Strengthening School Bus Safety in Canada – Part II

Key Findings from the Seat Belt Pilot Projects

Report of the Task Force on School Bus Safety

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1 EXECUTIVE SUMMARY

With an excellent safety record and an extensive suite of protective safety features, school buses continue to be the safest mode to transport children to and from school in Canada. At the same time, opportunities to improve school bus safety continue to emerge as safety features and related technologies evolve. This is why, in January 2019, the Council of Ministers Responsible for Transportation and Highway Safety (Council of Ministers) established an expert Task Force on School Bus Safety (Task Force) to identify ways to further enhance school bus safety, with an emphasis on three-point seat belts.

In February 2020, the Task Force published *Strengthening School Bus Safety in Canada*, a report which identifies a number of operational concerns and risk factors to address in advance of any potential regulatory action to require seat belt installation on school buses (e.g., potential misuse). To support Canadian jurisdictions in addressing these operational challenges, the Task Force developed a set of draft *Guidelines for the Use of Seat Belts on School Buses* (*Guidelines*). Recognizing the greatest risk to school children is outside the bus, the report of the Task Force also recommends that jurisdictions explore exterior safety and driver assistance features focused on supporting the bus driver with the driving task and deterring illegally passing motorists. Specifically, these features include infraction/stop arm cameras, extended stop arms, exterior 360° cameras, and automatic emergency braking.

Building on the initial work of the Task Force, the Council of Ministers agreed to launch pilot projects to explore the viability of requiring three-point seat belts on school buses and validate the draft *Guidelines*. From 2020 to 2023, Transport Canada, in partnership with the Governments of British Columbia and Ontario, conducted pilot projects in three school districts, involving six school buses equipped with three-point seat belts. Noting the recommendations of the Task Force, the pilots also explored the application of exterior safety and driver assistance features where possible.

This report presents the Task Force's findings from its exploration of the operational considerations associated with the installation and use of three-point seat belts on school buses, inclusive of the results of the pilot projects and discussions with key school bus safety stakeholders. The following is a summary of the key findings of the pilot projects:

- Most students were able to use seat belts properly with appropriate training and regular use. By the end of the pilot projects, only some junior kindergarten students continued to require assistance. Younger children (second grade and below) experienced the most challenges with proper seat belt use, particularly in the winter due to bulkier clothing.
- Overall, seat belts had a positive impact on student behaviour by keeping students seated, and in turn, reducing driver distraction.
- Seat belt use was impacted by the number of seat belts installed per seat relative to the student's physical size. In general, it was difficult for students fourth grade and above to be seated and buckled properly when seated three-per-seat.

- There exist a multitude of potential scenarios and risk factors that could affect how students evacuate from a school bus equipped with seat belts.
- Responsibility for ensuring students always remain buckled while on the school bus, especially in the event of a collision, remains a concern for drivers and operators.

Informed by the results of the pilots and key input from safety experts within the Task Force, the *Guidelines* were updated to better reflect real-world operations. Overall, the pilot projects validated the *Guidelines*, emphasizing a comprehensive approach to seat belt implementation. This approach focuses on seat belt-specific training for drivers, students, and support personnel; proper communication with relevant stakeholders, including parents/caregivers; regular monitoring, including reminders; and prompt enforcement for those resisting proper seat belt use protocol.

While the pilots provide valuable insight into operational considerations associated with the installation and use of three-point seat belts and other safety enhancing features, there were limitations. For example, the pilot projects' sample size was not representative of the wider range of considerations and realities of school bus transportation that may exist across Canadian communities (e.g., in larger urban cities). Furthermore, the presence of observers and monitors on the pilot buses may have influenced student behaviour and the use of seat belts, the time required to complete bus trips, and the driver's perceived workload. Broader implications, including but not limited to the impact of seat belt implementation on driver recruitment/driver shortages, as well as the full extent to which higher operating costs associated with the introduction of seat belts might have on the adoption of less safe modes of transportation, were also not examined by the pilot projects. It is also important to note that the purchase price of the school buses for the pilot projects is not reflective of their current value, which is assumed to be much higher.

2 INTRODUCTION

School buses continue to be the safest mode to transport children to and from school, more so than any other form of transportation. Even with this excellent safety record, there is room for improvement. This is why, in January 2019, an expert Task Force on School Bus Safety (the Task Force) was established to identify and assess potential measures to further improve school bus safety in Canada, both inside and outside the bus, with an emphasis on three-point seat belts.

In the *Strengthening School Bus Safety in Canada* report of 2020, the Task Force assessed key operational and financial considerations for seat belt installation and their use on school buses. This assessment revealed several operational concerns and risk factors to address in advance of any potential regulatory action to require seat belt installation. These concerns and risk factors included but were not limited to potential misuse, emergency evacuations, and liability. To support jurisdictions in addressing the operational considerations identified, the Task Force developed draft *Guidelines for the Use of Seat Belts on School Buses* (*Guidelines*). The *Guidelines* were informed by key findings, best practices, and operational guidance developed by United States (U.S.) jurisdictions in support of their school bus seat belt programs.

Building on the initial work of the Task Force, the Council of Ministers Responsible for Transportation and Highway Safety (the Council of Ministers) agreed to launch pilot projects to assess the viability of three-point seat belts on school buses in Canada. In line with the Task Force's ongoing efforts to work through various operational considerations identified in the *Strengthening School Bus Safety in Canada* report, the pilot projects would serve to validate and, as appropriate, augment the draft *Guidelines*. At the same time, recognizing the greatest risk to school children is outside the bus, the pilot projects would also serve as an opportunity to explore the application of exterior safety and driver assistance features, where possible. Presented in the *Strengthening School Bus Safety in Canada* report, these features are intended to support the bus driver with the driving task and deter illegally passing motorists, and include infraction/stop arm cameras, extended stop arms, exterior 360° cameras, and automatic emergency braking (AEB).

This report presents the Task Force's findings from its exploration of the operational challenges associated with the installation and use of three-point seat belts on school buses, including the results of the pilot projects and discussions with key school bus safety stakeholders.

2.1 CONTEXT

Fatalities involving school-aged children on school buses are rare and reinforce the impressive safety record of school bus transportation, especially when considering that 2.2 million children travel to and from school on approximately 52,000 school buses every day in Canada.[1] Statistics from Transport Canada's National Collision Database show that school buses are the safest way to transport children to and from school.[2] This strong occupant safety record is largely due to the extensive suite of structural and protective safety features built into the school bus, which are governed by a robust set of federal regulations and safety standards. These safety features include reinforced joints, stringent roof crush standards, electronic stability control to help prevent rollovers, window retention to mitigate ejection, emergency exit requirements, and compartmentalized seating (high-backed, padded seats that are spaced closely together). In addition, school bus transportation is a separate, unique, and specialized system. School buses are painted a distinctive shade of yellow, are equipped with flashing red lights and a stop arm designed to help keep children safe while getting on and off the bus. School buses are also driven by trained drivers, mostly during daylight hours, and are not typically used in inclement weather.

At the same time, evidence shows that seat belts can provide an additional layer of safety to complement the existing school bus design by reducing the risk of ejection and lowering the risk of serious injury, particularly in the event of a severe collision involving a rollover, side impact, or vertical lift scenario.[3] Recognizing this, in July 2018, Transport Canada introduced technical requirements for school bus manufacturers that choose to install seat belts on school buses. This regulatory measure ensures that lap-only seat belts cannot be installed, and that if a school bus operator chooses to order a new school bus with seat belts, there is a technical standard for manufacturers to follow that ensures correct installation (e.g. they must include a three-point seat belt and be anchored a certain way).

At present, equipping school buses with three-point seat belts remains optional in recognition of the strong safety record of school buses and the range of practical and financial considerations associated with seat belt installation and use. With these considerations in mind, the Task Force identified that mandatory installation of seat belts on school buses should be considered in a manner that does not compromise the safety provided by existing school bus occupant protection features and does not encourage the adoption of less safe modes of transportation.[4] Additionally, the Task Force emphasized that seat belt implementation should not take away from efforts to educate the public on school bus safety, and provide school bus safety-specific training to drivers and students. While some manufacturers have begun to offer three-point seat belts as standard equipment on new school buses, the decision to install seat belts currently rests with school bus owners/operators/school boards, together with provinces and territories.

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[1] Estimates based on StatsCan student population and Task Force jurisdictional assessment of fleet data.
[2] For the purposes of this report, "school-aged children" are age 17 and under.
[3] Task Force on School Bus Safety, *Strengthening School Bus Safety in Canada*, 15.
[4] Task Force on School Bus Safety, *Strengthening School Bus Safety in Canada*, 16.

As part of its aim to improve safety and address operational challenges associated with the installation and use of seat belts on school buses, the Task Force developed *Guidelines for the Use of Seat Belts on School Buses*, to be validated by the pilot projects. The Guidelines are designed to support those implementing school bus seat belt programs to ensure that seat belts, if installed, are always worn properly by all occupants. This work, coupled with the Task Force's findings from the pilot projects, is intended to help better understand the operational implications of mandating seat belts on school buses in Canada.

