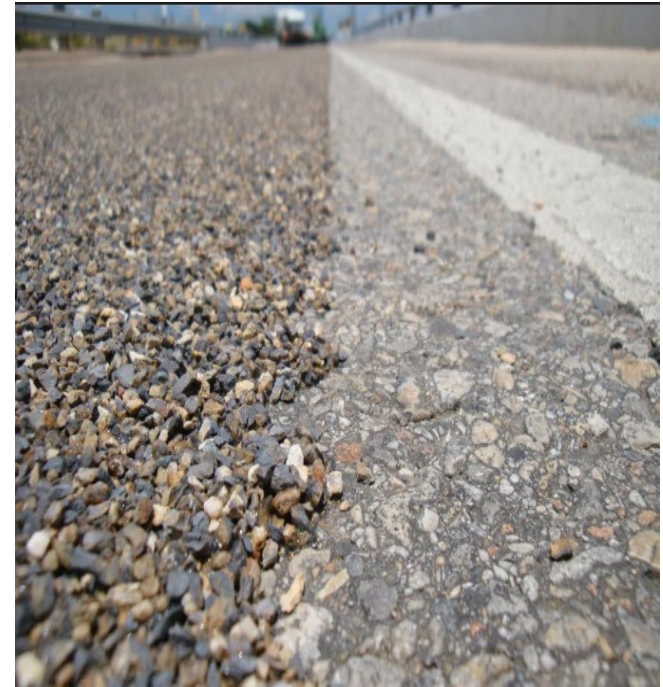


WSDOT CMF Short List



John Tevis, Design Liaison
July 10, 2018

Roger Millar, Secretary of Transportation

Keith Metcalf, Acting Deputy Secretary of Transportation

Our Safety Organization for Supporting Safety / CMFs

- WSDOT has no Safety (HSIP) Office
- We have what is called a Safety Matrix team made up of:
 - Traffic Operations Representatives
 - Design Representatives
- And our approving authorities are tasked with verifying that the CMFs used match the situation.

The Goals of our Short List

Our CMF Short List was never intended to replace the CMF clearinghouse.

- The **goals** for our CMF short list:
 - To only hold the vital few CMFs needed by our users
 - To **Reduce the amount of time** needed for our users to identify and select an appropriate and approved CMF
- **Four key considerations** for CMFs used at WSDOT
 - Quality of the research
 - Context of the treatment
 - Target crash type & crash severity
 - Quality, statistically significant, countermeasures

Populating our Short List

Example: we needed CMFs for Roundabouts because they were not in the predictive methods:

1. We needed Fatal & All Injury roundabout CMFs for:
 - a. Stop control to roundabout (U & R) (H & L speed)
 - b. Signal to roundabout (U & R)
2. We reviewed the clearinghouse for roundabout CMFs with the best CMF studies that matched our roundabout situations in Washington.
3. We found that NCHRP 705 matched our roundabout experiences the best.
4. We documented our findings and added the needed CMFs to Short List.

We have a report explaining each CMF on the short list.

The WSDOT Short List

It is imperative that the context of the CMF matches the context of the situation. Therefore, our Short List shows:

- The CMF ID number
- Countermeasure Title and Context
- Crash Pattern/Type **and** Severity Affected
- CMF **and** Standard Error
- Date Approved
- Study Reference
- Star Rating (Our users wanted to know)
- Special Notes to help users further understand:
 - The appropriate application of the CMF
 - Circumstances where the CMF **is not** applicable

The WSDOT Short List

So far we have 45 CMFs made up of:

- Shoulder Rumble Strips
- High Friction Surface Treatments
- Roundabouts
 - Signal to Roundabout
 - Stop Control to Roundabout (low speed)
 - Stop Control to Roundabout (high speed)
- J-Turns
- Two-Way Left Turn Lane on Two-Lane wo-Way Roadway
- Prepare to Stop When Flashing
- Raised Median at Uncontrolled Pedestrian Crossing
- Passing Lane on a 2-Lane High Speed Arterial

Our Approach to CMFs

1. The HSM Part C predictive methods, with built in CMFs, meet the needs of most of our users.
2. When the HSM Part C predictive methods do not meet users needs, our CMF Short List meets most of there needs.
3. If by chance the Short List does not have a needed CMF, we are prepared to help users find an **approved** CMF quickly in the CMF Clearinghouse.
4. Then, we will finish the investigation and add the CMF to the Short List.

