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National Highway Traffic Safety Administration

NHTSA

Preliminary Regulatory Evaluation

AMENDING PART 563 EVENT DATA RECORDERS (EDRS)

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1 EXECUTIVE SUMMARY

This Preliminary Regulatory Evaluation (PRE) analyzes the potential impacts of a Notice of Proposed Rulemaking (NPRM) to amend 49 CFR Part 563 (Part 563), "Event Data Recorders," (EDRs), in which the agency proposes to extend the EDR recording period for seven pre-crash data elements from 5 seconds of pre-crash data at a frequency of 2 Hz to 20 seconds at a frequency of 10 Hz.

EDRs are voluntarily equipped devices or functions that capture and record various data elements immediately prior to and during a crash. The agency established Part 563 in August 2006 and it became fully effective on September 1, 2012.[1] Part 563 standardizes requirements for data elements to be captured by EDRs that are voluntarily installed in light vehicles with a gross vehicle weight rating (GVWR) of 3,855 kilograms (kg, 8,500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5,500 pounds) or less. The requirements include recording duration, sampling frequency, data accuracy, and resolution for specified data elements and the survivability and retrievability of EDRs. In addition, Part 563 also specifies the requirements for vehicle manufacturers to make tools and/or methods commercially available so that crash investigators and researchers can retrieve data from EDRs. The agency estimates that 99.5 percent of model year 2021 applicable passenger vehicles have Part 563 compliant EDRs.

1.1 Reason for the NPRM

Section 24303 of the Fixing America's Surface Transportation Act (FAST Act), Pub. L. No. 119-14 (Dec. 4, 2015) requires NHTSA to conduct a study "to determine the amount of time event data recorders installed in passenger motor vehicles should capture and record for retrieval of

[1] 71 FR 51043, August 28, 2006. Amended on January 14, 2008 (73 FR 2179) and corrected on February 13, 2008 (73 FR 8408). Further amended on August 5, 2011 (76 FR 47478).

vehicle-related data in conjunction with an event in order to provide sufficient information to investigate the cause of motor vehicle crashes," and to submit a report containing the findings of this study to Congress. The Fast Act also requires that within two years of submitting the findings, NHTSA must "promulgate regulations to establish the appropriate period during which event data recorders installed in passenger motor vehicles may capture and record for retrieval vehicle-related data to the time necessary to provide accident investigators with vehicle-related information pertinent to crashes involving such motor vehicles." The agency completed the Event Data Recorders Duration Study (EDR Duration Study)[2] on May 2017 and submitted a Report to Congress summarizing the pre-crash time interval results of this study in determining crash causation on September 2018.[3] The NPRM starts the rulemaking process of this FAST Act mandate.

1.2 Proposed Amendments

Based on the EDR Duration Study, the agency proposes to extend the recording period for certain pre-crash data elements from the currently required 5 seconds to 20 seconds and increase their sampling frequency from 2 Hz to 10 Hz, i.e., increase from 2 samples per second to 10 samples per second. The selection of 20 seconds at 10 Hz would provide accurate pre-crash data for a crash reconstruction without burdening the industry.

The proposed amendments would affect 7 frequency-based pre-crash data elements:

- 3 of required elements as specified in Table I of Part 563 -- "Speed, Vehicle Indicated", "Engine throttle, % full (or accelerator pedal, % full)", and "Service brake, on/off",
- 4 of "if recorded" elements in Table II of Part 563 -- "Engine RPM", "ABS activity (engaged, non-engaged)", "Stability control (on, off, engaged)", and "Steering input."

[2] "Event Data Recorders (EDRs) Duration Study – Final Report", the report can be found in the docket of this NPRM.
[3] Can be found in the docket of this NPRM

1.3 Lead Time

The agency proposes an effective date of the first September 1st, one year from the publication of the final rule. For example, if the final rule were published on October 1, 2022, the effective date would be September 1, 2024. The agency believes one-year of lead time is adequate to allow manufacturers to integrate a robust and reliable EDR that can comply with the proposed upgrades.

1.4 Technological Feasibility

The proposed amendment might require upgrades on computer memory chips, computer processing units, back-up power, and data downloading tools. However, these upgrades do not demand any EDR technologies and tools that are not currently available. For example, some manufacturers voluntarily implemented the 10 Hz pre-crash recording in EDR data for steering angle and electronic stability control as early as 2010.[4] Specifically, EDRs in 2012 Chrysler vehicles already recorded all data elements specified in Table I and additional 5 elements in Table II of Part 563 at 10 Hz.[5,6]

1.5 Benefits

Based on the EDR Duration Study, a 20-seconds recording of pre-crash data elements would capture 90 percent of the pre-crash maneuver time for rear-end, intersection, and roadway departure crashes. These three crash modes comprised about 70 percent of all passenger vehicle crashes[7] and separately represented the most prevalent, relatively longer maneuvered time required, and relatively severe crashes (based on fatalities). With their aggregated crash size and the inclusion of crashes with relatively longer crash action durations, the agency

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[4] NASS CDS Case 2010-82-045. EDR download FTP site: https://www.nhtsa.gov/node/97996/2921. Download nass2010.zip.
[5] DOT HS 812 929, Pg 18.
[6] NASS CDS Case 2012-12-075. EDR download FTP site: https://www.nhtsa.gov/node/97996/2921. Download nass2012.zip.
[7] Derived from the NHTSA report "Target Crash Population for Crash Avoidance Technologies in Passenger Vehicles", March 2019, DOT HS 812 653.

concluded that the 20-second recording duration would ensure EDRs capture sufficient pre-crash information for the vast majority of crash scenarios.

Increasing the recording frequency to 10 Hz would reduce the impact of data drop out and provide improved resolution for the agency to better understand the real-world performance of advanced crash avoidance systems that is currently limited with the current 2 Hz sampling rate. Data drop out under current 2 Hz sample rate would result in situation where vehicle was believed in one state such breaking but data were not captured (or dropped) in the EDR. The agency notices, for example, that the following two pre-crash actions can be easily missed under the 2 Hz frequency: rapid vehicle control inputs where brake application and release or rapid reversals in steering input of less than 0.5 seconds and the quick, brief activation and deactivation of crash avoidance technologies.

Essentially, longer recording time and refined resolution will improve the representability and interpretability of recorded pre-crash information in crash investigation and crash causation study. Subsequently, the recorded EDR data will further enhance the quality of the agency maintained real-word crash database. NHTSA anticipates that the enhanced pre-crash data quality would augment the agency's ability to meet challenges stemming from advanced driver assistance systems (ADAS)[8] and eventually automated driving systems (ADS)[9] by establishing more realistic pre-crash vehicle movements that the agency can study, use in simulations and use to conduct safety impact analyses.

Furthermore, NHTSA knows through its conversations with manufacturers that EDR data is invaluable to improving their systems' performance. Longer recording time and refined resolution also provide Original Equipment Manufacturers (OEMs) with more granular pre-crash information that manufacturers can use to evaluate and develop improvements for their vehicle systems. In particular, these enhancements, i.e., longer recording time and refined

[8] ADAS refers to features on a vehicle to support human drivers.
[9] ADS on the vehicle can itself perform all driving tasks and monitor the driving environment – essentially, do all the driving – in certain circumstances.

resolution, would help OEMs when crash reconstructions are needed to determine whether defected hardware or software caused a certain type of crash.

Ultimately, consumers would benefit from the enhancements in the form of safer vehicles when OEMs improve their vehicle systems, and defective hardware and software could be more quickly remediated with the better EDR data.

