

# Ejections and Fatalities in Single-Vehicle Rollover Crashes: A Question of Restraint

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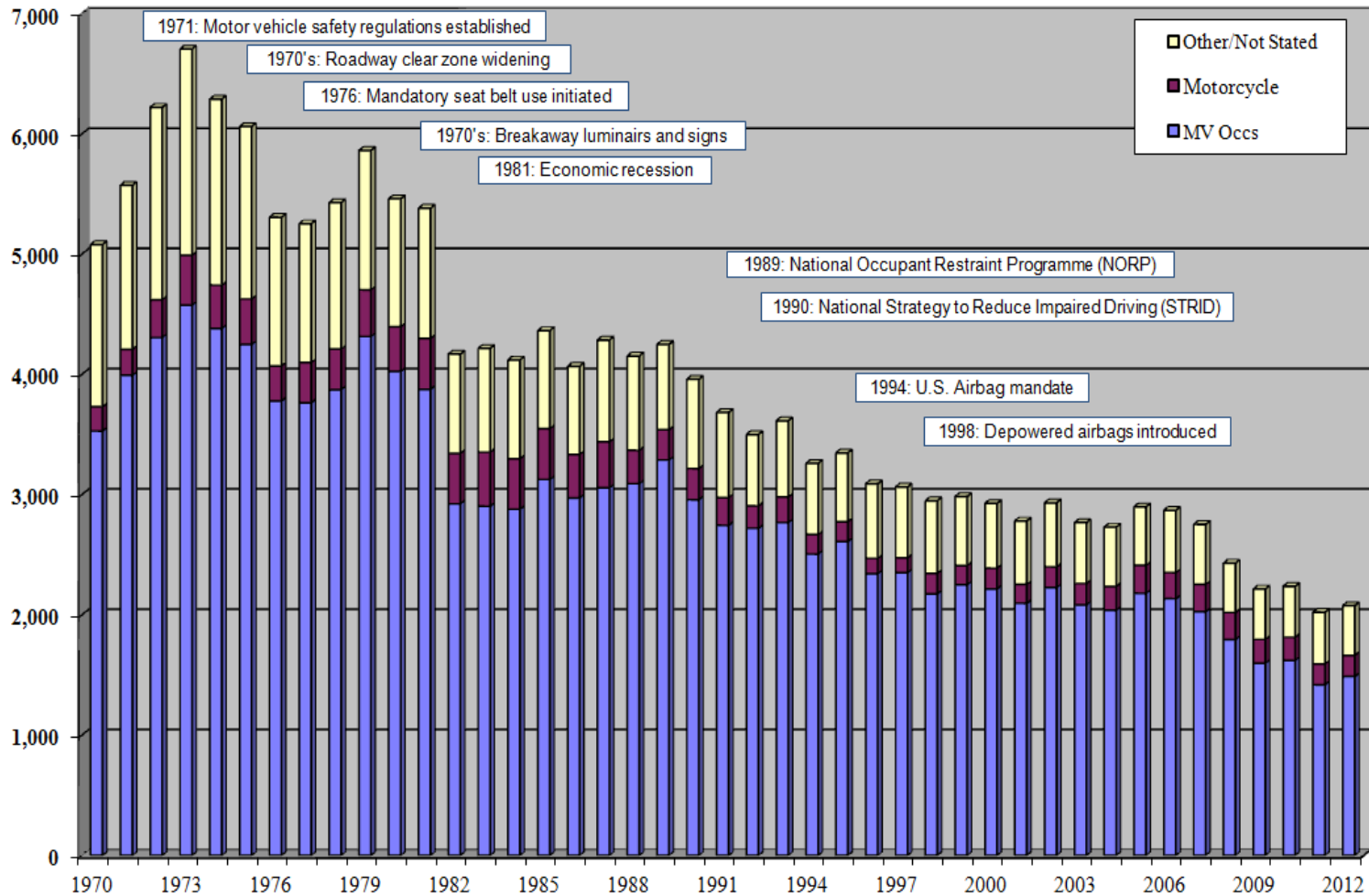
