | 41.3 | 33.7 | 158.9 | 18.1 | 13.9 | 71.3 | 38.6 | 56.2 | 90.3 | 48.6 | 40.6 |
| Level of Service (LOS) | E | D | C | F | B | B | E | D | E | F | D | D |
| Approach Delay, s/veh / LOS | 40.5 | | D | 70.2 | | E | 54.5 | | D | 50.0 | | D |
| Intersection Delay, s/veh / LOS | 54.6 | | | | | | D | | | | | |

| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.09 | B | 2.45 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.54 | B | 1.51 | B | 1.28 | A | 0.96 | A |

 HCS™ Streets Version 7.5 Generated: 6/5/2019 9:13:54 AM

# No Build Capacity Analysis

# HCS7 Two-Way Stop-Control Report

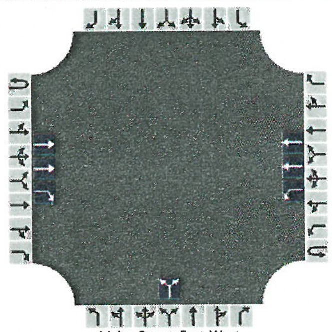
## General Information

| | |
|---|---|
| Analyst | |
| Agency/Co. | |
| Date Performed | 4/2/2019 |
| Analysis Year | 2022 |
| Time Analyzed | AM Peak Hour |
| Intersection Orientation | East-West |
| Project Description | Hurstbourne Development |

## Site Information

| | |
|---|---|
| Intersection | Hurstbourne Pkwy & Vassel |
| Jurisdiction | KYTC |
| East/West Street | Hurstbourne Pkwy |
| North/South Street | Vassel Rd |
| Peak Hour Factor | 0.92 |
| Analysis Time Period (hrs) | 0.25 |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 679 | 3 | 0 | 6 | 1204 | | | 10 | | 23 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 0 | | 0 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

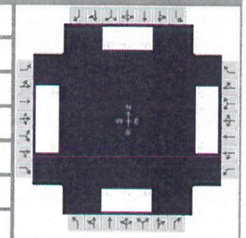
| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 6.80 | | 6.90 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.50 | | 3.30 | | | | |

## Delay, Queue Length, and Level of Service

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 7 | | | | | 36 | | | | | |
| Capacity, c (veh/h) | | | | | | 875 | | | | | 448 | | | | | |
| v/c Ratio | | | | | | 0.01 | | | | | 0.08 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.0 | | | | | 0.3 | | | | | |
| Control Delay (s/veh) | | | | | | 9.1 | | | | | 13.7 | | | | | |
| Level of Service (LOS) | | | | | | A | | | | | B | | | | | |
| Approach Delay (s/veh) | | | | | 0.0 | | | | 13.7 | | | | | | | |
| Approach LOS | | | | | | | | | B | | | | | | | |

# HCS7 Signalized Intersection Results Summary

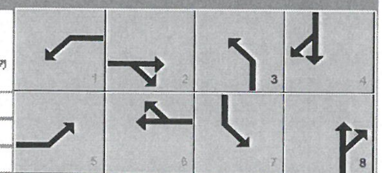
| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | AM 2022S Watterson Trail .xus | | |
| Project Description | AM Peak Hour No Build | | | | |



| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( v ), veh/h | 10 | 753 | 93 | 206 | 1059 | 13 | 364 | 291 | 686 | 16 | 72 | 53 |

| Signal Information | | | | |
|---|---|---|---|---|
| Cycle, s | 125.0 | Reference Phase | 2 |
| Offset, s | 0 | Reference Point | End |
| Uncoordinated | Yes | Simult. Gap E/W | Off |
| Force Mode | Fixed | Simult. Gap N/S | Off |

| | | | | | | |
|---|---|---|---|---|---|---|
| Green | 1.9 | 9.3 | 40.0 | 1.8 | 16.7 | 16.8 |
| Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 3.5 | 3.6 |
| Red | 3.0 | 3.0 | 1.8 | 3.0 | 3.0 | 2.8 |



| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 8.4 | 46.1 | 24.2 | 61.9 | 31.5 | 46.4 | 8.3 | 23.2 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( *MAH* ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.9 |
| Queue Clearance Time ( $g_s$ ), s | 2.7 | 27.0 | 17.1 | 34.1 | 27.0 | 42.0 | 3.3 | 6.7 |
| Green Extension Time ( $g_e$ ), s | 0.0 | 3.0 | 0.6 | 2.5 | 0.0 | 0.0 | 0.0 | 0.6 |
| Phase Call Probability | 0.31 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.45 | 0.99 |
| Max Out Probability | 0.00 | 0.08 | 0.20 | 0.65 | 1.00 | 1.00 | 0.00 | 0.00 |

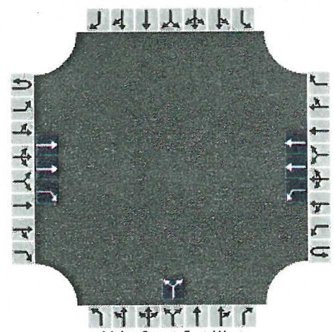
| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( v ), veh/h | 11 | 810 | 100 | 222 | 1139 | 14 | 391 | 313 | 738 | 17 | 77 | 57 |
| Adjusted Saturation Flow Rate ( s ), veh/h/ln | 1810 | 1781 | 1610 | 1795 | 1795 | 1610 | 1795 | 1870 | 1610 | 1682 | 1856 | 1610 |
| Queue Service Time ( $g_s$ ), s | 0.7 | 25.0 | 5.6 | 15.1 | 32.1 | 0.6 | 25.0 | 17.1 | 40.0 | 1.3 | 4.7 | 4.0 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 0.7 | 25.0 | 5.6 | 15.1 | 32.1 | 0.6 | 25.0 | 17.1 | 40.0 | 1.3 | 4.7 | 4.0 |
| Green Ratio ( *g/C* ) | 0.01 | 0.32 | 0.32 | 0.14 | 0.45 | 0.45 | 0.20 | 0.32 | 0.32 | 0.01 | 0.13 | 0.13 |
| Capacity ( c ), veh/h | 27 | 1140 | 515 | 254 | 1603 | 719 | 359 | 599 | 515 | 24 | 249 | 216 |
| Volume-to-Capacity Ratio ( *X* ) | 0.397 | 0.711 | 0.194 | 0.871 | 0.710 | 0.019 | 1.090 | 0.523 | 1.432 | 0.710 | 0.310 | 0.263 |
| Back of Queue ( *Q* ), ft/ln ( 95 th percentile) | 19.3 | 420.7 | 101.5 | 314 | 497.1 | 10.4 | 666 | 311.9 | 1686.2 | 39.4 | 101.8 | 72.9 |
| Back of Queue ( *Q* ), veh/ln ( 95 th percentile) | 0.8 | 16.6 | 4.1 | 12.5 | 19.7 | 0.4 | 26.4 | 12.3 | 67.4 | 1.5 | 4.0 | 2.9 |
| Queue Storage Ratio ( *RQ* ) ( 95 th percentile) | 0.04 | 0.00 | 0.23 | 0.70 | 0.00 | 0.02 | 2.66 | 0.00 | 6.74 | 0.26 | 0.00 | 0.49 |
| Uniform Delay ( $d_1$ ), s/veh | 61.0 | 37.4 | 30.8 | 52.5 | 28.0 | 19.3 | 50.0 | 34.7 | 42.5 | 61.3 | 48.9 | 48.5 |
| Incremental Delay ( $d_2$ ), s/veh | 12.8 | 3.8 | 0.8 | 17.3 | 2.7 | 0.0 | 73.8 | 1.1 | 205.2 | 42.3 | 1.0 | 0.9 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( d ), s/veh | 73.8 | 41.2 | 31.7 | 69.9 | 30.7 | 19.4 | 123.8 | 35.8 | 247.7 | 103.6 | 49.9 | 49.5 |
| Level of Service (LOS) | E | D | C | E | C | B | F | D | F | F | D | D |
| Approach Delay, s/veh / LOS | 40.5 | D | | 36.9 | D | | 168.1 | F | | 55.8 | E | |
| Intersection Delay, s/veh / LOS | 87.2 | | | | | | F | | | | | |

| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.11 | B | 2.45 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.25 | A | 1.62 | B | 2.87 | C | 0.74 | A |

# HCS7 Two-Way Stop-Control Report

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | | Intersection | Hurstbourne Pkwy & Vassel |
| Agency/Co. | | Jurisdiction | KYTC |
| Date Performed | 4/2/2019 | East/West Street | Hurstbourne Pkwy |
| Analysis Year | 2032 | North/South Street | Vassel Rd |
| Time Analyzed | AM Peak Hour | Peak Hour Factor | 0.92 |
| Intersection Orientation | East-West | Analysis Time Period (hrs) | 0.25 |
| Project Description | Hurstbourne Development | | |

