

**BC Coroners Service Child Death Review Panel
A Review of Road-Related Pedestrian, Cyclist and
Boarder Deaths in Children and Youth
2005-2014**

**REPORT TO THE CHIEF CORONER OF BRITISH
COLUMBIA**

June 2016

PREFACE

On October 7, 2015, the British Columbia Coroners Service (BCCS) held a child death review panel focused on road-related pedestrian, cyclist and boarder deaths of children and youth who died between 2005 and 2014.

In the 10 year period reviewed, 81 children and youth under the age of 19 years died in these types of road-related incidents. Their loss is deeply felt by family, friends and their community. The review of the circumstances that resulted in their deaths provided panel members with valuable information to consider in the course of determining what could be done to prevent this type of road-related deaths in the future. This report is dedicated to the families who lost loved ones.

Panel support was provided by the BCCS Child Death Review Unit (CDRU). Adele Lambert, Will Speechley, and Carla Springinotic compiled aggregate case reviews and a review of the research and statistics which formed the basis of the panel discussions.

I am sincerely grateful to the following members of this panel for sharing their expertise, bringing the support of their respective organizations and participating in a collaborative discussion. As well, I would like to recognise the contribution of Dr. Perry Kendall, Provincial Health Officer and Neil Arason, Ministry of Public Safety and Solicitor General, RoadSafetyBC for their input. The participant's contributions have generated action-oriented recommendations that I am confident will contribute to reducing road-related deaths in BC.

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Bob Downie	Chief of Police, Saanich Police
Gordon Li	Principals and Vice-Principals Association
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Dr. Robert Saunders	BC Coroner Service
Dr. Ian Pike	BC Injury Research and Prevention Unit
Alex Scheiber	Ministry of Children and Family Development
Dr. Shannon McDonald	First Nations Health Authority

On behalf of the panel, I submit this report and recommendations focused on preventing road-related deaths among young people to the Chief Coroner of BC for consideration.



Michael Egilson
Chair, Child Death Review Panel

EXECUTIVE SUMMARY

Road safety issues affect all of us. Every day children, youth and adults travel to and from school, work or home. Although there has been progress on reducing vehicle occupant deaths in British Columbia, more progress is needed to reduce the number of pedestrians and cyclists killed or injured on roadways. On average, over 2,400 pedestrians and 1,400 cyclists of all ages are injured and 58 pedestrians and 10 cyclists are killed in crashes every year in BC (ICBC, 2015).

To better understand road-related deaths of children and youth travelling by non-motorized methods and identify prevention opportunities, a child death review panel appointed under the *Coroners Act* was held in October 2015. The review panel was comprised of professionals with expertise in transportation, engineering, medicine, child welfare, Aboriginal health, child injury, public health, education, and law enforcement.

The circumstances of 81 child and youth pedestrians, cyclists and boarders (skateboarders, long boarders and tobogganers) who died as a result of road-related incidents between 2005 and 2014 were reviewed in aggregate. Current research and statistics were assessed and key themes identified.

The review found that:

- Most child and youth pedestrian fatalities occurred at non-intersection locations.
- Youth age 15 to 18 years were more likely to die in road-related collisions than all other child age groups.
- Almost half of children age 1 to 4 years in this review died in driveway incidents.
- More child and youth pedestrians died than cyclists or boarders.
- All but four of the 81 child or youth deaths occurred in a collision with a motor vehicle.

During this review the panel identified a lack of available data about pedestrian, cyclist and boarder injury events in general. Where data exists there are differences in data collection, data completeness and reporting requirements. The panel identified three key activities to reduce road-related pedestrian, cyclist and boarder deaths:

- Adopt safe systems approach to road designs;
- Increase traffic safety knowledge for children and youth (e.g., encourage the use of bike helmets for cyclists and boarders; and daytime running lights for cyclists); and
- Promote the adoption of legislation for new vehicle sensors and cameras.

These findings are the basis for the following recommendations put forward to the Chief Coroner by the panel:

Recommendation 1: Adopt Safe Road System Design and Infrastructure

- By December 2017, the Ministry of Public Safety and Solicitor General and Ministry of Transportation and Infrastructure (MOTI) will work collaboratively to expand crosswalk safety through the use of: dedicated pedestrian phases at traffic lights, leading pedestrian intervals at high incident locations, and also encourage municipalities to adopt these practices.
- By July 2016, the Ministry of Transportation and Infrastructure will require applicants accessing cycling infrastructure funding to meet best cycling infrastructure design standards.
- In a previous 2015 death review panel on young drivers, the BC Coroner Service made a recommendation that the Ministry of Transportation and Infrastructure consult with road safety, injury prevention and public health agencies to ensure that road safety and injury prevention are the paramount criteria used in the course of monitoring and reviewing existing speed limits and setting new speed limits on BC provincial road system. This recommendation should extend to all remaining road systems in BC, including residential streets.

Recommendation 2: Enhance Road Safety Education and Awareness

- The Ministry of Education and School Districts will solicit the views of students about how they get to school, road safety and what would make students feel safer when biking or walking.
- The Ministry of Education and School Districts will work with students to increase awareness and knowledge of road safety when travelling on foot, on boards and by bike. This could be supported through ‘road safety theme weeks’, road safe campaigns, or curriculum, and should include the topics of general road safety, the importance of being seen and bike helmet use.

Recommendation 3: Enact Vehicle Safety Legislation

- By 2018, Transport Canada will enact regulations that require all new vehicles in Canada to have rear-facing technology to alert drivers to the presence of pedestrians when backing up.

CHILD AND YOUTH ROAD-RELATED DEATHS

All pedestrians, cyclists and road users need access to safe roadways but children and youth are at a special disadvantage because of their smaller physical size, and their still developing coordination, cognitive skill and decision-making ability. Learning road safe behaviours is a continuous process, but the knowledge and skill challenge is greatest for children who are just beginning to navigate the world. The potential danger of our complex motorized transportation system is especially great for children and youth as they rely on non-motorized transport for independent mobility.

Children need skills to cross streets safely, and typically these skills are not developed until 9 to 11 years of age. These skills include: the ability to determine safe and dangerous sites, assess vehicle speed, judge safe gaps in traffic, determine and use a safe crossing area. For youth these learned skills may be impacted by developing competency with a new skill such as cycling or boarding, and a propensity for risk-taking, common at this stage of development.

It is imperative that drivers drive with greater caution around children and youth as they develop skills to safely cross and use roadways.

The following two cases provide tragic examples of preventable child and youth traffic fatalities. These two cases are representative of many of the circumstances found in other child fatalities.

ROAD CROSSINGS

On a late afternoon in winter a student and a friend were attempting to cross a highway with a posted speed of 80 km. The roadway was straight, the asphalt was dry and in good repair, but the daylight was beginning to fade. Traffic was heavy at this time, and there was no controlled crossing for pedestrians nearby. The teens were returning home from a shopping centre on a transit bus and had just been dropped off at a bus stop. The youths walked in front of the bus and ran to cross the road way. The bus driver sounded the horn warning of the danger as a vehicle was noticed to be approaching the bus from behind. The vehicle driving past the bus narrowly missed the first youth but tragically fatally struck the second. The friend stated "I thought the transit bus was like a school bus and that vehicles would stop". Witnesses indicated that neither pedestrian had looked for oncoming traffic, and because they were standing in front of the bus they could not be seen by or see oncoming traffic. No charges were considered against the driver of the vehicle. Improvements to the highway design were funded after this death to make the area safer for pedestrians, including pullouts for buses and better lighting and signage.

BACKOVERS

Early one afternoon in the springtime, the BC Ambulance Service was dispatched to a residence. On their arrival they found a very young child lying on the driveway with a severe head injury. The day had been warm and sunny and the family had been playing and completing outside chores, sweeping and tidying the yard. To complete the work, a parent needed to back a vehicle, a large SUV, from the home's driveway. The parent had moved the young children to a safe area on a deck away from the vehicle, leaving them alone briefly while the vehicle could be moved.

