



### Safety Benefits:

#### Chevron Signs

**25%** reduction in nighttime crashes.<sup>1</sup>

**16%** reduction in non-intersection fatal and injury crashes.<sup>2</sup>

#### Oversized Chevron Signs

**15%** reduction in fatal and injury crashes.<sup>3</sup>

#### Sequential Dynamic Chevrons

**60%** reduction in fatal and injury crashes.<sup>4</sup>

#### In-Lane Curve Warning Pavement Markings

**35 - 38%** reduction in all crashes.<sup>5</sup>

#### New Fluorescent Curve Signs or Upgrade Existing Curve Signs to Fluorescent Sheeting

**18%** reduction in non-intersection, head-on, run-off-road, and sideswipe in rural areas.<sup>1</sup>

For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://highways.dot.gov/safety/proven-safety-countermeasures> and <https://highways.dot.gov/safety/rwd/keep-vehicles-road/horizontal-curve-safety>.

## Enhanced Delineation for Horizontal Curves

Enhanced delineation at horizontal curves includes a variety of potential strategies that can be implemented in advance of or within curves, in combination, or individually.

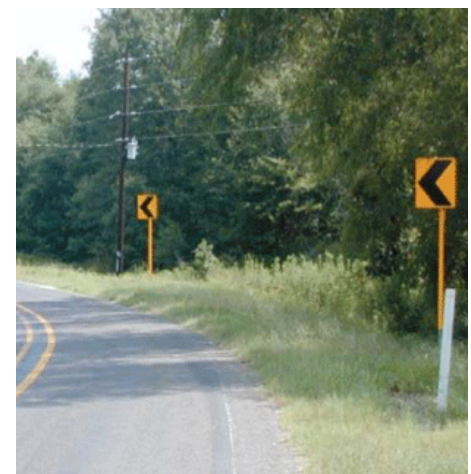
| Potential Strategies   | In Advance of Curve | Within Curve |
|--|---------------------|--------------|
| Pavement markings (standard width or wider)                              | ✓                   | ✓            |
| In-lane curve warning pavement markings                                  | ✓                   |              |
| Retroreflective strips on sign posts                                     | ✓                   | ✓            |
| Delineators  |                     | ✓            |
| Chevron signs  |                     | ✓            |
| Enhanced Conspicuity (larger, fluorescent, and/or retroreflective signs) | ✓                   | ✓            |
| Dynamic curve warning signs (including speed radar feedback signs)       | ✓                   |              |
| Sequential dynamic chevrons  |                     | ✓            |

Enhanced delineation treatments can alert drivers to upcoming curves, the direction and sharpness of the curve, and appropriate operating speed.

Agencies can take the following steps to implement enhanced delineation strategies:

1. Review signing practices and policies to ensure they comply with the Manual on Uniform Traffic Control Devices (MUTCD) principles of traffic control devices. Consistent practice for similar curves sets the appropriate driver expectancy.
2. Use the [systemic approach](#) to identify and treat problem curves. For example, Minnesota uses risk factors that include curve radii between 500 and 1,200 ft, traffic volumes between 500 and 1,000 vehicles per day, intersection in the curve, and presence of a visual trap.<sup>1</sup>

3. Match the appropriate strategy to the identified problem(s), considering the full range of enhanced delineation treatments. Once the MUTCD requirements and recommendations have been met, an incremental approach is often beneficial to avoid excessive cost.



Chevron signs with retroreflective strips on sign posts installed along a curve. Source: FHWA

1 (CMF ID: [2439,2431,2432](#)) Albin et al. Low-Cost Treatments for Horizontal Curve Safety 2016. FHWA-SA-15-084, (2016).

2 (CMF ID: [2438](#)) Srinivasan et al. Safety Evaluation of Improved Curve Delineation. FHWA-HRT-09-045, (2009).

3 (CMF ID: [8978](#)) Lyon et al. Safety Evaluation of Two Curve Warning Treatments: In-Lane Curve Warning Pavement Markings and Oversized Chevron Signs. Presented at the 96th TRB Annual Meeting, Paper No. 17-00432, (2017).

4 (CMF ID: [10362](#)) Hallmark, S. Evaluation of Sequential Dynamic Chevrons on Rural Two-lane Highways. FHWA, (2017).

5 (CMF ID: [10312,9167](#)) Donnell et al. Reducing Roadway Departure Crashes at Horizontal Curve Sections on Two-lane Rural Highways. FHWA-SA-19-005, (2019).