## Lanes




## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 828 | 4 | 0 | 8 | 1468 | | | 12 | | 28 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 0 | | 0 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 6.80 | | 6.90 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.50 | | 3.30 | | | | |

## Delay, Queue Length, and Level of Service

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 9 | | | | | 43 | | | | | |
| Capacity, c (veh/h) | | | | | | 760 | | | | | 374 | | | | | |
| v/c Ratio | | | | | | 0.01 | | | | | 0.12 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.0 | | | | | 0.4 | | | | | |
| Control Delay (s/veh) | | | | | | 9.8 | | | | | 15.9 | | | | | |
| Level of Service (LOS) | | | | | | A | | | | | C | | | | | |
| Approach Delay (s/veh) | | | | | 0.1 | | | | 15.9 | | | | | | | |
| Approach LOS | | | | | | | | | C | | | | | | | |



HCS™ TWSC Version 7.5
AM 2032 Ex Vassel.xtw

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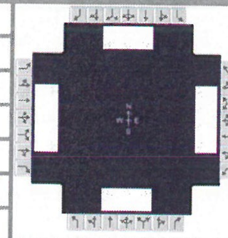
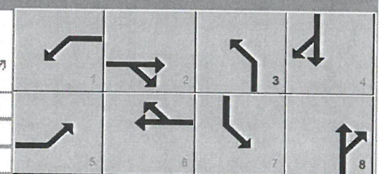
# HCS7 Signalized Intersection Results Summary

| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | AM 2032 S Watterson Trail.xus | | |
| Project Description | AM Peak Hour No Build | | | | |



| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( v ), veh/h | 8 | 618 | 76 | 169 | 869 | 11 | 298 | 239 | 562 | 13 | 59 | 44 |

| Signal Information | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cycle, s | 121.6 | Reference Phase | 2 | | | | | | | |
| Offset, s | 0 | Reference Point | End | Green | 1.5 | 6.6 | 40.0 | 1.5 | 15.6 | 17.9 |
| Uncoordinated | Yes | Simult. Gap E/W | Off | Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 3.5 | 3.6 |
| Force Mode | Fixed | Simult. Gap N/S | Off | Red | 3.0 | 3.0 | 1.8 | 3.0 | 3.0 | 2.8 |



| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 8.0 | 46.1 | 21.1 | 59.2 | 30.1 | 46.4 | 8.0 | 24.3 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( *MAH* ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.9 |
| Queue Clearance Time ( $g_s$ ), s | 2.6 | 20.7 | 14.1 | 26.1 | 23.3 | 42.0 | 3.0 | 5.7 |
| Green Extension Time ( $g_e$ ), s | 0.0 | 2.7 | 0.6 | 3.3 | 0.3 | 0.0 | 0.0 | 0.5 |
| Phase Call Probability | 0.25 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.38 | 0.98 |
| Max Out Probability | 0.00 | 0.01 | 0.03 | 0.07 | 1.00 | 1.00 | 0.00 | 0.00 |

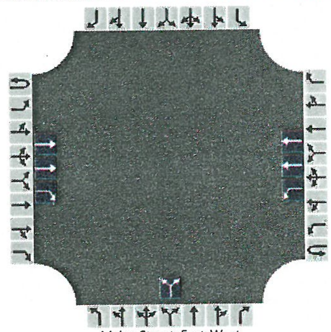
| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( v ), veh/h | 9 | 665 | 82 | 182 | 934 | 12 | 320 | 257 | 604 | 14 | 63 | 47 |
| Adjusted Saturation Flow Rate ( s ), veh/h/ln | 1810 | 1781 | 1610 | 1795 | 1795 | 1610 | 1795 | 1870 | 1610 | 1682 | 1856 | 1610 |
| Queue Service Time ( $g_s$ ), s | 0.6 | 18.7 | 4.4 | 12.1 | 24.1 | 0.5 | 21.3 | 13.0 | 40.0 | 1.0 | 3.7 | 3.1 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 0.6 | 18.7 | 4.4 | 12.1 | 24.1 | 0.5 | 21.3 | 13.0 | 40.0 | 1.0 | 3.7 | 3.1 |
| Green Ratio ( g/C ) | 0.01 | 0.33 | 0.33 | 0.12 | 0.44 | 0.44 | 0.19 | 0.33 | 0.33 | 0.01 | 0.15 | 0.15 |
| Capacity ( c ), veh/h | 23 | 1171 | 530 | 215 | 1567 | 703 | 348 | 615 | 530 | 21 | 274 | 237 |
| Volume-to-Capacity Ratio ( X ) | 0.381 | 0.567 | 0.154 | 0.843 | 0.596 | 0.017 | 0.920 | 0.418 | 1.141 | 0.671 | 0.232 | 0.199 |
| Back of Queue ( Q ), ft/ln ( 95 th percentile) | 15.6 | 325.4 | 78 | 252.4 | 387.1 | 8.7 | 442.4 | 247.6 | 980.3 | 32 | 78.5 | 57 |
| Back of Queue ( Q ), veh/ln ( 95 th percentile) | 0.6 | 12.8 | 3.1 | 10.0 | 15.4 | 0.3 | 17.6 | 9.7 | 39.2 | 1.2 | 3.1 | 2.3 |
| Queue Storage Ratio ( RQ ) ( 95 th percentile) | 0.03 | 0.00 | 0.17 | 0.56 | 0.00 | 0.02 | 1.77 | 0.00 | 3.92 | 0.21 | 0.00 | 0.38 |
| Uniform Delay ( $d_1$ ), s/veh | 59.6 | 33.7 | 28.8 | 52.4 | 26.1 | 19.4 | 48.1 | 31.7 | 40.8 | 59.8 | 45.8 | 45.5 |
| Incremental Delay ( $d_2$ ), s/veh | 14.4 | 2.0 | 0.6 | 11.9 | 1.7 | 0.0 | 27.6 | 0.6 | 84.2 | 42.1 | 0.6 | 0.6 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( d ), s/veh | 74.0 | 35.7 | 29.5 | 64.2 | 27.8 | 19.5 | 75.7 | 32.4 | 125.0 | 101.9 | 46.4 | 46.1 |
| Level of Service (LOS) | E | D | C | E | C | B | E | C | F | F | D | D |
| Approach Delay, s/veh / LOS | 35.4 | | D | 33.6 | | C | 91.5 | | F | 52.5 | | D |
| Intersection Delay, s/veh / LOS | 56.2 | | | | | | E | | | | | |

| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.11 | B | 2.44 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.11 | A | 1.42 | A | 2.44 | B | 0.69 | A |

# HCS7 Two-Way Stop-Control Report

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | | Intersection | Hurstbourne Pkwy & Vassel |
| Agency/Co. | | Jurisdiction | KYTC |
| Date Performed | 4/2/2019 | East/West Street | Hurstbourne Pkwy |
| Analysis Year | 2022 | North/South Street | Vassel Rd |
| Time Analyzed | PM Peak Hour | Peak Hour Factor | 0.92 |
| Intersection Orientation | East-West | Analysis Time Period (hrs) | 0.25 |
| Project Description | Hurstbourne Development | | |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 1251 | 15 | 0 | 21 | 830 | | | 6 | | 13 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 17 | | 8 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 7.14 | | 7.06 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.67 | | 3.38 | | | | |

## Delay, Queue Length, and Level of Service

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 23 | | | | | 21 | | | | | |
| Capacity, c (veh/h) | | | | | | 505 | | | | | 245 | | | | | |
| v/c Ratio | | | | | | 0.05 | | | | | 0.08 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.1 | | | | | 0.3 | | | | | |
| Control Delay (s/veh) | | | | | | 12.5 | | | | | 21.1 | | | | | |
| Level of Service (LOS) | | | | | | B | | | | | C | | | | | |
| Approach Delay (s/veh) | | | | | 0.3 | | | | 21.1 | | | | | | | |
| Approach LOS | | | | | | | | | C | | | | | | | |



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PM 2022 Ex Vassel - Copy.xtw

