Roadway Departure
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Introduction

According to the Federal Highway Administration, a roadway departure crash is a "non-intersection event that occurs after a vehicle crosses an edge line or center line, or otherwise leaves the traveled way." These departures can be voluntary (during passing maneuvers, for example) or involuntary (due to inattention). Multiple-vehicle crashes may be either head-on or sideswipes involving vehicles moving in the same or opposite directions. Single vehicles may collide with a fixed object or flip. Such crashes typically occur away from intersections, on shoulders, roadsides, or medians.

One approach to reducing these crashes is prevention – keeping vehicles on the road and in their lanes. The other approach is devising a forgiving roadway - an engineering solution to reduce the severity of those incidents that do occur. We propose using both approaches.

The Roadway Departure Emphasis Area Team, or EAT, will develop data-driven action plans to reduce the number and severity of roadway departure crashes in Kansas. Relevant data include both crash statistics and quantifiable results from safety measures designed to reduce crashes. This EAT will develop performance measures, set goals, select strategies and identify resources, including funding, legislation, staffing and agency leadership, that are required to create safety-related programs and projects that lessen the number of roadway departure crashes.

Strategies will address the 4E’s: engineering, education, enforcement, and emergency medical services. These could include, for example, low-cost safety improvements deployed systemically, high-cost safety improvements deployed via safety programs or construction projects, policy changes and research initiatives.

The Roadway Departure EAT first met October 15, 2009. These agencies were represented:

- American Traffic Safety Services Association (ATSSA)
- TranSystems
- Federal Highway Administration (FHWA)
- Kansas Highway Patrol (KHP)
- Kansas Department of Transportation (KDOT)

Identifying strategies and means of implementation are only part of the challenge. Deciding where, and to what extent, to apply a strategy is also critical. For example, when considering an engineering solution should we apply a low-cost strategy at 20 locations with a potential for crashes or apply a high-cost strategy at one location – seemingly similar to the 20 – that has a documented record of crashes?

A thorough understanding of the data related to roadway departure crashes is essential to answer these questions – and to the wise expenditure of our safety dollars. With input from the Data Support Team, the Roadway Departure EAT will have the tools to select sites and choose project types based on the actual causes of crashes.
Data Points

1. Roadway departure is the cause of less than a quarter of Kansas crashes but almost half the serious injuries and deaths.

Between 2005 and 2009, 1,197 fatalities and 4,168 disabling injuries resulted from roadway departures, making these the No. 1 source of danger to drivers and passengers in Kansas. During these years, such crashes accounted for 23 percent of all those reported in Kansas; yet 49 percent of the serious injuries or deaths were associated with them. In sum, compared with other crash causes, the impact of roadway departures on drivers and passengers is likely to be more severe.

Roadway departures can be deadly. They represent only 23 percent of all crashes but more than 58 percent of fatal crashes.

Similarly, roadway departure is the source of more than 47 percent of disabling injury crashes.
2. Roadway departures on state highways and local roads result in fatality and serious injury crashes.

Between 2005 and 2009, 56 percent of all fatalities occurred on state highways and 58 percent of roadway departure fatalities. During the same period, 48 percent of all disabling injuries occurred on state highways and 54 percent of roadway departure disabling injuries. There are far more miles of local roads, but state roads carry more traffic. When those factors are taken into consideration, both road classes have similar overall fatal crash rates: one death per 122 million vehicle miles traveled on state roads and one death per 130 million miles traveled on local roads. These statistics argue against a disproportionate focus on either system.

Between 2005 and 2009, about 58 percent of roadway departure fatalities occurred on state highways, with the remaining 42 percent on local roads.

Except in 2006, the distribution of disabling injuries by system has run parallel to the distribution of fatalities.
3. More than two-thirds of all roadway departure serious injuries and fatalities occur on rural roads and highways.

Between 2005 and 2009, over 75 percent of roadway departure fatalities occurred on local roads and state highways in rural areas. This is slightly higher than the figure for all fatalities: 71 percent occurred in rural areas. During the same period, 68 percent of roadway departure disabling injuries, and 54 percent of all disabling injuries, occurred in rural areas. In sum, statistics show that roadway departure crashes on rural roads, compared with those on urban roads, are deadlier and more injurious.

One contributing factor is obvious: Speed limits are higher on rural roads than most urban streets. Speeds are also higher on urban expressways and interstates, which account for nearly 40 percent of roadway departure fatalities in urban areas.

These numbers explain why the Roadway Departure EAT will concentrate on strategies that address rural roads, urban expressways and interstates.

Seventy-five percent of roadway departure fatalities occur on rural roads. That figure is striking given the level of use of Kansas roads: In 2009, the average daily vehicle-miles traveled on urban roads was about 41.2 million, on rural roads, about 39.6 million.

