SAFETY INVESTIGATION MANUAL
CHAPTER 6: COUNTERMEASURE SELECTION AND RECOMMENDED IMPROVEMENTS ANALYSIS

Online Training

Presented by:
Dr. Chris Monsere, Professor
Portland State University
Countermeasure Selection

• Countermeasure is a modification, improvement, or design intended to reduce crash frequency or severity

• Selection of countermeasures guided by data analysis and site investigation findings

• Is a “fix” to the safety issue

• Two approaches:
  • Countermeasures for overrepresented crash types
  • Strictly considering crash reductions

Crash Data Analysis

Site Investigation

Identify Candidate Countermeasures

Select potential countermeasures based on data analysis and site investigation findings

Discard countermeasure

Does the potential countermeasure meet sound engineering principles

YES

Recommend Improvements

NO
Countermeasure Selection

• Several resources to identify potential countermeasures
• Identification of potential countermeasures involves mapping the correctable crash type to a possible countermeasure
• SIM provides crash patterns and probable causes in Table 3, 4, 5, 6 in Chapter 5
• Countermeasures will to evaluated for cost effectiveness and feasibility
• Important to check if recommended solutions have delegated authority processes

FHWA Safety Emphasis Area websites are useful starting points
Countermeasure Effectiveness

- Crash Modification Factor (CMF)
  - A multiplicative factor representing the fraction of the total crashes expected after the countermeasure
- Crash reduction factor (CRF)
  - A percent reduction in the “before” crashes after implementing the countermeasure
- A CMF/CRF is relative to a given base condition
  - CMF < 1 = less crashes
  - CMF > 1 = more crashes
  - Note CRF = (1-CMF)
Base Conditions

• CMF/CRFs are the change from the base condition to the new condition specific to a crash type, severity and roadway context specific.
  • total crashes, run-off-road, night, wet weather, multi-vehicle
  • rural, urban, arterial, freeway

BEFORE

Urban, all-way stop controlled

AFTER

Urban, 1-lane roundabout
Key Resources

• ARTS CRF List
  • List of approved countermeasures and their CRF

• FHWA CMF Clearinghouse
  • Searchable by crash type, severity, roadway type and others
  • Uses a star rating system where more stars indicate a more reliable CMF.
  • Star rating based on study type, sample size, and quality of research
Example Problem

A location has 14 crashes per year.
Two countermeasures have been selected with a CRF1 = 10%, CRF2 = 30% (or CMF1 = 0.90 and CMF2 = 0.70)

A. How many crashes were reduced?
B. How many crashes will occur per year after the countermeasure?

With CRF
First, calculate the composite CRF = 0.1+(1-0.1)(0.3) = 0.37 or 37%
[Note: 0.1 is 10% in decimal form and 0.3 is 30% in decimal form.]
A. crashes reduced = 14[0.37] = 5.18 crashes
B. crashes expected after countermeasure = total – reduced = 14 - 5.18 = 8.82 crashes

With CMF
CMF = 0.90, CMF = 0.70, with CMF b) is easier to answer first
B. crashes expected after countermeasure = (14 crashes)(0.9)(0.7) = 8.82 crashes
A. crashes reduced = total – expected after = 14 - 8.82 = 5.18 crashes
Recommended Improvements

- Countermeasures must be economically feasible
  - Benefits considered as savings in crashes over the life of the project
  - Costs include initial capital investment
- ARTS program has benefit-cost and cost-effectiveness worksheets available.
- Final recommended countermeasures are identified by crash data analysis, field investigation, and were determined cost effective.

Example of a recommended and implemented countermeasure