

THE HAZARDOUS MATERIALS HIGHWAY ROUTING ROUTE PLANS ASSESSMENT REPORT TO CONGRESS

Pursuant to Section 1553(b) of the
Implementing Recommendations of the 9/11 Commission Act of 2007
Public Law 110-53
October 2009

EXECUTIVE SUMMARY

Section 1553(b) of the Implementing Recommendations of the 9/11 Commission Act of 2007 (the Act) requires the Secretary of the U.S. Department of Transportation (DOT) to complete an assessment of the safety and national security benefits achieved under existing requirements for route plans, in written or electronic format, for the transportation of explosives and radioactive materials. Section 1553(b) also requires the Secretary to submit a report containing the findings and conclusions of the assessment. This report fulfills that directive.

The assessment shall, at a minimum, include the following:

- (A) Compare the percentage of DOT recordable incidents and the severity of such incidents for shipments of explosives and radioactive materials for which such route plans are required with the percentage of recordable incidents and the severity of such incidents for shipments of explosives and radioactive materials not subject to such route plans.
- (B) Quantify the security and safety benefits, feasibility, and costs of requiring each motor carrier that is required to have a hazardous materials (HM) safety permit under Part 385 of Title 49, Code of Federal Regulations (CFR), to maintain, follow, and carry such a route plan that meets the requirements of Section 397.101 of that title when transporting the type and quantity of HM described in Section 385.403, taking into account the various segments of the motor carrier industry, including tank truck, truckload, and less than truckload carriers.¹

The percentage of HM incidents per miles traveled for commercial motor vehicles (CMV) required to have route plans was almost identical to the percentage of incidents per miles traveled for CMVs not required to have route plans. Route plan CMVs accounted for 16 percent of the miles traveled by the total population of HM carriers and were involved in 17 percent of the total HM incidents. The larger number of non-route plan CMVs accounted for 84 percent of the total miles traveled and were involved in 83 percent of the total HM incidents. Accordingly, there was no statistically significant difference between the rate of occurrence of HM incidents per mile traveled for CMVs required to have route plans and those not required to have route plans.

¹ The FMCSA evaluated security and safety costs and benefits of route plan requirements but did not have sufficient data to break out these data with respect to the distinct industry segments listed.

The Federal Motor Carrier Safety Administration (FMCSA) could not quantify benefits for national security because the probability of a malicious HM incident is unknown. However, FMCSA concluded that, based on the low per-trip cost of HM route plan tracking requirements and the potential cost of a malicious HM incident, the odds of a malicious HM incident occurring on a trip could be as low as 1 in 12.5 billion for security benefits to equal costs. It is estimated that about 1.5 million trips requiring route plans occur each year. The FMCSA believes it is reasonable to conclude that national security benefits exceed costs.

There are additional costs and other burdens to motor carriers required to carry route plans for the types of HM described in Section 385.403 of Title 49 CFR. The route plan requirement for transporters of certain explosives and radioactive materials under Title 49 CFR Section 397.67 and Section 397.101 predated the issuance of the final rule on HM Safety Permits in June 2004. For the remaining transporters of permitted HM, FMCSA concluded that its existing requirement to maintain a telephone number of an employee or motor carrier representative who is familiar with the routing of the permitted material aboard the vehicles enhances security and safety without imposing unreasonable costs or burdens upon motor carriers.

BACKGROUND

Section 1553(c) of the Act directs the Secretary to require motor carriers that have an HM safety permit under Part 385 of Title 49 CFR, to maintain, follow, and carry a route plan, in written or electronic format, that meets the requirements of Section 397.101 of Title 49 CFR, when transporting the type and quantity of HM described in Section 385.403 if the Secretary determines, under the assessment required by Section 1553(b) of the Act, that such a requirement would enhance security and safety without imposing unreasonable costs or burdens upon motor carriers.

In August 2003, FMCSA issued a Supplemental Notice of Proposed Rulemaking (SNPRM) proposing motor carriers that transport HM described in Section 385.403 adhere to written route plans. In the SNPRM, FMCSA proposed to require that the written route plan be carried in the vehicle and followed unless an alternate route is required by a law enforcement official or an emergency condition exists. In addition, FMCSA proposed to require that the driver have in the vehicle and make available to a law enforcement official upon request, the telephone number of an employee of the motor carrier to verify the motor vehicle's route.

