FMCSA Safety Program Effectiveness Measurement: Carrier Intervention Effectiveness Model, Version 1.0

The Carrier Intervention Effectiveness Model (CIEM) provides the Federal Motor Carrier Safety Administration (FMCSA) with a tool for measuring the safety benefits of carrier interventions conducted under the Compliance, Safety, Accountability (CSA) enforcement program. The CSA program includes an array of carrier intervention types that replace the universally-implemented compliance review that was used as part of the previous enforcement model. A major benefit of the new enforcement model will be an improved level of safety in the operation of commercial motor vehicles.

Using a phased approach, FMCSA began implementing the CSA program in 2010. During the implementation period, some carriers were still subject to compliance reviews under the earlier enforcement program. The safety impacts of these compliance reviews were previously measured by the Compliance Review Effectiveness Model (CREM). The new model, CIEM, incorporates both compliance reviews and additional intervention types when assessing safety benefits. Additional intervention types include:

- Warning letters.
- Offsite investigations.
- Onsite focused investigations.
- Onsite comprehensive investigations.

This approach yields national-level measurements of the effectiveness of FMCSA's current carrier interventions. Table 1 shows the safety benefits of all interventions, as calculated by the CIEM, for fiscal years (FYs) 2009–11. In 2011, carrier intervention led to an estimated 6,145 crashed avoided, 3,774 injuries prevented, and 201 lives saved.

Table 1. CIEM-reported safety benefits resulting from carrier interventions performed from FY 2009–11.

Fiscal Year	Crashes Avoided	Injuries Prevented	Lives Saved
2009	2,398	1,508	80
2010	1,685	1,051	55
2011	6,145	3,774	201

MODEL FINDINGS

All Carriers Receiving Interventions

This first iteration of the model (Version 1.0) was implemented for carriers receiving interventions in fiscal years (FYs) 2009–11. Total interventions exhibit an increase in FY 2010, from 28,331 to 31,372, followed by a larger increase to 58,230 interventions in FY 2011; the latter primarily reflects an increase in CSA warning letters. Onsite focused investigations and onsite comprehensive investigations exhibit year-to-year increases, while Performance and Registration Information Systems Management (PRISM) warning letters and compliance reviews experienced declines as expected during FMCSA's transition to the CSA enforcement program. The number of offsite investigations and non-rated reviews were relatively constant over the 3 years. Table 2 displays carrier interventions by type for FY 2009–11. The results of the CIEM indicate statistically significant crash rate reductions across all 3 years for carriers that received CSA interventions and had up to 20 PUs. For carriers with between 21 and 100 PUs, such a reduction was observed only in FY 2009 and FY 2011 but not in FY 2010. For carriers with more than 100 PUs the results were not statistically significant for any of the 3 years.

Table 2. Carrier interventions by type and number for FY 2009–11.

Intervention Type	Number of Interventions			Carriers Receiving Interventions		
	FY 2009	FY 2010	FY 2011	FY 2009	FY 2010	FY 2011
CSA Warning Letter	2,184	5,790	39,004	1,546	4,011	30,448
PRISM Warning Letter	7,500	7,415	1,764	5,003	5,073	1,206
Offsite Investigation	345	456	375	282	311	277
Onsite Focused Investigation	520	1,207	6,279	387	904	4,137
Onsite Comprehensive Investigation	386	829	1,399	243	507	758
Compliance Review	16,517	14,577	8,274	9,133	8,192	4,253
Non-Rated Review	879	1,098	1,135	235	662	587
Total	**28,331**	**31,372**	**58,230**	**16,829**	**19,660**	**41,666**

Additional Analysis

Given the large increase in CSA warning letters issued in FY 2011 compared with the previous year, additional insight can be gained by examining the impact of excluding warning letters from the model and by implementing the model only for carriers whose first intervention is a warning letter. Specifically, these separate model results reveal the extent to which the large increase in safety benefits observed in FY 2011 is associated with warning letters versus other intervention types.

This further analysis points to the following two conclusions for FY 2011, the modeled year with the most statistically significant results:

- Carriers receiving warning letters as a first intervention in FY 2011—the overwhelming majority of these being CSA warning letters—experienced substantial crash rate reductions (although this reduction was not as large as the reduction experienced by carriers receiving first interventions other than warning letters). The vast majority of the carriers receiving these letters did not receive a follow-up intervention, suggesting that the warning letter in and of itself can be an effective tool for improving motor carrier safety.

- The analysis suggests that the increase in safety benefits calculated by the model for FY 2011 is related to the fact that this year was the first time onsite and offsite interventions were supplemented by the issuance of a large number of warning letters.

MODEL APPROACH

The model computes carrier crash rates, defined as crashes per carrier power unit (PU), for carriers receiving interventions (i.e., treatment group carriers) for defined periods prior to and following the interventions. The difference between these carriers' pre- and post-intervention crash rates represents the change in their safety performance during this timeframe. To remove the effect of confounding factors from the calculation of the change in safety performance, the difference between pre- and post-intervention crash rates is adjusted by the change in crash rates experienced by the general carrier population during a corresponding timeframe. To control for systemic differences between small and large carrier operations, these adjustments are made within carrier size groups, based on their PU count. A set of carefully designed filters is used to identify and remove missing and outlier carrier data.

The model incorporates statistical significance testing, which only considers size group changes in crash rates that are statistically significant. Statistically significant results, measured in terms of crashes avoided, injuries prevented and lives saved, are then extrapolated to incorporate those carriers that received interventions but were not included in the initial model calculations because of missing or inaccurate data.

In summary, the results from implementing the CIEM for FY 2009 to FY 2011 identify the benefits of FMCSA carrier interventions during the phased CSA implementation. Future implementation of the model will enable FMCSA to continue to measure the impacts of carrier interventions.

To read the complete report, please visit: http://ntl.bts.gov/lib/54000/54400/54484/RRA-14-011-CIEM_Summary_Report-FINAL-508C.pdf.