Commercial Motor Vehicle Driver Restart Study

OVERVIEW

The Consolidated and Further Continuing Appropriations Act of 2015 directed the U.S. Department of Transportation to conduct a naturalistic study of the operational, safety, health, and fatigue impacts of the two hours-of-service (HOS) provisions. Under the new restart rule that went into effect on July 1, 2013, if commercial motor vehicle (CMV) drivers choose to use a provision allowing "restart" of the 60- or 70-hour duty-cycle limit, they were required to include at least two nighttime periods—defined as periods from 1 a.m. until 5 a.m.—in their restart breaks. Use of the 34-hour restart is limited to once every 168 hours. These two provisions were suspended on December 16, 2014.

To investigate the operational, safety, fatigue, and health impacts of these two restart provisions on CMV drivers, the Federal Motor Carrier Safety Administration (FMCSA) sponsored a naturalistic field study where participating drivers worked their normal schedules and performed their normal duties. As required by statute, and over a period lasting as long as 5 months, this study compared operational (work- and sleep-related), safety, fatigue, and health outcomes among CMV drivers using a restart period with 1, 2, or more than 2 nights. The study also analyzed the safety and fatigue effects on those drivers who had less than 168 hours between their restart periods and those drivers who had at least 168 hours between their restart periods. Key findings from the four outcome areas are highlighted in Table 1.

Table 1. Sample of key findings for the research domains examined in this study.

Domain	Research Question	Study Finding
Operational	Do drivers using the 1-night restart provision have longer work hours per day than drivers using a 2-night restart?	1-night restart: 10.20 work hours/24h 2-night restart: 10.11 work hours/24h
	Do drivers with <168 hours between restarts have longer work hours per day than drivers with ≥168 hours between restarts?	<168 hours: 10.11 work hours/24h ≥168 hours: 10.03 work hours/24h
Safety	Do drivers using the 1-night restart provision experience a higher rate of safety-critical events (SCEs) per 100 instrumented hours than drivers using a 2-night restart?	1-night restart: 0.34 SCEs/100h 2-night restart: 0.37 SCEs/100h
	Do drivers with <168 hours between restarts experience a higher rate of SCEs than drivers with ≥168 hours between restarts?	<168 hours: 0.36 SCEs/100h ≥168 hours: 0.37 SCEs/100h
Fatigue	Do drivers using the 1-night restart provision have slower psychomotor vigilance responses (lower reciprocal reaction times) on the PVT-B than drivers using a 2-night restart? **Note: PVT response speed ≥3.8 = good performance.**	1-night restart: 3.79 in duty periods (NR); 3.78 in restart periods (R) 2-night restart: 3.79 in NR; 3.77 in R
	Do drivers with <168 hours between restarts have slower psychomotor vigilance responses (lower reciprocal reaction times) on the PVT-B than drivers with ≥168 hours between restarts? **Note: PVT response speed ≥3.8 = good performance.**	<168 hours: 3.78 in NR; 3.76 in R ≥168 hours: 3.77 in NR; 3.73 in R
Health	Do drivers using the 1-night restart provision experience increased perceived stress compared with drivers using a 2-night restart? **Note: Stress scale ranges from 1 "not stressed" to 5 "very stressed."**	1-night restart: 1.54 in NR; 1.40 in R 2-night restart: 1.56 in NR; 1.42 in R
	Do drivers with <168 hours between restarts experience increased perceived stress compared with drivers with ≥168 hours between restarts? **Note: Stress scale ranges from 1 "not stressed" to 5 "very stressed."**	<168 hours: 1.57 in NR; 1.44 in R ≥168 hours: 1.57 in NR; 1.42 in R
	Across all provisions, do drivers sleep more during their restart periods than their duty cycles?	1-night restart: 6.47 sleep hours/24h in NR; 8.85 sleep hours/24h in R.* 2-night restart: 6.57 sleep hours/24h in NR; 8.82 sleep hours/24h in R.*
	Across all provisions, do drivers experience more stress during their duty cycles as compared to their restart periods?	Yes, higher stress indicated during duty cycle (see stress results, above).*

*Asterisk indicates statistical significance.

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STUDY DESCRIPTION

Drivers from a wide range of fleet sizes, operations, and industry sectors participated in the study. The original target sample size was 207 drivers. To allow for attrition, the research team empaneled 242 drivers, of which 235 contributed data to the analyses. Of these 235 drivers, 224 were male and the mean age was 45 years.