1.6 Costs

The agency considered several cost factors that would be affected by the proposed amendments: memory chip capacity increase, processor speed improvement, back-up power upgrade, data downloading tool software update, and the societal cost of carbon. After carefully examining each factor, the agency concludes that the additional cost to the industry and consumers associated with the proposed amendments most likely will be negligible. All potential memory, processor, and back-up power would be accommodated by the current or planned system capacity for the preparation of equipping vehicles with more safety functions and other subsystems, an observed industry trend. As for the data downloading tools, minor tweaks to the specialized software for transferring and interpreting might be needed, but the cables that are used for transferring EDR data would not be affected. Thus, the re-tooling cost would be negligible considering one tool can be used for many models of vehicles for many years. Finally, the proposed amendments would not increase the weight of vehicles, thus no additional carbon cost would accrue to society due to added fuel usage. Nevertheless, the agency seeks comments on our cost assumptions and conclusions. Please see the accompanying NPRM for detailed questions.

2 INTRODUCTION

This Preliminary Regulatory Evaluation (PRE) accompanies the National Highway Traffic Safety Administration's (NHTSA, the agency) Notice of Proposed Rulemaking (NPRM) to amend 49 CFR Part 563, Event Data Recorders (Part 563). In the NPRM, the agency proposes to revise EDR pre-crash recording duration and frequency by extending pre-crash data elements data from the currently required 5 seconds at a frequency of 2 Hz to 20 seconds at 10 Hz.

2.1 Background

EDRs are devices or functions that record vehicles' dynamic, time-series safety data just prior to or during a crash, intended for retrieval after the crash. The agency established Part 563 in August 2006 (71 FR 50998) and it became fully effective on September 1, 2012.[10] Part 563 standardizes performance requirements for data elements, data capture and format, data retrieval, and data survivability of onboard motor vehicle EDRs that are voluntarily installed in light vehicles with a gross vehicle weight rating (GVWR) of 3,855 kilograms (kg, 8,500 pounds) or less and an unloaded vehicle weight of 2,495 kg (5,500 pounds) or less. Part 563 also specifies the requirements for vehicle manufacturers to make commercially available tools and/or methods so that crash investigators and researchers can retrieve data from EDRs. The agency estimates that 99.5 percent of model year 2021 applicable passenger cars and other vehicles have Part 563 compliant EDRs.

Three tables, Tables I to III, in Part 563 specify the data recording requirements that are covered under the regulation. Table I lists the required data along with their recording interval (duration) and sampling frequency. Table II, parallel to Table I, is for the optional data elements if recorded. Table III provides the range, accuracy, and resolution for all reported data

[10] 71 FR 51043, August 28, 2006. Amended on January 14, 2008 (73 FR 2179) and corrected on February 13, 2008 (73 FR 8408). Further amended on August 5, 2011 (76 FR 47478).

elements. The agency established 5-second duration and 2 Hz frequency recording requirements because at the time, the agency concluded that it would be adequate to ensure the usefulness of the data in crash reconstruction. NHTSA also believed the 5-second duration would minimize the risk that the data capture process would overload the EDR's microprocessor and back-up power, which could cause a malfunction that could lead to a loss of data.[11]

2.2 Reasons for the NPRM

2.2.1 The Fixing America's Surface Transportation Act

Section 24303 of the Fixing America's Surface Transportation Act (FAST Act), Pub. L. No. 119-14 (Dec. 4, 2015), requires NHTSA to conduct a study "to determine the amount of time event data recorders installed in passenger motor vehicles should capture and record for retrieval of vehicle-related data in conjunction with an event in order to provide sufficient information to investigate the cause of motor vehicle crashes," and to submit a report containing the findings of this study to Congress. The FAST Act also requires that within two years of submitting the report to Congress, NHTSA must "promulgate regulations to establish the appropriate period during which event data recorders installed in passenger motor vehicles may capture and record for retrieval vehicle-related data to the time necessary to provide accident investigators with vehicle-related information pertinent to crashes involving such motor vehicles."

The agency conducted a EDR recording duration study titled "Event Data Recorders Duration Study" (EDR Duration Study)[12] in 2017 to discern pre-crash time interval that can assist in determining crash causation. On September 28, 2018, the agency submitted a Report to Congress summarizing the results of this study to the House Committee on Energy and

[11] NHTSA had originally proposed an 8-second duration in the NPRM. 69 FR at 32942 (June 14, 2004). However, NHTSA decided to reduce the duration in response to public comments. 71 FR at 51020 (Aug. 28, 2006).
[12] "Event Data Recorders (EDRs) Duration Study – Final Report," can be found in the docket of this NPRM.

Commerce and the Senate Committee on Commerce, Science, and Transportation. This NPRM is beginning the required rulemaking phase of this FAST Act mandate.

2.2.2 EDR Duration Study

To meet the agency's obligations under Section 24303 of the FAST Act, the agency contracted Virginia Polytechnic Institute and State University (Virginia Tech) to conduct the EDR Duration Study to determine the appropriate EDR recording duration for pre-crash data to improve crash causation investigation. The study design was first to examine the failure rate of the 5-seconds recording in capturing full pre-crash actions/maneuvers in real-world crashes. Then, the study analyzed data from naturalistic driving studies (NDS) to establish the recording duration threshold under which EDRs can sufficiently capture pre-crash actions/maneuvers for most crashes.

2.2.2.1 Failure Rates of 5-Seconds Recording Duration

The first part of the study was to examine EDR information for three pre-crash maneuvers for three crash modes and estimate the likelihood that these maneuvers were initiated 5 seconds before the impact, i.e., the failure rate of the 5-seconds recording. The three maneuvers examined were brake application, steering, and acceleration. The three selected crash modes were rear-end, intersection, and roadway departure crashes. The term, "Pre-crash maneuver duration" for the study was defined as the time duration between the beginning of the driver action and the time of an impact, where the time of impact (i.e., t = 0) is defined as the beginning of the EDR algorithm enable time. As such, for example, in the study, the driver brake application duration was the time between the earliest point at which the brake switch was recorded as "ON" and the initial impact on another vehicle or object. Steering Input duration was calculated as the time between the earliest non-zero steering angle recorded and the impact. Accelerator input duration was the earliest time when the driver completely released the accelerator (i.e. the accelerator position reads 0) and the impact.

EDR cases from the 2000-2015 National Automotive Sampling System Crashworthiness Data System (NASS-CDS) were used for the study. NASS-CDS is a nationally representative database

of passenger vehicle (PV) crashes where at least one PV was towed from the scene due to damage. It is an in-depth investigation of reported crashes including detailed vehicle exterior and interior damage information, crash severity delta-v, and occupant body region injury severity. The selected EDR cases had to be single event crashes where they either had an air bag deployment event or an event with a delta-v greater than 5 miles-per-hour recorded. These cases also had at least one non-missing pre-crash maneuver recorded. Overall, there were 225 rear-end crashes, 766 intersection crashes, and 330 roadway departure crashes for the analysis.[13]

Based on these EDR cases, the study established the cumulative time distribution for the three pre-crash maneuvers. These distributions showed that the 5-seconds duration failed to capture 9 percent of accelerator pedal releases, 35 percent of braking initiations, and 80 percent of steering initiations for rear-end crashes. For the intersection crashes analyzed, the corresponding failure rates are 5, 35, and 64 percent, respectively. For roadway departures, the respective failure rates are 8, 35, and 88 percent, respectively. **Table 2-1** presents the failure rates.

