

Canadian Multi-Disciplinary Collision Investigations



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Canada 

Overview

- ▶ Canadian Context
- ▶ Overview of Canada's MDCI Team
- ▶ Investigation Process
- ▶ Crash Investigation Examples
- ▶ MDCI Summary Approach & Objectives
- ▶ Path Forward



Canadian Road Safety Jurisdictions

A shared responsibility



FEDERAL AREAS OF RESPONSIBILITY⁵

Transport Canada:

- > Setting and enforcing compliance with safety standards for manufactured and imported vehicles (including the import of trial vehicles) as well as motor vehicle equipment (tires and child car seats);
- > Investigating and managing the recall and remedy of non-compliances and safety-related motor vehicle defects;
- > Motor vehicle safety research; and
- > Public education on motor vehicle safety issues.

Innovation, Science and Economic Development Canada:

- > Setting and enforcing compliance with technical standards and licensing requirements related to wireless technologies integrated in vehicles and roadside infrastructure (for trials involving the testing of connected vehicle technology).



PROVINCIAL/ TERRITORIAL AREAS OF RESPONSIBILITY

- > Driver Licensing;
- > Vehicle Registration;
- > Enacting and enforcing traffic laws and regulations (including trials);
- > Conducting safety inspections;
- > Regulating motor vehicle insurance and liability;
- > Public education on motor vehicle safety issues;
- > Adapting infrastructure to support AV deployment.



MUNICIPAL AREAS OF RESPONSIBILITY⁶

- > Enacting and enforcing by-laws;
- > Enforcing traffic laws and regulations;
- > Advocating for and accommodating testing;
- > Adapting infrastructure to support AV deployment;
- > Managing passenger transportation (including public transit and taxi cabs);
- > Parking;
- > Traffic control; and
- > Public education on motor vehicle safety issues.

Canadian Road Safety Authorities

Police

- ▶ Canadian police forces are responsible for investigating all road traffic collisions
- ▶ Each province or territory set their own reporting and investigation legislation

Transportation Safety Board (TSB)

- ▶ Mandate includes air, marine, rail and pipeline incidents
- ▶ Investigates incidents involving the road/rail interface
- ▶ Can make recommendations in relation to road vehicles as well as rail

Transport Canada (TC)

- ▶ Establishes federal vehicle standards and regulations as well as certain operational requirements for federally regulated motor carrier and drivers
- ▶ Investigates road incidents / potential vehicle safety equipment issues

Canadian Motor Vehicle Safety Act

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Transport Canada operates with mandates from:

The Canadian Motor Vehicle Safety Act (MVSA) and Motor Vehicle Transport Act (MVTA)

- ❖ Allows TC to propose, apply and enforce national safety standards
- ❖ MVSA Section 15 provides the collision investigator access to the vehicle
- ❖ MVSA Section 8 provides the means to retrieve/analyze information recorded by the vehicle
- ❖ Pursuant to MVSA
 - ❖ Canada Motor Vehicle Safety Standards (CMVSS)
 - ❖ Motor Vehicle Safety Regulations (MVSRs)

Certification Regime

The National Safety Mark (NSM) is used to indicate the vehicle compliance with the MVSA

- ❖ Certification is the responsibility of the manufacturer of the vehicle (Self-Certification)
- ❖ The compliance label is affixed to vehicles to indicate compliance
- ❖ Transport Canada conducts oversight and compliance activities



MDCI Mandate

Conduct Real-World Crash Investigations to:

- ▶ Examine the effectiveness of Canadian Motor Vehicle Safety Standards
- ▶ Identify the need for further regulatory action under the MVS Act
- ▶ Advance the development of road safety policy and regulations
- ▶ Collect real-time information on high profile crashes
- ▶ Obtain real-world crash data to validate laboratory results
- ▶ Support development of future regulatory initiatives

MDCI Team Evolution

Road Safety involves many disciplines:

- Road design - civil engineering
- Vehicle design - mech/elec engineering
- Behavioural factors - psychology
- Occupant injury/kinematics - medicine

Transport Canada MDCI Team History:

1969: Road and Motor Vehicle Traffic Safety Branch

- Develop and enforce safety standards
- Identification of safety defects

1970: Motor Vehicle Safety Act (MVSA) enabled = **Authority to Enforce Standards**

