

Practicing What We...Research:

How to Apply CMFs in Road Safety Audits, Consider CAVs/Technology, and Understand Recent Federal Research

Wednesday, December 7, 2022

2:00 – 3:30 PM EST



U.S. Department of Transportation
Federal Highway Administration



CRASH MODIFICATION FACTORS CLEARINGHOUSE

Agenda

- **Matt Hinshaw**, *Federal Highway Administration*
 - Overview of the CMF Clearinghouse
- **Taha Saleem**, *UNC Highway Safety Research Center and Manager of the CMF Clearinghouse*
 - Overview of the CMF Clearinghouse resources available for your assistance
- **Kate Bradbury**, *Parametrix*
 - Use of CMFs in an RSA for Olympic National Park
- **Karen Timpone**, *Federal Highway Administration*, and **Raul Avelar**, *Texas A&M Transportation Institute*
 - Impacts of CAV Technology on Proven Safety Countermeasures
- **Raghavan Srinivasan**, *UNC Highway Safety Research Center*
 - Overview of the various current and recently completed CMF-related National Cooperative Highway Research Program (NCHRP) projects

Webinar “Housekeeping”

- Participants are muted
- Submit questions via the Q&A option (Chat feature not available)
- The session is being recorded – will be posted on the CMF Clearinghouse site later
- Use the “Speaker View” option

Poll

- **How many people are attending the webinar at your location?**

Disclaimer

This presentation was created and is being co-presented by FHWA and outside parties. The views and opinions expressed in this presentation are the presenters' and do not necessarily reflect those of FHWA or the U.S. Department of Transportation (USDOT). The contents do not necessarily reflect the official policy of the USDOT.

Overview of the CMF Clearinghouse

Matt Hinshaw
FHWA Office of Safety

What is a Crash Modification Factor (CMF)?

- Multiplicative factor that reflects the expected safety effectiveness of a countermeasure
- Used to compute the expected number of crashes after implementing a given countermeasure at a specific site

CMF < 1	CMF = 1	CMF > 1
Decrease in Crashes	No Change in Crashes	Increase In Crashes

Source: FHWA

- Examples
 - CMF of 0 represents a 100% reduction in the number of crashes
 - CMF of 0.8 represents a 20% reduction in the number of crashes
 - CMF of 1.2 represents a 20% increase in the number of crashes

What is the CMF Clearinghouse?

- A regularly updated, online repository of CMFs,
- A mechanism for sharing newly developed CMFs, and
- Educational information on the proper application of CMFs.

Poll

- **How often do you use the CMF Clearinghouse?**
 - Daily
 - Weekly
 - Monthly
 - Once or Twice Per Year
 - Never

CMF Inclusion Criteria

- The CMF Clearinghouse presents CMFs from studies that meet the following criteria:
 - The study must be based on crash data
 - The study must have the objective of quantifying the safety effect of a roadway feature or characteristic
 - The study must be focused on determining the safety effect of an infrastructure characteristic, feature, or modification that would fall under engineering responsibilities
 - The study must explicitly present quantified CMF values or CMFunctions

Overview of the CMF Clearinghouse Resources Available for your Assistance

Taha Saleem
UNC Highway Safety Research Center

CMF Clearinghouse Homepage



CRASH MODIFICATION FACTORS CLEARINGHOUSE

[ABOUT THE CLEARINGHOUSE](#) | [USING CMFs](#) | [DEVELOPING CMFs](#) | [ADDITIONAL RESOURCES](#)

The **Crash Modification Factors Clearinghouse** provides a searchable database of CMFs along with guidance and resources on using CMFs in road safety practice.

ENTER SEARCH TERMS...

Countermeasure Name

SEARCH

FREQUENT SEARCHES: [ROUNDBOUT](#) | [SIGNAL](#) | [PEDESTRIAN](#) | [COMPLETE STREETS](#) | [TSMO](#) | [BROWSE ALL](#)



WHAT ARE CMFs?

