



Truck Routing Issues

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in cooperation with
Kentucky Transportation Cabinet
Commonwealth of Kentucky

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Research Report
KTC-17-20/SPR17-534-1F

Truck Routing Issues

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16. Abstract <p>Commercial vehicle drivers selecting inappropriate routes where the handling characteristics (e.g., off-tracking) and dimensions of their trucks are not consistent with a roadway's cross section and geometrics can damage the vehicle, harm adjacent property, or result in crashes. Analysis of crashes that involve the use of inappropriate routes indicate a significant number are caused by drivers receiving faulty directions from in-truck GPS units or adhering to incorrect directions provided by their companies. The Kentucky Transportation Center (KTC) investigated strategies to ensure truck drivers are given correct directions when traveling on Kentucky roadways. As part of this effort, this report reviews policies and regulations adopted by other states to ensure trucks have the proper grade GPS units. It also catalogues crashes that have occurred in the state of Kentucky where errant GPS directions contributed to incidents and highlights corrective actions that have been taken (e.g., installation of signage) to warn truck drivers of route restrictions or adverse conditions. Based on a review of incidents and case studies, the report presents recommendations to ameliorate the problem of truck drivers selecting inappropriate routes. Key suggestions include: requiring commercial vehicles to have GPS units designed specifically for truck routing; installing truck routing signs consistent with standards laid out in the <i>Manual on Uniform Traffic Control Devices</i>; installing warning signs in advance of low clearance bridges, low ground clearance railroad crossings, and weight-restricted routes; improving driver training on GPS systems and enhancing communication between drivers and trucking companies; and forging collaborative agreements between transportation agencies and mapping companies to ensure mapping products incorporate correct routing information.</p>					
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Table of Contents

Chapter 1: Background	2
Chapter 2: Literature Review	3
Chapter 3: Information from Highway District Interviews	4
Chapter 4: Case Studies for GPS-Related Traffic Crashes	6
Chapter 5: Route Case Studies	11
Chapter 6: Case Study Interview with Industry	21
Chapter 7: Truck Routing Case Studies	22
Chapter 8: Recommendations	25

Chapter 1: Background

Various problems occur when drivers of large trucks use inappropriate routes. The use of inappropriate routes has resulted in trucks damaging property and, in some instances, crashes. Specifically, truck drivers have used routes where the handling characteristics (such as off-tracking) and dimensions of their trucks were not consistent with the roadway cross section and geometrics. In several instances, the drivers stated that inappropriate route selection stemmed from following directions given by their GPS units or following directions provided by their company.

There is a need to investigate the methods used within the trucking industry to provide routing information to drivers as well as the methods transportation agencies and mapping companies rely on to provide accurate geospatial information and directions to truck drivers. This undertaking would involve a cooperative effort among the trucking industry, truck drivers, transportation agencies (both state and local), and GPS mapping companies.

Chapter 2: Literature Review

A Kentucky Transportation Center (KTC) researchers reviewed literature focused on truck routing using GPS mapping. The following bullet points summarize key insights from this review.

- Passenger vehicle GPS devices are not programmed to provide the type of information truck drivers need to avoid potential problems related to the characteristics of their truck. However, GPS systems designed specifically for trucks can be effective for avoiding these situations.
- Smartphone apps and over height detection systems can effectively warn truck drivers of low clearance bridges.
- The New York Department of Transportation (DOT) has recommended prohibiting drivers from using consumer GPS systems (i.e., not specific for trucks) and increasing fines for truck drivers traveling on non-truck routes. Other recommendations included: consider restricting trucks on routes with low clearance bridges which are currently unrestricted to trucks, requiring truck drivers with multiple crashes at low clearance bridges on unauthorized routes to purchase additional liability insurance, and using electronic monitoring to identify trucks on unauthorized routes.
- Due to an increase in truck bridge impacts, Maryland has updated its over height truck permit application process to include a height clearance route survey certification.
- Illinois law mandates the development of a brochure that describes the differences between truck and passenger vehicle GPS systems. The law requires that local governments provide truck route information to the Illinois DOT for online posting.
- New York City has a Truck Route Management and Community Impact Reduction program that includes an overview of traffic policies and regulations, a routing analysis, improved signing along the Truck Route Network, an education program, and community outreach.
- The Federal Motor Carrier Safety Administration (FMCSA) is working with states and the trucking industry to ensure that professional truck drivers recognize the importance of using navigation systems intended for commercial vehicles. These navigation systems notify truck drivers of route restrictions (such as low bridge overpasses).
- The FMCSA works with driver training schools to include electronic system selection information in their training programs.
- The FMCSA coordinates with states and the trucking industry to distribute its visor card (GPS Selection Guide for CMVs). This card provides tips on selecting a proper navigation system for trucks and their correct use.