- Team system vision was to have 1-Team per Province

1974: 10 Teams in Operation

- All 10-Teams gathered in Ottawa for the first Canadian Road Safety meeting

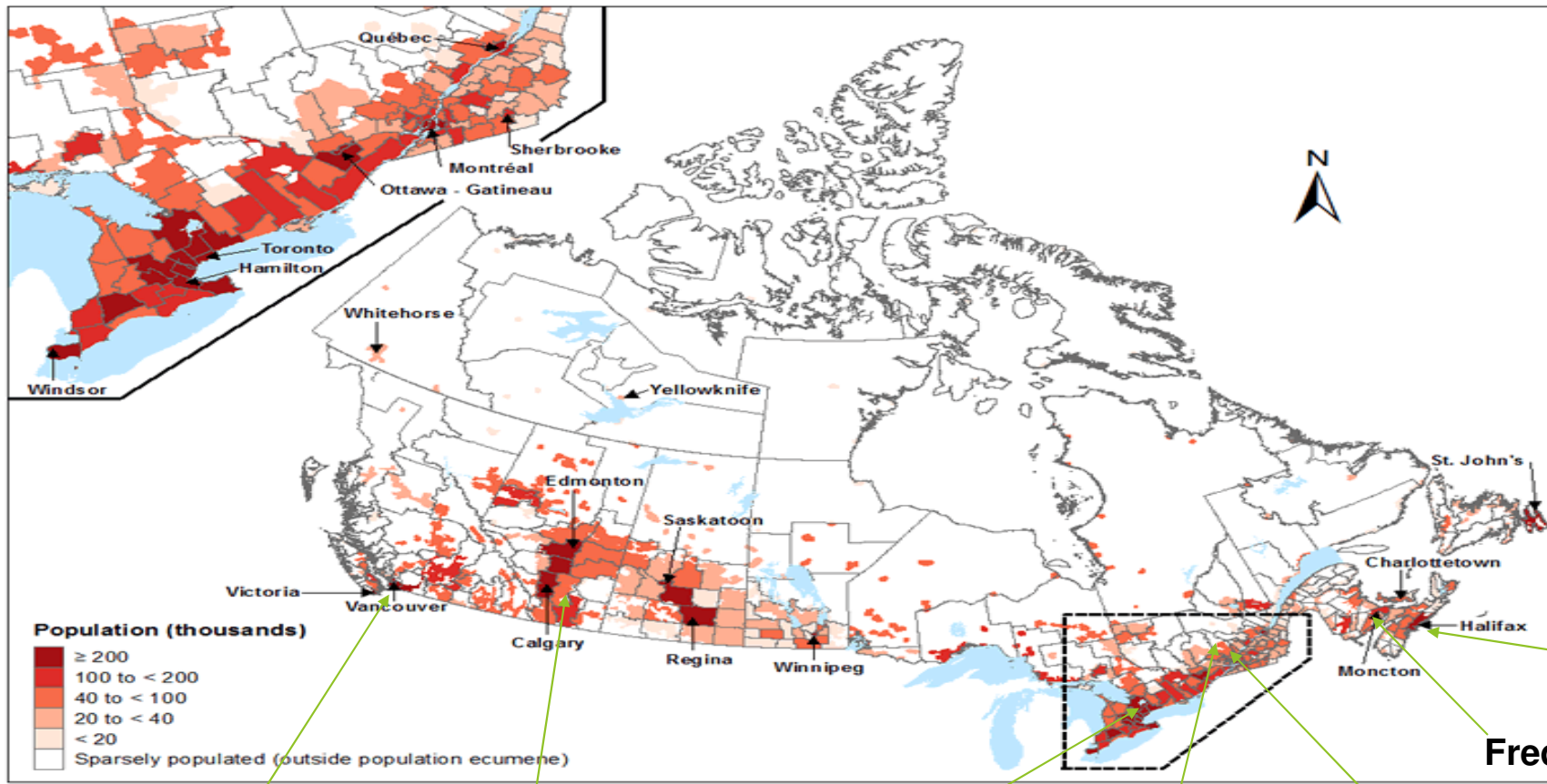
1990s: 9 Teams in Operation

- NS, NB, QC, 2-ON, SK, AB, BC and TC-HQ

2000s: 7 Teams in Operation



Today's MDCI Team



Vancouver BC

Calgary AB

Toronto ON

**Transport Canada
Ottawa ON**

Montréal QC

Halifax NS

Fredericton NB

Road Safety Partners

Provincial and Municipal Police Services and Royal Canadian Mounted Police (RCMP)