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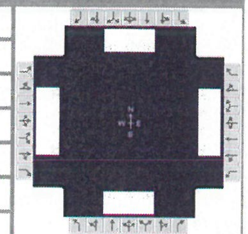
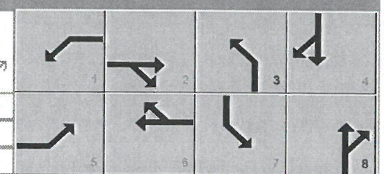
# HCS7 Signalized Intersection Results Summary

| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | PM 2022 S Watterson Trail.xus | | |
| Project Description | PM Peak Hour No Build | | | | |



| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( v ), veh/h | 34 | 974 | 256 | 451 | 750 | 17 | 69 | 104 | 300 | 16 | 232 | 32 |

| Signal Information | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cycle, s | 119.6 | Reference Phase | 2 | | | | | | | |
| Offset, s | 0 | Reference Point | End | Green | 4.2 | 14.3 | 40.0 | 1.7 | 4.7 | 22.7 |
| Uncoordinated | Yes | Simult. Gap E/W | Off | Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 0.0 | 3.6 |
| Force Mode | Fixed | Simult. Gap N/S | Off | Red | 3.0 | 3.0 | 1.8 | 3.0 | 0.0 | 2.8 |



| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 10.7 | 46.1 | 31.5 | 66.9 | 13.0 | 33.8 | 8.2 | 29.1 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( *MAH* ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.8 |
| Queue Clearance Time ( $g_s$ ), s | 4.4 | 34.8 | 27.0 | 19.2 | 6.8 | 25.3 | 3.1 | 16.7 |
| Green Extension Time ( $g_e$ ), s | 0.1 | 2.6 | 0.0 | 3.1 | 0.2 | 2.0 | 0.0 | 1.1 |
| Phase Call Probability | 0.70 | 1.00 | 1.00 | 1.00 | 0.92 | 1.00 | 0.44 | 1.00 |
| Max Out Probability | 0.00 | 0.80 | 1.00 | 0.01 | 0.00 | 0.05 | 0.00 | 0.02 |

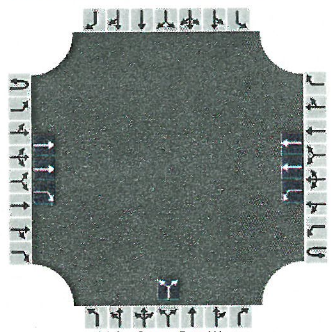
| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( v ), veh/h | 37 | 1047 | 275 | 485 | 806 | 18 | 74 | 112 | 323 | 17 | 249 | 34 |
| Adjusted Saturation Flow Rate ( s ), veh/h/ln | 1810 | 1795 | 1598 | 1795 | 1781 | 1610 | 1810 | 1885 | 1598 | 1810 | 1900 | 1610 |
| Queue Service Time ( $g_s$ ), s | 2.4 | 32.8 | 16.6 | 25.0 | 17.2 | 0.7 | 4.8 | 5.8 | 23.3 | 1.1 | 14.7 | 2.1 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 2.4 | 32.8 | 16.6 | 25.0 | 17.2 | 0.7 | 4.8 | 5.8 | 23.3 | 1.1 | 14.7 | 2.1 |
| Green Ratio ( *g/C* ) | 0.04 | 0.33 | 0.33 | 0.21 | 0.51 | 0.51 | 0.05 | 0.23 | 0.23 | 0.01 | 0.19 | 0.19 |
| Capacity ( c ), veh/h | 64 | 1200 | 534 | 375 | 1809 | 818 | 98 | 432 | 366 | 26 | 360 | 305 |
| Volume-to-Capacity Ratio ( X ) | 0.572 | 0.873 | 0.515 | 1.293 | 0.446 | 0.022 | 0.758 | 0.259 | 0.882 | 0.652 | 0.693 | 0.113 |
| Back of Queue ( Q ), ft/ln ( 95 th percentile) | 56.6 | 544.2 | 275.7 | 997.5 | 283.1 | 11.1 | 115.9 | 121.4 | 390.9 | 33.6 | 286.2 | 37.8 |
| Back of Queue ( Q ), veh/ln ( 95 th percentile) | 2.3 | 21.6 | 10.9 | 39.6 | 11.1 | 0.4 | 4.6 | 4.8 | 15.5 | 1.3 | 11.4 | 1.5 |
| Queue Storage Ratio ( *RQ* ) ( 95 th percentile) | 0.13 | 0.00 | 0.61 | 2.22 | 0.00 | 0.02 | 0.46 | 0.00 | 1.56 | 0.22 | 0.00 | 0.25 |
| Uniform Delay ( $d_1$ ), s/veh | 56.8 | 37.4 | 32.0 | 47.3 | 18.7 | 14.6 | 55.8 | 37.8 | 44.6 | 58.6 | 45.2 | 40.2 |
| Incremental Delay ( $d_2$ ), s/veh | 11.0 | 8.9 | 3.5 | 150.2 | 0.8 | 0.1 | 15.5 | 0.4 | 13.3 | 32.6 | 3.7 | 0.2 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( d ), s/veh | 67.8 | 46.3 | 35.5 | 197.5 | 19.5 | 14.7 | 71.3 | 38.3 | 57.8 | 91.3 | 49.0 | 40.4 |
| Level of Service (LOS) | E | D | D | F | B | B | E | D | E | F | D | D |
| Approach Delay, s/veh / LOS | 44.7 | D | | 85.4 | F | | 55.5 | E | | 50.4 | D | |
| Intersection Delay, s/veh / LOS | 62.1 | | | | | | E | | | | | |

| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.10 | B | 2.45 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.61 | B | 1.57 | B | 1.33 | A | 0.98 | A |

# HCS7 Two-Way Stop-Control Report

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | | Intersection | Hurstbourne Pkwy & Vassel |
| Agency/Co. | | Jurisdiction | KYTC |
| Date Performed | 4/2/2019 | East/West Street | Hurstbourne Pkwy |
| Analysis Year | 2032 | North/South Street | Vassel Rd |
| Time Analyzed | PM Peak Hour | Peak Hour Factor | 0.92 |
| Intersection Orientation | East-West | Analysis Time Period (hrs) | 0.25 |
| Project Description | Hurstbourne Development | | |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 1525 | 18 | 0 | 26 | 1012 | | | 8 | | 16 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 17 | | 8 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 7.14 | | 7.06 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.67 | | 3.38 | | | | |

## Delay, Queue Length, and Level of Service

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 28 | | | | | 26 | | | | | |
| Capacity, c (veh/h) | | | | | | 387 | | | | | 173 | | | | | |
| v/c Ratio | | | | | | 0.07 | | | | | 0.15 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.2 | | | | | 0.5 | | | | | |
| Control Delay (s/veh) | | | | | | 15.0 | | | | | 29.4 | | | | | |
| Level of Service (LOS) | | | | | | C | | | | | D | | | | | |
| Approach Delay (s/veh) | | | | | 0.4 | | | | 29.4 | | | | | | | |
| Approach LOS | | | | | | | | | D | | | | | | | |



HCS™ TWSC Version 7.5
PM 2032 Ex Vassel.xtw

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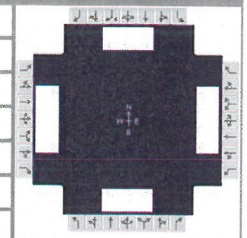
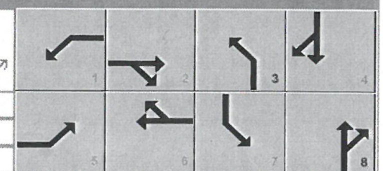
# HCS7 Signalized Intersection Results Summary

| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | PM 2032 S Watterson Trail.xus | | |
| Project Description | PM Peak Hour No Build | | | | |



| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( v ), veh/h | 41 | 1188 | 312 | 550 | 915 | 21 | 84 | 127 | 366 | 19 | 283 | 39 |

| Signal Information | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cycle, s | 126.6 | Reference Phase | 2 | | | | | | | |
| Offset, s | 0 | Reference Point | End | Green | 4.7 | 13.8 | 40.0 | 2.1 | 6.1 | 28.0 |
| Uncoordinated | Yes | Simult. Gap E/W | Off | Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 0.0 | 3.6 |
| Force Mode | Fixed | Simult. Gap N/S | Off | Red | 3.0 | 3.0 | 1.8 | 3.0 | 0.0 | 2.8 |



| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 11.2 | 46.1 | 31.5 | 66.4 | 14.7 | 40.5 | 8.6 | 34.4 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( *MAH* ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.8 |
| Queue Clearance Time ( $g_s$ ), s | 5.0 | 42.0 | 27.0 | 27.3 | 8.2 | 32.3 | 3.4 | 20.8 |
| Green Extension Time ( $g_e$ ), s | 0.1 | 0.0 | 0.0 | 3.4 | 0.3 | 1.8 | 0.0 | 1.1 |
| Phase Call Probability | 0.79 | 1.00 | 1.00 | 1.00 | 0.96 | 1.00 | 0.51 | 1.00 |
| Max Out Probability | 0.00 | 1.00 | 1.00 | 0.11 | 0.00 | 0.49 | 0.00 | 0.17 |

| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( v ), veh/h | 44 | 1277 | 335 | 591 | 984 | 23 | 90 | 137 | 394 | 20 | 304 | 42 |
| Adjusted Saturation Flow Rate ( s ), veh/h/ln | 1810 | 1795 | 1598 | 1795 | 1781 | 1610 | 1810 | 1885 | 1598 | 1810 | 1900 | 1610 |
| Queue Service Time ( $g_s$ ), s | 3.0 | 40.0 | 23.0 | 25.0 | 25.3 | 0.9 | 6.2 | 7.2 | 30.3 | 1.4 | 18.8 | 2.6 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 3.0 | 40.0 | 23.0 | 25.0 | 25.3 | 0.9 | 6.2 | 7.2 | 30.3 | 1.4 | 18.8 | 2.6 |
| Green Ratio ( g/C ) | 0.04 | 0.32 | 0.32 | 0.20 | 0.48 | 0.48 | 0.06 | 0.27 | 0.27 | 0.02 | 0.22 | 0.22 |
| Capacity ( c ), veh/h | 68 | 1134 | 505 | 354 | 1695 | 766 | 117 | 507 | 430 | 29 | 420 | 356 |
| Volume-to-Capacity Ratio ( X ) | 0.652 | 1.127 | 0.665 | 1.669 | 0.581 | 0.029 | 0.775 | 0.269 | 0.915 | 0.697 | 0.725 | 0.118 |
| Back of Queue ( Q ), ft/ln ( 95 th percentile) | 73.5 | 991.4 | 371.8 | 1624.5 | 399.8 | 16 | 146.3 | 150.4 | 507.5 | 41.5 | 358.3 | 47.1 |
| Back of Queue ( Q ), veh/ln ( 95 th percentile) | 2.9 | 39.3 | 14.8 | 64.5 | 15.7 | 0.6 | 5.9 | 6.0 | 20.1 | 1.7 | 14.3 | 1.9 |
| Queue Storage Ratio ( RQ ) ( 95 th percentile) | 0.16 | 0.00 | 0.83 | 3.61 | 0.00 | 0.04 | 0.59 | 0.00 | 2.03 | 0.28 | 0.00 | 0.31 |
| Uniform Delay ( $d_1$ ), s/veh | 60.1 | 43.3 | 37.5 | 50.8 | 24.0 | 17.6 | 58.3 | 36.5 | 44.9 | 62.0 | 45.8 | 39.5 |
| Incremental Delay ( $d_2$ ), s/veh | 14.1 | 68.7 | 6.8 | 313.0 | 1.5 | 0.1 | 14.3 | 0.4 | 20.5 | 34.7 | 5.9 | 0.2 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( d ), s/veh | 74.3 | 112.1 | 44.3 | 363.9 | 25.5 | 17.7 | 72.6 | 36.9 | 65.3 | 96.6 | 51.7 | 39.7 |
| Level of Service (LOS) | E | F | D | F | C | B | E | D | E | F | D | D |
| Approach Delay, s/veh / LOS | 97.3 | F | | 150.6 | F | | 60.1 | E | | 52.8 | D | |
| Intersection Delay, s/veh / LOS | 108.1 | | | | | | F | | | | | |

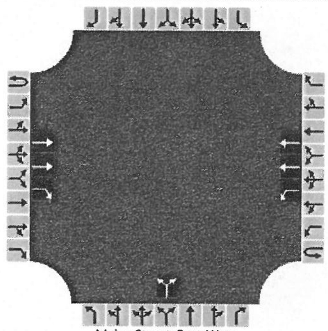
| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.10 | B | 2.45 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.85 | B | 1.81 | B | 1.51 | B | 1.09 | A |

# Build Capacity Analysis

# HCS7 Two-Way Stop-Control Report

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | | Intersection | Hurstbourne Pkwy & Vassel |
| Agency/Co. | | Jurisdiction | KYTC |
| Date Performed | 4/2/2019 | East/West Street | Hurstbourne Pkwy |
| Analysis Year | 2022 | North/South Street | Vassel Rd |
| Time Analyzed | AM Peak Hour | Peak Hour Factor | 0.92 |
| Intersection Orientation | East-West | Analysis Time Period (hrs) | 0.25 |
| Project Description | Hurstbourne Development | | |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 725 | 3 | 0 | 6 | 1250 | | | 10 | | 23 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 0 | | 0 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Undivided | | | | | | | | | | | | | | | |

## Critical and Follow-up Headways

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 6.80 | | 6.90 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.50 | | 3.30 | | | | |

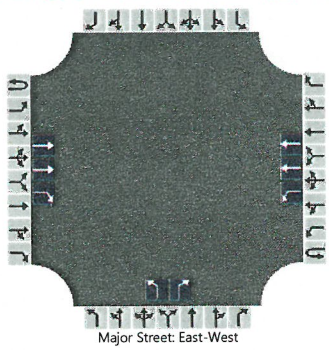
## Delay, Queue Length, and Level of Service

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 7 | | | | | 36 | | | | | |
| Capacity, c (veh/h) | | | | | | 838 | | | | | 269 | | | | | |
| v/c Ratio | | | | | | 0.01 | | | | | 0.13 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.0 | | | | | 0.5 | | | | | |
| Control Delay (s/veh) | | | | | | 9.3 | | | | | 20.4 | | | | | |
| Level of Service (LOS) | | | | | | A | | | | | C | | | | | |
| Approach Delay (s/veh) | | | | | 0.0 | | | | 20.4 | | | | | | | |
| Approach LOS | | | | | | | | | C | | | | | | | |

# HCS7 Two-Way Stop-Control Report

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | | Intersection | Hurstbourne & Proposed En |
| Agency/Co. | | Jurisdiction | KYTC |
| Date Performed | 4/2/2019 | East/West Street | Hurstbourne Pkwy |
| Analysis Year | 2022 | North/South Street | Proposed Entrance |
| Time Analyzed | AM Peak Hour | Peak Hour Factor | 0.92 |
| Intersection Orientation | East-West | Analysis Time Period (hrs) | 0.25 |
| Project Description | Hurstbourne Pkwy Development | | |

## Lanes




## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 1 | 0 | 1 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | L | | R | | | | |
| Volume (veh/h) | | | 678 | 70 | 0 | 109 | 1166 | | | 86 | | 123 | | | | |
| Percent Heavy Vehicles (%) | | | | | 3 | 3 | | | | 3 | | 3 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | No | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

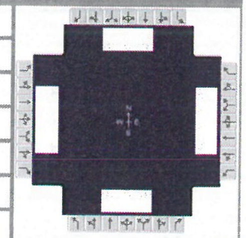
| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.16 | | | | 6.86 | | 6.96 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.23 | | | | 3.53 | | 3.33 | | | | |

## Delay, Queue Length, and Level of Service

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 118 | | | | 93 | | 134 | | | | |
| Capacity, c (veh/h) | | | | | | 803 | | | | 201 | | 626 | | | | |
| v/c Ratio | | | | | | 0.15 | | | | 0.46 | | 0.21 | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.5 | | | | 2.2 | | 0.8 | | | | |
| Control Delay (s/veh) | | | | | | 10.3 | | | | 37.5 | | 12.3 | | | | |
| Level of Service (LOS) | | | | | | B | | | | E | | B | | | | |
| Approach Delay (s/veh) | | | | | 0.9 | | | | 22.7 | | | | | | | |
| Approach LOS | | | | | | | | | C | | | | | | | |

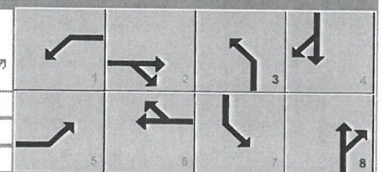
# HCS7 Signalized Intersection Results Summary

| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | 2022 AM S Watterson Trail.xus | | |
| Project Description | AM Peak Hour Build | | | | |



| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( v ), veh/h | 10 | 702 | 93 | 169 | 923 | 11 | 307 | 239 | 562 | 13 | 59 | 46 |

| Signal Information | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cycle, s | 121.6 | Reference Phase | 2 | | | | | | | | |
| Offset, s | 0 | Reference Point | End | Green | 1.8 | 6.3 | 40.0 | 1.5 | 16.1 | 17.4 |
| Uncoordinated | Yes | Simult. Gap E/W | Off | Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 3.5 | 3.6 |
| Force Mode | Fixed | Simult. Gap N/S | Off | Red | 3.0 | 3.0 | 1.8 | 3.0 | 3.0 | 2.8 |



| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 8.3 | 46.1 | 21.1 | 58.9 | 30.6 | 46.4 | 8.0 | 23.8 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( MAH ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.9 |
| Queue Clearance Time ( $g_s$ ), s | 2.7 | 23.9 | 14.1 | 28.3 | 24.0 | 42.0 | 3.0 | 5.7 |
| Green Extension Time ( $g_e$ ), s | 0.0 | 3.0 | 0.6 | 3.3 | 0.2 | 0.0 | 0.0 | 0.5 |
| Phase Call Probability | 0.30 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.38 | 0.98 |
| Max Out Probability | 0.00 | 0.03 | 0.03 | 0.14 | 1.00 | 1.00 | 0.00 | 0.00 |