As a result of comments received on the SNPRM identifying significant logistical problems with the proposal, FMCSA did not adopt route plans requirements for all HM listed in Section 385.403. However, the proposal affirming the route plan requirement for Class 1 and highway route-controlled quantity (HRCQ) of Class 7 materials remained in place. The FMCSA realized the importance of requiring the telephone number aboard the vehicle to verify the shipment's route. The FMCSA determined that, although the telephone-contact requirement is less comprehensive than a written route plan, it would provide an increased level of security.

The requirement of maintaining the telephone number aboard the vehicle provides enforcement officials with a means to ensure that the vehicle has not significantly deviated from its approved route and confirm the motor carrier's awareness of the HM being transported.

COMPARISON OF INCIDENTS AND SEVERITY

DATA ON MOTOR CARRIERS OF HAZARDOUS MATERIALS

There are 7,622 motor carriers (4,356 active and 3,266 currently inactive) identified within the FMCSA's Motor Carrier Management Information System (MCMIS) that transported explosive and radioactive HM during the 3-year period examined for this analysis. Approximately 1,200 of these motor carriers transport explosives and radioactive materials that require route plans, approximately 3,900 motor carriers transport explosive and radioactive materials or other types of HM that do not require route plans, and approximately 2,500 motor carriers transport various types of HM that require and do not require route plans. Table 1 categorizes the information by active and currently inactive motor carriers and by route plan requirement. Table 2 displays the percentages of carriers out of the total population of active and inactive carriers that transport HM shipments that (1) require a route-plan, (2) do not require a route plan, and (3) depending on the type of HM shipments, either require a route plan or do not require a route plan.

Table 1: Number of Motor Carriers Transporting Hazardous Materials				
Status	Plan Required	No Plan Required	Both	Total
Active	661	2,240	1,455	4,356
Inactive*	527	1,702	1,037	3,266
Total	1,188	3,942	2,492	7,622
*Inactive motor carriers are included because they transported explosive and radioactive materials during the period examined in this analysis.				

Source: MCMIS, May 2008

Table 2: Percentage of Motor Carriers Transporting Hazardous Materials				
Status	Plan Required	No Plan Required	Both	Total
Active	15%	51%	33%	100%
Inactive	16%	52%	32%	100%

Source: MCMIS, May 2008

The number of incidents for individual carriers should vary according to their total fleet mileage. In order to compare HM incidents across carriers, it is necessary to evaluate these incidents with respect to miles traveled. Carrier mileage, however, is often not reported or not reported accurately. Information on the number of CMVs operated by carriers, however, is readily available, and these data can be used to estimate mileage. Although the number of miles driven

by individual vehicles can vary, in general, the total vehicle miles driven by a particular carrier will, on average, be a fixed proportion to the number of vehicles operated by the carrier. Table 3 shows the number of CMVs owned by active and inactive motor carriers broken out into the three types of transport.²

Table 3: Number of Commercial Motor Vehicles to Each Type of Transport			
Motor Carriers Reporting 5,000 or Fewer Vehicles			
Status	Plan Required	No Plan Required	Both
Active	14,438	185,075	48,587
Inactive	6,302	120,628	41,339
Total	20,740	305,703	89,926

Source: MCMIS, May 2008

Table 4 below shows that motor carriers that transport exclusively with route plans (Class 1.1, 1.2, 1.3 or HRCQ of Class 7) have fleets about one-fourth the size of those that transport only combinations of Class 1.4, 1.5, 1.6 or non-HRCQ of Class 7. Those motor carriers transporting materials in both categories fall between, with approximately one and a half times as many CMVs per motor carrier as the group that require route plans and half as much as the group that does not require route plans.

Table 4: Commercial Motor Vehicles Per Motor Carrier to Each Type of Transport			
Motor Carriers Reporting 5,000 or Fewer Vehicles			
Status	Plan Required	No Plan Required	Both
Active	22	83	34
Inactive	12	71	40

Source: MCMIS, May 2008

Assuming that the total miles carriers' vehicles are driven will, on average, be a fixed proportion of the number of vehicles owned, the data presented above on CMVs can be used to determine the percentage of miles driven for each type of carrier transporting explosive and radioactive HM (route-plan, non-route-plan, or both), as shown in Table 5.

