FINAL

I-64 Corridor Study, Story Avenue to I-264 Jefferson County, Kentucky

Item No. 5-553.00

December 2021

KENTUCKY TRANSPORTATION CABINET

HMB

AECOM

EXECUTIVE SUMMARY

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Executive Summary

The I-64 Corridor Study was initiated by the Kentucky Transportation Cabinet (KYTC) in August of 2019 to evaluate potential improvement strategies to address safety and operational performance on I-64 between Story Avenue and I-264. Recent improvements to the Kennedy Interchange have improved operations and safety near the west end of the study area, but congestion persists along I-64 from Story Avenue to I-264 during both AM and PM peak hours.

This study is classified as a Planning and Environmental Linkage (PEL) Study. As defined by the Federal Highway Administration (FHWA), a PEL represents a collaborative and integrated approach to transportation decision making that considers environmental, community, and economic goals early in the transportation planning process and uses the information, analysis, and products developed during planning to inform the environmental review process. Along with the congestion and safety concerns within the study area, this corridor is surrounded by multiple environmental resources. These resources include Clifton Park, Beargrass Creek Greenway, Cherokee Park, Cochran Hill Tunnel, Cochran Hill Dog Run, Seneca Park, and Brown Park. The study area is illustrated in **Figure ES-1**.

The objective of the I-64 Corridor Study is to evaluate transportation needs related to safety and congestion of I-64 from Story Avenue to I-264.

The initial study goals are as follows:

- Reduce congestion
- Accommodate transportation demand
- Address roadway deficiencies
- Limit environmental effects

To accomplish the objective and goals, the Project Team (consisting of KYTC, Kentuckiana Regional Planning and Development Agency (KIPDA), and consultant staff) worked collaboratively with the public, local officials, and stakeholders to accomplish the following tasks:

- Conduct a comprehensive review of the existing conditions
- Identify locations in need of improvement
- Develop / evaluate improvement strategies
- Recommend any feasible improvement strategies for future programming

During the study, multiple collaborative meetings were held. These included three Project Team meetings made up of KYTC, KIPDA, Federal Highway Administration (FHWA), and consultant staff, as well as two local officials / stakeholders (LO/S) meetings. Each LO/S meeting was followed by a virtual public outreach effort to gather input from the community surrounding the study area.

Initial coordination efforts included two Project Team meetings, a LO/S meeting and public outreach effort. The first Project Team meeting provided an opportunity to review the project background and purpose of the study, present and discuss the existing conditions information, and discuss preliminary improvement strategy types to be considered. The second Project Team Meeting reviewed additional existing conditions analyses, environmental resources, and the public engagement plan.

Figure ES-1. Study Area

Based on an analysis of existing conditions, the following three types of improvement strategies were identified:

Transportation Systems Management and Operations (TSMO) Improvement Strategies
As defined by FHWA, TSMO is a set of strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system to levels that existed before extra capacity is needed. Some of these improvement strategies include enhanced traveler information, advance warning systems, variable message boards, High Occupancy Vehicle (HOV) lanes, and reversible lanes.

Spot and Safety Improvement Strategies
Spot and safety improvement strategies are less invasive ways to improve safety and congestion throughout the study area without making major modifications to I-64. A few examples of these types of improvements are extending acceleration / deceleration lanes at interchanges, adding auxiliary lanes to connect interchanges, or widening I-64 through targeted segments of the study area to address safety and congestion.

Major Widening Improvement Strategies
Major widening strategies include adding capacity to I-64 throughout the study area. These strategies were evaluated as a part of this study in an effort to evaluate all levels of strategies that could improve safety and congestion throughout the study area. Considering these strategies helped the Project Team compare the impacts of adding capacity throughout the corridor to the impacts of the TSMO and Spot and Safety improvements. Mitigating impacts to environmental resources surrounding the study area was critical to the development of any major widening strategy. These concepts can be considered long-term options if no other improvements are found to improve safety and congestion along this section of I-64.

Following the identification of improvement strategy types, a specific list of improvement strategies and locations was developed. Additional information and analysis were required to identify improvement strategies and their locations. This included the following:

- Build Forecast and Traffic Analysis
- Crash Analysis
- Geometric Constraints
- Environmental Constraints

The third and final Project Team meeting was held in October 2020. The materials presented and discussed during the meeting included: Public outreach effort – Survey No. 1 results; additional traffic analysis, environmental findings update, geotechnical findings, and an initial list of improvement strategies. Following the meeting, the consultant team refined the list of improvement strategies which were presented to the LO/S and the public. These are presented in **Table 14** of the main report.

The second LO/S meeting was held in December 2020. At this meeting the Project Team presented additional study findings and analysis and collected input on the revised list of improvement strategies. The second public outreach effort was also held from December 2020 until January 2021. Similar to the first, materials were provided in the form of an ArcGIS StoryMap, including the information compiled and presented at the final Project Team and LO/S meetings. The presentation concluded with an online survey from which 757 responses were received. Key statistics from the survey results are as follows:

- 54 percent of responses do not support any improvements to this section of I-64, while another 12 percent were not sure.

- However, when participants were asked about specific improvement strategies, 61 percent supported at least one TSMO improvement strategy.
- The public strongly opposed all Major Widening Strategies with 72 percent selecting the "none of the above" option. However, 20 percent responded that of all of the widening strategies presented they preferred the strategy *Widen to the Inside to Provide Three Lanes in each Direction and to Widen the Existing Tunnels on Center*.

The Project Team concluded that based on the current conditions, traffic projections, engineering analysis, and public feedback, only **Improvement Strategies A, B, and C are recommended as high priority, short term strategies**. **Improvement Strategy D** is recommended for further consideration. It should be considered a **low priority, long term solution** for the corridor that will require additional traffic analysis to confirm the potential congestion benefits.

The Improvement Strategies are described in **Table ES-1** and are detailed in **Figures ES-2, ES-3, ES-4, and ES-5**.

Table ES-1. Recommended Improvement Strategies

Improvement Strategy	Description
A	Provide Advance Warning System for Westbound I-64 at Grinstead Drive
B	Extend Acceleration and Deceleration Lanes at Mellwood Avenue, Grinstead Drive WB On Ramp, Cannons Lane, and I-64 Westbound On Ramp
C	Widen I-64 Off Ramp to Grinstead to Provide Dual Lefts onto Grinstead Drive
D	Widen I-64 to the Inside to Provide Auxiliary Lanes Between Mellwood Avenue and Grinstead Drive and also Between Cannons Lane and I-264 (no impacts to Cochran Hill Tunnel)

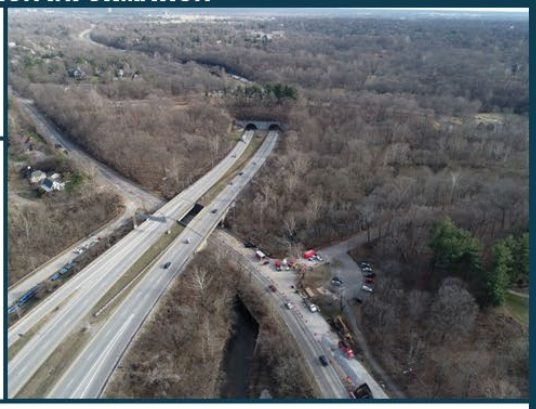
While one major widening improvement strategy was considered in more detail, it was found to **not be feasible** at this time given the extensive project cost, potential environmental impacts, and public opposition.

At this time, no additional funding is programmed to further study this corridor or for specific improvement strategies recommended in this study. **Improvement Strategy A** is proposed as a short-term, low cost TSMO improvement strategy and could be initiated either through the KYTC District 5 routine maintenance and traffic program or become part of a systematic program such as Pavement Rehabilitation or Highway Safety Improvement Program (HSIP). This strategy will also need to be coordinated with TRIMARC. For **Improvement Strategies B and C**, the next phase in the project development process is Phase I Preliminary Engineering and Environmental Analysis. If federal funds are used or permits will be required, additional environmental analyses will be required to satisfy the National Environmental Policy Act (NEPA). These strategies would also need to be integrated into Kentucky's Prioritization Program, Strategic Highway Investment Formula for Tomorrow (SHIFT). Through this mechanism, they can be funded in the highway plan. Improvement Strategies will also need to be incorporated into KIPDA's Metropolitan Transportation Plan and TIP and KYTC's Statewide Transportation Improvement Plan (STIP).

Figure ES-2. Improvement Strategy A – Advance Warning System

LOCATION INFORMATION

INTERSTATE 64



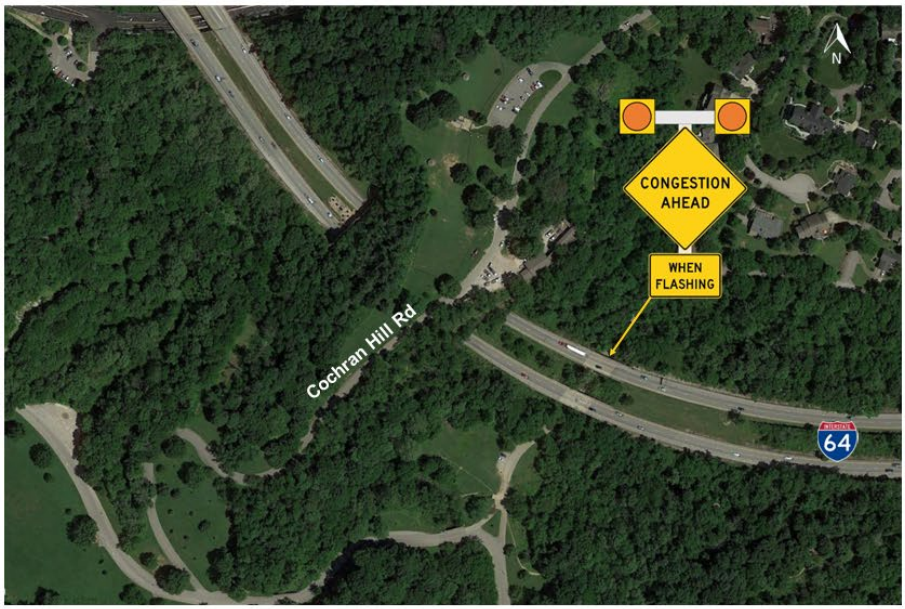
Key Details

- Maintains existing roadway capacity
- No impact to the Cochran Hill Tunnels
- Minimal to no right of way impacts

Issues

- I-64 is a heavily traveled corridor that experiences congestion during the peak hours, particularly at the interchanges and Cochran Hill Tunnels.
- Vehicles using the Grinstead Dr. WB off ramp are known to queue near or into mainline I-64, impeding the right through lane of I-64 WB.
- Interstate travel speeds and limited sight distance due to the Cochran Hill Tunnels.
- Public Feedback: 61% of responses indicated support for installation of an advance warning system at this location.

IMPROVEMENT CONCEPT



Provide Advance Warning System for WB I-64 at Grinstead Drive / Cochran Hill Tunnels

- Install advance warning system prior to the Cochran Hill Tunnels in the WB direction.
- This system will detect queuing on the WB off ramp of the Grinstead Dr. interchange.
- It will alert motorists traveling on I-64 WB if queuing vehicles are encroaching on the through lanes of I-64.

A

TSMO

PRIORITY

HIGH

LOCATION

I-64 / GRINSTEAD DR. INTERCHANGE (WESTBOUND TRAFFIC) MP 8.065

DATA

56% of the crashes that occurred from 2016 to 2019 between the WB Cochran Hill Tunnels and the Grinstead Dr. WB off ramp were rear end crashes

COST ESTIMATE / IMPACTS

2020 Dollars

Environmental Impact:
None

ROW Impact:
None

Utility Impact:
Low

Construction Cost:
$80,000

Figure ES-3. Improvement Strategy B - Extend Acceleration and Deceleration Lanes at Mellwood Avenue, Grinstead Drive WB On Ramp, Cannons Lane, and I-264 WB On Ramp Interchanges

LOCATION INFORMATION

INTERSTATE 64

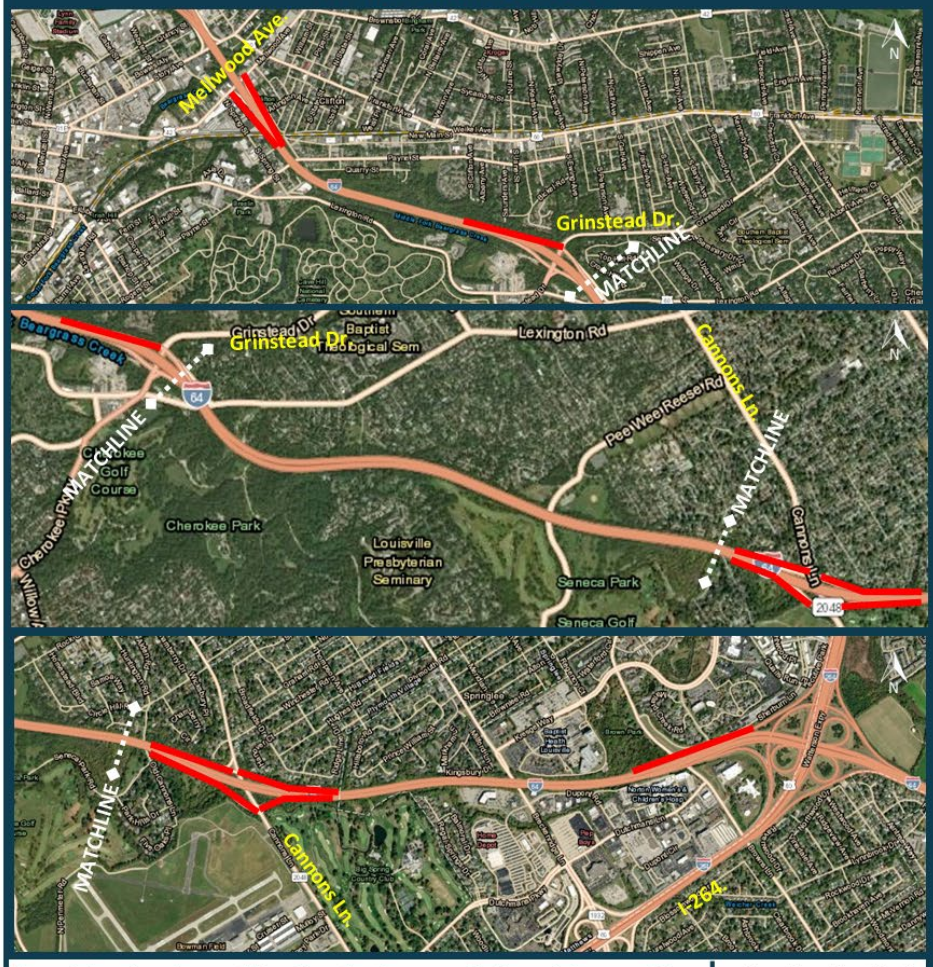
Key Details

- Primary goal of this strategy is to address safety and congestion at interchanges within the corridor
- No impact to the Cochran Hill Tunnels
- Minimal to no right of way impacts are anticipated

Issues

- Congestion prevalent at interchanges during the peak hours.
- Vehicles queuing at interchange ramps during the peak hours can impede I-64 mainline traffic and/or ramp deceleration areas.
- According to the crash density map, crashes are more prevalent at merge/diverge areas near interchanges.
- Mellwood Ave. EB On-Ramp to I-64 does not meet standards for acceleration length.
- Public Feedback: This improvement strategy scored highest among spot and safety improvements with an average score of 2.8 (rating from 1-5).

IMPROVEMENT CONCEPT



Extend Acceleration and Deceleration Lanes at Mellwood Avenue, Grinstead Drive WB On Ramp, Cannons Lane, and I-64 Westbound On Ramp

- Provides additional storage and acceleration/deceleration merge/diverge area.

Construction Cost Per Interchange (2020 Dollars):

Mellwood:	$1.4m
Grinstead:	$770k
Cannons:	$3.7m
I-264:	$770k

B

SPOT & SAFETY

PRIORITY

HIGH

LOCATION

MELLWOOD AVE., GRINSTEAD DR., CANNONS LN., & I-264 INTERCHANGES

DATA

41% of all crashes that occurred from 2016 to 2019 occurred during the peak hours

71% of all crashes that occurred from 2016 to 2019 were rear ends or side swipe/same direction

Excess Expected Crashes (EEC) for the entire corridor from 2016 to 2019 is 625

COST ESTIMATE / IMPACTS

2020 Dollars

Environmental Impact:

Would not interfere with surrounding environmental resources, however, considering the parks designation as Section 6(f) and Section 4(f) resources, their listing, or likely listing, on the NRHP, and Beargrass Creeks listing as an impaired stream, even small amounts of impacts would likely require thorough studies and coordination.

ROW Impact:

Low

Utility Impact:

Low

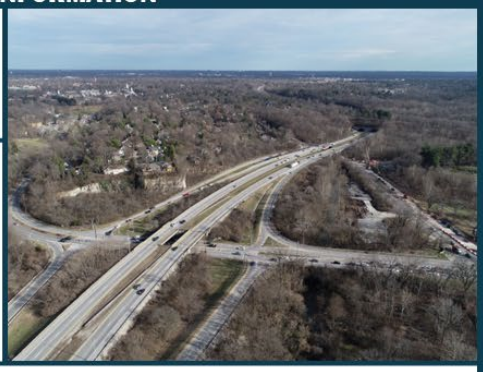
Construction Cost:

$6,700,000

Figure ES-4. Improvement Strategy C – Widen I-64 WB Off Ramp to Grinstead Drive to Provide Dual Lefts Onto Grinstead Drive

LOCATION INFORMATION

INTERSTATE 64



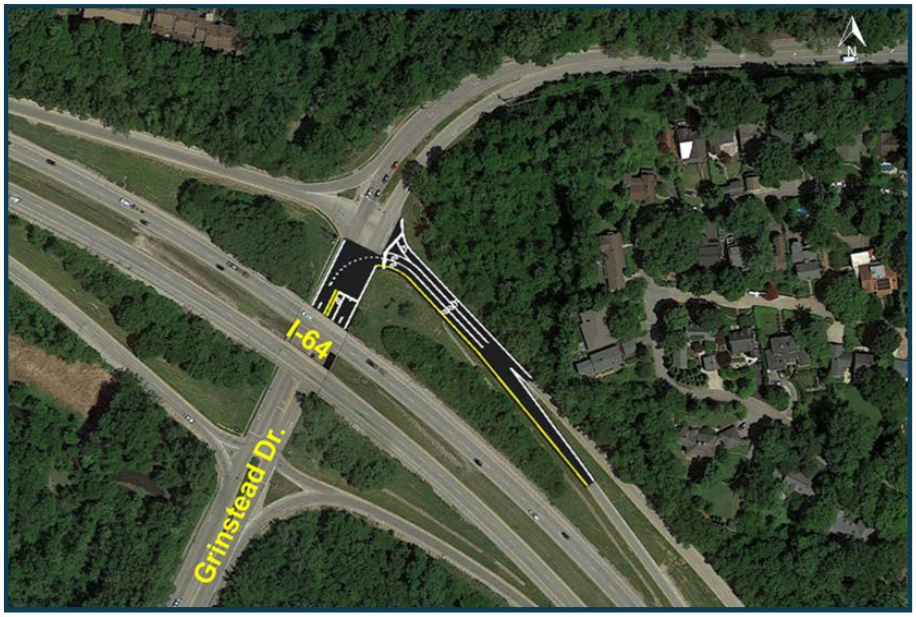
Key Details

- Primary goal of this strategy is to address safety and congestion at the Grinstead Drive interchange.
- No impact to the Cochran Hill Tunnels
- Minimal to no right of way impacts are anticipated

Issues

- Congestion prevalent at interchange during the peak hours.
- Vehicles queuing at interchange ramp during the peak hours can impede I-64 mainline traffic and/or ramp deceleration areas.
- According to the crash density map, crashes are more prevalent at merge/diverge areas near interchanges.
- Public Feedback: This improvement strategy was grouped with the extension of acceleration and deceleration lanes which collectively scored highest among spot and safety improvements with an average score of 2.8 (rating from 1-5).

IMPROVEMENT CONCEPT



Widen I-64 Off Ramp to Grinstead Drive to Provide Dual Lefts onto Grinstead Drive

- Due to the proximity to the WB Cochran Hill Tunnel, extending the deceleration length for the Grinstead Drive WB off-ramp would be difficult. As an alternative strategy to Improvement Option B at this interchange, widening the I-64 WB off ramp to provide dual left turn lanes onto Grinstead Dr. is recommended.

C

SPOT & SAFETY

PRIORITY

HIGH

LOCATION

GRINSTEAD DR. INTERCHANGE

DATA

38% of crashes that occurred in this WB segment from Grinstead to the tunnels from 2016 to 2019 occurred during the peak hours.

64% of all crashes in this segment were rear ends or side swipe/same direction

Excess Expected Crashes: Grinstead to Cannons – 223

COST ESTIMATE / IMPACTS

2020 Dollars

Environmental Impact:
None

ROW Impact:
None

Utility Impact:
Low

Construction Cost:
$660,000

Figure ES-5. Improvement Strategy D - Auxiliary Lanes between Mellwood Avenue and Grinstead Drive and Cannons Lane and I-264

LOCATION INFORMATION

INTERSTATE 64

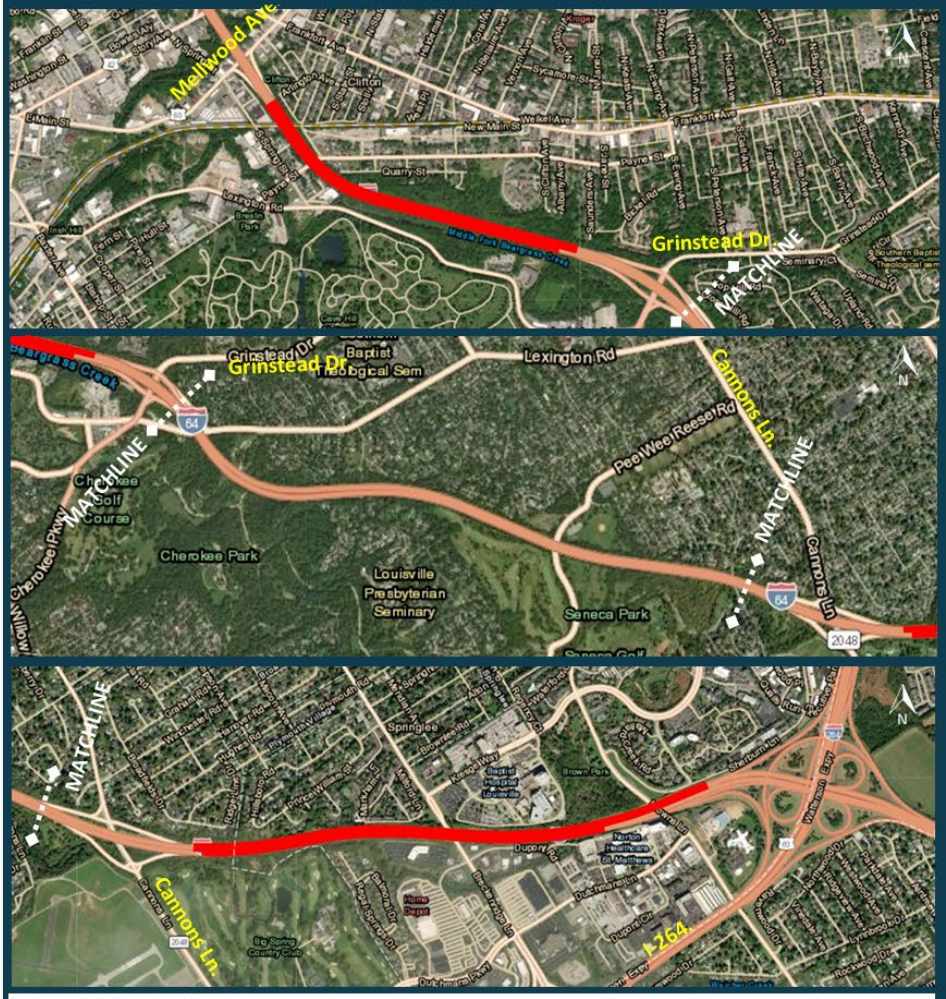
Key Details

- Primary goal of this strategy is to address safety and congestion at interchanges within the corridor
- No impact to the Cochran Hill Tunnels
- Existing LOS ranges from LOS D to LOS F in these sections of I-64 (peak hours)

Issues

- Congestion prevalent at interchanges during the peak hours
- Vehicles queuing at interchange ramps during the peak hours can impede on I-64 mainline traffic and/or ramp deceleration areas.
- Crashes are more prevalent at merge/diverge areas near interchanges.
- Public Feedback: This improvement scored second highest among spot and safety improvements with an average score of 2.0 (rating from 1-5), however, 54% of responses indicated that no improvements were needed along this section of I-64.

IMPROVEMENT CONCEPT



Widen I-64 to the Inside to Provide Auxiliary Lanes Between Mellwood Avenue and Grinstead Drive and Cannons Lane and I-264

- Widen I-64 to the inside to provide an auxiliary lane between the Mellwood Ave. and Grinstead Dr. interchanges and Cannons Ln. and I-264 interchanges.
- Install concrete median barrier between the EB and WB lanes.
- I-64 LOS during the peak hours is improved to LOS C for this build scenario in the sections widening occurs with the exception of I-64 EB PM from Mellwood to Grinstead in 2045.