Table 2-1
Failure Rate (in Percent) of 5-Seconds Recording of Pre-Crash Maneuver Initiations

Pre-crash Maneuvers	Rear-End	Intersection	Road Departure
Accelerator Pedal Release	9	5	8
Braking	35	35	35
Steering	80	64	88

Source: Table 29 of the EDR Duration Study

In parallel, the study also examined EDR cases from the National Motor Vehicle Crash Causation Study which was conducted from 2005-2007.[14] A total of 50 EDR cases met the selection

[13] Table 3 of the EDR Duration Study
[14] National Motor Vehicle Crash Causation Survey, Report to Congress, July 2008, DOT HS 811 059 https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811059

criteria that were used for NASS-CDS. Due to the small sample, it did not derive meaningful conclusions.

2.2.2.2 Sufficient Recording Duration

After finding that a 5-second recording duration is not adequate to capture the selected pre-crash actions/maneuvers, the Virginia Tech EDR Duration Study then proceeded to determine the recording time that is considered sufficient to capture these driver actions/maneuvers. For this, the EDR Duration Study analyzed cases from two naturalistic driving studies (NDS)[15]: 2002 100-Car NDS conducted by Virginia Tech Transportation Institute and the 2016 Second Strategic Highway Research Program (SHRP-2)[16] NDS which was conducted by the Transportation Research Board of The National Academies. All selected cases in the 100-Cars NDS were driving events, not crashes. These events were used to establish the driver reaction time in normal driving conditions. Cases from SHRP-2 were all crashes and used to develop the timespan distributions of driver pre-crash action durations. The following discusses the study approach and findings for rear-end, roadway departure, and intersection events/crashes.

2.2.2.2.1 Rear-End Events/Crashes

From the 100-Cars NDS, "car following" braking non-crash events with a stopped or travelling lead vehicle were used to develop the time duration distribution of driver braking and other event associated time matrixes under normal driving conditions. From the SHRP-2 NDS, striking rear-end crashes were retrieved and used to establish adequate recording time thresholds for fully capturing driver pre-crash behaviors.[17] In total, there were 868,151 non-crash braking events (from the 100-CARS NDS) and 111 rear-end striking crashes (from the SHARP-2 NDS). Of the non-crash events, 16 percent were lead vehicle stopped (LVS) and 84 percent were lead

[15] A naturalistic driving study is a research method that involves equipping vehicles with unobtrusive cameras and instrumentation to record real-world driver behavior and performance.
[16] SHRP-2 data was used to better capture the diversity of driver behavior nationwide.
[17] i.e., accelerator release, brake initiation, and evasive steering initiation.

vehicle moving (LVM). In contrast, 79 percent of rear-end striking crashes were LVS and 21 percent were LVM, a reversed pattern to that of non-crash events.

For rear-end events, the EDR Duration Study analyzed cumulative time distributions for four measurements to discern the time for recording the rear-end events (i.e., car following). These four measurements were (1) braking duration (Brake-Event-Duration), (2) time to closest approach to the lead vehicle (Time-to-Closest-Approach), (3) time to minimum time-to-collision (Time-to-Minimum-TTC), and (4) time-to- collision (TTC)-at-Brake. Brake-Event-Duration was calculated as the total "ON" duration of the brake light switch, or the time duration between when drivers depressed the brake pedal to the time when the brake pedal was released. Time-to-Closet-Approach was calculated from the time when drivers depressed the brake pedal to the time of the closest approach or distance of the lead vehicle.

From the distributions, it was found that the median (i.e., 50th percentile) Brake-Event-Duration was approximately 2.2 seconds, and the 90th percentile was approximately 8.1 seconds. For the other three measurements, the Duration Study only provided the results by the movement of lead vehicles (i.e., LVS and LVM). **Table 2-2** presents all the 50th and 90th percentile statistics separately by LVS and LVM. As shown, LVS has longer event durations when compared to that of LVM, except for TTC-at-Brake. The median Brake-Event-Duration was 12.7 seconds and the 90th percentile was 49.1 seconds for LVS and 1.9 and 6.7 seconds for LVM, respectively. The median Time-to-Closest-Approach was 4.5 seconds and the 90th percentile was 12.3 seconds for LVS and 1.5 and 5.4 seconds for LVM, respectively. The corresponding statistics for Time-to-Minimum-TTC is 2.0 seconds and 9.8 seconds for LVS, whereas they were 0.3 seconds and 2.9 seconds for LVM. For TTC-to-Brake, they were 4.0 and 10.7 seconds for LVS, and 7.7 and 29.0 seconds for LVM.

Table 2-2
The Median and 90th Percentile of Rear-End, Car Following Event Times
(in seconds)

Measurements	**Lead Vehicle Stopped (LVS)**		**Lead Vehicle Moved (LVM)**	
	Median	90th Percentile	Median	90th Percentile

Brake-Event-Duration	12.7	49.1	1.9	6.7
Time-to-Closest-Approach	4.5	12.3	1.5	5.4
Time-to-Minimum-TTC	2.0	9.8	0.3	2.9
TTC-at-Brake	4.0	10.7	7.7	29.0

Source: Table 19 of the EDR Duration Study

For striking rear-end crashes, time duration distributions were established for three pre-crash driver actions: final accelerator release, final brake initiation (for the scenario with alternative braking and releasing), and evasive steering initiation. **Table 2-3** presents the median and the 90th percentile statistics of the time distributions. As shown, the 90th percentile duration for the pre-crash driver actions, final accelerator release, brake initiation, and evasive steering was 12, 10, and 3 seconds, respectively.[18] Therefore, a 12-seconds recording can capture at least 90 percent of accelerator release, braking initiation, and evasive steering initiation pre-crash driver action time.

Table 2-3
The Median and 90th Percentile of Pre-Driver Action Time Distributions
(in seconds)

Pre-Driver Actions	Median	90th Percentile
Final Accelerator Release	1.6	11.8
Final Brake Initiation	1.3	9.6
Evasive Steering Initiation	0.5	2.7

Source: Table 21 of the EDR Recording Duration Study

2.2.2.2.2 Intersection Events/Crashes

The 100-Car NDS is the only source used for this crash/event mode since the SHARP-2 NDS did not exam intersection crashes. Therefore, no intersection crashes were analyzed in this

[18] Final accelerator release was calculated as the time point prior to impact, where impact is time 0, when the driver releases the accelerator (accelerator status "0") for the final time. Final brake initiation was calculated as the time point prior to impact when the driver depresses the brake pedal the last time since braking can be on/off over recorded period. Time of evasive steering initiation was calculated as the time point prior to impact when the driver's steering rate equaled or exceeded 500°/s for the first time. These metrics were not collected in the 100-car NDS.

regulatory impact analysis. Overall, a total of 11,682 intersection events over 143 stop sign-controlled intersections and 163 signalized intersections were in the sample. In the analysis, each of these events in normal driving[19] was divided into two stages: approaching and traversing through an intersection. The total event time duration (Total Time) thus was the sum of these two durations. The analysis used the cumulative distribution for approach time, traversal time, and the total time to discern the appropriate time duration for capturing the full intersection events. These times were measured separately by traffic control device (stop sign, signalized), driver approach movement (complete stop, low speed rolling stop/start, high speed rolling stop/start), and traversal action (straight, left turn), and the number of traffic lanes (2, 5, and 7 lanes). For rolling stop/start, low speed was defined when minimal traveling speed (mts) is between 3 and 10 mph (i.e., $3 \leq mts \leq 10$ mph) and high speed when mts is greater than 10 mph but less than 21 mph (i.e., $10 < mts \leq 20$ mph).)

