Truck Drivers' Hours of Service

March 12, 2008

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Report on
the Federal Motor Carrier Safety Administration
Interim Final Rule
for Hours of Service of Truck Drivers

Prepared for
Advocates for Highway and Auto Safety,
International Brotherhood of Teamsters,
Public Citizen, and the Truck Safety Coalition

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Introduction

A Regulatory Impact Analysis (RIA) has been offered by the Federal Motor Carrier Safety Administration (FMCSA) to support their current Interim Final Rule (IFR, Reference 1). This RIA relies on an estimation of incremental crash risk under differing driver schedules that were related to policy options under consideration by FMCSA. In addition, the Agency relies on an analysis of "fatigue-coded," fatal, truck crash rates to lend credence to its policy choice, extending truck drivers' hours of service from ten to eleven hours under certain circumstances.

Conclusions from cost-benefit analyses in the RIA are based on adjustments using a time on task (TOT) factor of predicted, fatigue-related crashes modeled by "psychomotor vigilance task." These adjustments are derived through a statistical analysis of actual fatal crashes involving medium and heavy trucks and their drivers' hours of service (HOS). The adjustments made by FMCSA rely upon a number of testable assumptions and judgments about the appropriate use of the crash data and the quality of the data.

We examine these issues in this report and present alternative analyses.

Claimed Policy Outcomes for Large Truck Crashes

According to the IFR, FMCSA analyzed summary data from the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS) "to examine trends in large truck fatal crashes, and fatigue-related fatal crashes before and after initial implementation of the 11-hour driving limit and the 34-hour restart in January 2004 [72 FR 71258]." From these data, the Agency determined that the 2005 rule "has not had a negative impact on safety; overall large truck safety has not been compromised by the 11-hour limit or the 34-hour restart [72 FR 71259]." These FMCSA data are summarized in Table 1, taken directly from the IFR.

Table 1. Fatal and Fatigue-coded Fatal Crashes Involving Large Trucks, by Calendar Year

Year	Fatal crashes with a large truck	Fatigue-coded crashes with a large truck	Fatigue-coded crashes with a large truck, as percent of total
2000	4,573	99	2.2
2001	4,451	65	1.5
2002	4,224	70	1.7
2003	4,335	74	1.7
2004	4,478	66	1.5
2005	4,551	82	1.8
2006	4,321	69	1.6

The summary FARS data cited by FMCSA are subject to a number of scientific criticisms: 1) there are no statistics presented to enable a comparison of large trucks with a control group composed of vehicles that were not affected by the regulation; 2) the summary data for large trucks are not limited to the sub-population of large trucks that were affected by the regulation that went into effect in 2004; 3) this analysis of "fatigue-coded," large truck, fatal crash rates fails to take into account other factors which might influence these rates, irrespective of the impact of the regulation that went into effect in 2004; 4) these data offer no evidence for what the rates might have been in 2004-2006 had the HOS regulation not been changed; and 5) the FMCSA's interpretation of the summary data does not account for random variability, unassociated with the HOS regulation.

Without examining similar, fatigue-coded, fatal crash rates for a comparison group of vehicles unaffected by the HOS regulation change, the claimed lack of a negative impact of the new regulation lacks a necessary scientific foundation. As a first step to address the lack of a control group, we derived similar fatigue coding statistics for fatal crashes from the FARS data (Reference 2) that involved no large trucks (as defined in Table 1). Such crashes could not have been affected by the HOS regulation. These summary statistics are given in Table 2 on the following page.

