US 60 Scoping Study, Paducah

McCracken County
Item No. 1-125.00
Final Report

Prepared for the Kentucky Transportation Cabinet
September 2012

Stantec

KENTUCKY TRANSPORTATION CABINET

Executive Summary

In 2011, the Kentucky Transportation Cabinet initiated the US 60 Scoping Study. Located west of downtown Paducah, this stretch of US 60 (Hinkleville Road) serves the largest retail area in West Kentucky that includes the Kentucky Oaks Mall and several large "big box" retailers. It also provides connectivity of that retail area to Interstate 24. The study was undertaken in an effort to develop solutions for long-standing problems related to traffic congestion and safety, as well as to accommodate anticipated increased travel in the future brought about by growth and system connectivity enhancements. A map of the study area is shown in **Figure ES-1**.

A catalyst for the study is KYTC Item No. 1-123.00, which involves the construction of a connector road from Olivet Church Road (KY 998) through the Kentucky Oaks Mall property to intersect with US 60 at New Holt Road. The project also includes the improvement of Olivet Church Road from the new connector road south to US 60. This is a Local Public Agency (LPA) project being administered by the City of Paducah. The study has evaluated anticipated traffic impacts associated with the new project on the surrounding roadway system, including Cairo Road (KY 305) to the north.

The study objectives were:

- Develop recommended improvements to relieve congestion and improve safety along US 60 (Hinkleville Road):
    - Short-term spot improvements
    - Long-term corridor improvements and strategies
- Identify impacts on KY 305/Cairo Road.
- Integrate local officials, other stakeholders, and the public into the process.

An analysis of crashes from 2006 – 2011 revealed that this section has a high crash rate. Contributing factors are peak period congestion and an incompatibility between the current access control and land use type, which is exacerbated by the high number of driveways and presence of a continuous two-way left-turn lane.

The study concluded that the construction of the new connector road through the Kentucky Oaks Mall property and the widening of Olivet Church Road from the new connector to US 60 should have little effect on traffic patterns in the area. The most noticeable effect is expected to be at the intersection of the connector road as it aligns with New Holt Road at US 60 and the impacts there can be mitigated with intersection improvements.

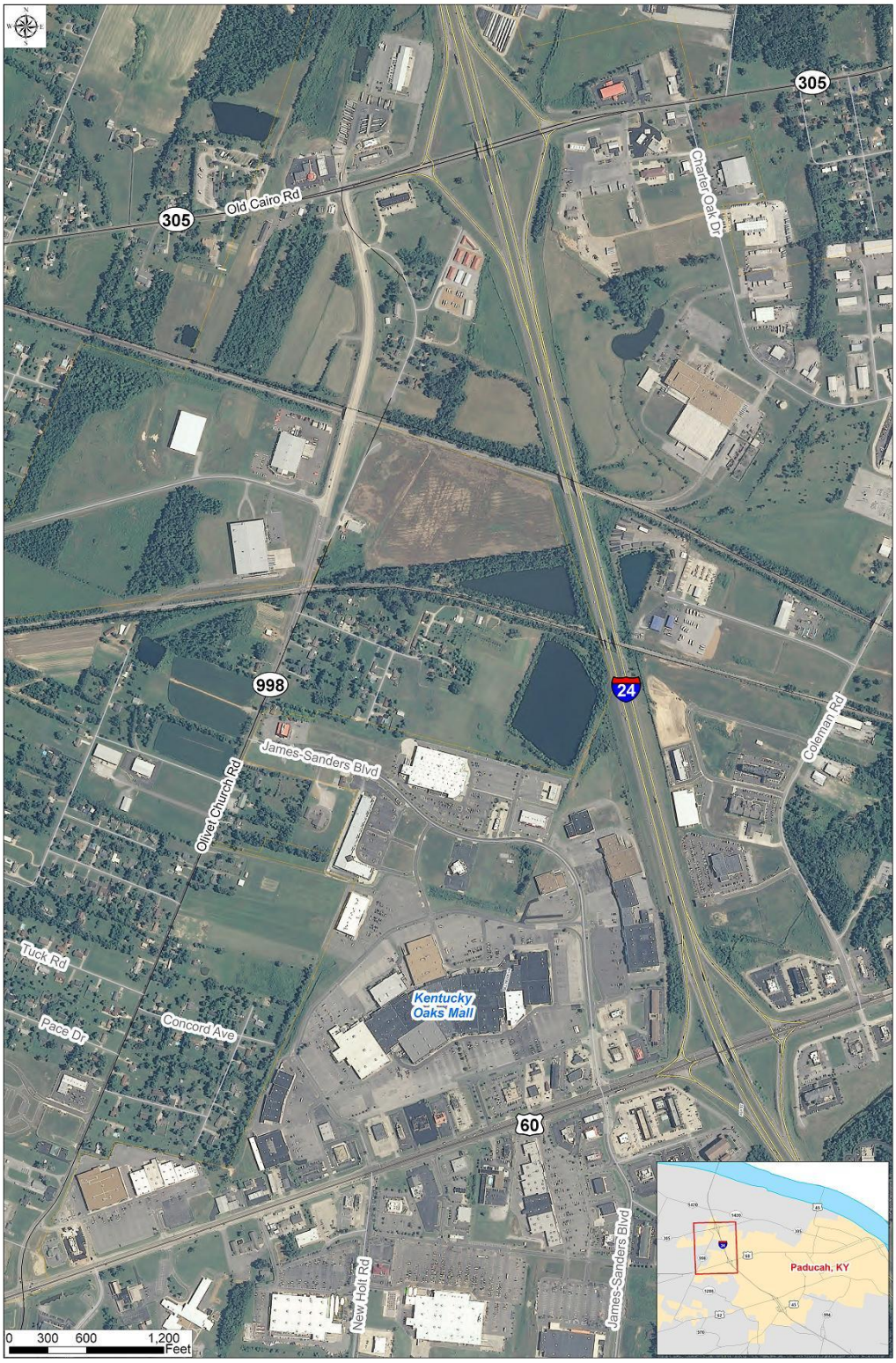

Figure ES-1. Project Study Area

The I-24/US 60 interchange is a bottleneck for several reasons:

- There are heavy peak period traffic volumes at the interchange ramp termini, both through volumes along US 60 and turning volumes from and to I-24;
- The spacing between the ramp junctions is relatively tight and the problem is compounded by closely spaced intersections on either side of the interchange – at James Sanders Boulevard and Coleman Road.
- The left-turn lanes on the internal approaches at the interchange are short, so it takes only a few queued left-turning vehicles to spill back into the through lanes.

The interchange is very similar to the New Circle Road (KY 4)/Harrodsburg Road (US 68) in Lexington, that was reconstructed as a Double Crossover Diamond (DCD) interchange in 2011. The cost-effective reconstruction of that interchange has resulted in fewer crashes, shorter delays and shorter traffic backups during peak periods. Reconstruction of the I-24/US 60 interchange to a DCD configuration is recommended as a means to improving traffic flow and safety through this area.

It was concluded that the current access control (access by permit) for US 60 is incompatible with the heavy retail land use west of I-24. This has been a big contributor to the high crash rates observed over the years, as shown in the traffic analysis. Implementation of access management strategies, especially the construction of a raised median along US 60 from James Sanders Boulevard to New Holt Road, is recommended. Opportunities to eliminate driveways through the use of shared access points should be investigated as well. Implementation of access management strategies must incorporate a thorough public involvement process that includes dialog with individual property owners.

This study also recommends the construction of intersection operational improvements at US 60/New Holt Road and US 60/James Sanders Boulevard, as described in Section 5, to provide localized capacity enhancements.

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1.0 Introduction

In the summer of 2011, the Kentucky Transportation Cabinet initiated the US 60 Scoping Study. Located west of downtown Paducah, this stretch of US 60 (Hinkleville Road) serves the largest retail area in West Kentucky that includes the Kentucky Oaks Mall and several large "big box" retailers. It also provides connectivity of that retail area to Interstate 24. The study was undertaken in an effort to develop solutions for long-standing problems related to traffic congestion and safety, as well as to accommodate anticipated increased travel in the future brought about by growth and system connectivity enhancements.

A catalyst for the study is KYTC Item 1-123.00, which involves the construction of a connector road from Olivet Church Road (KY 998) through the Kentucky Oaks Mall property to intersect with US 60 at New Holt Road. The project also includes the improvement of Olivet Church Road from the new connector road south to US 60. This is a Local Public Agency (LPA) project being administered by the City of Paducah. The study has evaluated anticipated traffic impacts associated with the new project on the surrounding roadway system, including Cairo Road (KY 305) to the north.

1.1 PURPOSE AND NEED

A Draft Purpose and Need Statement was developed that will serve as a starting point for initiation of the Environmental Process in a future phase(s) of the project. The Draft Purpose and Need Statement is as follows:

> *The US 60 corridor is the largest retail corridor in West Kentucky. It includes the Kentucky Oaks Mall, several "big box" retail stores (Walmart, Lowe's, Home Depot), numerous restaurants, and a host of other businesses. Located adjacent to Interstate 24, it is truly a regional activity center, readily accessible to all of West Kentucky, southern Illinois, southeastern Missouri, and southwestern Indiana.*
>
> *Functionally classified as an Urban Principal Arterial, this four-lane section of US 60 carries about 25,000 vehicles per day. There are periods of regularly recurring congestion, particularly during the afternoon peak and on weekends. An analysis of data for the last five years revealed that vehicle crashes are a major problem. The Critical Rate Factor (CRF) for the section shows that the computed crash rate is as much as four times the critical rate for this type of roadway. Furthermore, 70 percent of those crashes involved either rear-end or angle collisions, which can be linked directly to congested conditions or access problems associated with numerous driveways.*

Development in the corridor has increased steadily over the last 20 years and is expected to continue thus improvement options should consider both current and projected future needs. The purpose of the project is to reduce congestion and improve safety within the corridor while preserving access to businesses and other establishments.

1.2 STUDY OBJECTIVES

The study objectives were:

- Develop recommended improvements to relieve congestion and improve safety along US 60 (Hinkleville Road):
    - Short-term spot improvements
    - Long-term corridor improvements and strategies
- Identify impacts on KY 305/Cairo Road.
- Integrate local officials, other stakeholders, and the public into the process.

2.0 Existing Conditions

2.1 ROADWAY SYSTEM

2.1.1 Functional Classification

"Functional classification is the process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide. Basic to this process is the recognition that individual roads and streets do not serve travel independently in any major way. Rather, most travel involves movement through a network of roads. It becomes necessary then to determine how this travel can be channelized within the network in a logical and efficient manner. Functional classification defines the nature of this channelization process by defining the part that any particular road or street should play in serving the flow of trips through a highway network."[1]

There are three basic highway functional classifications: arterial, collector, and local roads. All streets and highways are grouped into one of these classes, depending on the character of the traffic (i.e., local or long distance) and the degree of land access that they allow. These classifications are described in **Table 1**.

[1] *FHWA Functional Classification Guidelines*, Planning, Environment, & Realty (HEP), Federal Highway Administration, US Department of Transportation, Washington, D.C.

Table 1. Federal Functional Classification System

Functional System	Services Provided
Arterial	Provides the highest level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control.
Collector	Provides a less highly developed level of service at a lower speed for shorter distances by collecting traffic from local roads and connecting them with arterials.
Local	Consists of all roads not defined as arterials or collectors; primarily provides access to land with little or no through movement.

It should be noted that Interstates and parkways fall within the arterial functional classification. Some states (such as Kentucky) denote these as a unique sub-class within the arterial functional classification.

A map of the study area and roadway system functional classification is shown in **Figure 1**. As shown, Interstate 24 and US 60 are Principal Arterials that provide accessibility to the study area. US 60 provides both east-west mobility through the study area and access to adjoining parcels.

2.2 AVERAGE DAILY TRAFFIC AND LEVELS OF SERVICE

2.2.1 Average Daily Traffic

Average Daily Traffic (ADT) volumes for study area roadways were obtained from the Kentucky Transportation Cabinet. A map of current ADT volumes is shown in **Figure 2**.

Figure 1. Study Area and Roadway System Functional Classification

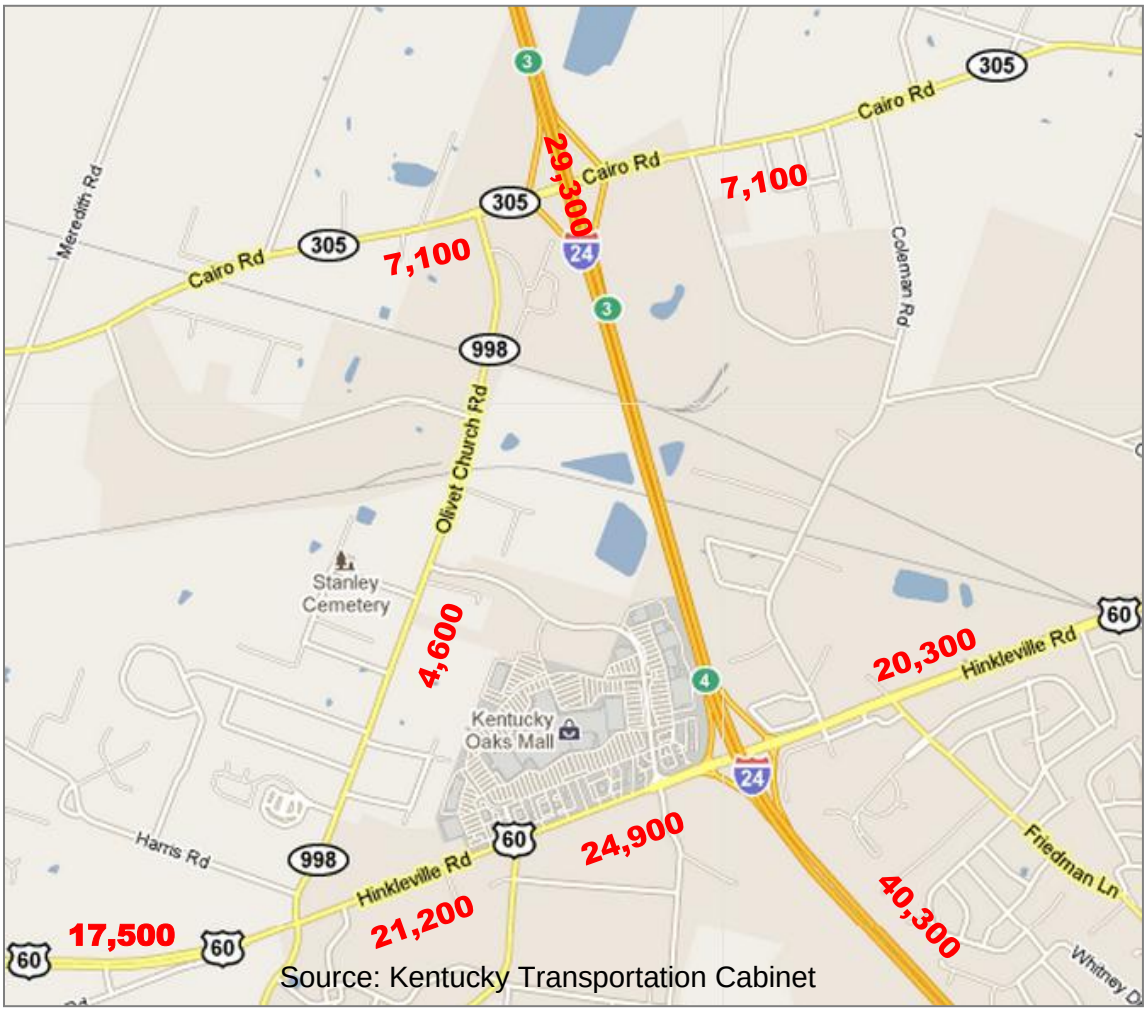


Figure 2. Existing Average Daily Traffic (ADT) Volumes

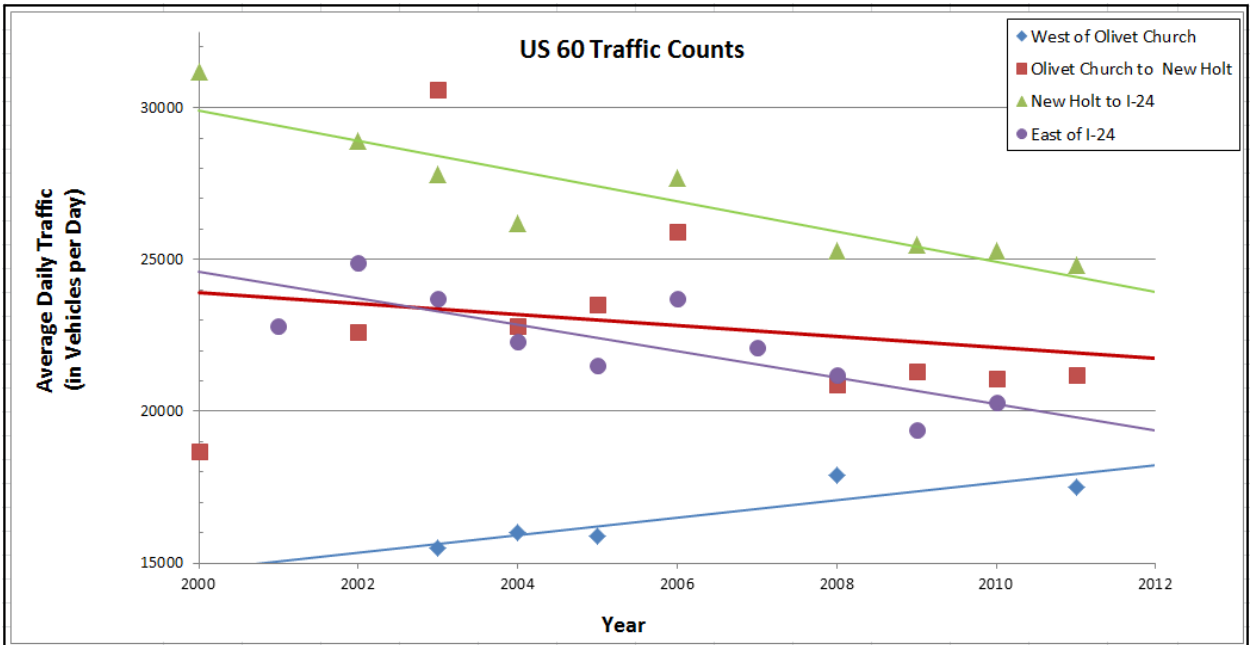
Of note, US 60 carries about 25,000 vehicles per day in the vicinity of the Kentucky Oaks Mall.

With the exception of the section west of Olivet Church Road, average daily traffic volumes along US 60 have declined slightly since 2000. This is illustrated in the graphic shown in **Figure 3**.

2.2.2 Levels of Service

The 2010 Highway Capacity Manual[2] (HCM) provides a methodology for evaluating the capacity and quality of service provided to road users traveling along an urban street segment. The method is applicable to an urban or suburban street segment such as US 60. The segment can be part of an arterial or collector street with one-way or two-way traffic and intersections on the segment can be signalized or unsignalized.

[2] *Highway Capacity Manual 2010*, Transportation Research Board of the National Academies, Washington, D.C., 2010.



Segment	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Legend
West of Olivet Church				15,500	16,000	15,900			17,900			17,500	
Olivet Church to New Holt	18,700		22,600	30,600	22,800	23,500	25,900		20,900	21,300	21,100	21,200	
New Holt to I-24	31,200		28,900	27,800	26,200		27,700		25,300	25,500	25,300	24,800	
East of I-24		22,800	24,900	23,700	22,300	21,500	23,700	22,100	21,200	19,400	20,300		

Figure 3. US 60 Traffic Trends

A street segment's performance is described by one or more quantitative measures that characterize some aspect of the service provided to the road-user group. Performance measures include automobile travel speed, automobile stop rate, and level of service. The methodology also can be used to evaluate service provided to other non-auto users of an urban street – pedestrians, bicyclists and transit riders. Because the study section of US 60 serves automobiles almost exclusively, these other modes were excluded from the analysis.

Level of service is a qualitative measure used to describe the operational characteristics. There are six discrete levels of service A – F, where Level-of-Service (LOS) A is used to describe free-flowing, uncongested travel conditions at one end of the range and LOS F is used to describe conditions associated with high levels of congestion and delay. Two performance measures are used to describe LOS for a given direction of travel along an urban street segment. One measure is travel speed for through vehicles, while the second is the volume-to-capacity (v/c) ratio for the through movement at the downstream boundary intersection of the street segment. Regardless of the average through speed, LOS F is reached when the v/c ratio is determined to be greater than 1.0.

