UNH T² Center Technical Note

Low Cost Traffic Improvements

Introduction

Agencies often apply low cost safety measures such as traffic control devices based upon standards in the MUTCD. Agencies may identify locations for application and adjustment of safety measures using a crash mitigation process which offers a high level of flexibility and provides credibility to safety improvement decisions as required under SAFETEA-LU.

Crash Mitigation Process

The crash mitigation process is an iterative process where high crash locations are identified based on data and knowledge of a roadway. Sites with the highest number of crashes and/or severity are evaluated to classify crashes. Contributing field conditions (curve radius, sight distance, existing signage...) are quantified and possible counter measures and solutions identified. Counter measures are selected and implemented, and evaluated over time.

Steps in the crash mitigation process are:

1. Identify Sites,
2. Collect Crash Experience,
3. Gather Field Condition,
4. Identify contributing factors and countermeasures,
5. Assess and select countermeasures, and
6. Implement and evaluate.

Low Cost Safety Improvements – A Case Study

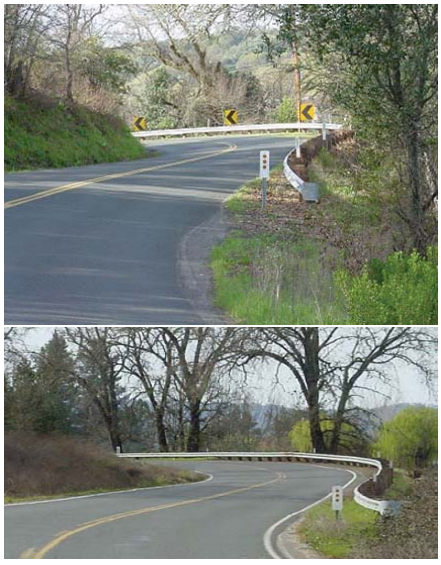
Mendocino County California successfully implemented this process and reduced crashes by 42% over a period of six years. The estimated cost savings exceeded 12 million dollars (based on the reduction in crashes) with a cost/benefit ratio of more than $150 dollars for every dollar spent.

The program initially targeted public awareness through improved roadway condition warning signs rather than increasing the application of regulatory signing. Stephen Ford, the project engineer's philosophy is that this is the most effective use of signing.

Initially, roads were evaluated for standard sign application. For example, look at the two geometrically similar curves shown below. What should the speed be approaching and entering either of the curves? What are the public's expectation when encountering speed advisories and guidance through curves?

Stephen Ford used a ball-bank indicator to determine the recommended speeds through curves using County guidelines.

A ball-bank indicator measures the force of a vehicle through a horizontal curve. It is mounted to the dashboard. The indicator is used to determine the recommend posted speed to safely navigate curves.



Ford used the indicator along with levels, sight distance measurements and other tools to determine the appropriate sign installations. He employed the crash mitigation process to evaluate the installation. This evolved into a triennial evaluation of all roadways in the county.

Identify Sites. Yearly, crash records from local law enforcement for one-third of the county roads were reviewed. Records were separated by location to identify higher crash areas.

Collect crash experience and gather field conditions. Locations were reviewed to identify similarities. On-site inspections determined field conditions and contributing factors.

Identify contributing factors and countermeasures. Counter measures were selected after the crash data analysis, on-site inspection, and evaluation of field conditions were completed. Ford used improved signing including curve signing, object markers, and delineators as countermeasures.

Assess and select countermeasures and implementation and evaluation. Improvements were recorded to determine which countermeasures were effective and adjustments to account for changes in traffic patterns and crash histories.

These low cost safety improvements were partially funded by the county and by special grants. These types of projects have become popular on rural roadways with SAFETEA-LU set asides for reduction of crashes on high crash location rural roadways.

Why use Low Cost Safety Improvements?

Fatality rates on rural roads are 2.5 times higher than on urban roads. Rural roads carry 40% of vehicular traffic. Traffic engineers and planners use many strategies to reduce crashes and ease traffic congestion known as *"Low Cost Safety Improvements."* Implementation of strategies have improved safety and reduced traffic congestion.

Local budgetary constraints indicate that low cost solutions are needed wherever feasible. "Low cost" is a relative term. Agencies with large budgets consider "low cost" differently than others. Many range from several hundred dollars to several thousand dollars. Research shows that "low cost" does not mean "low benefit."

Since highway capacity has not increased to accommodate population growth. Congestion and traffic delays are becoming more common in smaller cities and rural areas. Tools and information are necessary on modest traffic improvements (roadway geometry, signage, striping, etc.) for state and local traffic engineers to reduce congestion and improve flow.

What are They?

Strategies include pavement markings, static and dynamic signing, roadway lighting, raised medians, curb cuts, roadway geometric changes, or lane controls. They provide guidance, warning, and control needed for drivers to ensure safe and informed operation through traffic bottlenecks or congested areas.

Intersections: These actions have been implemented at intersections:

- Implement of all-red intervals,
- Replace 8-inch signal heads with 12-inch signal heads,
- Replace two-way stops with multi-way stops,
- Install back plates on traffic signals to improve visibility at some locations, and
- Remove on-street parking.

What speed should one attempt to drive around this curve? Evaluate the sign for standardization. See the solution at the end of the technical note.

Rural Two-Lane Roads: Numerous low cost traffic engineering improvements have been made to rural two-lane roads. Many treatments are designed to reduce the number of run-off-the–road crashes which account for a large number of accidents. Treatments include the following:

- Install bigger and brighter curve and chevron signs,
- Inside- and outside-curve paved shoulder with rumble strips,
- Install rumble warning panels in advance of curves,
- Repair shoulder edge drop-offs,
- Install paved shoulders,
- Install brighter and more durable pavement markings, and
- Flattened slopes.

