

MEASUREMENT OF TRUCKING SECTOR PRODUCTIVITY AND SAFETY

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Introduction

Using data gathered anonymously by remote satellite tracking between 2004 and 2009 in British Columbia, the authors examined the length and duration of continuous travel segments undertaken by drivers of large Class 8 highway trucks. In addition to quantifying the individual driving segment activity, an algorithm was developed to evaluate total moving activity for all of the sampled vehicles per 24 hour time period.

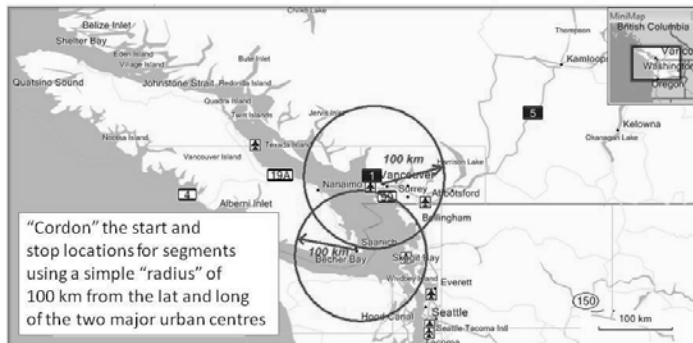
The process and context for raw information gathering has been previously reported by Ash and Conquist¹ in a paper about the creation of travel speed benchmarks for large heavy Class 8 highway trucks. Preliminary findings from the present research were presented by Ash² at CTRF in 2009 in which it was noted that the raw dataset appeared to blend the activity of trucks travelling near urban areas (essentially “peddling freight” within the lower mainland of BC) with populations of trucks that had driving segments occurring in more rural areas. In the latter case, one might anticipate that trip segments would be longer (distances and times) because of greater separation of trip generators, reduced traffic and access to longer stretches of open road. The same study encountered some computational difficulties coping with sampling gaps for many of the trucks that also travelled outside of the province during the sampling period or that had periods of “downtime” when they were not operating.

Both of these difficulties from the preliminary findings were resolved through creating new data handling algorithms to sample total trucking activity per 24 hour period of sampling and to geographically classify all the data into urban versus rural segments.

Urban versus Rural Operations

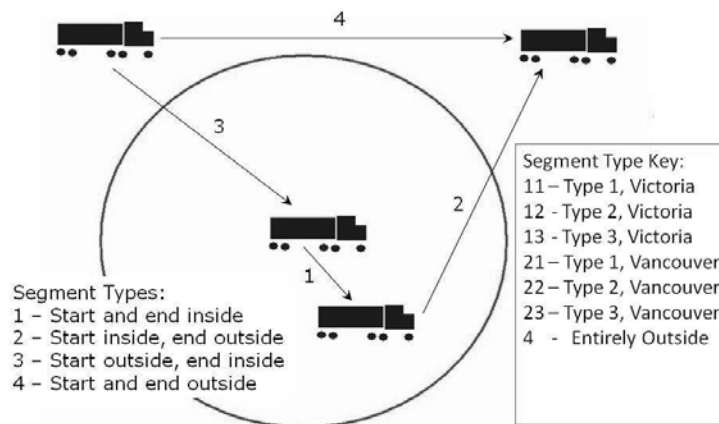
Exhibits 1 and 2, following illustrate how data segments were sorted.

Exhibit 1: Method of "Sorting" Truck Activity Data Segments



Source for base map: Google maps online (screen capture)

Exhibit 2: Key to Truck Activity Data Segment Organization



Based on lat, long values at the start and stop of every moving trip segment, a column of information was added to the dataset that classified every segment as one of 7 categories: 11,12,13 associated with the City of Victoria; 21,22,23 associated with the City of Vancouver; 4 associated with Strictly Rural Segments.

The results for our analysis of the 713 trucks sampled, by region of operation, were as follows:

Population	Category
176 trucks	with only rural segments
33 trucks	with only urban segments
404 trucks	with both rural and urban segments (longer distance hauling units based in the cities)

Literature Review

A brief review of related published research revealed significant emphasis on studying driver fatigue, most often focusing on trucking operations having higher risk likelihood such as longer distance operations with high utility of drivers.^{3,4,5,6,7,8} Frequently these projects were directed to factors such as the length of rest periods between daily activity, identifying whether naps prolonged driver alertness, alignment and regularity of schedules with 24 hour circadian rhythms as well as the risk of fatigue associated with total driving hours per day.

