**Project Summary Report:** 8225-001

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# Speed Limits Set Lower Than Engineering Recommendations

http://www.mdt.mt.gov/research/projects/traffic/speed_limits_lower.shtml

## Introduction

The Montana Department of Transportation (MDT) generally ensures that posted speed limits are set in accordance with engineering recommendations, which means that speed limits are typically set such that they are about equal to the observed 85th-percentile operating speed. However, for a variety of reasons, including the presence of school zones, citizen requests, political pressure, and perceived safety issues, posted speed limits on several roadways in Montana have been reduced to values lower than those recommended for the facility by engineering guidelines. This study examined the safety and operational effects of posting speed limits lower than engineering recommendations. Specifically, the objectives of this study were as follows:

- Quantify the change in mean and 85th-percentile vehicle operating speeds, pace, and speed limit compliance at sites where posted speed limits are set lower than engineering recommendations for different magnitudes of posted speed limit reductions;
- Quantify the relationship between speed limit compliance and presence of police enforcement at sites where posted speed limits are set lower than engineering recommendations; and
- Quantify the safety performance of roadway segments with posted speed limits set lower than engineering recommendations, measured by the frequency and severity of crashes.

## What We Did

The project involved four unique components: a comprehensive literature review, a survey of other state transportation agencies, the collection of speed and safety data from a variety of Montana roadways, and an analysis of these data. Each of these tasks involved the following:

1. The literature review broadly considered the relationships between several speed measures and how these speed measures are associated with safety performance. Further, the review described the relationship between various speed concepts, including the relationship between posted speed limits, operating speeds, and design speeds. Issues related to speed compliance and enforcement were also synthesized.
2. A survey of state transportation agencies was administered to identify current practices with respect to setting speed limits lower than engineering recommendations. The goal of the survey was

to determine if other state transportation agencies have experience setting posted speed limits lower than engineering recommendations and, if so, to identify any guidance that might exist for this practice.

3. Vehicle operating speed data were collected at sites (Figure 1) with speed limits set lower than engineering recommendations and at comparable sites with posted speed limits set equal to engineering recommendations for three levels of police enforcement. Statistical tests and regression models were estimated to compare these speed measures and to assess speed compliance at the two site types and compare speed compliance under the various levels of enforcement.
4. The research team used the empirical Bayes (EB) before-after approach to develop crash modification factors (CMFs) that describe the expected change in crash frequency when setting posted speed limits lower than engineering recommendations.

## What We Found

The literature review revealed that little published information exists on the practice of setting posted speed limits lower than engineering recommended values. The survey was sent to all state transportation agencies with representation on the AASHTO Subcommittee on Traffic Engineering, which included a total of 71 representatives from 51 states or territories. Twenty-two of the 28 responding agencies indicated that they engaged in the practice of setting speed limits lower than engineering recommendations.

**Figure 1: On-site Collection of Operating Speed Data**

About half of these agencies had a policy or guidance document describing the practice. Overall, few agencies reported evaluating the changes to operating speed or safety resulting from setting speed limits lower than engineering recommendations. About half of the 28 responding agencies evaluated driver compliance with the lower posted speed limit and found that the compliance was generally poor.

### *Operating Speed Analysis*

Operating speed data were collected at three sites with posted speed limits set 5 mph lower than engineering recommendations, two sites with posted speed limits set 10 mph lower than engineering recommendations, two sites with posted speed limits set 15 mph lower than engineering recommendations, one site with a posted speed limit set 25 mph lower than engineering recommendations, and four comparison sites with posted speed limits set equal to the engineering recommended values. Data were collected from each site on three unique days: one with no speed enforcement present, one with light speed enforcement present, and one with heavy speed enforcement present. Statistical models were developed to describe mean operating speeds, 85th-percentile operating speeds, and driver compliance with posted speed limits.

The operating speed evaluation produced results that were consistent with other state transportation agency experiences when setting posted speed limits lower than engineering recommendations. When the posted speed limit was set only 5 mph lower than the engineering posted speed limit, drivers tended to more closely comply with the posted speed limit. Compliance tended to lessen as the difference between the engineering recommended posted speed limit and the posted speed limit increased. When the posted speed limit was set 15 to 25 mph lower than the engineering recommended speed limit, there appeared to be a low level of compliance with the posted speed limit (Figure 2). The practice of light enforcement, which was defined as highway patrol vehicles making frequent passes through locations with posted speed limits set lower than engineering recommendations, appeared to have only a nominal effect on vehicle operating speeds. Known heavy enforcement, defined as a stationary highway patrol vehicle present within the speed zone, reduced mean and 85th-percentile vehicle operating speeds by approximately 4 mph. Additionally, known heavy enforcement increased the likelihood of driver compliance with the posted speed limit.

