



TRANSPORTATION DEVELOPMENT CENTRE (TDC)

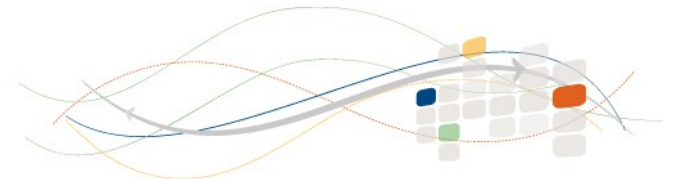


Mitigating Risky Behavior of Delayed Road Users at Occupied Highway-Railway Crossings: Review of Research and Issues

Daniel Blais, Project Officer, Accessibility and Human Factors

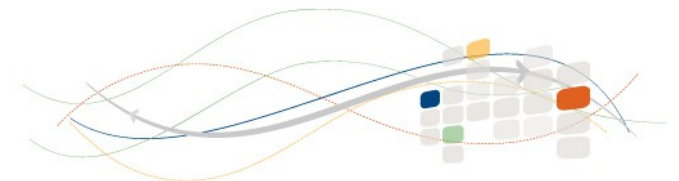
Outline

- Background
- Objective
- Methodology
- Results
- Conclusions



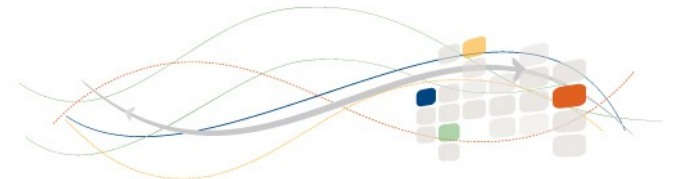
Background

- Blocked highway-railway crossings are an increasing safety concern (more rail traffic, less track, more urbanization)
- Can cause delays and may cause road users to engage in high-risk behavior
- Need to better understand ways to reduce high-risk behavior of road users and increase railway safety



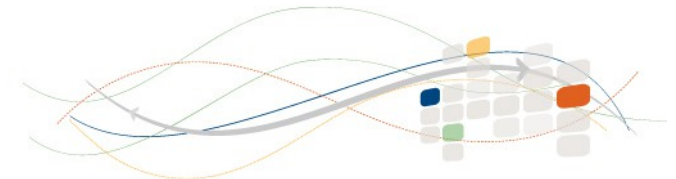
Project Team

- Transport Canada Rail Safety Directorate
- Railway Association of Canada
- Operation Lifesaver
- Federation of Canadian Municipalities
- Transportation Safety Board
- Naish Transportation Consulting



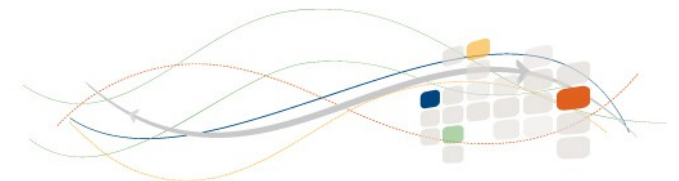
Objective

- Investigate blocked crossings:
 1. railway operational reasons for blocking crossings
 2. the relationship between increased urban development near railway facilities and blocked crossings
 3. road user behavior at blocked crossings and countermeasures to avoid risk taking behavior



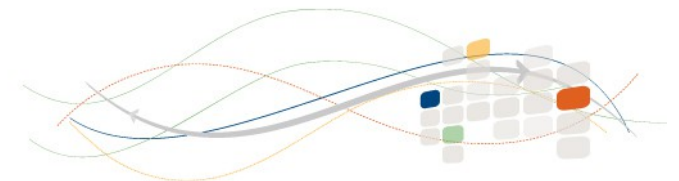
Occupied or blocked crossings

- Crossings where trains are standing or moving slowly
- Crossings where trains are switching over the crossing
- A signalized crossings where the warning system is operating (sometimes excessively)



