

BTS TRANSPORTATION PROBE DATA GUIDE: ELECTRONIC LOGGING DEVICE DATA

An Electronic Logging Device (ELD) is a piece of hardware that automatically records a commercial motor vehicle (CMV) driver's driving time and automatically maintains their hours-of-service (HOS) records. Mandated by the Federal Motor Carrier Safety Administration (FMCSA), ELDs are required for most motor carriers and drivers, including commercial buses, all of whom are required to maintain a log to record their HOS, files otherwise known as Records of Duty Status (RODS) [2018]. Intended to promote driver safety and ensure compliance with regulations, an ELD automatically records a driver's RODS, eliminating the need for manual paper logs and promoting easier, more accurate HOS recordkeeping. These records, which form a type of probe data, are conceptually rich with information for transportation planners.

CMVs, the focus of the ELD requirement, are defined as vehicles used as part of a business that is involved in interstate commerce and that fit any of the following descriptions: [FMCSA 2021]

- Weighs 10,001 pounds or more
- Has a gross vehicle weight rating or gross combination weight rating of 10,001 pounds or more
- Is designed or used to transport 16 or more passengers (including the driver) not for compensation
- Is designed or used to transport 9 or more passengers (including the driver) for compensation
- Is transporting hazardous materials in a quantity requiring placards

The HOS regulations that necessitate ELDs define the maximum amount of time drivers are permitted to be on duty (including driving time) and specify the number and length of rest periods necessary to help ensure drivers stay awake and alert. In general, all motor carriers and drivers operating CMVs must comply with the HOS regulations found in Title 49 Code of Federal Regulations 395.

ELDs automate and enhance the accuracy of HOS record-keeping, replacing traditional, driver-kept paper logs. Digitizing these records has improved safety, prevented fatigue-related accidents, and streamlined the tracking and management of driver hours. In generating accurate and tamper-proof records for a driver, ELDs reduce the risk of falsified logs and simplify adherence to HOS regulations by ensuring drivers and motor carriers stick to the HOS regulations (enforced via spot and regular audits), ultimately creating a safer road environment for all users.

Critical to transportation planners and statisticians, each ELD is embedded with a Global Positioning System (GPS) unit, which enriches individual records with location information. In fact, nearly all events the ELD records (e.g., trips and stop events) inherently have a geographic component, so the spatial data produced by the unit (and appended to all messages it

generates) contextualize and confirm the logged events and even note other events that might have been forgotten or missed by the driver when relying on memory alone. While these methods are a digital evolution of earlier, paper-based record keeping, drivers still retain access to the records produced by their ELDs.¹

All the while, FMCSA's ELD rules exempt some drivers in some situations, meaning the events that would have been logged from these types of trucks are not available for analysis: [Title 49]

- Drivers who operate short-haul routes (150 air-miles) may continue using timecards; they are not required to keep RODS and will not be required to use ELDs.
- Drivers who use paper RODS for no more than 8 days out of every 30-day period will not be required to use ELDs.
- Drivers who conduct drive-away-tow-away operations, in which the vehicle being driven is the commodity being delivered, will not be required to use ELDs.
- Drivers of vehicles manufactured before 2000 will not be required to use ELDs.

ELD-generated probe data, in their disaggregate, original forms, are not readily available to public consumers, although some are available through aggregate products created by the ELD vendors and analytics companies with which they have data-sharing agreements. The underlying disaggregate ELD messages, which are collected and stored by the company that owns the trucks in which the devices are installed (in collaboration with the vendor of the device), are currently only available to outside entities in response to an FMCSA- or a state-directed enforcement of HOS laws. As such, this discussion of ELD-based probe data, especially metrics that would rely on ELD message attributes only available from data in their disaggregate form, as an input for transportation statistics is primarily conceptual.