The gap between rural and urban locations as contributors to roadway departure disabling injuries has been closing slightly in recent years. But the fact that two-thirds of the injuries occur in rural areas is significant given that urban areas are more heavily traveled.
4. Rural Roadway Risks: High Speeds, Delays in Emergency Services

Urban boundaries are developed collaboratively by KDOT and local governments every 10 years, coinciding with the taking of the census, and often include unincorporated areas on the edge of town. As the charts below reveal, more crashes, resulting in more deaths and injuries occur on rural roads than on urban roads. Rural crashes account for 71 percent of all fatal crashes, but just 58 percent of the crashes in which property, alone, is damaged.

Of 140,609 miles of public roads in Kansas, 127,858 – 91 percent – are rural. On the other hand, only 49 percent of all vehicles miles traveled in Kansas are on rural roads. If the number of vehicle miles traveled on rural and urban roads is nearly equal, why do rural roadways experience more fatal and serious injury crashes as a result of roadway departure than urban roadways? There are a number of contributing factors:

- Higher speeds: Less traffic and fewer intersections and driveways mean drivers are more comfortable traveling at a higher rate of speed. The posted speed limit reflects that reality.
- Discovery time: The length of time from when the crash occurred to when they are discovered and transported has an impact on the patient’s survival. This is especially true for single-vehicle crashes.
- EMS: It takes longer for emergency vehicles in general and ambulances in particular to reach the crash scene and longer to deliver the injured to the nearest hospital or trauma center.
- Health care resources: Depending upon the severity of the injury, the patient’s needs may exceed the capability of the rural health care facility.
- Engineering standards: Many of our rural local roads were designed and built long before modern safety standards.

The greater the separation between vehicle miles of travel (VMT) and fatalities, the lower the fatality rate. (Information on functional classifications can be found in Appendix C.)
Urban disabling injuries are almost three-and-a-half times higher than urban fatalities, while rural disabling injuries are about two times higher than rural fatalities. This suggests urban crashes may be more survivable than rural crashes. But, rural interstate disabling injuries are almost four times higher than rural interstate fatalities. This indicates rural interstate crashes also have a high rate of survival. Therefore, in the case of single-vehicle crashes, discovery, emergency response and delivery are possible contributing factors.
Performance Measures

Consistent with this plan’s overall goal, the Roadway Departure EAT seeks to halve roadway departure fatalities and serious injuries within 20 years. In the five years between 2005 and 2009, we averaged 239 roadway-departure-related fatalities and 834 roadway-departure-related disabling injuries per year. Meeting our goal will require reducing the average fatalities per year to no more than 120, and the disabling injuries to at most 417, by the years 2025 to 2029.

The figure below depicts this goal for fatalities in the difficult context in which it must be achieved – a period of increased miles of vehicle travel in Kansas. KDOT planners project that between 2005 and 2009 and 2025 and 2029, Kansas will experience a 37 percent increase in vehicle miles traveled, making halving fatalities all the more challenging to achieve. Since 2005, the roadway departure fatality rate has decreased by 9 percent. To reach our goal, we would need to decrease the rate by an additional 63 percent over the next 20 years.

One barrier to halving roadway-departure-related fatalities in Kansas over the next 20 years: forecasts of a substantial increase in vehicle miles traveled.
Interim goals will let us track our progress. The chart below shows our five-year goals. Our aim is to achieve 50 percent of our goal within five years, 75 percent within 10 years and 100 percent within 20. We are optimistic that in the early years, the new primary seat belt law will reduce fatalities.

Achieving this goal would save about 1,629 lives over a twenty-year period.
Goals and Strategies

Articulating our objective – a radical reduction in the number of roadway departure crashes that kill or disable – is only a start. What goals and strategies will help us accomplish that objective? The roadway departure EAT has chosen the following.

1. Dedicate safety dollars to data-driven programs with the greatest potential to reduce the number of fatal and severe injury crashes on Kansas public roads.
2. Use available traffic records, crash data and roadway data to assist in safety program and project management.
3. Promote proven engineering strategies that focus on keeping drivers on the road and in their lanes.
4. Promote mitigation strategies that lessen the consequences of a crash.
5. Introduce experimental engineering strategies.
6. Promote enforcement campaigns that target locations and corridors with a higher-than-expected number of roadway departure crashes.
7. Promote education campaigns that target over-represented factors in roadway departure crashes.

There is no shortage of ideas about achieving these goals using a 4E approach: engineering centerline rumble strips and keeping the roadside clear of fixed objects, enforcing impaired driving and distracted driver laws, educating drivers and passengers about seat belt use and improving emergency medical service coordination to reduce the human cost of crashes, for example. The challenge for the roadway departure team is to identify realistic strategies, prioritize them and seek implementation.

