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MODERNIZING DATA COLLECTION AND REPORTING METHODS FOR THE SMARTWAY PROGRAM

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EXECUTIVE SUMMARY

The SmartWay programs in Canada and the United States are voluntary public-private partnerships designed to improve the efficiency and environmental performance of the freight sector. One of the most critical elements of SmartWay is data collection and benchmarking. Trucking companies that participate in SmartWay are responsible for completing annual reports that require data related to operations such as fleet composition, activity summaries, fuel consumption, etc. Currently, fleets must complete these reports manually, and the time needed to complete SmartWay submissions vary widely—from a few hours up to several days, depending on the fleet's sophistication in its data recording practices and familiarity with the SmartWay reporting process. In addition to the resource demand imposed on carriers, the SmartWay teams at Natural Resources Canada (NRCan) and the United States Environmental Protection Agency (EPA) also expend a sizable percentage of their staffing budgets on activities to ensure good data quality from the partner fleets.

In recent years, telematics technology has emerged in the trucking industry, driven to a large extent by regulatory requirements that commercial drivers maintain electronic logs. In addition to providing location tracking, telematics systems and electronic logging devices (ELDs) connect to on-board diagnostic (OBD) ports in vehicles and thus have access to the extensive operations data collected by various systems such as the engine, emissions aftertreatment systems, transmission and driveline, and chassis.

This study examines the use of telematics technology in the trucking sector and explores ways the SmartWay program can redesign data collection processes so fleets can take advantage of operations data already being recorded by telematics systems and ELDs. For fleet owners, leveraging the data being collected by telematics systems and ELDs has the potential to eliminate much of the manual data entry requirements of SmartWay reporting. In addition, SmartWay program staff would be able to devote less resources to data quality assurance efforts. To investigate these possibilities, the project team interviewed a range of stakeholders, including trucking fleets, a provincial trucking association, a telematics provider, and SmartWay program staff at NRCan and EPA. The following key findings of the study should be considered by the SmartWay teams as they contemplate ways to modernize the data collection methods utilized in the program.

FINDINGS

Electronic logging device regulations will require that virtually all commercial trucks operating in the United States and Canada have automated data collection. The U.S. ELD mandate will be fully implemented at the end of 2019, and Canada is expected to follow suit with a highly-aligned regulation that will begin in 2020. These regulations require trucking fleets doing business in these two countries to collect and record data related to location, driving behavior, and several other operating parameters. These requirements create opportunities for automatic SmartWay data collection.

Data collection and quality assurance represents a significant percentage of fleets' overall time spent engaging with the SmartWay program. The stakeholder interviews revealed that the time and resources associated with completing the SmartWay annual report varied widely among fleets. While more data-savvy trucking companies may only need an hour or two to finish inputting data in the SmartWay worksheets, smaller fleets with limited administrative support and those new to the SmartWay program may take several days and need assistance from SmartWay staff to complete the report. For many fleets, the sizable time commitment needed for the annual data submission report limits their ability to engage with the SmartWay program in other ways, such as attending SmartWay education events or exploring SmartWay verified technologies.

Several types of data are readily accessible from telematics systems. Onboard recording devices are required to collect several types of data related to vehicle operations. Basic ELDs meeting minimum regulatory requirements record vehicle activity and fuel consumption data. Beyond vehicle operations data, many telematics systems also have asset management functionality and thus have data on fleet characteristics that could be accessed for automatically completing portions of the SmartWay report. However, one primary limitation of a telematics-based data collection framework for SmartWay is that data related to payload is not captured by OBD systems. Payload-based information typically presents a relatively higher resource burden during the SmartWay submission process, and fleets will likely need to continue to complete these data fields manually.

Automating SmartWay data collection and submission is a value proposition for fleets, SmartWay staff, and telematics providers. All of the interviewees expressed a desire for SmartWay to modernize the data collection and reporting methods in the program. The fleet and trucking association representatives stated that automating much of the SmartWay data process could save them time and money and allow them to participate more fully in the program. However, a common theme in the interviews was that data privacy must be a major focus if automatic data collection is to be successfully implemented. Assuming robust privacy controls can be put in place, leveraging data from ELDs and telematics systems would improve data quality and make new types of data accessible to the program, In addition, SmartWay staff would have to spend less time on data management activities. Finally, the telematics company interviewed reported that they would market automatic SmartWay report creation to prospective customers.

INTRODUCTION

Fuel consumption and greenhouse gas (GHG) emissions associated with shipping is expected to outpace that of the passenger car sector in the coming decades (International Energy Agency, 2017). To mitigate the energy, climate, and local air quality impacts of this growth, many nations and regions around the world have developed voluntary "green freight" programs to improve the environmental performance of heavy-duty trucking fleets and supply chains. The first green freight program in the world, the SmartWay Transport Partnership, was developed by the United States Environmental Protection Agency (EPA) in 2004 (U.S. Environmental Protection Agency, 2018). Given the highly integrated nature of freight movement across North America, Natural Resources Canada (NRCan) introduced a Canada-specific SmartWay program in 2012 that is closely aligned with the U.S. program (Natural Resources Canada, 2019).

The primary objective of the SmartWay program is to leverage information to stimulate heightened environmental awareness and competition for the services of trucking fleets and other entities across supply chains. As such, data collection and benchmarking are arguably the most critical enterprises of the SmartWay program. Amassing and organizing data on fuel consumption, vehicle activity, and emissions allows the various stakeholders of the program to assess how carriers[1] compare in terms of performance metrics. In addition to fuel efficiency, the SmartWay program also collects and disseminates data related to pollutant emissions such as particulate matter (PM) and nitrogen oxides (NO_x). Using this information, fleet owners can analyze how they compare with similar fleets. Also, shippers and logistics providers that utilize trucking fleets are able to select companies based on performance criteria.

