Optimizing Commercial Vehicle Enforcement Investments and Activities to Improve Safety and Increase Revenue Collections

Report Number: KTC-22-01/SPR21-611-1F

DOI: https://doi.org/10.13023/ktc.rr.2022.01

Kentucky Transportation Center
College of Engineering, University of Kentucky, Lexington, Kentucky

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Research Report
KTC-22-01/SPR21-611-1F

Optimizing Commercial Vehicle Enforcement Investments and Activities to Improve Safety and Increase Revenue Collections

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Commonwealth of Kentucky

January 2022

1. Report No. KTC-22-01/SPR21-611-1F	**2. Government Accession No.**	**3. Recipient's Catalog No**
4. Title and Subtitle Optimizing Commercial Vehicle Enforcement Investments and Activities to Improve Safety and Increase Revenue Collections		**5. Report Date** January 2022 **6. Performing Organization Code**
7. Author(s): Brian Howell, Jennifer Walton, and Andrew Martin		**8. Performing Organization Report No.** KTC-22-01/SPR21-611-1F
9. Performing Organization Name and Address Kentucky Transportation Center College of Engineering University of Kentucky Lexington, KY 40506-0281		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** SPR 21-611
12. Sponsoring Agency Name and Address Kentucky Transportation Cabinet 200 Mero Street Frankfort, KY 40622		**13. Type of Report and Period Covered** Final Year **14. Sponsoring Agency Code**
15. Supplementary Notes Prepared in cooperation with the Kentucky Transportation Cabinet		

16. Abstract

The Kentucky Transportation Cabinet (KYTC) owns and maintains 14 fixed weigh stations for commercial vehicle enforcement. The Kentucky State Police (KSP) is responsible for staffing these facilities to conduct enforcement, while KYTC is responsible for constructing and maintaining these facilities. Like many states, Kentucky has experienced a decline of enforcement personnel to operate weigh stations limiting its ability to conduct inspections for safety enforcement and revenue collection. This study analyzes three CMV facilities for their impact on safety enforcement and revenue collection and determines their viability for potential replacement. All three existing weigh stations in Hardin, Fulton, and Henderson counties will be bypassed or removed due to future interstate and interchange construction plans. These weigh stations were assessed for the amount of revenue collected against operating expenses, the ratio of citations issued per violations, and the impact each weigh station had on overall safety. Researchers developed guidelines decision makers and stakeholders can use to determine the outcome for each of the three weigh stations: permanently close, replace with a new facility, or convert to remote monitoring. This guidance can be applied beyond the three facilities in the study, to help make future decisions on weigh stations across Kentucky.

17. Key Words truck facilities, weigh in motion scales, weigh stations, trucking, mileage-based user fees, replacement guidelines		**18. Distribution Statement** Unlimited with approval of the Kentucky Transportation Cabinet	
19. Security Classification (report) Unclassified	**20. Security Classification (this page)** Unclassified	**21. No. of Pages** 87	**19. Security Classification (report)**

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Executive Summary

The Kentucky Transportation Cabinet (KYTC) owns and maintains 14 fixed weigh stations for commercial vehicle enforcement. While enforcement responsibilities at these facilities fall under the Kentucky State Police (KSP), KYTC is responsible for their construction and maintenance. As the state transportation agency, KYTC is also responsible for issuing credentials, licenses, and license plates for commercial motor vehicles (CMVs) — as well as collecting taxes and fees from these same motor carriers. Two weigh stations near the construction of the new I-69 in Fulton and Henderson counties will eventually be bypassed by the route. A third facility in Hardin County along I-65 will eventually be demolished due to a proposed I-65 interchange reconstruction project. With heavy CMV volumes on interstates, weigh stations play an important role in monitoring commercial vehicles for compliance with both tax and safety regulations. To determine if these facilities should be replaced, KYTC initiated a study of the factors that impact the three weigh stations. Researchers at the Kentucky Transportation Center (KTC) evaluated the three facilities with a focus on assessing revenue collection and safety enforcement measures.

Kentucky has seen a steady decline of KSP Commercial Vehicle Enforcement (CVE) personnel that staff and conduct enforcement at weigh stations. With high interstate volumes of truck traffic, Kentucky relies on weigh station screening and CVE oversight to ensure the proper collection of commercial vehicle-related taxes such as Kentucky's weight-distance tax (KYU) and fuel taxes (KIT and IFTA). This study measured revenue collection against operating costs to provide a more comprehensive assessment on the feasibility of replacing weigh stations, focusing primarily on those revenue streams which are recouped by KYTC. Those revenue streams are primarily divided into three categories for weigh station analysis: impounds, temporary permits, and court revenues (KYTC portion).

To measure a weigh station's impact on identifying unsafe vehicles and/or drivers, KTC also collected violation and citation data from weigh stations for the years 2017 through 2019. Because Out-of-Service (OOS) violations are more serious, they were measured separately from general violations. There was a wide variability in the frequency of violations and citations across Kentucky weigh stations. Researchers also determined potential impact on safety by looking at a weigh station's proximity to crash hot spots.

The research included a search of any relevant studies on weigh stations, including those controlled remotely. Similar to Kentucky, other state DOTs are seeing a decline in CMV revenues collected, while the cost of pavement maintenance due to overweight vehicles is increasing. KTC collaborated with the KYTC project committee to select criteria to use in the decision to replace or close a facility, or convert it to a remote monitoring capability. The decision matrix helped evaluate facility site conditions, facility infrastructure, and operating characteristics, reflecting the project's mission of improving safety and generating revenues. The recommendations and findings are summarized as follows:

<u>Weigh Station Recommendations</u>

• Hardin Weigh Station: This facility resides on the second highest-volume CMV corridor in Kentucky among all weigh stations. At this critical location, the facility contributes significantly to safety through identified violations, citations, driver out-of-service rates, and vehicle out-of-service rates. This outdated facility can no longer accommodate the parking necessary to handle inspections commensurate with high traffic volumes. This facility should be replaced with a new facility and expanded parking to continue its safety mission while improving its ability to pull over CMV violators to enhance revenue collection efforts.

• Henderson Weigh Station: This facility demonstrates substantial safety improvements for this region through its identification of violations, citations, driver out-of-service rates, and vehicle out-of-service rates. This facility is also revenue positive meaning its annual revenues exceeds its annual operating expenses. This facility should be replaced with a new facility to continue its notable safety and revenue collection performance.

• Fulton Weigh Station: This facility resides on a low-volume corridor relative to other weigh stations. In fact, it ranks #14 of 14 for CMV volumes among all Kentucky weigh station sites. Due to this site location, it cannot advance safety

and revenue gains commensurate with other sites in more optimal locations. Therefore, this facility should be closed and replaced with a low-cost remote monitoring capability on the new I-69 corridor near Tennessee. This remote capability will allow for limited screening ability to detect certain violations such as licensing and registration. Furthermore, detection violations will be saved in Kentucky's data observation system which can better assist KYTC auditors and KSP enforcement with performing their respective duties.

Other Findings and Recommendations

• Weigh stations with high truck volumes in relation to their entrance ramp lengths and parking capacity have low truck traffic capture rates. KYTC should increase the entrance ramp length and optimize the parking capacity required for a replacement of the Hardin weigh station to improve the capture rate. KYTC should also evaluate the existing Shelby County weigh station and assess the feasibility of increasing its corresponding ramp length and parking capacity, respectively.

• High job turnover of inspectors at weigh stations negatively impacts weigh stations. KSP has enacted pay raises in recent years to counter these turnover challenges, but continued investigation is warranted to further improve its retention. KSP should investigate inspector compensation packages by seniority, position, location, and market conditions and identify best practices to improve KSP's ability to attract and retain high-quality candidates.

• Weigh stations across Kentucky are open only 33 percent of the time. KSP should evaluate options for increased hours of operation, particularly along high-volume corridors.

• Large disparities exist in enforcement intensity among weigh stations (Citations to Violations C/V rate). KSP should evaluate its policies and procedures for weigh station inspectors and sworn officers to improve overall enforcement intensity rates.

Chapter 1 Background

1.1 Introduction

Prior to 2004, the Kentucky Division of Vehicle Enforcement was under the Department of Vehicle Regulation (DVR) within the Kentucky Transportation Cabinet (KYTC). The responsibilities for commercial vehicle enforcement shifted from KYTC to the Justice and Public Safety Cabinet on June 16, 2004. Today, Commercial Vehicle Enforcement (CVE) is a division under the Kentucky State Police (KSP). Despite losing its enforcement role, KYTC is still responsible for issuing credentials, licenses, and license plates for commercial vehicles. KYTC also collects taxes and fees from motor carriers on behalf of Kentucky. KYTC owns and maintains the 14 fixed weigh stations utilized by KSP-CVE for enforcement activities.

1.2 Problem Statement

Due to the construction of I-69 in Western Kentucky, two weigh stations in Fulton County and Henderson County will be bypassed by the new route. A third facility at Hardin County will continue to be served by existing I-65 traffic but a proposed nearby I-65 interchange reconstruction project will involve its demolition. The Department of Highways is seeking information to determine how or if these CVE facilities should be replaced. With significant declines in KSP-CVE personnel and difficulty keeping current facilities open, it is not clear if these types of facilities are worth the investment. Further, despite increases in truck traffic, Kentucky has not seen similar increases in collection of commercial vehicle-related taxes such as Kentucky's weight-distance tax (KYU) and fuel taxes (KIT and IFTA). The concern is that limited KSP-CVE staffing may be resulting in reduced compliance to not only tax-related regulations, but also safety-related regulations.

1.3 Objectives

The Kentucky Transportation Center (KTC) evaluated commercial vehicle safety, revenues collected, and other factors to assess the feasibility of replacing the three weigh stations. The project objectives are as follows:

- To develop recommendations for CVE activities and investments that will serve to improve safety and increase revenue collections.
- To identify guidelines for replacement of CVE facilities.

Chapter 2 Literature Review

2.1 Methodology

The KTC research team began this study with a comprehensive literature review of previous studies related to CVE facilities. Initially, a search was conducted on the Transportation Research Board (TRB) online library, Transportation Research International Documentation (TRID)[1], using the keyword "weigh station". The search period of interest included January 1, 2005, to July 1, 2020. The research team then conducted a general online Google search of two key phrases: "Feasibility Study of a Remote Control Weigh Station" and "Feasibility Study of a Weigh Station". The two searches yielded six relevant studies on weigh stations across various states.

2.2 California

Overweight Trucks

California researchers evaluated the degree to which overweight trucks inflicted significant damage to their highways. In 2005, the Institute of Transportation Studies at the University of California, Berkeley and Davis focused their research efforts on the financial costs of roadways damaged by overweight trucks. They examined commercial motor vehicles traveling within California. At the time, California had 38 weigh stations across its network.

Pavement damage was calculated through a metric known as equivalent single axle loads or ESALs. The overall weight of the vehicle and its total number of axles contributes to the calculation of an ESAL. The equation used in this study was:

$$ESAL = X\ [\ (Weight / X) / 80\ kN\ ]^{4.2}$$

where X = the number of individual axles in an axle group
for steering and singles, X = 1
for tandems, X = 2
for tridems, X = 3

This equation demonstrated a non-linear relationship between ESAL and weight. In fact, increasing weight without increasing the number of axles resulted in an exponential increase on the ESAL load.[2]

Potential Savings

Employing this ESAL concept, the study's researchers examined the costs imposed by overweight vehicles and the potential savings incurred if those vehicles were removed from the roads. They initially assigned maintenance costs through an internal CALTRANS annual pavement report (2003). Using weigh station truck tracking, they determined that overweight vehicles contributed 5.34 percent to the road's ESAL load (despite making up only 2.67 percent of truck traffic). Based on these numbers, they attributed an additional "$20-30 million of pavement damage per year" due to overweight trucks.[3]

2.3 Michigan

Cost Assessment

Michigan researchers studied the potential benefits and costs associated with their weigh stations to better understand their full life-cycle impact. To justify replacing or constructing new weigh stations, Michigan initiated a comprehensive research study in 2015 that examined their 15 weigh stations for the costs and benefits. Costs were designated into two categories: operator and user costs. The former included construction, operation, and maintenance costs, while the latter focused on costs stemming from weigh station delays. Since this study examined existing weigh stations, the investigators focused on operations and maintenance costs. They also added labor costs for personnel and separated that from operating costs. The final cost estimates for this network are shown in Table 2.1.[4]

Table 2.1 Summary of Average Annual Operating and Maintenance Costs

Station Level	Annual Operating Cost	Annual Labor Cost*	Annual Maintenance Cost
Most Advanced	$31,655	$287,289	$38,000
Advanced	$22,651	$155,406	$37,800
Intermediate	$25,486	$143,894	$15,000
Basic	$9,094	$41,969	$11,000

**Annual labor cost is determined as $46.12 x (average daily working hours) x number of working days per year*

Benefit Assessment

The estimated benefits from the 15 weigh stations included reduced pavement deterioration (due to CMV weight compliance) and safety improvements that resulted from enforcement activities. Similar to other research studies, the concept of Equivalent Single Axle Loads (ESAL) was employed to determine the impact of overweight vehicles on pavement. Researchers collected data from the weigh stations on their observed truck traffic, most notably on each vehicle's number of axles. The ESAL values were calculated using the AASHTO Guide for the Design of Pavement Structures.[5] Once known, ESAL values were assigned by truck type (i.e., number of axles) to normal weight loads and oversize weight loads for both flexible and rigid pavements. The research team constructed four ESAL weighted average tables for these scenarios to compare results: 1) Unit Loading for Flexible Pavement, 2) Overweight Unit Loading for Flexible Pavement, 3) Unit Loading for Rigid Pavement, and 4) Overweight Unit Loading for Rigid Pavement. Next, these tables were used to estimate the average ESAL costs per lane-mile at $0.03 based on typical pavement maintenance expenses. The cost analysis revealed that overweight vehicles accounted for millions in additional pavement maintenance expenses. For example, the Monroe NB weigh station alone accounted for $3.89 million in additional expenses due to overweight vehicles.[6]

To determine the safety benefits from an estimated reduction in crashes, researchers investigated segments before, at, and after each individual weigh station. Crash data was collected over an eight-year period for the investigated sites as well as comparison segments. Negative binomial regression modeling was used for each of the three segment types: before, at, and after. The results from the three segment type analyses were as follows: 1) before – increased probability of crashes, 2) at – decreased probability of crashes, and 3) after – decreased probability of crashes. Collectively, the total safety benefit averaged across all sites and for all three segment areas was less than expected. The study found that the average reduction in crashes for each weigh station in any given year would be less than one crash. Consequently, the researchers did not include safety benefits derived from crash reductions within their final benefit-cost ratio determination.[7]

2.4 Georgia

Enforcement Trends

Georgia Tech researchers conducted a study to evaluate steadily declining revenues from commercial motor vehicle (CMV) enforcement activities in Georgia and surrounding states. They examined the period between 2007 and 2010, but limited data prevented definitive conclusions. Researchers looked into the performance of CMV oversize and overweight programs with the goal of formulating methods to improve declining revenue trends. The study initially focused on twelve states, including Alabama, Florida, Kentucky, Georgia, Minnesota, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Virginia, and Wisconsin. However, many states had recently shifted their CMV enforcement responsibilities from their departments of transportation to their state law enforcement agencies. This changeover, along with other factors, limited the ability to obtain data for CMV enforcement trends. Instead, the research team had to rely upon other existing data sourced from FHWA or national statistics such as the Arizona State University database. Due to the data limitation, the research targeted its final analysis on national trends (U.S. statistics) as well as on six specific states: Alabama, Florida, Georgia, North Carolina, South Carolina, and Tennessee.[8] In their analysis, researchers compared data across six categories: 1) number of inspections, 2) number of violations, 3) percent of total violations, 4) number of Out of Service (OOS) violations, 5) OOS percent, and 6) total weight

citation fines. As defined in federal guidelines, an overweight vehicle is defined by weigh limits on single axles (20,000 pounds), tandem axles (34,000 pounds), and gross vehicle weight (80,000 pounds).[9] This dataset from the analysis is shown in Table 2.2.

Table 2.2 Summary of Overweight Vehicles[10]

	# of Inspections	# of Violations	% of Total Violations	# of OOS Violations	OOS Percent	Total Weight Citation Fines ($)
AL 2007	2,654	2,764	4.73%	34	1.23%	
AL 2008	1,787	1,865	22.23%	13	0.70%	
AL 2009	1,599	1,674	19.33%	14	0.84%	
AL 2010	1,193	1,214	16.68%	6	0.49%	
FL 2007	14,753	15,965	10.34%	136	0.85%	
FL 2008	17,606	18,885	36.21%	111	0.59%	
FL 2009	12,266	13,203	33.02%	88	0.67%	
FL 2010	12,413	13,148	29.21%	26	0.20%	
A 2007	14,250	14,820	7.95%	20	0.13%	
GA 2008	11,519	11,968	36.81%	14	0.12%	
GA 2009	9,296	10,570	33.25%	38	0.36%	
GA 2010	6,653	6,800	19.77%	15	0.22%	
NC 2007						$10,681,660.29
NC 2008						$10,493,369.87
NC2009						$8,828,590.38
NC 2010	5,200	5,369	25.82%	0	0.00%	$8,499,796.20
SC 2007	13,123	13,765	28.93%	2	0.01%	
SC 2008	13,662	14,383	57.28%	2	0.01%	
SC2009	11,772	12,379	51.76%	3	0.02%	
SC 2010	9,679	10,028	47.70%	0	0.00%	
TN 2007	6,543	7,042	24.66%	23	0.33%	13,109,115.10
TN 2008	8,302	8,666	34.11%	34	0.39%	12,861,588.71
TN 2009	6,533	6,876	29.03%	42	0.61%	10,270,433.24
TN 2010	5,945	6,205	27.55%	20	0.32%	10,845,330.24
US 2007	242,333	308,832	6.01%	5,563	1.80%	
US 2008	247,222	316,878	27.98%	1,645	0.52%	
US 2009	221,953	291,867	25.67%	2,040	0.70%	
US 2010	211,951	278,961	24.18%	1,164	0.42%	

The data trends demonstrated consistent decreases for enforcement activities across all six states over the research period — a 32 percent decline in overall violations.[11]

Revenue Trends

The state of Georgia, like many surrounding states, continued to see declining revenues from their CMV enforcement program. What remained less clear were the underlying causes leading to those declines. The research team pointed to recent transitions in CMV enforcement responsibilities, reductions in enforcement staff, and the 2008 recession as possible factors contributing to declines.[12] However, the inability to obtain robust and consistent data across many states impaired their ability to draw sound conclusions. A true determination of lost revenues would estimate the full number of overweight vehicles on the road and compare to the corresponding percentage of those vehicles that were cited. Unfortunately, the data limitations and inability to model this prevented such an assessment.[13]

2.5 Washington State

Evaluation of Weigh Station Network

In 2016, a comprehensive Washington State study evaluated the overall effectiveness and efficiency of its weigh station network and identified key findings and recommendations for further improvement. This Washington State Joint Transportation Committee-sponsored study, led by Cambridge Systematics and BGM Consulting researchers, focused on three priorities: vehicle safety, highway preservation, and economic development. The research team collected and analyzed data, conducted key interviews, and identified best practices.[14]

Washington State has a network of 63 weigh stations—52 fixed and 11 mobile. Commercial motor vehicle enforcement responsibilities are divided primarily between two agencies: the Washington State Department of Transportation (WSDOT) and the Washington State Patrol (WSP). The former is responsible for constructing and maintaining weigh station sites, while the latter is primarily responsible for providing law enforcement personnel to conduct enforcement activities at those sites.[15] Weigh station inspections statistics and an overview are shown in Table 2.3 and Table 2.4.

Table 2.3 Weight Station Inspection Statistics[16]

Type of Site	Trucks Physically Weighed	Weight Fines	Number of Inspections	Number of Violations
Electronic Screening (11 open sites)	47,083	$1,126,010	48,097	59,558
No Screening, Fixed (37 open sites)	7,002	$184,887	7,984	10,237
Mobile (11 open sites)[a]	3,214	$578,763	26,363	43,214
Total	***57,299***	***$1,889,763***	***82,444***	***113,009***

Table 2.4 Weight Station Network Overview[17]

Criteria	Status (2014)
Number of Sites	52 fixed sites, 12 with WIM; 11 commonly used mobile sites
Number of Additional Scales	434 mobile scales
Personnel	169 total positions, average of 127 filled in 2014. Split between 81 Commercial Vehicle Enforcement Officers (CVEO) and 46 Troopers
Annual Site Traffic Volume	40 million trucks annually on adjacent roads
Number of Screenings (Mainline WIM)	1.9 million (2014)
Number of Inspections	82,400 (2014)
Total Annual Vehicles Weighed	57,000 (fixed scales)
Total Annual Citations	113,000 (weight and safety violations), $1.9 million in weight fines
Permits/Credentials Issued	No Data

Research Findings

The research study findings revealed overarching system gaps in communications, asset management, and data sharing. The report highlighted four major findings involving weigh stations, but this literature review will only focus on the three of primary relevance to this study. These three major findings are:

- Finding #1: Insufficient interagency communications and coordination between WSDOT and WSP resulted in adverse outcomes.[18]
- Finding #2: Lack of a weigh station asset management plan resulted in inadequate site planning and budgeting.[19]
- Finding #3: Insufficient data collection and sharing arrangements between WSDOT and WSP hindered their collective efforts to monitor and improve performance activities.[20]

Researchers proposed several recommendations to improve these conditions, as described in the research recommendations below.

Research Recommendations

Recommendation #1 to Finding #1 – "Formalize protocols for ownership and communication within and between agencies" – The study recommended improved communications between both agencies involving coordination of efforts, data sharing, leading and managing processes, and assessing site conditions (e.g., infrastructure, personnel). The authors also touted a need for establishing senior leader positions within the hierarchy of each agency to facilitate cross-dialogue and maintain needed continuity over time on enforcement activities. [21]

Recommendation #2 to Finding #1 – "Develop joint agency commercial vehicle-related outcomes and objectives" – This recommendation prescribed the need for both agencies to discuss and prioritize outcomes for weigh stations. A mutually agreed upon agenda involving proposed outcomes would allow both agencies to better monitor system performance and take measures to improve it.[22]

Recommendation #3 to Finding #1 – "Revisit agencies' roles and update documentation" – The existing memorandum of understanding (MOU) between WSDOT and WSP was insufficient in its scope. An expanded and clarified MOU could better align strategic purpose, financial goals, and operational processes between both agencies in operating the weigh station network.[23]

Recommendation #6 to Finding #2 – "Apply an asset management framework to truck inspection stations." – The lack of an asset management plan hindered decision-makers from comparing the pros and cons of investments and making informed decisions. The authors noted that an asset management plan would help to alleviate these information gaps by addressing the "Why" (i.e., funds for weigh stations compared to other priorities) and "What" (i.e., prioritizing specific infrastructure investments).[24] This recommendation also advocated a more in-depth analysis on weigh station investments across functional and conditional deficiencies. Table 2.5 demonstrates some key questions for agency officials to consider.

Table 2.5 Functional and Conditional Deficiencies[25]

Determining Functional Deficiency	Determining Conditional Deficiency
Is the site design, ramp length, and inspection areas sufficient to process truck volumes?	What year was the administration building constructed? Is it in good physical condition?
Is the infrastructure and hardware at the right level for the station type? E.g., are the scales installed and functional? Is the electronic screening equipment installed and functional?	What year were any ancillary buildings (inspection buildings) constructed or undergo substantive maintenance work? Are they in good physical condition?
Is the technology (software, fiber optics, e-screening) sufficient to process truck volumes and in good working condition?	Are the utilities (heat, electricity, water, plumbing) sufficient and in good condition?
Is the available technology within its life expectancy and performing according to design?	Is the building properly set up for optimal work flow (Computers facing the scale, signage controls easy to reach and operational?)
Is the physical infrastructure of the station (e.g., buildings) within its life expectancy?	Is there adequate staffing to operate the site?

Recommendation 7 to Finding #2 – "Maintain and publish a biennial needs list." – Simply stated, this recommendation encouraged officials from both agencies to jointly develop, prioritize, and publish an infrastructure needs list. By doing so, they can develop shared interests and coordinate their actions through their corresponding budgetary processes.[26]

Recommendation 9 to Finding #4 – "Develop a data sharing agreement between WSDOT and WSP." – Lack of shared data between both agencies impeded each agency's ability to monitor their performance. This agreement would formalize data collection and sharing processes across both agencies.

Recommendation 10 to Finding #4 – "Collect and maintain shared data." – This recommendation was simply an extension of the previous recommendation: to execute the sharing agreement. Once enacted, both agencies could better manage their efforts to achieve targeted outcomes.[27]

2.6 Oregon

Background

Due to fiscal imbalances, the Oregon Department of Transportation (DOT) assessed its infrastructure by applying prescribed decision-making criteria to its weigh station network. In 2019, the Oregon DOT evaluated its weigh station network, comprised of 81 stations. Oregon has been hindered in recent years by continually increasing expenses coupled with decreasing funds and personnel. In fact, this 12-year study revealed that maintenance expenses are rising nearly 17 percent per year. At the same time, weigh station funding is only increasing at 2.7 percent per year while also experiencing a staffing decline of 28 percent during this period. These alarming trends prompted decision-makers to examine new ways to conduct their commercial motor vehicle enforcement activities.