Short List Documentation

Every CMF chosen to be in the Short List is documented on a CMF Review Form in detail along with the reasons for choosing that particular CMF.

The *WSDOT CMF Short List* & the *CMF Review Form* for each CMF are available to staff on the WSDOT Intranet.

Questions?

CMF Rules of Engagement

We ask users not to spend a lot of time looking for CMFs.

1. When a user needs a CMF:
 - a. They can call us and we will find them an approved CMF **OR**
 - b. They can look for their situation in our CMF short list.
 - a. If they find their situation in the short list, that's great, they don't need approval for using that CMF.
 - b. The approving authority of the document will check that the CMF they chose does match their situation.

CMF Rules of Engagement

We ask users not to spend a lot of time looking for CMFs.

2. If they can't find a CMF in the Short List:
 - a. They can call us and we will help them find an approved CMF for their situation **or**
 - b. They can look for their situation in the clearinghouse. If they find a CMF they need to have it approved by the approving authority before they start using it.

CMF Rules of Engagement

We ask users not to spend a lot of time looking for CMFs.

- 3.** If they can't find a CMF in the Clearinghouse they can call us:
 - a. We will help them find an approved CMF for their situation
or
 - b. We will find a CMF with an approved set of assumptions
or
 - c. We will verify there is no existing CMF that matches their situation and suggest next steps based on their situation.

Next Steps for our Short List

- We are planning soon to add:
 - Diverging Diamond interchanges
 - Road Diets
- But for now, we are listening for more CMFs needed by our users.
- And, watching for better CMFs to update the CMFs we have now.

Questions?

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Highway Safety

[Highway Safety home](#)[Laws & Regulations](#)[Strategic Planning](#)[Pre-Design & Scoping](#)[Project Design & Construction](#)[Multimodal Safety](#)[Traffic Operations](#)[Manuals & Guidance](#)[Safety Tools](#)[Countermeasures](#)[Research](#)[Reports](#)[Contact QATSS](#)

Highway Safety Countermeasures

WSDOT Resources

[CMF Short List \(xls 29 kb\)](#)[Crash Modification Factor \(CMF\) Review Forms](#)[Form template \(doc 59 kb\)](#)

- [Shoulder Rumble Strips \(doc 76 kb\)](#)
- [Convert Signal to Roundabout \(doc 70 kb\)](#)
- [Friction Surfacing \(doc 65 kb\)](#)
- [Convert Stop Control to Roundabout \(doc 61 kb\)](#)
- [High Speed Roundabouts \(doc 65 kb\)](#)
- [J-Turn \(doc 300 kb\)](#)
- [TWLTL Added to 2-lane Rural Road \(doc 177 kb\)](#)
- [High Friction Surface Treatment \(doc 61 kb\)](#)
- [Pedestrian Crossing Raised Median \(doc 62 kb\)](#)
- [Install PTSWF at Signalized IS \(doc 70 kb\)](#)
- [Passing Lanes \(doc 83 kb\)](#)

AASHTO Resources

- [Crash Modification Factor Clearinghouse](#)
- [CMF Newsletter](#)
- [Star Quality Rating explanation](#)

WSDOT Crash Modification Factor (CMF) "Short List"

Revised June 17, 2015

This list is provided to aid in evaluation of the effectiveness of proposed safety countermeasures in an efficient and consistent manner

Crash Modification Factors (CMFs) must be used within the context shown.

* Interim CMFs may be used for any project.
These CMFs will be replaced with more statistically reliable CMFs matching the context and application for the countermeasure when available.

