

# **Electronic Logging Devices for Commercial Drivers**

## **Cost-Benefit Analysis (CBA) for Information Purposes**

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# 1. Executive Summary

## 1.1 Abstract

An Electronic Logging Device (ELD) is a device integrated with a commercial vehicle's on-board electronic systems that can be used to monitor and track a commercial driver's compliance with Hours of Service (HOS) regulations. ELDs are an effective compliance tool to reduce the potential for driver fatigue and likelihood of a driver reporting incorrect data on a paper logbook (also known as a daily log). ELDs are expected to improve road safety by increasing the accuracy of tracking driving hours (to ensure that allowable driving hours are not exceeded) and reducing potentially high-risk situations whereby drivers may operate in a fatigued state.

Transport Canada (TC) supports ELDs and a regulatory proposal that would require federally-regulated motor carriers (truck and bus) and their commercial drivers, who are currently required under the *Commercial Vehicle Drivers Hours of Service Regulations* (the Regulations) to maintain a daily log, to use ELDs to track and monitor HOS. This regulatory proposal is expected to encompass an amendment to the Regulations to *require*, rather than allow, drivers to use electronic logging devices. The current practice to self-report and document driving, on-duty and off-duty hours on paper logbooks allows the opportunity for some drivers to incorrectly fill out daily logs and some may operate above allowable HOS limits. This may hinder the effectiveness of the safety/societal impact of the current Regulations.

The costs of the proposal would directly impact provincial and federal governments, and federally-regulated truck and bus motor carriers whose drivers are currently required to maintain daily logs. Incremental costs include those associated with ELD acquisition, installation, activation and monitoring; training costs to drivers, roadside inspectors and auditors; and HOS compliance costs. HOS compliance costs reflect the additional expenditures that would be incurred by the industry in order to improve the compliance level under the proposed regulation, as carriers may need to hire additional drivers and/or purchase additional vehicles in order to redistribute the workload such that drivers would not violate any on-duty or driving time limits.

The benefits of the proposed regulation include: time savings to drivers, carrier clerical staff, as well as inspectors and auditors; paper logbook savings; reduced out-of service (OOS) detention time by reducing the propensity of drivers to be placed out of services from HOS violations; and improved road safety by reducing collisions involving Commercial Motor Vehicles (CMVs).

Transport Canada's first iteration of this cost-benefit proposal was initiated in 2014 and completed July 2015. As the timing of the U.S. final rule was uncertain, the estimation scope of the analysis was to account for all federally-regulated CMVs where the driver was required to maintain a logbook, including those that operate into the U.S. However, some drivers who operate CMVs into the U.S. can be affected by the final U.S. ELD rule (rather than the Canadian proposal), depending on the effective dates of each respective regulatory change. With the issuance of the U.S. final ELD rule in December 2015 and its proposed compliance date of December 2017 (December 2019 for existing technology), the exact implementation date of the Canadian ELD regulatory proposal has not been established. Despite this uncertainty, efforts will be made to align with U.S. compliance dates to the extent possible. As such, this proposal has been updated to present two outcomes, both assuming a two-year implementation timeframe:

1. Original outcome (referred to as "Outcome 1" in the proposal) where all in-scope CMVs (146,300 CMVs) with federally-regulated logbook drivers are included in the proposal (including U.S.-bound CMVs).
2. "Outcome 2" whereby a subset (64,200) of the CMVs identified in Outcome 1 with federally-regulated logbook drivers that operate within Canada exclusively is accounted for; assuming that all U.S.-bound CMVs (82,100 CMVs) are captured by the U.S. rule, with costs and benefits attributed to that proposal.

It should be noted that, while Outcome 2 is consistent with standard cost-benefit analytical methodologies (where the costs/benefits of affected stakeholders are attributed to other regulatory proposals due to an earlier implementation date of those proposals), it was decided to also present Outcome 1. This is done for information purposes where the document was originally drafted to capture all affected CMVs under the Canadian proposal in light of the uncertainty with compliance dates of both countries. Both outcomes refer to the same baseline regulatory proposal encompassing all federally-regulated drivers required to maintain a daily log. It should also be noted that the U.S. approach to quantifying costs and benefits in their analysis does not recognize the impact of other (Canadian) regulatory proposals.

The present value of the total costs of the regulatory proposal over a 10-year period is estimated at \$291.1 million in Outcome 1, and is approximately \$128.5 million in Outcome 2. The annualized value in Outcome 1 and Outcome 2 is \$41.4 million and \$18.3 million, respectively.

The present value of the total quantified benefits in Outcome 1 is approximately \$579.1 million, corresponding to an annualized value of \$82.5 million. Similarly, in Outcome 2 the present value of the total quantified benefits is estimated at \$256.0 million, equivalent to an annualized value of \$36.4 million. Among the total

benefits, savings to industry, including both motor carriers and drivers, account for the majority (99%) while the remaining benefits include time savings for roadside inspections and facility audits, as well as reduction in vehicle collisions. In addition, the proposal would also allow for synergies and consistency with U.S. rulemaking on ELDs. Given the considerable amount of cross-border movement of commercial vehicles (merchandise and passengers) between the two countries, the proposed regulation is expected to have a positive impact on cross-border commerce and support road safety by aligning regulatory requirements. Other qualitative benefits include meeting Canadians' interest in safer roads and transportation in Canada and enhancing carriers' capacity to move goods or passengers. Due to data limitations, these benefits are not quantified.

In terms of quantified costs and benefits, the present value of the net benefits is approximately \$288.0 million in Outcome 1 and \$127.5 million in Outcome 2.

Keeping with the desire to align (to the extent possible) the compliance date of the Canadian regulatory proposal with the U.S. compliance date of December 2017, section 3 shows two compliance periods (i.e., 1-year and 2-years) following publication in the *Canada Gazette*, Part II. A cost-benefit statement associated with a 1-year period is included for comparison purposes under Addendum A. The addendum shows that, for CMVs identified in Outcome 2 that operate exclusively within Canada under a 1-year implementation timeframe, the present value of the total costs of the regulatory proposal over a 10-year period is estimated at \$152.5 million, corresponding to an annualized value of \$21.7 million. The present value of the net benefits calculated is approximately \$155 million.

## 1.2 Costs and Benefits

Motor carriers regulated under federal jurisdiction and those drivers who are required to maintain a daily log are subject to the proposed regulation. TC estimates that there are approximately 170,000 federally-regulated trucks and 4,700 federally-regulated buses operating in Canada. Of these, it is estimated that about 146,300 CMVs (142,000 trucks and 4,300 buses) are operated by drivers who are required to maintain a daily log, among which 80,000 trucks and 2,100 buses operate into the U.S. on a regular basis while the remaining vehicles (62,000 trucks and 2,200 buses) operate exclusively within Canada. TC also assumes that the trucking fleet will grow at an annual rate of 3.1%, which is the average growth rate of the real GDP of the truck transportation industry over the past 5 years. On the other hand, the size of the bus fleet is expected to be stable over the period examined based on information from the industry. Vehicle retirement is also taken into account for both trucks and buses where the average lifespan is 6 years for trucks (power units) and 15 years for buses.

Some carriers have voluntarily decided to equip their vehicles with ELDs and the percentage of ELD usage is increasing. Based on data from a targeted ELD survey by the Canadian Trucking Alliance (CTA) of its membership, it is estimated that 28.0% of the trucks would only require ELD activation (as the ELD functionality is part of a more sophisticated Fleet Management System) and 15.5% would require new ELD hardware. In terms of buses, 14.0% of vehicles voluntarily use ELDs in their operations, indicating that 86% would require ELD devices under the proposed regulatory amendment. No ELD activation is considered as buses that have ELD capacity generally use the function.

The ratio of the number of drivers to vehicles is estimated based on industry information. Specifically, it is estimated that the ratio is 1.2 for trucks and 1.85 for buses where the latter is a weighted average of the ratio for motor coach buses (1.5) and the ratio for scheduled-service buses (2.5). The ratios suggest that for every truck, there are, on average, 1.2 truck drivers and for every bus, there are on average 1.85 bus drivers. Given the number of CMVs discussed above, there are 170,400 truck drivers and 7,955 bus drivers in Outcome 1, and about 74,400 truck drivers and 4,070 bus drivers in Outcome 2. The population of truck and bus drivers is assumed to follow the growth rate of truck and bus fleets, with the same driver-to-vehicle ratios over the 10-year period in the baseline scenario. Retirement and turnover of drivers are also taken into consideration. A report from the former Canadian Trucking Human Resources Council (now Trucking HR Canada) indicates an overall turnover rate of 6.7% (including those leaving the industry and those retiring) in the trucking industry, whereas the bus industry estimates a much higher turnover at 20%. Finally, it is assumed based on industry data that the wage rate of commercial drivers is \$30 per hour, including an overhead rate of 25% for benefits.

Based on data from provincial and territorial governments, there are about 1,052 roadside inspectors with an average of 282,587 daily log inspections conducted in Canada annually. Of the total number of inspections, it is estimated that about 102,156 annual inspections correspond to the 146,300 in-scope CMVs in Outcome 1, and 44,828 annual inspections correspond to the 64,200 operating-in-Canada CMVs in Outcome 2. Moreover, TC estimates that there are approximately 102 auditors with 976 audits conducted annually for those CMVs identified in Outcome 1 and 428 audits conducted annually in Outcome 2. The numbers of inspectors/auditors and inspections/audits are assumed to be stable over the 10-year period. Based on data submitted by provincial and territorial governments, the hourly wage rates of inspectors and auditors are \$57 and \$58, respectively (weighted average from 11 jurisdictions).

### Costs

Incremental costs include:

- Costs associated with ELDs, such as acquisition, installation, activation and monitoring costs;
- Training costs to drivers, roadside inspectors and auditors in order for them to be familiar with ELD functionality and/or to be able to accurately read and understand the display or printout structure of the ELD for compliance verification purposes.
- HOS compliance costs, which reflect the additional expenditures that would be incurred by industry in order to improve the compliance level under the proposed regulation. Motor carriers may have to hire additional drivers and/or purchase additional vehicles in order to redistribute the workload such that drivers would not violate any on-duty or driving time limits. The associated costs can include labour for new drivers, hiring and recruiting; a high wage rate resulted by the increased demand of drivers; and purchase and maintenance costs of additional CMVs.

In summary, the present value of the total costs over a 10-year period is \$291.1 million in Outcome 1, where a total of 146,300 CMVs are captured and is \$128.5 million in Outcome 2, where only 64,200 operating-in-Canada CMVs are taken into account. In either outcome, the present value of the costs to provincial and federal governments is approximately \$0.5 million for the training costs of inspectors and auditors, while the remaining costs \$290.6 million in Outcome 1 or \$128.0 million in Outcome 2 are additional costs to truck and bus carriers.

### Benefits

The benefits of this regulatory proposal include: time savings to drivers, carrier clerical staff, inspectors and auditors; paper logbooks savings; reduced OOS detention time by reducing the propensity of drivers to be placed out of services from HOS violations; and improved road safety. Specifically, benefits include:

- Reduced time for drivers to fill out paper logbooks and eliminating the time required for drivers to forward daily logs to their carriers;
- Saved purchase costs of paper logbooks;

- Time savings for motor carrier clerical personnel, as daily log information would be electronically transmitted and stored;
- Time savings for roadside inspectors and auditors as ELDs would allow them to more quickly and efficiently detect HOS violations at roadside and during compliance audits;
- Reduced OOS detention time due to improved compliance level; and
- Safety benefits by reducing collisions involving CMVs that may be attributable to driver fatigue or HOS violations.

The present value of the total quantified benefits is approximately \$579.1 million in Outcome 1 and is about \$256.0 million in Outcome 2, corresponding to an annualized value of \$82.5 million and \$36.4 million respectively. In both outcomes, savings to the industry, including both carriers and drivers, account for the majority (99.1%) of the total benefits, while the remaining benefits are the time savings on provincial inspections and federal audits, as well as reduction in vehicle crashes.

The proposal would also allow for general alignment with the U.S. rulemaking on requiring the use of ELDs. The Canadian and U.S. trucking industries are very synergistic and integrated and require similar regulatory environments to ensure competitive playing fields. Given that there is a considerable amount of cross-border movement of commercial vehicles (merchandise and passenger) between the two countries and both countries face similar (HOS) issues, the proposed regulatory change is expected to benefit road safety and industry competitiveness. Other qualitative benefits include meeting public expectations in safer transportation in Canada, enhancing carriers' capacity to move goods or passengers, and increased shipper satisfaction through an anticipated reduction in OOS detention time; however, due to data limitations, these benefits are not quantified.

Summary Table 1a and 1b present the cost-benefit statement of this regulatory proposal in Outcome 1 and Outcome 2, respectively.