High-Crash Locations: Low cost treatments implemented at high crash locations included the following:

- Create a left turn lane within the existing roadway,
- Add left turn phases to existing signals,
- Replace "Yield" signs with "Stop" signs at intersections,
- Replace two-way stops with multi-way stops,
- Install traffic signals,
- Use bigger and/or better signs,
- Install stop bars at "Stop" locations,
- Install pavement marking "Stop Ahead,"
- Install double-indicating "Stop" signs (add a left-side sign),
- Add back plates to signal installations,
- Replace 8-inch signal heads with 12-inch signal heads, adding "Signal Ahead" signs,
- Install strobe lights in signals to make signals more visible where background lighting is present,
- Provide longer all-red intervals in the signal timing, and
- Reduce lane widths to provide for additional lanes.

The following table illustrates examples of low cost traffic engineering improvements that have been implemented in NH.

Location	Description
Barnstead	Installed warning signs/ beacons at the intersection of Route 288 and N. Barnstead Road
Hampton	Restriped and narrowed lanes on Rt. 111 to 11 feet to provide wider bike lanes.
Bow	Restripe pavement to provide an auxiliary lane to convert an on-and off-ramp into a weave at interchange I-89 and I-93.

Horizontal Signage

Horizontal signing are pavement markings directly in the driver's line-of-sight and are supplemental to traditional signs.

Horizontal signing is used extensively in Europe where traffic engineers believe that the redundancy provides an important element to attain improved efficiency and safety.

The MUTCD includes provisions for horizontal regulatory, warning, and guide signing. Examples include STOP, arrow symbols, speeds (25 mph), stop/yield ahead, school crossing, pedestrian crossing, and route guidance (US 40).

In a Texas Transportation Institute (TTI) study, researchers applied the words CURVE 55 MPH on the pavement on a rural two-lane roadway approximately 400 ft. after the standard curve warning sign but prior to the curve. After installation, the average speed at the beginning of the curve decreased from 61 mph to 59 m.p.g. The estimated cost of the installation was $500.

TTI researchers applied lane direction pavement markings at a location where the traffic exits the highway onto a two-way, two-lane road. A pair of through lane arrow pavement markings were placed approximately 120 feet downstream of the exit ramp to provide drivers with an additional reminder that there was two-way traffic. The estimated cost was

$300.

The before-after data showed that the lane directional arrows were effective. Prior to installation, 385 wrong-way movements occurred. After installation, only 28 wrong-way movements occurred.

Post-Mounted Delineators and Chevrons

Post-mounted delineators and chevrons are two delineation treatments used to warn drivers of an approaching curve. They provide drivers with a better appreciation of the sharpness of the curve. The devices provide continuous tracking information to assist the driver to keep the vehicle in the travel lane while traversing the curve.

Several studies report that post-mounted delineators reduce crash rates on relatively sharp curves at night. National Cooperative Highway Research Program (NCHRP) Report 440, indicates that roads with post-mounted delineators (in the presence or absence of edge lines) have lower crash rates than roadways without post-mounted delineators. Research shows that the cost of post-mounted delineators is justified for roadways where the average daily traffic exceeds 1000.

According to FHWA, post-mounted delineators reduce fatal crashes by 15 percent, nonfatal injury crashes by 6 percent, and run-off-road crashes by 25 to 58 percent.

For more information on the installation and use of post-mounted delineators and chevrons see the MUTCD.

Solutions for the Aging Population

As the population ages, it becomes more important to consider improvements to signs, signals, and markings. Low cost treatments that have been implemented to improve the visibility of traffic control devices include the following:

- Install larger stop signs,
- Place flags on stop ahead and stop signs,
- Place a flashing beacon on stop signs,
- Install advance stop sign rumble strips, and
- Install larger 8-inch street name signs.

Conclusion

There are a number of "low cost" safety solutions available to engineers and planners to ease traffic congestion and increase safety. Many transportation agencies have quantitatively reduced injuries and crashes by taking these actions:

- Construct pedestrian islands,
- Install pedestrian sensors in crosswalks,
- Install more visible traffic signals and signs,
- Install rumble strips,
- Remove or delineate trees and utility poles, and
- Use advanced warning pavement markings.

These examples illustrate relatively inexpensive approaches that have proven to be effective in mitigating congestion and increasing safety in communities across the country. ❖

Source
http://www.dot.state.fl.us/trafficoperations/Operations/Studies/MUTS/Chapter11.pdf
Ford, Stephen, Calvert, Eugene, *Evaluation of a Low Cost Program of Road System Traffic Safety Reviews for County Highways*, November 2002
Latham, Fred, Trombly, Jeffrey Low Cost Traffic Engineering Improvements: A Primer, USDOT, FHWA, April 2003 http://www.ops.fhwa.dot.gov/publications/low_cost_traf/low_cost_traf.pdf
Low Cost Road Safety Solutions, ATTSSA, Fredericksburg, VA 2006 p. 3-4 and 24-25

Special thanks to G. Stuart Thompson, Assistant Director, UT LTAP for authoring a portion of this article.

Photo right: MUTCD requires the sign to be a turn rather than curve for speeds less than and equal to 30 mph, it makes a difference in most people's behavior

Technology Transfer Center
New Hampshire LTAP at UNH