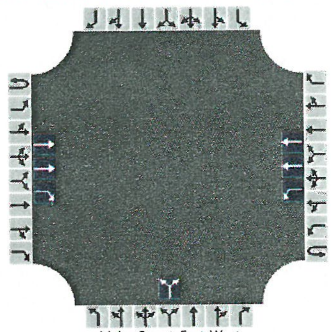
| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( v ), veh/h | 11 | 755 | 100 | 182 | 992 | 12 | 330 | 257 | 604 | 14 | 63 | 49 |
| Adjusted Saturation Flow Rate ( s ), veh/h/ln | 1810 | 1781 | 1610 | 1795 | 1795 | 1610 | 1795 | 1870 | 1610 | 1682 | 1856 | 1610 |
| Queue Service Time ( $g_s$ ), s | 0.7 | 21.9 | 5.4 | 12.1 | 26.3 | 0.5 | 22.0 | 13.0 | 40.0 | 1.0 | 3.7 | 3.3 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 0.7 | 21.9 | 5.4 | 12.1 | 26.3 | 0.5 | 22.0 | 13.0 | 40.0 | 1.0 | 3.7 | 3.3 |
| Green Ratio ( g/C ) | 0.02 | 0.33 | 0.33 | 0.12 | 0.43 | 0.43 | 0.20 | 0.33 | 0.33 | 0.01 | 0.14 | 0.14 |
| Capacity ( c ), veh/h | 27 | 1171 | 530 | 215 | 1557 | 699 | 356 | 615 | 530 | 21 | 265 | 230 |
| Volume-to-Capacity Ratio ( X ) | 0.395 | 0.644 | 0.189 | 0.843 | 0.637 | 0.017 | 0.926 | 0.418 | 1.141 | 0.671 | 0.239 | 0.215 |
| Back of Queue ( Q ), ft/ln ( 50 th percentile) | 10.4 | 243.8 | 53.8 | 151.2 | 279.8 | 4.8 | 311.5 | 147.3 | 686.5 | 17.8 | 43.9 | 33.4 |
| Back of Queue ( Q ), veh/ln ( 50 th percentile) | 0.4 | 9.6 | 2.2 | 6.0 | 11.1 | 0.2 | 12.4 | 5.8 | 27.5 | 0.7 | 1.7 | 1.3 |
| Queue Storage Ratio ( RQ ) ( 50 th percentile) | 0.02 | 0.00 | 0.12 | 0.34 | 0.00 | 0.01 | 1.25 | 0.00 | 2.75 | 0.12 | 0.00 | 0.22 |
| Uniform Delay ( $d_1$ ), s/veh | 59.3 | 34.7 | 29.2 | 52.4 | 26.9 | 19.6 | 47.9 | 31.7 | 40.8 | 59.8 | 46.3 | 46.1 |
| Incremental Delay ( $d_2$ ), s/veh | 12.7 | 2.7 | 0.8 | 11.9 | 2.0 | 0.0 | 28.9 | 0.6 | 84.2 | 42.1 | 0.7 | 0.7 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( d ), s/veh | 72.0 | 37.5 | 30.0 | 64.2 | 28.9 | 19.7 | 76.7 | 32.4 | 125.0 | 101.9 | 46.9 | 46.8 |
| Level of Service (LOS) | E | D | C | E | C | B | E | C | F | F | D | D |
| Approach Delay, s/veh / LOS | 37.0 | D | | 34.3 | C | | 91.6 | F | | 52.9 | D | |
| Intersection Delay, s/veh / LOS | 56.0 | | | | | | E | | | | | |

| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.11 | B | 2.44 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.20 | A | 1.47 | A | 2.45 | B | 0.70 | A |

# HCS7 Two-Way Stop-Control Report

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | | Intersection | Hurstbourne Pkwy & Vassel |
| Agency/Co. | | Jurisdiction | KYTC |
| Date Performed | 4/2/2019 | East/West Street | Hurstbourne Pkwy |
| Analysis Year | 2032 | North/South Street | Vassel Rd |
| Time Analyzed | AM Peak Hour | Peak Hour Factor | 0.92 |
| Intersection Orientation | East-West | Analysis Time Period (hrs) | 0.25 |
| Project Description | Hurstbourne Development | | |

## Lanes



Major Street: East-West

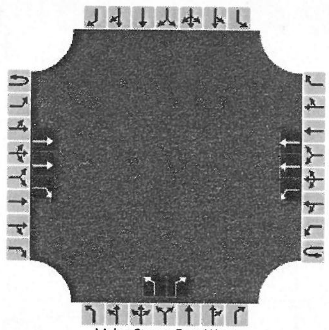
## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 874 | 4 | 0 | 8 | 1514 | | | 12 | | 28 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 0 | | 0 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Undivided | | | | | | | | | | | | | | | |
| **Critical and Follow-up Headways** | | | | | | | | | | | | | | | | |
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 6.80 | | 6.90 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.50 | | 3.30 | | | | |
| **Delay, Queue Length, and Level of Service** | | | | | | | | | | | | | | | | |
| Flow Rate, v (veh/h) | | | | | | 9 | | | | | 43 | | | | | |
| Capacity, c (veh/h) | | | | | | 728 | | | | | 185 | | | | | |
| v/c Ratio | | | | | | 0.01 | | | | | 0.24 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.0 | | | | | 0.9 | | | | | |
| Control Delay (s/veh) | | | | | | 10.0 | | | | | 30.3 | | | | | |
| Level of Service (LOS) | | | | | | B | | | | | D | | | | | |
| Approach Delay (s/veh) | | | | | 0.1 | | | | 30.3 | | | | | | | |
| Approach LOS | | | | | | | | | D | | | | | | | |

# HCS7 Two-Way Stop-Control Report

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | | Intersection | Hurstbourne & Proposed En |
| Agency/Co. | | Jurisdiction | KYTC |
| Date Performed | 4/2/2019 | East/West Street | Hurstbourne Pkwy |
| Analysis Year | 2032 | North/South Street | Proposed Entrance |
| Time Analyzed | AM Peak Hour | Peak Hour Factor | 0.92 |
| Intersection Orientation | East-West | Analysis Time Period (hrs) | 0.25 |
| Project Description | Hurstbourne Pkwy Development | | |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 1 | 0 | 1 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | L | | R | | | | |
| Volume (veh/h) | | | 832 | 70 | 0 | 109 | 1431 | | | 86 | | 123 | | | | |
| Percent Heavy Vehicles (%) | | | | | 3 | 3 | | | | 3 | | 3 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | No | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

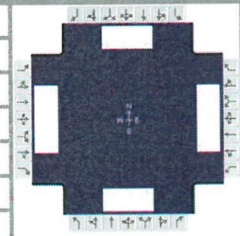
| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.16 | | | | 6.86 | | 6.96 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.23 | | | | 3.53 | | 3.33 | | | | |

## Delay, Queue Length, and Level of Service

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 118 | | | | 93 | | 134 | | | | |
| Capacity, c (veh/h) | | | | | | 694 | | | | 157 | | 552 | | | | |
| v/c Ratio | | | | | | 0.17 | | | | 0.60 | | 0.24 | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.6 | | | | 3.2 | | 0.9 | | | | |
| Control Delay (s/veh) | | | | | | 11.3 | | | | 57.1 | | 13.6 | | | | |
| Level of Service (LOS) | | | | | | B | | | | F | | B | | | | |
| Approach Delay (s/veh) | | | | | 0.8 | | | | 31.5 | | | | | | | |
| Approach LOS | | | | | | | | | D | | | | | | | |