**Summary Table 1a: Cost-benefit Statement – Outcome 1**

	Base Year 2016	2017	2020	Final Year 2025	Total (PV)	Annualized Value
<b>A. Quantitative Impacts</b>						
<b>Costs</b>						
Costs associated with ELDs	\$13,418,300	\$32,197,780	\$28,831,080	\$33,392,515	<b>\$196,708,257</b>	<b>\$28,006,830</b>
Training costs	\$2,188,608	\$5,106,624	\$0	\$0	<b>\$6,505,751</b>	<b>\$926,273</b>
Compliance costs	\$2,622,718	\$9,277,800	\$14,214,492	\$16,443,984	<b>\$87,380,072</b>	<b>\$12,440,956</b>
<b>Industry Total</b>	<b>\$18,229,626</b>	<b>\$46,582,204</b>	<b>\$43,045,572</b>	<b>\$49,836,499</b>	<b>\$290,594,080</b>	<b>\$41,374,059</b>
<b>Government</b>						
(training costs of inspectors/auditors)	\$158,579	\$368,799	\$0	\$0	<b>\$470,328</b>	<b>\$66,964</b>
<b>Total Costs</b>	<b>\$18,388,205</b>	<b>\$46,951,003</b>	<b>\$43,045,572</b>	<b>\$49,836,499</b>	<b>\$291,064,408</b>	<b>\$41,441,024</b>
<b>Benefits</b>						
Savings to industry	\$17,223,044	\$61,083,545	\$93,443,858	\$107,721,053	<b>\$574,029,388</b>	<b>\$81,728,871</b>
Crashes prevented	\$125,310	\$447,537	\$686,223	\$793,632	<b>\$4,215,892</b>	<b>\$600,248</b>
Savings to governments	\$29,299	\$101,501	\$141,609	\$141,609	<b>\$854,607</b>	<b>\$121,677</b>
<b>Total Benefits</b>	<b>\$17,377,653</b>	<b>\$61,632,583</b>	<b>\$94,271,690</b>	<b>\$108,656,294</b>	<b>\$579,099,887</b>	<b>\$82,450,796</b>
<b>Net Benefits</b>	<b>\$(1,010,551)</b>	<b>\$14,681,580</b>	<b>\$51,226,118</b>	<b>\$58,819,795</b>	<b>\$288,035,479</b>	<b>\$41,009,772</b>
<b>B. Qualitative Impacts</b>						
<i>Costs</i>	n/a					
<i>Benefits</i>	<ul style="list-style-type: none"> <li>• Improved harmonization with the U.S.</li> <li>• Enhanced carriers' capacity to move goods or passengers</li> <li>• Increased customer satisfaction through delay reduction due to less OOS orders</li> <li>• Meeting public expectations for safer transportation in Canada</li> </ul>					

**Note:** May not add to stated totals due to rounding

**Summary Table 1b: Cost-benefit Statement – Outcome 2**

	Base Year 2016	2017	2020	Final Year 2025	Total (PV)	Annualized Value
<b>A. Quantitative Impacts</b>						
<b>Costs</b>						
Costs associated with ELDs	\$5,950,735	\$14,280,520	\$12,692,140	\$14,684,210	<b>\$86,709,619</b>	<b>\$12,345,499</b>
Training costs	\$960,768	\$2,241,648	\$0	\$0	<b>\$2,855,856</b>	<b>\$406,610</b>
Compliance costs	\$1,154,383	\$4,086,979	\$6,258,520	\$7,231,984	<b>\$38,464,267</b>	<b>\$5,476,446</b>
<b>Industry Total</b>	<b>\$8,065,886</b>	<b>\$20,609,147</b>	<b>\$18,950,660</b>	<b>\$21,916,194</b>	<b>\$128,029,743</b>	<b>\$18,228,555</b>
<b>Government</b>						
(training costs of inspectors/auditors)	\$158,579	\$368,799	\$0	\$0	<b>\$470,328</b>	<b>\$66,964</b>
<b>Total Costs</b>	<b>\$8,224,465</b>	<b>\$20,977,946</b>	<b>\$18,950,660</b>	<b>\$21,916,194</b>	<b>\$128,500,071</b>	<b>\$18,295,519</b>
<b>Benefits</b>						
Savings to industry	\$7,610,618	\$27,025,777	\$41,312,601	\$47,546,510	<b>\$253,705,292</b>	<b>\$36,121,926</b>
Crashes prevented	\$56,688	\$202,883	\$310,292	\$358,030	<b>\$1,906,935</b>	<b>\$271,505</b>
Savings to governments	\$12,909	\$44,730	\$62,436	\$62,436	<b>\$376,774</b>	<b>\$53,644</b>
<b>Total Benefits</b>	<b>\$7,680,215</b>	<b>\$27,273,390</b>	<b>\$41,685,330</b>	<b>\$47,966,975</b>	<b>\$255,989,000</b>	<b>\$36,447,075</b>
<b>Net Benefits</b>	<b>\$(544,250)</b>	<b>\$6,295,444</b>	<b>\$22,734,670</b>	<b>\$26,050,781</b>	<b>\$127,488,929</b>	<b>\$18,151,555</b>
<b>B. Qualitative Impacts</b>						
<i>Costs</i>	n/a					
<i>Benefits</i>	<ul style="list-style-type: none"> <li>• Improved harmonization with the U.S.</li> <li>• Enhanced carriers' capacity to move goods or passengers</li> <li>• Increased customer satisfaction through delay reduction due to less OOS orders</li> <li>• Meeting public expectations for safer transportation in Canada</li> </ul>					

**Note:** May not add to stated totals due to rounding

### 1.3 Business and Consumer Impacts

The proposed regulatory amendment is not expected to impose any additional administrative burden on businesses. On the contrary, the requirement to use ELDs may significantly reduce the administrative burden on drivers and motor carriers by reducing the time needed to complete a daily log, eliminating the time that drivers spend forwarding daily logs to their carriers and the time that carrier personnel require to record, handle and store daily logs. The annualized value of the total administrative burden on businesses that will be reduced by the regulatory change is estimated at \$59,192,522 (OUTs) in Outcome 1, or \$26,162,483 in Outcome 2, with no new administrative burden (INs) imposed.

The present value of the total estimated costs on carriers is \$290,594,080, translating into an annualized value of \$243 per CMV (for both vehicles currently using ELDs and vehicles that would require ELDs) in Outcome 1. The estimated annualized value per CMV is approximately \$244 in Outcome 2 as well. Note that the average annual operational cost per CMV is estimated at \$355,000, based on an average travel distance of 100,000 km per year at the cost of \$3.55 per km. Therefore, the incremental cost due to this proposal is expected to be minimal compared to the annual operational costs per vehicle, representing about a 0.07% increase.

It is also expected that costs that may be passed on to Canadian consumers would be negligible as they represent a small fraction of the total operational costs incurred by motor carriers.

Finally, as the Canadian economy is highly integrated with the U.S. economy and the U.S. Federal Motor Carrier Safety Administration (FMCSA) is expected to impose a similar requirement when its final ELD rule becomes effective December 2017, no international competitiveness impact is anticipated. On the contrary, the general alignment with the U.S. rulemaking is expected to have benefits on road safety and industry competitiveness given the volume of cross-border CMV movement and commerce.

### 1.4 Distributional Impacts

As shown in previous sections, the costs of this regulatory proposal are expected to be primarily borne by the industry (truck and bus carriers). As the costs to motor carriers directly depend on the size of the business (number of trucks and drivers), small businesses (100 or less employees) are expected to incur lower costs as compared to medium-large firms with a larger operation scale. While small truck and bus carriers represent 98.7% and 90.5% of all businesses respectively, costs imposed on small

businesses account for 65.8% (for truck) and 38.6% (for bus), of the total industry costs in Outcome 1 where all in-scope CMVs are considered. Specifically, the present value of the total costs to the 21,809 small businesses (21,628 truck carriers and 181 bus carriers) is estimated at \$187.1 million over the 10-year period, as compared to \$103.5 million to the 306 large and medium businesses (287 truck carriers and 19 bus carriers). On average, the proposed regulation would cost \$1,193 per year per small trucking company (as compared to \$46,685 per large trucking carrier) and \$4,653 per year per small bus carrier (as compared to \$70,501 per large bus carrier). Due to the lack of information on the number and size of carriers that have exclusively-in-Canada operation, it is difficult to present the discussion above for Outcome 2. Should additional data be forthcoming, the analysis can be conducted for Outcome 2 in a more precise manner.

In terms of benefits, there are substantial time savings for drivers and quantifiable benefits to carriers and to the governments (inspection and auditing). Moreover, CMV drivers, the economy of the industry, local communities and Canadians could also be the primary beneficiaries of increased efficiencies (i.e. reduced OOS detention time for drivers) and a reduction in collisions involving commercial vehicles.

## 2. Regulatory Issues

### 2.1 Context of the Regulation

Road safety in Canada is a responsibility shared between the federal and provincial/territorial governments. The federal government is responsible for limited operational matters for commercial bus and truck motor vehicles under the *Motor Vehicle Transport Act* (MVTA). The provinces and territories are responsible for commercial vehicle enforcement and safety oversight on Canada's roads and highways, including the enforcement of their own regulations, as well as the federal regulations. All jurisdictions work together through the Canadian Council of Motor Transport Administrators (CCMTA) to develop and update standards under the National Safety Code (NSC), which is a code of minimum safety performance standards for the operation of commercial vehicles. In Canada, federal and provincial regulations governing commercial vehicles, drivers and motor carriers are based on NSC standards.

Since 2004, the Canadian Trucking Alliance (CTA), representing close to half of the number of trucks in the trucking industry, has called for government leadership and a universal mandate to require the use of ELDs as a proactive measure to improve HOS compliance and reduce falsification of daily logs. The CTA continues to seek support and clear intent from the Canadian Council of Deputy Ministers Responsible for

Transportation and Highway Safety (the Council) to advance a national mandate for ELDs.

The U.S. issued a final rule to mandate ELDs in December 2015 with a compliance date two years hence. Their analysis is based on a preferred option, which would require ELDs for drivers required to maintain a logbook. The U.S. has estimated an annual net benefit of more than \$1 billion, 26 lives saved and 562 injuries prevented. Canadian motor carriers will need to comply with the U.S. rule while operating in the U.S.

As the U.S. has advanced its ELD rule-making over the last several years through the issuance of draft rules, the basis for its regulation has been a technical standard outlining minimum performance requirements for ELDs. In order to assist Canada to be in a better state of readiness for the anticipated issuance of the U.S. final rule, the following steps have been taken:

- As directed by the Council, a CCMTA Project Group, with participation from several provincial and territorial governments and Transport Canada (TC), developed a performance-based, technical standard for ELDs, which is intended to be incorporated into the NSC. The standard, consistent with key technical elements of previous iterations of the U.S. ELD standard, remained in draft form pending issuance of the final U.S. rule. Now that the U.S. final rule has been published, CCMTA has developed a workplan to update the Canadian standard. The work is being undertaken by a working group chaired by TC and Ontario.
- Preparation of this cost-benefit analysis.

TC has legislative authority under the MVTA to amend the Regulations. A requirement for the use of ELDs by commercial drivers operating under the federal HOS rules that are currently required to maintain a daily log would be incorporated through amendment into the federal regulations. The technical performance standard for ELDs, once finalized, would either be incorporated into the Regulation or referenced in the NSC standard.

### *2.1.1 Fatigue and road safety*

Driver fatigue is a well-documented crash causation factor. However, the exact contribution of fatigue to crashes is difficult to quantify since databases such as TC's National Collision Data Base (NCDB) are often based on police reports that only consider instances when a police officer can detect or extrapolate, at the scene of a crash, that the driver may have lost consciousness and fallen asleep, or the driver admits to being fatigued.

“Falling asleep” incidents often have dramatic results, but they only represent the “tip of the iceberg” regarding the impact on road safety. Fatigue affects vigilance or the ability to detect critical signals in the environment, which occurs well before a driver falls asleep. This early manifestation of fatigue, called *hypovigilance*, critically alters the driving performance by creating significantly slower reaction times and impeding the ability to properly adapt to a dynamic driving environment. This causal factor often goes undetected and not accurately identified in official databases and, as such, the contribution of fatigue to crashes is vastly underestimated.

Even though police report databases usually tend to estimate the contribution of fatigue at below 5% of crashes, there is established consensus among the world’s leading experts in the field that fatigue is more likely responsible for about 15 to 20% of crashes. This makes it a very significant cause of accidents, surpassing alcohol and drug impairment (Akerstedt et al., 2000).

#### *Causes of fatigue*

The causes of fatigue are complex and systemic. At any given point in time, the alertness of an individual is modulated by an interaction between the following factors: time-awake (performance significantly decreases after 17 hours awake since last consolidated sleep period), lack of sleep or sleep problems (below 8 hours of consolidated sleep creates sleep loss) and accumulated fatigue.

#### *Interventions for commercial motor vehicle drivers*

HOS regulations are used to limit the amount of driving or allowable on-duty time in a day (limit time-awake effect) and to protect consolidated sleep periods. They help to mitigate the impacts of fatigue-generating factors and are therefore important to address driver fatigue. However, more can be done to complement and reinforce the Regulations.

HOS regulations make it illegal to drive more than 13 hours in a 16-hour window and help prevent drivers from operating a CMV after being awake for more than 17 hours. They also provide opportunity for more consolidated sleep by requiring drivers to be off-duty for 8 consecutive hours at least once every 24-hour period. HOS regulations therefore do positively impact road safety; however, they can be complemented by other tools to limit the opportunity for drivers to operate above the HOS.

ELDs are a compliance tool to help mitigate the effects of driver fatigue on road safety. It is generally known that a small portion of drivers tend to operate above HOS limits. The practice to self-report and document on-duty and off-duty cycles on paper logbooks does present opportunity to report incorrect data. It is in this context that ELDs can increase compliance and potentially have a positive safety impact. With tamper-resistancy, the

devices can limit the opportunity for CMV drivers to exceed allowable HOS limits or possibly operate fatigued. However, neither the HOS regulations, nor ELDs, will completely eliminate driver fatigue. ELDs are expected to reduce the occurrence of potentially high-risk situations where drivers may choose to exceed allowable hours.

## 2.2 The Issue Description

The Regulations require commercial drivers to maintain paper log books, but allow for the use of electronic media to capture the required information. The data logged is subject to examination by provincial and territorial enforcement personnel, who are also empowered to issue fines and lay charges under either provincial or federal regulations (depending on whether the carrier's operations qualify them as being provincially or federally regulated and whether enforcement personnel use the federal regulations). While ELD usage is on the rise, particularly by large carriers, some drivers do report incorrect data in their daily logs and some may work outside of the allowable HOS limits<sup>1</sup>. This creates potential competitive inequities between carriers and drivers in compliance with the HOS regulations and those violating the rules. Non-compliant carriers/drivers, by exceeding allowable driving and on-duty hours, are shipping product and meeting shippers' needs within deadlines that compliant carriers could never legally achieve.

An ELD is a device integrated with a commercial vehicle's on-board electronic systems and can be used to monitor and track driver compliance with existing HOS regulations. It can increase the accuracy of tracking driving hours (in an attempt to ensure that allowable driving hours are not exceeded), and reduce the administrative burden and driver time associated with filling out daily logs.