While the vehicle was slowly backing up one of the young children ran from the deck to behind the vehicle. The child could not be seen as the height of the vehicle and a fence obstructed the driver's view of the child. Although the vehicle was in good mechanical order, it had many blind spots, particularly for the size of the child. The vehicle ran over the child and the parent was not aware of the injuries until after the vehicle was stopped and had been exited. Although extensive medical support was provided the child could not be saved. No charges were considered against the driver of the vehicle.

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PART 1: INTRODUCTION

Road safety affects all of us. Every day children, youth and adults travel within their community to and from school, work and home as well as for social and recreational purposes. Although there has been progress on reducing vehicle occupant deaths in British Columbia, more progress is needed to reduce the number of pedestrians and cyclists killed or injured on roadways.

The death of a child or youth is tragic and devastating to family, friends and the community. In most cases this loss is compounded by the fact that the death could have been prevented. There are many more near-miss road-related incidents that result in injury, sometimes life altering and many more cases that are characterized as a ‘close call’. While this panel looked at children and youth who died as a result of a road-related pedestrian, cyclist or boarding crashes, the issues of road safety affect all British Columbians.

Pedestrians, cyclists and boarders are more vulnerable road users as they lack protection if struck by a motor vehicle. Every year in BC, over 2,400 pedestrians and 1,400 cyclists are injured and 58 pedestrians and 10 cyclists are killed in crashes involving motor vehicles (ICBC, 2015).

Literature suggests that children’s overall physical and cognitive development puts them at greater disadvantage as pedestrians and road users. Children need skills to cross streets safely. These skills include:

- The ability to determine safe and dangerous sites;
- Assess vehicle speed, and judge safe gaps in traffic; and
- Determine and use a safe crossing area.

For youth, these learned skills may be impacted by developing competency with a new skill such as riding a bicycle or board, and a propensity for risk-taking common at this stage of development. Drivers need to be prepared for unexpected events, especially as children and youth develop skills to safely cross and use roadways.

Pedestrian, cyclist and boarder deaths are preventable. To better understand road-related deaths in children and identify opportunities for prevention, a child death review panel appointed under the *Coroners Act* was held in October 2015. The circumstances of 81 children and youth deaths as a result of road-related pedestrian, cyclist and boarder crashes between 2005 and 2014 were reviewed in **aggregate**.

For the purpose of this review the following terms are defined as:

- Pedestrian – a person on foot, or child in a wheelchair or carriage
- Boarder – a person riding on a skateboard, longboard or toboggan
- Cyclist – a person riding on bicycle, tricycle or other pedal cycle
- Road Related – any fatality that occurred on a public roadway, railway line, or driveway
- Vulnerable Road User (VRU) – pedestrians, boarders, and cyclists

This review does not include deaths of drivers of motor vehicles, passengers in motor vehicles or deaths of persons riding on a motor vehicle.

DEATH REVIEW PANEL

A death review panel is mandated¹ to review and analyse the facts and circumstances of deaths to provide the Chief Coroner with advice on medical, legal, social welfare and other matters concerning public health and safety, and the prevention of deaths. A death review panel can review one or more cases before, during or after a coroner's investigation, an inquest or a review by the BCCS Child Death Review Unit (CDRU), and regardless of any decision made by a coroner or member of the CDRU.

The *Coroners Act* mandates the review of all deaths of children under age 19 years. The Chief Coroner has established a child death review panel to meet on specific occasions throughout the year to provide recommendations on the prevention of child and youth deaths. This process is consistent with the child death review principles laid out by the Honourable Ted Hughes in his 2006 report². The Chair of the CDRU was appointed chair of the child death review panel whose membership includes: CDRU coroners; and professionals with expertise in Aboriginal health, injury prevention, public health, medicine, child psychiatry, emergency health services, law enforcement, education and child welfare. In the course of reviewing children and youth road-related deaths that occurred between 2005 and 2014, the panel reviewed:

- BCCS investigative findings;
- Academic and research literature;
- Information provided by panel members;
- Environmental, social and medical factors associated with the deaths;
- Possible trends or themes;
- The current state of related public policy and strategies; and
- Existing challenges.

Each panel member shared their professional perspective and collectively identified actions towards preventing future vulnerable road user deaths.

LIMITATIONS AND CONFIDENTIALITY

The number of children and youth who died as a result of road-related deaths presents challenges in accurately analyzing and reporting information while protecting privacy and data accuracy. Provisions under the *Coroners Act* and *Freedom of Information and Protection of Privacy Act* allow for the BCCS to disclose information to meet its legislative mandate and support the findings and recommendations generated by the review process. For the purposes of this report, information is presented in aggregate form. Details that could identify the young people have been omitted to respect the privacy of the child who died and their families. The BCCS is sensitive to the privacy of children and families that we serve and proceeds with caution when reporting case review findings.

¹ Under the *Coroners Act*

² *BC Children and Youth Review, 2006*

PART 2: INTERNATIONAL, NATIONAL AND THE BC CONTEXT

Over the past decades, there have been many achievements to improve the safety of passenger vehicle occupants and reduce fatalities. Changes in vehicle design and improved safety equipment, speed management, road design and effective drinking and driving policies have contributed to the prevention of deaths. However, the safety for pedestrians and cyclists remains an issue as there has not been a corresponding reduction in injuries or fatalities for these vulnerable road users. The need for improved safety for all road users is a priority especially with the adoption of strategies to encourage physical activity, and green strategies promoting walking and cycling as means of transportation.

Although historically roads were built for non-motorized travel, most roads designed and built since the middle of the last century, have been designed for vehicle occupant safety rather than from the perspective of pedestrian and cyclist safety. A child's overall physical and cognitive development adds to their vulnerability.

International best practice and research has shown that fatalities and especially vulnerable road user fatalities can be reduced or prevented by adopting a Safe System Approach (SSA). This approach has four pillars and assumes that the most vulnerable part of the road system is the pedestrian and that the system needs to be designed around them. The SSA pillars include:

Safe Roadways which address roadway and intersection design, such as: separating vulnerable road users from motor vehicles in both time and space, increasing visibility through better lighting or removing obstructions to views, reducing crossing distances, and eliminating concurrent movement of vehicles and people.

Safe Speeds which includes speed limits appropriate to the complexity of the route (adjacent activities, presence and visibility of vulnerable road users, intersections, junctions), enforcement and neighborhood calming measures such as: rumble strips, humps, landscaping, and, on more major roads, speed cameras.

Literature indicates that at a speed of 30 km/h vehicles and pedestrians are able to co-exist with relative safety because drivers have more time to perceive, react and stop; consequently, pedestrians have more time to react to avoid being hit by motor vehicles as well. Vehicle speeds of less than 30 km/h reduce both the risk of a crash occurring and, if there is a crash, reduces the severity of resulting injuries significantly.

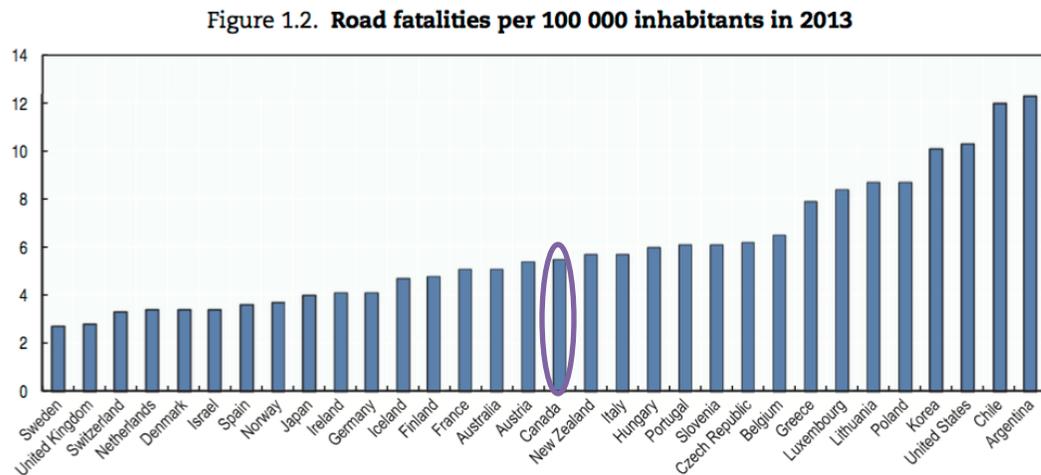
Safe Vehicles which consider effective vehicle design innovations such as rear-view cameras, pedestrian detection systems, softer vehicle fronts, truck side and underrun guards, and intelligent speed assistance.