A crash modification factor (CMF) is used to compute the expected number of crashes after implementing a countermeasure on a road or intersection.

[LEARN MORE](#)



UPCOMING WEBINAR

Practicing What We... Research
Wednesday, Dec. 7, 2022
2-3:30 p.m. EST

[LEARN MORE AND REGISTER](#)



UPDATED RATINGS

The CMF Clearinghouse transitioned to the CMF rating criteria developed as part of the NCHRP 17-72 project for the 2nd edition of the Highway Safety Manual on February 15, 2021.

[LEARN MORE](#)

Source: FHWA



CRASH MODIFICATION FACTORS CLEARINGHOUSE

“About The Clearinghouse”

The Crash Modification Factors Clearinghouse is a free, publicly available database of CMFs along with guidance and resources to help you understand and use CMFs for safety practice.

able database of CMFs
safety practice.

- CMF Clearinghouse User Guide
- CMF Clearinghouse Brochure
- CMF Update (e-Newsletter)
- CMF Clearinghouse Webinars
- FAQs
- Glossary
- Star Quality Rating
- Relationship to the Highway Safety Manual
- In the News
- Data Download (API)

FREQUENT SEARCHES: [ROUNDAABOUT](#) | [SIGNAL](#)

[NO](#) | [BROWSE ALL](#)



WHAT ARE CMFs?

A crash modification factor (CMF) is used to



UPCOMING WEBINAR

Practicing What We Research



UPDATED RATINGS

The CMF Clearinghouse transitioned to the CMF

Source:
FHWA

“Using CMFs”



USING CMFs

Using the CMF Clearinghouse to find and identify a CMF is often only the first step for a transportation practitioner. The following resources provide practical guidance on using CMFs.

[QUICK START GUIDE TO USING CMFs](#)

Are you new to using CMFs? This Quick Start Guide provides a 2-page overview of the process of selecting CMFs for prospective countermeasures and applying the CMFs to estimate safety benefits.

[CMFs IN PRACTICE](#)

The CMFs in Practice Series includes five separate guides that identify opportunities to consider and quantify safety in specific activities, including roadway safety management processes, road safety audits, design decisions and exceptions, development and analysis of alternatives and value engineering. The series also includes reference documents that provide background information on crash modification factors and safety performance functions.

- [QUANTIFYING SAFETY IN THE ROADWAY SAFETY MANAGEMENT PROCESS](#)
- [QUANTIFYING SAFETY IN THE ROAD SAFETY AUDIT PROCESS](#)
- [DESIGN DECISIONS AND EXCEPTIONS](#)
- [DEVELOPMENT AND ANALYSIS OF ALTERNATIVES](#)
- [USING CMFs TO QUANTIFY THE SAFETY IN THE VALUE ENGINEERING PROCESS](#)

[INVESTIGATION OF EXISTING AND ALTERNATIVE METHODS FOR COMBINING MULTIPLE CMFs](#)

This paper brings to light several issues associated with the application of multiple CMFs and provide guidance on how to estimate the combined treatment effect when multiple treatments are installed at a given location. The paper presents several existing methods for combining multiple CMFs and discusses the associated issues. Next, several ideas are explored for overcoming the identified issues. Finally, the methods are applied and compared to existing CMFs for multiple treatments in an attempt to validate the new procedures.

TRAININGS

- [APPLICATION OF CRASH MODIFICATION FACTORS COURSE \(SELF-PACED LESSON AND LIVE WEBINAR\)](#)
This course focuses on the application of Crash Modification Factors (CMFs) to select countermeasures. It covers the project development cycle (starting from network screening and site selection for safety review), diagnostics of safety concerns, cost-benefit evaluation, and countermeasure selection. Upon completion of the course, participants will be able to explain how CMFs are used to estimate the safety effects of highway improvements and apply CMFs to compare and select highway safety improvements. This course combines a web-conference and a self-paced lesson that aids in application to your current projects.
- [SCIENCE OF CRASH MODIFICATION FACTORS \(SELF-PACED LESSON AND LIVE WEBINAR\)](#)
This course provides participants with the knowledge and skills needed to critically assess the quality of Crash Modification Factors (CMFs). The course covers concepts underlying the measurement of safety and the development of CMFs, key statistical issues that affect the development of quality CMFs, key methodological issues that affect the development of quality CMFs, and the general and methodological issues and statistical thresholds used to recognize quality CMFs.