At present, carriers that participate in the SmartWay program are responsible for collecting, organizing, and submitting data by manually via standardized spreadsheets. The time needed to complete the SmartWay data reporting requirements can range from a few hours to several days, depending the level of sophistication of the data management practices of the fleet, as well as their familiarity with the SmartWay data submission process.

In recent years, the use of telematics systems has accelerated in the trucking sector in Canada, North America, and globally. These systems automatically collect multitudes of operations data related to vehicle location, speed, and various internal vehicle systems such as the engine, transmission, and chassis. The SmartWay program could utilize these onboard automated data collection devices, which are becoming increasingly commonplace in the U.S. and Canada due to electronic logging regulations. This study explores the possibility of leveraging telematics systems to modernize the data collection and submission process used by SmartWay partner fleets, focusing on the trucking sector. Currently, it takes significant time and resources to collect, organize, and ensure high data quality, and moving towards a higher degree of data automation could greater reduce the burden on both fleets and SmartWay staff.

The paper discusses telematics in the trucking industry and related onboard diagnostics technology. It also reviews the data collection and submission methods used by trucking fleet partners in the SmartWay program and presents a conceptual framework for how data collection can potentially be automated by leveraging telematics systems. Finally, the paper presents specific recommendations for improvements to the SmartWay program.

1 In this paper, the terms 'carrier' and 'fleet' are used interchangeably.

OVERVIEW OF TELEMATICS IN THE TRUCKING INDUSTRY

Telematics generally refers to any type of technology that merges telecommunications and information processing, typically for monitoring mobile assets. Two technologies form the foundational basis for telematics systems: Global positioning systems (GPS) and on-board diagnostics (OBD). GPS is a satellite-based navigation system that provides geo-spatial positioning using small electronic receivers to precisely determine location. OBD is the key enabling technology that allows telematics systems to access so much information about various vehicle systems and is discussed in more detailed in the following subsection.

ON-BOARD DIAGNOSTICS TECHNOLOGY

On-board diagnostic systems monitor the performance of engine and emissions aftertreatment components. The OBD system is designed to help ensure proper operation of emission control equipment, alerting the vehicle owner in the event of a malfunction. In addition, OBD systems are a valuable tool for vehicle technicians, as they supply vital automobile diagnostics data and important feedback about maintenance and repair needs.

OBD systems were first deployed in light-duty vehicles starting in the 1980s. Those first OBD systems were basic and had were not standardized, meaning that each manufacturer adopted a different system to read and communicate data to drivers and mechanics. By 1996, the OBD system was standardized in the United States, and the monitoring of emission systems for malfunctions was normalized across the range of manufacturers. Regulations requiring OBD systems were first introduced for heavy-duty vehicles (HDVs) in 2005 in Europe (Posada and Bandivadekar, 2015). The phase-in schedule of the U.S. Environmental Protection Agency (EPA) OBD requirements started with HDVs with a gross vehicle weight rating (GVWR) below 14,000 lbs. between 2005 and 2008, as an extension of technologies adopted for LDVs. These regulations were later extended to the heavier categories as part of the full phase-in of 2010 requirements for controlling pollutant emissions from heavy-duty engines and vehicles.

As shown in Figure 1, OBD systems draw data continuously from several systems on the vehicle, including the engine, emissions aftertreatment system, transmission and driveline, and other systems on the chassis and body. The protocols for OBD systems on commercial vehicles have been codified in the Society of Automotive Engineers J1939 standard (Society of Automotive Engineers, 2018). The most recent OBD systems ("OBD-II") have a 16-pin portal, and to access the OBD data, you must connect using a 16-pin plug. As illustrated in Figure 1, the automated logging device connects directly to the OBD portal and thus has access to OBD data at 1 Hz frequency. While the OBD port is integral to the vehicle and generally located below the steering wheel, the telematics or automated logging instrument is an external device that must be connected to the OBD to record data.