Safe Road Users which focus on the behaviours of all road users (drivers, pedestrians, cyclists etc.) and addresses risk factors such as: speeding, intoxication, distraction, visibility, protective equipment use, and poor and emerging decision making skills.

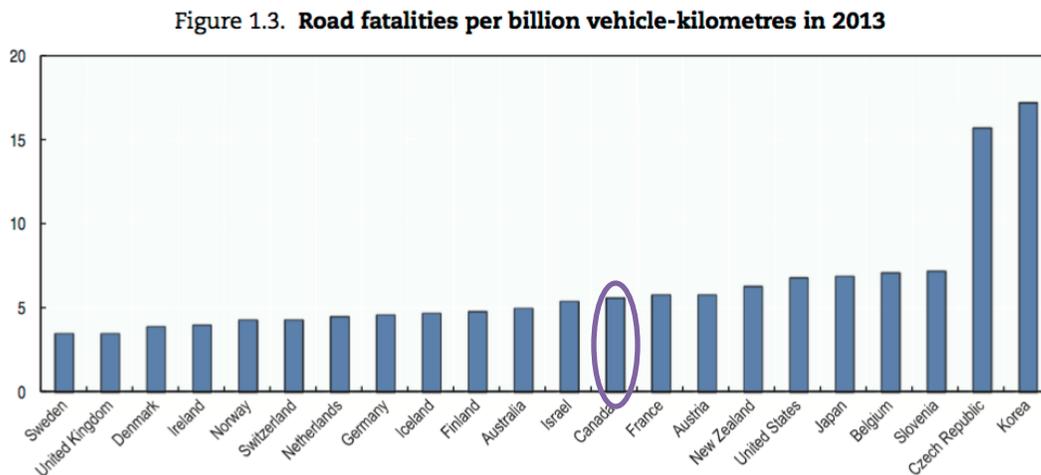
INTERNATIONAL

Countries that have adopted a Safe System Approach have made the most progress in reducing injuries and fatalities from road-related crashes (Countermeasures to Improved Pedestrian Safety in Canada, 2013). For example, Iceland, the UK, Norway, Denmark and Sweden who are leaders in road safety had fatality rates between 2.8 and 3.0 per 100,000, a rate that is half of that of Canada (Provincial Health Officers Report, 2016).

Figure 1 Road Fatalities per 100,000 population in 2013



Note: Provisional data for Australia, Canada, Ireland, Lithuania and the United States.



Note: Provisional data for Australia, Canada, Ireland, Lithuania and the United States. 2012 data for the Czech Republic.

(OECD/International Transport Forum, 2015)

As indicated in Figure 1, data from the International Transport Forum, ranked Canada 17 of 32 countries for road fatalities. Canada compares favourably with the United States when considering deaths per 100,000 population, but is only slightly better than the US when distance travelled is taken into account. By either measure, Canada lags behind most developed nations in road safety. If Canada achieved the road safety performance of the safest countries in the world,

about 1,000 lives would be saved each year. Adopting the Safe System Approach could reduce injuries and fatalities for all road users.

Studies and reports find that roadway design and intersection signal controls must be part of a safe system design for pedestrians (Countermeasures to Improved Pedestrian Safety in Canada, 2013). Studies agree that to reduce and prevent pedestrian and bicyclist injuries and death, road design should:

- separate vulnerable road users from motor vehicles through space or time;
- reduce or eliminate concurrent movement of vehicles and people;
- reduce pedestrian crossing distances; and
- increase visibility of vulnerable road users, and alert drivers to locations of crosswalks.

Increased visibility applies to all vulnerable road users. For example, evidence supports the use of daytime running lights by cyclists as a measure to reduce collisions with motor vehicles.

Additionally, data from the Insurance Institute for Highway Safety (IIHS) indicates that the presence of a sidewalk reduces pedestrian collisions by 88% as compared to no sidewalk. The IIHS recommends measures that separate pedestrians from traffic to prevent and reduce injuries and fatalities. These include road design strategies such as median refuge islands, barriers, pedestrian overpasses and underpasses and adjusting traffic signals to create an exclusive pedestrian phase, giving pedestrians a head start before vehicles get a green light (IIHS, 2013).

An international literature review on vehicle travel speeds and pedestrian injuries concluded that “reductions in vehicle speeds can have a very significant influence on pedestrian crashes and injuries. Evidence shows that pedestrians suffer much more serious injuries when struck by high-speed vehicles than when struck by vehicles going more slowly. Also, many pedestrian crashes would be prevented entirely had the vehicles been traveling more slowly, since driver and pedestrian would have had more time to perceive the threat and react to the risk, averting the crash altogether” (NHTSA, 1999).

Safer vehicle design features such as back up cameras, sensors, pedestrian detection and automatic braking are available or in development. Data from the US National Highway Safety Transportation Agency (NHSTA, 2013) indicates that each year an average of 210 fatalities and 15,000 injuries occur from back-up accidents, with children under 5 years of age accounting for 31 percent of these deaths. To address back-up accidents, the United States will require back-up cameras on most new vehicles by 2018 (NHTSA, 2015). NHTSA is also ‘pursuing research and working with industry partners to evaluate a variety of leading-edge pedestrian detection technologies that can both warn and automatically apply the brakes if the system detects a pedestrian collision is imminent’ (NHTSA, 2016).

CANADA

Canada falls behind other countries in prevention of pedestrian and cyclist fatalities. A report prepared by Transport Canada indicated that approximately 300 pedestrians (15.6% of motor vehicle related fatalities) and 62 cyclists (3.2% of motor vehicle related fatalities) died on Canadian roads in 2013 (Transport Canada, 2013).

Canadian data indicates that:

- 75% of all pedestrian traffic fatalities occurred on urban roads;
- 60% of all pedestrians killed in traffic crashes were trying to cross the road
- 6% of fatally injured pedestrians were under the age of 16 and of these, 20% ran out into the street;
- 67% of fatally injured pedestrians were not at fault for the crash;
- 33% of fatally injured pedestrians were struck by a driver who had committed a traffic infraction prior to the crash;
- 60% of pedestrians were killed at night or during dim light conditions;
- 40% of fatally injured pedestrians had been drinking (Transport Canada).

Canadian and international studies have found that for cyclists, safe road design means including facilities that physically separate cyclists from motor vehicles that is, where traffic speeds and volumes put them at risk in mixed traffic. Evidence supports that planners and engineers should design/plan for separation of all road users: pedestrians, cyclists and motorists (Abdul Rahman Masoud, 2013). One promising design approach, especially in residential neighbourhoods, is low connectivity street networks that contain complementary mixed land use activities close enough to walk and bike rather than drive. Low connectivity street networks are associated with increased safety, and 60% fewer vehicle-vehicle collisions and vehicle-pedestrian crashes. These types of streets and community designs preclude higher-speed shortcutting traffic and therefore generate reduced average vehicle speeds and thus safer walking and biking environments. (Masoud, 2013).

Similar to international findings, Masoud notes that vehicle speeds of less than 30 km/h reduce the risk of injuries significantly. A 30 km/h zone in residential areas reduces the likelihood of injury between motorists and non-motorized users and survivability if struck (Masoud, 2013).

