NOVA SCOTIA

Transportation and Infrastructure Renewal

Aulds Cove Weigh-In-Motion Evaluation Report

January 18, 2008

Acknowledgments

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Executive Summary

The Department of Transportation and Infrastructure Renewal installed a high speed Weigh-In-Motion (WIM) system in the Trans-Canada Highway (TCH) 104 at Aulds Cove at the beginning of the Causeway. The new system allows for high speed screening of commercial vehicles traveling eastbound on the highway, thus improving safety, saving compliant vehicles time, and eliminating possible resulting congestion. It also provides for more effective enforcement and better operation of the Aulds Cove Vehicle Compliance Station (VCS).

As part of this evaluation project, a Trucking Satisfaction Survey was conducted. Overall, the majority of the survey respondents were very satisfied (28.5%) or satisfied (66.6%) with the new WIM system. The survey results also indicate that:

- 86.7% of respondents strongly agree or agree that this part of the highway is safer as a result of the WIM system
- 85.7% strongly agree or agree that the WIM system accurately measures the weight of their truck
- 93.5% strongly agree or agree that the signage for the WIM system provides them with the direction they need
- 86.6% strongly agree or agree that the WIM system has decreased their time spent at the VCS

Twenty-three per cent of all commercial vehicles traveling the eastbound lane of the TCH 104 were required to report to the VCS in the 2007 study period compared to 60%-70% in the 2005 study period (i.e., 100% when scale house is open). It appears that commercial vehicles reporting to the VCS were also more compliant in the 2007 period compared to 2005:

- 15% of driver contacts resulted in Summary Offence Tickets being issued in 2005 compared to 11% in 2007
- Written warnings decreased from 8% of driver contacts in 2005 to 2% in 2007

1.0 Introduction

1.1 Background

The design of pavement and bridge structure is based on the weights of the heavy vehicles traveling on a highway. Weigh stations have been used for many years to weigh vehicles, enforce other regulatory requirements, and issue Summary Offence Tickets and warnings. Truck weight data provides valuable information to highway engineers regarding highway design and pavement management.

The literature shows that the effectiveness of fixed location truck weigh stations can be improved by the use of Weigh-In-Motion (WIM) scales. WIM technology has been utilized for many years to reduce delay and increase enforcement of overweight vehicles. WIM devices have been developed for weighing trucks with varying axle configurations at highway speeds. Weigh-in-motion is a sensory technology that is capable of estimating a moving vehicle's gross weight and the portion of that weight that is carried by each wheel, axle, or axle group, or combination thereof, by measurement and analysis of dynamic vehicle tire forces. Through WIM technology, trucks can be weighed dynamically and, based on the estimated weight, the vehicle can be signaled to enter a static scale for a more accurate measurement. The WIM system offers a method of recording and processing truck weight data, traffic volume, and vehicle classification and speed automatically without disrupting the truck driver, thus saving the vehicle time and eliminating possible resulting congestion. The WIM system provides highway planners, researchers and enforcement officials with statistical data.

In the north eastern portion of mainland Nova Scotia, the Trans-Canada Highway (TCH) narrows to two lanes. This stretch of roadway includes the Canso Causeway area and it is the only access to Cape Breton Island and on to Newfoundland. That is a major commercial and tourist route.

There is one vehicle compliance station (VCS) in the Canso Causeway area, located along this two lane, two-way section of the TCH 104 at Aulds Cove at the beginning of the Causeway on the mainland. Commercial vehicles traveling eastbound must turn left and cross the westbound lane traffic entering and exiting the VCS. Concern was expressed by the trucking industry and others that the maneuver is unsafe at any time, but the exposure to risk increases during the high-traffic tourist season.

During the mid-1990's, the Department installed a weigh-in-motion scale in the TCH 104, just west of the VCS, for data collection purposes. The use of high speed WIM technology was explored at that time as a means to screen eastbound commercial vehicles and, for those measured to be within weight limits, be exempted from reporting to the weigh station in the eastbound direction. WIM technology was not satisfactory at that time and the old system was maintained only for capturing data for vehicle counts and statistical reporting purposes. It used an IRD 1060 DOS-based system by International Road Dynamics Inc.(IRD), of Saskatchewan.

In 2004, the eastbound commercial traffic was estimated to be in the order of 220,000 vehicles per year, with about 70% of these vehicles (154,000) reporting to the weigh scale when the station was open. Of those reporting, it was estimated that the weight compliance rate was about 98% (151,000).[1]

At that time, the Department and the federal government agreed to install a new weigh-in-motion site in the eastbound lane of the TCH 104 at the Aulds Cove VCS to screen commercial vehicles for weight compliance. This was a jointly funded project under the Intelligent Transportation Systems (ITS) program from Transport Canada with the Province of Nova Scotia. The system was to conform with the ITS Architecture for Canada and the contractor was International Road Dynamics Inc. The completion of the system installation, calibration and performance testing was to be acceptable in accordance with the guidelines established in the ASTM E 1318-00 of Type III WIM systems.

The Aulds Cove WIM project was initiated in May 2005, to allow for high speed WIM screening of weight compliant commercial vehicles traveling eastbound on the TCH 104, thus improving safety, saving compliant vehicles time, and eliminating possible resulting congestion. Westbound vehicles would still be required to stop at the VCS. It was also expected to provide for more effective enforcement and better operation of the Aulds Cove VCS. The new system uses ISINC, a Windows-based system also by IRD.

