SAFETY INVESTIGATION MANUAL

CHAPTER 6: COUNTERMEASURE SELECTION AND RECOMMENDED IMPROVEMENTS ANALYSIS

Online Training

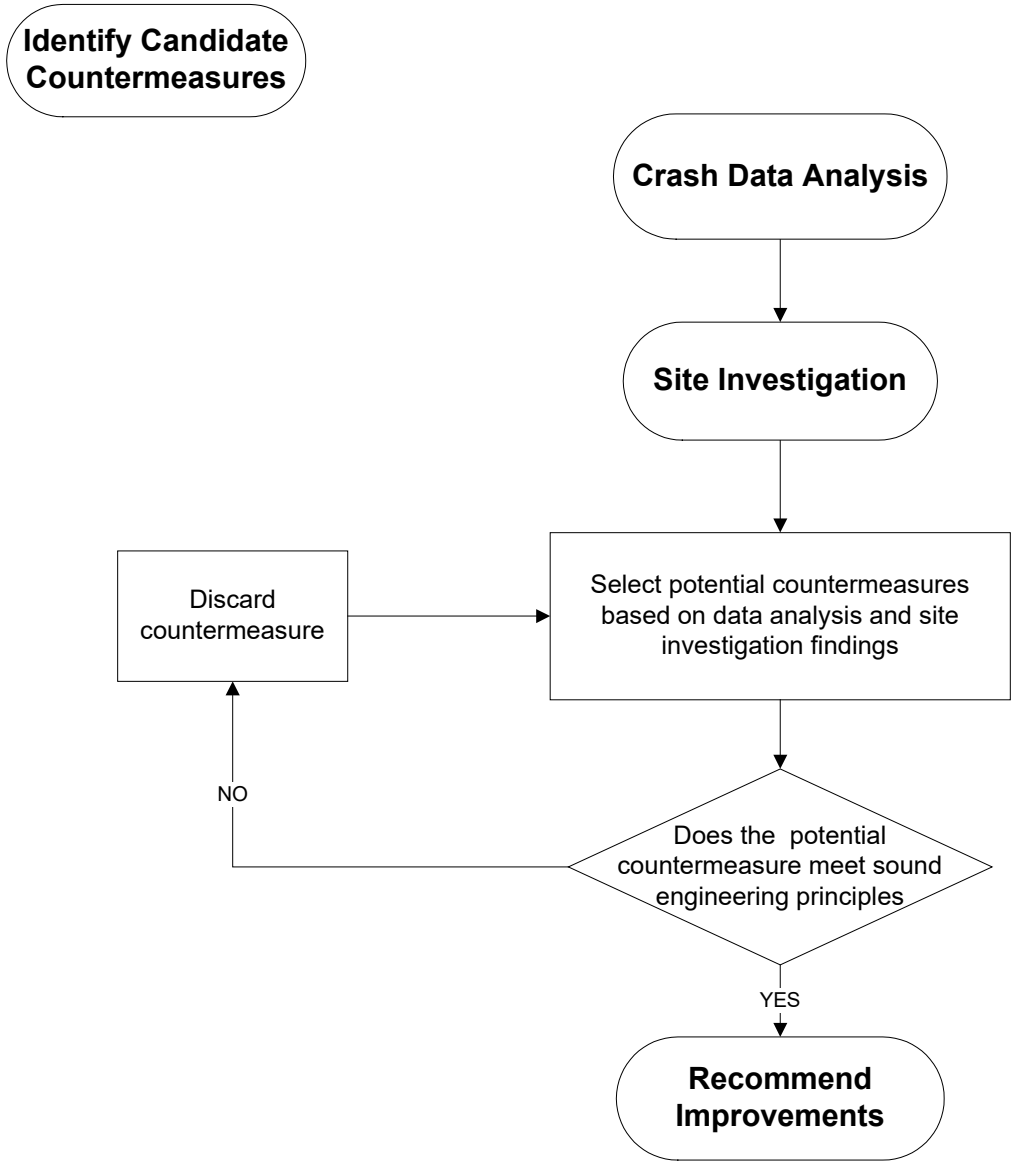
Presented by:

Dr. Chris Monsere, Professor

Portland State University

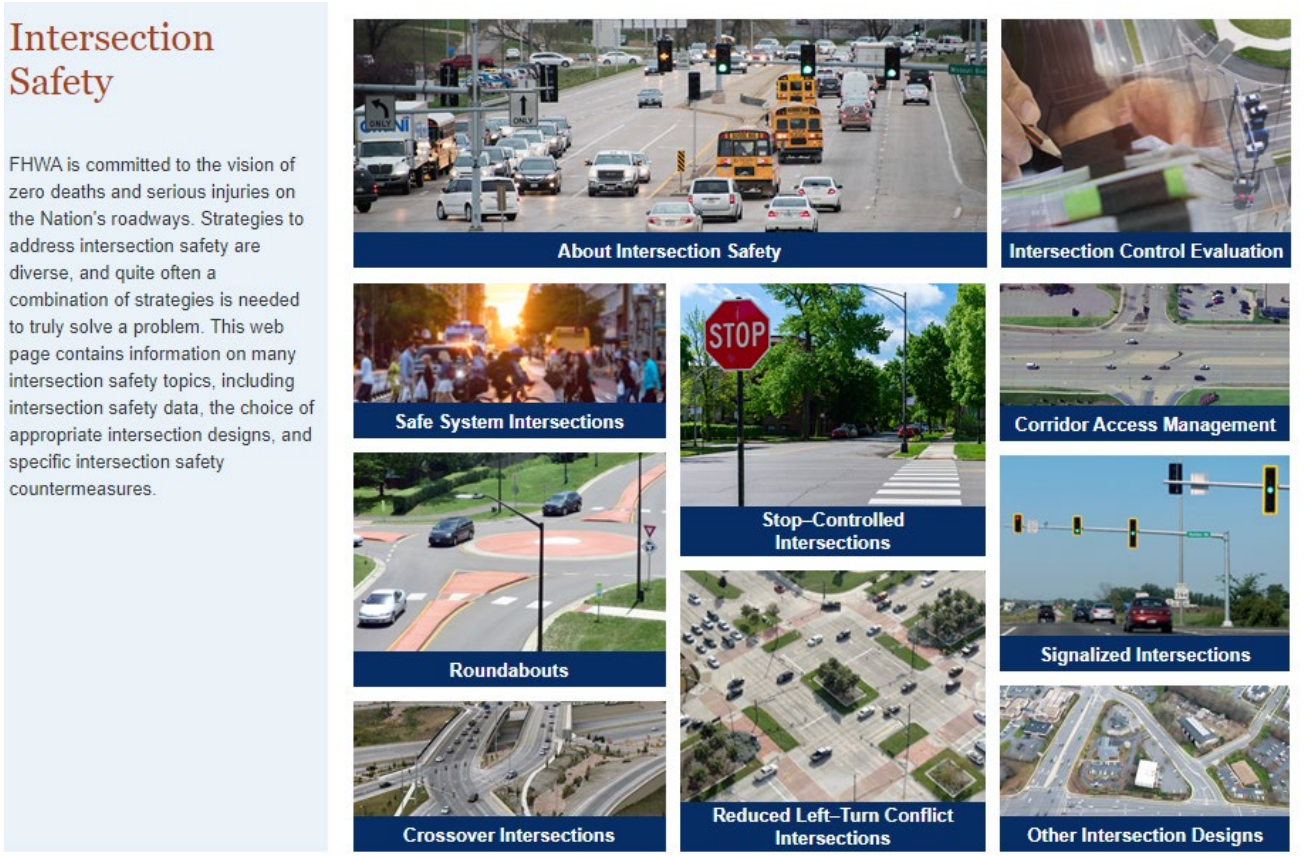
Countermeasure Selection

- 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



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

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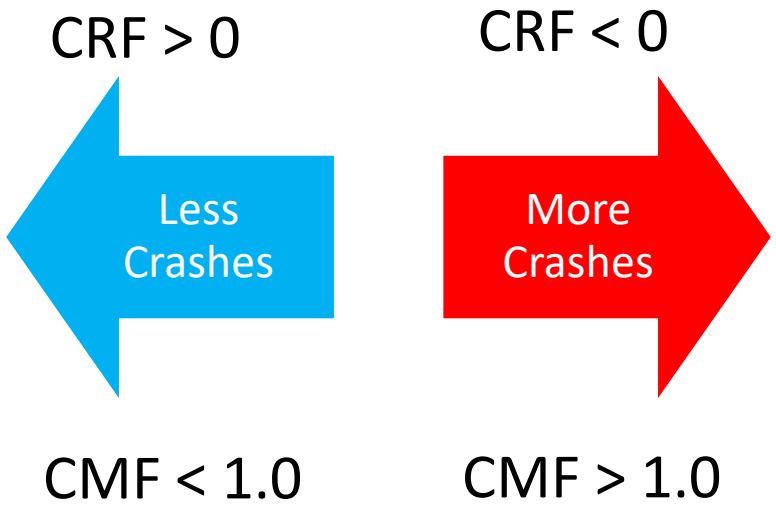
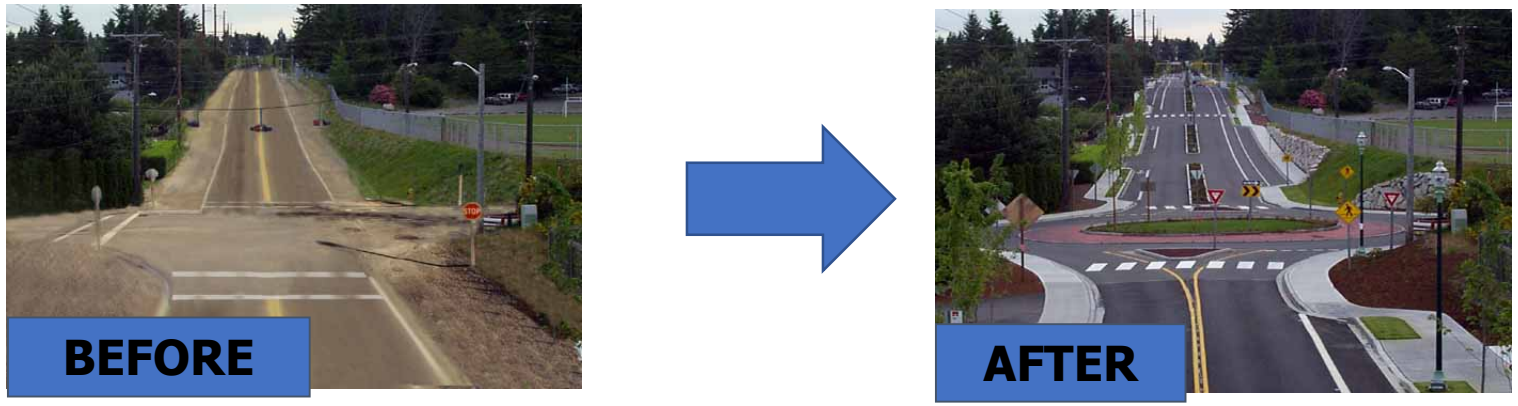
Countermeasure Effectiveness