All road users share responsibility for safe road behaviours. However, drivers must consider and plan for unexpected and sudden movements of children and youth as these vulnerable road users learn to safely travel on streets and roadways. “It is important to foster a social environment that instils an obligation in drivers to drive in a manner that takes into account the needs of all road users including pedestrians”. (Countermeasures to Safety)

BRITISH COLUMBIA

The *British Columbia Road Safety Strategy 2015 and Beyond* endorses the Safe Systems Approach. Current provincial data indicates that adopting this approach could reduce and then eliminate 350 fatalities and approximately 2,750 serious injuries that occur every year on BC public roads. The Strategy identifies that additional focus is needed to address pedestrian safety as pedestrian fatalities and injuries have remained constant over the past decade (British Columbia Road Safety Strategy 2015 and Beyond).

One proven countermeasure to lessen deaths and injuries is reduced speeds in urban areas (Countermeasures to Improved Pedestrian Safety in Canada, 2013). “The physics of reduced

speeds mean two things; exponentially shorter stopping distances and exponentially less raw kinetic (moving) energy released in a crash. Many urban areas in BC are reducing vehicle speeds, and Vancouver Coastal Health is currently developing a toolkit for municipalities in the Greater Vancouver area to create more lowered speed safe zones. Lowered speeds provide a major safety buffer. Reduced speeds also make people want to walk and cycle and that is good for human health” (Neil Arason, 2015). The 2016 Provincial Health Officer’s special report on road safety recommended a default speed limit of 30 km/h in municipalities and on treaty lands.

PART 3: LEGISLATION AND REGULATIONS

RoadSafetyBC proposes to the government road laws and policies to make travelling safer for drivers, passengers, pedestrians, cyclists and other road users. The main legal strategy for this is the Motor Vehicle Act (MVA) which falls under the auspices of the Ministry of Public Safety and Solicitor General. The Motor Vehicle Act outlines laws that govern the operation of motor vehicles and defines the rules for motorized vehicle operators, pedestrians and cyclists.

The Ministry of Transportation and Infrastructure is responsible for many other aspects of road safety in the province, including highway design, road signs, speed limits outside municipalities, vehicle standards and traffic flow. RoadSafetyBC and Ministry of Transportation and Infrastructure consult on many issues while they share authority of the Motor Vehicle Act.

Safe driving is no accident

PART 4: BC CORONER SERVICE CASE REVIEW FINDINGS

This ten year review (2005-2014) focuses on the circumstances of 81 children and youth who died as a result of road-related pedestrian, cyclist or boarder crashes or injuries in BC.

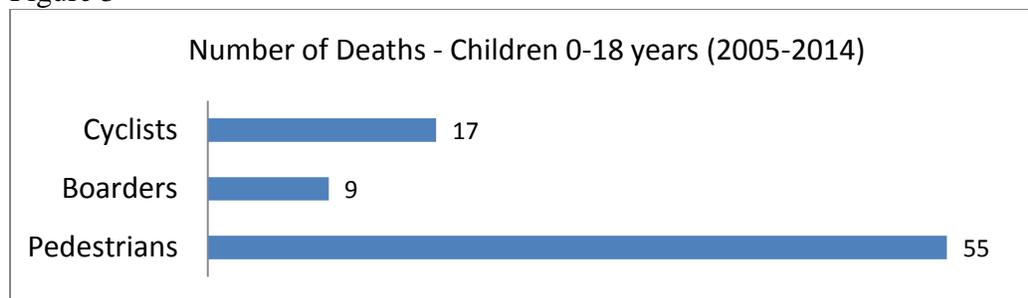
This review does not include deaths of occupants in motorized vehicles or deaths of person riding on a motor vehicle. All deaths were classified as Accidental Deaths.

A. THE YOUNG PERSON

During the time period 2005-2014 there were 81 children and youth (age 0 to 18 years) who died of injuries when standing, walking, cycling or boarding on a sidewalk, roadway or in a parking lot. In almost all of the deaths (95%, n=77) the child or youth was in a collision with a motorized vehicle. The remaining four deaths (5%) were the result of severe head injuries associated to a fall from a bike or a board while travelling on a roadway.

More than two thirds (68%, n=55) of the children and youth who died were pedestrians, while 21 percent (n= 17) were cyclists, and 11 percent (n= 9) were boarders (see Figure 3).

Figure 3



Source: BC Coroner Service

AGE

Almost half of the children who died were youth age 15-18 years (n=39). This age group had the most fatalities in all road users groups (pedestrian, boarders, and cyclists) and over twice the fatality rate when compared to each of the other child age groups (1.8 deaths per 100,000 population) (see Figure 4). It is unknown whether this difference could be because of more exposure (i.e., more walking, cycling or boarding) in this age group. Of the youth, over two thirds (67%, n=26) were pedestrians, while 18% (n=7) were cyclists, and 15% (n=6) were boarders.

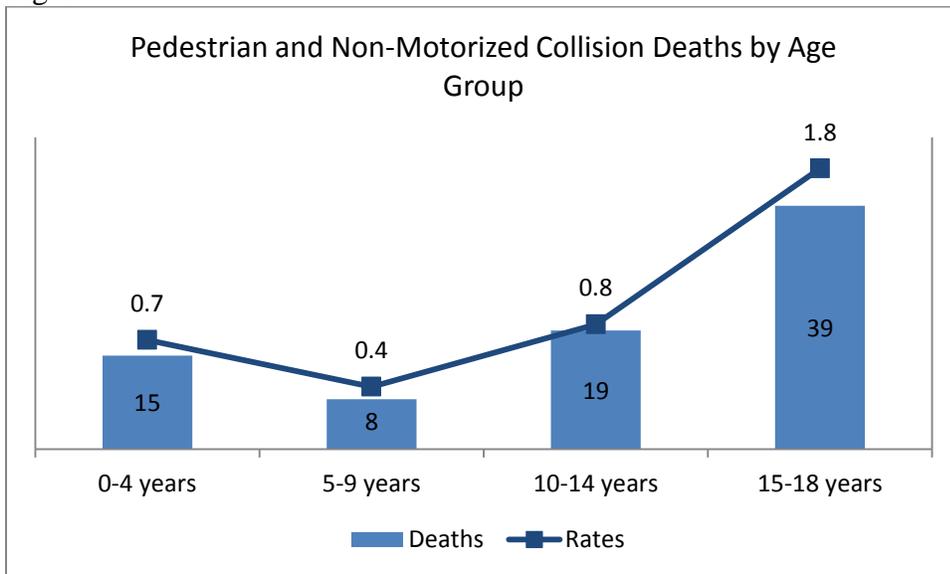
Children age 10-14 years comprised 23 percent (n=19) of the deaths. Over half (63%, n=12) were pedestrians, one third (32%, n=6) were cyclists, and 5% (n=1) were boarders.

Children age 5-9 years comprised 10 percent (n=8) of the deaths; most (75%, n=6) were pedestrians and two were cyclists.

There were a total of 15 deaths of preschool age children (0-4 year olds). Almost all (80%, n=12) of the preschool age children were pedestrians. Some were struck by a vehicle while standing on

a sidewalk or grassy roadside, or while walking or cycling along a roadway with an adult. Seven toddlers were fatally injured by vehicles reversing or moving forward in a driveway.

Figure 4

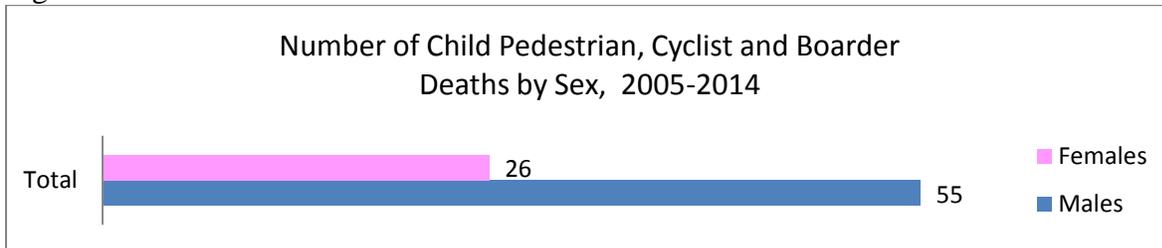


Source: BC Coroners Service

SEX

Twice as many males (68%, n=55) were killed than females (32%, n=26) (see Figure 5).