The high speed WIM system installed at Aulds Cove includes WIM electronics located next to the WIM scales/sensors in a roadside cabinet. The WIM electronics are responsible for retrieving truck data and communicating the truck data to the validation computer in the VCS. The system collects, sorts, analyses and stores Equivalent Single Axle Loads (ESALs), classification, site identification code, and lane and direction of travel data for each vehicle that passes through the site.[2]

The WIM electronics and its software can:

- Weigh and classify all vehicles in lanes where sensors are installed
- Perform weight compliance analysis on vehicles in accordance with Provincial regulations
- Insert sequence numbers for vehicle records for tracking purposes
- Perform data collection, data storage, file management and report generation functions for collected vehicle information

[1] Nova Scotia. Department of Transportation and Public Works - Weigh-In-Motion Proposal: ITS deployment and integration plan. 5 p. (2004)

[2] International Road Dynamics - High-Speed Weigh-In-Motion System, Aulds Cove, Nova Scotia. RFP 60125725 - Closing date March 30, 2005. pp. 11

- Capture images of trucks[3]

1.2 Project Description

The Province of Nova Scotia was to undertake the following steps:

- Prepare the site for the installation of WIM, including signage, bypass lane construction, preparing the road surface and obtaining power.
- Obtain all regulatory approvals and permits, install all components of the system; provide on-site supervision and traffic control, and restore the site to the original condition.
- Provide training to all vehicle compliance officers (VCO) on the daily operation and to specialized personnel on troubleshooting and maintenance.
- Conduct calibration and performance testing after installation following the guidelines established in the ASTM E 1318-00 for on-site acceptance of Type III WIM systems.
- Collect data for a period of six months and complete an evaluation report on the installation of the WIM, reporting on how the objectives were met, the outcomes achieved, and lessons learned.

During the installation and calibration of the new WIM system at the Aulds Cove vehicle compliance station a number of problems were encountered:

- The concrete slab eastbound was rough and had to be planed down to meet specifications.
- The surge protector for the LED boards caught fire and put the system out of order for a few weeks.
- The wireless system was not strong enough at first to work properly.
- The aluminum poles that hold the wireless equipment would shake in the wind and the equipment would move around and go out of alignment. The poles ended up being filled with concrete.
- The road side equipment (computer) was moved from roadside to the VCS so that it would have a stronger signal and be warm in a building.
- Westbound traffic unit would not classify or weigh properly in November 2006 because no temperature sensor was installed when the equipment was first installed. It was installed over a year later and then the 12' Piezo sensors were

[3] ___ Ibid. pp. 14

not long enough to give good results westbound. These sensors were replaced with 16' sensors in October 2007, adjusted in December, and passed auto-calibration testing as of January 16, 2008.

These problems have contributed to the extension of the WIM evaluation report time line which was originally planned for completion by September 2006. The system calibration issues also caused substantial changes to the data collection targets as data for 2006 was inconsistent and the old system was shut down in mid June 2005.

1.3 Evaluation Goal

The goal of the Weigh-In-Motion (WIM) evaluation is to assess how well the new WIM system installed in Nova Scotia has achieved its objectives.

1.4 Evaluation Objectives

The primary objective of this report is to evaluate improved safety as measured by the reduction in eastbound commercial vehicles required to cross the TCH lane and report to the VCS. The reduction of vehicles crossing the TCH would result in reduced conflict potential with opposing traffic and thus improve safety.

Other objectives of this evaluation are to determine the impact of the WIM on:

- ✦ Improvements to mobility and transportation efficiency
- ✦ Improvements to operational and regulatory efficiency
- ✦ Environmental impact
- ✦ Trucking industry satisfaction

1.5 Methodology

An evaluation proposal was developed by the Policy and Planning division in consultation with members of the TIR's WIM Evaluation Committee, established to oversee the project in September 2005. As part of the WIM evaluation, a Trucking Satisfaction Survey was planned to gather feedback from the truckers traveling the TCH 104 route affected by the WIM system.

The objectives for this evaluation and their respective measures were as follows:

1.5.1 To improve safety by reducing the number of eastbound commercial vehicles required to cross the westbound TCH lane and report to the VCS.

Measures:

- Comparison and analysis of the number of commercial vehicles in the eastbound lane that report to the scale house before and after the new WIM system installation.
    - Traffic volume reporting to the scale house.

1.5.2 To improve mobility and transportation efficiency and productivity for freight movement.

Measures:

- Comparison of transportation costs as a result of time and fuel savings
    - Based on the average delay per vehicle and the savings for these vehicles by-passing the scale.

1.5.3 To evaluate increases of operational and regulatory efficiencies for system users and the Department.

Measures:

- Number of violations identified
    - Change in the number of driver contacts versus change in traffic volume
        - Number of driver contacts
        - Number of trucks weighed
    - Change in the number of citations issued (tickets and written warnings) versus change in traffic volume
        - Number of Summary Offence Tickets (SOTs) issued
        - Number of written warnings issued
        - Number of Commercial Vehicle Safety Alliance (CVSA) inspections
        - Number of trucks reporting and by-passing

1.5.4 To evaluate the environmental impact, as measured by reduced air emissions.

Measures:

- Average amount of air emissions as a result of trucks acceleration, deceleration, and idling
    - Number of compliant vehicles in the eastbound direction bypassing the scale station
    - Amount of time truckers wait for traffic to turn to the westbound side of the scale house

- ✦ Idling wait time

1.5.5 To monitor and assess the trucking industry's satisfaction levels with the WIM scale at Aulds Cove:

Measures:

- ✦ Percentage of truckers satisfied with the new WIM system. (Source: Trucking Satisfaction Survey)

- ✦ Feedback from the Atlantic Provinces Trucking Association (APTA) and the Truckers Association of Nova Scotia (TANS)

1.6 Data

Data used in the WIM evaluation was collected with the new WIM system between January 1, 2007 to June 6, 2007, and compared to data from the old system collected between January 1, 2005 to June 6, 2005. Data were also used from the Trucking Satisfaction Survey, the Carrier Activity Profile (CAP) System, Vehicle Compliance Station's activity and statistical reports, and complemented with vehicle compliance staff knowledge.

