


 Transportation Safety Board of Canada    Bureau de la sécurité des transports du Canada



**TOOLS FOR PREVENTION:**  
*Investigating and understanding the human and organizational factors involved in the Sept. 2013 crash in Ottawa between an OC Transpo double-decker bus and a VIA passenger train.*

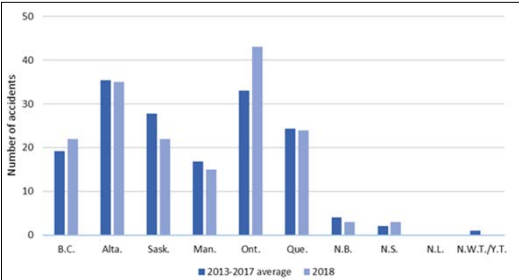
Christina (Missy) Rudin-Brown, Ph.D., CCPE  
 Manager / Senior Human Factors Investigator

  
Ontario Road Safety Forum – March 27, 2019

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## Level crossing crashes in Canada

- Although relatively uncommon (<1% of road fatalities), outcomes are substantial → top priority worldwide
- About 16,000 public level crossings in Canada
- From 2009 to 2018 (10 years) there were 1 708 level crossing crashes, with 224 fatalities



| Province / Territory | 2013-2017 average | 2018 |
|----------------------|-------------------|------|
| B.C.                 | 18                | 22   |
| Alta.                | 35                | 35   |
| Sask.                | 28                | 22   |
| Man.                 | 16                | 14   |
| Ont.                 | 33                | 43   |
| Que.                 | 24                | 24   |
| N.B.                 | 3                 | 4    |
| N.S.                 | 2                 | 3    |
| N.L.                 | 0                 | 0    |
| N.W.T./Y.T.          | 0                 | 1    |

Level crossing accidents by province / territory, 2013 – 2018


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## September 2013 crash between OC Transpo double-decker bus and VIA passenger train

R13T0192  
Crossing Collision  
OC Transpo / VIA  
18 September 2013

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## Who we are / How we investigate

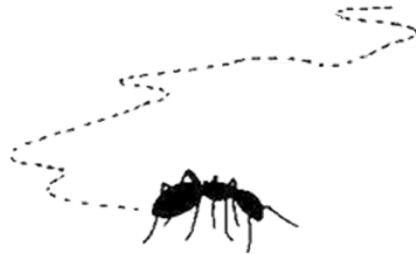
- Transportation Safety Board of Canada (TSB)
  - independent agency that investigates air, marine, pipeline, and rail occurrences (~230 employees, 5 Board members)
  - 6 'multi-modal' human factors investigators
  - apply multi-causality model of accident causation, (not a primary or "root" cause model)
- Our philosophy:
  - ***Why did actions and assessments make sense at the time given the conditions and circumstances present?***

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**Actions and decisions cannot be understood without -**



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**- understanding the context in which they took place.**



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## We use the SHELL model for data collection



- **S – software** (e.g., policies, training)
- **H – hardware** (e.g., vehicle)
- **E – environment** (e.g., weather, road)
- **L – liveware\*** (e.g., driver)
- **L – liveware** (e.g., passengers)

Edwards(1972)

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## Data collection tools used in OC Transpo investigation:

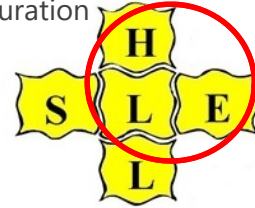
1. Accident re-enactment (September 28, 2013)
2. Passenger / eye witness interviews (over 100)
3. Next-of-kin interviews
4. Bus driver interviews
5. Review of driver records
  - Medical
  - Infractions
  - Training
6. Ergonomic assessment of bus driver workstation
7. OC Transpo / City of Ottawa interviews



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## 1. Accident re-enactment (September 28, 2013)

- Weather, position of sun, bus type & configuration
- Photos; video; braking analysis
- Speed of bus, train



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## 2. Passenger / eye witness interviews

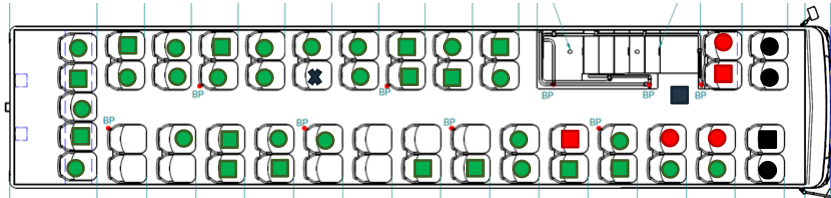
- Worked closely with police, Coroner
- Bus passengers
- Other motorists
- Other bus drivers
  - Eye witnesses
  - Those who saw driver that AM
  - Those who knew driver
- Train crew
- Train passengers



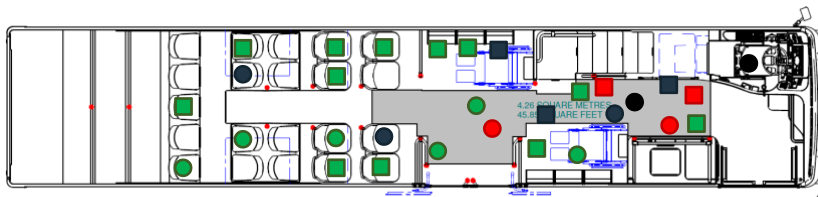
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## 2. Passenger / eye witness interviews