Table 2. Fatal and Fatigue-coded Fatal Crashes Not Involving Large Trucks, by Calendar Year

Year	Fatal crashes without a large truck	Fatigue-coded crashes without a large truck	Fatigue-coded crashes without a large truck, as percent of total
2000	32,953	1,186	3.6
2001	33,411	1,070	3.2
2002	34,267	1,094	3.2
2003	34,142	959	2.8
2004	33,966	1,017	3.0
2005	34,701	860	2.5
2006	34,267	847	2.5

An examination of Tables 1 and 2 shows that the percentage of fatigue-coded, fatal crashes that did not involve any large trucks actually fell faster over the period 2000-2006 than the comparable rate for fatal, large truck crashes. The percentage decline in fatigue-coded crashes was 26% for large trucks compared to 31% for crashes that did not involve any large trucks and that were not affected by the HOS rule that went into effect in 2004. It is reasonable to ask what factors might explain why fatigue-coded crash rates did not fall as fast for large truck crashes compared to non-truck crashes. A possible answer – among many – is a potentially negative impact of the change in the HOS regulation, allowing eleven hours of driving.

In addition to analyzing crashes for affected vs. unaffected comparison groups, FMCSA should also consider other, appropriate comparisons that would make it possible to understand the importance of potential differences which might confound the association with fatigue coding. Analyses by crash type (e.g., run-off-road, single vehicle, multi-vehicle) would be especially helpful. Such comparisons should control for differences in the fatigue coding rate that could be attributable to differences between the environment in which the vehicles operate (e.g., times of day, types of highways) as well as vehicle characteristics (such as sleeper berths), and driver characteristics (such as age).

In support of its policy decision to extend hours of service, FMCSA supplements the FARS analysis cited above with data about large trucks from the General Estimates System, as well as a subset of fatal crash data for combination unit trucks. However, comparison statistics for appro-

priate control groups unaffected by the regulation adopted in 2004 are never given in these analyses. FMCSA also believes that the policy choices reflected in the Interim Final Rule are supported by data from the Trucks in Fatal Accident (TIFA) database. These data are interpreted to show "an improvement over the pre-2003 period, in terms of the percentage of large truck drivers operating in the 11th hour who were coded as fatigued at the time of the crash [72 FR 71260]." Here, too, there are no data for an appropriate control group of comparison vehicles.

The problematic nature of the "fatigue" data coded from police accident reports (PARs) is well-known: "Unfortunately, there is no objective measure of fatigue that can be used by an investigating officer [Reference 3, p. 9]." This fact must partly explain the widely varying levels of fatigue coding between states, which also depend on such practicalities as accident report form design. Form design considerations include: the prominence of the item, fatigue, on the PAR form; whether fatigue has its own separate check-off box or is taken from a number of conditions on a list; and whether fatigue is combined with other driver conditions (e.g., ″fainting″). The PARs are also affected by periodic changes in content and format. In some states, fatal crashes and/or fatal crashes of commercial vehicles have supplemental forms which may invite closer attention to the potential causes of the crash, such as fatigue.

These issues become important to statistical analyses of the relationship between fatigue and hours of driving insofar as such problems may confound the basic association by calendar year. FMCSA should explore the potential impact of these considerations on their statistical analyses. Their conclusion that, "...there is no reason to believe that this under-reporting [of fatigue] varied from year to year during this period [Reference 1, 72 FR 71259]" would be strengthened by an informed, statistical analysis by calendar year by state showing this to be true. Such an analysis should be performed both for large truck crashes and for crashes not involving any large truck. FMCSA should also consider using vehicle drivers, rather than crashes, for these comparative studies of fatigue coding, since drivers are the focus of the regulation.

Time on Task Fatigue Crash Analysis

An appropriate analysis of fatigue coding and Time on Task depends heavily on the accuracy and quality of the data. According to the 2004 TIFA codebook (Reference 4), information such as drivers' hours of service was collected, "primarily by telephone interviews. The person or company contacted was, when possible, the owner of the vehicle as listed in the police report. If no

contact could be made with the owner, an attempt was made to reach the driver. If neither the owner nor the driver could be reached, as much information as possible was collected from other parties, such as the police officer who investigated the accident or the tow truck operator if the vehicle was towed from the scene (Reference 4, p. viii)."