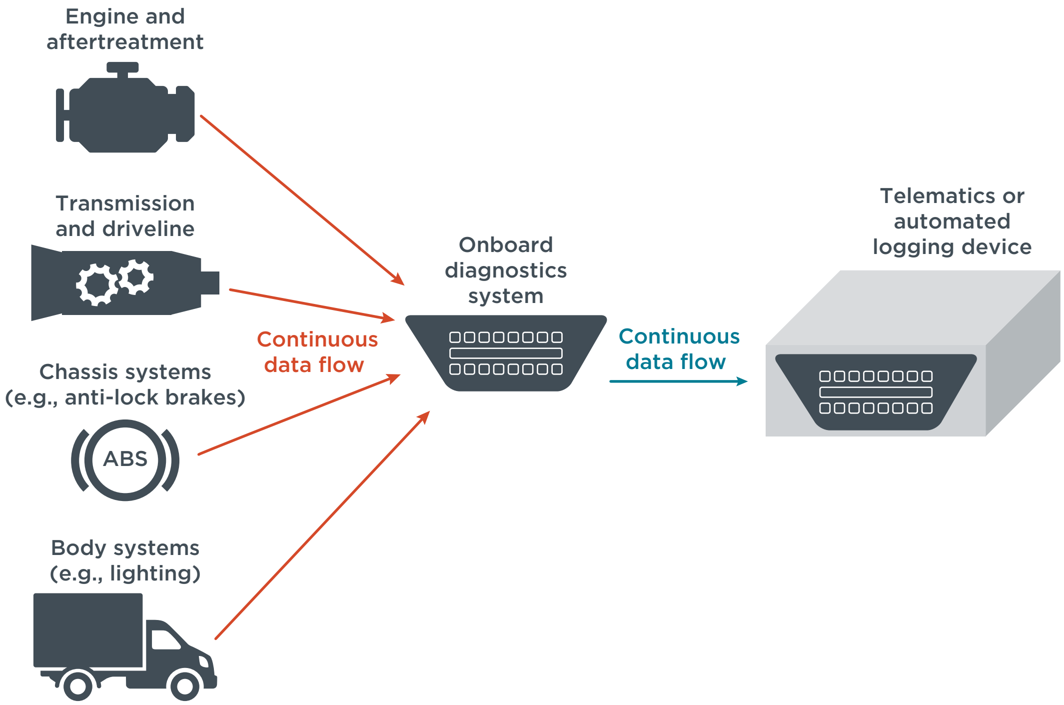

Figure 1: On-board diagnostics (OBD) systems are the key enabler for telematics technology.

TELEMATICS AND ON-BOARD ELECTRONIC DATA COLLECTION SYSTEMS

With the introduction of OBD in the trucking sector in North America, fleets began using automated data collection devices to replace paper records for hours-of-service reporting requirements in the mid-1980s (Sridhar, 2016). In 1988, the U.S. Federal Motor Carrier Safety Administration (FMCSA) published a rule that defined automatic on-board recording devices (AOBRDs) as “capable of recording driver’s duty status information accurately and automatically [and]…must be integrally synchronized with specific operations of the commercial motor vehicle in which it is installed. At a minimum, the device must record engine use, road speed, miles driven, the date, and time of day” (Federal Motor Carrier Safety Administration, 1988). The rule also set performance standards for their use.

In 2015, the FMCSA passed electronic logging device (ELD) regulation in order to create a safer work environment for truck drivers and make it easier and faster to accurately collect, manage, and share hours-of-service records (Federal Motor Carrier Safety Administration, 2019). The mandate, applicable to any commercial vehicle driver operating in the United States, requires the of use approved ELDs rather than paper records. Implementation of the U.S. regulation began in December 2017 and required drivers using paper records to start using ELDs. The rule also includes a two-year phase-in period that allows drivers to continue using AOBRDs until December 2019, after which ELDs are then required.

As is customary with safety and environmental regulations, Canada is moving forward with its own regulation that will be largely harmonized with the U.S. rule. In December 2017, Transport Canada proposed an ELD mandate for commercial vehicle operators (Transport Canada, 2017), and a final rule is expected sometime in 2019, with the implementation starting in 2020. Figure 2 summarizes the regulatory timelines for the ELD mandates in the U.S. and Canada.

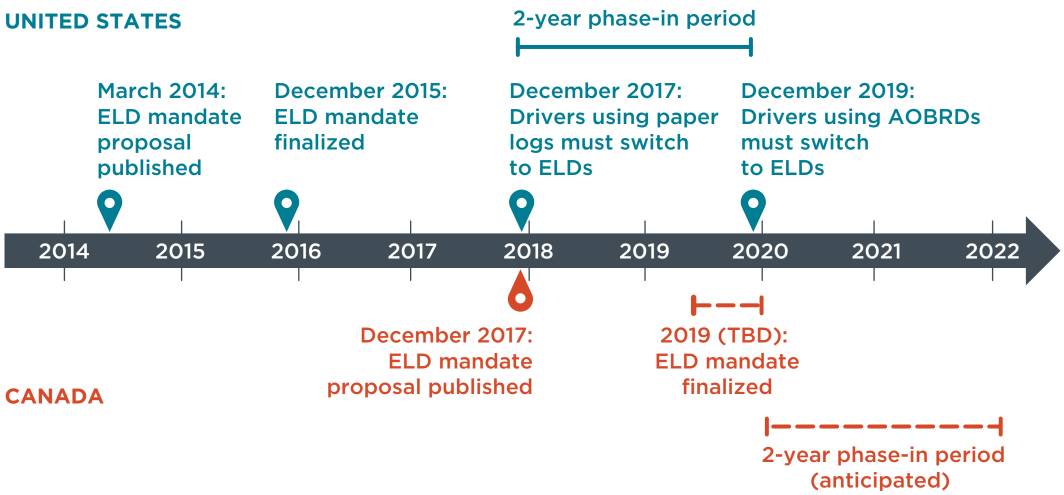

Figure 2: Regulatory timelines for the electronic logging device (ELD) mandates in the U.S. and Canada

In general, ELDs are AOBRDs with increased functionality. ELDs also impose additional restrictions for the driver. Both devices connect to OBD ports and have access to continuous OBD data, though the AOBRD is not required to record data as frequently as an ELD. The rules regarding documentation of certain events and situations are more specific for ELDs. Moreover, ELDs are required to warn drivers about any unassigned driving time[2] and miles that the device records when they log into the ELD. Finally, while there are no external communication provisions for AOBRDs, ELDs must be able to transfer data wirelessly or through a USB portal. For reference, Table A-1 in the Appendix provides a list of the data types recorded by OBD systems, as defined by the SAE J1979 standard (Society of Automotive Engineers 2012).