For automobiles, the LOS thresholds for urban street segments are provided in **Table 2**.

Table 2.Urban Street Segment Level of Service Criteria

Travel Speed as a Percentage of Base Free-Flow Speed (%)	LOS by Volume-to-Capacity Ratio[a]	
	≤ 1.0	> 1.0
> 85	A	F
> 67 - 85	B	F
> 50 - 67	C	F
> 40 - 50	D	F
> 30 - 40	E	F
≤ 30	F	F

[a]*Volume-to-capacity (v/c) ratio of through movement at downstream boundary intersection*

Source: Highway Capacity Manual 2010

For existing weekday P.M. peak periods (which was determined to be the most critical period), the HCM Urban Street Segments methodology was applied for the section of US 60 from Olivet Church Road to Coleman Road. This included the signalized diamond interchange ramps with Interstate 24. Results are shown in **Figure 4** for the westbound direction and in **Figure 5** for the eastbound direction for the existing weekday P.M. peak period.

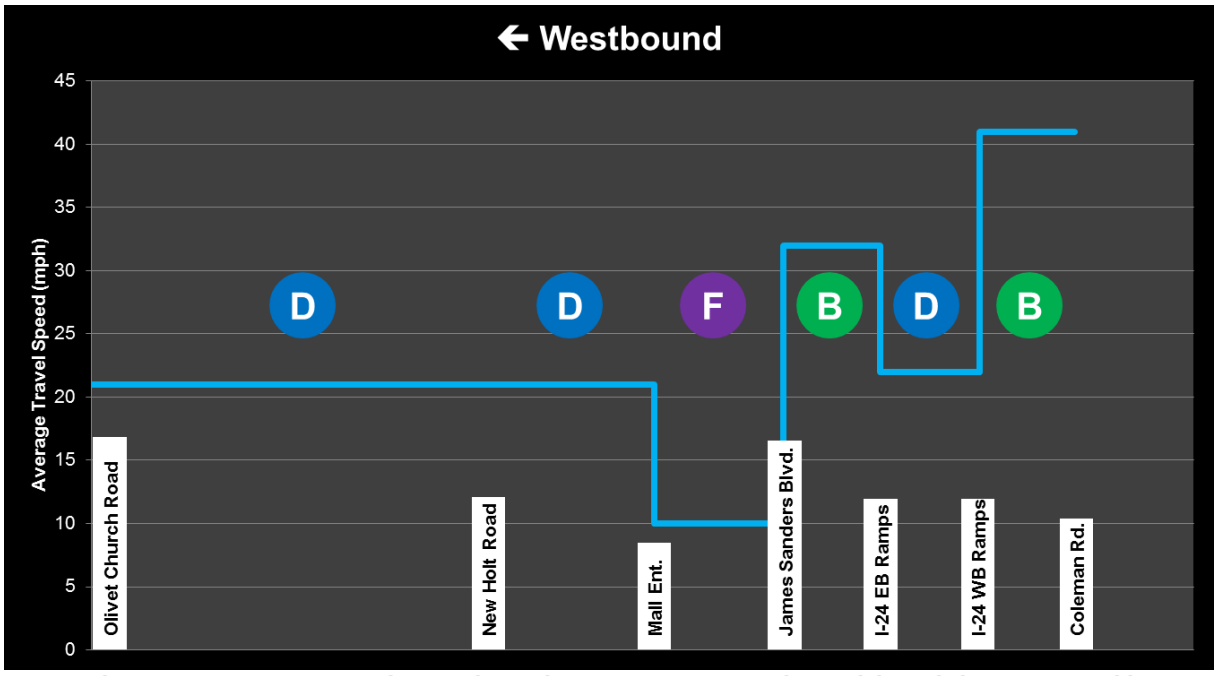


Figure 4. Average Travel Speeds and LOS - US 60 Westbound (Weekday P.M. Peak)

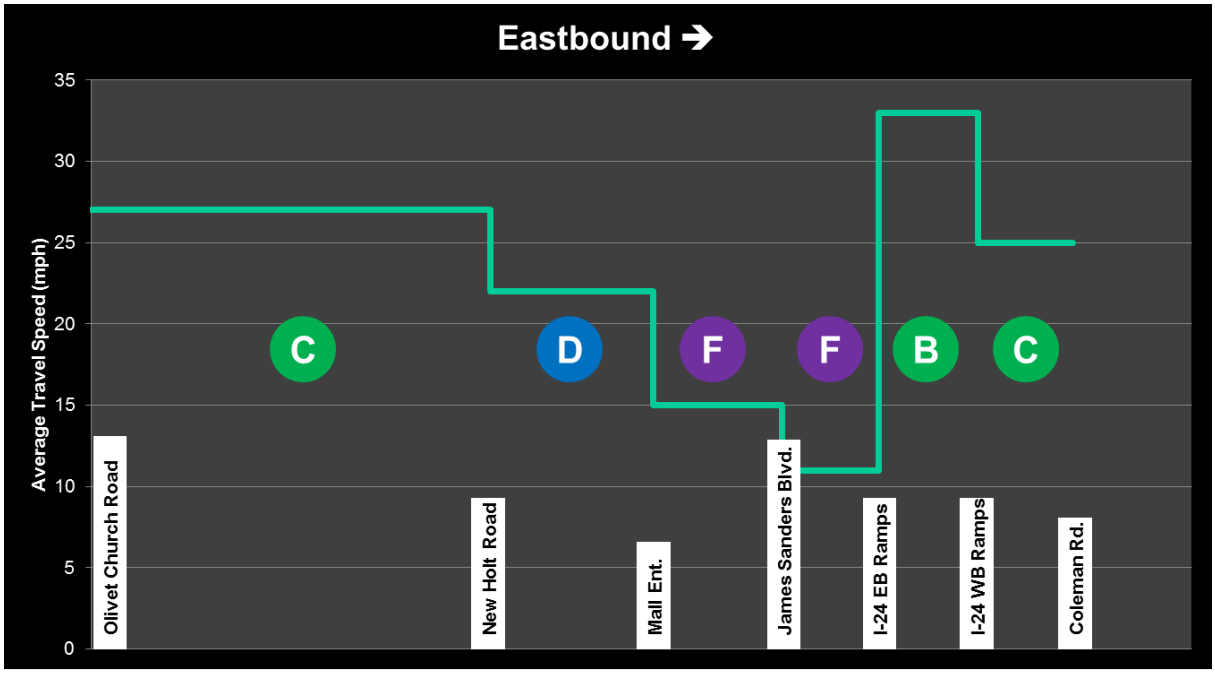


Figure 5. Average Travel Speeds and LOS - US60 Eastbound (Weekday P.M. Peak)

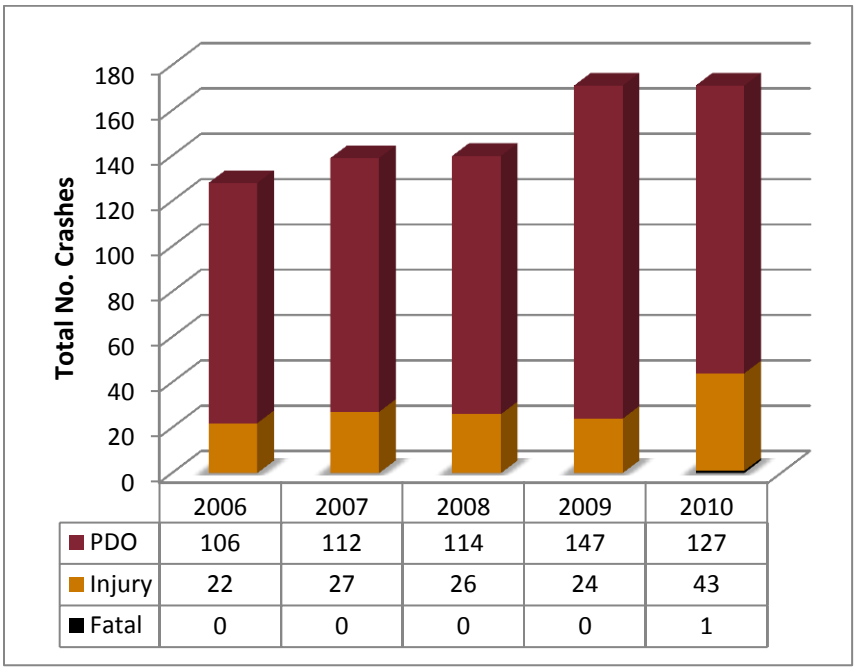
2.3 CRASH ANALYSIS

Crash data for the study segment of US 60 from west of Olivet Church Road to east of Coleman Road were obtained from the Kentucky Transportation Cabinet for the five-year period from January 1, 2006 through December 31, 2010. Data also were obtained for Olivet Church Road from US 60 to Cairo Road. A summary of reported crashes is shown in **Table 3**.

Table 3. Crash Summary 2006 - 2010

Roadway Segment	From - To Milepoint	Distance (mi)	Total Crashes
US 60			
Begin MP to KY 998 (Olivet Church Rd.)	9.280 - 9.587	0.307	23
KY 998 (Olivet Church Rd.) to West Park Dr.	9.587 - 9.710	0.123	13
West Park Dr. to New Holt Rd.	9.710 - 10.130	0.420	112
New Holt Rd. to Mall Entrance	10.130 - 10.308	0.178	135
Mall Entrance to James Sanders Blvd.	10.308 - 10.484	0.176	156
James Sanders Blvd. to I-24 Underpass	10.484 - 10.686	0.202	167
I-24 Underpass to Coleman Rd.	10.686 - 10.891	0.205	158
Coleman Rd. to Friedman Ln.	10.891 - 11.076	0.185	81
Friedman Ln. to End MP	11.076 - 11.300	0.224	54
Total Section	**9.280 - 11.300**	**2.020**	**899**
KY 998 (Olivet Church Road)			
Begin MP to KY 305 (Old Cairo Rd.)	2.200 - 4.017	1.817	20

For US 60, a breakdown of the 899 reported crashes by severity is shown in **Figure 6**. There was one fatal crash (in 2010); of the remaining, 142 were injury crashes and 756 were property-damage-only (PDO) crashes.



	2006	2007	2008	2009	2010
PDO	106	112	114	147	127
Injury	22	27	26	24	43
Fatal	0	0	0	0	1

Figure 6. US 60 Crash Severity (2006 - 2010)

Since the initial crash analysis was performed, crash data for an additional year (2011) were obtained and a detailed analysis of crash types was performed for the three-year period from January 1, 2009 through December 31, 2011. A summary of crashes by type is shown in **Figure 7**.

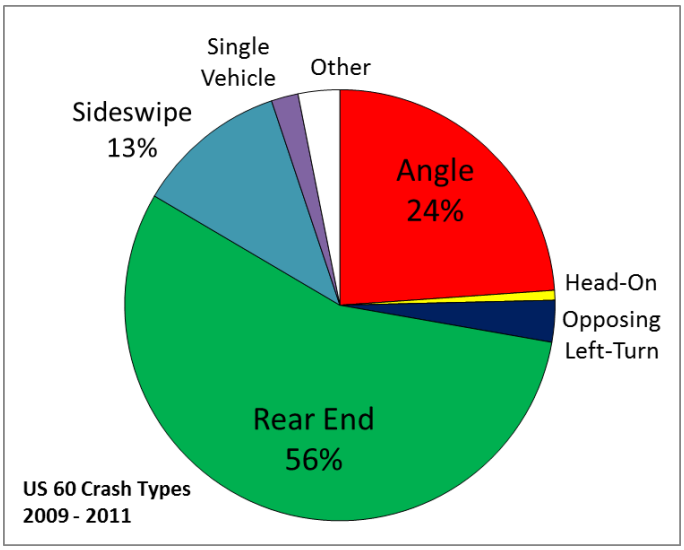


Figure 7. US 60 Three-Year (2009 - 2011) Crash Summary by Type

Of the 544 reported crashes for this three-year period, 303 (56%) were rear-end crashes, 130 (24%) were angle crashes, and 62 (13%) were sideswipe crashes.

Angle crashes were concentrated at three intersections along US 60: James Sanders Boulevard, the Mall entrance, and New Holt Road. A map of the angle crash locations is shown in **Figure 8**.

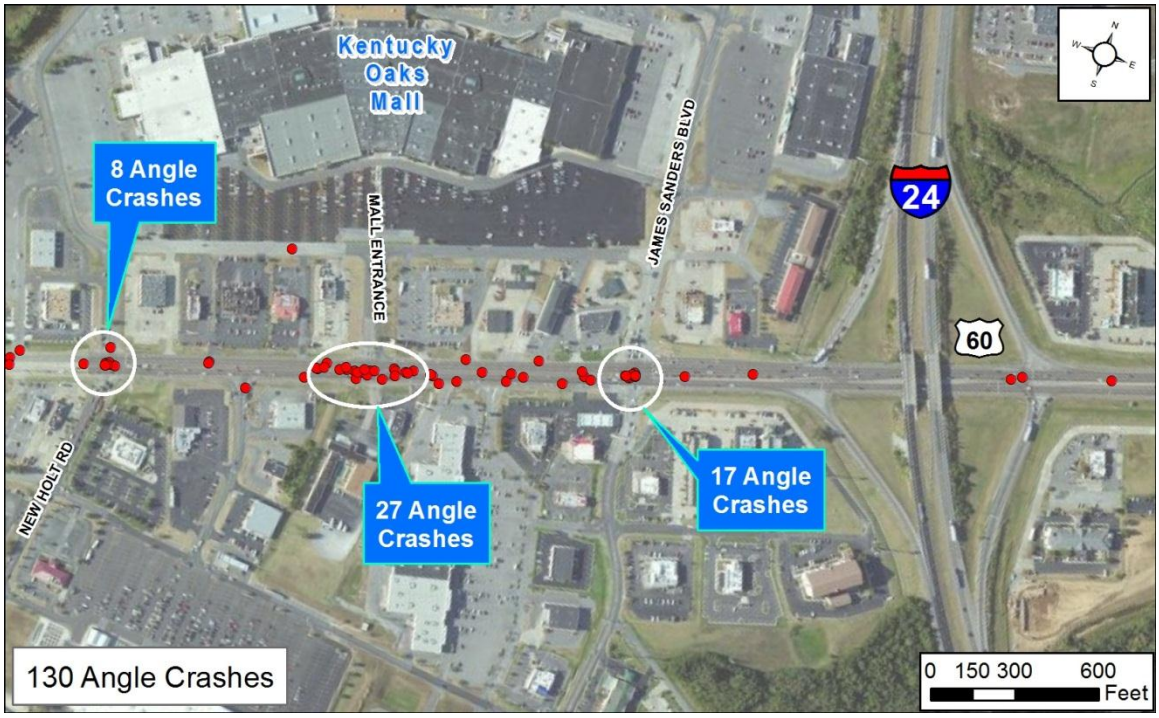


Figure 8. Angle Crash Locations (2009 - 2011)

Sideswipe crashes, which are associated with weaving and lane-changing maneuvers, were spread along the study section. However, as illustrated in **Figure 9**, the heaviest concentration occurred between James Sanders Boulevard and the eastbound I-24 ramps. This is associated with a heavy weaving movement as drivers exiting eastbound I-24 must make four lane changes within a distance of 700 feet in order to turn left onto southbound James Sanders Boulevard, where hotels, restaurants and the Home Depot are located.

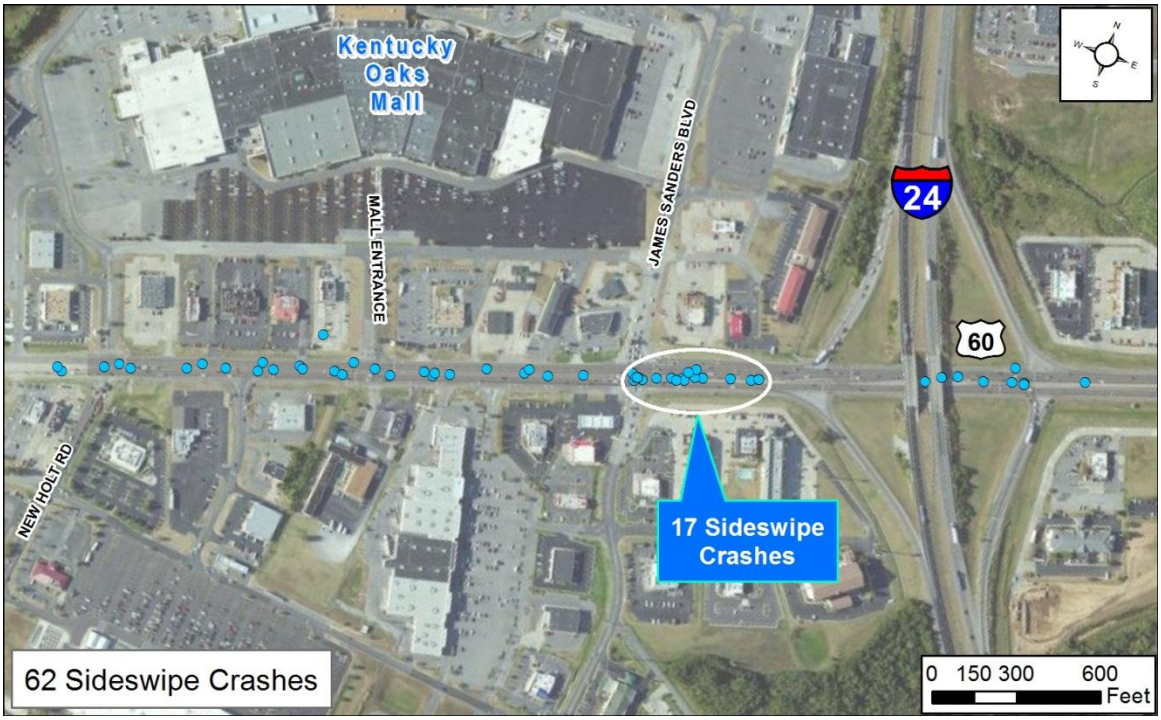


Figure 9. Sideswipe Crash Locations (2009 - 2011)

Rear-end crashes, the most prevalent, are scattered throughout the study section, as shown in **Figure 10**. Rear-end crashes are attributable to stop-and-go traffic associated with congestion.

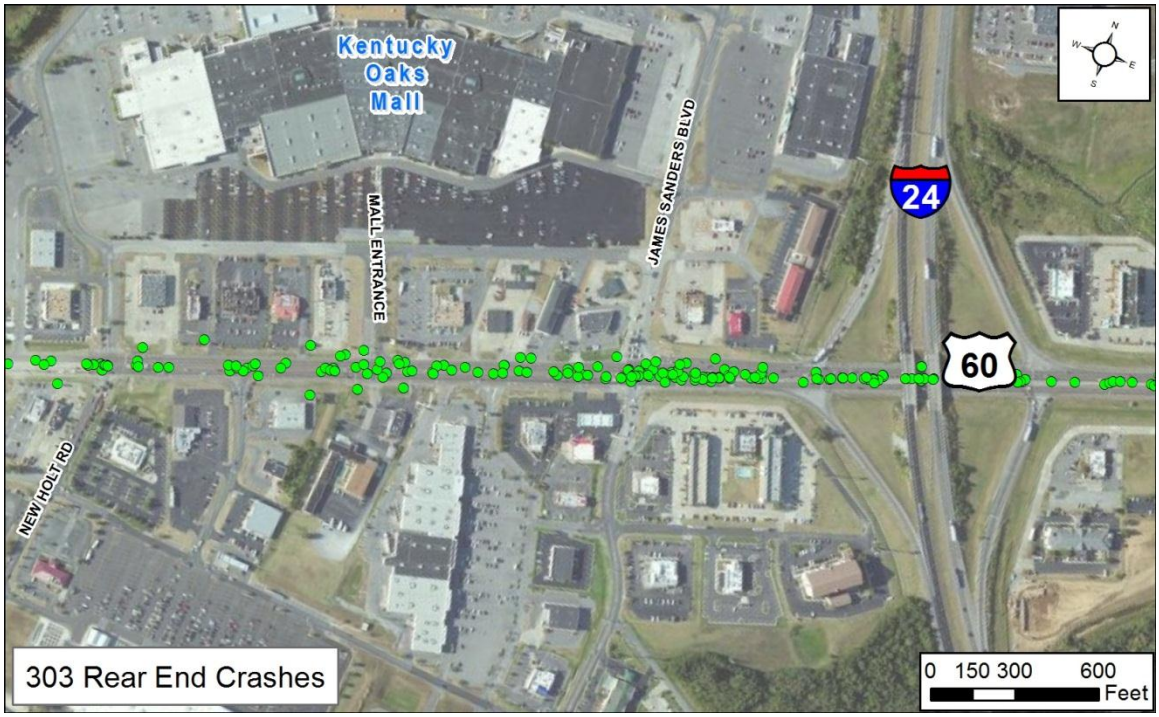


Figure 10. Rear-End Crash Locations (2009 - 2011)

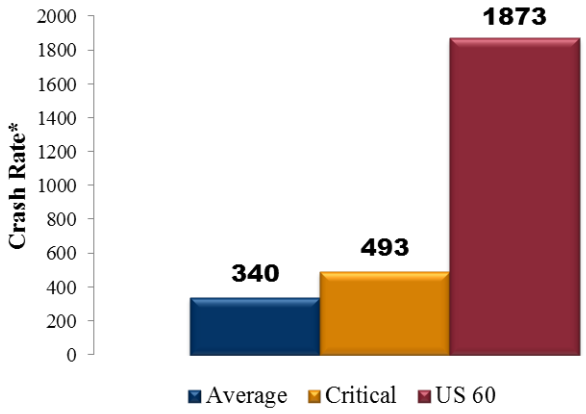
For the five-year period from 2006 to 2010, crash rates for roadway segments were computed. Crash rates, expressed as annual crashes per 100 million vehicle-miles traveled, relate the number or frequency of crashes to the amount of traffic on a roadway segment.