Assessment Criteria

To optimize state resources, the research study recommended the consideration of five main factors when evaluating weigh stations: 1) Strategic Freight Corridor Designation; 2) Seismic Lifeline Route Designation; 3) Annual Average Daily Traffic Truck (AADTT); 4) Enforcement Intensity (EI) Index; and 5) Weigh Station Backup Probability Index. [28]

The first two factors, strategic freight and seismic lifeline, are aligned with Oregon's strategic planning and processes. The first, strategic freight corridors, is a term used to describe the primary freight corridors across their state. The second, seismic lifeline routes, describe routes necessary for emergency transport services during disaster response.

[29] In both cases, these factors do not readily correlate with circumstances in Kentucky. Therefore, the focus of this literature review will be on the remaining three factors.

AADTT is a common measure that state DOTs use in measuring infrastructure needs. This traffic volume factor can help predict potential demand and existing constraints (e.g., congestion) at weigh stations. This study categorized AADTT counts by vehicle class and only considered Class 3 vehicles or higher. These vehicle types are typically the only ones subject to CMV enforcement audits of safety, taxes, and weights. In summary, the AADTT count was the first recommended measure for comparing needs across Oregon's weigh station network.[30]
The second factor, enforcement intensity (EI), was derived by an equation comparing potential with actual enforcement activities. This metric could help DOT officials better determine which weigh stations were actively monitoring and regulating CMV enforcement. This measurement consisted of the following:

Enforcement Intensity = [ENF x (SW + GL + LPR)] / [AADTT x 365 x 10]

Where:
ENF = Total Enforcement at Weigh site
SW = Total Annual Static Weighings
GL = Annual Greenlight Bypasses
LPR (License Plate Reader) = Total Annual Automated Bypasses
AADTT = Traffic Volume Projections for 2037[31]

The final factor, backup probability, determined the chances of a queue or backup forming from excessive trucks at the weigh station. High congestion spills out onto the highway and when this occurs, weigh stations need to bypass any incoming traffic to avert potential safety hazards on the highway. A tangential effect of backup includes not screening or identifying CMV violators. This measurement consisted of the following:

Backup Probability = $[(CT \times AADTT) \ / \ (ERL \times D\%)] * 100$

Where:
CT = Crossing Time
AADTT = Average Annual Daily Traffic Truck
ERL = Entrance Ramp Length
DS% = Percent of Design Standard Scale Site Entrance Ramp

The detailed report definitions, including collection methods, are shown in Table 2.6.

Table 2.6 Factors for Backup Probability[32]

CT	"Maximum time to transit through a weigh site. Crossing time is the maximum time, in minutes and seconds, from exiting the roadway until the CMV crosses the scale then merges back into traffic. These times were collected by staff at times when the scales were busiest and there was a full entrance ramp. In order to control for collection bias, staff was asked to collect minimum crossing times when trucks were not impeded.
AADT	Average Annual Daily Traffic Truck for CMVs for 2037. The higher the AADTT for CMVs, the more likely backups are to occur. Since there is little documentation of the design of the existing scales, especially being able to compare a ratio of future AADTT to AADTT projections used for the original design. So to keep it simple to obtain data, AADTT projections for 2037 are used.
ERL	Entrance Ramp Length (in feet) i.e., CMV capacity. Entrance ramp lengths were measured in feet from the point of the ramp exiting the roadway to the front edge of the scale deck. This is a measure of capacity to hold trucks waiting to weigh. The assumption for this data point is that longer ramps hold more trucks, therefore avoiding backups onto the main roadway.
DS%	Percentage of Design Standard size. If current design standards call for a certain length of ramp, but actual ramp size is below standard, the more below standard, the more likely a backup will occur."

2.7 Illinois

Weigh Station Guidelines

The Illinois Department of Transportation (DOT) developed a weigh station manual with guidelines and criteria for site selection and infrastructure capacity. When identifying an optimal location for a facility, Illinois planners identified several factors to consider for site placement. Those factors ranged from geographical boundaries to adjacent infrastructure requirements.

1. State Boundary: locate near state lines to better capture interstate traffic
2. High Volume Route: consider placement on a route with high traffic volumes
3. Bypass Route: locate away from bypass or alternate routes for trucks to avoid weigh station
4. Utilities: ensure utility infrastructure in place to accommodate weigh station building
5. Spacing: ensure at least 4,000-foot spacing between weigh station and adjacent ramps
6. Sight Distance: meet minimum sight distance requirements to weigh station exit ramp
7. Airports and Lighting Zones: avoid locating facilities near airports and areas with established restrictive lighting ordinances[33]

This manual also prescribes guidelines for weigh station capacity to accommodate truck volumes. In this context, entrance ramps should be able to accommodate sufficient truck volumes without generating excessive queues. Illinois designs their ramps to accommodate up to 25% of trucks expected to need a required static scale weighing. The facility parking lot must also meet minimum parking requirements which Illinois prescribes as a capacity of at least 10 trucks that can be held in overnight parking for detainment.[34]

2.8 National Guidelines

The research team also conducted a literature review to determine if national guidelines existed for assessing the replacement of weigh station facilities. This review focused on federal and other national-level transportation authorities, including the Federal Motor Carriers Safety Administration (FMCSA), Federal Highway Administration (FHWA), and the American Association of State Highway and Transportation Officials (AASHTO). Unfortunately, the guidance on this topic does not appear to exist within readily accessible technical research publications and/or federal guideline manuals.

Chapter 3 Facility Data

3.1 Methodology

The KTC research team focused on two principal elements of weigh station facilities for investigation: safety and revenues. Safety is and will always be a primary focus for transportation prioritization and funding. The Kentucky Transportation Cabinet and FMCSA value actions that can reduce crashes, injuries, and fatalities along the nation's roads. Although commercial motor vehicles crash less frequently than the general driving population, their excessive size and weight can often lead to more severe outcomes involving injuries and fatalities. The research team determined that any evaluation involving weigh station facilities should measure their potential impact on identifying unsafe vehicles and/or drivers to improve safety for CMV operations.

Revenue generation also represents a key priority in assessing the feasibility for replacing weigh stations. Similar to other state agencies, KYTC must make resourcing decisions among its portfolio of transportation programs. Weigh stations have traditionally demonstrated their utility in improving CMV safety, but their prohibitive capital and maintenance costs are resource intensive. The research team consequently assessed revenue collection against expenses to provide a more comprehensive assessment on the feasibility of replacing weigh stations.

3.2 Compliance & Safety

Inspections & Violations

Roadside inspectors assigned to the Kentucky State Police's CVE division conduct inspections of CMVs at weigh stations. Weigh stations identify which CMVs to pull into their facility based on roadside screening technologies. These technologies rely on guidelines from FMCSA, KYTC, and third parties such as PrePass that characterize vehicles that may be non-compliant and warrant further investigation. Once a vehicle is screened and selected, the inspector will ask the CMV to park at the facility to begin the inspection. First, the driver provides credentials for verification of licensing, registration, and other federal and state requirements. Next, the inspector has the driver demonstrate their CMV equipment operates correctly (e.g., lights, tire movement, etc.) The inspector then visually assesses the CMV and determine that the vehicle meets all requirements, such as sufficiently inflated tires.

Any vehicle and/or driver violations that are identified during the inspection are those prohibited actions as specified by law. At the federal level, FMCSA regulations found in Title 49 list the full range of violations for CMV vehicles and drivers, to include "speeding, reckless driving, improper lane change, texting while operating a vehicle, and not wearing safety belts."[35] State DOTs, including KYTC, also have their own state regulations including mandatory licensing and registration requirements for operations within the state. A roadside inspector helps identify those violations to help the driver or fleet operator correct those issues and improve safety.

In this analysis, the research team collected inspection and violation data for all Kentucky weigh stations from 2017 through 2019. This process yielded insights into inspection rates and discovered violations across Kentucky's weigh stations, including the three weigh stations of interest. Chapter 4 contains a discussion of the analysis and a summary of violation rates is shown in Table 3.1.

Table 3.1 Inspection & Violation Rates

Year	Safety Metric	KY	Fulton	Henderson	Hardin
2017	Inspections per screened vehicles	1.0%	1.4%	1.2%	1.1%
	Violations per inspection	1.23	0.40	1.83	1.84
2018	Inspections per screened vehicles	1.0%	2.0%	1.0%	1.6%
	Violations per inspection	1.00	0.46	1.71	1.15
2019	Inspections per screened vehicles	0.9%	2.2%	0.9%	0.8%
	Violations per inspection	1.13	1.19	1.70	0.91

Citations

A citation issued by an inspector for a violation is an official legal record requiring an offender to appear in court to respond to the issued charges. Most people think of a citation as a "ticket" issued by law enforcement, and each citation may have multiple violations on it. Once an offender appears in court, the adjudication process determines the penalties associated with the violations. Those violations may result in misdemeanors or felonies. Misdemeanors can result in fines and/or up to one year in jail. Serious felony charges can lead to imprisonment for at least one year or more. The full range of violation codes and associated cases by year and location can be found at Kentucky's Administrative Office of the Courts.[36]

The research team collected violation and citation data from KSP for 2017 through 2019. The frequency of violations and citations varied dramatically across different weigh stations. The full list of violations and citations are shown in Table 3.2. In addition, the research team assessed these trends and developed an enforcement rate index that measures the rate of citations issued per violation. This analysis is shown in Chapter 4.

Table 3.2 Number of Violations and Citations

Weigh Station	2017		2018		2019	
	Violations	Citations	Violations	Citations	Violations	Citations
Boone	515	16	161	3	91	8
Floyd[a]	10	1	31	1	0	0
Fulton	24	11	27	12	100	10
Hardin[b]	311	169	11	2	219	120
Henderson	198	48	213	21	167	15
Kenton	138	6	331	38	156	13
Laurel NB	324	191	153	7	402	230
Laurel SB	318	252	52	3	98	31
Lyon EB	925	656	726	446	282	109
Lyon WB	882	418	681	292	836	390
Rowan[c]	273	95	0	0	325	117
Scott	287	152	166	63	339	122
Shelby	180	134	190	47	131	62
Simpson	271	136	197	59	326	89
Total =	4,656	2,285	2,939	994	3,472	1,316
Average =	333	163	210	71	248	94

Out-of-Service Rates

Out-of-Service (OOS) violations represent a class of severe violations. These violations must be corrected before the driver and/or the vehicle is allowed to return to operation. An inspector can levy an OOS violation against a driver, the vehicle, or both. As serious violations, the research team assessed these trends as a separate category from general violations. KSP provided this information to KTC for all Kentucky weigh stations. The FMCSA OOS rates are found using their aggregated roadside inspection rates from the FMCSA Motor Carrier Management Information System (MCMIS).[37] The full results for OOS rates are shown in Table 3.3.

Table 3.3 Out-of-Service Rates

Year	OOS Rate	KY	Fulton	Henderson	Hardin	FMCSA
2017	Vehicle OOS	18.3%	6.0%	26.1%	21.3%	20.6%
	Driver OOS	3.3%	2.0%	4.7%	4.8%	5.1%
2018	Vehicle OOS	15.9%	7.9%	23.7%	15.7%	20.8%
	Driver OOS	3.5%	1.2%	4.0%	7.6%	4.8%
2019	Vehicle OOS	15.5%	15.1%	26.7%	11.1%	20.6%
	Driver OOS	3.6%	2.8%	4.7%	5.2%	5.0%

3.3 Weigh Station Revenues

With increasing demands and limited resources, the ability of a weigh station to garner revenues is critical to its long-term sustainability. Weigh stations generate multiple revenue streams from their operations. Some revenues may arise as drivers or their fleet managers pay for temporary permits at a weigh station, while others develop as offenders may need to go to court and pay legal fines. However, the category by which weigh stations generate revenues determines which agency will receive those funds. For instance, some court collections go to the general Kentucky treasury fund and are not transmitted to KYTC. Therefore, this study focused primarily on those revenue streams which are recouped by KYTC. Those revenue streams are primarily divided into three categories for weigh station analysis: impounds, temporary permits, and court revenues (KYTC portion).

Impounds

KSP has the authority to impound a CMV if there is a tax-related violation. When this occurs, the driver and/or motor carrier responsible for safety must pay the required impoundment fees before the CMV can be released. Using KYTC provided data, KTC collected revenues across impounds for all 14 weigh stations across the state. Impounds generated significant revenues for KYTC across the study period at nearly $3.6 million. The facilities located along interstates with significant CMV traffic typically generated the highest totals of impound revenues. Facilities meeting this criterion include the Boone facility located on I-75 near Cincinnati and the Simpson facility on I-65 located between Bowling Green and Nashville. Impound revenues by year and ranking are shown in Tables 3.4 and 3.5.

The research team also assessed the relationship between impound revenues and labor hours at a given site. Labor hours represent the number of staff on hand and their corresponding hours worked at the site. A high, positive correlation coefficient was found between the relationship of labor hours (staff x hours) and impound revenue generated at both the Fulton and Hardin facilities. This indicates the strong relationship between the number of inspectors at each site and their working hours to the weigh station's ability to generate revenue. This coefficient, however, does not consider other possible factors that could also contribute to revenue generation. Table 3.6 summarizes correlation coefficients for three locations. The last facility of interest, Henderson, did not demonstrate a high, positive correlation between those factors. It is unclear why this occurred. However, upon further study, the impound data at this site revealed several significant outliers from the norm that could have skewed the results. For instance, one single stop at Henderson yielded tens of thousands of dollars in revenue representing a sizable break from typical impound situations.

Table 3.4 Impound Revenues by Year

Weigh Station	Year				Total
	2016	2017	2018	2019	
Boone	$ 25,597	$ 193,342	$ 241,328	$ 283,004	$ 743,271
Floyd	$ 3,601	$ 3,386	$ 3,636	$ -	$ 10,623
Fulton	$ 1,717	$ 1,774	$ 1,824	$ 15,155	$ 20,470
Hardin	$ 59,175	$ 37,300	$ -	$ 27,504	$ 123,978
Henderson	$ 83,852	$ 53,133	$ 58,945	$ 36,300	$ 232,230
Kenton	$ 10,750	$ 30,513	$ 100,861	$ 49,223	$ 191,347
Laurel NB	$ 81,766	$ 36,489	$ 31,259	$ 192,324	$ 341,838
Laurel SB	$ 71,208	$ 30,454	$ 2,390	$ 15,925	$ 119,977
Lyon EB	$ 58,955	$ 136,397	$ 93,390	$ 63,231	$ 351,973
Lyon WB	$ 41,057	$ 72,648	$ 75,168	$ 94,162	$ 283,035
Rowan	$ 126,096	$ 19,539	$ -	$ 36,265	$ 181,900
Scott	$ 38,885	$ 27,305	$ 24,657	$ 26,163	$ 117,010
Shelby	$ 4,297	$ 18,671	$ 11,155	$ 15,080	$ 49,203
Simpson	$ 231,695	$ 154,913	$ 163,548	$ 278,327	$ 828,483
Total =	$ 838,650	$ 815,863	$ 808,159	$ 1,132,664	$ 3,595,337

Table 3.5 Impound Revenues by Rank

Weigh Station	Impound Revenues	Rank	Impounds / Annual Traff.	Impounds / Annual WIM
Boone	$ 743,271	2	$0.09	$0.50
Floyd	$ 10,623	14	$0.01	$4.19
Fulton	$ 20,470	13	$0.06	$0.11
Hardin	$ 123,978	9	$0.01	$0.14
Henderson	$ 232,230	6	$0.07	$0.29
Kenton	$ 191,347	7	$0.02	$0.13
Laurel NB	$ 341,838	4	$0.04	$0.15
Laurel SB	$ 119,977	10	$0.01	$0.08
Lyon EB	$ 351,973	3	$0.04	$0.25
Lyon WB	$ 283,035	5	$0.04	$0.23
Rowan	$ 181,900	8	$0.08	$0.32
Scott	$ 117,010	11	$0.01	$0.08
Shelby	$ 49,203	12	$0.01	$0.17
Simpson	$ 828,483	1	$0.08	$0.40
Total =	$ 3,595,337			

Table 3.6 Correlation Coefficients for Inspector Hours by Impound Revenue

Location	Coeff.	Explanation
Fulton	0.88	Strong positive relationship
Henderson	-0.10	Cannot infer relationship
Hardin	0.73	Strong positive relationship

KYU Temporary Permits

KYTC uses a KYU weigh-distance tax for CMVs operating in Kentucky. Any CMV in Kentucky must pay this tax to remain compliant. Weigh stations sometimes discover CMVs driving through Kentucky that are not licensed for KYU and have not been paying the associated tax. In these cases, an inspector can require that the CMV driver and/or fleet manager pay for a $40 temporary KYU permit. This permit is only good for 10 days but allows the driver to continue their trip without further disruption.

Although the numbers are relatively small, weigh stations typically discover thousands of these non-compliant cases each year, resulting in significant revenues. The research team collected information from 2016 through 2019 on the number of issued permits and total revenues generated by each weigh station. This information is shown in Tables 3.7 – 3.9.

Table 3.7 Temporary Permit Issuances by Weigh Station

Weigh Station	2016	2017	2018	2019	Total
Boone	70	624	470	365	1,529
Floyd	1	5	2	0	8
Fulton	7	10	13	25	55
Hardin	238	175	6	96	515
Henderson	121	89	99	61	370
Kenton	27	99	174	65	365
Laurel NB	304	210	124	277	915
Laurel SB	157	174	24	32	387
Lyon EB	301	514	218	169	1,202
Lyon WB	175	366	278	191	1,010
Rowan	623	121	0	93	837
Scott	177	88	57	48	370
Shelby EB	37	68	94	58	257
Simpson	331	254	391	418	1,394
Total =	2,569	2,797	1,950	1,898	9,214

Table 3.8 Temporary Permit Revenues by Weigh Station

Weigh Station	2016	2017	2018	2019	Total
Boone	$ 2,785	$ 25,125	$ 19,085	$ 14,555	$ 61,550
Floyd	$ 40	$ 200	$ 80	$ -	$ 320
Fulton	$ 280	$ 400	$ 520	$ 1,000	$ 2,200
Hardin	$ 9,520	$ 7,000	$ 240	$ 3,840	$ 20,600
Henderson	$ 4,825	$ 3,515	$ 3,960	$ 2,410	$ 14,710
Kenton	$ 1,080	$ 3,945	$ 6,990	$ 2,585	$ 14,600
Laurel NB	$ 12,115	$ 8,355	$ 4,960	$ 11,050	$ 36,480
Laurel SB	$ 6,265	$ 6,960	$ 960	$ 1,280	$ 15,465
Lyon EB	$ 11,950	$ 20,485	$ 8,675	$ 6,745	$ 47,855
Lyon WB	$ 6,985	$ 14,635	$ 11,145	$ 7,580	$ 40,345
Rowan	$ 24,890	$ 4,840	$ -	$ 3,705	$ 33,435
Scott	$ 7,080	$ 3,520	$ 2,340	$ 1,920	$ 14,860
Shelby EB	$ 1,480	$ 2,705	$ 3,865	$ 2,320	$ 10,370
Simpson	$ 13,225	$ 10,100	$ 15,550	$ 16,690	$ 55,565
Total =	$102,520	$111,785	$ 78,370	$ 75,680	$368,355

Table 3.9 Temporary Permit Revenue Rankings by Weigh Station

	Temp Permit Revenues	Rank	Temp Perm / Annual Traff.	Temp Perm / Annual WIM
Boone	$ 61,550	1	$0.01	$0.04
Floyd	$ 320	14	$0.00	$0.13
Fulton	$ 2,200	13	$0.01	$0.01
Hardin	$ 20,600	7	$0.00	$0.02
Henderson	$ 14,710	10	$0.00	$0.02
Kenton	$ 14,600	11	$0.00	$0.01
Laurel NB	$ 36,480	5	$0.00	$0.02
Laurel SB	$ 15,465	8	$0.00	$0.01
Lyon EB	$ 47,855	3	$0.01	$0.03
Lyon WB	$ 40,345	4	$0.01	$0.03
Rowan	$ 33,435	6	$0.02	$0.06
Scott	$ 14,860	9	$0.00	$0.01
Shelby	$ 10,370	12	$0.00	$0.04
Simpson	$ 55,565	2	$0.01	$0.03
Total =	$ 3,595,337			

The research team also assessed other temporary permits besides KYU. Weigh station inspections can identify violators of multiple permit categories including IFTA, KIT, KYU, IRP (<=55,000 lbs.), IRP (>55,000 lbs.), Temp OW/OD, and Temp Metal. Over the study period, multiple violations of all permit types were identified at weigh stations

across the state. However, KYU temporary permit revenues comprise the primary revenue source for KYTC and therefore, were the only temporary permit type considered in the analysis. The complete number of temporary permit violations and revenues found across all categories are shown in Appendix A.

The KYTC study advisory committee also requested an analysis of the relationship between KYU revenues and CMV traffic. KTC collected and analyzed data from 2013 to 2021 but did not find a strong correlation coefficient between the two (see Appendix A). It can be concluded that multiple factors are likely responsible for declining revenues, and those factors are assessed within the scope of this study.

Court Fees

CMV drivers that receive citations are required to appear in court and address their violations. The court may impose court costs and fees on that driver and/or the owner. The court costs are standard and range from $130 to $144 for typical CMV cases. The court may also impose additional fees related to the violation, as well as court-related fees. Typical CMV violations cover KYU, International Fuel Tax Agreement (IFTA), International Registration Plan (IRP), and various federal violations. Once levied, the courts collect the funds from the offender and distribute among the county, the state, and any relevant third parties. The Administrative Office of the Courts does not currently track exact costs and fees by their final distribution. Therefore, this study used a methodology from a previous KTC study that comprehensively analyzed court costs and fees across the state.[38]

The research team collected court data from the Administrative Office of the Courts and analyzed CMV citations and violations over the study period. The revenue projections reflect projected citation revenues through the courts and not through confirmed convictions. Some cases may be dismissed but this information was not readily available. This means that the court fees may be either under or overestimated, so this analysis provides a reasonable approximation. The results from the projected court revenues are shown in Tables 3.10 and 3.11 and Figure 3.1.

Table 3.10 Number of Court Charges by Weigh Station

Weigh Station	Year				Total
	2016[a]	2017	2018	2019	
Boone	131	150	148	94	523
Floyd	21	60	3	0	84
Fulton	30	23	31	36	120
Hardin	408	802	81	342	1,633
Henderson	434	598	400	303	1,735
Kenton	296	466	369	54	1,185
Laurel NB[b]	289	598	6.5	261.5	1,155
Laurel SB[b]	289	598	6.5	261.5	1,155
Lyon EB[b]	714	910	771	461	2,856
Lyon WB[b]	714	910	771	461	2,856
Rowan	144	128	0	305	577
Scott	417	761	241	249	1,668
Shelby	208	366	142	115	831
Simpson	222	308	91	267	888
Total =	4,316	6,678	3,061	3,210	17,265

a - 2016 court charges are extrapolated from 2017-2019 running average

b - The twin weigh stations in Laurel (NB/SB) and Lyon (EB/WB) were aggregated and split

Table 3.11 Court Revenues by Weigh Station

Weigh Station	Year				Total
	2016[a]	2017	2018	2019	
Boone	$ 12,386	$ 14,235	$ 14,001	$ 8,923	$ 49,545
Floyd	$ 2,025	$ 5,790	$ 285	$ -	$ 8,099
Fulton	$ 2,878	$ 2,215	$ 2,952	$ 3,469	$ 11,513
Hardin	$ 38,920	$ 76,259	$ 7,662	$ 32,839	$ 155,680
Henderson	$ 41,591	$ 57,435	$ 38,145	$ 29,193	$ 166,363
Kenton	$ 26,596	$ 41,727	$ 33,163	$ 4,898	$ 106,384
Laurel NB[b]	$ 27,629	$ 57,099	$ 628	$ 25,161	$ 110,516
Laurel SB[b]	$ 27,629	$ 57,099	$ 628	$ 25,161	$ 110,516
Lyon EB[b]	$ 68,445	$ 87,345	$ 73,739	$ 44,252	$ 273,781
Lyon WB[b]	$ 68,445	$ 87,345	$ 73,739	$ 44,252	$ 273,781
Rowan	$ 13,902	$ 12,352	$ -	$ 29,353	$ 55,606
Scott	$ 39,777	$ 72,432	$ 23,022	$ 23,879	$ 159,109
Shelby	$ 19,992	$ 35,117	$ 13,709	$ 11,150	$ 79,968
Simpson	$ 21,248	$ 29,442	$ 8,747	$ 25,556	$ 84,992
Total =	$ 411,463	$ 635,890	$ 290,418	$ 308,082	$ 1,645,853

a - 2016 court revenues are extrapolated from 2017-2019 running average

b - The twin weigh stations in Laurel (NB/SB) and Lyon (EB/WB) were aggregated and split

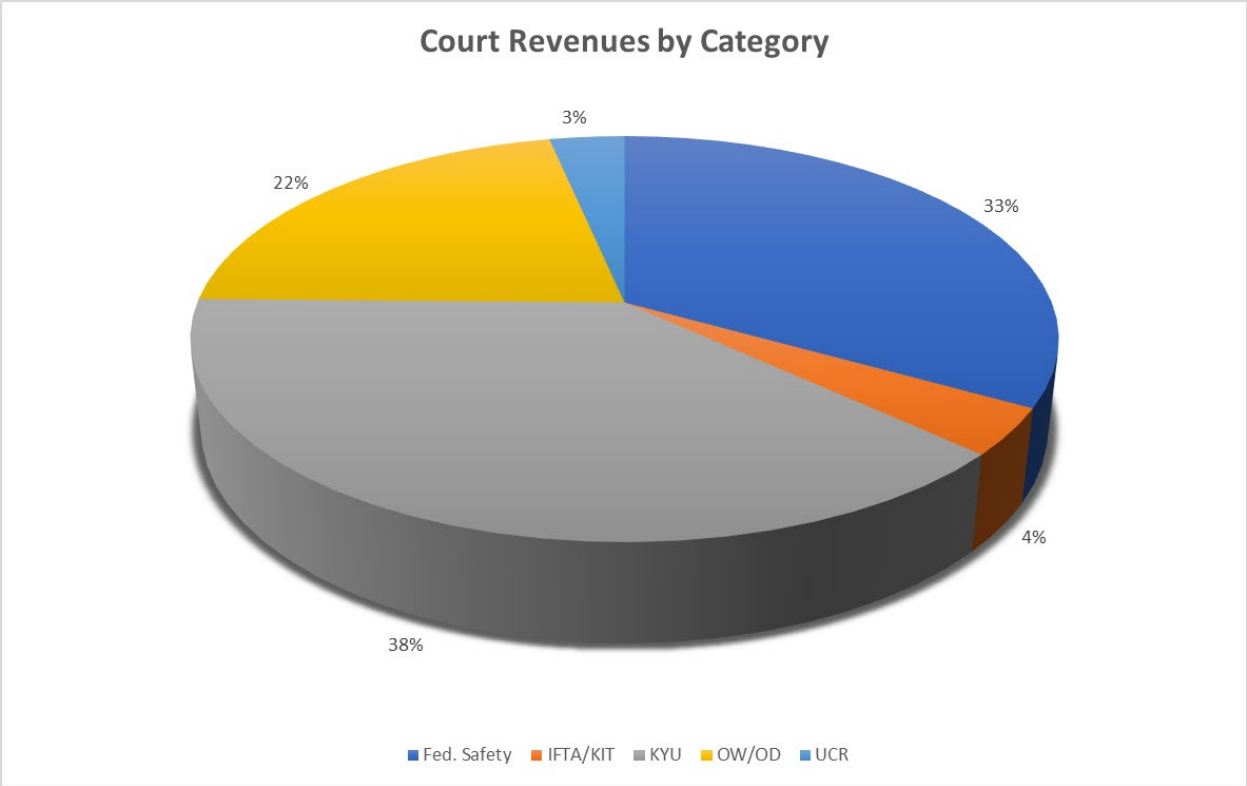

Figure 3.1 Court Revenues by Category

3.4 Weigh Station Expenses

The Fulton, Henderson, and Hardin weigh stations already have significant capital costs incurred from their initial construction. These costs are considered sunk costs and cannot be recovered. Consequently, the research team analyzed the costs associated with their ongoing operations and maintenance (O&M). This research effort primarily focused on three cost categories: utilities, capital improvements, and labor.