2 Unassigned drive time is how any driving not associated with a specific driver or support staff gets recorded in an ELD. The ELD regulation requires that anytime there is a driving event an electronic log is created. Each log must be assigned to a driver or annotated.

Table 1: Comparison of the functions and requirements of automatic on-board recording devices (AOBRDs) and electronic logging devices (ELDs)

	AOBRD	ELD
Data recording requirements	• Internal synchronization required, but not defined in the regulation • Date and time • Engine hours • Vehicle kilometers	• Internal synchronization with engine control module • Date and time • Engine hours • Vehicle kilometers
Recording location	Required at each change of duty status	Required for: • Each change of duty status • 60-min intervals when vehicle is in motion • Engine on and off instances • Beginning and end of personal use and yard moves
Hours-of-service alerts to driver	N/A	"Unassigned driving times/ miles" warning provided upon login
Communication methods	Not specified	Wireless data transfer or via USB
Compliance monitoring	Must identify sensor failures and edited data	Must monitor and record detectable malfunctions and data inconsistencies

Note: Adapted from Federal Motor Carrier Safety Administration (2017)

ELDs that can send information wirelessly are technically telematics systems, as they use telecommunications technology and are capable of data processing. There are also basic ELD systems that cannot transfer data wirelessly but meet the minimum FMCSA requirement to be capable of exporting data via USB. In the remainder of the paper, unless otherwise specified, "ELD" will refer to an ELD that cannot communicate wirelessly, and "telematics" and "telematics system" will refer to devices with wireless capabilities.

Figure 3 illustrates the data flows in a telematics system. The telematics device sends and receives signals from GPS satellites, and receives vehicle operations data from the OBD system. The telematics device transfers data wirelessly through the cellular network to the telematics provider's servers where it is processed and then made available to users via internet-connected computers and mobile devices.

Across the telematics industry, there is a great deal of variety in the functionality of the systems offered by various companies. Products range from basic systems that meet the minimum FCMSA requirements to comprehensive fleet management platforms that provide features related to asset tracking, preventative maintenance, route optimization, and driver behavior and management.

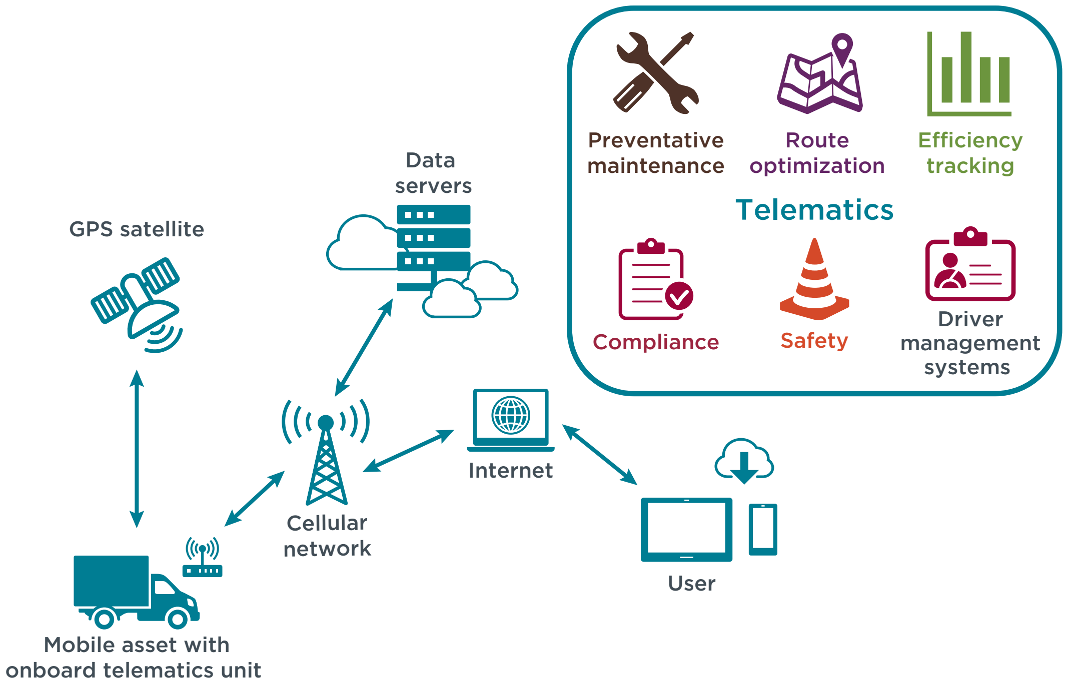

Figure 3: Overview of telematics systems and their primary uses in the trucking industry

Largely driven by the ELD mandate in the United States and the anticipated regulation in Canada, there has been a surge in the uptake of ELDs and telematics systems in the trucking industry in North America. Figure 4 summarizes the number of telematics systems that have been installed in the United States through 2018 and includes projections for 2019 to 2022. At present, Canada-specific data are not available, but as an approximation, including Canada would add roughly 10% to each of these values (C. Driscoll, Personal communication, February 28, 2019).

According to C.J. Driscoll & Associates, between 2010 and 2018, the number of telematics systems in tractor trucks grew from about 610 thousand to 2.7 million and is projected to grow to 3.4 million by 2022. The impact of the start of the ELD mandate is evident, as the number of installed systems in tractor trucks increased over 70% between 2016 and 2017. The number of devices on trailers and containers has grown from nearly 600 thousand in 2010 to approximately 1.3 million in 2018, and more accelerated growth is expected in the coming years—reaching about 2.3 million by 2022. From 2015 to 2018, the number of driver behavior management systems in use roughly doubled from about 300 to 600 thousand and is projected to reach around 1.1 million units by 2022.