Statewide, crash rates are computed for all Kentucky roads and average rates are computed for roads of similar types. For these same types, a Critical Crash Rate is computed. The Critical Crash Rate is higher than the Average Crash Rate for a given roadway type; at a 99.5 percent level of confidence, it means that roadway segments having an individual crash rate higher than the Critical Crash Rate very likely do so not by chance but due to some factor.

The Crash Rate Factor, or CRF, relates the comparison of a computed crash rate for a specific roadway segment to the calculated Critical Crash Rate for similar types of facilities across Kentucky. Mathematically, it is expressed:

$$Crash\ Rate\ Factor\ (CRF) = \frac{Roadway\ Segment\ Calculated\ Crash\ Rate}{Critical\ Crash\ Rate}$$

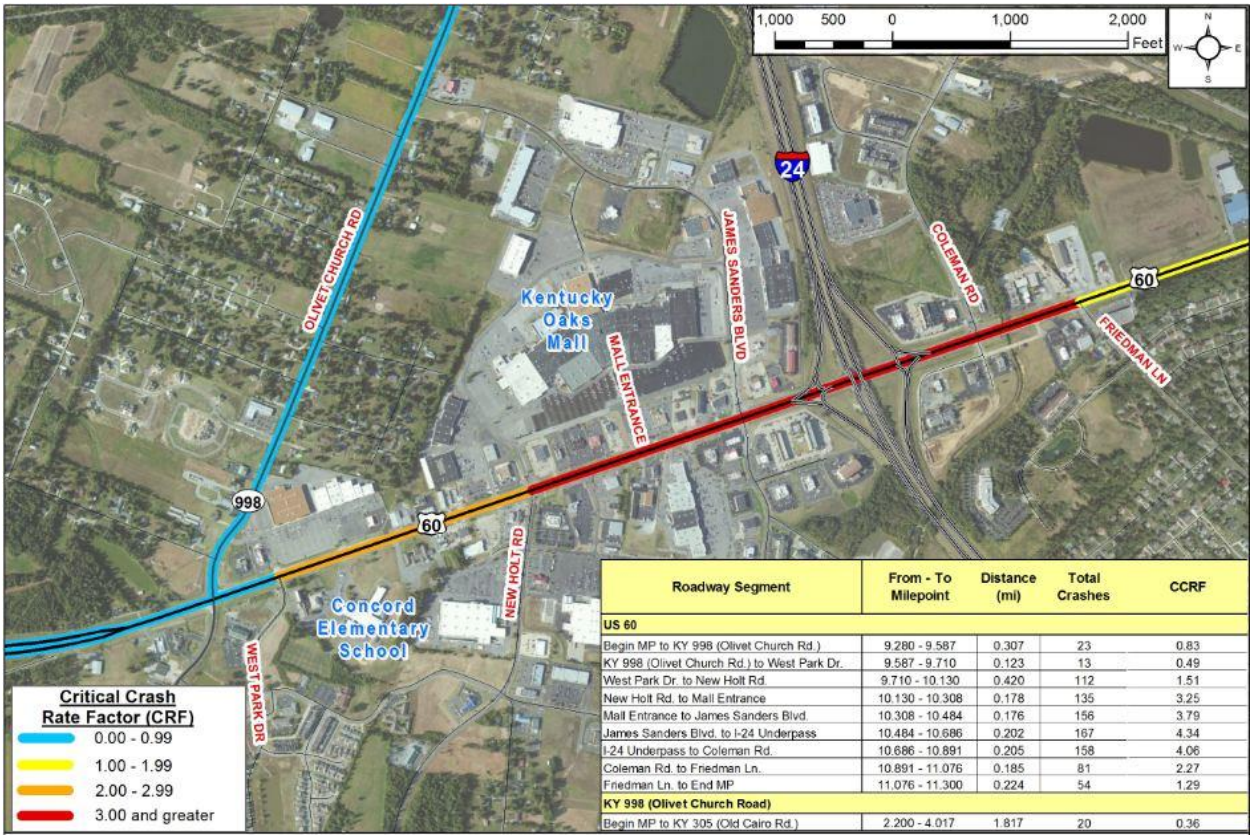
Thus, when the CRF for a given roadway segment is greater than 1.0, it means that the number of crashes along the segment, in relation to the traffic volume, very likely do not occur merely by chance but instead can be attributable to one or more causative factors. This is illustrated in **Figure 11**, where the computed CRF is 3.8. The Kentucky Transportation Cabinet uses the CRF as a measure to help prioritize safety improvements.



$$CRF = \frac{Calculated\ Crash\ Rate}{Critical\ Crash\ Rate} = \frac{1873}{493} = 3.8$$

Figure 11. Example CRF Computation

A map and summary of Crash Rate Factors for US 60 Hinkleville Road and Olivet Church Road is shown in **Figure 12**. With the exception of one segment at the west end, the CRF for the entire study section is greater than 1.0; for some segments, CRF values are greater than 4.0.



Roadway Segment	From - To Milepoint	Distance (mi)	Total Crashes	CCRF
US 60				
Begin MP to KY 998 (Olivet Church Rd.)	9.280 - 9.587	0.307	23	0.83
KY 998 (Olivet Church Rd.) to West Park Dr.	9.587 - 9.710	0.123	13	0.49
West Park Dr. to New Holt Rd.	9.710 - 10.130	0.420	112	1.51
New Holt Rd. to Mall Entrance	10.130 - 10.308	0.178	135	3.25
Mall Entrance to James Sanders Blvd.	10.308 - 10.484	0.176	156	3.79
James Sanders Blvd. to I-24 Underpass	10.484 - 10.686	0.202	167	4.34
I-24 Underpass to Coleman Rd.	10.686 - 10.891	0.205	158	4.06
Coleman Rd. to Friedman Ln.	10.891 - 11.076	0.185	81	2.27
Friedman Ln. to End MP	11.076 - 11.300	0.224	54	1.29
KY 998 (Olivet Church Road)				
Begin MP to KY 305 (Old Cairo Rd.)	2.200 - 4.017	1.817	20	0.36

Figure 12. Critical Crash Factors for Study Area Roadway Segments

3.0 Planned Projects

Several projects for the study area are listed in the Kentucky Transportation Cabinet's Six Year Highway Plan, as shown on the map in **Figure 13**. They are:

- Item 1-123 New Connector Road and Olivet Church Road Widening
- Item 1-125 US 60 Scoping Study (this study)
- Item 1-310.30, 1-310.50 Outer Loop Priority Sections 2 & 3
- Item 1-2703.00 US 60 Pavement Rehabilitation

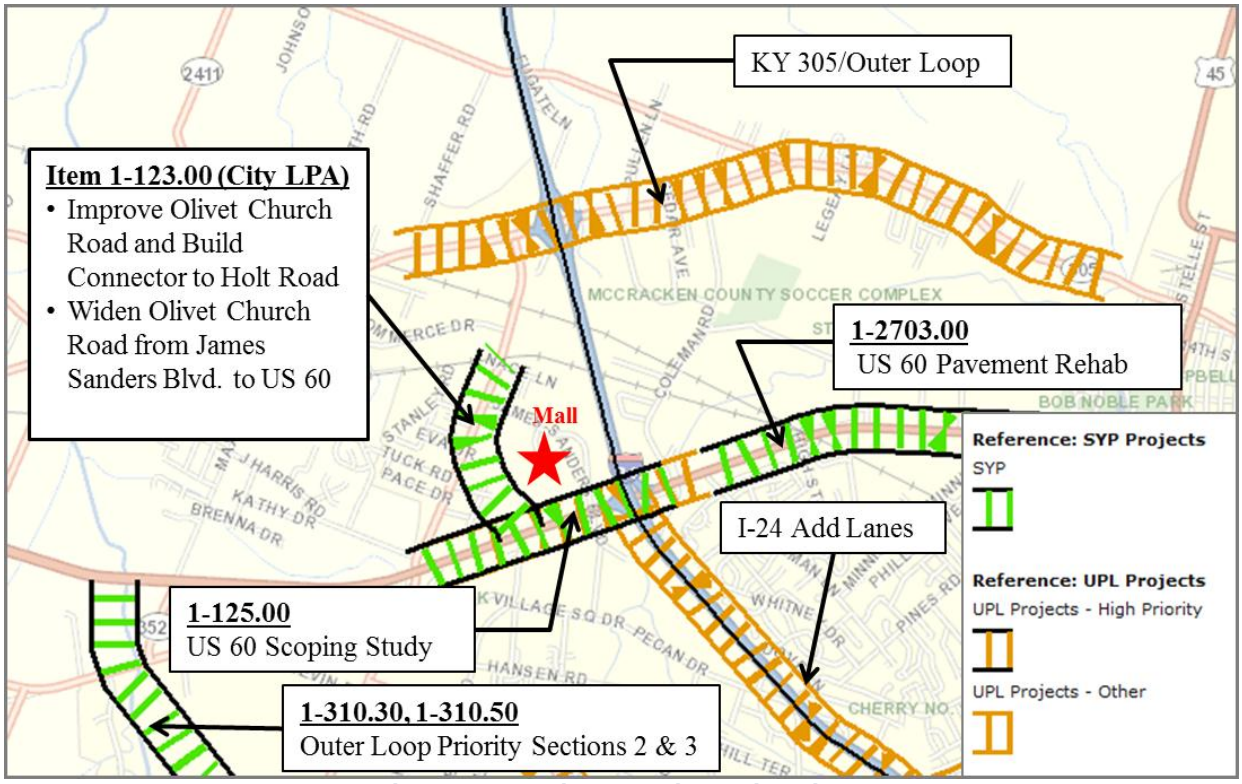


Figure 13. Study Area Planned Projects

Two other improvements have been identified as long-range, meaning they are not scheduled for funding at this time. They are:

- Improvement to KY 305 as the northern section of the Paducah Outer Loop
- Widening of I-24 to six lanes from US 60 to the US 62/US 45 interchange

Recommended projects from this US60 Scoping Study must compete for funding with the other projects currently on the UPL.

4.0 Future Traffic

For the purpose of evaluating potential transportation improvements, a 10-year horizon was selected for developing future year traffic forecasts. Whereas 20-year or even 30-year forecasts are sometimes considered, the 10-year horizon was selected for the following reasons:

- Right-of-way constraints will confine roadway improvements within existing right-of-way limits. The US 60 section is fully developed and right-of-way acquisition would be cost

prohibitive. Roadway improvements therefore would be limited primarily to operational and safety improvements and not major widening projects.

- Operational evaluations of improvement alternatives were performed for peak hour traffic conditions. Peak hour analyses beyond a 10-year horizon are speculative at best as land use changes, particularly in a retail corridor like US 60, can have a significant localized impact on traffic patterns. Thus, the argument can be made that operational analyses conducted for something greater than a 10-year horizon are diminished in significance due to potential inaccuracies.

- As was demonstrated in Section 2.0 of this report, traffic volumes on US 60 actually have declined in recent years. No doubt that this was in part attributable to the economic downturn that has happed since 2008. While uncertain that the decline will continue, it is also overly optimistic to assume that historic traffic growth rates observed in the late 1990's and in the early 2000's will return to these levels once the economic downturn ends. There is reason to believe that the construction of the Outer Loop Priority Sections 2 and 3, along with the opening of the new McCracken County Consolidated High School to the west later this year, will indeed induce land use changes that will reverse the traffic decline trend. However, it is unlikely that significant travel increases will occur over the next ten years, especially as funding for construction of the Outer Loop has not been committed yet and would not occur until after year 2016.

The Paducah-McCracken County Travel Demand Model was utilized to develop growth rates that were used to forecast future year peak hour traffic volumes. The model uses socioeconomic parameters such as county-wide population and employment to predict travel. Socioeconomic data from the model, which was updated recently, reinforce the relatively flat regional growth that is manifested in constant or declining traffic volumes, as shown in **Table 4**.

Table 4. McCracken County Population and Employment Growth (2010 - 2030)

Year	Total Population	Total Employment
2010	68,124	36,900
2030	72,521	42,286
Growth 2010 - 2030	6%	15%

Source: Paducah-McCracken County Travel Demand Model

Year 2010 and 2030 daily traffic assignments were developed using the travel demand model. A 10-year growth rate was interpolated from the traffic assignments and the growth rate was applied to existing peak hour traffic volumes to develop the future year volumes that were used in the analysis of alternatives. The overall growth rate applied to the existing peak hour traffic volumes was approximately five percent.

5.0 Identification and Analysis of Alternatives

5.1 IDENTIFICATION OF IMPROVEMENT ALTERNATIVES

As stated previously, the US 60 study section corridor is fully developed; it was acknowledged early in the study that major widening would be infeasible and that potential improvement projects should be focused on mitigating congestion bottlenecks and improving safety. Also it was acknowledged that KYTC Item No. 1-123.00, the widening of Olivet Church Road and construction of the new connector road from Olivet Church Road to US 60, should be evaluated to identify potential traffic impacts that should be mitigated. In following the study process, the following improvements were identified and evaluated:

- Item No. 1-123.00 Olivet Church Road Widening and New Connector Road
- I-24/US 60 Interchange Reconstruction
- US 60 Access Management Improvements
- US 60 Spot Intersection Improvements

5.2 US 60 TRAFFIC SIMULATION MODELS

A set of microscopic traffic simulation models was developed for the purpose of evaluating the improvement alternatives. The TransModeler® traffic simulation software by Caliper© Corporation was used to analyze peak period traffic conditions for the following scenarios:

- Existing (year 2011/2012) conditions
- Future (year 2022) No Build conditions (where “No Build” means no additional projects beyond those that are already committed in the Six-Year Highway Plan)
- Future (year 2022) anticipated conditions associated with the various improvement alternatives that were considered

It should be noted that Item 1-8702.00, the new access road from KY 305 (Cairo Road) to the Ohio River Megapark, was not considered as a committed project because it was not listed in the Six Year Highway Plan at the time of this study.

The software simulates individual vehicles traveling through the road network and compiles comparative performance measures used to define traffic conditions. A screen capture of a simulation scenario is shown in **Figure 14**.

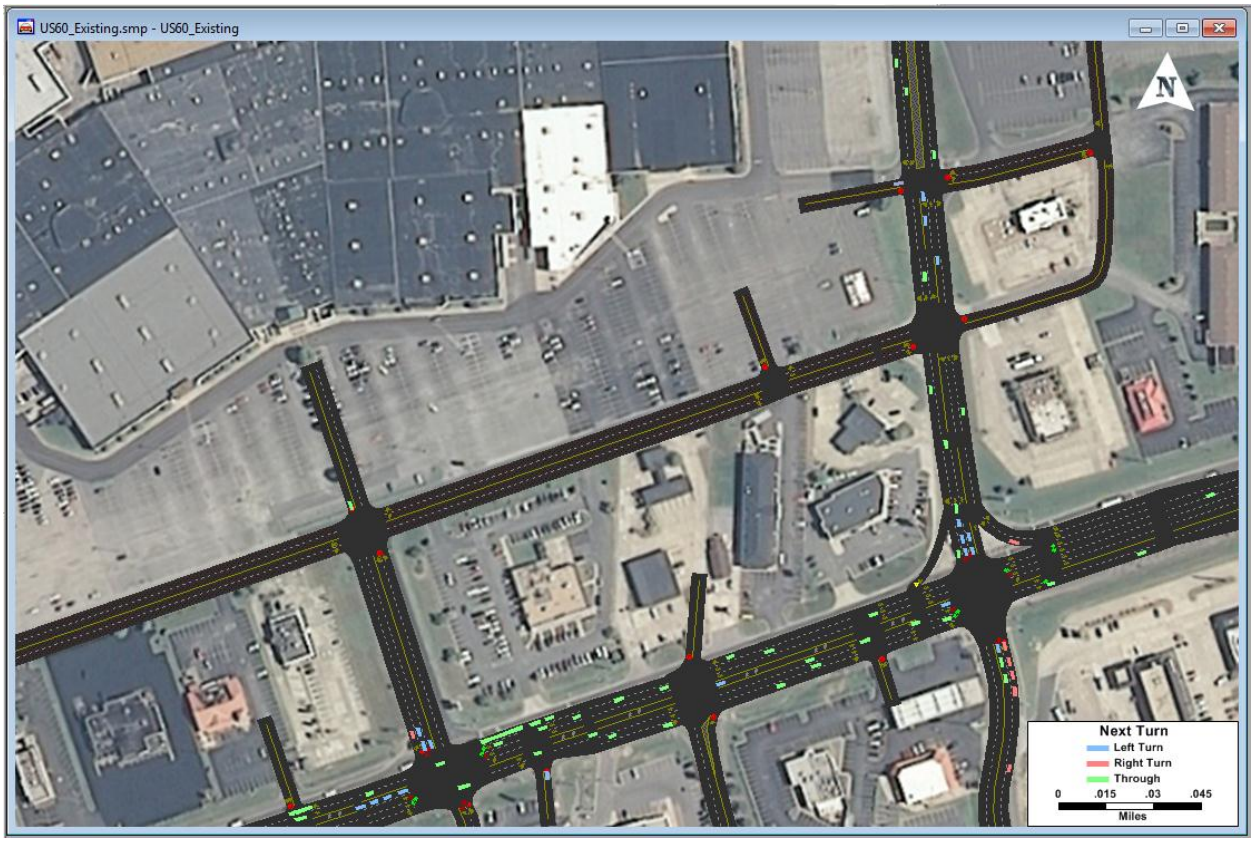


Figure 14. Traffic Simulation Model

Operational analyses (using simulation or other tools) typically are conducted for recurring peak times of the day, which represent a regularly recurring "worst case." In urban areas, this usually means the weekday A.M. and P.M. peak hours. In retail areas such as the US 60 study area, many businesses are not open yet during the weekday A.M. peak. Conversely, these areas also experience another "worst case" – the Saturday afternoon peak. This is the case for the US 60 corridor, due to the Kentucky Oaks Mall and the "big box" retail stores like Walmart, Lowe's and Home Depot. For the US 60 Scoping Study, the following peak traffic periods were analyzed as representative of regularly recurring "worst case" scenarios:

- Weekday P.M. peak (typically occurring sometime between 4:30 p.m. and 6:00 p.m.)
- Saturday peak (typically occurring between noon and 1:00 p.m.)

Examination of existing peak period traffic counts confirmed these assumptions.

5.3 EVALUATION OF ALTERNATIVES

For the purpose of evaluating the effectiveness of operational improvements, two primary performance measures were obtained from traffic simulation model runs:

- Average travel times along US 60 from between Coleman Road and Olivet Church Road (from which average travel speeds were derived); and
- Average intersection delay (in seconds per vehicle) for all vehicles passing through each signalized intersection.

5.3.1 Olivet Church Road Improvements

The planned improvements at Olivet Church Road (Item No. 1-123.00) include:

- Constructing a new connector road from Olivet Church Road through the Kentucky Oaks Mall property and connecting to US 60 at New Holt Road;
- Widening the section of Olivet Church Road between US 60 and the new connector;
- Making the new connector road the “through” road and terminating the southern section with STOP-control.