D

SPOT & SAFETY

PRIORITY

LOW

LOCATION

MP 6.736 to MP 8.065
MP 10.530 to MP 12.420

DATA

41% of all crashes that occurred from 2016 to 2019 occurred during the peak hours

71% of all crashes that occurred from 2016 to 2019 were rear ends or side swipe/same direction

Excess Expected Crashes:
Story to Grinstead—316
Cannons to I-264—86

COST ESTIMATE / IMPACTS

2020 Dollars

Environmental Impact:
No impacts to the tunnels would be anticipated. If the existing median is utilized, there is the potential for the improvement strategy to be constructed with minimal right of way acquired. In that case, environmental impacts may be avoided. However, if the auxiliary lane is constructed to the outside, impacts to the parks, historic areas, or other environmental resources are likely and could be significant.

ROW Impact:
Low

Utility Impact:
Low

Construction Cost:
$25,400,000

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Acronyms List

AASHTO	American Association of State Highway and Transportation Officials
AADT	Annual Average Daily Traffic
AADTT	Annual Average Daily Truck Traffic
ACS	American Community Survey
CRF	Critical Crash Rate Factor
CDAT	Crash Data Analysis Tool
CHAF	Continuous Highway Analysis Framework
CMF	Crash Modification Factor
DEA	Kentucky Division of Environmental Analysis
DHV	Design Hourly Volume
EEC	Excess Expected Crashes
EJ	Environmental Justice
EPA	U.S Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FY	Fiscal Year
GIS	Geographic Information System
HAZMAT	Hazardous Materials
HBA	Highway Beautification Act
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
HIS	Highway Information System
HOV	High Occupancy Vehicle
HSIP	Highway Safety Improvement Program
HSM	Highway Safety Manual
HUC	Hydraulic Unit Code
IPaC	Information for Planning and Consultation
KDOW	Kentucky Division of Water
KGS	Kentucky Geological Survey
KHC	Kentucky Heritage Council
KHFN	Kentucky Highway Freight Network
KIPDA	Kentuckiana Regional Planning & Development Agency
KPDES	Kentucky Pollutant Discharge Elimination System
KSNPC	Kentucky State Nature Preserves Commission
KSP	Kentucky State Police
KTC	Kentucky Transportation Center
KYTC	Kentucky Transportation Cabinet
LEP	Limited English Proficiency
LOJIC	Louisville / Jefferson County Information Consortium

Acronyms List (continued)

LO/S	Local Officials/Stakeholders
LOS	Level of Service
LWCFA	Land and Water Conservation Fund Act
MP	milepoint
MMUCC	Model Minimum Uniform Crash Criteria
mph	miles per hour
MRA	Multiple Resource Area
NAAQS	National Ambient Air Quality Standards
NBI	National Bridge Inventory
NEPA	National Environmental Policy Act
NHS	National Highway System
NHFN	National Highway Freight Network
NN	National Truck Network
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
OSA	Office of State Archaeology
PDO	property damage only
PEL	Planning and Environmental Linkage
PHFN	Primary Highway Freight Network
ROW	right-of-way
SHIFT	Strategic Highway Investment Formula for Tomorrow
SHPO	State Historic Preservation Office
STAA	Surface Transportation Assistance Act
STIP	Statewide Transportation Improvement Plan
TAMP	Transportation Asset Management Plan
TARC	Transit Authority of River City
T&E	Threatened and Endangered
TED	Transportation Enterprise Database
TIP	Transportation Improvement Program
TSMO	Transportation Systems Management and Operations
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
v/c	volume-to-capacity ratio

Chapter 1 – Introduction

The I-64 Corridor Study was initiated by the Kentucky Transportation Cabinet (KYTC) in August of 2019 to evaluate potential improvement strategies to address safety and operational performance on I-64 between Story Avenue and I-264. Recent improvements to the Kennedy Interchange have improved operations and safety near the west end of the study area, but congestion persists along I-64 from Story Avenue to I-264 during both AM and PM peak hours.

This study is classified as a Planning and Environmental Linkage (PEL) Study. As defined by the Federal Highway Administration (FHWA), a PEL represents a collaborative and integrated approach to transportation decision making that considers environmental, community, and economic goals early in the transportation planning process and uses the information, analysis, and products developed during planning to inform the environmental review process. Along with the congestion and safety concerns within the study area, this corridor is surrounded by multiple environmental resources. These resources include Clifton Park, Beargrass Creek Greenway, Cherokee Park, Cochran Hill Tunnels, Cochran Hill Dog Run, Seneca Park, and Brown Park. For graphical representation of these resources relative to the study area, refer to **Figure 1**.

1.1 Study Area

Illustrated in **Figure 1**, the study area includes I-64 from Story Avenue to I-264 (Milepoints (MP) 6.200 to 12.300) along with the following interchanges: Story Avenue/Mellwood Avenue (Exit 7), Grinstead Drive (Exit 8), Cannons Lane (Exit 10) and the eastbound off-ramp and the westbound on-ramp of the I-264 interchange (Exit 12). It also includes the Cochran Hill Tunnels, noted on the figure at approximate MP 8.400.

1.2 Study Objective and Goals

The objective of the I-64 Corridor Study is to evaluate transportation needs related to safety and congestion of I-64 from Story Avenue to I-264.

The initial study goals are as follows:

- Reduce congestion
- Accommodate transportation demand
- Address roadway deficiencies
- Limit environmental effects

To accomplish this study's objective and goals, the project team (consisting of KYTC, Kentuckiana Regional Planning and Development Agency (KIPDA) and consultant staff) worked collaboratively with the public, local officials, and stakeholders to complete the following tasks:

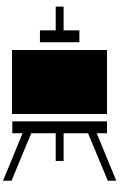
- Conduct a comprehensive review of the existing conditions
- Identify locations in need of improvement
- Develop / evaluate improvement strategies
- Recommend any feasible improvement strategies for future programming

This report serves as a compilation of the study information.

Figure 1. Study Area

1.3 Study Process

The process of this study is described in detail in the following seven chapters. Additional resource / reference materials are included in the appendices.

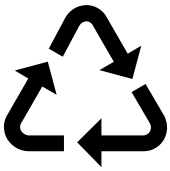


Chapter 1 - Introduction

The first chapter provides background introductory information about the study and provides the framework for the remainder of the report.

Chapter 2 - Existing Conditions

The second chapter encompasses collected data including geometrics, structures, existing traffic volumes and operations, and safety analysis.



Chapter 3 – Environmental Overview

This chapter is devoted to a summary of the potential natural, human, and socioeconomic impacts within the study area.

Chapter 4 - Initial Engagement Efforts

This chapter is devoted to a summary of initial outreach efforts which includes coordination between the Project Team concerning safety and operational analysis of the study area, a meeting with local officials / stakeholders (LO/S), and the initial public outreach effort to engage those within communities near the study area.

Chapter 5 - Improvement Strategies Development and Analysis

This chapter presents the process for which locations and potential improvement strategies were developed. It also includes a discussion on analysis procedures. Both an initial list of improvement strategies and revised list are presented.

Chapter 6 - Additional Engagement Efforts

This chapter is devoted to a summary of additional outreach efforts which includes a meeting with LO/S and an additional public outreach effort to engage those within the communities near the study area.

Chapter 7 - Study Outcomes

The final chapter presents the outcomes of the study as a prioritized list of locations and improvement strategies.

1.4 Previous Projects and Current Highway Plan Projects

Previously completed projects and current highway plan transportation improvements were identified in the study area that could impact this section of I-64 in the future. During this study, both *Kentucky's Fiscal Year (FY) 2020 – 2026 Highway Plan* and KIPDA *Fiscal Year (FY) 2020 – 2025 Transportation Improvement Program* (TIP) were enacted and are presented below.

Previous Projects

The most significant project that affected the study area was the Louisville Bridges Project which was completed in 2016. This project included upgrading the Kennedy Interchange (commonly referred to as Spaghetti Junction), improving the Kennedy Bridge to only serve southbound traffic, a new bridge (Abraham Lincoln Bridge) for I-65 serving northbound traffic, and reconfiguring roadways and bridges on the Indiana side of the Ohio River. The project affected the western end of the study area near the Story Avenue / Mellwood Avenue interchange where additional capacity was added on I-64.

A smaller project recently completed was the addition of a sidewalk along Cannons Lane between Willis Avenue and Bowman Field improving pedestrian connectivity north and south of I-64 within the study area.

Kentucky's FY 2020 – 2026 Highway Plan Projects

Current highway plan projects are primarily those that have been prioritized through Strategic Highway Investment Formula for Tomorrow (SHIFT) and have been included in *Kentucky's FY 2020 – 2026 Highway Plan*. **Table 1** contains additional information about current highway plan projects near or potentially impacting the study area.

FY 2020 – 2025 Transportation Improvement Program (TIP)

KIPDA's TIP is the short-range fiscal programming component of the Metropolitan Transportation Plan. Within the study area, all projects shown in the TIP were also included in the highway plan.

Table 1. Kentucky's FY 2020 – 2026 Highway Plan and KIPDA's FY 2020 – 2025 Transportation Improvement Program Projects

Item No. / KIPDA ID	Route	Begin Milepoint	End Milepoint	Project Type	Description	Construction Year	Construction Estimate
5-20009.00 / 2633	I-64	6.000	11.570	Pavement Rehabilitation	Address Pavement Condition on I-64 both directions from MP 6.000 to 11.570	2023/2024	$ 5,750,000
5-80052.00	I-64	10.300	11.200	Spot Improvements	Design and construct a sound barrier wall on the Westbound side of I-64 from MP 10.300 to 11.200 for approximately 4800' (18CCN)	2024	$ 3,210,000
5-20016.00 / 2892	I-264	12.700	18.410	Pavement Rehabilitation	Address pavement condition of PCC pavement on I-264 both directions from MP 12.700 to 18.410	2023/2024	$ 11,500,000
5-483.10 / 2602	I-71	14.100	18.000	Major Widening	Widen I-71 from four to six lanes from KY-329 (MP 14.100) to KY-393 (MP18.000)	2024	$ 34,000,000

Chapter 2 – Existing Conditions

In this chapter, the existing transportation network conditions are presented. This includes information on the roadway facility type and geometrics, structures, traffic volumes and operations, and crash history and analysis. Data for this chapter was collected from KYTC's Highway Information System (HIS) database, bridge inspection reports, National Bridge Inventory (NBI) forms, the KYTC Traffic Count Reporting System, site visits, and existing archive project plans.

2.1 Functional Class and Roadway Systems

The functional class, highway system designations, and truck routes for I-64 and the surrounding area are described below.

Functional Class

Functional classification is the process of grouping streets and highways by character of travel service and access to adjacent land uses. According to the HIS database, this section of I-64 is classified as an Urban Interstate. An Interstate is the highest classification of Arterials and is built with mobility and long-distance travel in mind. Interstates are designated by the Secretary of Transportation and are in the Principal Arterial classification.

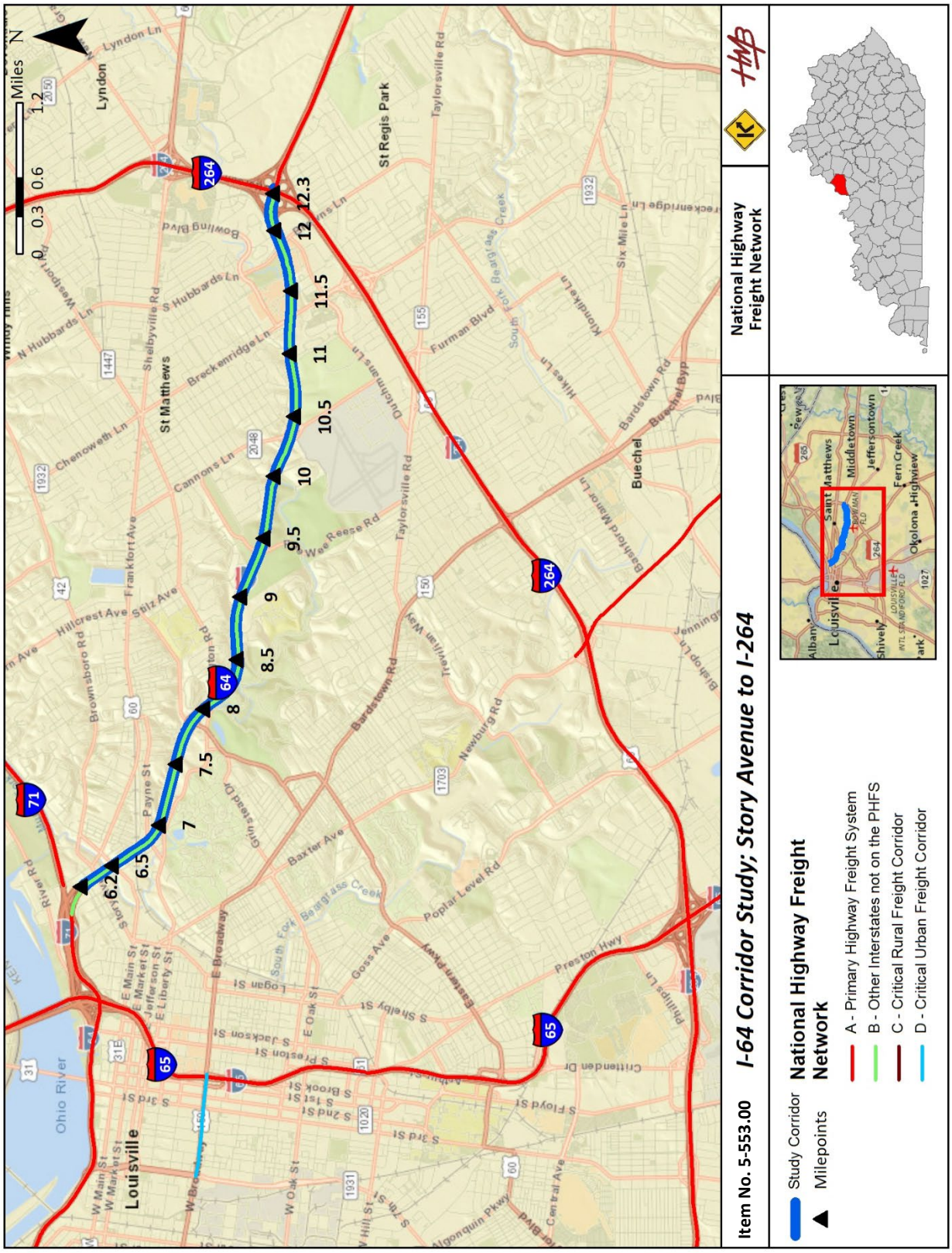
National Highway System

The National Highway System (NHS) is a network of strategic highways within the United States that are important to the nation's economy, defense, and mobility. I-64 is listed as a part of the Eisenhower Interstate System in the NHS.

Truck Routes

I-64 is an important link in Kentucky's freight network and is designated as Tier 1 in the Kentucky Highway Freight Network (KHFN). This designation means it is part of the Kentucky Primary Highway Freight Network (PHFN) and has a truck AADT (AADTT) > 7,000. It is also designated as Class B (Other Interstate) on the National Highway Freight Network (NHFN). The surrounding interstates are classified as Class A (Primary Freight Highways) and I-64 east of the I-264 interchange is also Class A. **Figure 2** illustrates the difference between this section of I-64 and surrounding interstates. I-64 is also a federal authorized route on the National Truck Network (NN). The NN was created by the federal Surface Transportation Assistance Act of 1982 (STAA) to require states to allow conventional combination trucks on the designated system serving to support interstate commerce connecting principal cities and densely developed areas.

Figure 2. Freight Network



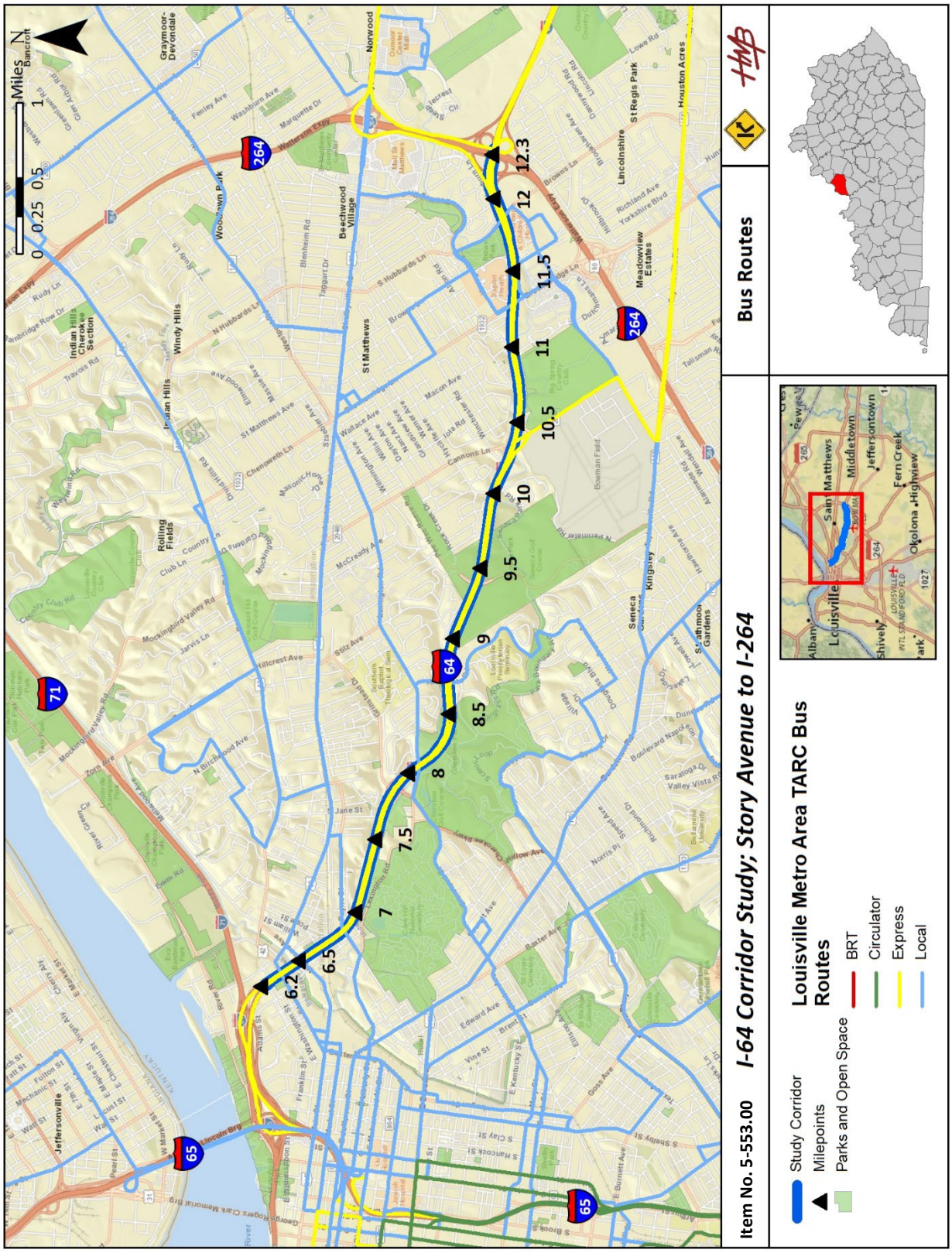
2.2 Multimodal Travel

The public transportation authority for the greater Louisville area is the Transit Authority of River City (TARC). I-64 currently carries a TARC express route and has several crossing transit routes, which would all need to be considered for projects on I-64. TARC plans to increase the multimodal functionality of the city by using technology to integrate apps with their services and planning infrastructure projects that promote trips across multiple modes of travel. Additionally, TARC is focused on increasing the walkability of the city of Louisville with plans dating back to 2010. **Figure 3** shows the existing bike and pedestrian facilities near and within the study area while **Figure 4** shows the TARC bus routes.

Per FHWA's 2019 Bicycle and Pedestrian Planning, Program, and Project Development guidance states that pedestrian and bicycle needs must be given "due consideration" under Federal transportation law. I-64 does not have designated pedestrian or bicycle facilities as an interstate facility nor is it currently part of a designated touring route. There are many routes that cross this interstate that have pedestrian and bicycle facilities that would need to be considered in any future bridge replacement projects and / or widening projects.

Figure 3. Bike and Pedestrian Trails / Paths

Figure 4. TARC Bus Routes



2.3 Roadway Geometric Characteristics

Current geometric characteristics of I-64 were identified through HIS queries and existing archived plans and compared with roadway design standards and common practices as set forth in the American Association of State Highway and Transportation Officials' (AASHTO) ***A Policy on Geometric Design of Highways and Streets, 7th Edition (2018)***, commonly referred to as the Green Book. Highway data assembled from HIS for use in this study includes:

- Typical Sections
- Speed Limits
- Horizontal and Vertical Curves
- Speed Change Lanes

Typical Sections

The typical section of I-64 varies throughout the study area. The normal typical section of I-64 (MP 6.400 – MP 8.305 and MP 9.219 to MP 12.700) consists of two 12-foot travel lanes in each direction, 10-foot paved outside shoulders (12-foot usable shoulder), 4-foot paved inside shoulders (6-foot usable shoulder), and a 40-foot-wide depressed median with a cable median barrier. From approximately MP 8.305 to MP 9.219 the eastbound and westbound lanes of I-64 are bifurcated, and the median width varies from 40 to 90 feet. The dimensions of the travel lanes and shoulders through this section are consistent with the normal typical section. The Cochran Hill Tunnels (MP 8.400) are located within the bifurcated section. The typical section for each tunnel consists of two 12-foot travel lanes, 3-foot outside and inside shoulders, and a concrete barrier wall outside of each shoulder. **Figure 5** illustrates the normal typical section of I-64 and **Figure 6** illustrates the typical section for the Cochran Hill Tunnels.

