SAFETY EFFECTS
of Traffic Sign Upgrades
in Albuquerque, New Mexico

Sign visibility is often classified as a nighttime concern. The Federal Highway Administration (FHWA) has recently added new regulations to the Manual on Uniform Traffic Control Devices (MUTCD) to partly address nighttime sign visibility with minimum maintained retroreflectivity requirements for traffic signs. One of the key factors leading the new MUTCD minimum sign retroreflectivity levels is nighttime safety—it has been proven that the highest crash rates occur during nighttime hours, partly because sign retroreflectivity degrades over time. The loss in retroreflectivity translates to a loss in conspicuity and legibility, and therefore decreases a sign's ability to command attention.

Albuquerque, New Mexico, has upgraded its traffic signs in several sections of the city. Albuquerque replaced all traffic signs with signs made from 3M Diamond Grade™ DG³ Reflective Sheeting, and this process provided an opportunity to evaluate the safety effects of a systemic-wide upgrade.

Upgrading traffic signs can benefit all drivers, especially older drivers. A key to recognizing and quickly comprehending signs is to understand the meaning of the various shapes and colors. Both daytime and nighttime drivers need conspicuous, legible signs in order to make important decisions at key locations, such as high-speed roadways, intersections, and exit ramps on high-speed facilities.

Upgrading traffic signs is also consistent with one of FHWA's primary goals, which is to improve safety on the nation's streets and highways. Also, older drivers greatly benefit from day and night sign-visibility improvements, whose numbers are expected to increase significantly in the next 30 years. When old signs are replaced, the degraded sign performance is abruptly improved by the new, bright sheeting. This change stands in contrast to the long, continual degradation that occurs in the years before replacement. Such a sudden change presents a unique opportunity to measure safety impacts of the replacement, and several municipalities have observed crash reductions after upgrading their signs.

Albuquerque, New Mexico, has upgraded its traffic signs in several sections of the city. The upgrade process replaced all traffic signs with signs made from 3M Diamond Grade™ DG³ Reflective Sheeting, which meets ASTM D 4956 Type XI. Because sign improvements are traditionally made on a case-by-case basis—since funding challenges can limit an agency's ability to implement widespread changes—the sign upgrade process in Albuquerque provided an opportunity to evaluate the safety effects of a systemic-wide upgrade.

The systemic improvements are still ongoing throughout the city; not every section has been addressed. The analyses of this study were arranged to compare the crash frequencies experienced on segments that had the upgraded signs with crash frequencies from years before treatment on those same segments or on segments in other parts of the city that have not yet been treated.

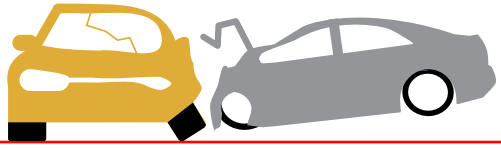
The proximity of control and test sites help ensure that factors such as weather conditions, climate, and driver behavior were not impacting the results, and that any difference can be attributed to sign upgrades. Findings indicate that, when viewed collectively as a systemic treatment, the upgraded signs may have contributed to reducing as many as 13 nighttime crashes across the entire collection of the treated segments. Crash reductions of other groups (such as total crashes or fatal and injury crashes) were less certain, though possible. When viewed at the level of individual segment, where effects of specific road features are also considered, the benefits of the upgraded signs were more elusive with no statistically significant findings directly related to the upgraded signs.

REDUCED

13

NIGHTTIME CRASHES

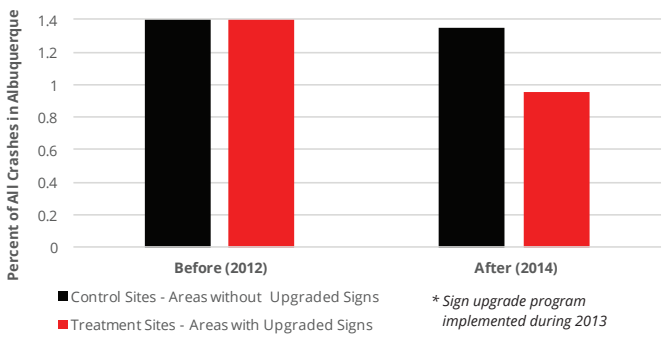
In Albuquerque, upgraded signs may have contributed to reducing as many as 13 nighttime crashes across the entire collection of the treated segments.



The analyses were performed with two different approaches. The first was macroscopic, evaluating the cumulative crash frequencies in the study areas. The analysis incorporated the crash frequencies in the entire city as a variable to account for regional trends. The second approach tested the crash frequencies at the level of individual segments, developing models that account for specific road features and traffic characteristics.

In the year following the 2013 sign upgrade program, the macroscopic analysis showed a decrease in 13 nighttime crashes (p=0.07, significant at a 90 percent confidence). This decrease was found while accounting for the differences in nighttime crashes expected in the two areas (the treatment segments tend to experience more crashes than the control segments) and while accounting for the number of crashes that occurred at night throughout the entire city. The results indicate that there may be similar reductions observed in fatal and injury crashes, though the effect was statistically less significant (p=0.15).

Reduction in Nighttime Injury and Fatal Crashes



Using the findings from this study, a benefit-cost analysis was conducted using the latest (2016) crash-cost estimates from US DOT, and total costs for the 2013 portion of the Albuquerque sign upgrade program ($445,954). The cost-benefit analysis was performed using a 12-year-service-life period. With a discount rate of four percent, and an assumed-sign-performance-degradation rate of five percent, the benefit-cost ratio of the sign upgrade program in Albuquerque revealed a strong benefit-cost ratio of 53. This indicates that the sign improvements are expected to save the agency $53 in reduced crash costs for every $1 invested in a sign upgrade program.

STRONG

BENEFIT-COST RATIO

53

For More Info

TRB Paper #17-02525; Safety Effects of Traffic Sign Upgrades in Albuquerque, New Mexico; Bradford Brimley, Seyedeh Maryam Mousavi, Paul Carlson, Karen Dixon

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