KENTUCKY AND ADAMS STREET (US 68X) IMPROVEMENT STUDY - FINAL REPORT

Kentucky Transportation Cabinet
Central Office, Division of Planning
Highway District 3, Bowling Green

In partnership with:

Stantec

October 2020

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

The Kentucky Transportation Cabinet (KYTC) in partnership with the City of Bowling Green, WKU, Bowling Green / Warren County Metropolitan Planning Organization (MPO), and Barren River Area Development District initiated the *Kentucky and Adams Street (US 68X) Improvement Study.* The goal of the study is to identify and evaluate potential traffic operational changes which are compatible with land use and increase safety for all modes of travel.

The study area includes the one-way couplet of Kentucky and Adams Streets (US 68X) from the northeast split at the Kentucky Street intersection with 6th Avenue/Veterans Memorial Lane to the southwest split at the University Boulevard intersection with Old Morgantown Road/College Heights Boulevard. The total corridor length is approximately 1.2 miles.

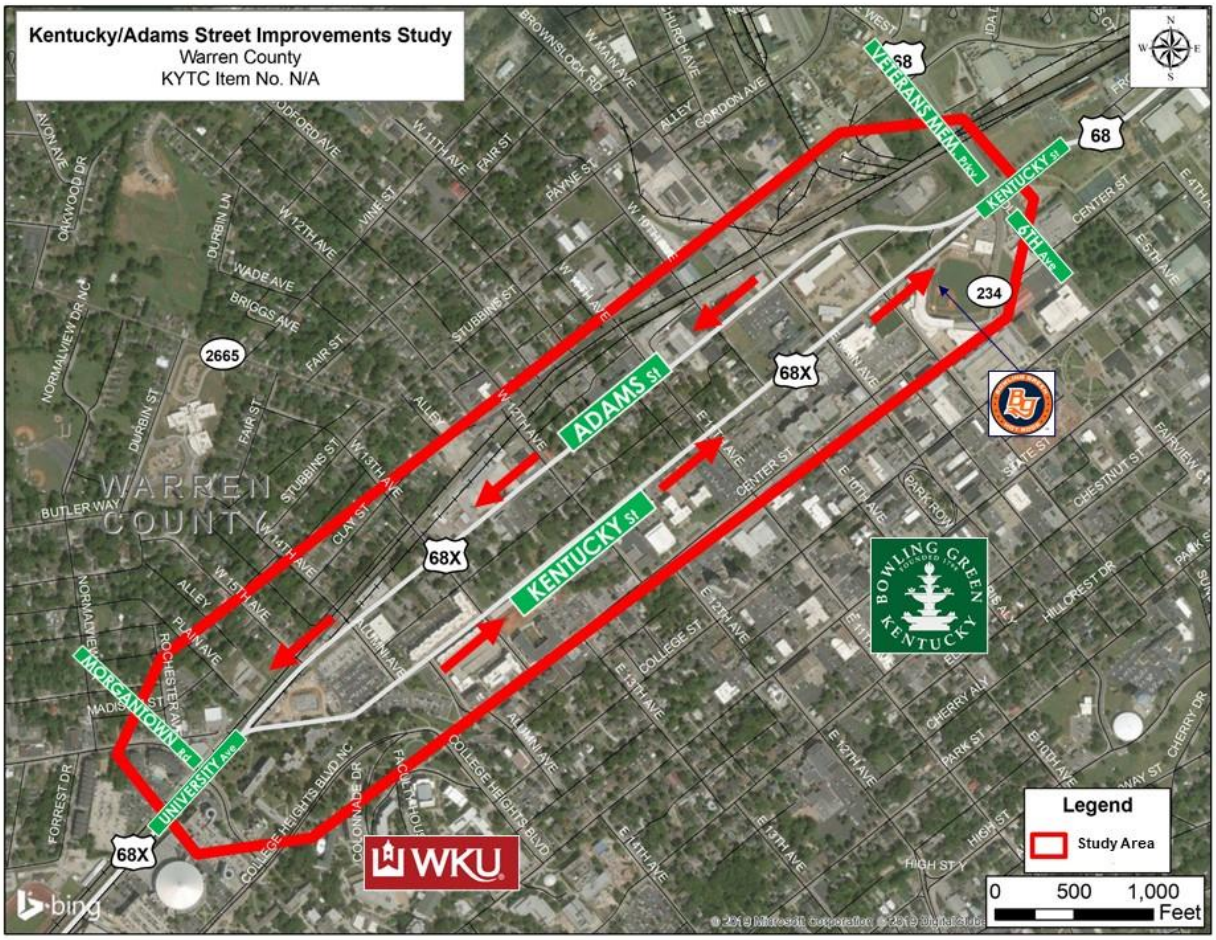


Figure ES-1: Study Area

In 2014, the *Downtown Bowling Green Traffic Circulation Study* included among its many recommendations a concept to convert Kentucky and Adams Streets to two-way traffic and to widen Adams Street to accommodate a five-lane section. This one-way couplet serves a number of important destinations including downtown Bowling Green as well as Western Kentucky University (WKU). The presence of student housing, university parking, and a

pharmacy on the north side of Kentucky Street results in a diverse array of roadway users and modes of travel and compels the need to encourage compliance of traffic control devices, particularly those related to pedestrian safety. Specifically, operational changes are desired to encourage more attentive driving, a reduction in speed, a reduction in crashes, and a greater tendency for motorists to yield to pedestrians. Opportunities to enhance multimodal facilities such as bike lanes are also desired.

EXISTING AND FUTURE CONDITIONS

Existing conditions of the transportation network were examined including current roadway facilities and geometrics, crash history, and traffic volumes within the study area. *The Downtown Bowling Green Traffic Circulation Study* TransModeler simulation model (2014) was used as the source for the Base Year (2020) simulation model to develop scenarios for the improvement concepts. Both an Environmental Red Flag Summary and a Socioeconomic Study were performed as part of the existing conditions analysis.

Future conditions in the years 2030 and 2045 were estimated to evaluate the prospective effectiveness of potential transportation improvement concepts. In addition to the existing model updates, a 2030 Existing plus Committed (E+C) network was also created which includes two project recommendations from the Study. The first is an intersection improvement project at the Russellville Road intersection with University Drive which includes widening of northbound University Drive to add a new left-turn onto westbound Russellville Road, widening of southbound University Drive to add an additional southbound through lane, and restriping of the eastbound Russellville Road approach lanes from a single left / dual-right to a dual-left / single-right. The second project is a new traffic signal at the College Street intersection with 7th Avenue.

To evaluate the adequacy of study area intersections and roadway segments, outputs from the simulation model were used to determine level of service (LOS). For signalized intersections, LOS is determined by the average total vehicle delay. In urban areas such as this, LOS D or better is desirable. The LOS results for the E+C network indicate that there is plenty of capacity in 2030. The six signalized intersections on Kentucky Street and Adams Street in the middle of the study area are expected to operate at LOS A while the two larger intersections on either end of the study area (University Avenue at Old Morgantown Road / University Heights Boulevard and Kentucky Street at Veterans Memorial Lane / 6th Avenue) will operate at LOS D in the PM. For all the scenarios during both peak periods, the larger intersections on either end of the study area inherently act to meter traffic traveling through Kentucky Street and Adams Street.

IMPROVEMENT CONCEPT DEVELOPMENT AND EVALUATION

Improvement concepts were developed based on a combination of input from the project team, a review of existing conditions, simulation model traffic analyses, and field reconnaissance. The project team studied several improvement concepts.

The first three concepts involved various configurations for converting both Kentucky and Adams Streets to two-way and severing Kentucky Street at the southwestern segment south of Alumni Avenue and at the northeastern segment north of 8th Avenue as shown in **Figure ES-2**.

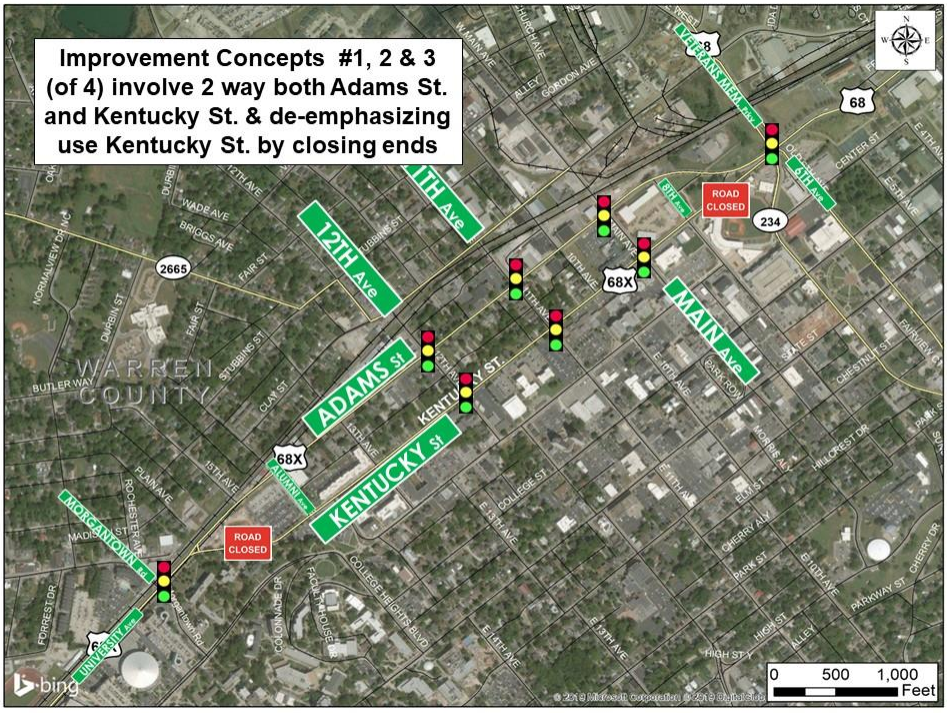


Figure ES-2: Two-Way Conversion of Kentucky and Adams, severing end segments of Kentucky Street

The fourth improvement concept involves retaining the existing one-way operation of both Kentucky and Adams Streets but reconfiguring the lanes of traffic from two to one and adding bike lanes. It is envisioned that should any of the four concepts be implemented, the reconfiguration would coincide with scheduled 2021 repaving for Kentucky and Adams Streets.

The four improvement concepts are summarized as follows:

- Improvement Concept 1 – An example of the potential lane configuration is shown on **Figure ES-3** which depicts the conversion of Kentucky and Adams Streets to two-way with no left-turn lanes at the signalized intersections, and the severing of Kentucky Street at the southwestern and northeastern ends.

Figure ES -3: Improvement Concept 1: Two-way without left-turn lanes

- Improvement Concept 2 – An example of the potential lane configuration is shown on **Figure ES-4** which depicts the conversion of Kentucky and Adams Streets to two-way with the addition of left-turn lanes by widening the approaches at the signalized intersections on Adams Street and the severing of Kentucky Street at the southwestern and northeastern ends.

Figure ES-4: Improvement Concept 2: Two-way with left-turn lanes at traffic signals on Adams Street

- Improvement Concept 3 – An example of the potential lane configuration is shown on **Figure ES-5** which depicts the conversion of Kentucky and Adams Streets to two-way with a center two-way left-turn lane (TWLTL) on the Adams Street corridor, the addition of left-turn lanes by widening the approaches at the signalized intersections on Kentucky Street, and the severing Kentucky Street at the southwestern and northeastern ends.

Figure ES-5: Improvement Concept 3: Three-lane widening on Adams Street

- Improvement Concept 4 – An example of the potential lane configuration is shown on **Figure ES-6** which depicts one-way, one-lane operation on Kentucky and Adams Streets with bike lanes.

Figure ES-6: Improvement Concept 4: One-way, one-lane with bike lanes on Kentucky and Adams

Based on input from the project team, Improvement Concept 4 was ultimately revised. Due to very little demand for parking on Adams Street, it was determined that the existing parking lane

could be restriped as a buffered bike lane while retaining the two one-way vehicular travel lanes, as shown in **Figure ES-7**.

Figure ES-7: Revised Improvement Concept 4 for Adams Street

The 2030 E+C simulation model was used as a basis for the development of models depicting each of the improvement concepts for the AM and PM peak periods. The improvement concepts were reviewed to help with the evaluation process and provide the project team with information that was used to make a final recommendation.

During the PM peak for Concept Improvement 1, the three signalized intersections on Adams Street in the middle of the study area failed to operate at a reasonable level of service (LOS) due to the queuing of vehicles including queues extending over 700 feet at 12th Street. Queuing occurs when a vehicle(s) waiting to turn left blocks vehicles traveling through the intersection because of the lack of a separate left-turn lane. The LOS and travel times for all other improvement concepts were acceptable for both the AM and PM peak hours. Concept Improvement 3 would require additional right-of-way acquisition and substantial utility relocation resulting in significantly higher cost to widen Adams Street to a three-lane corridor. A summary and comparison of all improvement concepts is shown in the evaluation matrix in **Table ES-1.**

Project Goals	Existing	Concept 1 (2-way, no left turn lanes)	Concept 2 (2-way w/ left turn lanes on Adams)	Concept 3 (2-way, 3 lane section on Adams & left turn lanes on Kentucky)	Concept 4 (1-way, road reconfiguration with bike lanes)
Est. Construction Cost	**$0**	**$$**	**$$$**	**$$$$**	**$**
Improves safety	✗	✗	✓	✓	✓
Provides opportunites to enhance multimodal facilities	✗	○	○	○	✓
Provides cost efficient alternative	✗	✓	○	✗	✓
De-emphasizes Kentucky St.	✗	✓	✓	✓	○
Accommodates 2030 traffic demand	✓	✗	✓	✓	✓
Key: ✓ Issue is completely addressed; ○ Issue is somewhat addressed; ✗ Significant issue that is not addressed					
Cost Key: $ = Very cheap, $$ = Minimal Cost, $$$ = Modest Cost, $$$$ = Significant Cost					

Table ES-1: Improvement Concept Comparison Matrix

Improvement Concept 2 and Improvement Concept 4 either completely or somewhat address all the project goals. Concept 2 does not provide bike lanes and has a higher cost due to the

widening needed to add left-turn lanes at the signalized intersections. Concept 4 partially de-emphasizes Kentucky Street by restriping it as a single lane for traffic.

CONCLUSIONS

Considering the technical data and results from the comparison matrix, the project team recommended the revised Improvement Concept 4 with one lane including a bike lane on Kentucky Street and two lanes with a separated bike lane on Adams Street. The parking lane on Adams Street will be replaced with a buffered bike lane. The LOS results for the E+C network indicate that there is plenty of capacity in 2030. Therefore, for the revised Improvement Concept 4 during both peak hours, the signalized intersections on Adams Street will operate at LOS A, and the signalized intersections on Kentucky Street will still operate at LOS B or better despite the reduction in lanes. Travel times on both Adams Street and Kentucky Street are expected to be similar to the E+C results of approximately 3 to 3.5 minutes. Reducing Kentucky Street to one lane will maintain a desired LOS through the study area while encouraging more attentive driving, reducing traffic speed, reducing the potential for crashes, and increasing the tendency for motorists to yield to pedestrians. This can all be accomplished within the existing right-of-way at low cost if completed with the next scheduled repaving project.

Reducing Kentucky Street to one lane will improve pedestrian safety by: 1) eliminating the multiple threat scenario which occurs on multi-lane approaches in the same direction; and 2) decreasing the distance that pedestrians are exposed to vehicular traffic in the crosswalk from 27 to 14 feet. Vehicle compliance (stopping) may also be improved with the addition of conspicuous ground-mount STATE LAW YIELD TO PEDESTRIANS (MUTCD R1-6) signs at marked crosswalks. There are three unsignalized pedestrian crosswalks on Kentucky Street within three blocks as shown in **Figure ES-7**. All three are MUTCD compliant, but these treatments are inconsistent as shown in the figure. It is recommended that the treatments for the pedestrian crosswalks be consistent for Kentucky Street.

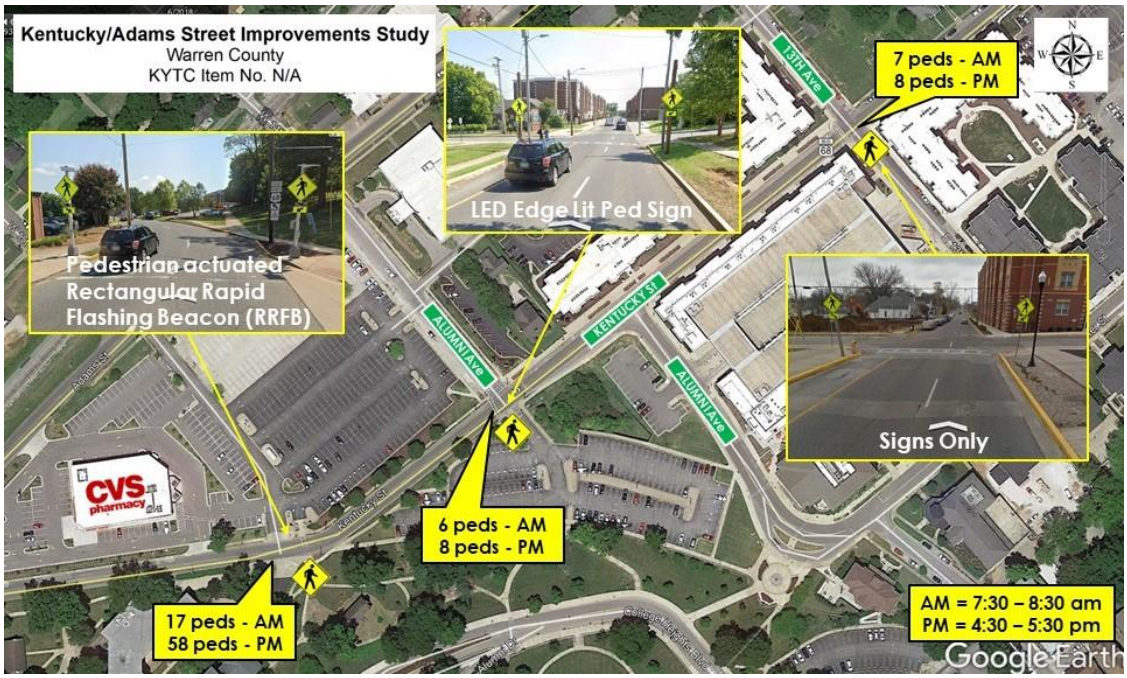


Figure ES-7: Existing Pedestrian Crosswalks at Unsignalized Intersections on Kentucky Street

1.0 INTRODUCTION

The Kentucky and Adams Street (US 68X) Improvement Study was initiated by the Kentucky Transportation Cabinet (KYTC) in partnership with the City of Bowling Green, Western Kentucky University (WKU), Bowling Green / Warren County Metropolitan Planning Organization (MPO), and Barren River Area Development District. This project includes an examination of Kentucky and Adams Streets (US 68X) in central Bowling Green, Kentucky.