Figure 5



Source: BC Coroners Service

It is unknown whether this difference could be because of greater exposure (i.e., more walking, cycling or boarding) in males than females, though this finding is consistent with the literature which shows higher child pedestrian and cyclist injury and fatality rates for males, even after exposure is taken into account. In general, it should be noted that male children have higher injury and fatality rates overall.

This review included an analysis of a child’s Aboriginal identity and involvement with child welfare. These groups are not mutually exclusive as some of the children and youth were identified as both.

ABORIGINAL CHILDREN AND YOUTH

In this review, 17 percent (n=14) of the total fatalities were identified as Aboriginal children and youth. Of these deaths, almost all (n=13) were pedestrians. Over half of the deaths of Aboriginal

children were youth age 15-18 years. The fatality proportion is twice what would be expected based on the proportion of BC children who are Aboriginal: 8% (2006 Census).

One Canadian study conducted in Alberta indicated that Aboriginal children are over-represented in pediatric trauma fatalities, and that pedestrian related deaths were over-represented in Aboriginal children (Ioana Bratu, D Lowe and L Phillips, 2013). This is consistent with other research findings for injuries that indicate that “First Nations children in Western Canada were reported to have injury hospitalization rates 1.2 to 2.9 times higher than those of the general population” (Statistics Canada, 2012).

CHILD WELFARE

Over 34 percent (n=28) of the children and youth who died had involvement within 12 months of their deaths with the Ministry of Children and Families (MCFD). The overrepresentation of children and youth involved with child welfare is consistent with research findings in other jurisdictions. Much of the research focused on child welfare and injury finds that children and youth involved with child welfare are from homes that pose a higher risk of injury, compared to the general population.

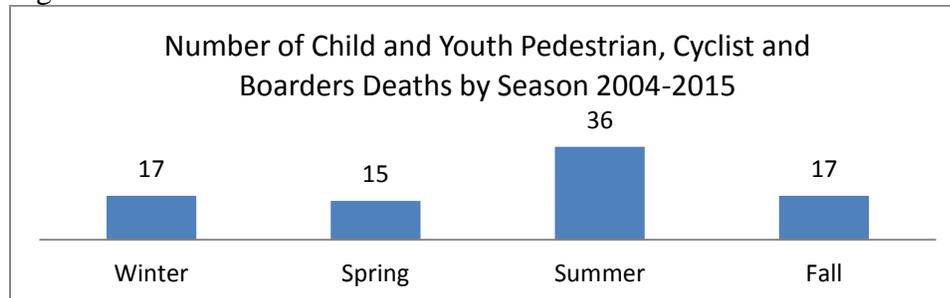
“Drive like your KIDS live here”

B. WHEN

TIME OF YEAR

In this review, more pedestrian, boarder and cycling deaths occurred during the summer months (see Figure 6), perhaps because involvement in these activities, especially cycling and boarding, is increased then. ICBC data for the whole population differs, indicating that crashes involving pedestrians were more often in the fall and winter months.

Figure 6

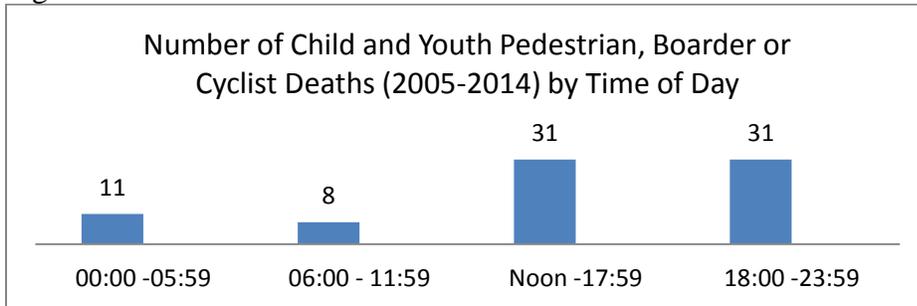


Source: BC Coroners Service

TIME OF DAY

In this review, over three quarters (76%, n=62) of the injuries causing death occurred between noon and midnight. An equal number of deaths (n=31) occurred between noon and 6 pm and 6 pm and midnight (see Figure 7).

Figure 7



Source: BC Coroners Service

Our findings are consistent with the literature for time of day. A series of reports based on Ontario fatality data found that the largest proportion of pedestrian collision deaths occurred between 3 p.m. and 10 p.m. The Insurance Corporation of BC (ICBC) identified common risk factors in motor vehicle crashes involving pedestrians. ICBC data indicated that:

- Crashes involving pedestrians more often occur between 3 and 6 pm.

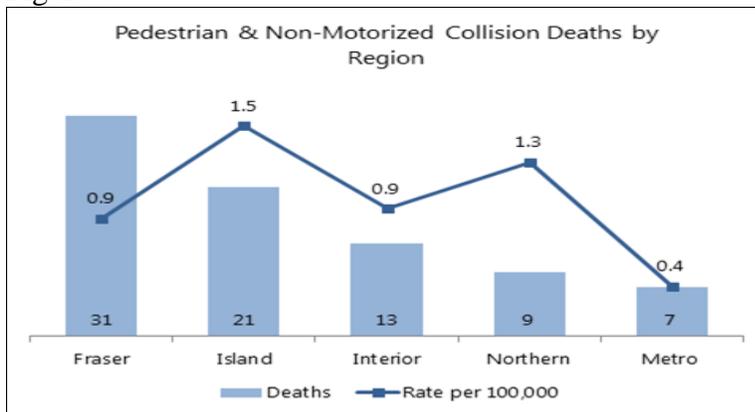
C. WHERE

For the 81 deaths reviewed, the region of the province, urban versus rural location, and the location on the roadway is described below.

CORONER REGION

The Fraser and Island regions had the highest total number of child deaths for pedestrian, cyclists and boarders. However, both Island and Northern regions had higher rates per 100,000 population. The Metro Coroner Region had the fewest deaths and the lowest fatality rate per 100,000 population (See Figure 8).

Figure 8

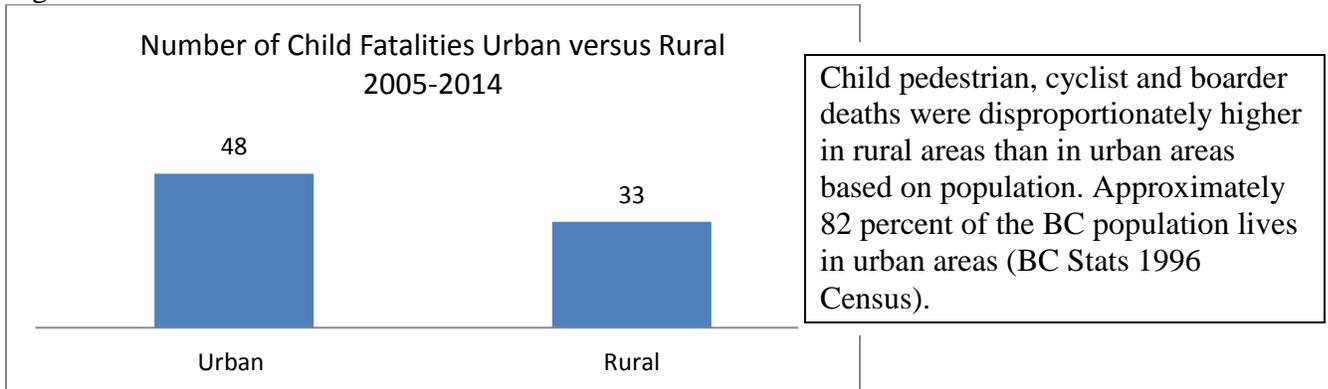


Source: BC Coroner Service

URBAN VERSUS RURAL

There were more fatalities in urban areas than rural areas across all age groups (see Figure 9). However, the numbers should be interpreted with caution. Categorization of urban or rural was based on information contained within a variety of documents including traffic reports, coroner reports and case notes. Different agencies may use different definitions for these terms. Currently there are no provincially established definitions for urban and rural.