Note, in this report, the term "school bus" refers to the Type C school bus as defined in the Canadian Standards Association (CSA) D250, which weigh over 4,581kg. According to 2019 data, this type of school bus makes up approximately 71% of the Canadian fleet.[5]

2.2 ROLES AND RESPONSIBILITIES

School bus safety is a shared responsibility between federal, provincial, and territorial (FPT) governments, along with school bus manufacturers, owners, and operators, school boards, and a diverse road safety community.

Under the *Motor Vehicle Safety Act*, Transport Canada is responsible for establishing regulations and setting safety equipment requirements, including specific safety requirements for occupant protection, structural integrity, bus window retention, release and emergency exit requirements, brake systems, and stability control on school buses. Like other vehicles, school buses must also comply with lighting, tires, wheels, mirrors, and other safety equipment requirements. Newly manufactured and imported vehicles are subject to the *Motor Vehicle Safety Regulations* (MVSR) and the *Canada Motor Vehicle Safety Standards* (CMVSS) at the time they are manufactured or imported into Canada. Transport Canada works with all levels of government to keep the CMVSS up-to-date and performs testing on vehicles, including school buses, to ensure compliance.

Provinces and territories enforce safety on Canada's roads and highways and set the rules of the road. They are also responsible for school bus driver and vehicle licensing, as well as policies related to the safe operation of school buses, including the proper use of seat belts. Some provinces/territories delegate certain authorities to municipalities to leverage their expert knowledge of local traffic conditions. In addition, most provinces and territories require that school buses are built in compliance with the Canadian Standards Association (CSA) D250 School Bus Standard, which complements federal requirements.

The CSA Committee consists of FPT government representatives, school bus operators, and manufacturers. Transport Canada is an active member and helps ensure that provincial/territorial regulations are aligned with federal requirements. The Committee is responsible for the CSA D250 School Bus Standard – a manufacturing standard that specifies the chassis and body requirements along with safety equipment requirements for school buses. It is applied to original equipment supplied by the bus manufacturer; any equipment installed on a

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[5] Task Force on School Bus Safety, *Strengthening School Bus Safety in Canada*, 12.

school bus by original equipment manufacturers are subject to all applicable CMVSS and to applicable CSA D250 Standards (if required by the province or territory).

As per the *Motor Vehicle Safety Act*, manufacturers are responsible for certifying that their vehicles, including school buses, are designed, and constructed in accordance with federal safety standards and other relevant requirements, including those set out in the *Motor Vehicle Safety Act*, MVSR, CMVSS, and the CSA D250 School Bus Standard (where applicable).

School bus owners, operators, and school boards all purchase or operate school buses that comply with federal safety standards, provide student transportation, plan routes, and ensure protocols are in place for student safety. They, in collaboration with their respective provincial/territorial government, determine whether to install seat belts on school buses. If a bus is equipped with seat belts, they would ensure protocols are in place for their proper use.

2.3 TASK FORCE GOVERNANCE STRUCTURE

The School Bus Safety Task Force (the Task Force) is made up of a two-tiered governance structure, consisting of an Advisory Panel and a Steering Committee.

The Advisory Panel is comprised of school board representatives, Canadian Standards Association D250 school bus committee members, school bus manufacturers, school bus fleet operators, safety advocates and functional experts in various areas related to school bus safety, school bus drivers, academia, as well as representatives of federal, provincial, territorial, and municipal jurisdictions. The Advisory Panel provides advice and expertise to the Steering Committee.

The Steering Committee is comprised of representatives from federal, provincial, and territorial governments and the Canadian Council of Motor Transport Administrators (CCMTA). The Steering Committee provides direction to the Task Force and manages project oversight. This includes the exchange and review of advice and expertise provided by the Advisory Panel, and the development and presentation of reports on the work of the Task Force.

2.4 UNITED STATES APPROACH TO SEAT BELTS

Canada's existing school bus seat belt regulations align with equivalent U.S. regulations. Federal Motor Vehicle Safety Standard No. 222 sets performance standards for seat belts that are voluntarily installed on "large school buses" with a gross vehicle weight rating (GVWR) greater than 10,000 pounds or 4,536kg. The decision of whether to install seat belts on these large school buses rests with each state or local jurisdiction. In addition, new "small school buses" (defined as having a GVWR of 10,000 pounds/4,536kg or less) must be equipped with three-point seat belts at all designated seating positions.

The U.S. National Highway Traffic Safety Administration (NHTSA) supports the installation of three-point lap and shoulder belts on school buses for added protection in the event of a lateral or side collision. NHTSA's Highway Safety Program Guideline No. 17 establishes the minimum requirements for a state highway safety program for pupil transportation safety and recommends that passengers in school buses and school-chartered buses with a GVWR of 10,000 pounds or less be required to wear occupant restraints where provided.[6] In May 2018, the National Transportation Safety Board also recommended states require all new large school buses be equipped with lap-shoulder belts for all passenger seating positions.[7]

In January 2021, NHTSA published Education on Proper Use of Seat Belts on School Buses, which provides the results of a project to understand how school districts that purchase large school buses with seat belts can maximize their effectiveness and benefit by improving proper usage. The project obtained observational data on the impact of seat belts on student behaviour as well as on bus driver distraction, examined how policies were carried out by school bus drivers, and assessed consequences for non-compliance. The project found that, overall, the most important factors were training, education, and enforcement. In addition, most survey respondents said that seat belts contributed to calmer and less distracting environments for school bus drivers.

Currently, eight U.S. states – Arkansas, California, Florida, Louisiana, Nevada, New Jersey, New York, and Texas – have laws requiring seat belts on large school buses.[8] Arkansas, Louisiana, and Texas' laws, however, are subject to appropriations or approval or denial by local jurisdictions. Iowa also adopted a rule in 2019 requiring three-point lap-shoulder belts in all new Iowa school buses.

The implementation of seat belts on school buses has also been considered elsewhere throughout the country. In August 2023, a fatal school bus collision in Clark County, Ohio led to renewed efforts to pass school bus safety policies, including House Bill 279. This bill would require every school bus that is purchased, owned, leased, or rented by a school district to be equipped with three-point seat belts within five years.

Following the fatal collision in Clark County, the Ohio School Bus Safety Working group was created to determine how school buses can be made safer. The working group held a series of roundtable discussions on various topics, including mandatory seat belt installation. In their January 2024 report detailing 17 recommendations to enhance the safety of school bus travel in Ohio, the working group did not recommend the state mandate seat belts for all school buses.[9] Implications of seat belts during emergency situations and costs were identified as the main considerations for this decision. However, because school bus hazards vary across school districts, the working group agreed that schools should continue to have the flexibility to invest in seat belts or other safety enhancing technology/equipment that best meet their needs. While the working group acknowledged the potential safety benefit seat belts can offer, seat belts

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[6] NHTSA, https://one.nhtsa.gov/nhtsa/whatsup/tea21/tea21programs/pages/PupilTransportation.htm
[7] National Conference of State Legislatures, "School Bus Safety," March 27, 2024. https://www.ncsl.org/transportation/school-bus-safety
[8] National Conference of State Legislatures, "School Bus Safety," March 27, 2024. https://www.ncsl.org/transportation/school-bus-safety
[9] *Ohio School Bus Safety Working Group Report*, 8. January 31, 2024. https://otso.ohio.gov/static/school-bus/School-Bus-Report-0124.pdf

remain one possible safety measure that districts could choose to employ. Members recognized the value of collision avoidance systems as an option to help prevent serious collisions altogether.

The working group's report also provides findings from a 2019 school bus seat belt pilot in Avon Lake City School District, Ohio. The district found that younger students struggled to buckle their own seat belts and some high school students could not fit in the shoulder belts. Since then, the district has not purchased school buses with seat belts because there were longer route times for buses with seat belts and drivers preferred buses without them.

2.5 PILOT PROJECTS

From 2020-2023, Transport Canada, in collaboration with the Government of British Columbia (B.C.) and the Government of Ontario, conducted pilot projects to assess operational considerations associated with the use of three-point seat belts on six school buses in three school districts. The pilot projects were a significant undertaking. In total, over 1,600 students ranging from junior kindergarten to grade twelve were transported over approximately 7,200 trips. The following buses and equipment were used in each district:

- Fraser-Cascade School District 78, B.C., launched in November 2020, with one Type C diesel bus equipped with three-point seat belts and four safety features: infraction cameras, a 360° camera system, an extended stop arm, and automatic emergency braking.
- Nanaimo-Ladysmith School District 68, B.C., launched in May 2021 with two Type C electric buses installed with three-point seat belts and three safety features: infraction cameras, a 360° camera system, and an extended stop arm.
- Sudbury Student Services Consortium, Ontario, comprising four coterminous school boards, launched in January 2021 with three Type C gasoline buses installed with three-point seat belts, infraction cameras, and a 360° camera system.

The pilot projects were originally intended to run for one academic year (September 2020 to June 2021) to capture a full range of environmental impacts on the use of seat belts and the other safety features. However, challenges resulting from the COVID-19 pandemic delayed the shipment of the buses and the installation of the safety features. Additionally, provincial public health measures, including school closures, resulted in reduced ridership and atypical seating arrangements, which impacted the ability to collect "real world" data. As a result, the pilots were extended until the end of the 2022-2023 school year.

