

US 31E - Bardstown Road Safety Study

Fairmount Rd to KY 1065

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Prepared for
TEAM KENTUCKY
TRANSPORTATION
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1 Introduction

The Kentucky Transportation Cabinet (KYTC), in collaboration with Louisville Metro, has identified the US 31E Bardstown Road corridor between Fairmount Drive and Beulah Church Road (KY 1065) as a critical corridor for a safety study. To address this need, KYTC contracted Palmer Engineering to perform a safety study focused on identifying short-term improvements aimed at enhancing safety and preventing fatal and serious injury crashes. Members of the project team include KYTC Central Office Division of Traffic Highway Safety Improvement Program, KYTC District 5, Louisville Metro, and Palmer Engineering.

Figure 1 illustrates the study area which begins at Fairmont Drive (MP 3.039) and extends to Beulah Church Road/Seatonville Road (KY 1065) (MP 5.549).

1.1 Recently Constructed, Committed, and Proposed Projects

The following is a list of recent highway projects along the corridor:

- 5-80261.00-Planning Study to improve safety, reduce congestion, and improve multi-modal transportation options along US 31E from the Bullitt County line to KY 1065 (Beulah Church Road/Seatonville Road), including the I-265 (Gene Snyder Freeway) Interchange.
- 5-0264.11-Construction of dual turn lanes and intersection improvements at Southpointe Blvd.
- 5-80250.00-Design of a realigned Old Bardstown Road to align with the entrance to Walgreens at Hillock Drive.

Figure 1: US 31E - Bardstown Road Study Area



2 Existing Conditions

To evaluate the existing conditions along US 31E, a comprehensive inventory of the existing physical and geometric design characteristics was completed using the following resources:

- KYTC Highway Information System (HIS)
- Highway Plan Projects, and local studies
- Kentucky State Police (KSP) Crash Data
- HERE speed data
- Field Review

The US 31E corridor begins at Fairmount Drive, and continues northbound to Broadwood Drive/Captain Place with a consistent four-lane divided highway typical, including a depressed median, 12-foot through lanes, and inside and outside paved shoulders. The surrounding land use is predominantly residential between Fairmount Drive and Broadwood Drive/Captain Place. Most intersections are unsignalized, except for the signalized intersection at Glenmary Farm Drive. Old Bardstown Road runs parallel to US 31E to the west, functioning as a frontage road distributing adjoining residential streets to US 31E.

As the corridor progresses from Broadwood Drive/Captain Place to Colonel Hancock Drive/Hillock Drive, the typical transitions to a five-lane section, consisting of four-through lanes and a two-way left-turn lane (TWLTL). North of Colonel Hancock/Hillock Drive, the density of access points increases as the surrounding land use shifts to more commercial and retail establishments.

North of Cedar Creek Road/Brentlinger Lane, an additional northbound lane is developed to service the eastbound and westbound I-265 ramps. The I-265 interchange is a partial cloverleaf configuration, with signalized intersections and a raised median along US 31E.

North of the I-265 interchange, the roadway transitions to a 5-lane section with a TWLTL. An additional southbound lane is developed to service the I-265 ramps at the Cedar Look Drive signalized intersection.

The posted speed limit is 55 mph from Fairmount Drive to Glenmary Farm Drive, after which it reduces to 50 mph for the remainder of the corridor towards downtown Louisville.

South of Broadwood Drive/Captain Place, there are not any pedestrian facilities or crossings along US 31E. North of Broadwood Drive/Captain Place, separated pedestrian facilities are present but are not continuous. There are not any pedestrian facilities within the I-265 interchange. Aside from the outside paved shoulders, there are no dedicated bicycle lanes or facilities throughout the corridor.

2.1 Safety

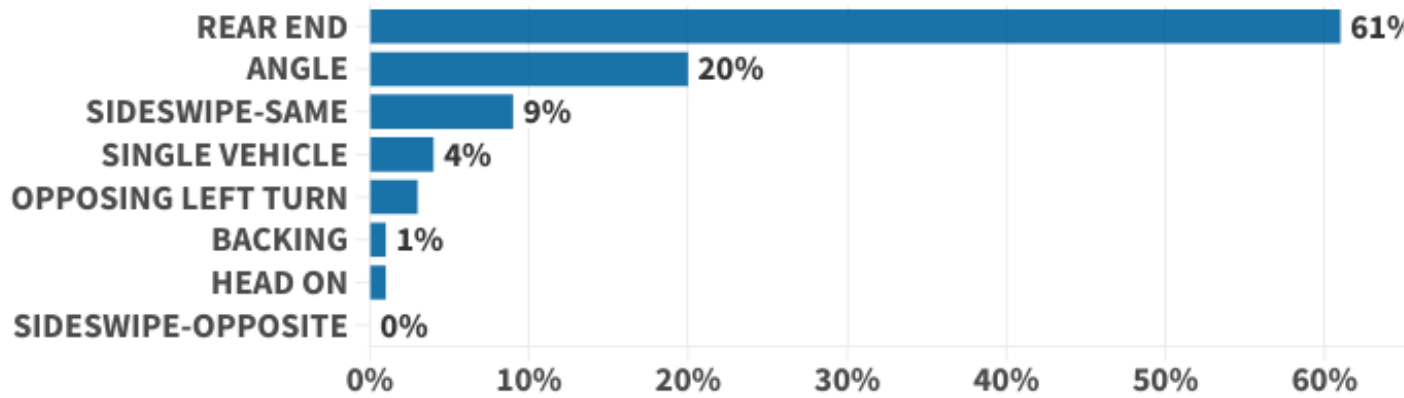
Historical Crash Analysis

An historical crash analysis was performed to examine traffic safety trends and to identify potential issues along US 31E. Crash data between 2017 and 2021 was collected from KYTC. Over the five year period there were 1,062 crashes within the study area. The majority of these crashes involved rear-end and angle collisions.

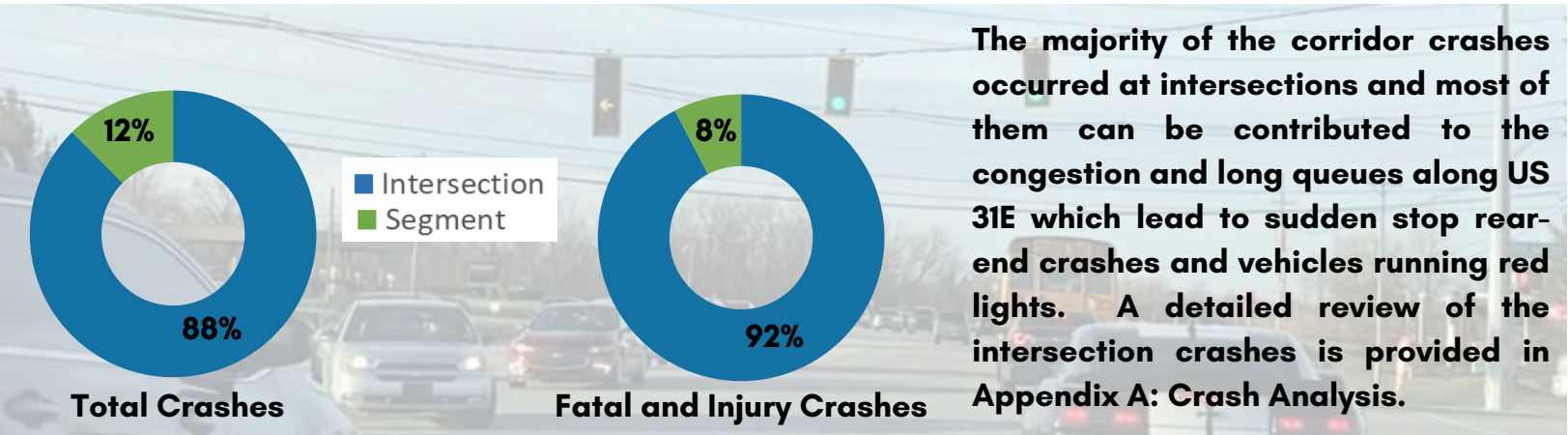
Figure 2: Crashes by Severity

Severity	Severity Description	Crashes	%
K	Fatal	2	0.2%
A	Suspected Serious Injury	15	1.4%
B	Suspected Minor Injury	52	4.9%
C	Possible Injury	97	9.1%
O	No Apparent Injury	896	84.4%
Total Crashes		1,062	100%

Figure 3: Crashes by Manner of Collision



Intersection Crashes

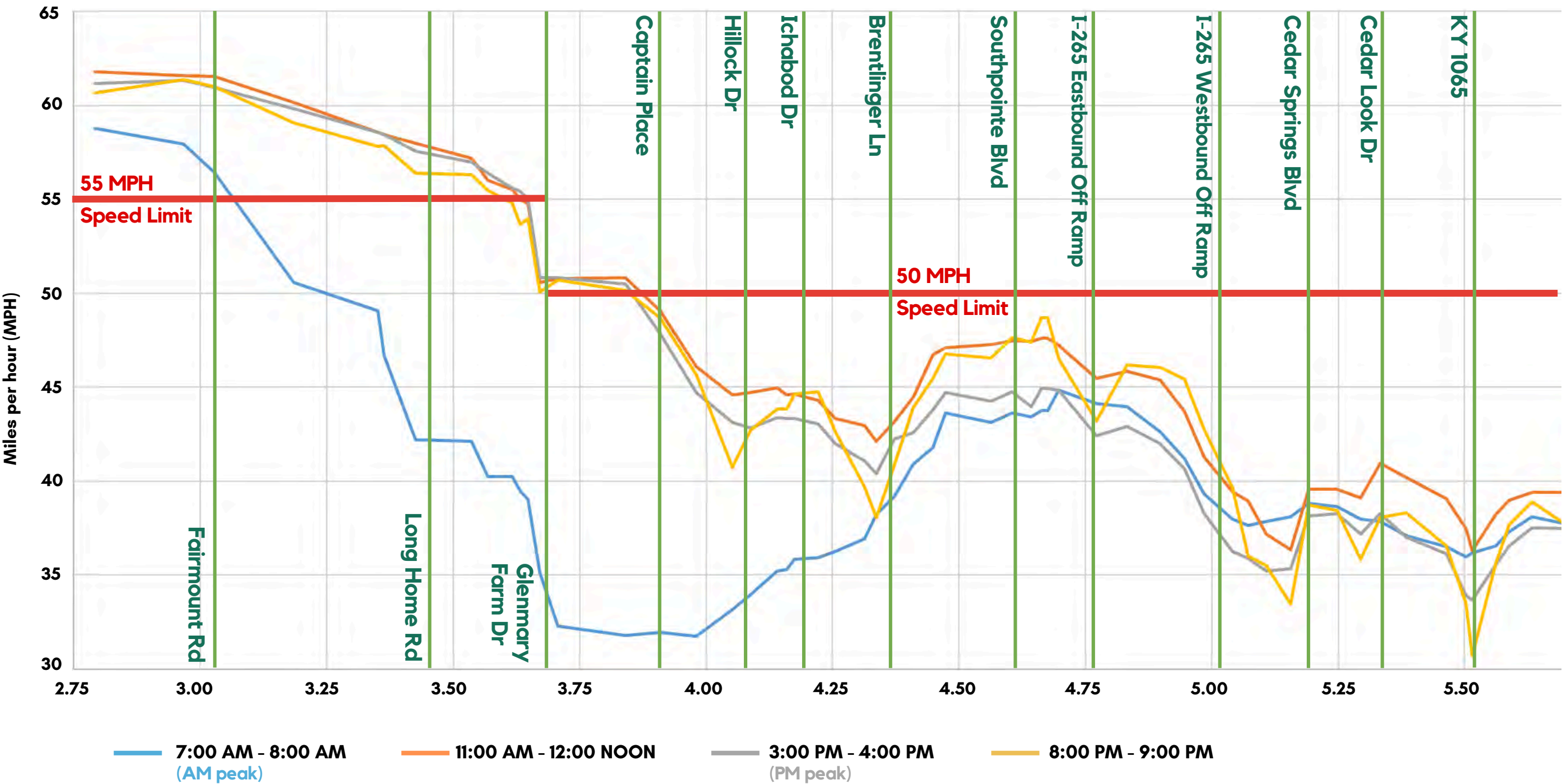


2.2 Corridor Speeds

South of the project area, US 31E is conducive to higher speeds due to the four-lane typical section and limited number of access points and intersections. Northbound traffic from the cities of Thixton and Mt. Washington travels through this section before reaching a signalized intersection at Thixton Lane, located approximately 1.1 miles south of the project area. As vehicles enter the project area, they encounter more signalized intersections and access points, leading to increased congestion and a reduction in speed. Vehicle speeds were collected throughout the project limits to aid in the analysis of existing conditions and in the development of potential safety improvements.

The KYTC Division of Planning obtained speed data along US 31E and Old Bardstown Road, focusing on weekday travel from 2018 and 2019. Speed data was provided for the northbound (cardinal) and southbound (non-cardinal) direction for various percentile speeds and vehicle type (passenger cars and commercial trucks). Existing corridor speeds were utilized in the development of the microsimulation model in Vissim which was calibrated to match the actual travel speeds observed along the corridor.

Figure 4: Speed Data in Northbound Direction (85th Percentile)



KYTC Speed Data Disclaimer: Speed or travel time values do not constitute official estimates until such time that they may be adopted or sanctioned by the Kentucky Transportation Cabinet. Any spatial relationships are estimates based upon the Kentucky Transportation Cabinet's linear referenced system. The Kentucky Transportation Cabinet makes no warranty, expressed or implied, as to the accuracy, completeness, reliability, or suitability for any particular purpose of the information or data and expressly disclaims liability for the accuracy thereof. Furthermore, The Kentucky Transportation Cabinet assumes no liability associated with the software, storage media, or methods of production of the Speed or Travel Time Data files and no responsibility for the updating or maintenance of the data.

2.3 Traffic Analysis

The traffic analysis for existing conditions involved developing baseline traffic volumes and analyzing traffic operations based on those volumes. Existing traffic volumes were developed by investigating historic count stations within and adjacent to the project area, gathering turning movement counts, and utilizing volume balancing to provide consistent traffic volumes throughout the project area. The corridor was driven during AM and PM Peak Periods to establish approximate baseline travel times.

Existing traffic operations were analyzed using Highway Capacity Software (HCS) to calculate travel delay and Level of Service (LOS). A microsimulation model was developed in Vissim to quantify performance measures including travel times and queue lengths. A summary of the existing traffic volumes and the analysis conducted is provided below.

2022 Existing Traffic Volumes

Traffic counts were collected at 14 intersections along US 31E, from Fairmount to KY 1065, in January 2022. The 24-hour traffic counts were conducted while Jefferson County schools were in session to account for the school traffic associated with Bates Elementary School, located off the US 31E and Southpointe intersection. The collected traffic counts were cross-checked with KYTC Count Stations data which provides Average Annual Daily Traffic (AADT), K factors, directional distribution, and truck percentages. The raw traffic data was balanced, and 2022 turning movements were developed for use in the existing traffic operations analysis. Signal timing along the corridor was provided by Louisville Metro.

During the AM Peak Period, heavier traffic flow is northbound on US 31E towards I-265. In the PM Peak Period, the heavier traffic flow is southbound on US 31E, although there remains a substantial volume of northbound traffic accessing commercial development along the corridor. Refer to Appendix B: Traffic Analysis for 2022 Existing Condition AM and PM turning volumes within the project area.

During the AM peak period, mainline peak hour volumes on US 31E include approximately 2,200 vehicles traveling northbound on US 31E towards the I-265 ramps. Notably, 61% of these vehicles (1,340) are accessing the ramps. Additionally, there is a heavy left turning movement from Old Bardstown to US 31E northbound at Hillock Drive, with 233 vehicles making this maneuver.

In the PM peak period, the mainline peak hour volumes include approximately 2,356 vehicles traveling southbound on US 31E from the I-265 ramps, and 1,506 vehicles traveling northbound. Side street approaches also experience increased traffic volumes this period.

2022 Existing Traffic Operations

Traffic operations at intersections along US 31E were analyzed using Highway Capacity Software (HCS) for both two-way stop controlled (TWSC) and signalized intersections to calculate delay and level of service (LOS). During the PM Peak, three intersections experience a LOS D, and 11 side street approaches experience a LOS F. Details on delay and LOS for the AM and PM peak hours are provided in Appendix B: Traffic Analysis.

A microsimulation model was developed in Vissim to quantify performance measures, such as travel times and queue lengths. Notably, northbound queues on US 31E backed into the preceding signal from Southpointe to Glenmary Farms. Side street approaches experience significant delay. The side street approach at Hillock Drive experiences delay up to 110 seconds per vehicle. The added outside slip lane for the I-265 ramps experiences queues from Southpointe back to Brentlinger, with a volume of 1336 vehicles per hour. Additionally, the northbound queues on US 31E extend from KY 1065 to Cedar Springs.

Queues along US 31E are heaviest in the southbound direction, with significant queueing also occurring on the side street approaches due to the 240 second cycle length used on the southern sections of this corridor. For example, side street approaches at Hillock Drive experience delays up to 203 seconds. The I-265 eastbound off-ramp experiences 112 seconds of delay, with the maximum queue length nearly reaching the gore point. North of the I-265 interchange, long queues extend from Cedar Springs to KY 1065, as well as on side street approaches. Detailed queue lengths at each intersection are displayed in Appendix C: Queue Analysis

Figure 5: US 31E - Bardstown Road Historical Count Station Data



3 Potential Improvements

Potential improvements were developed to improve safety along US 31E. These improvements were categorized into two alternatives: **Alternative 1: HSIP Safety Improvements** and **Alternative 2: Restricted Crossing U-Turn (RCUT) Corridor**.

Alternative 1: HSIP Safety Improvements focused on spot improvements at intersections, access management, and pavement widening to improve traffic flow at the I-265 interchange. The following is a list of the potential improvements examined under Alternative 1.

- Addition of a free-flow right-turn lane from the I-265 eastbound off-ramp, extending to the right-turn lane at Hillock Drive.
- Implementation of access management strategies from Hillock Drive to the Kohl's entrance, preventing left turns from Ichabod Drive and the gas station.
- Access management between Brentlinger Lane and Southpointe Blvd. to restrict left turns from access points
- Addition of a northbound lane along US 31E from Colonel Hancock to the existing added lane just north of Brentlinger Lane.
- Implementation of shared through and exit lane for northbound US 31E traffic to the I-265 westbound on-ramp.
- Rebuild the traffic signal at US 31E and Glenmary Farm Drive.
- Enhancement of pedestrian safety through improved sidewalk connectivity and safer intersection crossings.
- Realignment of Bartley Drive with the signalized intersection at Southpointe Blvd.
- Updates to overhead signage, including cantilever, panel and bridge-mounted signs.
- Closure of Old Bardstown Road at Fairmount Drive, redirecting traffic to Fairmount intersection and preventing through traffic along Old Bardstown Road.
- Reduction of the median width on US 31E at the I-265 interchange to provide additional shoulder width adjacent to barrier wall between US 31E and the ramps to I-265.

Alternative 2: Restricted Crossing U-Turn (RCUT) Corridor was analyzed using a Vissim microsimulation model and is recommended for further study, considering future traffic growth driven by ongoing development and increasing traffic volumes.

2022 Proposed Traffic Volumes

During the study period, various retail stores and restaurants were under construction at multiple locations along the project corridor, particularly between Hillock Drive and the I-265 ramps. Additional future developments, including big box retail stores near Cedar Creek Road and Southpointe Boulevard, are also planned. The 2022 baseline traffic volumes were projected to account for the recent development in the northwest quadrant at Cedar Creek Road. The proposed alternatives were analyzed using the traffic projections based on ITE Trip Generation. Detailed 2022 traffic volumes under study conditions are provided in Appendix B: Traffic Analysis.

During the proposed traffic analysis, the project team speculated that the annual traffic growth rate along the corridor could reach up to 5% over the next four years. This growth rate indicated that traffic volumes might necessitate improvements beyond the scope of the HSIP Safety Study. It was suggested that these volumes could warrant grade-separated options, which could be further explored in the upcoming KYTC Planning Study.

2022 Proposed Traffic Operations

Alternative 1: HSIP Safety Improvements were analyzed using Vissim microsimulation for both the AM and PM peak periods based on the proposed traffic volumes. Queue lengths and travel times were documented as performance measures and compared to existing conditions. Additionally, HCS and Synrho were utilized to determine intersection travel delays and LOS for the proposed improvements with results compared to existing conditions. AM and PM queue length graphics are presented in Appendix C: Queue Analysis. A travel time summary is presented in Appendix D: Travel Time.

Benefit Analysis

The Benefit Analysis for potential improvements included safety benefit and travel time savings. A potential crash reduction analysis was performed, estimating the reduction in total crashes and fatal and injury crashes. Crash reduction was analyzed for total crashes and for fatal and injury crashes only. The percent reduction in crashes was based on each improvement's associated Crash Modification Factor (CMF), the prevention of specific crash types, and other safety analysis tools. Potential crash savings were estimated using 2022 comprehensive crash costs specific to Kentucky.

Travel time savings were calculated using Vissim simulation results, comparing travel times between Alternative 1 and existing conditions. The value of travel time savings per hour were based on Table A-3: Value of Travel Time Savings in the US DOT Benefit-Cost Analysis Guidance manual. These savings were calculated based on weekday trips per year during peak hours. The annual benefits from crash reduction and travel time savings were projected over a 20-year project life to determine the potential lifetime benefits for the proposed safety improvements.

Construction Cost Estimate

Quantities for the potential safety improvements were developed based on planning-level design. Costs were calculated for items such as pavement, earthwork, drainage, signage, striping, maintenance of traffic, traffic signals, utilities, staking, and erosion control. A 20% contingency was applied to account for additional miscellaneous items.

The following is a summary of the traffic analysis, benefit analysis and construction cost estimate for the potential improvements that were studied along US 31E.

3A: I-265 Eastbound Off Ramp - Right Turn Free Flow Lane

Description

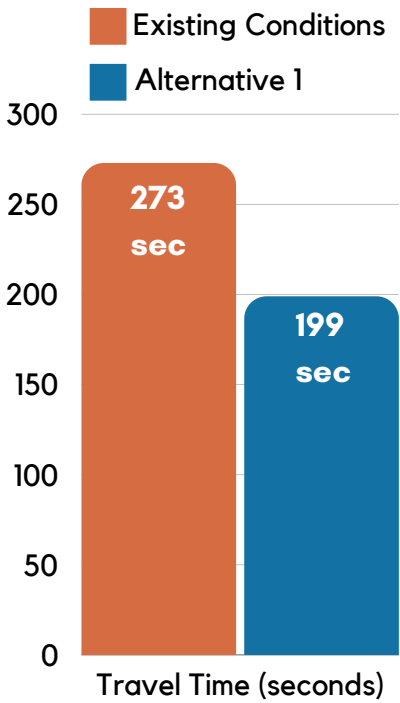
Construct an additional free-flow lane from the I-265 eastbound off-ramp right-turn, continuing along southbound US 31E through the Cedar Creek intersection and transitioning into the right-turn-only lane onto Hillock Drive at Old Bardstown. This improvement would operate similarly to the existing I-265 eastbound off-ramp right-turn onto KY 61 (Preston Highway).

Safety Analysis

The majority of the crashes (82) at the US 31E and I-265 EB off-ramp intersection involve rear-end crashes in the right-turn lane of the off-ramp. Of these 82 rear-end crashes, 8 resulted in injuries. Additionally, 20 crashes involved vehicles turning right onto US 31E from the off-ramp and failing to yield. There was also 1 pedestrian and 1 bicycle crash involving vehicles making this right turn. This Improvement has the potential to reduce total crashes at the intersection by 48% and injury crashes by 36%.



Traffic Analysis



During the PM peak hour, the average queue for the I-265 EB off-ramp right-turn lane is 259', with a maximum queue of 1,506'. The approach delay under the PM peak during existing conditions is 112 sec/veh, resulting in a LOS F. With the improvement, the average queue is reduced to nearly 0' and maximum queue is reduced to 33', for the inside right-turn lane. The approach delay during the PM peak improves to 22.4 sec/veh, resulting in a LOS C.

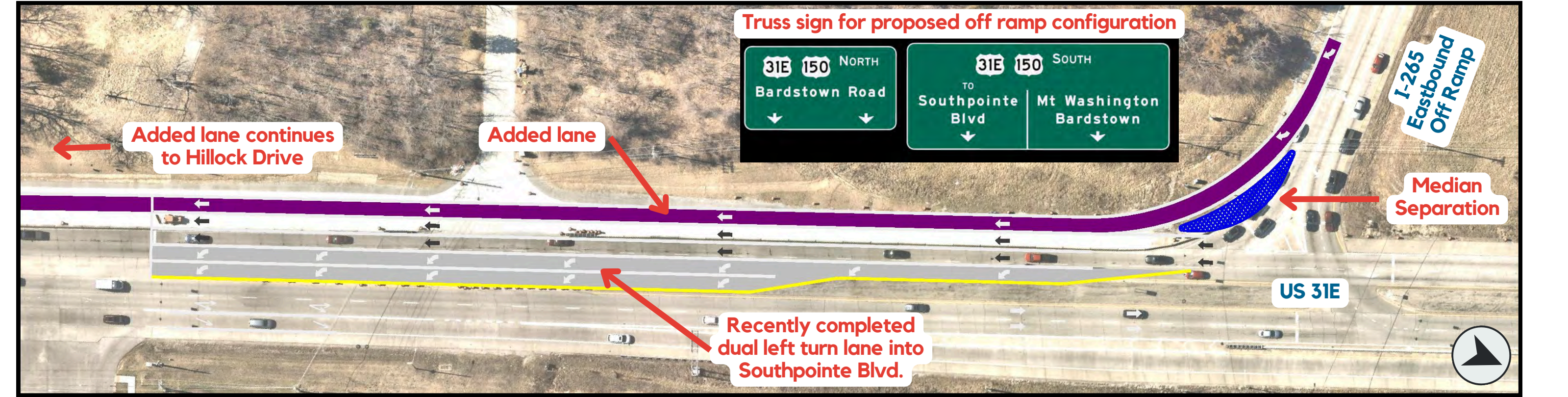
The improvement also results in a travel time savings of 74 seconds per vehicle traveling from the I-265 EB off-ramp to southbound US 31E, affecting approximately 500 vehicles during the PM peak hour.

Return on Investment

A detailed construction cost estimate was developed, including costs for full depth pavement for the added lane, paved shoulders, earthwork, drainage, striping, signing (truss), signal rebuilds, utility relocation, maintenance of traffic, staking, erosion control, and a 20% contingency.

Total Investment	Potential Benefit	Return on Investment
\$4,340,000	\$17,300,000	3.99

Improvement Concept



3B: US 31E Northbound Added Lane from Colonel Hancock Drive to I-265 Ramps

Description

Construct an additional northbound lane on US 31E starting at the Colonel Hancock Drive intersection and continuing north, tying into the existing added lane towards the I-265 ramps just north of the Brentlinger Lane intersection. The improvement also includes the construction of right-turn lanes into the gas station, Major Lane (Kohl’s entrance), and Brentlinger Lane.

Safety Analysis

A total of 95 rear-end crashes occurred along US 31E northbound between the Colonel Hancock Drive intersection and Southpointe Boulevard intersection. 4 of these crashes resulted in injuries. Additionally, 9 crashes involved northbound vehicles on US 31E running red lights. The proposed improvement is expected to reduce the number of stops during peak periods, alleviating travel time frustration among drivers. This improvement has the potential to reduce total crashes by 56% and injury crashes by 36% along the US 31E northbound corridor between Colonel Hancock Drive and Brentlinger Lane.