Goal 1: Dedicate safety dollars to data-driven programs with the greatest potential to reduce the number of fatal and severe injury crashes on Kansas public roads.

Current Strategies:

- Maintain sign retro-reflectivity (visibility when lighted by headlights) on state highways by replacing sign sheeting at scheduled intervals based on anticipated service life.
- Maintain pavement marking retro-reflectivity on state highways with a program that selects routes for maintenance based on the routine collection of retro-reflectivity data.
New Strategy:
- Recommend new distribution of Highway Safety Improvement Program, or HSIP, funding based on Kansas crash statistics. (This is a strategy jointly recommended by the roadway departure and intersections EATs.)
- Background: HSIP is a federal-aid safety program, established under SAFETEA-LU in federal fiscal year 2006, “to achieve a significant reduction in traffic fatalities and serious injuries on all public roads.” In 2011, Kansas received $28.4 million, which was distributed to the following safety programs:
  - Highway-Railway Grade Crossing and Rail Set-aside (42 percent)
  - Intersection Safety (24 percent)
  - Pavement Marking Set-aside (15 percent)
  - Lighting Set-aside (7 percent)
  - Signing Set-aside (6 percent)
  - High Risk Rural Roads (6 percent)
Some of this distribution is determined by SAFETEA-LU, but most of it results from KDOT practice. The purpose of this strategy is to reallocate the money based on the goals articulated in this document. KDOT will form a working group to review the history of fund distribution, review data and make recommendations. The working group will also explore ways to streamline federal and state spending by local jurisdictions.
- Method: policy
- Costs: minimal
- Lead agency and contact: KDOT, Traffic Engineering Section
- Challenges: changing existing programs and practices
- Target date: begin implementation following federal reauthorization of the HSIP program
Goal 2: Use available traffic records, crash data and roadway data to assist in safety program and project management.

New Strategy:

- Identify and analyze outstanding variables related to crashes that occur away from intersections and don’t involve animals, based on the Kansas 2010 Five Percent Report. (See Data Support chapter for action plan.)

Future Strategy:

- Develop a process to account for recommendations from traffic studies (such as road safety assessments and Traffic Engineering Assistance Program studies) to generate projects within existing safety programs and contribute to new and future projects in other programs.
Goal 3: Promote proven engineering strategies that focus on keeping drivers on the road and in their lanes.

Current Strategies:
- Maintain 6-inch-wide edge lines on state highways.
- Improve shoulders where reasonable.
- Install shoulder rumble strips where appropriate.
- Revitalize KDOT’s Wet Pavement Accident Reduction Team.

Adverse surface conditions are noted as a factor in about 15 to 20 percent of all crashes, depending on the year.
New Strategies:

- Research the potential impact of expanded use of centerline rumble strips
  - Background: The FHWA has designated centerline rumble strips, or CLRS, as one of its Nine Proven Countermeasures to reduce highway fatalities. CLRS target head-on crashes and sideswipes involving multiple vehicles. In 2007, KDOT established a policy on milled-in CLRS, allowing their use on two-lane rural highways with a shoulder width of at least three feet. Since 2007, KDOT has installed over 300 miles of CLRS, with more than 3,000 miles of state highways eligible based on the policy. If we eliminate the minimum shoulder width criterion additional state highway miles will be eligible. How many local roads utilize CLRS is unknown. An unresolved question remains, however: do drivers shy away from CLRS and increase their odds of running off the right side of the road?

Roadway departure events involving two or more vehicles are most commonly the result of same-direction sideswipes, but head-on collisions result in the highest number of fatalities.

- Method: research and policy
- Costs: $60,000
- Performance measure: reduction in head-on crashes on road types added under an expanded policy
- Lead agency and contact: KDOT, Highway Safety Unit
- Challenges: well-designed research that validates expansion of policy and additional project costs
- Target date: final research report in state fiscal year 2012
Create a program that funds the deployment of low-cost safety improvements at rural or high speed urban horizontal curves.

- Background: It’s estimated that in the Kansas state highway system, there are about 1,000 miles of curves – a tenth of the total roadway mileage. But about 17 percent of fatal crashes happen on horizontal curves. This program will take into account proven and experimental countermeasures to prevent crashes on rural horizontal curves and on urban high-speed curves. These would include, for example, adding high-friction materials to road surfaces and improving *delineation* (a term that refers to methods used by highway engineers to define roadway operating areas for drivers).

**Roadway Departure by Road Character Type (2005-2009)**

The contribution of curves and hills to injury and fatality statistics exceeds the proportion of the entire Kansas road system they represent.

- Method: program
- Costs: $250,000 annually (estimated)
- Performance measures: number of curves treated and consequent reduction in crashes
- Lead agency and contact: KDOT, Highway Safety Unit
- Challenges: funding a new program and identifying curves where treatment would be likely to produce the best results
- Target date: begin letting projects in state fiscal year 2013.