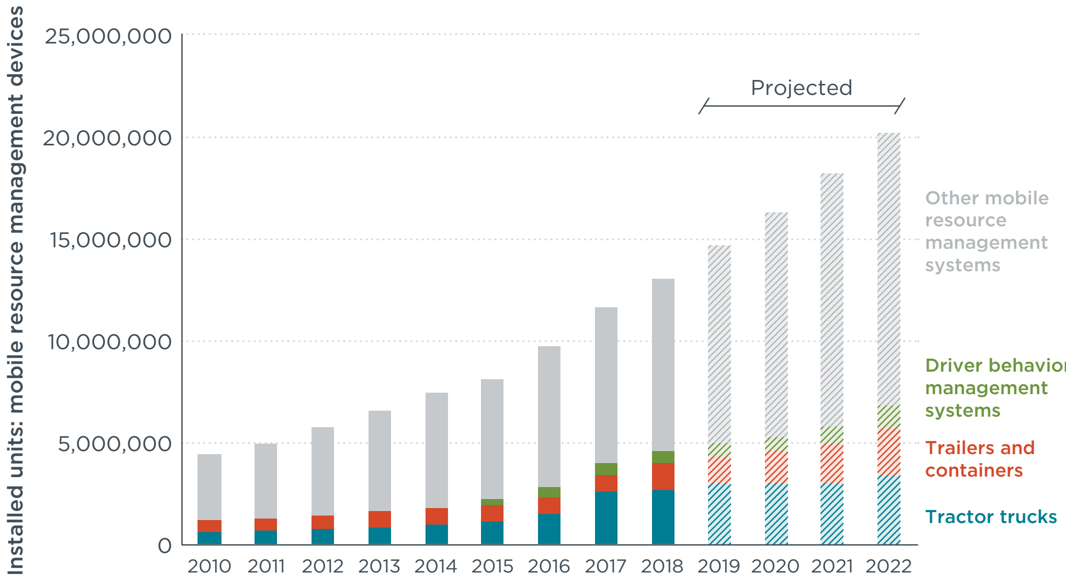

Figure 4: Historical (2010 – 2018) and projected (2019 – 2022) number of installed telematics units in the United States

Notes: Figure data from Driscoll (2019). Bold colors represent telematics systems used in the trucking sector. The gray portion represents units deployed in other applications.

DATA COLLECTION, REPORTING, AND QUALITY ASSURANCE METHODS USED IN THE SMARTWAY PROGRAM

In this section, we discuss the data collection and submission methods used by trucking fleet partners in the SmartWay program. Data requirements are summarized in Table 2. To inform this discussion, we analyzed the carrier data worksheets and guidance documents on the SmartWay website. In addition, telephone interviews were conducted with industry practitioners and SmartWay program staff. There were four primary findings from the SmartWay literature review and stakeholder interviews.

The time carriers spend collecting data and completing annual reports varies greatly, and automation of the SmartWay reporting process would create a more level playing field in terms of the resource burden imposed on fleets. Interviews with the various stakeholder groups revealed that there is a fairly significant range in the time and resources that fleets spend to complete their annual SmartWay submissions. The most sophisticated fleets have standardized procedures in place for measuring, recording, and analyzing operations data. Thus, extracting the information needed for the SmartWay worksheets takes a relatively small amount of time—typically on the order of two to four hours. These fleets tend to be larger companies that have dedicated staff who are responsible for managing operations data, and NRCan staff indicated that these carriers usually have at least one employee who is responsible for coordinating all SmartWay-related activities. At the other end of the spectrum, some smaller fleets must devote much more time to accumulate the necessary information and submit their reports to their partner account managers at SmartWay. According to NRCan and a representative from a provincial trucking association, fleets have reported that the process can sometimes take several days—particularly in situations when the person responsible for fulfilling the SmartWay requirements has other duties that take precedence. In general, these smaller or owner-operated fleets have difficulty finding time for activities that are not directly related to daily operations. This dynamic can be exacerbated in cases when the fleet is new to the SmartWay program and needs to navigate the reporting process for the first time.

With so much diversity across the trucking industry in the ways that fleets manage their businesses and measure and organize their operations data, it is not surprising that there is a wide range in the time and resources that fleets must commit to SmartWay reporting. Automating at least some elements of the data collection process would be especially beneficial to those fleets for which SmartWay membership presents a significant additional administrative burden.

Most fleets would welcome increased automation in the SmartWay data collection process. The fleets and a provincial trucking association interviewed expressed enthusiasm for introducing data automation in the SmartWay data collection process. One respondent stated that since SmartWay is a voluntary program, the government should aim to reduce the administrative burden on fleets and “particularly the smaller players that struggle to spare time from their revenue work for SmartWay.” Another fleet interviewee explained: “lots of this [SmartWay] data is living on a server somewhere already…we just have to figure out a way to get it to SmartWay without the need for so much manual data entry.”

However, some interview participants did express reservations with the idea of automating SmartWay data collection and reporting. A common sentiment was that there is probably very little appetite in the trucking industry for having any additional expenses related to SmartWay. Therefore, telematics companies would have to offer automatic SmartWay data preparation as a service that is free or relatively low cost. Respondents also raised the issue of privacy concerns. One fleet representative expressed that if SmartWay were to receive operations data automatically, some fleets may be very worried about government overreach and the “big brother effect.” Finally, NRCan revealed that a portion of fleets tend to be “old school” and prefer to fill out the SmartWay worksheets manually and even by hand in certain cases.