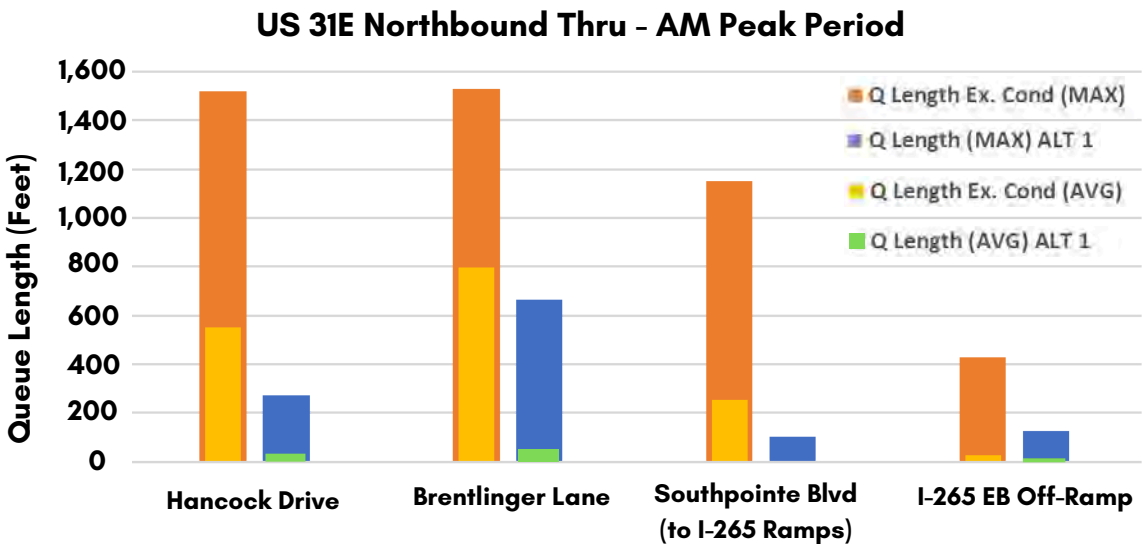
Total Crashes
56%

Injury Crashes
36%

Improvement Concept

Traffic Analysis

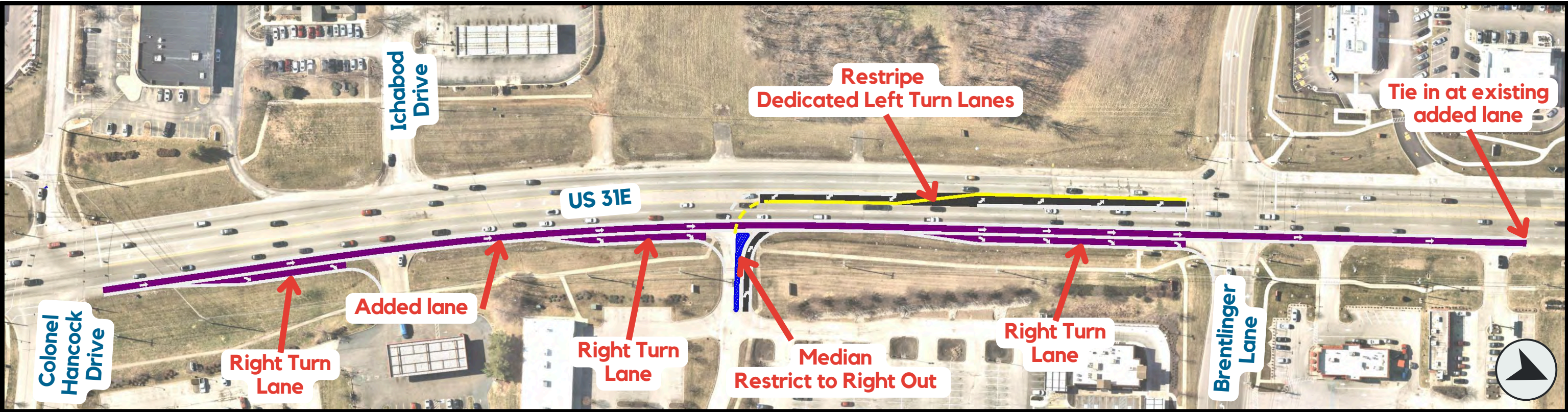
During the AM peak hour, maximum queue lengths along US 31E northbound extend back into the upstream intersection. The following is a comparison of northbound US 31E AM queue lengths for existing conditions versus Alternative 1.



Return on Investment

A detailed construction cost estimate was developed, including cost for full depth pavement for the added lane, paved shoulders, earthwork, drainage, striping, signing, signal rebuilds, maintenance of traffic, staking, erosion control, and a 20% contingency.

Total Investment	Potential Benefit	Return on Investment
\$2,166,000	\$5,489,000	2.53



3C: US 31E Northbound Shared Thru-Exit Lane to I-265 Ramps

Description

Widen the northbound section of US 31E as it approaches the slip ramp for I-265 ramps. The existing outside US 31E northbound thru lane is converted into a shared exit lane for vehicles heading towards the I-265 ramps. The outside slip lane will serve as a dedicated lane to eastbound I-265. This improvement will require rock excavation and the installation of trusses for new signage reflecting the updated configuration.

Safety Analysis

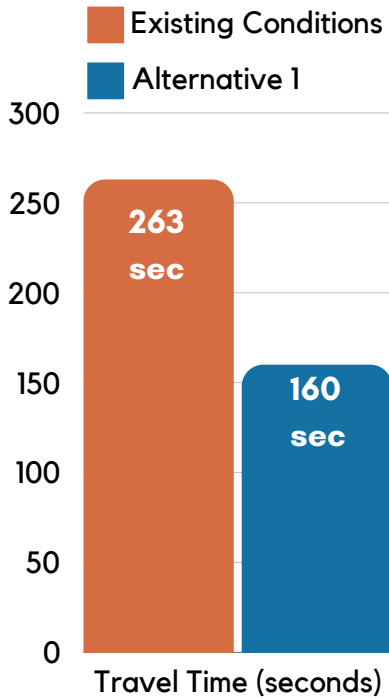
There were 20 rear-end crashes on US 31E northbound at the I-265 EB off-ramp intersection, with 3 of these crashes resulting in injuries. This improvement, combined with the addition of a northbound lane on US 31E, is expected to reduce the number of stops, potentially reducing rear-end crashes and improving traffic flow along US 31E. The improvement is anticipated to reduce both rear-end crashes and red-light running crashes.



Improvement Concept



Traffic Analysis



During the AM peak hour, the improvement will significantly reduce queue lengths as shown in the Traffic Analysis section for Improvement 3B. Travel time is also expected to improve with this configuration. See chart to the left for travel time from Fairmount Rd. to the I-265 ramps.

In the AM peak hour, over 1,350 vehicles travel northbound along US 31E to the I-265 ramps. Alt 1 is projected to reduce travel time by 103 seconds per vehicle during the weekday AM peak hour. Vehicles continuing through on northbound US 31E will save 89 seconds per trip.

At the I-265 eastbound off-ramp intersection, the approach delay for the northbound US 31E is 17.8 sec/veh under existing conditions. With Alternative 1, this delay is reduced to 4.4 sec/veh.

Return on Investment

A detailed construction cost estimate was developed, including costs for full depth pavement for the widened ramp construction, earthwork that includes rock excavation, drainage, striping, signing (3 trusses), signal rebuilds, maintenance of traffic, staking, erosion control, and a 20% contingency.

Total Investment	Potential Benefit	Return on Investment
\$3,316,000	\$7,098,000	2.14

3D: Access Management between Hillock Drive and Major Lane (Kohl's Entrance)

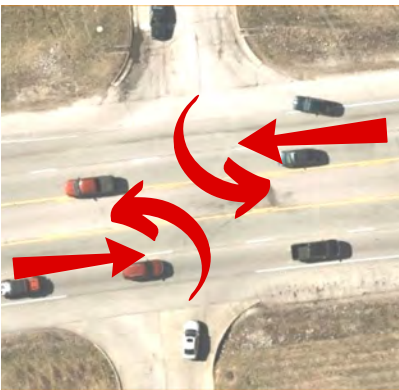
Description

Implement access management measures along the median of US 31E, starting at the Hillock Drive/Colonel Hancock Drive intersection and extending north to Major Lane at the Kohl's entrance. This access management strategy would consist of constructing a raised median and sections of lane separator curbs to prevent vehicles from making left turns into and out of access points between the Hillock Drive intersection and the Major Lane intersection. Existing backage roads would allow vehicles to reach access points where left turns are permitted, ensuring continued access to desired destinations.

Safety Analysis

There were 72 total crashes at the Ichabod Drive and gas station access point along US 31E. The predominant crash type involved vehicles turning left out of Ichabod Drive and US 31E southbound thru vehicles. This accounted for 42 angles crashes during the 5-year crash period. Of these, 7 crashes resulted in injuries, and 1 crash was fatal. Additionally, there were 4 angle crashes involving vehicles turning left out of the gas station and colliding with northbound vehicles on US 31E, with 3 of these crashes causing injuries. By restricting left-turn movements at these access points, the proposed access management would allow only right-in and right-out movements, effectively eliminating left-turn angle crashes.

Angle Crashes at Ichabod / Gas Station



46 Total Crashes
10 Injury Crashes
2 Serious Injury
1 Fatal Crash

Return on Investment

A detailed construction cost estimate was developed, including costs for raised median, removing existing concrete, lane separator curb, drainage, signing, striping, maintenance of traffic, staking, erosion control, and a 20% contingency.

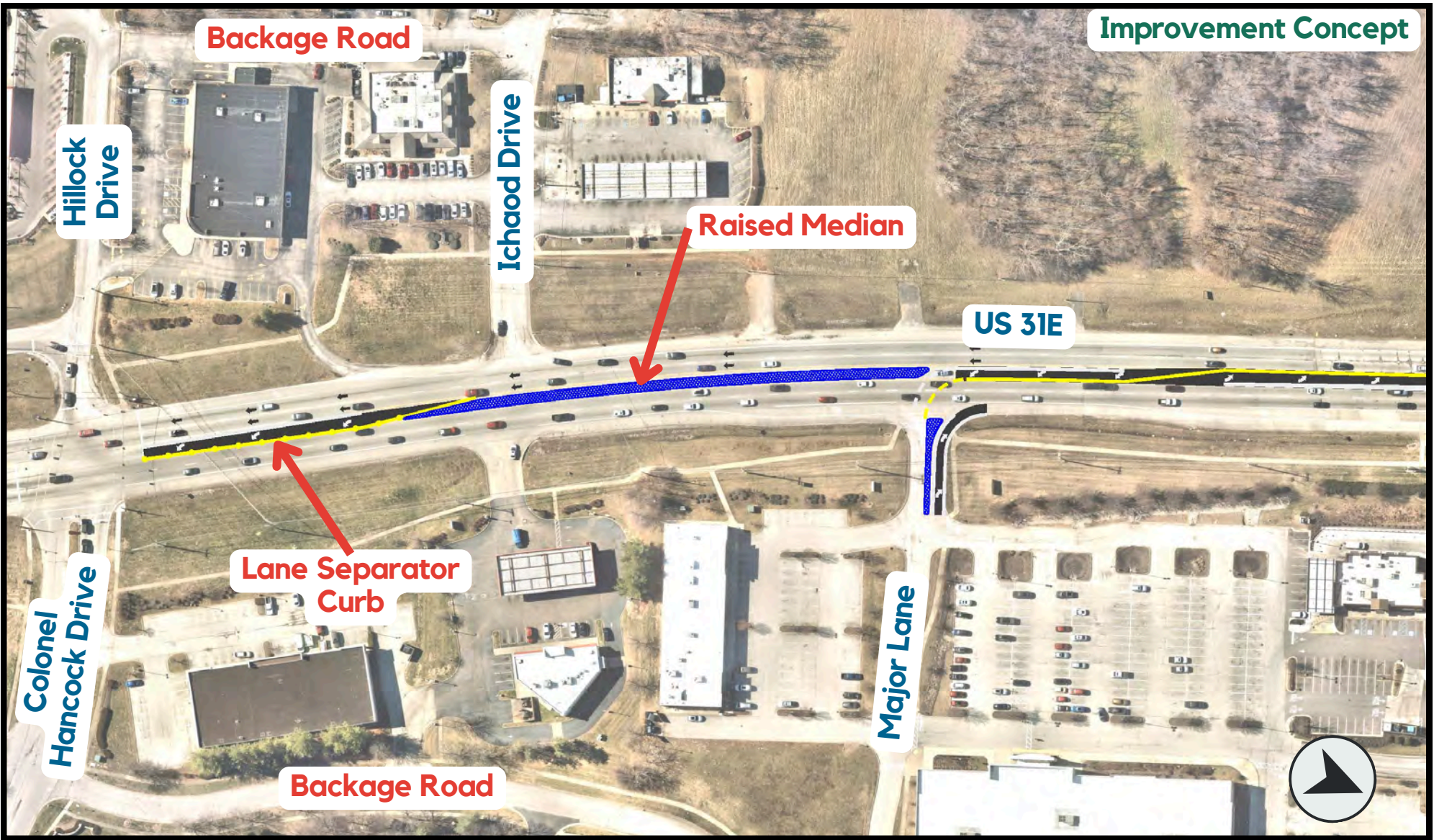
Total Investment	Potential Benefit	Return on Investment
\$409,000	\$16,950,000	41.44

Traffic Analysis

Approximately 30 vehicles turn left out of Ichabod Drive onto northbound US 31E during the AM and PM peak periods, while fewer than 5 vehicles turn left out of the gas station onto southbound US 31E.

During the AM peak period, the Ichabod Drive approach experiences a delay of 271 seconds, which increases to 665 seconds of during the PM peak. Left-turning vehicles essentially have to wait for gaps in traffic due to queues, leading to significant delays.

Restricting movements to right turns in and out at Ichabod Drive would reduce delays to 13 seconds during the AM peak and 52 seconds during the PM peak. Vehicles that would otherwise turn left can use backage roads to reach a nearby intersection where left turns are allowed, minimizing the impact of this redirection.



3E: Access Management between Brentlinger Lane and Southpointe Blvd

Description

Implement access management measures along the median of US 31E beginning at Brentlinger Lane / Cedar Creek Road intersection and continuing north to Southpointe Blvd. This access management strategy would involve constructing raised medians and sections of lane separator curbs to prevent left-turn movements into and out of access points between Brentlinger Lane and Southpointe Blvd. Most entrances in this section have existing backage roads that provide alternative routes, allowing vehicles to reach an access point where left turns are permitted.

Safety Analysis



6 Angle Crashes
(4 Injury)

Access to Restaurant
just north of
Brentlinger
Intersection

During the crash analysis period, development of the northwest quadrant off of Cedar Creek was nearing completion, with additional development underway along northbound US 31E between the church entrance and Southpointe Blvd. This ongoing development is expected to increase the number of access points along US 31E, with three currently proposed as full access, allowing left-turn movements into and out of the developments. Given the anticipated increase in access points, a crash pattern similar to that observed at Hillock Drive may emerge between Brentlinger Lane and Southpointe Blvd.

Return on Investment

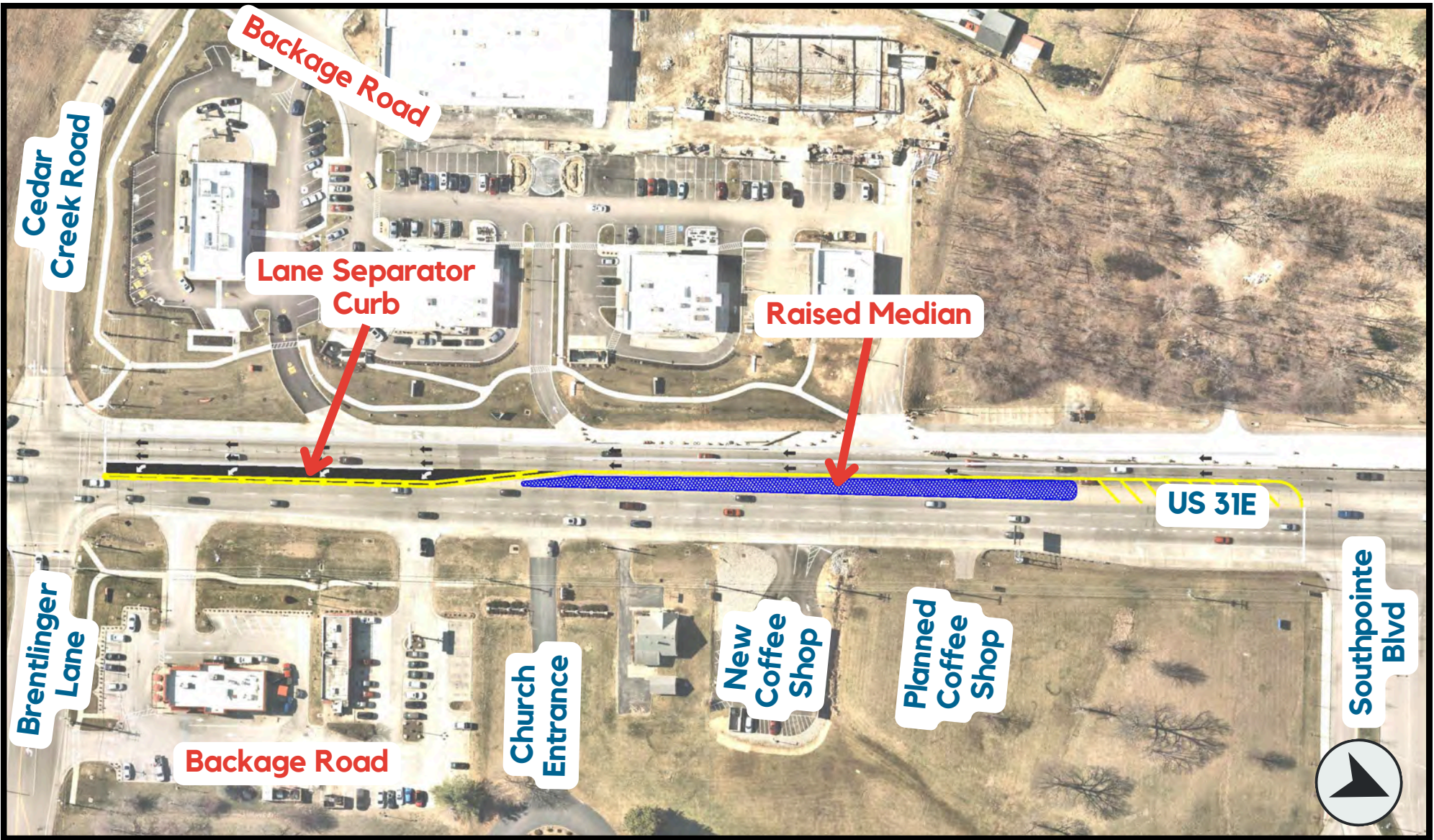
A detailed construction cost estimate was developed, including costs for raised median, removing existing concrete, lane separator curb, drainage, signing, striping, maintenance of traffic, staking, erosion control, and a 20% contingency.

Total Investment	Potential Benefit	Return on Investment
\$302,000	\$11,290,000	37.38

Traffic Analysis

Currently, there are minimal left-turn movements out of the existing access points for Popeyes and Waffle House. A backage road connects these establishments to Brentlinger Lane. The proposed development at the northwest quadrant of Cedar Creek Road will also have a backage road that connects to Cedar Creek Road. Traffic projections were included in the proposed analysis to account for the increase in traffic volume from the planned development and redistributed to the Cedar Creek Road and Brentlinger Lane intersection.

Improvement Concept



3F: Rebuild Signal at US 31E and Glenmary Farm Intersection

Description

The existing signal at the intersection of US 31E and Glenmary Farm / Providence Drive has a single span layout. This improvement involves rebuilding the traffic signal with four steel strain poles supporting traffic signal heads installed per each approach. The new configuration will allow for signal improvements, including retroreflective backplates and the conversion of 5-section doghouse signal heads to 4-section flashing yellow arrow signal heads, consistent with the other signalized intersections within the project area.

FHWA
Proven Safety
Countermeasure



15% reduction in
total crashes

Traffic signal heads equipped with retroreflective backplates are more visible and conspicuous in both daytime and nighttime conditions, enhancing drivers awareness. Rebuilding the traffic signal will allow for the installation of these improved signal heads, with the new steel strain poles designed to support the additional wind load requirements that the existing single-span signal cannot accommodate.



Safety Analysis

There were 29 total crashes that occurred during the 5-year crash analysis at the US 31E and Glenmary Farm Drive intersection, 7 of the crashes involved an injury collision. The installation of retroreflective backplates is predicted to reduce crashes by 15%, which is approximately 1 crash per year.

Traffic Analysis

No impact to existing condition traffic. A reduction in crashes would reduce delay associated with a crash.

Return on Investment

A detailed construction cost estimate was developed, including costs for a full signal rebuild using four steel strain poles with new signal equipment and a 20% contingency.

Total Investment	Potential Benefit	Return on Investment
\$209,000	\$914,000	4.37

Existing Single Span Signal at Glenmary Farm Drive Intersection



3G: Un-signalized Restricted Crossing U-turn (RCUT) intersections at US 31E and Fairmount Road, Long Home Road, and Glenmary Farm Drive

Description

Construct a Restricted Crossing U-Turn (RCUT) intersection at the first three intersections in the project area: Fairmount Rd, Long Home Rd, and Glenmary Farm Dr. The RCUT intersection modifies the direct left-turn and through movements from cross-street approaches. Minor road traffic makes a right turn followed by a U-turn at a designated location to continue in the desired direction. The RCUT intersections at these locations would all be unsignalized movements, with a single lane dedicated to the right-turn movement from the side streets and a single lane for the U-turn vehicles.

FHWA
Proven Safety Countermeasure



Safety Analysis

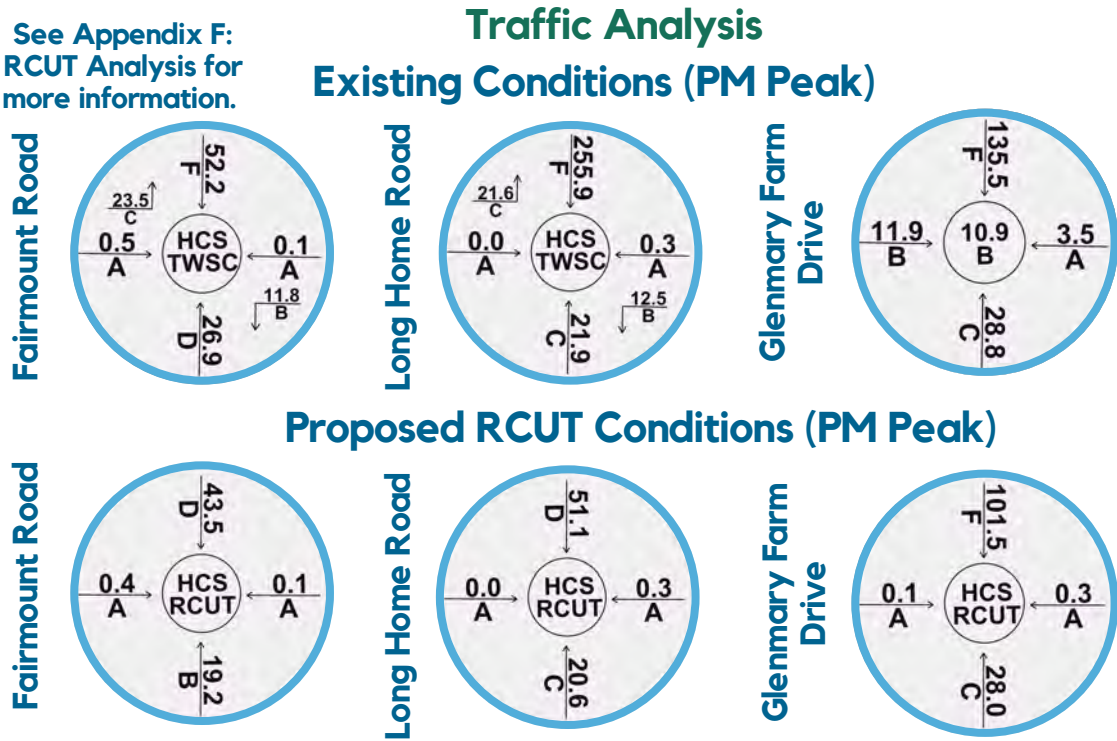
RCUT intersections simplify driver decision-making by reducing the number of conflict points from 42 at a conventional intersection to 24 in a RCUT intersection. The RCUT design reduces the likelihood of higher-severity crash types, such as angle and opposing left-turn crashes.

Two-Way Stop Controlled converted to RCUT

Signalized Intersection converted to RCUT

54% reduction in fatal and injury crashes

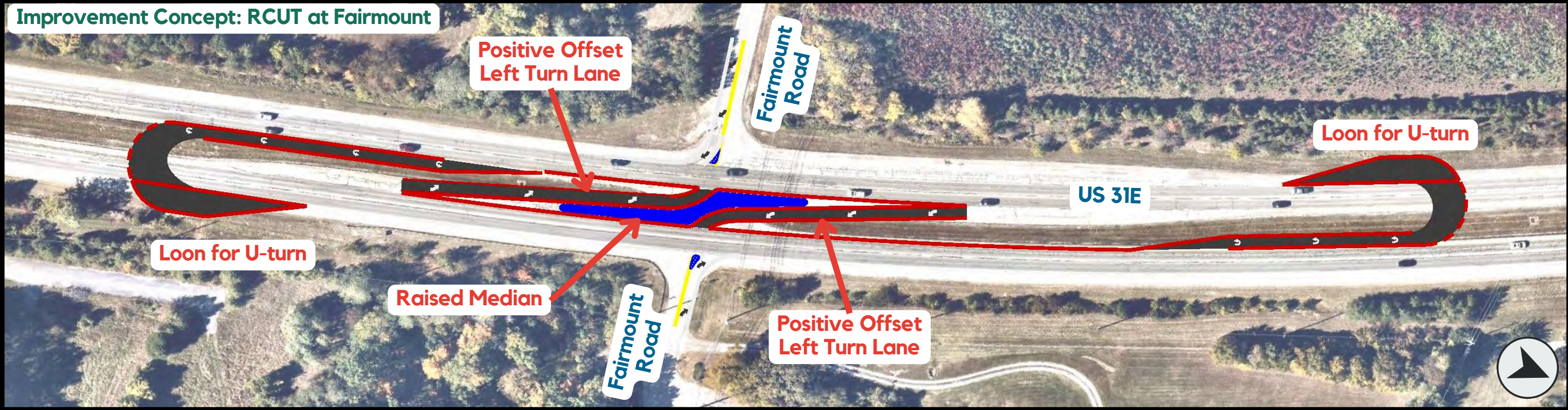
43% reduction in fatal and injury crashes



Return on Investment

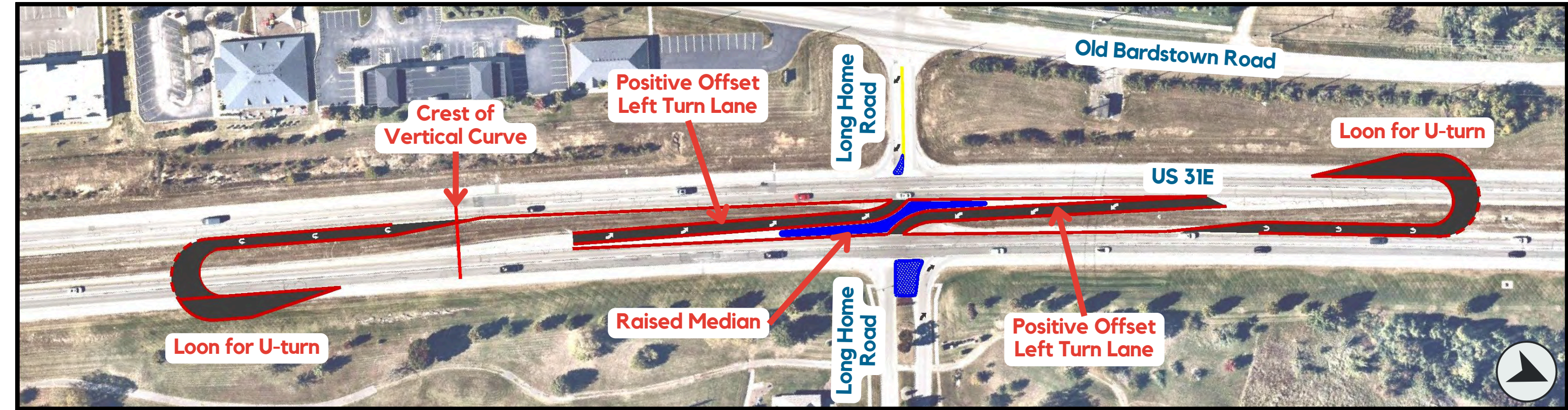
A detailed construction cost estimate was developed, including costs for full depth pavement for the loons and turn lanes, earthwork, drainage, striping, signing, lighting of the RCUT, maintenance of traffic, staking, erosion control, and a 20% contingency.