This planning study is funded with Federal Statewide Planning and Research (SPR) Chapter 7 funds. Future phases are not funded in *Kentucky's FY 2020 – FY 2026 Highway Plan,* but US 68X is scheduled to undergo pavement resurfacing in 2021.

1.1 STUDY AREA

The study area includes the one-way couplet of Kentucky and Adams Streets (US 68X) from the northeast split at the Kentucky Street intersection with 6th Avenue/Veterans Memorial Lane to the southwest split at the University Boulevard intersection with Old Morgantown Road/College Heights Boulevard. The distance between these two intersections is approximately 6,300 feet with major generators nearby, namely WKU and Bowling Green Ballpark, as shown in **Figure 1**. With the study area's proximity to WKU and downtown Bowling Green, traffic includes a mix of commuter travel to campus and local through traffic to downtown and the surrounding areas.

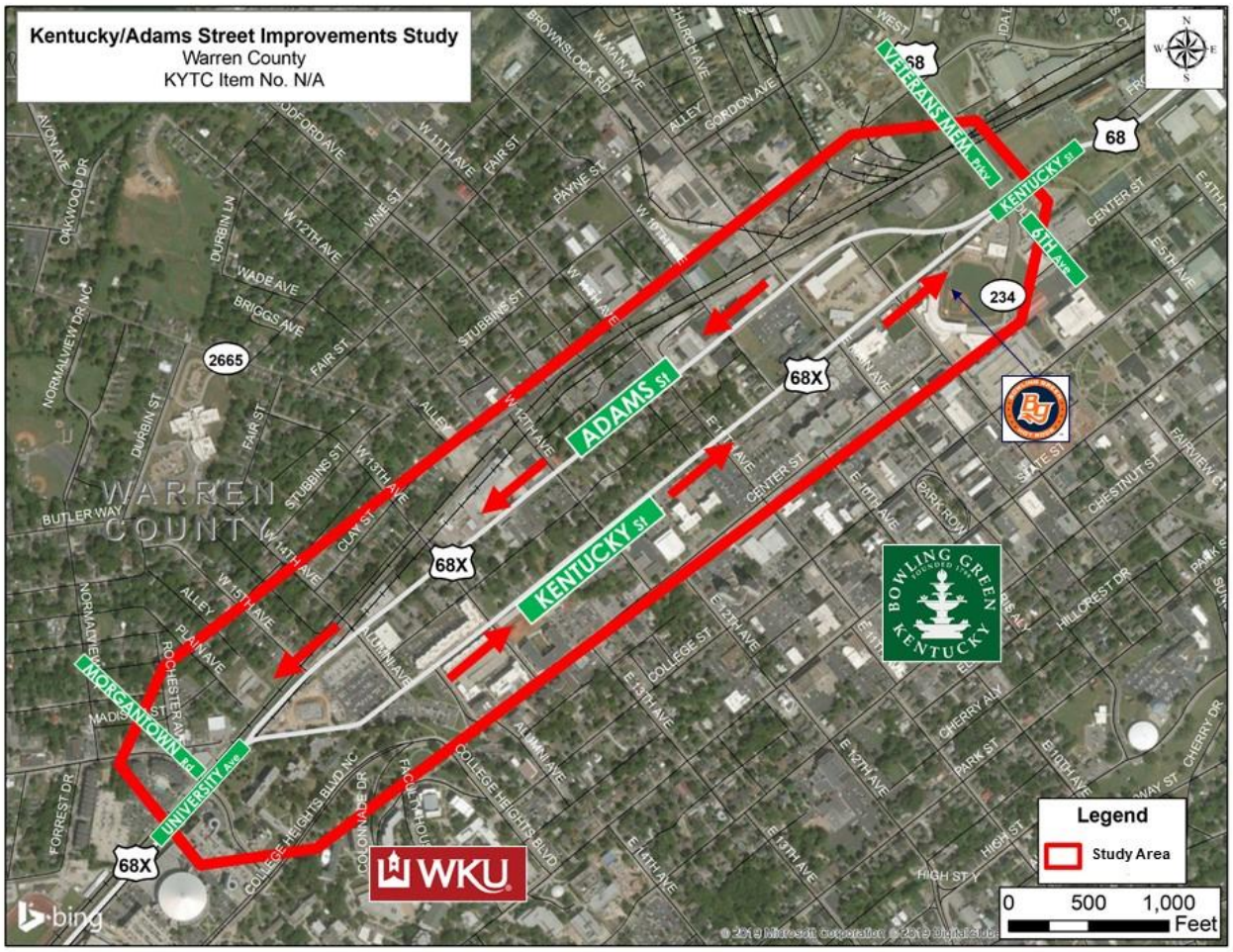


Figure 1 - Study Area

1.2 PROJECT HISTORY

In 2014, Stantec worked with KYTC and the Bowling Green/Warren County Metropolitan MPO on the *Downtown Bowling Green Traffic Circulation Study*[1]. This study investigated existing and future traffic needs within the city of Bowling Green and sought to determine how to best facilitate growth in the community. As part of the study, a long-term recommendation was to convert Kentucky and Adams Streets to two-way traffic and to widen Adams Street to accommodate a five-lane section. (2014 Estimated costs: Design = $800,000, Right-of-Way = $12,000,000, Utilities = $4,500,000, Construction = $5,400,000)

1.3 STUDY GOAL

Applying the principles of performance based flexible solutions, the long-term recommendation to convert Kentucky and Adams Street to two-way traffic and to widen Adams Street to

[1] https://www.warrenpc.org/wp-content/uploads/2018/04/Downtown%20Bowling%20Green%20Final%20Report%203-18-15%20.pdf

accommodate a five-lane section may not be practical. Kentucky Street borders the northern edge of WKU. The presence of new student housing, university parking, and a CVS on the north side of Kentucky Street results in a diverse array of roadway users and modes of travel and compels the need to encourage compliance of traffic control devices, particularly those related to pedestrian safety. Specifically, operational changes are desired to encourage more attentive driving, a reduction in speed, a reduction in crashes, and a greater tendency for motorists to yield to pedestrians. Opportunities to enhance multimodal facilities such as bike lanes are also desired. Therefore, the goal of the Kentucky and Adams Street (US 68X) Improvement Study is to identify and evaluate potential traffic operational changes which are compatible with land use and increase safety for all modes of travel.

1.4 PLANNED PROJECTS

There is one planned project in the immediate area listed in *Kentucky's FY 2020 – FY 2026 Highway Plan*:

- Item No. 3-8857.00: Major widening/reconstruction on US 31W from Campbell Lane (US 231) to University Boulevard (US 231X) (MP 10.561 – MP 11.688). This project ranks high in the District's Transportation Plan. Design began in 2017 and the 2020 Highway Plan includes $1,750,000 in FED funds for the right-of-way in fiscal year 2021, and $5,800,000 in State Construction High Priority Project (SPP) funds for utility phase in fiscal year 2023. The 2020 Highway Plan also proposes $4,550,000 in SPP funds for construction in fiscal year 2025.

2.0 EXISTING CONDITIONS

Conditions of the existing transportation network are examined in the following sections. The information compiled includes current roadway facilities and geometrics, crash history, and traffic volumes within the study area. Data for this section were collected from the KYTC Highway Information System (HIS) database, KYTC's Traffic Count Reporting System, aerial photography, as-built plans, and from field inspection.

2.1 ROADWAY SYSTEM

Functional classification is the grouping of roads, streets, and highways into integrated systems ranked by the level of mobility for through movements and access to adjoining land. This grouping acknowledges that roads serve multiple functions and it provides a basis for comparing roads. Functional classification can be used for, but is not limited to, the following purposes:

- Provide a framework for highways serving mobility and connecting regions and cities within a state.
- Provide a basis for assigning jurisdictional responsibility according to the roadway's importance.
- Provide a basis for development of minimum design standards according to function.
- Provide a basis for evaluating present and future needs.

- Provide a basis for allocation of limited financial resources.

Figure 2 shows the functional classification of roadways within the study area. Minor arterials (shown in blue) serve trips of moderate length to smaller geographic areas and provide connections between principal arterials. Collectors (shown in green) serve to connect local roads and the arterial network[2]. As a one-way couplet, Kentucky and Adams Street are classified as Urban Minor Arterials with posted speed limits of 35 miles per hour (mph). US 68 (6th Street) to the north is classified as an Urban Principal Arterial with posted speed limits of 35 mph. **Figure 3** shows the number of lanes and description of lane widths. Both Adams and Kentucky Streets include two one-way driving lanes and one parking lane.

With few exceptions, most portions of Kentucky Street and Adams Street within the study area are designed to control surface drainage with concrete curb and gutter. **Figure 4** shows the curb-to-curb width of Adams Street ranges from 27.75 feet northeast of 14th Street to 34 feet near the RC Cola Building while Kentucky Street has an average width of 30 feet. The measurements were collected using a laser measuring device during a field visit on February 4, 2020. Based on Warren County Property Valuation Administration (PVA) data, the existing right-of-way ranges from 42 to 55 feet on Adams Street and 42 to 50 feet on Kentucky Street.

Kentucky Revised Statutes (KRS) 189.222 requires weight limits on the state-maintained highway system. Both Kentucky Street and Adams Street are designated AAA truck highways in the study limiting the total gross weight of the vehicle and load to not exceed 80,000 pounds as shown in **Figure 5.**

[2] *Highway Functional Classification Concepts, Criteria and Procedures*. U.S. Department of Transportation/Federal Highway Administration. https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/section03.cfm#Toc336872985