1. CAPABILITIES

ELD data that are publicly available in disaggregate form could offer advantages, such as the following, for generating transportation statistics:

- Trip detection through algorithms analyzing movement patterns
- Use cases that need very precise location, speed, and vehicle-type information

2. LIMITATIONS

Expected limitations of ELD data for generating transportation statistics, aside from their current unavailability in disaggregate form, include the following:

- They are only available for the types of vehicles (CMVs) encapsulated by the HOS requirement.

¹ Paper logs recorded the times a driver was doing one of the following activities: "off duty" or "off," "sleeper berth" (if sleeper berth is used), "driving," and "on-duty not driving" or "on."

- They only capture work trips. In cases when an ELD captures a driver’s personal moves, they are scrubbed from public products based on ELD data.²
- They have limited driver demographic information.

3. VENDORS

By law, disaggregate ELD data are not available to public consumers, including those who solely wish to use their contents for statistical purposes.

Motor carriers purchase their ELDs from FMCSA-approved vendors. The messages produced by these devices are stored on a secure system, so they are only accessible to authorized entities.

All the while, some transportation data vendors and analytics companies have access to subsets or samples of ELD data through specific data-sharing agreements with device vendors, motor carriers, and drivers. In those cases, vendors build the data into other aggregate products that are then made available to public consumers and scrubbed of any personally identifiable information about specific drivers, even if the CMVs represented in their sample of ELD data are not a perfectly random sample of the commensurate vehicle populations.

4. MARKETS

The primary market for disaggregate ELD probe data is the universe of fleets, vehicle owners, and drivers who need to keep track of their HOS to comply with FMCSA requirements. As part of their purchase agreements, ELD vendors give these parties full access to the HOS records produced by their drivers and vehicles.

The few derived or aggregate ELD data products that exist are targeted toward the transportation-planning community and other third parties.

ELD data, in either their aggregate or disaggregate format, have no documented secondary markets outside the transportation sector.

5. SCALE OF TRANSPORTATION USES

ELD data are available for the entire United States as FMCSA regulations apply throughout the country. As a result, data are theoretically available for all places a truck can or would travel, although any GPS-derived attributes of an ELD message may be less reliable in parts of the country with poorer satellite coverage (similar to any other GPS-derived probe dataset).

² If the motor carrier has configured the driver user account to authorize personal use in accordance with Title 49 CFR 395.28(a), then the driver may allow the ELD to record that time by enabling the “personal conveyance special driving category” on the device. If the motor carrier has not configured the device to authorize personal conveyance, the driver may switch the ELD to “Off Duty” mode and manually note the beginning of their “personal conveyance period” in a separate log. Once that period has ended, the driver notes its end in the log and any events that occurred during that period.

6. GENERAL DETAILS

The following subsections detail background information on how ELD data are generated, why they exist as a data type, and the pieces of information represented in their data points.

6.1. How Are Data Captured

The following subsections detail the generation, capture, conveyance, and protection of ELD data points.

6.1.1. Trigger Mechanisms and Frequency

An ELD will record and send a data point—within the secure system accessible to the motor carrier, driver, and ELD provider—at the following key moments:

- When the driver starts and shuts down the engine, events which bookend any ELD-defined trip
- While the vehicle is in motion, following one of two models: [FMCSA 2022a]
 - Constantly emitting messages between power-up and power-down
 - Recording location data at 60-minute intervals, as required
- When the driver indicates a change in their duty status (i.e., working versus personal or yard visits), manually entered or keyed into the ELD [Schedler 2024]

A motor carrier can use any ELD unit that FMCSA [n.d.a] has approved as meeting its standards. Beyond the core data logging requirements, some units have greater or fewer add-on features than others.

