Improving Roadway Designs for Traffic Safety

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Traffic safety is a crucial component of transportation planning objectives when roadway developers are looking for ways to improve the driving experience to ensure everyone reaches their destination without harm. In the U.S., traffic accidents claim the lives of more than 32,000 drivers, passengers, bicyclists, and pedestrians every year and leave hundreds of thousands of others injured and disabled. Because of that, safety is a major concern in roadway design, maintenance, and operation.

Roadway engineers understand that there are numerous factors that affect the risk of traveling on highways, expressways, freeways, roads, and streets. This includes the type of travel, the amount of traffic, the types of vehicles, the condition of the street surface and the behavior of every driver sharing the road. Road construction developers have long used effective traffic planning strategies that focus on every risk the motorist faces. This includes distracted driving, drunk driving, poorly designed roads, unsafe vehicles, adverse weather conditions and the changing conditions of traffic during rush-hour.
Road engineers described normal traffic as motor vehicles operated by a sober, responsible drivers traveling in relatively new cars or trucks while wearing a seatbelt and traveling on an efficiently designed road. However, designing and constructing roads that accommodate “normal travel” motorists are not always the best ways to ensure safety when traveling. Instead, statisticians measure safe driving activity and/or behaviors by the numbers of fatalities, injuries or accidents per 100,000 vehicle miles, where the statistics present a much clearer image of how safe roads really are for drivers, passengers, pedestrians, and cyclists.

To ensure the roadways are truly safely designed and efficient, the engineer must consider every planning objective. This includes the reduction of congested areas on the roadways, better traffic control systems, quick access to the road by emergency medical service access responding to accidents and injuries, enforced traffic laws and ways to educate the public.

**Improving Roadway Design**

The nation’s roadways are routinely redesigned and upgraded to improve the safety and efficiency of the traveling public in private and commercial vehicles. For decades, the Federal Highway Administration (FHA) has provided recommendations to local, regional, and state government agencies on how to decrease roadway fatalities and severe injuries. Unfortunately, finding the construction funds to build new roads and improve existing roads occur slowly. Popular recommendations by the Federal Highway Administration include:

- **Install Rumble Strips**– Road engineers designing or updating highways and roadways should install rumble strips on shoulders and center lines that warn motorists of a lane departure by producing a loud noise when tires hit the strip and cause the vehicle to vibrate. Studies indicate that the numbers of sideswipe crashes and head-on collisions caused by traffic approaching from the opposite direction have been reduced by 14 percent nationwide since rumble strips were first installed. The addition of the rumble strips has also produced a reduction in the number of “run off the road” crashes on freeways by 38 percent and 18 percent on rural roads.

- **Install Median Barriers** – Since roadway engineers first began installing median barriers to separate opposing traffic on divided highways, the strong structures have reduced the numbers of cross median accidents. Because of that, the National Highway Traffic Safety Administration has encouraged states to continue using cable median barriers in appropriate areas to maximize safety on the roadway.

- **Redesign Roads with Safety Edges** – Installing a roadway safety is an effective paving design that is constructed with a 35-degree slope along the outer edge of the road. The addition of the safety edge reduces the potential of the wheel inadvertently falling over the edge of the road which can cause the motorist to lose control of the vehicle and cause a rollover crash. Untold numbers of horrific car accidents have been prevented with the installation of this safety edge design on many highways and roadways across the United States and in Illinois.
• **Install Roundabouts** – Roadway engineers are incorporating roundabouts in new street designs and road improvements areas because they are proven to be effective at reducing car crashes by upwards of 87 percent. Roundabouts eliminate the need for stoplights and produce better flows of traffic at some intersections because vehicles only need to yield the right-of-way to others in the circle.

• **Improve Turning Lanes** – Many busy intersections are burdened with heavy traffic making both right and left turns. A better design with multiple turning lanes can improve efficiency, maximize traffic flow and reduce the potential corrections dramatically. Studies show that a well-designed turning lane installed at a stop-controlled intersection can reduce accidents by up to 55 percent.