Based on these cumulative time distributions, it was found that the approach, traversal, and total times were the longest at 7-lanes intersections and the shortest at 2-lanes intersections. Also, time for straight traverse generally was shorter time than that of making left turn. **Table 2-4** provides a range for the median and 90th percentile statistics of the total time distribution by three approach movements. The lower bound of the range represents the minimum of the total times between straight traverse and making left turn at 2-lanes intersections and the upper bound is the maximum of the two traverse action times at 7-lanes intersections. As shown, a 15-seconds recording would capture approximately 50 percent of the event time. If extended to 20 seconds, 90 percent of the intersection event times would be captured.

[19] The sequence of driver actions leading to and resulting in an intersection collision can be divided into four phases: the approach phase, the traversal phase, any evasive action and finally the impact. For almost all intersection crash types, the driver actions which lead to the crash, e.g. running a red light, occurred during the approach phase. In most crashes once in the intersection, the error has already been committed. If an EDR can capture the approach phase of an intersection crash, then the entire crash will be captured. However, EDRs which record the time of transition between the approach and transversal phase can capture stop sign running, rolling stops, and red light running.

Table 2-4
The Median and the 90th Percentile of Total Time Durations for Intersection Events
(in seconds)

Stop Sign Intersections				
Approach Movements	Median		90th Percentile	
	Lower Bound	Higher Bound	Lower Bound	Higher Bound
Complete Stopped	11.8	14.4	14.8	18.8
Low Speed Rolling	10.8	13.9	15.0	17.8
High Speed Rolling	8.5	10.7	11.3	13.7
Signalized Intersections				
Complete Stopped	12.4	15.6	15.4	18.9
Low Speed Rolling	10.4	13.5	13.3	16.6
High Speed Rolling	6.7	8.9	9.5	11.9

Source: Tables 25 and 26 of the EDR Recording Duration Study

2.2.2.2.3 Roadway Departure

Like the rear-end mode, both 100-Car NDS and SHRP-2 NDS were used for analysis. Lane excursion events were selected from the 100-Car NDS. These events were minor lane departures that do not result in crashes, which occur because of normal lane keeping behavior. Roadway departure crashes were retrieved from the SHRP-2 study. Overall, the study examined a total of 2,548 lane excursion events and 26 roadway departure crashes.

For roadway departure events, the study used three measurements to describe the event time for roadway departure in normal driving conditions. One is the Departure-to-Recover time which was calculated from the moment when the subject vehicle crossed the lane line (Departure) to the time when it was back within the lane line (Recover). The second one is the Drift-to-Departure time which was estimated from the time when the driver began of the subject vehicle to drift out of the lane to the time when the vehicle's leading edge crossed the lane line. And, the last one is Drift-to-Recover, i.e., the entire duration for lane excursion, which is the time when the driver began to drift out of lane to the time when the vehicle recovers back within the lane lines. **Table 2-5** presents the 50th percentile and the 90th percentile statistics for these three measurements. As shown, a 6-seconds recording is expected to capture 90 percent of the roadway departure event time.

Table 2-5
Event Time Measurements for Roadway Departure
(in seconds)

Measurements	Median	90th Percentile
Departure-to-Recover	1.5	4.0
Drift-to-Departure	1.4	4.0
Drift-to-Recover	3.2	6.0

Source: Figures 47, 48, and 49 of the EDR Duration Study

For the 26 roadway departure crashes, the analysis examined their brake-application-to-departure time, throttle-release-to-departure time, and evasive-steering-to-departure time. As the name suggested, brake-application-to-departure time was the time when the driver of the subject vehicle pressed the brake or the last press (for the scenario with alternative braking and releasing) to the vehicle departure time. Similarly, throttle-release-to-departure time was defined as the time when the driver released throttle or the last to the vehicle departure time. Evasive steering time begins with the first instance when the steering rate was greater than 500 degrees per second.

Table 2-6 presents the median and the 90th percentile statistics for these time measurements. As shown, the median brake application was 1.9 seconds prior to road departure and the 90th percentile was about 14.0 seconds. The earliest brake application was observed occurring 21 seconds prior to road departure.[20] The median throttle-release-to-departure time was 23 seconds and the 90th percentile was 25.0 seconds. Note that all cases released the throttle more than 5.0 seconds before roadway departure.

Table 2-6
The Median and 90th Percentile of Pre-Crash Action Times for Roadway Departure Crashes
(in seconds)

Time Measurements	Median	90th Percentile

[20] Both lane and road departures were analyzed, because, while most normal lane excursions do not result in crashes, lane excursions can lead to road departure crashes if the driver does not initiate corrective measures in time. Therefore, a characterization of normal lane excursions duration provides a baseline to establish sufficient EDR recording duration in order to capture driver lane keeping behavior prior to road departure crashes.

Brake-Application-to-Departure	1.9	14.0
Throttle-Release-to-Departure	23.0	25.0
Evasive-Steering-to-Departure	*	*

Source: Figures 47, 48, and 49 of the EDR Duration Study
* Sample was not sufficient to derive meaningful statistics

2.2.2.2.4 Summary of Results

Table 2-7 summarizes the median and the 90th percentile statistics for the time-measurements examined. One measurement for each event mode: Time-to-Closest-Approach for rear-end events, Drift-to-Recover (i.e., Approach + Traverse) for intersection events, and Drift-to-Recovery for roadway departure events. Based on the statistics shown in this table, a 20-seconds recording of pre-crash data would capture 90 percent of pre-crash action times.[21]

Table 2-7
The Median and the 90th Percentile of Driver Action Duration by Event Modes
(in Seconds)

Event Modes	Driver Actions	Median	90th Percentile
Rear-End	Time-to-Closest-Approach	4.5	12.3
Intersection	Approach + Traversal	12.6-15.1	16.0-18.6[22]
Road Departure	Drift-to-Recovery	3.2	6.0

Source: Table 29 of the EDR Duration Study

The three crash modes comprised about 70 percent of all passenger vehicle crashes.[23] Separately, they represent the most prevalent, relatively longer driver action times required, and relatively severe crashes (based on fatalities). With the crash size and the inclusion of crashes representing the relatively longer pre-crash action duration in real-world crashes, the

[21] This duration is influenced heavily by the inclusion of intersection crashes. Without the inclusion of intersection crashes 12.3 seconds of data would encompass the 90th percentile recording duration for rear-end and road departure crashes.
[22] Note the range of time shown for intersection was derived from intersections with different number of lanes. The lower bound represents time for 2-lane intersections while the upper bound for 7-lane intersections.
[23] Derived from the NHTSA report "Target Crash Population for Crash Avoidance Technologies in Passenger Vehicles", March 2019, DOT HS 812 653

agency concludes that requiring a 20-second recording duration would ensure EDRs capture sufficient pre-crash information for the vast majority of crashes.

3 PROPOSED AMENDMENTS, TECHNOLOGIAL FEASIBLITY and LEAD TIME

3.1 Proposed Amendments

The agency proposes to amend the recording duration and sample frequency for pre-crash data elements that are specified in Table I and Table II of Part 563. The proposed amendments include:

- Extending the pre-crash data recording duration from currently required 5 seconds to 20 seconds.
- Increasing sampling frequency from 2 Hz to 10 Hz, i.e., increase sampling rate from 2 samples per second to 10 samples per second.

Overall, the proposed amendments would affect at least 3 required data elements (Table I of Part 563) and at most 7 data elements (3 required plus 4 "if recorded" in Table II). **Table 3-1** lists these affected data elements and the proposed criteria.