² In statistical analysis, it is standard practice to remove outliers, values that are apparently erroneous or skew the results, from a dataset. In this analysis, carriers that reported owning more than 5,000 vehicles were excluded because FMCSA believed it highly likely that many of these were data entry errors, and those entries that were accurate would have skewed the calculations for mileage. Twenty out of 4,350 active carriers and two inactive carriers were dropped.

Table 5: Percentage of Miles to Each Category				
Motor Carriers Reporting 5,000 or Fewer Commercial Motor Vehicles				
Status	Plan Required	No Plan Required	Both	Total
Active	6%	75%	20%	100%*
Inactive	4%	72%	25%	100%*
Total	5%	73%	22%	100%

*The percentages were rounded resulting in a total exceeding 100%.

Source: MCMIS, May 2008

Miles for carriers in the “both” category had to be distributed between route-plan and non-route-plan shipments. Unfortunately, FMCSA has no data on how much of a carrier’s operations is devoted to each type of HM cargo. An allocation of miles that exactly followed the distribution of plan-only and non-plan miles would have resulted in 6 percent of miles of route plan trips and 94 percent for non-route plan trips. However, this would have been the identical result from discarding the mileage data for carriers hauling both types of HM cargo, and the Agency believed it was necessary to utilize these data better by making some inferences based on the characteristics of these carriers. As table 4 showed, these carriers tended to be smaller, like the carriers hauling only cargo requiring route plans, than other HM carriers. Also, the required amount of liability insurance for cargo requiring route plans is five times greater than that required for other HM cargo, so it seems likely that a carrier registering to haul route-plan cargo would devote a substantial portion of its business to these commodities in order to recover the higher insurance costs. Both of these facts favored a higher proportion of miles being allocated to route plan trips. It was therefore assumed that for carriers hauling both types of cargo, miles were distributed evenly between route-plan and non-route-plan shipments. This allocation resulted in 16 percent of miles traveled for all route plan shipments.

Table 6: Percentage of Miles to Each Category After Distribution		
Carriers Reporting 5,000 or Fewer Trucks		
Status	Distributed Evenly	
	Plan Required	No Plan Required
Active	16%	84%
Inactive	16%	84%
Both	16%	84%

Source: MCMIS, May 2008

COMPARISON OF INCIDENTS

There were 98 HM incidents involving explosives or radioactive materials from January 1, 2005, through April 30, 2008. Of these, 17 HM incidents involved route-planned trucks carrying commodity-class 1.1, 1.2, or 1.3 HM, and HRCQ of radioactive materials. The remaining 81 incidents involved trucks without route plans and carrying class 1.4, 1.5, 1.6 HM, or

non-HRCQ class 7 radioactive materials loads. The percentage of incidents involving route-planned trucks is 17 percent (17 divided by 98 equals 0.1735). Table 7 summarizes the commodity, hazard class or division, and corresponding percentages.

Table 7: Hazardous Materials Incidents by Hazard Class³		
Class/Division	Plan Required	No Plan Required
1.1	7%	N/A
1.2	3%	N/A
1.3	7%	N/A
HRCQ Radioactive material	0%	N/A
1.4	N/A	39%
1.5	N/A	9%
9	N/A	1%
7 (Not HRCQ) Radioactive material	N/A	34%
	17%	83%

Source: Hazardous Materials Information System, July 2008

A comparison of the results presented in Table 6 and Table 7 indicates that the percentage of HM incidents for CMVs required to have route plans and CMVs not required to have route plans was found to be almost exactly proportional to miles traveled. As Table 7 shows, the percentage of HM incidents for CMVs required to have route plans is 17 percent, and the percentage of HM incidents for CMVs not required to have route plans is 83 percent. Of the total miles traveled by all HM carriers, Table 6 shows that the percentage of miles traveled by CMVs required to have route plans is 16 percent, and the percentage of miles traveled by CMVs not required to have route plans is 84 percent. Carrier miles may not capture all the risk for incidents that occur in the loading and unloading phase of shipments because the risk of incident in these phases may also be associated with shipment weight.⁴ Nevertheless, the percentage of HM incidents for CMVs required to have route plans that occurred only in transit phases was nearly identical to that percentage for all phases: 17.6 percent for in-transit versus 17.3 percent for all phases. The ratio of HM incidents to miles traveled is statistically the same for carriers required to have route plans and carriers not required to have route plans.