• **Properly Set Traffic Signals** – The increasing rate of red light running automobile accidents occurring at intersections many more catastrophic injuries of fatalities than ever before. However, these numbers can be reduced or eliminated by properly setting the traffic control device to extend the duration of the yellow light. Readjusting the length of time yellow light remains lit by one more second before it changes to read can significantly reduce numbers of red light violation by half and save lives.

• **Install Refuge Areas in Crosswalks** – The installation of pedestrian refuge areas (islands) away from the sidewalk and along with raised medians can reduce the number of pedestrian-related vehicle accidents. The Federal Highway Administration recommends that roadway engineers should install medians 4 feet to 8 feet wide in appropriate areas to improve pedestrian and bicyclists safety by providing a protective refuge.

• **Redesign Roads with Better Walkways** – Installing a pathway or sidewalk along the roadway can significantly reduce the number of pedestrian-related accidents by upwards of 88 percent. Studies have shown that constructing a 4-foot-wide pathway with a paved surface that runs parallel to the road is highly effective at increasing pedestrian traffic safety because it provides a protective buffer between moving traffic and walkers.

**Improving the Flow of Traffic**

The high concentration of vehicles traveling during Illinois rush hour draws attention to the importance of making significant changes in how traffic flow is handled to avoid congestion. However, updating existing roads or widening streets often does not occur fast enough to accommodate the state’s ongoing growth. Even so, the Illinois Department of Transportation (IDOT) has been working to reduce traffic jams by building better infrastructure and making intelligent choices on how to move traffic safely and efficiently through its road system.

The flow of passenger vehicle and commercial truck traffic on Illinois roadways is expected to grow significantly in the next few decades. Additionally, an improving economy in the state over the last ten years has increased the workforce, putting more cars and trucks on the road during rush hour. Because of that, agencies in charge of traffic at the local, county, and state levels have taken steps to better
utilize the existing roadway infrastructure and reduce the need for the construction of new roads. These steps to improve the flow of traffic involves:

- **Encouraging Flexible Work Hours** – Illinois encourages businesses to focus on developing flexible working hours to alleviate traffic congestion, roadway anxiety, and excess fuel consumption. The goal focuses on reducing the number of workers required to travel to their place of employment during the rush hour by car or truck. This can be accomplished by changing the business’ work schedule and encouraging employees to ride to work on scooters and bicycles or use mass transit.

- **Expanding Rush Hour Lanes** – Many large city road planners, including those in the Chicago metropolitan area, have improved traffic flow by temporarily adding extra rush hour lanes during peak and off-peak hours. This helps improve moving cars and trucks much easier by using plus-lanes for merging into traffic and decelerating off the road.

- **Encouraging Incident-Related Roadway Clearing** – As though heavily congested traffic is not enough to slow traffic down to a crawl; a minor fender-bender or vehicle breakdown can make traffic come to a complete stop. Because of that, it is essential that the road be cleared as quickly as possible. Studies show that more than ten percent of all traffic jams are the result of a minor incident occurring on the roadway.

- **Providing Travel Information in Real-Time** – Instant data made available in real-time on the radio or through a GPS navigational system can provide immediate alternative routes to circumvent accidents or breakdowns. Accessibility to roadway information is an easy solution for reducing traffic congestion, especially during the rush hour. Road engineers began installing matrix signs over many roadways that are positioned above the street. These signs provide up-to-date information on in inclement weather and traffic conditions so motorists can make responsible choices based on the existing road conditions in the miles up ahead.

- **Improving Park and Ride Options** – There are numerous multimodal locations all over the Chicago metropolitan area and other large cities in Illinois. These Park and Ride sites provide travelers more options and opportunities to reach their destination by parking their car and taking the bus, train or another mode of transportation. Installing more multimodal nodes throughout the city’s urban areas and the suburbs in convenient locations can reduce the amount of traffic on the busiest roadways and highways.