Utilities

All facilities require the use of utilities to power their ongoing operations. However, the range of utility categories differ between weigh stations since some facilities may not require or have access to select utilities (e.g., gas for Henderson and Hardin). The three sites all required the use of electricity which constituted the bulk of utility costs for two of the three sites. The aggregated utility expenses for each weigh station over the study period are shown in Table 3.12.

Table 3.12 Utility Expenses by Weigh Station (2016-2019)

Utilities	Fulton	Henderson	Hardin
Electric	$14,181	$23,727	$14,847
Water	$903	NA	$843
Sewer	$1,371	NA	NA
Gas	$761	NA	NA
Waste	$1,809	$3,739	$2,880
Phone	$3,381	$21,362	$4,761
Other	$857	NA	$4,440
Total =	$23,263	$48,828	$27,771

Capital Improvements

Capital improvements are characterized as facility infrastructure investments that significantly enhance or improve its condition. Typically, these improvements significantly exceed any costs associated with minor repairs or routine O&M costs, which are excluded from this analysis. KYTC provided comprehensive capital improvement expenses and descriptions for all weigh stations over the period (see Appendix B, Capital Improvement Expenses).

Capital improvement costs include most major repairs and renovations that are tracked at KYTC's Central Office. They do not account for minor repairs that are handled and paid for at the district level. The three sites of interest did not receive many capital improvements over the study period. Out of the total capital improvement costs across all weigh stations, these three sites received approximately 2.3 percent of the total allocation. However, there are 14 total weigh stations across the state. Assuming an equal distribution of capital improvement expenditures across each site, these three sites should have received approximately 21 percent (i.e., 3 out of 14) of the capital improvement expenditures. This analysis infers that these three sites have received less investment than might be warranted. Nevertheless, a detailed investigation of capital improvement allocations and their intended purpose was not conducted. The full list of expenses for these three stations and the overall state costs are shown Tables 3.13 and 3.14.

Table 3.13 Capital Improvement Expenses by Weigh Station

Facility	2016	2017	2018	2019	Total
Fulton	$1,575	$1,575	$1,670	$2,848	$7,667
Henderson	$4,340	$21,440	$4,600	$5,999	$36,379
Hardin	$1,575	$21,325	$1,670	$2,848	$27,417
Total	$7,490	$44,340	$7,939	$11,694	$71,464

Table 3.14 Total Capital Improvement Costs across all Weigh Stations

Total Capital Improvement Costs					Percent of
2016	2017	2018	2019	Total	Total CIP*
$131,044	$369,204	$1,775,801	$777,289	$3,053,338	2.3%

Personnel

Personnel costs typically represent the largest ongoing costs for weigh stations. This trend holds true for all three weigh stations of interest, as their largest single expense is labor. Weigh stations primarily have two types of personnel, roadside inspectors and sworn officers, but a select few may also have civilian administrative staff. For

the purposes of this study, the focus will be on roadside inspectors and sworn officers as the Fulton, Henderson, and Hardin facilities only have these two groups of workers. Inspectors and sworn officers both work within KSP, but only roadside inspectors are assigned exclusively to serving weigh stations. Consequently, the research team only examined the cost of inspectors since KSP sworn officers would continue to be employed and serve with or without the existence of a weigh station.

Roadside inspectors fall into two categories: Inspector I and Inspector II. The Inspector I category represents entry level, while the Inspector II category includes more experienced personnel. KSP provided the cost rates, including fringe, for both inspector types — ranging from approximately $21 per hour up to $27 per hour. This cost analysis assumed a standard 40-hour work week as its baseline and accounted for fringe benefits. Fringe benefits incorporate additional expenses spread out over the year in the form of comp time, holidays, annual leave, and sick leave. KSP provided inspector hours worked across all three weigh stations of interest for 2016 through 2019 (see Appendix B, Personnel Expenses). Those hours and cost rates were used to determine the inspector costs for each weigh station location, as shown in Table 3.15 and Figure 3.2.

Table 3.15 Inspector Costs by Weigh Station

Location	Classification	2016	2017	2018	2019	Total
Fulton	Inspector I	$ 20,278	$ 19,036	$ 9,152	$ 86,655	$ 135,121
	Inspector II	$ -	$ 11,681	$ 57,672	$ 5,520	$ 74,873
	Fulton Total	$ 20,278	$ 30,717	$ 66,824	$ 92,175	$ 209,994
Henderson	Inspector I	$ 48,406	$ 45,232	$ 19,184	$ -	$ 112,822
	Inspector II	$ -	$ 56,160	$ 56,511	$ 56,592	$ 169,263
	Hend. Total	$ 48,406	$ 101,392	$ 75,695	$ 56,592	$ 282,085
Hardin	Inspector I	$ 116,262	$ 119,900	$ 48,400	$ 15,620	$ 300,182
	Inspector II	$ -	$ -	$ -	$ 19,170	$ 19,170
	Hardin Total	$ 116,262	$ 119,900	$ 48,400	$ 34,790	$ 319,352
All Sites	All Total =	$ 184,946	$ 252,009	$ 190,919	$ 183,557	$ 811,431

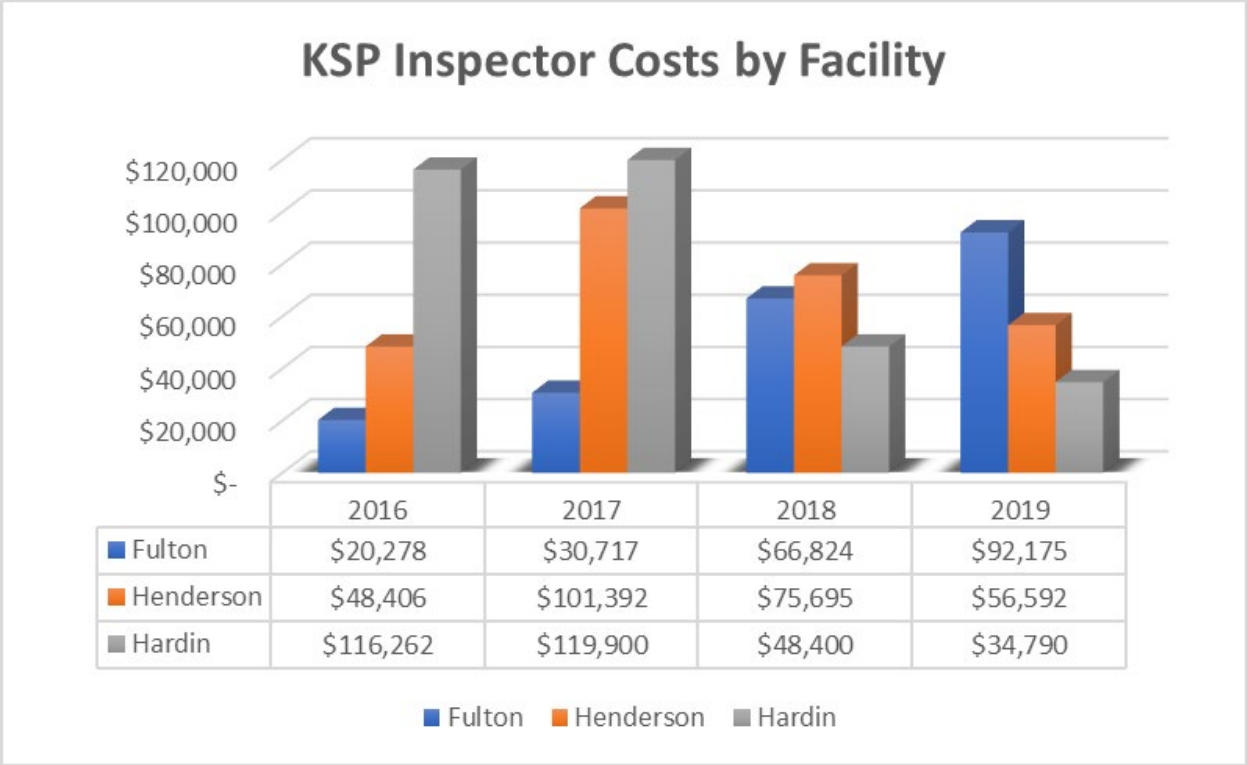

Figure 3.2 Inspector Costs by Weigh Station (Trends)

Chapter 4 Facility Replacement Guidelines

4.1 Overview

Project Purpose

Weigh station facilities help enforce and promote safety for the CMV community and generate revenues for the Kentucky Transportation Cabinet. However, their prohibitive construction and maintenance costs dictate a comprehensive set of guidelines when deciding to replace or update. The three weigh station facilities in this study—Fulton, Henderson, and Hardin—warrant replacement consideration due to bypass or demolition involving future interstate and interchange construction projects. The Fulton and Henderson facilities are placed on highways which will be replaced by the future Interstate 69 construction, meaning they will no longer serve the main thoroughfare used by CMV traffic. In the case of Hardin, a proposed I-65 interchange reconstruction project will involve demolition of this facility. The business case for continuing to operate the three facilities as they currently exist is no longer valid. As such, the KTC research team developed guidelines for KYTC to inform the decision to replace the three CMV facilities and any other facilities in the future.

Facility replacement guidelines must be developed in a manner that informs decision makers on the most effective course of action. The guidelines serve three goals:

- Assist decision-making for executive leadership and other stakeholders
- Provide structure and logic for taking specific actions directed at the facility
- Establish a roadmap for reaching the decision to replace, repair, or close the facility

Conversely, facility replacement guidelines are simply that, guidelines. This project does not supersede existing rules, regulations, or other official decisions that may impact the replacement of existing facilities. In other words, this project will not:

- Remove stakeholder concerns and the expertise of executive leadership or other decision-makers from the process
- Provide required standards for replacing facilities
- Supersede any established federal policies or rules

Replacement Criteria

Relevant and impactful criteria grouped within tiered categories formed the foundation for deciding whether to replace a weigh station facility. Building upon the initial literature review and data collection efforts, the research team collaborated extensively with the KYTC project committee to select and reach consensus on criteria to use in the decision-making process. Any replacement criteria would need to reflect the project's purpose of improving safety and generating revenues. In addition, the facility should be optimized to perform its mission effectively and efficiently. With these key factors in mind, the research team developed a list of several criteria meeting this intent. These criteria were also grouped into several overarching categories, or tiers, to better characterize them and make the process easier to navigate. The three tiers developed for this replacement guideline framework were site conditions, facility infrastructure, and operating characteristics.

Site conditions represent those local geographic and transportation conditions inherent to the site. Existing truck volumes, a site location near a state line, and the lack of nearby bypass routes were the three criteria listed within site conditions. Each of these three criteria are fundamental to the site and cannot be readily changed by KYTC. For instance, truck volumes represent those local traffic conditions, including CMV traffic, along the existing route. The site's proximity to a state boundary (e.g., Indiana) or the presence of nearby bypass routes that CMVs could use to avoid a weigh station are also relatively fixed conditions. Collectively, this tiered group represented the fundamental starting point, or baseline, for assessing the replacement of a facility.

Facility infrastructure encompass all the components of a weigh station. The criteria developed for this category help develop the layout for a proposed facility or help determine whether an existing site still has the capacity to serve

its intended purpose. Facility infrastructure criteria identified in this study include scale house, number of workstations, length of entrance ramp, number of CMV parking spaces, and any additional equipment that aids with inspection. The scale house is the onsite building where commercial vehicle enforcement staff, including inspectors, perform their work operations. Within this scale house, staff have access to workstations with accompanying desks, chairs, and computers. The length of the entrance ramp is critical since excessive incoming CMV volumes could overwhelm the facility's ability to screen vehicles resulting in queues forming on the connecting highway (contributing to safety concerns). The facility must also have enough parking spaces to accommodate inspected vehicles. For safety reasons, once a parking lot is filled, inspectors have limited ability to pull over more CMVs. The last criteria, additional equipment, represents a broader category of onsite equipment that can help staff better perform their jobs. Examples of additional equipment include e-screening capabilities (e.g., KATS, PrePass, etc.) and an inspection barn for performing undercarriage examinations, among others. While comprehensive, this list is not exhaustive and other infrastructure may be identified by future planners when deciding to replace a CMV facility.

Operating characteristics of the facility are defined by inputs (e.g., staffing levels, hours, and costs) and outputs (e.g., safety performance and revenues). KSP is responsible for staffing weigh station facilities with inspectors and sworn officers. For the purposes of this study, the primary focus is on inspectors as the full-time presence at weigh stations. Sworn officers may also lead or assist inspectors in conducting CMV inspections but their other duties, including roadside enforcement, take precedence over weigh station duties. Staffing levels are important since a larger staff can potentially perform more inspections. Similarly, the facility's hours of operation provide additional insight into how many CMVs can be screened and inspected during the course of a typical day. The third criteria, safety performance, represents a number of safety-related variables. These include number of inspections, number of violations, and citations issued, among others. Section 4.4 further elaborates on evaluating safety considerations.

A facility's revenues and costs represent the final criteria. A facility can generate revenues from CMV impounds, temporary permits, and court fees. After initial construction, ongoing costs occur through utility expenses, labor costs from staffing, and possibly capital improvement projects. All three categories and their criteria are shown below in Figure 4.1.

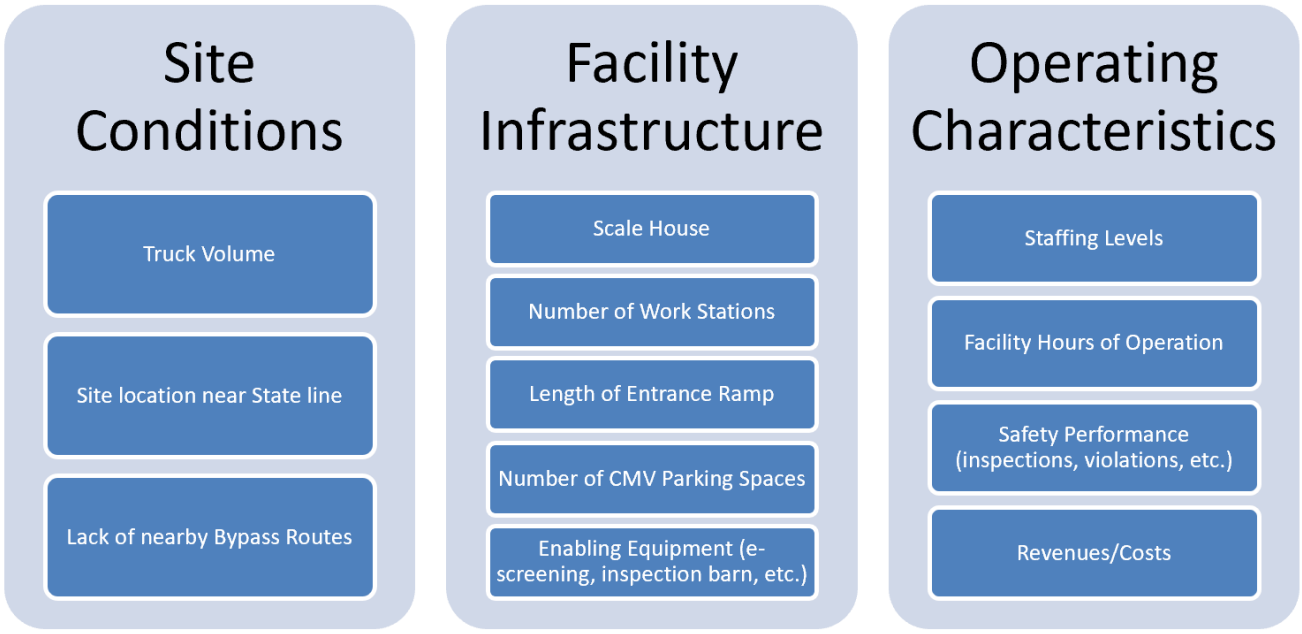

Figure 4.1 Criteria Tiers for Facility Replacement Guidelines

The research team met with the KYTC project committee on July 13, 2021, to discuss and validate these tiered groups of facility replacement criteria. This validation process occurred through an online survey tool, Mentimeter, to evaluate the criteria and share any additional insights or comments. As a result of this collaboration session, the

team decided to move forward with using the criteria to make decisions on replacing CMV facilities. The full list of Mentimeter survey questions and their accompanying results are shown in Appendix D.

4.2 Decision Framework

Formulation

The research team developed a decision tree from the tiers of weigh station criteria and presented this framework for KYTC leadership to use in deciding on facility replacement (see Figures 4.2 and 4.3). The tiers were represented by screening criteria within the decision tree framework and nodes were selectively placed to make replacement decisions.

Once a weigh station facility is selected for possible replacement, evaluators perform a screening of the facility through two parallel tier structures—the facility site conditions and the facility operating conditions. Each respective tiered condition incorporates the specific criteria discussed in Section 4.1 for the overall assessment. Further discussion on this evaluation process is discussed in Sections 4.3 through 4.5.

Once assessed, the evaluator will make the determination on whether to replace the facility. If the decision is no, the evaluator will determine whether to convert the existing facility to a remote monitoring facility or to simply close it. A remote monitoring facility uses video and other screening technology to capture CMVs traveling through an area and can help KYTC and KSP personnel with identifying certain non-compliant vehicles including those found delinquent on paying CMV taxes. However, a remote monitoring facility does not have inspectors and therefore cannot perform safety inspections. This limits its ability to fully evaluate safety deficiencies and take countermeasures. A remote monitoring facility can be best characterized as one with partial capabilities. The decision maker may choose to close the facility if the benefits offered by the facility, including remote capabilities, are no longer sufficient.

If a decision is reached to fully replace the facility, the evaluator will proceed to the decision tree for facility construction (Figure 4.3). In this scenario, KYTC has already decided where to construct a new facility. The fundamental question will then become: “What factors should be considered when designing and constructing the new facility?” The five facility infrastructure factors provide the basis for answering that question. Additional details for each of these criteria are described further in Section 4.5.

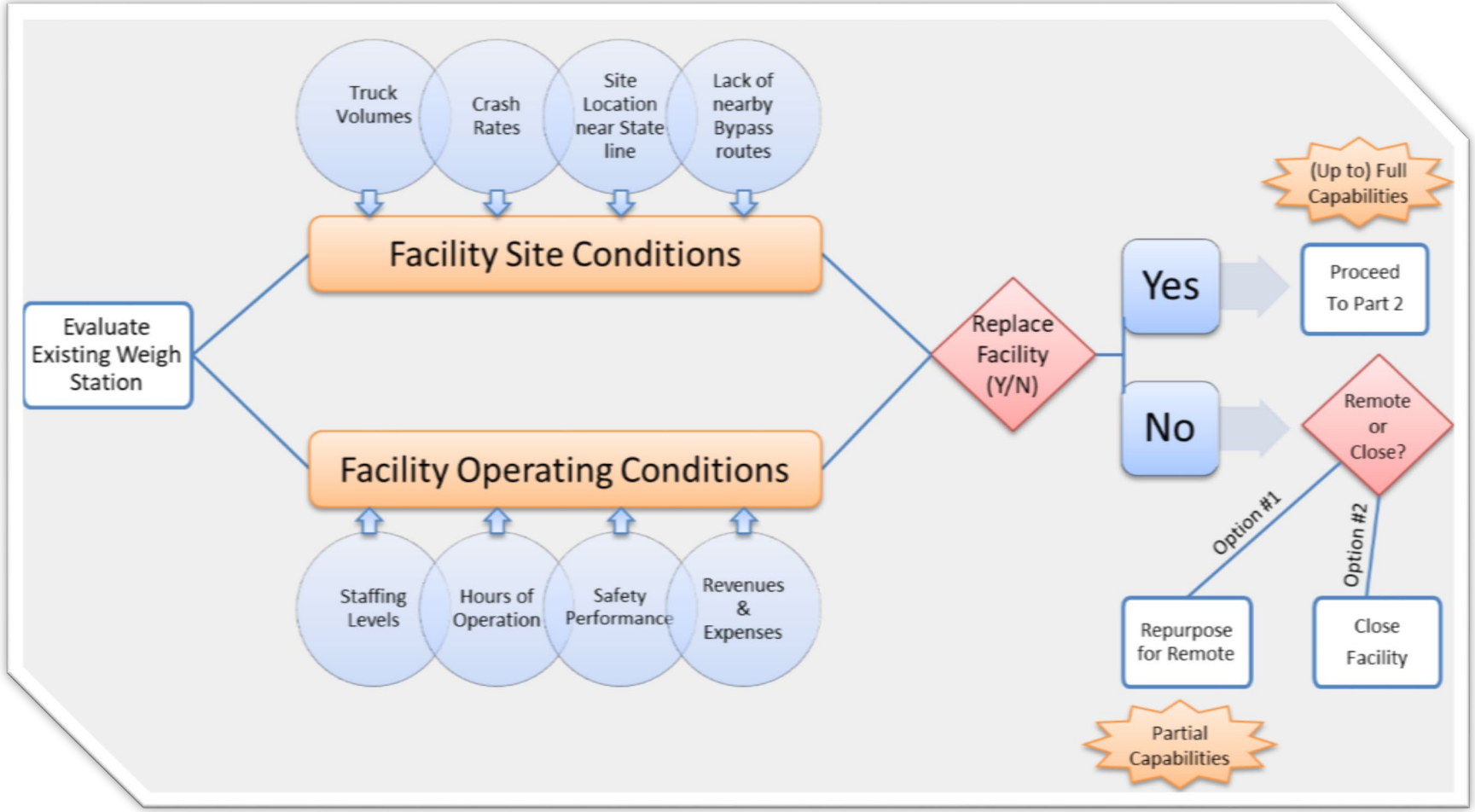

Figure 4.2 Decision Tree for Facility Construction (Replacement Options)