# HCS7 Signalized Intersection Results Summary

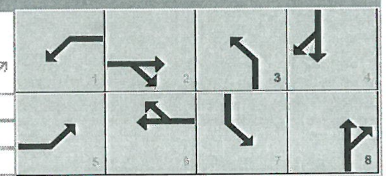
| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | 2032 AM S Watterson Trail.xus | | |
| Project Description | AM Peak Hour Build | | | | |



| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( v ), veh/h | 12 | 837 | 109 | 206 | 1113 | 13 | 372 | 291 | 686 | 16 | 72 | 55 |

| Signal Information | | | | |
|---|---|---|---|---|
| Cycle, s | 125.0 | Reference Phase | 2 |
| Offset, s | 0 | Reference Point | End |
| Uncoordinated | Yes | Simult. Gap E/W | Off |
| Force Mode | Fixed | Simult. Gap N/S | Off |

| | | | | | | |
|---|---|---|---|---|---|---|
| Green | 2.2 | 9.0 | 40.0 | 1.8 | 16.7 | 16.8 |
| Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 3.5 | 3.6 |
| Red | 3.0 | 3.0 | 1.8 | 3.0 | 3.0 | 2.8 |




| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 8.7 | 46.1 | 24.2 | 61.6 | 31.5 | 46.4 | 8.3 | 23.2 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( *MAH* ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.9 |
| Queue Clearance Time ( $g_s$ ), s | 2.9 | 30.7 | 17.1 | 36.7 | 27.0 | 42.0 | 3.3 | 6.7 |
| Green Extension Time ( $g_e$ ), s | 0.0 | 2.9 | 0.6 | 1.7 | 0.0 | 0.0 | 0.0 | 0.6 |
| Phase Call Probability | 0.36 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.45 | 0.99 |
| Max Out Probability | 0.00 | 0.27 | 0.20 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 |

| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( v ), veh/h | 13 | 900 | 117 | 222 | 1197 | 14 | 400 | 313 | 738 | 17 | 77 | 59 |
| Adjusted Saturation Flow Rate ( s ), veh/h/ln | 1810 | 1781 | 1610 | 1795 | 1795 | 1610 | 1795 | 1870 | 1610 | 1682 | 1856 | 1610 |
| Queue Service Time ( $g_s$ ), s | 0.9 | 28.7 | 6.7 | 15.1 | 34.7 | 0.6 | 25.0 | 17.1 | 40.0 | 1.3 | 4.7 | 4.1 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 0.9 | 28.7 | 6.7 | 15.1 | 34.7 | 0.6 | 25.0 | 17.1 | 40.0 | 1.3 | 4.7 | 4.1 |
| Green Ratio ( *g/C* ) | 0.02 | 0.32 | 0.32 | 0.14 | 0.44 | 0.44 | 0.20 | 0.32 | 0.32 | 0.01 | 0.13 | 0.13 |
| Capacity ( c ), veh/h | 31 | 1140 | 515 | 254 | 1595 | 715 | 359 | 599 | 515 | 24 | 249 | 216 |
| Volume-to-Capacity Ratio ( X ) | 0.411 | 0.790 | 0.227 | 0.871 | 0.751 | 0.020 | 1.114 | 0.523 | 1.432 | 0.710 | 0.310 | 0.273 |
| Back of Queue ( Q ), ft/ln ( 50 th percentile) | 12.5 | 329.2 | 67 | 198.1 | 374.5 | 5.8 | 479.9 | 196.1 | 1113.8 | 21.9 | 56.5 | 42.1 |
| Back of Queue ( Q ), veh/ln ( 50 th percentile) | 0.5 | 13.0 | 2.7 | 7.9 | 14.9 | 0.2 | 19.0 | 7.7 | 44.6 | 0.8 | 2.2 | 1.7 |
| Queue Storage Ratio ( *RQ* ) ( 50 th percentile) | 0.03 | 0.00 | 0.15 | 0.44 | 0.00 | 0.01 | 1.92 | 0.00 | 4.46 | 0.15 | 0.00 | 0.28 |
| Uniform Delay ( $d_1$ ), s/veh | 60.8 | 38.7 | 31.2 | 52.5 | 29.0 | 19.5 | 50.0 | 34.7 | 42.5 | 61.3 | 48.9 | 48.6 |
| Incremental Delay ( $d_2$ ), s/veh | 11.8 | 5.6 | 1.0 | 17.3 | 3.3 | 0.1 | 81.9 | 1.1 | 205.2 | 42.3 | 1.0 | 1.0 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( d ), s/veh | 72.6 | 44.3 | 32.2 | 69.9 | 32.3 | 19.5 | 131.9 | 35.8 | 247.7 | 103.6 | 49.9 | 49.6 |
| Level of Service (LOS) | E | D | C | E | C | B | F | D | F | F | D | D |
| Approach Delay, s/veh / LOS | 43.3 | D | | 38.0 | D | | 170.1 | F | | 55.8 | E | |
| Intersection Delay, s/veh / LOS | 87.1 | | | | | | F | | | | | |

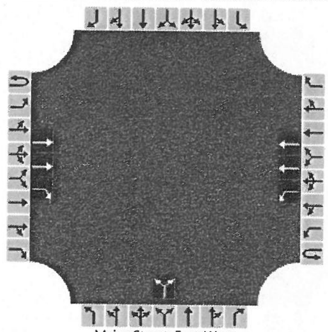
| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.11 | B | 2.45 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.34 | A | 1.67 | B | 2.88 | C | 0.74 | A |

 HCS™ Streets Version 7.5 Generated: 6/5/2019 9:19:47 AM

# HCS7 Two-Way Stop-Control Report

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | | Intersection | Hurstbourne Pkwy & Vassel |
| Agency/Co. | | Jurisdiction | KYTC |
| Date Performed | 4/2/2019 | East/West Street | Hurstbourne Pkwy |
| Analysis Year | 2032 | North/South Street | Vassel Rd |
| Time Analyzed | PM Peak Hour | Peak Hour Factor | 0.92 |
| Intersection Orientation | East-West | Analysis Time Period (hrs) | 0.25 |
| Project Description | Hurstbourne Development | | |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 1331 | 15 | 0 | 21 | 877 | | | 6 | | 13 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 17 | | 8 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 7.14 | | 7.06 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.67 | | 3.38 | | | | |

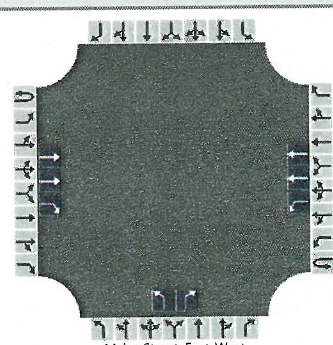
## Delay, Queue Length, and Level of Service

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 23 | | | | | 21 | | | | | |
| Capacity, c (veh/h) | | | | | | 468 | | | | | 223 | | | | | |
| v/c Ratio | | | | | | 0.05 | | | | | 0.09 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.2 | | | | | 0.3 | | | | | |
| Control Delay (s/veh) | | | | | | 13.1 | | | | | 22.8 | | | | | |
| Level of Service (LOS) | | | | | | B | | | | | C | | | | | |
| Approach Delay (s/veh) | | | | | 0.3 | | | | 22.8 | | | | | | | |
| Approach LOS | | | | | | | | | C | | | | | | | |

# HCS7 Two-Way Stop-Control Report

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | | Intersection | Hurstbourne & Proposed En |
| Agency/Co. | | Jurisdiction | KYTC |
| Date Performed | 4/2/2019 | East/West Street | Hurstbourne Pkwy |
| Analysis Year | 2022 | North/South Street | Proposed Entrance |
| Time Analyzed | PM Peak Hour | Peak Hour Factor | 0.92 |
| Intersection Orientation | East-West | Analysis Time Period (hrs) | 0.25 |
| Project Description | Hurstbourne Pkwy Development | | |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 1 | 0 | 1 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | L | | R | | | | |
| Volume (veh/h) | | | 1219 | 125 | 0 | 144 | 818 | | | 78 | | 146 | | | | |
| Percent Heavy Vehicles (%) | | | | | 3 | 3 | | | | 3 | | 3 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | No | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

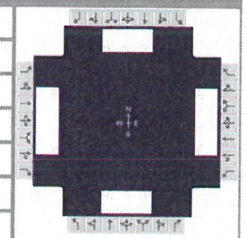
| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.16 | | | | 6.86 | | 6.96 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.23 | | | | 3.53 | | 3.33 | | | | |

## Delay, Queue Length, and Level of Service

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 157 | | | | 85 | | 159 | | | | |
| Capacity, c (veh/h) | | | | | | 454 | | | | 122 | | 402 | | | | |
| v/c Ratio | | | | | | 0.35 | | | | 0.69 | | 0.40 | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 1.5 | | | | 3.8 | | 1.8 | | | | |
| Control Delay (s/veh) | | | | | | 17.1 | | | | 83.5 | | 19.7 | | | | |
| Level of Service (LOS) | | | | | | C | | | | F | | C | | | | |
| Approach Delay (s/veh) | | | | | 2.6 | | | | 41.9 | | | | | | | |
| Approach LOS | | | | | | | | | E | | | | | | | |