Data related to payload, idling, and speed distribution typically present the most significant challenges to fleets and SmartWay program staff. Unsurprisingly, the types of data that fleets are not already mandated to track and report as part of their existing regulatory requirements tend to present the most difficulties during the SmartWay reporting process.

Using information gleaned from the interviews, we developed a qualitative assessment of the relative burden posed by each of the data points required by SmartWay (Table 2). In general, the low burden fields are basic information about the fleet, including contact information, operational category, and other inputs that do not factor into the fleet’s performance rankings. The fields labeled as moderate are operations statistics that most fleets have in some form but may need to be calculated or estimated in order to input the data. For example, virtually all companies have data for the total number of trucks in the fleet; however, truck counts by emissions control technology, model year, and vehicle class may not be tracked as part of the fleet’s normal operating procedures. Finally, the high burden fields are those data that fleets are least likely to be collecting. Even if these data are being collected, the measurement methods used by fleets can vary widely. From the interviews, it seems the data related to payload weight and volume, capacity utilization, idling, and speed distribution frequently give fleets the most difficulty. While the SmartWay teams put considerable effort into providing guidance and support for fleets during the reporting process, there inevitably are certain types of data and breakdowns of data that prove challenging—particularly for new SmartWay partners and less data-savvy companies. Additional specifics on data collection are discussed in the section, *Leveraging telematics systems to improve the SmartWay program*.

A substantial amount of SmartWay staff time is dedicated to supporting fleet annual report preparation and ensuring good data quality. The final finding to emerge from our analysis of the SmartWay program is the amount of resources NRCan devotes to ensuring high quality data from its partner fleets. The following estimates come from the interview with one of NRCan’s SmartWay team members. NRCan’s SmartWay program has roughly 8 full time-equivalent (FTE) staff, including several staff who split their time between SmartWay and other programs. Of the 8 FTEs, about 3 staff are the partner account managers responsible for managing relationships with the program’s partner trucking fleets. From the interview, the account managers spend roughly half of their time over the course of the year performing activities related to data management—namely, training and supporting fleets during “submission season” and various data quality assurance and quality control activities. Overall, with 3 out of 8 team members spending roughly half of their annual hours on fleet-related data, approximately 20% of NRCan’s total SmartWay staff time is dedicated to helping fleets prepare their annual reports and ensure good data quality.

Table 2: Qualitative comparison of the resource burden of each data type currently collected from SmartWay trucking fleets and the potential for data collection automation

	Current data collection resource burden	Data could be collected with basic ELD?	Data could be collected with advanced telematics system?
Contact information	low burden	X	X
Operation category: Truckload, LTL, drayage, package delivery, expedited	low burden		X
Body type: Dry van, Reefer, Flatbed, Tanker, Chassis	low burden		X
Percent of fleet operation in the United States and Canada	low burden		X
Long- versus short-haul split	low burden		X
Types of fuel used	low burden		
For less-than-truckload fleets, average number of loads per truck	low burden		
For less-than-truckload fleets, average weight per load	moderate burden		
Number of vehicles by engine model year and vehicle class	moderate burden		X
Total kilometers driven by vehicle class	moderate burden	X	X
Revenue kilometers driven by vehicle class	moderate burden	X	X
Empty kilometers driven by vehicle class	high burden		
Liters of fuel used by vehicle class	moderate burden	X	X
Allocation factor for body type by vehicle class	moderate burden		X
Average payload weight by vehicle class	high burden		
Average payload volume by vehicle class	high burden		
Capacity utilization by vehicle class	high burden		
Trailer counts by trailer type and length	moderate burden		X
Idle hours by vehicle type	high burden	X	X
Road type / speed distribution by vehicle class	high burden	X	X
Average days in service per year by vehicle class	low burden	X	X
Truck counts by particulate matter control technology, model year, and vehicle class	moderate burden		X

Cell color legend: low burden | moderate burden | high burden

LEVERAGING TELEMATICS SYSTEMS TO IMPROVE THE SMARTWAY PROGRAM

Having established a better understanding of how fleets currently complete their annual SmartWay reports and the associated resource demands on SmartWay program staff, it is possible to develop a framework for how to automate data collection and submission by integrating telematics systems into the SmartWay ecosystem.

Figure 5 is a high-level illustration of a proposed system for automating data collection and reporting. A key assumption is that the trucking company is already using a telematics system. As identified with the solid arrow at the top of the figure, the normal data flows between the fleet and the telematics provider will not be impacted. In other words, the SmartWay data automation piece (as shown with the dashed orange arrows) will be an additional service from the telematics provider. In step 1, the telematics company creates a SmartWay report for the fleet using data that is already being collected and processed. In this example, we assume that SmartWay staff has provided the telematics provider with a template and detailed instructions for how the data fields must be populated. In step 2, the SmartWay report is delivered to the fleet electronically—either via email, the telematic system's existing customer portal, or some other to-be-determined method. Finally, step 3 involves engagement from the fleet, who is responsible for reviewing the automated data inputs, making any necessary adjustments and additions, and delivering the completed final report to the SmartWay program using a simple upload interface.