Source: FHWA

“Developing CMFs”



DEVELOPING CMFs

Many researchers conduct studies in which they develop CMFs. However, it takes planning and intentional study design to produce good quality CMFs. The following resources provide guidance on how to produce the best quality CMFs as well as information on current CMF research needs.

[CMF CLEARINGHOUSE FLYER: "BETTER CMFs , SAFER ROADWAYS: TIPS FOR BUILDING HIGH-QUALITY CMFs "](#)

This two-page flyer provides a basic overview on how to develop high-quality CMFs, with information on questions such as, "What does a quality CMF study look like?" and "Why is documentation important?"

[A GUIDE TO DEVELOPING QUALITY CRASH MODIFICATION FACTORS](#)

The purpose of this guide is to provide direction to agencies interested in developing crash modification factors (CMFs). Specifically, this guide discusses the process for selecting an appropriate evaluation methodology and the many issues and data considerations related to various methodologies.

[RECOMMENDED PROTOCOLS FOR DEVELOPING CRASH MODIFICATION FACTORS](#)

The CMF Protocols provide guidance for the development and documentation of research studies that develop CMFs. The major goal of these protocols is to describe what pieces of the research study should be documented by the study authors and how various potential biases should be addressed.

[QUICK REFERENCE ON WHAT TO DOCUMENT ABOUT THE CMF YOU HAVE DEVELOPED](#)

This 2-page appendix from the above document provides a summary of the items should be documented in a report or article from a study which developed CMFs. It can serve as a quick reference for study authors to make sure that all necessary information has been included in the report. This information is critical for safety practitioners who need to know how this CMF can be applied and the CMF Clearinghouse team who need to know how to rate the CMF.

CMF NEEDS

[CMF MOST WANTED LIST](#)

The research topics in this list represent areas where crash-based safety evaluation research is needed.

[CMF NEEDS ASSESSMENT](#)

This report summarizes the proceedings of a workshop in 2014 that brought together CMF stakeholders to identify CMF research needs.

[SUBMIT A CMF RESEARCH NEED](#)

If you see a lack of CMFs for a particular topic, submit your idea for a future research need.

TRAININGS

[Developing Quality CMFs](#)

Coming soon via NHI

Source: FHWA

“Additional Resources”



CRASH MODIFICATION FACTORS CLEARINGHOUSE

[ABOUT THE CLEARINGHOUSE](#) | [USING CMFs](#) | [DEVELOPING CMFs](#) | [ADDITIONAL RESOURCES](#)

ADDITIONAL RESOURCES

The following resources are provided to assist CMF Clearinghouse users who are interested in obtaining guidance on other topics related to CMFs.

[HOW TO DEVELOP AND USE SPFS](#)

[RESOURCES FOR COUNTERMEASURE SELECTION](#)

[RESOURCES FOR COST BENEFIT ANALYSIS](#)

[RESOURCES FOR BEHAVIORAL COUNTERMEASURES](#)

[INTERNATIONAL RESOURCES](#)

[STATE SELECTED CMF LISTS](#)

[HIGHWAY SAFETY MANUAL](#)

[HISTORICAL RESOURCE: FHWA DESKTOP REFERENCE FOR CRASH REDUCTION FACTORS](#)

