CMF Clearinghouse Webinar, December 2014

Questions submitted by attendees with responses from CMF Clearinghouse team

Q: When will new CMFs be added to HSM? There are so many CMFs on CMF Clearinghouse but not included in the HSM.

A: The 2nd edition of the Highway Safety Manual is expected to be published in 2018 or 2019. New CMFs that have been added to the Clearinghouse since the 1st edition of the HSM will be incorporated in some manner yet to be determined.

Q: Why not use CRF's?

For many years, it was common for departments of transportation to use the term Crash Reduction Factor (CRF), which indicated the crash reduction in terms of a percentage (e.g., a CRF of 20 represented a reduction of 20%). In more recent years, it has become more widely accepted to refer to the effect on crashes in terms of a Crash Modification Factor (CMF), which indicates the effect of the countermeasure in terms of a multiplicative factor (e.g., a CMF of 0.80 represents a reduction of 20%). The first edition of the Highway Safety Manual (2010) presented CMFs instead of CRFs. One major reason for this change was the confusion that can arise when a countermeasure or change in road feature has a negative effect – that is, an increase in crashes. For example, a traffic signal may increase rear end crashes. Using CRFs, this would need to be indicated with a negative sign (e.g., -30%) to indicate that it is a negative reduction (increase). Using CMFs, this would be indicated by a value greater than one (e.g., 1.3), which presents less risk for confusion.

Q: The star rating system was not addressed. Is there any guidance on which stars should be used for predictive analysis? I have heard to only use 4 and 5 star rated CMFs.

You won't hear that kind of "rule of thumb" guidance from the Clearinghouse. The star rating system is provided by the Clearinghouse to inform users about the quality of each CMF. The rating is based on factors such as the design of the study and the sample size. The mission of the CMF Clearinghouse is to provide this information to users, but the Clearinghouse does not provide guidance on a "minimum acceptable" level of star rating. In general, all users should strive to use the highest rated CMF that applies to their situation. Those are important words: "applies to their situation". As much as possible, you should use CMFs that were developed under the same conditions as the site of interest where you intend to use the CMF (e.g., urban CMF for an urban area, etc.). Although statistical reliability (indicated by the star rating) is important, the application details are important too. It may be the case that a lower rated CMF will match the site conditions more closely. In these cases, it is the job of the user to determine if a closer match to the site conditions is important enough to warrant using a lower rated CMF.

Q: Are all CMFs applicable in the same way in different states? Isn't there a need for calibration of CMFs in addition to LCF [local calibration factor] for SPFs [safety performance functions]?

A: The safety research community has recognized the fact that while some CMFs might be applicable to many different areas of the country, other CMFs might be increased or decreased by differences in the terrain, driver population, design practices, and other factors. To this point, there is no guidance on calibrating CMFs to a local area, as is done with safety performance functions. There is an ongoing research project, NCHRP 17-63 "Guidance for Developing and Applying CMFs", which is addressing this issue.

Q: Should or can you average CMFs and if so are there any guidelines for doing this?

We assume you are postulating a scenario where you have searched for CMFs for a particular countermeasure and identified two or more CMFs that would seem to apply to your situation. First of all, check to see whether one of the CMFs would more closely fit your scenario. For example, if your site of interest is a rural location, and you have identified three potential CMFs that all apply to your countermeasure of interest, but they are for urban, rural, and suburban areas, respectively, it would be most appropriate to use the rural CMF.

However, if the potential CMFs are identical in terms of application details (e.g., area type, traffic volume range, number of lanes, etc.), then it would be reasonable to combine them. Calculating the average of the CMF values, while simple to perform, is not the most accurate method, since it does not account for the differences in variance that may exist among the CMFs. A fairly simple method was used for combining CMFs for the first edition of the Highway Safety Manual, using only the CMF value and its standard error. That method is illustrated on page 12-13 of the document titled "Methodology for the Development and Inclusion of Crash Modification Factors in the First Edition of the Highway Safety Manual" which can be accessed for free at: http://onlinepubs.trb.org/onlinepubs/circulars/ec142.pdf

Q: For an edgeline rumble strip countermeasure, is there a CMF to address loss of control crashes and another for drift off crashes?

A: In addition to producing a total CMF, study authors will sometimes produce CMFs specific to certain crash types, such as rear end or head on. In order to accommodate a wide range of studies, the CMF Clearinghouse database has codes for 23 specific crash types. However, very specific types, such as the ones you mention are not typical and there is not a unique Clearinghouse code for those. However, the Clearinghouse crash type code of "run off road" may address the type of crash you are referring to. Additionally, when there are very specific crash types indicated by a study author (e.g., crashes occurring

between 4 and 8pm on icy roads), the Clearinghouse will provide this information in the “comments” field of the CMF details.