Explore expanded use of edgeline rumble stripes.

- Background: In 2007, KDOT established a new policy for the use of centerline rumble strips and revised its policy on the use of shoulder rumble strips. Both edgeline rumble stripes, or ELRS, and shoulder rumble strips alert drivers when they drift off the road. The difference is that for ELRS the white edgeline is placed right over the top of the rumble strip while shoulder rumble strips are sited farther right, on the shoulder. Potential advantages to ELRS are improved visibility of the edgeline in wet weather, use on two-lane roads that lack shoulders and use on two-lane roads with narrow shoulders. An added benefit to using ELRS on two-lane roads with narrow shoulders is that ELRS
accommodate bicyclists. But few demonstration projects using edgeline rumble stripes have been completed in Kansas.

- Method: research and policy
- Costs: $60,000 (estimated)
- Lead agency and contact: KDOT, Highway Safety Unit
- Challenges: finding road segments for experimentation; policy changes that will raise project costs
- Target date: policy change, where appropriate, by July 2013

Future Strategy:
- Promote wider edgeline pavement markings on local roads.
- Experiment with the Safety Edge.
Goal 4: Promote strategies that mitigate the consequences of a crash.

Current strategy:
- Continue application of the most current Roadside Design Guide in highway design. The guide is a document that highway agencies commonly use to develop standards and policies.

New strategy:
- Create a program that funds the removal of fixed objects.
  - Background: In a “fixed-object crash,” a vehicle leaves its lane and runs into a ditch, an object (a light pole or tree, for example) or a barrier (such as a guardrail). Analyzing the types of objects struck, and at what frequency, might suggest targeted countermeasures or policy changes in fixed object placements.

Objects mostly likely to be hit when drivers leave the road include ditches, utility devices (such as a telephone pole) and median barriers. However, striking a tree results in the highest number of fatality crashes. Some objects are engineered and positioned in the roadside environment with driver survival in mind (median barriers and guardrails, for example) while others (like trees) are not.

- Method: program
- Costs: $250,000 annually (estimated)
- Performance measure: reduced numbers of crashes involving objects targeted by the program
- Lead agency and contact: KDOT, Bureau of Local Projects
- Challenges: funding a new program, partnering with local agencies to identify fixed objects, addressing environmental sensitivities to tree removal
- Target date: begin letting projects in federal fiscal year 2013
Goal 5: Promote enforcement campaigns that target locations and corridors with a higher than expected number of roadway departure crashes.

Current strategies:
- Support implementation and expansion of the primary seat belt law.
- Select stretches of road for targeted enforcement efforts.

Future strategy:
- Develop and implement a Safety Corridor Program.
  - Background: Several states have developed successful safety corridor programs. This approach begins by identifying highway corridors with safety issues, including but not limited to high crash frequencies or rates, then using a 4E approach to identify treatments and strategies to improve corridor safety.
Goal 6: Promote education campaigns that alert the public to the most frequent causes of roadway departure crashes.

Current strategies:

- Continue media campaigns highlighting the danger of impaired or distracted driving.
- Promote educational campaigns to let people know the likelihood of unbelted drivers and passengers being thrown from a vehicle in a rollover – and their survival rate.
- Provide training and educational materials to public works departments and other local agencies through the Local Transportation Assistance Program, or LTAP, at the University of Kansas and the Traffic Assistance Services for Kansas, or TASK, program at Kansas State University.
- Promote defensive driving training.

New strategy:

- Conduct road safety assessments on local roads under the umbrella of the High Risk Rural Roads Program.

  Background: The High Risk Rural Roads Program is a federal safety program for locally owned rural roads. Of the 140,000 miles of public roads in Kansas, about 130,000 are under the jurisdiction of cities, counties and townships. Ownership, however, is not the issue: The users of all public roads benefit from a road safety assessment, or RSA. According to the FHWA, an RSA is a “formal safety performance examination of an existing or future road or intersection by an independent and multi-disciplinary team. It estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users.”

On local roads, roadway departure crashes are evenly split between urban and rural settings. But rural roadway departure crashes tend to be more severe.
**ROADWAY DEPARTURE**

- Method: program
- Costs: minimal
- Performance measures: number of RSAs completed
- Lead agency and contact: KDOT, Bureau of Local Projects
- Challenges: finding and training volunteers to serve on teams, promoting local participation.
- Target date: immediate

Future strategy:
- Raise public awareness of more and less safe times to drive.


Total number of roadway departure crashes generally trends with traffic patterns throughout the day, and severity follows, especially between 4 a.m. and 9 p.m. At night however, particularly between 9 p.m. and 4 a.m., the total crash rate increases significantly (less traffic, similar number of crashes) with a greater share of these severe or fatal.