- First responders to vehicle collisions such as municipal or provincial police or the RCMP, collect vital information about the scene, victims and vehicles involved.
- Transport Canada assists the police with:
 - i) new technologies such as obtaining telemetry data and camera images
 - ii) component failure identification such as airbag non deployments and seatbelt failures

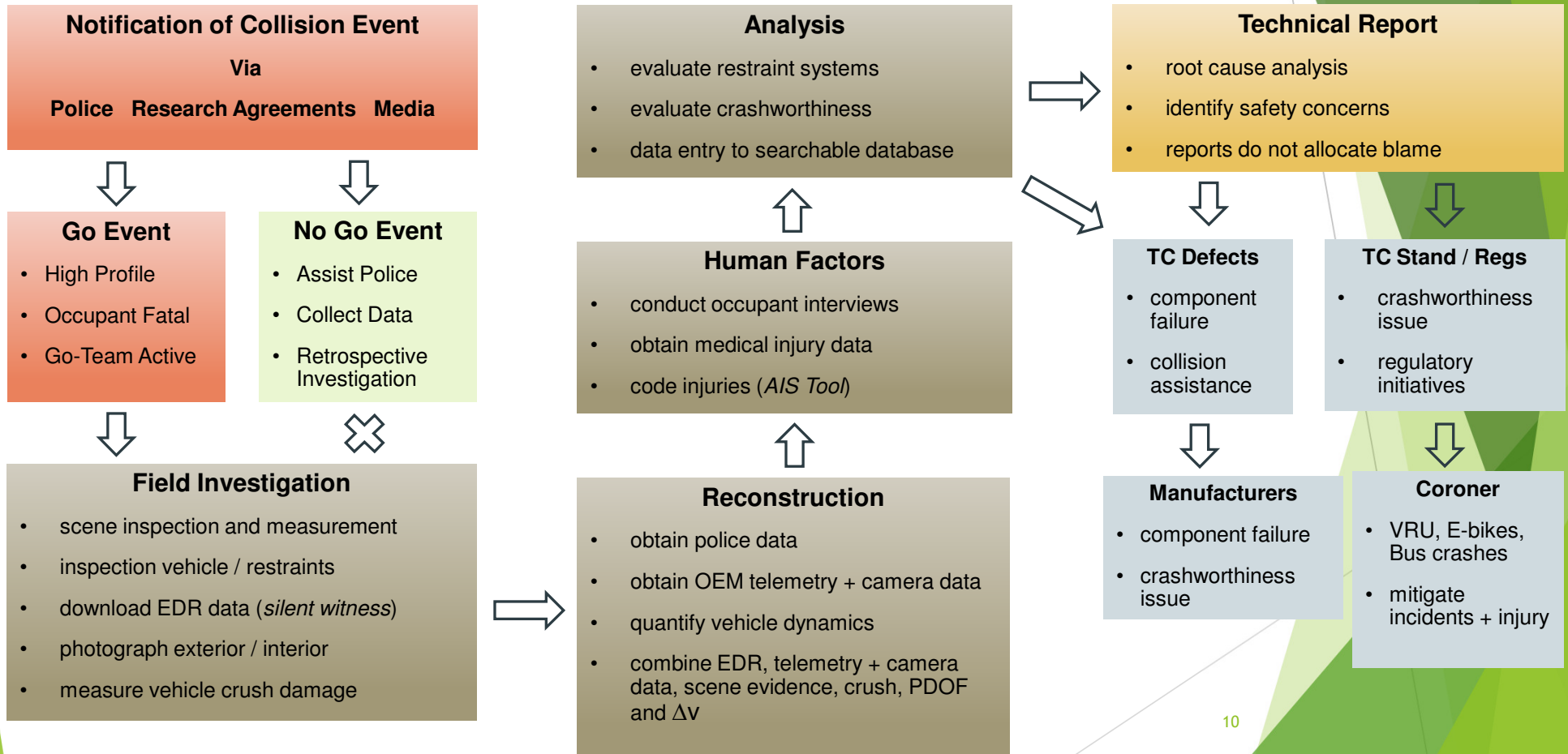
Health Authorities, Medical Facilities and Regional Coroners