A requirement for federally-regulated motor carriers and drivers to use ELDs would be incorporated through amendment into the Regulations and become effective following publication of the final *Canada Gazette*, Part II and an appropriate compliance period. The final ELD technical standard would most likely become a new NSC standard and therefore require approval by the CCMTA Board of Directors, the Council and Transportation Ministers. An acceptable lead time for industry to comply with the new requirement will be considered. Provincial and territorial regulatory bodies would also require similar lead times to mirror, or incorporate, any NSC standard for ELDs by reference with their respective regulations.

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<sup>1</sup> Although data is very limited to substantiate the claim, it is estimated that up to 5-10% of commercial drivers on the road at some point exceed allowable HOS limits.

Inconsistencies or misalignment between the Canadian and U.S. ELD requirements risk imposing conflicting barriers or regulatory burdens on motor carriers that operate internationally. The Canadian and U.S. trucking industries are very synergistic and integrated and, as such, require similar regulatory environments to ensure competitive playing fields. Similarly, in the absence of regulatory intervention in Canada and when the U.S. ELD rule comes into force, it risks creating competitive inequities between Canadian carriers operating into the U.S. (as they would be required to operate with ELDs under the U.S. rule) and Canadian carriers under federal jurisdiction solely operating domestically. While ELDs are not tamper-proof, current technology is highly tamper-resistant and would significantly reduce the opportunity for drivers to exceed HOS limits.

### 2.3 The Regulatory Proposal: An Overview of Objectives

The proposed regulatory amendment would apply to Canadian federally-regulated motor carriers and commercial drivers currently required to maintain a daily log. ELDs would reduce the opportunity for drivers to report incorrect data on paper logbooks and, over time, simplify and expedite the process to verify HOS compliance by roadside inspectors. Ideally, the same regulatory requirement would be reflected in provincial HOS regulations so as to apply equally to both federal and provincially/territorially-regulated carriers, which in turn would help facilitate fair competition amongst all carriers.

The regulatory amendment and NSC technical standard should be operationally feasible for both industry and government regulators and harmonized (to the extent possible) with the U.S. final rule. Disharmonizing with the U.S. requirement also risks imposing conflicting regulatory burdens in the way extra-provincial motor carriers operating into the U.S. are treated compared to domestic or intra-provincial motor carriers, particularly if an ELD requirement is not reflected in provincial HOS regulations. The need for a consistent “baseline” or similar technical foundation to the U.S. ELD rule is the reason why the Canadian ELD technical standard followed a side-by-side comparison approach throughout its development.

While an ELD requirement will improve HOS compliance, it is also expected to positively impact road safety. Driver fatigue is a contributing factor to collisions involving CMVs. While the direct benefit to road safety from mandatory ELDs is difficult to quantify, reducing the opportunity for drivers to report incorrect data in daily logs and exceed allowable HOS limits will help ensure that there are fewer fatigued drivers on the road.

It should also be noted that the scope of this cost-benefit analysis is limited to quantifying the costs and benefits to carriers, drivers and federal/provincial/territorial governments. It

does not examine issues related to the impact on driver pay, the supply chain or other externalities nor does it quantify societal costs or benefits.

### *Data Issues & Context*

Data availability presented significant challenges throughout the data collection phase of this project. There were no single or robust data sources to: establish a baseline for the number of federally-regulated commercial motor vehicles (CMVs) where drivers were required to maintain a daily log; estimate the percentage of U.S.-active CMVs; or accurately estimate current ELD usage industry-wide. Time savings for drivers to fill out daily logs vs. ELDs and accurate HOS out-of-service rates and detention times were also difficult to quantify. Due to the fact that ELD technologies are constantly evolving and improving and penetration in the trucking industry is steadily increasing, the ability for roadside inspectors to consistently verify driver HOS compliance is an iterative learning process. ELD unit displays differ depending on the technology, so the ability for provincial enforcement agencies to interface with multiple ELD technologies presents some challenges. As such, obtaining accurate estimates for time savings roadside, as well as during facility audits to verify compliance with ELDs vs. daily logs, were difficult.

In light of this, data estimates and baselines were intentionally kept conservative (with respect to the number of CMVs that will be affected by the proposal) to account for data integrity and quality issues. In instances where data was unavailable or unreliable, U.S. numbers, estimates and analytical methodologies from FMCSA's February 2014 Regulatory Impact Analysis were used.

The process to collect required data to be used in this cost-benefit analysis was open and transparent. Data collection requests were sent to all provincial and territorial governments through CCMTA's Compliance and Regulatory Affairs (CRA) Program Committee. All major trucking and bus associations within the regulated community were consulted and invited to submit data. This included the CTA, Private Motor Truck Council (PMTTC), Owner-Operators Business Association of Canada (OBAC), Motor Coach Canada (MCC), the Canadian Bus Association (CBA) and all major ELD suppliers in Canada. Many of these organizations were also consulted throughout the development of the technical standard. In light of their interest and support for ELDs, it should be noted that considerable input was received from the CTA, including data from a targeted ELD survey of their membership.

## 2.4 The Baseline Scenario: A Description

Voluntary use of ELDs currently exists in Canada. Many motor carriers were early adopters of electronic logging devices, formerly known as Electronic On-Board

Recorders (EOBRs). Although outside of the scope of this cost-benefit analysis, the proposed regulatory amendment would likely consider a longer implementation period (i.e. “grandfathering”) for existing units. However, the detail and eligibility of existing technology remains to be resolved.

ELD use is rapidly increasing, particularly by long-haul carriers, as it is typically a component of a more comprehensive Fleet Management System (FMS) used for vehicle function monitoring, driver-dispatch communications and vehicle routing. Stand-alone ELDs (solely for HOS monitoring) are less popular; however, they are still available from most ELD suppliers. Based on the CTA survey, about 84.5% of the respondents’ trucks are equipped with FMS with ELD capacity, and 56.5% of truck fleet have ELDs in use. Further, the survey results suggest that the carriers currently not monitoring HOS would not do so unless required by regulation.

In an effort to improve driver HOS monitoring and compliance, support efforts to improve road safety, and to ensure Canada’s regulatory policies and CMV safety technologies are aligned with the U.S., an ELD regulatory amendment for CMVs where drivers are required to maintain a paper daily log is fully supported by TC. In addition, in order to support national consistency and regulatory harmonization domestically between federal and provincial/territorial regulation, next steps would include finalizing the ELD technical standard and mirroring the new NSC standard for ELDs in the federal and provincial HOS regulations.

### 3. Options Considered

Four options were essentially considered for this analysis:

- A voluntary approach to ELD adoption;
- A 2-year phase-in period (referred to in this cost-benefit analysis as Outcome 1), where all in-scope CMVs (146,300 CMVs) with federally-regulated logbook drivers are included in the proposal (including U.S.-bound CMVs) (see Table 1a).
- A 2-year phase-in period (referred to in this cost-benefit analysis as Outcome 2) whereby a subset (64,200) of the CMVs and the federally-regulated logbook drivers identified in Outcome 1 that operate within Canada exclusively is accounted for, while assuming that all U.S.-bound CMVs (82,100 CMVs) are captured by the U.S. rule, with costs and benefits attributed to that proposal (see Table 1b); and
- A 1-year phase-in of Outcome 2 (see Addendum A).

It should be noted that earlier in the U.S. ELD rule-making process and developmental phase of the Canadian technical standard through the CCMTA working group, a targeted option was also considered. This targeted option would have required carriers with a poor HOS compliance record to install ELDs. It was the basis for previous iterations of the U.S. rule-making and was discussed by CCMTA's CRA Program Committee; however, it presented a number of competitiveness and enforcement challenges.

### 3.1 Voluntary Option

The voluntary option is essentially the baseline scenario (i.e., what is currently in practice today, where carriers chose to voluntarily install ELDs in their CMVs based on operational requirements). As mentioned above, most ELDs that are currently in use are part of a FMS whereby the HOS monitoring function is activated. More and more fleets are using ELDs to track drivers' HOS compliance; however, the adoption rate is typically driven by economics rather than regulation as carriers carefully assess the costs, benefits and applicability of ELDs to their specific needs. Feedback through industry associations from those carriers currently using ELDs has been positive.

### 3.2 ELD Regulatory Requirement: 2-year phase-in period

As stated above, the 2-year phase-in period has been divided into two Outcomes: Outcome 1 and Outcome 2. Both outcomes demonstrate significant benefits for carriers, drivers and enforcement agencies. Under these scenarios, applicable carriers would have 2 years after the publication of *Canada Gazette*, Part II to comply with the regulatory amendment and ramp-up acquisition, installation and/or activation of ELDs. These scenarios present lower total costs to carriers than the 1-year period option, as they allow for a longer phase-in.

### 3.3 ELD Regulatory Requirement: 1-year phase-in period

Under this scenario, applicable carriers would have 1-year after the publication of *Canada Gazette*, Part II to comply with the regulatory amendment and ramp-up acquisition, installation and/or activation of ELDs. This option was considered in light of the current relatively high use of ELDs in the Canadian fleet (56%); however, the condensed phase-in period would result in higher costs than those set out in a 2-year phase-in for those CMVs identified in Outcome 2. Costs for a 2-year phase-in would be lower than those for a 1-year phase-in, as the longer time period would allow operators greater flexibility for installation of ELDs (e.g., could be combined with other

maintenance) and would be consistent with the U.S. approach. Further, in a 2-year phase-in, present value costs would be discounted over a longer period of time.

## 4. A Profile of Affected Parties

The parties affected by this regulatory proposal would be the regulated community, namely federally-regulated truck and bus carriers and drivers employed by these entities, federal, provincial and territorial governments, as well as Canadians in general.

### 4.1 Motor Carriers

In 2013, the Gross Domestic Product (GDP) in the Canadian transportation services sector was \$58 billion, representing approximately 3.7% of the total GDP in Canada in the year.<sup>2</sup> Truck transportation represented the largest segment of transportation services, 30.7% (\$17.9 billion) of the sector's share of the GDP, while transit/passenger transportation accounted for 13.6% (\$8.0 billion).

Truck transport plays a unique and vital role in today's transportation system. Whether it is local transportation or part of the long distance supply chain, trucks are instrumental in enabling the proper functioning of the economy and ensuring the quality of life Canadians enjoy. Truck transportation moves 90% of all consumer products and foods within Canada and almost two thirds, by value, of our trade with the U.S.<sup>3</sup> This is a diverse industry made up of a few large companies but dominated by thousands of small and medium-sized businesses and independent owner-operators.

The Canadian trucking industry, which includes about 56,800 firms, consists of for-hire carriers, private carriers, owner operators and courier firms.<sup>4</sup> According to the Canadian Vehicle Survey, there were approximately 750,000 trucks (heavy vehicles weighing 4.5 tonnes or more) in 2009, representing a 24.8% increase as compared to 5 years ago<sup>5</sup>. In 2009, vehicles used for private trucking services accounted for the majority (42.6%) of the truck fleet, followed by for-hire trucks (25.9%) and owner-operator trucks (17.0%). Table 1 below presents the number of trucks by type of activity between 2004 and 2009.

<sup>2</sup> Source: Statistics Canada, *CANSIM Table 379-0031 - Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), monthly (dollars)*. Accessed on August 26, 2014.

<sup>3</sup> Source: Canadian Trucking Alliance, *Trucking in Canada*, available online at <http://www.cantruck.ca/iMISpublic/Content/NavigationMenu2/CTAIndustry/TruckinginCanada/default.htm>. Accessed August 26, 2014.

<sup>4</sup> Transport Canada, *Transportation in Canada 2011*.

<sup>5</sup> As the Canadian Vehicle Survey has been terminated, 2009 is the most recent year for which road motor vehicle fleet information is available.

**Table 1: Number of Trucks (Vehicles Weighing 4.5 tonnes or More),  
by Type of Activity 2004 -2009**

	2004	2005	2006	2007	2008	2009
For-hire trucking	166,095	168,960	182,387	196,516	194,892	194,287
Owner-operator trucking	125,862	110,114	121,174	140,689	148,542	127,575
Private trucking	235,618	253,996	245,039	262,014	293,365	319,012
Other activity type	72,649	83,424	84,068	102,633	97,031	107,987
<b>Total</b>	<b>600,223</b>	<b>616,494</b>	<b>632,668</b>	<b>701,851</b>	<b>733,832</b>	<b>748,861</b>

**Note:** The figures exclude buses, motorcycles, off road vehicles such as snowmobiles and dune buggies, and special equipment including cranes, street cleaner and snowplows. Trucks weighing less than 4.5 tonnes are not included due to data limitations.

**Source:** Statistics Canada, *Canadian Vehicle Survey, CANSIM Table 405-0116*: Number of vehicles in scope, by type of vehicle and type of activity, annual (number), provinces only.

In terms of origin and destination of the shipments transported by Canadian trucks, the majority is domestic shipments and about 16.8% out of the total 60.4 million shipments are trans-border moves going to or coming from the U.S. or Mexico<sup>6</sup>. In addition, road transportation, by value, continues to be the dominant transportation mode for moving goods between Canada and the U.S. In 2011, 45.1% (\$149 billion) of exports and 73.5% (\$162 billion) of imports between the 2 countries were transported by trucks<sup>7</sup>.

The passenger transportation system is also a key contributor to economic growth and social well-being. Using the North American Industrial Classification System (NAICS) codes, the industry can be categorized into 6 groups which are urban transit, scheduled intercity, charter, school bus, sightseeing and shuttle (NAICS code 485110, 485210, 485410, 485510, 485990 and, 487110). In 2012, about 1,242 companies operated in this industry in Canada which generated an estimated \$15.8 billion in revenue. While the number of operating companies has declined by 14.0% over the past 5 years, the revenue has increased by 52.3% from \$10.4 billion in 2007 to \$15.8 billion in 2012<sup>8</sup>. With respect to the number of vehicles in the passenger transportation industry, school buses account for over half (55.6%) of the total vehicles (69,997) in the industry, followed by

<sup>6</sup> Source: Statistics Canada, *Trucking Commodity Origin and Destination Survey, CANSIM table 403-0004*: Trucking commodity origin and destination survey, trucking industry, annual (number). Accessed August 26, 2014.

<sup>7</sup> Source: Transport Canada, *Transportation in Canada 2011*.