A screen capture of the simulation model of this scenario is shown **in Figure 15**.

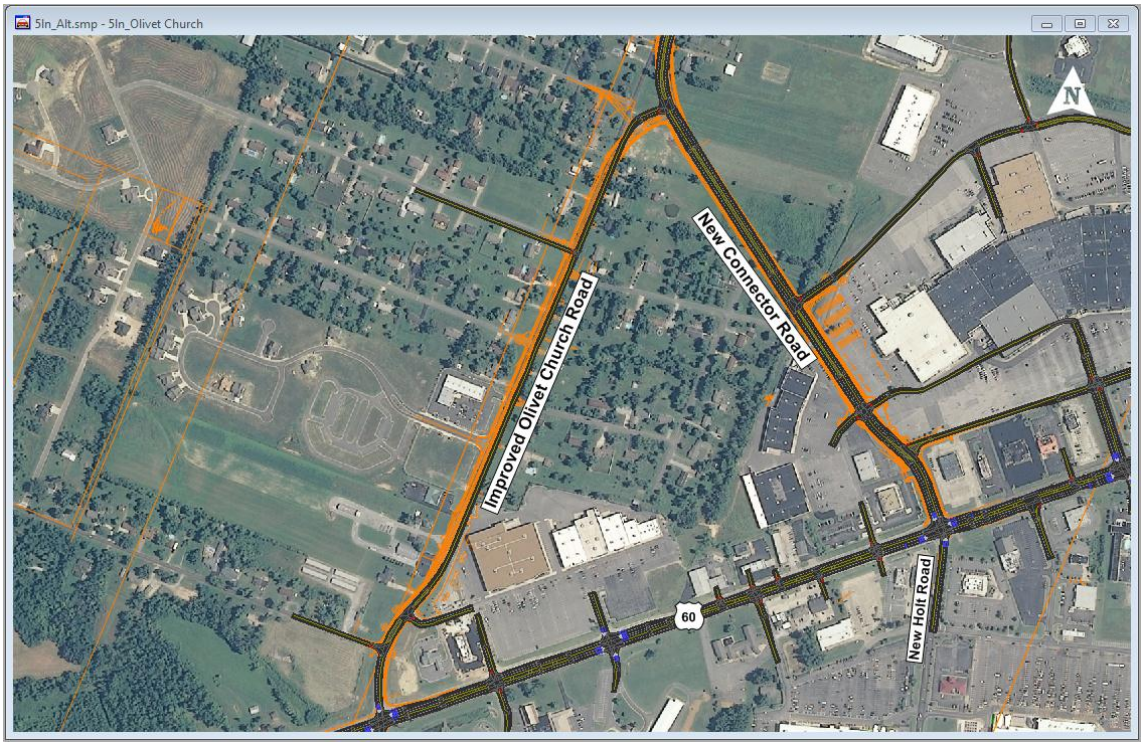
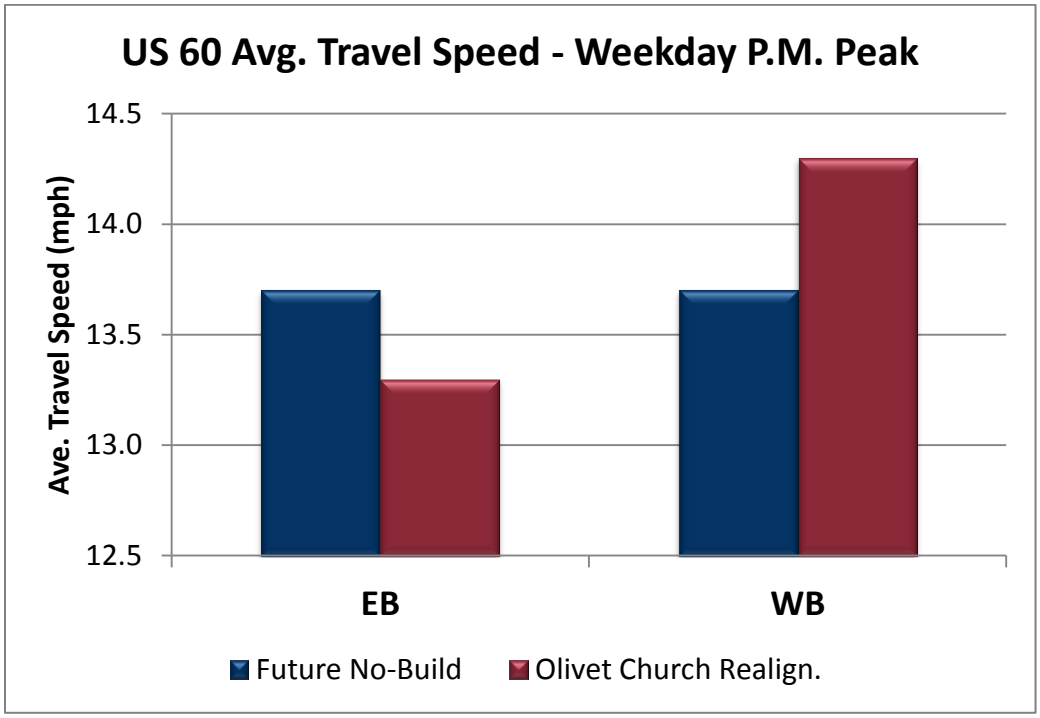


Figure 15. Olivet Church Road Improvements (Item 1-123)

From the simulation model, a summary of intersection delays along US 60 (from Olivet Church Road to James Sanders Boulevard) is shown in **Figure 16**. These are aggregated average intersection approach delays for the projected weekday P.M. peak and Saturday peak for the year 2022. Similarly, a summary of US 60 average travel speeds for this same section is shown in **Figure 17**.

Figure 16. Olivet Church Road Improvements - Summary of Intersection Delays



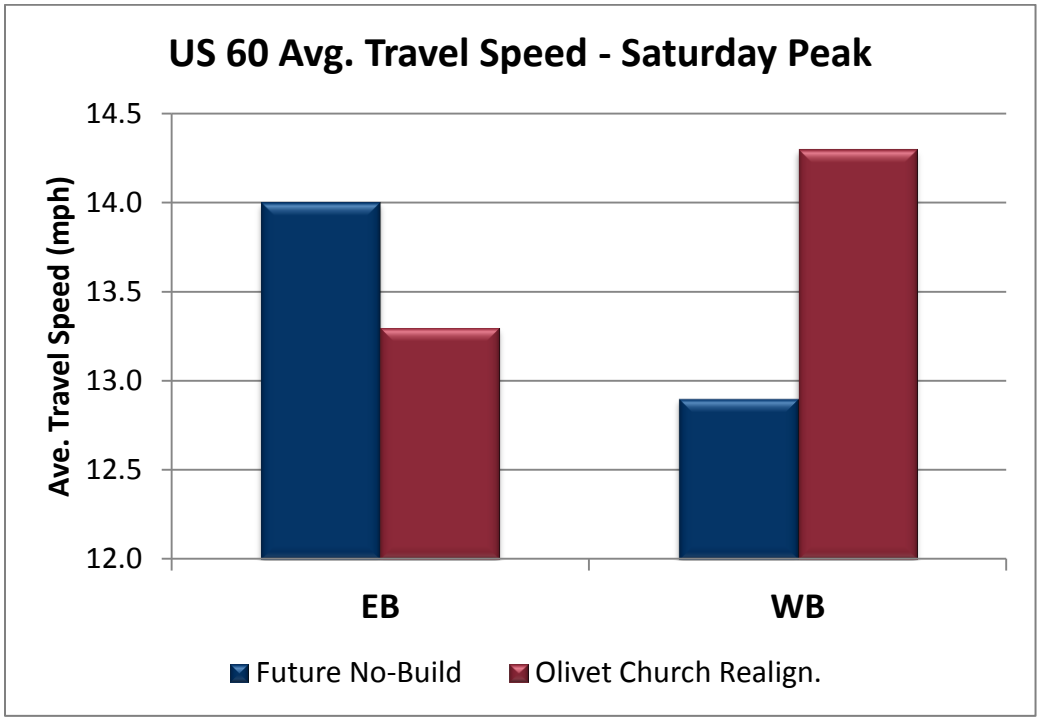


Figure 17. Olivet Church Road Improvements - Summary of Average Travel Speeds

Using the simulation models and the Paducah-McCracken County Travel Demand Model, it was concluded that:

- Some of the traffic would be shifted (25% - 45%) from Olivet Church Road to the new Connector Road;
- The improvement would result in minimal impacts to intersection delay and average travel speed along US 60, with the most noticeable impact at the New Holt Road intersection;
- The final magnitude of the traffic ultimately will be a function of traffic signal timing for US 60 intersections; and
- There is projected to be no discernible added traffic to Old Cairo Road as a result of the improvement.

It should be noted that no land use changes were assumed.

5.3.2 I-24/US 60 Interchange Reconstruction

The I-24/US 60 interchange is at the center of a bottleneck along the US 60 corridor. This is a signalized diamond interchange with closely spaced intersections on either side, as shown in **Figure 18**. Because of the close spacing, queue spillbacks into upstream intersections are a common occurrence. Furthermore, left-turn lane storage lengths to the entrance ramps for I-24 are short, resulting into spillback into the US 60 through lanes, which further exacerbates the congestion. An example of this is shown in **Figure 19**.

Figure 18. I-24/US60 Interchange - Closely Spaced Intersections

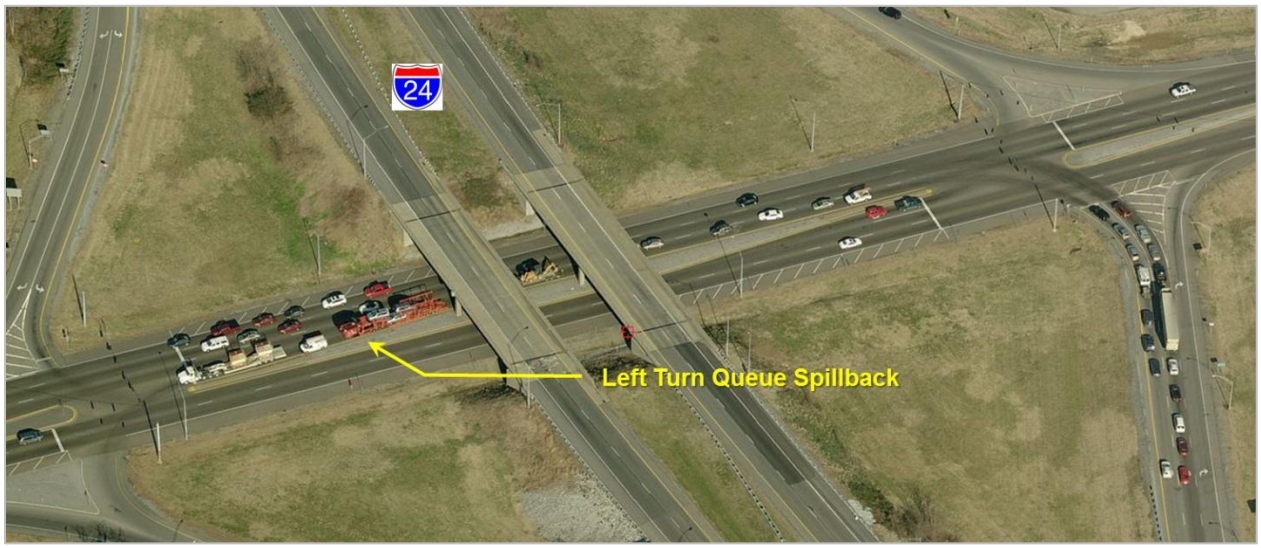


Figure 19. Short Left-Turn Lanes and Queue Spillback

US 60 carries three lanes in each direction through the I-24 interchange. Congestion issues are not related to inadequate through-lane capacity, but instead are a result of close intersection spacing and short interior left-turn lanes. Adding a second left-turn lane would provide only limited benefit – storage for about four more vehicles. Furthermore, adding interior left-turn lanes would have little to no effect in shortening exit ramp queues (the formation of one which can be seen in the right-hand side of the photo in Figure 19).

An innovative, cost-effective solution to easing this congestion bottleneck would be the reconstruction of this interchange as a Double Crossover Diamond (DCD) interchange. The sixth DCD interchange in the United States was constructed in 2011 at the New Circle Road (KY 4)/Harrodsburg Road (US 68) interchange in Lexington and has been very effective in alleviating congestion and reducing crashes.

The concept behind the DCD configuration is that traffic travelling through the interchange is crossed over to the left-hand side of the road. Left turns onto the freeway then are made unopposed, while through movements cross back over to the right-hand side of the arterial. Right-hand turns from the arterial to the freeway are made normally, upstream from the first signal. Signal operations are simplified and made more efficient, as traditional diamond interchange three-phase operations are reduced to two phases.

A schematic diagram of the Lexington DCD interchange is shown in **Figure 20**. The aerial photo illustrates the similarities between this location and the I-24/US 60 interchange in Paducah.

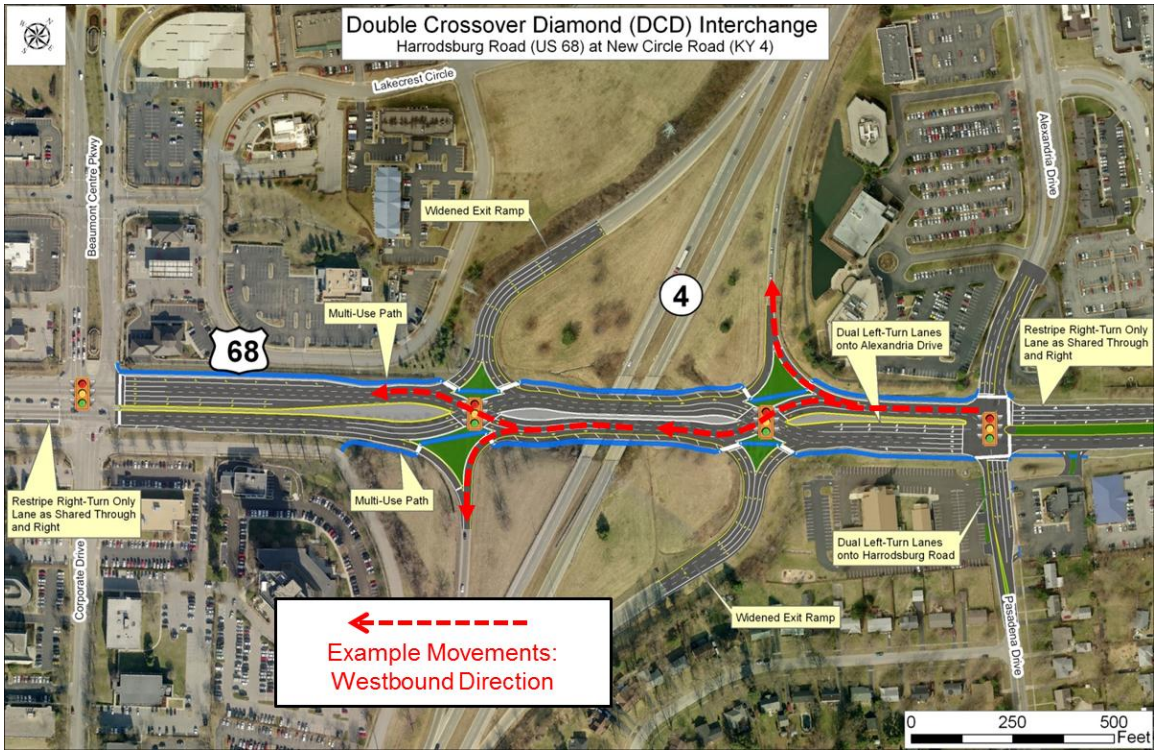


Figure 20. Lexington Double Crossover Diamond (DCD) Interchange

A simulation model with a DCD interchange at I-24 was created for the US 60 study section. A screen capture from that simulation model is shown in **Figure 21**. Simulation runs for year 2022 Weekday A.M. Peak and Saturday Peak scenarios were made and were compared to a No Build scenario where the existing interchange is left as is.

Figure 21. DCD Interchange Simulation

A comparison of average intersection delays between the No Build Scenario and the DCD interchange scenario is shown in **Figure 22**. These comparisons are for year 2022 Weekday P.M. Peak and Saturday Peak scenarios. It should be emphasized that the No Build scenario does not include the Olivet Church Road project, while the DCD scenario does include it. The results show that the DCD interchange generally results in lower average intersection delays along the route. The exception is at the intersection of the new connector road with US 60 and New Holt Road and these increased delays are a result of higher cross-street traffic at this intersection. It must be pointed out that intersection delays are highly influenced by traffic signal timing plans and assumed timing plans were created for the modified intersections.

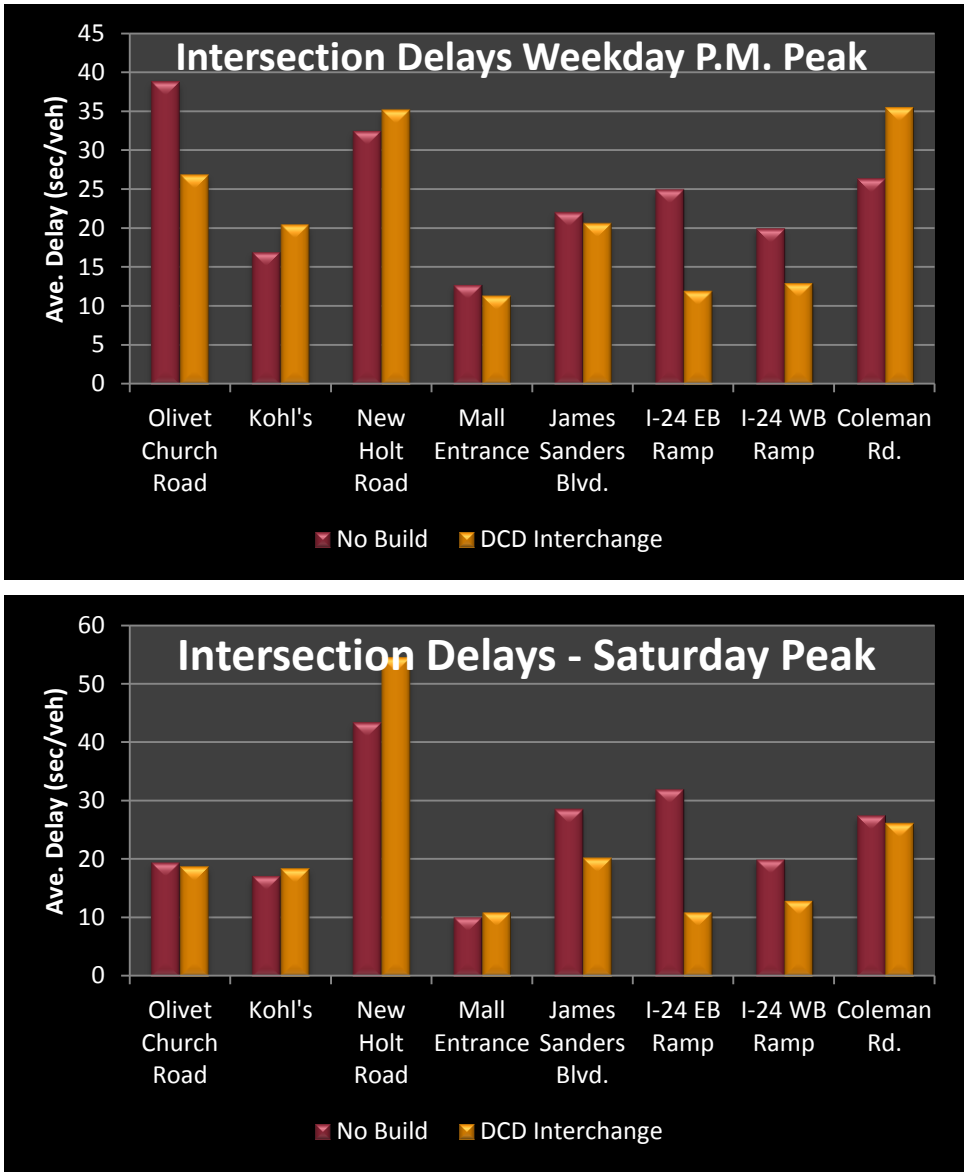


Figure 22. DCD Intersection vs. No Build - Average Intersection Delays

The simulation model was used to perform a detailed analysis and comparison of the conceptual DCD interchange versus the existing conventional diamond configuration. These comparisons were made for the year 2022 Weekday P.M. Peak and Saturday Peak scenarios. For each configuration, multiple simulation model runs were performed and average values were computed for the following performance measures:

- Average intersection delay (a volume-weighted average delay of the approach legs for each of the signalized intersections)
- Average queue length (the average queue length during the signal cycle for the approach legs to each signalized intersection)
- Maximum queue length (the average maximum distance from the stop bar to the back of queue, which usually occurs at the end of the red phase, for each of the subject approaches)
- Percent spillback (the percentage of time during the simulation runs that the back of the queue extended beyond the segment length; along US 60, this resulted in spillback into the upstream intersections, while on the Interstate 24 exit ramps, this resulted into spillback onto the main lanes).