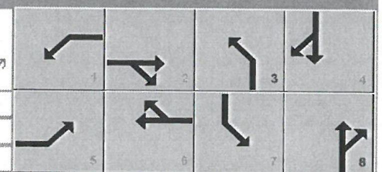
# HCS7 Signalized Intersection Results Summary

| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | 2022 PM S Watterson Trail.xus | | |
| Project Description | PM Peak Hour Build | | | | |



| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( v ), veh/h | 35 | 1061 | 273 | 451 | 844 | 17 | 84 | 104 | 300 | 16 | 232 | 36 |

| Signal Information | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cycle, s | 119.6 | Reference Phase | 2 | | | | | | | |
| Offset, s | 0 | Reference Point | End | Green | 4.3 | 14.2 | 40.0 | 1.7 | 6.0 | 21.4 |
| Uncoordinated | Yes | Simult. Gap E/W | Off | Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 0.0 | 3.6 |
| Force Mode | Fixed | Simult. Gap N/S | Off | Red | 3.0 | 3.0 | 1.8 | 3.0 | 0.0 | 2.8 |



| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 10.8 | 46.1 | 31.5 | 66.8 | 14.3 | 33.8 | 8.2 | 27.8 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( *MAH* ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.8 |
| Queue Clearance Time ( $g_s$ ), s | 4.4 | 39.1 | 27.0 | 22.1 | 7.9 | 25.3 | 3.1 | 16.9 |
| Green Extension Time ( $g_e$ ), s | 0.1 | 0.6 | 0.0 | 3.5 | 0.3 | 2.0 | 0.0 | 1.1 |
| Phase Call Probability | 0.71 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 0.44 | 1.00 |
| Max Out Probability | 0.00 | 1.00 | 1.00 | 0.02 | 0.00 | 0.05 | 0.00 | 0.02 |

| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( v ), veh/h | 38 | 1141 | 294 | 485 | 908 | 18 | 90 | 112 | 323 | 17 | 249 | 39 |
| Adjusted Saturation Flow Rate ( s ), veh/h/ln | 1810 | 1795 | 1598 | 1795 | 1781 | 1610 | 1810 | 1885 | 1598 | 1810 | 1900 | 1610 |
| Queue Service Time ( $g_s$ ), s | 2.4 | 37.1 | 17.9 | 25.0 | 20.1 | 0.7 | 5.9 | 5.8 | 23.3 | 1.1 | 14.9 | 2.4 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 2.4 | 37.1 | 17.9 | 25.0 | 20.1 | 0.7 | 5.9 | 5.8 | 23.3 | 1.1 | 14.9 | 2.4 |
| Green Ratio ( *g/C* ) | 0.04 | 0.33 | 0.33 | 0.21 | 0.51 | 0.51 | 0.06 | 0.23 | 0.23 | 0.01 | 0.18 | 0.18 |
| Capacity ( c ), veh/h | 65 | 1200 | 534 | 375 | 1807 | 817 | 117 | 432 | 366 | 26 | 339 | 288 |
| Volume-to-Capacity Ratio ( X ) | 0.581 | 0.951 | 0.550 | 1.293 | 0.502 | 0.022 | 0.769 | 0.259 | 0.882 | 0.652 | 0.735 | 0.135 |
| Back of Queue ( Q ), ft/ln ( 50 th percentile) | 32.4 | 460.4 | 183.2 | 666.1 | 204.6 | 6.2 | 76.7 | 67.4 | 258.6 | 18.6 | 181.6 | 24.1 |
| Back of Queue ( Q ), veh/ln ( 50 th percentile) | 1.3 | 18.3 | 7.3 | 26.4 | 8.1 | 0.2 | 3.1 | 2.7 | 10.3 | 0.7 | 7.3 | 1.0 |
| Queue Storage Ratio ( *RQ* ) ( 50 th percentile) | 0.07 | 0.00 | 0.41 | 1.48 | 0.00 | 0.01 | 0.31 | 0.00 | 1.03 | 0.12 | 0.00 | 0.16 |
| Uniform Delay ( $d_1$ ), s/veh | 56.8 | 38.9 | 32.5 | 47.3 | 19.5 | 14.7 | 55.1 | 37.8 | 44.6 | 58.6 | 46.5 | 41.4 |
| Incremental Delay ( $d_2$ ), s/veh | 11.2 | 16.5 | 4.0 | 150.2 | 1.0 | 0.1 | 13.9 | 0.4 | 13.3 | 32.6 | 4.8 | 0.3 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( d ), s/veh | 68.0 | 55.4 | 36.5 | 197.5 | 20.5 | 14.7 | 68.9 | 38.3 | 57.8 | 91.3 | 51.3 | 41.7 |
| Level of Service (LOS) | E | E | D | F | C | B | E | D | E | F | D | D |
| Approach Delay, s/veh / LOS | 52.0 | | D | 81.3 | | F | 55.6 | | E | 52.3 | | D |
| Intersection Delay, s/veh / LOS | 63.6 | | | | | | E | | | | | |

| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.10 | B | 2.45 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.70 | B | 1.65 | B | 1.35 | A | 0.99 | A |

# HCS7 Two-Way Stop-Control Report

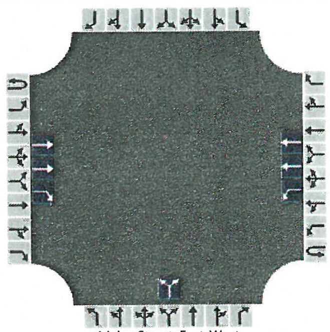
## General Information

| | |
|---|---|
| Analyst | |
| Agency/Co. | |
| Date Performed | 4/2/2019 |
| Analysis Year | 2032 |
| Time Analyzed | PM Peak Hour |
| Intersection Orientation | East-West |
| Project Description | Hurstbourne Development |

## Site Information

| | |
|---|---|
| Intersection | Hurstbourne Pkwy & Vassel |
| Jurisdiction | KYTC |
| East/West Street | Hurstbourne Pkwy |
| North/South Street | Vassel Rd |
| Peak Hour Factor | 0.92 |
| Analysis Time Period (hrs) | 0.25 |

## Lanes




## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 0 | 1 | 0 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | | LR | | | | | |
| Volume (veh/h) | | | 1605 | 18 | 0 | 26 | 1059 | | | 8 | | 16 | | | | |
| Percent Heavy Vehicles (%) | | | | | 0 | 0 | | | | 17 | | 8 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.10 | | | | 7.14 | | 7.06 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.20 | | | | 3.67 | | 3.38 | | | | |

## Delay, Queue Length, and Level of Service

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 28 | | | | | 26 | | | | | |
| Capacity, c (veh/h) | | | | | | 359 | | | | | 158 | | | | | |
| v/c Ratio | | | | | | 0.08 | | | | | 0.17 | | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 0.3 | | | | | 0.6 | | | | | |
| Control Delay (s/veh) | | | | | | 15.9 | | | | | 32.3 | | | | | |
| Level of Service (LOS) | | | | | | C | | | | | D | | | | | |
| Approach Delay (s/veh) | | | | | 0.4 | | | | 32.3 | | | | | | | |
| Approach LOS | | | | | | | | | D | | | | | | | |



HCS™ TWSC Version 7.5
2032 PM Ex Vassel.xtw

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# HCS7 Two-Way Stop-Control Report

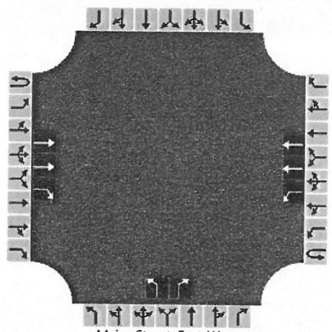
## General Information

| | |
|---|---|
| Analyst | |
| Agency/Co. | |
| Date Performed | 4/2/2019 |
| Analysis Year | 2032 |
| Time Analyzed | PM Peak Hour |
| Intersection Orientation | East-West |
| Project Description | Hurstbourne Pkwy Development |

## Site Information

| | |
|---|---|
| Intersection | Hurstbourne & Proposed En |
| Jurisdiction | KYTC |
| East/West Street | Hurstbourne Pkwy |
| North/South Street | Proposed Entrance |
| Peak Hour Factor | 0.92 |
| Analysis Time Period (hrs) | 0.25 |

## Lanes



Major Street: East-West

## Vehicle Volumes and Adjustments

| Approach | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | U | L | T | R | U | L | T | R | U | L | T | R | U | L | T | R |
| Priority | 1U | 1 | 2 | 3 | 4U | 4 | 5 | 6 | | 7 | 8 | 9 | | 10 | 11 | 12 |
| Number of Lanes | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | | 1 | 0 | 1 | | 0 | 0 | 0 |
| Configuration | | | T | R | | L | T | | | L | | R | | | | |
| Volume (veh/h) | | | 1496 | 125 | 0 | 144 | 1004 | | | 78 | | 146 | | | | |
| Percent Heavy Vehicles (%) | | | | | 3 | 3 | | | | 3 | | 3 | | | | |
| Proportion Time Blocked | | | | | | | | | | | | | | | | |
| Percent Grade (%) | | | | | | | | | 0 | | | | | | | |
| Right Turn Channelized | No | | | | | | | | No | | | | | | | |
| Median Type \| Storage | Left + Thru | | | | | | | | 1 | | | | | | | |