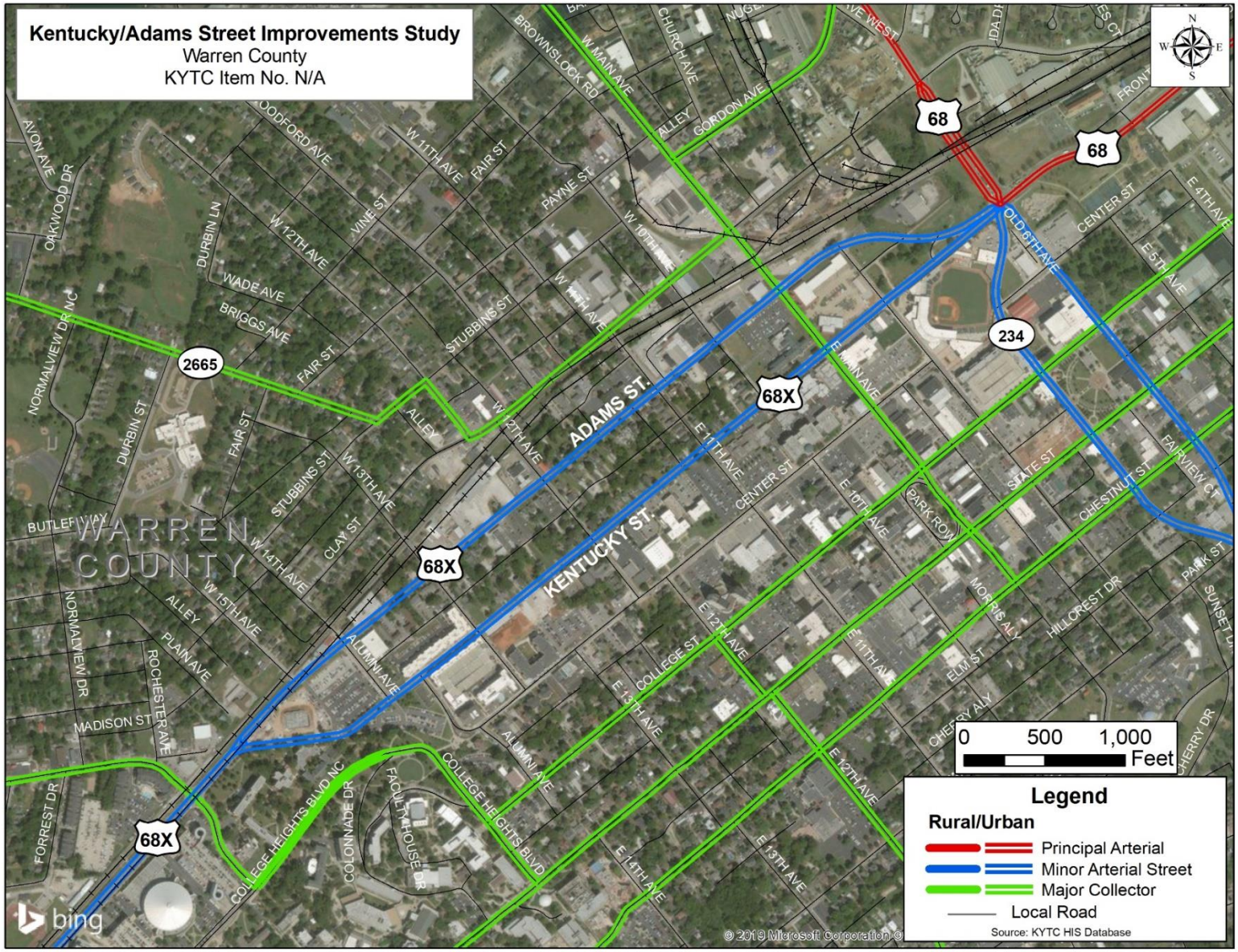


Figure 2 - Functional Classification

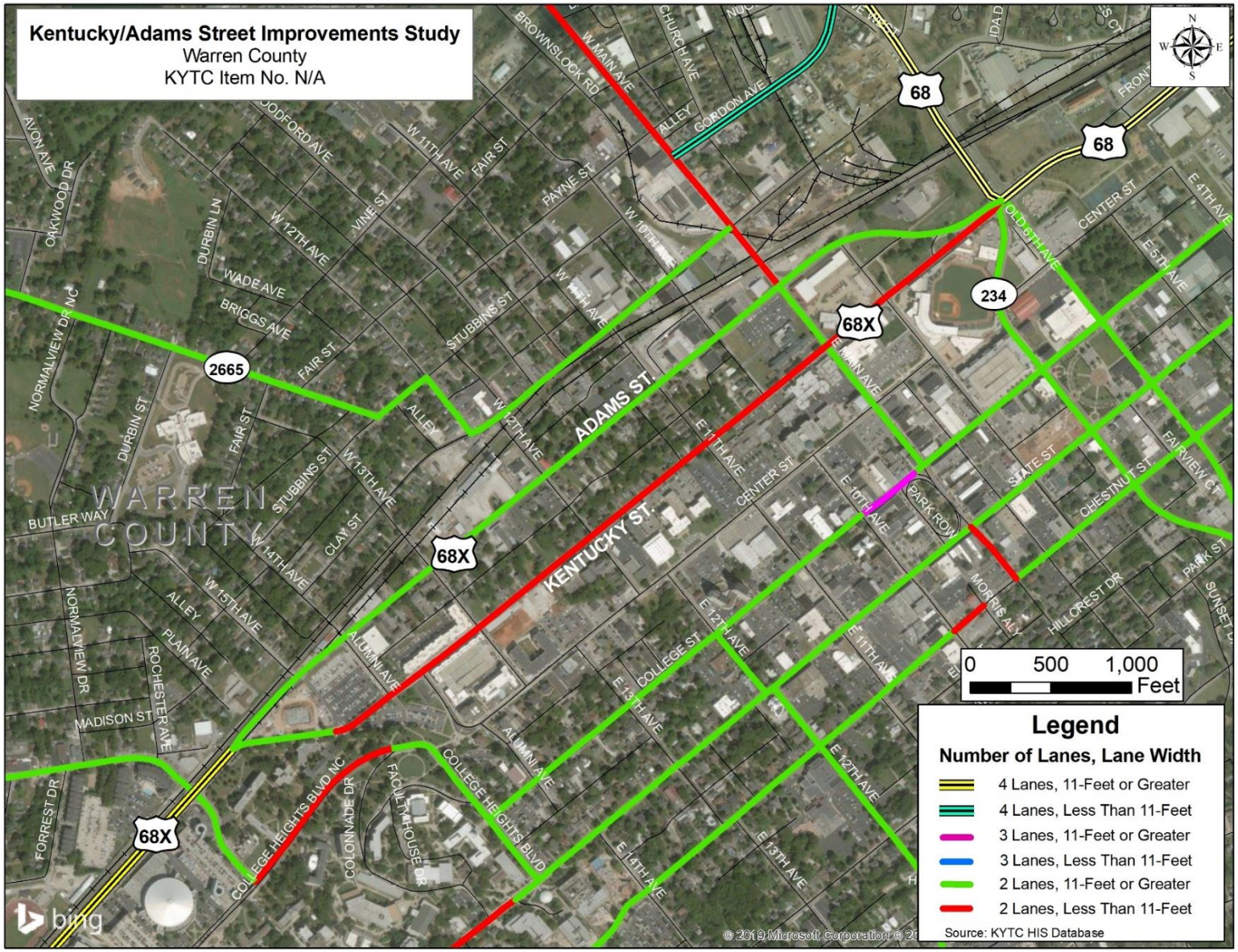


Figure 3 - Typical Sections

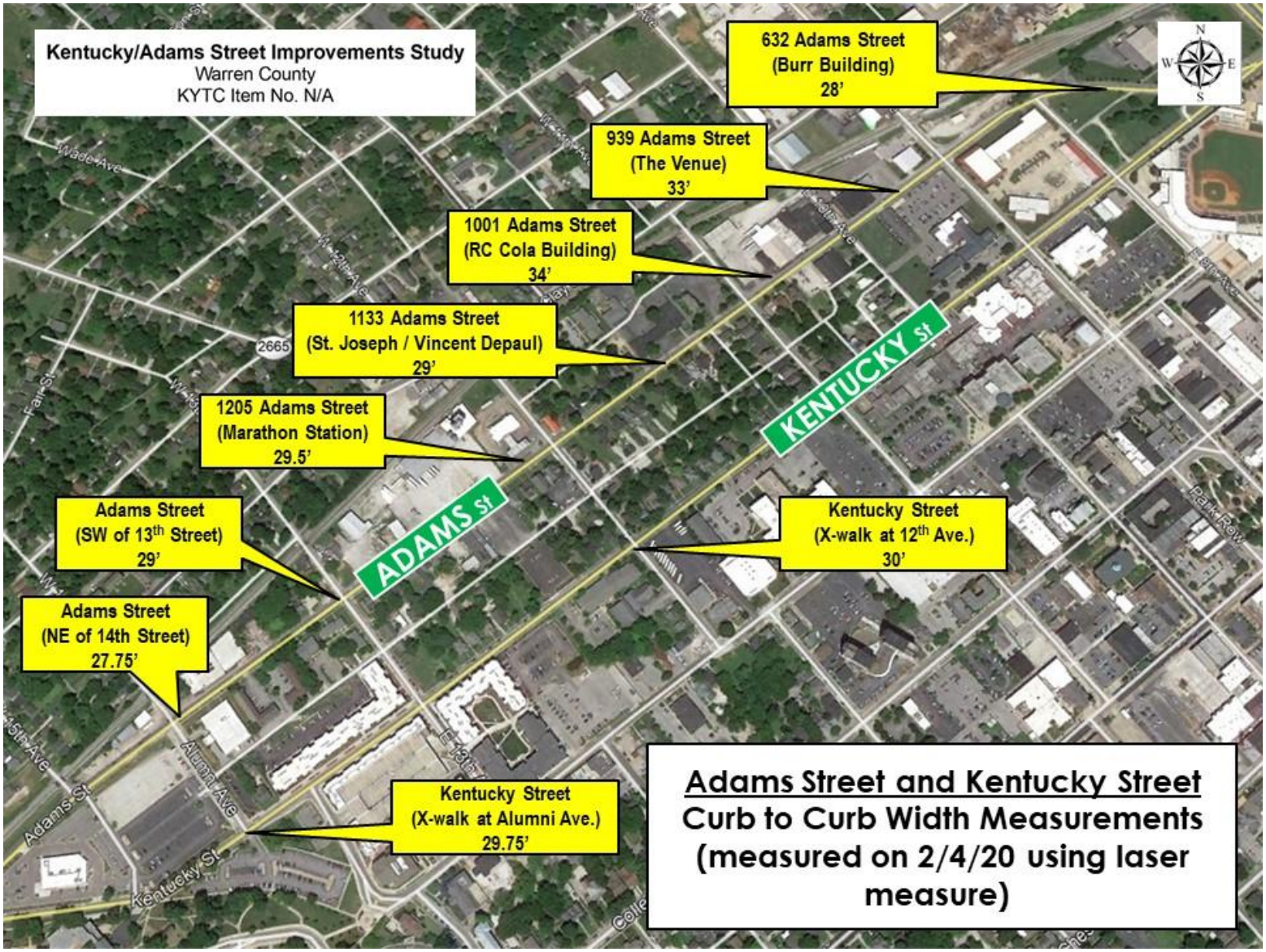


Figure 4 - Curb to Curb Width Measurements

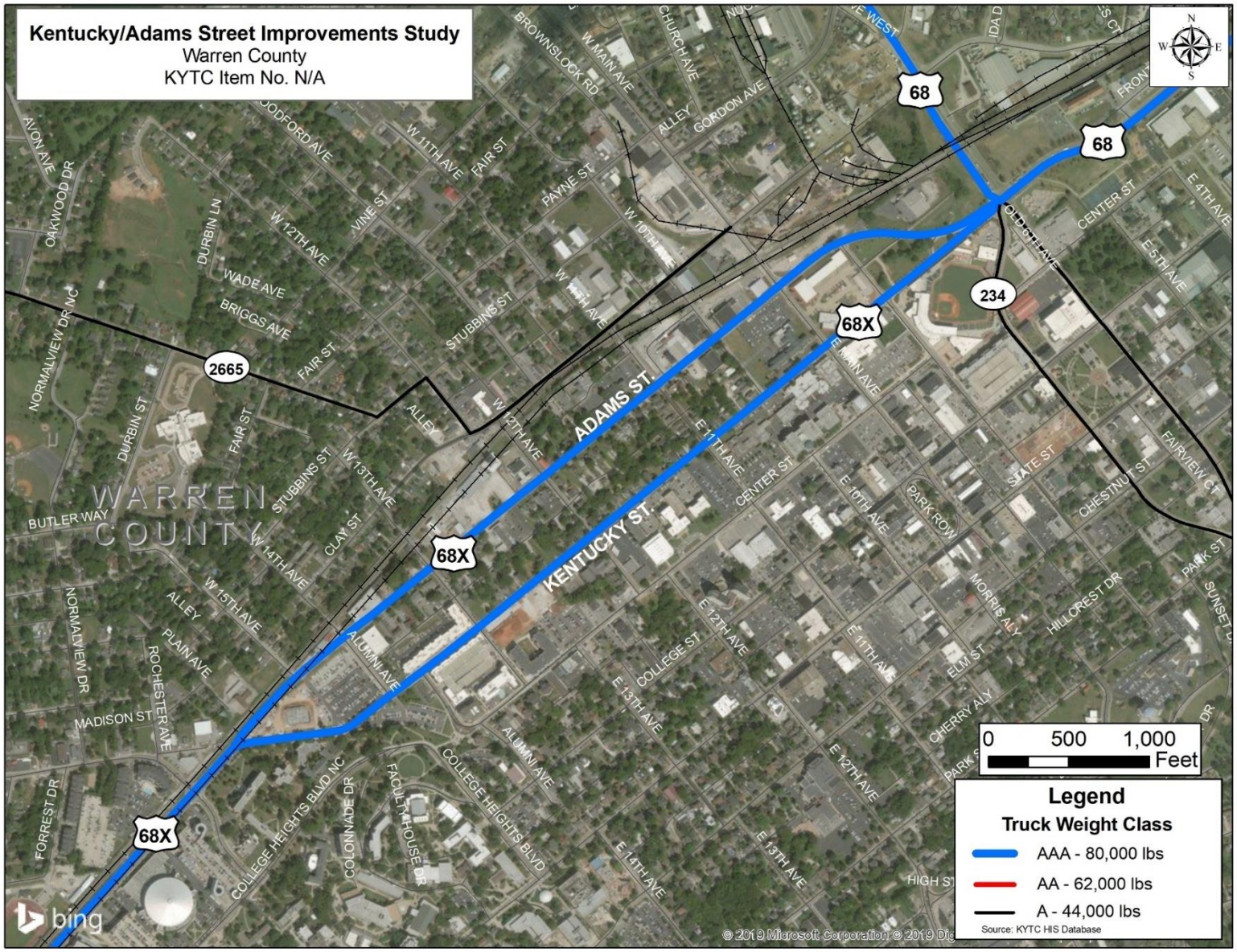


Figure 5 - Truck Weight Classification

Kentucky and Adams Street join at the south end of the study area to form University Drive. University Drive and Old Morgantown Road/College Heights Boulevard is the major intersection near the southwest split with the following approaches:

- **Eastbound Old Morgantown Road** – One shared thru/right-turn and a left-turn lane
- **Northbound University Drive** – One shared through/right-turn lane, one dedicated thru lane and a left lane
- **Westbound College Heights Boulevard** – One shared thru/left-turn and a right-turn lane
- **Southbound University Boulevard**
  One shared through/right-turn lane
  Dedicated thru lane and a left-turn lane

University Dr. and Old Morgantown Rd./ College Heights Blvd.

At the north end of the study area, Kentucky and Adams Street join and continue as Kentucky Street. The current Kentucky Street and E 6th Avenue / Veterans Memorial Lane is the major intersection near the northeast split with the following approaches:

Kentucky St and E 6th Ave./Veterans Memorial Ln.

- **Eastbound Veterans Memorial Lane** – Shared thru/right lane, dedicated thru lane and dual left-turn lanes.
- **Northbound Kentucky Street** – Shared thru/right lane, dedicated thru lane and a left-turn lane.
- **Westbound E 6th Avenue** – Shared thru/right lane, dedicated thru lane and a left-turn lane.
- **Southbound Kentucky Street** – Right-turn lane, two thru lanes and a left-turn lane.

2.2 MULTIMODAL TRAVEL

Multimodal travel in the study area includes pedestrians, bicyclists, and transit. Each of these modes of travel are important in moving people through the study area.

With the proximity to WKU and commuter parking, pedestrians and bicyclists are present along Kentucky and Adams Street. Based on GPS data from social-fitness app Strava[3], pedestrians are more concentrated on Kentucky Street, particularly on the southern portion close to WKU.

[3] http://www.strava.com/

Bicyclists are more prevalent on routes to the south of the study area than on Kentucky and Adams Streets.

Three unsignalized pedestrian crosswalks exist on Kentucky Street within three blocks as shown in **Figure 6**. The first and most heavily used (based on September 8, 2019 count) is a pedestrian actuated rectangular rapid flashing beacon near the entrance to CVS. To cross, pedestrians push a button and the beacons start flashing. The second crosswalk, at Alumni Avenue, has an LED edge lit pedestrian sign which flashes 24/7. The third, at 13th Avenue, has signs at either end of the crosswalk. All three are Manual on Uniform Traffic Control Devices (MUTCD) compliant, but not consistent with each other. Additionally, crosswalks at each of the signalized intersections are present along Adams and Kentucky Street.

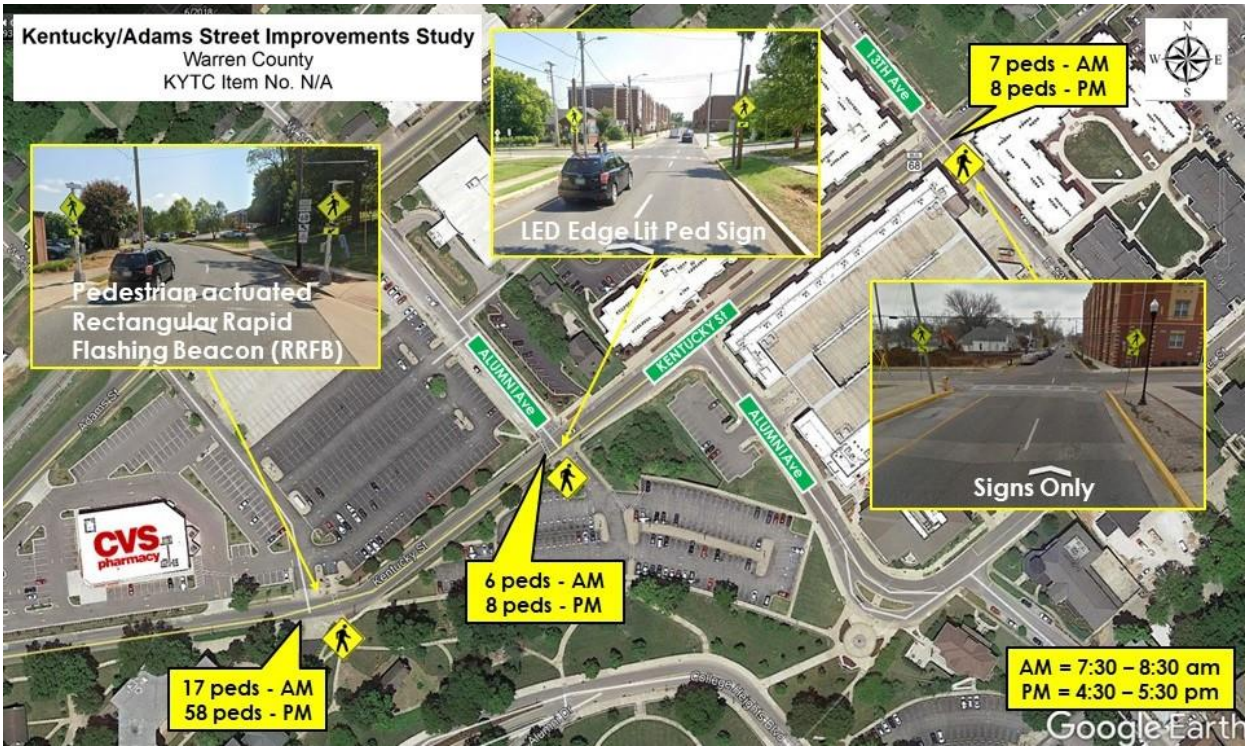


Figure 6 - Pedestrian Crosswalks on Kentucky Street

No bicycle-specific facilities are present in the study area. Bicycles share the travel lanes with motorists on Adams and Kentucky Street.

Several GO BG[4] (Red Line Route 1, Blue Line Route 2, Yellow Line Route 3) and WKU[5] (Hilltopper Route) bus routes that traverse the study area are shown in **Figure 7.** Diversion of routes and/or relocation of bus stops were considered during the development of improvement concepts.

[4] https://www.casoky.org/go-bg-transit
[5] https://www.wku.edu/transportation/transit/

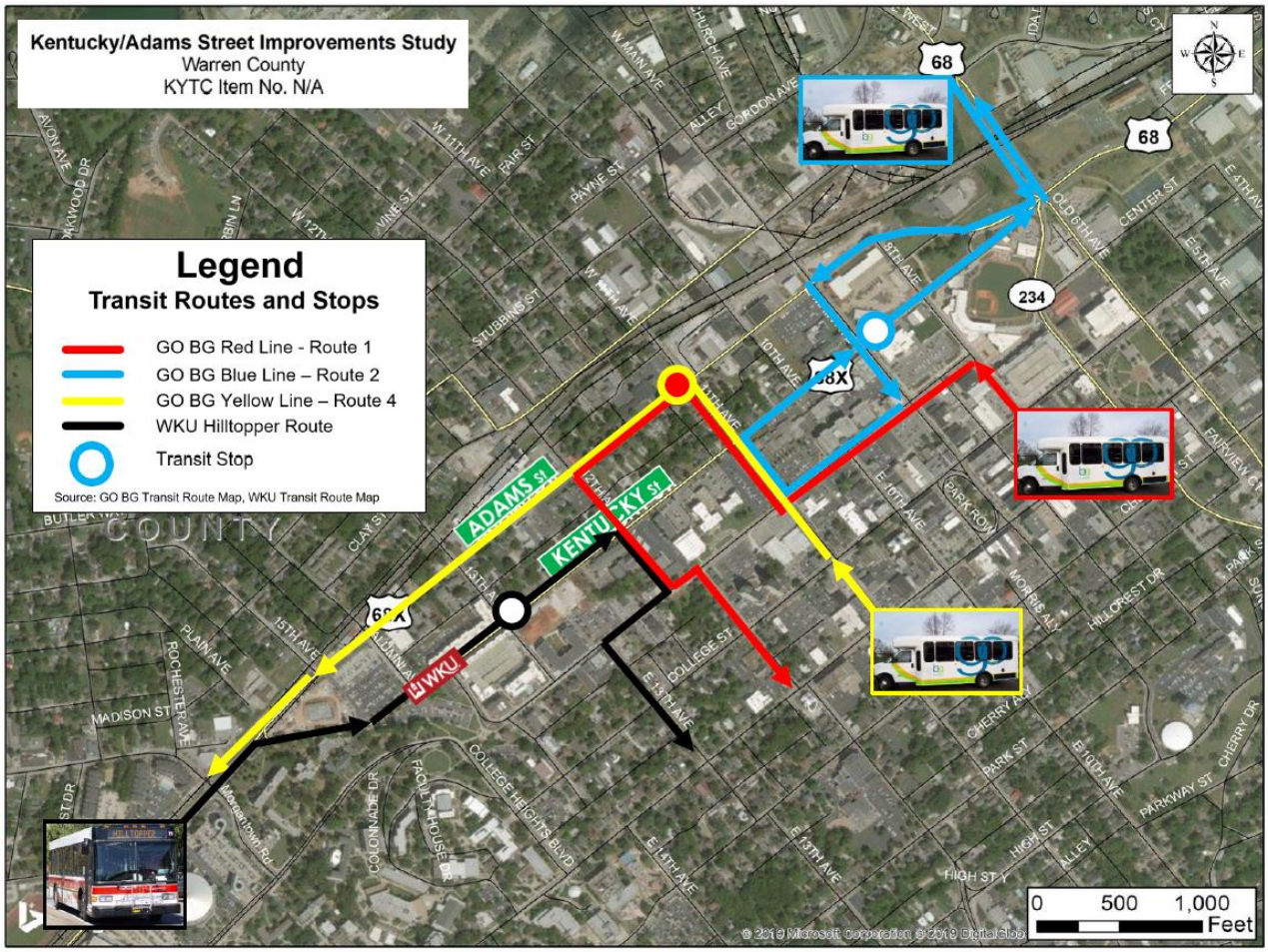


Figure 7 - Transit Routes and Stops

2.3 EXISTING TRAFFIC ANALYSIS

A review of the existing study area traffic revealed daily traffic volumes between 6,700 and 10,200 vehicles per day (VPD) on Adams Street and 7,800 VPD on Kentucky Street. South of the southwest split, University Drive (US 68X) carries 19,600 VPD. North of the northeast split, Kentucky Street (US 68) carries 16,500 VPD and Veterans Memorial Lane (US 68) carries 17,500 VPD. **Figure 8** displays the average daily traffic (ADT) for study area roadways.