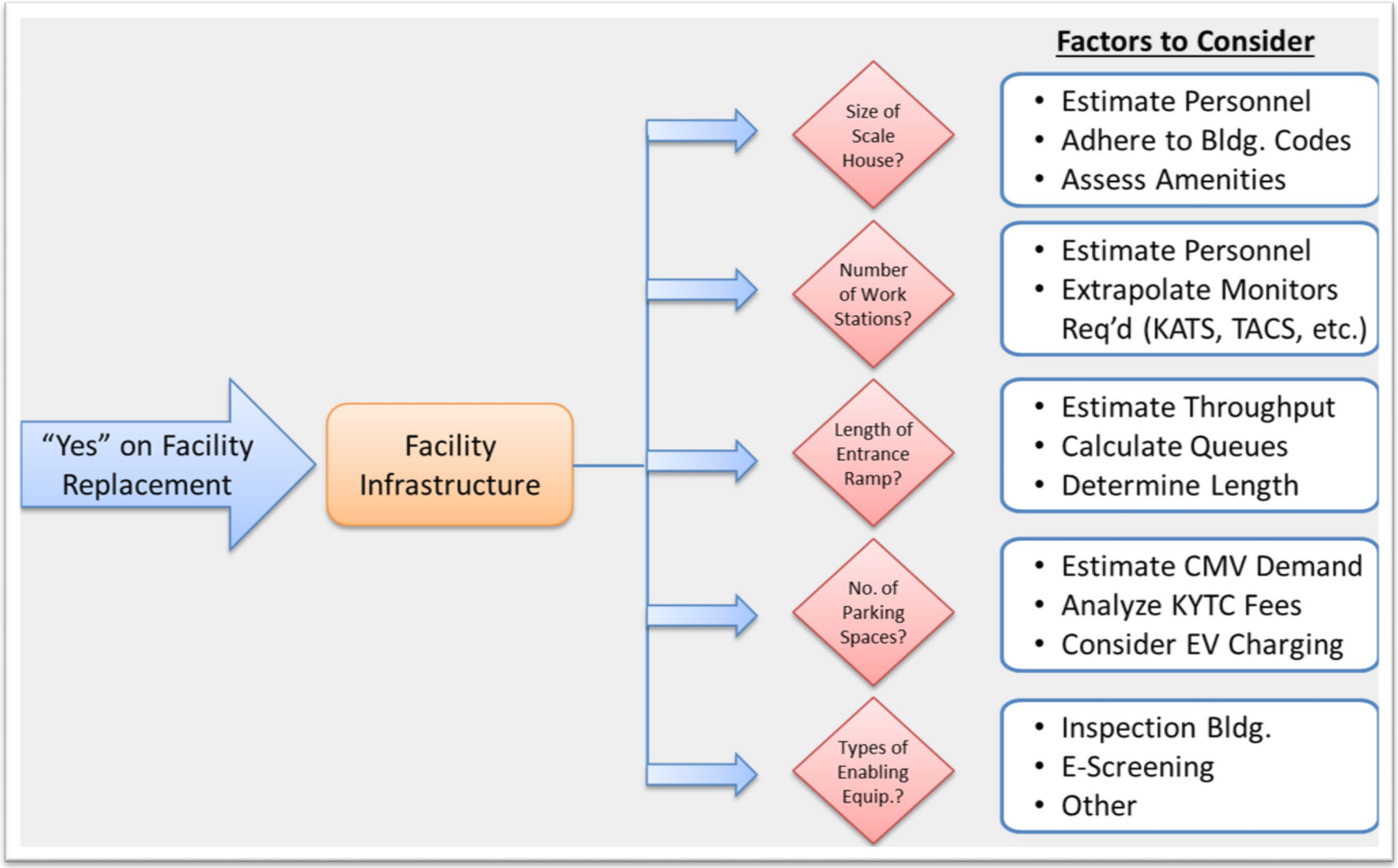

Figure 4.3 Decision Tree for Facility Construction (New Construction)

4.3 Site Conditions

Traffic Volumes

Traffic volumes are an important factor to consider when evaluating the replacement of a weigh station. High-volume corridors with significant CMV traffic provide the greatest opportunity to improve safety and generate revenues through a new facility. The research team obtained traffic volumes in the form of average annual daily traffic (AADT) from KYTC's DataMart portal, an online tool for accessing various KYTC publicly available datasets.[39] Traffic volumes are characterized by their highway segment number and corresponding route. From there, the portal allows for the extraction of additional relevant information including beginning Milepoint, ending Milepoint, county, AADT, percentage of trucks (single and combo), and the year this data was collected.

KTC began this analysis by extracting and analyzing all 18,561 route segments in KYTC's highway network. Locations for each weigh station were identified and further segregated to develop a table for weigh station analysis. The research team also assigned rank percentages to each location based on its AADT volume relative to all other KYTC route segments. For instance, the top AADT-ranked segment with a weigh station was the Kenton facility. This weigh station was located on a highway segment in the top 0.8 percent of traffic volume in the state. The traffic conditions at Kentucky's weigh stations vary dramatically, with primary interstates such as I-65 and I-75 generating the highest traffic volumes. The volumes drop off considerably for four facilities: Henderson, Rowan, Fulton, and Floyd.

To evaluate and prioritize weigh stations using AADT, the research team assigned a threshold that weigh stations should reside within the top 10 percent of AADT relative to other routes in order to be considered for replacement. This parameter ensures that weigh stations are prioritized along high volume corridors of CMV traffic, warranting a significant investment. The Hardin and Henderson facilities met this guideline while the Fulton facility did not. The complete truck volumes by weigh station rankings and percentages are shown in Table 4.1.

Table 4.1 Truck Volumes by Weigh Station Rankings & Percentages

Segment Number	Route	Begin Milepoint	End Milepoint	County	AADT	Rank Percent[a]	Percentage Trucks[b]	Year	Weigh Station	No. of Stations
149	059-I -0075 -000	166.263	169.439	Kenton	49,621	0.8%	19.2%	2020	Kenton (South)	1
172	008-I -0071 -000	72.081	77.724	Boone	43,403	0.9%	30.1%	2020	Boone (South)	1
179	107-I -0065 -000	1.98	5.979	Simpson	43,007	1.0%	31.9%	2020	Simpson (North)	1
182	063-I -0075 -000	28.852	38.187	Laurel	42,462	1.0%	28.2%	2018	Laurel (North/South)	2
198	047-I -0065 -000	85.686	91.086	Hardin	40,384	1.1%	35.7%	2020	Hardin (South)	1
216	106-I -0064 -000	35.163	43.332	Shelby	38,204	1.2%	22.0%	2020	Shelby (East)	1
217	105-I -0075 -000	129.199	136.468	Scott	38,187	1.2%	35.5%	2020	Scott (North)	1
252	051-US-0041 -000	17.343	20.977	Henderson	36,023	1.4%	10.9%	2020	Henderson (South)	1
364	072-I -0024 -000	33.88	39.501	Lyon	26,590	2.0%	36.6%	2020	Lyon (East/West)	2
1805	036-US-0023 -000	20.445	21.986	Floyd	9,676	9.7%	16.5%	2020	Floyd (North)	1
2244	103-I -0064 -000	137.268	148.665	Rowan	8,174	12.1%	22.3%	2020	Rowan (West)	1
5725	038-US-0051 -000	0	0.297	Fulton	2,706	30.8%	17.5%	2020	Fulton (North)	1

a - Rank percent = Segment No. / Total Route Segments

(indicates the AADT prioritization for a given segment with respect to the overall KYTC network)

b - KYTC Traffic Count Reporting System for all trucks (% Single + % Combo)

Crash Hotspots

Safety factors into whether to replace a facility, and high crash rates occurring in certain locations, or crash hotspots, have a significant impact on the decision. In this study, it was infeasible to conduct a full evaluation of crash rates across all of Kentucky's highways. A full research study and analysis using this approach would significantly exceed the resources available for this project. However, the research team was able to use a crash proxy in the form of crash hotspots for further analysis. KYTC and Western Kentucky University had previously analyzed CMV crashes in Kentucky with a focus on developing a top ten list for crash hotspots.[40] They agreed to share this information with the KTC research team for inclusion in this study.

Using the results from this previous work, the research team identified the top 10 crash hotspots across Kentucky involving the following roadway conditions:

- Rural Two-Lane
- Rural Multilane
- Urban Two-Lane
- Urban Multilane

The 40 crash hotspot locations were plotted on a map. Next, the research team developed a qualitative measure to assign potential impact to those weigh stations located near hotspots. This methodology assigned a higher priority to weigh stations located near crash hotspots because their potential to improve CMV safety in their area outweigh those weigh stations representing areas with lower crash frequencies. To this end, radii of 20 miles and 40 miles were plotted around each individual location. The 20-mile radius corresponded to hotspots located on nearby routes excluding the weigh station route, while the 40-mile radius was located on the same weigh station route. This decision was made because hotspots located on the same weigh station route will have a greater probability of impacting travel conditions at that weigh station than other nearby routes. The research team assigned a Yes/No occurrence for each weigh station meeting these crash proximity thresholds. Taking this one step further, for weigh stations near multiple crash hotspots (often along interstates), the research team prescribed a frequency number. For example, the Hardin and Fulton facilities were located near 4 and 1 crash hotspots, respectively, while the Henderson facility had no hotspots nearby. On the following page, the crash hotspots for all four roadway types are shown with the blue tabs indicating weigh station facilities and the red tabs indicating crash hotspots (Figure 4.4). Table 4.2 shows the results for all weigh station sites and their proximity to potential crash hotspots.

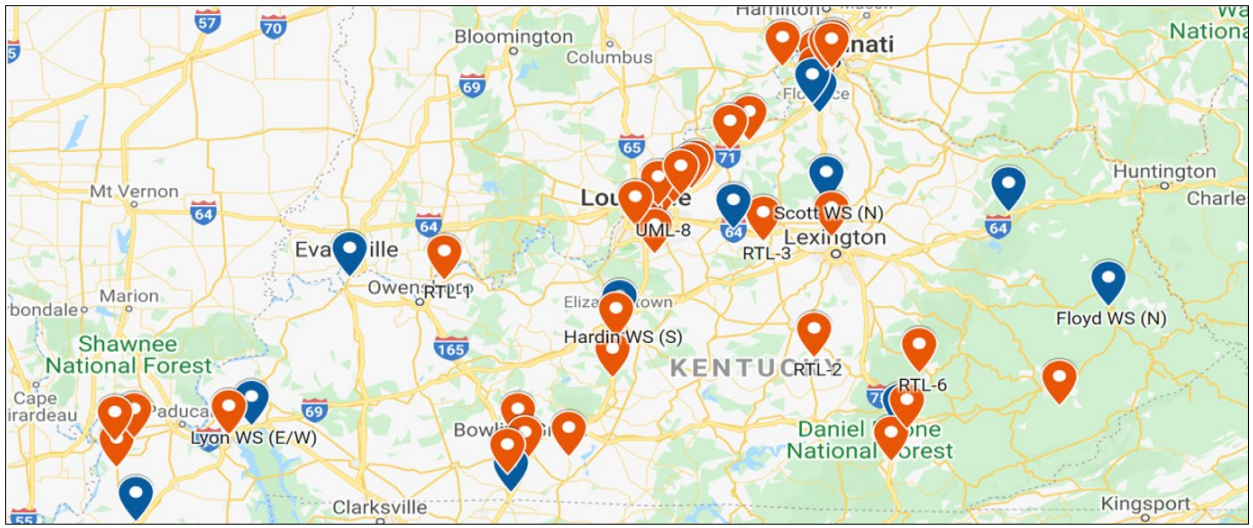

Figure 4.4 Crash Hotspots in Kentucky

Table 4.2 Crash Hotspot Analysis for Weigh Stations

Segment Number	Weigh Station	No. of Stations	Route	Begin Milepoint	End Milepoint	County	Crash Proximity[a]		
							Inside 40-	No. of Crash	Inside 20-
149	Kenton (South)	1	059-I -0075 -000	166.263	169.439	Kenton	Yes	5	
172	Boone (South)	1	008-I -0071 -000	72.081	77.724	Boone	Yes	3	
179	Simpson (North)	1	107-I -0065 -000	1.98	5.979	Simpson	Yes	1	
182	Laurel (North/South)	2	063-I -0075 -000	28.852	38.187	Laurel	Yes	2	
198	Hardin (South)	1	047-I -0065 -000	85.686	91.086	Hardin	Yes	4	
216	Shelby (East)	1	106-I -0064 -000	35.163	43.332	Shelby	Yes	1	
217	Scott (North)	1	105-I -0075 -000	129.199	136.468	Scott	Yes	1	
252	Henderson (South)	1	051-US-0041 -000	17.343	20.977	Henderson	No	NA	No
364	Lyon (East/West)	2	072-I -0024 -000	33.88	39.501	Lyon	Yes	1	
1805	Floyd (North)	1	036-US-0023 -000	20.445	21.986	Floyd	No	NA	No
2244	Rowan (West)	1	103-I -0064 -000	137.268	148.665	Rowan	No	NA	No
5725	Fulton (North)	1	038-US-0051 -000	0	0.297	Fulton	Yes	1	

Site Location

Two geographical conditions, the proximity of a weigh station to a nearby state line and/or a bypass route, constitute important consideration for assessing site conditions. The research team used findings from its literature review to incorporate these components into the analysis. The Illinois DOT had identified both conditions within their weigh station manual for use in identifying and selecting weigh stations for construction. Similarly, these conditions may be useful to KYTC decision-makers in assessing the feasibility of replacing weigh stations and identifying future sites. Weigh stations should be established near state boundaries to the maximum extent possible to better capture incoming CMV traffic from adjoining states. The further a weigh station resides from a state line, the greater the likelihood that CMV traffic may take detours away from a weigh station, thereby reducing its positive effect on safety and revenue collection. The same logic holds true for stations located near bypass routes. To the maximum extent possible, weigh stations should not be placed near bypass routes that can readily accommodate CMV traffic and allow CMVs to avoid traveling past the weigh station.

The Henderson facility is located near the Indiana state line, and the Fulton facility is located near the Tennessee state line. Both facilities are located less than one mile from state lines, maximizing their effectiveness in capturing incoming interstate CMV traffic. The Hardin facility, however, is not located near any state line. The Indiana border lies nearly 49 miles north along Interstate 65. The original rationale for its placement was not investigated during this study, but this location may have been selected based on the limited space available in the congested Louisville area next to Indiana. A decision to replace any of these facilities should consider the location of the Fulton and Henderson facilities along state borders, and aim to relocate the Hardin facility closer to its Indiana crossing. Similarly, any bypass routes within proximity to proposed weigh stations should be examined for their potential to allow CMV traffic to evade and bypass weigh stations. The research team did not examine the frequency or location of bypass routes in this study but recommends doing so before any future sites are considered for a weigh station.

4.4 Operating Characteristics

Staffing Levels

Weigh station personnel, primarily inspectors, carry out CMV screenings and inspections. The number of staff on hand has a direct impact on a weigh station's ability to monitor incoming CMVs. When the number of vehicles exceeds the capacity of inspectors to screen and/or inspect those vehicles, the facility becomes overwhelmed — often leading to the decision to direct all mainline CMV traffic to bypass the weigh station. Those trucks bypassing the facility will not be screened or inspected for non-compliance with safety or other regulatory measures. Consequently, staffing levels represent a key factor in assessing the operating characteristics for a facility as well as its overall effectiveness.

Over the last decade, KSP has experienced difficulties with retaining and staffing personnel at weigh stations across Kentucky, particularly in urban regions such as Northern Kentucky and Hardin County. Although KSP has hired numerous inspectors in recent years, they have traditionally experienced high turnover as wages have not been competitive with the prevailing job wages in surrounding areas with this trend particularly pronounced in urban areas. KSP acknowledged these difficulties and their potential to adversely impact safety outcomes and revenue generation. For example, KSP hired 38 inspectors during the 2017 calendar year but experienced 15 departures from that same cohort within one year of their initial hire. To counter these trends, KSP has taken efforts to overcome these wage disparities in order to increase inspector retention levels. In July 2019, KSP successfully enacted pay raises for their inspectors.[41] Despite this notable success, KSP recognizes the needs to continue to make efforts to achieve pay parity for its inspectors in a robust competitive economy and reduce its staff turnover challenges.

The research team collected staffing data from KSP and assessed trends over time. The first trend involved weigh station staff attrition. From 2016 through 2019, most weigh stations across the state experienced significant turnover. Attrition was analyzed by region since individual station data was not available. The weigh station assignments by region are as follows: 1) Fulton, Henderson, Lyon EB, and Lyon WB; 2) Hardin and Simpson; 3) Boone, Kenton, Scott, and Shelby; 4) Laurel NB and Laurel SB; 5) Rowan; and 6) Floyd. The retention percentage, or ability for a facility to retain its existing staff, is predominantly low across all regions except for regions 5 (75 percent) and 6 (information not available). As expected, the urban region of Northern Kentucky fared worst with a retention rate of only 6.3 percent for the period. The remaining regions (1, 2, 4) had retention percentages ranging from 26 to 36

percent. These low retention rates (i.e., high turnover) detract from having an experienced staff on hand and consume additional time and resources with the constant need to train new personnel. Table 4.3 shows the staffing hires and departures for these regions over the selected period.

Table 4.3 KSP Inspector Attrition for New Hires (2016-2019)

Region	Hires	Departures	Retention %
1	15	11	26.7%
2	9	6	33.3%
3	16	15	6.3%
4	11	7	36.4%
5	4	1	75.0%
6	NA	NA	NA

KSP has also experienced a steady loss of its sworn officers that assist with commercial vehicle enforcement. While inspectors primarily conduct weigh station inspections, sworn officers may also conduct inspections at weigh stations or more often, during roadside enforcement. KSP has seen a significant loss in its number of sworn officers from 2007 through 2021. In 2007, KSP had 162 sworn officers serving in CVE while that number has decreased to 68 as of 2021. This represents a 58 percent decrease in sworn officer staffing available for CVE activities over a 15-year period. In recognition of this issue, KSP provided its CVE sworn officers with a significant pay raise in January 2019 to help counter these recurring losses.[41]

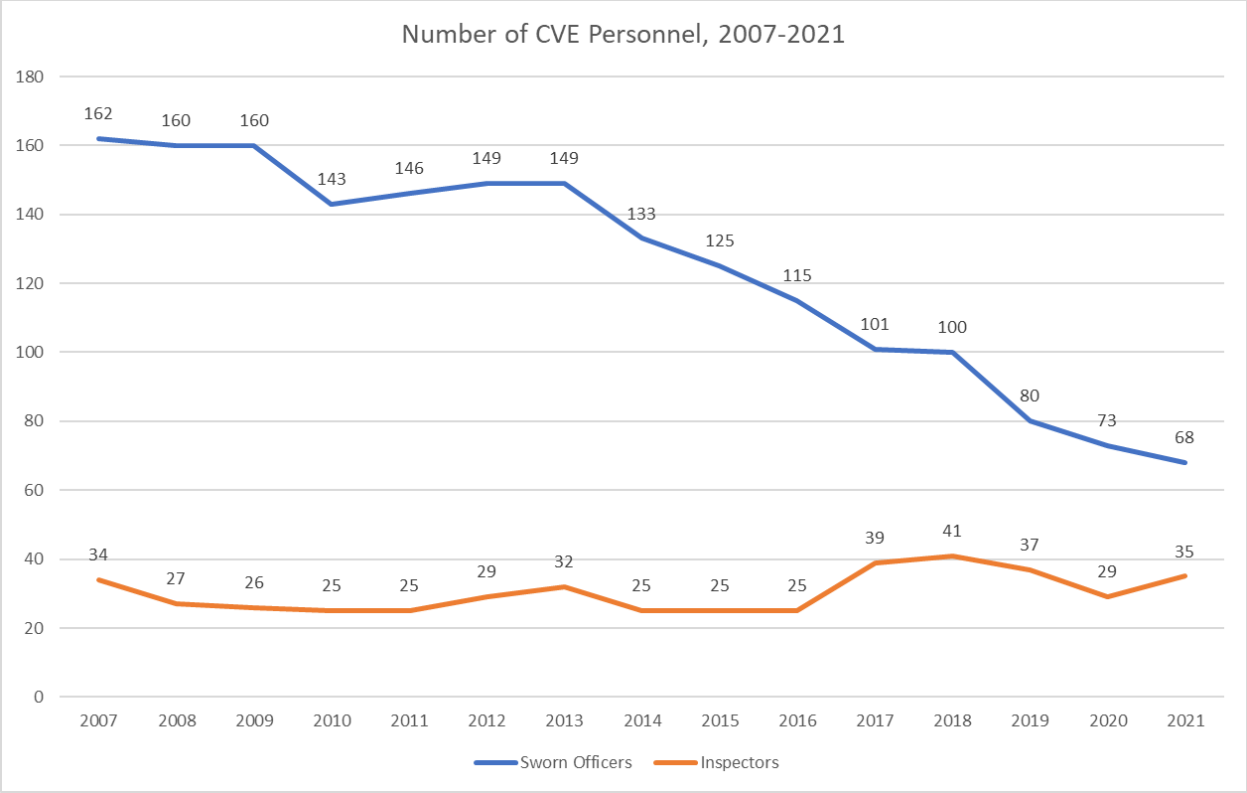

Figure 4.5 KSP Staffing Levels for Commercial Vehicle Enforcement

In summary, all regions including those covering the Fulton, Henderson, and Hardin facilities have experienced significant inspector turnover as well as a steady decline in sworn officer staffing. This impacts the facility's

operations and its ability to maintain continuity in its performance. The study also examined the relationship between the total number of staff present (inspectors and sworn officers) and the number of inspections conducted. The research team found that inspections seemed to decline in proportion to declining staffing levels from 2013 through 2019. However, due to data gaps, the study team could not perform a statistical analysis to definitively support that relationship. The research team also lacked individual weigh station information for hires and departures, further limiting its ability to analyze the data and draw conclusions. Drawing upon these insights, the research team used a 70 percent threshold for minimum staff retention levels when assessing weigh station replacement feasibility.

Facility Hours of Operation

As with any agency, weigh station facilities have designated hours of operation. Extended hours of operation provide additional opportunities to conduct screening and inspection activities, which promote safety and generates revenue. The research team used existing PrePass data to analyze all weigh station facilities in Kentucky for the percentage of time they are open. This information was obtained through annual weight enforcement reports issued by the Federal Highway Administration (FHWA).[42] This data provides an overview on when facilities equipped with PrePass screening technology are actively receiving and screening trucks on their ramps. Kentucky weigh stations all use this technology except Floyd and Fulton (although Fulton added this technology at the end of this study). Percent of time open does not account for those times when a facility is technically open, but the ramp is closed due to truck backlogs.

The research team identified a standard threshold of 33 percent open during a typical 8-hour workday. The study found that Henderson met this threshold (34.5 percent) while Hardin did not (22 percent). The Fulton station's open hours could not be found since this site lacked PrePass capability for much of the study (2016-2019). The full dataset for percent of time open across all weigh stations is shown in Table 4.4.

Table 4.4 Percent Time Open by Weigh Station

Location	Percent of Time Open				
	2016	2017	2018	2019	Average
Boone	9.0	37.8	37.0	30.1	28.5
Floyd	NA	NA	NA	NA	NA
Fulton	NA	NA	NA	33.3	NA
Hardin	23.1	28.5	17.0	19.2	22.0
Henderson	37.7	35.0	34.6	30.8	34.5
Kenton	19.5	19.5	50.6	20.4	27.5
Laurel (N)	49.8	49.8	50.7	61.7	53.0
Laurel (S)	40.5	40.5	36.1	29.9	36.8
Lyon (E)	27.1	27.1	48.5	34.4	34.3
Lyon (W)	26.6	26.6	50.4	39.2	35.7
Rowan	56.1	56.1	NA	51.8	54.7
Scott	39.7	39.7	48.8	52.9	45.3
Shelby	14.6	14.6	32.8	33.2	23.8
Simpson	33.1	33.1	51.4	38.0	38.9
Total =	31.4	34.0	41.6	36.5	35.9

Safety Performance

Weigh stations enhance public safety through enforcement screening and CMV inspections, which increases compliance with regulatory measures and improves safety outcomes. Carriers not in compliance have been shown to be at increased risks for crashes. In 2017, FMCSA's Office of Analysis, Research, and Technology analyzed the

relationship between credentialing violations and safety outcomes, particularly crashes. This study revealed carriers with IFTA, UCR, or IRP credentialing violations were "40.5 percent more likely to be involved in a crash".[43]

To characterize safety performance, the research team collected and analyzed safety metrics for CMV monitoring. The safety metrics only examined data originating at weigh station sites (i.e., not roadside) and included the number of inspections, violations, citations, vehicles out-of-service (OOS), and drivers out-of-service (OOS). In the initial assessment, four safety metrics were generated and compared between the three study sites (Fulton, Henderson, Hardin), Kentucky overall, and nationwide (FMCSA). The safety metrics included inspections per screened vehicles, violations per inspection, vehicle OOS rates, and driver OOS rates. The complete analysis of weigh stations' safety performance is shown in Table 4.5.

