



FMCSA Safety Program Effectiveness Measurement: Carrier Intervention Effectiveness Model, Version 1.1

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) 2010–12. In 2012, carrier interventions led to an estimated 5,283 crashes prevented, 3,235 injuries prevented, and 173 lives saved.

Table 1. CIEM-reported safety benefits resulting from carrier interventions performed from FY 2010–12.

Fiscal Year	Crashes Prevented	Injuries Prevented	Lives Saved
2010	1,830	1,142	59
2011	6,567	4,033	215
2012	5,283	3,235	173

MODEL FINDINGS

All Carriers Receiving Interventions

The model was implemented for carriers receiving the specified intervention types in FY 2012. Total interventions decreased from 58,199 in FY 2011 to 43,275 in FY 2012. The decrease primarily reflects a decline in CSA warning letters from a peak in FY 2011. In contrast, onsite focused investigations exhibited an increase in FY 2012.

Table 2 presents two sets of data for FY 2012 and for the two preceding fiscal years.⁽ⁱ⁾ The first three columns show the number of interventions conducted by FMCSA and its State partners and are considered as input into the model, by type, for each of the three fiscal years. The next three columns report the number of carriers receiving these intervention types as their first intervention in each fiscal year. Overall, the set of FMCSA intervention types specified in the model are shown to have reduced motor carrier crash rates in FY 2012 (as in prior years). Consistent with CREM results in prior years, crash rate reductions are generally more pronounced for the smaller carrier size groups.

ⁱ Some of the intervention counts for FY 2010 and FY 2011 differ from those reported in the previously published CIEM Summary Report for FY 2009–11 (January, 2015). Subsequent to the release of that report, FMCSA made minor modifications to the way the CIEM identifies particular intervention types in instances where such information was not recorded or ambiguous in MCMIS. The intervention counts in Table 2 reflect these changes.

Table 2. Carrier interventions by type and number of carriers, by first intervention.

Intervention Type	FY 2010 Interventions	FY 2011 Interventions	FY 2012 Interventions	Carriers Receiving Interventions (by first intervention) FY 2010	Carriers Receiving Interventions (by first intervention) FY 2011	Carriers Receiving Interventions (by first intervention) FY 2012
CSA Warning Letter	5,790	39,004	23,835	5,765	38,918	23,806
Offsite Investigation	687	639	618	620	623	608
Onsite Focused Investigation	1,199	6,246	10,470	1,090	5,427	9,809
Onsite Comprehensive Investigation*	829	1,400	7,039	775	1,357	6,665
PRISM Warning Letter	7,415	1,764	-	7,390	1,754	-
Compliance Review	14,564	8,263	-	13,177	7,638	-
Non-ratable Review	881	883	1,313	774	754	1,180
Total	31,365	58,199	43,275	29,591	56,471	42,068

*In FY 2012, all reviews that were previously considered motor carrier safety compliance reviews are now included in the CSA onsite comprehensive investigations total.

While total carrier interventions experienced a decline in FY 2012, overall percent reductions in crash rates for carriers receiving interventions were higher in FY 2012 than in the previous year. The result of these two opposing trends is a moderate decline in total safety benefits estimated by the model for FY 2012.

Additional Analysis

Further analyses were performed by implementing the model for two subsets of the full treatment group: carriers whose first intervention each year was not a warning letter, and carriers whose first intervention was a warning letter. For both subsets, statistically significant crash rate reductions were observed for carrier size groups 1, 2, and 3.⁽ⁱⁱ⁾ This further analysis provides a measure of the effectiveness of CSA warning letters. This finding demonstrates that warning letters, which are much less expensive than more labor-intensive interventions, can be an efficient tool in reducing crashes for many carriers.

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 prevented, 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, FY 2012 provides strong evidence for the effectiveness of FMCSA's carrier interventions. 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/60000/60500/60503/16-017-CIEM_Report-FY12-FINAL-508C.pdf.

ⁱⁱ Carrier size groups are as follows: 1 = 1–5 power units (PUs); 2 = 6–20 PUs; 3 = 21–100 PUs; 4 = 100+ PUs.