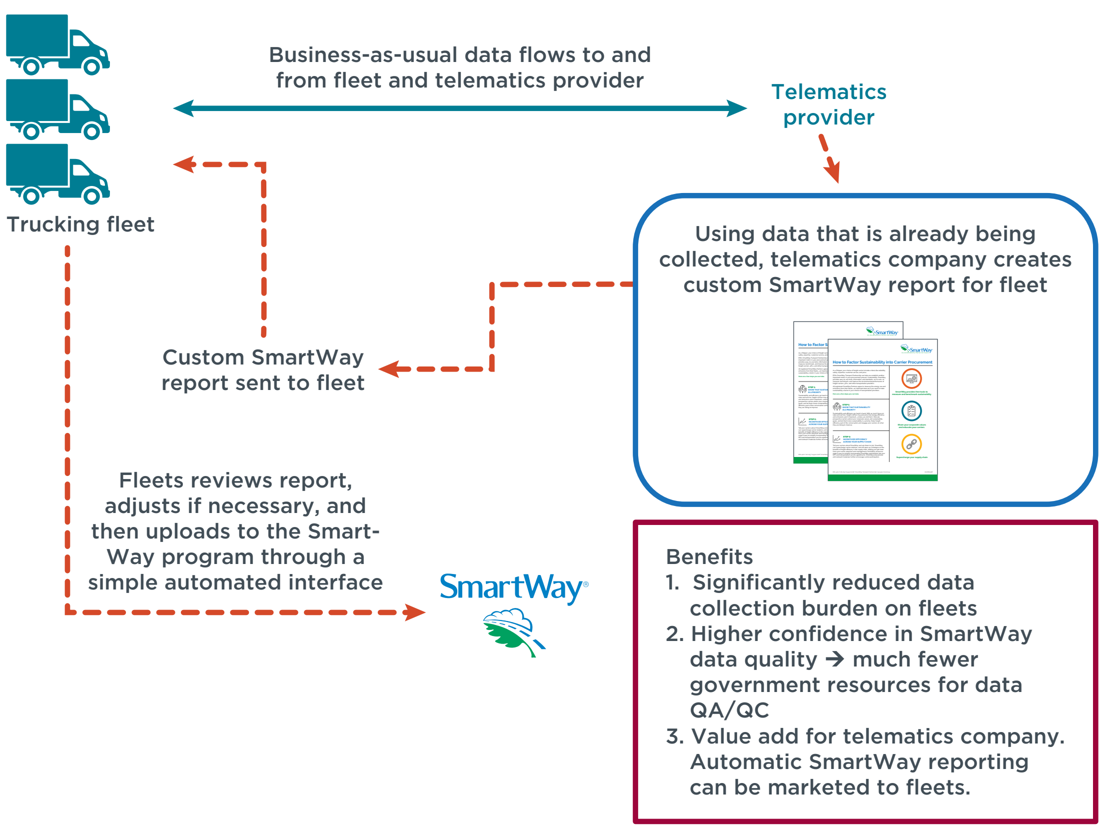

Figure 5: Proposed SmartWay data collection and reporting framework that leverages telematics systems

The following summarize the main takeaways from the stakeholder interviews regarding the proposed concept and considerations for the SmartWay program for further exploring its practicality.

Many types of vehicle operations data could be easily accessed in ELDs and telematics systems, but fleets would still need to input certain data manually. All the interviewees were receptive to the proposed automated structure, since a sizable portion of the data needed by SmartWay is already being collected by these systems. The representative from the telematics company assumed that the data could be exported to easily fit the SmartWay format and at very low cost, provided that SmartWay established clear guidelines that were easily accessible.

Returning to Table 2, the two righthand columns are an estimate of the data fields that could be provided by a basic ELD meeting the minimum regulatory requirements versus a more sophisticated telematics system. The SmartWay data that could automatically be reported by an ELD include operating statistics such as kilometers driven, fuel consumed, idling hours, and speed distributions. For the telematics system, we assume a comprehensive framework that includes fleet management functionality that would capture several additional data fields related to asset tracking and categorization. However, one of the key limitations of OBD systems—and, by extension, ELD and telematics systems—is that payload-related data is not measured or recorded. With payload-related information representing the majority of the data fields that typically presents fleets with the most difficulty, the inability to automate data collection in this area is an important shortcoming of the concept.

Given the significant variability of the various types of ELD and telematics systems on the market, this SmartWay automation scheme would have to be set up in a flexible manner. Each ELD or telematics provider would need to have the autonomy to select the data fields that their system could automatically populate.

Protecting data privacy is a critical issue. While all the interviewees were supportive of automating SmartWay data collection and reporting, several of the participants voiced concerns over data privacy. The representatives from the trucking fleets emphasized that data privacy would have to be a major focus if this concept is going to be implemented successfully. One of the respondents stated that SmartWay staff and telematics companies would need to design robust data protection processes and aggressively communicate to all SmartWay stakeholders that data will never be shared with third parties or other government agencies. However, though data privacy was voiced as a significant issue, none of the interviewees said that this is an insurmountable technical or programmatic barrier.

Telematics companies could market automatic SmartWay data collection and reporting to attract potential customers. One hypotheses going into this study was that companies offering telematics systems could derive added value by marketing the ability for their products to automate some of the SmartWay reporting process. In the interview with the telematics company representative, he surmised that automatic SmartWay data recording could be a useful marketing tool, since providers are always looking for ways to differentiate their systems in a highly competitive and saturated market. In addition, he expects that many of the fleets that have acquired basic ELD products to comply with the mandate will eventually look to upgrade to more comprehensive telematics solutions. For those fleets that are already SmartWay partners, he expects that many would be intrigued by the potential for a telematics system to reduce the paperwork burden of SmartWay membership.