Figure 9



Source: BC Coroners Service

D. HOW DID THE CRASH OCCUR

In this review, a combination of factors led to the fatalities. These factors included roadway design, speed, and road user behaviours. In some crashes a vulnerable road user entered the path of a vehicle abruptly or unexpectedly. Often they were obscured from a driver's vision either by visual obstructions, their lack of physical size or could not be seen due to low lighting and/or dark non-reflective clothing. In other crashes, the driver's action caused the collision.

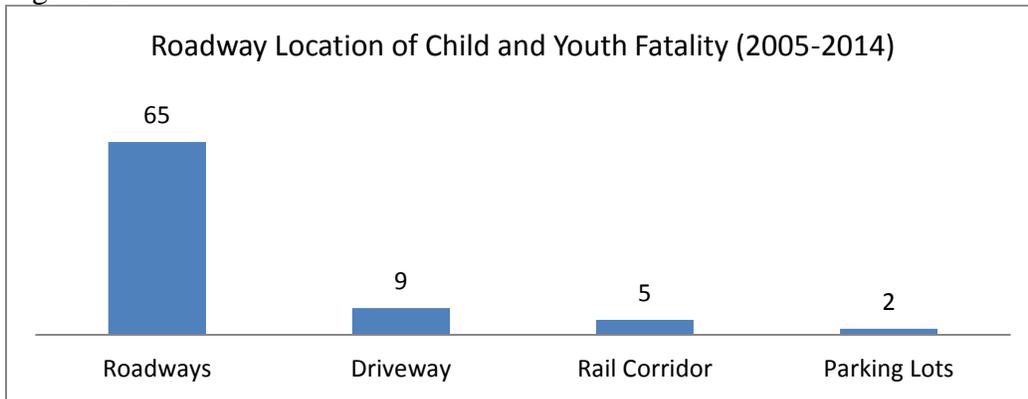
E. SAFE SYSTEM APPROACH & FACTORS NOTED IN THE CRASH

The following section applies the principles of a Safe System Approach to the crash analysis and considers the roadway, speed, and vehicle design as well as road user behaviours. Information was retrieved from police traffic analyst reports, coroner notes, scene photos and interviews with witnesses.

ROADWAY OR TRANSPORTATION CORRIDOR

The type of roadway or transportation corridor was indicated for all 81 fatalities. In this review, 80 percent (n=65) of fatalities occurred on roadways, 11 percent (n=9) on private driveways, 2 percent (n=2) in parking lots, and 6 percent (n=5) on railway corridors (see Figure 10).

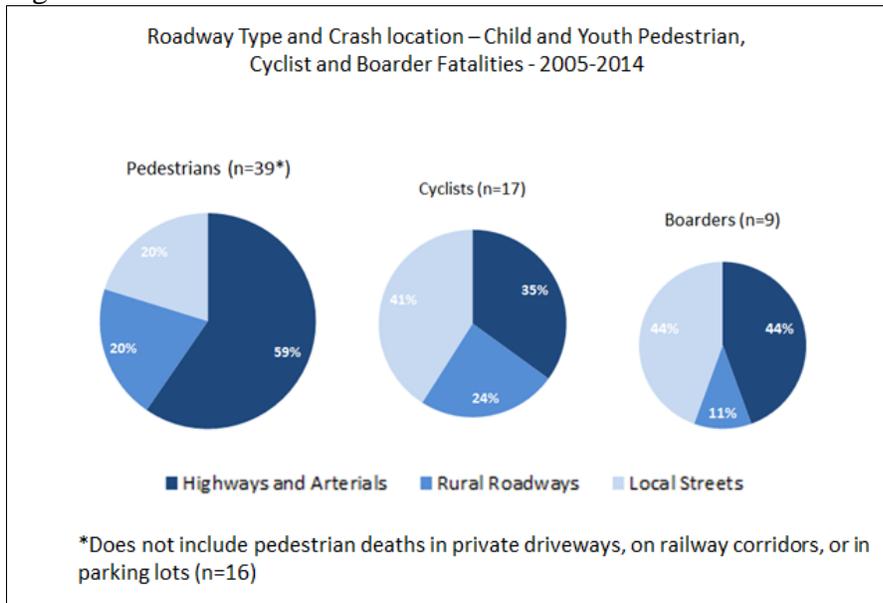
Figure 10



Roadway fatalities occurred on highways or arterials (n=33), local urban streets or laneways (n=19), and rural roadways (n=13). For all pedestrian, cyclists and boarders, the most common roadway crash site was highways or arterial routes (41%, n=33), then urban local streets or laneways (23%, n=19), and rural roadways (16%, n=13), private driveways (11%, n=9) and other locations³ (9%, n= 7) (see Figure 10).

- Crashes on highways or arterial routes resulted in 59% of pedestrian fatalities, 35% of all cyclist fatalities and 44% of all boarder fatalities;
- Crashes on rural roadways resulted in 20% of pedestrian fatalities, 24% of all cyclist fatalities and 11% of all boarder fatalities;
- Crashes on local streets resulted in 20% of pedestrian fatalities, 41% of all cyclist fatalities and 44% of all boarder fatalities (see Figure 11).

Figure 11



Source: BC Coroners Service

³ Railway corridors and parking lots

Road Design

In this review, 14 of the 65 roadway crashes occurred at intersections or designated crosswalks. Nine of these had signal lights including pedestrian signals. Five intersections were not controlled by lights, and were either a 4 way stop, 2-way stops or a T intersection.

Another 51 roadway crashes occurred at non-intersection locations. Of these, 36 deaths occurred when the child or youth entered or attempted to cross a roadway. For some of these fatalities the reason for crossing in an unmarked location was indicated. Distance between designated crossings was noted in four events. Some crossed at the unmarked location because a marked crosswalk was perceived to be too far away, or this was the shortest route to the destination.

Of the remaining roadway crashes, 13 occurred on the roadway itself, and two occurred on a sidewalk, or beyond a roadway shoulder.

Of the 17 cyclist crashes, five were on urban local streets or laneways, six were on urban arterials or highways, and six were on rural roads. Only two of the roadways had bike-specific infrastructure; they were painted bike lanes (i.e., not physically separated from the roadway) on 4- and 5-lane arterial streets. On four streets (all without bicycling infrastructure), the children were riding on the sidewalk either at the time of the collision (n=1) or immediately prior to entering an intersection (n=3). Sidewalk riding is a way for child cyclists to ride away from motor vehicle traffic, though it has not been shown to reduce risk for cyclists (whereas physically separated bike lanes do).

Cyclists on sidewalks face a far greater collision risk than cyclists on the roadway. Sidewalk cyclists surprise motorists and pedestrians by appearing from unexpected directions". (ICBC)

Most of the cycling crashes occurred at locations with little or no grade (n=10), several were on downhill grades (n=6), and one was on an uphill grade. Two cyclists crashed after losing control on a downhill grade with no motor vehicle involved.

Of the nine boarder crashes, seven occurred on two-lane roadways; one third of these roadways had paved shoulders and one had a designated bike lane. Two crashes happened on four-lane roadways. Three boarders were struck while in a travel lane at night, and four after entering a roadway without yielding. In two crashes no vehicle was involved, the boarder fell striking their head on the roadway.

Road Conditions

For 70% of the 67 crashes occurring on public roads or parking lots, the road was bare, dry and/or in good condition (n=47). In 13% of crashes the road was wet (n=8) or snow covered

(n=1). Road conditions were not reported in 17% (n=11) of crashes; however other factors were identified as contributing to the crash (n=10).

Lighting

In this review 46% (n=37) of crashes occurred during low light conditions (dusk or nighttime); 17 crashes in rural, and 20 crashes in urban locations. In these 37 crashes, the presence or absence of artificial street lighting was indicated in 28 cases, as follows:

- Six urban crash sites were noted as being “well-lit” (four intersections or cross-walks)
- 14 crash sites had street lights present, providing low or ambient lighting conditions, and
- Eight locations had no artificial lighting. The areas with “no lighting” were along rural roads (n=7) and highways (n=1).