³ The characteristics of radioactive materials (RAM) incidents may differ from those not involving RAM, but because there were no RAM incidents for trips requiring route plans, an analysis of RAM-only incidents was not possible.

⁴ A breakdown of freight volume by hazardous material commodity from the 2007 Commodity Flow Survey (CFS) will be released in several months. It may be appropriate to use ton-mileage from this dataset to construct a measure of risk when total distance traveled by goods is not the primary determinant of risk, such as may be the case for loading and unloading incidents (also accounting for the volumes associated with these incidents). A separate line of research into loading and unloading incidents could be conducted when these data become available.

Accordingly, FMCSA found no statistically significant difference between the rate of occurrence of HM incidents per mile traveled for CMVs required to have route plans and those not required to have route plans.⁵

SEVERITY OF INCIDENTS

The severity of an incident is determined by its impact in terms of injury, property damage, cost and impact on the transportation infrastructure. In some incidents, a spill occurs, but there are no impacts that affect the transportation infrastructure or surrounding community. In other cases, impacts on the transportation infrastructure occur, such as the closure of a major transportation artery to allow cleanup. Table 8 shows that HM incidents involving explosives and radioactive spills accounted for 33 percent of the total HM incidents and that major arteries were closed in 19 percent of incidents. Twenty-one percent of spills were attributable to CMVs requiring route plans. Although, as shown in Table 8, the percentage of spills attributable to route plan shipments is slightly larger than the percentage of all HM incidents attributable to route plan shipments, this 4 percentage point difference is not statistically significant.⁶ There were no serious RAM releases among these incidents.

The relative severity of incidents varies greatly with respect to injuries, fatalities, and cleanup cost. None of the hazmat incidents evaluated resulted in fatalities. Where spills occurred, no injuries were reported, and average cleanup costs were \$279 for route plan shipments and \$12,764 for non-route plan shipments. Incidents in which major transportation arteries were closed were relatively more severe, with major and minor injuries occurring in 5 percent of these types of incidents (both these injuries occurred in a single route-plan incident), while no injuries resulted from 95 percent of incidents. Average cleanup costs were much higher: \$724,388 for route plan shipments and \$32,462 for non-route plan shipments. The average cleanup cost for route plan shipments here is heavily influenced by the single incident in which injuries occurred; this incident was the most expensive among those recorded, with over \$2 million in cleanup costs. By comparison, the second most expensive incident was only one-tenth as costly. The predominant type of incident, one in which no spill or major road closure occurred, resulted in minor injuries in 2 percent of cases, a single non-route plan incident. The average clean up cost was \$12,571 for route plan shipments and \$6,404 for non-route plan shipments. Last, evacuations were required in 6 percent of spill incidents and 11 percent of closure incidents, in both cases fully attributable to non-route plan shipments.

⁵ The 95 percent confidence interval around the percentage for all incidents includes differences as large as ± 7.6 percentage points; that is, figures in this range do not have a statistically significant difference from the average percentages for all incidents. This range encompasses mileage estimates as low as 9.7 percent and as high as 24.9 percent for trips requiring route plans.

⁶ Again, the 95 percent confidence interval around the percentage for all incidents is ± 7.6 percentage points.

Table 8: Severity of the Hazardous Materials Incidents				
Severity of Incident		All	Plan*	No Plan*
Spill Occurred (33% of Incidents)	Any Fatalities	0%	.	.
	Any Major Injuries	0%	.	.
	Any Minor Injuries	0%	.	.
	No Injuries	100%	21%	79%
	Evacuation	6%	0%	100%
	Serious RAM Release	0%	.	.
	Average Cleanup Cost	\$10,116	\$279	\$12,764
Closure of Major Transportation Artery (19% of Incidents)	Any Fatalities	0%	.	.
	Any Major Injuries	5%	100%	0%
	Any Minor Injuries	5%	100%	0%
	No Injuries	95%	11%	89%
	Evacuation	11%	0%	100%
	Serious RAM Release	0%	.	.
	Average Cleanup Cost	\$141,713	\$724,388	\$32,462
No Spill, No Closure (53% of Incidents)	Any Fatalities	0%	.	.
	Any Major Injuries	0%	.	.
	Any Minor Injuries	2%	0%	100%
	No Injuries	98%	14%	86%
	Evacuation	0%	.	.
	Serious RAM Release	0%	.	.
	Average Cleanup Cost	\$7,235	\$12,571	\$6,404
All Incidents			17%	83%
*Percentages are percent of all incidents.				