Figure 5. I-64 Normal Typical Section

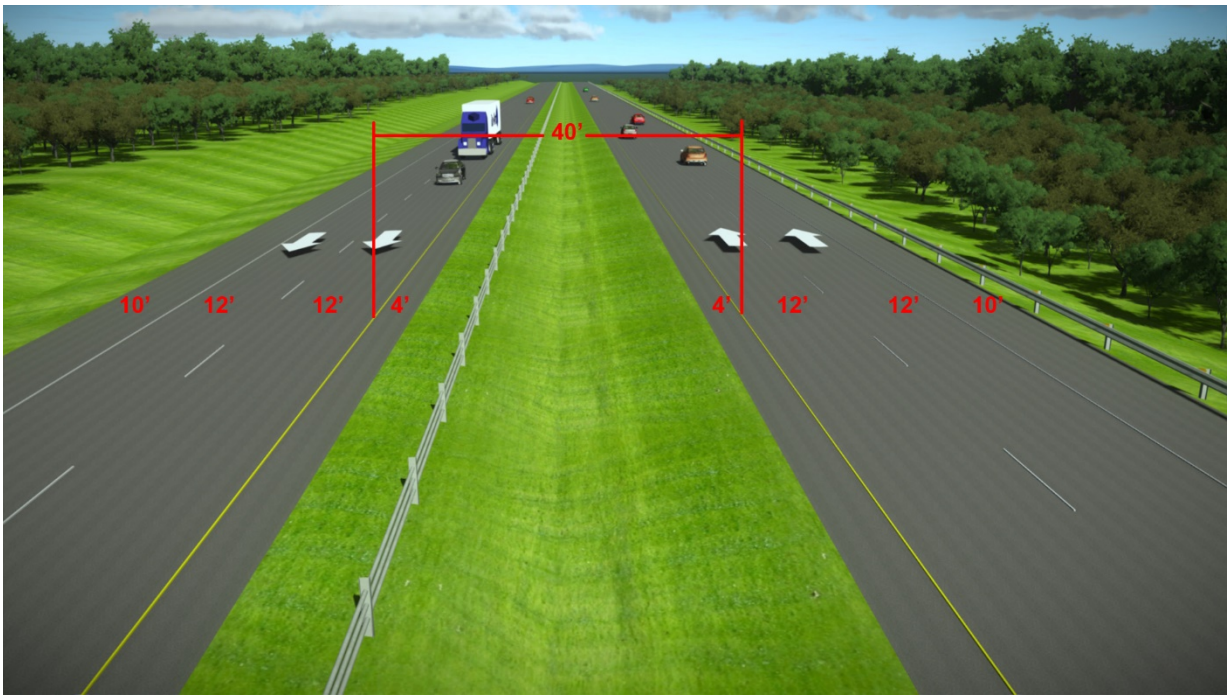
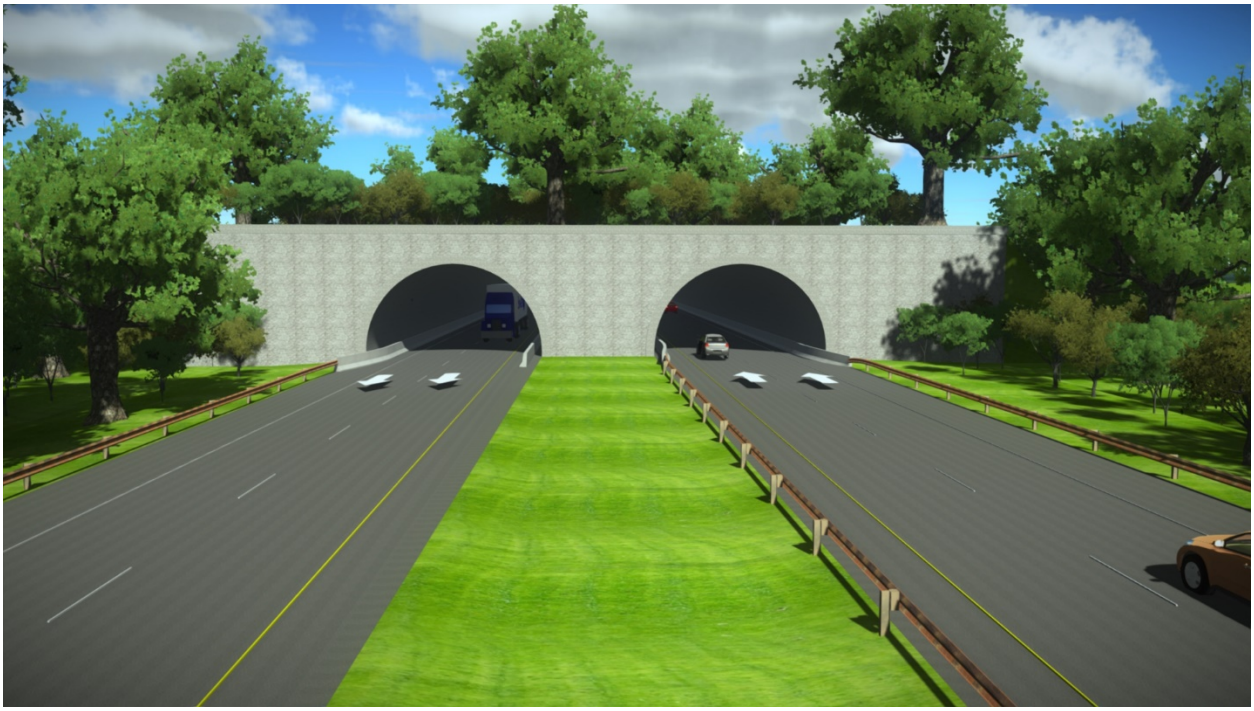
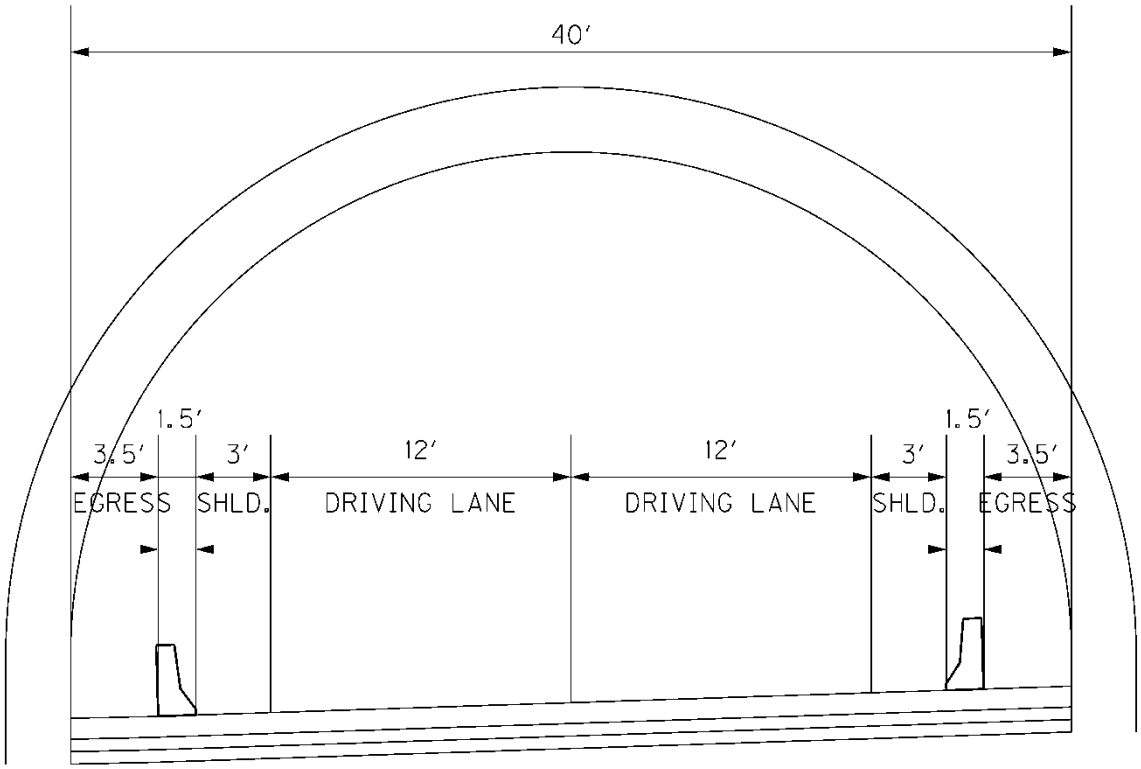


Figure 6. Cochran Hill Tunnels Typical Section





Speed Limits

The posted speed limit is 55 mph throughout the study area. Speed data, obtained from HERE Technologies, was provided by KYTC for I-64 (by milepoint) for the years 2015 – 2017. The data was divided into four time periods (7AM – 9AM, 9AM – 3PM, 3PM – 6PM, and 6PM – 7AM) during weekdays and includes minimum speed, maximum speed, and various percentile speeds. It is also divided by passenger vehicles and truck traffic. The following observations can be made from the plotted data:

- During the AM Peak Period (7AM – 9AM), traffic is consistently slower in the westbound direction with 50th percentile speeds ranging from a low of 40 miles per hour (mph) to 54 mph. In comparison, the 50th percentile speeds in the eastbound direction are almost all above the speed limit.
- During the PM Peak Period (3PM – 6PM), traffic speeds are lower in both directions between MPs 6.200 to 9.200. In the eastbound direction, speeds steadily increase and decrease only as traffic approaches I-264. East of MP 9.200, 50th percentile speeds are approximately 5 mph over the speed limit and 95th percentile speeds exceed 70 mph. A similar trend is observed in the westbound direction east of MP 9.200.
- During the Midday Period (9AM – 3PM), speeds are consistently above the speed limit, decreasing minimally as traffic approaches downtown Louisville.
- Overall, lower speeds resulting from congestion are primarily a peak period condition, with conditions consistently slower as traffic approaches downtown Louisville.

For additional detail on speed data, the plotted data is included in **Appendix A**.

Horizontal and Vertical Curves

Information from the existing archived plans was used to evaluate the horizontal and vertical curves on I-64. All existing geometrics were compared to current design guidelines found in the Green Book.

Vertical alignment elements are based on grade and curvature. The maximum grade on this section of I-64 is 2.5 percent, which meets the design criteria of interstates with a design speed of 55 mph through rolling terrain (5 percent maximum allowable grade). All crest and sag vertical curves meet stopping sight distance and headlight sight distance design criteria for a 55 mph design speed (495 feet).

All radii of horizontal curves meet minimum design criteria for a 55-mph design speed according to the Green Book. When coupling the horizontal curve radius with the corresponding superelevation, there were four curves that did not meet a design speed equivalent to the posted speed limit. However, the calculated side friction factor based on Equation 3-7 (Green Book) for each of these curves does not exceed 0.13. This is the maximum recommended side friction factor for a 55-mph design speed based on Figure 3-3 (Green Book). Crash history was analyzed at each of these curves and potential roadway departure crashes occurred in all four locations. Out of 14 potential roadway departure crashes, all were property damage only except for two crashes that occurred in the curve from MP 11.527 to MP 12.010. Additional detail on crash history and analysis is included in **Section 2.6**. The locations of the curves identified as having potential design deficiencies are shown in **Figure 7** and **Table 2** on the following pages.

Figure 7. Deficient Horizontal Curves

Table 2. Geometrically Deficient Horizontal Curves

Beginning Milepoint	Ending Milepoint	Midpoint	Radius	Super-elevation (%)	Posted Speed Limit	Current AASHTO Design Speed 8% Table	Curve Side Friction Factor (f)*	Potential Roadway Departure Crashes (2016 - 2019)
9.492	9.756	9.624	5371.48	2.20	55	45	0.02	3
10.355	10.978	10.667	5371.48	2.20	55	45	0.02	3
11.131	11.338	11.235	5729.58	2.20	55	50	0.01	3
11.527	12.010	11.769	5729.58	2.20	55	50	0.01	5

*Maximum friction factor for 55 mph is 0.13.

Speed Change Lanes

The length of a speed change lane for entering and exiting a highway is governed by the design speed of the highway and the design speed of the exiting curve of the ramp. The acceleration and deceleration lengths at interchanges throughout the study area were compared to Table 10-6 in the Green Book, which provides minimum acceleration and deceleration lengths given the design speed of the highway being entered or exited and the design speed of the ramp's entering or exiting curve.

The existing acceleration and deceleration lengths through this section of I-64 were determined using limited field review and statewide aerial imagery. Information regarding all acceleration and deceleration lanes throughout the study area is found in **Table 3**.

Table 3. Speed Change Lanes

Speed Change Lanes								
Interchange	Curve Radius (ft)	Superelevation (%)	Entering / Exiting Curve Design Speed (mph)	Divergence Angle (°)*	Measured Length (ft)	AASHTO Required Length (ft)	Difference (ft)	Meets AASHTO Criteria
Mellwood Avenue								
EB on ramp	1146	5.3	35	N/A	399	550	-151	NO
WB off Ramp	2292	4.2	45	2.9	438	235	203	YES
Grinstead Drive								
EB off ramp	1910	4.2	40	3.3	398	285	113	YES
EB on ramp	1432	4.8	40	N/A	292	320	-28	NO
WB off ramp	1432	4.8	40	3.6	502	285	217	YES
WB on ramp	3820	2.1	40	N/A	620	320	300	YES
Cannons Lane								
EB off ramp	1146	5.3	35	4	533	350	183	YES
EB on ramp	1146	3.5	25	N/A	799	780	19	YES
WB off ramp**	1432	6	N/A					
WB on ramp	1910	4.5	45	N/A	354	300	54	YES

* Divergence angle is measured from the outside edge of the traveled way of mainline and the outside edge of the exiting ramp. Divergence angle is only applicable for off ramps and is typically between two and five degrees.

** The Cannons Lane WB off ramp exits the interstate through a horizontal curve. Therefore, divergence angle and deceleration length are not applicable.

2.4 Structures

Structures identified through KYTC's Bridge Data Miner service can be seen in **Figure 8**. A bridge is classified as structurally deficient if the deck, superstructure, substructure, or culvert is rated in "Poor" or worse condition (any bridge with a condition rating of four or less on the FHWA National Bridge Inventory (NBI) condition rating scale in accordance with the Pavement and Bridge Condition Performance Measures final rule).

The *Kentucky Transportation Cabinet Transportation Asset Management Plan* (KYTC TAMP) published in 2019 outlines a method to calculate the estimated remaining life of a bridge that can be used for asset management purposes. The estimated remaining life is based on an assumed life of 75 years for a new bridge and is determined using three bridge components: deck, superstructure, and substructure. Each component is weighted and combined with the NBI rating per KYTC Bridge Inspection Reports to determine how much the bridge asset has depreciated. The estimated remaining life for each bridge in the study area can be found in **Table 4**.

Figure 8. Existing Structures - Condition

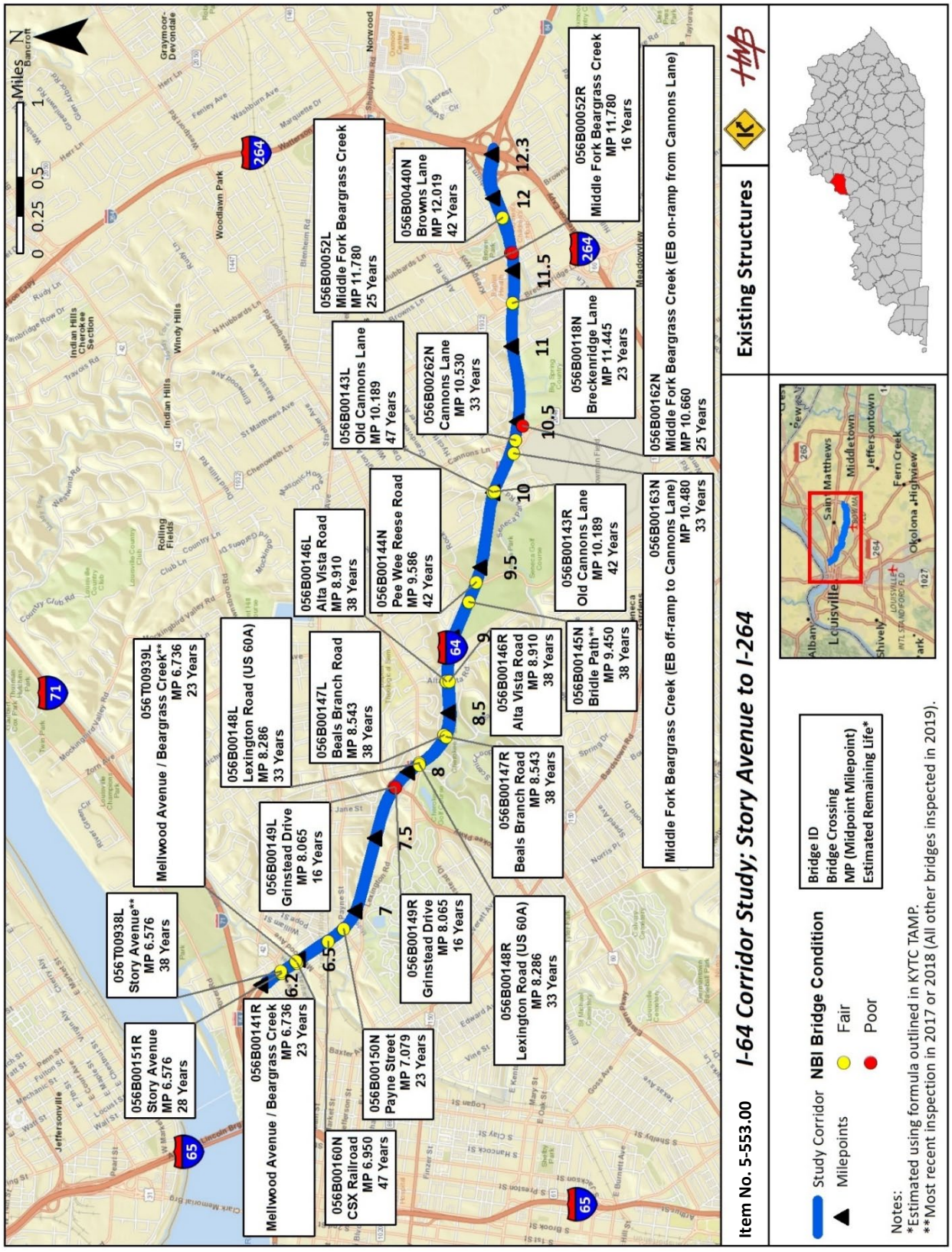


Table 4. Existing Structures

Bridge Crossing	Milepoint	Bridge ID	NBI Deck Rating	NBI Super-structure Rating	NBI Sub-structure Rating	Condition	Estimated Remaining Life* (Yrs)
Story Avenue	6.576	056B00151R	5	6	6	Fair	28
Story Avenue**	6.576	056T00938L	6	6	6	Fair	38
Mellwood Avenue / Beargrass Creek	6.736	056B00141R	5	6	5	Fair	23
Mellwood Avenue / Beargrass Creek**	6.736	056T00939L	5	6	5	Fair	23
CSX Railroad	6.950	056B00160N	7***	6	6	Fair	47
Payne Street	7.079	056B00150N	5	5	6	Fair	23
Grinstead Drive	8.065	056B00149R	5	4	5	Poor	16
Grinstead Drive	8.065	056B00149L	5	4	5	Poor	16
Lexington Road (US 60A)	8.286	056B00148R	6	5	6	Fair	33
Lexington Road (US 60A)	8.286	056B00148L	6	5	6	Fair	33
Beals Branch Road	8.543	056B00147R	6	6	6	Fair	38
Beals Branch Road	8.543	056B00147L	6	6	6	Fair	38
Alta Vista Road	8.910	056B00146L	6	6	6	Fair	38
Alta Vista Road	8.910	056B00146R	6	6	6	Fair	38
Bridle Path**	9.450	056B00145N	6	6	6	Fair	38
Pee Wee Reese Road	9.586	056B00144N	6	6	7	Fair	42
Old Cannons Lane	10.189	056B00143L	6	7	7	Fair	47
Old Cannons Lane	10.189	056B00143R	6	7	6	Fair	42
Middle Fork Beargrass Creek (EB off-ramp to Cannons Lane)	10.480	056B00163N	6	5	6	Fair	33
Cannons Lane	10.530	056B00262N	6	6	5	Fair	33
Middle Fork Beargrass Creek (EB on-ramp from Cannons Lane)	10.660	056B00162N	6	5	4	Poor	25
Breckenridge Lane	11.445	056B00118N	5	6	5	Fair	23
Middle Fork Beargrass Creek	11.780	056B00052L	6	4	5	Poor	25
Middle Fork Beargrass Creek	11.780	056B00052R	5	4	5	Poor	16
Browns Lane	12.019	056B00440N	6	6	7	Fair	42

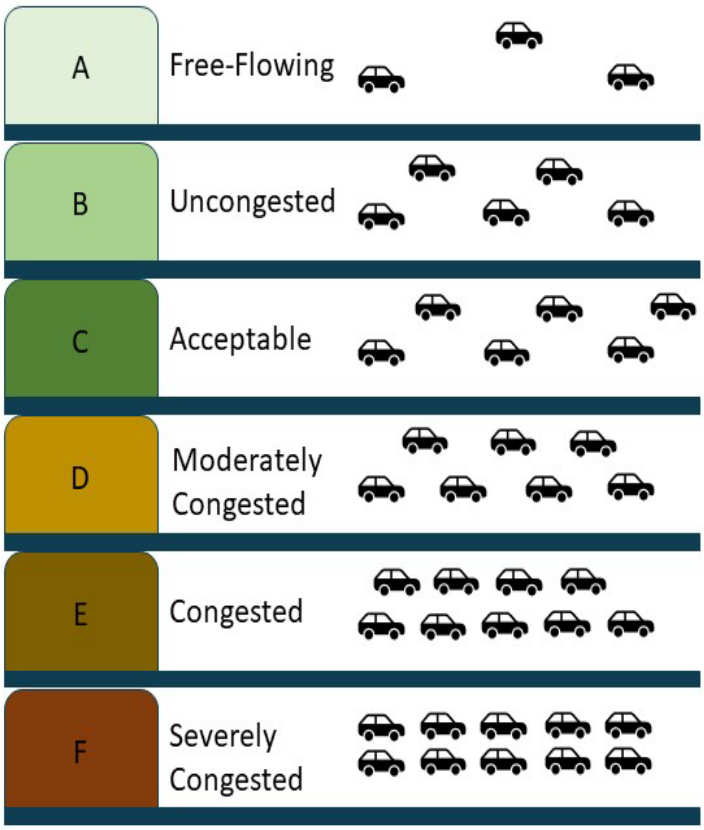
*Estimated using formula outlined in *KYTC TAMP.*
**Most recent inspection in 2017 or 2018 (All other bridges inspected in 2019).
***Deck last inspected in 2009.

2.5 Existing Traffic Volumes and Operational Analysis

Existing year (2020) traffic volumes for I-64 are based on the most recent KYTC count stations. The count years range from 2018 – 2019. While the COVID-19 Pandemic caused traffic volumes to unexpectedly decline during the second quarter of 2020, the Year 2020 forecasted volumes were based on pre-pandemic conditions. KYTC traffic count data was supplemented with data from Streetlight in areas where the most recent traffic count was out of date or traffic data was unavailable. Streetlight uses smartphones as sensors to measure vehicle, transit, bike, and foot traffic. Year 2020 volumes were calculated from these counts and calibrated using traffic volumes from the KIPDA Travel Demand Model, applying a growth factor when necessary, based on historic trends. The 2020 traffic volumes were forecasted to years 2025 and 2045. The I-64 Traffic Forecast is presented in **Appendix B**. For the No build scenario, the annual average daily traffic (AADT), annual average daily truck traffic (AADTT), and design hourly volume (DHV) for each mainline segment of I-64 is shown in **Figure 10** on the following page.

A Level of Service (LOS) analysis was performed for mainline I-64 segments using *Highway Capacity Software (HCS7)*. LOS is a qualitative measure of determining the operational characteristics of a roadway facility and is used to define the quality of traffic operations based on measures such as vehicle speed, travel time, comfort and convenience, maneuverability, congestion, and delay. There are six levels of service for each type of facility. The levels are designated by letters, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Acceptable operations for roadways in urban areas are LOS D or better. **Figure 9** presents a graphical depiction of LOS for reference.

Figure 9. Level of Service (LOS) Designations



In addition to providing the range of traffic flow according to letter grade, another reported performance measure is Volume to Capacity (V/C) ratio. The V/C ratio represents the proportion of traffic demand using the roadway for a designated time period in relation to its theoretical capacity to serve demand. A V/C ratio equal to or greater than 1.0 on freeway facilities indicates the roadway is operating at or above its theoretical design capacity representing severe congestion.

The levels of service and V/C ratios were determined for existing conditions (2020) and future No Build (2025 and 2045) scenarios in which no major widening would occur to I-64. Figure 9 shows that from Story Avenue to Grinstead Drive and from Grinstead Drive to Cannons Lane, I-64 operates at or worse than a LOS D. Throughout both segments, the LOS for the westbound direction ranges from E to F during the AM peak hour, while the LOS for the eastbound direction is F during the PM peak hour.

Figure 10. No Build Traffic Volumes and Operational Analysis

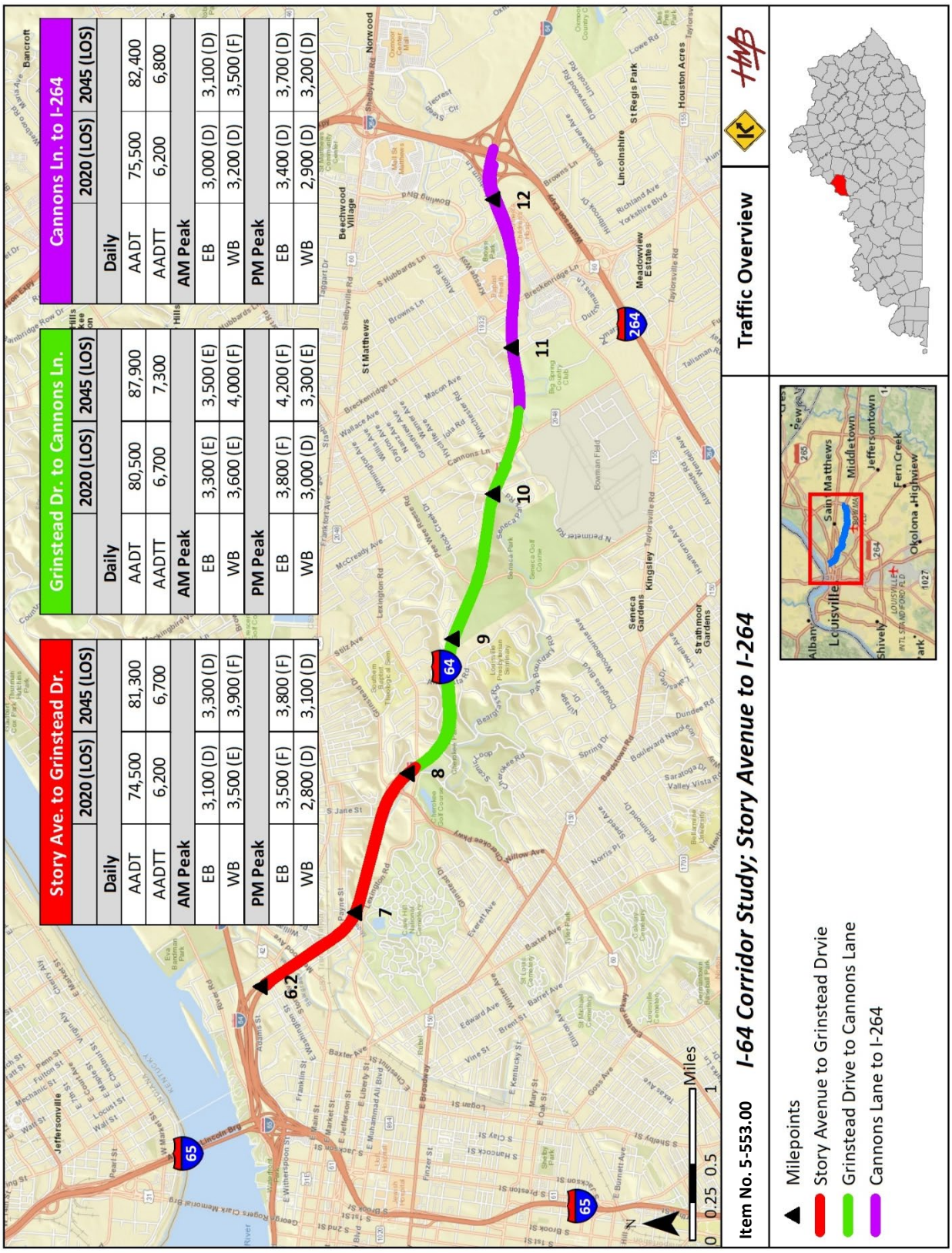


Table 5 contains the V/C ratio and LOS in the AM and PM peak period for the three primary mainline segments within the study area. The V/C ratios throughout the corridor range from 0.75 to 0.97. Appendix C presents a more detailed traffic analysis summary for LOS and contains all merge, diverge and mainline segments throughout the study area.