One adult observer per bus was hired to record data on seat belt use and the impact of seat belts on daily school bus transportation, including student behaviour and routing efficiencies. Observers collected data during each school bus trip and bi-monthly through a qualitative questionnaire. Observers also consulted drivers on their experience operating a school bus equipped with seat belts and the other safety features available on their buses.

In addition to the observer, the Sudbury Student Services Consortium engaged one adult monitor per bus to ensure proper seat belt use, allowing the observers to focus on data collection. While the B.C. school districts only used observers, their role evolved to support drivers in a similar manner to monitors. Each pilot bus was also equipped with interior cameras to support school bus operators with monitoring and enforcing proper seat belt use. Video footage was reviewed periodically to note specific challenges or behaviours associated with seat belts.

To help ensure expectations for proper seat belt use were well understood, school districts were provided with the *Guidelines for the Use of Seat Belts on School Buses.* School districts used the *Guidelines* to inform training sessions provided to their drivers, observers, and monitors, including explaining their roles and responsibilities for ensuring proper seat belt use. The training provided also ensured that observers understood their role in collecting data and providing feedback as part of the data collection process. School bus operators also delivered information sessions to their drivers so they could familiarize themselves with the driver assistance and exterior safety features installed on their respective buses.

Parents/caregivers of children involved in the pilots received notices outlining expectations and responsibilities of drivers, school administration, parents/caregivers, and students during the pilots. At the same time, students were advised of the consequences for non-compliance if they refused to use seat belts according to the school's policies for riding the bus, if they vandalized the equipment, or if they otherwise intentionally interfered with the project.

It should be noted that the scope of the pilot projects was limited due to a relatively small sample size and short duration. The pilot project sites were not necessarily representative of the wider range of operational considerations that exist across Canadian communities, including varying population densities in larger rural centers or urban cities. Variations in transportation infrastructure and social norms across different regions may also influence how seat belts are implemented.

2.6 SEAT BELT IMPLEMENTATION IN WATERLOO REGION

In addition to the pilot projects, the Task Force surveyed other jurisdictions who had implemented seat belts on school buses in Canada. The Student Transportation Services of Waterloo Region (STSWR) shared their experience. The STSWR services 32,000 students annually across two school boards, comprising 180 schools. The fleet contains 272 Type C school buses, 29 of which are equipped with three-point seat belts.

Following school bus collisions in 2019 and 2022 involving a rollover and side-impact collision respectively, the STSWR recognized that seat belts may have helped prevent injuries caused by children being ejected from their seats. Since then, they have gradually increased the number of school buses equipped with seat belts to better protect children in the event of similar collisions. Findings from STSWR's experience were shared with the Task Force throughout the pilot period, and their insight helped guide discussions related to the considerations identified from the pilot projects.

3 PILOT PROJECT RESULTS AND ANALYSIS

This section provides an overview of the school bus pilot project results, inclusive of key considerations discussed by the Task Force. These discussions aimed to better understand and explore implications of school bus seat belt installation based on findings from the seat belt implementation experience in the Waterloo Region; discussions regarding appropriately securing children aged four and younger; solutions to monitor and enforce seat belt use; the implications of child restraint systems; and the implications of driver liability/responsibility for ensuring seat belt use. Findings are presented against each of the operational challenges identified in the *Strengthening School Bus Safety in Canada* report and are followed by an overview of the amendments to the *Guidelines*. Findings related to the use of the other safety features recommended by the Task Force are contained in Annex A.

3.1 OPERATIONAL CONSIDERATIONS

3.1.1 Seat belt adjustment relative to child size

Based on seat belt use across the three pilot districts and Waterloo Region, three-point seat belts were generally able to fit most students properly, regardless of age and size. However, there were challenges with achieving proper use in all cases, especially for younger students, specifically kindergarten to second grade.

Younger students tended to require assistance with seat belt use more often than others. Drivers reported that younger students typically lack the physical strength or coordination to manipulate the seat belt easily and into the proper position. Specifically, many required aides to pull the seat belt away from their seat, positioning the belt properly and without tangles, and pulling the belt taut across their body once buckled.

Figure 1. Shoulder belt and guide adjuster

The shoulder belt guide adjusters also proved difficult for younger students to use correctly. The adjusters, as presented in Figure 1, were installed on all buses involved in the pilot projects. They are intended to allow children of various sizes to be secured properly by enabling the shoulder belt to be positioned on the middle of a child’s shoulder and across their chest. Incorrect positioning can result in the shoulder belt coming across the child’s neck.

Improper use of the adjuster was associated with challenges younger students experienced during the pilots. In addition to manipulating the seat belt, observers reported that younger students were not always clear on how to use the adjuster. For example, to ensure the seat belt is positioned at the correct angle, students must sit in a specific position on the seat, which was not always obvious to young students. In the district of Sudbury, some parents wanted to remove their children from the pilot because children complained that the seat belts were pushing into their necks (due to incorrect positioning of the shoulder belt).

To address this issue, the Sudbury Student Services Consortium (the Consortium) developed bilingual training videos on proper seat belt use to enhance their efforts to educate younger students and engage parents. At the time the videos were created, in-person training was not possible due to the COVID-19 pandemic. Noting the challenges students experienced, the Consortium encouraged parents to use those videos to help their children better understand and achieve proper seat belt use. The training videos proved to resolve the issue and were well received. The videos were then shared before the start of each subsequent school year during the pilot to help mitigate similar challenges. This highlighted two key factors of seat belt implementation: training and parent engagement, both of which are identified in the *Guidelines.*

Training involving clear demonstrations of proper use coupled with regular and extended use of seat belts was found to improve student proficiency with seat belt use over time. Additionally, parents played a significant role in supporting school bus operators and school districts outside of the bus by reinforcing the importance of wearing seat belts to their children. These results reinforce training and parent engagement as critical elements to effectively introduce seat belts on school buses.

The Task Force also noted the importance of appropriate training for younger students to ensure proper seat belt use. In anticipation of Québec phasing in optional kindergarten for four-year-olds, members of the Task Force shared insight on the implications of transporting younger children by school bus. School bus transportation providers identified the benefit of a "First Time Rider" Program – training designed to promote school bus safety to young children and their parents. These programs generally cover proper loading and unloading procedures, school bus ride protocols, and school bus safety information. This type of program could also be adapted to cover seat belt use to supplement any seat belt training provided.

Insight from the STSWR, which has been transporting kindergarten students on seat belt buses since 2021, also noted that kindergarten students require greater attention and time to be trained on proper seat belt use. They found that younger students benefit from direct interaction with an educator and require regular assistance with seat belt use. Depending on the child, they may benefit from additional measures to help ensure they are secured properly, including bus buddies. To facilitate buckling, STSWR also allows parents to help their children buckle their seat belt if they are among the first ones to board the bus. The STSWR highlighted the importance of formalized seat belt training for kindergarten students as a key measure for effective seat belt implementation.

All three pilot districts found that the number of students seated per seat impacted proper seat belt use relative to a child's size. The pilot project buses had a maximum occupancy configuration of three seat belts per bench seat. Figures 2 and 3 illustrate the seat belt assembly configuration for Nanaimo-Ladysmith and Sudbury, respectively. This configuration applied to all seats on the six pilot project buses except for the last row of seats, which had two seat belts due to the rear door emergency exit. All pilot districts reported that generally, seating three students per seat bench was only achievable for students below fourth grade (see Figure 4). Students in fourth grade and above could only be properly buckled and comfortable when seated two per bench. The middle seat belt's location also played a role in the seat belt being used properly. Specifically, the anchor for the shoulder belt was often found to be behind students' backs as opposed to their side. This became an issue for students below fourth grade as well. While younger and smaller students could sit three per seat, they had trouble accessing the buckles and the latches because they were behind them rather than to their side.

Figure 2. Seat belt assembly – Nanaimo-Ladysmith

Figure 3. Seat belt assembly – Sudbury

After accounting for the average age and size of students registered for transportation throughout the district, Fraser-Cascade found that the maximum capacity of their bus based on the students of their specific route would be closer to 55 passengers as opposed to 76 (maximum capacity). Although there was no impact on the capacity of any pilot routes, Sudbury anticipates challenges with route planning if seat belts were installed on all buses in their fleet, particularly on buses with a larger proportion of students above fourth grade. Currently, students in the district between seventh and twelfth grade are seated two per seat, while kindergarten to sixth grade students are seated three per seat. If seat belts are installed, they expect that seating assignments would need to be adjusted to allow fourth grade to twelfth grade students to be seated two per seat. Thus, the potential reduction in school bus seat capacity

Figure 4. Three students (grade 2, grade 5, and senior kindergarten) buckled on one seat bench.

posed by seat belt implementation presents broader implications for student transportation. Depending on student demographics, bus routes may need to be adjusted or additional buses may be required.