Based on this description, the survey respondents would have known that the truck driver in question was involved in a fatal crash. The respondent might even have known that fatigue was alleged to be a factor in the crash. Respondents might be understandably reluctant to admit to driving a number of hours that is illegal – particularly if the respondent is the truck driver or a potentially liable truck owner. This potential bias would affect not only how hours of driving are reported, but also whether or not a respondent could be found to report hours of driving. Our analysis of the data shows that these problems actually do affect the TOT fatigue crash analysis presented in the RIA and that the underlying data are biased by differential non-response.

The TOT adjustments discussed in the RIA are derived through a statistical analysis of actual fatal crashes involving medium and heavy trucks and their drivers' hours of service. Regression equations detailed in Exhibit (V)-9 of Appendix V of the RIA are based on 35,558 "sample" vehicles from the 1991-2004 TIFA database. It should be noted, however, that these vehicles are only a subset of the vehicles in the database; however, other vehicles in the dataset are missing data among the variables analyzed. The larger TIFA database actually includes 57,702 sample vehicles. These sample vehicles represent a weighted population total of 68,807 when considering hours of driving (which is derived from a supplemental sample survey). In 24,458 weighted cases from the larger dataset, the hours of service for the truck drivers is unknown for 36% of the total. (The percentage of cases with missing data after excluding government owned vehicles and daily rentals with a GVWR class less than 7 was 35% of the total.)

It would have been appropriate to cite this problematic level of non-response in the RIA. It would also have been appropriate to consider how these missing data might influence the TOT adjustments and whether the FMCSA's statistical analysis of Time on Task and fatigue coding is biased as a result.

It is of particular concern that the distribution of cases with missing hours of driving data in the full 1991-2004 TIFA database is not the same for the crashes with fatigued-coded drivers (41%; 506/1,226) as it is for the drivers without a fatigue code (35%; 23,674/66,845; note that 736 (weighted) of the TIFA vehicles also have missing data for fatigue coding). This contrast is es-

sentially unchanged (40% vs. 35%) after excluding government owned vehicles and daily rentals with a GVWR class less than 7.

It is our understanding that the TOT adjustments are actually derived from the data in Exhibit (V)-2 of the RIA, limited to the time period 1991-2002 when driving 11 hours or more under most circumstances was illegal. Reclassifying the data for hours driven into the categories of legal and illegal, yields Table 3.

Table 3. Reclassification of Data from RIA Exhibit (V)-2

Count Column Percent	Legal Hours <= 10	Illegal Hours > 10	Totals
Fatigue coded	565 1.6%	44 14.2%	609
Not fatigue coded	34,466 98.4%	266 85.8%	34,732
Totals	35,031	310	35,341

For Table 3, the estimate of the relative risk of driving illegal hours for fatigue-coded crashes is equal to 8.8 ((44÷310)/(565÷35,031)); odds ratio = 10.1; 95% CI: 7.2-13.9). (We note that we are not able to replicate this table exactly from the supporting dataset now in the docket, FMCSA-2004-19608 -2834.xls. However, the differences are small and may be due to the use of differing versions of the TIFA database.)

We then explored the question of how cases with missing data for the fatigue-coded drivers may differ from cases with missing data for drivers without fatigue-coding. We show also how these differences affect the estimation of relative risk.

For a number of vehicles with driving hours coded as "unknown," UMTRI researchers were able to ascertain that the driving hours were or were not within the legal limit, even if the specific number of hours driven could not be known. For the following analysis, we considered only those vehicles in years 1991-2002 (taken from Docket Item FMCSA-2004-19608 -2834.xls) for which fatigue coding is known, excluding government owned vehicles and daily rentals with a

GVWR class less than 7, and excluding vehicles for which the hours driven are coded as "not applicable." According to UMTRI's classification of the "unknown driving hours," 1.35% (28/2,073) of the drivers coded as under the legal limit for hours of driving were in fatigue-coded crashes. In contrast, 18.75% (21/112) of the drivers with more hours than the legal limit were coded as "fatigued." These figures are reflected in Table 4; note that all of the data in these tables are weighted by the appropriate sample weight (v1076).