The short list is not comprehensive. Users are free to explore crash modification factors from other sources.

If CMFs from other sources are identified, concurrence from the funding division must be obtained prior to use.

The CMFClearinghouse can be a good source of information and is found at: <http://www.cmfclearinghouse.org/>

WSDOT Reference Number	Category	Countermeasure -- Context	Crash Pattern Affected	CMF	Interim Status*	Std Error	Original Date Discussed	Date Approved	Date -- Study -- Reference	Star Rating	Notes
	Roadway Segments	Shoulder Rumble Strips New milled in shoulder rumble strips for single vehicle run off the road collisions on:									
CMF #3586			Rural Freeways, All Severity Collisions	0.89		0.1	10/23/2013	10/25/2013	NCHRP Report 641: Guidance for the Design and Application of Shoulder and Centerline Rumble Strips pages 1-3 and 80	3	
CMF #3448			Rural Freeways, Fatal & Injury Collisions	0.84		0.1	10/23/2013	10/25/2013		4	
CMF #3594			Rural Two-Lane Roads, All Severity Collisions	0.85		0.1	10/23/2013	10/25/2013		3	
CMF #3388			Rural Two-Lane Roads, Fatal and Injury Collisions	0.71		0.1	10/23/2013	10/25/2013		3	
	Pavement Enhancement	Friction Surfacing Install Friction Surfacing in locations with over represented Wet Pavement Crashes and Low Friction Numbers (32 or	Reduction of Wet Pavement Collisions, All Severities	0.43		0.03	Oct-13	1/8/2014	NCHRP Report 617 Accident Modification Factors for Traffic Engineering and ITS Improvements Pages 22-24 and TRR: Journal of the TRB No. 2068 Safety Effects of Targeted Program to Improve Skid Resistance, pages 135-139	4	
	Pavement Enhancement	High Friction Surface Treatment Install HFST in locations with higher than normal incidence of wet pavement skid type collisions									
Interim CMF #195			Ramps - Wet Road Crashes, All Severities Study CMF 0.22 with Standard Error 0.041	0.40	Interim	N/A	1/8/2014	1/8/2014	Evaluation of Low Cost Improvements - Pooled Fund Study - Phase VI Strategies 26-29 Pavement Safety Performance		
Interim CMF #195a			Curves - Wet Road Crashes, All Severities	0.48	Interim	0.064	1/8/2014	1/8/2014	Merritt, Lyon, Persaud		

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Documentation for CMF Identification/Recommendation for Including into the WSDOT CMF Table (Shoulder Rumble Strips)

Completed Review Date: 10/25/2013

Date that FHWA CMF Clearinghouse Was Accessed: 10/20/2013

Date that CMF(s) were added to the WSDOT CMF Table: 10/25/2013

Countermeasure: Shoulder Rumble Strips

Applicable Contexts/ Contexts Included in Review: (See attached "R S Final.xlsx" tab "Submitted CMFs")

Contexts	Crash Modification Factor (CMF)	Standard Error	WSDOT Reference Number
New Milled in shoulder rumble strips for Single Vehicle Run Off the Road collisions on:			
Rural Freeways, All Severity Collisions	CMF 0.89	0.1	WC-3586
Rural Freeways, Fatal & Injury Collisions	CMF 0.84	0.1	WC-3448
Rural Two-Lane Roads, All Severity Collisions	CMF 0.85	0.1	WC-3594
Rural Two-Lane Roads, Fatal & Injury Collisions	CMF 0.71	0.1	WC-3388

Completed by:

First and last name: John Tevis

Title, Office: Design Liaison Engineer

Telephone and Email: 360-705-7460 (Desk Phone) TevisJ@WSDOT.WA.Gov



1. Detailed Findings of Review For each of the CMFs listed Above:

Name / WSDOT ID# / Clearinghouse ID#: Install shoulder rumble strips / WC-3586 / 3586

Description:

New Milled in shoulder rumble strips for Single Vehicle Run Off the Road collisions on **Rural Freeways, All Severity Collisions (KABCO)**

CMF Value with Standard Error (note if SE is not available): CMF=0.89 - SE=0.1

Is the recommended CMF for: (Please check one)

Inclusion in the CMF Short List?