Seat belt extenders offered a solution to children that were too tall or large for the seat belt to secure their body properly. At the beginning of the Sudbury pilot project, seat belt extenders were required for two secondary students. The extenders enabled the seat belts to be properly fitted, and subsequently, the district stored two extenders on each seat belt bus if similar instances were to arise during the pilot. It is important to note that the monitors took care to install the extenders discreetly in order to mitigate potential bullying. If students were to feel negatively about their bodies due to the seat belt not fitting properly, it may impact their decision to buckle or remain buckled while riding the bus.

As the examples above illustrate, education and comfort can impact seat belt use, and measures such as sufficient training, support from parents, appropriate seating assignments, and seat belt extenders can help facilitate proper seat belt use.

3.1.2 *Winter clothing and its impact on proper seat belt use*

Winter clothing brings about some additional challenges with seat belt use, particularly for younger students (kindergarten to second grade). Based on observations made during the pilot projects and during seat belt implementation in Waterloo Region, younger children had difficulty with coordination when wearing winter coats and gloves, which impacted their ability to use seat belts properly on their own. Additionally, there was less space available for them to move around, making it difficult to manipulate the seat belt and locate the appropriate buckle efficiently, especially when seated three per seat and accounting for backpacks.

Challenges with seating students three per seat was most noticeable during the winter months, as bulky clothing increased the space required for students to sit and buckle themselves easily and sit comfortably.

The school districts involved in the pilots reported that some younger children who could buckle themselves during non-winter months required assistance at the beginning of winter months. Boarding was also much smoother and efficient overall during warmer months when winter clothing was not a factor. Generally, winter clothing was found to increase the time required for younger students to buckle and unbuckle, rather than preventing them from buckling at all.

3.1.3 *Seat Belt Misuse*

The pilot projects demonstrated that most students are able to use seat belts properly and independently after being appropriately trained and after using seat belts regularly for a certain period of time. All districts involved in the pilots along with Waterloo Region reported that seat belt use improved over time. The beginning of the school year proved to be when students required the most time to effectively use the seat belts. This was unsurprising given that the beginning of the school year is when new students learned to use seat belts for the first time, and returning students refreshed their knowledge.

Sudbury reported that students in fourth grade and above were able to use seat belts properly without any issues after the second or third time riding the school bus. Students in kindergarten to third grade required approximately one month of seat belt use before using them independently. By the end of the pilot project, only some junior kindergarten students continued to require assistance. While this cohort of students was able to fasten and unfasten the seatbelt independently, they required assistance to pull the seat belt away from the seat without having the belt tangle. Waterloo Region also reported that kindergarten students required more time to be trained on seat belt use and benefitted more from in-person demonstrations with an educator compared to the other students.

Kindergarten to second grade students tended to require regular assistance over a longer period due to challenges with misuse, both physical and behavioural. For example, the pilot teams – comprised of drivers, observers, and monitors (where used) – identified that younger students needed regular reminders to buckle their seat belt when boarding the bus. Typically, this was because they were easily distracted by socializing with their peers and often forgot to buckle up. Additionally, younger students tended to forget or may not have fully understood how to use seat belts properly following their initial instruction. For example, during the pilots, it was observed that this group of students occasionally buckled their seat belt with their backpack on; ignored the shoulder belt guide adjuster when putting their seat belt on; did not untangle their seat belt before buckling; and once buckled, they moved around in their seat, thereby pushing the shoulder belt guide adjuster out of the correct position. Incorrectly wearing a seat belt for any of these reasons poses a safety risk to the child by impacting the ability for the seat belt to function properly in the event of a collision.

This further underscores the importance of effective training. The importance of taking the extra time and effort to fully train young students, regularly remind them, and intervene when necessary to ensure proper seat belt use cannot be overstated. In some cases, creative solutions helped. For example, the use of songs sung while boarding the bus appeared to help younger students in Sudbury remember to remove their backpacks before buckling.

While secondary school students required less time to understand and use seat belts properly, there were different behavioural challenges involving this group. This group of students were less likely to use their seat belt without direct instruction while on the bus, which proved challenging as these students typically sat further from the bus driver. When addressing behaviour issues, pilot districts found that prompt and appropriate intervention was critical to effectively manage seat belt use. Each district employed a similar procedure for addressing non-compliance; incidents were addressed initially with a verbal warning issued by the driver. Subsequent issues were addressed with written reports completed by the driver and submitted to the school principal. Persisting issues could result in suspension from riding the school bus or loss of ridership privileges altogether.

However, various challenges were noted with administering non-compliance protocol, which limited their potential effectiveness. During the pilots, districts observed that drivers may not always be able to identify non-compliance issues given the proximity of their seat to the incident(s); completing behaviour reports was time-consuming; administering disciplinary protocol was inconsistent across buses due to differing views of the bus drivers; and some drivers were reluctant to engage school staff for support, even when needed.

Regardless of age, students exhibited various behaviours throughout the pilots which involved seat belt misuse. Namely, unbuckling while the bus was in motion and using twisted seat belts. Observers involved in the pilots reported that students often unbuckled themselves, especially during afternoon trips, either to change seats or move closer to the front of the bus. This type of behaviour was often observed as the bus emptied, or the student approached their stop. The pilot school districts reported that children moving seats is relatively common on all school buses, with or without seat belts. Additionally, after unbuckling, students often did not fully retract the seat belt or ensure the seat belt was straightened before exiting the school bus. Without intervention, seat belts became twisted or tangled. As a result, the pilot teams ensured all seat belts were straightened following the completion of each trip to facilitate swift boarding and buckling. The requirement for drivers to untwist and retract seat belts following each trip increased their workload.

Different design choices were identified as potential measures to mitigate seat belts from tangling. Nanaimo-Ladysmith reported that seat belts on the pilot buses tended to twist less often than seat belts installed on other buses in their district. It was noted that this could be due to the use of a thicker, more robust material for the belt. Sudbury suggested a more forceful automatic retraction feature may help prevent twisting and reduce driver workload. Regular inspections and maintenance could also help to ensure seat belts continue to retract properly over time with extended use.

Other measures to prevent seat belt twisting identified during the pilot projects included the use of support personnel, interior cameras, and seat belt warning systems. All pilot project drivers expressed the benefit of having another adult on the bus during seat belt implementation. While the B.C. pilot districts did not have monitors, the role of the observers was expanded to support the driver by providing reminders and helping younger students with seat belt use.

Based on this experience, support personnel could be valuable for directly observing and intervening with seat belt use when needed. Additionally, they may be able to better identify, understand, and address seat-belt related issues than the driver. At the same time, there are implications to consider. For example, pilot districts reported that after receiving assistance repeatedly, some young students started to expect their seat belt to be buckled for them and they stopped trying to buckle themselves. This went against the goal of training all students to independently buckle their seat belt properly. In addition, secondary students proved intimidating, and some monitors were not comfortable providing reminders or administering disciplinary action to these students even when needed.

Furthermore, monitors involve an added, potentially prohibitive cost. School bus operators in the Task Force indicated that if seat belts are required to be installed on school buses, it would not be feasible to have a monitor on each bus due to the added cost. For this reason, Sudbury reported that if seat belts are mandated on school buses in the future and support personnel were not available, "bus patrollers" (students who support the driver by helping younger students with seat belt use) may be a solution they explore. Given that students tend to require help more during the start of the school year as well as at the start of winter due to the impact of winter clothing, it may be worthwhile for schools to consider the use of support personnel for a limited period and phase them out as students learn to use seat belts properly themselves.

Interior cameras could also offer potential benefit during seat belt implementation as they provide comprehensive views of the school bus. During the pilot projects, interior cameras were periodically reviewed to monitor seat belt use and incidents involving behaviour issues. For example, in several cases, Nanaimo-Ladysmith was only able to address cases of seat belt misuse by reviewing interior camera footage. However, it is important to note that appropriate resources are required to make use of the interior cameras, as it takes time to review the footage. Use of interior cameras, like monitors, could be focused on the beginning of the school year and winter periods when assistance with proper use is required more often. Over the long term, cameras can support behaviour management by retroactively reviewing incidents.

The Task Force also reviewed seat belt warning/alert systems as a measure to support the driver with managing seat belt use. Seat belt warning systems are designed to assist the driver with monitoring seat belt use by tracking and displaying the occupancy and seat belt status of passenger seats. These systems use sensors installed on the seat belt buckle and/or the seat to communicate wirelessly with a dash mounted monitor. The monitor displays seat belt status in real time and provides visual and audible alerts to the driver when seat belts are unbuckled at an occupied seat. Some systems can also identify improper seat belt use, including when students move around in their seats or if there is an object, such as a backpack, between their body and the seat belt. This technology could positively impact drivers' ability to monitor seat belt use and behaviour of children seated at the middle or rear of the bus, that would otherwise not be possible to verify visually. Currently, there is insufficient evidence of this technology's utility from real-world applications to determine their effectiveness. However, it may be worthwhile for school bus operators to explore these systems based on their assessed needs.