Intersection	Total Investment	Potential Benefit	Return on Investment
Fairmount	\$960,000	\$879,000	0.92
Long Home	\$912,000	\$3,018,000	3.31
Glenmary	\$1,044,000	\$4,120,000	3.95

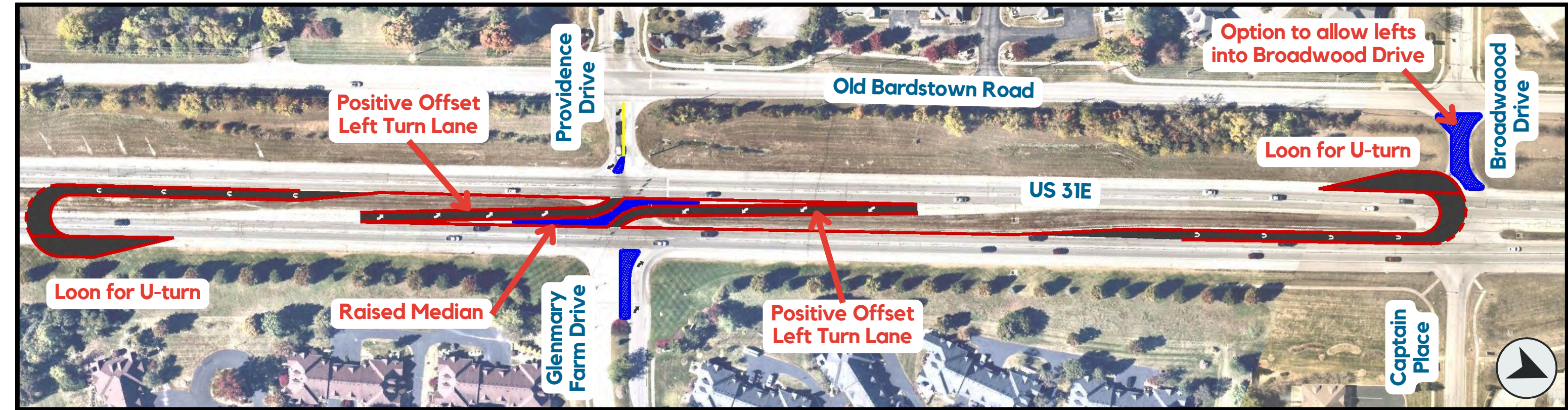


3G: Un-signalized Restricted Crossing U-turn (RCUT) intersections at US 31E and Fairmount Road, Long Home Road, and Glenmary Farm Drive

Improvement Concept: RCUT at Long Home Road



Improvement Concept: RCUT at Glenmary Farm Drive / Providence Drive



3H: Signalized Restricted Crossing U-turn (RCUT) intersections at US 31E at Hillock Drive and Brentlinger Lane Intersections

Description

Construct a signalized Restricted Crossing U-Turn (RCUT) intersection at US 31E and Hillock Drive / Colonel Hancock Drive intersection and Brentlinger Lane / Cedar Creek Road intersections. These RCUT intersections would control all movements with traffic signals, including the u-turning movements. The signals would enable independent signal progression for each direction of US 31E operating in two phase intervals. Due to high volume turning movements, dual right-turn lanes from the side streets and dual U-turn lanes would be implemented.

FHWA
Proven Safety
Countermeasure



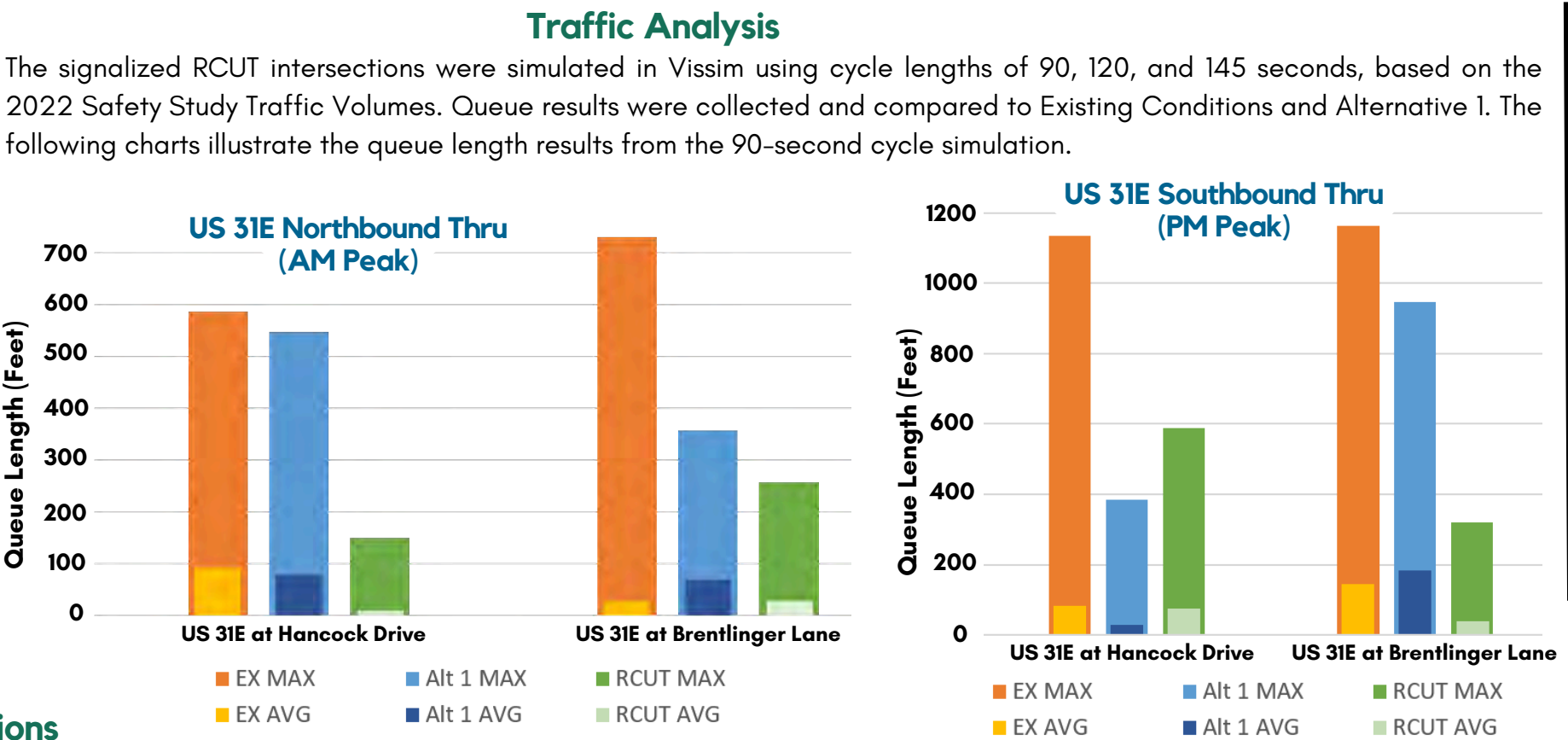
Safety Analysis

RCUT intersections simplify decision making for drivers by reducing conflict point from 42 at a conventional intersection to 24 at a RCUT intersection. RCUT intersections minimize the potential for higher severity crash types, such as angle and opposing left crashes.

Signalized Intersection converted to Signalized Superstreet RCUT

15% reduction in total crashes

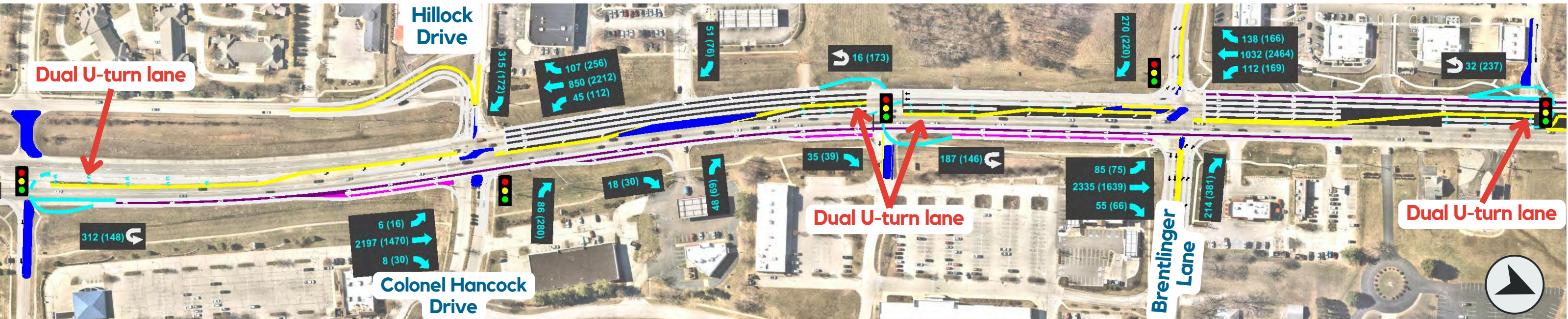
22% reduction in fatal and injury crashes



Further Analysis

Construction costs and safety benefit were not calculated as part of the Safety Study. Right-of-Way and Utility would need to be considered for the construction of the the signalized U-turn loons and widening of US 31E.

Improvement Concept: Signalized RCUT Intersections



3I: Disconnect Old Bardstown north of Fairmount Road

Description

During the existing conditions analysis, it was observed that vehicles traveling from Thixton and Mt. Washington towards I-265 frequently use Old Bardstown Road to bypass congestion from signalized intersections on US 31E, rejoining US 31E at the Hillock Drive intersection. This bypass route contributes to congestion at Hillock Drive, where the signalized intersection has only 70 feet of storage. The proposed improvement involves disconnecting Old Bardstown Road just north of Fairmount Road, redirecting traffic back to US 31E via Fairmount Road, which offers approximately 480 feet of storage. The Fairmount Road approach would be widened to accommodate both right and left turn lanes, with the potential to construct either a RCUT or a signalized intersection. Additionally, to handle the increased traffic from Fairmount Road, an option to construct an additional northbound lane on US 31E -- extending from the left-turn lane and continuing north -- is also considered.

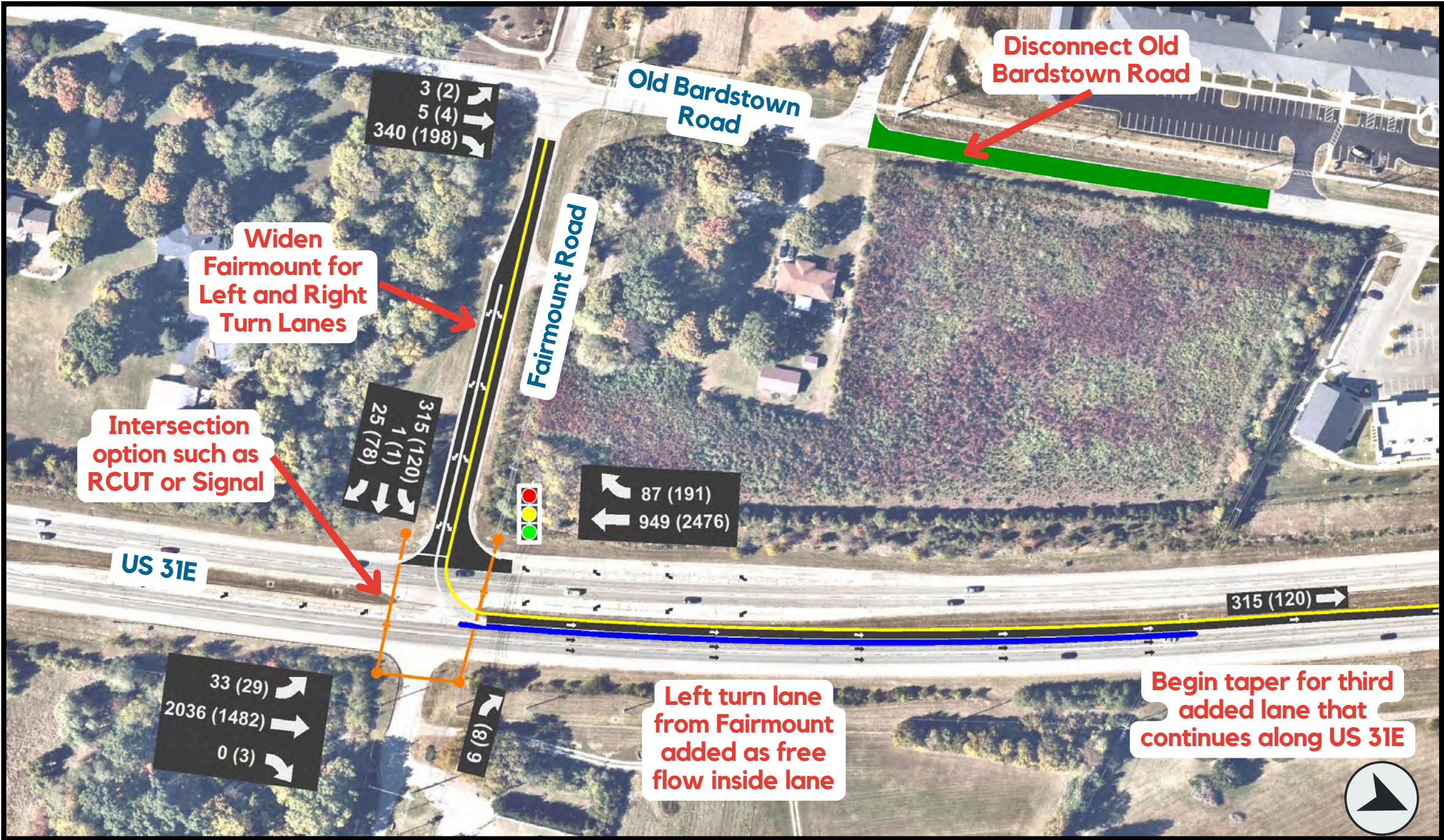
Analysis

Traffic counts during the existing conditions phase show that 340 vehicles during the AM peak period and 198 vehicles during the PM peak period travel along Old Bardstown Road from the south, bypassing US 31E to access the signalized intersections at Glenmary Farm Drive and Hillock Drive. Disconnecting Old Bardstown Road would redirect these vehicles to the Fairmount Drive approach, which provides significantly more storage capacity between Old Bardstown Road and US 31E. This change would alleviate congestion on Old Bardstown Road and reduce traffic volumes at the Glenmary Farm Drive and Hillock Drive intersections.

The expected increase in traffic at Fairmount Road may necessitate the construction of an alternative intersection, such as an RCUT or a modified Green-T intersection. One option is to have left-turning traffic from Fairmount continue in an added lane that would taper/merge back into US 31E or extend as a third lane up to the existing added lane north of the Brentlinger Lane intersection.

The Project Team recommended that the selected improvements be implemented first, with the option to further study this improvement at a later stage.

Improvement Concept



3J: Bow-tie Roundabouts at KY 1065

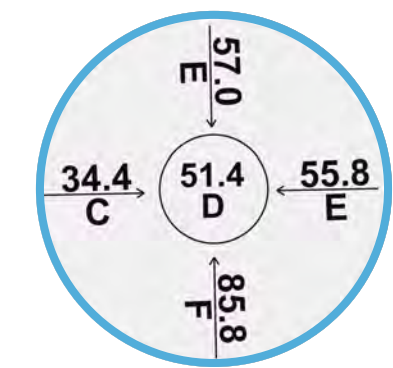
Improvement Concept

Description

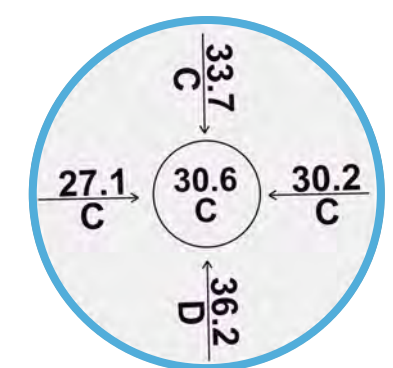
Convert the existing KY 1065 four-phased signal to a two-phase signal with turning movements routed through bow-tie roundabouts on KY 1065. On US 31E, construct a raised median to restrict left turning movements and corresponding signal phasing configuration at the intersection. Right-turn lanes onto KY 1065 would be added for vehicle making turning movements. Single-lane roundabouts would be constructed on each side of US 31 along KY 1065, allowing vehicles to make U-turns and continue straight on KY 1065 to reach their desired destination. The signal would operate in two phases: one phase for through and right-turning movements on US 31E and another for through and right-turning movements on KY 1065.

Analysis

The existing signal at the US 31E and KY 1065 intersection operates at LOS D, with an overall intersection delay of 51.4 seconds per vehicle. Northbound US 31E approach queues average 159 feet, with a maximum queue of 1,000 feet, while southbound queues average 489 feet, with a maximum of 1,557 feet. Westbound queues on KY 1065 average 222 feet, with a maximum of 1,155 feet.



Existing Conditions
US 31E @ KY 1065
(PM Peak)



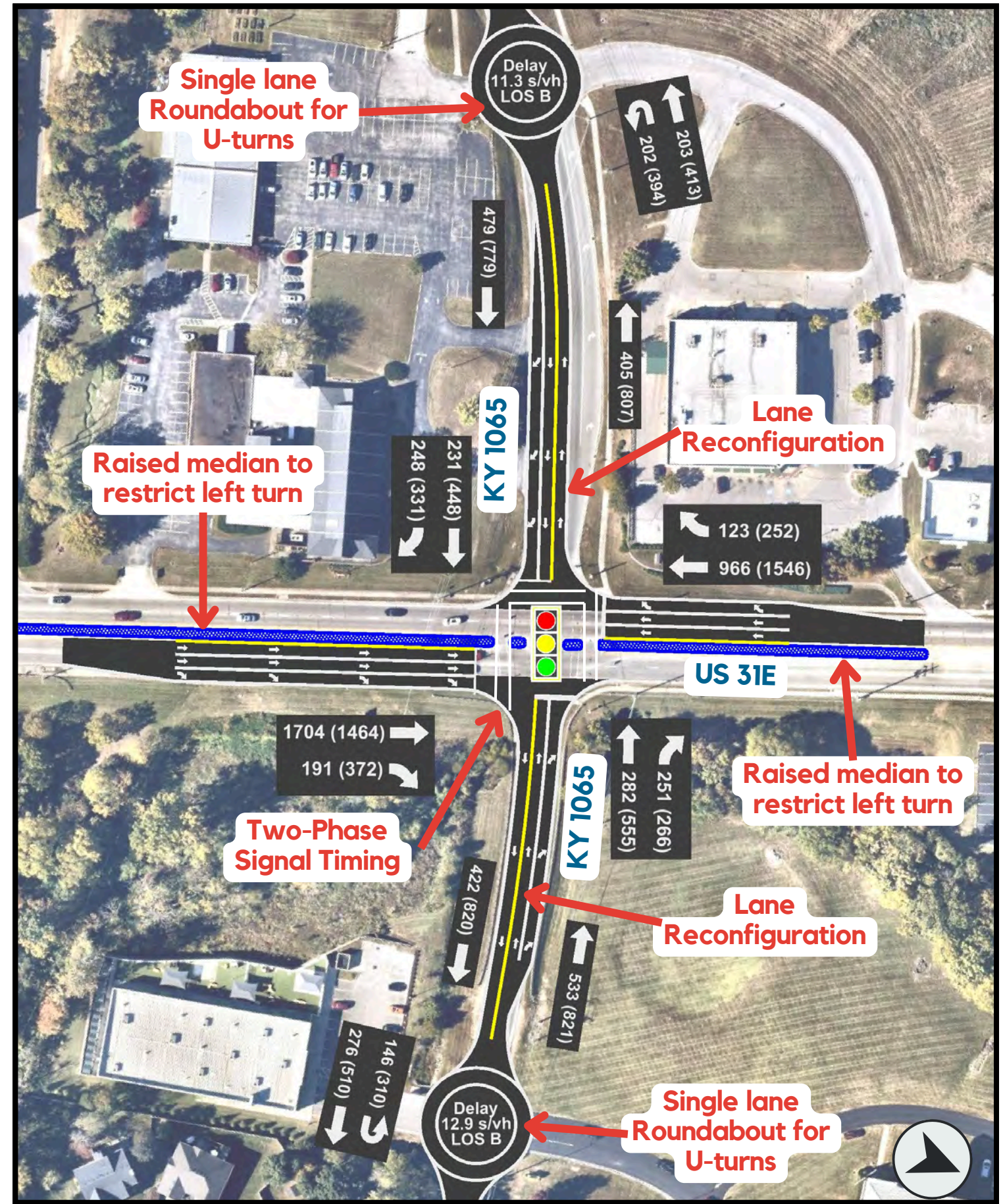
Proposed Conditions
Two-Phase Signal
US 31E @ KY 1065
(PM Peak)

By eliminating the left-turn movements and converting the intersection to a two-phase signal, the timing operations are expected to improve to a LOS C, with an overall intersection delay of 30.6 seconds per vehicle during the PM peak period.

Turning traffic would utilize roundabouts on the either side of KY 1065 to make U-turns before proceeding straight or turning right at the intersection. The single lane roundabouts are projected to operate at LOS B, with the east roundabout experiencing a delay of 11.3 seconds per vehicle and the west roundabout experiencing a delay of 12.9 seconds per vehicle.

During the five-year crash period, the intersection experienced 27 angle crashes, 10 of which resulted in injuries. By eliminating the left-turning conflict points, this improvement has the potential to significantly reduce angle crashes at the intersection. The high-severity angle crashes would be replaced with lower-severity sideswipe crashes at the roundabouts.

The Project Team recommended that the selected improvements be implemented first, with the option to further study this improvement at a later stage.



4 Recommended Improvements

Following the development of the potential improvement options, the Project Team reviewed the safety, traffic, and return on investment of each option. The Project Team selected improvements (highlighted in blue below) to be funded by the HSIP program aimed at reducing fatal and high severity crashes. These improvements are also expected to improve traffic flow along US 31E, particularly in the southbound direction. The Project Team recommended implementing these improvements first, with a plan to further analyze additional improvements -- such as signalized RCUT intersections -- due to anticipated traffic growth and development in the project area.

Recommendation Summary

Potential Improvement		Total Investment	Potential Benefit	Return on Investment	Recommendation
3A	Addition of a free-flow right-turn lane from the I-265 eastbound off-ramp, extending to the right-turn lane at Hillock Drive.	\$4,340,000	\$17,300,000	3.99	Selected to move forward to Final Design and Construction (Item No. 5-9047.00)
3B	Addition of a northbound lane along US 31E from Colonel Hancock Drive to the existing added lane just north of Brentlinger Lane.	\$2,166,000	\$5,489,000	2.53	Potential Six-Year Plan Project (grouped with 3C)
3C	Implementation of shared through and exit lane for northbound US 31E traffic to the I-265 westbound on-ramp.	\$3,316,000	\$7,098,000	2.14	Potential Six-Year Plan Project (grouped with 3B)
3D	Implementation of access management strategies from Hillock Drive to the Kohl's entrance, preventing left turns from Ichabod Drive and the gas station.	\$409,000	\$16,950,000	41.44	Selected to move forward to Final Design and Construction (Item No. 5-9047.00)
3E	Access management between Brentlinger Lane and Southpointe Blvd. to restrict left turns from access points.	\$302,000	\$11,290,000	37.38	Selected to move forward to Final Design and Construction (Item No. 5-9047.00)
3F	Rebuild the traffic signal at US 31E and Glenmary Farm Drive.	\$209,000	\$914,000	4.37	Not selected as part of Safety Study. Further study option for an alternative intersection.
3G	Construct unsignalized RCUT intersection at US 31E and Fairmount Road	\$960,000	\$879,000	0.92	Not selected as part of Safety Study. Potential HSIP Competitive Intersections.
	Construct unsignalized RCUT intersection at US 31E and Long Home Road	\$912,000	\$3,018,000	3.31	
	Construct unsignalized RCUT intersection at US 31E and Glenmary Farm Drive	\$1,044,000	\$4,120,000	3.95	
3H	Construct Signalized RCUT intersections at Hillock Drive and Brentlinger Lane	-	-	-	Recommended to be further studied following implementation of selected improvements and to account for the development and traffic growth.
3I	Closure of Old Bardstown Road at Fairmount Drive, redirecting traffic to Fairmount intersection and preventing through traffic along Old Bardstown Road.	-	-	-	Recommended to be further studied following implementation of selected improvements.
3J	Bow-tie Roundabouts at KY 1065	-	-	-	

During a Project Team meeting, additional improvements along US 31E were discussed for inclusion alongside the selected improvements. These will be incorporated into the final design and construction as part of KYTC Item No. 5-9047.00. Construction of the selected improvements are anticipated to begin in Summer 2025.

Additional Improvements to be Included

Realign Bartley Drive approach south on US 31E southbound to across from the Southpointe Blvd. signalized intersection. KYTC portion would involve constructing the entrance approach from edge of US 31E back close to existing right-of-way.
Intelligent Transportation System (ITS) / Transportation Systems Management and Operations (TSMO) Related Improvements - Upgrading the detection at signalized intersections - Upgrading signal controllers to 2070s - Deploying wireless communication routers - Installing quad-view cameras - Radar detection
Pedestrian safety will be included with the selected improvements with a focus on safe crossing at the I-265 eastbound off-ramp.
Lane separator curb will be included with the access management improvements to prohibit left turn maneuvers for access points near the intersections.
Update signing for I-265 along US 31E. Coordinate with KYTC Central Office Traffic to review and udpate existing cantilever, truss, and bridge mounted signing for I-265.