We found little published research on the length of individual driving segments though many driver manuals published by fleet operators and insurance companies encourage drivers to limit their driving segments by time and distance as a means for both disrupting the "hypnotic effect" of continuous driving as well as for undertaking en route checks of tires, braking components and load securement.^{9,10} In our review, we did not find any reports that attempted to answer whether drivers actually do limit their driving segments and to what distances and time intervals. Most of this behavior is not mandated in the regulations, which focus on daily and weekly limits, though the

United States Federal Motor Carrier Safety Regulations mandate stops at maximum 3 hour intervals or 150 miles (240 km) for checking load securement.¹¹

Few of the reports attempted to profile what proportion of trucking actually takes place at the limits of daily hours of service regulations for driving hours per day versus having fewer hours than the maximum. When one reviews the literature and regulatory discussions of the past 5 years, it would be easy to assume that most drivers actually are limited by the hours of service daily limits, rather than these being a constraint that may only directly affect a subset of the total industry. We did find one report which did attempt to profile daily hours of driving in context of assessing impact of hours of service limits on the trucking industry which indicated that the very high (>11 hrs/day) and extreme (>13 hrs/day) work time categories of service may represent approximately 11% and 6% of trucking activity respectively.¹²

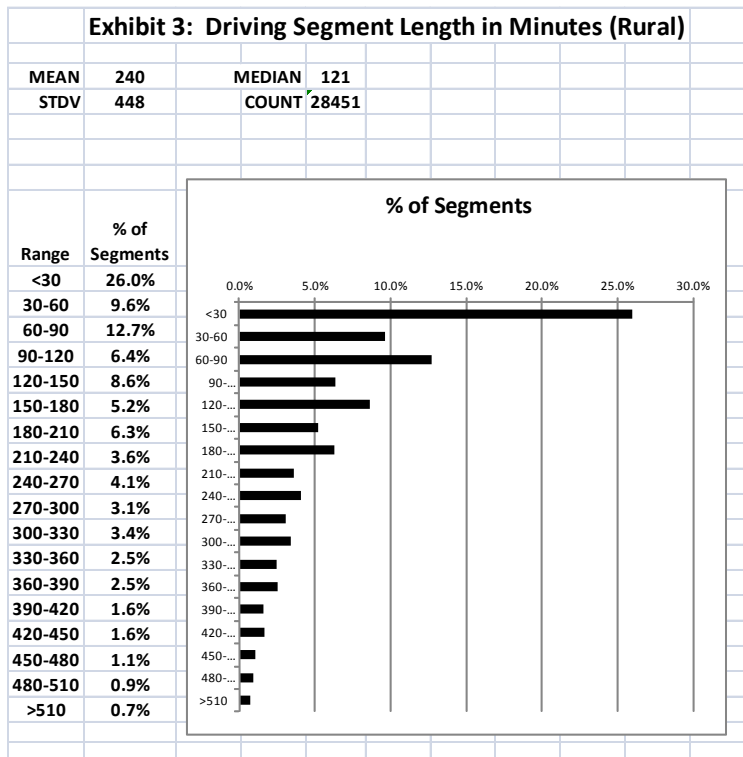
As noted previously, revised algorithms for processing our data, including sorting urban / regional activity from longer distance operations has improved our ability to answer the following questions. How long, in terms of distance and time, are the “continuous moving” segments of vehicle travel? How many hours and kilometers do vehicles travel on average in a day? Do these driver behaviors vary between predominantly urban operations and rural operations away from cities?

Our Results

Applying our algorithms to the first year of data that was collected from August through September of 2004, we derived our answers for these questions. The results from our sample are presented graphically in the following Exhibits 3 through 8.

Comparing Exhibits 3 and 4, we see that the average driving activity segment (i.e. by a driver in “one sitting”) lasted for approximately 240 minutes (4 hours) for exclusively rural operations and only 77 minutes for operations within 100 km radius of city centre. The

median values compared as 2 hours and 1 minute for rural operations versus 53 minutes for urban/regional truck travel. While these values indicate that approximately half of drivers make stops after driving “an hour or two”, we note that there are significant numbers of drivers who apparently are not heeding the (non-mandatory) recommendation that they shut down frequently for a short break to rest their eyes and make an en route equipment check. In Exhibit 3, for example, we are showing driving segments in excess of 4 hours for about 20% of the driving segments registered with about 1.5% of drivers operating continuously for over 8 hours.