Despite the challenges identified above, seat belts have been found to have a positive impact on student behaviour overall. All bus drivers across all pilot project districts confirmed an immediate change in student behaviour with the introduction of seat belt equipped buses. This change primarily involved students remaining seated, not turning around in their seats, and not changing seats while the bus was in motion. This reduced the noise level on the bus, which had a positive impact on driver distraction by allowing them to focus on the driving task. The very few behavioural issues observed on the pilot buses typically involved a minority of secondary school students who continuously refused to wear their seat belts.

3.1.4 Child Restraint Systems (CRS)

As of 1 April 2007, all newly built school buses in Canada are required to have a minimum number of seating positions equipped with lower and tether anchorages for child seats. The lower anchor allows for the base of a child car seat to be installed in the bus, while the tether anchor allows the top of a child car seat to be attached to the school bus seat. The number of anchors depends on the size of the school bus. The school buses for the pilot projects were equipped with anchors for eight seating positions – two in each of the first two rows.

In the *Strengthening School Bus Safety in Canada* report of 2020, the Task Force identified that the installation of three-point seat belts may result in an increase in the use of child car seats on school buses to secure children that do not meet the minimum size requirement for seat belts. Canadian and U.S. research suggests that appropriately installed infant or child restraints would improve occupant protection for small children. As such, Transport Canada recommends that children weighing less than 18 kilograms be transported in an appropriate child restraint system while on a school bus.[10]

The use of child restraint systems was not deemed necessary by school districts and school bus operators involved in the pilots as the children could be properly secured by the three-point seat belt, namely due to the shoulder belt guide adjuster. However, during the first year of the pilot project, the Sudbury Student Services Consortium tested the use of five-point child restraints as an alternative measure for securing smaller children. Two of these restraints (see Figure 5) were installed on each seat of the first two rows of each pilot bus and used to secure the youngest and smallest kindergarten students on the pilot routes.

Figure 5. Five-point restraint system

The Consortium found that the five-point restraint system was very challenging for children to use themselves. Despite familiarity with the belts, they were not able to buckle or unbuckle by themselves. Winter clothing also added another layer of difficulty. Use of the five-point restraints also delayed the bus route due to the time required to secure students. During the first school year of the pilot, an average of 5-7 minutes were added to each bus's run time to account for the use of seat belts, most of which was attributable to the use of the five-point child restraint.

Additionally, while robust, one of the tradeoffs with the design of this five-point apparatus was that it was not part of an integrated system. An integrated system allows the restraint to be folded into the seat if not in use, making it more comfortable for older children that do not require the

[10] Transport Canada, "Child Seats on School Buses." https://tc.canada.ca/en/road-transportation/publications/child-seats-school-buses

five-point restraint to use the seat. For these reasons, the Consortium decided not to continue with the five-point restraints after the first school year of the pilot project.

Members of the Task Force emphasized the implications of using other restraint systems on school buses, such as child car seats. For example, using child car seats would impact the ability for children to board the bus by themselves, as they would need to be properly secured by the driver, support personnel, or parent/caregiver. This would require additional training to ensure drivers and support personnel can properly install the child car seats and secure students in them if needed. Additional requirements on school bus drivers could impact driver retention and recruitment. The use of child car seats would also involve additional time to secure the child in, and/or install the child car seat if not already installed.

Use of child car seats could also impact the capacity of the bus, depending on whether the seats always remain installed. Moreover, while the use of an appropriate child restraint system for children weighing under 18 kilograms is intended to enhance the safety of these smaller school bus passengers, there are numerous implications and challenges involved in the application of these systems. As a result, the Task Force identified that there would be value in determining a recommended procedure for introducing child car seats to school bus transportation. Given the complexity of this issue, developing such a procedure was outside the scope of the pilot projects.

3.1.5 Emergency Exit Situations

Drivers involved in the pilot projects raised concerns about emergency exit situations on school buses equipped with seat belts, particularly in the event of a rollover collision where the bus ends up on its side or upside down. Due to practical limitations and safety reasons, these collision scenarios were not simulated. However, Sudbury Students Services Consortium conducted evacuation exercises with the bus right-side-up, to examine the potential impact of seat belts in an emergency exit situation where the driver is incapacitated and unable to assist students in evacuating the bus.

For this exercise, Sudbury used two different groups of students to simulate emergency exits and compared the time it took to evacuate buses with and without seat belts. The students involved in this simulation had not previously boarded a school bus equipped with seat belts or performed an emergency evacuation drill. Six tests were completed using two scenarios. The first scenario involved 24 students interspersed throughout the bus evacuating by the front exit only, then the rear exit only. The second scenario involved 48 students, all of which were seated next to at least one other student, evacuating the bus using the rear exit only.

Figure 6 outlines the seating assignments and number of students used for each scenario. Across all scenarios, the average time required to evacuate the bus without seat belts was around 66 seconds, and with seat belts was around 80 seconds. The results show that students onboard buses with seat belts required an average of 14.2 seconds longer in total to evacuate compared to buses without seat belts. The longest time increase to evacuate the bus equipped with seat belts was 32 seconds, with the shortest being only one second. Both instances occurred in the testing scenario involving 24 students interspersed throughout the bus and evacuating by the rear exit. Given that these students had neither practiced emergency exits nor used seat belts on school buses before this exercise, the results suggest that with increased training, students could become more proficient with seat belt use, further reducing the time required to exit the bus.

	Back Evacuation	Front Evacuation
Group1	1:35.97	1:10.38
Group2	1:12.30	0:53.18

	Back Evacuation	Front Evacuation
Group2	1:03.79	0:54.08
Group1	1:11.27	0:41.98

	Back Evacuation
Both Groups	1:48.49

	Back Evacuation
Both Groups	1:38.06

Figure 6. Sudbury Student Services Consortium Emergency Evacuation Exercise Results

The Task Force also discussed the implications of backpack placement on school buses with seat belts in respects to a collision and/or emergency exit situation. The original draft version of the *Guidelines* recommended backpacks be stored beneath the seat. However, observers from the pilot in Sudbury found this to be impractical, especially during the winter when the floor is wet and soiled. When backpacks are stored on the floor of the bus, they may also move out of their original position due to bumps or turns during the journey. A backpack that is moved into the aisle or the stairwell could become an obstacle in an emergency exit situation. Additionally, when backpacks moved during the pilot projects, students tended to unbuckle their seat belt to retrieve them. To avoid children unbuckling to retrieve their backpacks, children were instructed to keep their backpacks on their lap or on the seat beside them, if vacant.

Task Force members also noted that backpacks placed on the floor of the bus or the seat adjacent to a student could become a projectile during an emergency/collision. To help mitigate this risk, Task Force members suggested exploring different backpack storage solutions, including containment bars or baskets below each seat. The Task Force agreed that the *Guidelines* needed to be amended to reflect school board and school bus operator guidelines for keeping backpacks on a student's lap while seated on the bus. While it still may be possible for a backpack to become a projectile due to a collision if placed on a student's lap, the intention is to reduce the likelihood, while helping to ensure students remain seated and buckled.

The Task Force also heard from Orchard Farm School District in Missouri about modernizing school bus operations. They provided their perspective regarding seat belts on school buses, where the decision was taken not to install them due to emergency evacuation concerns. Specifically, waterways in their district raised concerns of a potential evacuation under water. This sheds light on the importance of considering the unique circumstances of each community in which school buses operate, and the implications that seat belts may pose.

The findings and discussions above indicate the role seat belts can play in emergency exit situations remains only partially understood. While the results of the emergency exit simulation exercise completed as part of the pilot projects seem to suggest that, with regular training, the time to evacuate a seat belt bus would be minimal, there are many other potential unique situations, each with different variables and risk factors, that need to be considered. As a result, the impact this additional time might have in an emergency exit situation is effectively unknown.

3.1.6 Loss of efficiency in routing solutions (additional time to secure seat belts)

Additional time may be required for seat belt-equipped buses to complete their routes. While seat belts seemed to have little impact on route schedules in Waterloo, the pilot school districts experienced delays. It is important to bear in mind that during the pilots, assistance with seat belt use was available and frequently provided during morning trips to ensure the bus would arrive at school on time. Delays to each stop were not typically lengthy, but over the whole trip, they compounded to a more noticeable amount.

Sudbury determined that an average of 3-5 additional minutes were required over the course of each trip to allow students time to buckle their seat belts. Based on planned route schedules, trip times in Sudbury ranged from around 20 to 50 minutes, with the average trip being around 30 minutes. Nanaimo-Ladysmith found that seat belt buses took an average of 10 minutes longer to complete each trip versus a bus without seat belts. However, these trips averaged 1.5-2 hours in total length. In Fraser-Cascade, delays were minimal, but this was likely associated with the observer being onboard to assist with seat belt use when needed. Without support personnel, it was estimated that up to 10 additional minutes may be required to complete the bus route when accounting for seat belt use. Like Nanaimo-Ladysmith, trips in Fraser-Cascade averaged around 1.5 hours in total length.

Delays due to seat belts can vary depending on several factors, including the number of students boarding the bus (which may vary across rural and urban areas), student behaviour, the ability of the students boarding to use seat belts properly and on their own, and lighting conditions. As previously identified, younger students not only experience more challenges with seat belt use than others, but they also require more time to buckle/unbuckle. For example, it might take longer for younger students to buckle because they use the incorrect buckle, or they are unable to untwist or untangle the belts efficiently.