Appendix A

Crash Analysis

Fairmount Road

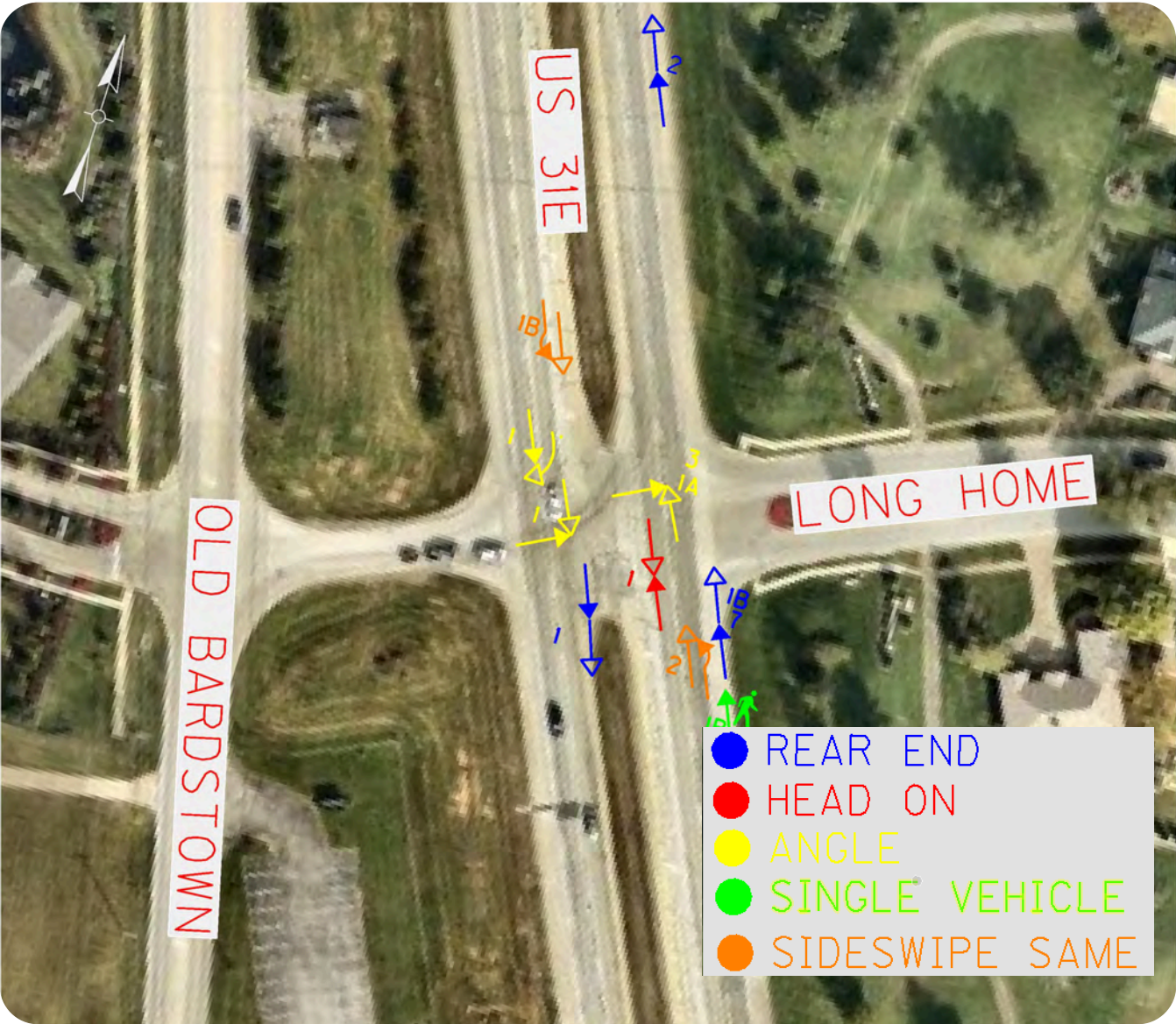


CRASH ANALYSIS - US 31E & FAIRMOUNT ROAD

Crash Range:
January 1, 2015 - December 31, 2019

CRASH TYPE		CRASHES	YEAR	CRASHES	ROAD CONDITION		CRASHES	LIGHT CONDITION		CRASHES	
FATAL	0	2015			2	WET		7	DAYLIGHT		10
INJURY	1	2016			1	DRY		4	DARK-HWY LIGHTING/OFF		1
POD	10	2017			1						
TOTAL	11	2018			6						
		2019			1						

Long Home Road



CRASH ANALYSIS - US 31E & LONG HOME ROAD

Crash Range:
January 1, 2016 - December 31, 2019

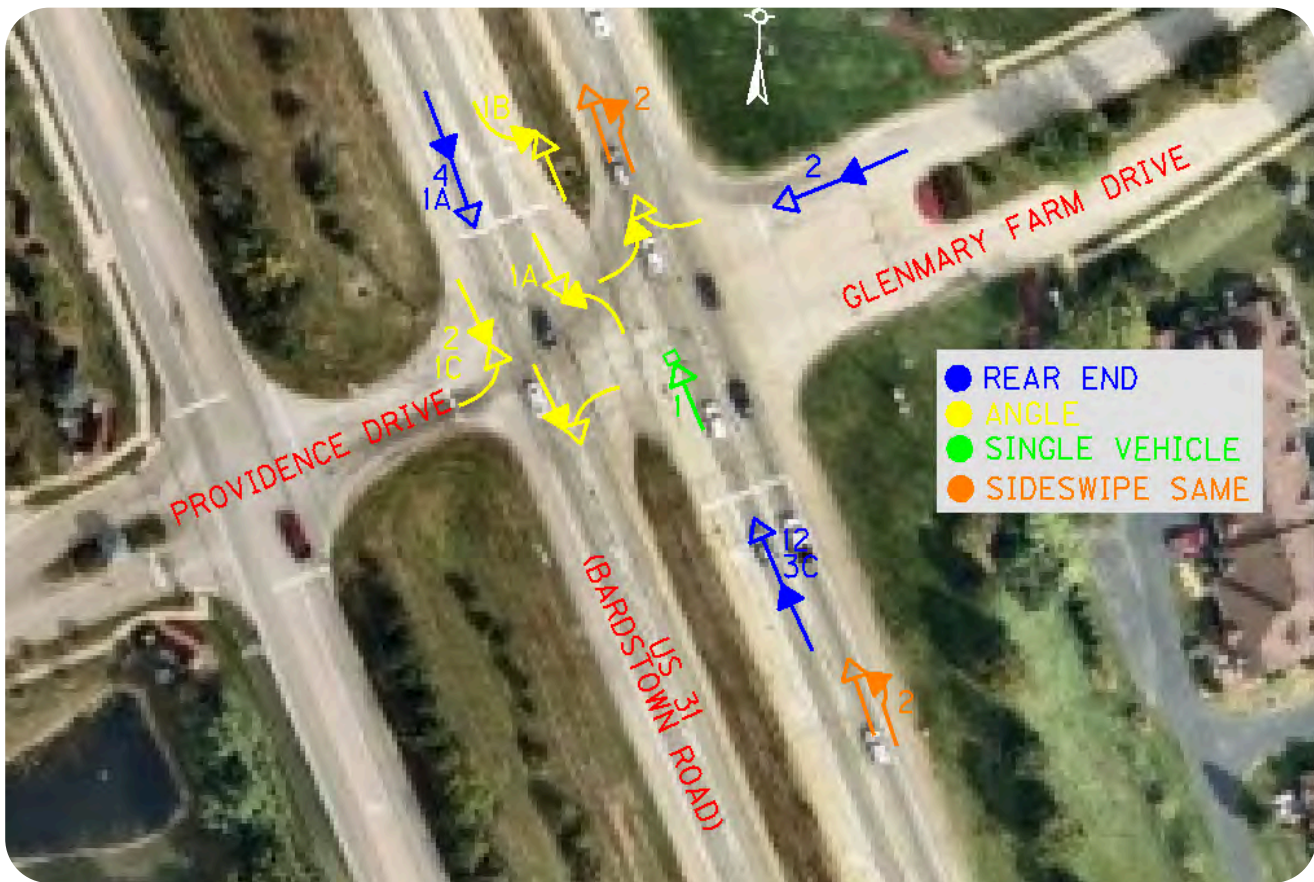
CRASH TYPE		YEAR		ROAD CONDITION		LIGHT CONDITION	
CRASHES		CRASHES		CRASHES		CRASHES	
FATAL	0	2016	6	DRY	16	DAYLIGHT	11
INJURY	4	2017	4	WET	1	DARK (UNKNOWN)	2
POD	13	2018	3			DAWN	2
TOTAL	17	2019	3			DARK-HWY LIGHTING/OFF	1
						OTHER	1

MANNER OF COLLISION	CRASHES	INJURY
REAR END	8	1
ANGLE	4	1
SIDESWIPE-SAME DIRECTION	3	1
HEAD ON	1	0
SINGLE VEHICLE	1	1

DIRECTIONAL ANALYSIS	CRASHES
BLANK	3
SIDESWIPE (COLLISION) – SAME DIRECTION	3
REAR END – OTHER:	2
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	2
OTHER INTERSECTION COLLISIONS	2
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	1
1 VEHICLE ENTERING/LEAVING ENTRANCE	1
ANGLE COLLISION – BOTH VEHICLES GOING STRAIGHT	1
ANGLE COLLISION – ONE VEHICLE TURNING RIGHT	1
COLLISION WITH NON-FIXED OBJECT	1

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	2
6:00 AM - 9:00 AM	8
9:00 AM - 11:00 AM	1
11:00 AM - 1:00 PM	1
1:00 PM - 4:00 PM	2
4:00 PM - 6:00 PM	0
6:00 PM - 9:00 PM	2
9:00 PM - 12:00 AM	1

Glenmary Farm Drive & Providence Drive



CRASH ANALYSIS - US 31E & GLENMARY FARM DR/PROVIDENCE DR

Crash Range:
January 1, 2015 - December 31, 2019

CRASH TYPE	CRASHES
FATAL	0
INJURY	7
POD	22
TOTAL	29

YEAR	CRASHES
2015	4
2016	7
2017	5
2018	2
2019	10

ROAD CONDITION	CRASHES
DRY	24
WET	5

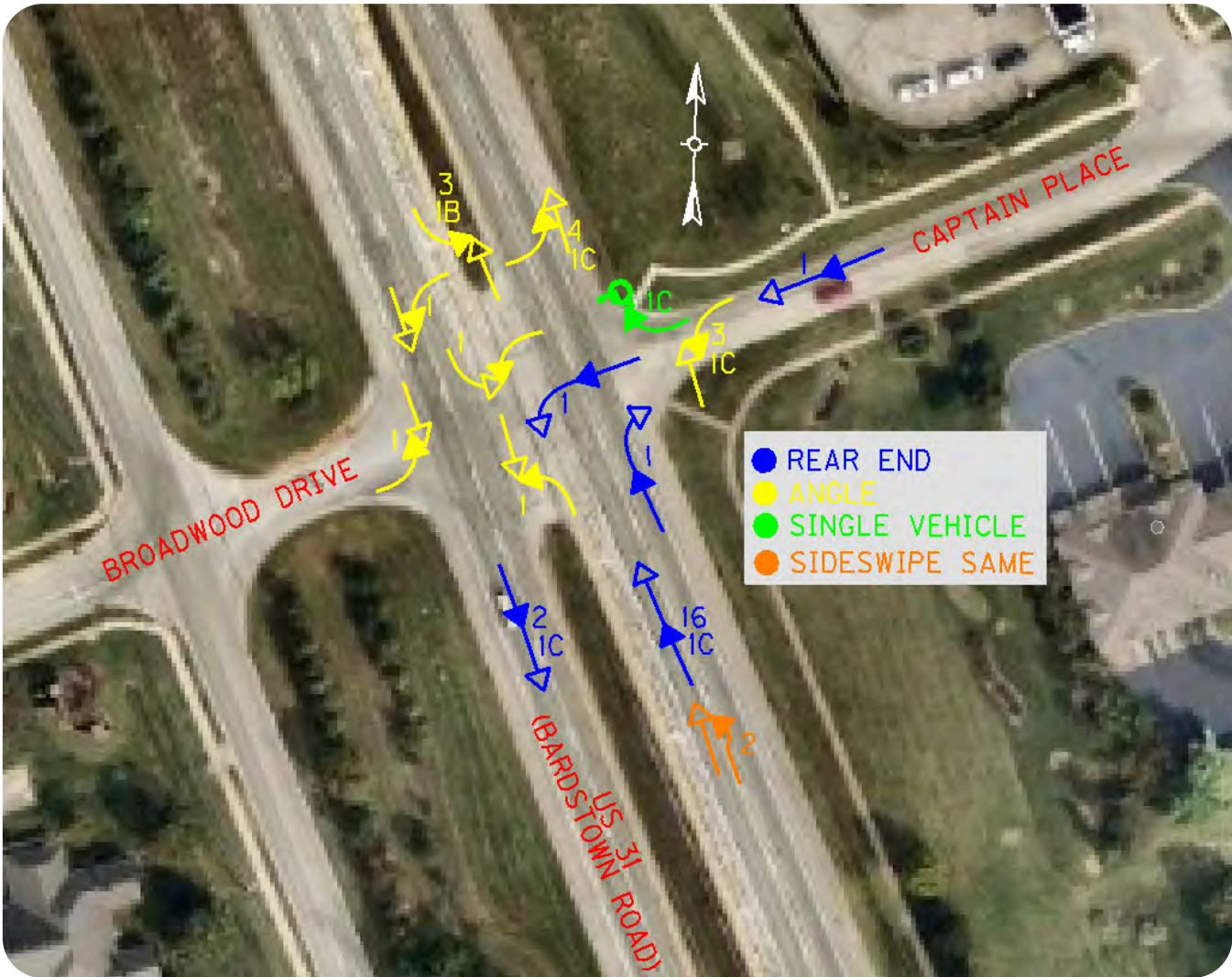
LIGHT CONDITION	CRASHES
DAYLIGHT	22
DARK-HWY-LIGHT/ON	2
DARK (UNKNOWN)	2
DUSK	1
DAWN	1
DARK-HWY LIGHTING/OFF	1

MANNER OF COLLISION	CRASHES	INJURY
REAR END	18	5
ANGLE	6	2
SIDESWIPE-SAME DIRECTION	4	0
SINGLE VEHICLE	1	0

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	0
6:00 AM - 9:00 AM	9
9:00 AM - 11:00 AM	1
11:00 AM - 1:00 PM	6
1:00 PM - 4:00 PM	6
4:00 PM - 6:00 PM	2
6:00 PM - 9:00 PM	5
9:00 PM - 12:00 AM	0

DIRECTIONAL ANALYSIS	CRASHES
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	6
OTHER INTERSECTION COLLISIONS	4
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	3
SIDESWIPE (COLLISION)-SAME DIRECTION	3
OTHER ROADWAY OR MID-BLOCK COLLISION	3
REAR END - OTHER:	2
SIDESWIPE-SAME DIRECTION	1
1 VEHICLE ENTERING/LEAVING ENTRANCE	1
ANGLE COLLISION - OTHER	1
REAR END IN TRAFFIC ONE VEHICLE STOPPED	1
HEAD-ON COLLISION	1
OCCUPANT FELL FROM MOVING VEHICLE	1

Captain Place & Broadwood Drive



CRASH ANALYSIS - US 31E & CAPTAIN PL/BROADWOOD DR

Crash Range:
January 1, 2015 - December 31, 2019

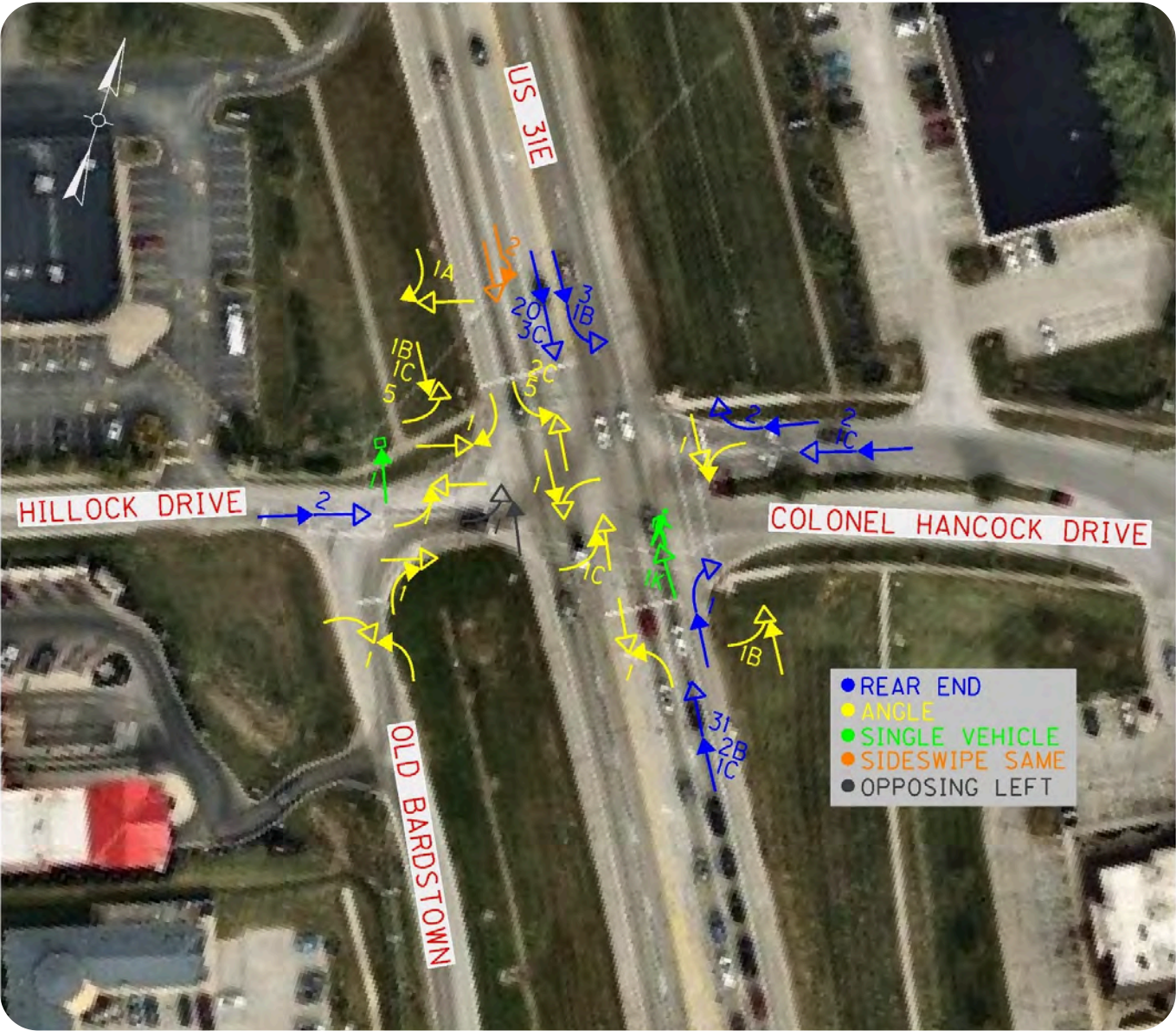
CRASH TYPE		YEAR		ROAD CONDITION		LIGHT CONDITION	
CRASHES		CRASHES		CRASHES		CRASHES	
FATAL	0	2015	9	DRY	30	DAYLIGHT	24
INJURY	6	2016	7	WET	8	DARK-HWY-LIGHT/ON	6
POD	33	2017	5	SNOW/SLUSH	1	DAWN	4
TOTAL	39	2018	6			DARK-HWY LIGHTING/OFF	2
		2019	10			DARK (UNKNOWN)	2
						DUSK	1

MANNER OF COLLISION	CRASHES	INJURY
REAR END	22	2
ANGLE	14	3
SIDESWIPE-SAME DIRECTION	2	0
SINGLE VEHICLE	1	1

DIRECTIONAL ANALYSIS	CRASHES
BLANK	7
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	7
OTHER INTERSECTION COLLISIONS	6
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	3
SIDESWIPE (COLLISION) – SAME DIRECTION	2
OTHER ROADWAY OR MID-BLOCK COLLISION	2
REAR END - ONE VEHICLE TURNING LEFT	2
OPPOSING LEFT TURN	1
REAR END IN TRAFFIC ONE VEHICLE STOPPED	1
COLLISION WITH PEDESTRIAN NON-INTERSECTION	1
VEHICLE BACKING IN INTERSECTION	1

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	3
6:00 AM - 9:00 AM	12
9:00 AM - 11:00 AM	3
11:00 AM - 1:00 PM	4
1:00 PM - 4:00 PM	10
4:00 PM - 6:00 PM	2
6:00 PM - 9:00 PM	4
9:00 PM - 12:00 AM	1

Colonel Hancock Drive & Hillock Drive



CRASH ANALYSIS - US 31E & COL HANCOCK DR/HILLOCK DR

Crash Range:
January 1, 2015 - December 31, 2019

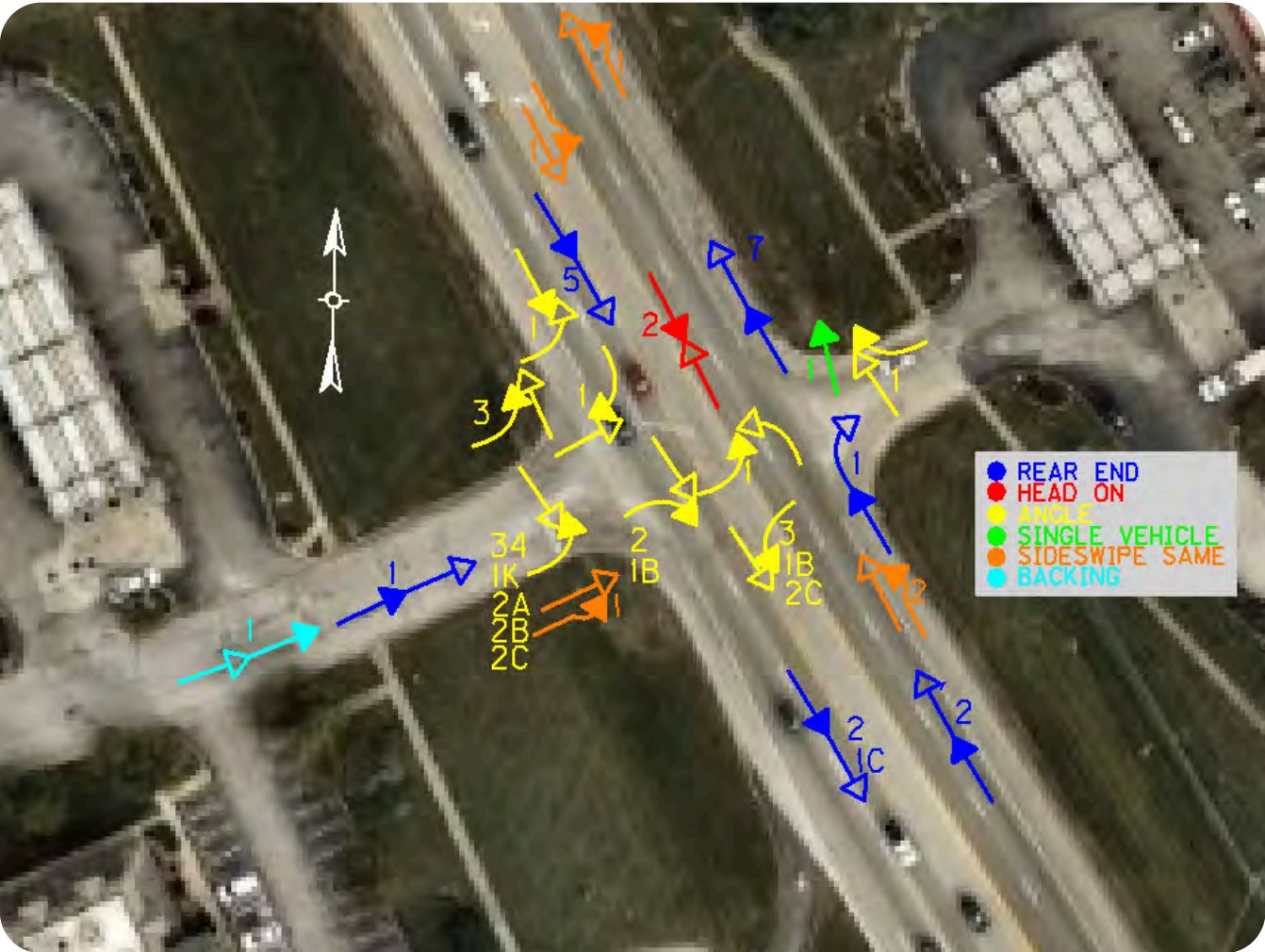
CRASH TYPE		YEAR		ROAD CONDITION		LIGHT CONDITION	
CRASHES		CRASHES		CRASHES		CRASHES	
FATAL	1	2015	19	DRY	67	DAYLIGHT	60
INJURY	17	2016	17	WET	22	DARK (UNKNOWN)	11
POD	74	2017	18	SNOW/SLUSH	1	DAWN	8
TOTAL	91	2018	15			DARK-HWY LIGHTING/OFF	2
		2019	16			DUSK	1

MANNER OF COLLISION	CRASHES	INJURY
REAR END	64	9
ANGLE	20	7
SIDESWIPE-SAME DIRECTION	2	0
OPPOSING LEFT TURN	1	0
SINGLE VEHICLE	3	1

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	0
6:00 AM - 9:00 AM	27
9:00 AM - 11:00 AM	6
11:00 AM - 1:00 PM	10
1:00 PM - 4:00 PM	14
4:00 PM - 6:00 PM	12
6:00 PM - 9:00 PM	15
9:00 PM - 12:00 AM	6

DIRECTIONAL ANALYSIS	CRASHES
BLANK	18
OTHER INTERSECTION COLLISIONS	13
REAR END – OTHER:	12
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	12
ANGLE COLLISION – OTHER	7
REAR END IN TRAFFIC ONE VEHICLE STOPPED	6
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	6
OTHER ROADWAY OR MID-BLOCK COLLISION	4
OPPOSING LEFT TURN	2
REAR END – ONE VEHICLE STOPPED	2
COLLISION WITH FIXED OBJECT IN INTERSECTION	2
ANGLE COLLISION – BOTH VEHICLES GOING STRAIGHT	1
SIDESWIPE (COLLISION) – SAME DIRECTION	1
COLLISION WITH PEDESTRIAN IN INTERSECTION	1
ANGLE COLLISION – ONE VEHICLE TURNING RIGHT	1
REAR END - ONE VEHICLE TURNING RIGHT	1
REAR END - ONE VEHICLE TURNING LEFT	1

Ichabod Dr & Gas Station



CRASH ANALYSIS - US 31E & ICHABOD DRIVE

Crash Range:
January 1, 2015 - December 31, 2019

KYTC - KTC Analysis:
Potential Savings: \$1,639,201

CRASH TYPE		YEAR		ROAD CONDITION		LIGHT CONDITION	
CRASHES		CRASHES		CRASHES		CRASHES	
FATAL	1	2015	12	DRY	57	DAYLIGHT	34
INJURY	13	2016	12	WET	15	DARK-HWY LIGHTING/OFF	12
POD	60	2017	12	SNOW/SLUSH	1	DARK-HWY-LIGHT/ON	10
TOTAL	74	2018	17	STANDING WATER	1	DUSK	3
		2019	13			DAWN	3
						DARK (UNKNOWN)	1