Source: FHWA

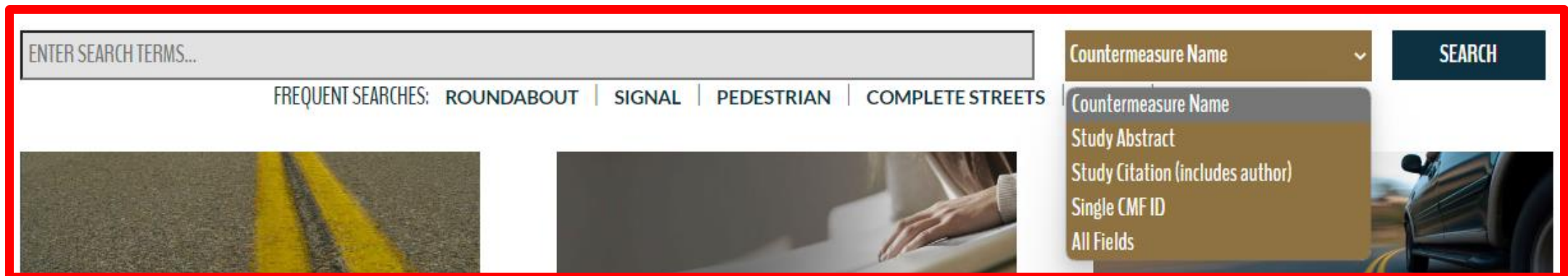


CRASH MODIFICATION FACTORS CLEARINGHOUSE

Searching for CMFs



The **Crash Modification Factors Clearinghouse** provides a searchable database of CMFs along with guidance and resources on using CMFs in road safety practice.



Source: FHWA

Filtering CMFs

SEARCH RESULTS

There were 346 CMFs returned for your search on "roundabout". [\[MODIFY YOUR SEARCH\]](#).

Having trouble deciding between similar CMFs? Use our [COMPARISON TOOL](#) or [CHECK OUT OUR FAQs](#).

Overwhelmed by too many results? See our [SEARCH TIPS](#).

- ▶ STAR QUALITY RATING
 - 1 (24)
 - 2 (166)
 - 3 (113)
 - 4 (39)
 - 5 (4)
- ▶ COUNTRY
 - U.S. & Canada (226)
 - International (120)
- ▶ CRASH TYPE
- ▶ CRASH WEATHER
- ▶ CRASH TIME OF DAY
- ▶ CRASH SEVERITY
- ▶ ROADWAY TYPE
- ▶ AREA TYPE
- ▶ INTERSECTION TYPE
- ▶ INTERSECTION GEOMETRY
- ▶ TRAFFIC CONTROL
- ▶ IN HSM

Results Control: [COLLAPSE ALL](#) | [EXPAND ALL](#)

Click on the links below to expand individual categories.

- ▶ Category: Bicyclists (6)
- ▶ Category: Interchange design (18)
- ▶ Category: Intersection geometry (314)
- ▶ Category: Speed management (8)

Source: FHWA

Comparing CMFs

SEARCH RESULTS

There were 346 CMFs returned for your search on "roundabout". [\[MODIFY YOUR SEARCH\]](#).

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Results Control: [COLLAPSE ALL](#) | [EXPAND ALL](#)
Click on the links below to expand individual categories.

[EXPORT ALL RESULTS TO EXCEL](#)

▼ Category: Bicyclists (6)

▼ Subcategory: None (6)

▼ Countermeasure: Replacement of traditional intersection with roundabout with a grade separated cycle path

Compare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
<input type="checkbox"/>	0.56	44	★☆☆☆☆	Vehicle/bicycle	All	Urban	DANIELS ET AL., 2009	The number of crashes in ... [READ MORE]
<input type="checkbox"/>	1.31	-31	★☆☆☆☆	Vehicle/bicycle	K (fatal),A (serious injury)	Urban	DANIELS ET AL., 2009	The number of crashes in ... [READ MORE]

[Compare](#) [Reset Compare](#)

*NOTE: You can compare CMFs across countermeasures, subcategories, and categories.