Initially, students involved in the pilots were observed while having the opportunity to use seat belts on their own, including untwisting the seat belts if needed. However, observers noticed that additional time was needed for these students to properly use their seat belt, which impacted the school bus's ability to keep to its route schedule. As a result, assistance was often provided without allowing students the opportunity to buckle by themselves. Drivers and observers would also ensure seat belts were untwisted and untangled following each trip to facilitate swift boarding for the next route. With respect to locating the correct buckle, Sudbury suggested that coloured belts and buckles may help facilitate proper seat belt use because it would be easy to associate the seat belt with the respective buckle, as exemplified by Figure 7.

Figure 7. Example of coloured center seat belt and buckle (Not used on pilot buses)

In general, drivers found that seat belts added time to complete bus routes when compared to buses without seat belts. This was noteworthy in the afternoon segment due to the time required for the driver to ensure all students were properly buckled prior to departing the school. Morning trips were easier to manage due to fewer students boarding at each stop. Despite the additional time required for students to board the bus and buckle themselves in, drivers reported minimal impact on motorist behaviour during the pilot project.

3.1.7 Driver Liability/Responsibility

Under certain provincial/territorial legislation, school bus drivers are responsible for ensuring passengers are secured appropriately while on the bus. This responsibility is a common concern drivers express with operating a school bus equipped with seat belts, due to the challenges involved in monitoring and enforcing proper seat belt use while safely operating a school bus. There are also concerns of students unbuckling while the bus is in motion and when the driver is focused on the driving task.

The pilot projects helped illustrate some of these challenges. For example, drivers reported that they could not identify whether all passengers were using seat belts from their seating position, regardless of how bright the seat belts were. The yellow shoulder belt guide adjusters used in B.C. helped drivers identify whether students in their field of vision were buckled. These were generally favourable to the black adjusters used in Sudbury, given their tendency to blend in with the seat belts and children's clothing. Despite this, beyond the sixth row of seats, only students in seats adjacent to the aisle were clearly visible. Consequently, many students were outside the driver's sightline.

The districts involved in the pilots and the Student Transportation Services of Waterloo Region reported that diligent follow up from drivers and support personnel is needed to ensure consistent seat belt use. Drivers reminded students daily to ensure they buckled themselves in immediately after boarding and before leaving school. However, this is not always sufficient to ensure seat belt use, as many students unbuckled their seat belts during the trip.

Figure 8. Nanaimo-Ladysmith seat belt sign

Monitoring or enforcing passengers for compliance while operating the school bus can distract drivers from the driving task, posing a safety risk. To supplement reminders and support drivers, Nanaimo-Ladysmith installed adhesive decals promoting seat belt use (captured by figures 8 and 9) throughout the interior of each of their pilot buses, and a similar strategy was adopted in Waterloo Region. Four signs were spaced out along the interior walls from the front of the bus to the back, on both the driver and passenger sides. While there was no indication as to whether the signage directly affected seat belt use, the district felt that together with reminders, they contributed to a clearer and stronger message to students.

Figure 9. seat belt sign placement on bus

In July 2018, Transport Canada published regulations amending the Motor Vehicle Safety Regulations mandating all medium and large highway buses, excluding school buses and transit buses, be equipped with Type 2 seat belts at each seating position.[11] Type 2 seat belts include having an upper torso restraint that cannot be detached from the pelvic restraint; can be adjusted by means of an emergency-locking retractor or an automatic-locking retractor; and cannot be detached from any anchorage point. Following this requirement, the Ministry of Transportation of Ontario (MTO) heard concerns from the busing industry reflecting the challenges with ensuring seat belt use as mentioned above. In response, a public consultation was held with safety stakeholders, industry, and police to explore proposed amendments to exempt bus drivers from ensuring passengers under the age of 16 must wear a seat belt.[12] In Ontario, the Highway Traffic Act requires drivers to ensure passengers under 16 occupy a seating position and are secured with a seat belt assembly, if present.

MTO presented preliminary results of the public consultation to the Task Force, which included that certain added safety requirements be considered as part of any proposed exemption to this legislation, including signage to notify passengers to wear their seat belts and audible announcements reminding passengers of the seat belt requirement. The comment period for the consultation closed in September 2021, and a regulatory impact analysis has ensued. Preliminary results indicate this change would impose no new costs to businesses and could lift an operational burden currently placed on bus drivers. The change would also allow operators to avoid having

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[11] Canada Gazette, "Regulations Amending the Motor Vehicle Safety Regulations (Bus Seat Belts and Other Amendments): SOR/2018-143-2." https://www.gazette.gc.ca/rp-pr/p2/2018/2018-07-11/html/sor-dors143-2-eng.html

[12] Ontario's Regulatory Registry, "Proposed amendments to Ontario's Highway Traffic Act to develop a regulatory amendment to exempt bus drivers from ensuring that passengers under the age of 16 must wear a seat belt." https://www.ontariocanada.com/registry/view.do?postingId=38612&language=en

to put into place new operational protocols to identify passengers under 16, and potentially needing to hire additional staff to monitor passenger seat belt usage on behalf of the driver.

Drivers in Waterloo and Sudbury echoed concerns about their responsibility under provincial legislation to ensure all students are properly secured while on the school bus. While school bus operators in these regions are generally supportive of having seat belts on their buses, that decision would pose a bearing on driver liability and responsibility and potentially impact driver retention and recruitment.

3.2 FINANCIAL CONSIDERATIONS

To establish a baseline understanding of the financial considerations associated with school buses in Canada, manufacturers and operators provided the following information as part of the *Strengthening School Bus Safety in Canada* 2020 report. At the time, type C school buses costed between $110,000 and $120,000 to purchase new. These costs have since increased. As of 2019, there were approximately 37,000 Type C buses registered in Canada.

- Adding seat belts increases the purchase price by $8,000-$18,000, depending on bus size and number of seats. Adding integrated child seats for small children (as an alternative to traditional child restraint systems) may further increase the cost.
- A limited number of buses are available for purchase at dealerships that are available on the day of the sale. At that time, the typical lead time to acquire a new bus was 2-4 months. This lead time has also since increased.
- Based on a fleet turnover rate of 10% per year, the annual capital cost to install seat belts on replacement buses is estimated to be $68 million per year across Canada, not accounting for any additional operational costs (e.g. human resources, maintenance, etc.).

Since the 2020 report however, there have been numerous impacts on the school bus industry that have affected school bus costs. This includes supply chain shortages, increased manufacturing costs, and increased lead times associated with the acquisition of new school buses and safety equipment. Thus, the overall costs of new school buses are greater than originally presented. In addition, the current cost of electric school buses is significantly higher than diesel and gasoline buses. For more details, refer to Annex C on the costs associated with the pilot projects, and to Annex D for current estimates for acquiring new school buses.

Retrofitting seat belts poses other challenges. In general, buses that have been in use for longer than four years would be deemed ineligible for retrofit due to exposure and aging structural features. However, according to manufacturers, not all buses in the 0–4-year-old range are eligible for retrofit, and they are unlikely to authorize retrofitting due to liability concerns.

The higher cost of new buses equipped with seat belts may also have a broader impact, including cost-push inflation forcing some operators out of the business, and may mean less available buses to transport school-aged children. This could result in children relying on other less safe options to travel to and from school. Additional analysis is required to accurately predict the effects of increased school bus costs and the risks associated with more children taking alternative means of transport to /from school due to a potentially reduced number of buses.

3.3 *GUIDELINES FOR THE USE OF SEAT BELTS ON SCHOOL BUSES*

Overall, the pilot projects validated the information contained in the draft *Guidelines for the Use of Seat Belts on School Buses*. Some amendments have been made based on findings from the pilot projects and key input from school bus safety experts within the Task Force. There is now more clarity around the placement of backpacks and recommendations to provide students and bus drivers with regular training at the beginning of each school year to ensure they understand their respective responsibilities in relation to proper seat belt use. Additional guidelines for ensuring proper use – including inspecting seat belts regularly for functionality issues, and greater flexibility around the type and location of seat belt user information guides within the school bus (e.g., signage, decals) were also incorporated. These amendments better reflect real-world operating conditions and provide more focused guidance to those school bus owners/operators and school boards that have chosen to install seat belts on their school buses.

4 CONCLUSION

The Task Force on School Bus Safety has undertaken extensive research and analysis in support of their mandate to explore opportunities to enhance school bus safety. The pilot projects conducted in B.C. and Ontario were critical to gaining insight into the viability of seat belts on school buses in a real-world setting. The initiative demonstrated that the use of seat belts was generally accepted and achievable by most children regardless of age and size. The implementation of seat belts also tended to have a positive impact on student behaviour, which reduced driver distraction. However, the pilot projects highlighted challenges and considerations associated with the installation and use of seat belts on school buses, such as the effects of winter clothing on seat belt use, the introduction of child seats, and the impact of seat belts during emergency evacuation situations. They also demonstrated that the proper use of seat belts on school buses requires training and active participation on the part of the students, parents/caregivers, school bus drivers, and school boards, in order to be effective.