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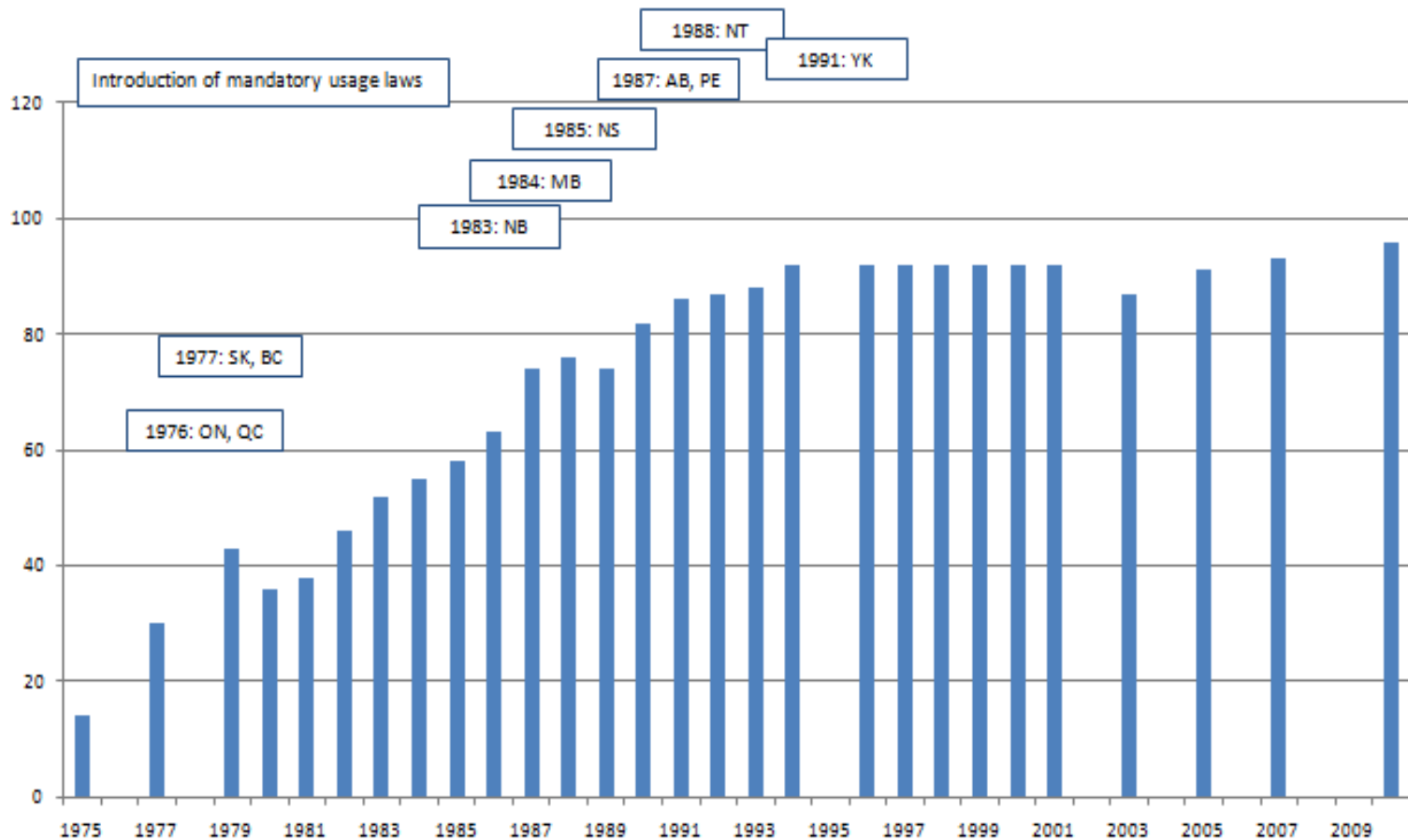
# Road Traffic Fatalities in Canada 1970-2012