Chapter 3: Information from Highway District Interviews

KTC researchers conducted telephone interviews with representatives from each of the 12 Kentucky Transportation Cabinet (KYTC) highway districts. KTC identified a person in each district to provide information related to truck routing. The job title of the person providing the information varied by district. The following questions were asked.

1. Are there examples of specific routes where there have been issues with trucks using roads not suited for the operating characteristics of tractor trailers?
2. Are there examples of specific locations where there are problems with vertical clearance?
3. What types of signing have been used at locations where truck routing is an issue?
4. Have they restricted truck use on specific routes through signing?
5. Have they changed the route designation of any routes to restrict trucks?
6. Have they communicated with the trucking industry concerning routing issues?
7. Are they aware of traffic crashes involving trucks on inappropriate routes?
8. Any issues with Designated Truck Network (DTN)?
9. Other comments concerning truck routing.

The following bullet points summarize information obtained from the interviews. Site visits were made to several of the routes identified as having a problem related to truck routing to document their characteristics and any related signing.

- Each district representative identified a few routes where there have been issues with trucks traveling on a road that has inadequate geometrics for large trucks due to truck drivers receiving improper GPS directions.
- There were a few examples of locations where trucks drivers, following GPS directions, had more than one crash at a location with a low vertical clearance.
- Signs (i.e., warning, guide, and regulatory signs) noted in the *Manual on Traffic Control Devices* (MUTCD) were typically installed on a road with problems where trucks had been improperly routed. Special signs were designed and installed in a few instances. Site visits included an attempt to document the types of signing used.
- There were a few examples provided where truck use was restricted on specific routes. However, there were questions concerning when and if truck restrictions can be made on designated truck routes. Truck prohibitions are more common on local (not state-maintained) roads.
- Routes are restricted for trucks over specific weights. Regulatory signs are installed that list the weight limits.
- Routes listed on the Kentucky Truck Weight Classification system and the Kentucky Designated National Truck Network are provided by KYTC to mapping companies. This information can be used in determining proper truck routes.

- There have been no changes in the designation of a route to restrict truck use on specific routes.
- Communication with the trucking industry has not occurred except in a few isolated instances.
- In a very few instances, KYTC has communicated with a mapping company to request the company alter their maps used to route trucks.
- A few locations were identified where a crash involving a large truck occurred and the truck driver indicated he was directed onto the inappropriate route by a GPS unit. Several of these routes were inspected to determine the roadway characteristics and related signs.
- There are routes maintained by local governments (both county and city) where truck restrictions have been implemented.

Chapter 4: Case Studies for GPS-Related Traffic Crashes

Conversations with highway district personnel identified locations where traffic crashes had occurred that involved a truck driver traveling on an improper route after using inaccurate GPS information. KTC also reviewed the state crash file using logic to identify where crashes occurred involving a truck traveling on an improper route. Crash reports were reviewed to determine if use of the GPS was noted in the police narrative.

The following bullet points discuss case studies where the GPS was noted in the police report narrative as a factor contributing to the truck driver using an improper route. An example of several drivers following their GPS onto a closed roadway is also given.