<sup>8</sup> Source: Statistics Canada, *Passenger Bus and Urban Transit Survey, CANSIM table 408-0005*: Canadian passenger bus and urban transit industries, revenue and expenses, by North American Industry Classification system (NAICS). Accessed August 26, 2014.

urban transit system (29.6%), interurban and rural bus transportation (5.3%), charter and sightseeing buses (5.2%) and other (4.4%).<sup>9</sup>

Motor carriers that are regulated under federal jurisdiction and commercial drivers who are required to maintain a daily log are subject to the proposed regulatory amendment. TC estimates that there are approximately 170,000 federally-regulated trucks and 4,300 buses (charter and scheduled service). Of these, it is estimated that about 142,000 trucks and all 4,300 buses are operated by drivers who are required to maintain a daily log. TC further assumes that, among these total CMVs, about 80,000 trucks and 2,100 buses operate into the U.S. on a regular basis while the remaining vehicles operate exclusively within Canada.

## 4.2 Drivers

According to the Annual Trucking Survey, there were approximately 201,108 persons employed in the trucking industry (excluding owner operators) in 2010 where 63.9% (130,000) were salaried drivers<sup>10</sup>. There were an additional 54,000 owner operators in the same year. The Passenger Bus and Urban Transit Survey suggests that the passenger transportation industry employed 109,833 employees in 2012, including 74,352 drivers and 7,127 mechanics. The average compensation per employee in this sector was \$61,000.

Two data sources provide the information for hourly wage rates in the transportation industry, but none contains the specific information related to drivers. For example, the Survey of Employment, Payrolls and Hours estimates that the average hourly wage rate for employees in the truck transportation industry (NAICS code 484) was \$24.81 in 2014 and the rate for employees in the transit and ground passenger transportation industry (NAICS code 485) was \$26.38 in the same year<sup>11</sup>. Feedback from the CTA survey, as well as several ELD suppliers, suggested that the average wage rate for CMV drivers was approximately \$30 per hour (including benefits). Recognizing that most long-haul truck drivers are compensated by the distance they travel (\$/km), the cost-benefit analysis required a \$/hour figure.

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<sup>9</sup> Source: Statistics Canada, *Passenger Bus and Urban Transit Survey*, CANSIM table 408-0010: Canadian passenger bus and urban transit industries, equipment operated, by North American Industry Classification system (NAICS). Accessed April 30, 2015.

<sup>10</sup> Source: Statistics Canada, *Annual Trucking Survey*, CANSIM table 403-0011: Trucking industry, employment statistics, by province and territory. Accessed August 26, 2014.

<sup>11</sup> Source: Statistics Canada, *Survey of employment, payrolls and hours (SEPH)*, CANSIM table 281-0030: Average hourly earnings for employees paid by the hour, for selected industries classified using the North American Industry Classification System (NAICS). Accessed August 26, 2014.

Only drivers who operate across an interprovincial and international boundary and are currently required to maintain a daily log will be affected by the proposed regulatory amendment. While ELDs will reduce the time that drivers spend completing and transmitting daily logs, it is also expected that they will increase HOS compliance and decrease the probability for drivers receiving OOS orders for HOS violations, and hence reduce detention time.

### 4.3 Transport Canada and Provincial and Territorial Governments

TC has authority over extra-provincial truck and bus carriers that carry goods or passengers across a provincial or international boundary on a regular and continuous basis. However, provincial and territorial governments regulate and oversee the on-road operations of the truck and commercial bus industry. In support of the Department's interest in reducing fatalities, injuries and collisions involving large commercial trucks and buses in Canada, TC, the provinces, territories and industry work closely on rules and regulations governing the safe operation of commercial vehicles, drivers and motor carriers. TC is responsible for the MVTA and the federal HOS regulation, which would be amended by this regulatory proposal in that it would essentially *require*, as opposed to allow, drivers to use an ELD to track HOS. While it is expected that the proposed regulatory change would not impose any additional costs on TC, training costs for roadside inspectors and facility auditors could incur an extra financial burden on provincial/territorial governments. However, it should be noted that the use of ELDs by CMV drivers is also expected to, over time, assist roadside inspectors and facility auditors to more easily verify HOS compliance, particularly as they become more familiar with the technology. Provincial and territorial governments have indicated that, at this time, they would not be investing in acquiring any ELD verification equipment and, as such, this is not included in the proposal as a cost item.

### 4.4 Canadians

Traffic collisions are a major cause of death of people aged 5 to 34 in Canada. The injuries sustained in collisions by all Canadians places a significant burden on our health care system in terms of emergency treatment, chronic care and rehabilitation (Ramage-Morin, 2008). In 2013, motor vehicle collisions were the cause of 1,923 deaths

and 165,306 personal injuries in Canada, and there were an estimated 226 fatalities and 4,512 injuries involving a semi-truck<sup>12</sup>.

In addition to vehicle drivers, victims of collision also include other vulnerable road users, such as pedestrians, riders of motorcycles and mopeds, and bicyclists. Over the period between 2004 and 2008, pedestrians accounted for 13% of traffic fatalities, followed by motorcyclists (8%) and bicyclists (2%). Further, about 20% of fatalities over the period from 2001-2005 involved heavy commercial trucks (Transport Canada, 2010). The majority of heavy truck casualty collisions occur during daytime hours, in clear weather on dry, undivided roads, and in higher speed zones. Two-thirds of straight truck casualty collisions occur in urban areas while 56% of tractor-trailer collisions occur in areas deemed “rural” (Transport Canada, 2010)<sup>13</sup>.

Canadians would benefit from the proposed regulatory change in that it is expected to contribute to a reduction in CMV crashes where fatigue is a contributing factor by preventing commercial drivers from exceeding allowable driving time. Further, as transportation costs might increase due to the mandatory use of ELDs (additional costs to carriers and shippers), there is the possibility that Canadians in general, as consumers, may incur a portion of the cost increase, as the costs may be passed from carriers and shippers onto consumers through the supply chain. Nevertheless, the rise of consumer prices is only a transfer from the motor carrier to producers/retailers, and hence, should not be double counted.

## 5. Costs and Benefits: Identification and Valuation

### 5.1 Methodology

The approach to cost-benefit analysis identifies, quantifies and monetizes, where possible, the incremental costs and benefits of the proposed regulatory amendments. It evaluates the impact of the regulatory proposal as compared to the baseline option of not imposing the ELD requirement. It also includes a baseline regulatory option of capturing all in-scope CMVs in the analysis, as well as an alternate outcome excluding U.S.-bound CMVs as the timing of the U.S. rule is now known. For comparative purposes, the analysis also includes an addendum with a cost-benefit statement based on a one-year compliance period.

While the present proposal would apply to all in-scope CMVs, both those operating exclusively within Canada and those operating into the U.S., the following estimation

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<sup>12</sup> Source: Transport Canada, *Canadian Motor Vehicle Traffic Collision Statistics 2013*, available at: [http://www.tc.gc.ca/media/documents/roadsafety/cmvtcs2013\\_eng.pdf](http://www.tc.gc.ca/media/documents/roadsafety/cmvtcs2013_eng.pdf)

<sup>13</sup> Source: Transport Canada, Motor Vehicle Safety, *Road Safety in Canada*, available at: <http://www.tc.gc.ca/media/documents/roadsafety/tp15145e.pdf>.

provides cost-benefit analyses for two outcomes given the uncertain timing issue of the Canadian regulatory proposal. Outcome 1 presents the results of the cost-benefit analysis for all federally-regulated CMVs (trucks and buses) and drivers required to maintain daily logs, including those operating into the U.S.; and Outcome 2 presents the results of the cost-benefit analysis for those federally-regulated CMVs and drivers operating within Canada exclusively.

The cost-benefit framework includes the following considerations:

- *Identification of the analysis period.* The time period used to evaluate the economic impact of this proposal is 10 years (2016-2025). The selection of this time horizon is based on the average lifespan for ELDs which is assumed to be 10 years. Using a longer time period of this cost-benefit analysis would not change the result of a positive net benefit.
- *Identification of the regulated community.* The stakeholders that are directly impacted by the proposal are the motor carriers and drivers that are federally-regulated and are required to maintain a daily log, provincial and territorial roadside inspectors who conduct commercial vehicle inspections and auditors who perform NSC facility audits.
- *Identification of the impacts of the proposal.* The following impact elements will be examined:
  - Costs associated with ELD acquisition, installation, activation and monitoring.
  - Costs for training drivers, inspectors and auditors;
  - Compliance costs to affected carriers;
  - Compliance benefits to affected carriers from the reduced OOS detention time by reducing the propensity for drivers to be placed OOS for HOS violations;
  - Time savings to drivers, carrier clerical staff, inspectors and auditors, as well as paper logbooks savings; and
  - Reduction in number of collisions involving CMVs.
- *Dollar value.* In the present proposal, all the dollar figures are presented in 2016 Canadian dollars.
- *Discount rate.* A discount rate of 7% is used to derive the present value of the option under consideration.
- *Conservative estimates.* Due to lack of data, some costs are underestimated as a precaution while others are omitted completely. Underestimation occurs where it is necessary to make an assumption because of insufficient data and where more

than one assumption is possible; in these cases, the assumption resulting in a more conservative estimate is used.

## 5.2 CMVs, drivers, inspectors and auditors

### *CMVs*

TC estimates that there are approximately 142,000 federally-regulated trucks and 4,300 federally-regulated buses (including motor coach and scheduled-service buses) that are required to maintain a daily log. These estimates are drawn from multiple sources. The baseline for trucks, obtained from Statistics Canada, is the number of motor vehicle registrations for CMVs weighing 4,500 kilograms and greater: 1,030,367<sup>14</sup>; however, this figure covers CMVs under both federal and provincial jurisdiction. Multiple data sources, including a 2009 CCMTA NSC Funding Report, a 2003 TC poll of jurisdictions, as well as industry estimates, suggest that the proportion of trucks operated by carriers under federal jurisdiction is between 17% and 20%. In this case, the 17% figure was chosen to ensure a conservative estimate, resulting in a total of 170,000 trucks.

The next step is to estimate the number of trucks where drivers are required to maintain a daily log, as some federally-regulated carriers operate trucks within 160 km of their home terminal and, as such, are exempt from having to maintain a daily log (e.g. less-than-truckload operations). Data from the CTA survey on trucks operated by drivers required to maintain a daily log, as well as data from the International Registration Plan (IRP) Inc., indicate that about 142,000 trucks are operated by daily log drivers. In terms of buses, TC assumes that there a total of 4,700 federally-regulated buses where 4,300 are operated by drivers required to maintain a daily log. As such, a total of 146,300 CMVs (trucks and buses) are subject to this regulatory proposal.

Among these CMVs, it is estimated that 80,000 trucks and 2,100 buses operate into the U.S. on a regular basis while the remaining vehicles operate exclusively within Canada. The truck estimate is drawn primarily from the IRP Clearinghouse data for actual Canadian trucks operated by carriers registered to travel in U.S. While industry and FMCSA estimates suggest that the number of Canadian trucks operating into the U.S. is higher (over the 100,000 mark), it should be noted that carriers typically register their entire fleets for U.S. operation, but only send a portion into the U.S. Therefore, the estimate of 80,000 for active U.S.-bound trucks is likely more reasonable based on available data sources.

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<sup>14</sup> Source: Statistics Canada, *Road motor vehicles, registrations, annual (number)*, CANSIM table 405-0004: Accessed July 14, 2015.

TC also assumes that the trucking fleet will grow at an annual rate of 3.1%, which was the average growth rate of the real GDP of the truck transportation industry (NAICS code 484) over the past 5 years. On the other hand, the size of the bus fleet is expected to be stable over the period examined. Vehicle retirement is considered for both trucks and buses where the average lifespan is 6 years for trucks and 15 years for buses.

Some carriers have voluntarily decided to equip their vehicles with ELDs, in many cases as a component of a FMS and, as a result, the percentage of ELD usage is steadily increasing. Based on data from the CTA survey, currently about 84.5% of trucks are equipped with FMS with ELD capacity and 56.5% of trucks have operational ELDs. Further, as the results showed that the vast majority of ELDs currently in use are not stand-alone units (the ELD function is integrated into the FMS), it follows that 28.0% (=84.5%-56.5%) of the trucks would only need ELD activation and 15.5% (=100%-84.5%) would require ELD hardware<sup>15</sup>. In terms of buses, 14.0% of the vehicles voluntarily use ELDs in their operations, indicating that 86.0% would require ELD devices under the proposed regulatory amendment. ELD activation is not considered for buses, as those that have ELD capacity generally use the functionality already.

Therefore, in Outcome 1, where all federally-regulated CMVs (trucks and buses) of which drivers are required to maintain a daily log are considered, 21,983 (=142,000 trucks \* 15.5%) trucks and 3,698 (=4,300 buses \* 86%) buses would require ELD hardware, and 39,746 (=142,000 trucks \* 28.0%) trucks would require ELD activation on their FMS. Similarly, in Outcome 2 where federally-regulated CMVs of which drivers are required to maintain a daily log operating within Canada exclusively are considered, 9,598 (=62,000 trucks \* 15.5%) trucks and 1,892 (=2,200 buses \* 86.0%) buses would require ELD hardware. In addition, 17,354 (=62,000 trucks \* 28.0%) trucks would require ELD activation on the FMS.

### *Drivers*

The ratio of the number of drivers to the number of vehicles is estimated based on industry information. Specifically, it is estimated that the ratio is 1.2 for trucks and is 1.85 for buses where the latter is a weighted average of the ratio for motor coach buses (1.5) and the ratio for scheduled-service buses (2.5). The ratios suggest that for every truck, there are on average 1.2 truck drivers and for every bus counted, there are on average 1.85 bus drivers. Given the number of CMVs discussed above, in Outcome 1 there are 170,400 (=142,000 trucks \* 1.2) truck drivers and 7,955 (=4,300 buses \* 1.85)

<sup>15</sup> There are likely stand-alone ELD units in use however the exact number is likely small and could not be quantified.

bus drivers, for a total of 178,355 CMV drivers, subject to this regulatory proposal. In Outcome 2, a total of 78,470 CMV drivers will be affected by the proposal, including 74,400 (=62,000 trucks \* 1.2) truck drivers and 4,070 (=2,200 buses \* 1.85) bus drivers.