Table 3-1
Data Elements Would Be Affected by the Proposed Amendments

Data Elements	**Proposed Recording Interval/Time (Relative to Time 0)**	**Proposed Data Sampling Rate (Samples per Second)**
Required Elements, Table I of Part 563		
Speed, Vehicle Indicated	-20 to 0 seconds	10
Engine throttle, % full (or accelerator pedal, % full)	-20 to 0 seconds	10
Service brake, on/off	-20 to 0 seconds	10
"If Recorded" Elements, Table II of Part 563		
Engine RPM	-20 to 0 seconds	10
ABS activity (engaged, non-engaged)	-20 to 0 seconds	10
Stability control (on, off, engaged)	-20 to 0 seconds	10
Steering input	-20 to 0 seconds	10

3.2 Technological Feasibility

The proposed amendment might require upgrades on computer memory chips, computer processing units, back-up power, and data downloading tools. However, these upgrades do not demand any EDR technologies and tools that are not currently available. For example, the 10 Hz pre-crash recording occurred for steering angle and electronic stability control as early as 2010.[24] Specifically, EDRs in 2012 Chrysler vehicles already recorded all data elements specified in Table I and additional 5 elements in Table II of Part 563 at 10 Hz.[25,26]

3.3 Lead Time

The agency proposes an effective date of the first September 1st, one year from the publication of the final rule. For example, if the final rule were published on October 1, 2022, the effective date would be September 1, 2024. The agency believes this is adequate to allow manufacturers to integrate a robust and reliable EDR that would comply with the proposed upgrades.

[24] NASS CDS Case 2010-82-045. EDR download FTP site: https://www.nhtsa.gov/node/97996/2921. Download nass2010.zip.
[25] DOT HS 812 929, Pg 18.
[26] NASS CDS Case 2012-12-075. EDR download FTP site: https://www.nhtsa.gov/node/97996/2921. Download nass2012.zip.

4 BENEFITS

The agency and the public have benefited from incorporating EDR information into crash and defects investigations, as the inclusion of EDR data leads to improved investigations and better understanding of injury causes and injury mechanisms. For example, in March 2010, NHTSA began to obtain data from Toyota EDRs as part of its inquiry into allegations of unintended acceleration (UA), and as follow-up to the recalls of some Toyota models for sticking and entrapped accelerator pedals. The Toyota unintended acceleration study[27] analyzed these cases and determined the root cause of each crash. EDR data helped the agency determine the root cause and support the safety recalls. Safety recalls illuminate defects in vehicles and make sure that these defects never cause issues again. Consequently, recalls prevent life loss and injuries due to vehicle defects.

Over time, EDR data gradually has been incorporated into the agency maintained real-world crash databases. The standardized EDR data in databases has assisted safety researchers and the agency to better understand vehicle crashes (e.g., the variation between the estimated vehicle velocity change (delta-v) and EDR recorded delta-v) and determine crash causation.[28] In 2016, the agency also used EDR data to establish crash scenarios and vehicle dynamics when evaluating the efficacy of vehicle-to-vehicle (V-to-V) communication technologies in a Notice of Rulemaking Proposal for V-to-V.[29] EDR data also can be used to assess whether the vehicle was operating properly at the time of the event, or to help detect undesirable operations. The use of EDR data in these safety evaluations and crash causation analyses eventually would benefit the public through the agency's consumer information and promulgated rules. Furthermore, we understand that vehicle manufacturers also have utilized EDR data in improving vehicle

[27] "Technical Assessment of Toyota Electronic Throttle Control (ETC) Systems," February 2011

[28] Even though crash investigators gather insightful information about the dynamics of crashes, some parameters cannot be determined or cannot be as accurately measured (such as the change in velocity) by traditional post-crash investigation procedures such as visually examining and evaluating physical evidence, e.g., the crash-involved vehicles and skid marks.

[29] Preliminary Regulatory Impact Analysis, FMVSS No. 150, Vehicle-to-Vehicle Communication Technologies for Light Vehicles, December 2016, HS 812 359

designs and developing more effective vehicle safety countermeasures. Trauma centers also value the EDR data in diagnosing injuries of the crash victims.

These experiences and activities affirmed the significant value of EDR pre-crash data although the agency did not quantify the benefits in this regulatory impact analysis. As discussed in the cost chapter of this regulatory impact analysis, costs associated with the rulemaking would be extremely small to manufacturers and consumers such that, in the practical sense, it is reasonable to assume the rulemaking would not generate additional costs. Therefore, there is no need to wait to have additional research to quantify the benefits, which would take several years and demand a great amount of resources from the agency and taxpayers. Furthermore, the research, if there is such in the future, would not alter the conclusion we tentatively make in this regulatory analysis that the proposed rule would provide benefits without incurring costs.

However, the EDR Duration Study found that the current 5 seconds pre-crash recording did not capture the initiation of pre-crash braking and steering maneuvers in a substantial percentage of cases. The proposed 20 seconds recording is to ensure that the initiation of pre-crash actions and maneuvers can be captured for most crashes. The three crash modes examined in the EDR Duration Study comprised about 70 percent of all passenger vehicle crashes, annually.[30] Separately, these crashes represent the most prevalent, relatively longer maneuvered times required, and relatively severe crashes (based on fatalities). Therefore, the agency believes that the proposed 20 seconds would be adequate to record the pre-crash actions for almost all the real-world crashes given the collective size of these three crashes and what they represent. The increase pre-crash data elements then would be expected to further improve crash investigations and enhance crash data quality.

[30] Derived from the NHTSA report "Target Crash Population for Crash Avoidance Technologies in Passenger Vehicles", March 2019, DOT HS 812 653

The proposed 10 Hz sample frequency would enhance the interpretability of recorded pre-crash information and prevent data drop-out due to the relatively course sampling rate under 2 Hz. Specifically, the improved acquisition frequency can capture rapid pre-crash vehicle control inputs (e.g., rapid brake application and release or quick reversals in steering input of less than 0.5 seconds) and the activation of crash avoidance technologies that would otherwise completely missed in the data stream under the current 2 Hz frequency sampling rate. The agency believes that without the sampling refinement, even with the proposed 20 seconds duration, crash investigators and researchers could still misinterpret the recorded data.

The proposed amendments, we believe, would fulfill the need for adequate recording of pre-crash actions for investigation/reconstruction without overtasking the vehicle power and memory. The agency expects that the proposed amendments that expand EDR data recording will aid in the improvement of existing safety standards and the development of new ones. An increasing number of vehicles in the fleet today have advanced safety technologies, including ADAS. These refined pre-crash EDR records would allow the agency and safety researchers to better understand driver pre-crash behavior and are expected to assist the agency and manufacturers in the performance evaluation of ADAS (e.g., lane departure warning, lane keeping assist, forward collision avoidance, and intersection movement assistance systems) and ADS by establishing more detailed crash scenarios for computer simulations, for example. NHTSA knows through its conversations with manufacturers that EDR data is invaluable to improving their systems' performance. Longer recording time and refined resolution also provide OEMs with more granular pre-crash information that manufacturers can use to evaluate and develop improvements for their vehicle systems.

5 COSTS

The agency considered several cost factors that could be impacted by the proposed amendments: increased storage memory capacity, processor speed improvement, back-up power upgrade, data downloading tool software reconfiguration, and the societal cost of carbon. After examining each factor, the agency concluded that the additional costs associated with the proposed amendments would be expected to be negligible since all potential memory, processor, back-up power and tool upgrades would be accommodated by the current system capacity or planned designed capacity for implementing more safety functions and other subsystems. The proposed amendments would not increase the weight of vehicles. Therefore, no additional carbon cost would be accrued to society due to added fuel consumption. In all, the agency does not expect the proposed amendments would generate additional costs to the industry and consumers. Finally, the agency determined that distributional effect is not applicable to this NPRM, i.e., no unbiased cost and benefit burden among different segments of the automobile industry and among different types of consumers. The following describes the agency's analysis of the cost factors in detail.