- **Intersection of KY 39 and Coleman Road in Pulaski County:** A fatal crash occurred at this intersection when a car traveled under the side of a trailer stopped across its lane of travel. The truck was stopped after the rear tandem wheels of the combination truck became stuck in a ditch when the driver attempted to turn left from Coleman Road onto KY 39. The crash occurred when it was dark. The truck driver said he was following GPS directions which led him onto the county road. An inspection of the accident site found that the county had placed “No Thru Truck Traffic” signs at both ends of the county road.



- **KY 1983 in Madison County:** A truck impacted a railroad underpass resulting in major damage to the structure. The driver stated he obtained his route from a “store bought” GPS. The driver stated that he realized the route was inappropriate for his truck but could not locate a place to turn around and did not notice the low clearance signs in advance of the underpass. The road also had a “No Trucks” sign at the intersection with US 25. This road has a Class A weight rating.



- **KY 1031 in Central City:** A truck driver stated he was following his GPS directions and did not observe the low clearance warning signs prior to his truck impacting a railroad underpass. This structure has been impacted several times. There are several low clearance warning signs both in advance and at the underpass (with flashing beacons at the structure).



- **Third Street in Louisville:** A truck driver stated he was following his GPS directions and misjudged the clearance on the railroad underpass. There are several warning signs in advance of the underpass (including a variable message sign that warns drivers when an over-height truck is detected).
- **KY 207 in Greenup County:** A combination truck traveled into a ditch in a sharp curve. The driver stated he was following his GPS directions to an industry. Signs are located on US 23 prior to the location where truck drivers would turn onto KY 207 that direct truck drivers to use US 23 to their destination. Although KY 207 has an AAA weight rating, the roadway geometrics are not appropriate for large trucks.



- KY 799 in Rowan County:** In two crashes at the same series of curves, a truck driver was unable to negotiate the curves and veered off the travel lanes. In both instances the driver said he was following his GPS directions. One police report narrative stated that the truck was on a road not permissible for its vehicle type. The other report noted that the driver did not observe the regulatory sign prohibiting trucks with more than three axles. One of the drivers stated that his GPS began to reroute him just prior to his crash. This road has a Class A weight rating, so in both instances the loaded tractor trailer would have been overweight.



- Flemingsburg:** A truck driver stated he was following his GPS directions when he failed to negotiate a traffic circle in the center of Flemingsburg; the crash resulted in damage to the adjacent property. The report noted that the driver was then redirected by the police.
- Melton Harmon Road in Whitley County:** A truck taking a detour from I-75 (due to traffic backup) became stuck on a one-lane county road. The truck driver explained his route selection by noting that he followed GPS directions to the location.
- KY 1198 in Bath County:** A truck driver stated he was following GPS directions when he realized he was starting to travel in the wrong direction. He attempted to turn around and return to the proper route when his truck went partially off the road and overturned.
- Sauer Lane in Daviess County:** A truck driver was following his GPS directions when his truck could not negotiate a sharp curve and contacted the adjacent guardrail. The driver stated he was directed to use this route to an industry.

- **Greenview Road in Boone County:** A GPS routed a driver on a road where the driver observed a “No Truck” sign. The truck damaged property when the driver attempted to turn around.



- **Gum Springs Road in McCracken County:** A truck driver followed his GPS directions down a narrow and curvy county road. The truck could not negotiate a sharp curve.
- **Graves Road in Boone County:** A truck driver was following GPS directions, leading him onto a road that had signs prohibiting combination trucks. The trailer off-tracked into a culvert.



- **Frankfort:** A truck driver stated he was on the wrong street after following GPS directions. The truck impacted a passenger car when it attempted to turn around.
- **Cynthiana:** A truck driver stated his GPS unit directed him to make an incorrect turn onto a street, causing him to run over a fire hydrant.
- **Danville:** A truck driver followed his GPS directions into an unfamiliar area and collided with a pole and wires when attempting to make a turn.
- **KY 149 in Clay County:** A truck driver stated his GPS unit directed him onto a road where he failed to negotiate a curve leading to a narrow bridge. The tractor overturned with the trailer

overturning into the river. The road has a Class A weight rating and the loaded tractor trailer would have exceeded the 44,000-pound weight limit.



