

APPENDIX E

User Guide for the CMF Combination Tool Spreadsheet

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Introduction

The CMF Combination Tool is a Microsoft Excel™ spreadsheet implementation of the homogeneity testing procedure developed under *NCHRP Project 17-63: Guidance for the Development and Application of Crash Modification Factors*.

This tool can be used to test two or more CMFs for the same treatment to determine if they are similar enough to be combined into a single CMF value. The CMFs must also address the same crash type (i.e., total crashes, rear end crashes, etc.). If the CMFs are able to be combined, the tool produces a value for the combined CMF. It also gives cautions for the use of the combined value.

NOTE: This tool is not intended for combining CMFs for different treatments. See below.

- Example: You have two CMFs that estimate the effect on total crashes of installing wider edgelines. You want to know if they are similar enough to be combined into a single value to be used for an upcoming project to widen edgelines. This tool is intended for this use.
- Example: You have two CMFs, one for the effect of wider edgelines and one for the effect of rumble strips. You want to calculate a single combined CMF that will provide an estimate of the effect on total crashes if both treatments were installed together. This tool is NOT for that use. However, guidance for that purpose is provided under NCHRP 17-63.

Using the Tool

To use the tool, a user inputs two or more CMFs and their standard errors (both required) and receives a calculated combined CMF. There must be at least two CMFs entered, but no more than 100 CMFs. Figure E1 shows the input screen from the Main tab of the tool.

CMF Combination Result Based on Homogeneity Testing		Summary Stats on the CMFs You Provided	
Combined CMF	Enter 2 or more CMFs in the shaded area below.	Number of CMFs being tested	0
Caution 1 (if applicable)		Range of CMF values	0 to 0
Caution 2 (if applicable)		Range of standard errors	0 to 0
Caution 3 (if applicable)			

CMF Input			
CMF Value (required)	CMF Standard Error (required)	Treatment Name (if desired)	Other Description (if desired)

Figure E1. Main Screen of CMF Combination Tool

The top middle portion of the sheet is used to display the resulting combined CMF and caution messages. The top right portion of the screen is used to display a summary of the CMFs entered by the user, including the number of CMFs, the range of the CMF values, and the range of the standard errors. The colored area below these areas is for user input.

The caution messages inform the user about certain conditions that might apply to the results.

- Caution 1 alerts the user if the combined CMF is greater than 1.0, indicating that the treatment may cause an increase in crashes.
- Caution 2 alerts the user if the combined CMF has a standard error which is large enough to put the reliability of the result in question.
- Caution 3 alerts the user if more than half of the CMFs have a statistical weight less than 4.0, which calls into question the reliability of the resulting combined CMF.

Example Images

The screenshots below provide a series of examples showing the tool being used to compare and potentially combine two CMFs. Figure E2 is an example of two CMFs being combined successfully. Figure E3 through Figure E6 show examples of CMFs which should not be combined or for which the combined result should be used with caution.

CMF Combination Result Based on Homogeneity Testing		Summary Stats on the CMFs You Provided	
Combined CMF	0.72	Number of CMFs being tested	2
Caution 1 (if applicable)		Range of CMF values	0.62 to 0.75
Caution 2 (if applicable)		Range of standard errors	0.04 to 0.06
Caution 3 (if applicable)			

CMF Input			
CMF Value (required)	CMF Standard Error (required)	Treatment Name (if desired)	Other Description (if desired)
0.75	0.04		
0.62	0.06		

Figure E2. Example of two CMFs that were combined into a single value.

CMF Combination Result Based on Homogeneity Testing		Summary Stats on the CMFs You Provided	
Combined CMF	CMFs should not be combined (variability is too large)	Number of CMFs being tested	2
Caution 1 (if applicable)		Range of CMF values	0.62 to 0.9
Caution 2 (if applicable)		Range of standard errors	0.04 to 0.06
Caution 3 (if applicable)			

CMF Input			
CMF Value (required)	CMF Standard Error (required)	Treatment Name (if desired)	Other Description (if desired)
0.9	0.04		
0.62	0.06		

Figure E3. Example of two CMFs that should not be combined because the statistical variability was too large.

CMF Combination Result Based on Homogeneity Testing		Summary Stats on the CMFs You Provided	
Combined CMF	0.86	Number of CMFs being tested	2
Caution 1 (if applicable)	If you will be implementing this treatment, be aware that it may potentially increase crashes (the upper level of the confidence interval exceeds 1.0).	Range of CMF values	0.8 to 0.9
Caution 2 (if applicable)		Range of standard errors	0.1 to 0.1
Caution 3 (if applicable)			

CMF Input			
CMF Value (required)	CMF Standard Error (required)	Treatment Name (if desired)	Other Description (if desired)
0.9	0.1		
0.8	0.1		

Figure E4. Example of two CMFs that have a combined result that indicates that the treatment might increase crashes.

CMF Combination Result Based on Homogeneity Testing		Summary Stats on the CMFs You Provided	
Combined CMF	0.72	Number of CMFs being tested	2
Caution 1 (if applicable)		Range of CMF values	0.62 to 0.9
Caution 2 (if applicable)	The combined CMF has a relatively large standard error, so it may not be a reliable basis for decision making. If the CMF is used, consider the decision that would be made if the true CMF value were as low as 0.56, and the decision that would be made if the true CMF value were as high as 0.93. If the decisions reached are not the same, then the combined CMF should not be used.	Range of standard errors	0.1 to 0.2
Caution 3 (if applicable)			

CMF Input			
CMF Value (required)	CMF Standard Error (required)	Treatment Name (if desired)	Other Description (if desired)
0.9	0.2		
0.62	0.1		

Figure E5. Example of two CMFs that have a combined result that should be used with caution for producing quantitative estimates of crash frequency reduction because the result may be statistically unreliable due to a large standard error.

CMF Combination Result Based on Homogeneity Testing		Summary Stats on the CMFs You Provided	
Combined CMF	0.80	Number of CMFs being tested	4
Caution 1 (if applicable)		Range of CMF values	0.65 to 0.8
Caution 2 (if applicable)		Range of standard errors	0.05 to 0.5
Caution 3 (if applicable)	The reliability of this combined CMF is questionable because more than half of the CMFs have a statistical weight of less than 4.0.		

CMF Input			
CMF Value (required)	CMF Standard Error (required)	Treatment Name (if desired)	Other Description (if desired)
0.8	0.05		
0.7	0.4		
0.72	0.5		
0.65	0.42		

Figure E6. Example of four CMFs that have a combined result that should be used with caution for producing quantitative estimates of crash frequency reduction because the result may be statistically unreliable due to low statistical weights.