## Critical and Follow-up Headways

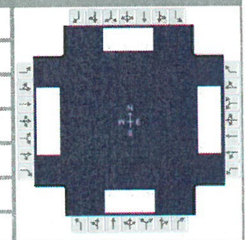
| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Critical Headway (sec) | | | | | | 4.1 | | | | 7.5 | | 6.9 | | | | |
| Critical Headway (sec) | | | | | | 4.16 | | | | 6.86 | | 6.96 | | | | |
| Base Follow-Up Headway (sec) | | | | | | 2.2 | | | | 3.5 | | 3.3 | | | | |
| Follow-Up Headway (sec) | | | | | | 2.23 | | | | 3.53 | | 3.33 | | | | |

## Delay, Queue Length, and Level of Service

| | EB U | EB L | EB T | EB R | WB U | WB L | WB T | WB R | NB U | NB L | NB T | NB R | SB U | SB L | SB T | SB R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rate, v (veh/h) | | | | | | 157 | | | | 85 | | 159 | | | | |
| Capacity, c (veh/h) | | | | | | 346 | | | | 83 | | 319 | | | | |
| v/c Ratio | | | | | | 0.45 | | | | 1.02 | | 0.50 | | | | |
| 95% Queue Length, $Q_{95}$ (veh) | | | | | | 2.3 | | | | 5.7 | | 2.6 | | | | |
| Control Delay (s/veh) | | | | | | 23.7 | | | | 194.1 | | 26.9 | | | | |
| Level of Service (LOS) | | | | | | C | | | | F | | D | | | | |
| Approach Delay (s/veh) | | | | | 3.0 | | | | 85.1 | | | | | | | |
| Approach LOS | | | | | | | | | F | | | | | | | |

# HCS7 Signalized Intersection Results Summary

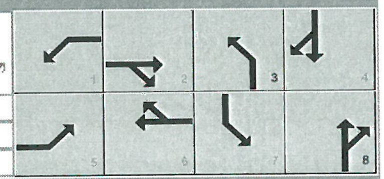
| General Information | | | | Intersection Information | |
|---|---|---|---|---|---|
| Agency | | | | Duration, h | 0.25 |
| Analyst | | Analysis Date | 4/2/2019 | Area Type | Other |
| Jurisdiction | | Time Period | | PHF | 0.93 |
| Urban Street | Hurstbourne Pkwy | Analysis Year | 2019 | Analysis Period | 1> 7:00 |
| Intersection | S Watterson Trail | File Name | 2032 PM S Watterson Trail.xus | | |
| Project Description | PM Peak Hour Build | | | | |



| Demand Information | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Demand ( v ), veh/h | 43 | 1275 | 329 | 550 | 1008 | 21 | 99 | 127 | 366 | 19 | 283 | 43 |

| Signal Information | | | |
|---|---|---|---|
| Cycle, s | 126.6 | Reference Phase | 2 |
| Offset, s | 0 | Reference Point | End |
| Uncoordinated | Yes | Simult. Gap E/W | Off |
| Force Mode | Fixed | Simult. Gap N/S | Off |

| | | | | | | |
|---|---|---|---|---|---|---|
| Green | 4.8 | 13.7 | 40.0 | 2.1 | 0.9 | 26.7 |
| Yellow | 3.5 | 3.5 | 4.3 | 3.5 | 3.5 | 3.6 |
| Red | 3.0 | 3.0 | 1.8 | 3.0 | 3.0 | 2.8 |



| Timer Results | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Assigned Phase | 5 | 2 | 1 | 6 | 3 | 8 | 7 | 4 |
| Case Number | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 |
| Phase Duration, s | 11.3 | 46.1 | 31.5 | 66.3 | 15.9 | 40.5 | 8.6 | 33.1 |
| Change Period, ( $Y+R_c$ ), s | 6.5 | 6.1 | 6.5 | 6.1 | 6.5 | 6.4 | 6.5 | 6.4 |
| Max Allow Headway ( MAH ), s | 4.9 | 3.8 | 4.9 | 3.8 | 4.9 | 5.0 | 4.9 | 4.8 |
| Queue Clearance Time ( $g_s$ ), s | 5.2 | 42.0 | 27.0 | 31.1 | 9.3 | 32.3 | 3.4 | 21.1 |
| Green Extension Time ( $g_e$ ), s | 0.2 | 0.0 | 0.0 | 3.2 | 0.3 | 1.8 | 0.0 | 1.1 |
| Phase Call Probability | 0.80 | 1.00 | 1.00 | 1.00 | 0.98 | 1.00 | 0.51 | 1.00 |
| Max Out Probability | 0.00 | 1.00 | 1.00 | 0.32 | 0.00 | 0.49 | 0.00 | 0.20 |

| Movement Group Results | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach Movement | L | T | R | L | T | R | L | T | R | L | T | R |
| Assigned Movement | 5 | 2 | 12 | 1 | 6 | 16 | 3 | 8 | 18 | 7 | 4 | 14 |
| Adjusted Flow Rate ( v ), veh/h | 46 | 1371 | 354 | 591 | 1084 | 23 | 106 | 137 | 394 | 20 | 304 | 46 |
| Adjusted Saturation Flow Rate ( s ), veh/h/ln | 1810 | 1795 | 1598 | 1795 | 1781 | 1610 | 1810 | 1885 | 1598 | 1810 | 1900 | 1610 |
| Queue Service Time ( $g_s$ ), s | 3.2 | 40.0 | 24.6 | 25.0 | 29.1 | 0.9 | 7.3 | 7.2 | 30.3 | 1.4 | 19.1 | 3.0 |
| Cycle Queue Clearance Time ( $g_c$ ), s | 3.2 | 40.0 | 24.6 | 25.0 | 29.1 | 0.9 | 7.3 | 7.2 | 30.3 | 1.4 | 19.1 | 3.0 |
| Green Ratio ( g/C ) | 0.04 | 0.32 | 0.32 | 0.20 | 0.48 | 0.48 | 0.07 | 0.27 | 0.27 | 0.02 | 0.21 | 0.21 |
| Capacity ( c ), veh/h | 69 | 1134 | 505 | 354 | 1692 | 765 | 135 | 507 | 430 | 29 | 400 | 339 |
| Volume-to-Capacity Ratio ( X ) | 0.671 | 1.209 | 0.701 | 1.669 | 0.640 | 0.030 | 0.789 | 0.269 | 0.915 | 0.697 | 0.760 | 0.136 |
| Back of Queue ( Q ), ft/ln ( 50 th percentile) | 43 | 835.2 | 262.8 | 1051.1 | 305.6 | 8.9 | 94.5 | 83.5 | 352.9 | 23.1 | 239.6 | 29.4 |
| Back of Queue ( Q ), veh/ln ( 50 th percentile) | 1.7 | 33.1 | 10.4 | 41.7 | 12.0 | 0.4 | 3.8 | 3.3 | 14.0 | 0.9 | 9.6 | 1.2 |
| Queue Storage Ratio ( RQ ) ( 50 th percentile) | 0.10 | 0.00 | 0.58 | 2.34 | 0.00 | 0.02 | 0.38 | 0.00 | 1.41 | 0.15 | 0.00 | 0.20 |
| Uniform Delay ( $d_1$ ), s/veh | 60.1 | 43.3 | 38.1 | 50.8 | 25.1 | 17.7 | 57.6 | 36.5 | 44.9 | 62.0 | 47.0 | 40.6 |
| Incremental Delay ( $d_2$ ), s/veh | 14.9 | 102.6 | 7.9 | 313.0 | 1.9 | 0.1 | 13.4 | 0.4 | 20.5 | 34.7 | 7.3 | 0.3 |
| Initial Queue Delay ( $d_3$ ), s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay ( d ), s/veh | 75.0 | 145.9 | 46.0 | 363.9 | 26.9 | 17.8 | 71.0 | 36.9 | 65.3 | 96.6 | 54.3 | 40.9 |
| Level of Service (LOS) | E | F | D | F | C | B | E | D | E | F | D | D |
| Approach Delay, s/veh / LOS | 124.1 | F | | 144.2 | F | | 60.2 | E | | 55.0 | D | |
| Intersection Delay, s/veh / LOS | 116.9 | | | | | | F | | | | | |

| Multimodal Results | EB | | WB | | NB | | SB | |
|---|---|---|---|---|---|---|---|---|
| Pedestrian LOS Score / LOS | 2.12 | B | 2.10 | B | 2.45 | B | 2.46 | B |
| Bicycle LOS Score / LOS | 1.95 | B | 1.89 | B | 1.54 | B | 1.10 | A |