- **Sugar Camp Branch Road in Owsley County:** A police narrative noted that a GPS unit gave the truck driver the wrong directions to deliver a load, resulting in the truck traveling on a one-lane road. The truck became stuck when attempting to turn around.
- **Ferguson Street in Pulaski County:** A truck driver stated his “in-truck GPS” instructed him to turn down a street for a delivery and he realized the directions were not correct. His truck collided with a pole when it attempted to exit the street.
- **Johnson Hollow Road in Bullitt County:** A truck driver stated he was following GPS directions when his truck contacted overhanging power lines.
- **Mortons Gap in Hopkins County:** A truck driver stated he became lost while following his GPS directions and collided with a pole while turning around.
- **KY 6014 in Pulaski County:** The driver of a pickup stated he was following his GPS directions when he drove past the end of a road and struck a warning sign. The police narrative noted that several similar crashes had occurred at this location. The crash occurred at the end of a rerouted road where the GPS mapping had not been updated in the involved vehicles.



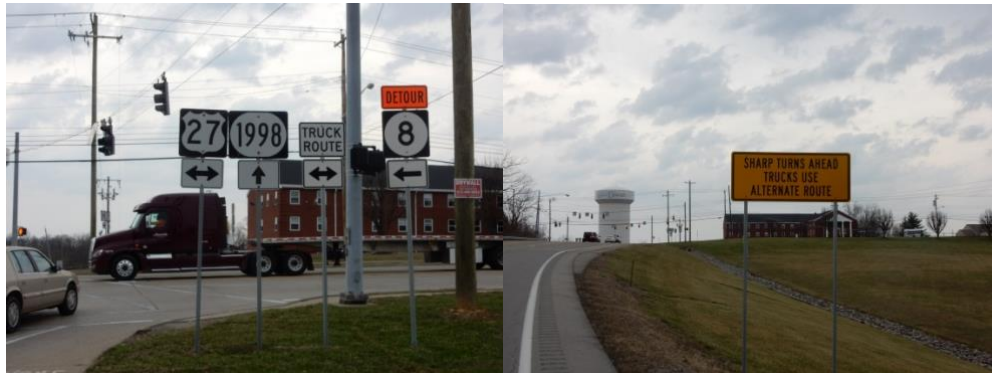
Chapter 5: Route Case Studies

Interviews with district offices identified several routes where efforts had been made to prevent the drivers of large trucks from entering inappropriate routes. The following bullet points describe some countermeasures state and local agencies have used to address situations where truck drivers enter roads not suitable for large trucks. Countermeasures have involved the installation of various types of signing to either prohibit truck traffic on certain routes or to provide warning or guidance to truck drivers.

- **KY 207 in Greenup County:** Truck drivers were being directed by their GPS to use KY 207 (which has several sharp curves) to a specific industry. GPS units indicated this route because using KY 207 is shorter than US 23. A sign was placed on US 23 prior to the KY 207 turnoff informing truck drivers to use US 23 to travel to their destination.



- **KY 1998 in Campbell County:** A state route with adverse geometrics was being used as a truck route over a preferable route (US 27) for trucks. A warning sign was installed on KY 1998 in advance of the intersection with US 27 along with a truck route sign at the intersection.



- **KY 416 in Henderson County:** Truck drivers were using a state route as a shortcut between two parkways. The route has a Class A weight rating. A regulatory sign was installed at a parkway

interchange exit stating, “Notice: No Trucks over 22 Tons,” which is the weight limit for a Class A road.



- **New Lair Road in Harrison County:** The GPS directions to several companies (in an industrial park) instructed truck drivers to take a road inappropriate for large trucks. Drivers were backing onto US 27 when they entered the county road and observed its cross section. Signs were placed on US 27 in advance of the county road directing drivers to the industrial park.