The population of the truck and bus drivers is assumed to follow the growth rate of truck and bus fleets, with the same driver-to-vehicle ratios over the 10-year period. Retirement and turnover of drivers are also taken into consideration. Data from TruckingHR Canada indicates an overall turnover rate of 6.7% (including leaving the industry and retirement) in the trucking industry, whereas the bus industry estimates a much higher turnover at 20%. Finally, the wage rate of drivers is \$30 per hour, including an overhead rate for benefits of 25%, according to the industry.

### *Inspectors and auditors*

According to the data TC collects from the provinces and territories as part of the reporting requirements under the NSC funding agreement, there are about 1,052 roadside inspectors who conduct an average of 282,587 daily log inspections (Commercial Vehicle Safety Alliance Level 1-3 driver inspections, 2009/10 – 2013/14) conducted in Canada annually. Assuming that the inspection of vehicles is based on random selection, it is estimated that in Outcome 1, 36.15%<sup>16</sup> of the total CMVs subject to inspection are operated by federally-regulated drivers required to maintain a daily log, including those operating into the U.S. This suggests that 36.15% of the annual 282,587 inspections are for federally-regulated drivers with daily-log requirement. Similarly, in Outcome 2 it is calculated that 15.86%<sup>17</sup> of the annual 282,587 inspections are for those federally-regulated drivers with daily-log requirement who operate CMVs within Canada exclusively. Following this, it is calculated that 102,156 annual inspections correspond to the 146,300 in-scope CMVs in Outcome 1, and 44,828 annual inspections correspond to the 64,200 operating-in-Canada CMVs in Outcome 2.

TC estimates that there are approximately 102 auditors with 1,166 facility audits completed annually. As the number of facility audits covers all federally-regulated vehicles, it is estimated that 976 audits are conducted annually for the 146,300 in-scope CMVs in Outcome 1 and 428 audits conducted annually to the 64,200 operating-in-

<sup>16</sup> It is estimated that about 400,000 commercial trucks and 4,700 commercial buses are subject to roadside inspection annually. Therefore, the percentage of the federally-regulated CMVs with the daily log requirement (including those operating into the U.S.) out of the total CMVs that are subject to inspection is calculated at 36.15% (= 146,300/(400,000+4,700)). This rate is applied Scenario 1.

<sup>17</sup> The percentage of the federally-regulated CMVs with the daily log requirement (excluding those operating into the U.S.) out of the total CMVs that are subject to inspection is calculated at 15.86% (=64,200/ (400,000+4,700)). This rate is applicable to Scenario 2.

Canada CMVs in Outcome 2, following the assumption that each facility/vehicle has the same probability of receiving the audit. The numbers of inspectors/auditors and inspections/audits are assumed to be stable over the 10-year period. Based on feedback from a data request sent to provinces and territories, the hourly wage rate for inspectors and auditors is \$57 and \$58, respectively (weighted average from 11 jurisdictions).

## 5.3 Costs of the Regulatory Proposal

### *5.3.1 Costs associated with ELDS*

Costs associated with ELDs include the following cost items: acquisition costs of the hardware, installation costs, activation costs and monitoring service costs. The average lifespan for ELDs is assumed to be 10 years. Therefore, the replacement costs of ELDs are not considered here as the ELD service duration covers the entire time period of the analysis.

While the regulatory amendment is expected to come into force in year 3 (2 years after publication of the final regulation), it is expected that carriers will start to ramp up the acquisition, installation and activation of ELDs ahead of the anticipated effective date (January 1, 2018). It is assumed that 30% of the ramp-up will be completed in year 1 (2016) and 70% will be completed in year 2 (2017). In this way, starting in 2018, CMVs would be fully prepared to comply with the regulatory amendment. It should be noted that these dates were selected strictly for analysis purposes in this proposal and the actual regulatory schedule may change. Note that vehicles that will retire from the service in year 1 and year 2 are not included in the ramp-up scope, as they will be replaced by new vehicles.

Every year, a number of new vehicles will be added to the truck and bus fleet. New vehicles added to the truck fleet consist of two parts: the increased demand due to economic activity and industry growth, and the replacement of old trucks that will be retired from the fleet. As the size of the bus fleet is assumed to be stable over the 10-year period, new buses entering into service will replace those buses exiting service at a 1:1 ratio. It is estimated that on average trucks have a lifespan of 6 years and buses have an average lifespan of 15 years. Further, based on industry input, it is assumed that ELD units are transferrable, so that if a vehicle equipped with an ELD (as required by the proposed regulatory amendment) is about to retire from service, the ELD device will be transferred to the new vehicle, as ELDs remain functional over the entire analysis period. While there will be no extra acquisition costs for the transfer, installation costs will be incurred every time an ELD unit is transferred. In terms of new trucks purchased due to industry growth, it is assumed that the fleet would follow the same adoption rate as compared to the baseline scenario (i.e., 15.5% would require ELD hardware and 28.0%

would require ELD activation). Table 2 presents the numbers of vehicles that require ELD units, ELD activation or ELD transfer, respectively, in each year by operation scope.

**Table 2: Numbers of CMVs Requiring ELD Hardware, Activation and Transfer, by Type of Vehicle and Operation Scope**

	# of CMVs requiring ELD hardware		# of CMVs requiring ELD activation		# of CMVs requiring ELD transfer		Total # of CMVs with ELD in use	
	In Canada	Cross-border	In Canada	Cross-border	In Canada	Cross-border	In Canada	Cross-border
<b>Trucks</b>								
2016	3,817	4,925	6,901	8,904	-	-	10,718	13,829
2017	6,386	8,240	11,546	14,898	-	-	28,650	36,967
2018	316	408	3,464	4,470	1,600	2,064	29,538	38,113
2019	326	421	3,482	4,493	1,600	2,064	30,454	39,295
2020	336	434	3,500	4,516	1,600	2,064	31,398	40,513
2021	347	447	3,520	4,541	1,600	2,064	32,372	41,769
2022	357	461	4,076	5,260	1,897	2,448	33,375	43,064
2023	368	475	4,113	5,308	1,906	2,460	34,409	44,399
2024	380	490	4,151	5,356	1,916	2,472	35,476	45,775
2025	392	505	4,190	5,407	1,926	2,485	36,576	47,194
<b>Buses</b>								
2016	618	590	-	-	-	-	618	590
2017	1,274	1,216	-	-	-	-	1,892	1,806
2018	-	-	-	-	126	120	1,892	1,806
2019	-	-	-	-	126	120	1,892	1,806
2020	-	-	-	-	126	120	1,892	1,806
2021	-	-	-	-	126	120	1,892	1,806
2022	-	-	-	-	126	120	1,892	1,806
2023	-	-	-	-	126	120	1,892	1,806
2024	-	-	-	-	126	120	1,892	1,806
2025	-	-	-	-	126	120	1,892	1,806

According to industry feedback and input from multiple ELD suppliers, the costs of ELDs at an entry or middle level (for example, less sophisticated FMSs with ELD capability, which are what the vast majority of carriers would use) can range from \$300 to \$900. There is a likelihood that mobile ELD applications entering the market could push the costs down even further<sup>18</sup>. As such, it is assumed that the acquisition cost of an ELD device is \$600, and the associated installation cost is \$220 per device. The ELD activation fee is estimated at \$15 per unit. Another cost item related to the use of ELDs is the monthly (monitoring) service fee, which is estimated at \$30 per month. Costs of removing the ELDs from the replaced vehicles are not considered.

Multiplying the unit cost of each item by the corresponding number of CMVs, the present value of the total costs associated with the use of ELDs over the 10-year period is estimated at \$196,708,257, corresponding to an annualized value of \$13,107,481. Table 3 presents a summary of the relevant costs by type of vehicle and operation scope.

**Table 3: Summary of the costs (PV) associated with the use of ELDs**

	<b>Outcome 1</b> In Canada & cross-border	<b>Outcome 2</b> In Canada only
Acquisition costs	\$17,050,233	\$7,593,184
Installation costs	\$11,091,545	\$4,918,766
Activation costs	\$1,242,936	\$542,689
Monitoring costs	\$167,323,542	\$73,654,980
<b>Total costs (PV)</b>	<b>\$196,708,257</b>	<b>\$86,709,619</b>

**Note:** May not add to stated totals due to rounding.

### 5.3.2 Training costs

While the present proposal does not mandate specific training requirements for drivers and inspectors/auditors, it is assumed they will be trained in order to become familiar with ELD functionality and/or to be able to accurately read and understand the printout format of the electronic logging results for compliance verification purposes. Therefore, the opportunity costs of receiving training on the use of ELDs for drivers, roadside inspectors and auditors are examined. Prior to the expected effective date of the

<sup>18</sup> Source: Canadian Trucking Alliance, *White paper on the Transportation of Dangerous Goods by Truck in Canada, Fall/Winter, 2013/2014*.

regulation (January 1, 2018), drivers and inspectors/auditors should have already interacted with ELDs or other interfaces similar to ELDs. Similar to the ramp-up of acquisition and installation of ELDs for vehicles, it is assumed that 30% of the current drivers and inspectors/auditors will be trained in year 1 (2016), and the remaining 70% will be trained in year 2 (2017) in order to be fully prepared for the effective date of January 1, 2018. Current drivers who are expected to retire prior to 2018 will not be trained, so there are no costs included for them. New employees are assumed to be trained in the specific year that they join the industry.

The additional ELD training costs due to the proposed regulatory amendment will be taken into account only for current drivers who have previously taken the HOS and daily log training and will continue to stay in the industry. ELD training costs for new drivers entering into the industry in the following years will not be included as it is assumed that the costs of receiving ELD training are similar to the costs of receiving paper daily log training. In the absence of the amendment, new drivers would be required to take HOS and daily log training regardless (typically as part of the safety training provided upon being hired by a new carrier), so it is assumed that there is no incremental impact/cost of switching from one to the other (paper log book to ELD training). Further, for the sake of simplicity, it is also assumed that drivers moving from one carrier to another (turnover within the industry) are able to use other ELDs without any further training requirement, even if the devices may be slightly different. Following this, it is calculated that a total of 151,984 drivers would be trained during year 1 and year 2 in Outcome 1 and a total of 66,717 drivers would be trained during the ramp-up period in Outcome 2. The industry estimates that the average driver training cost is \$48 per driver. It follows that the present value of the total training (opportunity) costs for drivers is approximately \$6,505,751 in Outcome 1 and \$2,855,856 in Outcome 2.

As discussed earlier, there are approximately 1,052 roadside inspectors and 102 auditors. The numbers of inspectors and auditors are assumed to be stable over the 10-year period. All current employees would be required to take the ELD training and retirement is not considered here due to the small population. The training costs for inspectors and auditors would be the same in both Outcome 1 and Outcome 2, as (regardless of the number of vehicles they inspect or audit) they would have to receive the same training. Using information provided by nine jurisdictions, TC estimates that the average inspector/auditor training cost is about \$457 per person. The present value of the total training costs for inspectors and auditors is \$470,328 in both Outcome 1 and Outcome 2.

In summary, the present value of the total training costs over the 10-year period is estimated at \$6,976,079 in Outcome 1, corresponding to an annualized value of \$993,237. In Outcome 2, the present value of the total training costs over the 10-year period is \$3,326,184, corresponding to an annualized value of \$473,574. Table 4 presents a summary of the training costs for drivers, inspectors and auditors by operation scope.

**Table 4: Summary of training costs (PV)**

	<b>Outcome 1</b> In Canada & cross-border (U.S. border)	<b>Outcome 2</b> In Canada only (crossing provincial / territorial borders)
Drivers	\$6,505,751	\$2,855,856
Inspectors	\$428,747	\$428,747
Auditors	\$41,581	\$41,581
<b>Total costs (PV)</b>	<b>\$6,976,079</b>	<b>\$3,326,184</b>

### 5.3.3 HOS compliance costs

It is expected that the use of ELDs will improve compliance with the HOS rules. Compliance costs reflect the anticipated expenditures that would be incurred by the industry in order to improve the compliance level under the proposed regulatory change, as carriers would have to hire additional drivers and/or purchase additional vehicles in order to redistribute the workload to compensate for an anticipated reduction in driving and on-duty time (i.e. such that drivers would not violate any on-duty or driving time limits). Therefore, the associated costs can include labour costs for new drivers, hiring and recruiting costs, a higher wage rate as a result of increased demand for drivers, and the purchase and maintenance costs of additional CMVs.

This approach does not suggest that all carriers and drivers violate the rules or operate at a level of non-compliance, as the vast majority abide by the HOS regulations and operate within the limits. Although data was very limited to properly quantify the level of compliance, it is recognized that some carriers and drivers exceed allowable limits. The percentage of drivers/carriers that are exceeding allowable HOS limits is estimated at approximately 5%, and possibly as high as 10%. ELDs will be expected to reduce this non-compliance in the industry at a certain effectiveness rate (expectation of full compliance with ELDs is unrealistic, as some will continue to violate the rules). Using the current Canadian HOS OOS violation rate, the approach outlined below, based on the

U.S. model, is used to estimate the additional costs required to maintain a similar service level in the industry under the proposed scenario.