- The collection of medical data and record of injuries sustained in collision analysis allows investigators to gain an understanding of the performance of safety devices, such as seat belts and airbags, during a collision.
- Information regarding the severity, location and type of injury assists in evaluating the effectiveness of these features in vehicles.

Provincial/Territorial/Municipal Ministries of Transport

- Transport Canada also works with provincial/territorial/municipal transport ministries as needed to collect statistical data on motor vehicle collisions
- Specific information on commercial vehicle collisions and incidents that may inform safety standards and/or regulations.

Investigative Process



Data Retrieval Event Data Recorder

- Pre-Crash Data -

- 5-second window
- Vehicle speed (km/h)
- Engine RPM
- Throttle position (0-100%)
- Brake switch (on/off)
- Steering input
- ABS - Traction Control
- Cruise control
- Drive Gear select
- Long/Lat accelerations (g)
- Yaw rate (deg/sec)



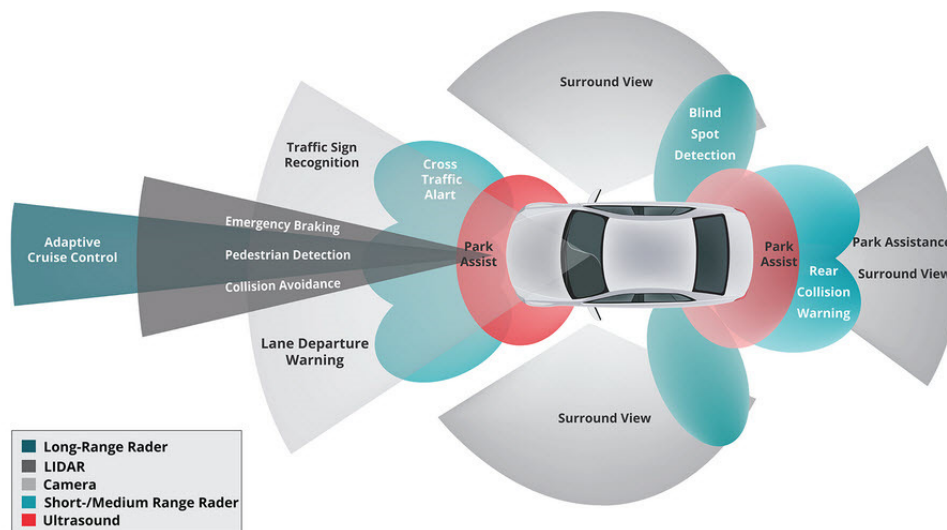
- Crash Data -

- Longitudinal velocity (Δv km/h)
- Lateral velocity (Δv km/h)
- Longitudinal acceleration (g)
- Lateral acceleration (g)
- Window usually around 300 ms
- Airbag firing times (ms)
- Diagnostic trouble codes
- Rollover angular rate (deg/sec)
- Rollover data longer window

Data Retrieval

New Vehicle Technologies

- New vehicles equipped with Cameras, Radars, and Sensors = DATA
- Data is recorded at Pre-Programmed Triggers
- Telemetry (cloud) Data is Proprietary to the Manufacturer
- Canadian MVSA allows access to OEM Proprietary Data
- **Canadian Experience = Manufacturers are Co-operative**
- **Advanced investigator Training Required (SAE / Manufacturers)**



Radar

LIDAR

Camera/Imaging

Canadian Crash Example # 1

Rear Occupant Crash Investigation

Context

- Rural head-on crash, Maritime Province of Nova Scotia
- RCMP and TC Halifax Field Team on-scene
- Crash involved 2 vehicles:
 1. SUV MY2011
 - Δv 75 km/h
 - 4 passengers:
 - major injuries for driver,
 - moderate injuries for passenger
 - **fatal** for 2 rear passengers
 2. Pickup MY2011
 - Δv 60 km/h
 - 2 passengers: minor injuries