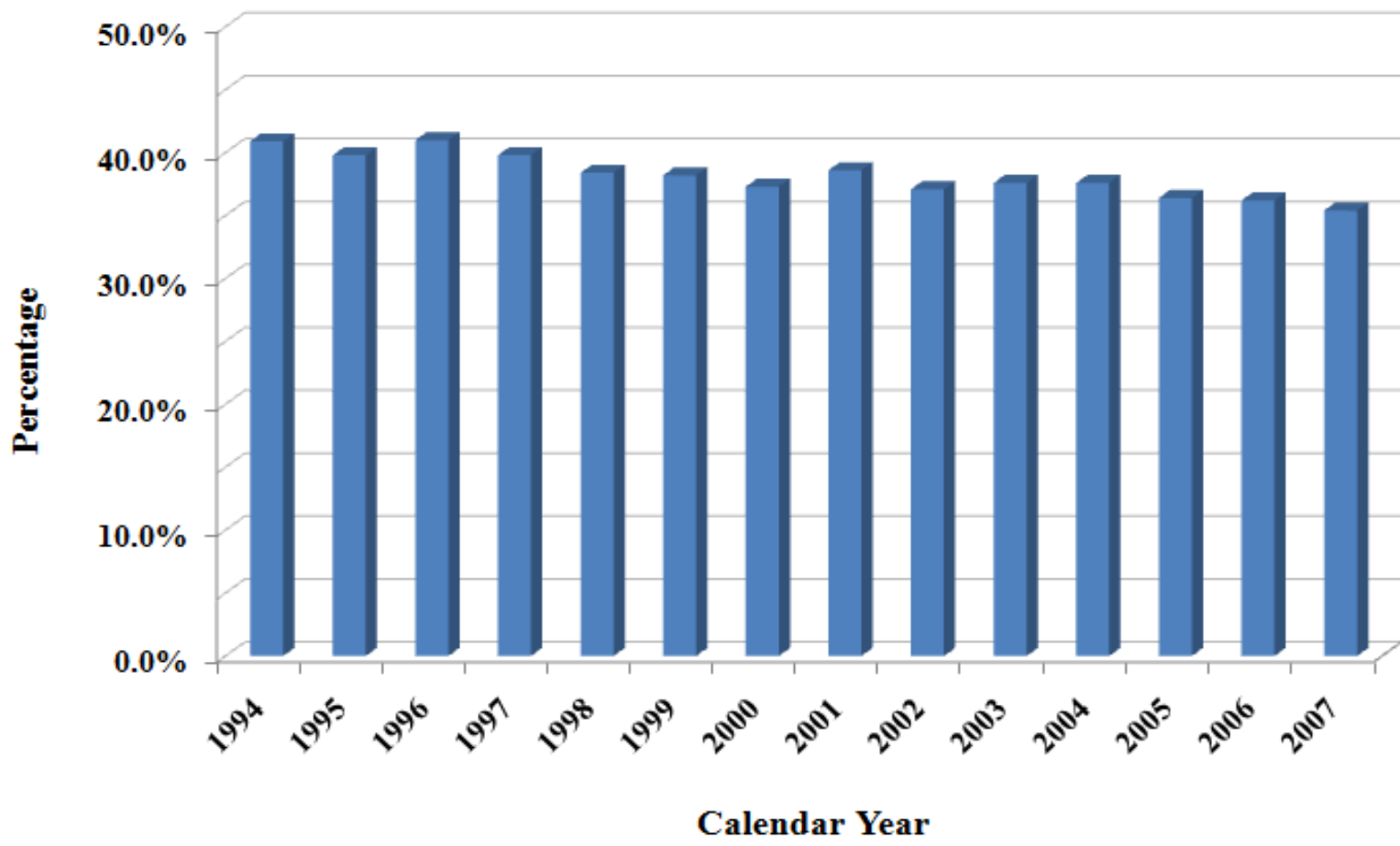
# Seat Belt Use in Canada 1975-2010

**Seat Belt Use Rate on Urban Roads (%)**





# Percentage of Passenger Vehicle Occupant Fatalities Reported as Unrestrained





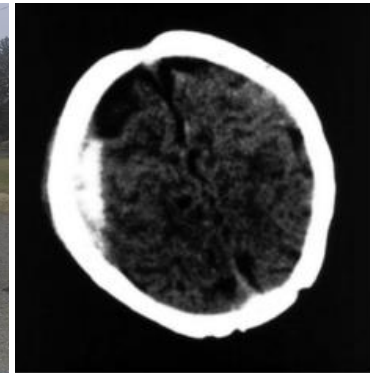
# Single-Vehicle Rollover Collisions

- 57% of fatally-injured passenger vehicle occupants were not using seat belts
- 80% of unrestrained passenger vehicle occupants, fatally injured in single-vehicle rollovers, were ejected from their vehicle