Source: FHWA

Comparing CMFs

Countermeasure Name	Conversion of intersection into high-speed roundabout	Conversion of intersection into high-speed roundabout	Conversion of intersection into high-speed roundabout	Conversion of intersection into high-speed roundabout
CMF ID	<u>5229</u>	<u>10434</u>	<u>10438</u>	<u>10439</u>
CMF	0.659	0.59	0.62	0.57
Study Reference	<u>QIN ET AL., 2013</u>	<u>BAGLEY, D.L., 2020</u>	<u>BAGLEY, D.L., 2020</u>	<u>BAGLEY, D.L., 2020</u>
<i>Unadjusted Standard Error CMF</i>	<i>0.094</i>	<i>0.1</i>	<i>0.17</i>	<i>0.11</i>
CMFunction				
<i>Star Rating</i>	★★★☆☆	★★★★☆	★★★★☆	★★★★☆
<i>Rating Score Total</i>	45	110	105	105
<i>Crash Type</i>	All	All	All	All
<i>Crash Severity</i>	All			
<i>Crash Time of Day</i>	All	All	All	All
<i>Area Type</i>	All	All	All	All
<i>Road Division Type</i>	All			
<i>Road Type</i>	<i>Not specified</i>	All	All	All
<i>Number of Lanes</i>	2,4			
Intersection Type	Roadway/roadway (not interchange related)	Roadway/roadway (not interchange related)	Roadway/roadway (not interchange related)	Roadway/roadway (not interchange related)
<i>Intersection Geometry</i>	<i>3-leg,4-leg</i>	<i>3-leg,4-leg</i>	<i>3-leg</i>	<i>4-leg</i>

Source: FHWA

CMF Details

CMF / CRF DETAILS

CMF ID: 2944

REPLACEMENT OF TRADITIONAL INTERSECTION WITH ROUNDABOUT WITH A GRADE SEPARATED CYCLE PATH

DESCRIPTION: INSTALLATION OF A ROUNDABOUT WITH A GRADE SEPARATED CYCLE PATH IN PLACE OF A TRADITIONAL (SIGNALIZED OR UNSIGNALIZED) INTERSECTION.

PRIOR CONDITION: TRADITIONAL SIGNALIZED OR UNSIGNALIZED INTERSECTION

CATEGORY: BICYCLISTS

STUDY: [INJURY CRASHES WITH BICYCLISTS AT ROUNDABOUTS: INFLUENCE OF SOME LOCATION CHARACTERISTICS AND THE DESIGN OF CYCLE FACILITIES, DANIELS ET AL., 2009](#)

Star Quality Rating:	☆☆☆☆ [VIEW SCORE DETAILS]
Rating Points Total:	35

Crash Modification Factor (CMF)	
Value:	0.56
Adjusted Standard Error:	
Unadjusted Standard Error:	0.691

Crash Reduction Factor (CRF)	
Value:	44 (This value indicates a decrease in crashes)
Adjusted Standard Error:	
Unadjusted Standard Error:	69.1

Source: FHWA

Applicability	
Crash Type:	Vehicle/bicycle

Downloading CMFs (Option 1)

SEARCH RESULTS

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Results Control: [COLLAPSE ALL](#) | [EXPAND ALL](#)
Click on the links below to expand individual categories.

EXPORT ALL RESULTS TO EXCEL

▼ Category: Bicyclists (6)
▼ Subcategory: None (6)
▼ Countermeasure: Replacement of traditional intersection with roundabout with a grade separated cycle path

Compare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
<input type="checkbox"/>	0.56	44	★☆☆☆☆	Vehicle/bicycle	All	Urban	DANIELS ET AL., 2009	The number of crashes in ... [READ MORE]
<input type="checkbox"/>	1.31	-31	★☆☆☆☆	Vehicle/bicycle	K (fatal),A (serious injury)	Urban	DANIELS ET AL., 2009	The number of crashes in ... [READ MORE]

[Compare](#) [Reset Compare](#)

*NOTE: You can compare CMFs across countermeasures, subcategories, and categories.