Table 5. I-64 V/C and LOS - No Build

Segment	Direction	2020 Volume to Capacity Ratio (V/C)		2020 Level of Service (LOS)		2025 Volume to Capacity Ratio (V/C)		2025 Level of Service (LOS)		2045 Volume to Capacity Ratio (V/C)		2045 Level of Service (LOS)	
Peak Period		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Story Avenue to Grinstead Drive	EB	0.83	0.89	D	F	0.86	0.89	D	F	0.89	0.86	D	F
	WB	0.94	0.75	E	D	0.96	0.78	E	D	0.89	0.83	F	D
Grinstead Drive to Cannons Lane	EB	0.89	0.93	E	F	0.92	0.92	E	F	0.94	0.92	E	F
	WB	0.98	0.81	E	D	0.99	0.84	F	D	0.93	0.89	F	E
Cannons Lane to I-264	EB	0.81	0.82	D	D	0.83	0.82	D	D	0.83	0.79	D	D
	WB	0.86	0.78	D	D	0.88	0.81	D	D	0.85	0.86	F	D
Facility Travel Time (min)/LOS	EB	N/A	N/A	**6.90/D**	**8.10/F**	N/A	N/A	**7.00/D**	**8.30/F**	N/A	N/A	**7.10/D**	**9.60/F**
	WB	N/A	N/A	**7.00/E**	**6.50/D**	N/A	N/A	**7.10/F**	**6.50/D**	N/A	N/A	**8.40/F**	**6.70/D**

EB – Eastbound, WB - Westbound

2.6 Crash Analysis

As part of this study, historical crash data was analyzed to identify locations along the portion of I-64 in the study area that could be considered high crash locations.

Crash Analysis Methods

The statistical crash analysis was performed based on methods that compare existing crash rates with crash rates of similar types of facilities. These methods included the Critical Crash Rate method and the Excess Expected Crashes (EEC) method. Detailed crash reports were analyzed for specific locations as needed.

1. Excess Expected Crashes - KYTC crash analysis methodology has been evolving, transitioning from the Critical Crash Rate method, and progressing toward the EEC methodology based on the AASHTO Highway Safety Manual (HSM) procedures. HSM methods allow for the ability to estimate potential crash frequency on roadways, and the potential effects that differences in roadway characteristics have on crashes (e.g., a 3-foot shoulder versus a 10-foot shoulder). If the EEC is negative, it indicates that there are fewer crashes than expected for a roadway of this type. The Kentucky Transportation Center (KTC) provided the EEC along with the factors and formulas to use for each segment of the study corridor. KTC uses a tool called CDAT (Crash Data Analysis Tool) which accesses crash data from 2013 to 2017.

   EEC analysis uses historical observed crash data for a specified time period and roadway segment length. The segments are based on KYTC's traffic count segments, and those typically change when there is a change in roadway characteristic (e.g., lane width, number of lanes) or at a breakpoint such as an intersecting road. **Table 6** shows the EECs by segment.

Table 6. CDAT Excess Expected Crashes by Segment (2013 - 2017)

Segment	Begin Description	End Description	Length (Miles)	EEC
1	Story Avenue	Grinstead Drive	1.489	316
2	Grinstead Drive	Cannons Lane	2.465	223
3	Cannons Lane	I-264	1.89	86

2. Critical Crash Rate - KYTC also uses a systematic procedure to identify locations having high crash rates. The actual number of crashes, as obtained from the KSP Collision Database, occurring within a roadway segment is used to calculate the Actual Crash Rate using the number of crashes, roadway length, AADT, and the number of years for which crash data is being examined. Using an analysis procedure from KTC and referenced in *The Analysis of Traffic Crash Data in Kentucky (2014-2018)*, Actual Crash Rates are compared to the Critical Crash Rates for similar types of Kentucky roadways. The Critical Crash Rate is the rate which is statistically greater than the Average Crash Rate for similar roadways, and it represents a rate which crashes may be occurring in a non-random fashion. This ratio of Actual Crash Rate to the Critical Crash Rate is the Critical Crash Rate Factor (CRF). Thus, a CRF greater than 1.0 indicates crashes may be occurring more often than can be attributed to random occurrence. This procedure is used as a screening technique indicating locations where further analysis may be needed. It is not a definitive statement of a crash problem, nor a measurement of a crash problem.

   Historical crash records were extracted from the Kentucky State Police's (KSP) *Collision Database* for a three-year period (November 2016 – October 2019) and are presented in **Appendix C**. Crashes were analyzed in 0.3-mile "spots" over the entire length of the study corridor. Based on this analysis, there were 24 high crash spots with a CRF greater than 1.0. An overview of these high crash spot locations is presented in **Figure 11**, and additional information, including the calculated CRF for each spot analyzed is presented in **Table 7.** CRFs highlighted in red in the table are values that are above the 1.0 threshold.

Figure 11. High CRF Spots (0.3 Mile)

Table 7. High CRF Spots (0.3 Mile)

Location			Direction	Crashes				Critical Rate Factor (CRF)
Roadway	Begin Milepoint	End Milepoint		Fatal	Injury	PDO	Total	
I-64	6.097	6.397	EB	0	1	11	12	1.06
I-64	6.400	6.700	EB	0	4	22	26	2.38
I-64	6.741	7.041	EB	0	1	15	16	1.47
I-64	6.925	7.225	EB	1	1	9	11	1.01
I-64	7.247	7.547	EB	0	5	9	14	1.28
I-64	7.552	7.852	EB	0	4	42	46	4.19
I-64	7.864	8.164	EB	0	2	16	18	1.54
I-64	8.200	8.500	EB	0	6	26	32	2.73
I-64	8.504	8.804	EB	0	2	14	16	1.37
I-64	9.934	10.234	EB	0	0	14	14	1.20
I-64	10.249	10.549	EB	0	1	13	14	1.29
I-64	10.767	11.067	EB	0	0	9	9	0.84
I-64	11.555	11.855	EB	1	2	7	10	0.94
I-64	6.307	6.607	WB	0	1	8	9	0.82
I-64	6.640	6.940	WB	0	10	22	32	2.93
I-64	6.948	7.248	WB	0	5	11	16	1.47
I-64	7.299	7.599	WB	0	0	1	12	1.10
I-64	7.989	8.289	WB	0	11	35	46	3.93
I-64	8.330	8.630	WB	1	5	9	15	1.28
I-64	8.800	9.100	WB	0	4	8	12	1.02
I-64	9.243	9.543	WB	0	1	16	17	1.45
I-64	9.591	9.891	WB	0	3	16	19	1.62
I-64	9.910	10.210	WB	0	0	16	16	1.37
I-64	10.225	10.525	WB	0	3	12	15	1.28
I-64	10.532	10.832	WB	0	4	15	19	1.78
I-64	11.002	11.302	WB	0	2	16	18	1.68
I-64	11.432	11.732	WB	0	2	11	13	1.22
I-64	11.747	12.047	WB	0	3	22	25	2.34
I-64	12.000	12.300	WB	0	2	16	18	1.68

PDO = Property Damage Only

High-Level Crash Analysis

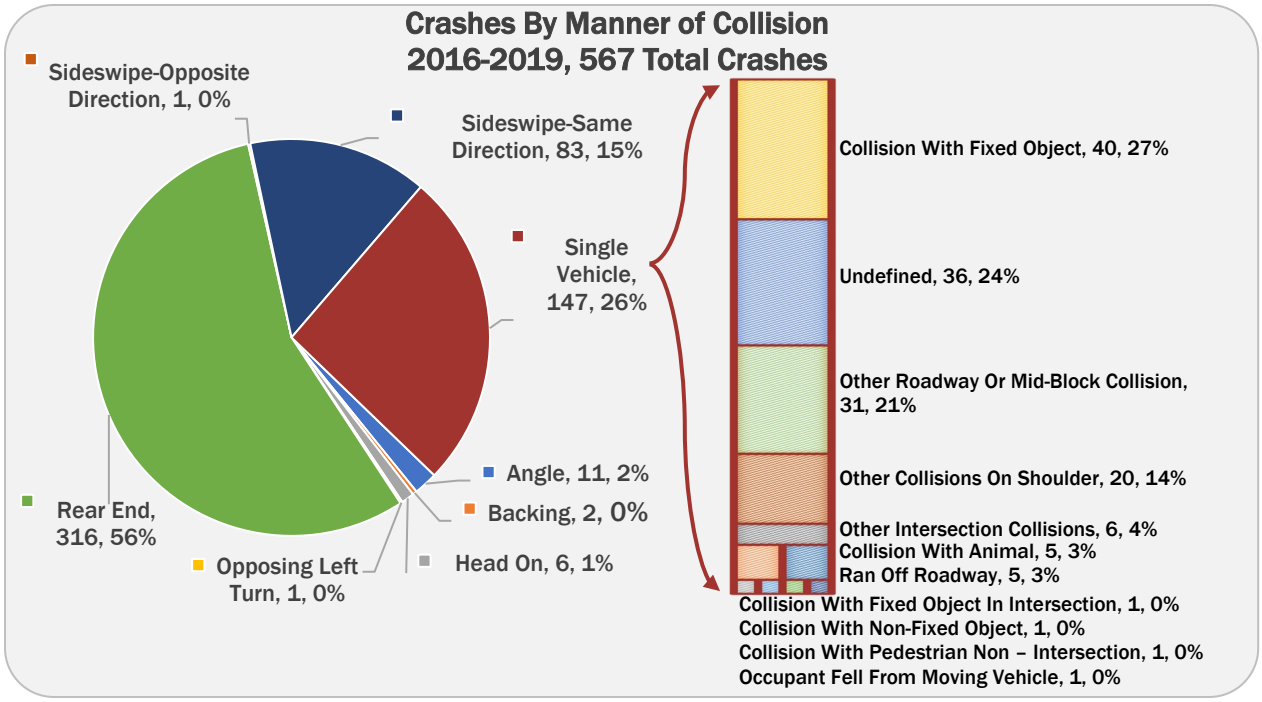
Aside from these two crash analysis methods, a high-level crash analysis was performed by analyzing the historical crash information provided by the KSP (Kentucky State Police) Collision Database and plotting all crashes along the corridor during the 3-year time period by their geographic coordinates. This involved analyzing statistics such as manner of collision, collision severity, daylight versus dark conditions, weather conditions, directional analysis, and others to find trends or help determine what could be contributing to crashes along the corridor.

Overall, there were 567 crashes within the 3-year timeframe in the study area. Summary statistics are provided in **Figure 12**. An overview map of the crash distribution density is presented in **Figure 13** as a heat map. **Figure 14** shows the manner of collision for the fatal (K) and suspected serious injury (A) crashes in the study area.

Crash severities are classified based on the 4th Edition of the Model Minimum Uniform Crash Criteria (MMUCC 4th Edition) KABCO Injury Classification Scale which Kentucky adopted in 2017 and was required to be adopted by all states on or before April 15, 2019. KABCO is defined in accordance with the MMUCC as follows:

- **Fatal Injury (K):** A fatal injury is any injury that results in death within 30 days after the motor vehicle crash in which the injury occurred. If the person did not die at the scene but died within 30 days of the motor vehicle crash in which the injury occurred, the injury classification should be changed from the attribute previously assigned to the attribute "Fatal Injury."
- **Suspected Serious Injury (A):** A suspected serious injury is any injury other than fatal which results in one or more of the following:
    - Severe laceration resulting in exposure of underlying tissues/muscle/organs or resulting in significant loss of blood
    - Broken or distorted extremity (arm or leg)
    - Crush injuries
    - Suspected skull, chest or abdominal injury other than bruises or minor lacerations
    - Significant burns (second and third degree burns over 10 percent or more of the body)
    - Unconsciousness when taken from the crash scene
    - Paralysis
- **Suspected Minor Injury (B):** A minor injury is any injury that is evident at the scene of the crash, other than fatal or serious injuries. Examples include lump on the head, abrasions, bruises, minor lacerations (cuts on the skin surface with minimal bleeding and no exposure of deeper tissue/muscle).
- **Possible Injury (C):** A possible injury is any injury reported or claimed which is not a fatal, suspected serious or suspected minor injury. Examples include momentary loss of consciousness, claim of injury, limping, or complaint of pain or nausea. Possible injuries are those which are reported by the person or are indicated by his/her behavior, but no wounds or injuries are readily evident.
- **No Apparent Injury (O):** Also known as Property Damage Only (PDO), No Apparent Injury is a situation where there is no reason to believe that the person received any bodily harm from the motor vehicle crash. There is no physical evidence of injury and the person does not report any change in normal function.

Figure 12. Crash Summary Infographic



Crashes by Severity

4 Fatal Crashes (K) (1%)
– 4 Fatalities

90 Injury (ABC) Crashes (16%)
– 130 Injuries
- 10 A (2%)
- 42 B (7%)
- 38 C (7%)

473 Property Damage Only (O) Crashes (83%)

Other Statistics to Note:

153 Non-Dry Condition Crashes (27%)
Wet – 136 (24%)
Snow/Slush – 3 (3%)
Ice – 5 (1%)
Water – Standing or Moving – 5 (1%)
Flooded – 1 (0%)
Other – 3 (1%)

420 Crashes Along Straight Segments (75%)
144 Crashes Along Curve Segments (25%)
Level– 489 (86%)
Grade – 61 (11%)
Hillcrest – 14 (2%)
Undefined – 3 (1%)

185 Non-Daylight Condition Crashes (33%)
Dark – 159 (28%) – 63 Dark and No Lighting (11%)
Dawn – 16 (3%)
Dusk – 10 (2%)
Daylight – 381 (67%)
Undefined – 1 (0%)

240 Non-Clear Weather Condition Crashes (37%)
Cloudy – 125 (22%)
Raining – 106 (19%)
Snowing – 2 (1%)
Sleet, Hail, or Freezing Rain – 3 (1%)
Blowing Sand/Soil/Dirt/Snow – 1 (0%)
Other – 3 (1%)

Figure 13. Crash Density (All Crashes)

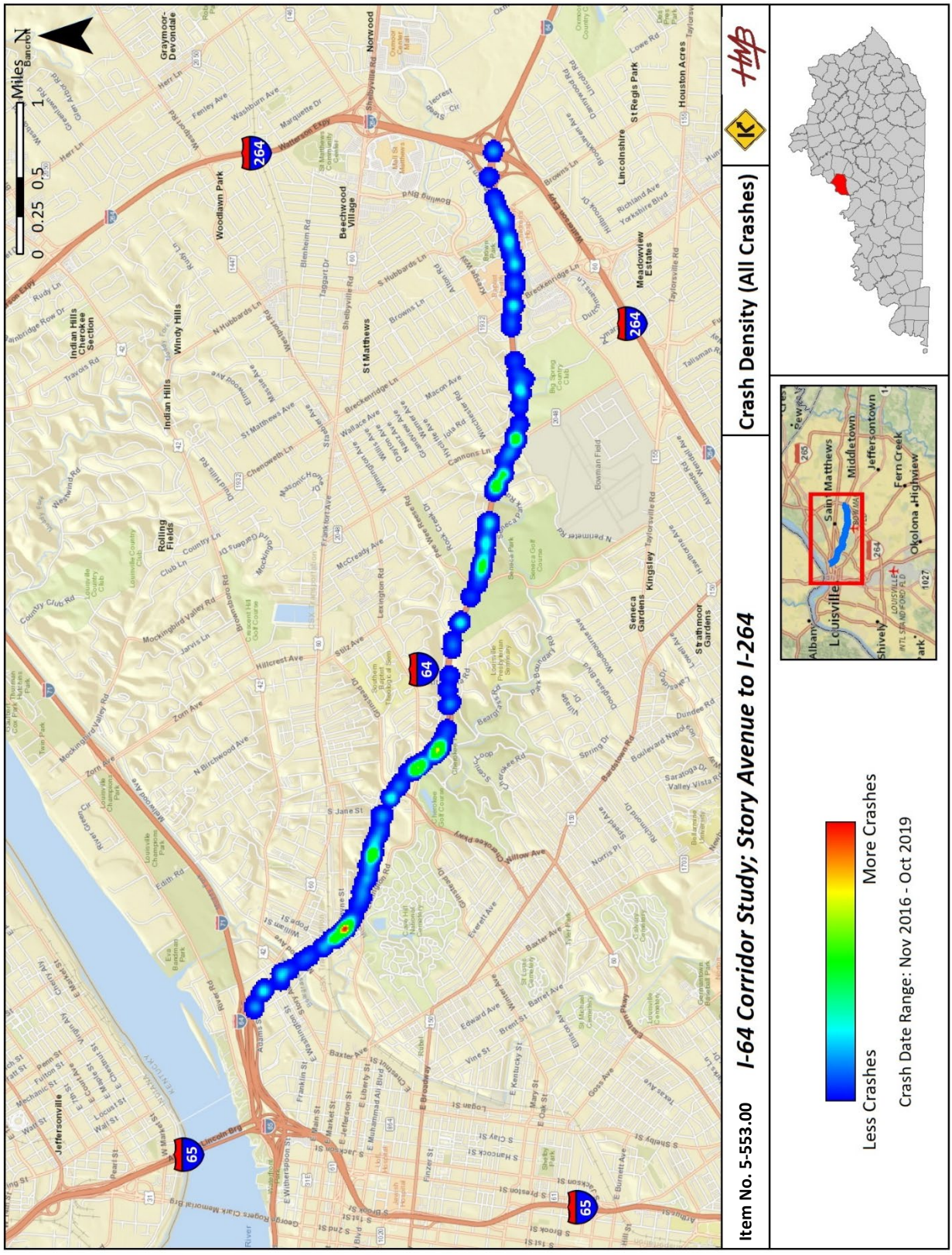
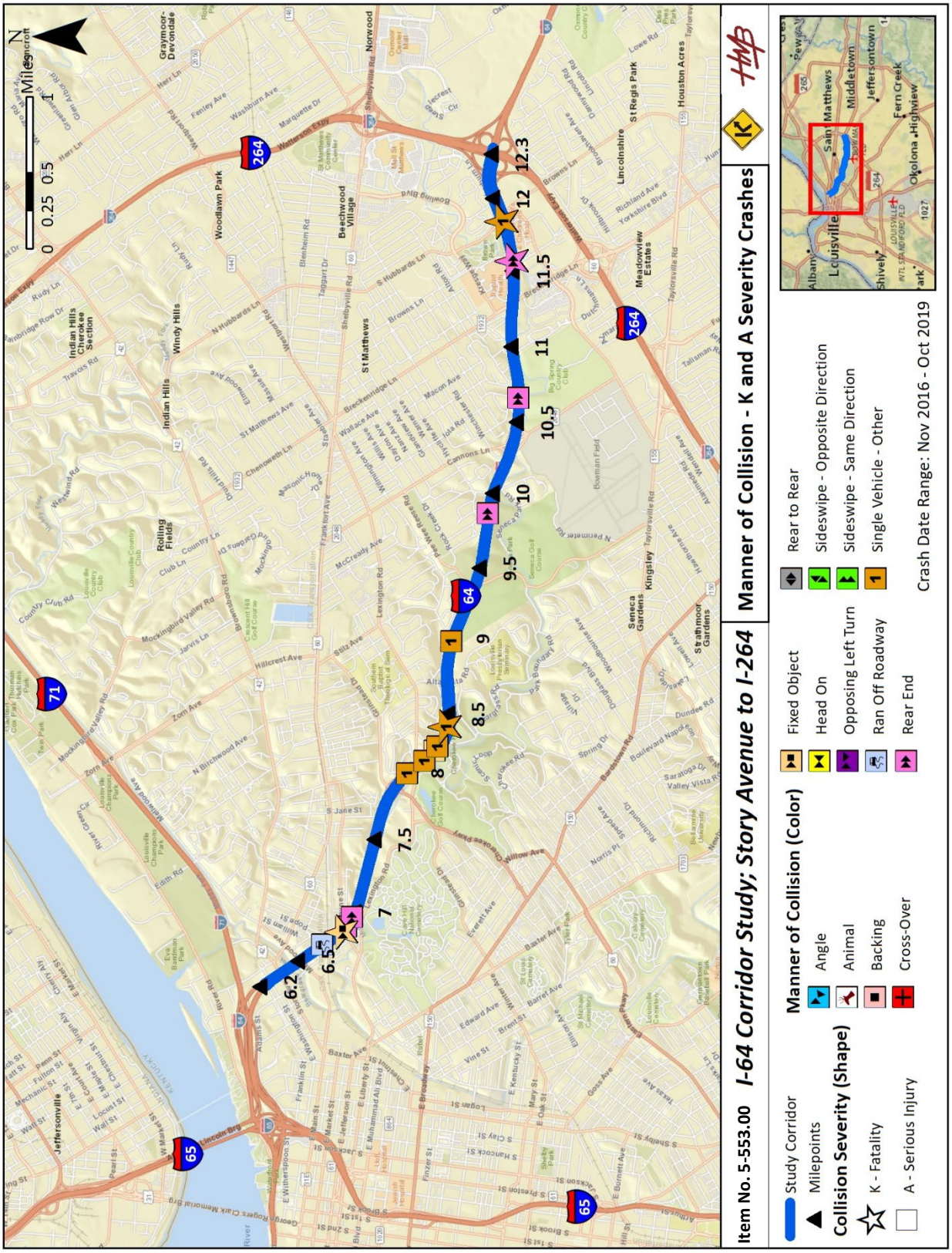


Figure 14. Manner of Collision - K (Fatal) & A (Severe Injury) Crashes



Chapter 3 – Environmental Overview

Along with the congestion and safety concerns within the study area, this corridor is surrounded by multiple environmental resources. These resources include Clifton Park, Beargrass Creek Greenway, Cherokee Park, Cochran Hlll Tunnels, Cochran Hill Dog Run, Seneca Park, and Brown Park. With this awareness, KYTC decided on a collaborative approach between the planning and environmental processes for this I-64 Corridor Study, referred to as a Planning and Environmental Linkage (PEL). As part of the PEL approach, an environmental review was completed to gain a full understanding of all the environmental resources and areas of concern that exist within the study area. These resources would then be considered during the development of potential improvement strategies and throughout the decision-making process.

A 250-foot buffer from the existing I-64 edge of pavement was used as the Environmental Corridor (Corridor) during this review. The review was completed using available GIS databases and online mapping, as well as coordination with regulatory agencies and stakeholders.

3.1 Natural Environment

The natural environment includes all things that are not man-made, such as air, land, water, vegetation, and animal life. The following is a summary of the various natural environmental attributes within the Corridor.

Geology

The Corridor is within the Outer Bluegrass region, known for its rich soils and deposits of limestone rock. The limestone (Louisville, Sellersburg and Jeffersonville) is formed from the Silurian and Devonian ages, with the Silurian formation covering the majority of the Corridor and Devonian formation primarily located at the eastern end. In Louisville, these limestones are mined and known to contain ample fossils. The Waldron and New Albany shales can also be present in these formations.

The topography found within the Outer Bluegrass region is rolling terrain and valleys with little flat land. According to the Kentucky Geological Survey (KGS), the Corridor is underlain by bedrock with high potential for karst development. The KGS database also shows two known sinkholes within the Corridor. Both locations are within a wooded area just north of I-64 at approximate MP 7.300. There are several other sinkholes just outside the Corridor, particularly in the area of Pee Wee Reese Road near Seneca Park. These sinkholes are shown on **Exhibit 1 of Appendix D**.

Watershed

The United States Geological Survey's (USGS) hydrologic units are a designation that describe geographic drainage areas. The United States is divided based on large drainage areas and subdivided down to regions, basins, and watersheds. The Corridor is in the sub-basin 8-digit Hydrologic Unit Code (HUC) Lower Ohio Silver-Little (05140101). It overlaps two subwatershed 11-digit HUC's, the Beargrass Creek HUC (05140101250) and the Ohio River HUC (05140101260). The Beargrass Creek watershed is the primary watershed for the Corridor, as it covers all except 800 feet at the far western end of the Corridor.

Streams

Middle Fork Beargrass Creek is a primary feature within the Corridor. The stream crosses I-64 once at the eastern end of the Study Area and then stays just south of the interstate, flowing in and out of the 250-foot Corridor. There is over 12,000 linear feet of Middle Fork Beargrass Creek within the Corridor. This includes a 1-mile continuous stretch, from the interstate's US 60 (Lexington Road)

overpass to the Payne Street overpass, where Middle Fork Beargrass Creek is directly parallel to the interstate.

Outside of the Corridor, Middle Fork Beargrass Creek empties into Beargrass Creek. Beargrass Creek then flows north between Story Avenue and Mellwood Avenue at the western termini of the Corridor. Beargrass Creek empties into the Ohio River approximately 1-mile downstream from the project Corridor. The streams are shown on **Exhibit 1 of Appendix D.**

The water quality of the streams in the Corridor has been negatively impacted by the loss of pervious surfaces due to urban development. Water quality has also been negatively impacted from sanitary sewer overflows and combined sewer overflows. As a result, both Middle Fork Beargrass Creek and Beargrass Creek are listed on the Kentucky Division of Water's (KDOW) 303(d) list of impaired streams. The 303(d) listing identifies 35.8 miles of Middle Fork Beargrass Creek as not supporting swimming due to the amounts of fecal coliform exceeding pollution standards. Middle Fork Fork Beargrass Creek is also listed for not supporting aquatic life from near US 60 (Lexington Road) to its confluence with Beargrass Creek. The 303(d) listing for Beargrass Creek is also noted as not supporting aquatic life from Middle Fork Beargrass Creek to the Ohio River backwaters. Due to these 303(d) listings, a Kentucky Pollutant Discharge Elimination System (KPDES) permit would require either a 25-foot buffer zone between disturbance and the edge of the two streams or alternative protective practices incorporated into the project.

There are also multiple tributaries of these two perennial streams within the Corridor. There are no special use waters, exceptional waters, or wild or scenic rivers within the Corridor.

Floodplains, and Floodway

Federal Emergency Management Agency (FEMA) Flood Maps show the 1 percent Annual Chance Flood Hazard surrounding Middle Fork Beargrass Creek, a tributary of Middle Fork Beargrass Creek, and Beargrass Creek. This floodplain is the widest in the area where Middle Fork Beargrass Creek flows between I-64 and US 60 (Lexington Road). In addition, there is a regulatory floodway associated with Middle Fork Beargrass Creek and with Beargrass Creek. Refer to **Exhibit 1 of Appendix D** for the floodplains in the Corridor.