All of these performance measures are affected by traffic signal timing, so it must be pointed out that the analyses represents a hypothetical scenario based on assumed signal timing parameters. Given that qualification, the results of the detailed interchange analyses for the DCD and its comparison to a diamond interchange are summarized in **Figure 23**.

The results show that:

- Average intersection delays are lower for the DCD than for a conventional diamond interchange. This is expected, as DCD operations contain one less signal phase than a diamond interchange and opposing left turns are eliminated.
- In general, average queue lengths and maximum queue lengths are typically shorter for a DCD, reducing the probability of queue spillback. On the I-24 exit ramps, queues can be virtually eliminated with a DCD configuration, as well as the possibility of spillback onto the main lanes.

Average travel speeds along US 60 from Olivet Church Road to Coleman Road would be slightly lower for a DCD when compared to a diamond interchange, but not significantly, as shown in **Figure 24**. This is primarily due to a lower design speed for the arterial section through the DCD as compared to the posted speed of 45 mph. A 25 mph design speed is necessary to safely accommodate the crossover movements through the DCD. In the simulation model, the 25 mph design speed was designated as the desired speed through the interchange. If the 45 mph posted speed limit were modeled, there would be little or no difference in average travel speed between the two alternatives.

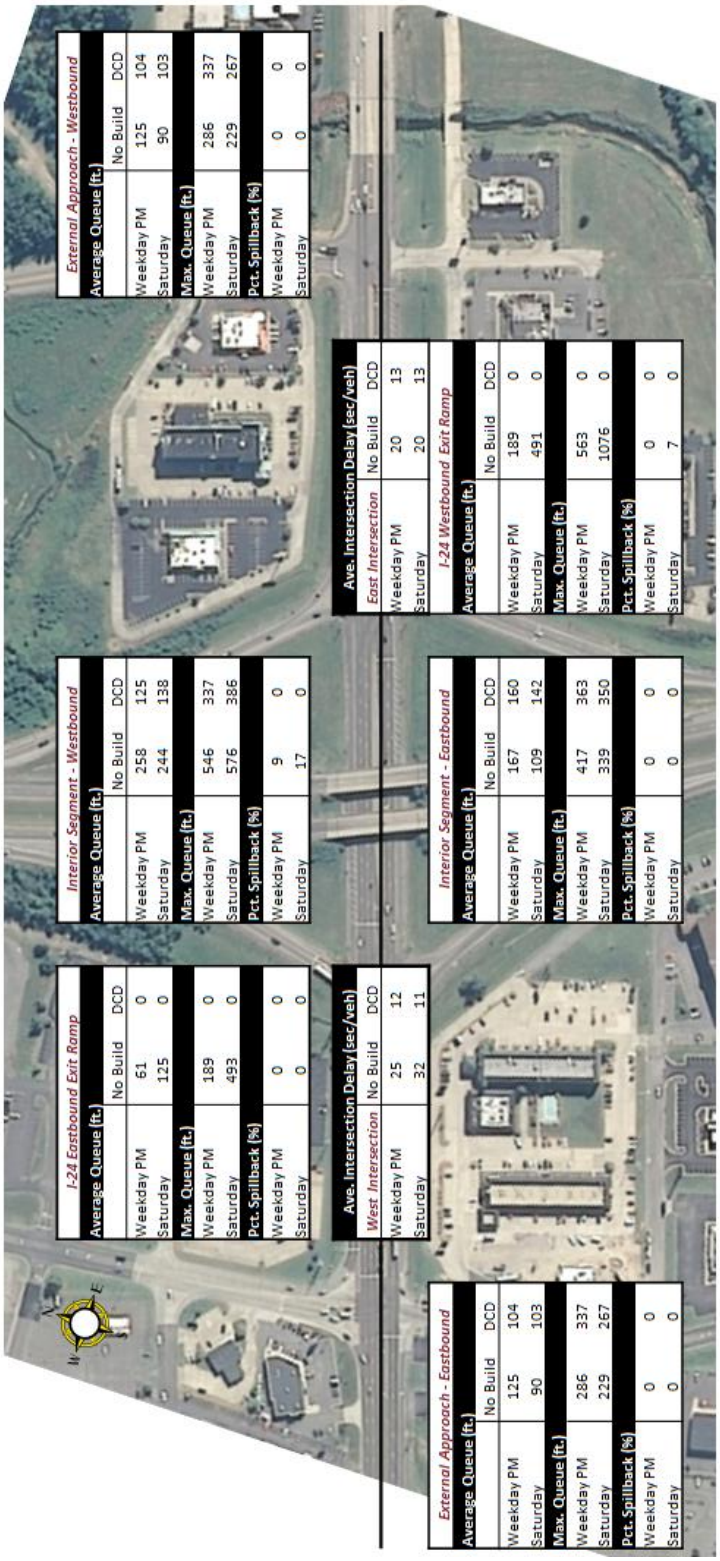


Figure 23. Operational Comparison - DCD vs. Diamond Interchange

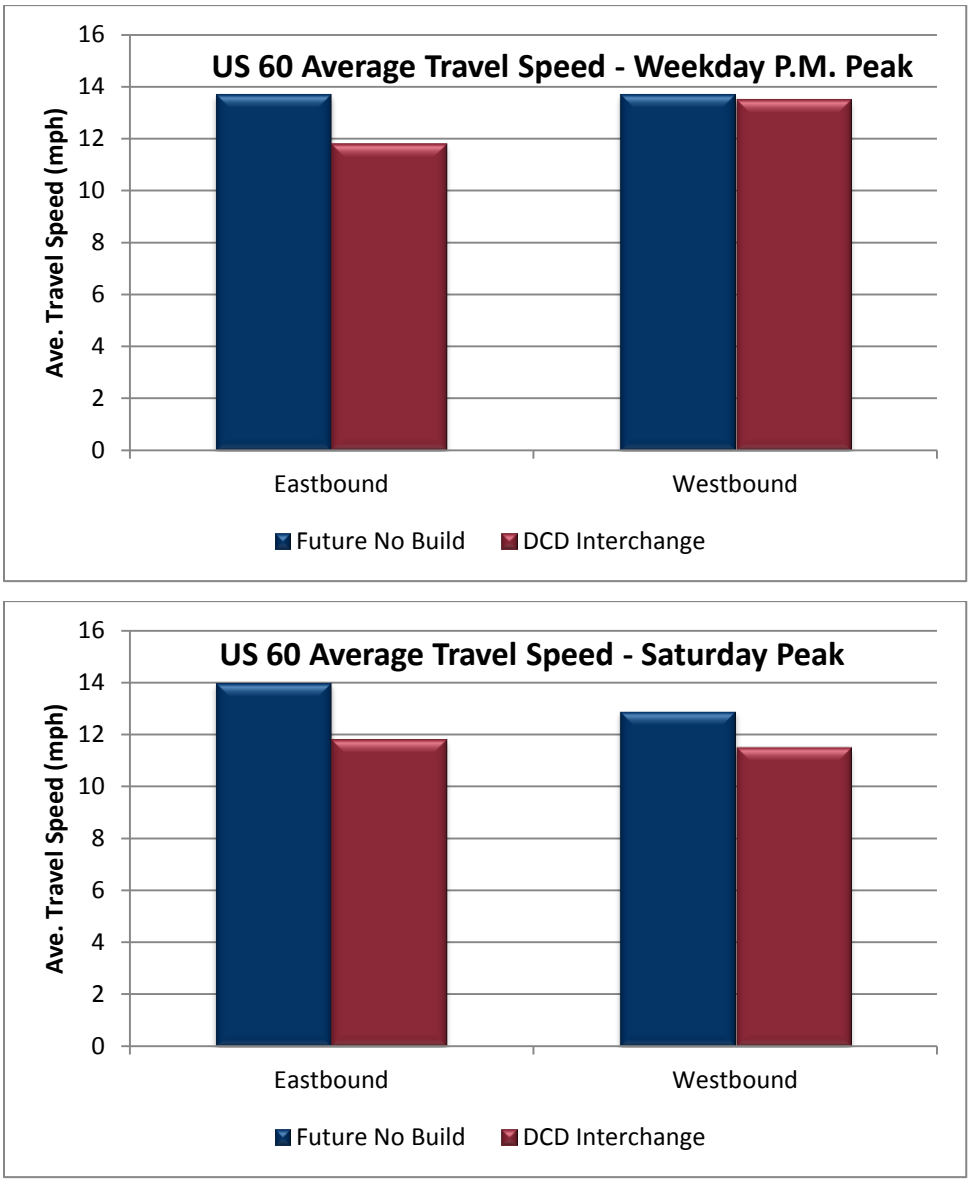


Figure 24. DCD Intersection vs. No Build - Average Travel Speeds

A conceptual design drawing of a Double Crossover Diamond interchange at this location is shown as **Figure A-1** in **Appendix A**.

Operationally, the DCD interchange was demonstrated to be a viable alternative to alleviating what has been a long-standing bottleneck at this location. The safety benefits that have been realized in Lexington and at other DCD locations throughout the United States would be realized here as well.

5.3.3 US 60 Access Management Improvements

US 60 is a four-lane divided roadway through the study section from Olivet Church Road to Coleman Road. Between Coleman Road and James Sanders Boulevard, the roadway is divided by a raised median. From James Sanders Boulevard to Olivet Church Road, the roadway is divided by a continuous two-way left-turn lane (TWLTL).

Access control along the study section is by permit, which means that access points are allowed based on considerations of safety and the interest of the highway user. Where there is access control by permit, permits historically have been granted one at a time, without the context of a "big picture" or overall plan. The US 60 corridor is an example of the result that occurs when there is heavy retail development on an arterial where access control is by permit.

From James Sanders Boulevard to Olivet Church Road, a distance of 0.9 miles, there are 19 unsignalized access points on the north side of the road and there are 16 on the south side of the road. Including the signalized intersections, there are a total of 40 access points. A few of these access points have restricted movements (right-in/right-out, for example), but most allow all movements.

Access management is defined as the systematic control of the location, spacing, design and operation of driveways, median openings, interchanges and street connections. It also encompasses roadway design treatments such as medians and appropriate spacing of traffic signals. Lack of access management results in a higher crash experience and greater traffic congestion. The high Crash Rate Factor was pointed out previously, in Section 2.3. Upon review of the crash types, it is believed that as many as one-third of all reported crashes that occur along US 60 are in some way related to a lack of access management.

Use of parallel frontage and backage roads to provide direct access to businesses is an effective access management strategy, especially when used in combination with raised medians. Between James Sanders Boulevard and New Holt Road, the Mall Ring Road to the north and Bell Aire Drive to the south already function as backage roads for businesses with frontage along US 60, as shown in **Figure 25**. As the section from Coleman Road to James Sanders Boulevard is divided by a raised median, it would be logical to extend the raised median farther west, at least to New Holt Road. This would limit unsignalized driveways along US 60 to right-in/right-out access, but full movements (including U-turns) would be allowed at signalized intersections and rear access to businesses would be provided via the backage roads.

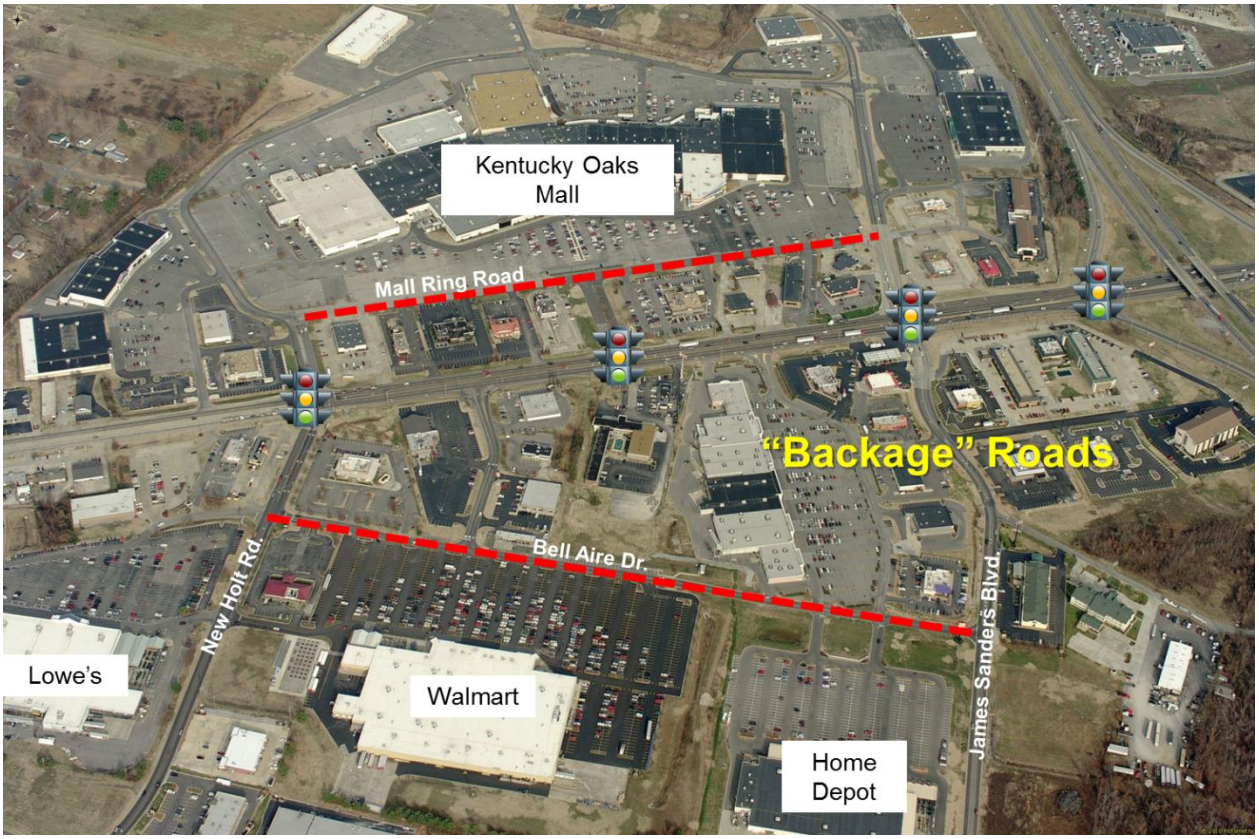


Figure 25. Backage Roads Provide Secondary Access to Businesses

West of New Holt Road, no backage roads exist and some businesses would not have full ingress and egress if a raised median were constructed. Because crash rates are not as high for the section west of New Holt Road, the benefits of constructing a raised median here would be fewer than for the section to the east and would be significantly offset by access limitations.

The traffic simulation modeling software was used for creating an access management scenario and comparing it with the No Build scenario. The comparison was made for year 2022 Weekday P.M. Peak and Saturday Peak scenarios. The simulation model included traffic ingress and egress movements for unsignalized driveway intersections. Assumptions for the access management scenario included:

- Constructing a raised median along US 60 between James Sanders Boulevard and New Holt Road;
- Restricting unsignalized access drives along this section to right-in/right-out access; and
- Allowing U-turns at James Sanders Boulevard, the Mall entrance, and New Holt Road intersections.

A comparison of average intersection delays for the No Build and Access Management scenarios is shown in **Figure 26**. As mentioned before, delays are a function of signal timing

parameters which were assumed. The three intersections for which the construction of a raised median would have the most significant effects are James Sanders Boulevard, the Mall entrance, and New Holt Road. At those locations, predicted average delays would be slightly higher when compared to the No Build. This is logical – intersection volumes would be higher as mid-block turns are redirected to signalized intersections. These movements include U-turns that would be necessary once mid-block left turns are eliminated.

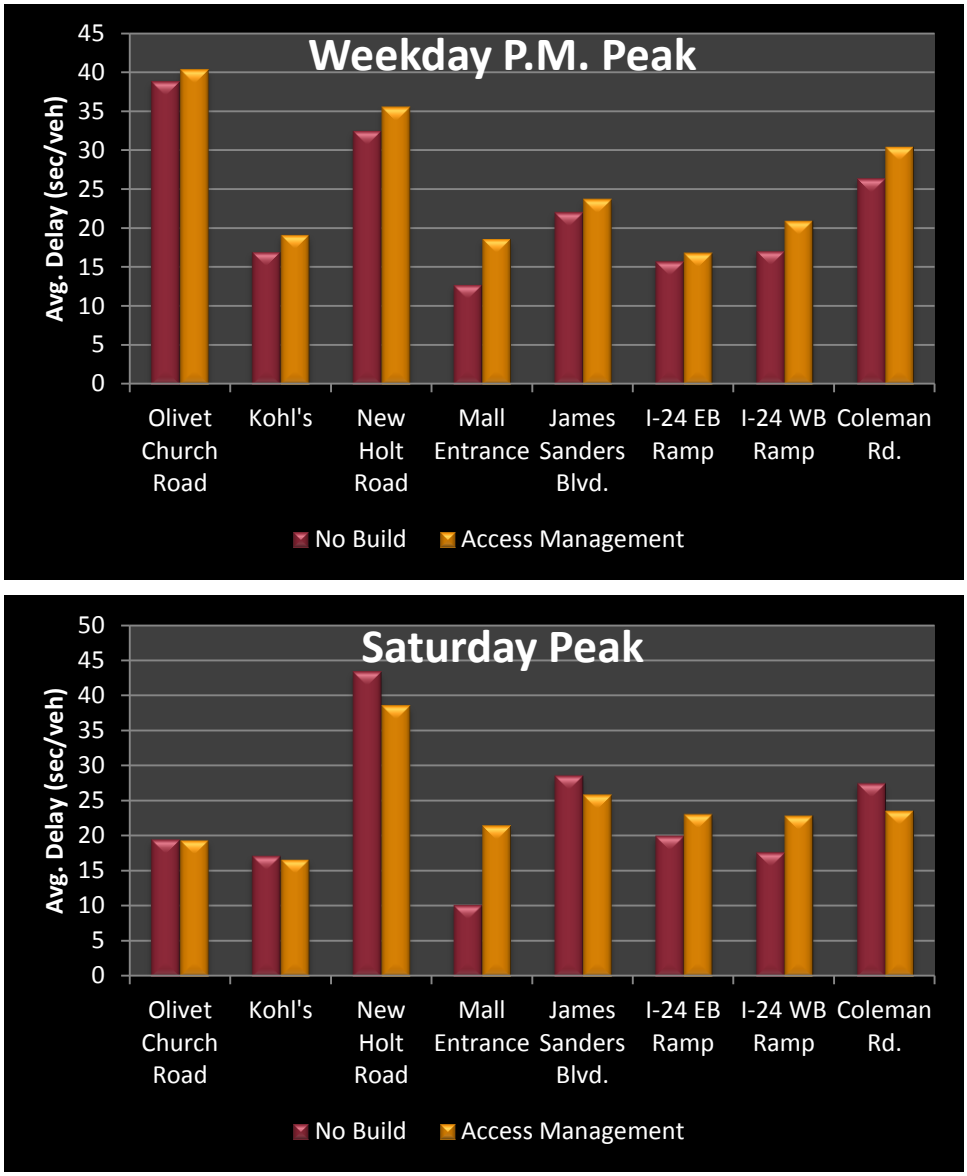


Figure 26. Access Management vs. No Build - Intersection Delays

Average travel speeds are predicted to be slightly slower with the construction of a raised median, primarily due to lane changing maneuvers of right-turning vehicles making a U-turn at a downstream intersection in the simulation. Due to resource and data collection requirements, the simulation model did not include the backage roads that in reality would eliminate many of

these lane-changing movements (as many drivers would use the backage roads in order to make a left turn at a signalized intersection instead of multiple lane changes followed by a U-turn). A summary of the comparison of average travel speeds for the section of Hinkleville Road from Olivet Church Road to James Sanders Boulevard is shown in **Figure 27**. Considering the limitations of the model, the logical conclusion is that the implementation of access management principles – primarily construction of the raised median – would not seriously degrade travel speeds along US 60. It should be clarified that average travel speeds reported in Figure 26 are computed by dividing the distance traveled by the total travel time, which includes delay at intersections.