A study intake survey of self-reported driving indicated that 10 percent drove primarily during the day, 75 percent drove a mixture of day and night, and 15 percent drove primarily at night. Of the 235 drivers who contributed data, 132 contributed to both the 1-night restart condition and the 2-night or more-than-2-night restart condition.

Data collection tools (described in Table 2) included electronic logging devices, onboard monitoring systems, wrist-worn actigraphy devices, and smartphones for the Brief Psychomotor Vigilance Tests (PVT-Bs), subjective ratings, and sleep diaries.

CONCLUSIONS

The study did not find meaningful differences in the provisions on the key outcome metrics noted in Table 1. Drivers using the 1-night restart and those using the 2-night restart had similar average daily working hours (10.11–10.22 hours), average hours of sleep (6.47–6.57 hours in duty periods; 8.82–8.85 hours in restart periods), average numbers of safety critical events (SCEs) per 100 hours instrumented driving time (0.34–0.37), average PVT response speeds (3.78–3.79 in duty periods; 3.77–3.78 in restart periods), and average subjective stress scores (1.54–1.56 in duty periods; 1.40–1.44 in restart periods).

Likewise, drivers taking a restart in less than 168 hours and those taking a restart in at least 168 hours had similar results: 10.03–10.11 work hours per 24 hours; 0.36–0.37 SCEs per 100 hours instrumented driving time; PVT scores of 3.77–3.78 during duty periods and 3.73–3.76 during restart periods; and stress scores of 1.57 in duty periods and 1.42–1.44 in restart periods.

The study did reconfirm that the 34-hour restart provided drivers an opportunity for the needed sleep time and sleep quality to recover from any acute or cumulative fatigue, and to reduce their subjective stress. This was evident in the fact that drivers averaged approximately 6.5 hours of sleep per day during duty periods, and 8.6 hours of sleep during restart periods.

This finding clearly shows the importance of off-duty time and that drivers need this extra time to recover from sleep debt that is accrued during the duty cycle. Similarly, perceived stress was higher during the duty cycle as compared to the restart period, again highlighting the importance of the restart period. Therefore, though differences in the manner by which the restart provisions were used may be negligible with respect to the outcome domains, drivers do benefit from a 34-hour restart period.

To read the complete report, please visit: http://www.fmcsa.dot.gov/safety/research-and-analysis/cmv-driver-restart-study-final-report.

Table 2. Summary of assessment technologies used in the study.

Technology	Short Description	What it Measured	Performance Assessment
Onboard monitoring system (OBMS)	An electronic monitoring system with video recorder was installed on the dashboard of each instrumented vehicle. An OBMS event is triggered by certain criteria (e.g., hard braking, swerving, etc.) and reviewed.	• Safety-critical events (SCEs).	Occasionally the OBMS did not function properly (e.g., malfunctioning OBMS, object blocking cameras, etc.). In some cases, a driver operated a truck not equipped with an OBMS (e.g., equipped truck was being repaired). Also, the 8-second video length was not sufficient to identify driver fatigue during a SCE.
Electronic logging device (ELD)	Device that electronically tracks drivers' on- and off-duty driving time for hours-of-service (HOS) monitoring purposes.	• HOS. • Driver duty status.	There were no technical issues experienced with the ELDs, although the study team was unable to collect ELD data for a few drivers.
Wrist actigraph	Device similar to a wristwatch that collects movement information while worn and is used to measure sleep/wake patterns.	• Sleep timing. • Sleep quantity.	The most common reason for malfunction was battery discharge. The total amount of data lost to device malfunction constituted 5 percent of the total number of study days.
Smartphone application (app)	Interactive data collection program installed on a smartphone. The app allows study participants to record sleep/wake times and caffeine use and collects subjective ratings pertaining to fatigue, stress, and difficulty of drive.	• Sleep timing and quantity. • Caffeine consumption. • Perceived fatigue and stress (using fatigue/stress scales). • Perceived difficulty of drive and degree of drive hazards.	During the study, 21 smartphones were lost or damaged. The total amount of data lost to smartphones being lost or damaged constituted 1.4 percent of the total percentage of smartphone measures.
Brief Psychomotor Vigilance Test (PVT-B)	Interactive data collection app installed on a smartphone. Each PVT-B lasts 3 minutes and requires drivers to react to triggers that appear on the screen.	• Behavioral alertness.	See performance assessment for smartphone app (above).