



July 23, 2012

Crash Weighting Research Plan

Will crash weighting improve the capability of FMCSA to identify high crash-risk motor carriers?

INTRODUCTION:

Why research crash weighting?

The Federal Motor Carrier Safety Administration (FMCSA) is conducting a research study to better understand the safety benefits of adjusting crash weights in the Safety Measurement System (SMS) based on the carrier's role in the crash (i.e., preventability). The Crash Indicator in SMS currently utilizes all crashes. This safety measurement area has proven to be one of the better predictors of future crash risk. FMCSA is considering modifying the Crash Indicator to weight crashes not only based on severity and timeliness but also on the role of the motor carrier in the crash.

SMS is a core component of the Agency's compliance and enforcement programs. SMS is designed to help the Agency prioritize its resources to have the greatest impact on the compliance and safety of the commercial motor vehicles operating on the nation's highways. Currently, the SMS Crash Indicator considers a motor carrier's histories or patterns of high crash involvement, including frequency and severity, based on information from state-reported crashes.

In response to stakeholder interest and in line with FMCSA's commitment to continuous improvement, the Agency has taken steps to consider whether a carrier's role in crashes is a better indicator of future crash risk. The Agency conducted an initial analysis that tested the coding accuracy and consistency of police accident reports (PARs) as a potential source of information for determining a carrier's role in crashes. (The PAR Analysis Results are available online at http://csa.fmcsa.dot.gov/documents/PARCodingTest_7-2012.pdf). The outcome of this analysis indicated that there was approximately 93% agreement between PARs coded by two different coders.

Although this initial analysis provided key information about the consistent and accurate coding of PARs, additional questions remain that must be explored to assess the feasibility of accurately determining a motor

carrier's role in crashes and ascertain whether that determination is a better indicator of future crash risk.

RESEARCH GOAL

The planned research study will provide necessary insight to ensure Agency decisions related to the development of a crash weighting process are based on sound analysis and science. The research will focus on answering the following key questions:

1. Do police accident reports (PARs) across the nation provide sufficient, consistent, and reliable information to support crash weighting determinations?
2. Will a crash weighting determination process offer an even stronger predictor of crash risk than crash involvement and how will crash weighting be implemented into SMS?
3. How would the Agency manage the process for making crash weight determinations including public input to the process?

The Agency's approach toward answering these questions in the planned research study is described in the following sections.

RESEARCH APPROACH

Sufficiency, consistency, and reliability of PARs to support crash weighting

To validate the potential use of PARs in determining the role of the motor carrier in a crash, it needs to be established that PARs are a sufficient and reliable source of information. Research and analysis will be performed to better understand the accuracy of the PAR. The first step will be to leverage prior work in this area, including studies from various states, work done in Canada, and studies completed by NHTSA, and FMCSA. Particular attention will be paid to lessons learned from the Agency's PAR Analysis Results.

To determine whether PARs are a sufficient and reliable source of information on which to base crash weights, FMCSA will also code two sets of PARs that are aligned

with records in two databases to determine the role of the motor carrier in the crash:

- **Fatality Analysis Reporting System (FARS)** – this data set contains information on all fatal crashes that is acquired from the PAR, medical records, and supplemental information gathered by the FARS analyst. FARS data from 2008 – 2010 (approximately 10,000 crashes that involved a large truck or motorcoach) will be reviewed to determine the role of the motor carrier in the crash.
- **National Motor Vehicle Crash Causation Study (NMVCCS)** – this data set includes crashes that involved at least one light passenger vehicle and resulted in that vehicle being towed due to damage¹. The 1,530 crashes in NMVCCS involving large trucks or motorcoaches will be reviewed to determine the role of the motor carrier in the crash.

Crashes that have been coded to determine the motor carrier's role in the crash will be analyzed by cross-checking the PAR with the supplemental information found in various data sets to see if the PAR coding results are upheld. The results will be reported in terms of discrepancies found between the data sets including example discrepancies. This analysis will be done in two phases based on the availability of data:

Phase 1: Comparing Large Truck Crash Causation Study (LTCCS) data to PAR

Phase 2: Comparing FARS/NMVCCS data to PAR

PARs will then be evaluated to investigate whether they are a sufficient data source for determining crash weight and if the Motor Carrier Management Information System (MCMIS) data alone provides enough information to make a crash weighting determination for use in analysis. The evaluation will be conducted on single-vehicle crashes and crashes with out-of-service (OOS) violations.