Wetlands

The National Wetland Inventory (NWI) identified one freshwater forested / shrub wetland within the Corridor. This wetland is located along Beargrass Creek. The wetland is shown in **Exhibit 1 of Appendix D.**

Spring and Water Wells

There are three wells (1 active, 2 inactive) within the Corridor. All three are located where Middle Fork crosses I-64 at approximate MP 11.700 (see **Exhibit 1 of Appendix D**). There are no known springs within the Corridor.

Threatened and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) website was used to obtain a list of federally listed Threatened and Endangered (T&E) species. USFWS lists three bats, ten mussels, and one plant as known or expected to be in or near the Corridor. No critical habitat for the listed species is noted within the Corridor. The T&E species are included in **Table 8**.

Table 8. List of Threatened / Endangered Species

Common Name	Scientific Name	Status
Bats		
Gray bat	*Myotis grisescens*	Endangered
Indiana bat	*Myotis sodalist*	Endangered
Northern long-eared bat	*Myotis septentrionalis*	Threatened with 4d Rule
Mussels		
Clubshell	*Pleurobema clava*	Endangered
Fanshell	*Cyprogenia stegaria*	Endangered
Northern Riffleshell	*Epioblasma torulosa rangiana*	Endangered
Orangefoot Pimpleback	*Plethobasus cooperianus*	Endangered
Purple Cat's Paw	*Epioblasma obliquata obliquata*	Endangered
Rabbitsfoot	*Quadrula cylindrica cylindrica*	Threatened
Ring Pink	*Obovaria retusa*	Endangered
Rough Pigtoe	*Pleurobema plenum*	Endangered
Sheepnose Mussel	*Plethobasus cyphyus*	Endangered
Spectaclecase	*Cumberlandia monodonta*	Endangered

Bats

Preferred habitat for the Indiana bat and northern-long eared bat includes caves during the winter months and forested areas during the summer months. The gray bat is primarily found within caves year-around, although it too uses riparian forested habitat for foraging. All three bat species can also be found within bridge crevices.

Despite its urban setting, a large amount of forested habitat exists within the Corridor. Along the majority of the Corridor, I-64 is separated from its adjacent land uses by a line of forested area. There are also clusters of forested areas throughout the Corridor, primarily near the local parks. In addition to the forested habitat, overpasses and interchanges, along the interstate, present numerous bridges with potential for bat usage.

KYTC typically mitigates for the habitat loss associated with tree clearing through usage of the *Programmatic Biological Opinion on the Effects of Transportation Projects in Kentucky on the Indiana Bat and Gray Bat*. Per this Biological Opinion, the Corridor would be considered "Unsurveyed" habitat. The northern long-eared bat qualifies for use of USFWS's Final 4(d) Rule.

Mussels

Middle Fork Beargrass Creek and Beargrass Creek have habitat suitable for mussel species, although their designation on the 303(d) list indicates that their water quality does not support aquatic life.

3.2 Human Environment

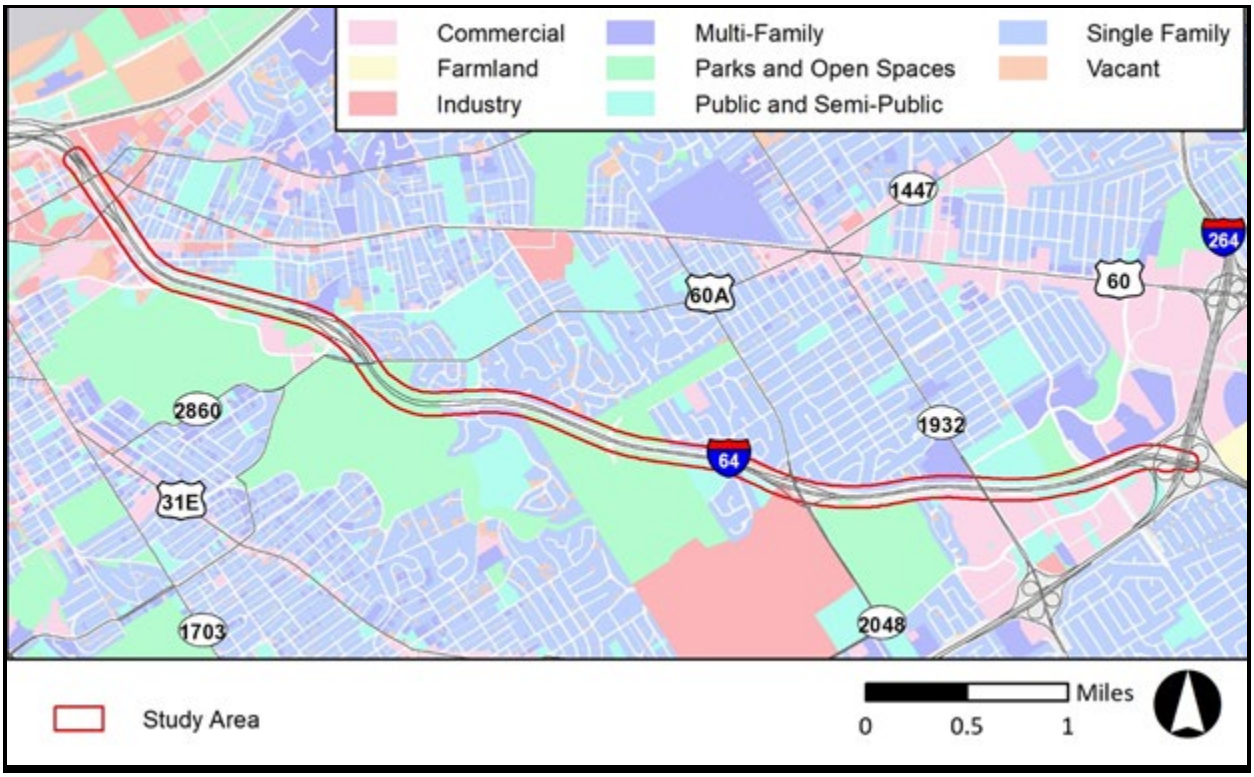
The human environment entails the relationship between the people and the environment around them. This includes man-made infrastructure, such as parks and historic resources, as well as natural conditions, such as air quality and noise. The following is a summary of the human environmental attributes within the Corridor.

Land Use

Designated land use of the Corridor was obtained from the Louisville / Jefferson County Information Consortium (LOJIC) website. Within the 429 acres of the Corridor, the large majority (56.75 percent) is existing KYTC right-of-way. Parks and open spaces are the next largest land use at 17.82 percent, followed by public and semi-public land (8.40 percent) and then single-family areas (8.36 percent). The remaining land use types, including commercial, industry, multi-family, and vacant all represent less than 4 percent of the total land use in the Corridor. Land use for the Corridor is shown on **Figure 15** below. In the western end of the Corridor, between Story Avenue and Mellwood Avenue, the land use is primarily commercial and industrial. A mix of residential properties are then introduced before the land use converts to parks and open space to the south and public and semi-public land use to the north. This includes the Cherokee Park that borders I-64. Also, just outside of the Corridor to the north is the Clifton Historic District, a heavily residential neighborhood of mostly single-family residences.

These land uses continue east to the Grinstead Drive interchange. Following this interchange, parks and open space is the primary land use on both sides of the interstate (Cherokee Park and Seneca Park), with a small section of single-family residences between the two parks. Then, after a stretch of single-family residential properties, the parks and open space land use is on both side of the Corridor (Seneca Park). Moving east, the areas north of I-64 remain primarily residential, including several locations of multi-family residences. The areas to the south of the interstate include Industrial (Bowman Field), parks and open space, and then commercial up to I-264.

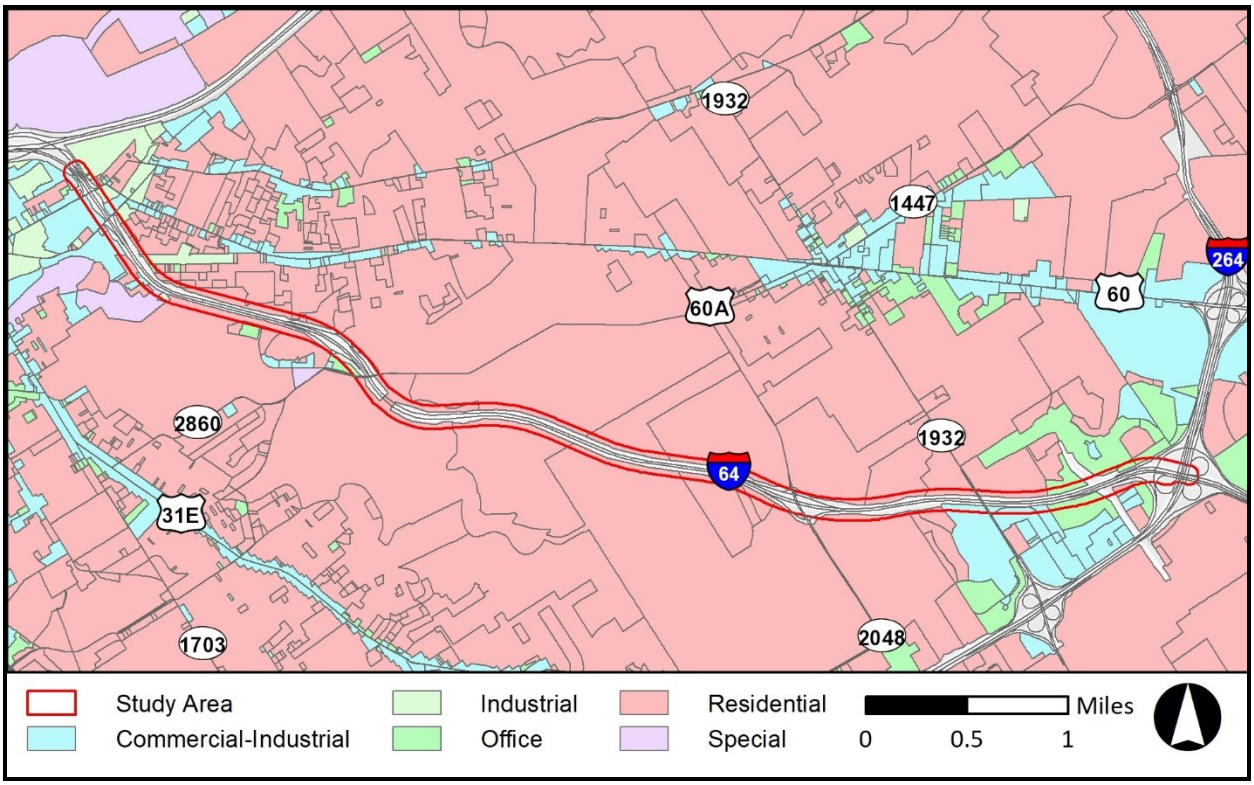
Figure 15. Land Use



Zoning

The vast majority of the Corridor is zoned for Residential use. There are portions, particularly at either end of the Corridor, that are zoned for Commercial-Industrial, Industrial, Office, and Special. See **Figure 16** for the land use designations within the Corridor.

Figure 16. Land Zoning



Population Demographics

A *Socioeconomic Study* was completed to establish baseline conditions for socioeconomic resources in the Corridor. Using U.S. Census's 2019 American Community Survey (ACS) data, this analysis focused on the eleven Block Groups within the Corridor and compared their demographics to those of Jefferson County. The demographics analyzed include low-income, minority, and elderly populations, as well as persons with a disability and persons with limited English proficiency (LEP).

Results of the *Socioeconomic Study* found that the demographics of the Corridor were relatively similar to those of Jefferson County, which was used as the reference threshold. Only the racial minority population was noticeably different than the county, with the Corridor having less than half of a racial minority percentage than the county. The Corridor did have a higher percent of population over age of 65 and a higher percent of population with limited English proficiency than the county, but a lower percent of racial minority residents, population below poverty levels, and population with a disability.

Refer to **Table 9** for a summary of the population demographics.

Table 9. Summary of Population Demographics

Population Group	No. of Block Groups Higher than Jefferson County Threshold
Racial Minority Population	0
Population by Persons Age 65 and Older	7
Population by Persons below Poverty Level	4
Population by Disability Status	2
Population with Limited English Proficiency Age 18 Years and Older	4

Source: U.S. Census Bureau 2019 ACS 5-Year Estimates

This data is a planning-level overview of the Corridor and the demographics of the residential population within it. If federal funds are utilized to implement any of the proposed improvement strategies, a more detailed socioeconomic study would be required as part of the environmental process and documentation required by the National Environmental Policy Act (NEPA). The *Socioeconomic Study* is included in **Appendix D**.

Community Areas of Interest

Adjacent to I-64 within the Corridor are an abundance of community resources. These resources are primarily south of I-64 but are also intermixed with residential neighborhoods on the north. Important community areas of interest, from east to west within the Corridor, include:

- *Medical Facility Complex* – north and south of I-64, near the interchange with Watterson Expressway (I-264), are multiple hospitals and medical facilities.
- *Big Spring Country Club* – this private country club offers 18-hole golf course, tennis courts, and swimming pools. It is located in the southeast quadrant of the I-64 and Cannons Lane interchange.
- *Seneca Park and Seneca Park Golf Course* – this 530-plus acre park is primarily to the south of I-64, although portions do extend north of the interstate. It offers numerous recreational activities, including a golf course, horseback riding trails, baseball fields, basketball courts, and tennis courts. Within the Corridor are portions of the golf course and the basketball courts.
- *Cherokee Park* – the 400-plus acres of park property provides multiple recreational activities, highlighted by the 2.4-mile Scenic Loop and by Beargrass Creek meandering through it. Most of the park area is south of I-64, including the golf course, frisbee golf, playground, basketball court, and archery range. The Park extends north of I-64 with a dog park called the Cochran Hill Dog Run. These areas are connected, with I-64 tunneling under the park property via the Cochran Hill Tunnels.
- *Beargrass Creek Greenway at Irish Hill* – this park is the only urban nature preserve owned by the Kentucky State Nature Preserves Commission (KSNPC). It is a mostly forested area with a walking trail built along Beargrass Creek. The majority of this park is within the Corridor.
- *Clifton Park* – this neighborhood park offers a playground, tennis court, and basketball court. The majority of this park is within the Corridor.
- *Story Avenue Park* – this small park is adjacent to the I-64 westbound off ramp onto Story Avenue. It includes a playground, basketball court, and small walking trail. The entirety of this park is included in the Corridor.

No other schools, cemeteries, fire / police stations, libraries, or other type of community institutions were identified within the Corridor. Just outside the Corridor are the valued community

resources of Bowman Field (a general aviation airport), and Cave Hill Cemetery (a large national cemetery containing several notable Kentucky citizens). These resources are shown on **Exhibit 2** in **Appendix D**.

Cultural Resources – Historic

There are numerous historically significant resources along the I-64 corridor between Story Avenue and Watterson Expressway (I-264). To properly identify the previously recorded cultural historic sites, as well as provide a general outlook on potential resources, a *Cultural Resources Overview* was completed for this study. This overview included coordination with the Kentucky Heritage Council (KHC) to identify sites listed on the National Register of Historic Places (NRHP) The *Cultural Resources Overview* identified the following historic resources within and surrounding the Corridor. These resources are shown on **Exhibit 2 in Appendix D**.

Cherokee Park

Cherokee Park is listed individually as a large NRHP boundary property within the Olmsted Park System of Louisville. It's 1982 listing on the NRHP identified the park as significant in areas of *Community Planning* and *Landscape Architecture*. The Olmsted Park System of Louisville was designed so that its individual parks are connected by parkways. The concept and design was developed by Frederick Law Olmsted, who is considered the founder of American landscape architecture. This system is one of only four park systems that Olmsted completed in the world.

Cochran Hill Tunnels

The Cochran Hill Tunnels are approximately 500-feet long and were constructed along both eastbound and westbound I-64 to avoid direct impacts to the historic Cherokee Park above the interstate. While the tunnels are not listed on the NRHP, they have been designated as *Nationally and Exceptionally Significant Features of the Federal Interstate Highway System* because of their exceptional significance to the development of environmental sensitive design in the area of transportation engineering. This designation means the tunnels are excluded from the *Section 106 Exemption Regarding Effects to the Interstate Highway System*, which excludes the majority of the nation's interstates system from consideration as a historic property under the National Historic Preservation Act. Therefore, the tunnels will be subject to consideration under Section 106 and Section 4(f) processes.

James Brown House / Wildwood Farm

The James Brown House / Wildwood Farm is located north of I-64 and is near the eastern limits of the Corridor. It was listed on the NRHP in 1983 for its architecture / engineering with a period of significance of 1800 to 1824. Today the property is primarily occupied with apartment complexes, however, and the James Brown House is currently used as the complex clubhouse and the stone smokehouse is still extant on the property.

Butchertown Historic District

The Butchertown Historic District covers much of the downtown Louisville area between I-65 and I-64. This district contains a mix of industrial, commercial, and residential resources. It was originally listed in the NRHP under Criterion A and in 1976 Criterion C. In 2019 a boundary increase was added. The Butchertown Historic District is also a local preservation district.

Clifton Historic District

The Clifton Historic District is a residential neighborhood north of I-64 between Mellwood Avenue and Grinstead Drive. It was listed on the NRHP in 1983 and its boundary was increased in 1994. Over 900 buildings are contributing resources to its significance in architecture, education, and industry between the years of 1870 and 1930. There is also a small park, named Clifton Park, within the district that was mentioned in the designation report. The Clifton Historic District is

also a local preservation district. The majority of Clifton Park and approximately ten residential homes exist within the historic district and the Corridor.

Louisville Reach Historic District
This historic district is located just outside the Corridor. It is not listed but has been determined eligible for the NRHP. The 1948 floodwall boundary at Butchertown may be a determined-eligible property within the Louisville Reach Historic District. As determined eligible in 2020, the discontiguous district is eligible under Criterion A within flood control and community planning. Significant dates span from 1947 to 1956. Alterations that affect drainage and its stability may affect its eligibility.

Beargrass Creek Canal
The Beargrass Creek Canal within the Corridor has not been assessed, however, portions of the creek south of the Corridor have been determined eligible for listing to the NRHP by the U.S. Army Corps of Engineers (USACE) and the State Historic Preservation Office (SHPO). These past determinations could be pertinent for future surveys within the Corridor.

Other Cultural Historic Sites and Districts
There are numerous other entities within and surrounding the Corridor that could be pertinent cultural historic resources, including:

- *Cave Hill Cemetery* – this national cemetery is listed on the NRHP and is located just outside of the Corridor to the south of I-64 and between Grinstead Drive and Payne Street.
- *Bowman Field Airfield Historic District* – the airport and contributing buildings are outside the Corridor, however, depending on the improvement option, the cultural historic buffer may include the airfield and historic district. In addition, the airspace over adjacent areas, including I-64, may need to be considered.
- *Railroad Bridges Multiple Resource Area (MRA)* – with a MRA recommended for west Louisville, the railroad bridges within the eastern part of Louisville may need to be considered for a separate MRA that include the bridges for the Louisville and Nashville rail line over I-64 and South Charlton Street.
- *Seneca Park* – While the park is included in the Olmsted Park System of Louisville, it was not included in the system's NRHP listing in 1982. Any future survey will need to evaluate Seneca Park for inclusion in this listing. In addition, the park's golf course, which has been recommended eligible for the NRHP. Within the Corridor, both north and south of I-64, are portions of the golf course, basketball courts, and open areas.
- *Other Recreational Areas* – recreational areas not previously mentioned include Beargrass Creek Greenway at Irish Hill, Big Spring Country Club, and the Story Avenue Park. Potential impacts on the integrity and setting to these large, open, recreational areas will need to be considered.
- *Residential Homes/Subdivisions* – the mid-century residential subdivisions along the Corridor that have not been previously assessed are possibly eligible as a historic district. Within these districts are residential homes that also would be potentially eligible for the NRHP. These sites will be surveyed as part of future improvement strategies.

Cultural Resources - Archaeological
As a part of the *Cultural Resources Overview* a records check was completed at the Office of State Archaeology (OSA). This research indicated that while only a small portion of the Corridor has been subjected to previous archaeological surveys, seven previously identified archaeological sites have been mapped within the Corridor. The documented archaeological sites indicate potentially significant historical resources in the western end of the Corridor. In addition to the documented sites, background research also identified numerous areas of interest for potential archaeological resources.

The background research completed shows there is a moderate to high probability of additional archaeological sites associated with both historic and prehistoric eras represented in the area. Historical materials are expected to include middens, artifacts, and features associated with previous residential buildings, eighteenth-century stations, the rail line, quarries, and extant residential buildings. Any improvement option chosen to move forward should examine both new right-of-way and potentially undisturbed existing right-of-way.

Section 4(f)

Parks and recreation lands, wildlife and refuges, and historic sites require special consideration under Section 4(f) of the U.S. Department of Transportation Act of 1966. Consideration of 4(f)-properties requires the FHWA to determine that there is no feasible and prudent alternative that avoids the property. It also requires that potential impacts are minimized as much as possible.

The historic sites and the parks previously discussed would all require consideration under Section 4(f). These known and potential sites include, but are not limited to, the following:

- Cherokee Park
- Seneca Park and Seneca Park Golf Course
- Beargrass Creek Greenway at Irish Hill
- Story Avenue Park
- Clifton Park
- Beargrass Creek Canal
- Eligible structures within the Butchertown Historic District
- Eligible structures within the Clifton Historic District
- Eligible structures within the Louisville Reach Historic District
- James Brown House/Wildwood Farm

While there is some overlap in the requirements of Section 4(f) with Section 106 of the National Historic Preservation Act of 1966, there are also substantial differences between the two. Therefore, potential improvement strategies must evaluate and assess impacts under both criteria. In addition, the parks within the Corridor shall be evaluated as both a recreational facility and historic site.

Section 6(f)

The Land and Water Conservation Fund Act (LWCFA) of 1965 developed a federal program intended to provide funding to develop and preserve outdoor recreational areas. When LWCF grants are utilized for land or facilities, Section 6(f) of this law requires coordination with the National Park Service prior to converting them from their recreational use. In addition, Section 6(f) requires that when the conversion is to take place, they must be replaced with land elsewhere that provides the same value of what is being converted.

Coordination with Kentucky's Department for Local Governments occurred to determine whether the parks within the Corridor have received LWCFA grants. Records show that both Seneca Park and Cherokee Park have received two LWCFA grants. Seneca Park received grants in 1974 and in 1984 and Cherokee Park received grants in 1985 and 1987. While it is believed that these grants were for development outside of the Corridor, the laws of Section 6(f) apply to the entire park at the time the grant is issued. Therefore, the entire park area within the Corridor is considered a Section 6(f) resource and converting any land within these boundaries to transportation use would require analysis under the LWCFA. These locations are outlined in **Exhibit 2 of Appendix D**.

Noise and Air Quality

Noise

A preliminary noise analysis was performed for the Corridor. Using existing lane lines and traffic volumes, a straight-line model was built in FHWA's Traffic Noise Model (TNM), version 2.5, software.

This model was used to locate the distance from the roadway where traffic noise would exceed or meet 66 decibels. This sound level would be considered a noise impact for exceeding the FHWA's and KYTC's Noise Abatement Criteria for noise-sensitive land uses such as residential homes, parks, and Section 4(f) sites, among others.

The preliminary analysis showed that noise-sensitive land uses within 310 feet of the existing edge of pavement would likely exceed the 66 decibel criteria. Within this distance are numerous residential properties, multi-family residences like apartments and townhomes, parks, recreational areas, outdoor common areas at commercial locations, and others. If future projects qualify as a Type I Activity (per 23 CFR 772), a more detailed highway traffic noise analysis would be required to determine all noise impacts and to evaluate the reasonableness and feasibility of a barrier wall.

Air Quality

As required by the Clean Air Act, the U.S. Environmental Protection Agency (EPA) set National Ambient Air Quality Standards (NAAQS) for six common air pollutants. Those that are caused by transportation-related sources include carbon monoxide (CO), ozone (O_3), particulate matter ($PM_{2.5}$ and PM_{10}), and nitrogen dioxide (NO_2). The Corridor is within the 2015 non-attainment area for ozone. Therefore, to meet the air quality regulatory requirements, any improvement option that becomes a project shall be a part of a conforming transportation plan. This typically occurs in the metropolitan planning organization's (KIPDA) Transportation Implementation Program (TIP).

Hazardous Materials

Sites with the potential for hazardous materials or underground storage tanks were identified by reviewing EPA database and available mapping. Potential sites were identified primarily at either end of the Corridor and surrounding the I-64 interchange with Grinstead Drive. Sites identified include those within the hospital complex at I-64 and Watterson Expressway (I-264), gas stations and construction sites near Grinstead Drive, and also brownfield sites and industrial sites surrounding the western end of the Corridor. These sites are shown on **Exhibit 2** in **Appendix D.**

Visual Impacts

The Highway Beautification Act (HBA) was signed into law in 1965 in an attempt to preserve the scenic areas adjacent to federal highways. While the primary implementation of this bill regulated billboards, junkyards, and other unappealing sights, it has also been utilized to purchase easements along some highways.

With it known that these easements have been purchased along I-64, deed research and coordination was performed to try and discover if there were HBA easements along the Corridor. As of November of 2021, one location with a HBA easement has been found. This area is located between Beargrass Creek and Lexington Road, approximately 0.5-mile west of Grinstead Drive (shown on **Exhibit 2** in **Appendix D**). Additional deed research may be required for any improvement option chosen to move forward to ensure additional HBA easements are not located in the area.