# Causes of Fatal Collisions Study

- In-depth collision investigation programme capturing human, vehicle and environmental factors related to fatal crashes
- Three phases of data collection between October, 2004 and December, 2009
- Phase 1 – Pilot study, Ottawa, ON and Saskatoon, SK
- Phase 2 – Added Fredericton, NB, Montreal, QC and London, ON
- Phase 3 – Montreal, QC and London, ON only



# Causes of Fatal Collisions Study

- 358 collisions were documented in the study
- Filtering criteria for the present paper:
  - Single-vehicle crash
  - Rollover as the harmful event
  - Light-duty vehicle  
(passenger car, light truck or van)
  - Unrestrained occupant
  - Ejected
  - Fatal injuries
- 26 criteria crashes



# Frequent Occurrences

- Loss of directional control
- Run-off roadway onto soft shoulder , followed by a rollover
- High speed on loose gravel
- Abrupt lane-change manoeuvres
- Inadequate recovery/over-steering
- Yaw, tripping, rollover
- Impacts to poles or trees





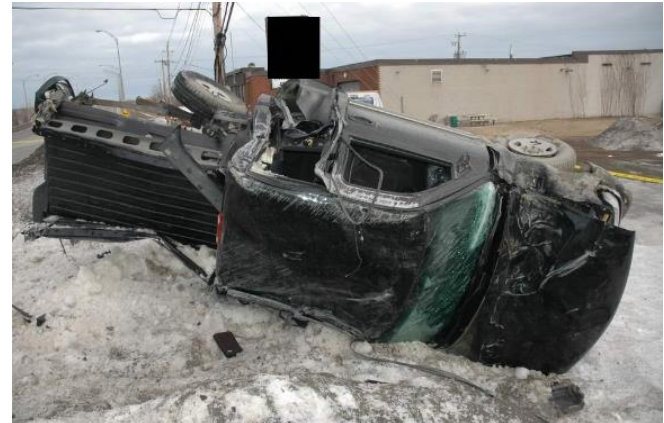
## Case Study - 2003 Nissan Xterra SUV

- Driver shoulder checking prior to lane change
- Traffic ahead slowed down
- Steered abruptly to the right to avoid impact
- Over-corrected, yaw, rollover
- 38-year-old female driver and 5 children (5-15 years) belted, minor or no injuries
- Two 13-year-old males, unbelted, rear cargo area
- Both completely ejected
- One – fatal head injuries
- Second – fractured leg, serious facial injuries



# Case Study - 2001 Chevrolet Silverado

- 47-year-old male driver
- BAC 300 mg%
- Left bar, racing with nephew, 50 km/h zone
- 193 km/h (EDR)
- Lost directional control
- Ran off roadway, sheared off breakaway luminaire
- Ran over a snow bank and rolled over
- Driver completely ejected
- Fatally injured



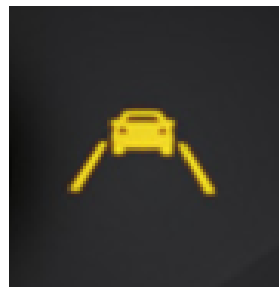
# Observations

- High speed
- Young, male drivers
- Impairment (alcohol, drugs)
- Light truck involvement
- Hard-steering manoeuvres
- Failure to use seat belts



# Countermeasures

- Electronic stability control (ESC)
- Pre-safe systems (close windows, sunroof)
- Lane departure warning
- Ejection mitigation, rollover curtains
- Advanced seat belt reminder systems
- Passive alcohol sensing





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