The February 2014 FMCSA Regulatory Impact Statement that accompanied the U.S. ELD Supplemental Notice of Proposed Rule-Making<sup>19</sup> estimated that the total cost for all long-haul CMVs in the U.S. to reach full compliance was approximately \$1,483 million (2011 USD), which was based on a non-compliance rate of 6.5%. Using Commercial Vehicle Safety Alliance (CVSA) *Roadcheck* data (5-year annual average, 2009/10-2013/14) and driver OOS violations (HOS and false logs), the annual average HOS OOS violation rate in Canada is estimated at 2.81%, approximately 43.2% ( $=2.81\% / 6.5\%$ ) of the U.S. rate. Therefore, the compliance cost that would be needed in the U.S. industry to bring it into full compliance with the HOS rule based on a lower violation rate (2.81%) would be about \$641 million ( $=\$1,483 \text{ million} * 43.2\%$ , 2011 USD), equivalent to \$671 million (2015 CAD) after adjusting for the exchange rate and inflation. This total cost corresponds to a fleet size of 2,137,000 long-haul CMVs in the U.S. As this cost-benefit analysis includes a total of 146,300 in-scope CMVs (Outcome 1) under the proposed regulatory change, the corresponding total cost of reaching full compliance for all in-scope CMVs is estimated at \$45.9 million ( $=\$671 \text{ million} * 146,300 \text{ Canadian in-scope CMVs} / 2,137,000 \text{ U.S. long haul CMVs}$ , 2015 CAD). This equates to about \$314 per CMV compliance cost ( $\$45.9 \text{ million} / 146,300 \text{ vehicles}$ ). A straightforward calculation can show the same compliance cost per vehicle applies to Outcome 2 as well.

Note that this cost figure (\$314) is a weighted average based on both vehicles currently operating with ELDs and those not using ELDs. As the former group has already used ELDs in operation (with the effectiveness of ELDs), the impact of ELDs (in reducing the OOS rate) as a result of the proposed regulatory change should be only calculated for ELD non-users. For those current ELD users, no additional impact is expected to result from the proposed requirement. Combining information for both trucks and buses, it is estimated that current ELD-user vehicles represent approximately 55.3% of the entire fleet in case 1 (55.1% in Case 2) while the remaining 44.7% are non-ELD users (44.9% in Outcome 2). In addition, TC assumes a 45% effectiveness rate (same as the U.S. effectiveness rate) of ELDs in reducing the HOS OOS violations, as an ELD regulatory requirement is not expected to lead to full HOS compliance.

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<sup>19</sup> This analysis was completed based on the draft U.S. rule prior to issuance of the final rule December 2015.

To illustrate the compliance costs attributable only to the new ELDs that would be placed into service as a result of this proposal, we need to isolate the particular impact of the current ELD users who have a lower violations rate than the rest of the fleet. Specifically, the above discussion can be translated into the following formula as shown in equation (1):

Eq (1):

Compliance cost per CMV = [(100% - 45% ELD effect) × percentage of CMVs with ELDs × compliance cost per CMV without ELD] + [percentage of CMVs without ELDs × compliance cost per CMV without ELD]

On the right hand of Eq (1), the first part in the bracket is the share of the compliance costs of current ELD users and the second part in the bracket is the share of the compliance costs of CMVs without ELDs. To explain in another way, a CMV equipped with an ELD would bear 55% (=100% - 45%) of the cost due to the ELD effect, and a CMV without an ELD would completely bear the full compliance costs. Taking Outcome 1 as an example, and substituting the discussed information into the formula, it follows that:

$$\$314 = 55\% \times 55.3\% \times \textit{compliance cost per CMV without ELD} + 44.72\% \times \textit{compliance cost per CMV without ELD}$$

Then, the compliance cost per CMV without an ELD can be solved by rearranging the above equation. Following this, it is calculated that the full compliance cost is about \$418 per ELD for non-ELD users, which represents the cost of improving the compliance level from the existing rate to 100% for vehicles that currently do not use ELDs. Given the effectiveness rate of 45% in reducing OOS, the associated compliance cost per CMV for each new ELD installed as required by the Regulation is then calculated at \$188 (= \$418 \* 45%). This corresponds to the cost of reducing the existing non-compliance rate by 45%. Given the minor differences between the percentages of current ELD-user vehicles and non-ELD users in Outcome 1 and Outcome 2, the full compliance cost for each new ELD installed in Outcome 2 is still calculated approximately at \$188.

Multiplying this cost figure (\$188) by the number of ELDs (shown in Table 2) that are used in each year as a result of the regulation, the present value of the total compliance costs over the 10 years is \$87,380,072 in Outcome 1 and \$38,464,267 in Outcome 2.

#### 5.3.4 Total costs

As shown above, in Outcome 1 where the impact of all affected vehicles and drivers are presented, the total costs of the regulatory proposal over the 10-year period are estimated

at \$291,064,408 in the present value, equivalent to an annualized value of \$41,374,059 (see section 5.5 for detailed breakdown). In Outcome 2, where the costs of affected vehicles and drivers that operate within Canada exclusively are considered, the present value of the total costs is approximately \$128,500,071, corresponding to an annualized value of \$18,295,519.

## 5.4 Benefits of the Regulatory Proposal

### 5.4.1 Driver time savings

The use of ELDs is expected to reduce the time that drivers spend maintaining paper logbooks. Assuming that on average each driver needs to complete 240 daily logs (=48 weeks \* 5 days) per year<sup>20</sup> and using ELDs would save about 4.5 minutes per daily log as compared to completing paper logbooks, then each driver would save 18 hours (=4.5 minutes \* 240 daily log / 60 minutes per hour) per year to maintain a daily log. The 4.5 minute estimate (6.5 minutes for paper logbook and 2 minutes for ELDs) is based on FMCSA's analysis and interaction with the devices. These estimates were not challenged during a public Information Collection Request. Although industry and supplier estimates range from 6 to 23 minutes saved per driver per day, the 4.5 minute estimate is used as it is viewed as more robust and backed by extensive analysis and consultation. For the purpose of comparison, a sensitivity analysis will be conducted using both the 6 and 23 minute estimates.

In addition, as data logged within ELDs will be automatically transmitted, their use will also eliminate the time spent on forwarding daily logs to carriers. It is assumed that each daily log submission takes about 5 minutes and drivers submit daily logs 25 times a year, it follows that 2.08 hours (=5 minutes \* 25 submissions / 60 minutes per hour) to be saved for every driver annually.

Therefore, a total of 20.08 hours (=18 hours + 2.08 hours) per driver will be saved as a result of the proposed regulatory amendment. Applying the average hourly wage rate of drivers (\$30), the annual time savings per driver, or opportunity costs saved, are calculated at \$602.50 (=20.08 hours \* \$30). Note that the time savings in year 1 and year 2 require special treatment due to the ramp-up period. Specifically, the time savings in the first 2 years are estimated at \$326.4 per driver. Finally, multiplying the per-driver time savings by the number of drivers operating CMVs required to have an ELD, the present value of the total time savings to drivers is \$344,709,024 in Outcome 1 and

<sup>20</sup> It is assumed that on average drivers work 48 weeks per year, where the remaining 4 weeks cover vacation, sick leave and statutory holidays.

\$152,357,823 in Outcome 2, translating into an annualized value of \$49,078,810 and \$21,692,326, respectively.

#### *5.4.2 Logbook cost savings*

ELDs would eliminate the need for paper logbooks. Market information suggests a 1-month supply of driver's daily paper logbooks costs about \$3.50, amounting to an annual value \$42 per driver<sup>21</sup>. The average annual value of logbooks saved is estimated at \$22.80 per driver for the ramp-up period in year 1 and year 2. Multiplying the value of savings per drive by the number of corresponding affected drivers in each year, the present value of total paper logbook cost savings over the 10 years is \$24,029,509 in Outcome 1 and \$10,620,794 in Outcome 2.

#### *5.4.3 Clerical time savings*

As electronic daily log data will be automatically transmitted and stored, it is assumed that carrier clerical personnel would no longer need to handle these documents manually. Carriers suggest that clerical employees normally take about 3.5 minutes to file each paper daily log that has been received. Therefore, using ELDs would result in annual time savings of 14 hours (=3.5 minutes \* 240 daily log / 60 minutes per hour) for each driver. Similarly, in year 1 and year 2, the annual time savings are about 7.6 hours per affected driver. At an estimated hourly wage rate of \$25 for clerical staff of carriers, the present value of the total clerical time savings over the 10-year period is estimated at \$200,245,906 in Outcome 1 and \$88,506,619 in Outcome 2. Table 5 summarizes driver time savings, logbook cost savings and clerical time savings by operation scope.

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<sup>21</sup> JJ Keller sells multiple versions of Canadian driver's daily log books, which are consistent with the Canadian requirements of the Commercial Vehicle Drivers Hours of Service Regulations. The prices range from \$1 to \$6.24 each depending on product type and volume of purchase. The product (product code: 13248 616-MP) with a price at the middle range (\$3.52) is selected for the calculation purposes. <http://www.jjkeller.com/shop/Product/Canadian-Drivers-Daily-Log-Book-English-Retail-Packaging>. Accessed September 3, 2014.

**Table 5: Summary of time savings and logbook cost savings (PV)**

	<b>Outcome 1</b> In Canada & cross-border (U.S. border)	<b>Outcome 2</b> In Canada only (crossing provincial / territorial borders)
Driver time savings	\$344,709,024	\$152,357,823
Logbook cost savings	\$24,029,509	\$10,620,794
Clerical time savings	\$200,245,906	\$88,506,619
<b>Total costs (PV)</b>	<b>\$568,984,439</b>	<b>\$251,485,236</b>

#### 5.4.4 Roadside inspector and auditor time savings

It is expected that ELDs can assist roadside inspectors to more effectively and quickly detect HOS violations. Based on survey feedback from provinces and territories, the time for roadside inspectors to verify a paper daily log is about 17 minutes on average as opposed to 14 minutes for verifying a daily log with ELDs, which suggests a 3-minute time saving per inspection. As stated previously, the annual average number of total daily-log inspections (CVSA level 1-3) over the past 5 years (2009/10-2013/14) is 282,587, including both federally-regulated and provincially-regulated vehicles. As estimated previously in section 5.2, about 102,156 inspections correspond to the 146,300 in-scope CMVs in Outcome 1 and 44,828 annual inspections correspond to the 64,200 in-scope CMVs in Outcome 2. A portion of these CMVs have already voluntarily adopted ELDs in their fleet. Therefore, only inspections for those vehicles which would require either ELD hardware or ELD activation due to the proposed regulation will show a time savings.

In Outcome 1, approximately 44.72% of the federally-regulated CMVs (weighted average of trucks and buses) would require either ELD hardware or ELD activation as a result of the proposed regulation. It is then estimated that 45,685 ( $=102,156 * 44.72\%$ ) inspections will take less time with the Regulation starting in year 3. During the ramp-up period, 9,456 and 32,748 inspections will be affected – taking less time, in year 1 and year 2, respectively. At the hourly wage rate of \$57 for inspectors, the present value of the total time saved for these roadside inspections over the 10 years is \$785,789, corresponding to an annualized value of \$111,879. Similarly, in Outcome 2, it is calculated that about 44.9% of the affected CMVs would require either ELD hardware or ELD activation. It follows that 20,140 ( $=44,828 * 44.9\%$ ) inspections will take less time starting in year 3. About 4,163 and 14,431 inspections will take less time in year 1 and year 2 due to the use of ELDs during the ramp-up period. The present value of the total

time saved for these roadside inspections over the 10 years is therefore estimated at \$346,380 and is equivalent to an annualized value of \$49,317. In addition, ELDs would also reduce the time required by auditors to conduct HOS compliance audits by 27 minutes per audit. As discussed earlier, TC estimates that approximately 1,166 facility audits are completed annually. As these audits can be undertaken on any federal carrier, the corresponding CMV population subject to federal audit is 174,700 federally-regulated CMVs (170,000 trucks and 4,700 buses). Assuming that each of these CMVs has an equal probability of receiving an audit, it is estimated that 437 audits in Outcome 1 and 193 audits in Outcome 2 will take less time once the Regulation is fully implemented (starting in year 3)<sup>22</sup>. During the ramp-up period, 90 and 313 audits will be impacted in year 1 and year 2, respectively, in Outcome 1, and 40 and 138 audits will be impacted in year 1 and year 2, respectively, in Outcome 2. At the hourly wage rate of auditors (\$58), the present value of the total time saved for audits over the 10 years is estimated at \$68,818 in Outcome 1 and \$30,394 in Outcome 2.

#### *5.4.5 Reduced out-of-service (OOS) detention time*

Existing research and anecdotal reporting by motor carriers suggest that a regulatory requirement to use ELDs would result in improved compliance with HOS rules. Serious HOS violations can result in OOS orders where further operation of a commercial motor vehicle by its driver is prohibited for a specified period of time or for some violations until a required condition is met.

There are multiple costs associated with the OOS detention for both drivers and motor carriers. For short-haul drivers paid by the hour, the detention can result in docked time and, for long-haul drivers paid by the kilometre, there could be fewer trips or kilometres being travelled. In either case, the employment income of the driver will be reduced. The delays due to the detention can have an even greater impact on the affected carriers. For example, the remedy for the violation may require the carrier to replace the driver with one that is fit for duty. Having to re-position a replacement driver can result in even more substantial delays and significant costs, if the detention occurs at a location far from the home terminal where the replacement driver is located. The carriers then have 2 drivers assigned to the same vehicle, which reduces the carriers' service level and capacity to move transported goods or passengers, which may, in turn, further exacerbate the impact

<sup>22</sup> In Outcome 1, there are a total of 146,300 in-scope CMVs, representing 83.74% of the total federally-regulated CMVs (174,700). As shown earlier, about 44.7% are currently non-ELD users. Assuming that each of these CMVs has an equal probability of receiving an audit, it follows that 437 ( $=1,166 * 83.74% * 44.7%$ ) will take less time starting in year 3. In Outcome 2, there are a total of 64,200 in-scope CMVs, representing 36.75% of the total federally-regulated CMVs (174,700). As shown earlier, about 44.9% are currently non-ELD users. Assuming that each of these CMVs has an equal probability of receiving an audit, it follows that 193 ( $=1,166 * 83.74% * 44.9%$ ) will take less time starting in year 3.

of the driver shortage issue. It is also possible that delayed freight may result in cancelled contracts or a shipper levying penalties to the carriers for late delivery. While not every individual impact can be quantified due to lack of data, this section estimates the saved income loss during the detention period for drivers.