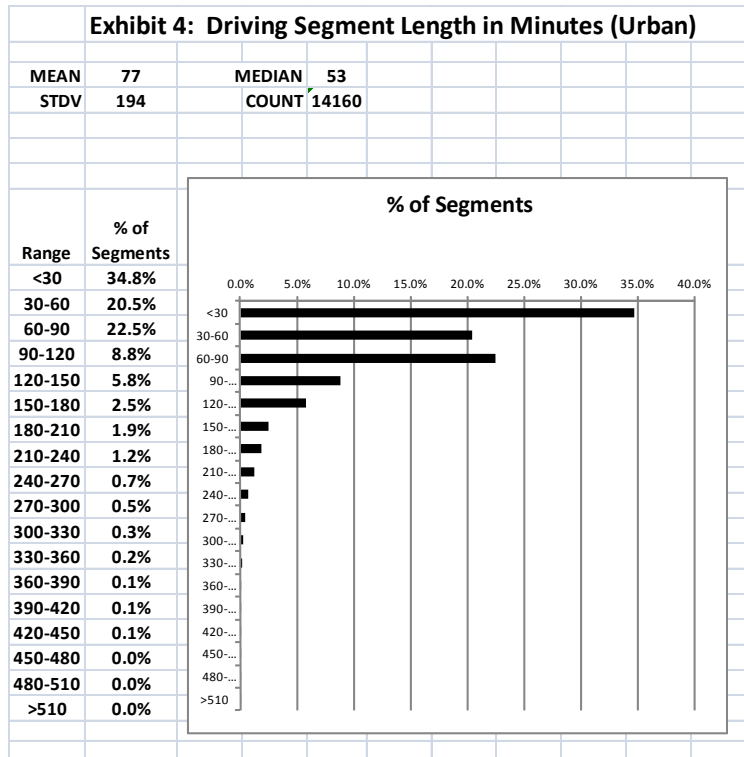
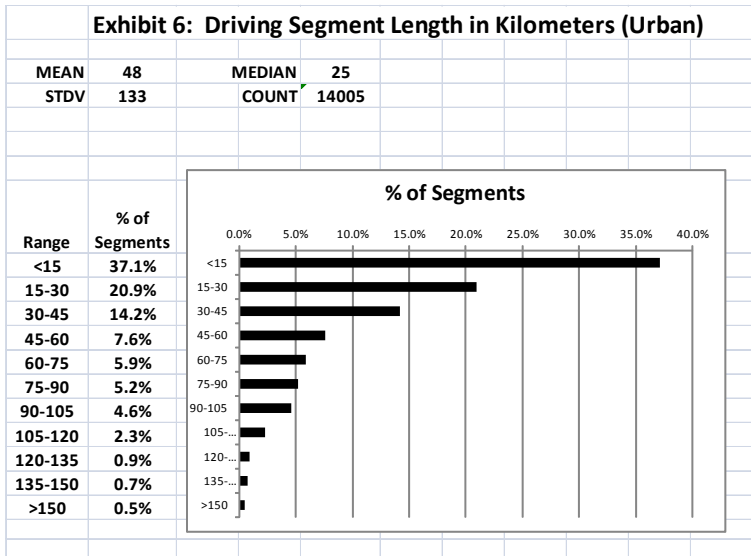
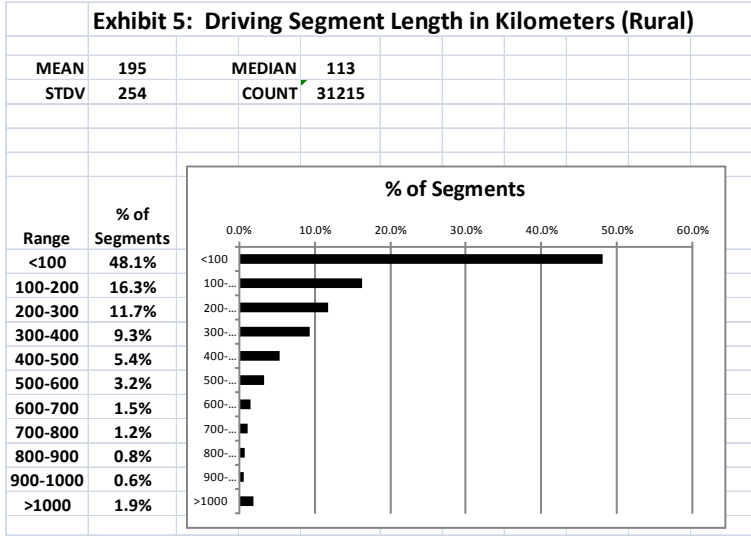
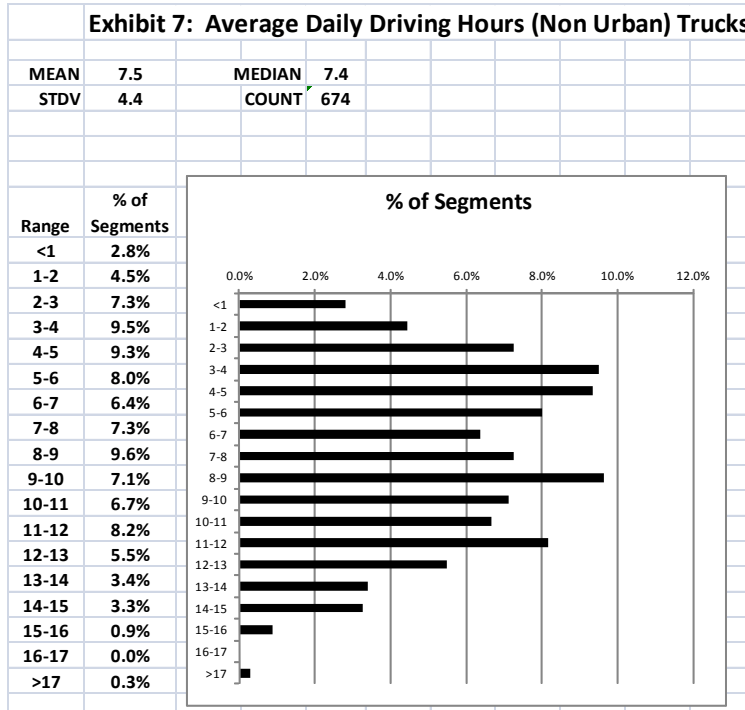


