



Kansas LTAP Fact Sheet

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What Are Human Factors and How Do They Affect Roadway Safety?

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To reduce traffic crashes, you need to understand what causes them. A good way to start is by grouping the potential causes into three broad categories: road user, the vehicle, and the road and its environment. (See sidebar on next page.) The causes of most crashes will usually fall into one or more of these.

Studies show that road-user error is cited as the cause of most crashes (nearly 57 percent of the time), followed by roadway conditions (34 percent of the time) and vehicle defect or malfunction being the contributing factor only 12 percent of the time.

“Human factors” is a term used in transportation research for the application of knowledge about human abilities, limitations, and other human characteristics to the design of equipment and the driving environment.

When it comes to roadway safety, the road user is a key player. Consequently, human factors should be considered as an integrated part of the roadway and vehicle design process. Considering a combination of all contributing factors to crashes (road user, roadway, vehicle, and weather) allows for more thoughtful safety improvements.

Road-user expectancy

As drivers gain experience, they expect things to happen as they always have. For example, drivers expect that a green light on a traffic signal will be followed by a yellow light, then red. Or drivers adjust their speed as they look at an upcoming curve because it looks similar to other curves they have driven before. This is called driver’s expectancy.

The more experienced the driver, the greater the expectancy, which can be good and bad in terms of roadway safety. More driving experience leads to quicker and more accurate reactions as long as driver’s expectancy is met. However, a sudden change in road conditions violates this expectancy and increases the likelihood of driver error and increased reaction time because the driver takes longer to understand the situation and respond to it. If the extra time



To get down to the nuts and bolts of incorporating human factors into roadway design in your community, consult **Human Factors Guidelines for Road Systems—Second Edition**. It is designed to be a resource for roadway designers, traffic engineers, and other practitioners. Its purpose is to provide the best factual information and insight on road users’ characteristics, in a useful format, to facilitate safe roadway design and operational decisions.

The impetus behind this effort was the recognition that current design references have limitations in providing the practitioner with adequate practical guidance for incorporating road user needs and capabilities when dealing with design and operational issues.

The Guidelines are designed to work in concert with the national Highway Safety Manual (HSM).

You can download the Human Factors Guidelines for free at <http://www.trb.org/Main/Blurbs/167909.aspx>, or purchase it in hard copy.

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is not available, a crash may result. For example, if a signal changes from green to red, or a curve becomes suddenly tighter halfway through, driver expectancy is violated, and a driver may react in an erratic or incorrect way.



The driving task

Although most of us take it for granted, driving is hard work because it requires us to do several things at the same time. When we drive, we control the vehicle by slowing down and speeding up. We also guess what other road users might do and decide whether we need to do something to avoid them—all while steering the vehicle.

There are limits to how much information drivers can process at a time. When there is too much information for drivers to accurately or safely process, they make mistakes. To simplify the driving tasks to a certain degree, roadway elements should be designed and laid out in a way to give drivers enough time to make several easy decisions rather than forcing them to make one complex decision in a hurry.

Roadway information leads the road user to decide to do something. The results of that action provide more information, which then starts the process over again. What complicates this process are distractions for the driver both inside and outside the vehicle (e.g. using a cell phone, listening to the radio, weather conditions, etc.) Whatever draws the driver's attention from the road should be minimized. It is the road department's job to focus on the engineering aspect of this goal and minimize surprises on the road.

Information phase of driving. Driving involves noticing the information and recognizing its meaning. For example, signs have standardized shapes and colors to help drivers easily recognize their message.

Decision phase of driving. Road users combine the information they gather from the roadway elements with their driving experience to make a decision. It takes skill and experience to make the right decision. Separating information and decision points for road users is the key to helping them reach the right decision.

Action phase of driving. For a road to be safe, the road user needs time to respond. Reaction time is the time it takes for the road user to notice a condition, decide what to do about it and then take an action. More complex situations require a longer reaction time.

Examples of considering human factors in roadway design

- Avoid designing roads with sharp curves just over the crest of a hill.
- Place signs at locations where drivers expect them and can see them.



Sources:

- Road Safety Fundamentals, FHWA Office of Safety, 2005.
- Highway Safety Manual, AASHTO, 2010.
- Road Safety 365, A Safety Workshop for Local Governments FHWA, October 2010.
- FHWA Office of Safety. Human Factors Webpage. http://safety.fhwa.dot.gov/intersection/human_factors/
- Transportation Research Board. NCHRP Report 600: Human Factors Guidelines for Road Systems: Second Edition Human Factors Guidelines for Road Systems—Second Edition. 2012. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_600Second.pdf

Primary Causes of Vehicle Crashes

Road users. These are all people who use the roadway including drivers, motorcyclists, bicyclists and pedestrians. Human factors refer to characteristics of road users and the actions they take, or otherwise fail to take, that cause a crash. Human factors may include road users who are inattentive, distracted, tired, ill, under influence of medications, intoxicated by alcohol or drugs, not restrained by seat belts, and etc. Age also affects a road user's ability to be safe on the roadway.

Vehicle factors. These may be mechanical failures, such as bad brakes, worn-out tires, seat belt malfunction, and etc.

Road-related factors. These include limited sight distance, poorly marked roads, missing road signs, sudden changes in roadway alignment and widths, and etc.

Weather. Weather conditions affect not only the roadway environment but also vehicle performance and road users' judgment.

- Install and use approved traffic control devices properly.
- Most drivers can read only three or four familiar words at a glance, so avoid overloading them with information.
- Always consider information needs of both older and novice drivers.

This article is a brief introduction to the topic of human factors. For detailed, practical information on incorporating human factors in roadway design, consult the *Human Factors Guidelines for Road Systems—Second Edition*, recently updated. This is considered the most comprehensive resource for design practitioners on this topic. See sidebar on page 1. ■

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