Canadian Crash Example # 1

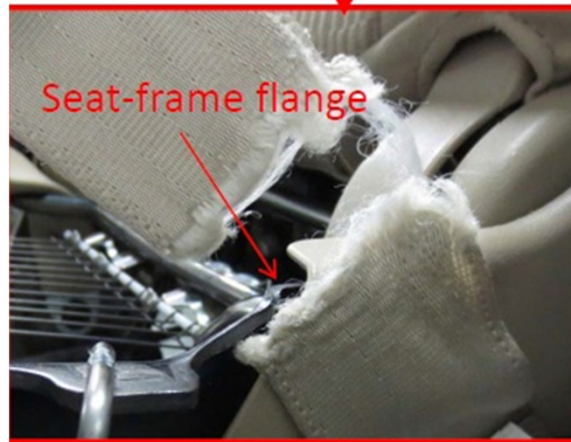
Field Investigation

Inspection of the Case Vehicle SUV

- Right-rear seatbelt webbing had failed
- Investigator identified the location of the seatbelt webbing separation was in proximity to the metal seat cushion frame edge



Right-Rear Seatbelt

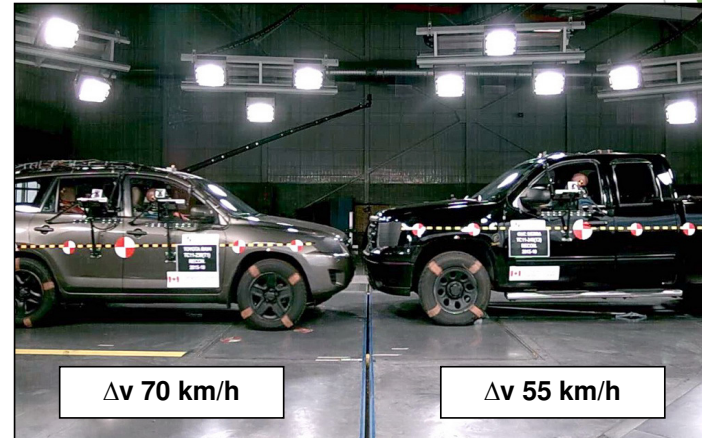


Canadian Crash Example # 1

Reconstruction Crash Test

Crash Test Summary

- Both rear seatbelts separated at the lap portion near the exposed metal edge of the seat structure
- The location and appearance of the separated seatbelts in the crash test were similar in appearance to the seatbelt damaged in the case vehicle



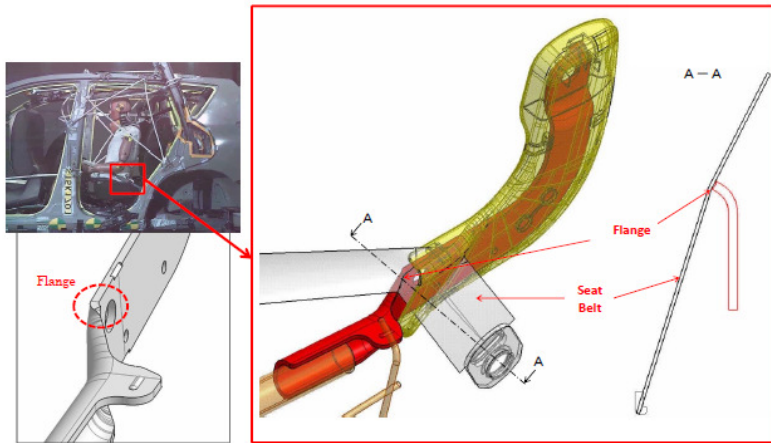
Motor Vehicle Test Centre

- The largest and most advanced automotive test and research center in Canada located in Blainville, QC
- Collision Laboratory, Environmental Chambers and Test Tracks

Canadian Crash Example # 1

Defect Investigation

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Transport Canada Defect Investigation