It is also important to note that there were limitations to the pilot projects. The limited sample size was not representative of the wider range of operational considerations that exist across Canadian communities (e.g., in larger rural centers or urban cities). In addition, the presence of the observers and monitors may have influenced the findings around seat belt implementation. This includes, but is not limited to student behaviour, the time it took to complete bus trips, and the driver's perceived workload and experience operating a bus equipped with seat belts. Finally, it is important to re-emphasize that broader implications associated with the introduction of three-point seat belts on school buses in Canada were not fully examined by the pilot projects. This included the impact of mandatory seat belts on school bus costs; operating costs (e.g., the use of monitors); driver retention, recruitment, and existing shortages; and perceived safety risks of school buses equipped with seat belts versus school buses without seat belts. All of these elements could pose a risk in children using less safe modes of transportation to get to and from school. These are important considerations which fall outside the scope of the pilot projects.

In addition to examining the viability of seat belts on school buses, the pilot projects helped to validate the guidance provided in the *Guidelines for the Use of Seat Belts on School Buses* using information from real-world applications. The knowledge gained through this initiative, coupled with the Task Force's expertise and work completed to date, informed important amendments to the *Guidelines*. These amendments clarify protocols and procedures to help all school aged passengers use seat belts properly. These guidelines are an important safety tool. In addition to the guidance they provide, they also provide practicable advice to assist with the implementation of school bus seat belt programs across Canada.

School bus safety will remain a priority for the Task Force at all levels of government and industry. Transport Canada will continue to assess safety considerations related to seat belts as they emerge and explore opportunities to research and test innovative solutions to improve school bus safety, including regulatory and non-regulatory measures.

4.1 KEY FINDINGS

Below are key findings from the school bus pilot projects. Note that students on each of the pilot buses had access to assistance if they were unable to use seat belts properly.

- Overall, three-point seat belts were able to properly fit most children involved in the pilot projects regardless of age and size.
- Most children were able to use seat belts properly by themselves after being trained and having the opportunity to use seat belts on the school bus for a certain amount of time. Junior kindergarten students tended to require regular assistance with seat belt use.
- Winter clothing impacted the ability of younger children (generally kindergarten to second grade) to use seat belts properly on their own. While winter clothing generally increased the time required for all students to buckle and unbuckle, it did not prevent them from buckling altogether.
- Seat belts tended to have a positive impact on student behaviour. They reduced cases of students standing, turning around in their seats, changing seats while the bus was in motion, and the overall noise level on the bus. In turn, this had a positive effect on the driver's ability to focus on the driving task.
- Twisted and loose seat belts posed a barrier to effective seat belt use. This occurred often after a student unbuckled, as the seat belt tended to be left loose and not fully retracted. If not fully retracted and straightened out after each use, this presented an added challenge for children to buckle themselves properly.
- In general, only students below fourth grade could be properly buckled and comfortably seated in a three-per seat configuration, whereas students in fourth grade and above could only be properly buckled and comfortably seated two per seat. Ensuring all students can be properly buckled could impact the actual capacity of the school bus.
- During emergency exit simulations, evacuating school buses equipped with seat belts took longer than on a school bus without seat belts. However, the pilot projects demonstrated the importance of proper training and regular seat belt use, in reducing the time to complete an evacuation on a bus equipped with seat belts, where the bus is right-side up (and without any other complications).
- Additional time, between 5-10 minutes on average (depending on the planned length of the route), was required for buses equipped with seat belts to complete their routes compared to buses without seat belts.
- Ensuring seat belts are always worn properly by all students was a challenge for school bus drivers to accomplish alone. Effective communication with students and parents/caregivers, diligent monitoring including reminders, and prompt enforcement were required to ensure all passengers used seat belts properly.

5 ANNEX A: EXTERIOR SAFETY AND DRIVER ASSISTANCE FEATURES

The purchase of new school buses for the pilot projects presented a unique opportunity to explore safety features focused on supporting drivers with the driving task and deterring illegally passing motorists. These features, recommended for exploration by the Task Force in the *Strengthening School Bus Safety in Canada* report of 2020, included 360° camera systems, extended stop arms, infraction/stop arm cameras, and automatic emergency braking (AEB) systems. As a result, the pilot project scope included optional use of these features. This section presents a summary of the findings from their use.

5.1 EXTERIOR 360° CAMERA SYSTEMS

Exterior 360° camera systems are designed to help the driver better detect and protect children and other vulnerable road users around the exterior of the bus. These systems were equipped on all pilot buses.

Overall, the 360° camera system was useful for providing increased visibility around the school bus. Drivers found the views provided by the system to be helpful to verify whether students were around the bus, particularly before pulling away from a loading zone or a bus stop.

However, the location of the display appeared to affect driver acceptance of the technology. Drivers in Nanaimo-Ladysmith found that looking up at the display was counterintuitive. Additionally, they felt the images were too small and difficult to clearly ascertain with a short glance. During regular operations, they preferred using their mirrors and standard blind spot checks rather than the camera system.

Similarly, drivers in Sudbury found the display to be disorienting when learning how to use the system. However, after a few weeks of use, the cameras became a regular part of blind spot checks during loading/unloading scenarios. Driver perception of the technology was generally positive.

The driver in Fraser-Cascade was also inclined to use the technology despite the position of the monitor. While they continued to use their mirrors at first, the driver recognized the enhanced views the system offered, which was particularly useful during loading scenarios. While the experience was positive overall, the driver noted that some improvements could be made. For example, a sunshade on the driver's side would mitigate glare, and a larger monitor would make using the system easier in general.

All drivers indicated that the views provided by the cameras were not always clear during snowy or slushy conditions. This resulted in the camera lenses needing to be cleaned often. During winter months, the lenses were typically cleaned twice daily – prior to morning and afternoon trips. During the summer months, lenses were cleaned daily prior to morning trips.

5.2 EXTENDED STOP ARM

Extended stop arms are designed to further deter motorists from passing while children are entering or leaving the school bus. Extended stop arms were equipped on the pilot buses in Fraser-Cascade and Nanaimo-Ladysmith, but not in Sudbury. Sudbury decided against equipping their buses with extended stop arms due to the cost of the system.

In the districts where the extended stop arms were used, they were well received by school bus drivers and demonstrated potential to reduce stop arm violations. In Nanaimo-Ladysmith, the extended stop arm was associated with a reduction in violations on one bus route. Prior to the pilot, this route consistently saw at least two stop arm violations per week. The same bus route equipped with the extended stop arm saw only two violations during the entirety of the pilot period (May 2021 to June 2023). At the same time, it is difficult to measure the effectiveness of the extended stop arm on the observed stop arm violations given inconsistent reporting of violations before and after the installation of the extended stop arm. Additionally, it is difficult to quantify what other factors may have led to a reduction in violations, such as potential reduced traffic due to the pandemic.

It is important to note that in British Columbia, a significant proportion of the bus stops for these suburban/rural routes involved pulling completely off the road for pickups and drop offs. When the bus pulled completely off the road, stop arms were not used. As a final note, the additional time required to deploy the extended stop arm was not measured but did not seem to affect the timing of the bus route or the behaviour of nearby motorists.

5.3 INFRACTION/STOP ARM CAMERA SYSTEM

Infraction/stop arm cameras help prevent dangerous incidents caused by passing motorists. These cameras were equipped on all six pilot school buses.

Throughout the pilot period, Sudbury observed a total of 27 stop arm infractions, 23 of which were reported to the Greater Sudbury Police using evidence captured by the infraction cameras. The police confirmed that citations were issued for 90% of the infractions reported. The infraction camera system provided important support to bus drivers. By capturing key information needed to report illegally passing motorists, it allowed them to focus on managing student passenger safety while loading/unloading.

The four infractions that went unreported were due to unclear views of the offending vehicle's license plate caused by wet weather conditions. In Nanaimo-Ladysmith, this is also what prevented the system from successfully capturing a clear enough image for one of the two illegally passing vehicles during the pilot period. As a result, it was recommended that drivers clean the cameras daily, and if needed, before the start of each trip to help ensure the lenses were unobstructed. No infractions were observed in Fraser-Cascade, but their drivers were provided the same instruction for cleaning the camera lenses. However, Sudbury reported that when raining or snowing heavily, it can be very difficult to obtain useful information from the camera.

Sudbury and Nanaimo-Ladysmith also found that the reporting process can be time-consuming. It takes time to download, review, and upload the video footage captured by the camera system in addition to completing the infraction report and submitting it to police. As a result, there may be room for improvement by way of automated features incorporated into the camera system to streamline the reporting process for school bus operators.

5.4 AUTOMATIC EMERGENCY BRAKING SYSTEM

Automatic emergency braking (AEB) systems help reduce the severity of a collision or avoid it entirely. AEB was only equipped on the school bus in Fraser-Cascade, and automatic braking was never required during the pilot project. At the beginning of the pilot, there was an issue with the system triggering when it was not required.