New turning movement counts from the Fall of 2019 were collected for the existing AM (7:30 AM – 8:30 AM) and PM (4:30 PM – 5:30 PM) peak hours. These counts, which included pedestrian counts, were taken at the following locations:

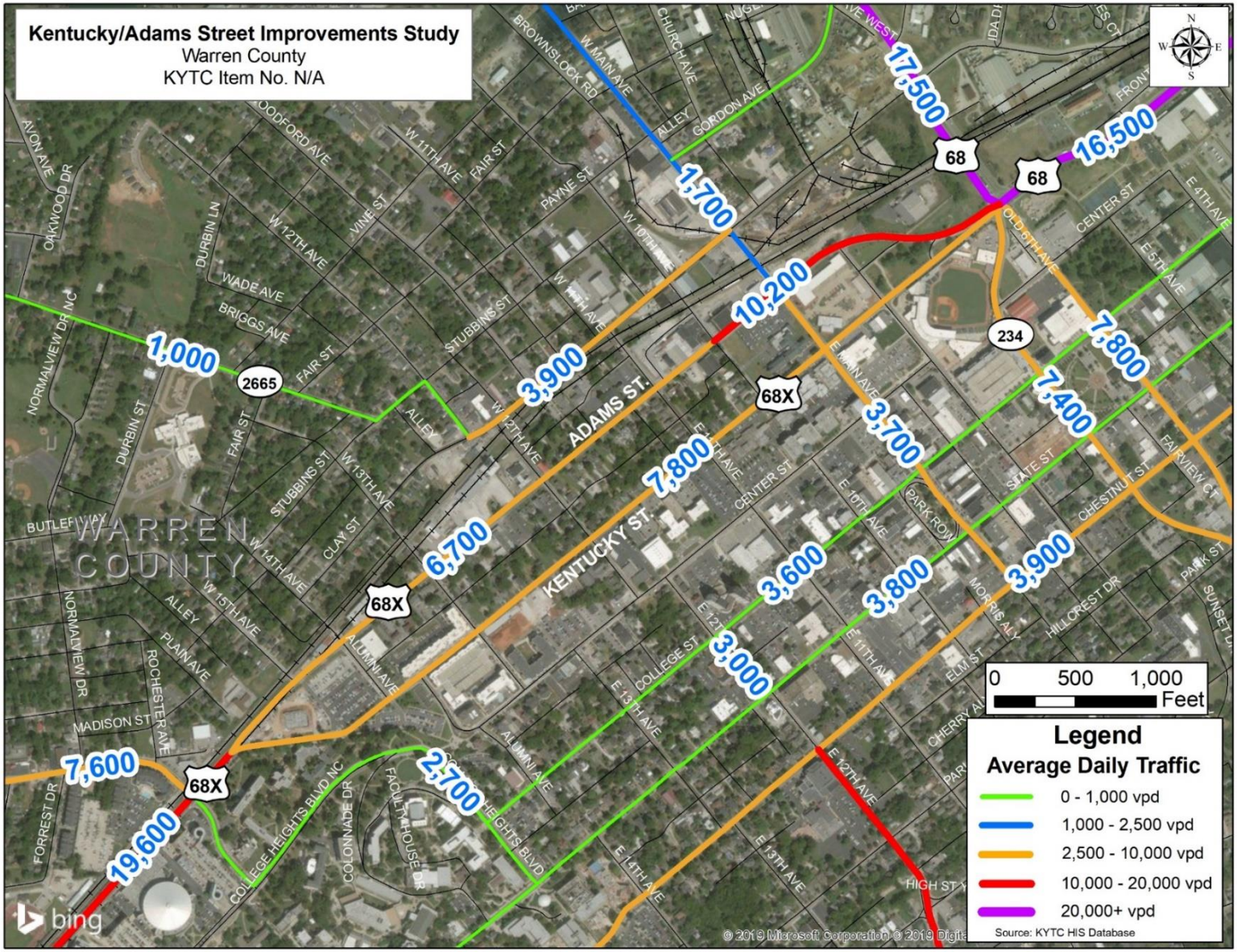


Figure 8 - Average Daily Traffic (ADT) Volume

- University Drive (US 68X) at Old Morgantown Road
- Kentucky Street (US 68X) at CVS
- Adams Street (US 68X) at CVS
- Kentucky Street (US 68X) at Alumni Avenue
- Adams Street (US 68X) at Alumni Avenue
- Kentucky Street (US 68X) at 13th Avenue
- Adams Street (US 68X) at 13th Avenue
- Kentucky Street (US 68X) at 12th Avenue
- Adams Street (US 68X) at 12th Avenue
- Kentucky Street (US 68X) at 11th Avenue
- Adams Street (US 68X) at 11th Avenue
- Kentucky Street (US 68X) at 10th Avenue
- Adams Street (US 68X) at 10th Avenue
- Kentucky Street (US 68X) at Main Avenue
- Adams Street (US 68X) at Main Avenue
- Kentucky Street (US 68X) at 8th Avenue
- Adams Street (US 68X) at 8th Avenue
- Kentucky Street (US 68X) at 6th Avenue (US 68

Additional counts from the 2019 *Russellville Road (US 68X and US 231X) Planning Study* and the Bowling Green/Warren County MPO *US 31W Bypass Study* were used to update model counts at the following locations:

- University Drive (US 68X) at Russellville Road (US 231X)
- University Drive (US 68X) at Creason Street
- University Drive (US 68X) at Normal Street
- University Drive (US 68X) at Nashville Road (US 31W)
- Nashville Road (US 31W) at Chestnut Street
- Nashville Road (US 31W) at Cabell Drive
- Nashville Road (US 31W) at Broadway Avenue (US 231X)
- Nashville Road (US 31W) at 10th Avenue

Combined peak hour turning movement counts are shown in **Figure 9**.

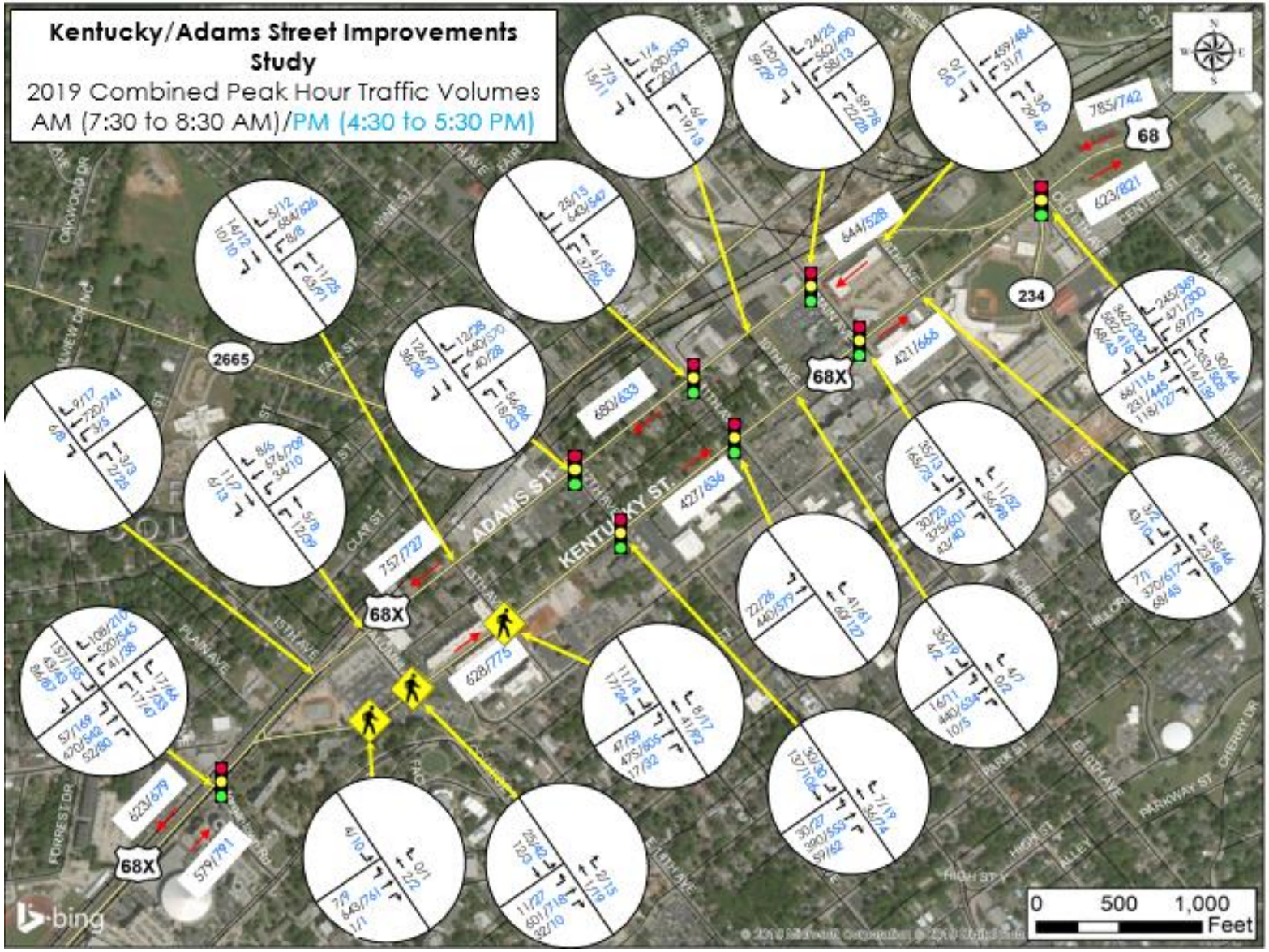


Figure 9 - 2019 Peak Hour Turning Movement Counts

2.4 BASE YEAR (2020) SIMULATION MODEL

The *Downtown Bowling Green Traffic Circulation* Study TransModeler simulation model (2014) was used as the source for the simulation model and network. Separate model scenarios are included for the AM peak hour (7:30 am – 8:30 am) and the PM peak hour (4:30 pm – 5:30 pm). Aerial imagery and field notes were used to enhance and update the network to include current turn lanes and operational controls such as traffic signals and speed limits. **Figure 10** presents the simulation model study area, which covers downtown Bowling Green including US 31W, US 68, and US 68X. The focused study area, shown in red, includes Kentucky and Adams Streets (US 68X). A few network updates included the following:

- University Drive and Normal Street – add a right turn lane on Normal Street
- Left turn lanes added on Chestnut Street between 6th and 8th Avenues

Turning movement counts from the original model were used for most intersections outside those shown on **Figure 9**.

2.4.1 Model Validation and Results

The updated traffic simulation model was calibrated to known traffic conditions. Visual audits were performed throughout the calibration process. At the beginning of the process, areas with heavy congestion were specifically targeted to ensure that these areas reflected existing traffic conditions. Intersections were checked to ensure that the turning movement and link-based counts were accurate. Once errors in data and the model geography were resolved, areas where the traffic was inconsistent with expected volumes were examined. In rare cases where necessary for low volume external nodes, minor adjustments were made to trip tables to reflect professional judgement of expected minimal traffic levels from those locations. An iterative process of incremental adjustments made in isolation was used to bring model volumes closer to counts and ensure the overall balance of the model was maintained.

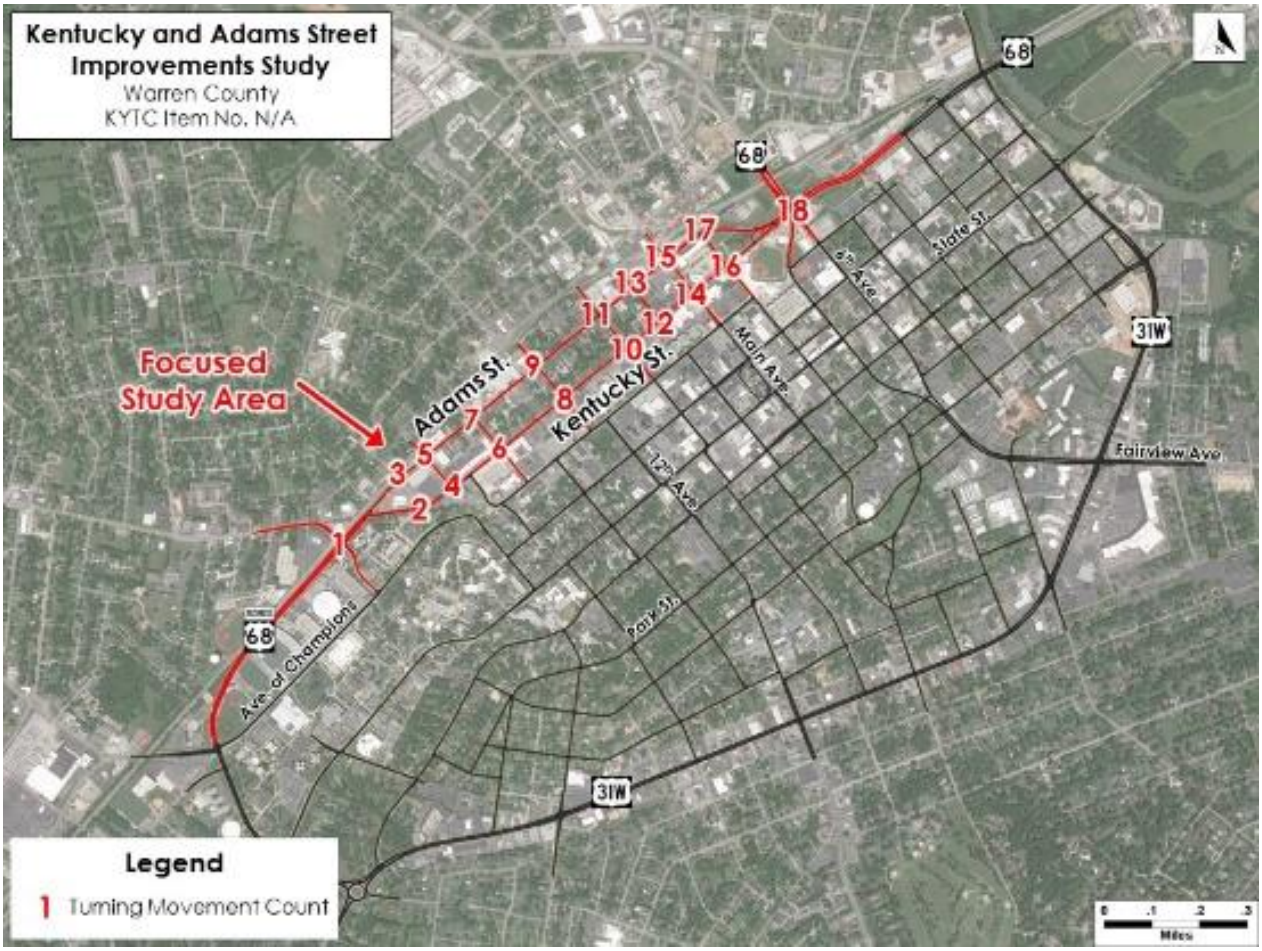
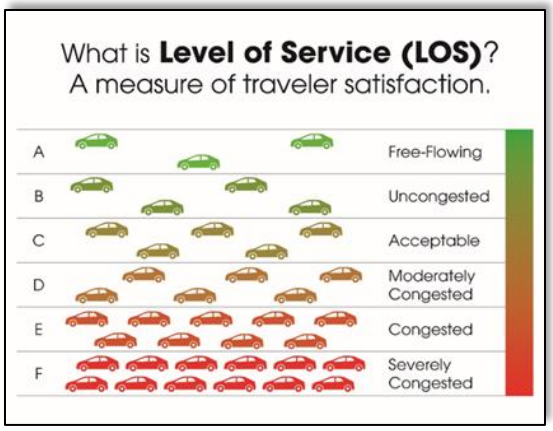


Figure 10 - Simulation Model Study Area

Model speeds and travel times were collected using the Corridor Travel Time output feature. Selection sets were created for the links that comprise Kentucky Street and Adams Street, and operational data were collected on each of these corridors for five iterations of the model simulation. Model speeds and travel times were compared to actual data collected during the February 2020 site visit. The first step in calibrating the speeds was to ensure that the default road classification speed limit and actual speed limit were the same. Locations with posted speed limits that did not match up with the default road classification speed limit were corrected. Signal timing plans and driver parameters were also checked to validate speeds and travel times.

A full calibration memo is included in **Appendix A**.

To evaluate the adequacy of study area intersections and roadway segments, outputs from the simulation model were used to determine level of service (LOS). LOS is a qualitative measure describing operational conditions within a traffic stream, based on factors such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. For signalized intersections, LOS is determined by the average total vehicle delay. In urban areas such as this, LOS D or better is desirable.



Intersection LOS was calculated for the AM and PM peak hours. All intersections within the study area operate at an acceptable LOS for both the AM and PM peaks, as shown in **Figure 11** and **Figure 12**, respectively. Intersection approach LOS can be found in **Appendix B**.

Travel times and queue lengths at the intersections were also calculated from the model. Existing travel times are between 2.9 and 3.3 minutes for both AM and PM peak hours for both Kentucky and Adams Street. **Table 1** displays the existing AM travel times and **Table 2** displays the PM travel times. Queue lengths can be found in **Appendix B**.