Data was gathered from the IRD System monitored by the Census Team, Traffic Engineering, Department of Transportation and Infrastructure Renewal, on a monthly interval (per day of month in a 24-hour period) by type of Vehicle Classification Count (vehicle categories 5-23) at the Canso Causeway VCS.

- ▸ Number of commercial vehicles traveling eastbound lane that have to cross the westbound lane of traffic to report to the VCS.

- ▸ Number of vehicles that bypass the VCS (i.e., that are compliant with weights of vehicles as required by the *Weights and Dimensions of Vehicles Regulations made under Section 191 of the Motor Vehicle Act*, RSNS 1989, c.293., or when the VCS is closed)

The vehicle classification chart used in 2005 followed the Federal Highway Administration (FHWA) Vehicle Classification system (U.S. Department of Transportation); the Department adopted the Nova Scotia Scheme in 2007. Although both schemes cover all the categories of vehicles, the class numbers and vehicle representations are different.

Data was also gathered from the Vehicle Compliance Officers (VCOs) Activity Summary reports of the Department:

- Number of occurrences or driver contacts[4]
- Number of Summary Offence Tickets (SOTs) issued
- Number of written warnings issued

The number of driver contacts/occurrences were divided by four because each driver contact activity consists of truck load weighing plus a random check average of three to four different activities relating to other regulation/legislation.

Hours of Operation of Vehicle Compliance Station

- Weekly summary of hours of operation of the Aulds Cove Vehicle Compliance Station for similar period in 2005 and 2007

It is important to note that during this period the number of vehicle compliance officers (VCOs) changed. Eleven new VCOs were hired and trained in 2006 so that the vehicle compliance stations in Nova Scotia may operate on a 24-hour period five days/week. In 2007, the Aulds Cove VCS increased its hours of operation with one more operator.

In 2005, all commercial vehicles (100%) were required to report for weighing when the Aulds Cove station was open. With the WIM system compliant carriers traveling the eastbound lane are signed to by-pass; only non-compliant carriers and a random number of compliant vehicles are required to report.

2.0 Comparison Before and After the WIM System Installation

Due to problems with the WIM system installation and its calibration, the time line of six months period of data collection had to be delayed from 2006 to 2007. Data collected from the old system covers the period of January 1, 2005 to June 6, 2005, and is compared to the data collected with the new WIM system for the same period in 2007.

2.1 Findings

2.1.1 Traffic Volume Reporting to the Vehicle Compliance Station

Objective: *To improve safety by reducing the number of eastbound commercial vehicles required to cross the westbound TCH lane and report to the vehicle compliance station.*

[4] Driver contacts refers to those instances where the Vehicle Compliance Officer communicates directly with the driver.

Between January 1, 2005, and June 6, 2005, all commercial vehicles (100%) traveling in the eastbound lane were required to report to the vehicle compliance station when it was open, resulting in 60%-70% of all commercial vehicles reporting to the VCS. Between January 1, 2007 and June 6, 2007, 23% of all commercial vehicles were required to report to the VCS.

Almost 8 in 10 trucks (77%) bypassed the VCS after the new WIM system was installed. Safety improved because the amount of eastbound traffic required to cross the westbound TCH lane and report to the VCS was substantially reduced.

2.1.2 Transportation Efficiency and Productivity for Freight Movement

Objective: *To improve mobility, transportation efficiency and productivity for freight movement*.

Allowing safe and weight compliant commercial vehicles to bypass without stopping can reduce congestion at weight and inspections stations. WIM technology implementation enhances productivity by reducing travel times and operating cost, extending operating radius within safe working hours. The literature review also indicates that electronic screening reduces maintenance and rehabilitation costs of road infrastructure by enforcing weight limits, and reduces driver/shipper/receiver operation by improving the predictability of estimated time of arrival.[5]

Congestion is difficult to measure. The amount of time trucks usually stop to cross the TCH to report to the VCS on the westbound lane is estimated to be from about 30 seconds to a maximum of three minutes. That is also the estimated maximum time trucks would stop for inspection at the VCS. When a traveling commercial vehicle's weight is compliant there is no need to stop to report. In 2007, 77% of commercial vehicles bypassed the VCS compared to 30%-40% of all commercial vehicles bypassing in 2005. For this reason the use of the WIM system improved mobility, reduced time and fuel, and increased savings for those vehicles bypassing the vehicle compliance station.

The view that the new WIM system improved mobility and transportation efficiency and productivity for freight movement is also confirmed by the fact that:

- Over eight in ten of the Trucking Satisfaction Survey respondents strongly agree (17.9%) or agree (68.7%) that the WIM system decreased their time spent at the VCS.

- Almost six in ten survey respondents strongly agree (9.1%) or agree (50.6%) that their fuel efficiency has increased as a result of the new WIM system.