6.1.2. Location Determination Technology

For the ELD messages that entail a location component, this information is generated and defined under these conditions:

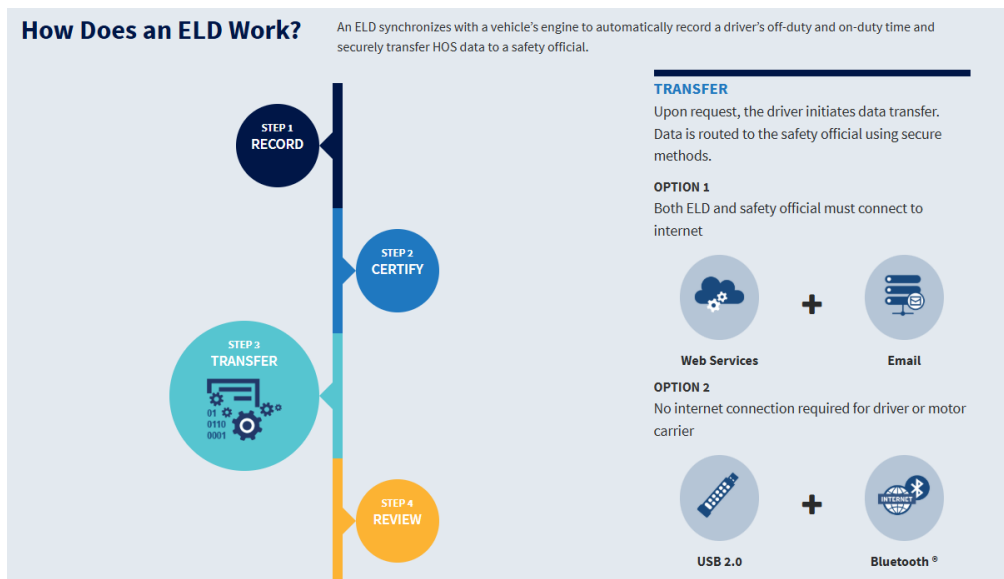
- Coordinates are primarily determined through GPS tracking devices that are built directly into the vehicles by their original equipment manufacturers or via aftermarket devices [Samsara 2025]. The GPS-enabled device that sends ELD messages may also be the same device the fleet uses to do broader fleet tracking (refer to *BTS Transportation Probe Data Guide: Fleet GPS Data* [BTS 2026] for more information).
- The installed GPS unit has a receiver that communicates with a constellation of 24 or more GPS satellites orbiting the Earth, calculating its precise position (latitude, longitude, and altitude) and the exact time via the amount of time it takes for signals to travel to and from at least 4 satellites. If the GPS unit of the ELD can contact more satellites, the ensuing location estimate is more precise. Nevertheless, the ELD only uses its GPS unit to determine the vehicle's location as it emits pings for other required purposes.
- ELDs are hooked directly to the truck engine via an electronic control module, allowing the device to pull other nonlocational telematics information from the vehicle.

6.1.3. Data Transmission

ELD data points are transferred from the device through the following procedures:

- Any data generated by the ELD are ultimately owned by the fleets and accessible to the driver, even if a third-party company built the device and hosts the data it produces.
- Devices transmit their data to the secure server using wireless web services and email from the CMV (via a driver) to the motor carrier safety official (Figure 1) [FMCSA 2017a].
- Device data can also be transferred locally, as required, using a thumb or flash drive (USB2.0) and/or Bluetooth®.

Figure 1. How ELDs Work



Source: FMCSA n.d.b.

6.1.4. Identifiers and Privacy

Identifying information on the driver represented in the data points from an ELD is protected through the following procedures:

- The driver and fleet owner have full identifying information on the vehicle and its owner available for their internal data management and review.
- If an FMCSA safety official requests access to an ELD record as part of an audit, the commercial vehicle driver details available to them include the driver's identifier (ID), authenticated user ID, vehicle ID, and motor carrier ID. Once requested, these details are transmitted from the vehicle unit to the safety official for review, but none of these data are available in public, ELD-derived statistical products.

6.1.5. Observation Unit

The unit of analysis for LBS data is defined as follows:

- The unit is a driver.
- All details relate to the vehicle the driver owns or uses on behalf of the fleet who owns the ELD and any data it produces. The driver does not own the ELD.
- If a driver moves vehicles, they input their information into an ELD in the new vehicle.

6.2. Data Source Background

The following subsections provide background on the history, development, and application of ELD data, especially vis-à-vis the generation of transportation statistics.