Further exploration of this proposed system will require the SmartWay team to engage directly with telematics providers. The interview with a representative from a telematics company revealed that there currently is no industry association representing telematics providers. Consequently, if NRCan elects to explore this concept in more detail, it will be necessary to contact telematics companies directly. He recommended that NRCan target industry events that are well-attended by numerous telematics and ELD providers. Moreover, he suggested that NRCan approach well-respected bodies such as the Truck Maintenance Council, as well as national and provincial trucking associations. Cultivating strategic relationships with such entities will help NRCan to better understand the various needs of trucking fleets, telematics companies, and other stakeholders so that it can move forward with modernizing the data collection methods of the SmartWay program while avoiding as many unintended consequences as possible.

CONCLUSIONS

Regulatory requirements and rapid advancements in technology have accelerated the use of telematics systems in the trucking sector. This study explores whether there are ways that SmartWay program can redesign some of the data collection processes so that fleets can take advantage of the operations data that telematics systems and ELDs are already recording automatically. Leveraging the data being collected by telematics systems and ELDs has the potential to eliminate much of the manual data entry requirements of SmartWay reporting, and there could also be important benefits for SmartWay program staff, who would not need to devote as much time to data quality control activities. To better inform the study, we interviewed a range of stakeholders, including trucking fleets, a provincial trucking association, a telematics provider, and SmartWay program staff at NRCan and EPA. The following are the primary findings of the project as the SmartWay teams consider ways for modernizing the data collection methods utilized in the program.

FINDINGS

ELD mandates will require that virtually all commercial trucks operating in the United States and Canada have automated data collection. The regulations in the U.S. and Canada require that trucking fleets doing business in these two countries collect and record various data related to location, driving behavior, and several other operating parameters. These requirements create opportunities for automatic SmartWay data collection.

Data collection and quality assurance represents a significant percentage of fleets' overall time engaging with the SmartWay program. While more data-savvy trucking companies may only need an hour or two to input data in SmartWay worksheets, smaller fleets with limited administrative support and those that may be new to the SmartWay program may take several days and need help from their partner account managers to complete the report.

Several types data are readily accessible from telematics systems. Basic ELDs record vehicle activity and fuel consumption data. Beyond vehicle operations data, many telematics systems also have asset management functionality and thus have data on fleet characteristics that could be accessed for automatically completing portions of the SmartWay report.

Automating SmartWay data collection and submission is a value proposition for fleets, SmartWay staff, and telematics providers. All interviewees expressed a desire for SmartWay to modernize the data collection and reporting methods in the program. Automating data collection and reporting can potentially save significant time and resources for both fleets and SmartWay staff, and can be an additional marketing avenue for companies that provide telematics.

APPENDIX

Table A-1: Data collected by on-board diagnostics (OBD) systems, per the SAE J1939 standard

Data type	Minimum value	Maximum value	Units
Calculated engine load	0	100	%
Engine coolant temperature	-40	215	°C
Fuel pressure	0	765	kPa
Intake manifold pressure	0	255	kPa
Engine revolutions per minute (RPM)	0	16,383.75	RPM
Vehicle speed	0	255	km/hr
Injection timing advance	-64	63.5	Degrees before top dead center
Intake air temperature	-40	215	°C
Mass air flow rate	0	655.35	grams/sec
Throttle position	0	100	%
Oxygen sensors			
Voltage	0	1.275	Volts
Current	-128	128	mA
Short-term fuel trim	-100	99.2	%
Fuel-air equivalence ratio	0	2	Ratio
Run time since engine start	0	65,535	seconds
Distance traveled with malfunction indicator lamp on	0	65,535	km
Fuel rail pressure relative to manifold vacuum	0	5,177	kPa
Fuel rail gauge pressure	0	655,350	kPa
Commanded exhaust gas recirculation (EGR) rate	0	100	%
EGR error	-100	99.2	%
EGR temperature			
Commanded evaporative purge	0	100	%
Fuel tank level input	0	100	%
Warm-ups since codes cleared	0	255	Count
Distance traveled since codes cleared	0	65,535	Km
Evaporative system vapor pressure	-8,192	8,192	Pa
Absolute barometric pressure	0	255	kPa
Absolute evaporative system vapor pressure	0	328	kPa
Catalyst temperature	-40	6,513.5	°C
Control module voltage	0	65.535	Volts
Absolute load value	0	25,700	%
Fuel-air commanded equivalence ratio	0	2	Ratio
Relative throttle position	0	100	%
Ambient air temperature	-40	215	°C

Data type	Minimum value	Maximum value	Units
Accelerator throttle position	0	100	%
Ethanol fuel percent	0	100	%
Battery pack remaining life	0	100	%
Engine oil temperature	-40	210	°C
Fuel injection timing	-210	302	Degrees
Engine fuel rate	0	3,213	liters/hr
Engine torque (demand and actual)	-125	130	%
Engine torque	0	65,535	Nm
Engine friction (percent torque)	-125	130	%
Turbocharger compressor inlet pressure			
Turbocharger RPM			
Turbocharger temperature			
Charge air cooler temperature			
Exhaust temperature			
Exhaust pressure			
Exhaust flow rate			
Diesel particulate filter (DPF) temperature			
Nitrogen oxides (NOx) sensor			
DPF sensor			
Selective catalytic reduction (SCR) sensor			
Run time for auxiliary emissions control device			
Run time for engine			
Vehicle odometer			

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