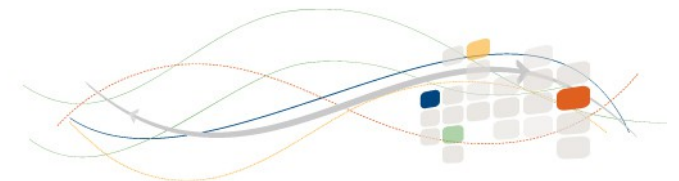
Scope

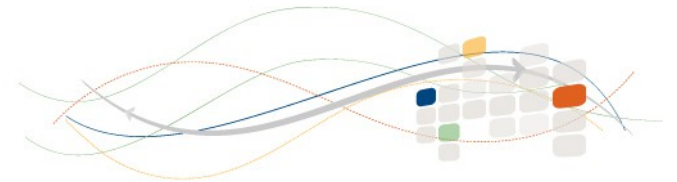
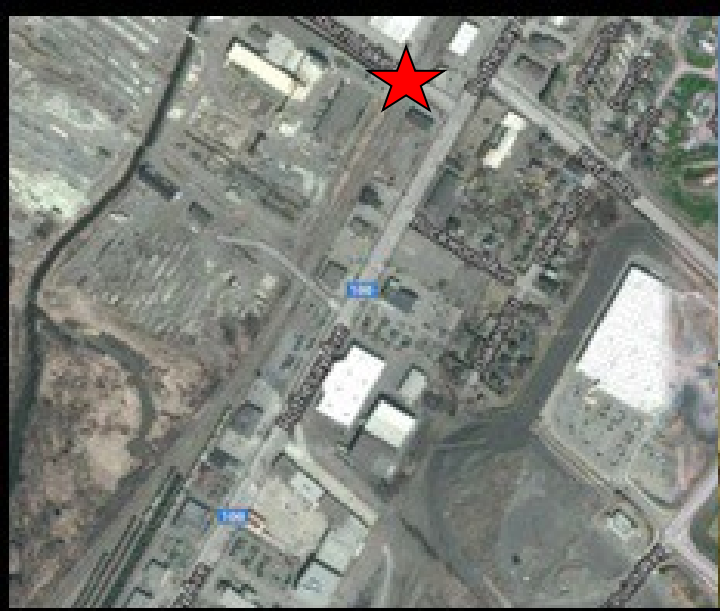
- This research was primarily a review of:
 - National and international policy, rules and regulations
 - Existing research on 3 areas stated in objective
 - Issues from industry and municipalities (consultations)
- Results will guide future research to reduce risky behavior of road users