Upper level



Lower level



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## 3. Next-of-kin interviews

- Spouse, other relatives of driver
  - Hours of work and rest
  - Medical factors
  - Psychosocial factors
  - Habits
  - Personality



Fatigue analysis – (e.g.) Fatigue Avoidance Scheduling Tool (FAST):



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#### 4. Bus driver interviews

- Sample of other bus drivers who use crossing, drive similar routes, double-decker bus
  - Hours of work
  - Work conditions
  - SOPs
  - Training
  - Crossing characteristics



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#### 5. Review of driver records

- Infractions
- Training
- History / familiarity with crossing
- Medical
  - Worked closely with Coroner
  - Specialist in colour vision deficiencies

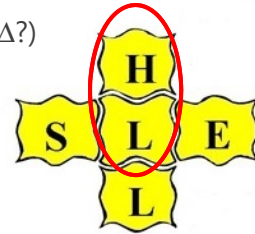


Colour vision deficiency - evaluation of polarized sunglasses:

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## 6. Ergonomic assessment of driver workstation

- Double-decker; 3 other types of bus (any Δ?)
- Bus drivers and mechanics
- Assessed:
  - accommodation and adjustability;
  - driver's reach to, and use of, controls; and
  - positioning and use of in-vehicle displays.



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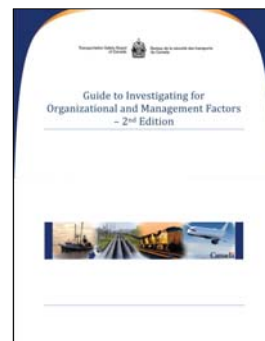
## 7. OC Transpo / City of Ottawa interviews

- Training dept; Enforcement; Ops; Risk mgnt; Technology; Union; CEO



### Organizational / Management factors:

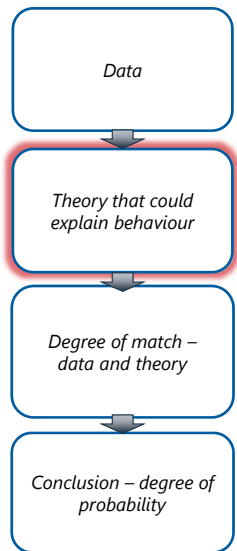
1. Agency-controlled driver distractions
2. Ongoing driver performance monitoring
3. Route scheduling
4. On-time performance; speed enforcement



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## Analysis -

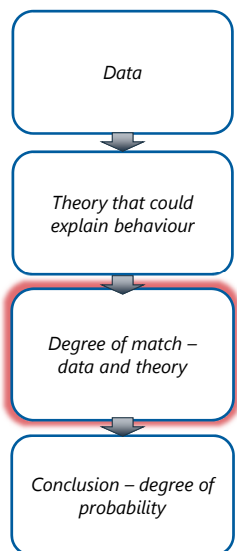


### E.g., Safety deficiency: Distraction / inattention

- Significant cause of traffic crashes
- Previously identified as contributing factor to level crossing crashes
- External distractions unique to level crossings tend to divert drivers' attention during periods in which they must be making, or have made, a decision (Eck, 2002)
- Engagement in secondary tasks at crossings common (Ngamdung & daSilva, 2012; 2013)

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## Analysis -



### E.g., Safety deficiency: Distraction / inattention

- **Visual distraction:**
  - use of on-board video monitor
  - company required drivers to check the monitor at station stops and while the bus was in service.
  - risk that company did not effectively manage.
- **Cognitive distraction:**
  - heavier workload of negotiating left-hand curve,
  - nearby passenger conversations about upper deck seating,
  - perceived need to make a 'no-standing on upper deck' announcement

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## Findings (related to distraction):

- "The driver was likely visually distracted by looking at the video monitor during the critical driving sequence of negotiating the left-hand curve and approaching the crossing."
- "Conversations between the driver and a passenger and among passengers near the driver, as well as the perceived need to make an announcement to passengers standing on the upper deck, created a situation where the driver was likely cognitively distracted in the seconds before the accident."
- "OC Transpo did not identify or mitigate the risks arising from driver attention being inappropriately directed at the video monitor when the bus was in motion and from the need to make announcements if passengers were observed standing on the upper deck."

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## All findings



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## Recommendations (status March 2019)

### The Board recommends that:

the Department of Transport, in consultation with the provinces, develop comprehensive guidelines for the installation and use of in-vehicle video monitor displays to reduce the risk of driver distraction.

*"Satisfactory intent"*

the Department of Transport develop and implement crashworthiness standards for commercial passenger buses to reduce the risk of injury.

*"Satisfactory intent"*

the Department of Transport require commercial passenger buses to be equipped with dedicated, crashworthy event data recorders.

*"Satisfactory in part"*

the Department of Transport provide specific guidance as to when grade separation should be considered.

*"Satisfactory intent"*

the City of Ottawa reconsider the need for grade separation at the Woodroffe Avenue, Transitway, and Fallowfield Road level crossings.

*"Satisfactory intent"*

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For more information: [www.tsb.gc.ca/oc-via-en](http://www.tsb.gc.ca/oc-via-en)

Questions?

Thank-you!

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