Chapter 4 – Initial Engagement Efforts

During the course of the study, multiple collaborative meetings were held. These included three Project Team meetings, two LO/S meetings, and two public outreach surveys to gather input on potential improvement strategies to I-64 within the study area.

Initial engagement efforts included two of three Project Team meetings, the first of two LO/S meetings, and the first of two public outreach efforts. The public outreach efforts were conducted virtually due to health and safety concerns resulting from the COVID-19 pandemic. For the public outreach effort, a presentation was provided in the form of an ArcGIS StoryMap, concluding with an online survey to gather input.

The initial meetings are discussed below, while the subsequent meetings with the Project Team, LO/S, and the public were conducted after the development of potential improvement strategies and are discussed in **Chapter 6.**

4.1 Project Team Meeting No. 1

The first Project Team meeting was held on Friday, December 6, 2019 at KYTC District 5 Office. Attendees included KYTC Central Office staff, KYTC District 5 staff, KYTC Division of Environmental Analysis (DEA) staff, FHWA, KIPDA, and the consultant teams. Existing conditions and the project history were discussed as well as the study goals. The materials presented and discussed during the meeting included:

- Study History (including the significance of the Cochran Hill Tunnels)
- Review of Existing Conditions (including crash and traffic data)
- Preliminary Improvement Strategy Types
- Study Communication Plan

For additional detail regarding information presented and discussed at the meeting, refer to the meeting minutes found in **Appendix E**.

4.2 Project Team Meeting No. 2

The second Project Team meeting was held on Thursday, June 4, 2020, and was conducted virtually due to health and safety concerns resulting from the COVID-19 pandemic. A presentation was given by the consultant through an ArcGIS StoryMap. Attendees included KYTC Central Office staff, KYTC District 5 staff, FHWA, KIPDA, and the consultant teams. The materials presented and discussed during the meeting included:

- Study History / Study Purpose
- Public Engagement Plan
- Crash / Speed Data Analysis
- Preliminary Traffic Forecasts
- Environmental Resources Near the Study Area
- Preliminary Improvement Strategies
- LO/S Meeting Presentation

For additional detail regarding information presented and discussed at the meeting, refer to the meeting minutes found in **Appendix E**.

4.3 Local Officials / Stakeholder Meeting No.1

The first LO/S meeting was held on Wednesday, July 29, 2020, to present initial findings, collect input on congestion and safety perceptions throughout the study area, and discuss potential improvement strategy types. The meeting was conducted virtually due to health and safety concerns resulting from the COVID-19 pandemic. The invitation list was prepared by the consultant team with input from KYTC and KIPDA. Attendees included representatives from various local jurisdictions (state representatives, mayors, city council members, local public service organizations etc.), local police departments, CSX railroad, Louisville Regional Airport Authority, and the Kentucky Heritage Council. A presentation was given by the consultant through an ArcGIS StoryMap. Survey polls were conducted throughout the meeting to provide opportunities for interaction along with question-and-answer periods at the end of each topic. The materials presented and discussed during the meeting included:

- Study Purpose, Goals, and Schedule
- Existing Conditions Overview
- Environmental Resources Near the Study Area
- Potential Improvement Strategy Types
- Public Outreach Survey No. 1 Review

During the meeting, attendees were asked if they think improvements are needed in this section of I-64. 65 percent responded major improvements are needed including adding capacity, while 31 percent responded minor improvements are needed. The remaining four percent responded no improvements are needed. In addition, attendees were asked what types of improvements they were most supportive of for this section of I-64. With the ability to select more than one answer, at least 60 percent were supportive of each improvement type. For additional detail regarding information presented and discussed and survey poll responses during the meeting, refer to the meeting minutes found in **Appendix E**.

4.4 Public Outreach Effort – Survey No. 1

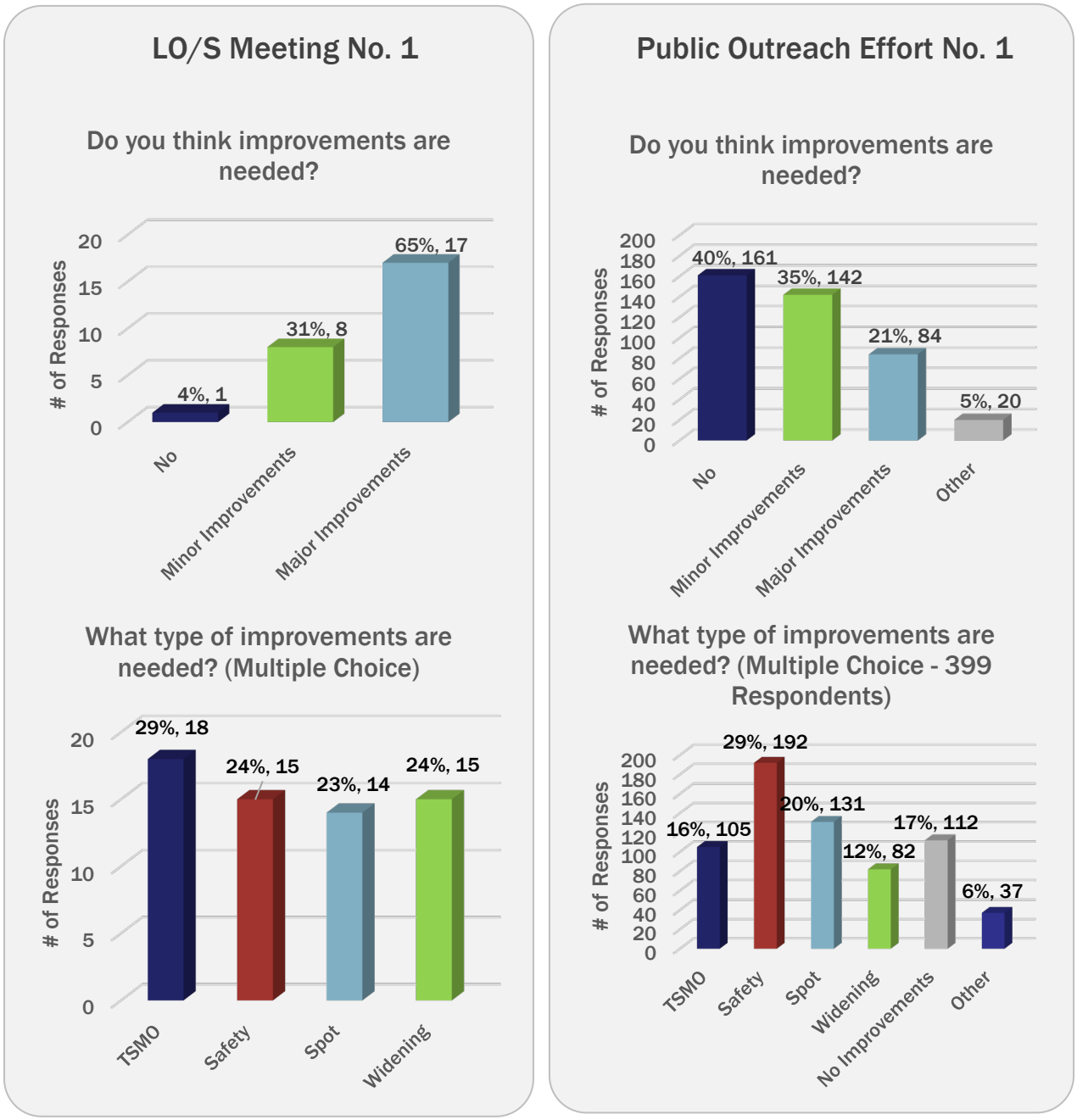
The first public outreach effort was held from August 5, 2020, to September 2, 2020, and was conducted virtually due to health and safety concerns resulting from the COVID-19 pandemic. A presentation was provided in the form of an ArcGIS StoryMap, including the information compiled and presented at the first two Project Team meetings. The presentation concluded with an online survey from which 412 responses were received. The survey was focused on the following:

- Public Perception of the Existing Conditions (Congestion, Safety, etc.)
- Environmental Concerns Near the Study Area
- Necessary Improvements to the Study Area (If Any)
- Potential Improvement Strategy Types

Figure 17 shows the responses to some of the critical questions asked within the survey.

Additional engagement efforts are discussed in **Chapter 5** and **Chapter 6**. The full survey and a summary of responses can be found in **Appendix E.**

Figure 17. Public Outreach Effort Survey Summary



TSMO – Transportation Systems Management and Operations

Chapter 5 – Improvement Strategies Development and Analysis

This chapter discusses the process of identifying what types of improvement strategies could benefit the study area, in depth analysis that helps refine improvement strategies, and the development of a list of revised improvement strategies to present to the public. The existing conditions analyses and coordination with KYTC personnel informed and guided the development and evaluation of locations and strategies. Improvement strategies were considered along I-64 throughout the study area and at the following interchanges: Story Avenue, Mellwood Avenue, Grinstead Drive, Cannons Lane, and the eastbound off-ramp and the westbound on-ramp of the I-264 interchange.

5.1 Identification of Improvement Strategy Types

Based on an analysis of existing conditions, the following three types of improvement strategies were identified: Transportation Systems Management and Operation (TSMO), Spot and Safety, and Major Widening. These improvement strategy types potentially impact the area surrounding the corridor at different levels. All improvement strategy types aim to improve safety and congestion throughout this section of I-64.

Transportation Systems Management and Operations (TSMO) Improvement Strategies

As defined by FHWA, TSMO is a set of strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system to levels that existed before extra capacity is needed. Some of these improvement strategies include enhanced traveler information, advance warning systems, variable message boards, High Occupancy Vehicle (HOV) lanes, and reversible lanes.

Spot and Safety Improvement Strategies

Spot and safety improvement strategies are less invasive ways to improve safety and congestion throughout the study area without making major modifications to I-64. A few examples of these types of improvements are extending acceleration / deceleration lanes at interchanges, adding auxiliary lanes to connect interchanges, or widening I-64 through targeted segments of the study area to address safety and congestion.

Major Widening Improvement Strategies

Major widening strategies include adding capacity to I-64 throughout the study area. These strategies were evaluated as a part of this study in an effort to evaluate all levels of strategies that could improve safety and congestion throughout the study area. Considering these strategies helped the Project Team compare the impacts of adding capacity throughout the corridor to the impacts of the TSMO and Spot and Safety improvements. Mitigating impacts to environmental resources surrounding the study area was critical to the development of any major widening strategy. These concepts can be considered long-term options if no other improvements are found to improve safety and congestion along this section of I-64.

5.2 Analysis for Improvement Strategy Development

Following the identification of improvement strategy types, a specific list of improvement strategies and locations was developed. This included the following:

Build Forecast and Traffic Analysis

Year 2025 and 2045 traffic forecasts for I-64 were generated based on evaluation of historical traffic growth analysis and consultation with the KIPDA Travel Demand Model that was updated and provided to the project team. The forecasts utilized traffic counts obtained from KYTC's traffic database, which included counts from 2019 and 2020.

The traffic forecasts for years 2025 and 2045 are applied in a Build scenario traffic analysis using *HCS7*. The five Build scenarios analyzed as a part of this study are as follows:

- Full Widening – Consists of widening I-64 throughout the study area adding a lane in each direction.
- Partial Widening – Consists of widening I-64 from Story Avenue to Grinstead Drive and Cannons Lane to I-264 adding a lane in each direction. The additional lanes will start and end at the ramps of each interchange.
- Modified Partial – Consists of widening I-64 from Story Avenue to Grinstead Drive and Cannons Lane to I-264 adding a lane in each direction. The additional lanes will be carried through the eastbound off-ramp / westbound on-ramp of the Grinstead Drive interchange terminating near the I-64 bridges over Grinstead Drive. Conversely, the additional lanes will be carried through the entire Cannons Lane interchange, terminating in between Cannons Lane and the Cochran Hill Tunnels.
- One Express Lane – Consists of widening I-64 and adding an express lane in between the eastbound and westbound lanes. The express lane is reversible and will be dedicated to westbound traffic during the AM peak period and to eastbound traffic during the PM peak period.
- Two Express Lanes – Consists of widening I-64 and adding two express lanes in between the eastbound and westbound lanes. The express lanes are reversible and will be dedicated to westbound traffic during the AM peak period and to eastbound traffic during the PM peak period.

Each 2045 Build scenario was compared to the 2045 No Build scenario discussed in **Chapter 2** to determine if congestion would be improved through adding capacity to this section of I-64. Based on this comparison, several conclusions were made:

- The Full Widening scenario improves I-64 operations to LOS D or better.
- The Partial Widening scenario improves I-64 operations to LOS D or better from Story Avenue to Grinstead Drive and Cannons Lane to I-264. A bottleneck is created where the lanes are added / dropped at interchange ramps, which affects a portion of the segments where widening occurs during the PM peak hour.
- The Modified Partial scenario improves I-64 operations to LOS D or better from Story Avenue to Grinstead Drive and Cannons Lane to I-264. A bottleneck is created where the additional lanes are dropped. Carrying the additional lanes through the interchanges is an improvement upon the operations of I-64 compared to the Partial Widening scenario.
- Both express lane scenarios improve I-64 operations to LOS D or better, with the exception of the exit and entry points of the express lane(s). The Two Lane Express Lane scenario is an improvement upon the operations of I-64 compared to the One Lane Express Lane scenario.

A summary of the traffic forecast volume results (AADT) is found in **Table 10**, and a summary of the No Build and Build scenario traffic analyses (LOS, V/C, and facility travel time) is found in **Table 11.** Level of Service for all mainline segments including all ramp merges and diverges are included in **Appendix B**.

Table 10. 2025 and 2045 Forecasted Traffic Volumes

Segment	Direction	2025 AADT	2025 Peak Hour Volume		2045 AADT	2045 Peak Hour Volume	
Peak Period			AM	PM		AM	PM
No Build							
Story Avenue to Grinstead Drive	EB	37,700	3,200	3,600	40,400	3,300	3,800
	WB	38,200	3,600	2,900	40,900	3,900	3,100
Grinstead Drive to Cannons Lane	EB	41,200	3,400	3,900	44,200	3,500	4,200
	WB	40,700	3,700	3,100	43,700	4,000	3,300
Cannons Lane to I-264	EB	37,700	3,100	3,500	40,400	3,100	3,700
	WB	39,200	3,300	3,000	42,000	3,500	3,200
Full Widening							
Story Avenue to Grinstead Drive	EB	45,000	3,700	4,200	49,700	4,000	4,600
	WB	45,000	4,100	3,200	49,700	4,600	3,600
Grinstead Drive to Cannons Lane	EB	48,400	3,900	4,600	53,500	4,300	5,000
	WB	47,700	4,200	3,500	52,700	4,700	4,000
Cannons Lane to I-264	EB	43,900	3,500	4,100	48,500	3,800	4,400
	WB	45,300	3,700	3,300	50,100	4,100	3,700
Partial Widening / Modified Partial Widening							
Story Avenue to Grinstead Drive	EB	40,600	3,400	3,900	43,800	3,700	4,200
	WB	41,200	3,700	3,000	44,200	4,000	3,200
Grinstead Drive to Cannons Lane	EB	42,400	3,400	4,000	45,300	3,700	4,300
	WB	42,100	3,700	3,100	45,000	4,000	3,300
Cannons Lane to I-264	EB	39,100	3,100	3,600	42,000	3,400	3,800
	WB	41,700	3,400	3,100	44,700	3,600	3,300
Express Lanes							
Story Avenue to Grinstead Drive	EB	44,800	3,200	1,900	49,500	3,400	2,100
	WB	44,300	1,700	2,900	48,900	1,900	3,200
Grinstead Drive to Cannons Lane	EB	48,100	3,400	2,200	53,100	3,600	2,500
	WB	46,800	1,800	3,100	51,700	2,000	3,500
Cannons Lane to I-264	EB	43,500	3,100	1,700	48,100	3,200	1,900
	WB	44,100	1,300	3,000	48,700	1,400	3,300

Table 11. 2025 and 2045 Traffic Analysis Summary

Segment	Direction	2025 Volume to Capacity Ratio (V/C)		2025 Level of Service (LOS)		2045 Volume to Capacity Ratio (V/C)		2045 Level of Service (LOS)	
Peak Period		AM	PM	AM	PM	AM	PM	AM	PM
No Build									
Story Avenue to	EB	0.86	0.89	D	F	0.89	0.86	D	F
Grinstead Drive	WB	0.96	0.78	E	D	0.89	0.83	F	D
Grinstead Drive	EB	0.92	0.92	E	F	0.94	0.92	E	F
to Cannons Lane	WB	0.99	0.84	F	D	0.93	0.89	F	E
Cannons Lane to	EB	0.83	0.82	D	D	0.83	0.79	D	D
I-264	WB	0.88	0.81	D	D	0.85	0.86	F	D
Facility Travel	EB	N/A	N/A	**7.00/D**	**8.30/F**	N/A	N/A	**7.10/D**	**9.60/F**
Time (min)/LOS	WB	N/A	N/A	**7.10/F**	**6.50/D**	N/A	N/A	**8.40/F**	**6.70/D**
Full Widening									
Story Avenue to	EB	0.66	0.75	C	D	0.72	0.82	C	D
Grinstead Drive	WB	0.74	0.57	C	C	0.83	0.65	D	C
Grinstead Drive	EB	0.70	0.83	C	D	0.77	0.90	D	E
to Cannons Lane	WB	0.76	0.63	D	C	0.85	0.72	D	C
Cannons Lane to	EB	0.63	0.73	C	D	0.68	0.79	C	D
I-264	WB	0.66	0.59	D	C	0.74	0.66	D	C
Facility Travel	EB	N/A	N/A	**6.60/C**	**6.70/D**	N/A	N/A	**6.60/C**	**7.00/F**
Time (min)/LOS	WB	N/A	N/A	**6.30/C**	**6.20/C**	N/A	N/A	**6.40/D**	**6.20/C**
Partial Widening									
Story Avenue to	EB	0.61	0.66	C	C	0.67	0.65	C	F
Grinstead Drive	WB	0.66	0.54	C	C	0.61	0.57	C	C
Grinstead Drive	EB	0.92	0.93	E	F	0.93	0.93	F	F
to Cannons Lane	WB	0.99	0.84	F	D	0.93	0.89	F	E
Cannons Lane to	EB	0.56	0.54	C	C	0.56	0.53	C	C
I-264	WB	0.61	0.56	C	C	0.62	0.59	C	C
Facility Travel	EB	N/A	N/A	**6.80/D**	**8.20/F**	N/A	N/A	**7.30/F**	**9.20/F**
Time (min)/LOS	WB	N/A	N/A	**6.80/F**	**6.30/C**	N/A	N/A	**7.90/F**	**6.40/C**
Modified Partial Widening									
Story Avenue to	EB	0.61	0.66	C	C	0.67	0.75	C	D
Grinstead Drive	WB	0.66	0.54	C	C	0.62	0.57	C	C
Grinstead Drive	EB	0.92	0.93	E	F	0.93	0.93	F	F
to Cannons Lane	WB	0.99	0.84	F	D	0.93	0.89	F	E
Cannons Lane to	EB	0.56	0.54	C	C	0.56	0.53	C	C
I-264	WB	0.61	0.56	C	C	0.64	0.59	C	C
Facility Travel	EB	N/A	N/A	**6.50/C**	**7.90/F**	N/A	N/A	**7.10/F**	**8.60/F**
Time (min)/LOS	WB	N/A	N/A	**6.60/F**	**6.30/C**	N/A	N/A	**7.90/F**	**6.40/C**
One-Lane Express Lane									
Story Avenue to	EB	0.86	0.73	D	D	0.89	0.84	D	D
Grinstead Drive	WB	0.68	0.78	C	D	0.69	0.83	C	D
Grinstead Drive	EB	0.92	0.81	E	D	0.94	0.95	E	E
to Cannons Lane	WB	0.71	0.84	C	D	0.72	0.89	D	E
Cannons Lane to	EB	0.83	0.63	D	C	0.83	0.74	D	F
I-264	WB	0.58	0.81	C	D	0.56	0.86	C	D
Facility Travel	EB	N/A	N/A	**7.00/D**	**6.70/D**	N/A	N/A	**7.10/D**	**7.80/F**
Time (min)/LOS	WB	N/A	N/A	**7.00/F**	**6.50/D**	N/A	N/A	**7.60/F**	**6.70/D**
Two-Lane Express Lane									
Story Avenue to	EB	0.86	0.52	D	C	0.89	0.60	D	C
Grinstead Drive	WB	0.46	0.78	B	D	0.45	0.83	B	D
Grinstead Drive	EB	0.92	0.60	E	C	0.94	0.70	E	C
to Cannons Lane	WB	0.49	0.84	B	D	0.47	0.89	B	E
Cannons Lane to	EB	0.83	0.43	D	B	0.83	0.55	D	C
I-264	WB	0.35	0.81	B	D	0.32	0.86	B	D
Facility Travel	EB	N/A	N/A	**7.00/D**	**6.70/F**	N/A	N/A	**7.10/D**	**6.70/F**
Time (min)/LOS	WB	N/A	N/A	**7.90/F**	**6.50/D**	N/A	N/A	**7.90/F**	**6.70/D**

Additional Crash Analysis

In addition to the crash analysis discussed in **Section 2.6**, further investigation showed relationships between groups of crashes. **Figure 20**, on the following page, illustrates the relationship between the direction and the time of day in which crashes occurred. From Story Avenue to Grinstead Drive, crashes occurred more frequently in the eastbound direction during the PM peak period, and from Cannons Lane to I-264, crashes occurred more frequently in the westbound direction during the AM peak period. A comparison between the No Build traffic analysis and crash frequency by direction suggested that as congestion increases within these two segments, so does crash frequency.

Geometric Constraints

The typical sections of I-64 and the typical sections of the Cochran Hill tunnels were assessed to determine the potential impacts of improvement strategies that include widening. With a 40-foot depressed median present in the I-64 normal typical section (**Section 2.3, Figure 5**), most widening can occur within the median (**Figure 18**). This minimizes impacts outside of the I-64 right of way and, therefore, environmental resources along the corridor. Conversely, widening I-64 to the outside (**Figure 19**) would create greater potential for impacts to resources outside of the I-64 right of way. As a result, it was determined that any improvement strategy that includes widening should utilize the depressed median to reduce impacts.

The typical section for the Cochran Hill Tunnels (**Section 2.3, Figure 6**) will not accommodate an additional lane without being modified. This information led to a variety of capacity-increasing improvement strategies, some of which exclude the segment of I-64 that contains the Cochran Hill Tunnels.