This is consistent with the feedback received from the members of Atlantic Provinces Trucking Association (APTA) (see page 13) who feel that the WIM technology saves

[5] Transport Canada - Study on ITS Applications within the Canadian Trucking Industry. pp. 1-19 <http://www.tc.gc.ca/pol/EN/Report/its/ITS2.htm> (Accessed 11/15/2005).

time and impacts on wait times in lineups, reducing driver stress. Members of the Truckers Association of Nova Scotia (TANS) like having the ability to know they are legally loaded without having to stop at the VCS (see page 13).

2.1.3 Operational and Regulatory Efficiencies

Objective: To evaluate increases of operational and regulatory efficiencies for system users and the Department.

WIM technology allows authorities to concentrate on a greater number of potential unsafe vehicles. On a regular basis, vehicle compliance officers weigh all commercial vehicles reporting to the VCS and randomly check an average of three to four other activities such as hours of work, vehicle registration, loads for dangerous goods, vehicle dimensions and other requirements, as stipulated by the regulations.[6]

During the period January 1, 2005, to June 6, 2005, the VCS at Aulds Cove was open for 1,779.5 hours. Commercial vehicle drivers called in by VCOs include drivers from both eastbound and westbound lanes. Vehicle compliance officers talk with some drivers and check for other regulatory requirements; this activity is referred to as driver contacts. Of those driver contacts, 15% were issued SOTs and 8% received written warnings.

In 2007, the Aulds Cove VCS had one more operator working on shifts providing increased hours of operation. During the data sample period (January 1st to June 6th), the VCS was open for 2,293.6 hours. Of all driver contacts, both eastbound and westbound, 11% were issued SOTs and only 2% received written warnings.

Table 1: Driver Contacts

Driver Contacts, Number of Summary Offence Tickets (SOTs) and Written Warnings Issued January 1 - October 31						
Year	**VCS Hours of Operation***	**Driver Contacts**	**SOTs Issued**	**% Tickets**	**Written Warnings**	**% Warnings**
2005	1,779.5	2,758	403	15%	225	8%
2007	2,293.6	3,682	414	11%	69	2%

* January 1 - June 6

The decrease in the percentage of SOTs and written warnings issued may be partially attributed to the WIM system, but may also be the result of the increase in the number of hours the VCS is open. Drivers know the VCS is open more often and tend to comply

[6] Routine duties of a VCO include inspections under the Commercial Vehicle Drivers Hours of Work Regulations, Commercial Vehicle Trip Inspection, Dangerous Goods, Motor Carrier Act, Motor Vehicle Act, Motor Vehicle Inspection Regulations, Public Highways Act, Regulations Respecting Weights and Loads, and Weights and Dimensions of Vehicles Regulations.

more. Also during this time period a Training and Outreach position was established. The position has been providing information sessions on the legislation and regulations to trucking associations, businesses and other industry stakeholders.

2.1.4 Environmental Impact

Objective: To evaluate the environmental impact, as measured by reduced air emissions as a result of trucks acceleration, deceleration, and idling

Literature research indicates that speed, vehicle model and year, fuel performance, idling, congestion, and pavement design, management, and weight enforcement all contribute to the amount of vehicle emissions and its environmental impact.

Studies show that emissions and energy use would be dramatically decreased if vehicles could operate at steady speeds and never had to stop. When a vehicle accelerates to a given road speed, a substantial amount of energy is transferred into the momentum of the vehicle. When the vehicle slows or stops, this energy is consumed, either through vehicle drag or through the application of the vehicle's brakes. When the vehicle is stopped the engine is still running and thus is still generating emissions and using fuel.[7]

We were unable to measure the average amount of air emissions as a result of truck's acceleration, deceleration and idling because the accurate measurement of emissions would require an identification of vehicles, drivers and routes involved, as well as the installation of specific tools inside the truck cabin and the participation of the truck fleet companies.

For the purpose of our evaluation report, we used the number of weight compliant vehicles on the eastbound lane of the TCH 104 at Aulds Cove bypassing the vehicle compliance station to demonstrate that the WIM system provided an impact in the decrease of idling wait time. Only 23% of commercial vehicles now report to the VCS, compared to 60%-70% with the old system. Therefore, there are substantial savings in idling time, and in deceleration and acceleration, thus having a positive impact on air emissions and the environment.

Results of the Trucking Satisfaction Survey show that over eight in ten respondents indicated they strongly agree (17.9%) or agree (68.7%) that the WIM system has decreased their time spent at the vehicle compliance station (see question 5C, page 21).

2.1.5 Trucking Industry Satisfaction

Objective: To monitor and assess the trucking industry's satisfaction levels with the WIM scale at Aulds Cove.

[7] Environment Canada - Trucks and Air Emissions, p. 23

A Trucking Satisfaction Survey was prepared to gather feedback from the truckers traveling the TCH 104 at Aulds Cove. The survey was conducted on October 25, 2007, between 8:00 a.m. and 9:00 p.m. Only truckers traveling the westbound lane were interviewed. On that day, truckers who made more than one trip in that stretch of the highway were only interviewed once. Interviewers also classified the type of trucks being driven by interviewees following the Nova Scotia categories of vehicle weights and dimensions limits by configuration.

The survey gathered information about the frequency of trips, the time of day and the time of year truckers travel the eastbound lane of the highway. A question with five general statements about the WIM system gathered feedback on the accuracy of the WIM weighing of the truck, satisfaction with the signage on the highway, the period of time spent at the VCS, fuel efficiency, and overall highway safety as a result of the new WIM system. There was one question related to the overall satisfaction of the truckers with the WIM technology. (See Appendix B, page 26)

Over nine in ten truckers (92.7%) agreed to participate in the survey; a total of 319 surveys were completed. Most survey respondents (41.1%) were driving a six-axle Tractor Semi Trailer. Over two in ten survey respondents drove a five-axle Tractor Semi Trailer (27.7%), or a Straight Truck (23.7%).