- **Near Exit 121 on I-65 in Bullitt County:** A county road was being used by truck drivers to travel to and from a truck stop at an interstate interchange. The local government placed signs on several streets in the area stipulating that no trucks (specifically, no semi-trucks) were permitted on local streets. The sign also noted the weight limit.



- Pelly Road in Kenton County:** A city-maintained road was being used by truck drivers to travel between two state routes. Signs were placed on both the state and city roads to prohibit trucks on Pelly Road. One sign noted a city ordinance that prohibited trucks on Pelly Road.



- Business Route at Springfield in Washington County:** Truck drivers were being routed by their GPS units onto a business route that included a local road and a roundabout instead of the preferable bypass route. Guide and truck prohibition signs were installed.



- **Between KY 73 and US 68 in Logan County:** Truck drivers were routed by their GPS units onto a county road to an industry. A guide sign was placed on KY 73 directing truck drivers to the specific industry and the county placed truck prohibition signs on its road.



- **KY 80 near London:** Truck drivers were being directed onto inappropriate routes to a distribution center. Signs were installed on both KY 80 and the adjacent KY route directing drivers to remain on KY 80.



- **Lebanon in Marion County:** Truck drivers were driving on city streets rather than using the bypass route to the industrial park. Additional guide signs were installed on state routes to direct truck drivers to the industrial park. There was also communication between the local Office of Economic Development and the local industries to direct truck drivers to use the bypass. This communication also asked the logistics managers from each industry to coordinate with truck drivers to ensure that they had the most recent and accurate data available on their GPS units.



- KY 1812 in Breathitt County:** Truck drivers were being routed by their GPS units onto a state road with very severe curves. A non-typical warning sign was placed at the start of the road warning drivers of switchback curves and directing them to use an alternative route.



- West Wilson Road in Russell County:** Truck drivers were directed by their GPS units onto a county road to an industry. The county road narrows significantly and is impassable for large trucks. The county placed truck prohibition signs.



- **Burkes Springs Road in Marion County:** Truck drivers were using a county road to access an industry (from GPS directions) rather than alternative state routes. The county placed a sign at the intersection with the state route noting “No Thru Semi Trucks.” County officials also communicated with the industry about the proper routes for truck drivers accessing their facility.



- **KY 3076 in Boone County:** Truck drivers traveling from I-275 to KY 8 were routed by their GPS units onto a narrow road. The road has numerous severe curves. A sign warning of the curves and truck prohibition signs were installed.



- **KY 1198 in Bath County:** A version of a truck prohibition sign was installed to limit commercial truck traffic on a road where the geometrics were inappropriate for large trucks.



- **Third Street in Louisville:** After a series of crashes in which truck drivers following GPS directions impacted a low clearance overpass, an active warning sign was installed to provide additional warning of the bridge clearance. Other warning signs are also installed.



- **KY 1136 in Hardin County between KY 1868 and US 31W:** Truck prohibition signs were placed along a section of this roadway. The prohibition is a result of low ground clearance railroad crossing in this section of KY 1136.



- **Oak Street in Louisville:** After a series of crashes in which truck drivers following their GPS units impacted a low clearance bridge, the railroad company worked with the transportation agency to improve advance warning signs. The railroad company also painted the overpass to increase its visibility.



- US 68 in Hopkinsville:** The most direct route through Hopkinsville is the US 68 business route. However, this route takes drivers through the central business district, which is not appropriate for large trucks. Regulatory signs have been installed informing trucks they must use the US 68 bypass.



- KY 57 in Bourbon County:** Truck drivers had been provided incorrect information for the proper route to make a delivery. This resulted in large trucks traveling on a route with a height limitation and drivers being forced to turn around in a parking lot, resulting in damage to the property. Warning and regulatory signs were installed to stop the drivers before they reached the low overpass. However, drivers continued to have problems due to the routing directions.



- The following images are examples of truck prohibition signs used (primarily by counties and cities) on roads where truck drivers were led by GPS units onto inappropriate routes. Inspections have found a range of signs used, with many signs being either non-standard or installed improperly.