- Right-rear seatbelt webbing had failed
- It was determined the seat frame edge cut the webbing while the seatbelt was in tension
- The exposed seat structure may pose an important safety risk to rear occupants in severe frontal crashes
- Manufacturer was made aware and provided with the reconstruction data

Manufacturer's Response

- Conducted testing and confirmed Transport Canada results
- The rear outboard seatbelts in the test vehicle separated as a result of contact with a portion of the metal seat cushion frame flange edge
- Announced a **Worldwide Safety Recall** of 2.87 million vehicles

Canadian Crash Example # 2

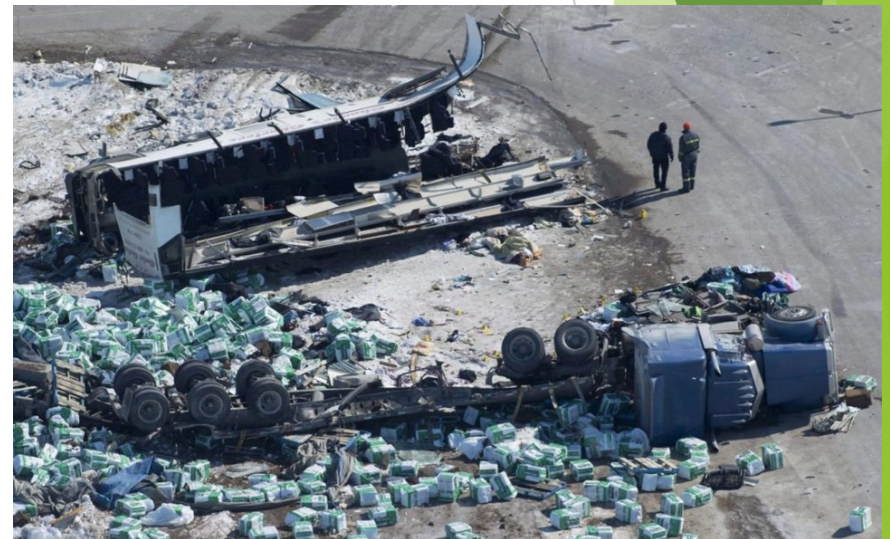
Humboldt Coach Bus Crash Investigation

Context

- Rural intersection crash, Prairie Province of Saskatchewan
- Coach Bus (hockey team) vs. Transport Truck (hauling peat moss bales)
- Truck (90 km/h) failed to stop at intersection and T-boned Coach Bus
- Coach Bus passengers: **16-fatal and 13-injured**
- RCMP and TC Calgary Field Team on-scene

Outcomes

- Investigation led to **substantive regulatory changes**:
 - standards for entry training of truck drivers
 - seatbelts required on all new buses
 - mandated electronic logging devices (ELD)



MDCI Summary Approach and Objectives

- Multi-Disciplinary Team Approach
- Investigate Collisions with several Fatalities
- Conduct In-Depth Investigations of Fatal Collisions
- Attend 'Live' Collision Scenes
- Field investigation → Reconstruction → Analysis → Report
- Accessibility to Medical Data via *formal agreements*
- Close Links with Police via *formal agreements*
- Accessibility to OEM Proprietary Data via *legislation*
- Reports do not Allocate Blame or Liability
- Learn from Incidents / Root Cause Analysis

The Path Forward

Connected and Automated Vehicles

- Electric and hybrid technology is becoming more prevalent
- Vehicles will communicate between themselves and infrastructure
- Automated vehicles will access and generate large amounts of data from the nearby roadway environment (V2X) and other roadway users (V2V)
- Data will be used to execute decisions. When a collision occurs, the key source of information for identifying the cause will be the vehicle itself
- Physical and electronic evidence from V2X and V2V must be collected and analyzed in order to identify the cause of the crash
- A documented process for the collection of AV collision data elements is necessary
- The data should also contain information related to the status of the AV system and if the AV system or the human driver was in control of the vehicle at the time of the crash
- These areas are being deliberated via the UNECE WP.29 EDR/DSSAD IWG

International Alignment

Meeting Proposal

Proposed MDCI International Meeting

- Shared international experience
- What approaches have been successful
- Data retrieval topics
- New technologies
- Share lessons learned
- Sharpen our strategies
- Make our roads safer for everyone

Questions / Comments?

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