Table 4.5 Safety Performance for Weigh Stations

Year	Safety Metric	KY	Fulton	Henderson	Hardin	FMCSA
2017	Inspections per screened vehicles	1.0%	1.4%	1.2%	1.1%	NA
	Violations per inspection	1.23	0.40	1.83	1.84	NA
	Vehicle Out-of-Service (OOS)	18.3%	6.0%	26.1%	21.3%	20.6%
	Driver Out-of-Service (OOS)	3.3%	2.0%	4.7%	4.8%	5.1%
2018	Inspections per screened vehicles	1.0%	2.0%	1.0%	1.6%	NA
	Violations per inspection	1.00	0.46	1.71	1.15	NA
	Vehicle Out-of-Service (OOS)	15.9%	7.9%	23.7%	15.7%	20.8%
	Driver Out-of-Service (OOS)	3.5%	1.2%	4.0%	7.6%	4.8%
2019	Inspections per screened vehicles	0.9%	2.2%	0.9%	0.8%	NA
	Violations per inspection	1.13	1.19	1.70	0.91	NA
	Vehicle Out-of-Service (OOS)	15.5%	15.1%	26.7%	11.1%	20.6%
	Driver Out-of-Service (OOS)	3.6%	2.8%	4.7%	5.2%	5.0%

Sources: KSP and FMCSA

The research team established thresholds to evaluate these metrics including: 1) violations per inspection > 1.0, 2) vehicle OOS > 20 percent, and 3) driver OOS > 5 percent. The initial 1.0 threshold for violations per inspection was determined to represent elevated risks for trucks. This measure means that, on average, a truck is found to have at least one violation when inspected at a facility. The second two measures involved out-of-service rates for the vehicle and driver and were derived using national FMCSA data through MCMIS. In both cases, the OOS rates were compiled and analyzed across the nation as discovered by state inspectors. This data revealed that inspected trucks, on average, violated vehicle and driver OOS rules at rates of 20 percent and 5 percent, respectively. The research team subsequently used these nationwide average OOS rates as the critical threshold for assessing KY weigh station performance. Overall, the Henderson and Hardin sites exceeded several of these safety thresholds (6 and 5, respectively), while Fulton only exceeded one threshold.

For the second safety assessment, the research team developed a measure to characterize and evaluate the enforcement rate for KYU violations across Kentucky's weigh stations. The KYU license or permit is required for CMVs operating in Kentucky at 60,000 pounds and over. It is a weight-distance tax levied by the number of miles driven on Kentucky roadways during a given period. Each CMV must comply with KYU-established procedures or risk financial and other penalties stemming from violations.

Inspections sometimes reveal CMV non-compliant operators not possessing a valid KYU license or permit. These violations should result in a citation and a future date to appear in court. The rate at which citations occur per violations (C/V rate) can help characterize the enforcement intensity for a weigh station. Some locations may simply issue violations to the CMV operator rather than a citation. This study used the enforcement rate as a second safety performance measure for evaluation.

To begin, the research team conducted a search on KYU violations occurring from 2017 through 2019. KSP inspectors and/or sworn officers complete their reports on CMVs failing to meet this requirement and provide descriptions for each violation. This information is found through inspection data housed in KSP's SAFETYNET portal, a database management system that collects and reports information on transportation items such as crashes, inspections, and other compliance metrics. To characterize these occurrences, the research team categorized KYU violations as those descriptions including text as follows: "kyu", "taxable", "weight-distance", and "weight distance". Example text descriptions found during this assessment included:

- company does not have a weight distance tax license (KYU) or current permit at time of inspection
- failing to add taxable unit to taxable inventory
- failure to add taxable unit to KYU database
- no Kentucky weight distance tax (KYU) permit sold
- operating a CMV in Kentucky without a KYU permit.

This search and analysis revealed wide disparities between different sites and their rates of enforcement. In fact, the enforcement intensity rate varied from 3.5 percent all the way to 62.6 percent. For the purposes of this study, the research team developed an enforcement intensity threshold of 50 percent as the minimum guideline. The Hardin, Henderson, and Fulton facilities were found to have rates of 53.8, 14.5, and 21.9 percent, respectively. For this focus group, only the Hardin station met this recommended criterion. The complete list of violations, citations, and the C/V rate (i.e., enforcement rate) are shown in Table 4.6.

Table 4.6 Enforcement Rate (C/V) by Weigh Station

Weigh Station	2017			2018			2019			All			C/V Rate Ranking
	Violations	Citations	C/V Rate	Violations	Citations	C/V Rate	Violations	Citations	C/V Rate	Violations	Citations	C/V Rate	
Boone	515	16	3.1%	161	3	1.9%	91	8	8.8%	767	27	3.5%	14
Floyd[a]	10	1	10.0%	31	1	3.2%	0	0	NA	41	2	4.9%	13
Fulton	24	11	45.8%	27	12	44.4%	100	10	10.0%	151	33	21.9%	10
Hardin[b]	311	169	54.3%	11	2	18.2%	219	120	54.8%	541	291	53.8%	3
Henderson	198	48	24.2%	213	21	9.9%	167	15	9.0%	578	84	14.5%	11
Kenton	138	6	4.3%	331	38	11.5%	156	13	8.3%	625	57	9.1%	12
Laurel NB	324	191	59.0%	153	7	4.6%	402	230	57.2%	879	428	48.7%	4
Laurel SB	318	252	79.2%	52	3	5.8%	98	31	31.6%	468	286	61.1%	2
Lyon EB	925	656	70.9%	726	446	61.4%	282	109	38.7%	1,933	1,211	62.6%	1
Lyon WB	882	418	47.4%	681	292	42.9%	836	390	46.7%	2,399	1,100	45.9%	6
Rowan[c]	273	95	34.8%	0	0	NA	325	117	36.0%	598	212	35.5%	9
Scott	287	152	53.0%	166	63	38.0%	339	122	36.0%	792	337	42.6%	7
Shelby	180	134	74.4%	190	47	24.7%	131	62	47.3%	501	243	48.5%	5
Simpson	271	136	50.2%	197	59	29.9%	326	89	27.3%	794	284	35.8%	8

a - Floyd County weigh station closed during 2019

b - Hardin County weigh station closed during most of 2018

c - Rowan County weigh station closed during 2018

Revenues and Costs

Along with safety, the ability of a weigh station to generate revenues commensurate to or even exceeding its operational costs is a significant factor when assessing the feasibility of replacing a weigh station. The data collection and analysis procedures employed within this study were previously described in detail in Chapter 3, Sections 3.3 and 3.4. To recap, the research team analyzed total revenues and total costs for each weigh station. This effort used impounds, temporary permits, and court fees for revenues and utilities. Costs were measured by staff salaries and capital improvements. Both revenues and costs were assessed over a 4-year period (2016-2019) for the three weigh stations in the study (Hardin, Henderson, and Fulton). This study did not equate or quantify potential safety benefits in dollar costs because the scope and costs for such an effort exceeded the work plan requirements for this project. Weigh station revenues exceeded $5.6 million for the three sites between 2016 and 2019. The primary driver of revenue was impounded vehicles at weigh stations. The revenues by category, total revenues, and total costs are shown in Tables 4.7 – 4.9 and Figure 4.6.

Table 4.7 Weigh Station Revenues by Category

Impounds	$ 3,595,337
Temporary Permits	$ 368,355
Courts	$ 1,645,853
Total	$ 5,609,545

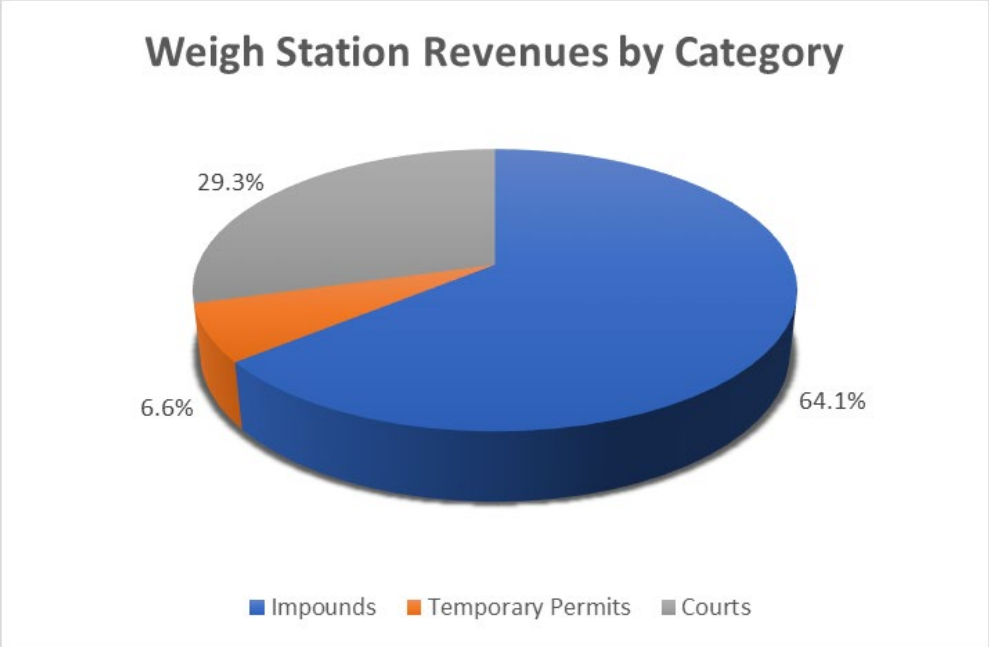

Figure 4.6 Weigh Station Revenues by Category

Table 4.8 Total Revenues by Weigh Station

Location	2016	2017	2018	2019	Total
Fulton	$ 4,876	$ 4,389	$ 5,295	$ 19,624	$ 34,184
Hardin	$ 107,615	$ 120,559	$ 7,902	$ 64,183	$ 300,258
Henderson	$ 130,268	$ 114,083	$ 101,050	$ 67,903	$ 413,303
Total	$ 242,758	$ 239,030	$ 114,247	$ 151,710	$ 747,745

Table 4.9 Total Costs by Weigh Station

Location	2016	2017	2018	2019	Total
Fulton	$ 27,668	$ 38,108	$ 74,309	$ 100,839	$ 240,924
Hardin	$ 124,780	$ 148,168	$ 57,012	$ 44,580	$ 374,540
Henderson	$ 64,954	$ 135,039	$ 92,503	$ 74,798	$ 367,293
Total	$ 217,402	$ 321,315	$ 223,824	$ 220,217	$ 982,757

The weigh stations differed significantly in their revenues and costs which, in turn, showed up in their corresponding revenue to cost ratios. The research team developed revenue to cost (R/C) ratios as a measure to assess a weigh station's financial viability. In other words, this reflected a station's ability to sustain itself. This ratio incorporated the total revenues determined from 2016-2019 and divided them by their corresponding costs over the same period. A R/C ratio less than 1 means that costs exceed revenues, 1 means that costs equal revenues, and a ratio greater than 1 means that revenues exceed costs. The Fulton, Hardin, and Henderson weigh stations had R/C ratios of 0.14, 0.80, and 1.13, respectively. R/C ratios at 1.0 or greater are preferred since they do not represent an ongoing financial liability for KYTC (Table 4.10). The Henderson weigh station was the only facility that was self-sustaining in this regard although the Hardin weigh station nearly approached this level.

Table 4.10 Revenue to Cost Ratios

Fulton	0.14
Hardin	0.80
Henderson	1.13

4.5 Facility Infrastructure

Weigh stations have distinct infrastructure requirements that allow them to perform their enforcement activities. Weigh stations must accommodate both CMV traffic for inspections and the full-time staff that perform those inspections. At a minimum, weigh stations should have a scale house, facility workstations, entrance ramp, parking spaces, and required equipment to function properly. These site assets are described in this section. Furthermore, additional site descriptions and photos for all three facilities can be seen in Appendix E.

Scale House

Facility infrastructure begins with the requirement to house onsite KSP staff that will screen and inspect vehicles. The scale house is the weigh station building where staff work and execute their duties. KYTC planners should assess a potential location for the conditions that dictate how the scale house is designed, including its capacity. For instance, weigh stations located along major interstates with high CMV traffic may warrant additional KSP staff to run the facility. This condition may, in turn, necessitate a larger scale house to accommodate increased staffing needs. An example of a scale house (Henderson weigh station) is shown below in Figure 4.7.

Figure 4.7 Henderson Scale House

Number of Workstations

A workstation is a space containing the necessary equipment for a staff member to perform his or her job. In most scenarios, a weigh station should have a designated space for each assigned member to that facility. The workstation would typically have a chair, desk, and at least one computer to facilitate a productive working environment. The requirement for a given number of workstations should be determined during the planning and development phase since this will impact the scale house's design and size.

Length of Entrance Ramp

Entrance ramps connect the mainline highway to the CMV screening point of the weigh station facility. CMVs leave the mainline and enter the weigh station ramp for subsequent screening and possible inspection. Oregon defines their entrance ramps as the ramp distance from where it exits the highway to the front edge of the weigh-in-motion scale deck.[32] The entrance ramp must have a minimally sufficient length to capture expected CMV traffic without generating queues that spill onto the mainline, potentially creating a safety hazard. If a queue forms, the weigh station would need to divert all CMVs on the mainline from entering the facility to prevent spillover onto the mainline. This truck bypass procedures often occurs automatically as many weigh stations are equipped with an automatic shutoff feature which activates whenever the ramp gets backed up. KYTC planners should design a weigh station's entrance ramp with these factors in mind.

Number of CMV Parking Spaces

CMV parking spaces are a key consideration when forecasting CMV traffic and expected inspections. When selected for inspection, CMVs must leave the screening entrance ramp and pull into the onsite parking lot for a stationary inspection. Weigh stations located along high-volume traffic corridors may generate excessive CMV traffic and warrant increased inspections. Some weigh station facilities have sufficient parking spaces to accommodate their inspection needs while others do not. For instance, the Henderson facility has a total of 35 truck parking spaces while the Hardin facility only has 5 spaces. For the Hardin site, this challenge is compounded by the fact that the weigh station lies on a more heavily traveled interstate corridor than Henderson. Figure 4.8 illustrates differences between these two parking facilities.

Figure 4.8 Henderson (L) and Hardin (R) Parking Lots

Truck parking has also become an increasingly critical issue for the overall CMV community. Extensive driver surveys have revealed the shortage of overnight truck parking as one of the most important issues they face.[44] Truck drivers are constantly searching for areas to park overnight and frequently park along ramps and parking lots found at rest areas. These parking actions may pose a safety hazard when they obstruct the shoulder, which has become a concern of both KYTC and KSP. KYTC planners should consider evaluating the need for overnight parking for future weigh station renovations or additions.

The infrastructure needed for truck parking, scale houses, entrance ramps, and workstations all represent key design factors when considering the replacement of a weigh station facility. A summary of the infrastructure assets for the Fulton, Hardin, and Henderson facilities is shown in Table 4.11.

Table 4.11 Categories for Facility Infrastructure at Weigh Stations

	Fulton	Hardin	Henderson
Ramp Status[a]	Sufficient	Insufficient (too short)	Sufficient
Scale House[a]	Sufficient (new location required in future)	Insufficient (new location required and outdated)	Sufficient (new location required in future)
Truck Parking[b]	3-5 spaces	5 spaces	35 spaces
Work Stations[b]	2-3	2	4

Sources: FMCSA, 2017 and KTC, 2021

Enabling Equipment

Kentucky weigh stations utilize an array of enabling equipment to optimize their screening and enforcement activities and enhance their operations. In general, weigh stations have access to various market technologies that can better enable them to meet their goals. Nevertheless, some notable technologies stand out as particularly value-added for Kentucky's weigh stations. Those technologies include weigh-in-motion/sorting systems, the KATS system, infrared brake screening, parking monitoring systems, and tire pressure detection systems. Brief descriptions of each technology are provided below.

1. Weigh-in-motion (WIM)/Sorting system: This system automatically detects and weighs commercial motor vehicles as they enter a weigh station's entrance ramp and pass over a looped-sensor array embedded in the concrete. These loops send signals to the station's network and if appropriate, direct the incoming vehicle to a static scale or parking area for further examination.

2. KATS system: The Kentucky Automated Screening System (KATS) is hardware that reads the license plates on incoming vehicles, including USDOT and KYU numbers, and screens that information for state and federal compliance with credentials and safety regulations. This system employs video cameras, optical character recognition (OCR) technology, and interfaces with other onsite equipment (e.g., WIM) to perform its operations.

3. Infrared brake screening: This technology uses thermal/infrared sensors to monitor the brakes on a moving vehicle and indicate its temperature. The system will notify inspectors when a vehicle's brakes deviate from normal temperature ranges.

4. Parking monitoring systems: This system deploys parking lot surveillance cameras to monitor and assess parking lot space availability. These systems can provide space availability information to weigh station staff and the public. For the latter, some systems may feed into electronic signs located before weigh station entrances as well as parking lot websites and smartphone apps.

5. Tire pressure detection system: This system uses embedded sensors within the weigh station's entrance ramp to monitor weigh differentials on truck tires and identify potentially unsafe vehicles due to missing or underinflated tires. Tire results for each incoming vehicle are relayed to the station inspectors in real-time and allow them to pull over any vehicles with suspected tire issues for further examination.

One other weigh station component that should be considered in a weigh station's design is the inspection barn. While not technically an enabling equipment, this onsite building provides an area for inspectors to conduct their inspections throughout the vehicle. Most notably, each inspection barn has a "pit" located below the vehicle for easy examination of the vehicle's undercarriage.

4.6 Decision Matrix

The final analysis compared the results for all three facilities against the ideal site conditions and operating characteristics. A weigh station would receive a green star each time it satisfactorily met a threshold. The final matrix assigned Henderson, Hardin, and Fulton with 5, 4, and 2 stars, respectively. The higher number of stars corresponds to a higher priority assigned for replacing that facility.

The factors marked as NA (Not Applicable) were not evaluated. The study team did not evaluate a site's proximity to a "bypass" since all three sites would need to be moved if selected for replacement. To this extent, additional study would be required to better understand the bypass factor and accompanying traffic patterns for any future relocations. In the second factor, staffing levels were only available by region, not by individual site, and therefore could not be fully assessed for their impact across the three sites of interest. The full results for this decision matrix are shown below in Figure 4.9.

	Hardin	Henderson	Fulton
1 – Truck Volumes	• Yes ★	• Yes ★	• No
2 – Crash Hotspots	• Yes ★	• No	• Yes ★
3 – Near State Line	• No	• Yes ★	• Yes ★
4 – Away from Bypass	• NA	• NA	• NA
5 – Staffing Levels	• NA	• NA	• NA
6 – Hours of Operation	• No	• Yes ★	• Unk
7a – Safety (Metrics)	• Yes ★	• Yes ★	• No
7b – Safety (Enforcement)	• Yes ★	• No	• No
8 – Revenues & Expenses	• No	• Yes ★	• No

Figure 4.9 Matrix Analysis for Replacement Guidelines

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Chapter 5 Conclusion

5.1 Replacement Recommendations for Fulton, Hardin, and Henderson Weigh Stations

KTC assessed numerous factors for inclusion in KYTC's guidelines for replacement of weigh stations. The focus was on improving safety and increasing revenues. These factors can be used by KYTC decision-makers when deciding whether to replace existing weigh station sites or when making construction decisions about future weigh stations. Per the study results, KTC recommends the following:

1. Fulton: Close this facility and convert to remote monitoring capability
2. Hardin: Replace and upgrade the facility on Interstate 65
3. Henderson: Replace facility on the future Interstate 69

In the case of the Fulton weigh station, remote monitoring takes advantage of technology to screen trucks as they drive down the interstate and can detect certain violations including credentials, registration, and safety (i.e., score, status, and history). Therefore, an onsite building and parking lot will no longer be required for a future facility and existing site staff could be reallocated to other priority locations. This decision is based on low traffic volumes, negligible safety benefits, and limited opportunities for revenue generation. The decision presents increased opportunities for improving safety and increasing revenues elsewhere. Nevertheless, the remote monitoring technology will allow KSP and KYTC to monitor CMV vehicles through this corridor and assist them with their duties. For example, KSP can use this technology to identify trends on this corridor and possibly target their roving patrols to conduct roadside enforcement.

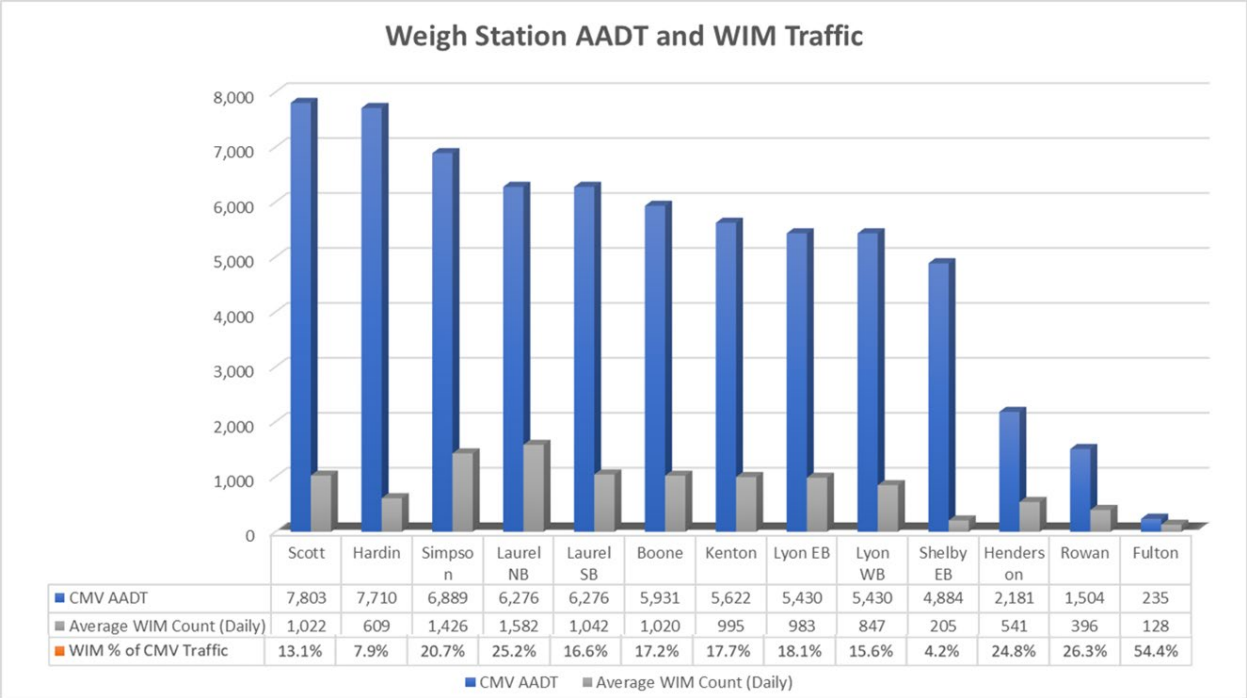
The Hardin and Henderson weigh stations should be replaced due to their potential for improving safety and generating revenues. Both sites handle high truck volumes (particularly Hardin) and exceed multiple safety performance thresholds for violations, citations, driver out-of-service rates, and vehicle out-of-service rates. If either site were removed without replacement, safety benefits for CMV traffic in those regions will be lost. Both facilities have demonstrated a high return on investment (ROI) for revenue generation. As it currently exists, the Henderson weigh station actually nets a positive revenue to cost ratio for operations. Essentially, this means that the facility can continuously sustain itself without external funds upon completion of construction. A newly built Henderson weigh station in an optimal location with sufficient site conditions (e.g., truck volumes) should replicate or even improve upon this ROI.

While it does not yet demonstrate a positive ROI, the Hardin weigh station nearly approaches the threshold, with a revenue to cost ratio of 0.80. This relatively high ROI occurs despite severe infrastructure constraints; most notably, the insufficient entrance ramp length and truck parking capacity to adequately screen and inspect the volumes of trucks found on this corridor. A newly built weigh station with greater CMV parking capacity could more readily capture incoming I-65 southbound traffic from Indiana. In fact, Hardin staff currently rank third out of all 14 weigh stations in their enforcement rate (citations issued to violations discovered). Any substantive increase in parking capacity at a new site should easily translate into significant safety improvements and revenue gains as onsite staff can pull over and inspect additional trucks that, under current conditions, would have bypassed the station.

5.2 Other Findings & Recommendations

Finding #1: Weigh stations with high truck volumes in relation to their entrance ramp lengths and parking capacity have low truck traffic capture rates. Eleven of the fourteen weigh stations have high truck volumes in the top 5 percent of all daily traffic for roadway segments in Kentucky (excluding Rowan, Fulton, and Floyd). Ten stations have daily truck volumes exceeding 4,500 trucks per day. This daily demand generates significant opportunities for weigh stations to capture that truck traffic in improving safety and generating revenues. However, the Hardin and Shelby weigh stations have diminished capture rates (WIM % of CMV Traffic) relative to their peer stations of 7.9 percent and 4.2 percent, respectively. These low capture rates are primarily due to their insufficient ramp lengths and inadequate parking capacity.

FMCSA conducts annual assessments on all Kentucky weigh stations by reviewing select characteristics and identifying any deficiencies. In their 2020 report, FMCSA identified the Hardin and Shelby weigh stations as having insufficient ramp lengths for their facilities, the only two weigh stations failing to meet these entrance ramp standards in Kentucky. Since these ramps are short, both facilities frequently have to bypass large volumes of truck traffic during normal operations as their entrance ramps quickly fill to capacity. Trucks that are bypassed do not receive any screening for safety violations and may present undue risk to the traveling public.[42] The Hardin and Shelby weigh station also have minimal parking capacity as evidenced by their 5-space and 6-space lots, respectively. These constraints result in parking lots quickly filling up, which similarly requires those facilities to bypass other trucks that might warrant onsite inspections. The full list of tables and figures used in generating CMV AADTs, WIM % of CMV Traffic, and other related information is in Appendix C, Traffic Volumes. Figure 5.1 shows AADT for trucks and corresponding WIM traffic entering a facility (i.e., captured trucks).