Although the number of drivers issued OOS orders vary every year and the duration of their detention time are unknown, TC obtains annual data from provincial and territorial governments that can be used to calculate an estimate. The data is drawn from the total number of driver inspections, HOS convictions and the percentage of drivers being declared OOS for HOS violations during *Roadcheck* (a 72-hour period driver and commercial vehicle inspection blitz held in all jurisdictions). Data from *Roadcheck* provided us with an annual average percentage (2.81%) of inspections that resulted in HOS OOS orders over the past 5 years (2009/10-2013/14)<sup>23</sup> and by applying this to the average number (282,587) of total driver inspections (CVSA level 1- 3)<sup>24</sup> over the same period, it is calculated that about 7,946 ( $=282,587 * 2.81\%$ ) OOS orders are issued every year. Given that nearly all inspections are conducted at commercial vehicle inspection stations, most of which are located at or near provincial and territorial boundaries or the international border, it is expected that 30% of the driver inspections and related OOS orders are associated with CMVs operating under federal jurisdiction.

After removing the number of U.S. vehicles being inspected (assumed at 10%), the number of OOS orders issued for federally-regulated vehicles with the daily log requirement is calculated at 2,585 ( $=7,946 * (1-10%) * 36.15\%$ ) in Outcome 1<sup>25</sup>. Similarly, the number of OOS orders issued for in-scope CMVs in Outcome 2 is 1,134 ( $=7,946 * (1-10%) * 15.86\%$ )<sup>26</sup>. Note that this figure (2,285 in Outcome 1 and 1,134 in Outcome 2) corresponds to the weighted average number of estimated orders issued to both vehicles that voluntarily use ELDs and non-ELD users. As discussed previously, there are a total of 178,355 drivers in Outcome 1, including 170,400 ( $=142,000 * 1.2$ ) truck drivers and 7,955 ( $=4,300 * 1.85$ ) bus drivers, while in Outcome 2, a total of 78,470 CMV drivers will be affected, including 74,400 truck drivers and 4,070 bus drivers. It is mentioned earlier that TC assumes an effectiveness rate of 45% of ELDs in reducing OOS. The following approach is to attempt to remove the particular impact of the current ELD users from the rest of the fleet that would require new ELDs under the proposed

<sup>23</sup>Complete compiled data from Roadcheck 2015 for all Level I-III driver / HOS violations was not available at the time of writing. However, preliminary Roadcheck 2015 results showed a national driver OOS rate of 2.1% (based on Level I inspections only).

<sup>24</sup> It is assumed that all inspections of drivers under federal jurisdiction involve a daily log.

<sup>25</sup> See footnote 16 for an explanation of the percentage 36.15% ( $=146,300 / (400,000+4,700)$ ), which represents the percentage of the federally-regulated CMVs with the daily log requirement out of the total CMVs subject to roadside inspection.

<sup>26</sup> See footnote 17 for an explanation of the percentage 15.86%.

regulatory amendment. Similar to the logic indicated in Eq (1), the following formula is used:

Eq (2)

$$\text{Number of OOS orders for all in-scope CMVs} = [(100\% - 45\% \text{ ELD effect}) \times \text{number of drivers operating CMVs with ELDs} \times \text{OOS rate per driver operating CMVs without ELDs}] + [\text{number of drivers operating CMVs without ELDs} \times \text{OOS rate per driver operating CMVs without ELDs}]$$

Eq (2) indicates that drivers operating CMVs with ELDs will have a lower OOS rate, 55% of the rate for drivers operating CMVs without ELDs. The following illustration will take Outcome 1 for example, and the calculation for Outcome 2 should follow the same logic. In Outcome 1, among the 178,355 drivers, about 97,440 drivers operate CMVs with ELDs and the remaining 80,915 drivers operate CMVs without ELDs. Substituting all of the information into Eq (2), it follows that:

$$2,585 = 55\% \times 97,440 \times \text{OOS rate per driver operating CMVs without ELDs} + 80,915 \times \text{OOS rate per driver operating CMVs without ELDs}$$

Rearranging this equation and solving for the OOS rate per driver operating CMVs without ELDs, we obtain 1.92%. Multiplying 1.92% by 55% yields the OOS rate per driver operating CMVs with ELDs which is 1.06%. Therefore the detention rate for non-ELD user vehicles will be reduced by 0.86% (=1.92% -1.06%) when they start to use ELDs. Multiplying the reduction rate by the number of drivers operating CMVs, which will be required to use ELDs under the proposed scenario, OOS detentions that will be reduced due to the implementation of the proposal can be estimated. Table 6 presents the number of OOS detentions orders that are expected to be reduced over the 10 years in Outcome 1 and Outcome 2, respectively.

**Table 6: Number of OOS Detention Orders that are Expected to be Reduced**

	<b>Outcome 1</b> In Canada & cross- border (U.S. border)	<b>Outcome 2</b> In Canada only (crossing provincial / territorial borders)
Year 1	148	65
Year 2	526	232
Year 3	761	335
Year 4	783	345
Year 5	805	354
Year 6	829	364
Year 7	852	375
Year 8	877	386
Year 9	902	397
Year 10	928	408

Under the Regulations, OOS orders result in further operation of a CMV by its driver being prohibited for a specified period of 8 to 72 hours depending on the type of the violation or until the eligibility to drive is re-established. TC assumes that 10 hours are a reasonable number of hours to use for the latter case. As it is difficult to know the type and the number of each HOS violation that results in an OOS order, TC extrapolated information from the HOS conviction data included in the carrier profiles. While not all violations can result in an OOS order (e.g. failing to maintain a daily log), the reverse is also true where an OOS order may be given even though no charge may be laid. Nevertheless, TC assumes that the mix of convictions examined is similar to those that result in an OOS detention order. From the data, a weighted average length of the detention time is calculated for all HOS convictions found in one year that would normally result in an OOS order. The HOS conviction information concludes that 112,582 is the minimum number of OOS detention hours that could be incurred for the corresponding 3,322 HOS convictions issued annually on average over the last 5 years, suggesting an average detention time of 34 hours per OOS order.

At the hourly rate of \$30 for drivers, the present value of the total saved income loss due to the OOS detention time is \$5,044,949 (number of hours \* hourly rate \* number of reduced detentions in each year), corresponding to an annualized value of \$718,287. Similarly, the present value calculated in Outcome 2 is \$2,220,055 with an annualized value of \$316,086. Note that this quantified saved income loss only represents a portion

of the total benefits from reduction of the detention time given that many other benefits are difficult to quantify.

#### 5.4.6 Safety benefits (*Reduced vehicle crashes*)

By reducing HOS violations and opportunity for drivers to exceed allowable HOS limits, it is expected that ELDs can reduce the crash risk for CMVs as well. While it is difficult for TC to identify those vehicle crashes that are directly attributable to driver fatigue or HOS violations, the NCDB, which contains all police-reported motor vehicle collisions on public roads in Canada, provides the number of crashes where fatigue or falling asleep is a contributing factor. It is estimated that a total of 300 crashes occur in Canada annually (based on a 5-year average, 2007-2011) where fatigue or falling asleep is a contributing factor. This number is likely understated.

Applying the percentage (14.8%) of total CMVs that are federally-regulated with the daily log requirement, it is calculated that 42 (=300 \* 14.1%) crashes correspond to the 146,300 CMVs (truck and bus) that are subject to the regulatory proposal in Outcome 1. Similarly, in Outcome 2 approximately 19 crashes correspond to the 64,200 CMVs where fatigue or falling asleep was a contributing factor. This suggests a weighted average (of ELD users and non-ELD users) crash risk of 0.0287% for the current fleet in Outcome 1, and a weighted average crash risk of 0.0296% in Outcome 2. TC assumes an effectiveness rate of 10% for ELDs in reducing those types of crashes that might be related to drivers exceeding allowable limits and/or fatigue. A 10% effectiveness rate is more realistic than the 45% rate used elsewhere in this proposal, as it is highly unlikely that ELDs will be 45% effective at reducing collisions involving drivers exceeding driving or on-duty time limits. Data demonstrates that most CMV fatigue-related collisions involved drivers that were operating within allowable HOS limits. As such, ELDs are assumed to be less effective in reducing these crashes. CMV drivers operating in excess of allowable limits (estimated at 5-10%) are likely more fatigued than compliant drivers and therefore, it is expected that ELDs would be more effective at reducing the crash risk for this group of non-compliant drivers. To calculate the reduced crash risk due to the use of ELDs, the following formula is used:

Eq (3)

$$\text{Number of crashes for all in-scope CMVs} = [(100\% - 10\% \text{ ELD effect}) \times \text{number of CMVs with ELDs} \times \text{crash risk for CMVs without ELDs}] + [\text{number CMVs without ELDs} \times \text{crash risk for CMVs without ELDs}]$$

Take Outcome 1 for example to illustrate the estimation. Substituting all of the necessary information into the above formula, the crash rates for CMVs with and without ELDs in use in the absence of regulation are calculated at 0.0304% and 0.0273%

(=0.0304% \* 90%), respectively. It follows that using ELDs would reduce the CMV crash rate by 0.0030% (=0.0304% - 0.0273%). Multiplying the reduction crash rate (0.0030%) by the number of vehicles that would be required to use ELDs by the regulation in each year, the number of annual crashes that could be prevented can be estimated. For example, during the ramp-up period (2016 and 2017), 0.42 crashes would be prevented in 2016 and 1.50 crashes would be prevented in 2017. Starting in 2018, the number of prevented crashes would slightly increase annually, as more CMVs would be operated with ELDs. Table 7 presents the estimated number of vehicle crashes that could be prevented in each year in both Outcomes.

**Table 7: Estimated number of prevented crashes**

	<b>Outcome 1</b> In Canada & cross-border (U.S. border)	<b>Outcome 2</b> In Canada only (crossing provincial / territorial borders)
Year 1	0.42	0.19
Year 2	1.50	0.68
Year 3	2.17	0.98
Year 4	2.23	1.01
Year 5	2.30	1.04
Year 6	2.37	1.07
Year 7	2.44	1.10
Year 8	2.51	1.14
Year 9	2.58	1.17
Year 10	2.66	1.20

The number of collisions by severity obtained from the NCDB data and the cost information for different types of crashes from a TC report<sup>27</sup> are used to estimate the weighted average costs per crash in Canada. Three types of collisions are considered – fatal collisions, collisions with injury and collisions with property damages only (PDO). Among the total 300 collisions where fatigue or falling asleep is a contributing factor, 7 are fatal collisions (note that a fatal collision might have multiple fatalities), 105 are collisions with injury and the remaining 188 are collisions with PDO. Therefore, the

<sup>27</sup> Source: Transport Canada, *Analysis and Estimation of the Social Cost of Motor Vehicle Collisions in Ontario* (Exhibit III-3 and Exhibit IV-1), 2007. Available at: <http://www.tc.gc.ca/media/documents/roadsafety/TP14800E.pdf>.

weighted average costs per collision are calculated at \$298,358. See Table 8 for detailed information.

**Table 8: Estimated Average Social Costs of Motor Vehicle Collisions by Collision Type**

	Fatal collisions	Collisions with injury	PDO collisions
Costs of fatalities per collision	\$10,003,919	nil	nil
Costs of Injuries per collision	\$271,313	\$82,894	nil
Other costs per collision	\$522,031	\$29,596	\$10,988
Costs per collision by collision type	<b>\$10,797,263</b>	<b>\$112,4907</b>	<b>\$10,988</b>
% of each collision type	<b>2.33%</b>	<b>35.09%</b>	<b>62.57%</b>
Weighted average costs per collision	<b>\$298,358</b>		

Finally, multiplying the weighted average costs of \$298,358 by the number of crashes that are expected to be prevented by ELDs, the present value of the total benefits (costs saved) of the prevented collisions over the 10-year period is approximately \$4,215,892 in Outcome 1 and \$1,906,935 in Outcome 2.

#### *5.4.7 Total benefits*

Therefore, the present value of the total quantified benefits in Outcome 1 is approximately \$579.1 million (\$260.0 million in Outcome 2), corresponding to an annualized value of \$82.5 million (\$36.4 million in Outcome 2). Table 9 below presents a detailed breakdown of the total benefits. Among the total benefits, savings to the industry, including both carriers and drivers, account for the majority while the remaining benefits include the time savings on inspections and audits, as well as improved road safety (reduction in vehicle crashes).

**Table 9: A Detailed Breakdown of Total Benefits (present value)**

	<b>Benefit items</b>	<b>Outcome 1</b> In Canada & cross-border (U.S. border)	<b>Outcome 2</b> In Canada only (crossing provincial / territorial borders)
Benefits to carriers	Driver time savings	\$344,709,024	\$152,357,823
	Clerical time savings	\$ 200,245,906	\$88,506,619
	Paper logbook cost savings	\$ 24,029,509	\$10,620,794
	Reduced OOS detention time	\$5,044,949	\$2,220,055
Benefits to governments	Roadside inspector time savings	\$785,789	\$346,380
	Auditor time savings	\$68,818	\$30,394
Improved safety	Crash prevented	\$4,215,892	\$1,906,935
<b>Total Benefits</b>		<b>\$579,099,887</b>	<b>\$255,989,000</b>

## 5.5 Net Benefits

The present value of the net benefits over the 10 years is \$288 million in Outcome 1 and \$127,488,929 million in Outcome 2. The cost-benefit statement of the regulatory proposal in each outcome is presented in the following tables.