INTERIM STATUS ONLY? **Explain:** Because the AADT window is in question. This CMF will be used without a window in an interim status for now.

Other? **Explain:** _____

Context: (List all the context available from Clearinghouse and Study)

NAME: Shoulder rumble strips

TYPE: Milled in

COLLISION TYPES: Single Vehicle Run Off the Road collisions

ROADWAY TYPES: Freeways

COLLISION SEVERITIES: All Severity Collisions (KABCO)

AREA TYPE: Rural

PRIOR CONDITION: N/A

STATE: MO & PA

INTERSECTION RELATED: N/A

AADT WINDOW: N/A - The clearinghouse shows "Minimum 6,777 & Maximum 37,112" but because of uncertainty, we have decided for now to open this CMF up for all AADTs

Weather conditions: N/A

NUMBER OF LANES: Multilane

SPEED LIMIT: N/A

CRASH TIME OF DAY: Night & Day

MEDIAN TYPE: Divided

Functional class: N/A

Adjacent land use/ development: N/A

In transition zone from either high speed to low speed OR from low speed to high speed environment: N/A

Effect on bicyclists and/or pedestrians: N/A

Source Document Name (bold studies used with page references):

- **NCHRP Report 641: Guidance for the Design and Application of Shoulder and Centerline Rumble Strips**
 - **Reference:** Pages 1-3 & 80
 - **Type of study:** Regression cross-section
 - **Sample size:** Not specified in Clearinghouse.
 - **Notes on the study:** <provide as much detail as possible> (What kind of notes do we want?)
 - **FHWA CMF Clearinghouse star rating:** 3
- **WSDOT Design manual Section 1600.06(1)(b), 1. & 2 (See below)**
 - **Reference:** pages 1600-10 & 1600-11

2. Special Notes for Appropriate Application

Provide this discussion for each CMF.

Detailed discussion on special notes for consideration to support appropriate application. For example, topography, contexts, presence of vulnerable users, areas where it would have particular maintenance issues (say areas with snow plows in use), or special considerations for installation, maintenance etc.

NOTE. Include specific and full references to support any statements included in this item.

Policies for Rumble Strip use: See Design Manual Section 1600.06(1)(b), 1. & 2 below:

1. Divided Highways

Install shoulder rumble strips on both the right and left shoulders of rural Interstate highways. Consider them on both shoulders of rural divided highways. Use the Shoulder Rumble Strip Type 1 pattern on divided highways.

Omitting shoulder rumble strips on rural Interstate highways is a design exception (DE) under any of the following conditions:

- When another project scheduled within two years of the proposed project will overlay or reconstruct the shoulders or will use the shoulders for detours.
- When a pavement analysis determines that installing shoulder rumble strips will result in inadequate shoulder strength.
- *When overall shoulder width will be less than 4 feet wide on the left and 6 feet wide on the right.*

2. Undivided Highways

Shoulder rumble strip usage on the shoulders of undivided highways demands strategic application because bicycle usage is more prevalent along the shoulders of the undivided highway system. Rumble strips affect the comfort and control of bicycle riders; consequently, their use is to be limited to highway corridors that experience high levels of run-off-the-road collisions. Apply the following criteria in evaluating the appropriateness of rumble strips on the shoulders of undivided highways.