Darkness or low lighting may impair a vulnerable road user’s ability to determine safe gaps in traffic, or the speed of the oncoming traffic.

SPEED

Most (n=48) of the fatalities occurred in urban settings where the default speed limit is 50 km/h; the rest were in rural locations where the default speed limit is 80 km/h. Posted speed limits may differ from the default. Speed limits and vehicle speed were assessed in 63 crashes⁴.

In this review, 34 roadways had a posted speed of 50 km/h, 16 roadways had posted speeds of 60-70 km/h, and seven roadways had speed limits of 80-100 km/h. There were four (laneway, street, and parking lot) with a posted limit of 25 km/h or less and two roadways with a posted limit of 30 km/h. Crash analysis indicated that the driver was exceeding the posted speed limit in 24% (n=15) of fatalities. For these, the estimated driver speeds were between 5 km and 40 kilometers above the posted limit. The speed limit was exceeded in 10 crashes where the posted speed was 50 km/h.

Cyclist speed was noted in two cases: a single cyclist who crashed travelling downhill on a highway was estimated at 55 km/h. and another gained significant speed on a downhill roadway. The lack of functional bike brakes was noted as a factor in two crashes.

VEHICLES

In this review, the vehicle type was known for all but one of the 72 collisions involving a motor vehicle: 82% (n=59) were passenger vehicles (cars, SUVs, vans, pickup trucks), 14% (n=10) were commercial vehicles (tractor/trailers, commercial vans, dump truck, tow truck, bus), 3% (n=2) were motorcycles. Whether any of these vehicles had sideguards or underrun protection is unknown. Commercial vehicles appear to be over-represented in this child and youth fatalities; ICBC data indicate that heavy vehicles are involved in 4.6% of BC crashes, versus 14% of these deaths (ICBC, 2015).

⁴ Speed limits were not relevant for crashes in private driveways, on railway lines, in some parking lots, or for crashes not involving a motor vehicle.

In our review, visual obstructions related to vehicle design led to the deaths of nine children who died when struck by a vehicle either reversing or moving forward in a driveway or parking lot. Seven of the nine children (77%) who died were toddlers who had exited the home or a safe area unnoticed, and were unseen behind the vehicle or to the passenger side of the vehicle. None of the vehicles had detection systems or back up cameras. Vehicle design (high tailgates, truck canopies, vehicle height) resulted in the child being obstructed from driver’s view in side or rear view mirrors.

As well, possible visual obstruction was noted in some crashes involving right hand turns in intersections. For two crashes, the truck cab height, tall window sills and B pillars may have created a partial view obstruction for drivers when performing a shoulder check.

ROAD USERS

ICBC data indicates that top contributing factors for pedestrian collisions includes: driver distraction; driver failure to yield the right of way, and weather (ICBC, 2015).

DRIVER BEHAVIOUR

All road users must have skills to judge when, where and how to safely travel along or across a roadway. There is a need to be familiar with traffic safety rules, detect other road users and adjacent activities, assess speeds, judge safe gaps in traffic, and turn safely. Drivers must be aware of locations where vulnerable road users may be (especially at intersections, along local streets, and along roadways without sidewalks, shoulders, or bike lanes) and drive for those conditions, including potentially driving at speeds slower than speed limits allow.

This review identified that driver error or behaviour was a factor in 28 (39%, n=72) of the deaths that involved a collision with a motor vehicle.

These errors included: exceeding the posted speed limit (15), intoxication (4), distraction due to either fatigue or inattention (3) or failure to yield or stop (2) (see Table 1). In addition, there were 7 incidents where the driver left the scene of the crash. Charges were known to be filed against 14 drivers.

Table 1

Driver-Related Factors in Fatalities	(n=72)
Exceeding the posted speed limit	21%
Intoxication	6%
Distraction (inattention or fatigue, but not texting or use of handheld devices)	4%
Failure to yield or stop	3%
Medical event	1%

Source: BC Coroners Service

VULNERABLE ROAD USER

In this review several common themes emerged as related factors in child and youth road user fatalities.

DEVELOPMENTAL SKILLS, KNOWLEDGE AND PERCEPTIONS

Like drivers, vulnerable road users must develop the skills to judge when, where and how to safely cross or travel along a roadway. There is a need to be familiar with traffic safety rules, detect vehicles, assess vehicle speed, judge safe gaps in traffic, and determine and use a safe crossing area. For children and youth, many of these skills are developing, and may be compromised by risk-taking behaviours. Knowledge about traffic and safety is usually taught by family members and is affected by personal experience and opportunities to practice. Our review identified a number of scenarios that suggest gaps in knowledge of the children and youth who died.

- Several children were struck by vehicles when they crossed a roadway after exiting a transit bus. A survivor indicated that they thought traffic would stop to allow them to cross, just as with a school bus.
- Many of the cyclists (n=8) were travelling in the wrong direction on the street (against traffic) suggesting they were using “pedestrian” rules and didn’t know cyclist rules. This may have had an impact on some crashes, especially where they entered an intersection from the “wrong” side, opposite to motor vehicle traffic flow.
- Three cyclists were riding on sidewalks, typically not allowed under the Motor Vehicle Act.
- For twelve fatalities, the child or youth was crossing a roadway with someone or in a group. The child may have followed the actions of others or relied on another’s judgment to determine if it was safe to cross.

VISIBILITY

It is especially important for all vulnerable road users to be visible at night, dusk or dawn, or in difficult weather conditions such as rain or fog. In this review, 46% (n=37) of the vulnerable road users were crossing or travelling on a roadway or railway line during darkness. For example, eight boarders, cyclists or pedestrians were struck from behind while riding or walking in the travel portion of the roadway at night, and 20 were struck while crossing a roadway during darkness. Dark, non-reflective clothing was noted in almost half (46%, n=17) of the fatalities which occurred during low light conditions. Whether the cyclists who died had working bike lights was only recorded in 2 cases: one had lights, the other did not.

Low visibility may interfere with a driver’s ability to see a vulnerable road user and react in time to avoid a collision.

Pedestrians, cyclists and boarders cannot rely on the assumption that drivers see them. Wearing light colored and reflective clothing may increase visibility. The use of daytime running lights for cyclists also improves visibility and has been shown to reduce collision risk.



DISTRACTION

In this review, pedestrian, boarder, or cyclist distraction rarely played a role in the collisions. Only 7% of the cases noted use of a cell phone, earbuds or texting at the time of the crash.

IMPAIRMENT- TOXICOLOGY RESULTS FOR PEDESTRIANS, CYCLISTS AND BOARDERS

Toxicology testing was completed for 39 of the children and youth who died. Coroners request toxicology where the crash investigation indicates relevance to cause of death. The majority of tests (n=36) were performed on older children and youth (29 toxicology tests were completed for 15-18 year olds, and 7 toxicology tests were completed for 10-14 year olds).

Toxicology results were positive in 27 of all tests performed for alcohol and/or marijuana use.

- 23 of 29 (79%) 15-18 year olds who had toxicology completed tested positive for either alcohol or marijuana.
- 4 of 7 (57%) 10-14 year olds who had toxicology completed tested positive for either alcohol or marijuana.



Half of all pedestrian crash deaths involve alcohol.

Source: NHTSA 2012

Data show that use of alcohol increases pedestrian and cyclist risk of being in a collision.

LACK OF HELMET USE

This review found that 80% (n=26) of boarders and cyclists who died were not wearing a helmet. For some of these individuals, a helmet would not have prevented the death. However for 15 youth not wearing a helmet, the Coroner findings were that a helmet may have been protective (see Table 2).

Helmet use is mandated by law for bicyclists in BC and is recommended for boarders.