6.2.1. Original Purpose

The development of ELD data was centered on the following goals:

- Automating and enhancing the accuracy of HOS record-keeping: HOS records are stored with the motor carrier until and unless an accident or audit occurs, at which time FMCSA and state safety officials are granted access to the ELD records.
- Containing an immutable record of when drivers were or were not working and thereby complying with their required HOS: Drivers are expected to take their HOS breaks and avoid driving additional unrested hours when they might be fatigued or less aware.
- Helping fleets streamline the tracking and management of driver hours, whether to ensure FMCSA regulatory compliance or for their own fleet-management purposes: In these cases, the ELD data serve a role like truck fleet GPS data (for more details on the latter, refer to *BTS Transportation Probe Data Guide: Fleet GPS Data* [BTS 2026]).

6.2.2. Transportation Focus

As noted in [Section 6.1](#), disaggregate ELD data are not available to any entity other than the original trucker, the trucking company responsible for the truck, and the ELD data vendor. The only public products based on ELD data are aggregations sold by select device vendors to data analytics companies with which they have data-sharing agreements.

The use cases for ELD data for transportation statistical purposes would be similar when working with aggregate data from a vendor or, in the case of future availability, the original, disaggregate ELD log messages. Example use cases include the following:

- Illustrate actual and observed CMV travel behavior
- Understand safety issues (e.g., fatigued drivers, HOS breaks, truck stopping locations)
- Study transportation infrastructure improvements to reduce collisions between CMVs and other road users (e.g., cars, other CMVs, bikes, pedestrians)

6.3. Data Contents

The following subsections note the pieces of information contained in ELD data points, including those generated initially by the device and those estimated during subsequent steps.

6.3.1. Core Attributes

The following data elements are available for all disaggregate ELD data points and are generated by default by the original device (therefore, they are available only to the driver, fleet owner, device manufacturer, and—when requested by law—safety official validating HOS compliance):

- Date and time³
- Engine hours, measured as elapsed time since the trip start
- Vehicle miles, measured as total odometer readings since the trip start
- General vehicle location, provided as textual information describing its general proximity to a specific city, town, or place, and not specific latitude–longitude coordinates⁴
- Engine power status, noted as on or off
- Vehicle motion status, noted as moving or stopped
- Duty status, noted as driving, on-duty not driving, off-duty, or sleeper berth (manually entered by the driver into the ELD)

Figure 2 provides an example of an HOS compliance report, which references data points logged from an ELD for a specific truck [FMCSA 2022a].

The regularly emitted ELD ping messages also include columns noting whether the vehicle is moving and the duty status of the driver.

Additional default attributes are only available to the driver, fleet, device manufacturer or software supplier, and—if requested by law during an HOS enforcement action—the assigned safety official:

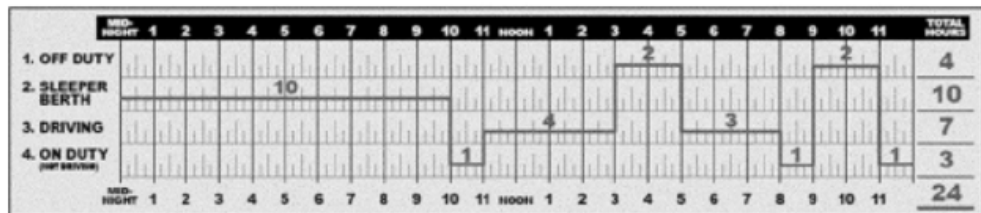
- Driver ID
- Authenticated user identification (whether the driver is authenticated)
- Vehicle identification
- Motor carrier identification

³ If a trip started at 7:00AM on 8/1/2025, this time would be the start, and all subsequent events or readings on that day would be marked in minutes or hours since that start.

⁴ If the point was at M street and New Jersey Ave in Washington, DC (U.S. Department of Transportation headquarters), it would not give the exact location but will just say “Washington, DC.”