- A warning sign was installed to advise truck drivers of a change in the road configuration and specifically told drivers to reprogram their GPS units.



Chapter 6: Case Study Interview with Industry

To understand the truck industry's perspective on truck routing, a local Office of Economic Development (in Lebanon) distributed a survey to local industries. It should be noted that additional signs had been installed in the area prior to the survey to provide more information to truck drivers and direct them to the proper route to the industries. A limited number of responses (from six industries) were obtained. The following is a summary of information obtained from the survey.

- The number of daily deliveries varied from 10 to 350.
- Only one industry stated that drivers had a problem using the proper route to their location. They indicated the problem occurs because their company name was not on the sign directing drivers to the industrial park and the sign was too close to the turn.
- The industries do not have input into truck routing for deliveries and do not tell drivers what type of GPS device they should use.
- The only suggestions for improvements were placing their company name on the guide signs and improving roadway lighting.
- They were not aware of any crashes involving a truck driver using an improper route.
- There were comments noting that the additional signing had improved routing to their location. Another comment observed that enforcement could stop truck drivers using improper routes and improve compliance.

Chapter 7: Truck Routing Case Studies

This chapter discusses a few case studies where a truck routing issue resulted in the installation of additional signs and pavement markings and, in several examples, more than signing. The case studies include proposals to change the roadway designation related to trucks, prohibit truck travel on a US route, and reroute trucks on a US route designated with a AAA weight rating.

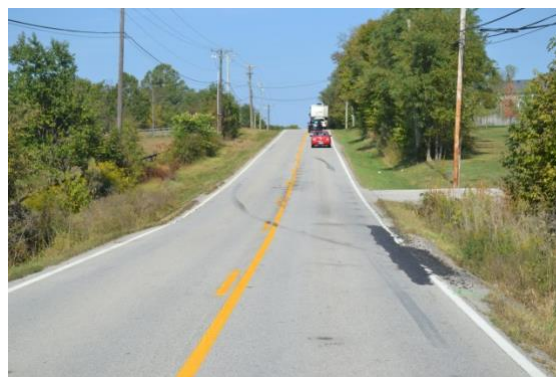
- Residents requested that large trucks be prohibited from traveling on a section of KY 151 in Franklin and Anderson Counties. Specifically, truck drivers traveling eastbound on I-64 used KY 151 (a two-lane road with narrow shoulders) to travel from the interstate to Lawrenceburg. There is an alternative four-lane road with wide shoulders (US 127) available to travel from the interstate to Lawrenceburg. An eastbound truck driver would have to remain on I-64 about five miles past the KY 151 interchange to use the US 127 route. A review of crash data did not show a problem related to commercial vehicles on KY 151. The roadway geometry and roadway cross section on KY 151 are adequate to accommodate large trucks. An alternative method to route truck drivers onto the four-lane road and away from the two-lane road is to coordinate with mapping companies to direct truck drivers traveling eastbound on I-64 to continue to the US 127 interchange. While this route (for eastbound drivers on I-64) is slightly longer (about five miles), the time difference is minimal due to the roadway characteristics of US 127 compared to KY 151. Both routes have a AAA truck weight classification.



- After several crashes involving large trucks and residents voicing their concerns, truck travel was banned along a 7.1-mile section of US 119 in Letcher County (over Pine Mountain from Whitesburg toward Harlan). A section of the road was reconstructed to widen curves and provide pavement markings to allow a buffer zone between the lanes and permit tractor trailers to off-track and not intrude into the opposing lane. After the construction project was completed, the road was opened to truck traffic. This case study shows unique alternatives (initially a truck ban and then road reconstruction) to alleviate issues with large trucks.