	Scott	Hardin	Simpson	Laurel NB	Laurel SB	Boone	Kenton	Lyon EB	Lyon WB	Shelby EB	Henderson	Rowan	Fulton
CMV AADT	7,803	7,710	6,889	6,276	6,276	5,931	5,622	5,430	5,430	4,884	2,181	1,504	235
Average WIM Count (Daily)	1,022	609	1,426	1,582	1,042	1,020	995	983	847	205	541	396	128
WIM % of CMV Traffic	13.1%	7.9%	20.7%	25.2%	16.6%	17.2%	17.7%	18.1%	15.6%	4.2%	24.8%	26.3%	54.4%

Figure 5.1 AADT and WIM Traffic by Weigh Station

Recommendation #1: KYTC should evaluate the entrance ramp length and available parking capacity required for a future Hardin replacement facility to improve the capture rate. A sufficiently long entrance ramp and increased parking capacity should better enable that facility to improve safety and increase revenues for interstate truck traffic. KYTC should also evaluate the existing Shelby County weigh station and assess the feasibility of increasing its entrance ramp length and parking capacity.

Finding #2: High turnover for inspectors at weigh stations negatively impacts weigh stations. Kentucky weigh stations experience a low retention rate for newly hired inspectors at 4 of the 5 evaluated regions (region 6 data was unavailable). From 2016 through 2019, KSP hired a total of 51 inspectors for regions 1 through 4. These regions include Fulton, Henderson, Lyon (EB/WB), Hardin, Simpson, Boone, Kenton, Scott, Shelby, and the Laurel (NB/SB) weigh stations. In the same period, those facilities experienced the departure of 39 inspectors, with many of those from the newly hired. This corresponds to an approximate 23.5 percent retention rate across those regions. The most severe retention rate was found in region 3 in Northern Kentucky, at only 6.3 percent. These high turnover rates impose excessive upfront costs and training for KSP, only to lose them later. Furthermore, this turnover prevents weigh stations from operating at fully staffed capacity, which negatively impacts safety and revenue generation.

Recommendation #2: KSP should evaluate options to increase retention for inspectors at Kentucky weigh stations, particularly in urban areas. One such option is to investigate the competitiveness of pay for this occupation in relation to other competing occupations in the area. A more competitive compensation package should improve the ability to hire and retain staff for these positions in the future. KSP has made strides in pay parity in recent years with a significant pay raise given to its inspectors in July 2019. Nevertheless, KSP should continue to examine its inspector compensation packages and its competitiveness in recruiting and retaining qualified inspector candidates. At a minimum, any compensation investigation should include an evaluation of pay rates relative to prevailing market-wages for target candidates, incentives for retention through possible inclusion of a step pay scale by position and/or years in service, and the use of locality pay for highly competitive regions such as urban areas. For the latter, KYTC has recently adopted locality pay for several occupations in low retention regions, particularly urban areas, and noticed an improvement in their attrition rates. Coincidentally, these same urban areas experiencing the greatest turnover also present the greatest opportunities for improved safety and increased revenue collection since they comprise the majority of truck volumes and potential violations.

Finding #3: Weigh stations across Kentucky are open only 33 percent of the time, on average, corresponding to a nearly 8-hour standard workday. This limited time window means that trucks may bypass a weigh station for the remaining 66 percent of the day without screening or possible inspection.

Recommendation #3: KSP should evaluate the options for increased hours of operation to improve safety and increase revenues based on the probability of identifying additional non-compliant trucks on the road. This evaluation should prioritize weigh stations located along high-volume corridors where truck traffic remains high during off-hours. In addition, KSP should continue working to improve its attrition rate (see previous finding) and better enable CMV facilities to be fully staffed over a longer period of time.

Finding #4: Large disparities exist in enforcement intensity among weigh stations, as measured by the ratio of citations issued to violations discovered. Inspectors have some latitude in performing their safety inspections based on a driver's history, the nature of the violation, and other relevant factors. In some cases, an inspector may write up a citation for a given violation/s while another inspector may not. This discrepancy leads to disparities in citations issued per violations discovered across weigh stations (C/V rate). Analyzing data from 2017 through 2019, enforcement intensity as measured by the C/V rate ranged from a high of 62.6 percent to a low of 3.5 percent. The average, median, and standard deviation for C/V rates across the entire 14 stations were 34.9 percent, 39.2 percent, and 19.8 percent, respectively. The standard deviation of 19.8 percent stands out as particularly high for this range and demonstrates the unevenness in this measurement of enforcement.

Recommendation #4: KSP should evaluate its policies and procedures for weigh station inspectors and sworn officers and identify improvements in how violations and citations are issued. Measures to improve consistency and increase C/V rates across weigh stations should improve safety outcomes and generate additional revenues, particularly at locations with low C/V rates.

Appendix A — Revenues

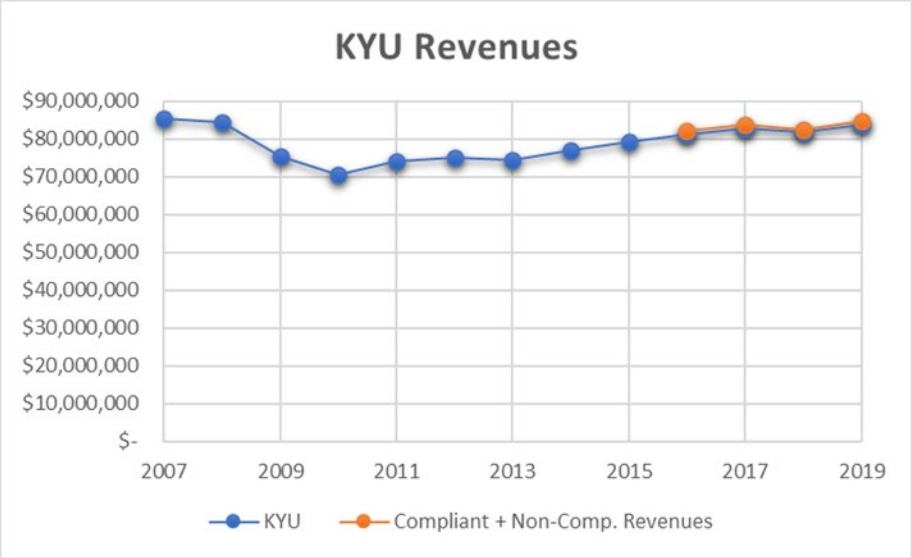


Figure A.1 KYU Revenues

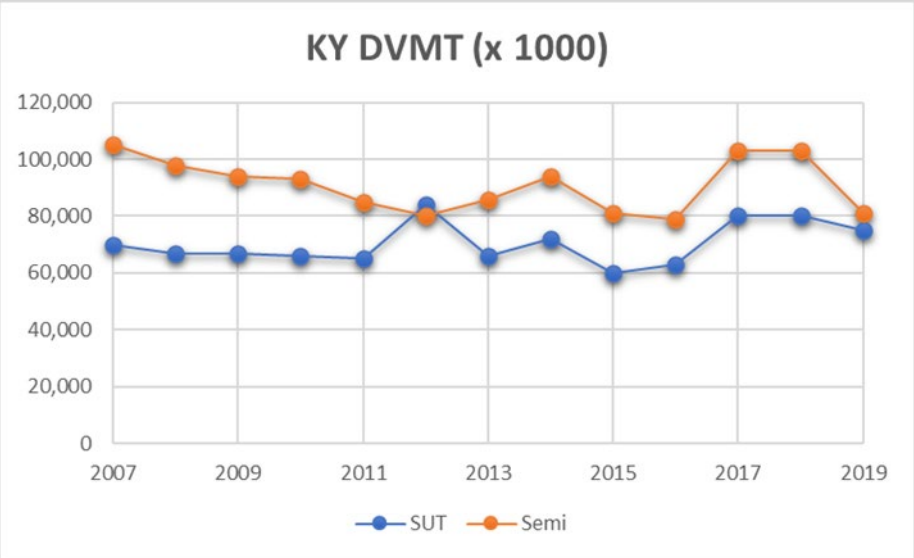


Figure A.2 Kentucky Directional Vehicles Miles Traveled (DVMT)

Table A.1 Temporary Permit Types by Number

	2016	2017	2018	2019	Total
IFTA Permit	64	83	101	102	350
KIT Permit	3	26	2	1	32
KYU Permit	2,435	2,621	1,786	1,734	8,576
Non-Reciprocal(IRP) <= 55,000	16	25	14	17	72
Non-Reciprocal(IRP) > 55,000	51	36	36	44	167
Temp OW/OD	0	2	2	0	4
Temp Metal Commodity	0	4	9	0	13
Total	2,569	2,797	1,950	1,898	9,214

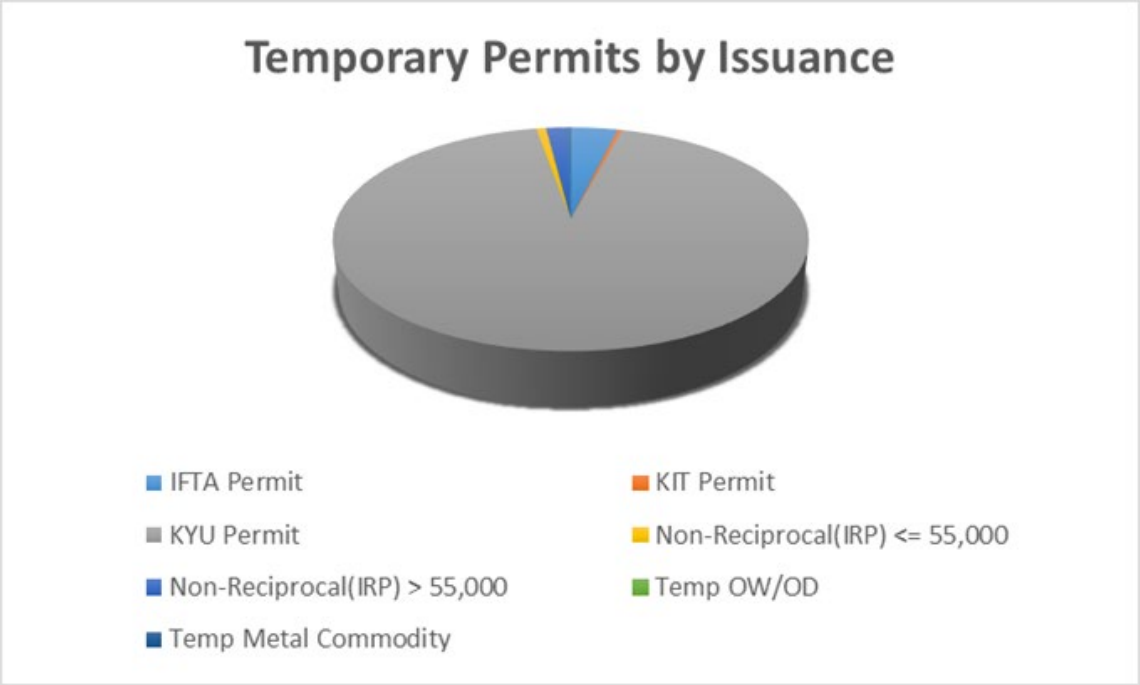


Figure A.3 Temporary Permit Types

Table A.2 Temporary Permit Types by Revenue

	2016	2017	2018	2019	Total
IFTA Permit	$ 2,560	$ 3,320	$ 4,040	$ 4,080	$ 14,000
KIT Permit	$ 120	$ 1,040	$ 80	$ 40	$ 1,280
KYU Permit	$ 97,400	$104,840	$ 71,440	$ 69,360	$ 343,040
Non-Reciprocal(IRP) <= 55,000	$ 400	$ 625	$ 350	$ 440	$ 1,815
Non-Reciprocal(IRP) > 55,000	$ 2,040	$ 1,440	$ 1,440	$ 1,760	$ 6,680
Temp OW/OD	$ -	$ 120	$ 120	$ -	$ 240
Temp Metal Commodity	$ -	$ 400	$ 900	$ -	$ 1,300
Total	$102,520	$111,785	$ 78,370	$ 75,680	$368,355

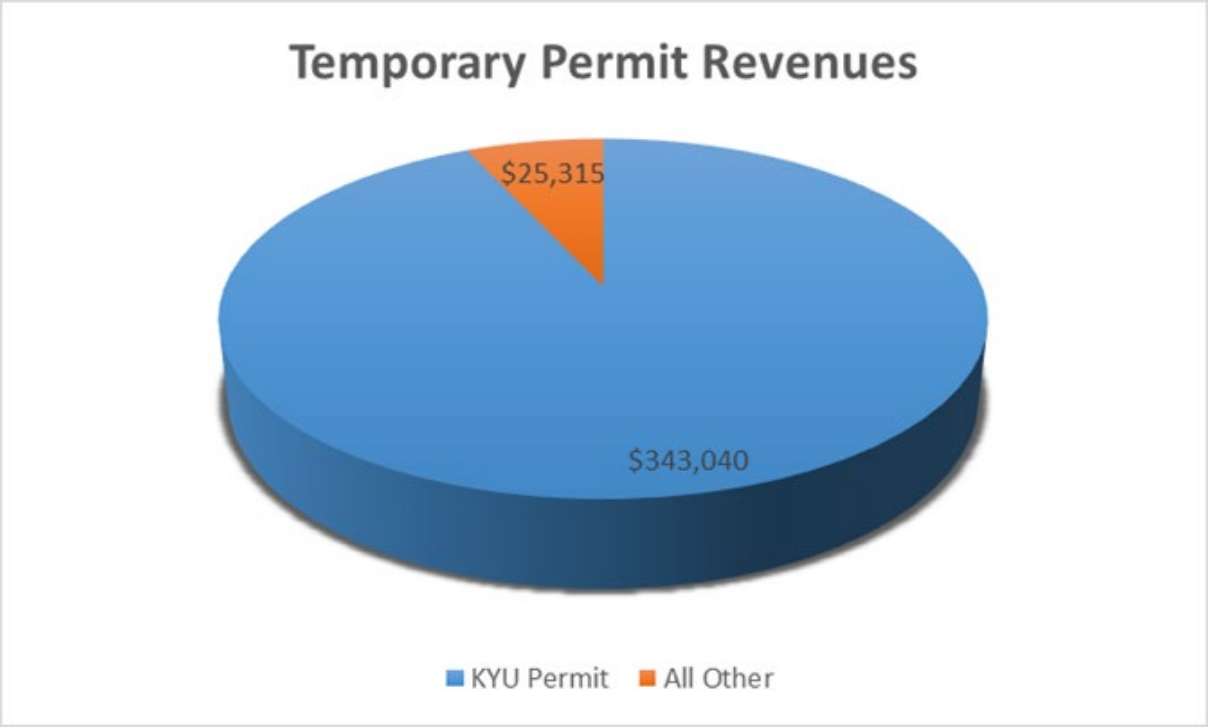


Figure A.4 Temporary Permit Revenues by KYU and All Others

Appendix B — Expenses

Capital Improvement Expenses

Table B.1 Capital Improvement Preventive Maintenance by Weigh Station

Facility	2016	2017	2018	2019	2020
Fulton	$1,575	$1,575	$1,670	$1,795	$1,795
Henderson	$4,340	$4,340	$4,600	$4,946	$4,946
Hardin	$1,575	$1,575	$1,670	$1,795	$1,795
Others	$36,217	$36,217	$38,390	$42,665	$42,665
Total	$43,707	$43,707	$46,329	$51,200	$51,200

Table B.2 Overheight System Upgrade and Installation Costs

Facility	2016	2017	2018	2019	2020
Fulton				$1,053	
Henderson		$17,100		$1,053	
Hardin		$19,750		$1,053	
Others		$191,350		$11,583	
Total		$228,200		$14,742	

Table B.3 Total Costs with Preventive Maintenance and Overheight Systems

Facility	2016	2017	2018	2019	2020	Total
Fulton	$1,575	$1,575	$1,670	$2,848	$1,795	$9,462
Henderson	$4,340	$21,440	$4,600	$5,999	$4,946	$41,325
Hardin	$1,575	$21,325	$1,670	$2,848	$1,795	$29,212
Total	$7,490	$44,340	$7,939	$11,694	$8,535	$79,999

Table B.4 Renovations and Upgrades for All Weigh Stations

Facility	2016	2017	2018	2019	2020
Total		$85,123	$1,333,572	$533,195	$632,921

* No costs provided for Fulton, Henderson, and Hardin counties in this category

Table B.5 Total Capital Improvement Expenditures for All Weigh Stations

Total Capital Improvement Costs				
2016	2017	2018	2019	Total
$131,044	$369,204	$1,775,801	$777,289	$3,053,338

Personnel Expenses

Table B.6 Inspector Rates

	2016 W/Fringe
Inspector I	$ 21.61
Inspector II	$ 23.35
	2017 W/Fringe
Inspector I	$ 22.00
Inspector II	$ 27.00
	2018 W/Fringe
Inspector I	$ 22.00
Inspector II	$ 27.00
	2019 W/Fringe
Inspector I	$ 22.00
Inspector II	$ 27.00

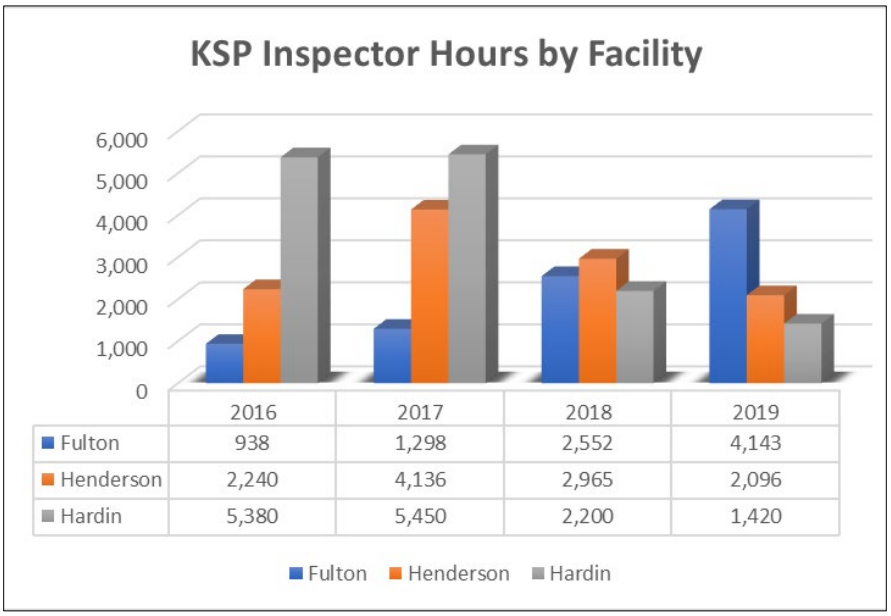


Figure B.1 KSP Inspector Hours

Table B.7 KSP Inspector Hours by Weigh Station

Location	Classification	2016	2017	2018	2019	Total
Fulton	Inspector I	938	865	416	3,939	6,158
	Inspector II	0	433	2,136	204	2,773
	Total	938	1,298	2,552	4,143	8,932
Henderson	Inspector I	2,240	2,056	872	0	5,168
	Inspector II	0	2,080	2,093	2,096	6,269
	Total	2,240	4,136	2,965	2,096	11,437
Hardin	Inspector I	5,380	5,450	2,200	710	13,740
	Inspector II	0	0	0	710	710
	Total	5,380	5,450	2,200	1,420	14,450
All Sites	Total	8,558	10,884	7,717	7,659	34,819

Assumptions:

1) Assume 40 hour work week (Hardin @ 10 hrs, 4 days & Fulton/Hend @ 8 hrs, 5 days)

2) Hours includes fringe benefits (comp, holidays, annual, sick)

Appendix C — Traffic Volumes

Table C.1 Average Annual Daily Trucks (AADTS) at Weigh Stations

	Year																		
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Laurel NB		5,584	5,669	5,049	5,457	5,697	5,500	5,218	4,964	5,288	5,316	6,233	5,347	5,557	6,435	7,449	7,015	6,430	5,988	
Simpson	5,068	5,411	5,869	5,769	5,340	5,970	6,199			5,469				6,266	5,875	6,475	6,697	6,892	6,898	7,070
Laurel SB		5,584	5,669	5,049	5,457	5,697	5,500	5,218	4,964	5,288	5,316	6,233	5,347	5,557	6,435	7,449	7,015	6,430	5,988	
Boone	4,911	4,941	4,655	4,580	4,429	5,243	5,182	5,499	5,152	5,107	5,167	5,529	5,207		5,996	5,414	5,951	6,353	5,492	5,927
Scott		6,461	6,070	5,910	6,354		6,319	6,816	6,745	6,265				6,389	6,971	8,045	8,628	7,732	8,035	6,817
Kenton		4,169	4,831	4,888	4,821	4,677	4,840	5,032	4,581	4,716	4,725		4,764	4,966	5,063				5,936	5,277
Lyon EB	4,411	4,484	4,466	4,612	4,777	4,850	4,703	4,539	4,283	4,228	4,411	4,374	4,746			4,381	5,342	5,479	5,340	5,557
Hardin	7,217	7,092	6,324	6,252	6,073	5,984	6,395						7,022	7,389	6,695	6,716				7,982
Lyon WB	4,411	4,484	4,466	4,612	4,777	4,850	4,703	4,539	4,283	4,228	4,411	4,374	4,746			4,381	5,342	5,479	5,340	5,557
Henderson		1,916	2,014	2,123	2,189	2,052	2,036	1,965		1,916	2,031	2,052	2,097			2,244	2,237	2,170	2,165	2,153
Shelby EB	4,043	4,186	4,307	4,328	4,296	3,999	4,328	5,108	4,076	4,120		4,186	4,192	4,374	4,434	4,534		4,888	4,745	5,069
Rowan		1,391	1,569	1,457	1,435	1,491	1,346	1,368	1,391	1,457		1,335	1,445	1,473	1,393	1,525	1,453	1,520	1,543	1,500
Fulton			387			331						276						243	228	
Floyd		1,113				1,286			1,187			1,154			945			854	840	

Source: KYTC Traffic Count Reporting System (KYTC Division of Planning), https://datamart.kytc.ky.gov/EDSB_SOLUTIONS/CTS/

Methodology: Truck AADTS = (% Single + % Combo) * (All Vehicles' AADT)

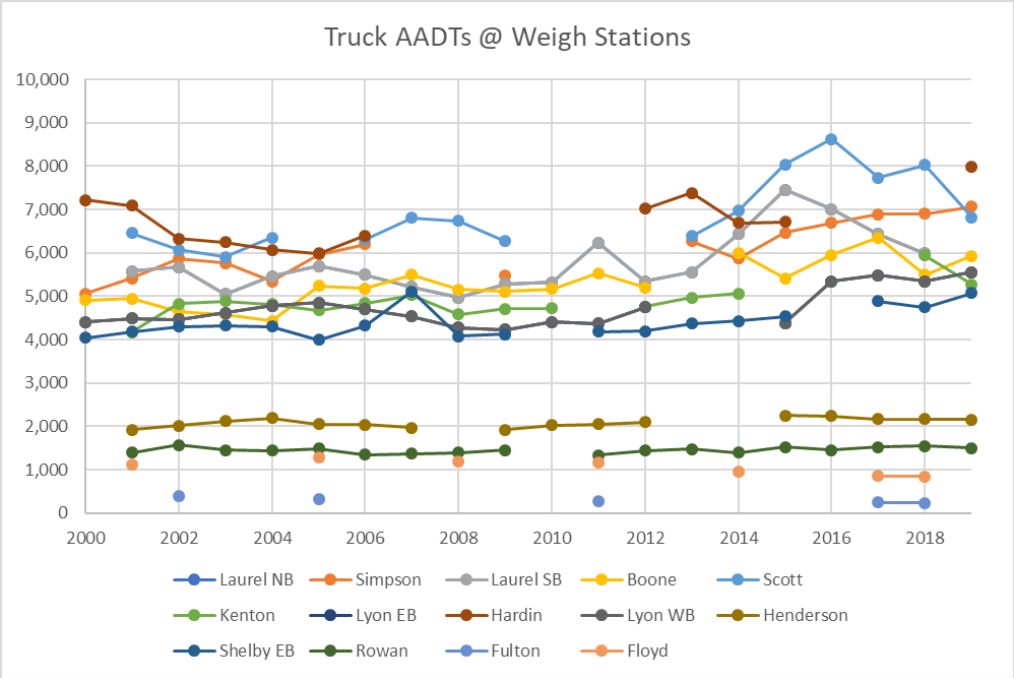


Figure C.1 CMV AADTs by All Weigh Station

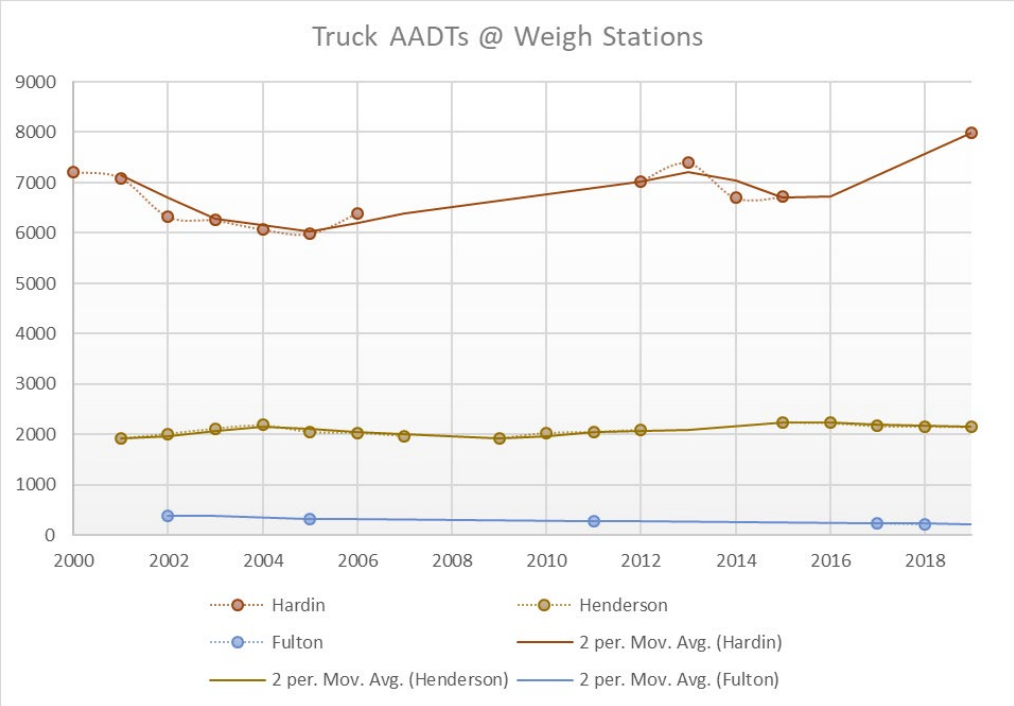


Figure C.2 CMV AADTs by Fulton, Hardin, and Henderson Weigh Stations

Table C.2 AADTs by Weigh Station

	2016	2017	2018	2019	Average
Laurel NB	7,015	6,430	5,988	5,671	6,276
Simpson	6,697	6,892	6,898	7,070	6,889
Laurel SB	7,015	6,430	5,988	5,671	6,276
Boone	5,951	6,353	5,492	5,927	5,931
Scott	8,628	7,732	8,035	6,817	7,803
Kenton	5,540	5,735	5,936	5,277	5,622
Lyon EB	5,342	5,479	5,340	5,557	5,430
Hardin	7,443	7,619	7,798	7,982	7,710
Lyon WB	5,342	5,479	5,340	5,557	5,430
Henderson	2,237	2,170	2,165	2,153	2,181
Shelby EB	4,834	4,888	4,745	5,069	4,884
Rowan	1,453	1,520	1,543	1,500	1,504
Fulton	235	243	228	235	235
Floyd	843	854	840	851	847