**Table 10a: Cost-benefit Statement – Outcome 1**

	Base Year 2016	2017	2020	Final Year 2025	Total (PV)	Annualized Value
<b>C. Quantitative Impacts</b>						
<b>Costs</b>						
Costs associated with ELDs	\$13,418,300	\$32,197,780	\$28,831,080	\$33,392,515	<b>\$196,708,257</b>	<b>\$28,006,830</b>
Training costs	\$2,188,608	\$5,106,624	\$0	\$0	<b>\$6,505,751</b>	<b>\$926,273</b>
Compliance costs	\$2,622,718	\$9,277,800	\$14,214,492	\$16,443,984	<b>\$87,380,072</b>	<b>\$12,440,956</b>
<b>Industry Total</b>	<b>\$18,229,626</b>	<b>\$46,582,204</b>	<b>\$43,045,572</b>	<b>\$49,836,499</b>	<b>\$290,594,080</b>	<b>\$41,374,059</b>
<b>Government</b>						
(training costs of inspectors/auditors)	\$158,579	\$368,799	\$0	\$0	<b>\$470,328</b>	<b>\$66,964</b>
<b>Total Costs</b>	<b>\$18,388,205</b>	<b>\$46,951,003</b>	<b>\$43,045,572</b>	<b>\$49,836,499</b>	<b>\$291,064,408</b>	<b>\$41,441,024</b>
<b>Benefits</b>						
Savings to industry	\$17,223,044	\$61,083,545	\$93,443,858	\$107,721,053	<b>\$574,029,388</b>	<b>\$81,728,871</b>
Crashes prevented	\$125,310	\$447,537	\$686,223	\$793,632	<b>\$4,215,892</b>	<b>\$600,248</b>
Savings to governments	\$29,299	\$101,501	\$141,609	\$141,609	<b>\$854,607</b>	<b>\$121,677</b>
<b>Total Benefits</b>	<b>\$17,377,653</b>	<b>\$61,632,583</b>	<b>\$94,271,690</b>	<b>\$108,656,294</b>	<b>\$579,099,887</b>	<b>\$82,450,796</b>
<b>Net Benefits</b>	<b>\$(1,010,551)</b>	<b>\$14,681,580</b>	<b>\$51,226,118</b>	<b>\$58,819,795</b>	<b>\$288,035,479</b>	<b>\$41,009,772</b>
<b>D. Qualitative Impacts</b>						
<i>Costs</i>	n/a					
<i>Benefits</i>	<ul style="list-style-type: none"> <li>• Improved harmonization with the US</li> <li>• Enhanced carriers' capacity to move goods or passengers</li> <li>• Increased customer satisfaction through delay reduction due to less OOS orders</li> <li>• Meeting public expectations for safer transportation in Canada</li> </ul>					

**Note:** May not add to stated totals due to rounding

**Table 10b: Cost-benefit Statement – Outcome 2**

	Base Year 2016	2017	2020	Final Year 2025	Total (PV)	Annualized Value
<b>C. Quantitative Impacts</b>						
<b>Costs</b>						
Costs associated with ELDs	\$5,950,735	\$14,280,520	\$12,692,140	\$14,684,210	<b>\$86,709,619</b>	<b>\$12,345,499</b>
Training costs	\$960,768	\$2,241,648	\$0	\$0	<b>\$2,855,856</b>	<b>\$406,610</b>
Compliance costs	\$1,154,383	\$4,086,979	\$6,258,520	\$7,231,984	<b>\$38,464,267</b>	<b>\$5,476,446</b>
<b>Industry Total</b>	<b>\$8,065,886</b>	<b>\$20,609,147</b>	<b>\$18,950,660</b>	<b>\$21,916,194</b>	<b>\$128,029,743</b>	<b>\$18,228,555</b>
<b>Government</b>						
(training costs of inspectors/auditors)	\$158,579	\$368,799	\$0	\$0	<b>\$470,328</b>	<b>\$66,964</b>
<b>Total Costs</b>	<b>\$8,224,465</b>	<b>\$20,977,946</b>	<b>\$18,950,660</b>	<b>\$21,916,194</b>	<b>\$128,500,071</b>	<b>\$18,295,519</b>
<b>Benefits</b>						
Savings to industry	\$7,610,618	\$27,025,777	\$41,312,601	\$47,546,510	<b>\$253,705,292</b>	<b>\$36,121,926</b>
Crashes prevented	\$56,688	\$202,883	\$310,292	\$358,030	<b>\$1,906,935</b>	<b>\$271,505</b>
Savings to governments	\$12,909	\$44,730	\$62,436	\$62,436	<b>\$376,774</b>	<b>\$53,644</b>
<b>Total Benefits</b>	<b>\$7,680,215</b>	<b>\$27,273,390</b>	<b>\$41,685,330</b>	<b>\$47,966,975</b>	<b>\$255,989,000</b>	<b>\$36,447,075</b>
<b>Net Benefits</b>	<b>\$(544,250)</b>	<b>\$6,295,444</b>	<b>\$22,734,670</b>	<b>\$26,050,781</b>	<b>\$127,488,929</b>	<b>\$18,151,555</b>
<b>D. Qualitative Impacts</b>						
<i>Costs</i>	n/a					
<i>Benefits</i>	<ul style="list-style-type: none"> <li>• Improved harmonization with the US</li> <li>• Enhanced carriers' capacity to move goods or passengers</li> <li>• Increased customer satisfaction through delay reduction due to less OOS orders</li> <li>• Meeting public expectations for safer transportation in Canada</li> </ul>					

**Note:** May not add to stated totals due to rounding

## 5.6 Administrative Burden

This regulatory proposal would not impose any additional administrative burden on businesses. On the contrary, the requirements of using ELDs would significantly reduce the administrative burden on drivers and carriers through time savings of filling out a daily log; the elimination of the time that drivers spend forwarding daily log to their carriers; and the time carrier personnel use to record, handle and store the received daily logs. Specifically, 4.5 minutes of drivers and 3.5 minutes of carrier clerical staff can be

saved for each daily log completed and received, and another 5 minutes for drivers can be saved whenever daily logs are forwarded to carrier facilities. A total of \$544,954,930 measured in present value for these three items will be saved over a 10-year period in Outcome 1. In comparison, the present value is calculated as \$240,864,442 in Outcome 2. The annualized value of the total administrative burden on businesses that will be reduced by the Regulation is \$59,192,522 (OUTs) in Outcome 1 (and \$26,162,483 in Outcome 2) where no new administrative burden (INs) will be imposed.

## 5.7 Sensitivity Analysis Approach

Sensitivity analysis involves changing key parameters and assumptions in order to assess how this affects the costs and benefits of the regulatory proposal. Specifically, the technique is to vary the value of one variable at a time, while keeping all other variables constant, in order to observe the impact of the variation of the variable on the final result.

In the present cost-benefit analysis, the sensitivity analysis is carried out on the variable representing the time savings for drivers to fill out a daily log with ELDs versus manual paper logbooks. In the cost-benefit analysis (base scenario), 4.5 minutes per daily log was used which was based on the U.S. data, which was deemed to be more robust, as it was backed by extensive analysis and public input. However, during the data request and input phase of this project, other driver time savings estimates were provided including from the CTA survey and ELD suppliers. As such, the average time savings per daily log was reported to be as high as 23 minutes per daily log or as low as 6 minutes per daily log. Therefore, the sensitivity analysis is conducted on this variable where all other variables are kept constant. Table 11 presents the results of the sensitivity analysis for the variable – time savings for drivers to fill out a daily log with ELDs.

**Table 11: Sensitivity Analysis on the Time Savings for Completing a Daily Log with ELDs**

	4.5 minutes per Daily Log Base scenario	6 minutes per Daily Log Scenario 1	23 minutes per Daily Log Scenario 2
	<b>Outcome 1</b> In Canada & cross-border		
Time savings to drivers in completing daily log	\$308,950,827	\$411,934,435	\$1,579,082,003
All other benefits	\$270,149,061	\$270,149,061	\$270,149,061
<b>Total Benefits</b>	<b>\$579,099,887</b>	<b>\$682,083,496</b>	<b>\$1,849,231,064</b>
<b>Total costs</b>	<b>\$291,064,408</b>	<b>\$291,064,408</b>	<b>\$291,064,408</b>
<b>Net Benefits</b>	<b>\$288,035,479</b>	<b>\$391,019,088</b>	<b>\$1,558,166,656</b>
	<b>Outcome 2</b> In Canada only		
Time savings to drivers in completing daily log	\$136,553,070	\$182,070,759	\$697,937,911
All other benefits	\$119,435,931	\$119,435,931	\$119,435,931
<b>Total Benefits</b>	<b>\$255,989,000</b>	<b>\$301,506,690</b>	<b>\$817,373,842</b>
<b>Total costs</b>	<b>\$128,500,071</b>	<b>\$128,500,071</b>	<b>\$128,500,071</b>
<b>Net Benefits</b>	<b>\$127,488,929</b>	<b>\$173,006,619</b>	<b>\$688,873,771</b>

**Note:** May not add to stated totals due to rounding

## 6. Distributional Analysis

As shown in previous sections, the costs of the proposed regulation are expected to be primarily born by the industry (truck and bus carriers). Specifically, in Outcome 1 costs to carriers and drivers represent 99.8% of the total costs with the remaining 0.2% (of the \$291 million) accounting for government costs in training inspector and auditors. In comparison, these two percentages are 99.6% and 0.4% respectively in Outcome 2. As the costs to carriers directly depend on the size of the business (number of trucks and number of drivers), small businesses are expected to incur lower costs as compared to medium-large firms with a larger operation scale. According to data from Statistics Canada, it is estimated that there are a total of 21,915 truck carriers and 200 bus carriers that would be subject to the proposal. Among these carriers, 21,628 truck carriers and

181 bus carriers are small businesses with 100 employees or less. While small truck carriers and bus carriers represent 98.7% and 90.5% of all businesses, costs imposed to small businesses only account for 65.8% and 38.6%, respectively, of the total industry costs. The present value of the total costs to the 21,809 small businesses (21,628 truck carriers and 181 bus carriers) is estimated at \$187.1 million over the 10-year period, as compared to \$103.5 million to the 306 large and medium businesses (287 truck carriers and 19 bus carriers). On average, the proposed regulation would cost \$1,193 per year per small trucking company (as compared to \$46,685 per large trucking carrier) and \$4,653 per year per small bus carrier (as compared to \$70,501 per large bus carrier).

Due to the lack of information concerning the number and size of carriers by operation scope (in Canada exclusively versus cross-border operation or both), it is difficult to present similar results for Outcome 2. However, due to similar costs per CMV in both Outcomes, small businesses with smaller number of vehicles are still expected to incur lower costs as compared to medium-large firms in Outcome 2.

## 6.1 Impacts on Business Operation and Consumers

The present value of the total estimated costs on carriers is \$290,594,080, translating into an annualized value of \$243 per CMV in Outcome 1. The estimated annualized value per CMV is approximately \$244 in Outcome 2. The incremental cost due to this proposal is expected to be minimal as compared with the annual operational costs per vehicle. For example, according to the results of the Full Cost Investigation project conducted by TC in collaboration with provincial and territorial transport departments, the average operational cost (including labour costs, repair and maintenance, insurance costs, etc.) per km is approximately \$3.55<sup>28</sup>. In addition, TC assumes that long-haul CMVs, on average, travel about 100,000 km per year. Multiplying the two figures, it follows that the average annual operational cost per CMV is approximately \$355,000. Therefore, for truck and bus owners, the incremental costs of \$243 (or \$234) per year (per CMV) due to the proposal are negligible (representing only about a 0.07% increase), not to mention the benefits brought by the proposed regulatory amendment.

In addition, it is expected that the costs that would be passed onto consumers would also be negligible as these costs represent a small fraction of the total costs to these truck and bus carriers to operate their business.

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<sup>28</sup> Source: Transport Canada, *Estimation of Costs of Heavy Vehicle Use per Vehicle-kilometer in Canada*, 2006. Available at <http://www.bv.transports.gouv.qc.ca/mono/0965385.pdf>. The average operation cost of \$3.55 per km is an average of the per-km average operation costs of tractor-trailer and straight truck operations in both congested and uncongested conditions.

## 6.2 Competitiveness Impacts

As the Canadian economy is highly integrated with the American economy and the U.S. final rule would impose similar requirements, no international competitiveness impact is anticipated on the trucking and bus industry.

## Addendum A:

**CMVs identified in Outcome 2 that operate exclusively within Canada  
1-year implementation timeframe**

	Base Year Year 1	Year 2	Year 5	Final Year Year 10	Present Total (PV)	Annualized Value (AV)
<b>A. Quantitative Impacts</b>						
<b>Costs</b>						
Costs associated with ELDs	\$15,722,140	\$12,099,995	\$14,309,260	\$16,301,330	<b>\$102,371,410</b>	<b>\$14,575,386</b>
Training costs	\$3,488,208	\$0	\$0	\$0	<b>\$3,260,007</b>	<b>\$464,152</b>
Compliance costs	\$3,022,413	\$6,125,056	\$7,103,016	\$8,076,480	<b>\$46,394,748</b>	<b>\$6,605,568</b>
<b>Industry Total</b>	<b>\$22,232,761</b>	<b>\$18,225,051</b>	<b>\$21,412,276</b>	<b>\$24,377,810</b>	<b>\$152,026,166</b>	<b>\$21,645,106</b>
<b>Government</b> (training costs of inspectors/auditors)	\$527,378	\$0	\$0	\$0	<b>\$492,877</b>	<b>\$70,175</b>
<b>Total Costs</b>	<b>\$22,760,139</b>	<b>\$18,225,051</b>	<b>\$21,412,276</b>	<b>\$24,377,810</b>	<b>\$152,519,043</b>	<b>\$21,715,280</b>
<b>Benefits</b>						
Savings to industry	\$20,023,920	\$40,436,396	\$46,672,956	\$52,907,859	<b>\$304,978,842</b>	<b>\$43,422,126</b>
Crashes prevented	\$149,179	\$327,376	\$352,062	\$402,783	<b>\$2,325,777</b>	<b>\$331,138</b>
Savings to governments	\$33,831	\$62,436	\$62,436	\$62,436	<b>\$411,793</b>	<b>\$58,630</b>
<b>Total Benefits</b>	<b>\$20,206,930</b>	<b>\$40,826,208</b>	<b>\$47,087,455</b>	<b>\$53,373,079</b>	<b>\$307,716,412</b>	<b>\$43,811,894</b>
<b>Net Benefits</b>	<b>-\$2,553,210</b>	<b>\$22,601,157</b>	<b>\$25,675,179</b>	<b>\$28,995,269</b>	<b>\$155,197,369</b>	<b>\$22,096,614</b>
<b>B. Qualitative Impacts</b>						
Costs	n/a					
Benefits	<ul style="list-style-type: none"> <li>• Improved harmonization with the U.S.</li> <li>• Enhanced carriers' capacity to move goods or passengers</li> <li>• Increased customer satisfaction through delay reduction due to less OOS orders</li> <li>• Meeting public expectations for safer transportation in Canada</li> </ul>					