Table 2

	Helmet Use	No Helmet Use	Unknown
Boarders	0	8	1
Cyclists	3	13	1
Total	3	21	2

Evidence indicates that “children are at increased risk for traumatic brain injuries due to falls and blunt head trauma, two common mechanisms of bicycle-related injuries” (Campbell-Furtick, M., Phillips, JL, Overton TL, Nolen HP, Gandhi RR, et al. 2016). “Proper use of bicycle helmets has been found to reduce, not only the risk of head, brain, and facial injuries, but also death” (Campbell-Furtick, et al. 2016). Helmet use has been estimated to reduce the odds of head injury by 50 percent (Insurance Institute for Highway Safety, Highway Loss Data Institute, 2016).

Table 3 below summarizes the factors identified in vulnerable road user deaths. These factors are not mutually exclusive. In some fatalities more than one contributory factor was noted.

Table 3: Related Factors in Fatalities – (Pedestrian, Boarder, Cyclist)	(n=81)
Not wearing a helmet (Cyclist/Boarder (n=26*))	76%*
On roadway/railway line (standing, walking, laying, working, playing)	48%
Improper crossing of roadway or intersection	42%
Toxicology positive for alcohol or drugs (Pedestrian, Cyclist, Boarder)	32%
Darting or running into roads	25%
Not visible (dark clothing, no lighting, obstructed view etc.)	23%
Pedestrian inattention/distraction (talking, earbuds, texting etc.)	7%

Source: BC Coroners Service

SPECIALIZED INVESTIGATIONS

When a road collision occurs, a number of agencies may complete an investigation as part of their respective mandate. In these road related deaths, the BC Coroners Service and police completed investigations. Depending on the circumstances, other agencies may conduct an investigation (e.g., insurance companies, Ministry of Transportation and Infrastructure).

In several of the fatalities in this review, the coroner’s report noted that actions were taken by other agencies following a specialized investigation. Actions included: the installation of a stop sign, brush clearing, moving a bus stop and installation of a pedestrian crosswalk, installation of a barrier in the median to discourage pedestrians from crossing at the crash location, adding street lights along a roadway, improved signage or installation of a painted bike lane.

Following a coroner’s investigation, recommendations may be put forward to the Chief Coroner for consideration. These recommendations address systemic issues with policies and practices and are intended to prevent future deaths in similar circumstances. Of the 81 cases reviewed, there was one with a Coroner’s Recommendation related to a cyclist death that the Superintendents of all school districts in British Columbia receive a copy of the Coroner’s Report for informational purposes , and one [Inquest](#) with six recommendations related to the death of a pedestrian.

PART 5: RECOMMENDATIONS

The overall findings of this review indicate that pedestrian, cyclist and boarder deaths are preventable. These deaths could be reduced or prevented through implementing a range of safe system actions including safe road system design and infrastructure, road safety education and awareness, including encouraging the use of helmets for cyclists and boarders, and lobbying for vehicle sensors and/or back up cameras on all new vehicles in Canada.

During this review the panel identified a lack of available data about events in general. Where data exists, there are differences in data collection and reporting requirements. As well, the review found a need for additional provincial training for vulnerable road users related to awareness, prevention and safety. The panel identified three key activities to reduce road-related pedestrian deaths.

The recommendations arising from the death review panel were developed in a manner that was:

- Collaborative;
- Attributable to the deaths being reviewed;
- Focused on identifying opportunities for improving public safety and prevention of future deaths;
- Targeted to specific parties;
- Realistically and reasonably implementable; and
- Measurable.

Infrastructure and Road System Design

Roadway design and intersection signal controls must be part of a safe system design for vulnerable road users. To reduce and prevent pedestrian, cyclist and boarder injuries and death, road design should separate vulnerable road users from vehicles through space or time and reduce or eliminate concurrent movement of vehicles and people. For cyclists, boarders, and pedestrians these include road design strategies such as sidewalks, separated bike lanes, crosswalks, median refuge islands, barriers, overpasses and underpasses and adjusting traffic signals to create an exclusive non-motorized user phase, giving pedestrians, cyclists and boarders a head start before vehicles get a green light.

Recommendation 1: Adoption of Safe Road System Design and Infrastructure

- By December 2017, the Ministry of Public Safety and Solicitor General and Ministry of Transportation and Infrastructure (MOTI) will work collaboratively to expand crosswalk safety through the use of: dedicated pedestrian phases at traffic lights, leading pedestrian intervals at high incident locations, and also encourage municipalities to adopt these practices.
- By July 2016, the Ministry of Transportation and Infrastructure will require applicants accessing cycling infrastructure funding to meet best cycling infrastructure design standards.

- In a previous 2015 death review panel on young drivers, the BC Coroner Service made a recommendation that the Ministry of Transportation and Infrastructure consult with road safety, injury prevention and public health agencies to ensure that road safety and injury prevention are the paramount criteria used in the course of monitoring and reviewing existing speed limits and setting new speed limits on BC provincial road system. This recommendation should extend to all remaining road systems in BC, including residential streets.

Awareness and Education

All road users must develop the skills to judge when, where and how to safely cross or travel along a roadway. There is a need to detect vehicles, use road safe behaviours if cycling, and determine and use a safe crossing area. For children and youth these learned skills may be compromised by traffic flow and roadway design within their school's neighborhood.

Recommendation 2: Road Safety Education and Awareness

- The Ministry of Education and School Districts will solicit the views of students about how they get to school, road safety and what would make students feel safer when biking or walking.
- The Ministry of Education and School Districts will work with students to increase awareness and knowledge of road safety when travelling on foot, on boards and by bike. This could be supported through 'road safety theme weeks', road safe campaigns, or curriculum, and should include the topics of general road safety, the importance of being seen and bike helmet use.

Federal Legislation

Lack of visibility is a key factor for many child deaths. A child's small stature in relation to vehicle height means that a child may not be seen by side or rear view mirrors. Vehicle blind spots compromise drivers' ability to see and avoid collisions.

Recommendation 3: Enact Vehicle Safety Legislation

- By 2018, Transport Canada will enact regulations that require all new vehicles in Canada to have rear-facing technology to alert drivers to the presence of pedestrians when backing up.

PART 9: GLOSSARY AND REFERENCES

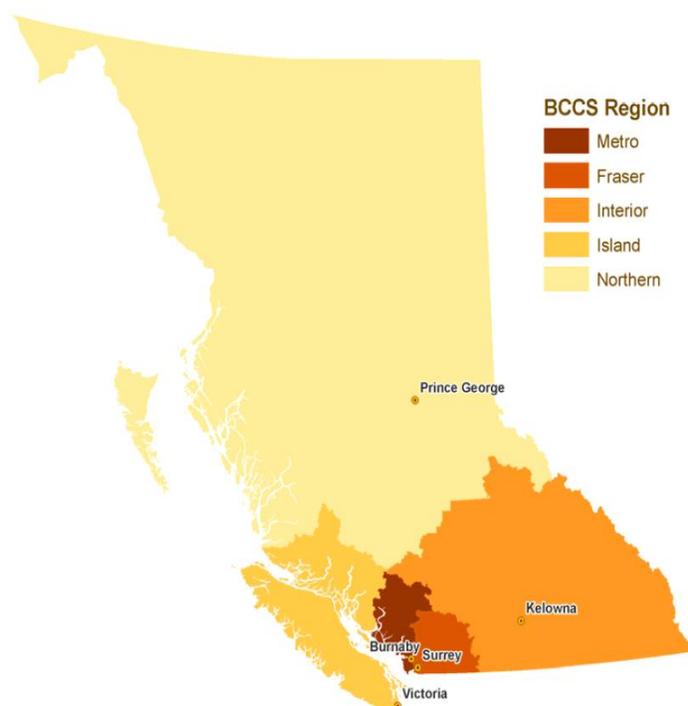
GLOSSARY

Aboriginal: Reference used to encompass First Nations (status and non-status), Metis and Inuit people in Canada.

Aggregate: Presentation of individual findings as a collective sum.

First Nations: Status and non-status “Indian” peoples in Canada. An individual recognized by the federal government as being registered under the Indian Act is referred to as a Registered Indian (commonly referred to as a Status Indian).

APPENDIX 1: BC CORONERS SERVICE REGIONS



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