- 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

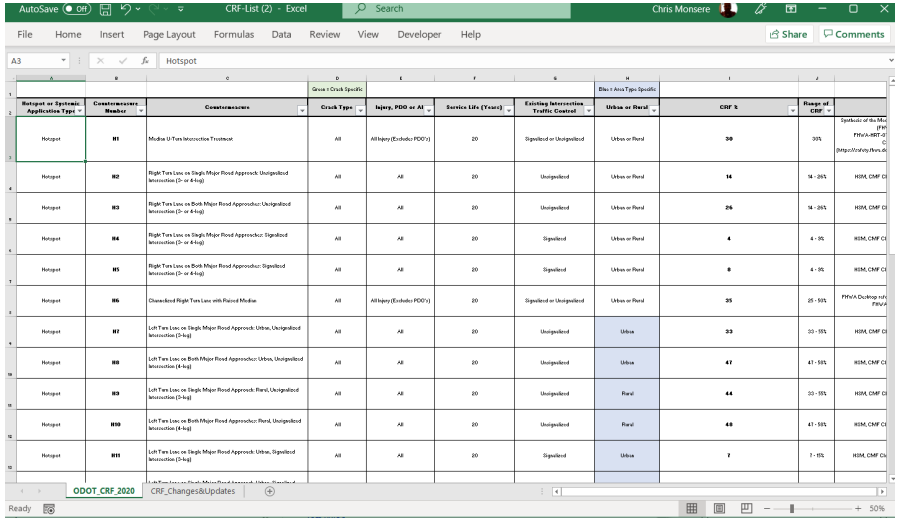


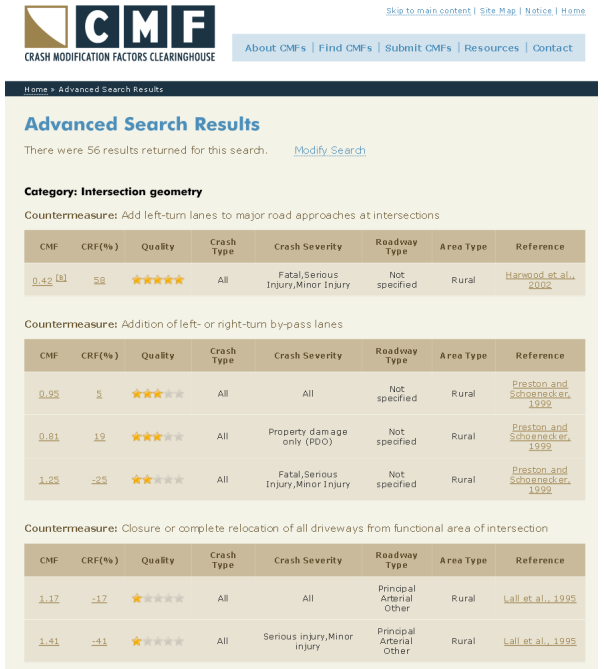
Urban, all-way stop controlled

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





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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

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