5.1 Memory Capacity Increase

The proposed amendments would increase the sample points for each of the affected pre-crash data elements from the currently required 11 samples (= 2 samples per second * 5 seconds + 1 initial sample) to 201 samples (= 10 * 20 + 1), i.e., an additional 190 data points per affected data element. For a minimal of 3 affected data elements (required) and the maximum of 7 data elements (required + "if recorded"), a total of 570 (= 190 * 3) to 1,330 (190 * 7) additional data points would be generated and recorded.

An agency's EDR Technologies Study[31] estimated that it is about 1 byte per sample and the total memory for recording all data elements in Table I and Table II is 0.072 Kb and 0.858 Kb,

[31] DOT HS 812 929

respectively.[32] Based on 1 byte per sample, the additional required memory would range from 0.570 to 1,330 kilobytes (Kb). Combining Table 1 and Table II as the upper bound, the baseline total memory for currently complied EDRs is estimated to range from 0.072 to 0.930 Kb. Adding the additional memory to the baseline, the total memory for EDRs that would comply with the proposed amendments is estimated to range from 0.642 (= 0.072 + 0.570) to 2.260 (= 0.930 + 1.330) kb. **Table 5-1** lists the estimated memory capacity for Part 563 complied EDRs and the proposed amendments.

Table 5-1
Estimated Memory Capacity for EDR Use
(in kb)

EDRs	Lower Bound*	High Bound**
Currently Complied	0.072	0.930
Proposed		
Additional Needed	0.570	1.330
Proposed Total(1)	0.642	2.260

(1) Currently Complied + Additional
*for all elements in Table I
** for both required and "if recorded", i.e., Table I and Table II combined

The EDR Technology Study found that a typical microprocessor used for the Air Bag Control Module (ACM) is either 32 Kb or 64 Kb of flash memory and a fraction of those capacities is for EDRs. We understand that flash memory design is flexible and can have different block structures, block sizes, and/or block combinations and the memory chips were implemented in various subsystems or function modules. Some manufacturers might store EDR data in different memory chips, i.e., put data close to the individual subsystem/function that utilizes the data instead of housing all in a centralized one (i.e. imbedded in ACM). We believe this memory strategy is more effective in using memory space and more scalable for managing the ever growing of automotive data. Given that the increased memory is very small and that the

[32] Tables 20 and 21 in DOT HS 812 929. There are 3 data elements in Table I and 4 in Table II that are frequency based. We assume 1 Byte of memory for each data sample (11 Bytes for each data element). This results in 33 and 44 Bytes of frequency-based data in Tables I and II, respectively.

industry trend is continuing to incorporate more memory capacity and faster processors for processing the ever growing of data, the agency believes that the memory changes can be accommodated by the existing or planned memory design. Specifically, more memory and faster processors are critical to the performance of ADAS, highly automated driving functions, and other electronic subsystems (such infotainment, navigation, communication) in vehicles.

Although the agency expects that the additional costs negligible, the agency acknowledges the possibility that an ACM is at its full memory usage. Under this scenario, vehicle manufacturers could take alternative remedies such as moving to a larger chip, implementing a different memory design strategy, or reducing the number of optional Table II data elements.[33] The agency seeks comment on what remedies the industry would take to meet the proposed requirements without reducing the number of "if recorded" elements and/or crash events and what the corresponding costs might be. The agency also seeks comments on any other cost factors that we need to consider such as redesign for a larger unit, additional capacity for Random-Access Memory (RAM).[34]

5.2 Processor Speed Improvement

Through the EDR Technologies Study, the agency found that more than a decade ago at least one vehicle manufacturer was recording 20 seconds of data at 5 Hz. Since then, manufacturers may have improved the processing speed of their ACM in order to handle additional crash deployable components, such as ejection mitigation curtains. We also understand that some manufactures used distributed EDR, i.e., not couple with ACM. This distributed EDR design is expected to be scalable and thus has the flexibility to integrate the proposed amendments. In addition, manufacturers also have continued using faster processors to process the expansion

[33] In this situation, there could be additional cost to move to a larger chip. According to the EDR Technologies Study reported that the cost of flash memory (the type that could be used to permanently store an EDR image) was 0.00072 $/megabyte (Mb) in 2013, with the projection of a drop to 0.0004 $/Mb by 2017.

[34] An internet search for automotive grade microprocessor chips with 64 Kb and 128 Kb flash memory capacity indicate that they also had 4 Kb of available SRAM integrated with the chip. https://www.microchip.com/wwwproducts/en/AT90CAN64

of automotive data from vehicle infotainment and growing number of sensors (image and video) and to enable higher performance of ADAS (e.g., adaptive cruise control, lane keeping, automatic braking, and driver monitoring systems) and a greater user experience of these subsystems. Furthermore, faster processors also are important for working efficiently with data from external systems such as GPS satellites for navigation and vehicle-to-roadway communication units for traffic management and safety. Thus, the proposed changes would not significantly affect the throughput of processors.

5.3 Back-up Power Upgrade

Similar to the reasons provided above for processor improvement, the agency concludes that the proposed changes would not increase the cost for back-up power supply upgrade of applicable vehicles.

5.4 Data Downloading Tools

Data downloading tools are specialized equipment for accessing the recorded data in passenger vehicles. The tool is a collection of hardware and software that is designed to retrieve and download an image the stored EDR data (i.e., not altering the data) and translate the data into readable format. The hardware components include interface modules, cables, and adapters. Currently, there are several commercially available tools (e.g., Bosch, Tesla, GIT - Kia, and GIT - Hyundai). Their price ranges from $1,200 to $8,000.[35] This does not include software annual license fee which is about $1,200 per license per year. Furthermore, if including every cable and adopters for every car supported by these tools, the complete set price can increase to $17,000 to $28,000.[36]

The proposed amendments would increase the number of recoded data points and alter its written locations on the memory chips. This would require minor tweaks to the specialized software for transferring and interpreting the data but would not affect cables that were used

[35] As of July 23, 2021, https://crashdatagroup.com/
[36] Paid by NHTSA

for data transferring. Thus, the cost would be negligible considering one tool can be used for many models of vehicles for many years.

5.5 Societal Costs of Carbon

The proposed amendments would not increase the weight of vehicles. Therefore, no additional carbon cost would be accrued to society due to added fuel consumption.

5.6 Distributional Effects

Distribution effects exist if the estimated costs and benefits are disproportionally shared among different segments of automobile industry and among different consumer types. The agency believes the distribution effects are not applicable for this NPRM since the proposed amendments would not impose additional costs for both original vehicle manufacturers and multistage manufacturers. Furthermore, the proposed changes also would not affect the price of vehicles paid by the consumers and would not cause economic burdens to the society.

6 REGULATORY ALTERNATIVES

The agency considered two alternatives: (1) 20-second recording and 2 Hz sample frequency and (2) 15 seconds and 5 Hz sampling rate. Although all these are no-cost alternatives, the first alternative does not have the necessary resolutions for interpreting recorded data. The second alternative with the 15 second recording does not capture a sizeable portion of pre-crash actions. Given that the proposed amendments are the most valuable to crash investigation/reconstruction and that the agency does not expect the proposed amendments would result in any additional economic impact, the agency decided not to select either of these alternatives.