Figure 18. Normal Typical Section - Widen to the Inside

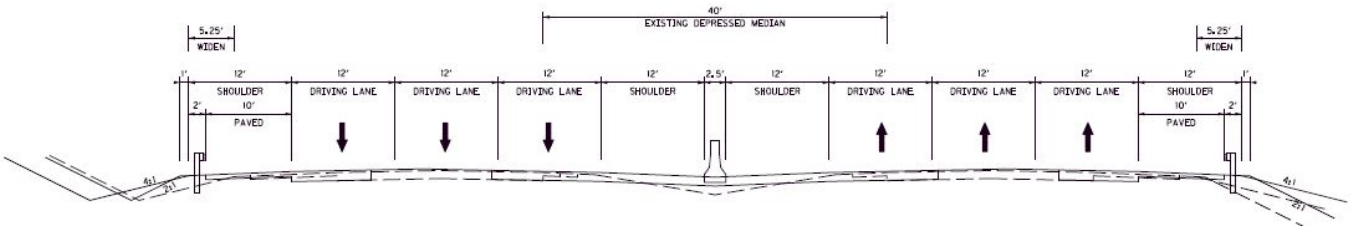


Figure 19. Normal Typical Section - Widen to the Outside

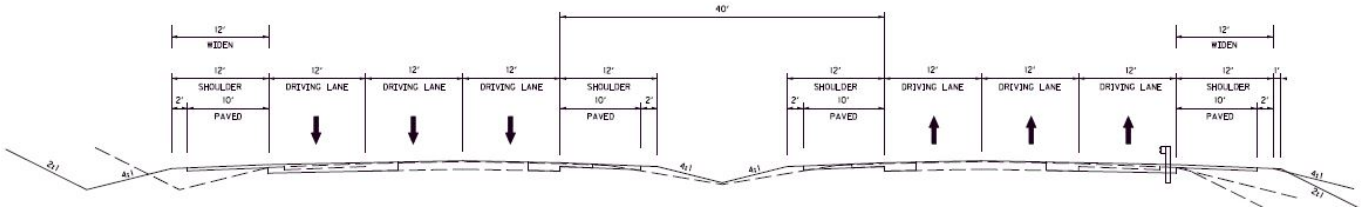
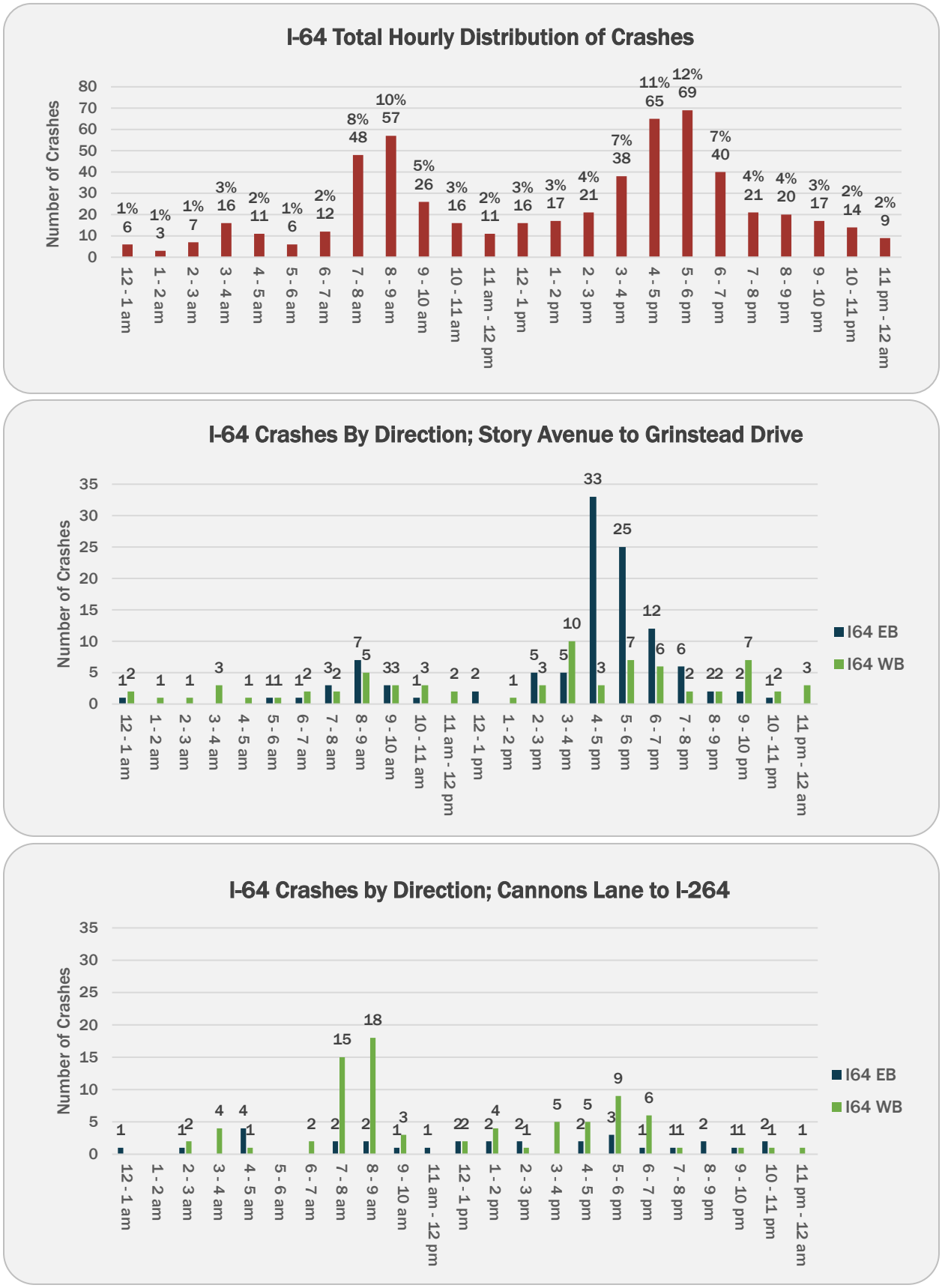


Figure 20. I-64 Crashes by Hour and Direction



5.3 Initial List of Improvement Strategies

Utilizing the gathered information, an initial list of improvement strategies was developed. **Table 12** provides a summary of the improvement strategies and their locations. The following information is compiled pertaining to each improvement strategy:

- Tunnel Strategy (e.g., work required on/to the tunnels associated with each improvement strategy)
- Number of Lanes
- Tunnel Impacts
- Roadway Capacity

These improvement strategies were presented to the Project Team for further review and additional analysis prior to the second public engagement effort.

5.4 Project Team Meeting No. 3

The third and final Project Team meeting was held on Monday, October 19, 2020, and was conducted virtually due to health and safety concerns resulting from the COVID-19 pandemic. A presentation was given by the consultant through an ArcGIS StoryMap. Attendees included KYTC Central Office staff, KYTC District 5 staff, FHWA, KIPDA, and the consultant teams. The materials presented and discussed during the meeting included:

- Public Outreach Effort – Survey No. 1 Results
- Additional Traffic Analysis
- Environmental Findings Update
- Geotechnical Findings
- Initial List of Improvement Strategies

Based on geotechnical and engineering findings, the consultant team concluded that any improvement strategy that would involve converting the Cochran Hill Tunnels from two tunnel sections to one tunnel is not feasible. The Project Team agreed to thoroughly review all other improvement strategies and provide input to the consultant team. Upon receiving feedback from all parties, the consultant team refined the list of improvement strategies which were presented to the LO/S and the public. For additional detail regarding information presented and discussed at the meeting, refer to the meeting minutes found in **Appendix E**.

Table 12. Initial List of Improvement Strategies

Strategy	Description	Tunnel Strategy	Number of Lanes	Tunnel Impacts	Capacity
Transportation Systems Management and Operations (TSMO)	Enhanced Traveler Information	Maintenance Only	Maintain 2 Lanes Each Direction	No Impacts	Maintains Existing Capacity
	Reversible Lanes Through the Tunnels and Along the Entire Corridor	Reversible Lanes Within the Existing Tunnels	2 Lanes Each Direction During Off-Peak and 3 and 1 During the Peak Periods	Existing Typical Section Doesn't Provide Adequate Width to Accommodate Movable Barrier	Increases Peak Direction Capacity While Decreasing Non-Peak Direction
	Ramp Metering at Grinstead and Cannons Interchanges	Maintenance Only	Maintain 2 Lanes Each Direction	No Impacts	Manages Existing Capacity
	HOV/Bus Lanes Utilizing Existing Roadway Width				
Spot and Safety	Widen Westbound Lane Between Cannons and I-264 and Eastbound Lane Between Story and Grinstead	Maintenance Only	Maintain 2 Lanes Each Direction with Spot Improvement Widening	No Impacts	Increases Capacity West of Grinstead and East of Cannons
	Extend Acceleration and Deceleration Lanes at Interchanges		2 Lanes Each Direction		Increases Ramp Capacity
	Develop Auxiliary Lanes Between Mellwood and Grinstead Interchanges and Cannons and I-264 Interchanges		Maintain 2 Lanes Each Direction with Auxiliary Lanes		Increases Capacity West of Grinstead and East of Cannons
	Widen I-64 to 3 Lanes in Each Direction West of Grinstead and East of Cannons	Maintenance Only	3 Lanes Each Direction West of Grinstead and East of Cannons and Maintain 2 Lanes Each Direction in between	No Impacts	Increases Capacity West of Grinstead and East of Cannons; Maintains Capacity Between Grinstead and Cannons
Major Widening	Widen I-64 to 3 Lanes in Each Direction; Widen to the Inside of the Existing Lanes; Existing Tunnels Widened to the Outside	Widen Tunnels to the Outside: 3 Lanes Each Direction	3 Lanes Each Direction	Avoids Electrical System Between Tunnels; Can't be Widened Under Traffic	Increases Capacity Throughout Corridor
	Widen I-64 to 3 Lanes in Each Direction; Widen to the Inside of the Existing Lanes; Existing Tunnels Widened to the Inside	Widen Tunnels to the Inside: 3 Lanes Each Direction		Impacts Electrical System and Narrows Pillar; Can't be Widened Under Traffic	
	Widen I-64 to 3 Lanes in Each Direction; Widen to the Inside of the Existing Lanes; Existing Tunnels Widened on Center	Widen Tunnels On Center: 3 Lanes Each Direction		Impacts Electrical System; Can Potentially be Widened Under Traffic	
	Widen I-64 to 3 Lanes in Each Direction; Widen to the Inside of the Existing Lanes; Existing Tunnels Converted to 1 Tunnel	Convert Two Tunnels to 1 Tunnel	3 Lanes Each Direction	Not Considered Feasible	
	Widen I-64 to 3 Lanes in Each Direction; Widen to the Inside of the Existing Lanes and Have a Reduced Shoulder Width; Existing Tunnels Widened or Converted to 1 Tunnel	Widen Tunnels or Convert 2 Tunnels to 1 Tunnel	3 Lanes Each Direction	Varies	
	Widen I-64 to 3 lanes in Each Direction; Widen to the Outside of the Existing Lanes; Existing Tunnels Widened or Converted to 1 Tunnel		3 Lanes Each Direction	Varies	
	Widen I-64 to 3 Lanes in Each Direction East and West of the Tunnels; Construct a 3rd Tunnel to the South to Accommodate EB traffic; the Existing EB Tunnel Will be Dedicated to Traffic in the Peak Direction	Maintain Existing 2 Tunnels and Add Third Tunnel to the South	3 Lanes Each Direction (Except at Tunnels - 4 and 2)	Maintains Existing Tunnels; Construct 3rd Tunnel	Increases Capacity Throughout Corridor Except at Tunnel for the Non-Peak Direction
	Widen I-64 to 3 Lanes in Each Direction East and West of the Tunnels; Construct a 3rd Tunnel to the North to Accommodate WB traffic; the Existing WB Tunnel will be Dedicated to Traffic in the Peak Direction	Maintain Existing2 Tunnels and Add 3rd Tunnel to the North	3 Lanes Each Direction (Except at Tunnels - 4 and 2)	Maintains Existing Tunnels; Construct 3rd Tunnel	
	Widen I-64 to 3 Lanes in Each Direction East and West of the Tunnels; Construct a 3rd Tunnel to the North or South and Widen Middle Tunnel to Accommodate 2 Way Traffic	Maintain Existing 2 Tunnels and Add 3rd Tunnel to the North or South	3 Lanes Each Direction	Maintain 1 Tunnel; Widen 1 Tunnel; Construct 3rd Tunnel	Increases Capacity Throughout Corridor
	Construct 1 Express/Reversible Lane Between Story and I-264; Existing Tunnels Converted to 1 Tunnel	Convert 2 Tunnels to 1 Tunnel	Maintain 2 Lanes Each Direction; Add 1 Express Lane	Not Considered Feasible	Increases Peak Hour Capacity for Peak Direction
	Construct 1 Express/Reversible Lane between Story and I-264; Construct New Tunnel North or South of I-64; the Existing Tunnel in the Middle will be Dedicated to the Express Lane	Maintain Existing 2 Tunnels and Add 3rd Tunnel to the North or South	Maintain 2 Lanes Each Direction; Add 1 Express Lane	Maintains Existing Tunnels; Construct 3rd Tunnel	
	Construct 2 Express/Reversible Lanes between Story and I-264; Existing Cochran Hill Tunnels Converted to 1 Tunnel	Convert 2 Tunnels to 1 Tunnel	Maintain 2 Lanes Each Direction; Add 2 Express Lanes	Not Considered Feasible	
	Construct 2 Express/Reversible Lane between Story and I-264; Construct New Tunnel North or South of I-64; the Existing Tunnel in the Middle will be Dedicated to the Express/Reversable Lanes	Maintain Existing 2 Tunnels and Add 3rd Tunnel to the North or South	Maintain 2 Lanes Each Direction; Add 2 Express Lanes	Maintains Existing Tunnels; Construct 3rd Tunnel	
	Use the shoulder to Accommodate an Additional Lane of Traffic in the Peak Hour(s); Existing Tunnels Converted to 1 Tunnel to Accommodate Full Shoulders	Convert 2 Tunnels to 1 Tunnel	3 Lanes Each Direction During Peak Hours	Not Considered Feasible	Increases Peak Hour Capacity
	Use the Shoulder to Accommodate an Additional Lane of Traffic in the Peak Hour(s); Widen the Existing Tunnels to Accommodate Full Shoulders	Widen Existing 2 Tunnels	3 Lanes Each Direction During Peak Hours	Varies	

5.5 Revised List of Improvement Strategies

Utilizing the gathered information and input from the Project Team, the initial list of improvement strategies was reduced from 18 to 13. This reduction included both eliminating initial improvement strategies and adding improvement strategies. **Table 13** provides a summary of how initial improvement strategies were modified, and **Table 14** provides a summary of the revised list of improvement strategies. Any environmental concern associated with each improvement strategy was added to the revised list. It is important to note that any potential improvement strategy that would involve widening the existing Cochran Hill Tunnels would require additional geotechnical and environmental studies to better determine impacts and potential mitigation to both the existing Cochran Hill Tunnel sections and Cherokee Park.

Table 13. Improvement Strategy Modifications

Description	Modification
Transportation Systems Management and Operations (TSMO)	
Advance Warning System	**Added –** Stakeholders have observed and analysis showed there is queuing present at the Grinstead Drive interchange westbound off-ramp. When this queuing backs up onto the interstate, vehicles traveling westbound will be notified to proceed with caution prior to entering the Cochran Hill Tunnel.
Spot and Safety	
Extend Acceleration and Deceleration Lanes at Interchanges	**Modified -** Due to delay caused by the traffic signal on Grinstead Drive, vehicles queue from the signal onto the I-64 westbound off-ramp. Stakeholders noted during peak this queue can stretch back to I-64 westbound mainline and affect through traffic. Adding storage to this ramp in the form of a dual left turn lane at the intersection of the I-64 westbound ramps and Grinstead Drive has been added to this improvement strategy.
Major Widening	
Widen I-64 to 3 Lanes in Each Direction; Widen to the Inside of the Existing Lanes; Existing Tunnels Widened to the Outside	**Eliminated -** Not feasible at this time due to preliminary geotechnical findings and complexity and cost in widening the tunnels to the outside.
Widen I-64 to 3 Lanes in Each Direction; Widen to the Inside of the Existing Lanes; Existing Tunnels Widened to the Inside	**Eliminated -** Not feasible at this time due to preliminary geotechnical findings and complexity and cost in widening the tunnels to the inside.
Widen I-64 to 3 Lanes in Each Direction; Widen to the Inside of the Existing Lanes and Have a Reduced Shoulder Width; All Tunnel Variations	**Eliminated -** Not feasible at this time due to preliminary geotechnical findings and complexity and cost in widening the tunnels to the outside/inside. Reduced shoulder width is not desired.
Widen I-64 to 3 lanes in Each Direction; Widen to the Outside of the Existing Lanes; All Tunnel Variations	**Eliminated -** Widening to the outside would result in impacting multiple environmental resources, including parks, historic sites and districts, Beargrass Creek, and others.
Widen I-64 to 3 Lanes in Each Direction East and West of the Tunnels; Construct a 3rd Tunnel to the North or South and Widen Middle Tunnel to Accommodate 2 Way Traffic	**Eliminated -** Would require both constructing a new tunnel and widening one existing tunnel. Other improvement strategies affecting the tunnels include one or the other.
Use the Shoulder to Accommodate an Additional Lane of Traffic in the Peak Hour(s); Widen the Existing Tunnels to Accommodate Full Shoulders	**Eliminated -** This strategy would still require some widening throughout the corridor and widening both tunnels and only increases capacity during the peak hour.

Table 14. Revised List of Improvement Strategies

Strategy	Description	Tunnel Strategy	Number of Lanes	Tunnel Impacts	Capacity	Right-of-Way Impacts	Environmental Concerns
Transportation Systems Management and Operations (TSMO)	Enhanced Traveler Information	Maintenance Only	Maintain 2 Lanes Each Direction	No Impacts	Maintains Existing Capacity	No R/W Impacts Anticipated	None
	Advance Warning System						
	Ramp Metering at Grinstead and Cannons Interchanges					Minimum R/W may be Required at Ramp Termini	Minimal impacts dependent on R/W. These impacts would not interfere with existing use of the surrounding environmental resources.
	HOV/Bus Lanes Utilizing Existing Roadway Width					No R/W Impacts Anticipated	None
Spot and Safety	Widen Westbound Lane Between Cannons and I-264 and Eastbound Lane Between Story and Grinstead	Maintenance Only	Maintain 2 Lanes Each Direction with Spot Improvement Widening	No Impacts	Increases Capacity West of Grinstead and East of Cannons	Minimum R/W may be Required	Widening could potentially occur within the existing right of way and, if so, environmental impacts would not occur. However, if additional right of way is required, impacts to the Beargrass Creek Greenway at Irish Hill would be likely. Noise impacts to sensitive land uses are anticipated (e.g., residences, parks, etc.).
	Extend Acceleration and Deceleration at Interchanges		2 Lanes Each Direction		Increases Ramp Capacity	Minimum R/W may be Required at Ramps	Minimal impacts dependent on R/W. These impacts would not interfere with existing use of the surrounding environmental resources; however, considering the parks designation as Section 6(f) and Section 4(f) resources, their listing, or likely listing, on the NRHP, and Beargrass Creek's listing as an impaired stream, even small amounts of impacts would likely require thorough studies and coordination.
	Develop Auxiliary Lanes Between Mellwood and Grinstead Interchanges and Cannons and I-264 Interchanges		Maintain 2 Lanes Each Direction with Auxiliary Lanes		Increases Capacity West of Grinstead and East of Cannons; Maintains Capacity Between Grinstead and Cannons	Minimum R/W may be Needed West of Grinstead and East of Cannons	Widening could potentially occur within the existing right of way and, if so, environmental impacts would not occur. However, if additional right of way is required, impacts to the Beargrass Creek Greenway at Irish Hill would be likely. Noise impacts to sensitive land uses are anticipated (e.g., residences, parks, etc.).
	Widen I-64 to 3 Lanes in Each Direction West of Grinstead and East of Cannons		3 Lanes Each Direction West of Grinstead and East of Cannons and Maintain 2 Lanes Each Direction In between				
Major Widening	Widen I-64 to 3 Lanes in Each Direction; Widen to the Inside of the Existing Lanes; Existing Tunnels Widened on Center	Widen Tunnels on Center: 3 Lanes Each Direction	3 Lanes Each Direction	Impacts Electrical System; Can Potentially be Widened Under Traffic	Increases Capacity Throughout Corridor	Minimum R/W may be Required	Widening to the inside would avoid impacting many of the environmental resources through the corridor. However, widening the existing tunnels on center would directly impact these historic structures. In addition, there are potential impacts to the park above the tunnels. Extensive studies, coordination, and public involvement to determine impacts and potential mitigation to both the existing Cochran Hill Tunnels and to Cherokee Park would be necessary. Noise impacts to sensitive land uses are anticipated (e.g., residences, parks, etc.).
	Widen I-64 to 3 Lanes in Each Direction East and West of the Tunnels; Construct a 3rd Tunnel to the South to Accommodate EB traffic; the Existing EB Tunnel Will be Dedicated to Traffic in the Peak Direction	Maintain Existing Two Tunnels and Add Third Tunnel to the South	3 Lanes Each Direction (Except at Tunnels - 4 and 2)	Maintains Existing Tunnels; Construct 3rd Tunnel	Increases Capacity Throughout Corridor Except at Tunnel for the Non-Peak Direction	Minimum R/W may be Required Except at Tunnels Where 3rd Tunnel Will Require Additional R/W	Widening to three lanes could be completed with minimal impacts to environmental resources but constructing a third tunnel to the south would impact Cherokee Park. The process required by Section 106, Section 4(f), and Section 6(f) would be applicable. Noise impacts to sensitive land uses are anticipated (e.g., residences, parks, etc.).
	Widen I-64 to 3 Lanes in Each Direction East and West of the Tunnels; Construct a 3rd Tunnel to the North to Accommodate WB traffic; the Existing WB Tunnel will be Dedicated to Traffic in the Peak Direction	Maintain Existing Two Tunnels and Add 3rd Tunnel to the North					
	Construct 1 Express/Reversible Lane between Story and I-264; Construct New Tunnel North or South of I-64; the Existing Tunnel in the Middle will be Dedicated to the Express Lane	Maintain Existing Two Tunnels and Add 3rd Tunnel to the North or South	Maintain 2 Lanes Each Direction; Add 1 Express Lane		Increases Peak Hour Capacity	Requires Additional R/W Including at Tunnel Where Third Tunnel Will Require Additional R/W	A new tunnel, whether north or south, would result in impacts to Cherokee Park. Impacts to the tunnels are also possible. Constructing an express / reversible lane may also impact other resources in the corridor, including Beargrass Creek at Irish Hill, Seneca Park, and others. These improvement strategies have a wider footprint than adding a lane in each direction with the majority of widening occurring in the median. Noise impacts to sensitive land uses are anticipated (e.g., residences, parks, etc.).
	Construct 2 Express/Reversible Lane between Story and I-264; Construct New Tunnel North or South of I-64; the Existing Tunnel in the Middle will be Dedicated to the Express/Reversable Lanes	Maintain Existing Two Tunnels and Add 3rd Tunnel to the North or South	Maintain 2 Lanes Each Direction; Add 2 Express Lanes			Requires Additional R/W Including at Tunnel Where Third Tunnel Will Require Additional R/W	

Chapter 6 – Additional Engagement Efforts

Additional engagement efforts included the final LO/S meeting and the final public outreach efforts. The meeting with LO/S was an opportunity to share results from the first public outreach effort, provide additional information and analysis that led to the list of revised improvement strategies, and to gather input from various perspectives on identifying areas of concern resulting from the improvement strategies presented. The information presented during this meeting was provided to the community during the final public outreach effort to gather further input on the improvement strategies.

6.1 Local Officials / Stakeholder Meeting No. 2

The second LO/S meeting was held on Tuesday, Dec 8, 2020, to present additional study findings and analysis and collect input on the revised list of improvement strategies (See Table 14). The meeting was conducted virtually due to health and safety concerns resulting from the COVID-19 pandemic. The invitation list was prepared by the consultant team with input from KYTC. Attendees included representatives from various local jurisdictions (state representatives, mayors, city council members, local public service organizations etc.), local police departments, CSX railroad, Louisville Regional Airport Authority, and the Kentucky Heritage Council. A presentation was given by the consultant through an ArcGIS StoryMap. The materials presented and discussed during the meeting included:

- Public Outreach Effort – Survey No. 1 Results
- Additional Traffic Analysis – Build Scenarios
- Environmental Resources Near the Study Area
- Revised Improvement Strategies
- Public Outreach Survey No. 2

For additional detail regarding information presented and discussed and survey poll responses during the meeting, refer to the meeting minutes found in **Appendix E**.

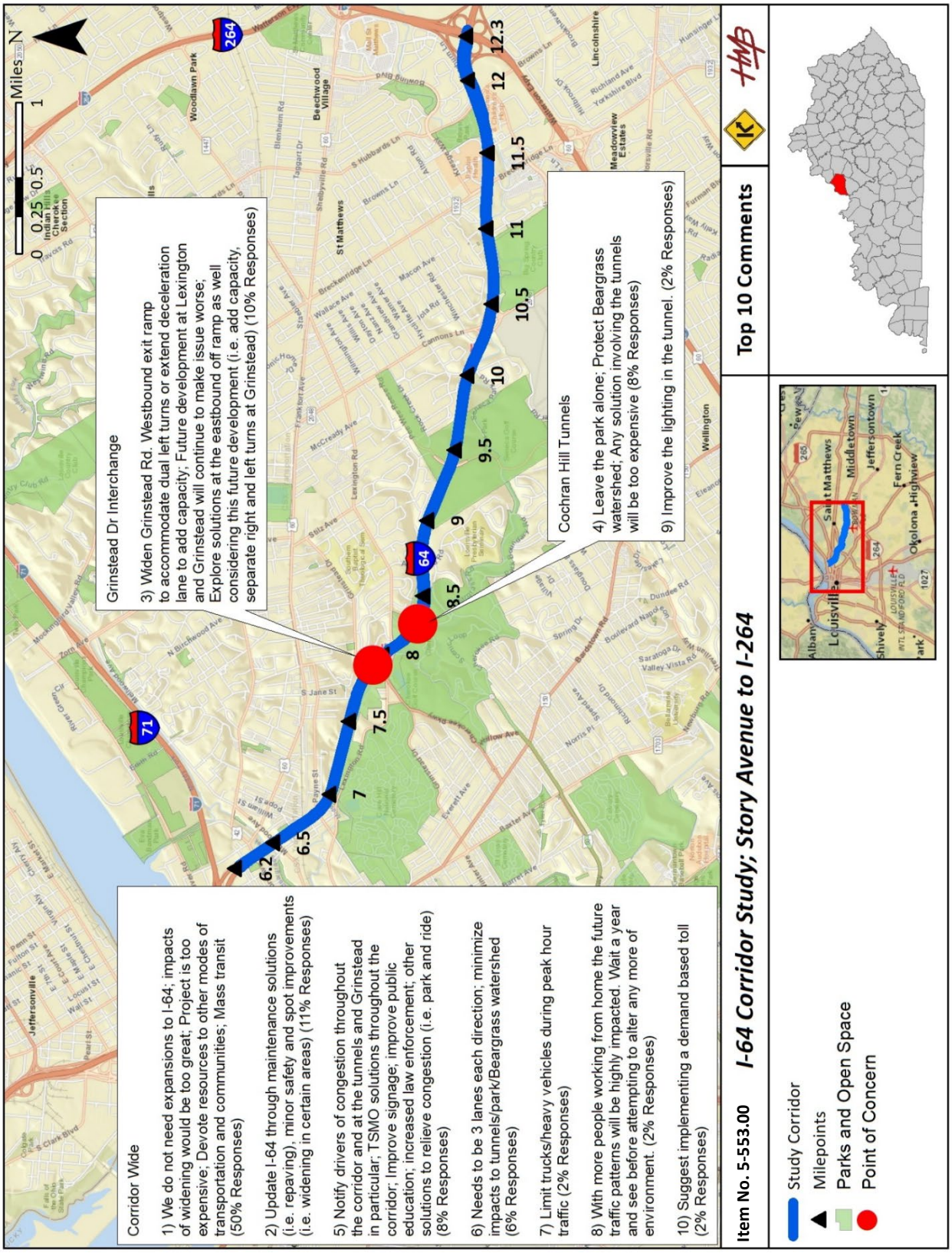
6.2 Public Outreach Effort – Survey No. 2

The second public outreach effort was held from December 10, 2020, to January 10, 2021, and was conducted virtually due to health and safety concerns resulting from the COVID-19 pandemic. A presentation was provided in the form of an ArcGIS StoryMap, including the information compiled and presented at the final Project Team and LO/S meetings. The presentation concluded with an online survey from which 757 responses were received. The survey focused on the revised list of improvement strategies developed by the Project Team (Table 14). Key statistics from the survey results are as follows:

- 54 percent of responses do not support any improvements to this section of I-64, while another 12 percent were not sure.
- However, when participants were asked about specific improvement strategies, 61 percent supported at least one TSMO improvement strategy.
- When asked to select one major widening strategy along this section of I-64, 72 percent chose “None of the Above”, while 20 percent preferred “Widen to the Inside to Provide Three Lanes in Each Direction; Existing Tunnels Widened on Center”.

