Ontario Commercial Vehicle Survey – Use of GIS for Data Collection, Processing, Analysis and Dissemination

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Introduction
Ontario Commercial Vehicle Survey (CVS) is part of the National Roadside Study (NRS) conducted by Transport Canada about every five years across Canada on major highways and international border crossings. The NRS is roadside a truck driver intercept survey that captures many aspects of the trip, including the route, commodity, vehicle weights and dimensions, and driver and carrier profile.

In the past 10 years, significant improvements have been made to data collection, processing, and reporting techniques to enhance the accuracy of the survey data. Direct Data Entry method was introduced in 1995, followed by GIS based data processing and reporting techniques in the 1999-2001 survey. The ongoing 2005/2007 survey software includes a GIS based routing component that will enable the surveyor to confirm the route with the driver and modify it, if required, to get an accurate profile of the highways used for the trip.

Currently the CVS is the most comprehensive source of intercity commercial vehicle characteristics and commodity flow information available to the Ministry of Transportation, Ontario. The data have been used by various levels of government and private sector consultants for studies to prioritize multi year strategic investments.

GIS Platform
TransCAD is the primary GIS platform used by MTO at various stages of the data collection, review, analysis and reporting of CVS data. In addition, an ArcGIS based reporting product has also been developed to generate reports in a pre-defined format.

Data Collection
In the 1999-2001 survey, there was no GIS component used in the data collection phase. Surveys were conducted using a Direct Data Entry software on tablet computer using a DOS based application. No routing based validity checks were performed. Drivers were asked to list the highways used in the trip to confirm the route during the data processing phase.

Data Processing
The primary assumption in CVS is that a survey is not only a sample at the site where it was collected, but also forms a secondary sample for all sites along the route of the projected trip. Therefore, it is imperative that each record be reviewed for accuracy and cleansed as much as possible to ensure that the survey is assigned to the sites that are appropriate to the sequence of trip-legs.

Both GIS and non-GIS techniques had been used to review each record for the following issues.
- Handwriting recognition issues – incorrect interpretation of entries
- Incorrect jurisdictions
- Missing border and/or provincial crossings
- Drivers interpretation of “trip” definition
During the survey, up to 11 geographic points directly related to the trip were collected, in addition to another four location-based data points indirectly related to that trip. An application, ROCMOD, ran in the TransCAD environment provided all this information on a single screen in order to process the surveys on a record-by-record basis.

Every time a route was generated, the application compiled a list of predefined points of interest (POI) along the route. At the data processing stage, the points of interest were limited to the survey stations and provincial crossings only. More points are being added later to enable assignments and traffic analysis, as required. Currently, there are more than 1000 directional POIs on the Network across Canada and the U.S. These POIs play a pivotal role in the expansion of the database as control points to eliminate double counting associated with combining surveys from more than 150 sites captured over several months. These points also aid in future analysis by acting as select-link analysis points.

**Data Assignment and Analysis**

There are no zone systems in the CVS model. Since TransCAD does not restrict the number of zones for an assignment, o-d matrices are created on an on-demand basis using the nodes closest to trip-stops as centroids. A trip is broken down into several sub-trips to accommodate all the intermediate stops. It was found that about 15% of the truck trips did not follow the shortest path between the origin and the destination. Breaking down of the trips was found to be necessary in order to trace the path of these trips correctly.

The use of dynamic generation of o-d matrices provides MTO with tremendous flexibility to assign trips. Any subset of the database can be selected and assigned to the network by simply specifying the condition for the selection.

Another advantage of compiling the matrices on-demand is that it allows the user to perform robust select link analyses compared to traditional select-link analysis based on a pre-defined matrix. In fact, in MTO’s model, a select-link assignment is treated the same way as any other assignment. It also allows the user to perform “multi-link” analysis where trips common to multiple highway links can be assigned to the network. For example, all trips that passed both Ambassador Bridge between Ontario and Michigan, and Peace Bridge between Ontario and New York can be easily selected and assigned to the network.

**Reporting**

MTO has recently launched a new application to create a three or four page report containing commonly requested charts, graphs, and maps that summarise various characteristics of the truck traffic. Most reports are three pages long with the exception of Data Collection Sites (DCS) for which a four-page report is produced. In addition to the standard report, DCS reports contain summaries of site-specific data such as summaries of the sample collected at the site and average traffic characteristics.

The CVS Reporting System was developed using ArcGIS platform in order to utilise corporately available resources within MTO. A report can be created for any predefined point-of-interest (POI) on the highway system. It also allows users to perform “area” or “corridor” type analysis using several POIs and looking at trips that passed any one or all of the selected POIs. A POI may be selected using a search list or the map.
The Reporting System takes the select link analysis another step further by allowing the user to study the truck characteristics in detail at any point on the highway system. In addition, similar to the CVS assignment procedures, the custom report feature of the Reporting System allows the user to produce reports based on any subset of data (e.g. all international trips, or truck with dangerous goods, etc.)

**Lessons Learned and Future Innovations under Development**

In 1999-2001, a significant amount of time was spent on data review that resulted in delays in releasing the data. Even though it was recognised at that time that the accuracy of the data can be ensured only by minimising the errors and omissions during data collection, due to the limitation in technology, comprehensive validity checks would have resulted in sizable increase in survey time.

With the availability of affordably priced routing software, such as Microsoft MapPoint, and advancements in computer technology with significantly higher computing power, it became possible to incorporate the routing component in the 2005/2007 National Roadside Study during the face-to-face survey. By incorporating an off the shelf consumer based routing product, the survey software is now able to harness the power of locating detailed addresses on the map to project the accurate route of the trip. In previous surveys, except for some major urban areas, primarily only municipal level information was collected. Surveyors had no ability to check the validity of the address given to them and cross-reference zip or postal codes with address and place name information provided by truck drivers.

Validating addresses and routes used for the trip during the survey is expected to significantly improve the quality of the data collected in the 2005/2007 survey and promotes consistency in the collection of detailed trip end data.

**Other Innovative Commercial Vehicle Tracking Methods**

Roadside interviews are the most suitable avenue to collect data about intercity movements. However, it is impossible to use roadside surveys in an urban environment due to safety issues. In addition, with emerging privacy concerns, it is becoming increasingly difficult to conduct roadside interviews. It would be almost impossible to conduct roadside surveys in about a decade from now.

MTO is currently in the process of investigating the use non-intrusive of GPS data to supplement, and eventually replace, data collected from roadside surveys. The number of trucks equipped with GPS receivers, which records the location of the vehicle every few seconds, have been increasing steadily over the past few years. In addition to providing detailed origin-destination information, The GPS technology provides many other potential benefits, including:

2. Link level congestion analysis – travel time, speed
3. Near real-time international border transit time monitoring.
4. Tools and reporting systems to measure economic impacts delays due to incidents.
5. Fuel consumption and pollution analysis using GPS units that include engine data retrievers
6. Impacts of High Occupancy Vehicle (HOV) lanes on General Purpose Lane (GPL) traffic.