Table C.3 WIM % of CMV Traffic (2016)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Average
Days in Month	31	29	31	30	31	30	31	31	30	31	30	31	
Laurel NB													
WIM (monthly)	46,071	52,096	44,763	43,323	52,420	60,804	50,988	47,568	46,379	47,410	44,317	51,940	
CMV AADT	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	
CMV Traffic (monthly)[a]	217,453	203,424	217,453	210,439	217,453	210,439	217,453	217,453	210,439	217,453	210,439	217,453	
WIM % of CMV Traffic	21.2%	25.6%	20.6%	20.6%	24.1%	28.9%	23.4%	21.9%	22.0%	21.8%	21.1%	23.9%	22.9%
Scott													
WIM (monthly)	38,417	36,781	38,986	38,861	39,907	45,147	45,147	32,791	32,227	33,306	19,362	35,703	
CMV AADT	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	
CMV Traffic (monthly)[a]	267,483	250,226	267,483	258,855	267,483	258,855	267,483	267,483	258,855	267,483	258,855	267,483	
WIM % of CMV Traffic	14.4%	14.7%	14.6%	15.0%	14.9%	17.4%	16.9%	12.3%	12.4%	12.5%	7.5%	13.3%	13.8%
Simpson													
WIM (monthly)	28,754	36,553	33,968	41,907	41,116	51,814	44,135	41,955	19,966	35,580	19,036	39,829	
CMV AADT	6,697	6,697	6,697	6,697	6,697	6,697	6,697	6,697	6,697	6,697	6,697	6,697	
CMV Traffic (monthly)[a]	207,592	194,199	207,592	200,895	207,592	200,895	207,592	207,592	200,895	207,592	200,895	207,592	
WIM % of CMV Traffic	13.9%	18.8%	16.4%	20.9%	19.8%	25.8%	21.3%	20.2%	9.9%	17.1%	9.5%	19.2%	17.7%
Laurel SB													
WIM (monthly)	16,539	31,068	38,979	31,687	30,555	30,555	22,729	42,416	40,248	35,743	35,242	38,479	
CMV AADT	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	7,015	
CMV Traffic (monthly)[a]	217,453	203,424	217,453	210,439	217,453	210,439	217,453	217,453	210,439	217,453	210,439	217,453	
WIM % of CMV Traffic	7.6%	15.3%	17.9%	15.1%	14.1%	14.5%	10.5%	19.5%	19.1%	16.4%	16.7%	17.7%	15.4%
Kenton													
WIM (monthly)	23,206	26,679	22,071	12,842	23,670	16,003	23,954	25,378	18,859	23,643	21,050	28,015	
CMV AADT	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540	5,540	
CMV Traffic (monthly)[a]	171,726	160,647	171,726	166,186	171,726	166,186	171,726	171,726	166,186	171,726	166,186	171,726	
WIM % of CMV Traffic	13.5%	16.6%	12.9%	7.7%	13.8%	9.6%	13.9%	14.8%	11.3%	13.8%	12.7%	16.3%	13.1%
Hardin													
WIM (monthly)	10,476	11,591	52,439	20,762	7,456	15,064	25,379	32,321	27,894	28,207	26,304	24,159	
CMV AADT	7,443	7,443	7,443	7,443	7,443	7,443	7,443	7,443	7,443	7,443	7,443	7,443	
CMV Traffic (monthly)[a]	230,745	215,858	230,745	223,302	230,745	223,302	230,745	230,745	223,302	230,745	223,302	230,745	
WIM % of CMV Traffic	4.5%	5.4%	22.7%	9.3%	3.2%	6.7%	11.0%	14.0%	12.5%	12.2%	11.8%	10.5%	10.3%
Lyon EB													
WIM (monthly)	22,175	19,371	24,999	21,563	20,964	21,385	23,432	23,132	22,434	20,443	0	21,623	
CMV AADT	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	
CMV Traffic (monthly)[a]	165,603	154,919	165,603	160,261	165,603	160,261	165,603	165,603	160,261	165,603	160,261	165,603	
WIM % of CMV Traffic	13.4%	12.5%	15.1%	13.5%	12.7%	13.3%	14.1%	14.0%	14.0%	12.3%	0.0%	13.1%	12.3%
Lyon WB													
WIM (monthly)	16,477	18,906	17,174	18,860	21,862	27,075	16,323	19,237	14,894	17,109	16,025	17,076	
CMV AADT	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	5,342	
CMV Traffic (monthly)[a]	165,603	154,919	165,603	160,261	165,603	160,261	165,603	165,603	160,261	165,603	160,261	165,603	
WIM % of CMV Traffic	9.9%	12.2%	10.4%	11.8%	13.2%	16.9%	9.9%	11.6%	9.3%	10.3%	10.0%	10.3%	11.3%
Henderson													
WIM (monthly)	16,222	15,888	18,272	19,044	16,261	19,355	18,130	15,074	17,272	16,942	15,047	16,237	
CMV AADT	2,237	2,237	2,237	2,237	2,237	2,237	2,237	2,237	2,237	2,237	2,237	2,237	
CMV Traffic (monthly)[a]	69,347	64,873	69,347	67,110	69,347	67,110	69,347	69,347	67,110	69,347	67,110	69,347	
WIM % of CMV Traffic	23.4%	24.5%	26.3%	28.4%	23.4%	28.8%	26.1%	21.7%	25.7%	24.4%	22.4%	23.4%	24.9%
Rowan													
WIM (monthly)	19,313	17,453	17,956	19,889	17,605	15,286	17,663	20,021	15,661	18,599	14,704	17,510	
CMV AADT	1,453	1,453	1,453	1,453	1,453	1,453	1,453	1,453	1,453	1,453	1,453	1,453	
CMV Traffic (monthly)[a]	45,032	42,127	45,032	43,580	45,032	43,580	45,032	45,032	43,580	45,032	43,580	45,032	
WIM % of CMV Traffic	42.9%	41.4%	39.9%	45.6%	39.1%	35.1%	39.2%	44.5%	35.9%	41.3%	33.7%	38.9%	39.8%
Boone													
WIM (monthly)	7,580	4,435	9,853	17,678	15,272	14,928	12,031	14,166	16,405	12,798	12,188	16,886	
CMV AADT	5,951	5,951	5,951	5,951	5,951	5,951	5,951	5,951	5,951	5,951	5,951	5,951	
CMV Traffic (monthly)[a]	184,494	172,591	184,494	178,543	184,494	178,543	184,494	184,494	178,543	184,494	178,543	184,494	
WIM % of CMV Traffic	4.1%	2.6%	5.3%	9.9%	8.3%	8.4%	6.5%	7.7%	9.2%	6.9%	6.8%	9.2%	7.1%
Shelby EB													
WIM (monthly)	11,641	10,342	6,162	1,501	3,191	3,756	4,473	6,160	5,781	1,764	968	2,697	
CMV AADT	4,834	4,834	4,834	4,834	4,834	4,834	4,834	4,834	4,834	4,834	4,834	4,834	
CMV Traffic (monthly)[a]	149,861	140,193	149,861	145,027	149,861	145,027	149,861	149,861	145,027	149,861	145,027	149,861	
WIM % of CMV Traffic	7.8%	7.4%	4.1%	1.0%	2.1%	2.6%	3.0%	4.1%	4.0%	1.2%	0.7%	1.8%	3.3%
Fulton													
WIM (monthly)	2,797	1,964	0	379	390	3,746	2,855	3,382	3,398	2,762	1,856	0	
CMV AADT	235	235	235	235	235	235	235	235	235	235	235	235	
CMV Traffic (monthly)[a]	7,290	6,819	7,290	7,054	7,290	7,054	7,290	7,290	7,054	7,290	7,054	7,290	
WIM % of CMV Traffic	38.4%	28.8%	0.0%	5.4%	5.4%	53.1%	39.2%	46.4%	48.2%	37.9%	26.3%	0.0%	27.4%
Floyd													
WIM (monthly)	0	0	0	0	0	0	148	0	241	0	0	0	
CMV AADT	843	843	843	843	843	843	843	843	843	843	843	843	
CMV Traffic (monthly)[a]	26,121	24,436	26,121	25,278	26,121	25,278	26,121	26,121	25,278	26,121	25,278	26,121	
WIM % of CMV Traffic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	1.0%	0.0%	0.0%	0.0%	0.1%

Table C.4 WIM % of CMV Traffic, 2017

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Average
Days in Month	31	28	31	30	31	30	31	31	30	31	30	31	
Laurel NB													
WIM (monthly)	61,346	61,700	69,562	51,077	72,293	0	48,984	66,166	59,856	0	63,159	52,725	
CMV AADT	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	
CMV Traffic (monthly)[a]	199,333	180,042	199,333	192,903	199,333	192,903	199,333	199,333	192,903	199,333	192,903	199,333	
WIM % of CMV Traffic	30.8%	34.3%	34.9%	26.5%	36.3%	0.0%	24.6%	33.2%	31.0%	0.0%	32.7%	26.5%	25.9%
Simpson													
WIM (monthly)	41,582	33,298	42,156	38,343	59,988	61,187	46,296	65,025	53,130	40,873	61,850	48,581	
CMV AADT	6,892	6,892	6,892	6,892	6,892	6,892	6,892	6,892	6,892	6,892	6,892	6,892	
CMV Traffic (monthly)[a]	213,649	192,974	213,649	206,757	213,649	206,757	213,649	213,649	206,757	213,649	206,757	213,649	
WIM % of CMV Traffic	19.5%	17.3%	19.7%	18.5%	28.1%	29.6%	21.7%	30.4%	25.7%	19.1%	29.9%	22.7%	23.5%
Laurel SB													
WIM (monthly)	43,997	48,943	56,271	49,203	57,194	0	46,914	65,300	52,869	0	40,119	34,726	
CMV AADT	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	6,430	
CMV Traffic (monthly)[a]	199,333	180,042	199,333	192,903	199,333	192,903	199,333	199,333	192,903	199,333	192,903	199,333	
WIM % of CMV Traffic	22.1%	27.2%	28.2%	25.5%	28.7%	0.0%	23.5%	32.8%	27.4%	0.0%	20.8%	17.4%	21.1%
Boone													
WIM (monthly)	23,372	18,666	27,994	25,715	50,464	43,870	40,409	48,141	32,536	27,254	57,321	55,168	
CMV AADT	6,353	6,353	6,353	6,353	6,353	6,353	6,353	6,353	6,353	6,353	6,353	6,353	
CMV Traffic (monthly)[a]	196,954	177,894	196,954	190,601	196,954	190,601	196,954	196,954	190,601	196,954	190,601	196,954	
WIM % of CMV Traffic	11.9%	10.5%	14.2%	13.5%	25.6%	23.0%	20.5%	24.4%	17.1%	13.8%	30.1%	28.0%	19.4%
Scott													
WIM (monthly)	39,800	37,678	26,796	33,132	38,849	41,217	40,392	47,458	40,484	12,647	41,939	34,657	
CMV AADT	7,732	7,732	7,732	7,732	7,732	7,732	7,732	7,732	7,732	7,732	7,732	7,732	
CMV Traffic (monthly)[a]	239,686	216,491	239,686	231,955	239,686	231,955	239,686	239,686	231,955	239,686	231,955	239,686	
WIM % of CMV Traffic	16.6%	17.4%	11.2%	14.3%	16.2%	17.8%	16.9%	19.8%	17.5%	5.3%	18.1%	14.5%	15.4%
Kenton													
WIM (monthly)	27,725	23,973	23,160	21,791	31,440	32,469	37,334	43,559	33,913	36,219	44,204	39,197	
CMV AADT	5,735	5,735	5,735	5,735	5,735	5,735	5,735	5,735	5,735	5,735	5,735	5,735	
CMV Traffic (monthly)[a]	177,770	160,566	177,770	172,035	177,770	172,035	177,770	177,770	172,035	177,770	172,035	177,770	
WIM % of CMV Traffic	15.6%	14.9%	13.0%	12.7%	17.7%	18.9%	21.0%	24.5%	19.7%	20.4%	25.7%	22.0%	18.8%
Lyon EB													
WIM (monthly)	23,947	25,268	24,453	24,151	30,074	27,881	23,920	25,824	31,458	34,549	41,255	57,412	
CMV AADT	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	
CMV Traffic (monthly)[a]	169,864	153,425	169,864	164,384	169,864	164,384	169,864	169,864	164,384	169,864	164,384	169,864	
WIM % of CMV Traffic	14.1%	16.5%	14.4%	14.7%	17.7%	17.0%	14.1%	15.2%	19.1%	20.3%	25.1%	33.8%	18.5%
Hardin													
WIM (monthly)	24,337	24,546	31,507	28,862	31,194	30,270	30,031	36,177	27,144	31,683	23,325	30,073	
CMV AADT	7,619	7,619	7,619	7,619	7,619	7,619	7,619	7,619	7,619	7,619	7,619	7,619	
CMV Traffic (monthly)[a]	236,177	213,321	236,177	228,559	236,177	228,559	236,177	236,177	228,559	236,177	228,559	236,177	
WIM % of CMV Traffic	10.3%	11.5%	13.3%	12.6%	13.2%	13.2%	12.7%	15.3%	11.9%	13.4%	10.2%	12.7%	12.5%
Lyon WB													
WIM (monthly)	16,813	20,059	21,491	18,373	23,805	18,221	20,059	27,012	20,632	23,091	36,202	30,924	
CMV AADT	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	5,479	
CMV Traffic (monthly)[a]	169,864	153,425	169,864	164,384	169,864	164,384	169,864	169,864	164,384	169,864	164,384	169,864	
WIM % of CMV Traffic	9.9%	13.1%	12.7%	11.2%	14.0%	11.1%	11.8%	15.9%	12.6%	13.6%	22.0%	18.2%	13.8%
Henderson													
WIM (monthly)	16,829	16,990	20,545	16,266	17,690	18,490	16,508	20,275	17,285	4,125	14,514	14,210	
CMV AADT	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	
CMV Traffic (monthly)[a]	67,267	60,758	67,267	65,098	67,267	65,098	67,267	67,267	65,098	67,267	65,098	67,267	
WIM % of CMV Traffic	25.0%	28.0%	30.5%	25.0%	26.3%	28.4%	24.5%	30.1%	26.6%	6.1%	22.3%	21.1%	24.5%
Shelby EB													
WIM (monthly)	4,931	9,493	9,083	11,129	12,465	19,253	14,438	16,180	8,738	14,405	20,953	2,944	
CMV AADT	4,888	4,888	4,888	4,888	4,888	4,888	4,888	4,888	4,888	4,888	4,888	4,888	
CMV Traffic (monthly)[a]	151,528	136,864	151,528	146,640	151,528	146,640	151,528	151,528	146,640	151,528	146,640	151,528	
WIM % of CMV Traffic	3.3%	6.9%	6.0%	7.6%	8.2%	13.1%	9.5%	10.7%	6.0%	9.5%	14.3%	1.9%	8.1%
Rowan													
WIM (monthly)	15,034	15,610	16,503	16,647	15,957	8,780	14,908	17,281	11,213	0	0	0	
CMV AADT	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	
CMV Traffic (monthly)[a]	47,129	42,568	47,129	45,609	47,129	45,609	47,129	47,129	45,609	47,129	45,609	47,129	
WIM % of CMV Traffic	31.9%	36.7%	35.0%	36.5%	33.9%	19.3%	31.6%	36.7%	24.6%	0.0%	0.0%	0.0%	23.8%
Fulton													
WIM (monthly)	0	2,471	2,927	5,210	3,026	4,318	2,995	5,129	1,735	5,173	5,102	4,438	
CMV AADT	243	243	243	243	243	243	243	243	243	243	243	243	
CMV Traffic (monthly)[a]	7,523	6,795	7,523	7,280	7,523	7,280	7,523	7,523	7,280	7,523	7,280	7,523	
WIM % of CMV Traffic	0.0%	36.4%	38.9%	71.6%	40.2%	59.3%	39.8%	68.2%	23.8%	68.8%	70.1%	59.0%	48.0%
Floyd													
WIM (monthly)	0	0	761	415	724	0	0	213	10	0	0	0	
CMV AADT	854	854	854	854	854	854	854	854	854	854	854	854	
CMV Traffic (monthly)[a]	26,465	23,904	26,465	25,611	26,465	25,611	26,465	26,465	25,611	26,465	25,611	26,465	
WIM % of CMV Traffic	0.0%	0.0%	2.9%	1.6%	2.7%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.7%

Table C.5 WIM % of CMV Traffic (2018)