Source: Hazardous Materials Information System, July 2008

QUANTIFYING BENEFITS, FEASIBILITY, AND COSTS

ANALYSIS OF COSTS

The FMCSA addressed benefits and costs in its June 30, 2004, Final Rule on HM Safety Permits. Route plans required under 49 CFR 397.101 for Class 7 radioactive materials and 49 CFR 397.67 for certain explosive materials predated the issuance of the Final Rule. The Final Rule did not expand the application of these pre-existing route plan requirements under sections 397.67 and 397.101. The Final Rule, however, added two additional routing requirements. First, the driver should be able to provide the telephone number of a carrier employee or representative who could verify that the shipment was within the general area for the expected route for the permitted material. Second, the driver should communicate with the motor carrier at the beginning and end of a duty tour and at the pickup and delivery of a permitted load. The Final Rule required that the motor carrier maintain records of these communications for a period of

6 months. The cost-benefit analysis for the Final Rule estimated the costs of the wholly new operational requirement of this rule, the requirement for shipment tracking records. These records would be gathered either by electronic tracking or via communication with CMV drivers. The rulemaking analysis determined that the annual cost to carriers was about \$2.7 million.⁷ The FMCSA updated these costs estimates to account for changes in the number of carriers and overall inflation that has occurred since the rule was enacted. The number of carriers affected by this rule has been stable over this period, and most of the updated costs reflect the conversion of the original cost estimates to 2007 dollars. The FMCSA currently estimates the annual costs to be about \$3.1 million.

ANALYSIS OF SECURITY BENEFITS

Security benefits of the HM Safety Permit program are specifically associated with the shipment tracking requirements of that rule. These benefits can be calculated by multiplying the probability of an intentional HM incident that is otherwise prevented by the probable cost of the avoided incident. Because the probability of an intentional HM incident is not known, the Agency cannot calculate security benefits. However, FMCSA can evaluate security benefits by calculating the probability of an intentional incident at which security benefits break even with costs.

The analysis conducted for the June 30, 2004, HM Safety Permit Rule estimated the cost of a malicious HM incident to be \$25 billion. The current costs to carriers of the HM Safety Permit program's tracking requirements are \$3.1 million annually and about \$2.00 per trip. Security benefits will equal costs if the odds of an HM shipment being used in a malicious incident are as remote as 1 in 12.5 billion (\$25 billion divided by 2).

The analysis prepared for the HM Safety Permit Rule estimated that over 1.5 million HM CMV trips requiring route plans occur annually. The transportation of explosives and radioactive materials has not been used in a malicious incident since the implementation of the HM Safety Permit Rule. There had not been a malicious act involving explosives or radioactive materials transported in a CMV prior to the implementation of the HM Safety Permit Rule. Although the probability of explosives or radioactive materials being used in a malicious act is not precisely known, no such incident has occurred in any of over 1.5 million annual CMV trips. Nevertheless, because the per trip cost of these requirements is small (\$2.00), and because the potential damages from a malicious incident are so large (\$25 billion), these requirements may still provide positive net benefits even if the probability of a malicious incident is extremely small.

CONCLUSION

The number of incidents involving CMVs requiring route plans per miles traveled by such CMVs is in the same proportion as the HM incidents to miles traveled for CMVs without route plans. Essentially, no difference exists in the HM incident rates per mile for CMVs required to have route plans and CMVs not required to have route plans.

⁷ The analysis also estimated an additional annual cost of about \$5,000 to carriers for permit renewals, and annual costs to FMCSA of \$2.0 million.

The June 30, 2004, HM Safety Permit rule implemented new shipment tracking requirements. The current cost of these requirements is estimated to be \$3.1 million annually and about \$2.00 per trip, and these requirements were intended to avoid malicious HM incidents estimated to cost society \$25 billion per incident. Among an estimated 1.5 million annual trips, no malicious HM incident using a CMV has occurred before or after the implementation of these requirements. However, the benefits of the tracking requirements will break even with costs even if the odds of a malicious HM incident are as remote as 1 in 12.5 billion.

The FMCSA believes the existing requirements to maintain a telephone number of a verifying employee aboard the vehicle required, communication at the start and end of a HM delivery, and recordkeeping provide a cost-beneficial method that enhances security and safety without imposing unreasonable costs or burdens upon motor carriers.