- A route used by truck drivers to travel to a landfill in Scott County has caused concern among residents (due to travel by large trucks on a two-lane section of US 25). The landfill is located less than two miles from Exit 136 on I-75. Garbage trucks traveling northbound on I-75 use Exit 129 and travel on KY 620 and then US 25 to the landfill (it is approximately 6.8 miles from exiting the interstate to the landfill). The alternative route would let drivers traveling northbound on I-75 continue north to Exit 136 and then use KY 32 (approximately 9.1 miles from driving past Exit 129 to the landfill). The issue with using Exit 129 (rather than Exit 136) is that this route requires traveling on a two-lane road (US 25) for a longer distance, and this section of US 25 has much higher average daily traffic compared to the alternative route. There should be no reason for a driver southbound on I-75 to not use Exit 136. Truck drivers on I-75 northbound would be directed by their GPS to use Exit 129 rather than Exit 136 to travel to the landfill since the distance is about 2.3 miles less. However, the time difference would be minimal given that most of the travel would be on an interstate (rather than a two-lane road) when using Exit 136. A method to ameliorate this situation would be for the companies and the landfill operators to direct drivers to use the Exit 136 route. The landfill is located a short distance north of Georgetown, which has directed its drivers to use the Exit 136 route.



- The interchange of the Western Kentucky Parkway and Pennyryle Parkway was reconstructed when a portion of the Western Kentucky Parkway was designated as part of I-69. A routing problem occurred after the redesign when truck drivers intending to continue south toward Hopkinsville followed I-69 in a westerly direction since it is generally a north/south road. When the truck drivers

realized they were traveling west rather than south, they either continued to the next interchange or improperly used a crossover. At least one crash resulted from a truck driver's improper use of a crossover. Although the existing signs conformed to standard practice, additional signs and pavement markings were installed to provide drivers with the information necessary to travel in the desired direction at the interchange.



Chapter 8: Recommendations

Based on this study's investigation and analysis, recommendations were developed to address the problem of truck drivers traveling on inappropriate routes given the operating characteristics of their vehicle. In many cases, selecting an inappropriate route was the result of improper GPS directions. Recommendations are grouped into the following three areas: the vehicle (truck), the environment (roadway), and human-related (driver, trucking industry, transportation agency). The following points summarize potential countermeasures.

Vehicle (Truck)

- Require that trucks be equipped with GPS units specifically designed for truck routing (rather than the general GPS units appropriate for passenger vehicles).

Environmental (Roadway)

- Establish consistent signing related to truck routing, using signs that conform to the *Manual on Uniform Traffic Control Devices* (MUTCD).
- Install additional route signing to direct truck drivers to specific destinations (industries).



- Install regulatory signs prohibiting trucks from routes with inadequate roadway cross-section and geometrics. The MUTCD (signs R5-2 and R-4) allows selective exclusion signs to prohibit designated types of traffic (such as trucks) from particular roadways.



- Install advance warning signs and delineation for low clearance height bridges.



- Install warning signs in advance of low ground clearance railroad crossings.



- Install regulatory signs restricting tractor trailer travel on state-maintained roads with a Class A weight rating (maximum weight of 44,000 pounds or 22 tons).



Human (truck drivers, trucking industry, transportation agency, mapping companies)

- Provide training to truck drivers to ensure use of proper GPS software (specifically, a GPS navigator with truck routing).

- Increase coordination between trucking companies and their drivers to provide drivers with information to determine proper routes (considering the characteristics of the road and the truck).
- Improve communication within transportation agencies (state and local) concerning the timing of roadway restrictions and closures so this information can be provided to mapping and trucking companies.
- Improve communication between transportation agencies and mapping companies to reduce the possibility of routing trucks onto improper routes.
- Transportation agencies should provide roadway geometric and cross-section data (curvature, grade, pavement width) to mapping companies to assist in identifying routes not suitable for large trucks.
- Develop a method of communication between transportation agencies and mapping companies that lets agencies inform companies of changes in their roadway network.
- Develop a method of communication between transportation agencies and the trucking industry to assist with determining proper truck routing.
- Monitor crashes involving large trucks to determine those in which improper GPS directions were a contributing factor in the accident. Specifically, use the crash data file to identify crashes where GPS is noted in the police report narrative.