### *Safety Evaluation*

The safety evaluation included reported crash frequency data

| Characteristic | Odds ratio of speed limit compliance |
|---|---|
| Unverified or verified heavy enforcement | 1.117 |
| Posted speed limit of 50 or 55 mph | 2.401 |
| Posted speed limit of 60, 65 or 75 mph | 4.285 |
| 5 mph difference in engineering recommended and posted speed limit | 3.604 |
| 10 mph difference in engineering recommended and posted speed limit of 10 mph | 1.887 |
| 15 or 25 mph difference in engineering recommended and posted speed limit | **0.892** |

Values greater than 1.0 indicate improved speed limit compliance; values less than one indicate reduced speed limit compliance

**Figure 2: Operating Speed Evaulation for Compliance**

from six sites with posted speed limits set 5 mph lower than engineering recommendations; five sites with posted speed limits set 10 mph lower than engineering recommendations; two sites with posted speed limits set 15 mph lower than engineering recommendations; and one site with a posted speed limit set 25 mph lower than engineering recommendations. The research team used the empirical Bayes before-after approach to develop CMFs (Figure 3) to describe the expected change in crash frequency when setting posted speed limits lower than engineering recommendations. The EB analysis properly accounts for statistical factors such as regression-to-the-mean, differences in traffic volume, and crash trends (time series effects) between the periods before and after posted speed limits were set lower than engineering recommendations.

While data were only available for a handful of sites that implemented this practice, the before-after analysis found a statistically significant reduction in total and fatal + injury crashes at locations with posted speed limits set 5 mph lower than engineering recommendations. Locations with posted speed limits set 10 mph lower than engineering recommendations experienced a decrease in total crash frequency but an increase in fatal + injury crash frequency. The safety effects of setting speed limits 15 to 25 mph lower than engineering recommendations are less clear, as the results were not statistically significant, likely due to the small sample of sites included in the evaluation.

## What the Researchers Recommend

When considering the experiences of other state transportation agency practices and the speed and safety evaluation results from the present study, it appears that setting posted speed limits 5 mph lower than the engineering recommended practice may result in operating speeds that are more consistent with the posted speed limits and overall safety benefits (defined as an expected decrease in total and fatal + injury crash frequency). The safety benefits are presumably observed because drivers tend to more closely comply with posted speed limits at locations where the posted speed limit is just 5 mph below the engineering recommended values. Police enforcement appears to only significantly impact operating speeds when heavy enforcement is present. However, the effect is likely to diminish when the enforcement period concludes. The practice of setting posted speed limits 15 or 25 mph lower than engineering recommended speed limits does not appear to produce operating speeds consistent with the posted speed limit or provide safety benefits, although the sample size is small.

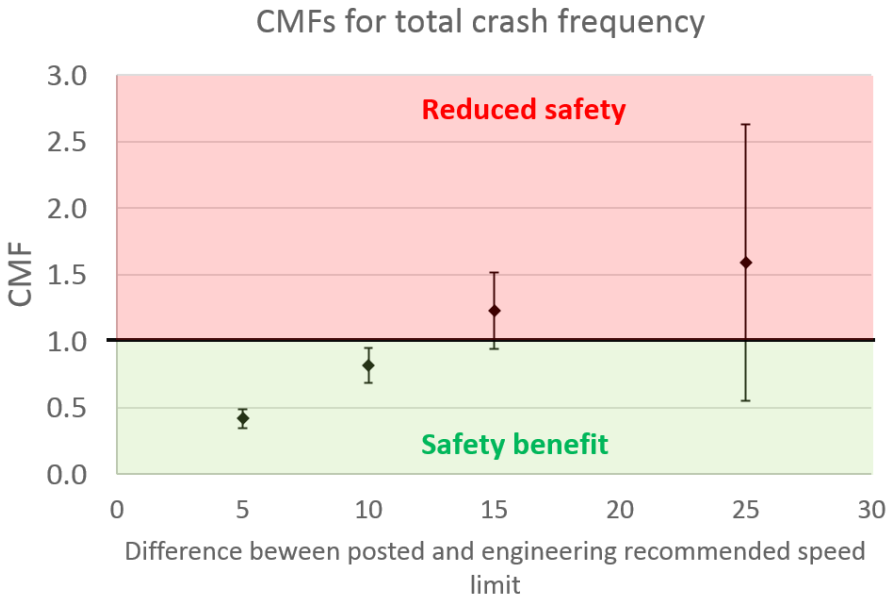


**Figure 3: Crash Modification Factors (CMF)**

## For More Details . . .

The research is documented in Report FHWA/FHWA/MT-16-008/8225-001
http://www.mdt.mt.gov/research/projects/traffic/speed_limits_lower.shtml

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## **MDT Implementation Status:** August 2016

The information gained from this research project will be used as appropriate and needed when making speed limit related decisions and policies.