MANNER OF COLLISION	CRASHES	INJURY
ANGLE	43	11
REAR END	19	1
SIDESWIPE-SAME DIRECTION	5	0
OPPOSING LEFT TURN	3	2
HEAD ON	2	0
SINGLE VEHICLE	1	0
BACKING	1	0

DIRECTIONAL ANALYSIS	CRASHES
BLANK	13
ANGLE COLLISION – OTHER	12
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	10
1 VEHICLE ENTERING/LEAVING ENTRANCE	9
OPPOSING LEFT TURN	4
SIDESWIPE-SAME DIRECTION	4
REAR END – OTHER:	2
OTHER ROADWAY OR MID-BLOCK COLLISION	2
OPPOSITE DIRECTION-BOTH VEHICLES GOING STRAIGHT	1
REAR END – ONE VEHICLE STOPPED	1
HEAD-ON COLLISION	1
REAR END - ONE VEHICLE TURNING RIGHT	1
VEHICLE BACKING NONINTERSECTION	1
COLLISION WITH FIXED OBJECT IN INTERSECTION	1
COLLISION WITH FIXED OBJECT NON INTERSECTION	1
COLLISION WITH ANIMAL NON INTERSECTION	1

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	6
6:00 AM - 9:00 AM	11
9:00 AM - 11:00 AM	3
11:00 AM - 1:00 PM	4
1:00 PM - 4:00 PM	6
4:00 PM - 6:00 PM	14
6:00 PM - 9:00 PM	17
9:00 PM - 12:00 AM	13

Major Lane (Kohls Entrance)



CRASH ANALYSIS - US 31E & MAJOR LANE (KOHLS ENTRANCE)

Crash Range:
January 1, 2015 - December 31, 2020

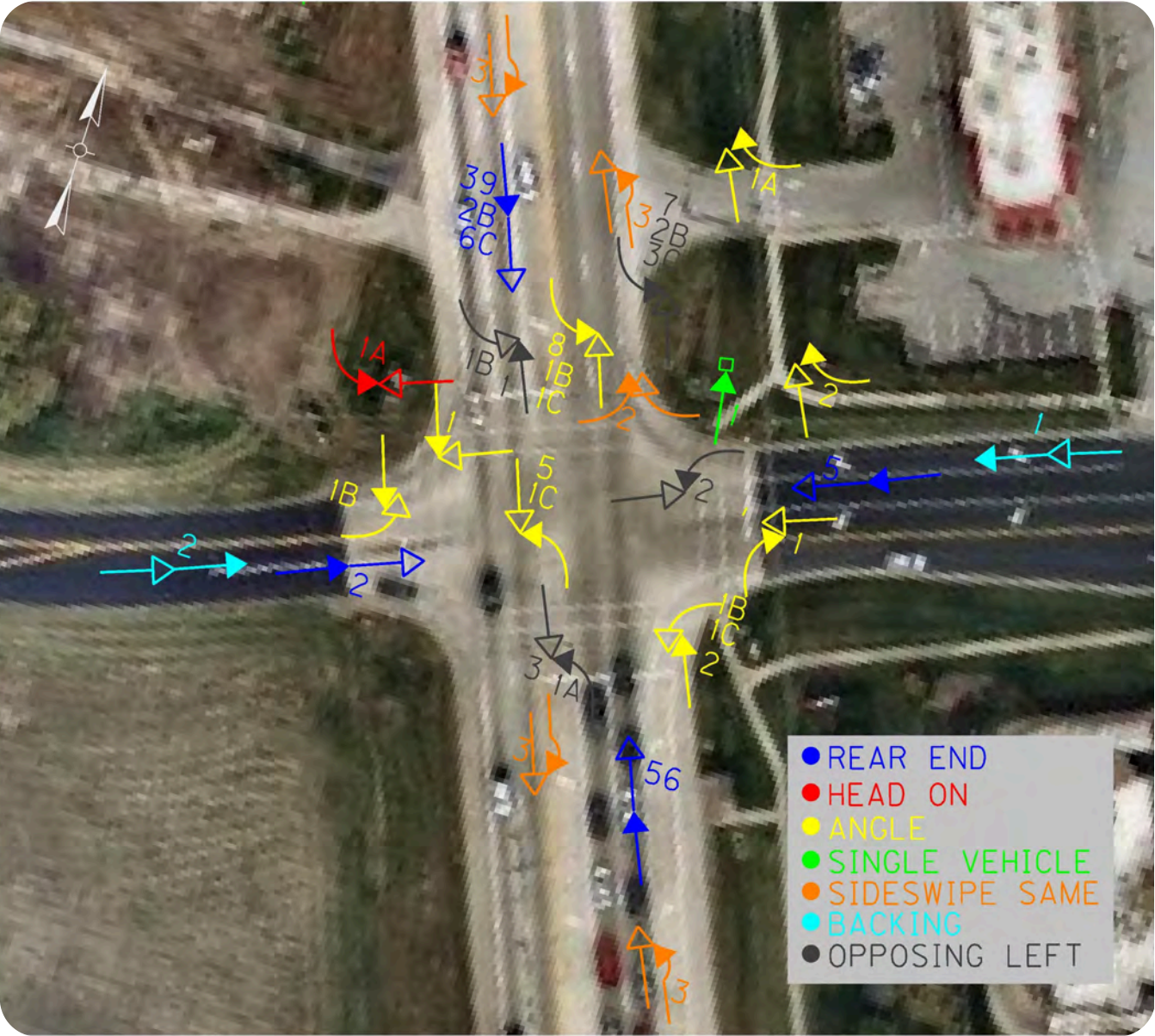
CRASH TYPE		YEAR		ROAD CONDITION		LIGHT CONDITION	
CRASHES		CRASHES		CRASHES		CRASHES	
FATAL	0	2015	2	DRY	15	DAYLIGHT	14
INJURY	2	2016	3	WET	2	DUSK	2
POD	16	2017	4	STANDING WATER	1	DAWN	2
TOTAL	18	2018	2				
		2019	1				
		2020	1				

MANNER OF COLLISION			DIRECTIONAL ANALYSIS	
			CRASHES	INJURY
REAR END			12	1
ANGLE			4	0
OPPOSING LEFT TURN			2	1

DIRECTIONAL ANALYSIS		CRASHES
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING		5
OTHER ROADWAY OR MID-BLOCK COLLISION		5
BLANK		3
1 VEHICLE ENTERING/LEAVING ENTRANCE		3
REAR END IN TRAFFIC ONE VEHICLE STOPPED		2

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	0
6:00 AM - 9:00 AM	1
9:00 AM - 11:00 AM	2
11:00 AM - 1:00 PM	6
1:00 PM - 4:00 PM	2
4:00 PM - 6:00 PM	3
6:00 PM - 9:00 PM	2
9:00 PM - 12:00 AM	1

Brentlinger Lane & Cedar Creek Road



CRASH ANALYSIS - US 31E & BRENTLINGER LN/CEDAR CREEK RD

Crash Range:
January 1, 2015 - December 31, 2019

KYTC - KTC Analysis:
Potential Savings: \$1,676,962

CRASH TYPE	CRASHES
FATAL	0
INJURY	24
POD	127
TOTAL	151

YEAR	CRASHES
2015	28
2016	28
2017	26
2018	23
2019	39

ROAD CONDITION	CRASHES
DRY	116
WET	33
STANDING WATER	1
ICE	1

LIGHT CONDITION	CRASHES
DAYLIGHT	111
DARK-HWY-LIGHT/ON	20
DARK-HWY LIGHTING/OFF	11
DUSK	4
DAWN	2
DARK (UNKNOWN)	2
OTHER	1

MANNER OF COLLISION	CRASHES	INJURY
REAR END	97	8
ANGLE	22	7
SIDESWIPE-SAME DIRECTION	14	0
OPPOSING LEFT TURN	12	7
HEAD ON	1	1
SINGLE VEHICLE	2	1
BACKING	3	0

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	3
6:00 AM - 9:00 AM	21
9:00 AM - 11:00 AM	9
11:00 AM - 1:00 PM	21
1:00 PM - 4:00 PM	31
4:00 PM - 6:00 PM	41
6:00 PM - 9:00 PM	16
9:00 PM - 12:00 AM	9

DIRECTIONAL ANALYSIS	CRASHES
BLANK	24
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	24
REAR END – OTHER:	23
OTHER INTERSECTION COLLISIONS	21
OPPOSING LEFT TURN	10
1 VEHICLE ENTERING/LEAVING ENTRANCE	9
OTHER ROADWAY OR MID-BLOCK COLLISION	8
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	5
SIDESWIPE (COLLISION) – SAME DIRECTION	5
SIDESWIPE-SAME DIRECTION	5
REAR END IN TRAFFIC ONE VEHICLE STOPPED	4
ANGLE COLLISION – BOTH VEHICLES GOING STRAIGHT	3
REAR END – ONE VEHICLE STOPPED	3
VEHICLE BACKING IN INTERSECTION	2
ANGLE COLLISION – OTHER	1
HEAD-ON COLLISION	1
ANGLE COLLISION – ONE VEHICLE TURNING RIGHT	1
VEHICLE BACKING NON INTERSECTION	1
NON-COLLISION OBJECTCOLLISION	1

Southpointe Blvd



CRASH ANALYSIS - US 31E & SOUTHPOINTE BLVD

Crash Range:
January 1, 2015 - December 31, 2019

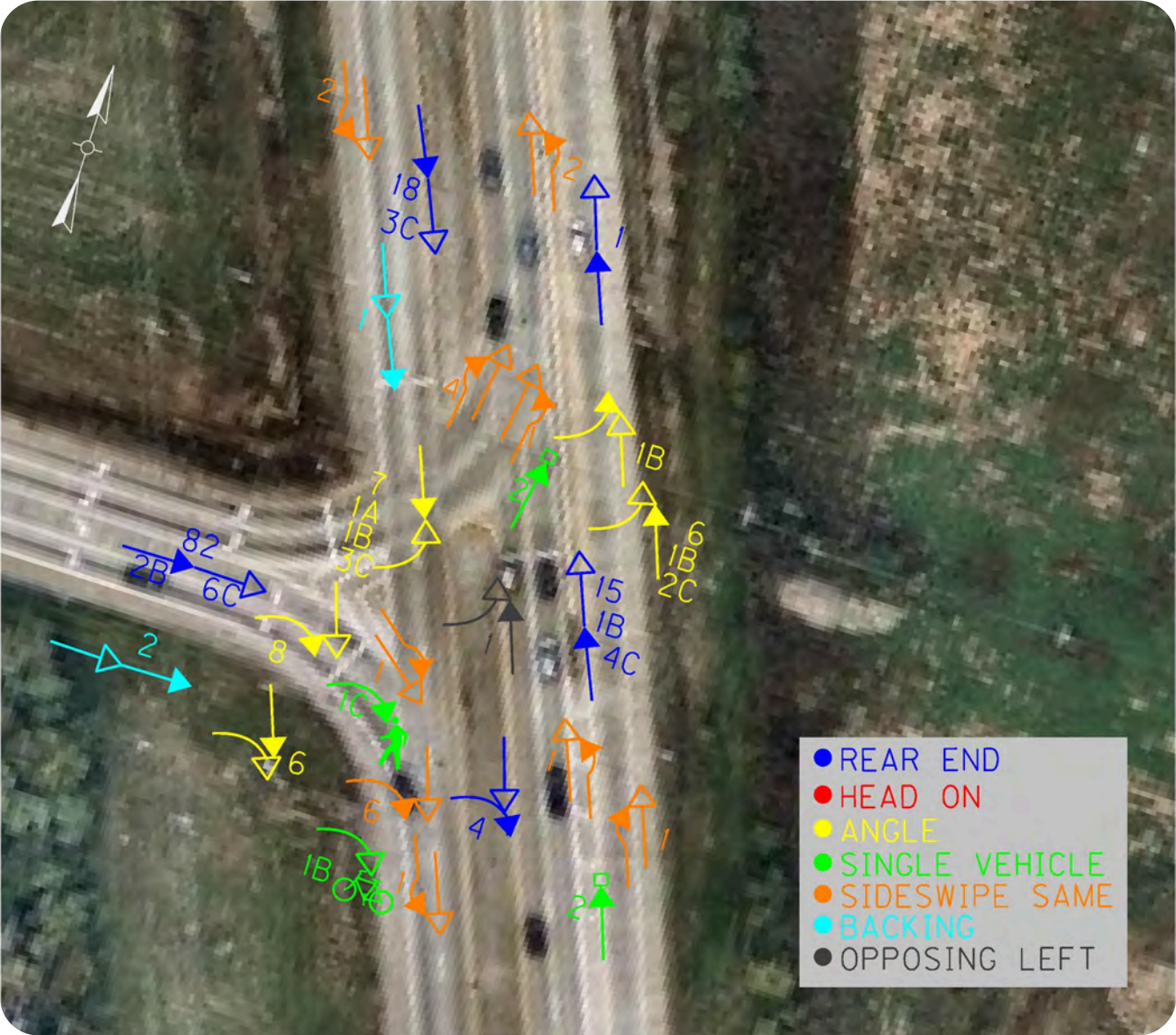
CRASH TYPE		YEAR		ROAD CONDITION		LIGHT CONDITION	
CRASHES		CRASHES		CRASHES		CRASHES	
FATAL	0	2015	3	DRY	19	DAYLIGHT	20
INJURY	4	2016	7	WET	5	DARK-HWY-LIGHT/ON	2
POD	20	2017	4			DARK-HWY LIGHTING/OFF	1
TOTAL	24	2018	9			DARK (UNKNOWN)	1
		2019	1				

MANNER OF COLLISION	CRASHES	INJURY
REAR END	19	2
ANGLE	5	2

DIRECTIONAL ANALYSIS	CRASHES
BLANK	11
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	9
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	3
1 VEHICLE ENTERING/LEAVING ENTRANCE	1

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	0
6:00 AM - 9:00 AM	3
9:00 AM - 11:00 AM	1
11:00 AM - 1:00 PM	1
1:00 PM - 4:00 PM	4
4:00 PM - 6:00 PM	11
6:00 PM - 9:00 PM	3
9:00 PM - 12:00 AM	1

I-265 EB OFF-RAMP



CRASH ANALYSIS - US 31E & I-265 EB OFF-RAMP

Crash Range:
January 1, 2015 - December 31, 2019

KYTC - KTC Analysis:
Potential Savings: \$598,684

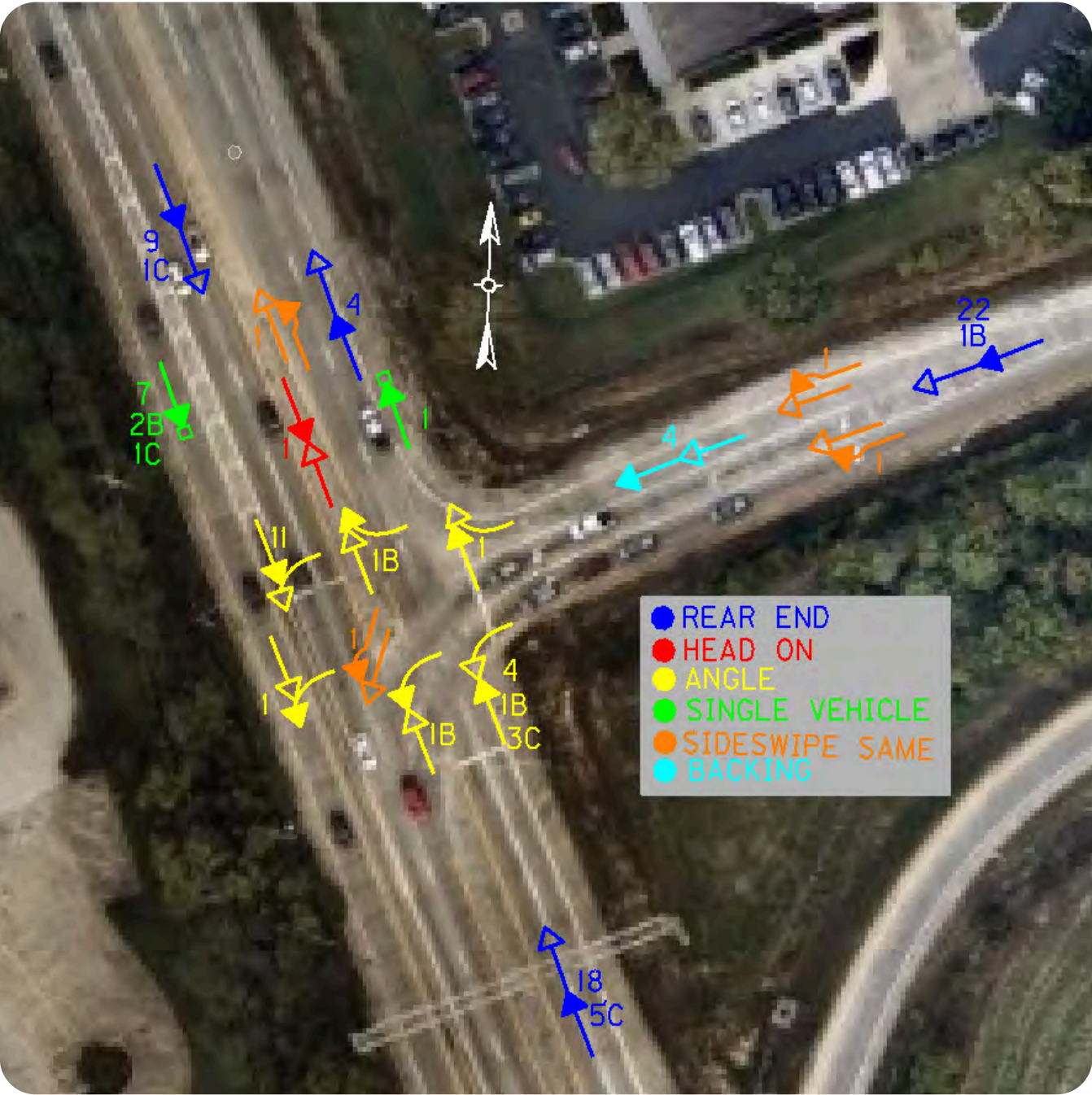
CRASH TYPE CRASHES		YEAR CRASHES		ROAD CONDITION CRASHES		LIGHT CONDITION CRASHES	
FATAL	0	2015	34	DRY	157	DAYLIGHT	156
INJURY	29	2016	40	WET	43	DARK-HWY-LIGHT/ON	25
POD	172	2017	36	ICE	1	DUSK	10
TOTAL	201	2018	34			DARK (UNKNOWN)	6
		2019	41			DARK-HWY LIGHTING/OFF	2
						DAWN	2

MANNER OF COLLISION	CRASHES	INJURY
REAR END	133	16
ANGLE	40	9
SIDESWIPE-SAME DIRECTION	18	1
OPPOSING LEFT TURN	1	0
SINGLE VEHICLE	6	2
BACKING	3	0

DIRECTIONAL ANALYSIS	CRASHES
BLANK	21
REAR END – OTHER:	19
OTHER INTERSECTION COLLISIONS	18
SIDESWIPE (COLLISION) – SAME DIRECTION	14
OTHER RAMP RELATED COLLISIONS NO LISTED ABOVE	13
REAR END - ON RAMP	11
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	11
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	10
ANGLE COLLISION – OTHER	7
REAR END IN TRAFFIC ONE VEHICLE STOPPED	7
REAR END - ONE VEHICLE TURNING RIGHT	5
REAR END – ONE VEHICLE STOPPED	4
1 VEHICLE ENTERING/LEAVING ENTRANCE	3
OTHER ROADWAY OR MID-BLOCK COLLISION	3
ANGLE COLLISION – ONE VEHICLE TURNING RIGHT	2
OTHER COLLISION ON SHOULDER	2
COLLISION WITH PEDESTRIAN IN INTERSECTION	1
REAR END - BOTH VEHICLES GOING STRAIGHT	1
ANGLE COLLISION – BOTH VEHICLES GOING STRAIGHT	1
VEHICLE BACKING IN INTERSECTION	1
OPPOSING LEFT TURN	1
VEHICLE BACKING NON INTERSECTION	1

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	3
6:00 AM - 9:00 AM	15
9:00 AM - 11:00 AM	16
11:00 AM - 1:00 PM	33
1:00 PM - 4:00 PM	50
4:00 PM - 6:00 PM	35
6:00 PM - 9:00 PM	36
9:00 PM - 12:00 AM	13

I-265 WB OFF-RAMP



CRASH ANALYSIS - US 31E & I-265 WB OFF-RAMP

Crash Range:
January 1, 2015 - December 31, 2019

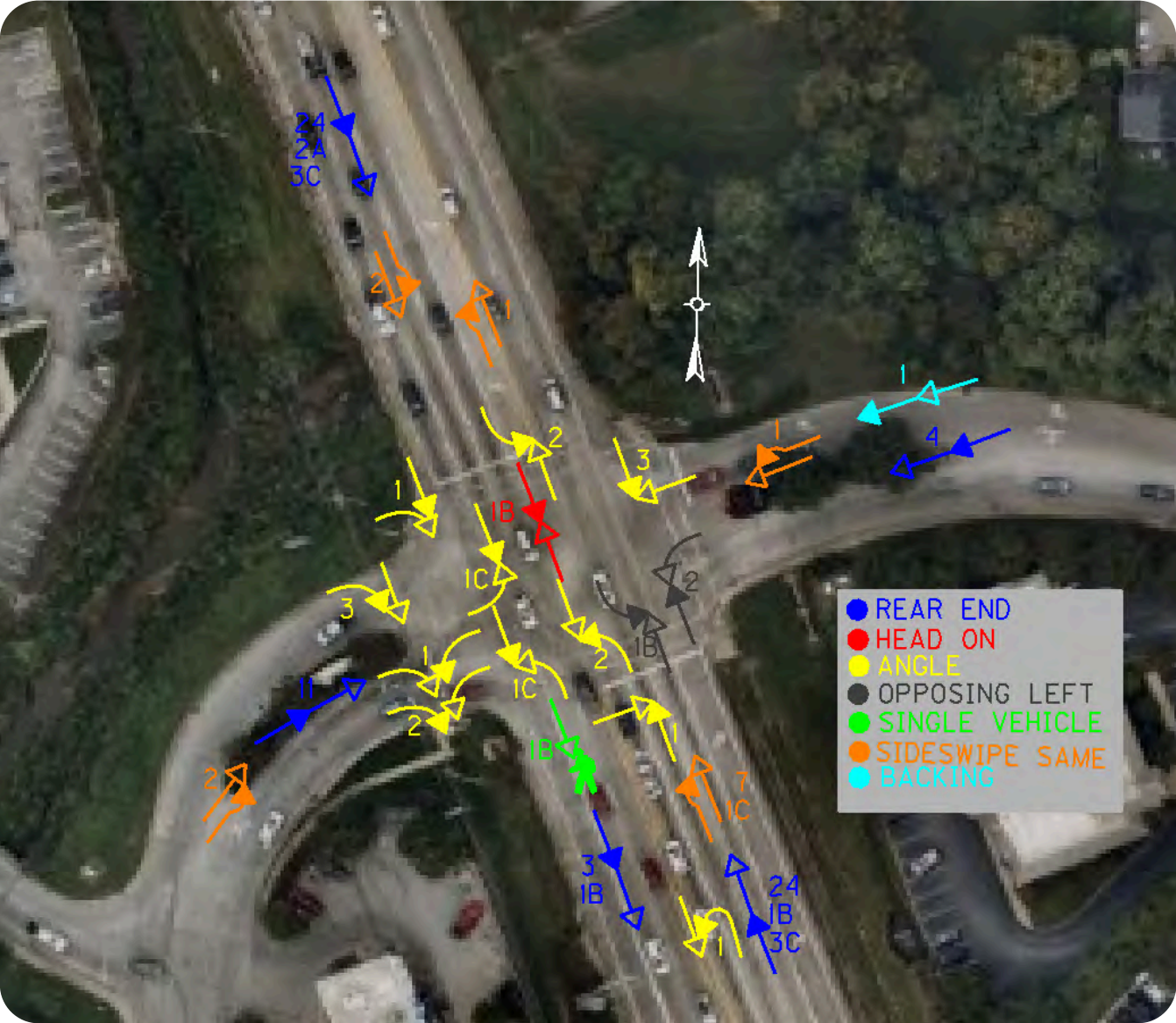
CRASH TYPE		YEAR		ROAD CONDITION		LIGHT CONDITION	
CRASHES		CRASHES		CRASHES		CRASHES	
FATAL	0	2015	17	DRY	73	DAYLIGHT	79
INJURY	16	2016	19	WET	31	DARK-HWY-LIGHT/ON	14
POD	89	2017	22	SNOW/SLUCH	1	DARK-HWY LIGHTING/OFF	2
TOTAL	105	2018	25			DUSK	6
		2019	20			DAWN	4
						DARK (UNKNOWN)	2

MANNER OF COLLISION	CRASHES	INJURY
REAR END	60	7
ANGLE	25	6
SINGLE VEHICLE	11	3
SIDESWIPE-SAME DIRECTION	4	0
BACKING	4	0
HEAD ON	1	0

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	5
6:00 AM - 9:00 AM	6
9:00 AM - 11:00 AM	10
11:00 AM - 1:00 PM	8
1:00 PM - 4:00 PM	28
4:00 PM - 6:00 PM	23
6:00 PM - 9:00 PM	19
9:00 PM - 12:00 AM	5

DIRECTIONAL ANALYSIS	CRASHES
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	22
BLANK	15
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	13
REAR END – OTHER:	8
OTHER INTERSECTION COLLISIONS	8
REAR END – ONE VEHICLE STOPPED	5
COLLISION WITH FIXED OBJECT NON-INTERSECTION	5
SIDESWIPE (COLLISION) – SAME DIRECTION	5
OTHER RAMP RELATED COLLISION	4
COLLISION WITH FIXED OBJECT IN INTERSECTION	4
MULTIPLR VEHICLE COLLISION ON RAMP	3
ANGLE COLLISION – OTHER	2
REAR END IN TRAFFIC ONE VEHICLE STOPPED	2
REAR END - ON RAMP	2
OPPOSING DIRECTION-BOTH VEHICLES GOING STRAIGHT	2
ANGLE COLLISION – BOTH VEHICLES GOING STRAIGHT	1
1 VEHICLE ENTERING/LEAVING ENTRANCE	1
OTHER ROADWAY OR MID-BLOCK COLLISION	1
REAR END - ONE VEHICLE TURNING RIGHT	1
VEHICLE BACKING NON-INTERSECTION	1

CEDAR SPRINGS BLVD



CRASH ANALYSIS - US 31E & CEDAR SPRINGS BLVD

Crash Range:
January 1, 2015 - December 31, 2019

KYTC - KTC Analysis:
Potential Savings: \$3,676,211

CRASH TYPE	CRASHES
FATAL	0
INJURY	17
POD	107
TOTAL	124

YEAR	CRASHES
2015	27
2016	22
2017	24
2018	23
2019	22

ROAD CONDITION	CRASHES
DRY	91
WET	33

LIGHT CONDITION	CRASHES
DAYLIGHT	##
DARK-HWY-LIGHT/ON	##
DARK-HWY LIGHTING/OFF	##
DUSK	##
DAWN	##
DARK (UNKNOWN)	##
OTHER	##

MANNER OF COLLISION	CRASHES	INJURY
REAR END	79	10
ANGLE	21	3
SIDESWIPE-SAME DIRECTION	16	1
OPPOSING LEFT TURN	4	1
HEAD ON	1	1
SINGLE VEHICLE	1	1
BACKING	1	0
SIDESWIPE-OPPOSITE DIRECTION	1	0