Overall, one-third of the data (33.9%) were collected between 11:00 a.m. and 2:00 p.m. Over one-third (35.0%) reported traveling during all times of the day, and the majority (80.7%) use this route year round.

Most respondents indicated they were very satisfied (28.5%) or satisfied (66.6%) with the new WIM system. Over half of the respondents (55.2%) feel they the Nova Scotia WIM system is similar to other WIM systems that they have used, and over one-third (35.7%) feel that it is better.

When asked to indicate if they agreed or disagreed with general statements about the WIM system, the following was found:

- Most respondents indicated they either strongly agree (16.3%) or agree (69.4%) that the WIM system accurately measures the weight of their truck.

- Almost all respondents indicated they either strongly agree (15.4%) or agree (78.1%) that the signage for the WIM system provides them with the direction they need.

- Most respondents indicated that they strongly agree (17.9%) or agree (68.7%) that the WIM system has decreased their time spent at the vehicle compliance station.

- Just under two-thirds of respondents indicated they strongly agree (9.1%) or agree (50.6%) that their fuel efficiency has increased as a result of the new WIM system.

- Most respondents indicated they strongly agree (29.7%) or agree (57.0%) that this part of the highway is safer as a result of the new WIM system.

The two trucking associations in Nova Scotia were also asked to provide feedback on the WIM system. Their response was as follows:

Atlantic Provinces Trucking Association (APTA)

Most of the carriers said they had no reports either positive or negative. They added that they were not surprised by this as most of their drivers bought into the technology from the start and it is used in other jurisdictions. Overall comments were positive from the carriers as they felt that it saves time and also impacts on things like lowering driver stress for not having to sit in lineups. This is a major issue for this sector of the industry.

Truckers Association of Nova Scotia (TANS)

The high speed WIM station at Aulds Cove has been received well. The truckers like having the ability to know they are legally loaded without having to stop. They mentioned that it would be nice if they did not have to report when returning in the westbound lane. There are many times when truckers are empty and they have to stop on the return trip.

3.0 Conclusion

Findings of this project can be summarized as follows:

- Safety has increased as the potential for traffic conflict has decreased at the TCH 104 at Aulds Cove area because fewer vehicles are reporting to the vehicle compliance station:
    - In 2007, three-quarters (77%) of commercial vehicles bypassed the vehicle compliance station after the new WIM system was installed, compared to 30%-40% in the old system.
    - Most respondents of the Trucking Satisfaction Survey strongly agree (29.7%) or agree (57.0%) that this part of the highway is safer as a result of the new WIM system.
- Mobility, transportation efficiency, and productivity for freight movement has improved:
    - By reducing the need to stop to report when a traveling commercial vehicle's weight is compliant, the use of the WIM system improved mobility, reduced time and fuel, and increased savings.

- Almost two-thirds of survey respondents strongly agree (9.1%) or agree (50.6%) that their fuel efficiency has increased as a result of the WIM system.

- Operational and regulatory efficiencies:
  - It appears commercial vehicles are more compliant as evidenced by fewer tickets and written warnings issued in 2007 compared to 2005 figures.
    - Summary Offence Tickets decreased from 15% of driver contacts in 2005 to 11% in 2007.
    - Written warnings also decreased from 8% of driver contacts in 2005 to 2% in 2007.

- Environmental Impact:
  - The decrease in the percentage of commercial vehicles reporting to the VCS demonstrates a decrease of idling wait time, and acceleration and deceleration, thus having a positive impact on the environment.
  - Most (86.6%) respondents of the Trucking Satisfaction Survey feel that the WIM system has decreased their time spent at the VCS.

- The trucking industry satisfaction levels with the WIM scale at Aulds Cove is positive:
  - Most respondents of the Trucking Satisfaction Survey reported being very satisfied (28.5%) or satisfied (66.6%) with the new WIM system.

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Appendices

Appendix A: Trucking Satisfaction Survey Report

Trucking Satisfaction Survey Results

A summary of responses to each question in the survey questionnaire follows. A sample of the questionnaire used is included as Appendix B

Due to rounding not all tables and graphs will add to 100%. Percentages in the tables and graphs in the report do not include blank responses in cases where respondents did not answer questions. Only truckers traveling the westbound lane were interviewed.

Based on the volume of traffic on that part of the highway on Thursdays, 900 questionnaire forms and 75 return trip signs were printed. Thirty-four of the return signs were distributed (45.4%) to participants expected to be by the VCS more than once that day so that they did not have to complete another survey.

Table 2 shows how many completed surveys were received and the response rate. Over nine in ten truckers (92.7%) agreed to participate in the survey.

Table 2: Trucking Survey Response Rate

Number of Responses		Response Rate
Completed Surveys	319	92.7%
Refused to Participate	25	7.3%
# Forms Used	344	100%

The survey gathered information about the frequency of trips, the time of the day and the time of the year truckers travel the eastbound lane of the TCH 104 at Aulds Cove. The survey also included a question with five general statements about the WIM system asking truckers to indicate their level of agreement with the statements. Statements included the accuracy of the weigh-in-motion weighing of the truck, satisfaction with the signage on the highway, the period of time spent at the weigh station, fuel efficiency and overall highway safety as a result of the new WIM system. There was one question related to the overall satisfaction of the truckers with the WIM technology.