- *Consult the region and Headquarters Bicycle and Pedestrian Coordinators to determine bicycle usage along a route, and involve them in the decision-making process when considering rumble strips along bike touring routes or other routes where bicycle events are regularly held.*
- *Use on rural roads only.*
- *Determine that shoulder pavement is structurally adequate to support milled rumble strips.*
- *Posted speed is 45 mph or higher.*
- *Provide for at least 4 feet of usable shoulder between the rumble strip and the outside edge of shoulder. If guardrail or barrier is present, increase the dimension to 5 feet of usable shoulder. Field-verify these dimensions.*
- *Preliminary evaluation indicates a run-off-the-road collision experience of approximately 0.6 crashes per mile per year. (This value is intended to provide relative comparison of crash experience and is not to be used as absolute guidance on whether rumble strips are appropriate.)*
- *Do not place shoulder rumble strips on downhill grades exceeding 4% for more than 500 feet in length along routes where bicyclists are frequently present.*
- *An engineering analysis indicates a run-off-the-road collision experience considered correctable by shoulder rumble strips.*

For projects that will remove and potentially replace existing shoulder rumble strips, evaluate the criteria for shoulder width and downhill grades for compliance with placement guidance. Discontinue rumble strips where the downhill grade exceeds 4% for more than 500 feet. If the usable shoulder width between the rumble strip and outer edge of shoulder is less than 4 feet (5 feet if guardrail or barrier is present) reevaluate the appropriateness of the rumble strips. Assess the existing shoulder rumble strip's impact on run-off-the-road crash experience and bicycling. Assess alternate rumble strip patterns and placement options. Consult the region and Headquarters Bicycle and Pedestrian Coordinators. Document decisions to continue or discontinue shoulder rumble strip usage where the existing usable shoulder width between the rumble strip and outer edge of shoulder is less than 4 feet (5 feet if guardrail or barrier is present).

Consult with the region or Headquarters Bicycle and Pedestrian Coordinator for determining levels of bicycle traffic for your project. The Shoulder Rumble Strip Type 2 or Type 3 pattern is used on highways with minimal bicycle traffic. When bicycle traffic on the shoulder is determined to be high, the Shoulder Rumble Strip Type 4 pattern is used.

3. Special Notes for Circumstances Where CMF Values Would Not Be Applicable

Provide this discussion for each CMF.

For example, if the CMF was a conversion to a traffic signal from a 2-way STOP controlled intersection, then this item would include a note about high speed rural conditions where the reduction in overall severity of collisions are unlikely given that rear-end collisions will increase but that severity of these collisions are generally high. Other may include volume ranges, etc.

These CMFs cannot be used in a context that does not match one of the Listed contexts above.

NOTE. Include source and page numbers to support any statements included in this item.

4. List All Documents that Were Reviewed

SPACE TO COPY AND PASTE INFORMATION FROM THE FHWA CMF CLEARINGHOUSE



CMF ID	Study Title	Context	Counter measure	CRF	CMF	Crash Type	Crash Severity	Roadway Type	Area Type	Publication Year	Star Quality Rating	Prior Condition	Unadjusted Error
3586	NCHRP Report 641: Guidance for the Design and Application of Shoulder and Centerline Rumble Strips	New Shoulder rumble strips	Install shoulder rumble strips	11	0.89	Run off road, Wet road Single vehicle	All	Principal Arterial Other Freeways and Expressways Rural freeways	Rural	2009	3		11.0
3448	NCHRP Report 641: Guidance for the Design and Application of Shoulder and Centerline Rumble Strips	New Shoulder rumble strips	Install shoulder rumble strips	16	0.84	Run off road, Single vehicle	Fatal Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways Rural freeways	Rural	2009	4	No Rumble Strips	8.22
3594	NCHRP Report 641: Guidance for the Design and Application of Shoulder and Centerline Rumble Strips	New Shoulder rumble strips	Install shoulder rumble strips	15	0.85	Run off road, Wet road Single vehicle	All	Principal Arterial Other Freeways and Expressways	Rural	2009	3		10.2
3388	NCHRP Report 641: Guidance for the Design and Application of Shoulder and Centerline Rumble Strips	New Shoulder rumble strips	Install edgeline rumble strips	29	0.71	Run off road Single vehicle	Fatal Serious injury, Minor injury	Principal Arterial Other Freeways and Expressways	Rural	2009	3		13.9