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	6
6:00 AM - 9:00 AM	5
9:00 AM - 11:00 AM	7
11:00 AM - 1:00 PM	20
1:00 PM - 4:00 PM	35
4:00 PM - 6:00 PM	20
6:00 PM - 9:00 PM	17
9:00 PM - 12:00 AM	14

DIRECTIONAL ANALYSIS	CRASHES
BLANK	17
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	16
REAR END – OTHER:	13
OTHER INTERSECTION COLLISIONS	13
REAR END – ONE VEHICLE STOPPED	13
SIDESWIPE (COLLISION) – SAME DIRECTION	9
OTHER ROADWAY OR MID-BLOCK COLLISION	9
ANGLE COLLISION – OTHER	7
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	6
1 VEHICLE ENTERING/LEAVING ENTRANCE	4
ANGLE COLLISION – BOTH VEHICLES GOING STRAIGHT	2
REAR END IN TRAFFIC ONE VEHICLE STOPPED	2
REAR END - ONE VEHICLE TURNING RIGHT	2
REAR END - BOTH VEHICLES GOING STRAIGHT	1
HEAD-ON COLLISION	1
COLLISION WITH PEDESTRIAN IN INTERSECTION	1
1 VEHICLE PARKED POSITION (NOT PARKING LOT/DRIVEWAY)	1
ANGLE COLLISION – ONE VEHICLE TURNING RIGHT	1
SIDESWIPE (COLLISION) - OPPOSITE DIRECTION	1
VEHICLE BACKING IN INTERSECTION	1
COLLISION WITH PARKED VEHICLE	1
MEDIAN CROSS - OVER COLLISION	1

CEDAR LOOK DRIVE



CRASH ANALYSIS - US 31E & CEDAR LOOK DRIVE

Crash Range: January 1, 2015 - December 31, 2019
KYTC - KTC Analysis: Potential Savings: \$3,963,937

CRASH TYPE		CRASHES	
FATAL		0	
INJURY		28	
POD		105	
TOTAL		133	

YEAR	CRASHES
2015	15
2016	23
2017	22
2018	13
2019	13

ROAD CONDITION	CRASHES
DRY	75
WET	20

LIGHT CONDITION	CRASHES
DAYLIGHT	95
DARK-HWY-LIGHT/ON	24
DUSK	3
DAWN	4
DARK-HWY LIGHTING/OFF	1
DARK (UNKNOWN)	6

MANNER OF COLLISION	CRASHES	INJURY
REAR END	75	15
ANGLE	31	9
SIDESWIPE-SAME DIRECTION	12	0
OPPOSING LEFT TURN	9	2
HEAD ON	2	1
SINGLE VEHICLE	2	1
BACKING	1	0
SIDESWIPE-OPPOSITE DIRECTION	1	0

TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	0
6:00 AM - 9:00 AM	6
9:00 AM - 11:00 AM	2
11:00 AM - 1:00 PM	21
1:00 PM - 4:00 PM	27
4:00 PM - 6:00 PM	28
6:00 PM - 9:00 PM	11
9:00 PM - 12:00 AM	0

DIRECTIONAL ANALYSIS	CRASHES
BLANK	23
OTHER INTERSECTION COLLISIONS	14
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	14
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	11
SIDESWIPE (COLLISION) – SAME DIRECTION	11
REAR END – OTHER:	10
REAR END IN TRAFFIC ONE VEHICLE STOPPED	8
ANGLE COLLISION – OTHER	6
REAR END - ONE VEHICLE STOPPED	4
OPPOSING LEFT TURN	4
ANGLE COLLISION – BOTH VEHICLES GOING STRAIGHT	3
1 VEHICLE ENTERING/LEAVING ENTRANCE	3
HEAD-ON COLLISION	2
COLLISION WITH PEDESTRIAN IN INTERSECTION	1
1 VEHICLE PARKED POSITION (NOT PARKING LOT/DRIVEWAY)	1
ANGLE COLLISION – ONE VEHICLE TURNING RIGHT	1
REAR END – ONE VEHICLE TURNING RIGHT	1
VEHICLE BACKING NON INTERSECTION	1
REAR END - ONE VEHICLE TURNING LEFT	1

KY 1065 (BEULAH CHURCH / SEATONVILLE ROAD)



CRASH ANALYSIS - US 31E & KY 1065

Crash Range:
January 1, 2015 - December 31, 2019

KYTC - KTC Analysis:
Potential Savings: \$1,605,919

CRASH TYPE	CRASHES
FATAL	0
INJURY	21
POD	121
TOTAL	142

YEAR	CRASHES
2015	23
2016	25
2017	33
2018	26
2019	22

ROAD CONDITION	CRASHES
DRY	98
WET	43
SNOW/SLUSH	1

LIGHT CONDITION	CRASHES
DAYLIGHT	98
DARK-HWY-LIGHT/ON	21
DARK-HWY LIGHTING/OFF	8
DUSK	9
DAWN	4
DARK (UNKNOWN)	1
OTHER	1

MANNER OF COLLISION	CRASHES	INJURY
REAR END	86	9
ANGLE	27	10
SIDESWIPE-SAME DIRECTION	14	0
OPPOSING LEFT TURN	4	2
HEAD ON	1	1
SINGLE VEHICLE	2	0
SIDESWIPE-OPPPSITE DIRECTION	4	0
REAR TO REAR	4	0

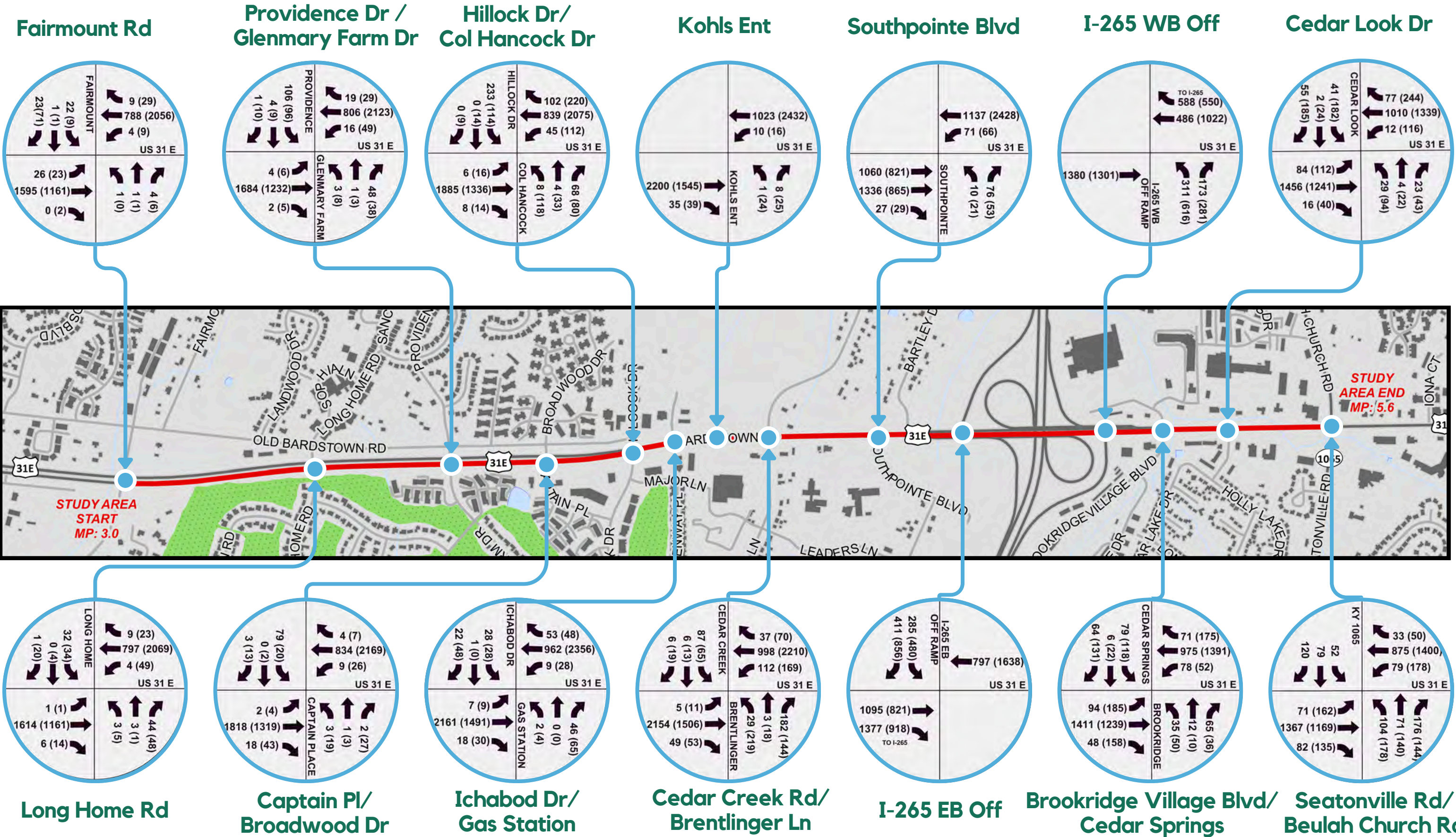
TIME OF CRASH	CRASHES
12:00 AM - 6:00 AM	3
6:00 AM - 9:00 AM	7
9:00 AM - 11:00 AM	12
11:00 AM - 1:00 PM	18
1:00 PM - 4:00 PM	32
4:00 PM - 6:00 PM	29
6:00 PM - 9:00 PM	30
9:00 PM - 12:00 AM	11

DIRECTIONAL ANALYSIS	CRASHES
REAR END IN TRAFFIC LANES BOTH VEHICLES MOVING	20
REAR END – OTHER:	19
BLANK	18
OTHER INTERSECTION COLLISIONS	16
ANGLE COLLISION – OTHER	15
SIDESWIPE (COLLISION) – SAME DIRECTION	12
OTHER ROADWAY OR MID-BLOCK COLLISION	11
REAR END IN TRAFFIC ONE VEHICLE STOPPED	10
1 VEHICLE ENTERING/LEAVING ENTRANCE	8
ANGLE COLLISION - ONE VEHICLE TURNING LEFT	3
OPPOSING LEFT TURN	2
OPPOSITE DIRECTION-BOTH VEHICLES GOING STRAIGHT	2
REAR END - BOTH VEHICLES GOING STRAIGHT	2
COLLISION IN PARKING LOT	1
REAR END – ONE VEHICLE TURNING LEFT	1
COLLISION WITH BICYCLE IN INTERSECTION	1
SIDESWIPE (COLLISION) - OPPOSITE DIRECTION	1

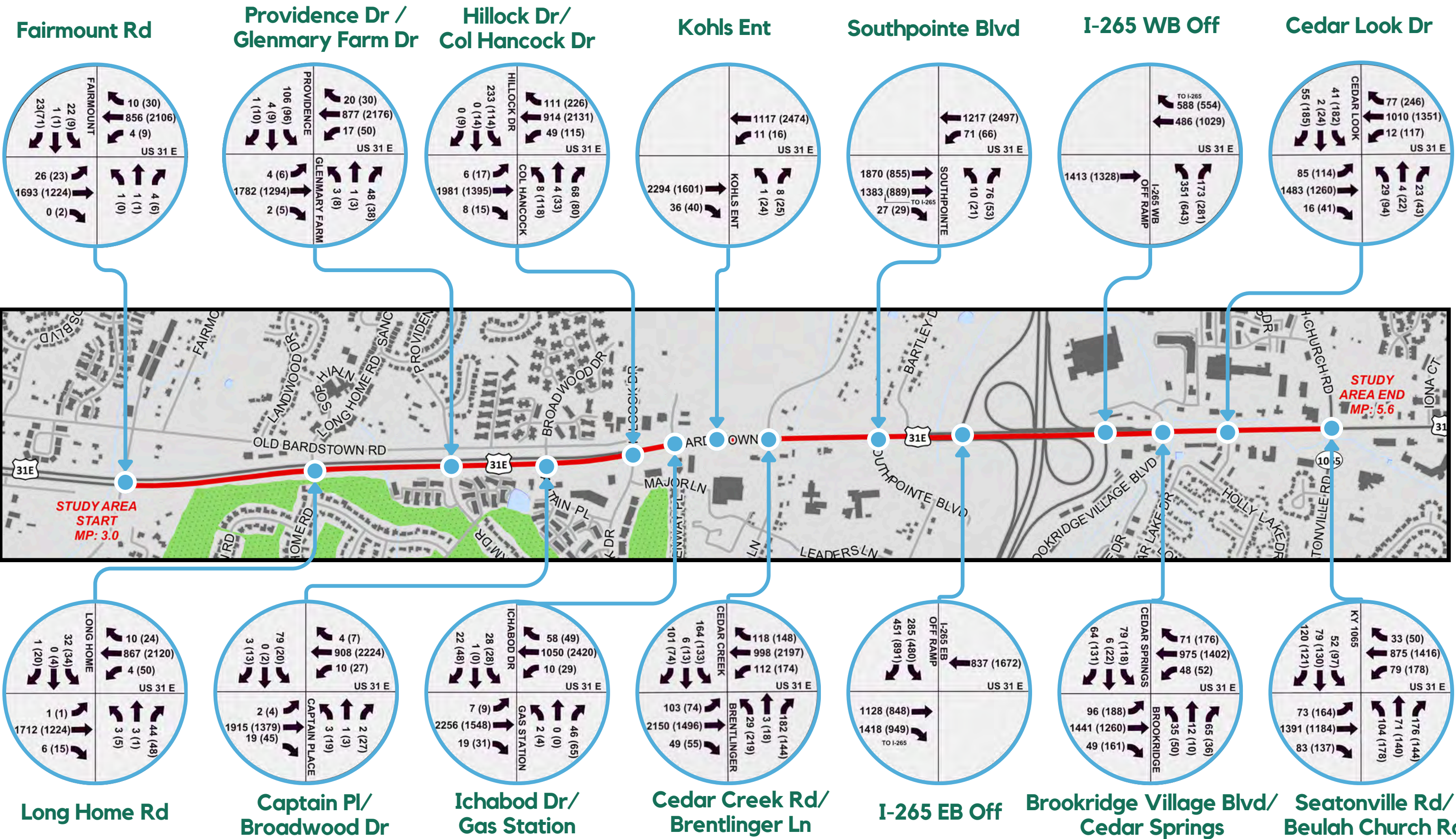
Appendix B

Traffic Analysis

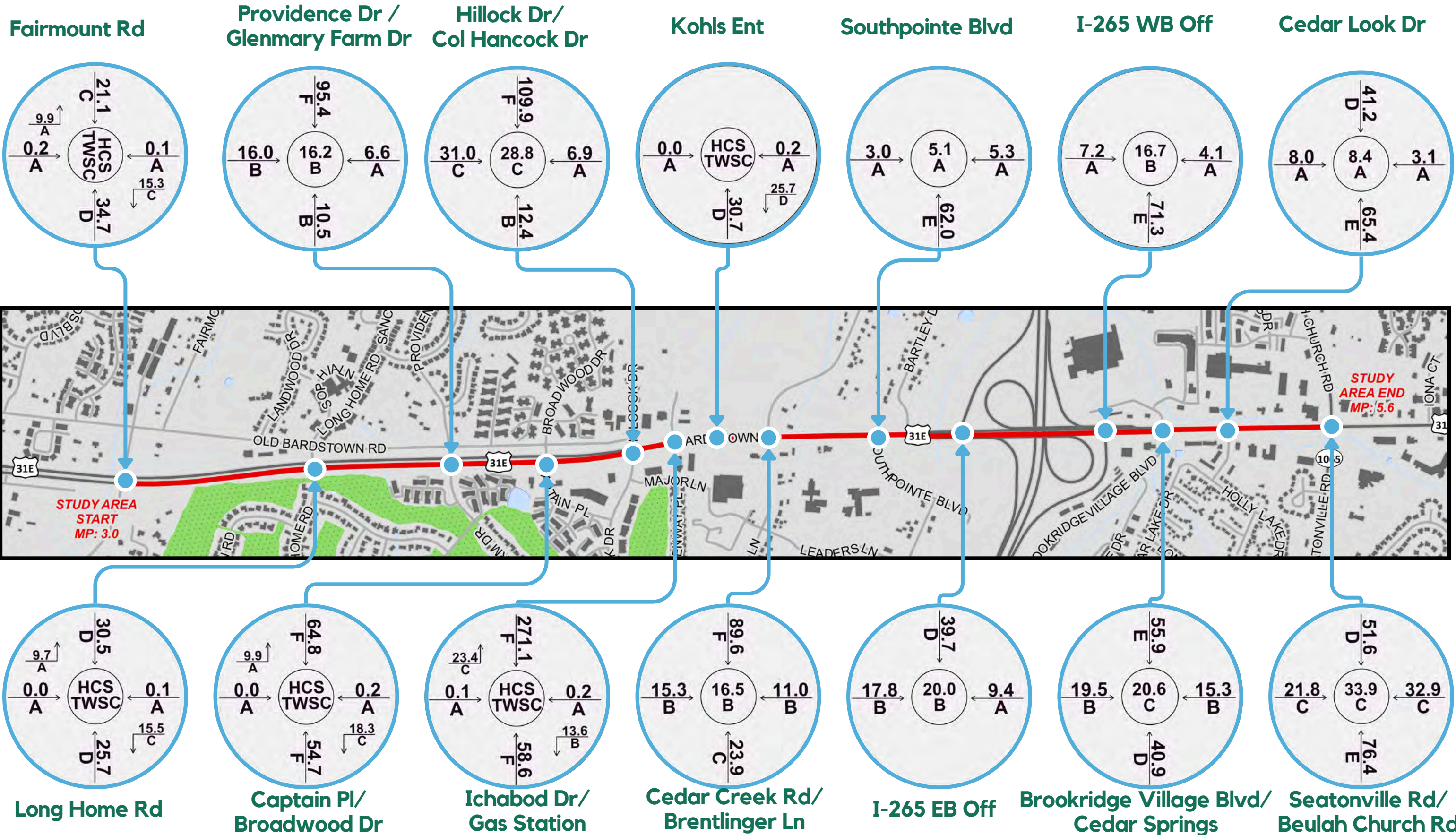
2022 Traffic Volumes -- AM (PM) -- Existing Conditions (Traffic Counts)



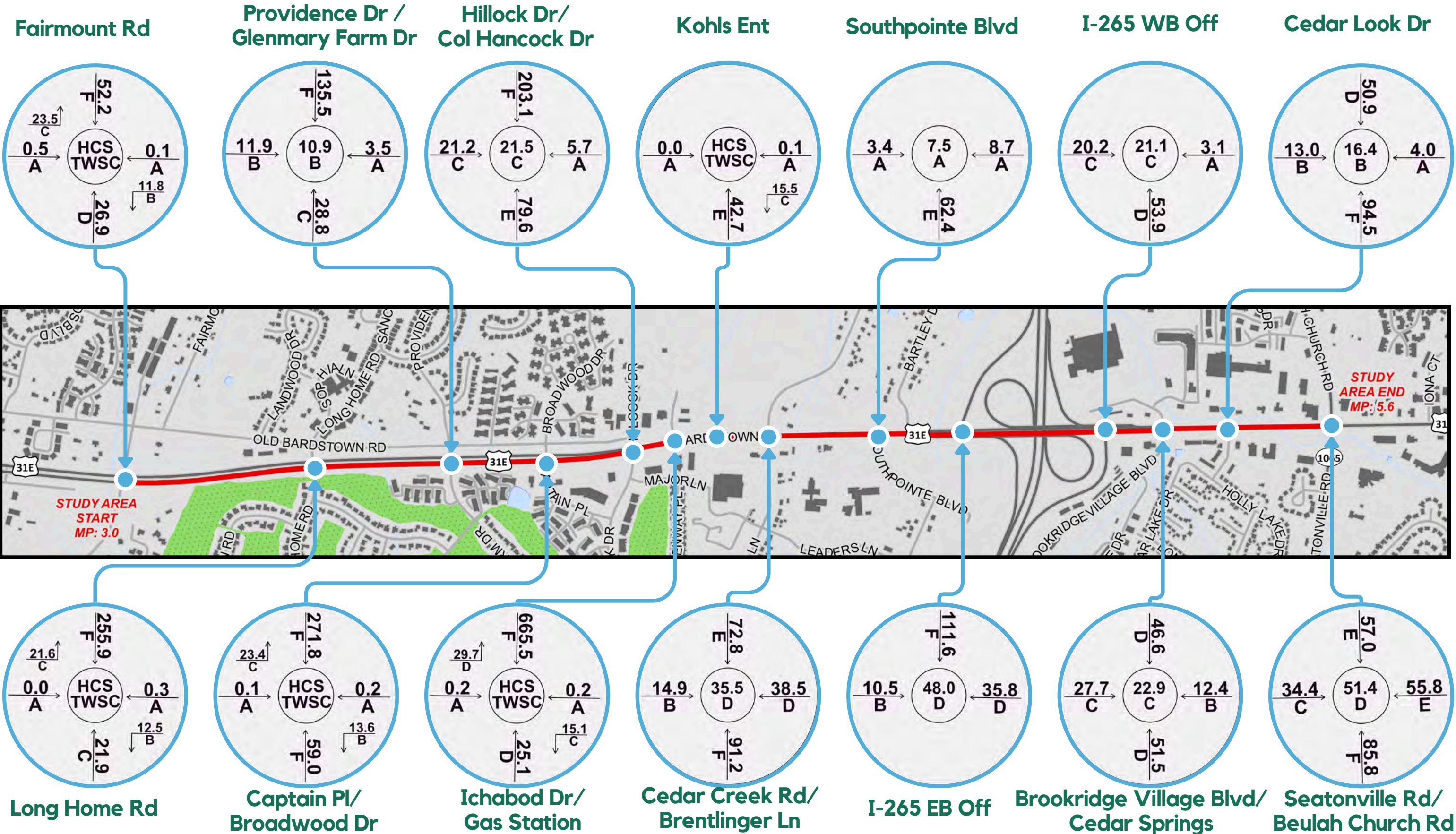
2022 Traffic Volumes -- AM (PM) -- Study Conditions (Development)



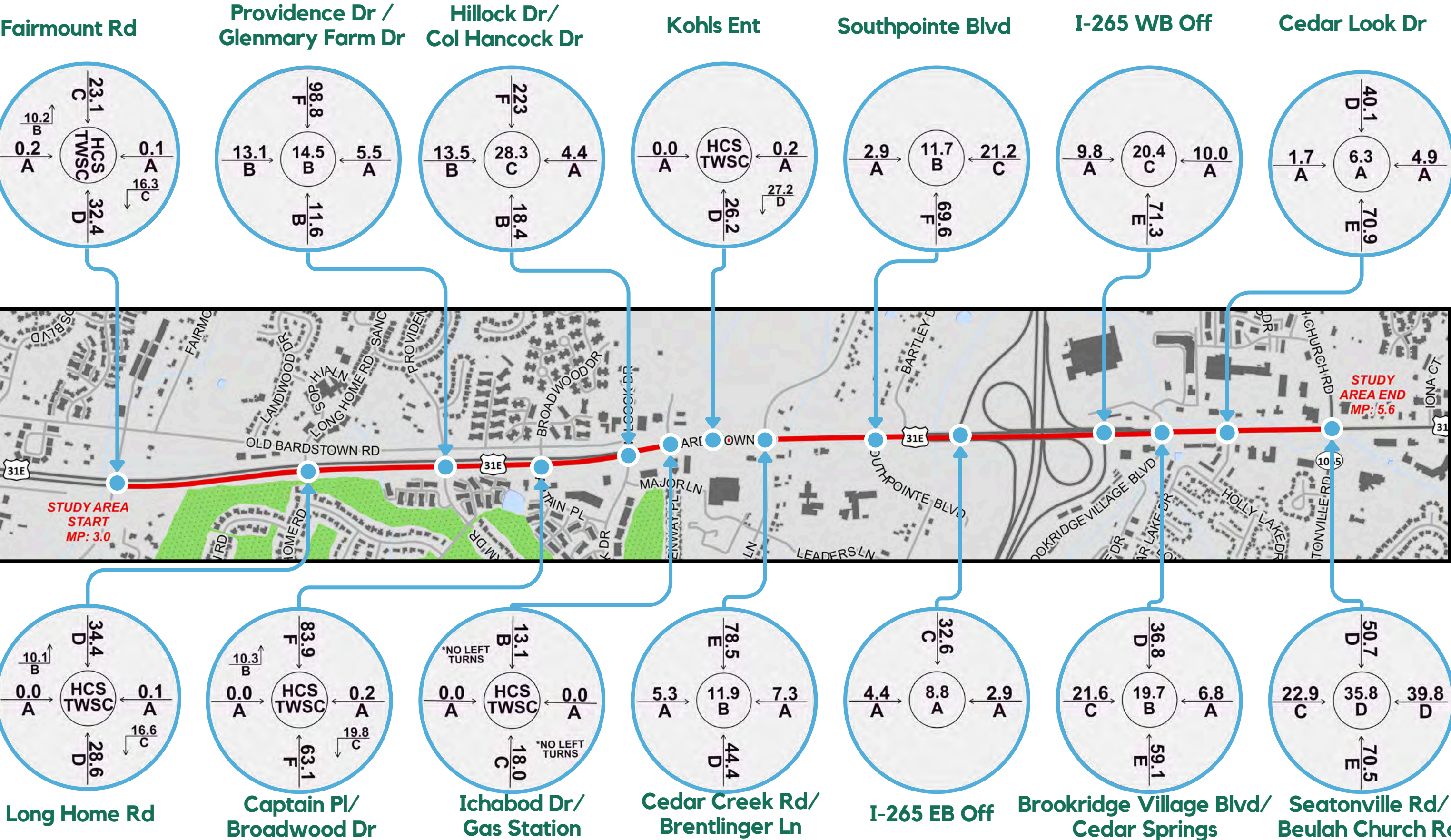
Existing Conditions -- Level of Service AM (Delay - sec/veh)