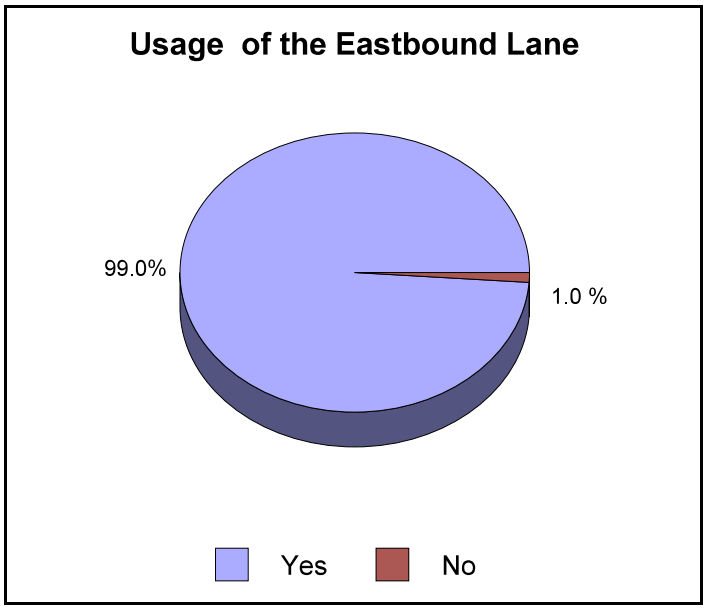
Interviewers classified trucks, by sight, during the interview using the following vehicles classification.[8] The categories used included vehicle weights and dimensions limits by configuration.

Table 3: Commercial Vehicle Categories used in the Trucking Satisfaction Survey

Category #	Description
Category 5	Tractor Semi-Trailer: (four-axle, five-axle and six-axle tractor semi-trailers)
Category 6	A Train Double
Category 7	B Train Double
Category 8	C Train Double
Category 9	Straight Truck: (two-axle, three-axle and four-axle straight trucks)
Category 10	Truck - Pony Trailer
Category 11	Tandem Steering Axle Truck - Pony Trailer
Category 12	Truck - Full Trailer
Category 13	Tandem Steering Axle Truck - Full Trailer

The following is a summary of responses to the survey questionnaire:

Question 1: Do you travel in the eastbound track of TCH 104 at Aulds Cove?

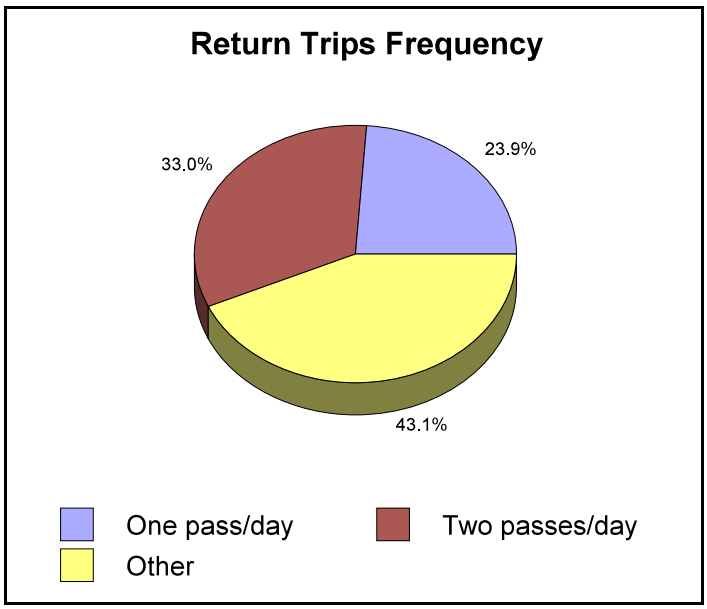


The majority of respondents (99.0%) reported traveling in the eastbound lane of the Trans-Canada Highway 104 at Aulds Cove in Nova Scotia.

[8] The types of vehicles used were selected from the Nova Scotia's Vehicle Classification System (i.e., the types of trucks allowed on Nova Scotia highways) as listed in the *Schedule A - Vehicle Weights and Dimensions Limits of the Weights and Dimensions of Vehicles Regulations made under Section 191 of the Motor Vehicle Act*, R.S.N.S. 1989, c.293.

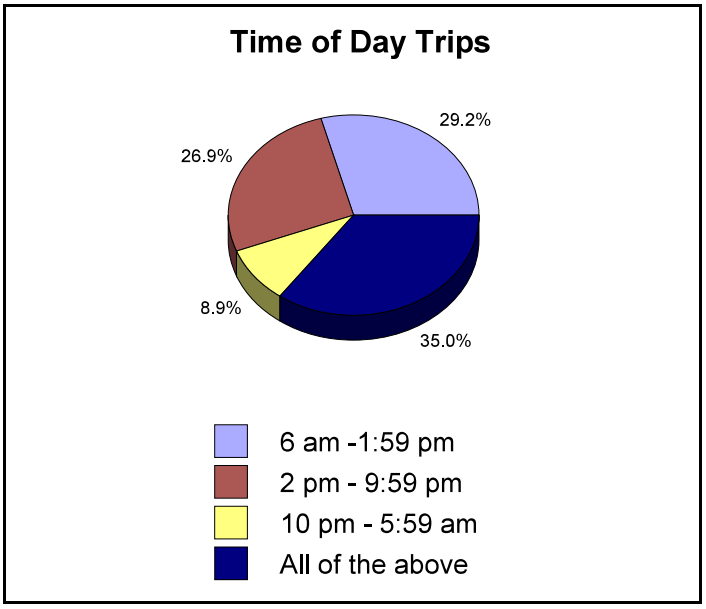
Question 2: How often do you make return trips in the section of the TCH 104 at Aulds Cove?