Table 1: Existing AM and PM Travel Times (in minutes)

Model	Scenario	Adams		Kentucky	
		6th to Old Morgantown	Old Morgantown to 6th	6th to Old Morgantown	Old Morgantown to 6th
7:30 - 8:30 AM	2020	2.9			3.1
4:30 - 5:30 PM	2020	3.0			3.3

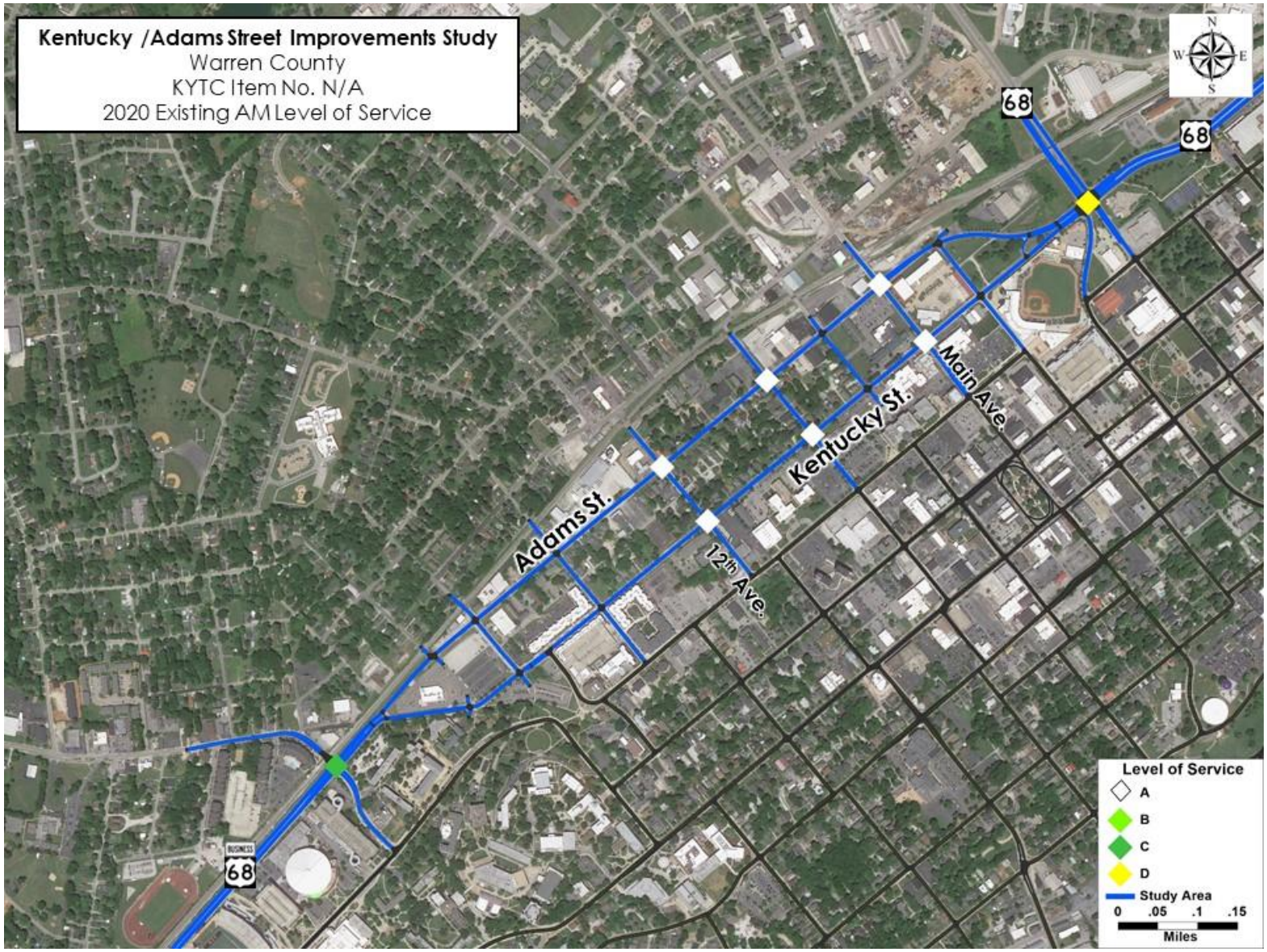


Figure 11 - Existing (2020) AM Level of Service

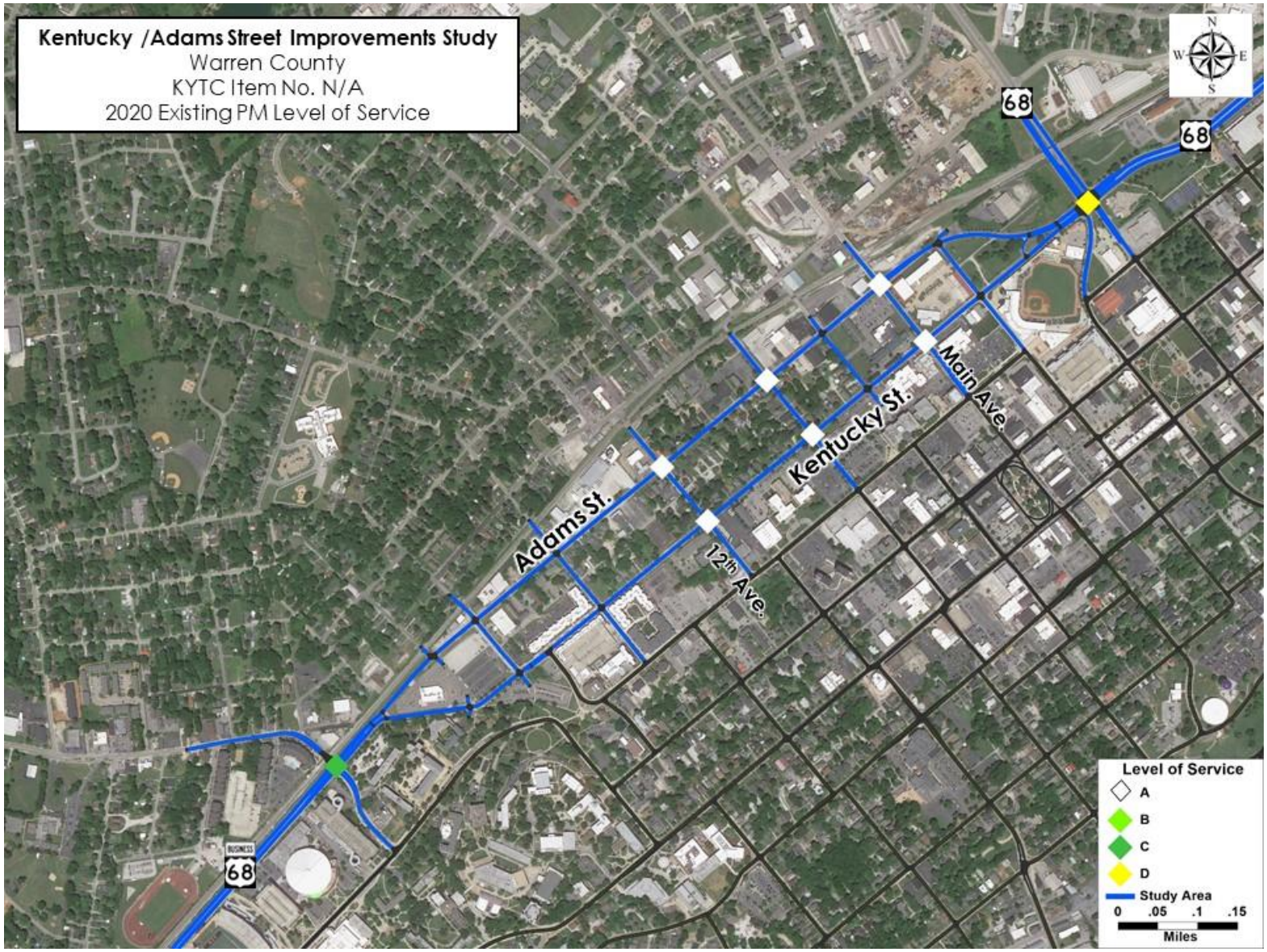


Figure 12 - Existing (2020) PM Level of Service

2.5 CRASH HISTORY

To quantify safety concerns, a crash analysis was performed within the study area. Over the three-year period from January 1, 2017 to December 31, 2019, there were 298 crashes on the one-way couplet of Kentucky and Adams Streets (US 68X). Of the 298 crashes, 55 (18 percent) resulted in an injury and 243 (82 percent) were property damage only. The most common crash types were angle collisions (89 crashes, 30 percent), sideswipe same-direction (88 crashes, 30 percent), and rear ends (69 crashes, 23 percent). **Figure 13** displays the breakdown of crashes by crash type. Crash records and locations are included in **Appendix C**.

Of the 298 crashes in the study area there was one fatality in 2016 at the intersection of Kentucky Street and Veterans Memorial Lane / 6th Avenue which was attributed to defective brakes on the collision report. **Figure 14** demonstrates the distribution of crashes by severity.

2.5.1 Bicycle/Pedestrian Crashes

To quantify safety concerns for bicycles and pedestrians, the crash analysis was extended to a five-year period from January 1, 2015 to December 31, 2019 because bicycle and pedestrian crashes are more sporadic. Over the five-year period, there was one collision with a bicyclist reported, two collisions with a pedestrian in an intersection, and two collisions with a pedestrian not in an intersection. The locations are shown on **Figure 15.**

2.5.2 Excess Expected crashes (EEC)

Excess Expected Crashes (EEC) were calculated by the Kentucky Transportation Center (KTC) for both Kentucky and Adams Streets. EEC is a measure of crash frequency at a given site compared to what is expected based on current conditions (geometrics, traffic, etc.) based on methodology provided in the *Highway Safety Manual*. A positive EEC indicates more crashes are occurring than would be expected. Portions of both Kentucky and Adams Streets have EECs above 0.0, as shown in **Figure 16**. Particularly, the southwest portion of Kentucky Street in the vicinity of WKU is identified as an area of concern.