Many survey respondents provided additional comments providing thoughts on the plan for this section of I-64 going forward. The most frequently received comments can be found in **Figure 21.** The full survey and a summary of responses can be found in **Appendix E.**

Figure 21. Top 10 Comments from Public Survey



Chapter 7 – Study Outcomes

Based on the operational and safety analysis, environmental considerations, Project Team input, LO/S input, and public feedback, five improvement strategies were considered in more detail and are discussed in the following sections.

7.1 Final Evaluation of Improvement Strategies

Five improvement strategies were evaluated in more detail to quantify planning-level cost estimates, constructability, and potential right-of-way and environmental impacts. These improvement strategies are described in **Table 15**.

Table 15. Improvement Strategies Evaluated in More Detail

Improvement Strategy	Description
A	Provide Advance Warning System for Westbound I-64 at Grinstead Drive
B	Extend Acceleration and Deceleration Lanes at Mellwood Avenue, Grinstead Drive WB On Ramp, Cannons Lane, and I-64 Westbound On Ramp
C	Widen I-64 Off Ramp to Grinstead to Provide Dual Lefts onto Grinstead Drive
D	Widen I-64 to the Inside to Provide Auxiliary Lanes Between Mellwood Avenue and Grinstead Drive and Cannons Lane and I-264
E	Widen I-64 to Three Lanes in Each Direction to the Center, and Widen Each Tunnel on Center

Public Input

As discussed in Section 6.2, the majority (54 percent) of public survey participants did not feel any improvements were needed along this section of I-64. However, when asked about specific improvement strategies, greater support existed. For the TSMO strategies, the Advance Warning System strategy received the highest support at 61 percent. For the Spot and Safety strategies, each were scored individually on a scale of one to five. Extending Acceleration and Deceleration Lanes at Grinstead Drive and Cannons Lane Interchanges received the strongest support with an average score of 2.8. Developing Auxiliary Lanes between Mellwood Avenue and Grinstead Drive and Cannons Lane and I-264 received the next highest score; however, it received an average score of 2.0.

The public strongly opposed all Major Widening Strategies with 72 percent selecting the "none of the above" option. However, 20 percent responded that of all of the widening strategies presented, they preferred the strategy *Widen to the Inside to Provide Three Lanes in each Direction and to Widen the Existing Tunnels on Center*. This preference was greater than all other Major Widening Strategies combined.

Planning-Level Conceptual Modeling

As illustrated in **Section 5.2**, **Figure 18**, widening one lane in each direction on the inside will require an additional 5.25 feet of pavement beyond what is currently provided. Using this typical section as a template, additional modeling was conducted to better identify the project disturb limits and understand potential right of way impacts. Based on this additional analysis, outside of

the Cochran Hill Tunnels, it was determined minimal right of way would be required along the corridor. The right of way impacts identified could potentially be mitigated by shifting the alignment and/or by utilizing retaining walls. These assumptions would need to be confirmed during a potential future phase, once more detailed survey and geotechnical data is gathered, but these preliminary assumptions helped form the basis for the planning-level cost estimates and right of way and environmental impacts discussed below.

Planning-level Cost Estimates

Planning-level (high-level) cost estimates were produced for each of the improvement strategies by estimating the 2020 construction costs. No surveying or detailed design was performed. Construction quantities such as pavement, earthwork, structures, traffic items, etc. were estimated for each improvement strategy to determine the planning-level construction cost. Factors were applied to increase this amount to account for contingencies, miscellaneous items not estimated, and small-project inflation. Construction costs are included on each summary sheet.

Right of Way and Environmental Impacts

For the Advance Warning System (Strategy A), no right of way would be acquired, the tunnels would not be affected, and the environmental resources would not be impacted. There are no environmental concerns with this improvement option.

Numerous environmental resources surround the interchanges. Not all existing ramps are recommended for acceleration or deceleration lane extensions due to the proximity to the tunnel and other right-of-way and environmental constraints. To accommodate Improvement Strategies B and C, direct impacts to the resources would likely be minimal and would not interfere with the resources use; however, considering some of the park designations as Section 6(f) and Section 4(f) resources, their listing, or eligible listing, on the NRHP, and Beargrass Creek listing as an impaired stream, even small amounts of impacts would likely require thorough studies and coordination.

No impacts to the tunnels would be anticipated for adding an auxiliary lane between each interchange (Improvement Strategy D). If the existing median is utilized, as is recommended for all widening strategies, there is the potential for the improvement strategy to be constructed with minimal right of way acquired. In that case, most environmental impacts may be avoided. One exception could be noise impacts. This strategy adds capacity to I-64 and increases the likelihood of noise impacts to noise sensitive land uses such as homes and parks. It's anticipated that the growth in traffic would cause noise impacts to these areas. A noise analysis will be required to determine the degree of these noise impacts and to evaluate the ability of noise barriers to attenuate the noise level. While not recommended, if the auxiliary lane is constructed to the outside, impacts to the parks, historic areas, or other environmental resources are likely and could be significant.

Improvement Strategy E, widening to three lanes in each direction to the center, and widening each tunnel on center, would avoid impacting many of the environmental resources through the corridor, but would directly impact the Cochran Hill Tunnels and potentially impact Cherokee Park above the tunnels. As described in the *Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System,* the Cochran Hill Tunnels are of exceptional significance to the development of environmentally sensitive design in the area of transportation engineering. These underground tunnels were constructed in 1974 to preserve the National Register site directly above the highway. The site is Cherokee Park, a verdant landscape designed by Frederick Law Olmsted, which is part of the larger Olmsted Park system in Louisville. Kentucky Highway engineers and Vollmer Associates, Inc., in consultation with the general public, developed these environmentally sensitive tunnels to avoid destroying the important Olmsted landscape. These unique, groundbreaking tunnels were the first attempts to ameliorate the effects of highway construction

on a Kentucky roadway. Extensive studies, coordination, and public involvement to determine impacts and potential mitigation to both the existing Cochran Hill Tunnels and to Cherokee Park would be required. Both resources would follow the process of a Section 106 and Section 4(f) for historic properties. Cherokee Park would also require consideration as a Section 6(f) resource. As with Improvement Strategy D, this strategy adds capacity to I-64 and increases the likelihood of noise impacts to noise sensitive land uses such as homes and parks.

7.2 Conclusions

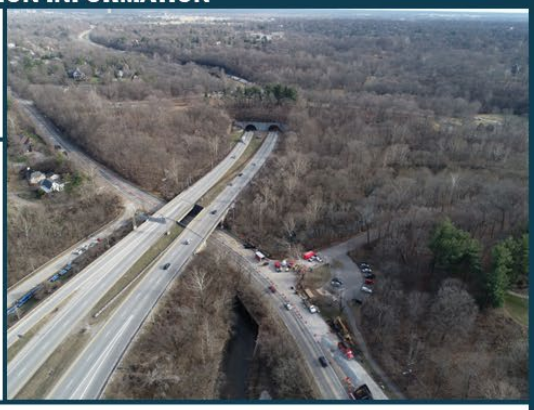
The Project Team concluded that based on the current conditions, traffic projections, engineering analysis, and public feedback, **only Improvement Strategies A, B, and C are recommended as high priority, short term strategies**. **Improvement Strategy D** is recommended for further consideration. It should be considered a **low priority, long term solution** for the corridor that will require additional traffic analysis to confirm the potential congestion benefits. The improvement strategies are presented in **Figures 22** through **25**.

While Improvement Strategy E was considered in more detail, it was found to **not be feasible at this time** given the extensive project cost, potential environmental impacts, and public opposition.

If any of the assumptions made in this study substantially change in the future, these conclusions may need to be revisited.

Figure 22. Improvement Strategy A - Advance Warning System

LOCATION INFORMATION



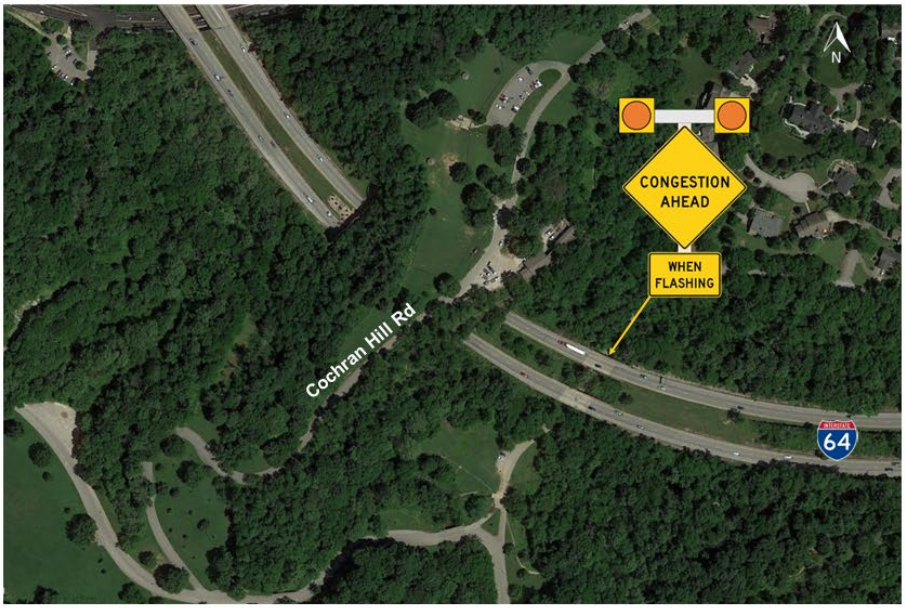
Key Details

- Maintains existing roadway capacity
- No impact to the Cochran Hill Tunnels
- Minimal to no right of way impacts

Issues

- I-64 is a heavily traveled corridor that experiences congestion during the peak hours, particularly at the interchanges and Cochran Hill Tunnels.
- Vehicles using the Grinstead Dr. WB off ramp are known to queue near or into mainline I-64, impeding the right through lane of I-64 WB.
- Interstate travel speeds and limited sight distance due to the Cochran Hill Tunnels.
- Public Feedback: 61% of responses indicated support for installation of an advance warning system at this location.

IMPROVEMENT CONCEPT



Provide Advance Warning System for WB I-64 at Grinstead Drive / Cochran Hill Tunnels

- Install advance warning system prior to the Cochran Hill Tunnels in the WB direction.
- This system will detect queuing on the WB off ramp of the Grinstead Dr. interchange.
- It will alert motorists traveling on I-64 WB if queuing vehicles are encroaching on the through lanes of I-64.

A

TSMO

PRIORITY

HIGH

LOCATION

I-64 / GRINSTEAD DR. INTERCHANGE (WESTBOUND TRAFFIC) MP 8.065

DATA

56% of the crashes that occurred from 2016 to 2019 between the WB Cochran Hill Tunnels and the Grinstead Dr. WB off ramp were rear end crashes

COST ESTIMATE / IMPACTS

2020 Dollars

Environmental Impact:
None

ROW Impact:
None

Utility Impact:
Low

Construction Cost:
$80,000

Figure 23. Improvement Strategy B - Extend Acceleration and Deceleration Lanes at Mellwood Avenue, Grinstead Drive WB On Ramp, Cannons Lane, and I-264 WB On Ramp Interchanges

LOCATION INFORMATION

INTERSTATE 64

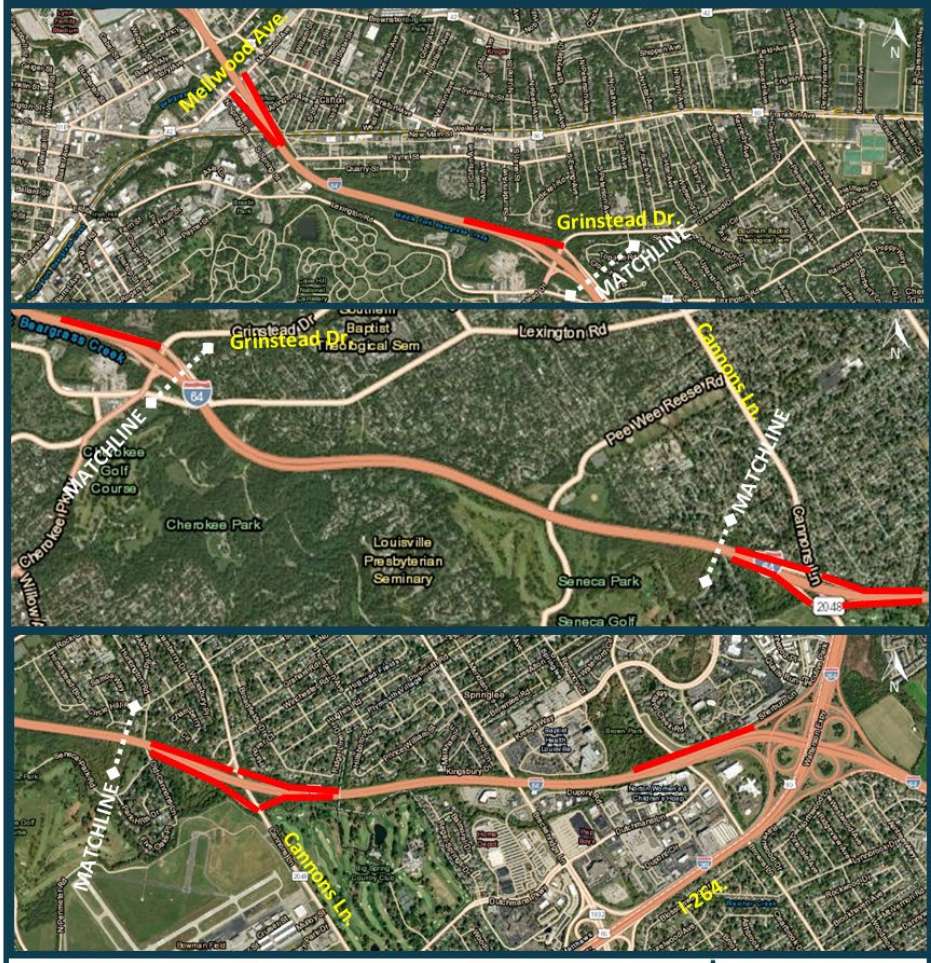
Key Details

- Primary goal of this strategy is to address safety and congestion at interchanges within the corridor
- No impact to the Cochran Hill Tunnels
- Minimal to no right of way impacts are anticipated

Issues

- Congestion prevalent at interchanges during the peak hours.
- Vehicles queuing at interchange ramps during the peak hours can impede I-64 mainline traffic and/or ramp deceleration areas.
- According to the crash density map, crashes are more prevalent at merge/diverge areas near interchanges.
- Mellwood Ave. EB On-Ramp to I-64 does not meet standards for acceleration length.
- Public Feedback: This improvement strategy scored highest among spot and safety improvements with an average score of 2.8 (rating from 1-5).

IMPROVEMENT CONCEPT



Extend Acceleration and Deceleration Lanes at Mellwood Avenue, Grinstead Drive WB On Ramp, Cannons Lane, and I-64 Westbound On Ramp

- Provides additional storage and acceleration/deceleration merge/diverge area.

Construction Cost Per Interchange (2020 Dollars):

Mellwood:	$1.4m
Grinstead:	$770k
Cannons:	$3.7m
I-264:	$770k

B

SPOT & SAFETY

PRIORITY

HIGH

LOCATION

MELLWOOD AVE., GRINSTEAD DR., CANNONS LN., & I-264 INTERCHANGES

DATA

41% of all crashes that occurred from 2016 to 2019 occurred during the peak hours

71% of all crashes that occurred from 2016 to 2019 were rear ends or side swipe/same direction

Excess Expected Crashes (EEC) for the entire corridor from 2016 to 2019 is 625

COST ESTIMATE / IMPACTS

2020 Dollars

Environmental Impact:

Would not interfere with surrounding environmental resources, however, considering the parks designation as Section 6(f) and Section 4(f) resources, their listing, or likely listing, on the NRHP, and Beargrass Creeks listing as an impaired stream, even small amounts of impacts would likely require thorough studies and coordination.

ROW Impact:

Low

Utility Impact:

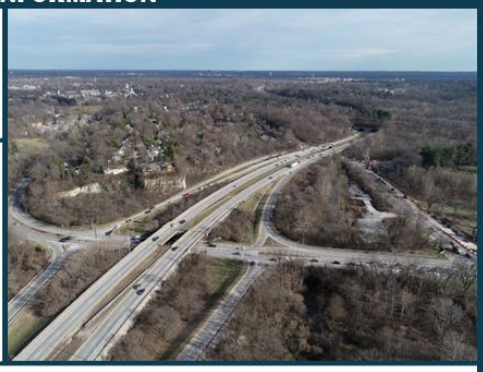
Low

Construction Cost:

$6,700,000

Figure 24. Improvement Strategy C – Widen I-64 WB Off Ramp to Grinstead Drive to Provide Dual Lefts Onto Grinstead Drive

LOCATION INFORMATION



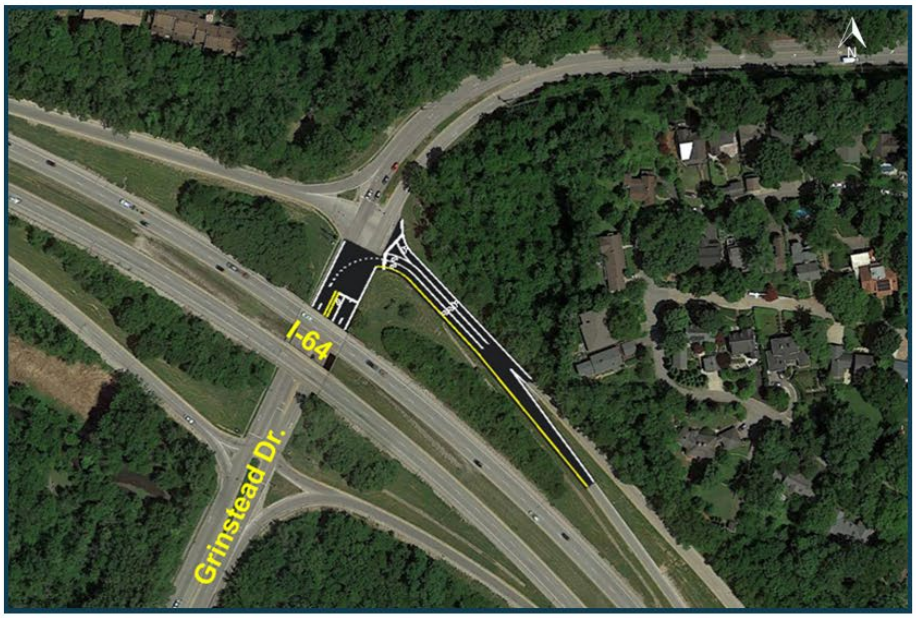
Key Details

- Primary goal of this strategy is to address safety and congestion at the Grinstead Drive interchange.
- No impact to the Cochran Hill Tunnels
- Minimal to no right of way impacts are anticipated

Issues

- Congestion prevalent at interchange during the peak hours.
- Vehicles queuing at interchange ramp during the peak hours can impede I-64 mainline traffic and/or ramp deceleration areas.
- According to the crash density map, crashes are more prevalent at merge/diverge areas near interchanges.
- Public Feedback: This improvement strategy was grouped with the extension of acceleration and deceleration lanes which collectively scored highest among spot and safety improvements with an average score of 2.8 (rating from 1-5).

IMPROVEMENT CONCEPT



Widen I-64 Off Ramp to Grinstead Drive to Provide Dual Lefts onto Grinstead Drive

- Due to the proximity to the WB Cochran Hill Tunnel, extending the deceleration length for the Grinstead Drive WB off-ramp would be difficult. As an alternative strategy to Improvement Option B at this interchange, widening the I-64 WB off ramp to provide dual left turn lanes onto Grinstead Dr. is recommended.

C

SPOT & SAFETY

PRIORITY

HIGH

LOCATION

GRINSTEAD DR. INTERCHANGE

DATA

38% of crashes that occurred in this WB segment from Grinstead to the tunnels from 2016 to 2019 occurred during the peak hours.

64% of all crashes in this segment were rear ends or side swipe/same direction

Excess Expected Crashes: Grinstead to Cannons – 223

COST ESTIMATE / IMPACTS

2020 Dollars

Environmental Impact:
None

ROW Impact:
None

Utility Impact:
Low

Construction Cost:
$660,000

Figure 25. Improvement Strategy D - Auxiliary Lanes between Mellwood Avenue and Grinstead Drive and Cannons Lane and I-264

LOCATION INFORMATION

INTERSTATE 64

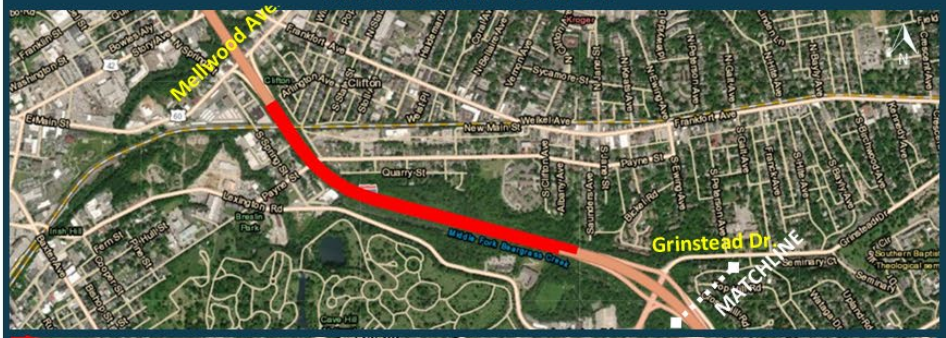
Key Details

- Primary goal of this strategy is to address safety and congestion at interchanges within the corridor
- No impact to the Cochran Hill Tunnels
- Existing LOS ranges from LOS D to LOS F in these sections of I-64 (peak hours)

Issues

- Congestion prevalent at interchanges during the peak hours
- Vehicles queuing at interchange ramps during the peak hours can impede on I-64 mainline traffic and/or ramp deceleration areas.
- Crashes are more prevalent at merge/diverge areas near interchanges.
- Public Feedback: This improvement scored second highest among spot and safety improvements with an average score of 2.0 (rating from 1-5), however, 54% of responses indicated that no improvements were needed along this section of I-64.

IMPROVEMENT CONCEPT



Widen I-64 to the Inside to Provide Auxiliary Lanes Between Mellwood Avenue and Grinstead Drive and Cannons Lane and I-264

- Widen I-64 to the inside to provide an auxiliary lane between the Mellwood Ave. and Grinstead Dr. interchanges and Cannons Ln. and I-264 interchanges.
- Install concrete median barrier between the EB and WB lanes.
- I-64 LOS during the peak hours is improved to LOS C for this build scenario in the sections widening occurs with the exception of I-64 EB PM from Mellwood to Grinstead in 2045.

D

SPOT & SAFETY

PRIORITY

LOW

LOCATION

MP 6.736 to MP 8.065
MP 10.530 to MP 12.420

DATA

41% of all crashes that occurred from 2016 to 2019 occurred during the peak hours

71% of all crashes that occurred from 2016 to 2019 were rear ends or side swipe/same direction

Excess Expected Crashes:
Story to Grinstead—316
Cannons to I-264—86

COST ESTIMATE / IMPACTS

2020 Dollars

Environmental Impact:
No impacts to the tunnels would be anticipated. If the existing median is utilized, there is the potential for the improvement strategy to be constructed with minimal right of way acquired. In that case, environmental impacts may be avoided. However, if the auxiliary lane is constructed to the outside, impacts to the parks, historic areas, or other environmental resources are likely and could be significant.

ROW Impact:
Low

Utility Impact:
Low

Construction Cost:
$25,400,000

7.3 Next Steps

At this time, no additional funding is programmed to further study this corridor or for specific improvement strategies recommended in this study. **Improvement Strategy A** is proposed as a short-term, low cost TSMO improvement strategy and could be initiated either through the KYTC District 5 routine maintenance and traffic program or become part of a systematic program such as Pavement Rehabilitation or Highway Safety Improvement Program (HSIP). This strategy will also need to be coordinated with TRIMARC. For **Improvement Strategies B and C**, the next phase in the project development process is Phase I Preliminary Engineering and Environmental Analysis. If federal funds are used or permits will be required, additional environmental analyses will be required to satisfy the National Environmental Policy Act (NEPA). These strategies would also need to be integrated into Kentucky's Prioritization Program, Strategic Highway Investment Formula for Tomorrow (SHIFT). Through this mechanism, they can be funded in the highway plan. Improvement Strategies will also need to be incorporated into KIPDA's Metropolitan Transportation Plan and TIP and KYTC's Statewide Transportation Improvement Plan (STIP).

7.4 Additional Information

Written requests for additional information should be sent to KYTC Division of Planning Director, 200 Mero Street, Frankfort, Kentucky 40622. Additional information regarding this study can be obtained from the District 5 Project Manager at (502) 210-5400 or by mail at 8310 Westport Rd, Louisville, Kentucky 40242.