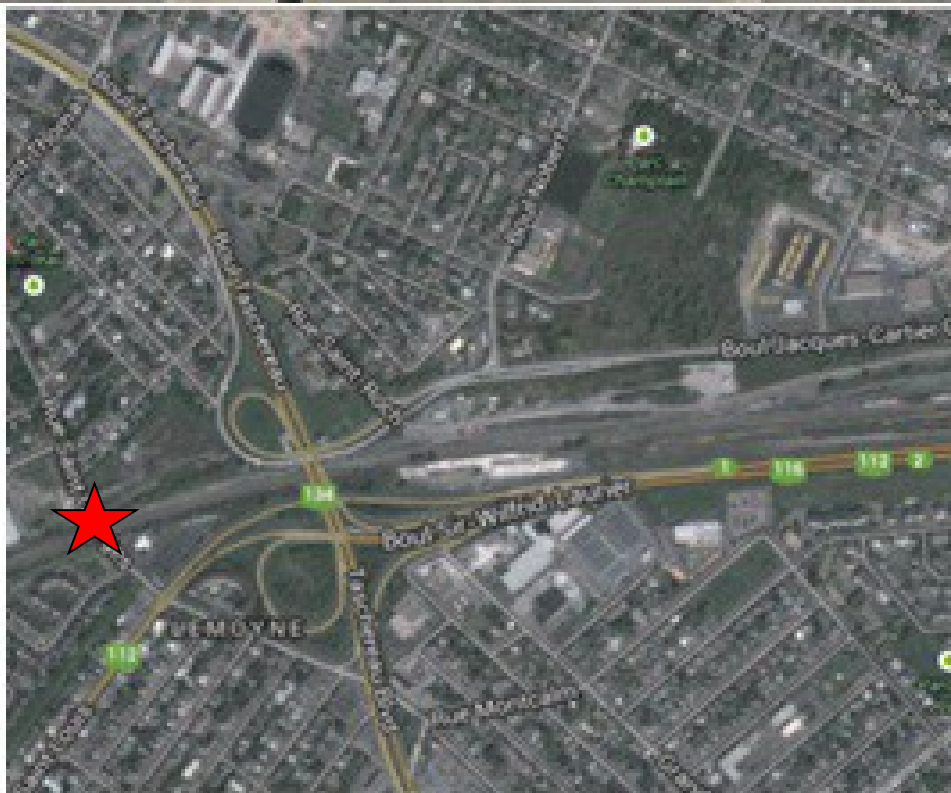


Types and causes of blockages

- STATIONARY TRAINS AND SLOW MOVING LONG TRAINS
- RAILWAY SWITCHING OPERATIONS
- EXCESSIVE CROSSING WARNING SIGNAL OPERATION
- FREQUENT CROSSING SIGNAL OPERATION

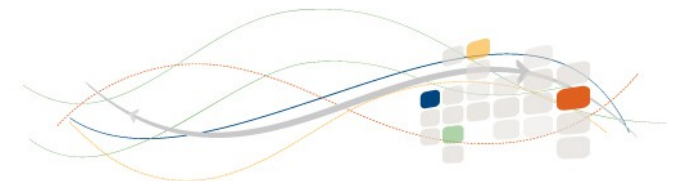






Road user behavior

- CHARACTERISTICS OF CROSSING USERS
- AGE AND GENDER DIFFERENCES
- PEDESTRIAN BEHAVIOUR
- CRITICAL WAIT TIMES
- RESEARCH REGARDING ANGER, AGGRESSION, MOOD AND RISK TAKING
- DELAY PERCEPTION



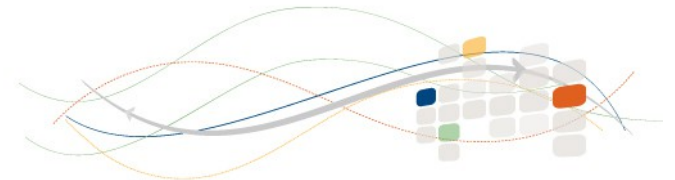
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Proximity and Land Use

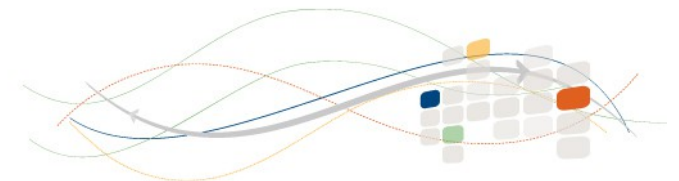
- Increasing urbanization and increasing commodity rail traffic inevitably lead to congestion in areas where the two meet





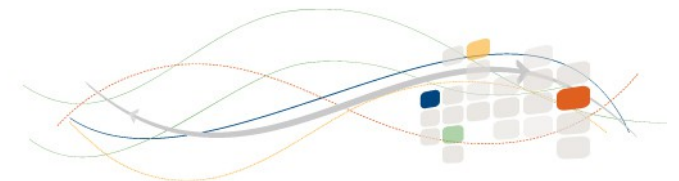
Comparable international issues

- Europe
 - Blocked crossings are typically related to significant delays caused by second train issues
 - Remedied by having the train cross at the same time
- Australia
 - Crossing signals interconnected with nearby highway signals and scheduling to reduce blockages and back ups