Figure 2. ELD Information

Record Date	USDOT #	Driver License Number	Driver License State	ELD ID	Trailer ID
20-Nov-14	123456789	D000368210361	IL	987654	Unit #
Time Zone	Driver Name	Co-Driver Name	ELD Manufacturer	Shipping ID	Data Diagnostic Indicators
CST	Smith, Richard		Acme ELDs	BL1234567890	No
24 Period Starting Time	Driver ID	Co-Driver ID	Truck Tractor ID	Unidentified Driver Records	ELD Malfunction Indicators
Midnight	1234567		Unit #	No	No
Carrier	Start End Odometer	Miles Today	Truck Tractor VIN	Exempt Driver Status	Start End Engine Hours
Acme Trucking	39564 - 39984	420	1M2P267Y5AM022445	No	758.2-765.7
Current Location	File Comment			Print/Display Date	
6 mi. NE North Auburn, CA				20-Nov-14	



Time	Location	Odometer	Eng Hours	Event Type/Status	Origin
20-Nov-14					
0:00	49 mi NNE Fallon, NV	39564	758.2	SB	Driver
10:00	49 mi NNE Fallon, NV	39564	758.2	Login	Driver
10:00	49 mi NNE Fallon, NV	39564	758.2	ODND	Driver
10:52	49 mi NNE Fallon, NV	39564	758.2	Power Up	Auto
11:00	49 mi NNE Fallon, NV	39564	758.2	Driving	Auto
12:00	2 mi E Fernley, NV	39624	759.3	Int Location	Auto
13:00	7 mi NNE Truckee, CA	39684	760.3	Int Location	Auto
14:00	6 mi SSE Meadow Vista, CA	39744	761.3	Int Location	Auto
15:00	3.5 mi SW Davis, CA	39804	762.3	Off Duty	Driver
17:00	3.5 mi SW Davis, CA	39804	762.3	Driving	Auto
18:00	1 mi E Emeryville, CA	39864	763.4	Int Location	Auto
19:00	4 mi SSW Univ. of California, CA	39924	764.4	Int Location	Auto
20:00	6 mi NE North Auburn, CA	39984	765.5	ODND	Driver
21:00	6 mi NE North Auburn, CA	39984	765.7	Off Duty	Driver
23:00	6 mi NE North Auburn, CA	39984	765.7	ODND	Driver
23:58	6 mi NE North Auburn, CA	39984	765.7	Cert	Driver
23:58	6 mi NE North Auburn, CA	39984	765.7	Logout	Driver

Source: FMCSA 2022b.

6.3.2. Non-Universal Attributes

Data elements that may be available for an ELD data point (i.e., outside the core attributes but still generated by the device) include nonrequired or nonstandard information, such as the following:

- Advanced telematics data, optional for ELD compliance but commonly included
- Engine speed and load
- Fuel efficiency and idling
- Diagnostics and fault codes
- Safety-related events (harsh braking, collisions)

ELDs do not include data on the contents of a truck, including the commodity being hauled, or the presence of a trailer or chassis unit. This information is known to the owner of the truck with the ELD but is not made available in subsequent, aggregate products.

6.3.3. Derived Attributes

Data elements that are not inherently generated by the ELD include any derived attributes added ex-post-facto by the user of purchased or received ELD-derived data through their negotiations and contracts with the original software and hardware providers.

None of the core ELD message attributes that could be used for safety and HOS compliance are allowed to be derived.

6.3.4. Sample Characteristics

The sample penetration of LBS data vis-à-vis the traveling American public is characterized by the following:

- The sample of trucks represented in ELD data is the population of CMVs used as part of a business involved in interstate and intrastate commerce and that do not belong to one of the exempted groups (listed in the introduction on page 2).
- Independent, owner-operated trucks will carry ELDs if they do not belong to an exempted group.

6.3.5. Data Quality

The following are known concerns about the quality and usability of ELD data:

- They are affected by standard GPS discrepancies (i.e., canyon effect, communication errors or outages).
- They are affected by environmental factors (i.e., weather impacts on GPS communication or transmittal).