Source: FHWA



Downloading CMFs (Option 2)

The screenshot shows the CMF Clearinghouse website. At the top is a dark blue header with the CMF logo and the text 'CRASH MODIFICATION FACTORS CLEARINGHOUSE'. Below this is a brown navigation bar with links for 'ABOUT THE CLEARINGHOUSE', 'USING CMFs', and 'DEV'. The main content area has a white background with a section titled 'CMF CLEARINGHOUSE DATA DOWNLOAD'. Under this title, it says 'Last Update: September 14, 2022' and provides a paragraph of text: 'This page provides downloads of the entire CMF Clearinghouse database. This is intended to help users integrate the Clearinghouse into analytical tools. The data is provided in two formats, XML (.xml) and Excel (.xlsx). These data files are updated regularly.' Below this text are four underlined links: 'DATA DICTIONARY', 'DATA DOWNLOAD - XML DOCUMENT', 'DATA DOWNLOAD - EXCEL SPREADSHEET', and 'DATA DOWNLOAD - CSV FILE'. On the right side, a brown navigation menu is open, listing various resources. The 'Data Download (API)' link is highlighted with a red rectangular border.

CMF CLEARINGHOUSE DATA DOWNLOAD

Last Update: September 14, 2022

This page provides downloads of the entire CMF Clearinghouse database. This is intended to help users integrate the Clearinghouse into analytical tools. The data is provided in two formats, XML (.xml) and Excel (.xlsx). These data files are updated regularly.

[DATA DICTIONARY](#)

[DATA DOWNLOAD - XML DOCUMENT](#)

[DATA DOWNLOAD - EXCEL SPREADSHEET](#)

[DATA DOWNLOAD - CSV FILE](#)

- CMF Clearinghouse User Guide
- CMF Clearinghouse Brochure
- CMF Update (e-Newsletter)
- CMF Clearinghouse Webinars
- FAQs
- Glossary
- Star Quality Rating
- Relationship to the Highway Safety Manual
- In the News
- Data Download (API)**

Source: FHWA

CMF Clearinghouse Rating System

- The CMF Clearinghouse transitioned to the CMF rating criteria developed as part of the NCHRP 17-72 project for the 2nd edition of the Highway Safety Manual on February 15, 2021



Poll

- **Were you aware that the CMF Clearinghouse has transitioned to a new rating system?**
 - Yes
 - No
 - Not Sure

CMF Clearinghouse Rating System

The **Crash Modification Factors Clearinghouse** provides a searchable database of CMFs along with guidance and resources on using CMFs in road safety practice.

ENTER SEARCH TERMS... Countermeasure Name

FREQUENT SEARCHES: [ROUNDAABOUT](#) | [SIGNAL](#) | [PEDESTRIAN](#) | [COMPLETE STREETS](#) | [TSMO](#) | [BROWSE ALL](#)



WHAT ARE CMFs?

A crash modification factor (CMF) is used to compute the expected number of crashes after implementing a countermeasure on a road or intersection.

[LEARN MORE](#)



UPCOMING WEBINAR

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[LEARN MORE AND REGISTER](#)



UPDATED RATINGS

The CMF Clearinghouse transitioned to the CMF rating criteria developed as part of the NCHRP 17-72 project for the 2nd edition of the Highway Safety Manual on February 15, 2021.

[LEARN MORE](#)

Source: FHWA

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Wrap-Up

Matt Hinshaw
FHWA Office of Safety

All CMFs in the CMF Clearinghouse have a Unique Identification Number (ID)

- The CMF ID allows you to easily document the CMF in a report, study, or presentation for future reference
- The CMF ID also allows others to quickly and easily find the CMF in the CMF Clearinghouse to determine if it is applicable to a particular scenario

Where to Find the CMF ID?



CMF / CRF DETAILS

CMF ID: 3127

CONVERT MINOR-ROAD STOP CONTROL TO ALL-WAY STOP CONTROL

DESCRIPTION:

PRIOR CONDITION: TWO-WAY STOP SIGN CONTROL WITH AND WITHOUT FLASHING BEACONS.