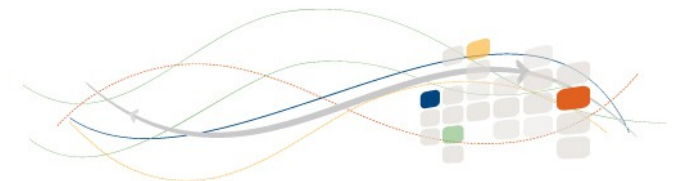
Compliance & enforcement

- Photo enforcement at crossings can increase compliance (50% to 69% increase)
- The longer the time between lowering of the gates and the arrival of the train, the higher the rate of violations
- Warning system reliability exerts a predictable effect on motorists



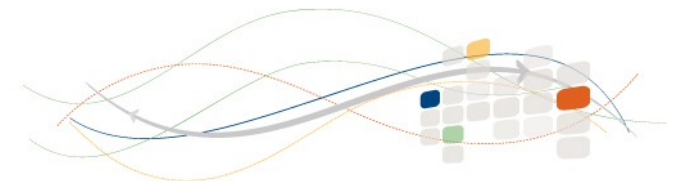
Regulations relating to crossing violations

- US
 - No federal regulation on crossing blockage; each state has its own regulations
- Canada
 - 5 minute rule (stopped vs slow moving)
 - New regulations proposed



TSB accident records

- 29 Records found using key words: climbing through, climbing over, climbing under, crossing, and trespasser
- Accident are often severe



Some possible solutions to mitigate or remove delays

- Technology based solutions
 - Pre-emption of road traffic signals
 - Interconnection of rail and traffic signal systems (upgrading)
 - Monitoring and communications to ID and re-route
 - ITS and real time information

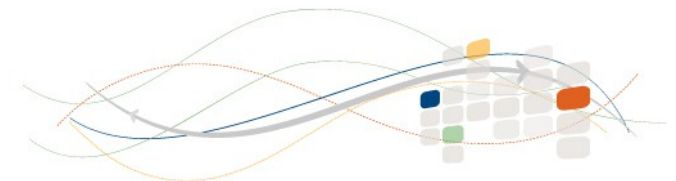


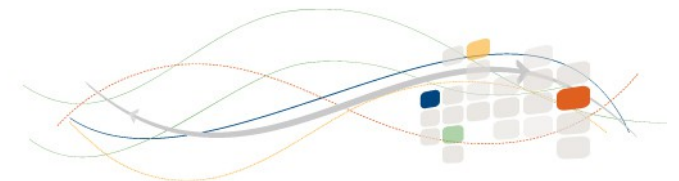


Image of a variable message sign, could be applied to notify road users of time of occupied crossing to reduce risky behavior



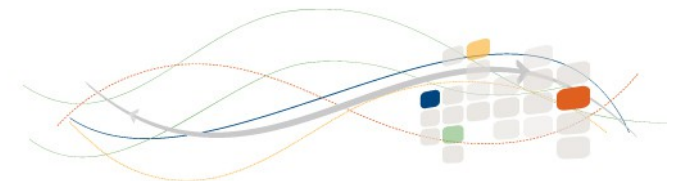
Some possible solutions to mitigate or remove delays

- Operational solutions
 - Relocation of crew change points
 - Scheduling
 - Updating infrastructure to meet capacity
 - Using new systems to optimize operations



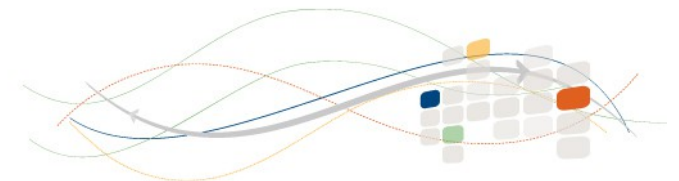
Benefit – cost analysis of problem mitigation

- The daily weekday delay cost is just over \$28,000
- Value of lost time to road users would be around \$6.22 million/year
- Reducing road user delay by 10 - 15% cost savings could be between \$622,000 and \$933,000/year



Conclusion / next steps

- Victims of success
- The delay effect of blocked crossings on many road users is immediate and negative
- Many opportunities to address the problem
- This research will guide future R&D efforts to address risk taking behaviour at occupied crossings



Questions?

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