¹ National Highway Traffic Safety Administration. *National Motor Vehicle Crash Causation Survey: SAS Analytical Users Manual*. December 2008.
<http://www-nrd.nhtsa.dot.gov/Pubs/811053.pdf>

Single-vehicle crashes in MCMIS can be easily identified, and it is hypothesized that these crashes would receive the full crash weighting since only one vehicle is involved in the crash. The major exceptions to this rule are collisions with non-motorized vehicles and pedestrians. The single-vehicle crashes will be compared to the crash weight determination coming from the FARS and LTCCS data to determine if this hypothesis is valid. If results prove promising, the single-vehicle crash data will be used in analysis to determine the benefits of crash weighting.

Lastly, crashes with post-crash inspections that result in an OOS violation will be evaluated and compared to the crash weight determinations coming from the FARS and NMVCCS data. If the carrier is found to have a driver with an OOS violation or vehicle with a pre-crash OOS violation (which means they should not have been on the road), the crash would automatically be given the highest crash weight.

Crash weighting versus crash involvement as a predictor of crash risk

Both the benefits and feasibility of weighting crashes prior to their inclusion in the SMS are currently unknown. FMCSA is seeking to estimate the value added by weighting crashes. The expected benefits are a better predictive quality of future crashes and more efficient management of limited resources to target motor carriers for intervention. There are several possibilities for how weighted crashes could be used in SMS. Analysis will be performed to determine what method best supports FMCSA's safety and efficiency goals.

A literature search will be conducted to see whether there are examples of similar analyses in industry or academia that could be considered or applied. As part of this literature search, we will seek out industry studies and attempt to consult with insurance companies to find any existing analysis results that could assist in establishing crash weighting.

To test the expectation that weighting crashes will enable better predictions of future crash risk and more efficiently target enforcement, analysis will be performed using a set of weighted crashes to identify carriers and drivers with a high risk of future crashes. Output from this analysis will then be compared to the current Crash Indicator measure in SMS. The data set used in this analysis will include any crashes that have been reliably coded to determine the carrier's role in the crash. This data set may include crashes that were not coded using the standard PAR method (for example, the single-vehicle crashes from MCMIS described above) if it has been determined that an alternative method of deciding accountability is adequate.

A carrier-based model will be created as part of the analysis in whatever form is best supported by the data. Several driver-based models will also be tested. An SMS effectiveness test will provide a quantitative environment to compare the predictive results of various approaches to crash weighting and will be used to assess the various models.

Process for crash weight determinations

The first part of this analysis will be to review the current proposed business process to determine crash weighting while taking into account input received from the public, the field, and lessons learned from the prior analysis in this study (described above). FMCSA will examine the results to identify an effective, efficient, and fair process and evaluate the benefits and costs of implementing the approach. Analysis will also be conducted to determine the feasibility of full implementation in SMS that compares possible scaling methods. Examples of potential scaling methods include: 1) all crashes are weighted prior to submission to SMS, which would require significant resources, and 2) carriers are required to submit PARs to FMCSA for review.

The second part of this analysis will be to examine how FMCSA could accept public input into the crash

weighting determination process, how the additional information would be used in the process, and what costs are associated with this process.

TIMELINE

This research study is expected to conclude in the summer of 2013. Upon completion of the research study, FMCSA will publicize the results and announce next steps. (For more detail, see *Appendix A.*)

CONCLUSION

In summary, the goal of the planned research study is to enable FMCSA to make well-informed decisions about the prospect of adjusting crash weights in the SMS based on the carrier's role in a crash. The Agency will first investigate whether PARs are a sufficient, consistent, and reliable source of information on which to base a weighted crash system. Then, using the set of crashes that have been reliably coded for accountability, the Agency will investigate whether a system using weighted crashes could potentially provide better predictions of which carriers will get into more crashes than the current system. Finally, public input will be solicited on the proposed crash weighting process. This input will be organized and presented for consideration along with lessons learned from other stages of the analysis. Once the study is complete, the Agency will be better prepared to make informed decisions on the potential design of a crash weighting process that will ensure the effectiveness and efficiency of the Agency's enforcement model.

See the CSA website to stay informed about this research going forward and other CSA activities:
<http://csa.fmcsa.dot.gov/>

APPENDIX A:

Crash Weighting Research Plan and Timeline:

Analysis to support question 1: 12 months

The schedule for question 1 adjusts to onboarding PAR reviewers and conducting the analysis.

Detailed Task Plan to Support Approach:	1 month
Literature Review:	2 months
Phase 1 – Initial LTCCS Analysis Results:	6 months
Phase 2 – Final FARS/NMVCCS Analysis Results:	12 months

Analysis to support question 2: 12 months

Detailed Task Plan to Support Approach:	1 month
Literature Review:	3 months
Phase 1 – Initial Single-Vehicle Analysis Results:	4 months
Phase 2 – Final Analysis Results:	12 months

Analysis to support question 3:

The schedule for question 3 is to be determined-dependent on the analysis results of question 2 and the comment period of the Federal Register process.

TOTAL ANALYSIS DURATION: 12 months