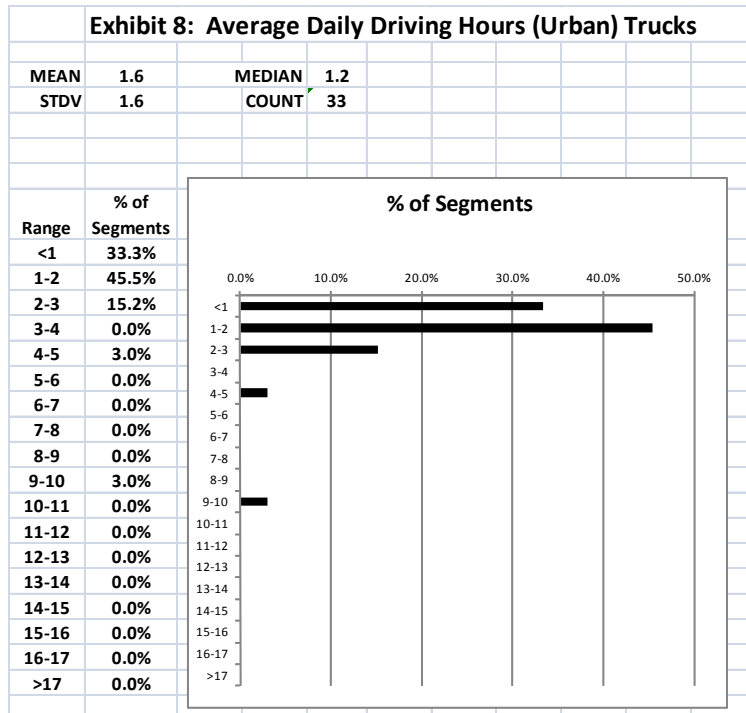
Exhibit 4 shows a shorter interval between stopping the vehicle than for the longer distance rural segments though it may be argued that traffic conditions closer to the urban centres may contribute to fatigue concerns sooner for this type of driving which may include higher levels of congestion than rural driving.

Exhibits 5 and 6 show the comparison of segment driving distances for the same types of driving – again with similar patterns as for the time spent driving.



Exhibits 7 and 8 compare average daily driving activity in hours for longer distance and urban only trucks sampled.





In viewing these results, we note from Exhibit 7 that 4.5 % of longer distance trucks are operating in excess of 14 hours per day with a further 8.9% between 12 and 14 hours per day. The mean and median values for hours operated per day are significantly less than the maxima in hours of service regulations.

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