An investigation into these unintended braking events using a detailed description from the driver and a forward-facing dash camera to observe the events revealed that the system was triggered repeatedly at a specific location of the bus route where the roadway expanded from a single lane to two lanes. It was determined that, in anticipation of the second lane emerging, the bus driver would accelerate forward. In doing so, the bus would occasionally approach the vehicle in front of them closely enough to trigger the automatic braking system. Once the issue was identified, the driver adapted their approach at this location of the roadway, which prevented any further unintended braking events. In the aftermath, the district highlighted that this could be a useful example included in future training programs focused on the use of driver assistance features.

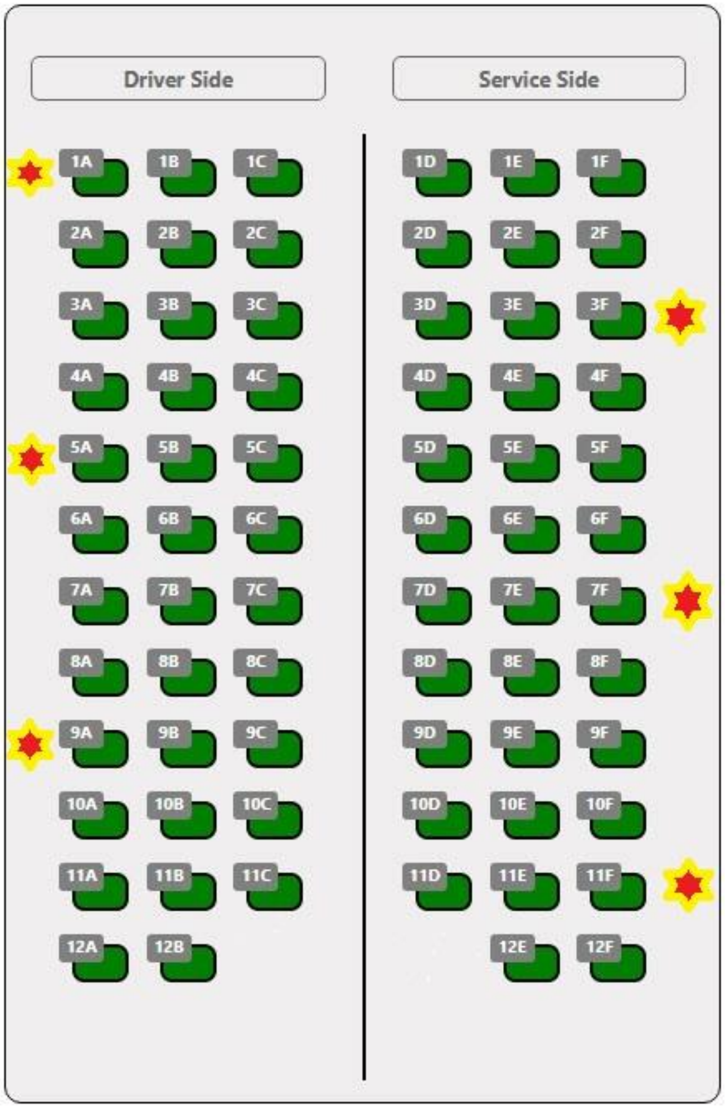
6 ANNEX B: SCHOOL BUS AND EQUIPMENT SPECIFICATIONS

	BRITISH COLUMBIA		
	Fraser Cascade	Nanaimo Ladysmith	
Bus Information			
Manufacturer	IC Bus	Western Canada IC Bus	Western Canada IC Bus
Make/Model	IC CE 76P	International 20-01 76P Electric Bus	International 20-01 76P Electric Bus
Diesel/Electric	Diesel	Electric	Electric
# of Individual Seats	76	76	76
# of Seating Positions	24 (3/Bench) 2 (2/Bench)		
Seat Belts			
Retrofit/OEM	OEM	OEM	OEM
Manufacturer	IC Bus	IMMI	IMMI
Interior Cameras			
Retrofit/OEM	Retrofit	Retrofit	Retrofit
Manufacturer	Gatekeeper Systems	Seon	Seon
# of Interior Cameras	5	5	5
Locations on the Bus (front, middle, back)	1 front, 3 driver side, 1 back	Door, front & rear	Door, front & rear
Hard Drive / Wireless Download / Live Broadcasting	Hard Drive	Hard Drive	Hard Drive
Infraction/Stop Arm Cameras			
Retrofit/OEM	Retrofit	Retrofit	Retrofit
Manufacturer	Gatekeeper Systems	Seon	Seon
# of Cameras	3	2	2
360° Cameras			
Retrofit/OEM	Retrofit	Retrofit	Retrofit
Manufacturer	Gatekeeper Systems	Rosco	Rosco
# of Cameras	4	4	4
Display Type/Location	Rear View Mirror	Upper cabin monitor	Upper cabin monitor
Recording (yes/no)	Yes	No	No

	BRITISH COLUMBIA (CONT'D)		
	Fraser Cascade	**Nanaimo Ladysmith**	
Extended Stop Arm			
Retrofit/OEM	Retrofit	Retrofit	Retrofit
Manufacturer	MJG Technology	MJG Technology	MJG Technology
Total Length	1.83 m	1.98 m	1.98 m
Stop Signal Size	46 cm x 46 cm	Current to the Federal specifications	Current to the Federal specifications
Deployment Mechanism (hydraulic, electric)	Electric	Linear Actuator & Air/Pneumatic Double Acting Cylinder	Linear Actuator & Air/Pneumatic Double Acting Cylinder
Location on Bus (front/back)	Driver Side Front	Rear	Rear
AEB			
Included (yes/no)	Yes	N/A	
Manufacturer	Bendix		
Forward Collision Warning	Yes		
Pedestrian Detection	No		
Other Technologies	N/A		
Event Triggered Camera	Yes		
Fleet Tracking System	Yes		
Lane Departure Warning	Yes		
Pedestrian and Cyclist Detection Warning	No		
Headway Monitoring Warning	No		
Speed Limit Indicator	Yes		

ONTARIO (Sudbury)			
	Bus 1	**Bus 2**	**Bus 3**
Bus Information			
Manufacturer	Girardin Blue Bird	Girardin Blue Bird	Girardin Blue Bird
Make/Model	Vision	Vision	Vision
# of Individual Seats	71	71	71
# of Integrated Seats	8	8	8
# of Seating Positions	23 (3/bench), 1 (2/bench)	23 (3/bench), 1 (2/bench)	23 (3/bench), 1 (2/bench)
Seat Belts			
Retrofit/OEM	OEM	OEM	OEM
Manufacturer	Girardin Blue Bird	Girardin Blue Bird	Girardin Blue Bird
Interior Cameras			
Retrofit/OEM	Retrofit	Retrofit	Retrofit
Manufacturer	Gatekeeper	Gatekeeper	Gatekeeper
# of Interior Cameras	6	6	6
Locations on the Bus (front, middle, back)	At 1A, 5A, 9A, 3F, 7F and 11F	At 1A, 5A, 9A, 3F, 7F and 11F	At 1A, 5A, 9A, 3F, 7F and 11F
Hard Drive / Wireless Download / Live Broadcasting	Hard Drive & Wireless Download	Hard Drive & Wireless Download	Hard Drive & Wireless Download
Infraction/Stop Arm Cameras			
Retrofit/OEM	Retrofit	Retrofit	Retrofit
Manufacturer	Gatekeeper	Gatekeeper	Gatekeeper
# of Cameras	2 (1 forward facing, and 1 rear facing)	2 (1 forward facing, and 1 rear facing)	2 (1 forward facing, and 1 rear facing)
360° Cameras			
Retrofit/OEM	Retrofit	Retrofit	Retrofit
Manufacturer	Gatekeeper	Gatekeeper	Gatekeeper
# of Cameras	4	4	4
Display Type/Location	Embedded in rear view mirror	Embedded in rear view mirror	Embedded in rear view mirror

Sudbury Interior Camera Placement



7 ANNEX C: COSTS OF THE PILOT PROJECTS

Costs* (Incl. Taxes)	BRITISH COLUMBIA		ONTARIO
	Fraser Cascade	Nanaimo Ladysmith	Sudbury
School Bus (initial cost)	$113,900 (diesel)	$325,000 per bus (electric)	$140,685 per bus (gasoline)
Seat Belt Installation	$12,000	$12,000 per bus	Included in bus cost
Observer Cost	$29,411 (one observer)	$66,862 (for two observers)	$26,852.48 per observer
Monitor Cost	N/A		$26,852.48 per monitor

* The costs identified above are not necessarily representative of jurisdictional costs. The cost of buses and equipment can vary depending on the manufacturer/distributor, vehicle/product availability, etc.

8 ANNEX D: 2024 ESTIMATES FOR ACQUIRING NEW SCHOOL BUSES

School Bus Type	Unit Price*	Lead Time (approx.)
Type C – Diesel	$176,964	7 months
Type C – Electric	$504,227	10 months

*The estimates identified above do not include applicable taxes or fees.

Unit price and lead times are a cumulative average based on information provided by 5 school bus manufacturers: Girardin Blue Bird, Thomas Built Buses, IC Bus, The Lion Electric, and BYD. At the time of inquiry, GreenPower Motor did not supply Type C school buses.