When asked how often they make return trips in the section of the Trans-Canada Highway 104 at Aulds Cove, over 2 in 10 respondents (23.9%) reported making one pass per day while one-third of respondents (33.0%) reported making two passes per day.



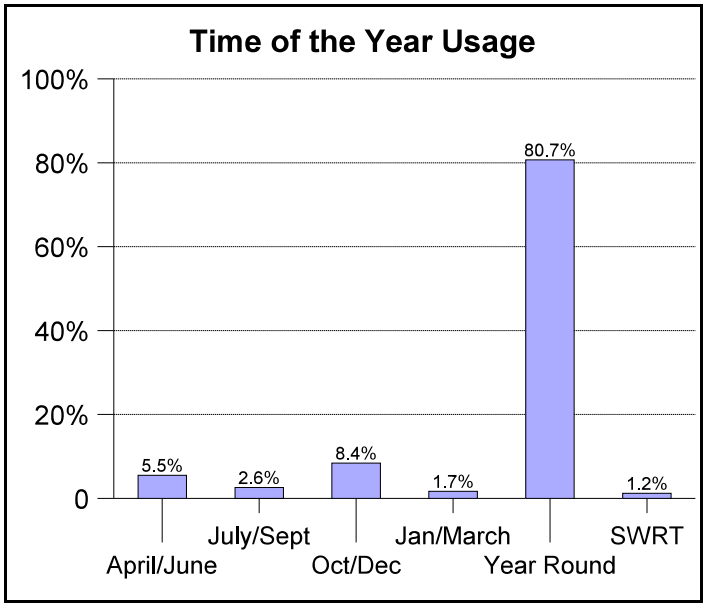
Over 4 in 10 respondents (43.1%) reported making other types of return trips. Almost one-quarter of this group (24.0%) reported traveling this section of the highway once a week, 13.8% reported traveling two times a week, and 8% said they travel this section of the highway three times a week. One in 10 (10.9%) reported traveling once a month.

Question 3: What part of the day do you use the eastbound lane of the TCH 104 at Aulds Cove?



The percentage of respondents using the eastbound lane was highest for those traveling between 6:00 a.m. and 1:59 p.m. (29.2%), followed by those traveling between 2:00 p.m. and 9:59 p.m. (26.9%). Over 3 in 10 respondents (35.0%) reported that they travel during all times of the day.

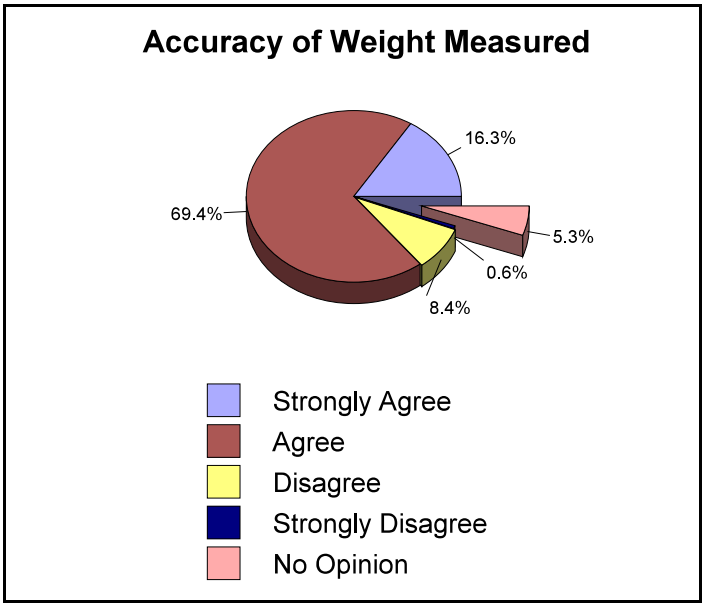
Question 4: What time of the year do you use this route? (Check all that apply)



The majority of respondents (80.7%) use this route year round.

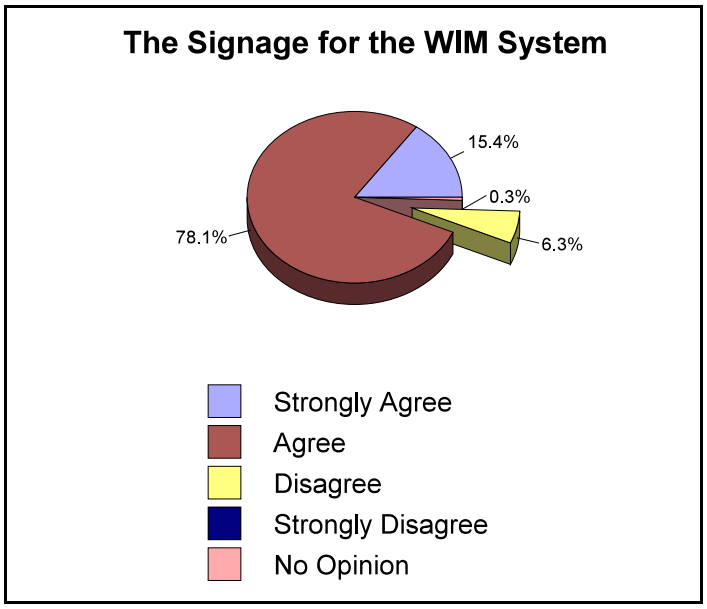
Question 5: Please indicate the response that best describes how much you agree or disagree with the following general statements about the weigh-in motion system.