Providing drivers with more attractive and convenient ways to reach their destination has the potential minimizing the traffic volume, improving roadway conditions and saving the state and motorists money by decreasing the cost of constructing new roads and reducing the amount of gas burned in heavily congested traffic areas.

**Reducing the Number of Vehicle Accidents**

Reducing the number of accidents that occur every day requires understanding the
factors involved in a crash, including the weather, the road condition, the type of vehicle being driven, and the expertise to the driver behind the wheel. Human behavior is one of the leading reasons there so many accidents that is often overlooked by the driver. This is because every driver would never expect to be involved in a crash. Instead, the motorist will overestimate their abilities as a driver and surprisingly make human errors that affects them directly along with their passengers, and others sharing the roadway including motorists, cyclists, and pedestrians.

### Poorly Designed Roads

Human performance is the weakest component of the driving experience. When bad driving is blended with a poorly designed road, the result can be catastrophic. Many roadways are problematic when pedestrians and bicyclists are not separated from moving vehicles traveling at high speeds or in commercial areas, at parks, in front of bus stops and schools. An effective road design with plenty of signage can be crucial necessity to overcome human error. This is because quality road design allows drivers to make instant decisions including when to slow down when to move out of the way or for the need to change lanes to avoid a collision, crash or accident involving a pedestrian.

### Poorly Placed Speed Cameras

Speed is a significant problem, especially in accidents that occur in residential areas. While some cities have installed speed cameras throughout the community, most are installed in locations that are not prone to accidents involving bicyclists and pedestrians. Frustrated motorists uncongested driving down crowded two-lane roads often make dangerous decisions to outmaneuver oncoming traffic, which can result in severe injuries or fatality.

### Bad Intersection Designs

Many older communities have streets that were designed to maximize traffic flow at the expense of pedestrians. This is because street planners back then failed to install sidewalks at many locations in front of commercial buildings and residential neighborhoods. The lack of sidewalks and pathways almost always encourages dangerous pedestrian behavior, especially when these areas run parallel to traffic traveling at high speeds.

Many pedestrian crosswalks throughout major cities are dangerous because of heavy traffic, broad roads, and high-speed traffic. In some communities, pedestrians must cross six or eight lanes of traffic that travels 45 to 50 miles an hour. In areas where the traffic control is ineffective, the pedestrian is often faced is often challenged making difficult choices in deciding when to cross the lanes safely because the traffic control system is not properly set to accommodate the protection of walkers and bicyclists.

Poorly lit intersections and roadways can be extremely problematic, especially in the older parts of the city. Traveling can quickly become unsafe on roads without reflectors and markers, especially when the road is constructed without safety edges.
to keep motorists from over correcting the steering wheel when driving off the narrow road. Even speed bumps can cause significant problems for drivers in areas without signage to alert the driver in ample time to avoid a serious hazard, even when the motorist is traveling at the posted speed limit.

How to Make Roads Safer

Automobile crashes remain one of the leading causes of death around the world. Because of that, roadway engineers must plan new roads that are designed to enhance the safety of everyone. This includes taking measures that:

- **Reduce Speed** – Traveling at a high rate of speed can determine the consequences of a crash that could include fatalities, severe injuries, and property loss. Hitting someone while traveling in a vehicle traveling 35 mph doubles the likelihood of killing the victim compared to traveling at just 30 mph. If every motorist followed the speed limit while wearing their seatbelt, thousands of lives could be saved and hundreds of thousands of injuries could be prevented every year.

Reducing the speed of traffic usually requires strict law enforcement by patrolling officers, the installation of speed cameras, better road designs and speed detection systems. These improvements can help alter the motorist’s behavior to drive at the speed limit.

- **Staying Safe inside the Car** – With advancements in vehicle equipment technology, motorists and passengers are only half as likely to lose their lives in a crash or collision compared to the number of fatalities just three decades ago. Major improvements including advanced electronics and airbags provide effective ways to stay safe in the event of an accident. That said, the seat belt is by far the best safety piece of equipment ever installed in a vehicle. Statistics show that using a seat belt can reduce the potential risk of dying in an accident by more than 60 percent.