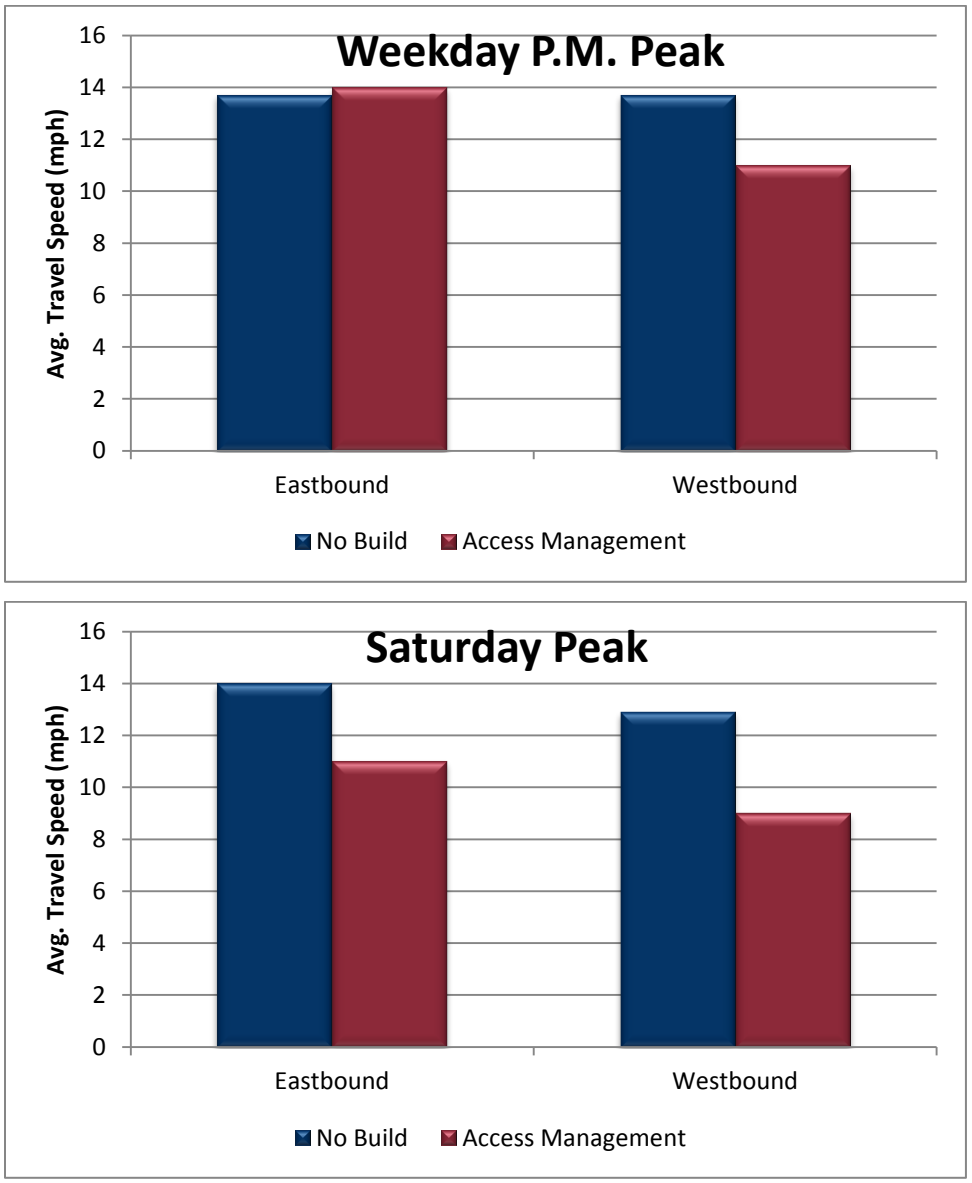


Figure 27. Access Management vs. No Build - Average Travel Speeds

Access-related safety problems along US 60 can be tied to two factors: 1) the high density of access points; and 2) the continuous TWLTL from James Sanders Boulevard to Olivet Church Road. It has been well documented that crash rates increase with increasing access density. The combination of the high access point density and the TWLTL exacerbates the problem.

While there may be opportunities to combine driveways and reduce the overall number of access points, construction of a raised median will have the greatest impact on reducing access-related crashes. Research[3] has shown that:

- Raised medians are safer than flush (5-lane) medians or undivided roadways;
- U-turns are generally safer than direct left turns;
- Medians improve pedestrian safety; and
- Adding a raised median can reduce crash rates by 35 percent to 50 percent.

A conceptual design drawing of a raised median from James Sanders Boulevard to New Holt Road is shown as **Figure A-2** in **Appendix A**.

5.3.4 Spot Improvements

As stated, one of the study objectives was to identify short-term, relatively small-scale spot improvements that will improve safety and reduce congestion and delay. Two locations were identified for which spot improvements will be beneficial in both the short term and the long term.

US 60 at James Sanders Boulevard

There is a heavy left-turn movement from westbound US 60 to southbound James Sanders Boulevard, yet there is only a single left-turn lane to accommodate the demand. Westbound left-turn queues regularly extend back to the intersection at the I-24 ramps. The combination of the Home Depot, restaurants and hotels located along the south section of James Boulevard has resulted in this heavy demand. James Sanders Boulevard also provides a connection to US 62 to the south via Pecan Drive. It is doubtful that the current level of traffic using this road was ever anticipated when US 60 was widened and only the single left-turn lane was included.

Also it should be noted that there are three westbound through lanes along US 60 between the I-24 eastbound ramps and James Sanders Boulevard, but only two in the eastbound direction. The majority of eastbound traffic approaching James Sanders Boulevard is through traffic. Better operations could be realized if the eastbound right-turn lane at James Sanders Boulevard were converted to a combined through/right-turn lane and if the eastbound shoulder between James Sanders Boulevard and the I-24 eastbound ramps were converted to a travel lane that terminates at the ramp. A schematic diagram of these improvements is shown in **Figure 28**.

[3] *Access Management Manual*, Transportation Research Board, Washington, D.C., 2003

Figure 28. Conceptual Spot Improvements - US 60 at James Sanders Boulevard

These improvements were evaluated using traffic simulation. As shown in **Figure 29**, average control delay at the intersection could be reduced for both the Weekday P.M. peak period and the Saturday peak period. The simulation represents a hypothetical example assuming a specific signal timing plan for each period for the future year 2022. Actual results may vary from these, depending on actual signal timing parameters that would be implemented.

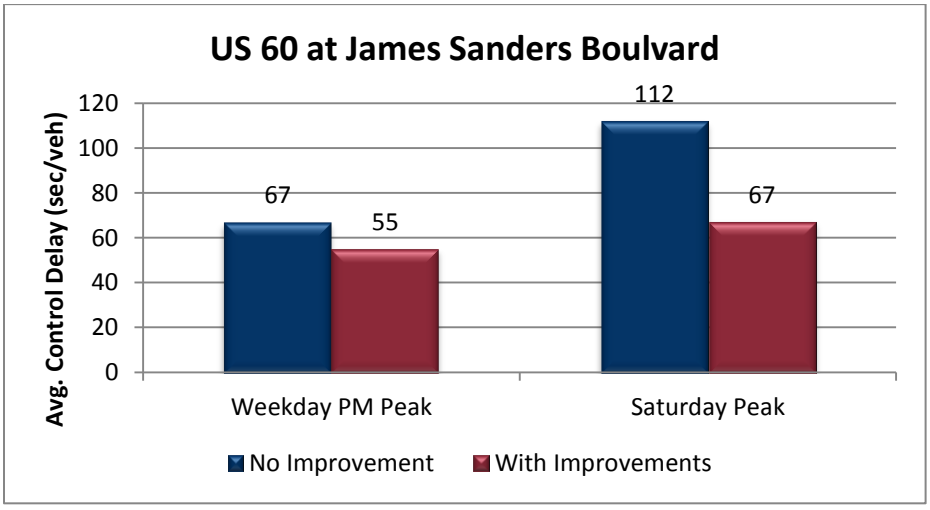


Figure 29. Evaluation of Spot Improvements – US 60 at James Sanders Boulevard

US 60 at New Holt Road/New Connector Road

New Holt Road provides another connection between US 60 and US 62 to the south. The proposed new connector road that passes through the Kentucky Oaks Mall property will align with New Holt Road at this intersection. The New Holt Road approach currently is skewed so

that it does not intersect with US 60 at 90 degrees. This is considered to be a geometric deficiency that decreases the efficiency of signal operations. Furthermore, the current configuration requires signal timing “split phasing” for the cross streets; that is, the northbound and southbound approaches move in separate phases, which reduces the efficiency further.

While the construction of the Paducah Outer Loop Priority Sections 2 and 3 will better facilitate travel between US 60 and US 62 to the south, New Holt Road will continue to serve a dual role of providing both mobility and access in this area. Furthermore, given the likelihood of land use change in this corridor once the Outer Loop is built, the possibility of increased travel along New Holt Road is likely, especially with its direct connection to the new connector road. Given these factors, adding a lane to the northbound New Holt Road approach appears to be justified. The lane should be a combined through/right-turn lane, as illustrated in **Figure 30**. This will require right-of-way acquisition and the adjacent drainage structure at the southeast corner of the intersection may present design and construction issues that should be investigated further. Additionally, opportunities to re-align the northbound approach so that it intersects US 60 more closely to 90 degrees should be investigated.

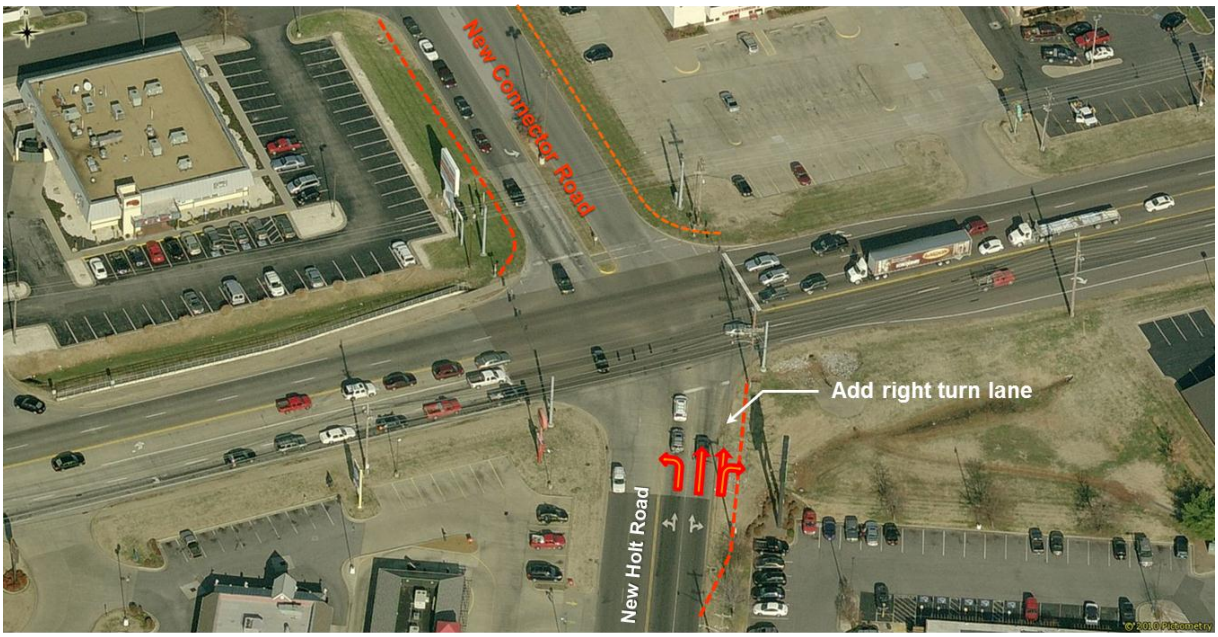


Figure 30. Conceptual Spot Improvements - US 60 at New Holt Road

Using simulation, these conceptual improvements were evaluated and the results are presented in **Figure 31**. It was demonstrated the improvements would reduce average control delays for both the Weekday P.M. peak and Saturday peak. As before, traffic volumes for the year 2022 were used in the analyses. In this case, it was assumed that the new connector road had been completed as planned.

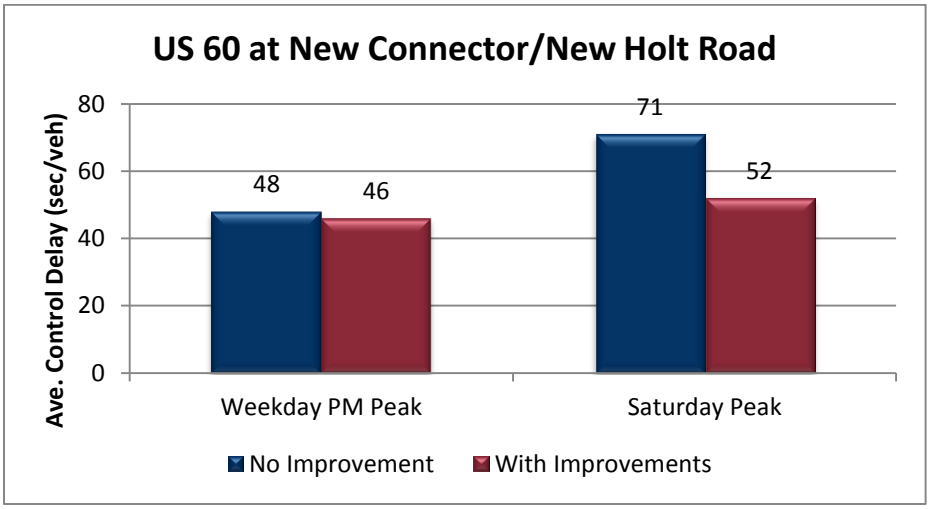


Figure 31. Evaluation of Spot Improvements – US 60 at New Holt Road/New Connector Road

5.4 COST ESTIMATES

Cost estimates for the improvements discussed and evaluated in this study are presented in **Table 5**.

Table 5. US 60 Scoping Study Recommended Improvements Cost Estimates

Improvement		Design	Right-of-Way	Utilities	Construction	Total
DCD Interchange at I-24		$700,000	$100,000	$300,000	$3,500,000	$4,600,000
Raised Median – James Sanders Boulevard to New Holt Road		$150,000	$100,000	$250,000	$1,500,000	$2,000,000
New Holt Road Intersection Improvements	Low	$0	$0	$10,000 to $15,000	$50,000 to $75,000	$60,000 to $90,000
	High	$15,000 to $20,000	$0	$15,000 to $20,000	$150,000 to $200,000	$180,000 to $240,000

The cost estimates for the intersection improvements at New Holt Road ranges from $60,000 to $90,000 at the low end to $180,000 to $240,000 at the high end, depending on the extent of the improvements. The objective of improvements at this location is to improve signal efficiency by removing the need for split-phased signal timing on the cross street. Low end improvements involve simply restriping the New Holt Road approach to provide a dedicated left-turn lane and a combined through/right-turn lane. High end improvements involve the construction of an additional lane on the northbound approach. Cost estimates are in current year dollars.

6.0 Environmental Overview

An environmental overview was conducted as part of this scoping study and the final report was submitted under separate cover. The Executive Summary from that report is presented here:

> This Environmental Overview has been completed for the US 60 Scoping Study to identify environmental resources and potential issues of concern, and to establish an environmental footprint for consideration in the development of project alternatives and avoidance and minimization of impacts. The study area assessed for this report extends 300 feet on either side of the US 60 centerline, in addition to 300 feet from each intersection with Olivet Church Road (KY 998) at the west terminus and Coleman Road at the east terminus. The resulting study area is approximately 1.4 miles in length and encompasses approximately 101 acres, including US 60 from Mile Point 9.55 to Mile Point 10.95.
>
> Natural environment resources identified within the study area and issues which must be addressed if impacts occur include:

- Aquatic resources: Four streams, three potential wetlands and one pond were identified within the study area. Coordination with the KYTC District 1 Environmental Coordinator should be conducted regarding wetlands located in roadside ditches within state right-of-way. A comprehensive stream and wetland survey and impact assessment will need to be conducted for the project. Unavoidable impacts to streams and/or wetlands will require coordination with the U.S. Army Corps of Engineers (USACE) and Kentucky Division of Water (KDOW) and a determination of Section 404/401 permitting and mitigation requirements will be needed.

- 100-Year floodplain: FEMA mapped 100-year floodplain and floodway occur at the east project terminus associated with Perkins Creek. Review and coordination with the local floodplain coordinator for the City of Paducah, McCracken County and the KDOW, Surface Water Permits Branch, Floodplain Management Section will be required to determine the impacts to floodplains and floodway of Perkins Creek, to determine limitations on construction activities in these areas, and to determine local and state permit requirements.

- Groundwater resources: Five water wells, primarily monitoring use, are present at three locations within the study area. Water wells affected by the project will need to be sealed per KYTC standard specifications.

- Public water supplies: The majority of the study area is within a Source Water Assessment and Protection (SWAP) area, which includes surface drainages that flow into Perkins Creek. Construction activities may require the preparation of a Groundwater Protection Plan per 401 KAR 5:307. Coordination with the Purchase

Area Development District and the local water utility should be undertaken to identify requirements of the local SWAP Program, limitations on construction activities, and local permit requirements.

- Threatened and endangered species habitat: There are no reported occurrences of federal listed species within the study area boundaries, and no potential habitat for federal listed species was identified. Known habitat for multiple federal and state listed species is present downstream from the study area in the Perkins Creek watershed. Potential habitat for two state-listed species (Purple lilliput mussel [state-endangered] and Redspotted sunfish [state-threatened]) was identified within the study area (Stream S1). The Kentucky State Nature Preserves Commission has requested the development of a written erosion control plan to address the protection of aquatic habitats which are the primary habitat for federal and state listed species in and downstream of the proposed project.

- Section 4(f)/6(f) public resources: No publicly accessible recreational use areas (Section 4(f) Resources) or federally funded recreation or conservation areas (Section 6(f) Resources) were identified in the study area.

Human environment resources identified within the study area and issues which will require being addressed include:

- Social resources: One school and two churches occur within the study area. The project should consider context sensitive solutions with respect to these facilities in regards to maintaining traffic flow, pedestrian safety and noise considerations.

- Section 4(f) and Section 106 resources: Cultural historic and archaeological resources have not been previously evaluated in the study area. A Phase I archaeological site investigation may be required to determine the presence or absence of significant archaeological sites throughout the extent of the study area. A cultural historic survey performed by a KYTC pre-qualified consultant will be required to determine the presence (and NRHP eligibility) or absence of cultural historic resources in the study area. In particular, two Kentucky Heritage Council “Historic Coded Properties” mapped within the study area will need to be evaluated for Section 106 applicability.

- Potential hazardous materials concern sites: Nine sites were identified within the study area including three active UST facilities, four historic UST facilities, one RCRA-regulated business and two un-regulated businesses (one dry cleaner operation and one automotive service station which is also an historic UST facility). A Phase I survey for hazardous materials concerns including UST’s and potentially contaminated soils will be required for the project.

- Municipal Separate Storm Sewer System (MS4): The City of Paducah is registered as an MS4 with the regulated boundary covering all of the study area except the extreme western end. Coordination with the KYTC-District 1 Environmental Coordinator, the KYTC-DEA and local MS4 Coordinator (City of Paducah, Rick Murphy) will be required as the project construction plans are developed and an NPDES NOI permit is prepared.

- Noise-sensitive receptors: Eleven receptors were identified within or adjacent to the study area (one elementary school, two churches and eight hotels/motels) that may be sensitive to increased noise impacts. A project specific traffic noise impact analysis may need to be conducted to identify and mitigate traffic noise impacts from the proposed project.

The footprint for the natural environment is shown in **Figure A-3** in Appendix A. Likewise, the human environment footprint is shown in **Figure A-4**.