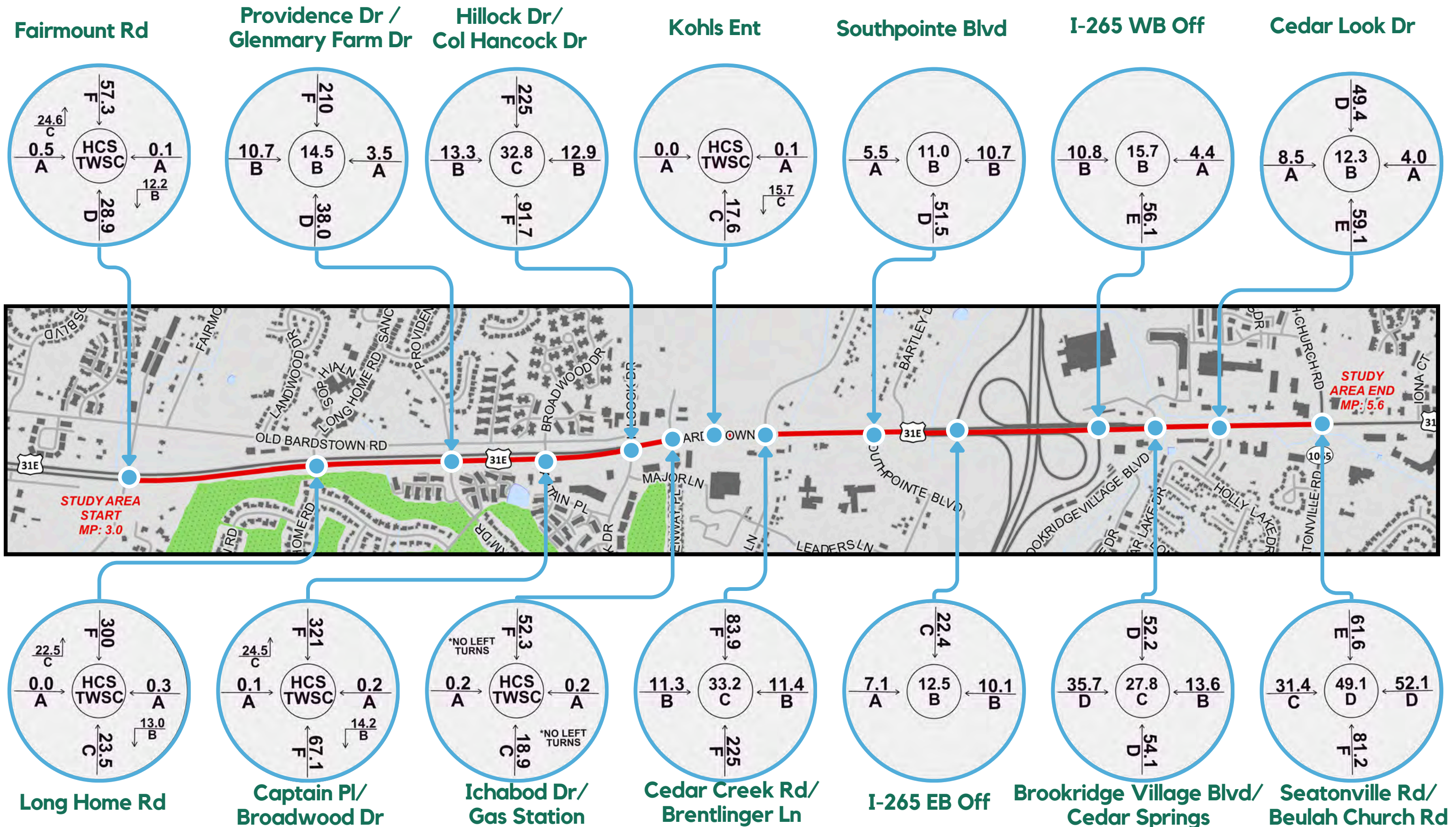
Existing Conditions -- Level of Service PM (Delay - sec/veh)



Alternative 1 -- Level of Service AM (Delay - sec/veh)



Alternative 1 -- Level of Service PM (Delay - sec/veh)



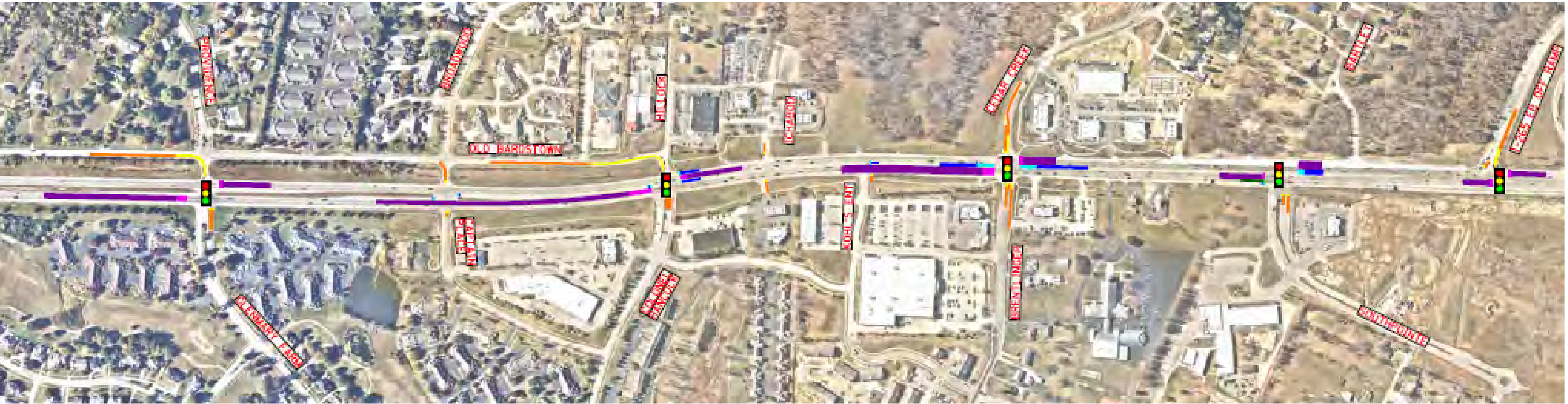
Appendix C

Queue Analysis

Existing Conditions - Vissim Queue: AM Peak



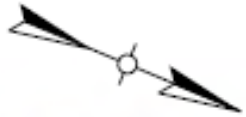
Proposed Conditions - Vissim Queue: AM Peak



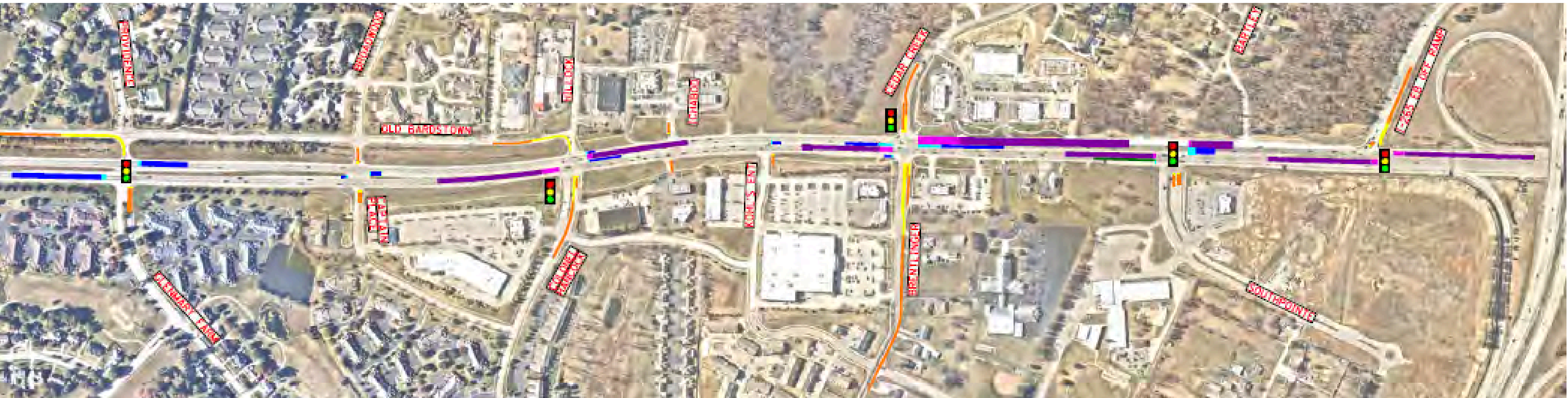
Existing Conditions - Vissim Queue: PM Peak



- | | | | |
|--|-----------------------------|--|----------------------------------|
| | US31E THRU - AVERAGE QUEUE | | SIDE STREET - AVERAGE QUEUE |
| | US31E THRU - MAXIMUM QUEUE | | SIDE STREET - MAXIMUM QUEUE |
| | US31E TURNS - AVERAGE QUEUE | | TO I-265 ON RAMP - AVERAGE QUEUE |
| | US31E TURNS - MAXIMUM QUEUE | | TO I-265 ON RAMP - MAXIMUM QUEUE |



Proposed Conditions - Vissim Queue: PM Peak



Existing Conditions - Vissim Queue: US 31E @ Fairmount Road

AM Peak



PM Peak



Existing Conditions - Vissim Queue: US 31E @ Long Home Road
AM Peak



PM Peak



Existing Conditions - Vissim Queue: US 31E @ Glenmary Farm Drive AM Peak



PM Peak



Existing Conditions - Vissim Queue: US 31E @ Captain Place
AM Peak



PM Peak



Existing Conditions - Vissim Queue: US 31E @ Hillock Drive / Colonel Hancock Drive
 AM Peak PM Peak



Existing Conditions - Vissim Queue: US 31E @ Ichabod Drive
AM Peak



PM Peak



Existing Conditions - Vissim Queue: US 31E @ Major Lane (Kohls Entrance)
AM Peak



PM Peak



Existing Conditions - Vissim Queue: US 31E @ Brentlinger Lane / Cedar Creek Road

AM Peak

PM Peak



Existing Conditions - Vissim Queue: US 31E @ Southpointe Blvd.
AM Peak



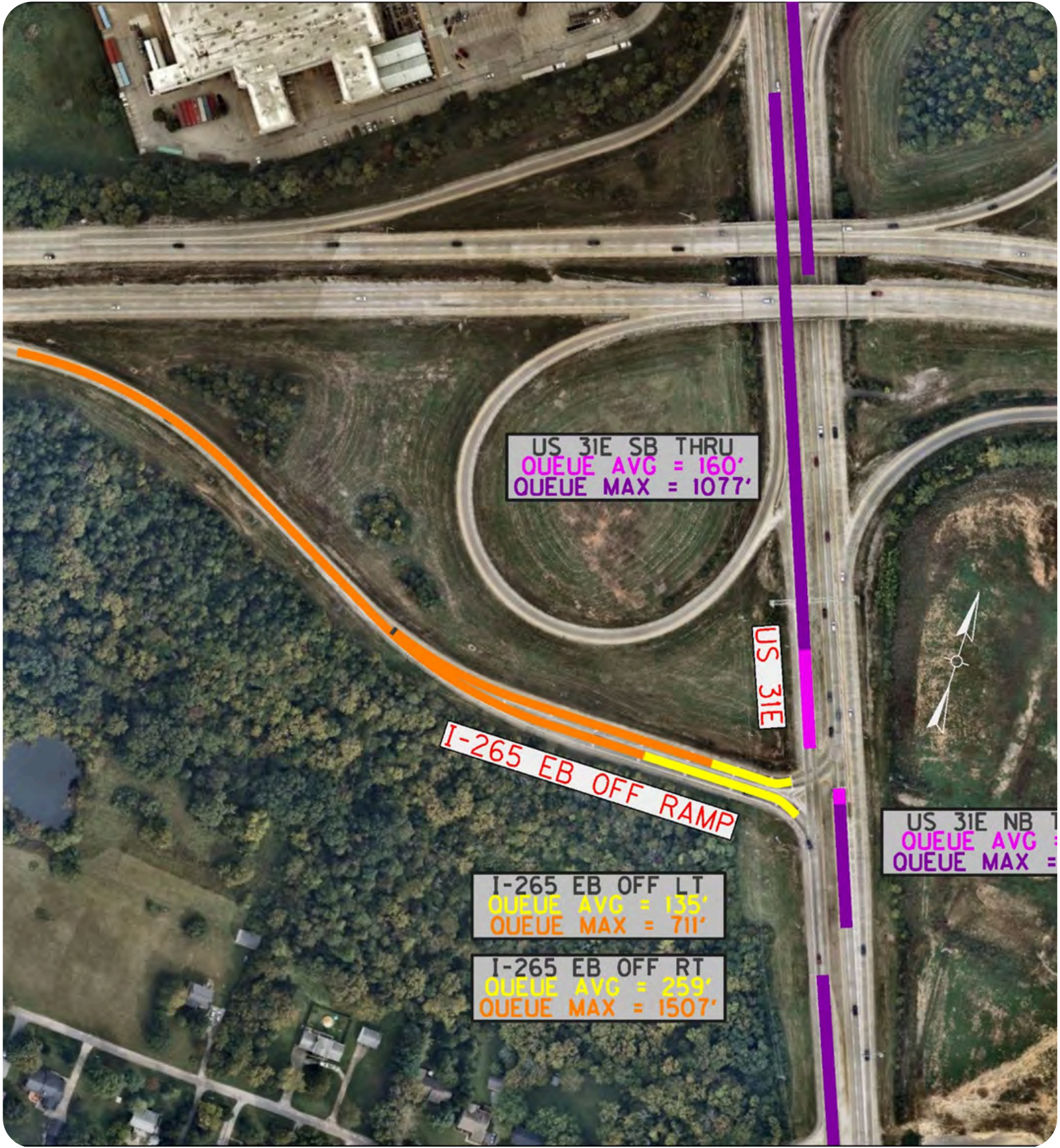
PM Peak



Existing Conditions - Vissim Queue: US 31E @ I-265 EB Off-Ramp
AM Peak



PM Peak



Existing Conditions - Vissim Queue: US 31E @ I-265 WB Off-Ramp
AM Peak



PM Peak



Existing Conditions - Vissim Queue: US 31E @ Cedar Springs Blvd. / Brookridge Village Blvd.
AM Peak PM Peak



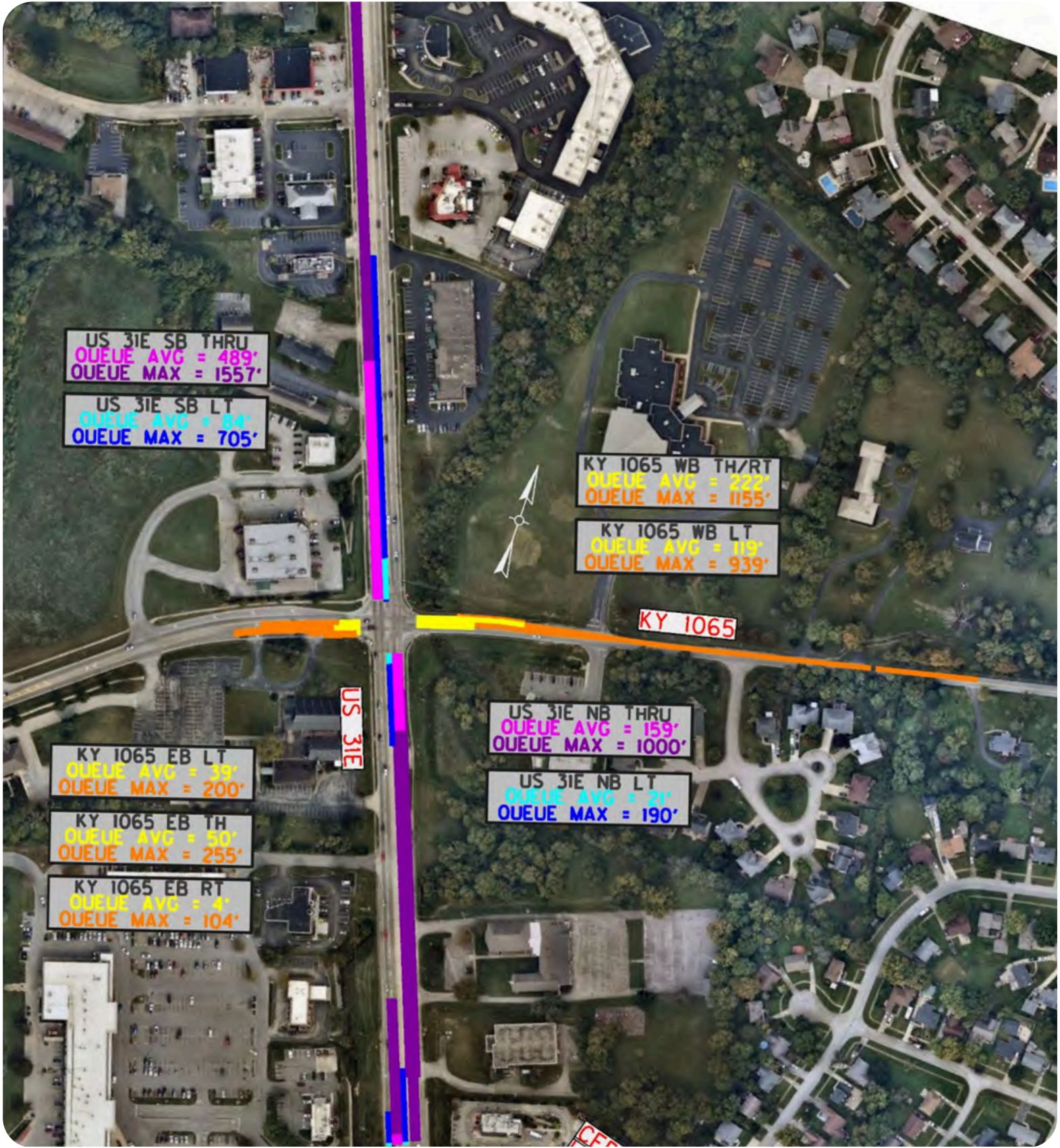
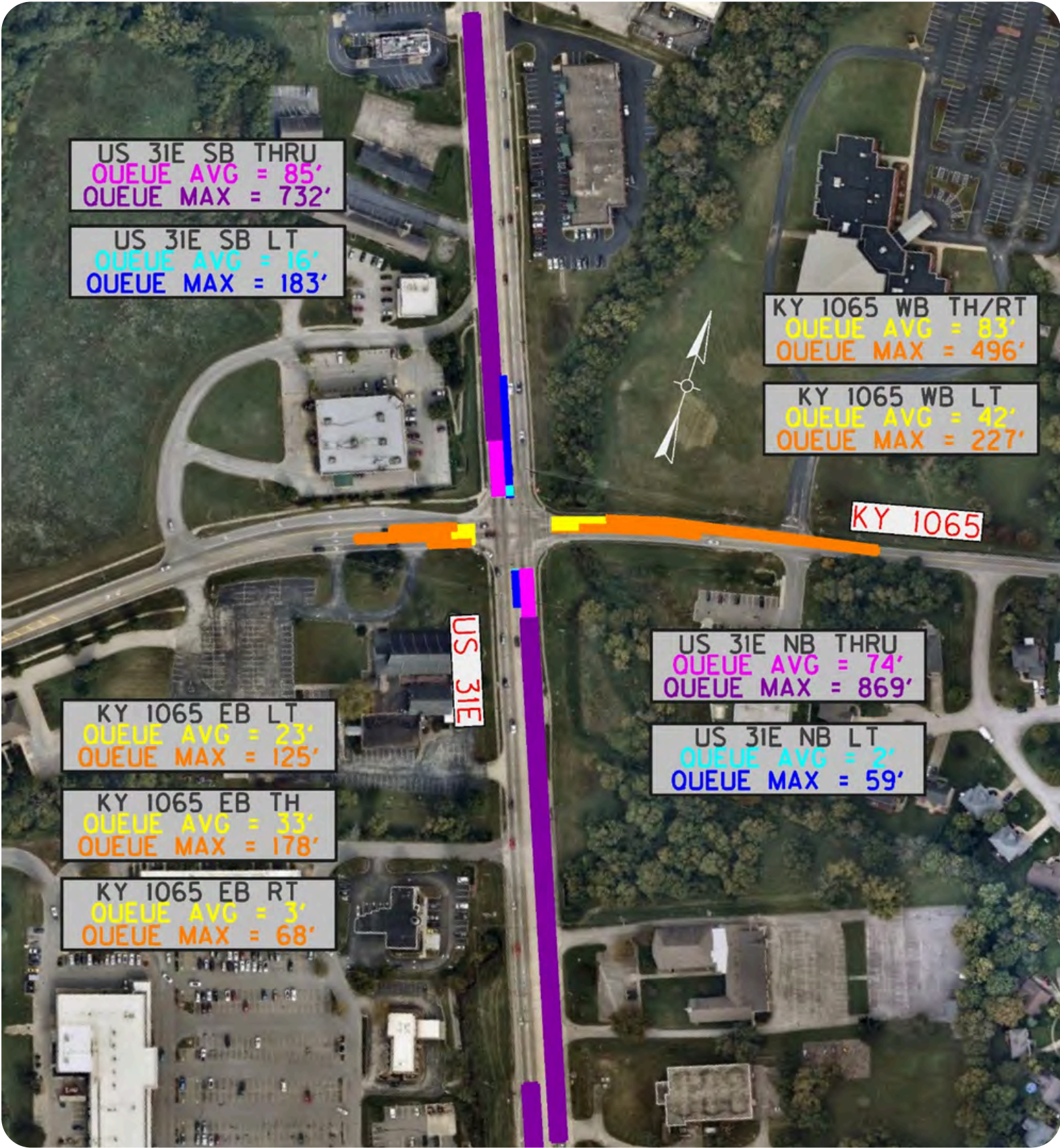
Existing Conditions - Vissim Queue: US 31E @ Cedar Look Drive AM Peak



PM Peak



Existing Conditions - Vissim Queue: US 31E @ KY 1065 (Seatonville Road / Beulah Church Road)
AM Peak

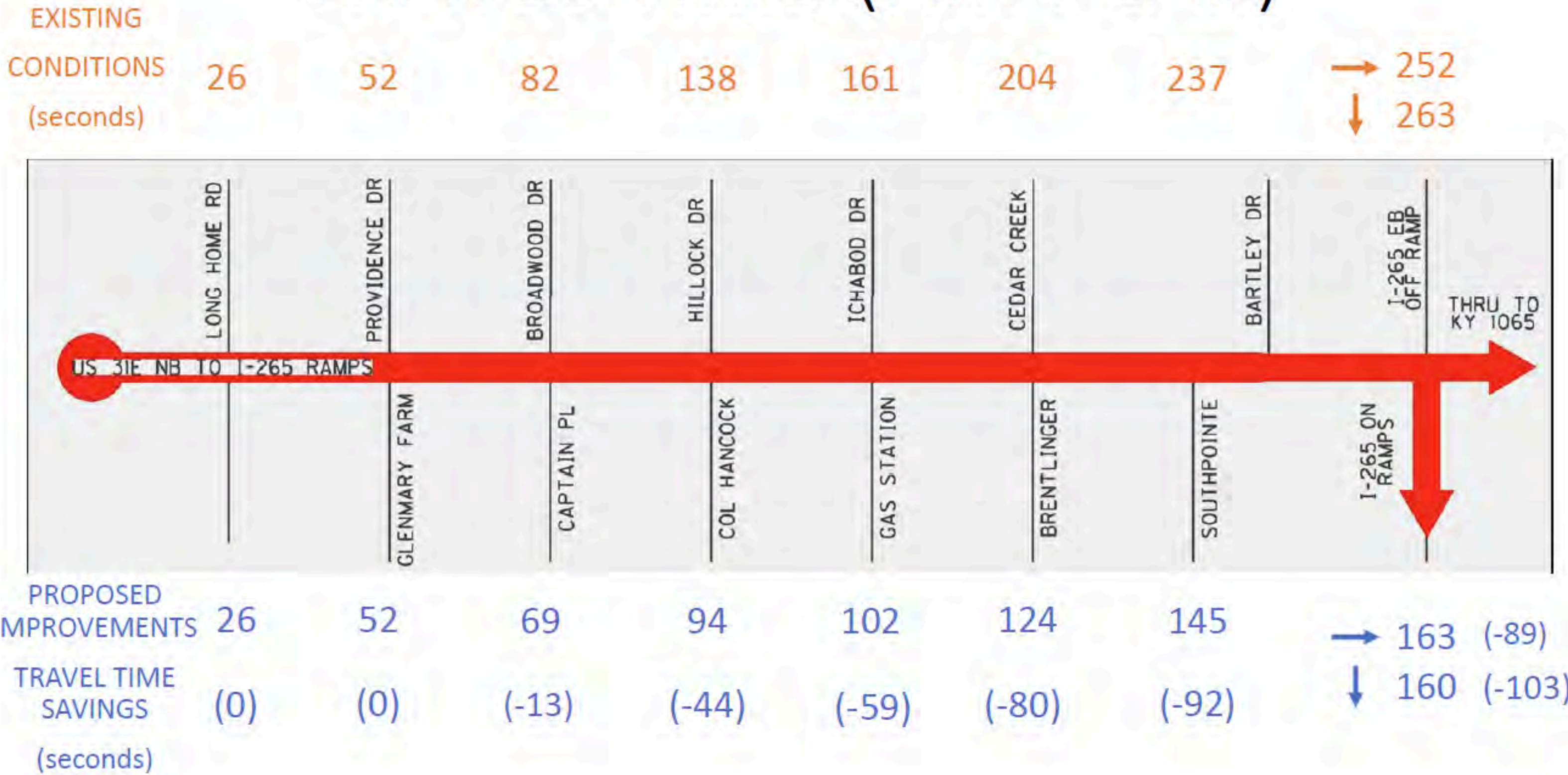


Appendix D

Travel Time

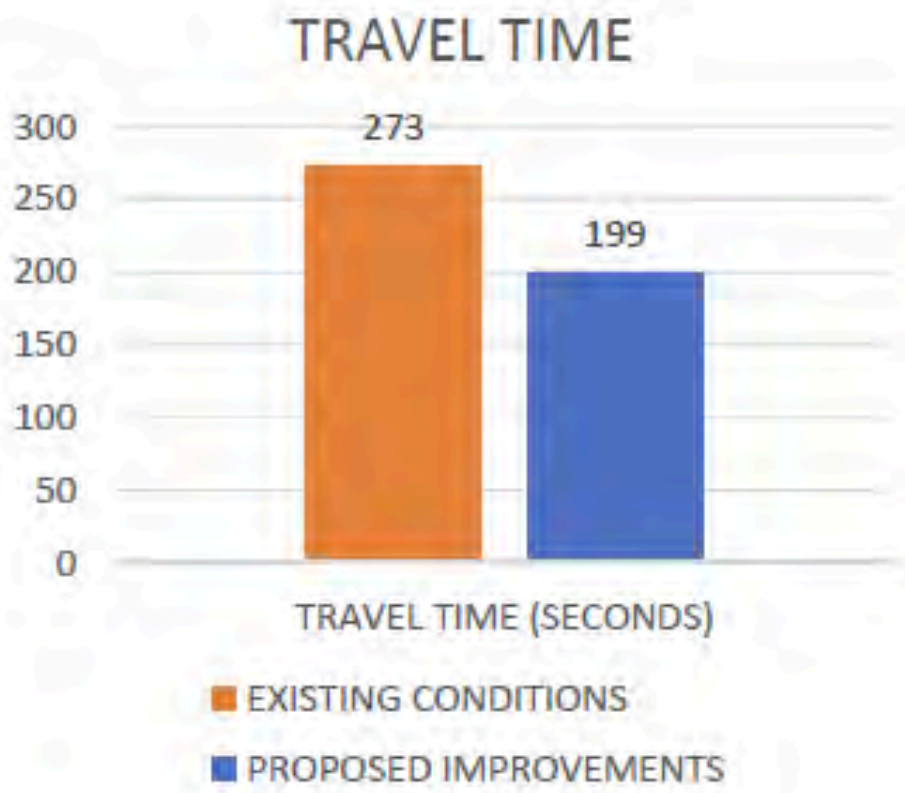
US 31E Northbound Travel Time: Existing Conditions vs. Alternative 1 Proposed Improvements

TRAVEL TIME (AM PEAK)



US 31E Southbound Travel Time: Existing Conditions vs. Alternative 1 Proposed Improvements

TRAVEL TIME (PM PEAK)



Travel Time savings of *74 seconds* per vehicle traveling from I-265 EB Off Ramp to US 31E SB (approx. 500 vehicles during PM PEAK)

Appendix E

Concept Plans

Selected Improvements for Final Design and Construction (Plan Sheet 1)



Selected Improvements for Final Design and Construction (Plan Sheet 2)



Selected Improvements for Final Design and Construction (Plan Sheet 3)



Alternative 1: Potential Improvements (Plan Sheet 1)



Alternative 1: Potential Improvements (Plan Sheet 2)