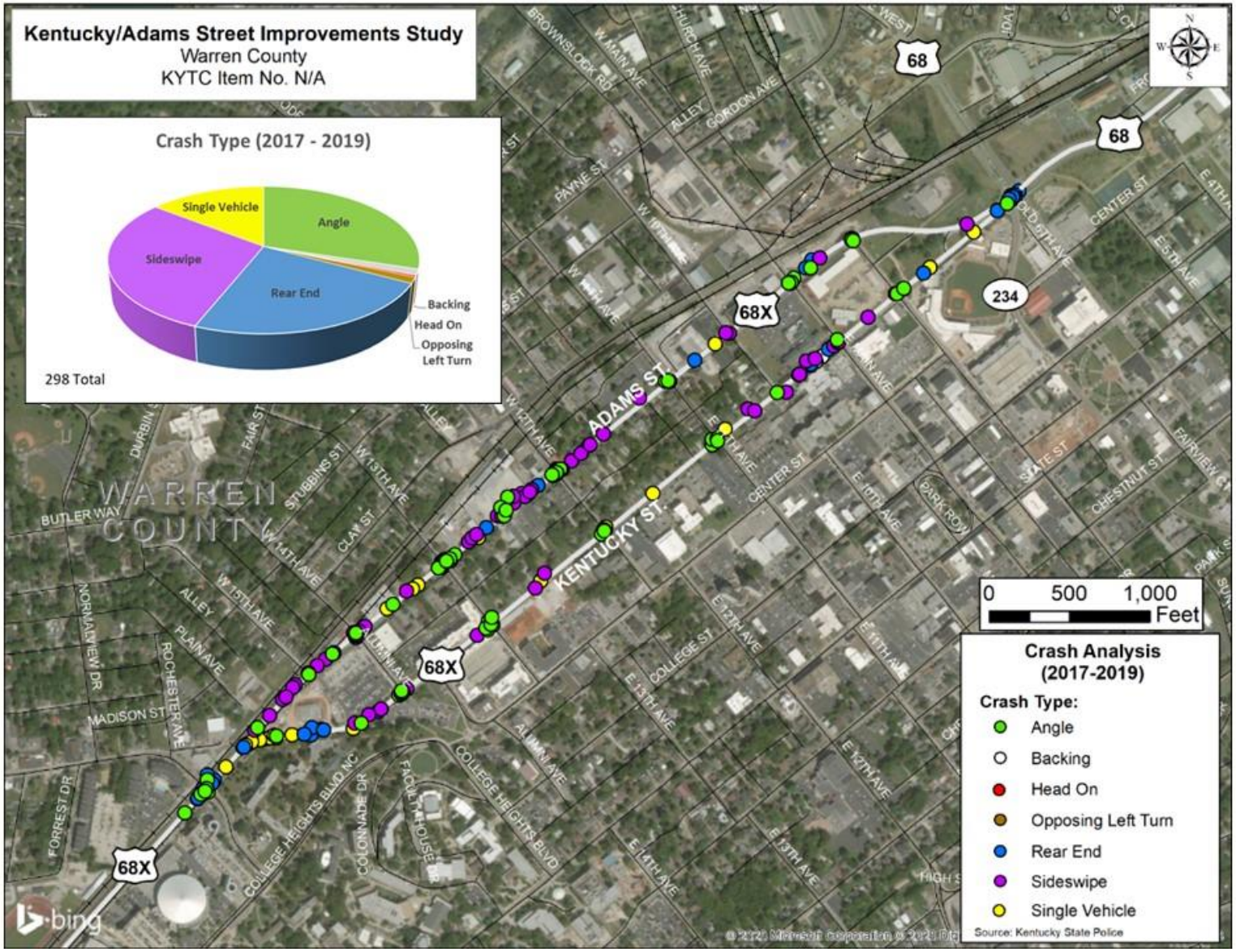


Figure 13 - Crash Type

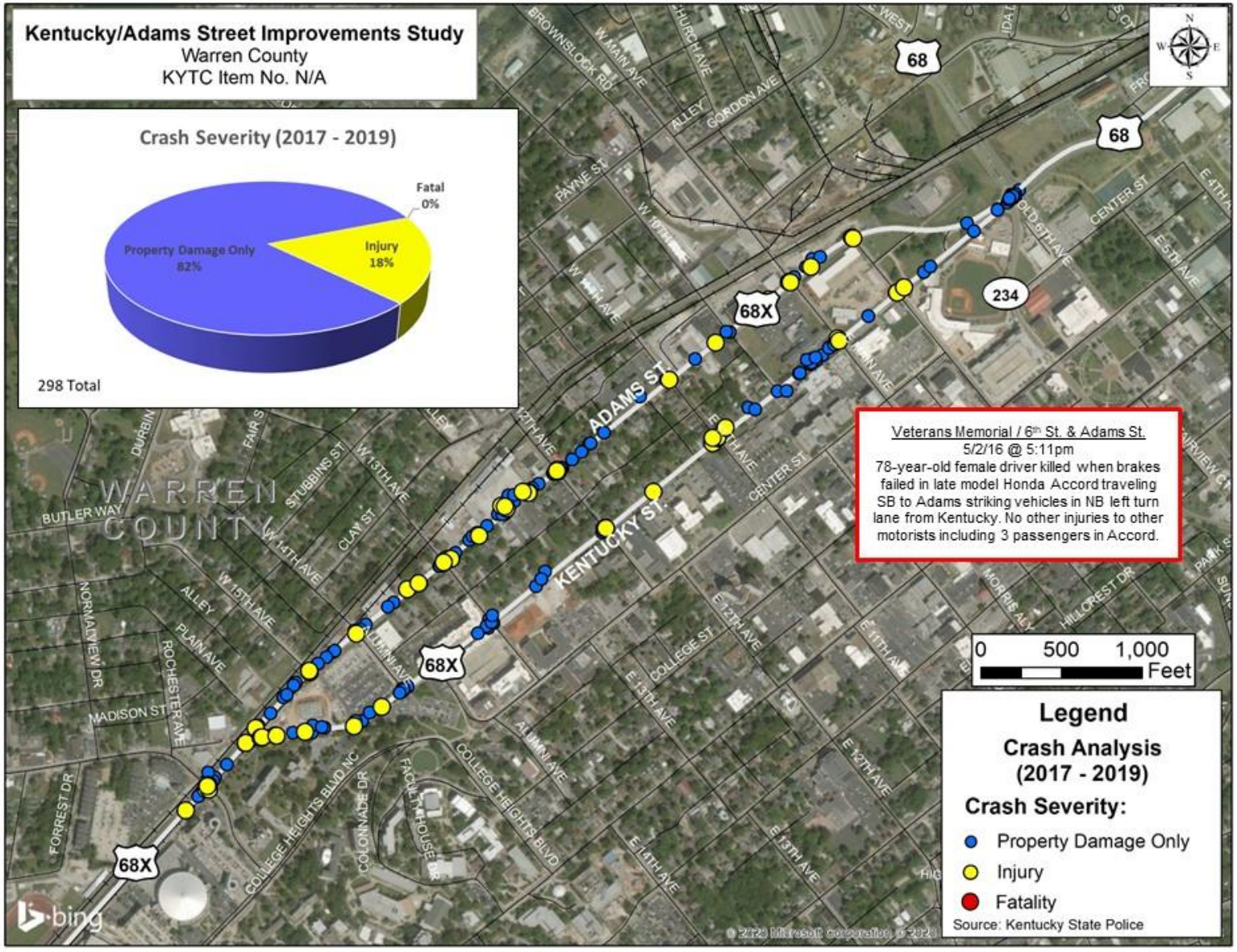


Figure 14 - Crash Severity

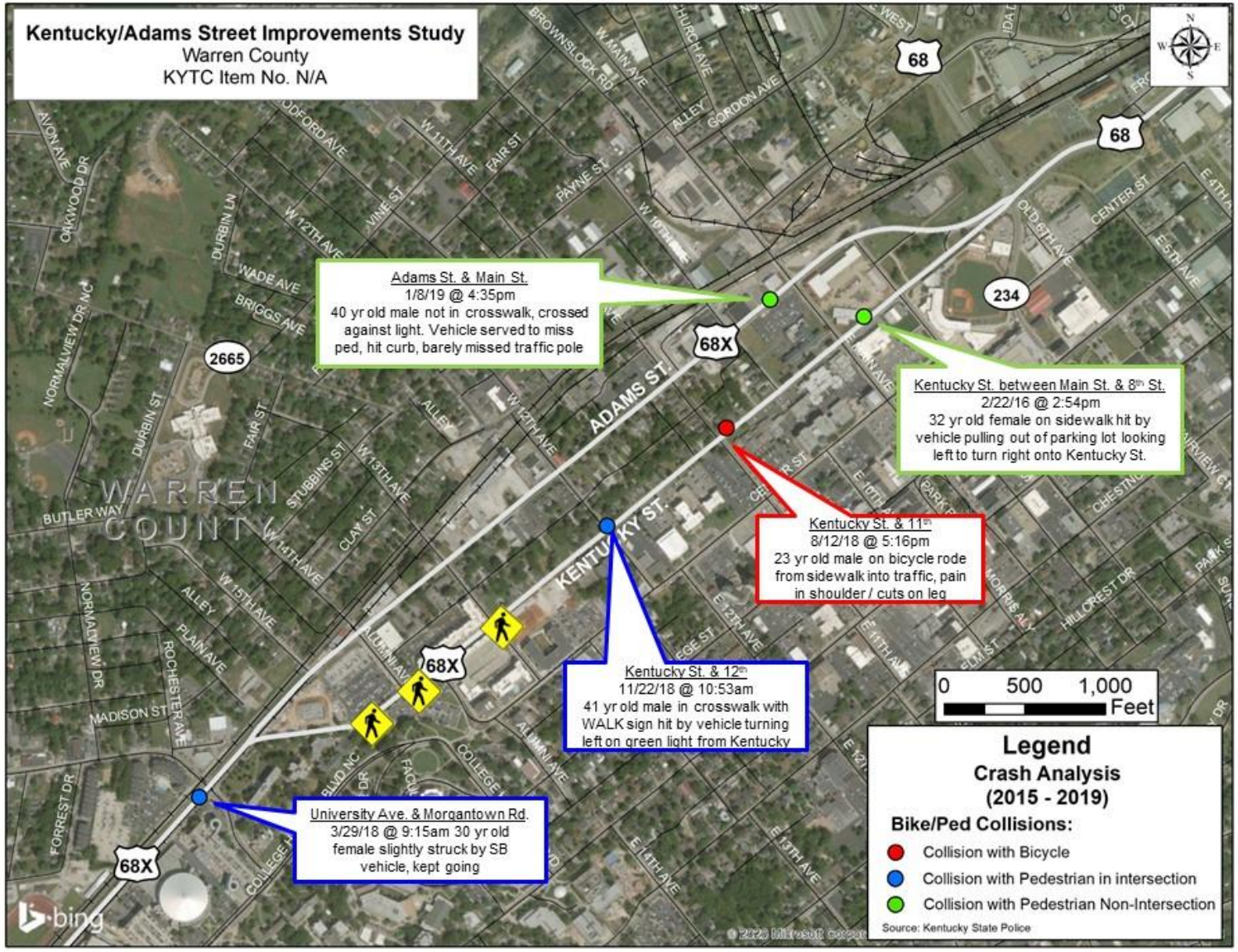


Figure 15 - Bicycle/Pedestrian Collisions

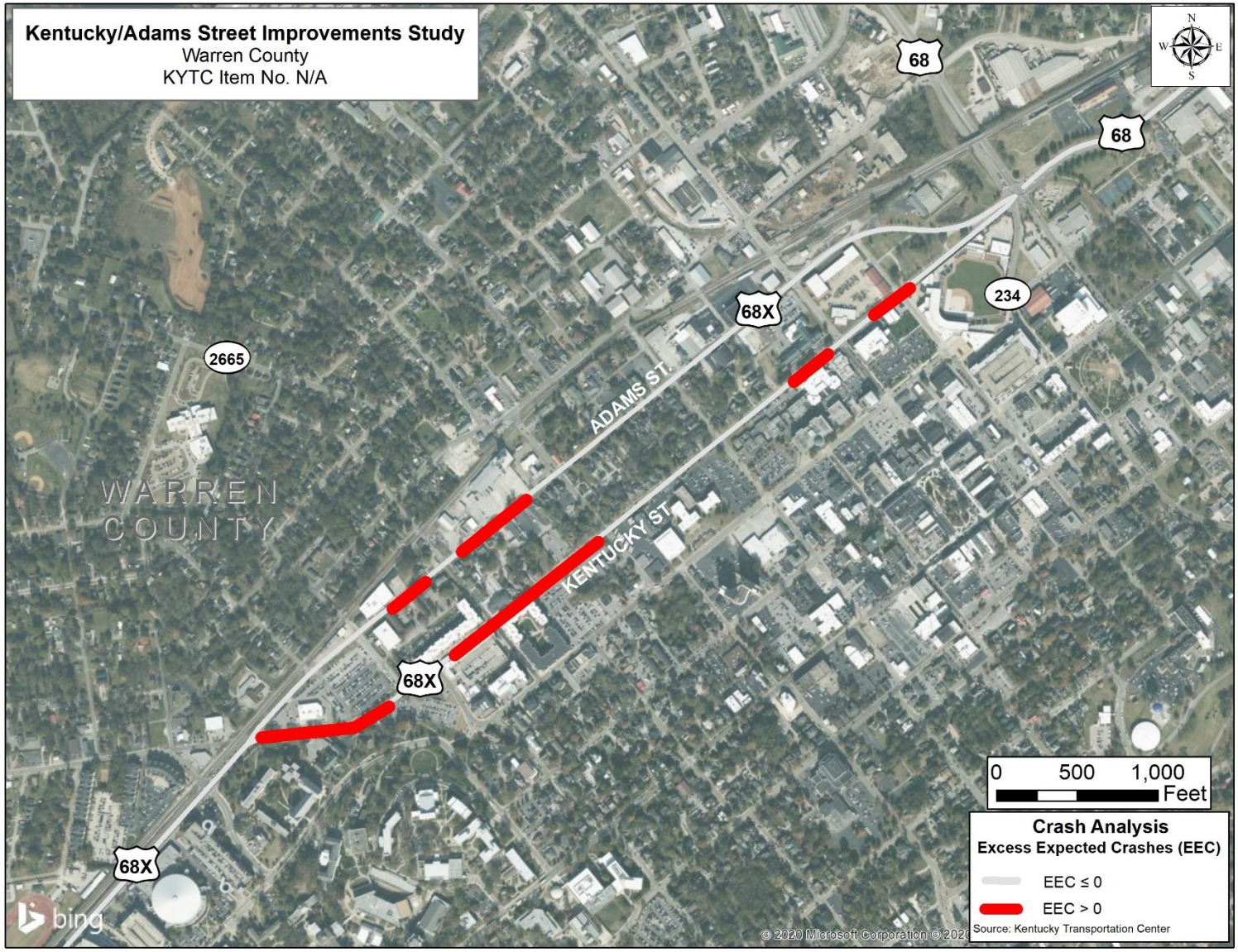


Figure 16 - Excess Expected Crashes

3.0 ENVIRONMENTAL OVERVIEW

An Environmental Red Flag Summary was performed to identify environmental resources of significance, potential jurisdictional features, and other environmental areas of concern that should be considered during future project development. Natural and human environmental resources within the study area were identified from a literature/database review, as well as a windshield survey. The complete document is included in **Appendix D**.

More detailed environmental studies may be required as individual projects are further developed, particularly if federal funds are used or if permits are required. If a future project is federally funded, the National Environmental Policy Act (NEPA) requires that potential environmental impacts regarding jurisdictional wetlands, archaeological sites, cultural historic sites, and federally endangered species must be avoided if feasible and prudent. If not, then impact minimization efforts are required. Mitigation for unavoidable impacts may also be necessary.

4.0 SOCIOECONOMIC STUDY

A Socioeconomic Study was completed by the Barren River Area Development District (BRADD) and is attached as **Appendix E**. This report presents an overview of the findings for selected socioeconomic characteristics in the Kentucky/Adams Street Improvement Study area summarizing 2014-2018 American Community Survey (ACS) statistics in and near the project area using tables, charts, and maps. The data presented in this document is intended to highlight areas of concern that will require additional analysis should any project be advanced to future phases. Statistics are provided for minority, elderly, poverty status, limited English proficiency (LEP), and disabled populations for the nation, state, region, county, and block groups located within the project area.

The methodologies used in this planning document are appropriate for identifying possible areas of concern in small urban areas and potential project corridors.

5.0 FUTURE CONDITIONS

It is necessary to estimate future conditions to evaluate the prospective effectiveness of potential transportation improvement concepts. This chapter summarizes the anticipated future conditions within the study area.

Based on the recently updated Warren County Travel Demand Model (updated in 2018), traffic volumes are expected to grow approximately 1.5 percent per year along Kentucky and Adams Streets. **Table 2** presents the projected 2030 and 2045 ADTs based on this annual growth rate. Growth is expected to be higher over the next ten years before slowing down between 2030 and 2045

Table 2: 2030 and 2045 ADTs

Route	2019 ADT	Ann. Growth Rate	2030 ADT	2045 ADT
Kentucky St.	8,000	1.5%	9,200	11,500
Adams St.	7,000	1.5%	7,900	9,900

Origin-Destination (O-D) data from Streetlight Insight® was used to better understand traffic patterns in the study area. External zones (shown on **Figure 17**) were set up at the major arterials around Bowling Green including Old Morgantown Road, Russellville Road, Nashville Road, Broadway Avenue, Fairview Avenue, Louisville Road, and Veterans Memorial Lane. Two additional zones were created, one in the southwestern portion of the study area to capture WKU traffic and another in the northeastern portion of the study area to capture downtown traffic. A “middle filter” was placed on Kentucky and Adams Streets to ensure that all trips counted to/from the external zones traveled on Kentucky and Adams Streets. **Figure 17** shows the percentages of trips passing through the Kentucky and Adams Streets middle filter coming from the external zones and **Figure 18** shows the percentages of trips going to the zones.

Of the trips that originate at the Louisville Road zone and travel through the middle filter on Kentucky and Adams Streets, 75 percent are through trips traveling to Old Morgantown Road or Russellville Road. An additional 16 percent travel to the southwest WKU zone.

Of the trips that originate at the Russellville Road zone and travel through the middle filter on Kentucky and Adams Streets, 56 percent travel through to Louisville Road and Veterans Memorial Lane. Additionally, 36 percent travel to the northeast downtown Bowling Green zone.

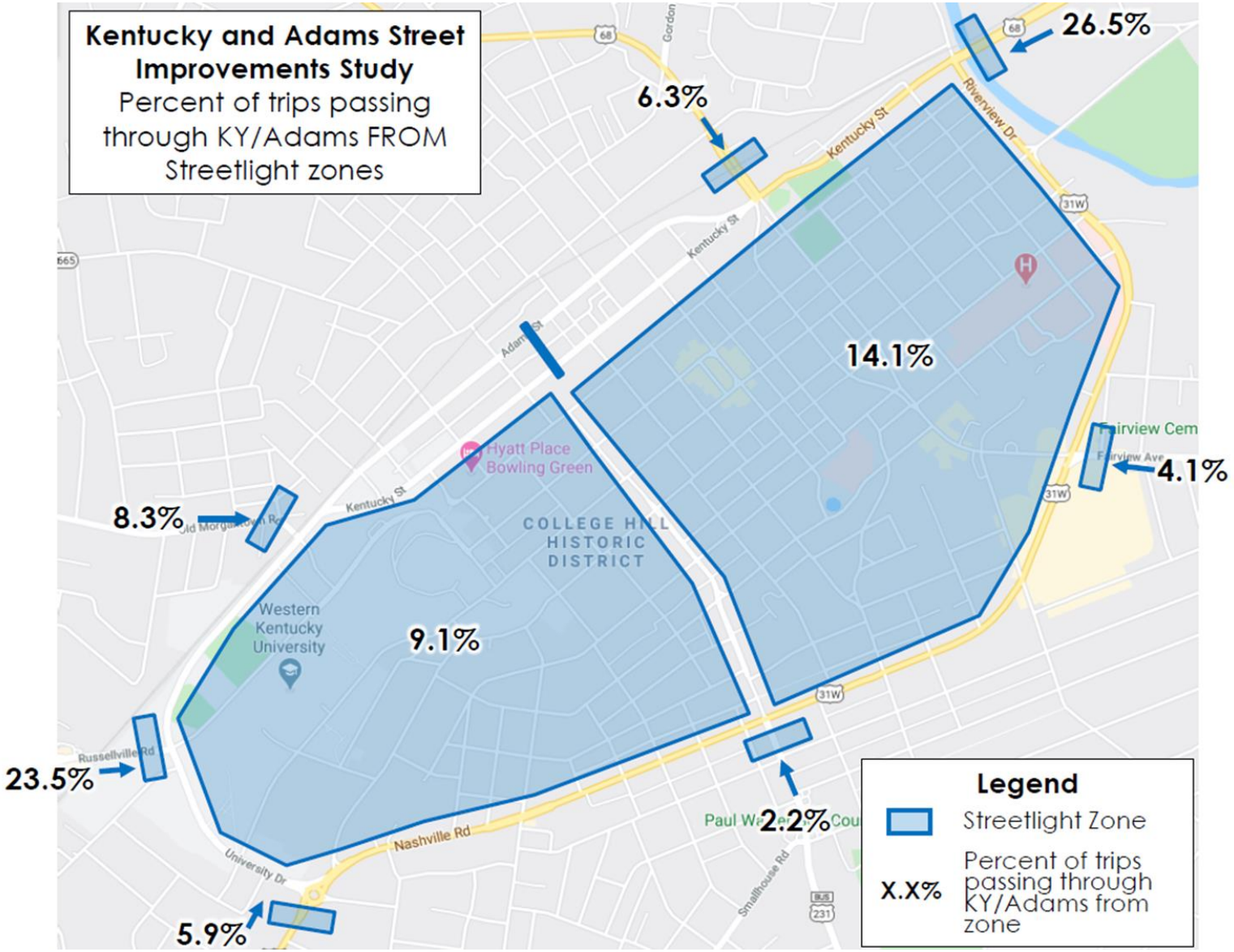


Figure 17 - Percent of Streetlight Trips Coming From External Zones

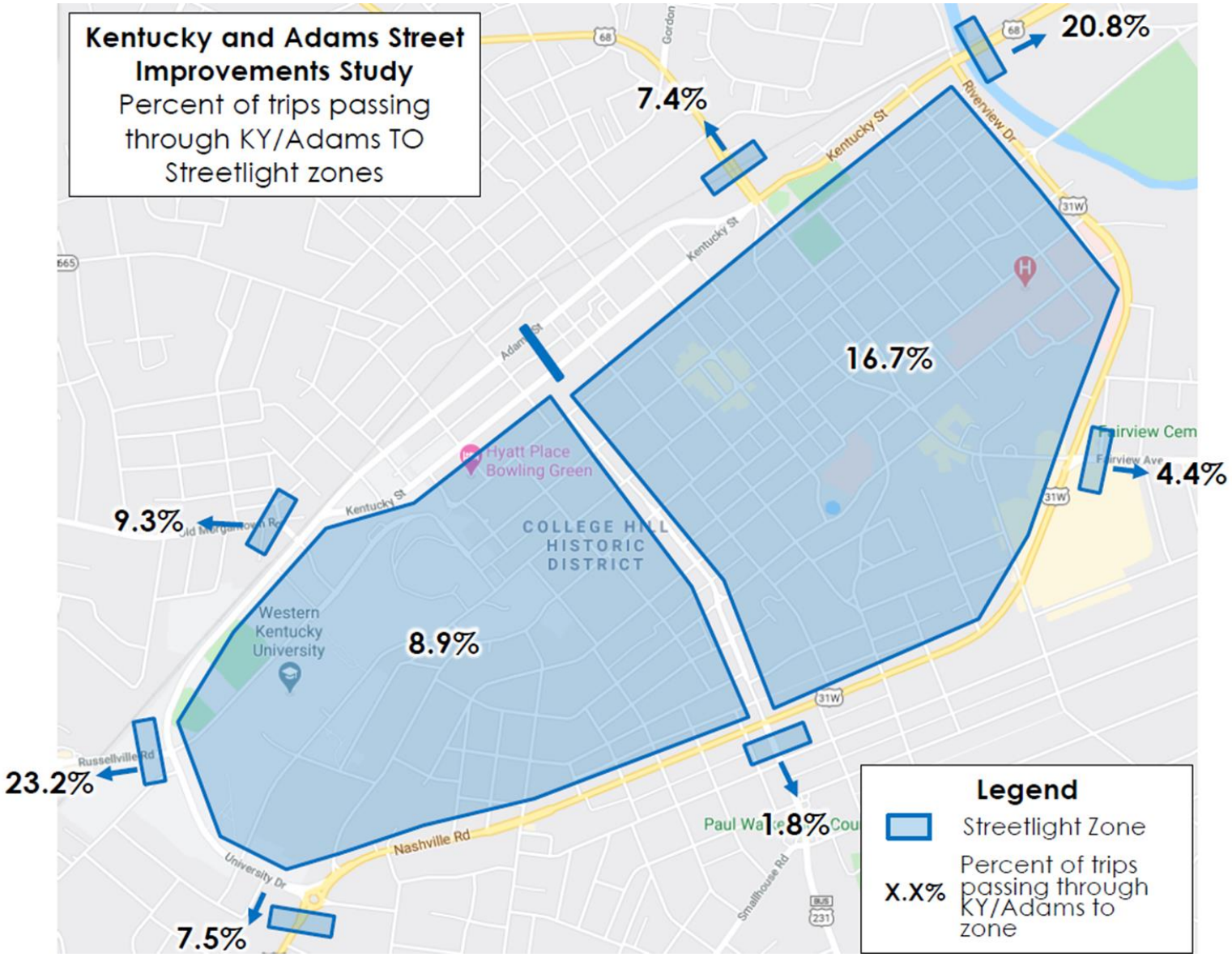


Figure 18 - Percent of Streetlight Trips Going To External Zones

5.1 2030 EXISTING PLUS COMMITTED (E+C) SCENARIO

In addition to the existing model updates, a 2030 Existing plus Committed (E+C) network was also created which includes two project recommendations from the Study. The first is an intersection improvement project at the Russellville Road intersection with University Drive which includes widening of northbound University Drive to add a new left-turn onto westbound Russellville Road, widening of southbound University Drive to add an additional southbound through lane, and restriping of the eastbound Russellville Road approach lanes from a single left / dual-right to a dual-left / single-right as shown in orange in **Figure 19**. The second project is a new traffic signal at the College Street intersection with 7th Avenue.

Without these two projects, congestion at the intersections would meter traffic from entering and exiting the study corridors, which dramatically decreases the simulated volumes on Kentucky Street and Adams Street. The modeled improvements at the Russellville Road intersection were based on the recommendations from the recently completed *Russellville Road (US 68X and US 231X) Planning Study*[6]. The results of that study concluded that, without improvement, the Russellville Road intersection would not be capable of serving future demand. The 2030 simulation model developed for this study further confirms this conclusion.

Installing a traffic signal at the intersection of College Street and 7th Avenue was recommended in the 2014 *Downtown Bowling Green Circulation Study*. Without a signal at this intersection, the simulation modeling showed significant congestion and queuing that affected traffic patterns within the current study area.

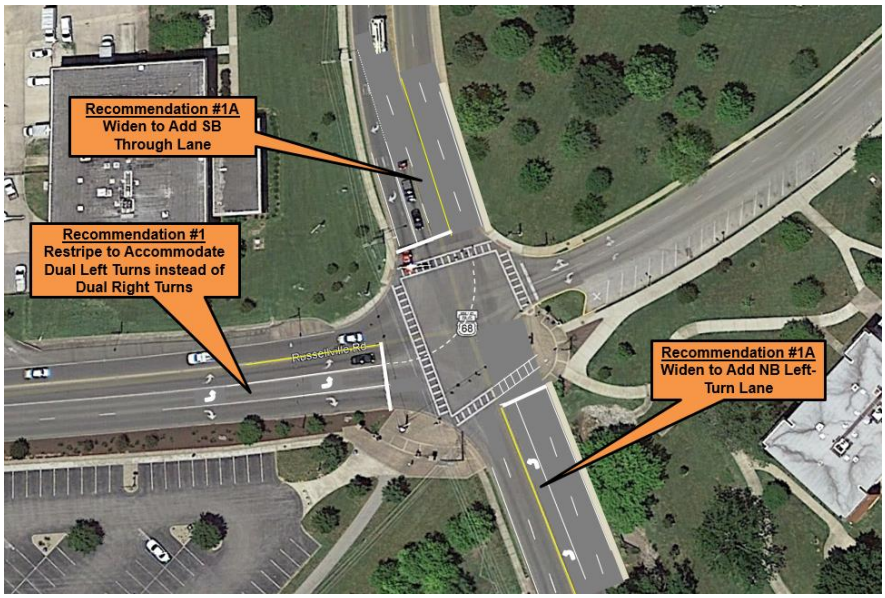


Figure 19 – 2014 *Downtown Bowling Green Circulation Study*'s Recommended Improvements at US 231X (University Drive and Russellville Road)

[6] https://transportation.ky.gov/Planning/Pages/Project-Details.aspx?Project=Russellville%20Road%20(US%2068X%20and%20US%20231X)%20Planning%20Study

5.2 E+C SIMULATION MODEL RESULTS

The Base Year (2020) simulation model discussed in Chapter 2 was used to develop scenarios for the improvement concepts. The E+C LOS maps, shown in **Figures 20 and 21**, indicate that there is plenty of capacity in 2030. The six signalized intersections on Kentucky Street and Adams Street in the middle of the study area are expected to operate at LOS A while the two larger intersections on either end of the study area (University Avenue at Old Morgantown Road / University Heights Boulevard and Kentucky Street at Veterans Memorial Lane / 6th Avenue) will operate at LOS D in the PM. For all the scenarios during both peak periods, the larger intersections on either end of the study area inherently act to meter traffic traveling through Kentucky Street and Adams Street.