Table 4. UMTRI Classification of Drivers with Unknown Hours Driving

Count, Cell Percent, Column Percentage Row Percentage	Unknown Driving Hours, but Legal	Unknown Driving Hours, but Illegal	Totals
Fatigue coded	28 1.28% 1.35% 57.14%	21 0.96% 18.75% 42.86%	49
Not fatigue coded	2,045 93.59% 98.65% 95.74%	91 4.16% 81.25% 4.26%	2,136
Totals	2,073	112	2,185

We then combined these drivers who could be classified as fatigued or not fatigued as well as legal or not legal, with the data from Exhibit (V)-2. Table 5 on the following page presents results from this step. Note that the relative risk of driving illegal hours for fatigue-coded crashes has been raised from 8.8 calculated from Table 3 to 9.6 (=(65÷422)/(593÷37,104)) calculated from Table 5.

Table 5. Combination of Tables 3 and 4

Count, Column Percent-age	Legal Hours <= 10	Illegal Hours > 10	Totals
Fatigue coded	593 1.6%	65 15.4%	658
Not fa-tigue coded	36,511 98.4%	357 84.6%	36,868
Totals	37,104	422	37,526

According to Docket Item FMCSA-2004-19608 -2834.xls, excluding government owned vehicles and daily rentals with a GVWR class less than 7, and excluding vehicles for which the hours driven are coded as "not applicable," there are 347 fatigue-coded drivers and 16,599 non-fatigue coded drivers in years 1991-2002 for which hours driving is not only unknown but also unclassifiable as legal or illegal. If these cases are like the other unknowns in Table 4, approximately 57% of the 347 (= 198) would be classed in the legal driving category and 43% of the 347 (= 149) would be classed in the illegal driving category. Similarly, approximately 95.74% of 16,599 (= 15,892) would be classed in the legal category and 4.26% of 16,599 (= 707) would be classed in the illegal category. The resulting counts could then be added to the counts in Table 5 to assess how this would change the estimation of relative risk. The results are given in Table 6 on the following page.

Table 6. Combination of Table 5 with Remaining "Unknown" Drivers

Count, Column Percent-age	Legal Hours <= 10	Illegal Hours > 10	Totals
Fatigue coded	791 1.5%	214 16.7%	1,005
Not fa-tigue coded	52,403 98.5%	1,064 83.3%	53,467
Totals	53,194	1,278	54,472

This step raised the estimate of the relative risk of driving illegal hours for fatigue-coded crashes from 9.6 calculated using data in Table 5 to 11.26 (=(214÷1,278)/(791÷53,194)). Compared to the original estimate of 8.8, these two steps including the large number of cases with unknown driving hours raised the estimate of the relative risk of driving illegal hours for fatigue-coded crashes by approximately 28%.

The apparent bias in the relative risk of driving illegal hours for fatigue-coded crashes indicates that the fitted logistic model relied upon for the TOT adjustment equation is also biased by the missing data. This bias is likely to underestimate the increasing risk for fatigue coding with each additional hour of service. This underestimate is due to high rates of non-response (i.e., missing data for hours of driving) that differ by fatigue coding. The potential to underestimate the effect of Time on Task on fatigue coding should not seem surprising, given the sources for these data and the circumstances under which the data are collected. Our results show the need for a better source of unbiased data or a more robust methodology that would be better suited to the purpose intended by FMCSA.

FMCSA used a bootstrap simulation technique to estimate the uncertainty of the difference in the predicted probability of fatigue coding for the eleventh hour of driving compared to the mean predicted probability for hours 1 to 10. However, this simulation is based on the same data used for the fitted logistic model (see Reference 5, pp. 71-72, pp. V-8 - V-10). Insofar as these data

are biased by high rates of missing data for hours of driving that differ by fatigue coding categories, the data are less well suited to demonstrate the uncertainty inherent in the the derived Time On Task multiplier. A better study based on unbiased data and/or a more robust methodology would be more appropriate for this purpose.

References

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