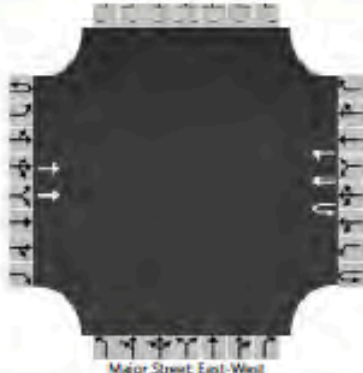
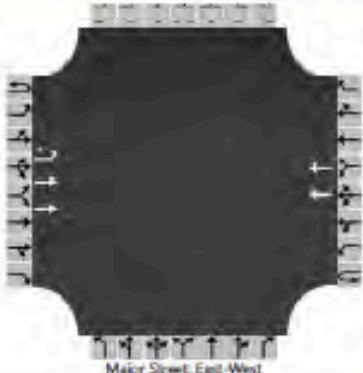


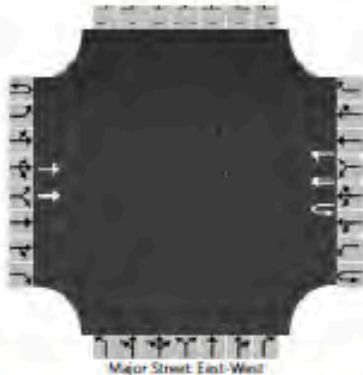
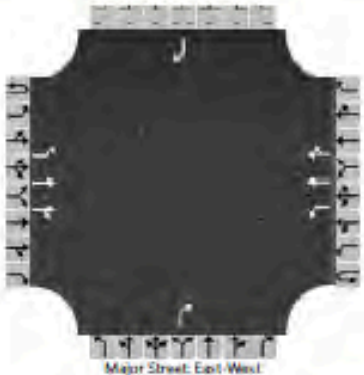
Alternative 1: Potential Improvements (Plan Sheet 3)

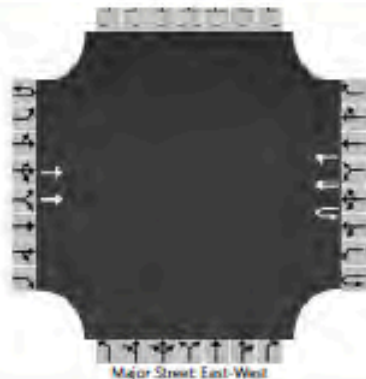


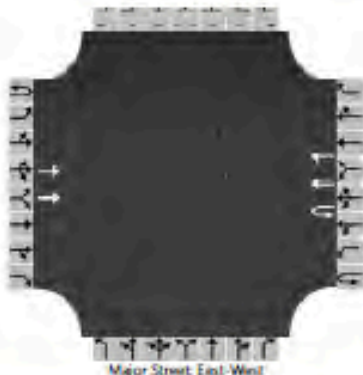
Appendix F

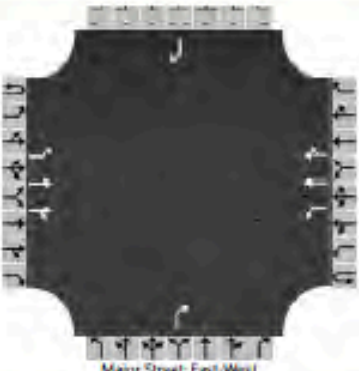
RCUT Analysis

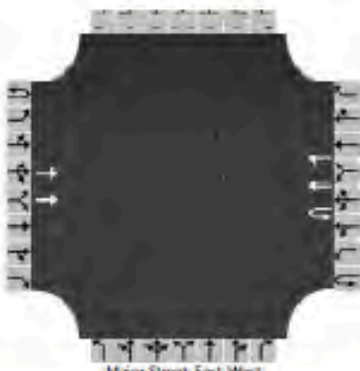
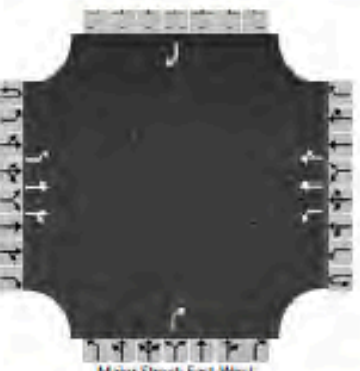
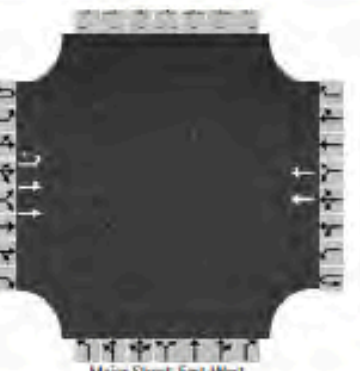
General Information				Alternative Intersection Information													
Agency	KYTC			Intersection Type		RCUT with TWSC											
Analyst	Palmer Engineering		Analysis Date	7/18/2024		Segment One Distance, ft		760									
Jurisdiction			Duration, h	0.25		Segment Two Distance, ft		580									
Intersection	Fairmount Rd		PHF	0.92		Arterial Direction		East-West									
Main Intersection File	2022_AM_Fairmount_RCUT MAIN.xtw																
West Crossover File	2022_AM_Fairmount_RCUT WEST.xtw																
East Crossover File	2022_AM_Fairmount_RCUT EAST.xtw																
Project Description	US 31E																
Demand	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One Demand (v), veh/h			1719		23		880										
Intersection Two Demand (v), veh/h	0	28	1715	1	0	4	857	11				6				48	
Intersection Three Demand (v), veh/h	2		1719				870										
(1) West Crossover				(2) Main Intersection				(3) East Crossover									
																	
Major Street: East-West				Major Street: East-West				Major Street: East-West									
Queue-to-Storage Ratio	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One (R _q)					0.03												
Intersection Two (R _q)		0.01				0.00						0.02				0.02	
Intersection Three (R _q)	0.00																
Alternative Intersection Results																	
O-D	O-D Movements		Flow Rate (veh/h)		Control Delay (s/veh)		EDTT (s/veh)		ETT (s/veh)		v/c>1?		R _q >1?		LOS		
EBL	EBL(2)		28		10.1		—		10.1		No		No		B		
EBT	EBT(2)		1840		0.0		—		0.0		—		—		A		
EBR	EBR(2)		0								—		—				
WBL	WBL(2)		4		18.3		—		18.3		No		No		B		
WBT	WBT(2)		930		0.0		—		0.0		—		—		A		
WBR	WBR(2)		11		0.0		—		0.0		—		—		A		
NBL	NBR(2) + EBU(3) + WBT(2)		1		29.6		13.9		43.5		No		No		D		
NBT	NBR(2) + EBU(3) + WBR(2)		1		29.6		13.9		43.5		No		No		D		
NBR	NBR(2)		4		18.7		—		18.7		No		No		B		
SBL	SBR(2) + WBU(1) + EBT(2)		24		32.4		18.8		51.2		No		No		D		
SBT	SBR(2) + WBU(1) + EBR(2)		1		32.4		18.8		51.2		No		No		D		
SBR	SBR(2)		25		12.3		—		12.3		No		No		B		
Overall Results			EB		WB		NB		SB								
Approach ETT, s/veh LOS			0.2	A	0.1	A	27.0	C	31.8	C							
Intersection ETT, s/veh LOS			0.7				A										

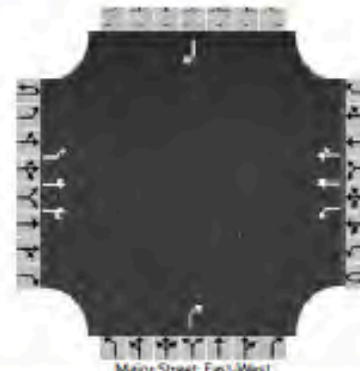
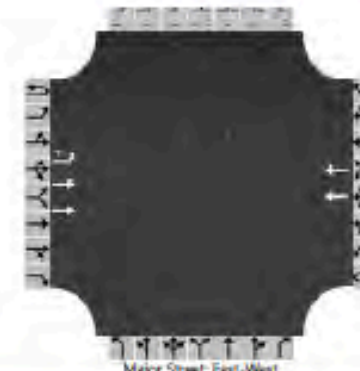
General Information								Alternative Intersection Information								
Agency	KYTC							Intersection Type				RCUT with TWSC				
Analyst	Palmer Engineering			Analysis Date		7/16/2024		Segment One Distance, ft				760				
Jurisdiction				Duration, h		0.25		Segment Two Distance, ft				580				
Intersection	Fairmount Rd			PHF		0.92		Arterial Direction				East-West				
Main Intersection File	2022_PM_Fairmount_RCUT MAIN.xtw															
West Crossover File	2022_PM_Fairmount_RCUT WEST.xtw															
East Crossover File	2022_PM_Fairmount_RCUT EAST.xtw															
Project Description	US 31E															
Demand	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Intersection One Demand (v), veh/h			1249		10		2177									
Intersection Two Demand (v), veh/h	0	23	1233	3	0	9	2108	31				7				81
Intersection Three Demand (v), veh/h	1		1239				2145									
(1) West Crossover				(2) Main Intersection				(3) East Crossover								
																
Queue-to-Storage Ratio	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Intersection One (R _q)					0.01											
Intersection Two (R _q)		0.02				0.00						0.02				0.11
Intersection Three (R _q)	0.00															
Alternative Intersection Results																
O-D	O-D Movements		Flow Rate (veh/h)		Control Delay (s/veh)		EDTT (s/veh)		ETT (s/veh)		v/c>1?		R _q >1?		LOS	
EBL	EBL(2)		25		24.0		-		24.0		No		No		C	
EBT	EBT(2)		1330		0.0		-		0.0		-		-		A	
EBR	EBR(2)		2		0.0		-		0.0		-		-		A	
WBL	WBL(2)		10		12.1		-		12.1		No		No		B	
WBT	WBT(2)		2289		0.0		-		0.0		-		-		A	
WBR	WBR(2)		33		0.0		-		0.0		-		-		A	
NBL	NBR(2) + EBU(3) + WBT(2)		0								No		No			
NBT	NBR(2) + EBU(3) + WBR(2)		1		40.4		13.9		54.3		No		No		D	
NBR	NBR(2)		7		14.2		-		14.2		No		No		B	
SBL	SBR(2) + WBU(1) + EBT(2)		10		53.1		18.8		71.9		No		No		E	
SBT	SBR(2) + WBU(1) + EBR(2)		1		53.1		18.8		71.9		No		No		E	
SBR	SBR(2)		77		39.4		-		39.4		No		No		D	
Overall Results			EB		WB		NB		SB							
Approach ETT, s/veh LOS			0.4	A	0.1	A	19.2	B	43.5	D						
Intersection ETT, s/veh LOS			1.2				A									

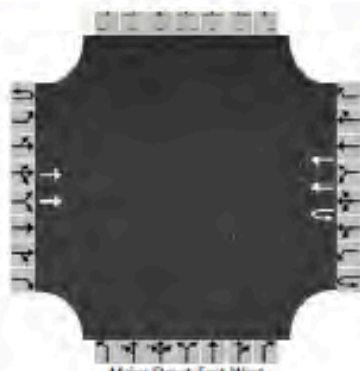
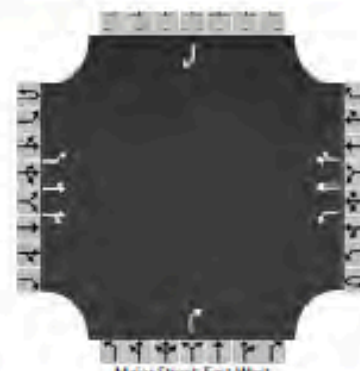
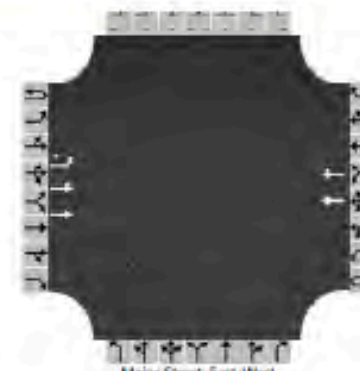
General Information				Alternative Intersection Information												
Agency	KYTC			Intersection Type		RCUT with TWSC										
Analyst	Palmer Engineering	Analysis Date	7/16/2024		Segment One Distance, ft		760									
Jurisdiction		Duration, h	0.25		Segment Two Distance, ft		580									
Intersection	Fairmount Rd	PHF	0.92		Arterial Direction		East-West									
Main Intersection File	2022_AM_Fairmount_RCUT MAIN.xtw															
West Crossover File	2022_AM_Fairmount_RCUT WEST.xtw															
East Crossover File	2022_AM_Fairmount_RCUT EAST.xtw															
Project Description	US 31E															
Demand	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Intersection One Demand (v), veh/h			1719		23		880									
Intersection Two Demand (v), veh/h	0	28	1715	1	0	4	857	11				6				46
Intersection Three Demand (v), veh/h	2		1719				870									
(1) West Crossover				(2) Main Intersection				(3) East Crossover								
																
Queue-to-Storage Ratio	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Intersection One (R _q)					0.03											
Intersection Two (R _q)		0.01				0.00						0.02				0.02
Intersection Three (R _q)	0.00															
Alternative Intersection Results																
O-D	O-D Movements		Flow Rate (veh/h)		Control Delay (s/veh)		EDTT (s/veh)		ETT (s/veh)		v/c>1?		R _q >1?		LOS	
EBL	EBL(2)		28		10.1		-		10.1		No		No		B	
EBT	EBT(2)		1840		0.0		-		0.0		-		-		A	
EBR	EBR(2)		0				-		-		-		-		A	
WBL	WBL(2)		4		18.3		-		18.3		No		No		B	
WBT	WBT(2)		930		0.0		-		0.0		-		-		A	
WBR	WBR(2)		11		0.0		-		0.0		-		-		A	
NBL	NBR(2) + EBU(3) + WBT(2)		1		29.6		13.9		43.5		No		No		D	
NBT	NBR(2) + EBU(3) + WBR(2)		1		29.6		13.9		43.5		No		No		D	
NBR	NBR(2)		4		18.7		-		18.7		No		No		B	
SBL	SBR(2) + WBU(1) + EBT(2)		24		32.4		18.8		51.2		No		No		D	
SBT	SBR(2) + WBU(1) + EBR(2)		1		32.4		18.8		51.2		No		No		D	
SBR	SBR(2)		25		12.3		-		12.3		No		No		B	
Overall Results			EB		WB		NB		SB							
Approach ETT, s/veh LOS			0.2	A	0.1	A	27.0	C	31.8	C						
Intersection ETT, s/veh LOS			0.7				A									

General Information				Alternative Intersection Information													
Agency	KYTC			Intersection Type				RCUT with TWSC									
Analyst	Palmer Engineering		Analysis Date	7/16/2024		Segment One Distance, ft				760							
Jurisdiction			Duration, h	0.25		Segment Two Distance, ft				580							
Intersection	Fairmount Rd		PHF	0.92		Arterial Direction				East-West							
Main Intersection File	2022_PM_Fairmount_RCUT MAIN.xtw																
West Crossover File	2022_PM_Fairmount_RCUT WEST.xtw																
East Crossover File	2022_PM_Fairmount_RCUT EAST.xtw																
Project Description	US 31E																
Demand	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One Demand (v), veh/h			1249		10		2177										
Intersection Two Demand (v), veh/h	0	23	1233	3	0	9	2108	31				7				81	
Intersection Three Demand (v), veh/h	1		1239				2145										
(1) West Crossover				(2) Main Intersection				(3) East Crossover									
																	
Queue-to-Storage Ratio	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One (R _q)					0.01												
Intersection Two (R _q)		0.02				0.00						0.02				0.11	
Intersection Three (R _q)	0.00																
Alternative Intersection Results																	
O-D	O-D Movements		Flow Rate (veh/h)		Control Delay (s/veh)		EDTT (s/veh)		ETT (s/veh)		v/c>1?		R _q >1?		LOS		
EBL	EBL(2)		25		24.0		-		24.0		No		No		C		
EBT	EBT(2)		1330		0.0		-		0.0		-		-		A		
EBR	EBR(2)		2		0.0		-		0.0		-		-		A		
WBL	WBL(2)		10		12.1		-		12.1		No		No		B		
WBT	WBT(2)		2289		0.0		-		0.0		-		-		A		
WBR	WBR(2)		33		0.0		-		0.0		-		-		A		
NBL	NBR(2) + EBU(3) + WBT(2)		0								No		No				
NBT	NBR(2) + EBU(3) + WBR(2)		1		40.4		13.9		54.3		No		No		D		
NBR	NBR(2)		7		14.2		-		14.2		No		No		B		
SBL	SBR(2) + WBU(1) + EBT(2)		10		53.1		18.8		71.9		No		No		E		
SBT	SBR(2) + WBU(1) + EBR(2)		1		53.1		18.8		71.9		No		No		E		
SBR	SBR(2)		77		39.4		-		39.4		No		No		D		
Overall Results			EB		WB		NB		SB								
Approach ETT, s/veh LOS			0.4	A	0.1	A	19.2	B	43.5	D							
Intersection ETT, s/veh LOS			1.2				A										

General Information					Alternative Intersection Information												
Agency	KYTC				Intersection Type				RCUT with TWSC								
Analyst	Palmer Engineering		Analysis Date	7/16/2024		Segment One Distance, ft				580							
Jurisdiction			Duration, h	0.25		Segment Two Distance, ft				770							
Intersection	Long Home		PHF	0.92		Arterial Direction				East-West							
Main Intersection File	2022_AM_Long Home_RCUT MAIN.xtw																
West Crossover File	2022_AM_Long Home_RCUT WEST.xtw																
East Crossover File	2022_AM_Long Home_RCUT EAST.xtw																
Project Description	US 31E																
Demand	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One Demand (v), veh/h			1719		32		871										
Intersection Two Demand (v), veh/h	0	1	1744	6	0	4	870	13				50				33	
Intersection Three Demand (v), veh/h	6		1788				881										
(1) West Crossover				(2) Main Intersection				(3) East Crossover									
																	
Major Street: East-West				Major Street: East-West				Major Street: East-West									
Queue-to-Storage Ratio	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One (Rq)					0.05												
Intersection Two (Rq)		0.00				0.00						0.15				0.04	
Intersection Three (Rq)	0.00																
Alternative Intersection Results																	
O-D	O-D Movements		Flow Rate (veh/h)		Control Delay (s/veh)		EDTT (s/veh)		ETT (s/veh)		v/c>1?		Rq>1?		LOS		
EBL	EBL(2)		1		10.0		—		10.0		No		No		A		
EBT	EBT(2)		1861		0.0		—		0.0		—		—		A		
EBR	EBR(2)		7		0.0		—		0.0		—		—		A		
WBL	WBL(2)		4		16.7		—		16.7		No		No		B		
WBT	WBT(2)		942		0.0		—		0.0		—		—		A		
WBR	WBR(2)		11		0.0		—		0.0		—		—		A		
NBL	NBR(2) + EBU(3) + WBT(2)		3		33.3		17.5		50.8		No		No		D		
NBT	NBR(2) + EBU(3) + WBR(2)		3		33.3		17.5		50.8		No		No		D		
NBR	NBR(2)		48		22.3		—		22.3		No		No		C		
SBL	SBR(2) + WBU(1) + EBT(2)		35		32.9		13.2		46.1		No		No		D		
SBT	SBR(2) + WBU(1) + EBR(2)		0								No		No				
SBR	SBR(2)		1		12.2		—		12.2		No		No		B		
Overall Results			EB		WB		NB		SB								
Approach ETT, s/veh LOS			0.0	A	0.1	A	25.5	C	45.2	D							
Intersection ETT, s/veh LOS			1.1				A										

General Information								Alternative Intersection Information									
Agency	KYTC							Intersection Type				RCUT with TWSC					
Analyst	Palmer Engineering			Analysis Date		7/16/2024		Segment One Distance, ft				580					
Jurisdiction				Duration, h		0.25		Segment Two Distance, ft				770					
Intersection	Long Home			PHF		0.92		Arterial Direction				East-West					
Main Intersection File	2022_PM_Long Home_RCUT MAIN.xtw																
West Crossover File	2022_PM_Long Home_RCUT WEST.xtw																
East Crossover File	2022_PM_Long Home_RCUT EAST.xtw																
Project Description	US 31E																
Demand																	
	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One Demand (v), veh/h			1240		38		2145										
Intersection Two Demand (v), veh/h	0	1	1258	19	0	50	2125	25				54				58	
Intersection Three Demand (v), veh/h	6		1306				2194										
(1) West Crossover				(2) Main Intersection				(3) East Crossover									
																	
Major Street: East-West				Major Street: East-West				Major Street: East-West									
Queue-to-Storage Ratio																	
	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One (Rq)					0.03												
Intersection Two (Rq)		0.00				0.02						0.10				0.27	
Intersection Three (Rq)	0.01																
Alternative Intersection Results																	
O-D	O-D Movements			Flow Rate (veh/h)		Control Delay (s/veh)		EDTT (s/veh)		ETT (s/veh)		v/c>1?		Rq>1?		LOS	
EBL	EBL(2)			1		22.1		-		22.1		No		No		C	
EBT	EBT(2)			1330		0.0		-		0.0		-		-		A	
EBR	EBR(2)			16		0.0		-		0.0		-		-		A	
WBL	WBL(2)			54		13.2		-		13.2		No		No		B	
WBT	WBT(2)			2304		0.0		-		0.0		-		-		A	
WBR	WBR(2)			26		0.0		-		0.0		-		-		A	
NBL	NBR(2) + EBU(3) + WBT(2)			5		44.1		17.5		81.6		No		No		E	
NBT	NBR(2) + EBU(3) + WBR(2)			1		44.1		17.5		81.6		No		No		E	
NBR	NBR(2)			52		15.9		-		15.9		No		No		B	
SBL	SBR(2) + WBU(1) + EBT(2)			37		47.9		13.2		81.1		No		No		E	
SBT	SBR(2) + WBU(1) + EBR(2)			4		47.9		13.2		81.1		No		No		E	
SBR	SBR(2)			22		33.6		-		33.6		No		No		C	
Overall Results																	
			EB		WB		NB		SB								
Approach ETT, s/veh LOS			0.0	A	0.3	A	20.6	C	51.5	D							
Intersection ETT, s/veh LOS			1.3				A										

General Information					Alternative Intersection Information												
Agency	KYTC				Intersection Type				RCUT with TWSC								
Analyst	Palmer Engineering		Analysis Date	7/16/2024		Segment One Distance, ft				1000							
Jurisdiction			Duration, h	0.25		Segment Two Distance, ft				700							
Intersection	Glenmary		PHF	0.92		Arterial Direction				East-West							
Main Intersection File	2022_AM_Glenmary_RCUT MAIN.xtw																
West Crossover File	2022_AM_Glenmary_RCUT WEST.xtw																
East Crossover File	2022_AM_Glenmary_RCUT EAST.xtw																
Project Description	US 31E																
Demand	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One Demand (v), veh/h			1788		110		881										
Intersection Two Demand (v), veh/h	0	4	1888	6	0	17	880	21				52				111	
Intersection Three Demand (v), veh/h	4		1938				914										
(1) West Crossover					(2) Main Intersection					(3) East Crossover							
																	
Queue-to-Storage Ratio	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	
Intersection One (R _q)					0.16												
Intersection Two (R _q)		0.00				0.01						0.07				0.23	
Intersection Three (R _q)	0.00																
Alternative Intersection Results																	
O-D	O-D Movements			Flow Rate (veh/h)		Control Delay (s/veh)		EDTT (s/veh)		ETT (s/veh)		v/c>1?	R _q >1?		LOS		
EBL	EBL(2)			4		10.1		—		10.1		No	No		B		
EBT	EBT(2)			1937		0.0		—		0.0		—	—		A		
EBR	EBR(2)			2		0.0		—		0.0		—	—		A		
WBL	WBL(2)			18		19.2		—		19.2		No	No		B		
WBT	WBT(2)			953		0.0		—		0.0		—	—		A		
WBR	WBR(2)			22		0.0		—		0.0		—	—		A		
NBL	NBR(2) + EBU(3) + WBT(2)			3		36.6		17.3		53.9		No	No		D		
NBT	NBR(2) + EBU(3) + WBR(2)			1		36.6		17.3		53.9		No	No		D		
NBR	NBR(2)			52		25.4		—		25.4		No	No		C		
SBL	SBR(2) + WBU(1) + EBT(2)			115		46.6		24.7		71.3		No	No		E		
SBT	SBR(2) + WBU(1) + EBR(2)			4		46.6		24.7		71.3		No	No		E		
SBR	SBR(2)			1		13.8		—		13.8		No	No		B		
Overall Results				EB		WB		NB				SB					
Approach ETT, s/veh LOS				0.0	A	0.3	A	27.4	C	70.8	E						
Intersection ETT, s/veh LOS				3.3				A									

General Information					Alternative Intersection Information											
Agency	KYTC				Intersection Type				RCUT with TWSC							
Analyst	Palmer Engineering		Analysis Date	7/15/2024		Segment One Distance, ft				1000						
Jurisdiction			Duration, h	0.25		Segment Two Distance, ft				700						
Intersection	US 31E @ Glenmary / Provide...		PHF	0.92		Arterial Direction				East-West						
Main Intersection File	2022_PM_Glenmary_RCUT MAIN.xtw															
West Crossover File	2022_PM_Glenmary_RCUT WEST.xtw															
East Crossover File	2022_PM_Glenmary_RCUT EAST.xtw															
Project Description	RCUT - Proposed Conditions															
Demand	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Intersection One Demand (v), veh/h			1305		105		2194									
Intersection Two Demand (v), veh/h	0	8	1390	14	0	50	2184	33				49				115
Intersection Three Demand (v), veh/h	11		1428				2258									
(1) West Crossover				(2) Main Intersection				(3) East Crossover								
																
Queue-to-Storage Ratio	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Intersection One (R _q)					0.09											
Intersection Two (R _q)		0.01				0.02						0.04				1.09
Intersection Three (R _q)	0.02															
Alternative Intersection Results																
O-D	O-D Movements		Flow Rate (veh/h)		Control Delay (s/veh)		EDTT (s/veh)		ETT (s/veh)		w/c>1?	R _q >1?	LOS			
EBL	EBL(2)		7		23.8		—		23.8		No	No	C			
EBT	EBT(2)		1407		0.0		—		0.0		—	—	A			
EBR	EBR(2)		5		0.0		—		0.0		—	—	A			
WBL	WBL(2)		54		14.4		—		14.4		No	No	B			
WBT	WBT(2)		2365		0.0		—		0.0		—	—	A			
WBR	WBR(2)		33		0.0		—		0.0		—	—	A			
NBL	NBR(2) + EBU(3) + WBT(2)		9		47.8		17.3		65.1		No	No	E			
NBT	NBR(2) + EBU(3) + WBR(2)		3		47.8		17.3		65.1		No	No	E			
NBR	NBR(2)		41		17.2		—		17.2		No	No	B			
SBL	SBR(2) + WBU(1) + EBT(2)		104		80.5		24.7		105.2		No	Yes	F			
SBT	SBR(2) + WBU(1) + EBR(2)		10		80.5		24.7		105.2		No	Yes	F			
SBR	SBR(2)		11		62.9		—		62.9		No	Yes	F			
Overall Results			EB		WB		NB		SB							
Approach ETT, s/veh LOS			0.1	A	0.3	A	28.0	C	101.5	F						
Intersection ETT, s/veh LOS			3.7				F									