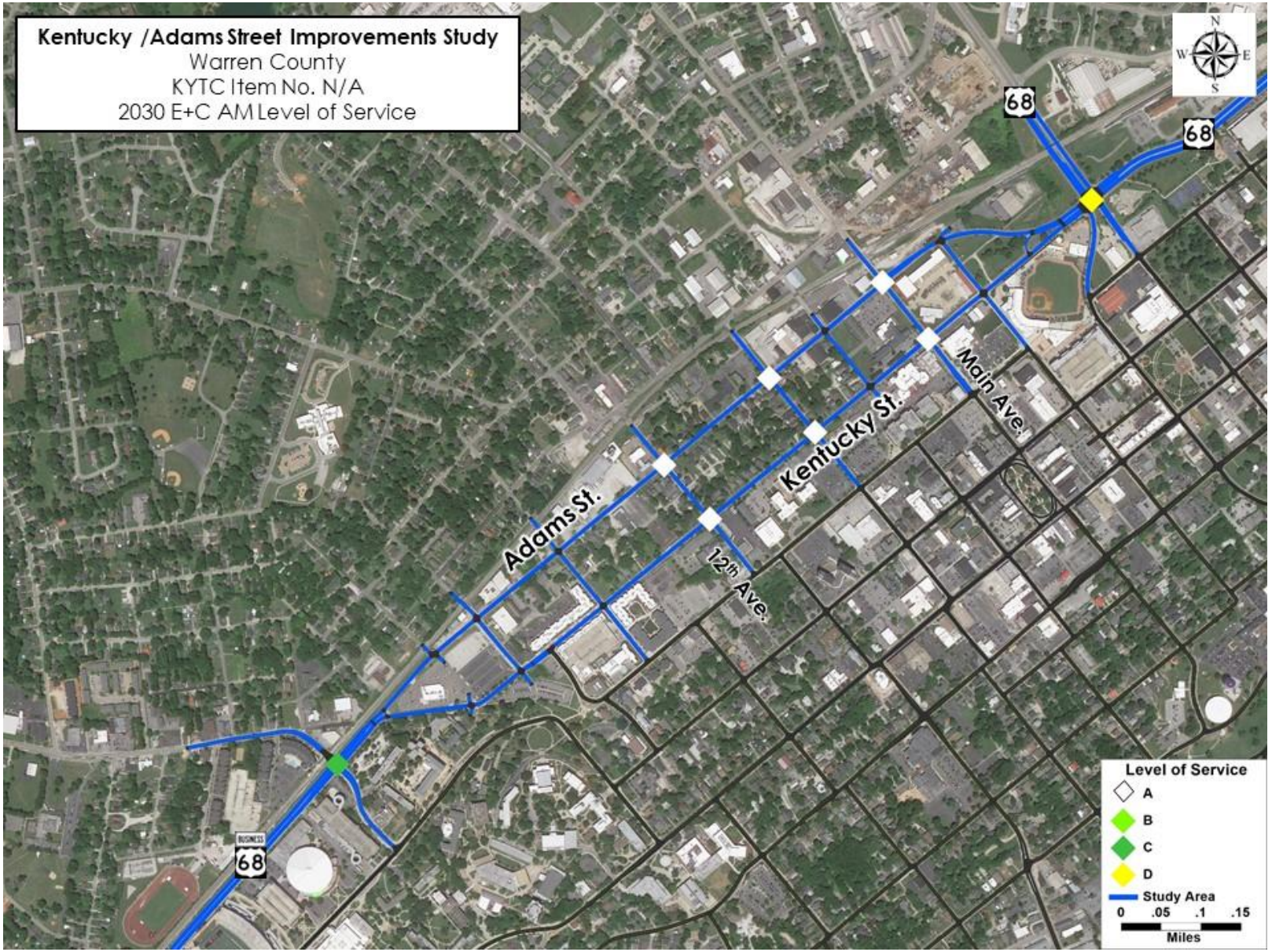


Figure 20 - 2030 E+C AM Level of Service

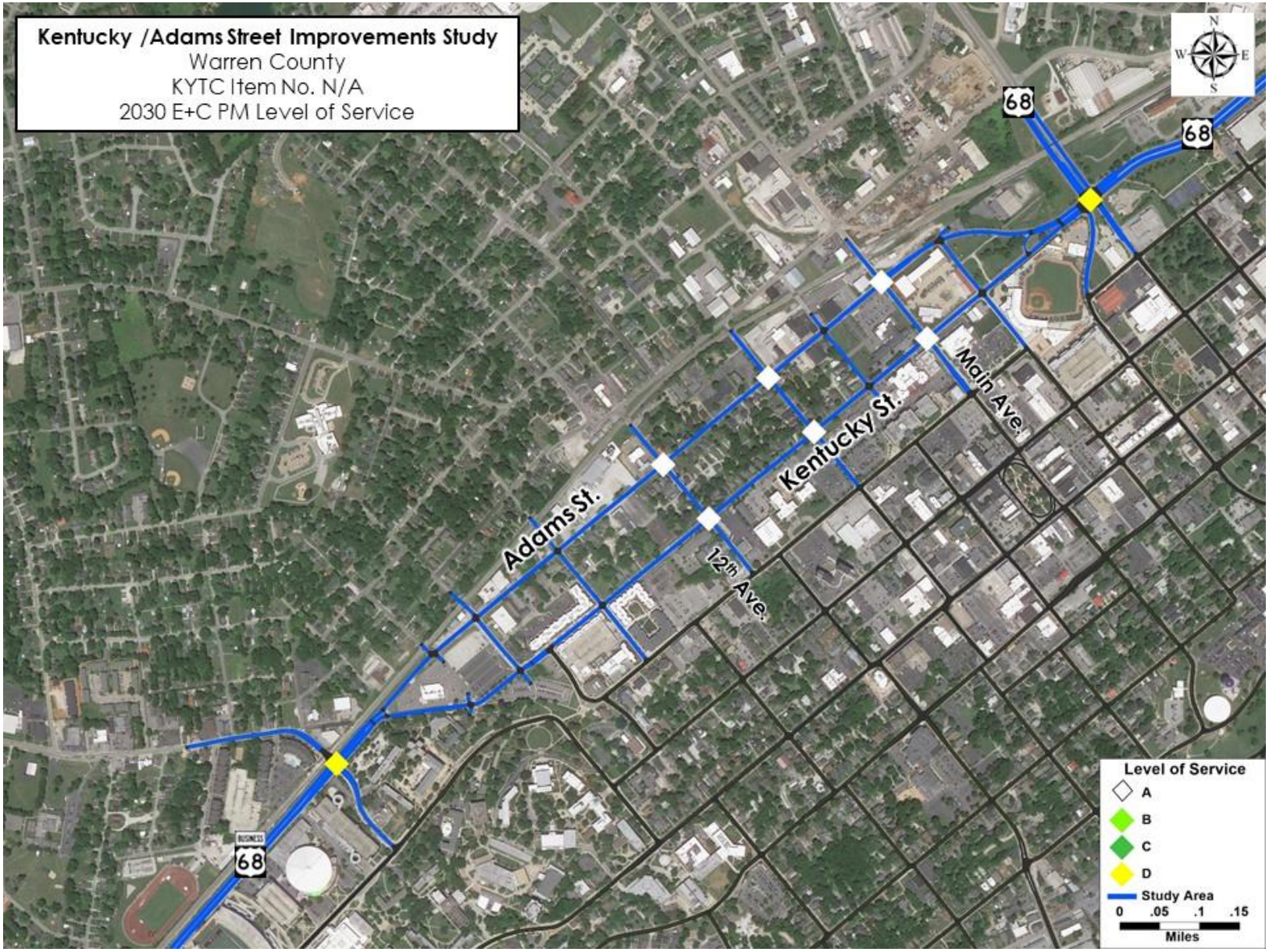


Figure 21 - 2030 E+C PM Level of Service

6.0 FIRST PROJECT TEAM MEETING

Over the course of the study, the project team held two virtual meetings to coordinate on key issues. The project team consisted of representatives from KYTC Central Office, KYTC District 3, the City of Bowling Green, Bowling Green – Warren County MPO, WKU, and the consultant Stantec. Detailed summaries of each meeting are presented in **Appendix F**.

The project team first met via teleconference on April 30, 2020. The purpose of the meeting was to present the results of the existing conditions analysis and to get feedback from the project team on potential improvement concepts.

Key discussion items included the following:

- In addition to the 2030 E+C projects, the project team agreed to study four improvement concepts. The first three concepts involve various configurations of converting both Kentucky and Adams Streets to two-way and severing Kentucky Street at the southwestern segment south of Alumni Avenue and at the northeastern segment north of 8th Avenue as shown in **Figure 22**. The fourth improvement concept involves retaining the existing one-way operation of both Kentucky and Adams Streets but reducing the lanes of traffic from two to one and adding bike lanes. The four improvement concepts are summarized as follows:

    - Improvement Concept 1 – Involves the conversion of Kentucky and Adams Streets to two-way with no left-turn lanes at signalized intersections, and the severing of Kentucky Street at the southwestern segment south of Alumni Avenue and northeastern segment north of 8th Avenue

    - Improvement Concept 2 – Involves the conversion of Kentucky and Adams Streets to two-way with widening to provide left-turn lanes at the approaches of three signalized intersections on Adams Street, and the severing of Kentucky Street at the southwestern segment south of Alumni Avenue and northeastern segment north of 8th Avenue

    - Improvement Concept 3 – Involves the conversion of Kentucky and Adams Streets to two-way with a center two-way left-turn lane (TWLTL) on Adams Street by widening the corridor, the addition of left-turn lanes at the signalized intersections on Kentucky Street by widening the approaches, and the severing of Kentucky Street at the southwestern segment south of Alumni Avenue and northeastern segment north of 8th Avenue

    - Improvement Concept 4 - One lane, one-way operation on Kentucky and Adams Streets with bike lanes

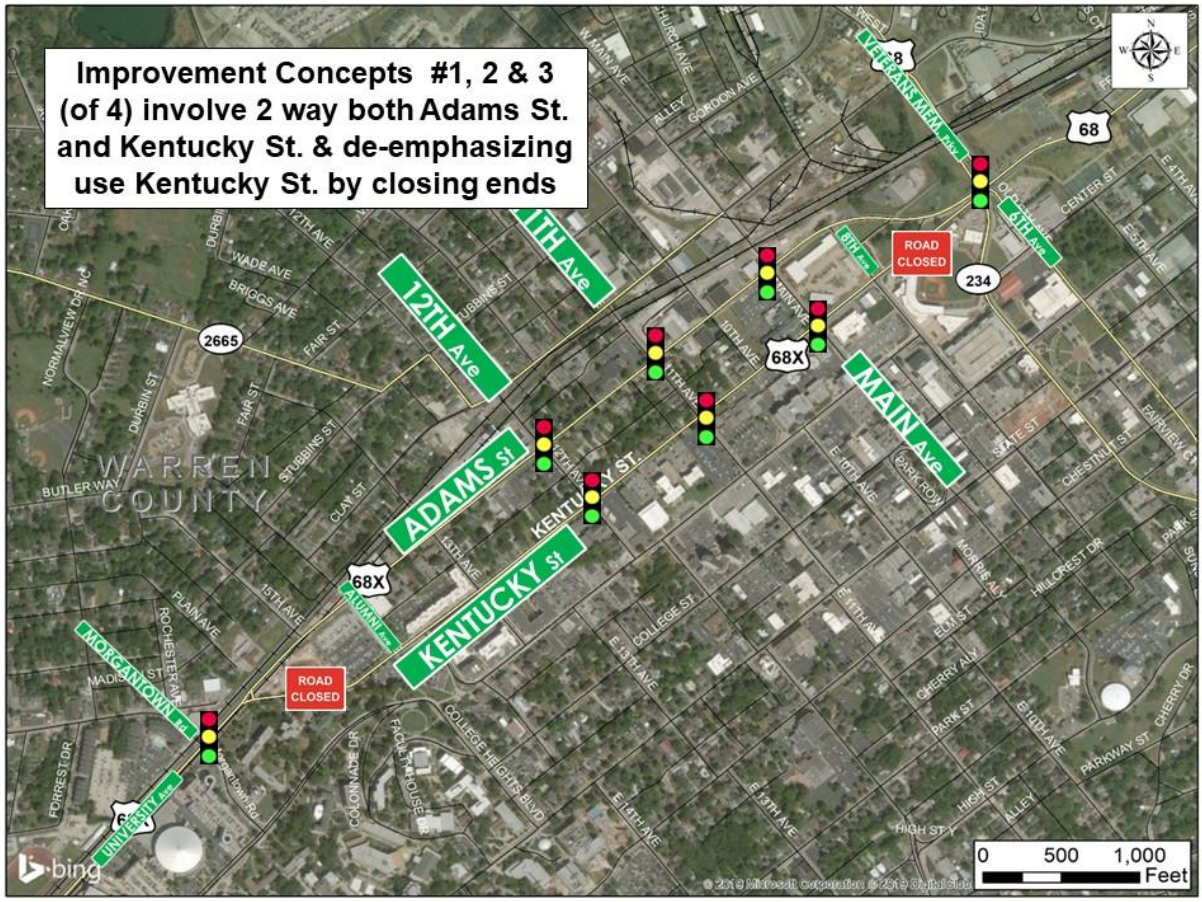


Figure 22 - Two-Way Conversion of Kentucky and Adams, severing end segments of Kentucky Street

- It was noted that there is a resurfacing project on Kentucky and Adams Streets scheduled for 2021.
- Growth rates are consistent with rates from the Russellville Road Study.
- Over the past 20 years, traffic volumes have declined on both Adams and Kentucky Street due to the opening of Veterans Memorial Lane.

7.0 INITIAL CONCEPT DEVELOPMENT

Improvement concepts were developed based on a combination of input from the project team, a review of existing conditions, simulation model traffic analyses, and field reconnaissance. Over the course of the study, the project team worked to determine which improvement concepts best satisfied the study goals. These concepts were carried forward for future evaluation. Traffic operations for the improvement concepts were analyzed using the traffic simulation model. Along with the E+C, this study examined several other types of improvements discussed below.

Improvements Concepts

- Two-way conversion with no left-turn lanes
- Two-way with left-turn lanes on Adams St.
- Two-way with TWLTL for all of Adams St. and left-turn lanes on Kentucky St.
- One-way, one lane on both Kentucky and Adams Street

7.1 IMPROVEMENT CONCEPT 1

Improvement Concept 1 involves converting Kentucky and Adams Streets to two-way, removing traffic from the southwestern portion of Kentucky Street to create a friendlier bicycle/pedestrian area near WKU's campus, and forcing US 68X through traffic to use Adams Street. **Figure 23** shows an example of two-way traffic on Adams Street with single-lane approaches at the Main Avenue intersection. This will be used as a starting point for comparison for two-way conversion concepts with turn lanes.

Figure 23 - Adams Street Two-Way Conversion with Single-Lane Approaches

Some additional comments on Concept 1 include the following:

- It is envisioned that the project would coincide with scheduled repaving.
- Additional costs would include reworking of transition to two-way traffic at ends of study area, the closure of Kentucky Street and revision of six traffic signals to accommodate two-way traffic.

7.2 IMPROVEMENT CONCEPT 2

Improvement Concept 2 involves converting Kentucky and Adams Streets to two-way with left-turn lanes at signalized intersections, removing traffic from the southwestern portion of Kentucky Street to create a friendlier bike/ped area near WKU's campus, and forcing US 68X through traffic to use Adams Street. **Figure 24** shows an example of two-way traffic on Adams Street with left-turn lanes at the Main Avenue intersection.

Figure 24 - Adams Street Two-Way Conversion with Left-Turn Lanes

Some additional comments on Concept 2 include the following:

- It is envisioned that the project would coincide with scheduled repaving.
- Additional costs would include reworking of transition to two-way traffic at ends of study area, closure of Kentucky Street, revision of six traffic signals to accommodate two-way traffic, widening of approaches for three signalized intersections on Adams Street (rebuild traffic signal Adams & 12th St.), right-of-way costs with temporary easements, and utility conflicts.

7.3 IMPROVEMENT CONCEPT 3

Improvement Concept 3 involves converting Kentucky and Adams Streets to two-way, removing traffic from the southwestern portion of Kentucky Street, and widening Adams Street to three lanes (one lane in each direction and a TWLTL, as shown on **Figure 25**. Kentucky Street will have one lane in each direction with left-turn lanes at signalized intersections.

Figure 25 - Adams Street Three-Lane Widening

Some additional comments on Concept 3 include the following:

- It is envisioned that this concept would require acquisition of right-of-way and involve numerous utility conflicts which would result in significant costs.
- The traffic signal at Adams Street and 12th Avenue would have to be rebuilt.
- Additional costs for reworking of transition to two traffic way at ends of study area, closure of Kentucky Street, widening of approaches at three signalized intersections to accommodate two-way on Kentucky Street.

7.4 IMPROVEMENT CONCEPT 4

Improvement Concept 4, shown in **Figure 26**, involves maintaining the existing one-way couplet and restriping Kentucky and Adams Streets from two lanes to one lane. Dedicated bike lanes could be added to both routes as well as left turn lanes at the signals.