	2018												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Average
Days in Month	31	28	31	30	31	30	31	31	30	31	30	31	
Simpson													
WIM (monthly)	56,490	68,030	26,607	71,431	25,878	54,675	66,070	54,525	51,121	58,452	49,453	42,920	
CMV AADT	6,898	6,898	6,898	6,898	6,898	6,898	6,898	6,898	6,898	6,898	6,898	6,898	
CMV Traffic (monthly)[a]	213,845	193,150	213,845	206,946	213,845	206,946	213,845	213,845	206,946	213,845	206,946	213,845	
WIM % of CMV Traffic	26.4%	35.2%	12.4%	34.5%	12.1%	26.4%	30.9%	25.5%	24.7%	27.3%	23.9%	20.1%	25.0%
Kenton													
WIM (monthly)	47,944	44,484	50,049	54,646	55,740	54,683	44,549	64,144	38,728	49,884	39,981	30,496	
CMV AADT	5,936	5,936	5,936	5,936	5,936	5,936	5,936	5,936	5,936	5,936	5,936	5,936	
CMV Traffic (monthly)[a]	184,027	166,218	184,027	178,091	184,027	178,091	184,027	184,027	178,091	184,027	178,091	184,027	
WIM % of CMV Traffic	26.1%	26.8%	27.2%	30.7%	30.3%	30.7%	24.2%	34.9%	21.7%	27.1%	22.4%	16.6%	26.6%
Laurel NB													
WIM (monthly)	55,078	59,195	64,860	56,947	63,550	50,153	53,181	59,739	54,749	51,963	0	0	
CMV AADT	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	
CMV Traffic (monthly)[a]	185,628	167,664	185,628	179,640	185,628	179,640	185,628	185,628	179,640	185,628	179,640	185,628	
WIM % of CMV Traffic	29.7%	35.3%	34.9%	31.7%	34.2%	27.9%	28.6%	32.2%	30.5%	28.0%	0.0%	0.0%	26.1%
Boone													
WIM (monthly)	53,215	53,215	77,685	77,685	36,551	39,049	34,504	39,487	29,908	29,908	33,260	32,591	
CMV AADT	5,492	5,492	5,492	5,492	5,492	5,492	5,492	5,492	5,492	5,492	5,492	5,492	
CMV Traffic (monthly)[a]	170,264	153,787	170,264	164,772	170,264	164,772	170,264	170,264	164,772	170,264	164,772	170,264	
WIM % of CMV Traffic	31.3%	34.6%	45.6%	47.1%	21.5%	23.7%	20.3%	23.2%	18.2%	17.6%	20.2%	19.1%	26.9%
Lyon EB													
WIM (monthly)	40,317	47,462	52,371	54,794	52,951	43,478	45,478	39,882	29,656	32,064	29,686	21,110	
CMV AADT	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	
CMV Traffic (monthly)[a]	165,540	149,520	165,540	160,200	165,540	160,200	165,540	165,540	160,200	165,540	160,200	165,540	
WIM % of CMV Traffic	24.4%	31.7%	31.6%	34.2%	32.0%	27.1%	27.5%	24.1%	18.5%	19.4%	18.5%	12.8%	25.1%
Lyon WB													
WIM (monthly)	31,153	34,797	42,366	38,398	41,860	36,532	37,983	42,640	30,589	39,228	26,233	22,686	
CMV AADT	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	5,340	
CMV Traffic (monthly)[a]	165,540	149,520	165,540	160,200	165,540	160,200	165,540	165,540	160,200	165,540	160,200	165,540	
WIM % of CMV Traffic	18.8%	23.3%	25.6%	24.0%	25.3%	22.8%	22.9%	25.8%	19.1%	23.7%	16.4%	13.7%	21.8%
Scott													
WIM (monthly)	42,140	40,072	5,129	50,097	40,847	46,942	43,593	51,615	7,602	46,015	0	0	
CMV AADT	8,035	8,035	8,035	8,035	8,035	8,035	8,035	8,035	8,035	8,035	8,035	8,035	
CMV Traffic (monthly)[a]	249,079	224,974	249,079	241,044	249,079	241,044	249,079	249,079	241,044	249,079	241,044	249,079	
WIM % of CMV Traffic	16.9%	17.8%	2.1%	20.8%	16.4%	19.5%	17.5%	20.7%	3.2%	18.5%	0.0%	0.0%	12.8%
Laurel SB													
WIM (monthly)	40,723	43,655	45,848	44,874	39,276	29,407	29,407	11,953	2,056	25,618	0	0	
CMV AADT	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	5,988	
CMV Traffic (monthly)[a]	185,628	167,664	185,628	179,640	185,628	179,640	185,628	185,628	179,640	185,628	179,640	185,628	
WIM % of CMV Traffic	21.9%	26.0%	24.7%	25.0%	21.2%	16.4%	15.8%	6.4%	1.1%	13.8%	0.0%	0.0%	14.4%
Henderson													
WIM (monthly)	13,238	15,965	19,376	17,142	21,191	18,469	17,840	16,289	16,173	17,136	15,128	13,835	
CMV AADT	2,165	2,165	2,165	2,165	2,165	2,165	2,165	2,165	2,165	2,165	2,165	2,165	
CMV Traffic (monthly)[a]	67,115	60,620	67,115	64,950	67,115	64,950	67,115	67,115	64,950	67,115	64,950	67,115	
WIM % of CMV Traffic	19.7%	26.3%	28.9%	26.4%	31.6%	28.4%	26.6%	24.3%	24.9%	25.5%	23.3%	20.6%	25.5%
Shelby EB													
WIM (monthly)	431	5,843	7,024	9,080	8,767	7,431	12,189	8,466	8,967	2,520	0	0	
CMV AADT	4,745	4,745	4,745	4,745	4,745	4,745	4,745	4,745	4,745	4,745	4,745	4,745	
CMV Traffic (monthly)[a]	147,101	132,865	147,101	142,355	147,101	142,355	147,101	147,101	142,355	147,101	142,355	147,101	
WIM % of CMV Traffic	0.3%	4.4%	4.8%	6.4%	6.0%	5.2%	8.3%	5.8%	6.3%	1.7%	0.0%	0.0%	4.1%
Fulton													
WIM (monthly)	5,165	5,948	5,309	5,737	5,619	6,125	6,694	6,906	6,641	6,513	4,078	2,907	
CMV AADT	228	228	228	228	228	228	228	228	228	228	228	228	
CMV Traffic (monthly)[a]	7,062	6,378	7,062	6,834	7,062	6,834	7,062	7,062	6,834	7,062	6,834	7,062	
WIM % of CMV Traffic	73.1%	93.3%	75.2%	83.9%	79.6%	89.6%	94.8%	97.8%	97.2%	92.2%	59.7%	41.2%	81.5%
Hardin													
WIM (monthly)	21,605	21,119	4,014	0	0	0	0	0	0	0	0	0	
CMV AADT	7,798	7,798	7,798	7,798	7,798	7,798	7,798	7,798	7,798	7,798	7,798	7,798	
CMV Traffic (monthly)[a]	241,737	218,343	241,737	233,939	241,737	233,939	241,737	241,737	233,939	241,737	233,939	241,737	
WIM % of CMV Traffic	8.9%	9.7%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%
Rowan													
WIM (monthly)	0	0	0	0	0	0	0	0	0	0	0	5,495	
CMV AADT	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	
CMV Traffic (monthly)[a]	47,847	43,216	47,847	46,303	47,847	46,303	47,847	47,847	46,303	47,847	46,303	47,847	
WIM % of CMV Traffic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	11.5%	1.0%
Floyd													
WIM (monthly)	0	0	0	0	22	0	0	0	0	0	0	0	
CMV AADT	840	840	840	840	840	840	840	840	840	840	840	840	
CMV Traffic (monthly)[a]	26,041	23,521	26,041	25,201	26,041	25,201	26,041	26,041	25,201	26,041	25,201	26,041	
WIM % of CMV Traffic	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table C.6 WIM % of CMV Traffic (2019)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Average
Days in Month	31	28	31	30	31	30	31	31	30	31	30	31	
Laurel NB													
WIM (monthly)	48,027	37,662	27,833	43,382	38,522	36,047	40,218	43,690	62,286	61,711	51,121	48,403	
CMV AADT	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	
CMV Traffic (monthly)[a]	175,789	158,778	175,789	170,119	175,789	170,119	175,789	175,789	170,119	175,789	170,119	175,789	
WIM % of CMV Traffic	27.3%	23.7%	15.8%	25.5%	21.9%	21.2%	22.9%	24.9%	36.6%	35.1%	30.1%	27.5%	26.0%
Simpson													
WIM (monthly)	54,280	44,622	50,514	46,571	45,398	38,083	35,650	46,448	43,030	0	0	27,077	
CMV AADT	7,070	7,070	7,070	7,070	7,070	7,070	7,070	7,070	7,070	7,070	7,070	7,070	
CMV Traffic (monthly)[a]	219,174	197,964	219,174	212,104	219,174	212,104	219,174	219,174	212,104	219,174	212,104	219,174	
WIM % of CMV Traffic	24.8%	22.5%	23.0%	22.0%	20.7%	18.0%	16.3%	21.2%	20.3%	0.0%	0.0%	12.4%	16.8%
Boone													
WIM (monthly)	34,199	29,669	31,000	27,786	39,473	37,923	35,169	25,216	20,046	13,987	22,294	17,544	
CMV AADT	5,927	5,927	5,927	5,927	5,927	5,927	5,927	5,927	5,927	5,927	5,927	5,927	
CMV Traffic (monthly)[a]	183,738	165,957	183,738	177,811	183,738	177,811	183,738	183,738	177,811	183,738	177,811	183,738	
WIM % of CMV Traffic	18.6%	17.9%	16.9%	15.6%	21.5%	21.3%	19.1%	13.7%	11.3%	7.6%	12.5%	9.5%	15.5%
Lyon EB													
WIM (monthly)	29,792	21,853	25,460	31,447	32,348	28,747	26,016	274	30,625	38,824	33,839	32,798	
CMV AADT	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	
CMV Traffic (monthly)[a]	172,263	155,593	172,263	166,707	172,263	166,707	172,263	172,263	166,707	172,263	166,707	172,263	
WIM % of CMV Traffic	17.3%	14.0%	14.8%	18.9%	18.8%	17.2%	15.1%	0.2%	18.4%	22.5%	20.3%	19.0%	16.4%
Lyon WB													
WIM (monthly)	27,802	24,333	23,533	28,258	28,525	26,941	29,261	29,622	23,863	31,018	22,425	18,793	
CMV AADT	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	5,557	
CMV Traffic (monthly)[a]	172,263	155,593	172,263	166,707	172,263	166,707	172,263	172,263	166,707	172,263	166,707	172,263	
WIM % of CMV Traffic	16.1%	15.6%	13.7%	17.0%	16.6%	16.2%	17.0%	17.2%	14.3%	18.0%	13.5%	10.9%	15.5%
Laurel SB													
WIM (monthly)	8,963	23,182	37,817	23,226	27,657	30,190	26,775	24,502	35,362	40,639	22,534	23,879	
CMV AADT	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	5,671	
CMV Traffic (monthly)[a]	175,789	158,778	175,789	170,119	175,789	170,119	175,789	175,789	170,119	175,789	170,119	175,789	
WIM % of CMV Traffic	5.1%	14.6%	21.5%	13.7%	15.7%	17.7%	15.2%	13.9%	20.8%	23.1%	13.2%	13.6%	15.7%
Scott													
WIM (monthly)	0	0	18,670	5,261	35,636	36,498	0	36,323	48,032	36,497	21,092	19,962	
CMV AADT	6,817	6,817	6,817	6,817	6,817	6,817	6,817	6,817	6,817	6,817	6,817	6,817	
CMV Traffic (monthly)[a]	211,339	190,887	211,339	204,522	211,339	204,522	211,339	211,339	204,522	211,339	204,522	211,339	
WIM % of CMV Traffic	0.0%	0.0%	8.8%	2.6%	16.9%	17.8%	0.0%	17.2%	23.5%	17.3%	10.3%	9.4%	10.3%
Kenton													
WIM (monthly)	28,534	26,621	28,534	27,833	32,820	31,274	24,083	7,490	10,037	7,460	5,620	4,229	
CMV AADT	5,277	5,277	5,277	5,277	5,277	5,277	5,277	5,277	5,277	5,277	5,277	5,277	
CMV Traffic (monthly)[a]	163,576	147,746	163,576	158,300	163,576	158,300	163,576	163,576	158,300	163,576	158,300	163,576	
WIM % of CMV Traffic	17.4%	18.0%	17.4%	17.6%	20.1%	19.8%	14.7%	4.6%	6.3%	4.6%	3.6%	2.6%	12.2%
Rowan													
WIM (monthly)	20,927	20,469	24,333	19,624	18,280	16,092	17,519	16,753	15,979	19,010	13,169	19,897	
CMV AADT	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	
CMV Traffic (monthly)[a]	46,502	42,001	46,502	45,002	46,502	45,002	46,502	46,502	45,002	46,502	45,002	46,502	
WIM % of CMV Traffic	45.0%	48.7%	52.3%	43.6%	39.3%	35.8%	37.7%	36.0%	35.5%	40.9%	29.3%	42.8%	40.6%
Hardin													
WIM (monthly)	0	14,251	20,512	14,346	19,816	18,807	18,661	22,287	18,540	15,526	24,416	18,561	
CMV AADT	7,982	7,982	7,982	7,982	7,982	7,982	7,982	7,982	7,982	7,982	7,982	7,982	
CMV Traffic (monthly)[a]	247,428	223,483	247,428	239,446	247,428	239,446	247,428	247,428	239,446	247,428	239,446	247,428	
WIM % of CMV Traffic	0.0%	6.4%	8.3%	6.0%	8.0%	7.9%	7.5%	9.0%	7.7%	6.3%	10.2%	7.5%	7.1%
Henderson													
WIM (monthly)	12,686	16,506	14,639	18,136	18,452	14,300	15,455	18,564	15,522	18,403	15,633	11,077	
CMV AADT	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	2,153	
CMV Traffic (monthly)[a]	66,746	60,287	66,746	64,593	66,746	64,593	66,746	66,746	64,593	66,746	64,593	66,746	
WIM % of CMV Traffic	19.0%	27.4%	21.9%	28.1%	27.6%	22.1%	23.2%	27.8%	24.0%	27.6%	24.2%	16.6%	24.1%
Fulton													
WIM (monthly)	2,377	2,772	4,404	4,323	2,998	4,762	7,473	7,900	4,664	4,664	1,649	4,407	
CMV AADT	235	235	235	235	235	235	235	235	235	235	235	235	
CMV Traffic (monthly)[a]	7,281	6,576	7,281	7,046	7,281	7,046	7,281	7,281	7,046	7,281	7,046	7,281	
WIM % of CMV Traffic	32.6%	42.2%	60.5%	61.4%	41.2%	67.6%	102.6%	108.5%	66.2%	64.1%	23.4%	60.5%	60.9%
Shelby EB													
WIM (monthly)	0	0	0	11,440	10,341	0	0	0	0	0	0	0	
CMV AADT	5,069	5,069	5,069	5,069	5,069	5,069	5,069	5,069	5,069	5,069	5,069	5,069	
CMV Traffic (monthly)[a]	157,147	141,940	157,147	152,078	157,147	152,078	157,147	157,147	152,078	157,147	152,078	157,147	
WIM % of CMV Traffic	0.0%	0.0%	0.0%	7.5%	6.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%
Floyd													
WIM (monthly)	0	0	0	0	0	0	0	0	0	0	0	0	
CMV AADT	851	851	851	851	851	851	851	851	851	851	851	851	
CMV Traffic (monthly)[a]	26,379	23,826	26,379	25,528	26,379	25,528	26,379	26,379	25,528	26,379	25,528	26,379	
WIM % of CMV Traffic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table C.7 WIM % of AADT

	Year				Average
	2016	2017	2018	2019	
Laurel NB	22.9%	25.9%	26.1%	26.0%	25.2%
Simpson	17.7%	23.5%	25.0%	16.8%	20.7%
Laurel SB	15.4%	21.1%	14.4%	15.7%	16.6%
Boone	7.1%	19.4%	26.9%	15.5%	17.2%
Scott	13.8%	15.4%	12.8%	10.3%	13.1%
Kenton	13.1%	18.8%	26.6%	12.2%	17.7%
Lyon EB	12.3%	18.5%	25.1%	16.4%	18.1%
Hardin	10.3%	12.5%	1.7%	7.1%	7.9%
Lyon WB	11.3%	13.8%	21.8%	15.5%	15.6%
Henderson	24.9%	24.5%	25.5%	24.1%	24.8%
Shelby EB	3.3%	8.1%	4.1%	1.2%	4.2%
Rowan	39.8%	23.8%	1.0%	40.6%	26.3%
Fulton	27.4%	48.0%	81.5%	60.9%	54.4%
Floyd (US 23)	0.1%	0.7%	0.0%	0.0%	0.2%

Table C.8 AADT and WIM Rankings

	CMV AADT		WIM % of CMV Traffic		
	Average AADT	Rank	Average WIM %	Average WIM Count (Daily)	Rank
Scott	7,803	1	13.1%	1,022	11
Hardin	7,710	2	7.9%	609	12
Simpson	6,889	3	20.7%	1,426	5
Laurel NB	6,276	4	25.2%	1,582	3
Laurel SB	6,276	5	16.6%	1,042	9
Boone	5,931	6	17.2%	1,020	8
Kenton	5,622	7	17.7%	995	7
Lyon EB	5,430	8	18.1%	983	6
Lyon WB	5,430	9	15.6%	847	10
Shelby EB	4,884	10	4.2%	205	13
Henderson	2,181	11	24.8%	541	4
Rowan	1,504	12	26.3%	396	2
Fulton	235	13	54.4%	128	1

* Removed Floyd (US 23) from analysis due to neglible WIMs

Appendix D — Mentimeter Survey

Q1: (5 responses)
On a scale of 1 to 5, how important are these factors in determining whether to keep or close a facility?

- Truck volume – 4.8
- State line – 4
- Bypass routes – 3.2

Q2: (5 responses)
Please rank these factors in terms of importance when considering whether to keep or close a facility:

- Truck volume – 1
- State line – 2
- Bypass Routes – 3

Q3: (5)
Should these factors be considered in the decision to keep or close a facility?
Condition of scale house – 2

- Size of scale house (# of workspaces) – 1.8
- Length of entrance ramp – 1.8
- Number of CMV parking spaces – 1.8
- Availability of enabling technology – 1.8

Q4: (5)
Should these factors be considered in the decision to keep or close a facility?

- Staffing levels at facility – 2
- Hours of operation – 1.8
- Safety performance measures – 2
- Revenues collected vs. costs – 2

Q5
What other items should be considered when determining whether to keep or close a facility?

- Potential location of the new facility
- If KYTC is going to construct a new facility, then will need an adequately large area since their footprint is very large.
- Road access during construction
- If the right lane is out during construction, then would have to account for a short-term closure.
- Can remote monitoring be utilized for issuing warnings/citations or collection of revenue?
- KYTC has already proven its ability to use technology to monitor traffic conditions for truck reporting. KYTC may want to look at ways to issue citations through technology instead of building a new facility with the need for staffing. This technology could utilize KATS and other technology enablers on the front-end while recognizing the need for a law enforcement mechanism on the back end.
- Parking requirements
- One of the issues we deal with is parking along the ramps and shoulders. If we do construct a new facility, we need to size it where trucks will not park overnight alongside ramps and shoulders which present a safety challenge.
- Is there another way to monitor info obtained from existing weigh station?
- Look at high crash avenues
- Hardin facility is almost non-existent but has one of the highest volumes and crash rates in the state. The safety characteristics for a weigh station area should also be given consideration when deciding on its utility.

Ken also stated that this I-65 area has the highest truck traffic percentage among all interstate corridors within the state.

- Costs
- Weigh station facilities are very expensive to build so this factor would have to come into consideration.

Appendix E — Facility Photos

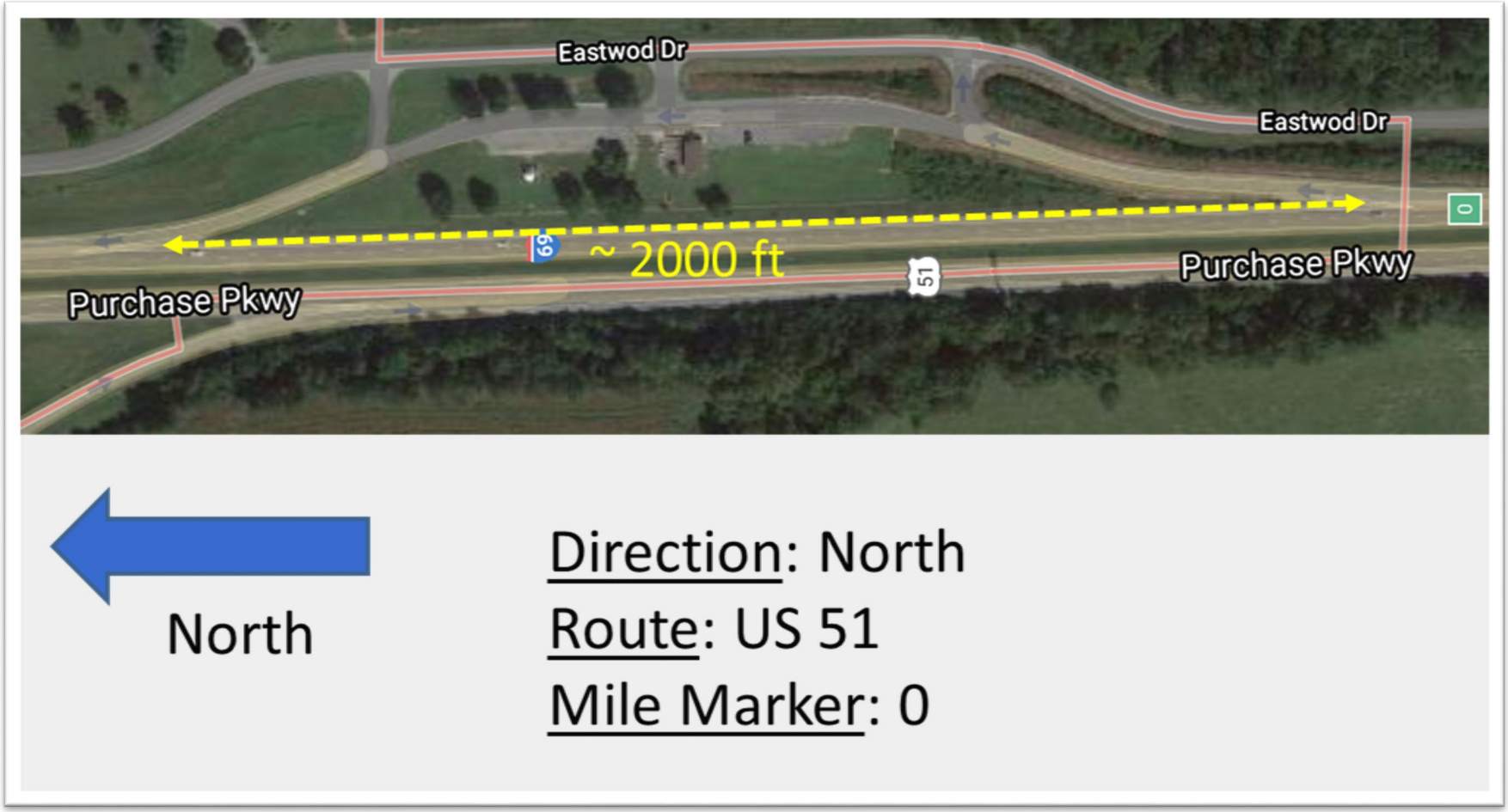


Figure E.1 Fulton Weigh Station Planar Map

Figure E.2 Fulton Weigh Station Photos

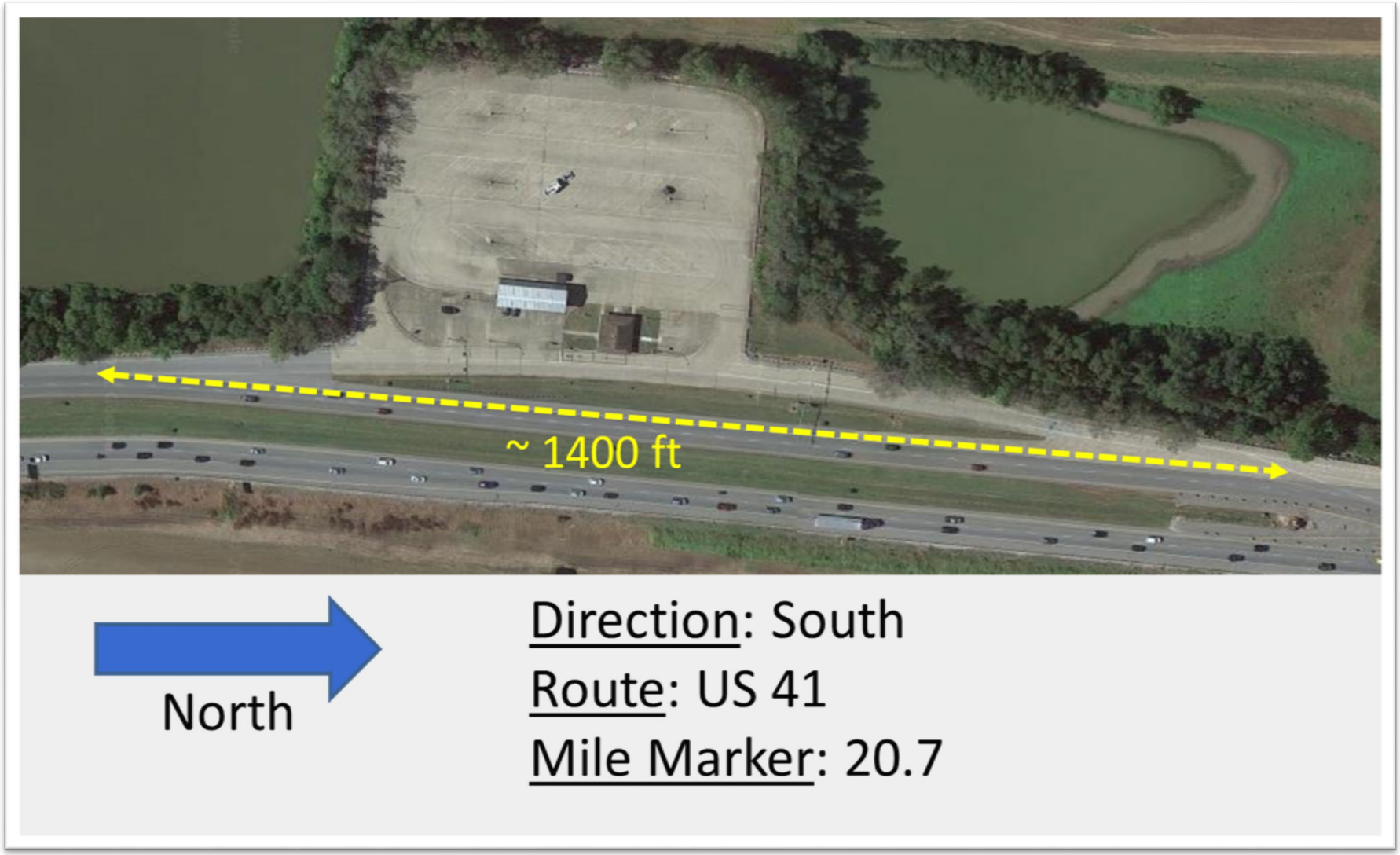


Figure E.3 Henderson Weigh Station Planar Map

Figure E.4 Henderson Weigh Station Photos

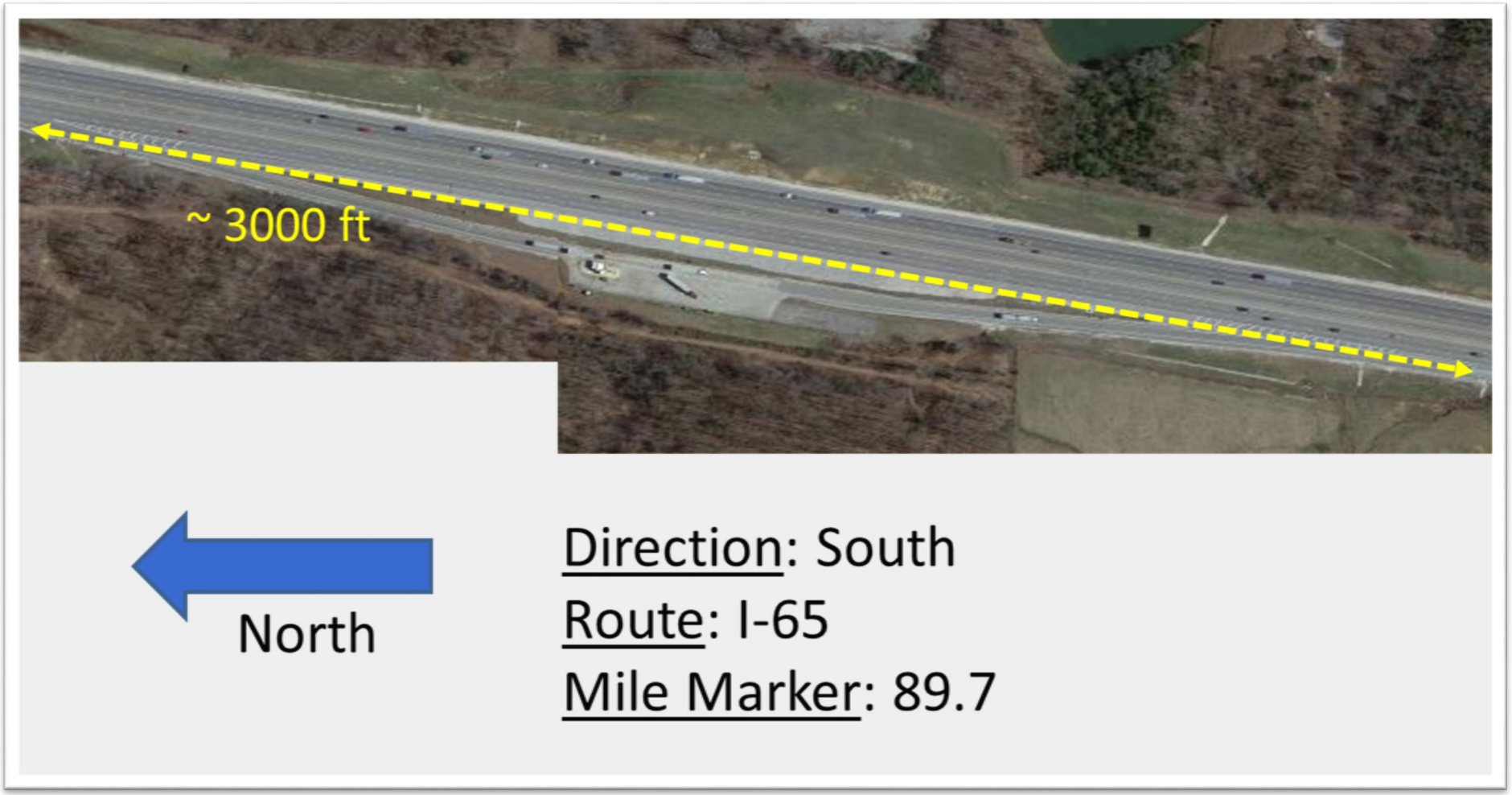


Figure E.5 Hardin Weigh Station Planar Map

Figure E.6 Hardin Weigh Station Photos

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