7 REGULATORY FLEXIBILITY ACT, UNFUNDED MANDATES REFORM ACT, AND OTHER ACTS ANALYSIS

7.1 Regulatory Flexibility Act

Pursuant to the Regulatory Flexibility Act (5 U.S.C. 601 et seq., as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996), whenever an Agency is required to publish a notice of proposed rulemaking or final rule, it must prepare and make available for public comment a regulatory flexibility analysis (RFA) that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small governmental jurisdictions). The Small Business Administration's regulations at 13 CFR part 121 define a small business, in part, as a business entity "which operates primarily within the United States." (13 CFR 121.105(a)(1)). However, no regulatory flexibility analysis is required if the head of an Agency certifies the proposed or final rule will not have a significant economic impact on a substantial number of small entities. SBREFA amended the Regulatory Flexibility Act to require Federal agencies to provide a statement of the factual basis for certifying that a proposed or final rule will not have a significant economic impact on a substantial number of small entities.

The head of NHTSA has made such a certification with regard to this NPRM. The factual basis for the certification (5 U.S.C. 605(b)) is set forth below. While NHTSA is not required to issue an initial RFA (IRFA) by certifying as it did above, the agency discusses below the issues that would be addressed by an IRFA. By discussing these issues, NHTSA explains its analyses of the potential effects of this NPRM on small entities. Section 603(b) of the Act specifies the content of a RFA. Each RFA must contain:

1. A description of the reasons why action by the agency is being considered;
2. A succinct statement of the objectives of, and legal basis for a proposed rule;
3. A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply;
4. A description of the projected reporting, recording keeping and other compliance requirements of a proposed rule including an estimate of the classes of small entities

which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;

5. An identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap or conflict with the proposed rule;
6. Each initial regulatory flexibility analysis shall also contain a description of any significant alternatives to the proposed rule which accomplish the stated objectives of applicable statutes and which minimize any significant economic impact of the rule on small entities.

1. Description of the reasons why action by the agency is being considered

The agency is considering this action to extend the recording duration for voluntarily installed EDR technology in light vehicles from the currently required 5 seconds to 20 seconds for pre-crash data elements that are specified in Table I and Table 2 of Part 563. In addition, the agency also proposes to increase their sampling frequency from 2 Hz to 10 Hz, i.e., from 2 samples per second to 10 samples per second. The agency found that the 5-second recording failed to capture a significant portion of drive actions for rear-end, intersection, and roadway departure crashes and the 2 Hz sampling frequency lacked the resolutions for interpreting critical pre-crash movements to discern crash causation. Therefore, the action is to ensure that EDRs can record sufficient pre-crash information to further assist crash investigation/reconstruction and root cause of the crashes. Subsequently, the expanded EDR data can improve the agency's maintained real-world crash databases and allows the agency to meet the safety challenges imposed by ADAS and automated driving functions. Furthermore, this action is being taken in accordance with a mandate in Section 24303 of the Fixing America's Surface Transportation (FAST) Act, P.L. 114-94, to amend the EDR standard recording duration to provide crash investigators with pertinent crash-related information.

2. Objectives of, and legal basis for, the proposal or final rule

Under 49 U.S.C. 322(a), the Secretary of Transportation (the "Secretary") has authority to prescribe regulations to carry out the duties and powers of the Secretary. One of the duties of

the Secretary is to administer the National Traffic and Motor Vehicle Safety Act, as amended (49 U.S.C. 30101 et seq.) The Secretary is authorized to issue Federal Motor Vehicle Safety Standards (FMVSS) that are practicable, meet the need for motor vehicle safety, and are stated in objective terms.[37] The Secretary has delegated the responsibility for carrying out the National Traffic and Motor Vehicle Safety Act to NHTSA.[38]

The objectives of this proposed rule are to meet the agency's obligations under Section 24303 of the FAST Act and to help ensure that that critical pre-crash data is captured at a frequency necessary to understand the performance and effectiveness of crash avoidance technologies and with sufficient granularity to prevent misinterpretation.

The legal basis for this proposed rule is NHTSA's authority to promulgate regulations under 49 U.S.C. 322, 30101, 30111, 30115, 30117, 30166, 30168; delegation of authority at 49 CFR 1.50.

3. Description and estimate of the number of small entities to which the proposal or final rule will apply

The proposed rule applies to vehicle manufacturers who produce light vehicles with a GVWR not greater than 3,855 kg (8,500 pounds), including final-stage manufacturers and alterers.[39] Business entities are defined as small businesses using the North American Industry Classification System (NAICS 2017) code[40], for the purposes of receiving Small Business Administration assistance. One of the criteria for determining size, as stated in 13 CFR 121.201[41], is the number of employees in the firm. The proposed rule would affect business in transportation equipment manufacturing. Affected business in transportation equipment

[37] 49 U.S.C. 30111(a).
[38] 49 U.S.C. 105 and 322; delegation of authority at 49 CFR 1.
[39] Final-stage manufacturers perform manufacturing operations on incomplete vehicles from other l manufacturers and complete the manufacturing process. 49 CFR 567.3. An alterer is a person who alters by addition, substitution, or removal or components (other than readily attachable components) a certified vehicle before the first purchase of the vehicle other than for resale. Id.
[40] The latest version modified by the Office of Management and Budget effective January 1, 2017; https://www.census.gov/naics/
[41] Effectiveness as of August 19, 2019; https://www.ecfr.gov/cgi-bin/text-idx?SID=b919ec8f32159d9edaaa36a7eaf6b695&mc=true&node=pt13.1.121&rgn=div5#se13.1.121_1201

manufacturing include: (a) To qualify as a small business in Automotive Manufacturing (NAICS 336111), the firm must have fewer than 1,500 employees, (b) In Light Truck and Utility Vehicle Manufacturing (NAICS 336112), the firm must have fewer than 1,500 employees, (c) In Motor Vehicle Body Manufacturing (NAICS 336211), the firm must have fewer than 1,000 employees, (d) In Other Motor Vehicle Parts Manufacturing (NAICS 336390), the firm must have fewer than 1,000 employees, and (e) In All Other Transportation Equipment Manufacturing (NAICS 336999), the firm must have fewer than 1,000 employees.

Small volume light-vehicle manufacturers

If adopted, the proposal would directly affect 20 single stage motor vehicle manufacturers.[42] None of these are qualified as small business. However, NHTSA analyzed current small manufacturers, multistage manufacturers, and alterers that currently have Part 563 compliant EDRs and found that 13 motor vehicle manufacturers affected by this proposal would qualify as a small business. Most of the multistage manufacturers and alterers have 1,500 or fewer employees. However, these small businesses adhere to original equipment manufacturers' instructions in manufacturing modified and altered vehicles. Based on our knowledge, original equipment manufacturers do not permit a final stage manufacturer or alterer to modify or alter sophisticated devices such as air bags or EDRs. Therefore, multistage manufacturers and alterers would be able to rely on the certification and information provided by the original equipment manufacturer. There are three U.S. domestic vehicle manufacturers that would qualify as a small business. **Table 7-1** summaries information about the 13 small domestic manufacturers as of June 2021.[43]

Table 7-1
Small Vehicle Manufacturers

[42] BMW, Fiat/Chrysler (Ferrari and Maserati), Ford, Geely (Volvo), General Motors, Honda (Acura), Hyundai, Kia, Lotus, Mazda, Mercedes, Mitsubishi, Nissan (Infiniti), Porsche, Subaru, Suzuki, Tata (Jaguar and Land Rover), Tesla, Toyota (Lexus), and Volkswagen/Audi.