Figure 26 - Kentucky Street - Single Lane with Bike Lane

Some additional comments on Concept 4 include the following:

- It is envisioned that the project would coincide with scheduled resurfacing. The one-lane restriping could be implemented during the resurfacing. Very minimal additional costs would include some additional striping treatments and signs. Traffic signal heads may need to be shifted to improve visibility with a single lane.
- This concept would reduce the crossing distance where pedestrians were exposed to vehicular traffic from 28 feet to 14 feet.
- This concept would not shift traffic from Kentucky Street onto Adams Street.
- Kentucky Street would remain open to traffic in the vicinity of WKU.

8.0 SECOND PROJECT TEAM MEETING

The project team met via a teleconference on June 25, 2020. The purpose of the meeting was to discuss the initial improvement concepts and get feedback from the project team on changes that should be considered.

Key discussion items included the following:

- Various options for bicycle accommodations along Kentucky and Adams Streets were discussed for Improvement Concept 4, including:
  - Two travel lanes, a buffer, and a bike lane
  - A parking lane, a driving lane, a buffer, and a bike lane
  - Two-way cycle track as shown in **Figure 27**
  - Double buffered bike lane

Figure 27 - Two-Way Cycle Track

- There was a question of if one lane on Kentucky and Adams Streets would be sufficient for traffic during special events. Roadway design does not typically focus on accommodating special events. However, consideration could be given to using the parking and bike lane to create a second through lane during special events, if needed.

9.0 REVISED IMPROVEMENT CONCEPT 4

Based on feedback during the second project team meeting, Improvement Concept 4 was slightly revised. The original concept involved keeping Adams Street as one-way but restriping one of the two travel lanes as a bike lane while retaining parking on the right side of the road. A field review and aerial mapping analysis revealed very little demand for parking on Adams Street. Therefore, it was determined that the existing parking lane could be restriped as a bike lane with a buffer while retaining the two vehicular travel lanes as shown in **Figure 28**. It should be noted that there is a single-family residence (1171 Adams Street) near the 12th Avenue intersection without off-street parking. The single-family residence does have back-alley access but there is not an existing parking area on the parcel. There are approximately 10 on-street

public parking spaces on 12th Avenue between Adams Street and Clay Street and 11 on-street public parking spaces on 12th Avenue between Adams Street and Kentucky Street which would be reasonable parking alternatives if parking on Adams Street was eliminated. All other properties on Adams Street have available off-street parking on or adjacent to their parcel. Improvement Concept 4 would not be revised for Kentucky Street.

Both the original and revised Improvement Concept 4 were analyzed to determine their safety, congestion, and multi-modal benefits in the study area.

Figure 28 - Revised Concept 4 Adams Street Typical Section

9.1 SIMULATION MODEL RESULTS

The 2030 E+C simulation model discussed in Chapter 5 was used to develop scenarios for the improvement concepts. As discussed previously, for all the scenarios during both peak periods, the intersections on either end of the study area (University Avenue at Old Morgantown Road / University Heights Boulevard and Kentucky Street at Veterans Memorial Lane / 6th Avenue) inherently act to meter traffic that will traverse through the study area on Kentucky Street and Adams Streets.

Intersection LOS for approaches and queue lengths are located for all concepts including the E+C in **Appendix B**. Maps of LOS for the signalized intersections for the projected 2030 volumes for each peak period are included in **Appendix G.** The summary of the LOS for signalized intersections are presented in **Table 3**.

Table 3: LOS for Signalized Intersections

Signalized Intersection	Concept 1 LOS		Concept 2 LOS		Concept 3 LOS		Concept 4 LOS		Revised Concept 4 LOS	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
University at Old Morgantown	C	D	C	D	B	C	C	D	C	D
Kentucky at 12th	A	A	A	A	A	A	A	B	A	B
Kentucky at 11th	A	A	A	A	A	A	A	B	B	B
Kentucky at Main	A	A	A	A	B	B	B	B	B	B
Kentucky at 6th/Vet. Mem.	D	D	D	D	C	C	D	C	D	C
Adams at Main	B	C	B	B	B	B	B	B	A	A
Adams at 11th	B	C	A	A	A	A	A	A	A	A
Adams at 12th	B	D	B	A	B	B	B	B	A	A

During the AM peak for Improvement Concept 1, the three signalized intersections on Kentucky Street in the middle of the study area operate at LOS A**.** On Adams Street, the three signalized intersections in the middle of the study area operate at LOS B. During the PM peak, the three signalized intersections on Adams Street in the middle of the study area operate at LOS C and D due to the queuing of vehicles of over 700 feet at 12th Street. Queuing occurs when a vehicle(s) waiting to turn left blocks vehicles traveling through the intersection because of the lack of a separate left-turn lane. Although LOS D or better is typically desirable in urban areas for most intersections, it may not be reasonable for a two-phase traffic signal on Adams Street when it is currently operating at LOS A.

For Improvement Concept 2, adding left-turn lanes resolves the queuing issues and provides improved LOS A and B at the signalized intersections on Adams Street. The three signalized intersections in the middle of the study area on Kentucky Street continue to operate at LOS A.

For Improvement Concept 3, the six signalized intersections on Kentucky and Adams Streets in the middle of the study operate at LOS B or better. The larger intersections on either end of the study area also operate with improved efficiency, resulting in improved LOS and slightly less metering as compared to other improvement concepts.

For Improvement Concept 4, Kentucky and Adams Streets operate at LOS B or better. Similarly, the revised Improvement Concept 4 shows a slight improvement from LOS B to A for two intersections on Adams Street and a slight degradation from LOS A to B for Kentucky Street at 11th Avenue.

Figures 29 and 30 present the AM and PM travel times. For the 2030 AM peak, travel times on both Adams Street and Kentucky Street for all improvement concepts (except for Concept 1) are expected to be similar to the E+C results of approximately 3 to 3.5 minutes. For the 2030 PM Peak, travel times on both Adams Street and Kentucky Street for all improvement concepts are expected to remain at approximately 3 to 3.5 minutes (again, with the exception of Improvement Concept 1) on Adams Street. Travel times for Improvement Concept 1 on Adams Street increase to approximately 5 minutes in the 2030 PM Peak. Queue lengths on Adams Street for Improvement Concept 1 for 2030 PM Peak are expected to extend over 700 feet due to left turning vehicle(s) blocking the through lane at signalized intersections.

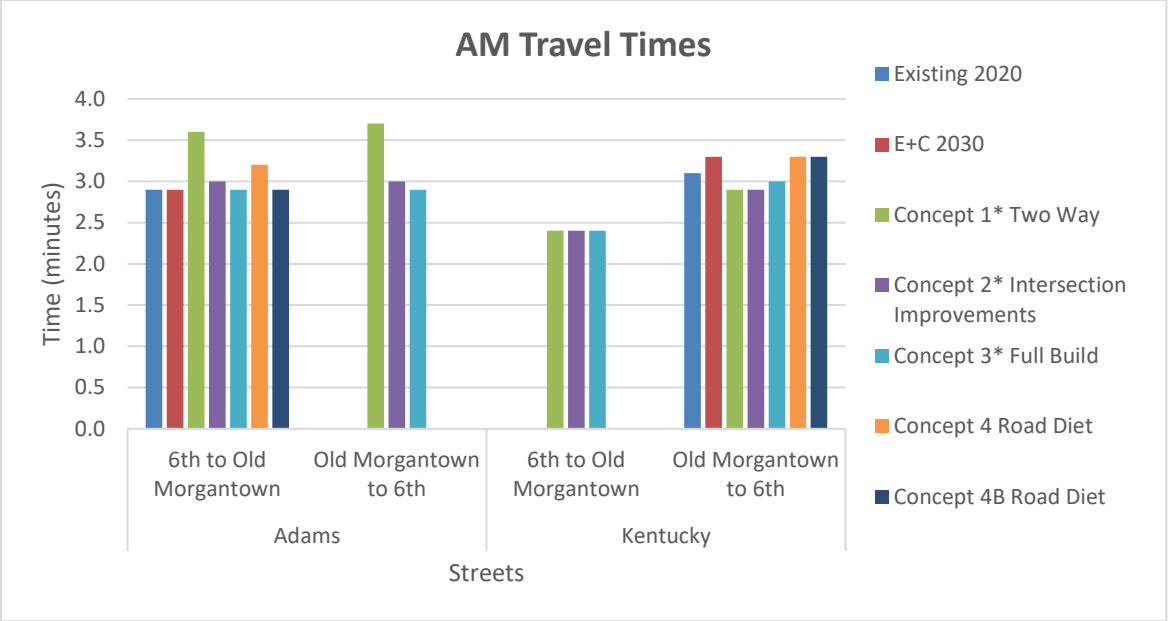


Figure 29 - AM Travel Times

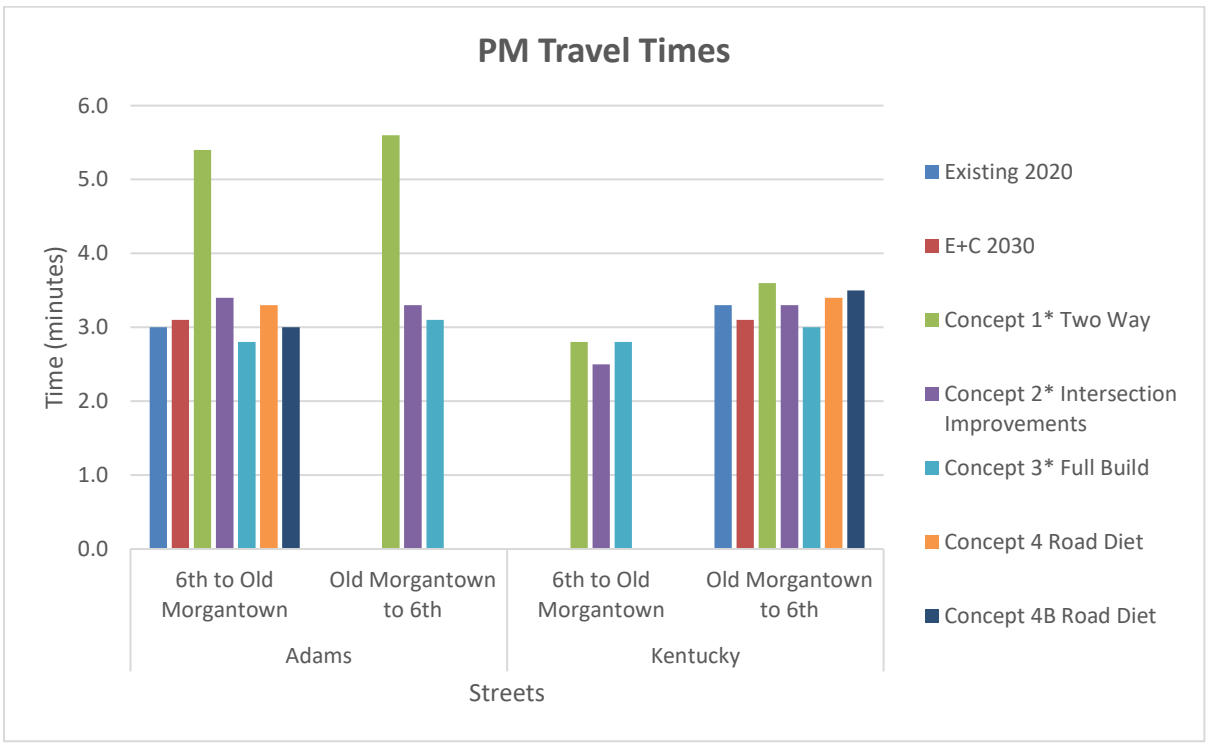


Figure 30 - PM Travel Times

10.0 CONCLUSIONS

This section provides a summary of the overall conclusions and recommendations for the Kentucky and Adams Street (US 68X) Improvement Study to identify and evaluate potential traffic operational changes which are compatible with land use and increase safety for all modes of travel. The conclusions and recommendations are based on examination of technical analyses, project team input, and engineering judgement.

10.1 COMPARISON MATRIX

The improvement concepts were reviewed to help with the evaluation process and provide the project team with information that will be used to make final recommendations regarding concept(s) to be carried forward for future development. Each improvement concept was analyzed to determine the extent to which it satisfies the following project goals:

- Improve safety for all modes of travel
- Provide opportunities to enhance multimodal facilities
- Provide cost efficient alternative
- De-emphasize Kentucky Street
- Accommodate 2030 traffic demand

Concept 2 (two-way with left turn lanes at signalized intersection on Adams) and Concept 4 (one-way Road Diet) either completely or somewhat address all the project goals. Concept 2 only somewhat enhances multimodal by providing bike lanes on Kentucky Street but not for Adams Street and has an increased cost. Concept 4 only somewhat de-emphasizes Kentucky Street but has very low cost. A summary of the complete comparison matrix is shown in **Table 4**.

Table 4: Comparison Matrix

Project Goals	Existing	Concept 1 (2-way, no left turn lanes)	Concept 2 (2-way w/ left turn lanes on Adams)	Concept 3 (2-way, 3 lane section on Adams & left turn lanes on Kentucky)	Concept 4 (1-way, road reconfiguration with bike lanes)
Est. Construction Cost	**$0**	**$$**	**$$$**	**$$$$**	**$**
Improves safety	✗	✗	✓	✓	✓
Provides opportunites to enhance multimodal facilities	✗	○	○	○	✓
Provides cost efficient alternative	✗	✓	○	✗	✓
De-emphasizes Kentucky St.	✗	✓	✓	✓	○
Accommodates 2030 traffic demand	✓	✗	✓	✓	✓
Key: ✓ Issue is completely addressed; ○ Issue is somewhat addressed; ✗ Significant issue that is not addressed					
Cost Key: $ = Very cheap, $$ = Minimal Cost, $$$ = Modest Cost, $$$$ = Significant Cost					

10.2 TYPICAL SECTION RECOMMENDATIONS

This study was undertaken to seek feasible strategies to identify and evaluate potential traffic operational changes which are compatible with land use and increase safety for all modes of traffic on Kentucky and Adams Streets in Bowling Green. Evaluation was accomplished through examination of technical analyses, project team input, and engineering judgement. Considering the technical data and results from the comparison matrix, the project team decided to recommend revised Improvement Concept 4 with one lane including a bike lane on Kentucky Street as shown in **Figure 31** and two lanes with a bike lane on Adams Street. The parking lane on Adams Street will be replaced with a buffered bike lane. Reducing Kentucky Street to one lane will maintain a desired LOS through the study area while encouraging more attentive driving, reducing traffic speed, reducing crashes, and increasing the tendency for motorists to yield to pedestrians. This can all be accomplished within the existing right-of-way at low cost if completed with the next scheduled repaving project.

Figure 31 - Kentucky Street - Single Lane with Bike Lane

10.3 BICYCLE AND PEDESTRIAN RECOMMENDATIONS

The traffic simulation model examined the various vehicular lane configurations for the improvement concepts but did not specifically model bike lanes. For both the original and revised Improvement Concept 4, there are multiple options for the extra pavement created by the reduction of lanes for Kentucky Street, which currently has parking on the left side of the road. Bicycle facility concepts such as a two-way cycle track and a double-buffered bike lane were considered by the project team. Ultimately those concepts were determined to be less desirable than a single buffered bicycle lane on the right side of the road that matches the directionality of the auto travel lane. **Figure 32** displays Kentucky Street one-way configuration with a buffered bike lane on the right and a parking lane on the left. Parking could also be removed at the approach to signalized intersections to accommodate a dedicated turning lane in the most appropriate direction. The National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide provides guidance for intersection treatments of bike lanes.

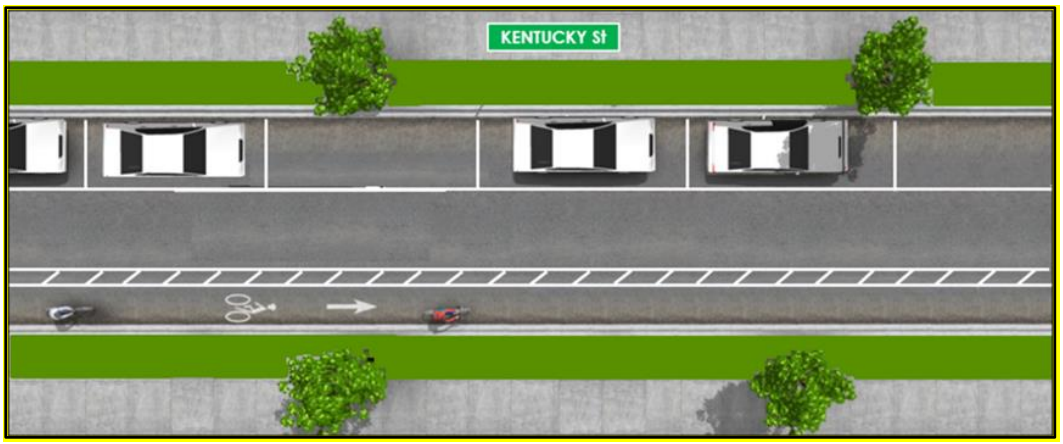


Figure 32 - Kentucky Street Bike Lane Rendering

The project team also discussed if a single lane on Kentucky Street would be sufficient for traffic during large events such as WKU football and basketball games. It was noted that roadway design does not typically focus on accommodating special events. However, consideration could be given to using the parking and bike lane to create a second through lane on Kentucky Street during special events, if needed.

MUTCD R1-6

Reducing Kentucky Street to one vehicular travel lane will improve safety at the three unsignalized pedestrian crosswalks described in **Section 2.2** by eliminating the multiple threat scenario which occurs on multi-lane approaches in the same direction. Safety for pedestrians is also improved by decreasing the distance that pedestrians are exposed to vehicular traffic in the crosswalk from 27 to 14 feet. Curb extensions or bumpouts may be considered to further accentuate the expected presence of pedestrians. Vehicle compliance (yielding) may also be improved with the addition of conspicuous ground-mount STATE LAW YIELD TO PEDESTRIANS (MUTCD R1-6) signs. It is recommended that the treatments for the three pedestrian crosswalks at unsignalized intersections be consistent for Kentucky Street.

11.0 CONTACTS/ADDITIONAL INFORMATION

Written requests for additional information should be sent to Mikael Pelfrey, P.E., Director, KYTC Division of Planning, 200 Mero Street, Frankfort, KY 40622. Additional information regarding this study can also be obtained from the KYTC District 3 Project Manager, Benjamin Hunt, at (270)746-7898 Ext. 278.