7.0 Public Involvement

Public involvement for this study consisted of meetings with the Project Advisory Team and meetings with local officials and stakeholders. No public meeting was held. The following is a schedule of Project Advisory Team and local officials/stakeholder meetings:

Date	Meeting
June 11, 2011	Project Advisory Team Meeting
June 11, 2011	Local Officials and Stakeholders Meeting
March 5, 2012	Project Advisory Team Meeting
May 23, 2012	Combined Project Advisory Team/ Local Officials and Stakeholders Meeting

Local official and stakeholder involvement included representatives from:

- Kentucky Transportation Cabinet District Office and Central Office Planning
- City of Paducah Engineering and Planning Departments
- Paducah City Police
- McCracken County Sheriff and Emergency Management
- Purchase Area Development District
- Kentucky Oaks Mall
- Barkley Regional Airport

Meeting summaries are located in **Appendix B**.

8.0 Conclusions and Recommendations

The study concluded that the construction of the new connector road through the Kentucky Oaks Mall property and the widening of Olivet Church Road from the new connector to US 60 should have little effect on traffic patterns in the area. The most noticeable effect is expected to be at the intersection of the connector road as it aligns with New Holt Road at US 60 and the impacts there can be mitigated with intersection improvements.

The I-24/US 60 interchange is a bottleneck for several reasons:

- There are heavy peak period traffic volumes through the interchange ramp termini, both through volumes along US 60 and turning volumes from and to I-24;
- The spacing between the ramp junctions is relatively tight and the problem is compounded by closely spaced intersections on either side of the interchange – James Sanders Boulevard to the west and Coleman Road to the east.
- The left-turn lanes on the internal approaches at the interchange are short, so it does not take very many queued left-turning vehicles to spill back into the through lanes.

This interchange and surrounding land use are very similar to the New Circle Road (KY 4)/Harrodsburg Road (US 68) Double Crossover Diamond (DCD) interchange in Lexington that was constructed in 2011. The cost-effective reconstruction of that interchange has resulted in fewer crashes, shorter delays and shorter traffic backups during peak periods. Reconstruction of the I-24/US 60 interchange to a DCD configuration is recommended as a means to improving traffic flow and safety through this area.

It was concluded that the current access control (access by permit) for US 60 is incompatible with the heavy retail land use west of I-24. This has been a big contributor to the high crash rates observed over the years, as shown in the traffic analysis. Implementation of access management strategies, especially the construction of a raised median along US 60 from James Sanders Boulevard to New Holt Road, is recommended. Opportunities to eliminate driveways through the use of shared access points should be investigated as well. Implementation of access management strategies must incorporate a thorough public involvement process that includes dialog with individual property owners.

This study also recommends the construction of intersection operational improvements at US 60/New Holt Road and US 60/James Sanders Boulevard, as described in Section 5, to provide localized capacity enhancements.

9.0 Appendix A

Conceptual Design Drawings

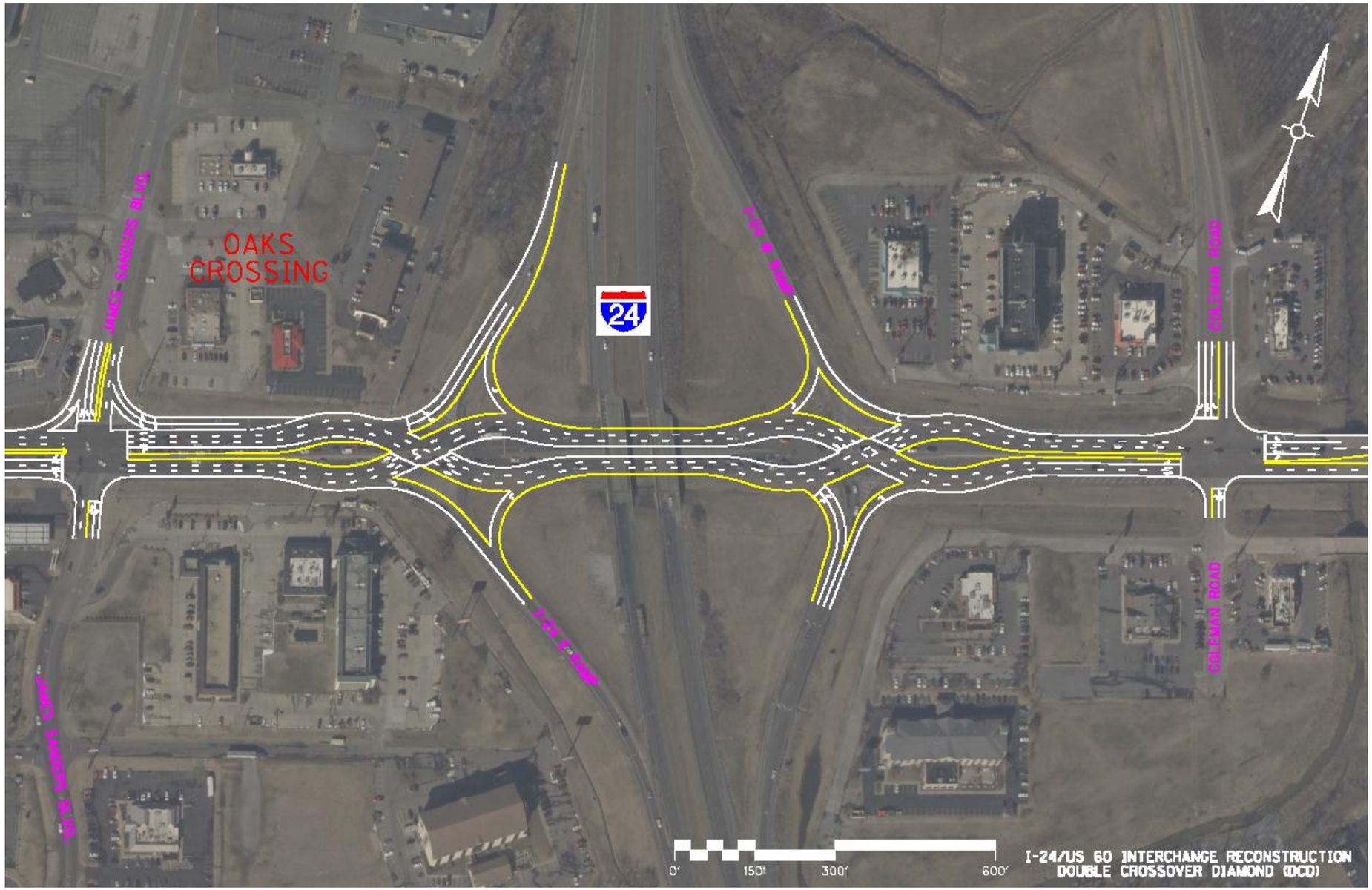


Figure A- 1. Conceptual Design Drawing - Double Crossover Diamond Interchange

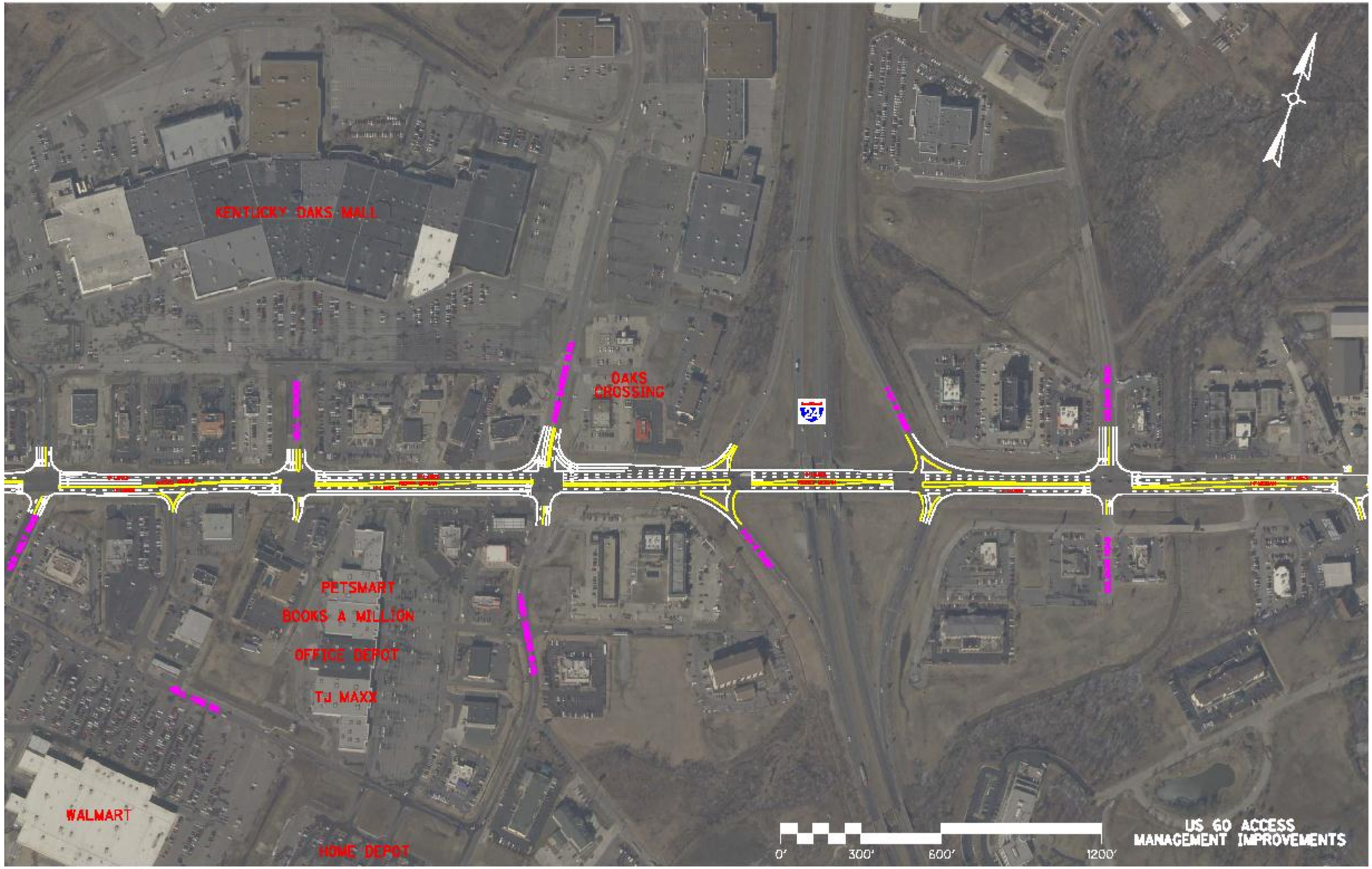


Figure A- 2. Conceptual Design Drawing - Raised Median

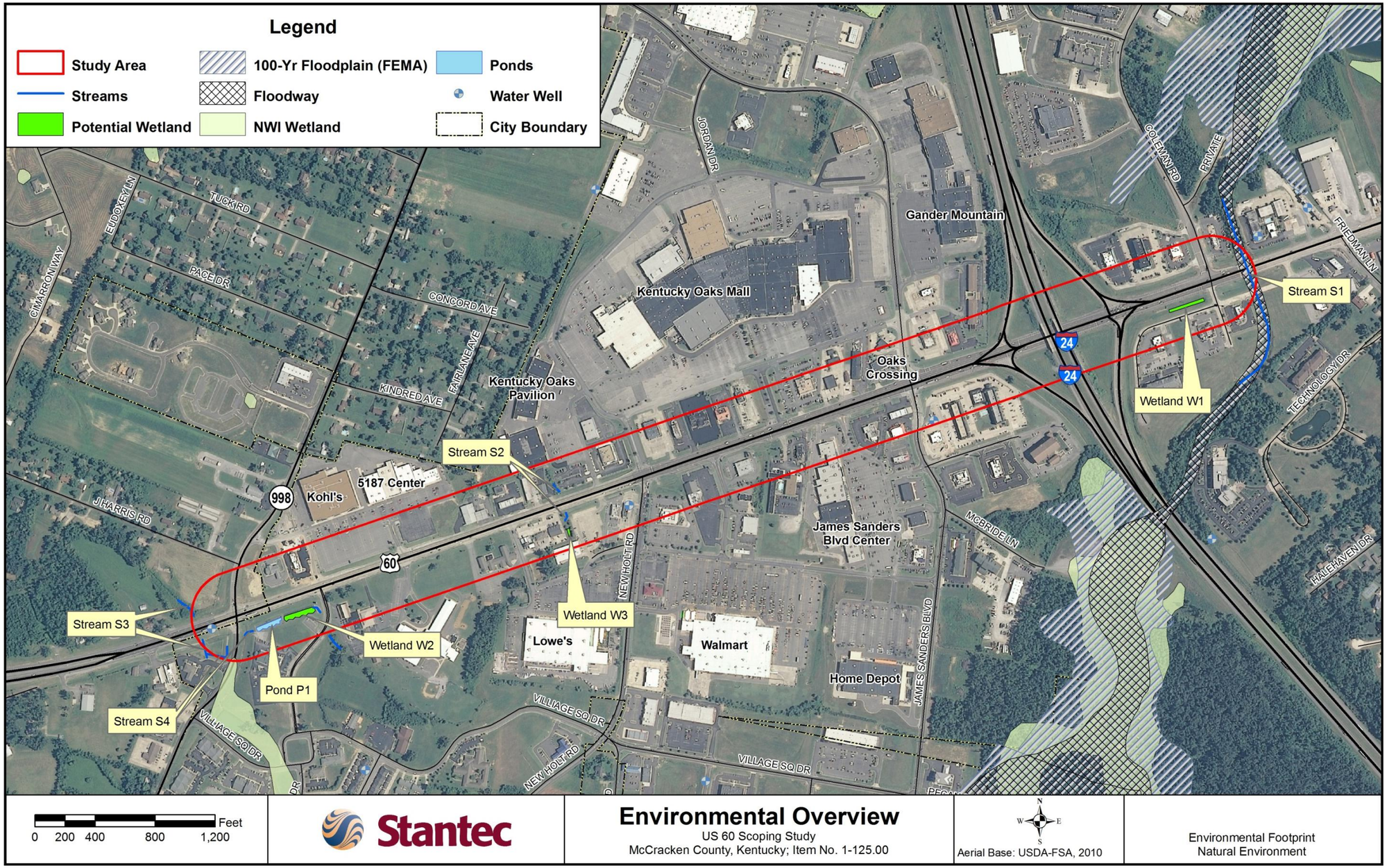


Figure A- 3. Natural Environment Footprint

KENTUCKY TRANSPORTATION CABINET

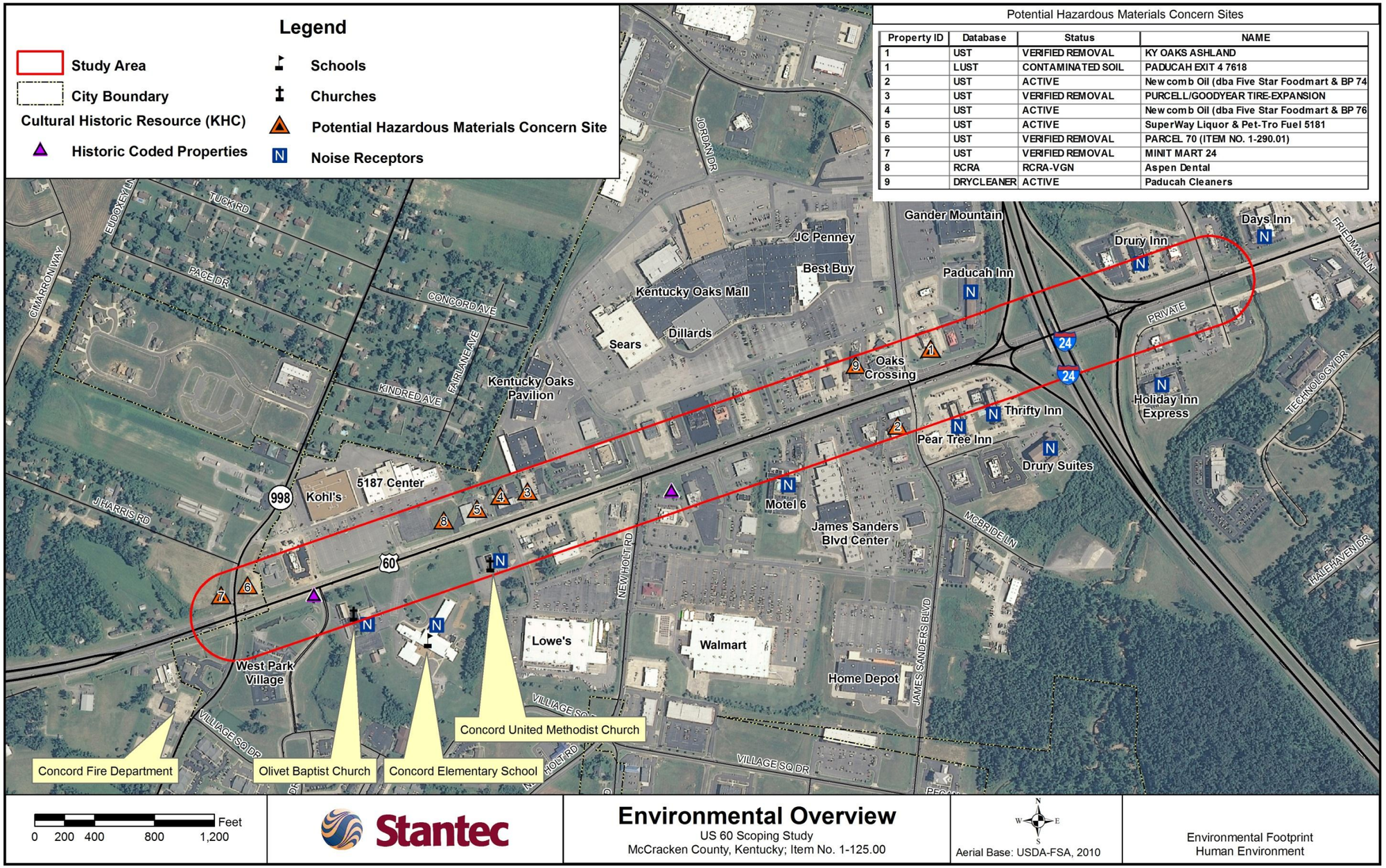


Figure A- 4. Human Environment Footprint

10.0 Appendix B

Meeting Summaries

US 60 Scoping Study
KYTC Kickoff Meeting – June 10, 2011
Summary

The kickoff meeting with the KYTC project team for the US 60 Scoping Study was held at the District 1 office in Paducah on June 10, 2011. Attendees were:

- Tom Creasey, ENTRAN
- Mark Butler, ENTRAN
- Jessica Herring, KYTC District 1
- Chris Kuntz, KYTC District 1
- Jim LeFevre, KYTC District 1
- Jill Asher, KYTC Central Office Div. of Planning
- Tonya Higdon, KYTC Central Office Div. of Planning
- Mike McGregor, KYTC District 1
- Randy Williams, KYTC District 1
- Blake Beyer, KYTC District 1
- David Davis, KYTC District 1
- Susan Oatman, KYTC District 1
- Jordan Leonard, KYTC District 1
- Jacob Northington, KYTC District 1
- Kyle Poat, KYTC District 1
- Scott Thomson (via teleconference), KYTC Central Office Div. of Planning

After introductions, Tom Creasey of ENTRAN discussed the project purpose and need. He stated that the US 60 study area was the major retail corridor in the region and that average daily traffic has ranged from 25,000 to 30, 000 vehicles per day. Congestion and safety have been problems for many years and, with a projected increase in travel due to construction of Priority Section 3 of the Outer Loop and the new McCracken County Consolidated High School to the west, these problems are expected to worsen. He stated that the study objectives are to:

1. Develop short-term and long-term recommended improvements to relieve congestion and improve safety along US 60 (Hinkleville Road);
2. Identify impacts on KY 305/Cairo Road; and
3. Integrate local officials, other stakeholders, and the public into the process.

Tom explained that US 60 in the vicinity of the Kentucky Oaks Mall is functionally classified as an Urban Principal Arterial and is part of the National Highway System. It is also a State Designated Truck Route. The cross-section contains two lanes in each direction; from Coleman Lane to James Sanders Boulevard, these lanes are median-divided, while from James Sanders Boulevard to Olivet Church Road, there is a continuous two-way left-turn lane (TWLTL). There is an additional through lane in the westbound direction from James Sanders Boulevard to the mall main entrance.