Q: I prefer to use CMFs which were developed for certain area types (rural or urban) rather than CMFs that apply everywhere.

A: We agree with this approach. Any CMF user should endeavor to use a CMF that is as similar as possible to the intended site of interest. This might mean using an urban CMF when analyzing an urban site, or it might mean matching on some other factor, such as number of lanes or roadway class. If there is not a CMF available to match the conditions of the site of interest, then a more general CMF would be the next best option. For example, if the site of interest is urban, but there are not separate urban and rural CMFs available in the Clearinghouse, the next best option would be a general CMF that applies to all area types.

Q: Why would you ever multiply CMF's? Would you just choose one? Multiplying will give you a much smaller CMF. For example, 0.5x0.5 = 0.25. This makes no sense.

A: If you are applying two countermeasures which are expected to have independent effects, that is, they will address different crash types, it would be reasonable to estimate their combined effect by multiplying. For example, this could be true for an application of shoulder rumble strips (to decrease run off road crashes) and crosswalk enhancements (to decrease pedestrian crashes) on a segment of road. In your example, each countermeasure has a CMF of 0.5 (presumably for “total crashes”), which means that the countermeasure is expected to decrease the total crashes by half. If it is true that both countermeasures in your example have independent effects, then one countermeasure would reduce the total crashes by half (0.5), and the second countermeasure would further reduce that by half (0.25).

However, in most situations, countermeasures which are applied together at one location are related in terms of which crash type they address. For instance, an agency might apply post-mounted delineators and wider edgelines together at horizontal curves. Both of these countermeasures are intended to improve the delineation of the curve and prevent run off road crashes. In this case, multiplying their CMFs would not be appropriate. If both countermeasures had a CMF of 0.5 for total crashes, then the first countermeasure could be expected to reduce total crashes by half (0.5), but the effectiveness of the second countermeasure would be much more limited, since the first countermeasure has already reduced the type of crash that the second countermeasure is targeting. Thus, conservatively we can use 0.5 as the final CMF, or we can increase it slightly with the assumption that the second countermeasure will still have some effect. A white paper by Gross and Hamidi (http://www.cmfclearinghouse.org/collateral/Combining_Multiple_CMFs_Final.pdf) provides further details on when it is appropriate to multiply and when it is appropriate to use another method to estimate the combined effect.

Q: How should I conduct a benefit/cost analysis for combined CMF's?

If you are applying multiple countermeasures to one location, you will need to calculate the anticipated benefit of the installation using a CMF. This might be the multiplied product of two or more CMFs or it might be a more conservative estimate if the countermeasures are related to each other (see the answer to the previous question). Once you have determined the CMF value for the combined treatment of the site of interest, you can proceed with calculating the anticipated crash savings using the CMF and the anticipated costs of the combined treatments.

Q: How about for point countermeasures, such as installing a sign or a flashing light pole, etc. when there is no CMF in the Clearinghouse? What would you suggest?

In these situations, you will have to rely more heavily on engineering judgment. If you are interested in a countermeasure for which there are no CMFs in the Clearinghouse, try looking at similar countermeasures to see what would be a reasonable range of estimates for CMFs. For example, if you are interested in CMFs for a type of curve delineation and there is not an entry in the Clearinghouse for that countermeasure, look at the CMFs for related countermeasures such as post mounted delineators, raised pavement markers, or chevron signs. These countermeasures would address the same type of issue (clearer and more conspicuous alerts about upcoming curves) and the CMFs for these treatments may be the best source for determining the CMF to use for the countermeasure of interest. To this end, the Clearinghouse groups similar countermeasures into categories and subcategories to make it easier for users to see related countermeasures.

Q: I am looking for a CMF for the installation of a pedestrian barrier in the median to prevent mid-block pedestrian crossings. I haven't found anything. Any suggestions?

A: At this current date (December 2014), there are no CMFs in the Clearinghouse that would address the situation you pose. This is more often the case with pedestrian safety treatments, since there has been little crash-based research to develop pedestrian-related CMFs. Sometimes, there may be a CMF in the Clearinghouse for a countermeasure that is similar to the one for which you cannot find a CMF. However, that does not appear to be the situation here. Without solid research evidence, you must rely more heavily on engineering judgment. In this situation, if you anticipate that the pedestrian barrier will be effective and will prevent most pedestrians from crossing the road at that location, it would be reasonable to assume a highly effective CMF (i.e., a smaller value for the CMF).

Q: Are crash modifications factors meant to also be used in construction projects?

There is an entire category of the Clearinghouse dedicated to workzone CMFs. There are currently 82 workzone-related CMFs in the Clearinghouse (December 2014), addressing construction related actions such as “modify work zone length” and “single lane closure”.