Decades ago, state legislators mandated that every driver must wear a seatbelt. Almost immediately, these new laws helped to reduce road traffic injuries and emergency room admissions by more than 35 percent.

- **Child Safety Seats** – Mandating that every child 4 years and younger must be restrained in a child safety seat when traveling can reduce the potential risk of childhood deaths by automobile accidents significantly. Many communities have overcome the financial barriers to help families who cannot afford a child safety seat by absorbing the cost of booster seats and safety seats to make them available to anyone.

- **Wearing a Helmet** – In Illinois, helmet use is not mandatory, and many bikers choose not to wear the protective head device to look “cool” or let the wind blow through their hair. However, every rider on a motorcycle, scooter, or bicycle who wears a helmet is 88 percent less likely to suffer a brain injury or head trauma when struck by another vehicle.

- **Legalize Driverless Cars** – Someday soon, driverless (autonomous) vehicles
will be transporting passengers on all roads, highways, and freeways throughout the nation without a driver behind the wheel. While moving in a vehicle without a driver is a scary thought, human error remains the major reason why most accidents occur.

- **Eliminating Risky Driver Behavior** – Additionally, computer operated and autonomously steered cars and trucks could improve the flow of traffic on all roads, increase fuel efficiency, overcome heavy congestion and reduce the number of accidents.

- **Avoid Distractions** – According to the National Highway Traffic Safety Administration (NHTSA), motorists are four times more likely to be involved in an accident when using smartphones and other electronic devices while driving. However, talking on the phone or sending text messages are not the only distracting actions. Some motorists groom themselves while driving, put on makeup, have intensive conversations with other occupants inside the vehicle, drink beverages, eat food, or constantly fiddle with the sound system.

- **Increase Visibility** – Many car accidents are caused by the failure to see others on the roadway. Poor visibility continues to be extremely problematic on poorly designed roadways or on streets that lack efficient traffic controls. It is crucial to turn on the vehicle’s lights during times of inclement weather, especially in snowstorms, falling rain, and fog. Motorcyclists and bicyclists should wear bright reflective clothing and install reflectors on the front, rear and sides of their bike to increase their visibility to others.

- **Strict Law Enforcement** – State legislatures have enacted drinking driving laws to control the traveling public and reduce the number of alcohol and drug-related accidents that often cause catastrophic injuries or death. Many communities enforce zero-tolerance consequences for underage drinkers and first-time offenders with a blood alcohol level at or above the legal limit.

- **Make Street and Infrastructure Improvements** – Many of the road traffic systems throughout the U.S. are out of date or were never designed to reduce injury or death should an accident occur. Modern design including the construction of roundabouts and better signage reduce automobile accidents by more than 40 percent.

Other significant improvements to highways, roadways and side streets include the installation of controlled crossings to make it safer for pedestrians and cyclists. That improvement along with installing adequate street lighting to increase nighttime visibility and rumble strips to alert the driver unintentionally moving out of their lane. Today’s roadway engineers separate traffic lanes from sidewalks and add better signage to crosswalks to eliminate problems with vulnerable pedestrians who share the road.

- **Motorist Assistance Systems** – In recent years, carmakers started selling their cars and trucks with intuitive integrated safety features that are known to eliminate many of the common risks associated with driving. The installation of seatbelts in vehicles was the first safety feature added by automakers. This was followed by cruise control and airbags.
However, advancements in technology in recent years has made driving much simpler due to the driver-assist motion detectors. Additionally, alcohol detection systems allow some motorists who have been convicted of a DUI to continue driving. This is because the device restricts the engine from turning on if the driver’s breath registers an alcohol content level that is less than the legal limit.

Sources:

- http://www.idot.illinois.gov/transportation-system/safety/roadway/index

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