Crash data were analyzed for the five-year period from January 1, 2006 through December 31, 2010. A total of 2,160 crashes reported, including one fatal crash and 142 injury crashes. The Critical Crash Rate and Critical Crash Rate Factor (CRF) were explained. It was pointed out that the calculated crash rate for this section was as much as four times the Critical Crash Rate for some of the segments, indicating that crashes are very problematic along US 60 and that they are not occurring merely by chance. Tom Creasey pointed out there is a correlation between the high crash rate, rear-end crashes symptomatic of crashes, and right-angle crashes associated with heavy access point turning volumes. Short-term improvements will have a particular emphasis on improving safety.

Current planned projects were discussed. These include:

- The new connector from Oliver Church Road to New Holt Road and improvements to Olivet Church Road (KYTC Highway Plan Item 1-123.00);
- Outer Loop Priority Section 3 (KYTC Highway Plan Item 1-310.50);
- US 60 Resurfacing ((KYTC Highway Plan Item 1-2703.00);
- KY 305/Outer Loop (KYTC UPL project); and
- I-24 widening to six lanes from US 44/US 62 to US 60 (KYTC UPL project).

This study (Item 1-125.00) is contained in the Highway Plan as well.

Other alternatives being considered include spot improvements, access management along US 60, and interchange improvements at I-24/US 60. Tom Creasey discussed the Double Crossover Diamond (DCD) interchange concept (also known as a Diverging Diamond Interchange, or DDI) and ENTRAN's role in designing the DCD that is under construction presently at KY 4 (New Circle Road) and US 68 (Harrodsburg Road) in Lexington. The characteristics of the I-24/US 60 interchange are similar to the Lexington site.

- The basic activities under this study were discussed. These include:
- Existing Conditions Analysis
- Environmental Overview
- Geotechnical Review
- Alternatives Analysis
- Recommendations
    - Spot Improvements
    - Major Corridor Improvements
- Meetings
- Final Report

The 12-month project scheduled also was presented and discussed. It was pointed out that one public meeting will be held midway through the project, likely in November.

A question-and-answer session was held at the end of the presentation. Tom Creasey asked if "big fix" options should be considered in addition to short-term spot improvements. It was suggested that spot improvements should be itemized and prioritized, and that major improvements should be mentioned, but that a big emphasis should not be placed on them at this time because of the shortage of funding. Tom stated that a "big fix" likely would not take care of all of the problems and that recommendations should include a combination of both. Recommendations should include access management principles.

The question was raised if left-turn prohibition was going to be considered. Tom pointed out that the KYTC Division of Traffic preformed some analyses using traffic simulation on this issue back in 2009. The results were inconclusive and the topic will be addressed more fully as part of this scoping study.

Tom discussed the I-24/US 60 interchange. The DCD alternative will be compared a single point urban interchange (SPUI) option as well as any potential improvements to the existing urban diamond configuration.

Scott Thomson asked if travel time information would be used to compare the DCD alternative with existing conditions. Tom said yes; the District office will collect travel time data, which will be used to calibrate the simulation model. Travel times for candidate alternatives will be compared with the base (existing) condition.

Scott Thomson asked if bypass through lanes could be considered for those trips passing through the study section that were not associated with retail trips in the mall vicinity. Tom said that those would be considered but warned that it may not be a simple concept to implement and likely would result in acquiring additional right-of-way. Turning movements at intersections will be a significant factor to consider. Any idea is "on the table" however at this point in the study.

It was concluded that all of the significant factors involved in the study at this point have been identified and will be addressed.

US 60 Scoping Study
Local Stakeholders and Officials Meeting – June 10, 2011
Summary

The kickoff meeting with local stakeholder and officials for the US 60 Scoping Study was held at the District 1 office in Paducah on June 10, 2011. Attendees were:

- Tom Creasey, ENTRAN
- Mark Butler, ENTRAN
- Donald Hodgson, Paducah Police Department
- Rick Murphy, Paducah City Engineer
- Randy Williams, KYTC District 1
- Stacey Courtney, Purchase Area Development District
- Chris Kuntz, KYTC District 1
- Mike McGregor, KYTC District 1
- Jessica Herring, KYTC District 1
- Kyle Poat, KYTC District 1
- Jordan Leonard, KYTC District 1
- Blake Beyer, KYTC District 1
- Susan Oatman, KYTC District 1
- Allen Wilson, Kentucky Oaks Mall
- Joshua Sommer, City of Paducah Planning Department
- Tonya Higdon, KYTC Central Office Planning
- Jill Asher, KYTC Central Office Planning

After introductions, Tom Creasey of ENTRAN discussed the project purpose and need. He stated that the US 60 study area was the major retail corridor in the region and that average daily traffic has ranged from 25,000 to 30, 000 vehicles per day. Congestion and safety have been problems for many years and, with a projected increase in travel due to construction of Priority Section 3 of the Outer Loop and the new McCracken County Consolidated High School to the west, these problems are expected to worsen. He stated that the study objectives are to:

1. Develop short-term and long-term recommended improvements to relieve congestion and improve safety along US 60 (Hinkleville Road)
2. Identify impacts on KY 305/Cairo Road
3. Integrate local officials, other stakeholders, and the public into the process

Tom explained that US 60 in the vicinity of the Kentucky Oaks Mall is functionally classified as an Urban Principal Arterial and is part of the National Highway System. It is also a State Designated Truck Route. The cross-section contains two lanes in each direction; from Coleman Lane to James Sanders Boulevard, these lanes are median-divided, while from James Sanders Boulevard to Olivet Church Road, there is a continuous two-way left-turn lane (TWLTL). There is an additional through lane in the westbound direction from James Sanders Boulevard to the mall main entrance.

Crash data were analyzed for the five-year period from January 1, 2006 through December 31, 2010. A total of 2,160 crashes reported, including one fatal crash and 142 injury crashes. The Critical Crash Rate and Critical Crash Rate Factor (CRF) were explained. It was pointed out that the calculated crash rate for this section was as much as four times the Critical Crash Rate for some of the segments, indicating that crashes are very problematic along US 60 and that they are not occurring merely by chance. Tom Creasey pointed out there is a correlation between the high crash rate, rear-end crashes symptomatic of crashes, and right-angle crashes associated with heavy access point turning volumes.

Current planned projects were discussed. These include:

- The new connector from Oliver Church Road to New Holt Road and improvements to Olivet Church Road (KYTC Highway Plan Item 1-123.00);
- Outer Loop Priority Section 3 (KYTC Highway Plan Item 1-310.50);
- US 60 Resurfacing ((KYTC Highway Plan Item 1-2703.00);
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Other alternatives being considered include spot improvements, access management along US 60, and interchange improvements at I-24/US 60. Tom Creasey discussed the Double Crossover Diamond (DCD) interchange concept (also known as a Diverging Diamond Interchange, or DDI) and ENTRAN's role in designing the DCD that is under construction presently at KY 4 (New Circle Road) and US 68 (Harrodsburg Road) in Lexington. The characteristics of the I-24/US 60 interchange are similar to the Lexington site.

- The basic activities under this study were discussed. These include:
- Existing Conditions Analysis
- Environmental Overview
- Geotechnical Review
- Alternatives Analysis
- Recommendations
    - Spot Improvements
    - Major Corridor Improvements
- Meetings
- Final Report

The 12-month project scheduled also was presented and discussed. It was pointed out that one public meeting will be held midway through the project, likely in November.

Rick Murphy asked if the study will address impacts to Olivet Church Road. Tom Creasey said that the focus of this study will be on US 60 and the traffic simulation model being developed will not cover Olivet Church Road, but traffic impacts to the extent of increased traffic and change in level of service on Olivet Church Road will be identified.

Tom Creasey asked if there was a comprehensive plan for Paducah. Josh Sommer said that it can be found on the City's Web site at http://www.ci.paducah.ky.us/paducah/comprehensive-plan. Tom clarified that the study will involve traffic projections for the period 10 years from now and potential land use changes also need to be considered.

One of the potential short-term solutions might be signing improvements to assist out-of-state drivers who are not familiar to the area. It was pointed out that signs might be part of the current problem, as they create a "visual overload." Tom said that overhead lane use signs might be considered.

There was a general agreement that the study should address "big fix" alternatives in addition to short-term improvements. Rick Murphy said he doesn't think the DCD interchange could be built quickly enough, as something is needed right now. Tom pointed out that an improvement to the interchange would solve a lot of problems but not all.

The question was asked how much of the 25,000 – 30,000 average daily traffic on US 60 was traveling through the corridor. Tom said that an estimate of this amount can be made using the McCracken County travel demand model, but that actual origin-destination data does not exist and will not be collected.

Tom said that at this point none of the alternatives being considered includes adding extra through lanes on US 60. This would be an expensive endeavor that would involve right-of-way acquisition.

Rick Murphy pointed out that there exists a bad weaving problem for eastbound I-24 traffic exiting onto US 60 westbound and turning left to go south on James Sanders Boulevard. The weave involves moving across several lanes of traffic over a distance of 300 feet. Tom stated that crash records likely would point out this problem as well.

The question was asked if bike lanes are being considered. Tom said that the approach to this project will be multimodal and that pedestrians and bicycles will be addressed. Rick Murphy pointed out that pedestrian phases at traffic signals can have a significant effect on automobile traffic flow and congestion. Tom said that he did not anticipate major changes to current timing plans as part of this study. It was the consensus of the group that there is very little pedestrian crossing activity along US 60 today.

Rick Murphy discussed the numerous access drives along the study section and asked if ENTRAN has ever recommended the closing of driveways. Tom cited the US 31W Access Management Plan that ENTRAN developed for the Elizabethtown/Radcliff area and that this particular recommendation was made there. It was asked if ENTRAN has demonstrated success with implementing access management

principles. Tom said that ENTRAN does have demonstrated success with implemented access management projects around Kentucky.

Rick Murphy mentioned that the City, at the request of the Kentucky Oaks Mall, collects traffic counts on the day after Thanksgiving at all of the Mall access points. The access point used the least is the main entrance to the Mall on US 60. Allen Wilson thinks it's because of the signal timing and long delays to drivers entering and leaving the mall at this intersection. This intersection will be scrutinized under this study for potential modifications.

Meeting Notes

US 60 Scoping Study Progress Meeting

FILE 17856005.LA002

Date/Time:	March 5, 2012 12:00 PM CST
Place:	District 1 Office, Paducah
Attendees:	Ashley Day (Stantec) Brian Aldridge (Stantec) Tom Creasey (Stantec) Susan Oatman (KYTC D1) Jessica Herring (KYTC D1) Blake Beyer (KYTC D1) Mike McGregor (KYTC D1) Tonya Higdon (KYTC C.O. Planning) Keith Damron (KYTC C.O. Planning) Chris Kuntz (KYTC D1)

Discussion Items:

- Tom Creasey stated that the purpose of the meeting was to review the status of the study with the project team, especially in light of schedule delays that had been incurred. He also reviewed the purpose and need for the study and the objectives. Average daily traffic volumes in the area were reviewed and it was pointed out that area traffic has declined a little in the last few years due to the economy. Brian Aldridge presented a graphic showing the decline. A summary of weekday p.m. peak hour and Saturday peak hour intersection turning movement counts was distributed. These are the counts from 2009 and 2011 that are being used in the simulation models.

- Brian reviewed the crash statistics. He presented maps locating crashes by type for the last three years and mentioned that US 60 is very similar to Harrodsburg Road in Lexington, where the Double Crossover Diamond (DCD) interchange with New Circle Road was constructed recently. A high number of sideswipe crashes between I-24 and James Sanders Boulevard likely are due to weaving movements across US 60. Most of the rear-end crashes occurred between New Holt Road and I-24.

- The planned projects for the area were reviewed. Simulation model network alternatives have been created for:

1. Existing roadway network
2. New Connector Road between Olivet Church Road and US 60 at New Holt Road
3. New Connector Road plus I-24/US 60 DCD
4. New Connector Road plus I-24/US 60 DCD plus access management

- Brian reviewed further the Harrodsburg Road/New Circle Road DCD interchange,

again pointing out the similarities with US 60. Specifically he reviewed available crash data and pointed out how crashes along Harrodsburg Road have declined considerably since the DCD was reconstructed. He anticipates that a DCD at I-24/US 60 would have similar safety benefits.

- Brian discussed traffic operations along Harrodsburg Road since the construction has been complete. Almost all of the significant backups have been reduced significantly, by about 50%, when compared to the pre-construction state.

- Alignment information for the Olivet Road Connector project was received. Brian pointed out that the connector road intersection with the mall ring road (which serves as a backage road for businesses fronting US 60) is shown as a right-in/right-out intersection, but left turns from the ring road onto the connector would be desirable if access management is implemented.

- A big reason for existing backups along US 60 at I-24 are the short left-turn lanes on the internal approaches between the I-24 ramp intersections. A DCD would eliminate these short turn lanes and the backups they cause.

- The proximity of the James Sanders Boulevard intersection to I-24 also will present some challenges, but the impacts can be mitigated if a DCD were to be constructed. The proposed intersection approach geometry was discussed.

- Brian pointed out there are 19 unsignalized access drives on the north side of US 60 and 16 on the south side from I-24 to Olivet Church Road, so an access management alternative including a non-traversable median is worthy of consideration. He showed a graphic that highlighted parallel backage roads on both the north and south sides of US 60 (slide 36). There will be some businesses that would lose direct left-turn access to/from US 60 (see slides 37 and 38), but this could be mitigated. Mike McGregor pointed out that these businesses were located west of New Holt Road, where traffic and crash conditions aren't as bad.

- Brian presented preliminary simulation model output for intersection delays and travel times. The main contributor to delay is turning activity from and onto US 60, not the through movements. He discussed some options for reconfiguring the US 60/New Holt Road intersection, which has the highest average delay of all intersections at present. The split signal phasing at this location constitutes part of the problem.

- Brian also reviewed travel times for the three alternatives when compared to the existing situation. Also speeds through the DCD are slower and this gives the appearance that there is no difference in travel times. It was pointed out that speeds are much more uniform, resulting in smoother traffic flow.

- The simulation models were observed. It was pointed out that the existing US 60 cycle lengths were preserved (150 seconds) but that half-cycles were used at the DCD intersections. Brian reiterated that the proximity of the James Sanders Boulevard was an issue that would come into play with the DCD alternative and he

thinks that can be mitigated.

- The Olivet Church Road Connector was discussed. Olivet Church Road currently carries less than 5,000 vehicles per day. It is uncertain what land use changes might take place once the project is built, but traffic volumes are not expected to increase significantly west of the mall once this is built. At this time construction of the connector plus widening of Olivet Church Road to five lanes (as desired by the City) does not seem to be necessary; improving Olivet Church Road to three lanes should suffice.

- Keith Damron pointed out that any access management strategies that include redirecting traffic away from existing US 60 intersections and driveways should direct traffic to public streets and not private streets. He pointed out that District 1 staff need to identify which streets in the corridor are privately owned and by whom. Brian mentioned that the backage roadways that would receive more traffic are already connected to the businesses and are currently used by motorists. No new connections to these facilities are required.

- Tom Creasey pointed out that access management strategies should be implemented as an overall plan and will require significant public involvement and meetings with individual business and property owners.

- Cost estimates will be developed as part of the evaluation of alternatives.

- It was decided that a modified access management alternative will be evaluated where the length of the raised median will be reduced (transitions back to the existing five-lane section west of New Holt Road) and the US 60/New Holt Road intersection will be reconfigured.

- The schedule for the remainder of the project will be discussed. If there are no requests for additional alternatives to be developed and evaluated, the alternatives analyses can be completed by the end of March 2012. The second stakeholder and local officials meeting can be held in April, with the public meeting also at that time or in May. The final report can be completed by the end of June 2012. Tom said that Stantec will submit a revised project schedule to the KYTC.

The meeting adjourned at approximately 2:20 PM.
The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

STANTEC CONSULTING SERVICES INC.

Tom Creasey
Transportation Planning Manager
Tom.Creasey@stantec.com

Attachments: Presentation slides, turning movement summary, sign-in sheet

Meeting Notes

US 60 Scoping Study: Local Officials/Stakeholders Meeting

17856005

Stantec

Date/Time: May 23, 2012 1:00 PM

Place: KYTC District 1 Headquarters, Paducah, KY

Attendees:
Jessica Herring, KYTC District 1
Mike McGregor, KYTC District 1
Susan Oatman, KYTC District 1
Keith Todd, KYTC District 1
Jill Asher, KYTC Central Office Planning
Tonya Higdon, KYTC Central Office Planning
Blake Beyer, KYTC Environmental
Stacey Courtney, Purchase ADD
Steve Ervin, City of Paducah
Jon Hayden, McCracken Co. Sheriff
Paul Carter, McCracken Co. EMA
Richard Roof, Barkley Regional Airport
Dan Key, Washburn Key & Lowry
Tom Creasey, Stantec Consulting Ltd.
Mark Butler, Stantec Consulting Ltd.
Ashley Day, Stantec Consulting Ltd.

Item:

Introduction

Tom Creasey (TC) began with verbal introductions of participants and a review of the agenda.

Presentation

TC began the visual slide presentation which is available in pdf or Powerpoint from KYTC District 1.

- The Purpose and Need, and study objectives were reviewed.
- Average Daily Traffic (ADT) on US 60 east of Olivet Church Rd. has been

consistent over the past ten years with an overall slight decline, while ADT has risen west of Olivet Church Rd.

Richard Roof (RR) asked whether this overall decline was due to commuters diverting to avoid the corridor. Jon Hayden suggested the extension of New Holt Rd. going south along with James Sanders Blvd. could serve as alternative routes. TC agreed that such a diversion was possible, but that the study area did not extend far enough south to capture direct evidence of this.

- TC reviewed the speed profile of the corridor and crash statistics, which revealed a significantly high crash rate consistent with a corridor containing too many access points and unsignalized left turns.
- TC reviewed the planned projects in the corridor area, noting in particular the new alignment connecting Olivet Church Rd. with New Holt Rd. at US 60. TC stated that simulation analysis of the new alignment demonstrated that speeds on US 60 were not affected and that the new alignment would divert between 25-45% of traffic away from the current intersection of Olivet Church Rd. and US 60.

  RR stated that the traffic due to development south of US 60 off of New Holt Rd. was already creating congestion issues and wondered whether the new alignment connection would increase such congestion in this general location. TC reiterated that the study area did not extend far enough south to analyze traffic conditions in that specific area.

- TC addressed the I-24 interchange, noting the limited storage for left-turning traffic and the interstate ramps. A Double Crossover Diamond (DCD) interchange would increase the efficiency of the interchange (lower crashes, backups and delays) without requiring the rebuilding of the I-24 overpass, thereby providing the most cost effective solution.

- TC addressed access control issues, particularly the large number of unsignalized access points (35) between James Sanders Blvd. and Olivet Church Rd. The presence of rear access for businesses on both sides of US 60 offered an alternative to the virtually unlimited front access. TC reviewed the study's access management recommendations, in particular the incorporation of a raised median between James Sanders Blvd. and New Holt Rd. and the incorporation of U-turns at signalized intersections.

- TC reviewed suggested spot improvements at US 60 and New Holt Rd. and at US 60 and James Sanders Blvd.

- TC reviewed cost estimates for the DCD ($4 mil.), raised median ($2 mil.) and spot improvements ($10,000 - $100,000).

- TC reviewed next steps: Final Report and KYTC's highway plan preparation.

Questions

Dan Key asked two questions:

1) Could federal money be used for the DCD interchange? TC responded that it could.

2) Would not the widening on I-24 to six lanes move more traffic more quickly to the US 60 intersection and consequently increase back-ups at the interchange? TC responded that ramp back-ups were a problem now and that the DCD configuration would alleviate these back-ups by a significant level, primarily by removing one phase from traffic signalization.

Steve Ervin (SE) asked if any pedestrian and cyclist improvements were considered in the study. TC responded that these modes were discussed at the study kick-off meeting, but that there was not enough evidence of pedestrian or cyclist activity to warrant specific improvements. TC acknowledged that it is a “chicken and egg” quandary, as the area now was so inhospitable to such modes and that the commercial development layouts were specifically designed to encourage auto-oriented convenience. SE responded that he mentioned it because the City of Paducah was planning a greenway along the US 60 corridor to the east that stopped at Coleman Rd. and he was curious if there was any potential to connect to it. TC thought that that would likely require the participation of the commercial property managers.

The meeting adjourned at 2:30 PM.

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

STANTEC CONSULTING SERVICES INC.

Mark Butler
Senior Transportation Planner
Mark.Butler@stantec.com