

# Assessing the Prevalence of Driver Drowsiness in Canada: Analysis of Observer Ratings of Drowsiness from the Canada Naturalistic Driving Study

## **BACKGROUND**

The impact of driver drowsiness/fatigue on our nations roadways is largely underestimated and the risks are misunderstood (Tefft, 2012). Analyses based on crash databases found that driver fatigue contributed to only 1% to 6% of crashes. (Campbell, Smith, and Najm, 2003; Wang, Knipling, and Goodman, 1995) However, several studies have found driver fatigue to be a more significant contributor to crash occurrence. Klauer, Dingus, Neale, Sudweeks, and Ramsey (2006) reported that severe fatigue (eyelid closures, microsleeps) was a contributing factor for 20% of crashes and 16% of near-crashes in the 100 Car dataset. This study also reported that drowsy drivers had an increased risk rate of four to six times that of an alert driver. Also, Tefft (2012) conducted a study using a multiple imputation statistical analyses using NASS CDS data. His results suggested that 7% of all crashes, 13% of injury crashes, and 16.5% of all fatal crashes involved a drowsy driver. These combined studies provide evidence that the impact of drowsy drivers is underestimated and additional research is needed to better understand the impact of drowsy driving on crashes.

With its high-resolution information on driver behavior and environment/roadway conditions, the Canada Naturalistic Driving Study (NDS) presents a unique opportunity to gain an even greater understanding of the prevalence of driver drowsiness and an increased knowledge about the risks of driver drowsiness by age group.

## **METHOD**

The Canada Naturalistic Driving Study is the largest and most comprehensive NDS ever done in Canada where we collected unprecedented real-time driver behavior data along with driver's interaction with vehicle, environment/roadway types. The data was collected in

Saskatoon, Saskatchewan using 140 vehicles that were instrumented with Data Acquisition System (DAS) developed at VTTI from June 2013 until August, 2015. These drivers were in the study for either 24, 18, or 12 months. The ages of the primary participants ranged from 18 years to 75 years of age. The study has collected driving performance variables from multiple vehicle sensors (vehicle speed, multi-axis acceleration, Global Positioning System, lane position, etc.), roadway/traffic conditions, as well as continuous video from four cameras (driver's face, forward view, rear view, and over the shoulder) from each participant.

Data coding of safety critical events (e.g., CNCs) using a set of trigger criteria (i.e., a hard braking event exceeding a g-force of -0.5 g) and control segments was completed. For each instance in which a kinematic trigger is exceeded, a trained data coder watched the corresponding video and recorded the associated event, driver behaviors, environmental/roadway variables, and scenario-specific variables of interest. Trained data coders has also recorded driver behaviors and environmental/roadway variables for randomly selected control segments (where no CNC and/or elevated g-force events event has occurred) based on driving exposure (VMT).

Trained data coders have assigned ORD ratings to each safety critical event and control segment that have already been identified in the Canada NDS. ORD is drowsiness measure obtained by trained coders observing video of the driver's face and estimating drowsiness levels based upon facial tone, slow eyelid closures, and mannerisms (rubbing, yawning, and nodding, etc.).

Analyses will be conducted to evaluate the prevalence of moderate and severe drowsiness by drivers of different age groups. Prevalence by time of day, day of week, and geographic location will also be assessed to determine if there are any differences between urban, suburban, and rural driving. Characteristics of trips with fatigue present will also be reported and analyzed using either parametric or nonparametric statistical tests.

## **EXPECTED RESULTS**

These analyses would provide much greater insight into the prevalence and characteristics of moderate and severe drowsiness in Saskatchewan, Canada. This analysis will also demonstrate the power of the ORD rating and the greater insight in to the environmental and driver variables that are most impacted by moderate and severe driver drowsiness. The results and generated

database information are expected to contribute to the design of more effective driver fatigue countermeasures and collision avoidance warning systems to save lives of these drowsy drivers, their passengers, and all other road users placed at risk by drowsy drivers.