CATEGORY: INTERSECTION TRAFFIC CONTROL

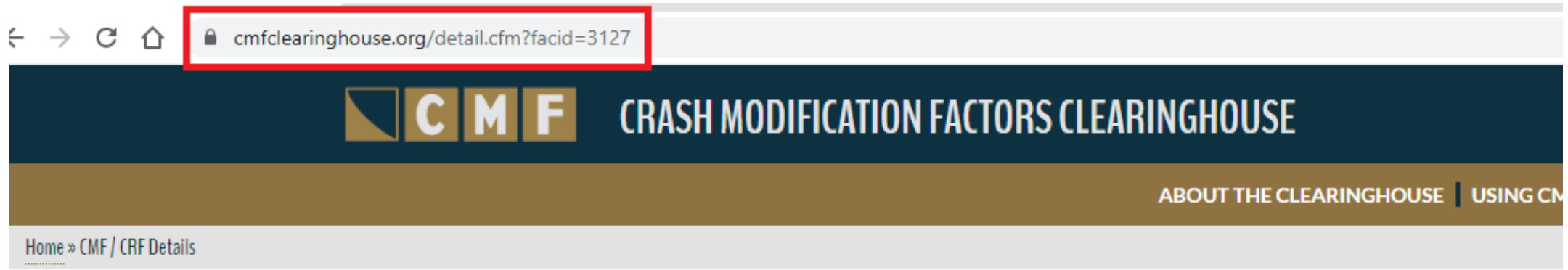
STUDY: EVALUATION OF THE CONVERSION FROM TWO-WAY STOP SIGN CONTROL TO ALL-WAY STOP SIGN CONTROL AT 53 LOCATION

2010

Location of unique URL on the CMF Details web page. (Source: FHWA)

Each CMF Details page has a unique URL, or web address. For example, the URL for CMF ID 3127 is <http://www.cmfclearinghouse.org/detail.cfm?facid=3127>.

Where to Find the CMF ID?



The CMF ID is listed at the top of the CMF Details web page.

CMF / CRF DETAILS

CMF ID: 3127

CONVERT MINOR-ROAD STOP CONTROL TO ALL-WAY STOP CONTROL

DESCRIPTION:

PRIOR CONDITION: TWO-WAY STOP SIGN CONTROL WITH AND WITHOUT FLASHING BEACONS.

CATEGORY: INTERSECTION TRAFFIC CONTROL

STUDY: EVALUATION OF THE CONVERSION FROM TWO-WAY STOP SIGN CONTROL TO ALL-WAY STOP SIGN CONTROL AT 53 LOCATION

2010

Location of unique URL on the CMF Details web page. (Source: FHWA)

How to Search for a CMF using a CMF ID?



The **Crash Modification Factors Clearinghouse** provides a searchable database of CMFs along with guidance and resources on using CMFs in road safety practice.

The CMF ID can also be used for a Single CMF ID Search

Searching for a CMF using the CMF ID number. (Source: FHWA)



Source: FHWA

Remember to Always
Cite the Site!
*Share the CMF ID When Referencing a
Specific CMF*

Wrap-up

- Future activities
 - White Paper on Lessons Learned During Combining CMFs
 - Convert programming language from ColdFusion to PHP
 - Change domain name to dot.gov
- Post-webinar survey
- Certificate of attendance

Wrap-up

- New NHI Course!
 - *Introduction to Data Driven Safety Analysis (DDSA) (380125)*
 - Upon completion of the course, participants will be able to:
 - Explain the value of using DDSA to support decision-making
 - Describe the application of DDSA methods to consider safety performance.
 - Identify data to support DDSA methods and decisions.
 - Communicate the results of DDSA to other transportation and safety professionals.
 - Identify tools and resources to support DDSA.
 - *Look out for a link to this course or search NHI's website*
 - **No charge to participants**

www.CMFClearinghouse.org

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U.S. Department of Transportation
Federal Highway Administration



CRASH MODIFICATION FACTORS CLEARINGHOUSE