Further, incorrect installation of the ELD, whether by the trucking company or device manufacturer, can lead to erroneous log messages.

Known quality validation methods for ELDs include the following:

- If a safety official demands it, drivers need to be able to provide full HOS and ELD data records.
- The owner must verify that the ELD continues to transfer data using the methods it is designed to support. This verification must happen every 7 days, either automatically or via a manual step from the driver [FMCSA 2017b]. The specific means of verification are left up to the provider. If the ELD has transferred data in this timeframe, that would be an acceptable means of verifying connectivity. FMCSA will also make available a verification function for the telematics option that may be used to verify connectivity without transferring an ELD file. FMCSA has access to ELD data but does not retain any data unless a violation occurs [FMCSA 2017c].
- If motor carriers want detailed GPS location data on their trucks, they use fleet GPS and not just ELDs. ELDs give this information irregularly, which means they can be used for benchmarking but not with as much detail as fleet GPS [BTS 2026].
- For the fleets or companies that own the trucks, they can compare ELD outputs to other benchmark data, such as route consistency and driver benchmarking.

7. TEMPORAL AND SPATIAL SCALES OF THE DATA

The following subsections characterize the historical, temporal, and spatial coverage, availability, and precision of ELD data.

7.1. Temporal Coverage

Details on the historical penetration and availability of ELD data in the United States include the following:

- They were mandated as a requirement in 2019 [Motive 2025]. Historical archiving policies dictated by FMSCA are noted under Title 49 CFR Part 395 Subpart B. ELD data are likely archived by the motor carriers and drivers, but it is not known whether those archives can ever be made available for public or statistical use.
- Their historic availability may vary significantly by vendor and region. Some device vendors indicate the trucking companies or fleets that use their services.

7.2. Temporal Resolution

The following describe the precision of temporal information generated with an ELD:

- ELDs collect baseline location data at least every 60 minutes when in motion.
- Location data may be provided more frequently if an event or change-of-status occurs.

7.3. Spatial Coverage

Geographic distribution depends on fleet coverage as some fleets' operations cover the entire United States while others are regional. Nevertheless, the collective data produced by all units should theoretically cover all parts of the United States served by trucks falling under the FMCSA ELD mandate. The only theoretical exceptions are areas entirely served by trucks outside the mandate or geographic areas susceptible to poorer GPS connections (i.e., urban canyons), where the relative accuracy of locational information attached to an ELD position would be lessened.

7.4. Spatial Resolution

Details on the precision of spatial information generated with ELD data include the following:

- For enforcement purposes (i.e., what is provided to an FMCSA inspector reviewing an ELD record for an inspection), location is recorded textually at a general proximity, describing the approximate distance and direction to the nearest city, town, or village, rather than precise street addresses [FMCSA 2017a].
- While a driver is on-duty, the required location accuracy of an ELD-produced, GPS-based log message is within a 1-mile radius. However, when the driver uses the truck off-duty or for personal conveyance, the location data accuracy is reduced to an approximate 10-mile radius. ELDs, after all, are for drivers to record their HOS and are not intended for trucking companies to track their own fleets.

8. USE CASES OF THE DATA

The following subsections list documented use cases and applications of ELD data, with specific attention given to those related to transportation planning and statistics.

8.1. Transportation Use Cases

Transportation-centric applications of ELD data are currently limited to what few public products exist that aggregate ELD message contents into their consumable outputs.

Example applications follow:

- Origin–destination studies: Understand travel patterns between regions and roughly estimate CMV volumes between broad geographic areas
- Traffic operation and path analysis: Know when, where, and on which routes CMVs are operating at different times of day

The applications of ELD data are not expected to significantly differ should they be made available for statistical use in their disaggregate form in the future.

Due to requirements for HOS compliance, the population of trucks represented in ELD data is larger than that represented by fleet GPS because the former includes owner-operator trucks.

8.2. Nontransportation Use Cases

No well-documented examples of nontransportation-centric applications of ELD data exist.

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