[43] Information gathered from many sources including the individual company's website and other sites such as https://craft.co/, https://www.theverge.com, and https://en.wikipedia.org/

Manufacturer	Type of Vehicles	Employees (Appx.)	MSRP for Vehicles
Anteros Coachworks	Specialty Sports Car	2	$110,000
Callaway Cars	Specialty Sports Cars	50	~$17,000 above base (GM) vehicle price
Carroll Shelby International	Specialty Sports Cars	170	$86,085-$180,995+
Equus Automotive	Specialty Sports Cars	25	$250,000+
Falcon Motorsports	Specialty Sports Cars	2	$300,000-$400,000
Faraday Future	Electric	475	$225,000
Fisker Inc.	Electric	<200	$37,500+
Karma Automotive (1)	Electric	660	$84,000 to $135,000
Panoz	Specialty Sports Cars	<50	$159,900+
Rivian	Electric	1,300	$69,000-$72,500+
Rossion Automotive	Specialty Sports Cars	70	$80,000
Saleen Automotive	Specialty Sports Cars	170	$48,000-$100,000+
SSC North America	Specialty Sports Cars	9	$2,000,000

(1) https://craft.co/karma-automotive

While the manufacturers listed in the table above are qualified as small businesses, none of them would be significantly affected by this rulemaking. Vehicles that contain EDRs are already required to comply with Part 563. This proposed rule would not require additional hardware or equipment, but instead would only adjust the recording time and sampling rate for up to 7 pre-crash data elements which the agency believes current or planned systems are capable of accommodating. Therefore, the agency believes that the proposal will not have a significant economic impact on these 13 small vehicle manufacturers.

We believe that the market for the vehicle products of these small manufacturers is highly inelastic. Purchasers of these products are enticed by the desire to have a highly customized

vehicle. Generally, under this circumstance, if any price increase, the price of competitor's models will also need to be raised by a similar amount, since all light vehicles must comply with the standards. Therefore, any reasonable price increase will not have any effect on sales of these vehicles. In all, the agency does not expect the proposed amendments would generate additional costs to the industry and consumers. Based on this analysis, the agency believes that the proposed amendments will not have an additional economic impact on these small domestic vehicle manufacturers.

4. A description of the projected reporting, recording keeping and other compliance requirements of a proposed rule including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record

If finalized, this proposed rule will not result in reporting, record keeping, and other compliance requirements beyond what is already required by 49 CFR Part 563.

5. An identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap or conflict with the proposed rule

There are no other relevant Federal regulations that may duplicate, overlap or conflict with the proposed update to 49 CFR Part 563.

6. Each initial regulatory flexibility analysis shall also contain a description of any significant alternatives to the proposed rule which accomplish the stated objectives of applicable statutes and which minimize any significant economic impact of the rule on small entities

The agency considered two alternatives (1) 20-second recording and 2 Hz sample frequency and (2) 15 seconds and 5 Hz sampling rate. However, the first alternative cannot have the necessary resolutions for interpreting recorded data. For the second alternative, the 15 second recording still miss capturing a significant portion of pre-crash actions. Thus, the Agency knows of no significant alternatives to the proposed rule that will accomplish the stated objectives

that would also have less economic impact. As stated above, NHTSA does not expect this proposal, if finalized, to result in any significant economic impact on small entities.

7.2 Unfunded Mandates Reform Act

The Unfunded Mandates Reform Act of 1995 (Public Law 104-4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditures by State, local or tribal governments, in the aggregate, or by the private sector, of more than $100 million annually (adjusted annually for inflation with base year of 1995). Adjusting this amount by the implicit gross domestic product price deflator for the year of 2020 results in $158 million (113.625/71.868 = 1.581).[44] The assessment may be included in conjunction with other assessments, as it is here.

This NPRM would not result in the expenditure by State, local, or tribal governments, in the aggregate, of more than $158 (2020 $) million annually. It also will not result in the expenditure of that magnitude by vehicle manufacturers and/or their suppliers. The agency estimated that the annual cost is neglectable as discussed previously in the costs section of this PRE.

7.3 Paperwork Reduction Act

Under the Paperwork Reduction Act of 1995 (PRA), a person is not required to respond to a collection of information by a Federal agency unless the collection displays a valid OMB control number. This NPRM would not establish any new information collection requirements.

[44] National Income and Product Accounts, Table 1.1.9, Implicit Price Deflators for Gross Domestic Product as of May 27, 2021, Bureau of Economic Analysis, https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey

7.4 National Technology Transfer and Advancement Act

Under the National Technology Transfer and Advancement Act of 1995 (NTTAA) (Pub. L. 104-113), "all Federal agencies and departments shall use technical standards that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments." Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies, such as SAE. The NTTAA directs us to provide Congress, through OMB, explanations when we decide not to use available and applicable voluntary consensus standards. However, the NTTAA requires agencies to use voluntary consensus standards in lieu of government-unique standards except where inconsistent with law or otherwise impractical.

There are several consensus standards related to EDRs, most notably are those standards published by SAE (J1698 - Event Data Recorder) and IEEE (Standard 1616, IEEE Standard for Motor Vehicle Event Data Recorder). NHTSA carefully considered the consensus standards applicable to EDR data elements in establishing Part 563. Consensus standards for recording time/intervals, data sample rates, data retrieval, data reliability, data range, accuracy and precision, and EDR crash survivability were evaluated by NHTSA and adopted when practicable. This particular rulemaking exceeds the pre-crash data recording durations of the SAE and IEEE standards (e.g., SAE and IEEE recommend recording 8 seconds of pre-crash data). This is because, as explained below, the results of the study on EDR recording duration suggest that the recommended recording duration by these standards would not capture the initiation of crash avoidance maneuvers.

Section 24303 of the Fixing America's Surface Transportation Act (FAST Act) directed NHTSA to conduct a study to determine the amount of time EDRs should capture and record pre-crash data to provide sufficient information for crash investigators, and to conduct a rulemaking based on this study to establish the appropriate recording period in NHTSA's EDR regulation.

NHTSA conducted an EDR recording duration study and submitted a Report to Congress summarizing the results of this study in September 2018. This particular rulemaking exceeds the pre-crash data recording durations of the SAE and IEEE standards (e.g., SAE and IEEE recommend recording 8 seconds of pre-crash data) based upon the new information obtained from the EDR Recording Duration study. The results of the study on EDR recording duration suggest that the recommended recording duration by these standards would not capture the initiation of crash avoidance maneuvers. NHTSA declines to adopt the voluntary consensus standards for the pre-crash recording because such a decision would be inconsistent with the best available information to the agency, conflict with the outcome of a study required by the FAST Act, and would not accord with the FAST Act mandate.

8 EXECUTIVE ORDERS

8.1 Executive Order 12866, Executive Order 13563

NHTSA considered the potential impacts of the NPRM under Executive Order 12866, "Regulatory Planning and Review" (58 FR 51735, October 4, 1993) and Executive Order 13563, "Improving Regulation and Regulatory Review" (76 FR 3821, January 21, 2011). E.O. 12866 provides for making determinations whether a regulatory action is "significant" and therefore subject to review by the Office of Management and Budget (OMB). This NPRM is nonsignificant under E.O. 12866 and was not reviewed by OMB.

As discussed in this NPRM, the additional pre-crash data that would be collected by EDRs under the proposed rule would be valuable for the advancement of vehicle safety by enhancing and facilitating crash investigations, the evaluation of safety countermeasures, advanced restraint and safety countermeasure research and development, and certain safety defect investigations. The improvements in vehicle safety will occur indirectly from the collection of this data.

We estimate that about that 99.5 percent of model year 2021 passenger cars and other vehicles with a GVWR of 3,855 kg or less are already equipped with Part 563-compliant EDRs. As discussed in the costs section, the agency believes that no additional hardware would be required by the proposed amendment; therefore, the compliance costs would be negligible.