Q5A: The new weigh-in-motion system accurately measures the weight of my truck.



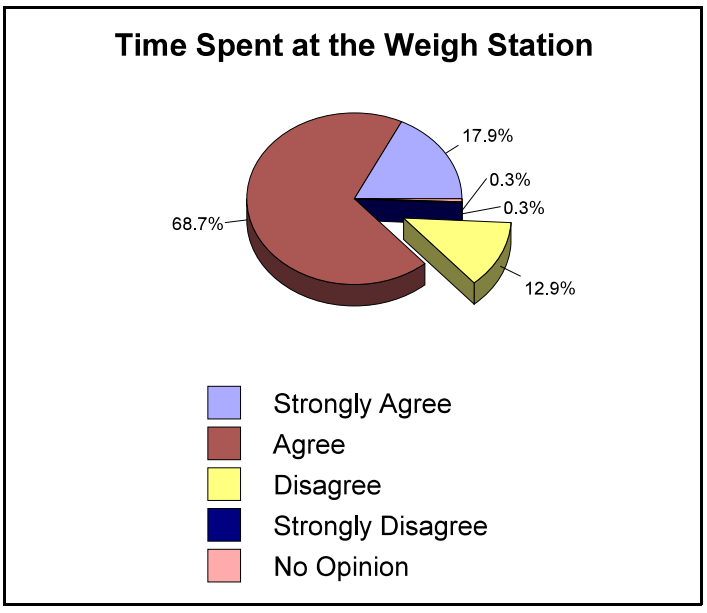
Most respondents strongly agree (16.3%) or agree (69.4%) that the WIM system accurately measures the weight of their truck. Only 9% of the respondents disagree with the accuracy of weight measured by the WIM system.

Q5B The signage for the weigh-in-motion system provides me with the direction I need.



Most respondents strongly agree (15.4%) or agree (78.1%) that the signage for the WIM system provides them with the direction they need.

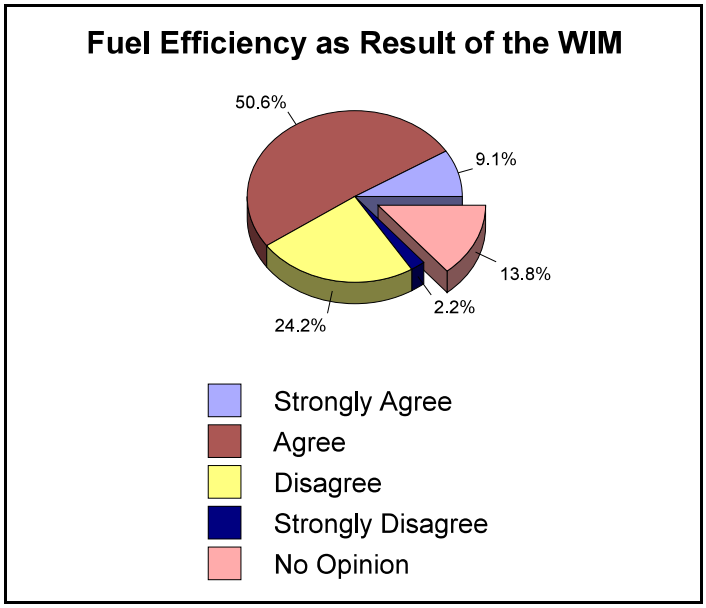
Q5C: The new weigh-in-motion system has decreased the time that I spend at the weigh station.



Most respondents strongly agree (17.9%) or agree (68.7%) that the WIM system has decreased their time spent at the weigh station.

Over one in 10 respondents disagree (12.9%) that the WIM system decreased the time spent at the weigh station.

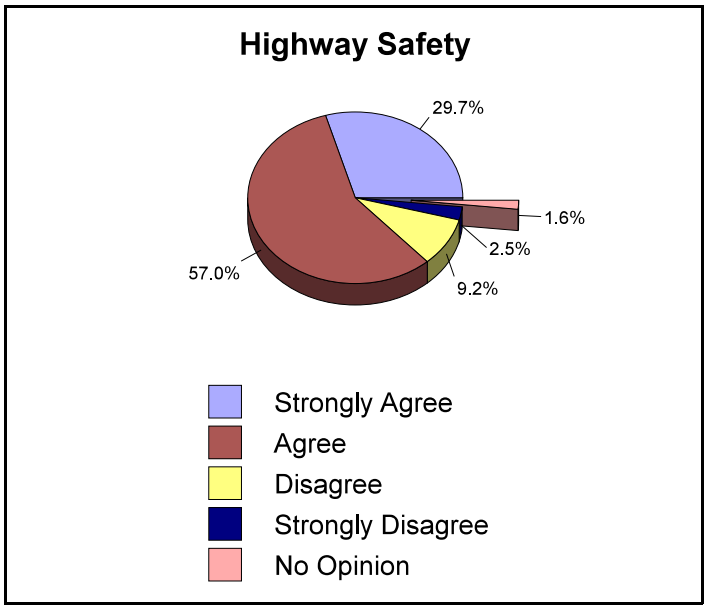
Q5D: My fuel efficiency has increased as a result of the new weigh-in-motion system.



Almost 6 in 10 respondents strongly agree (9.1%) or agree (50.6%) that their fuel efficiency has increased as a result of the new WIM system.

Over one-quarter of respondents disagree (24.2%) or strongly disagree (2.2%) that their fuel efficiency increased as a result of the new WIM system.

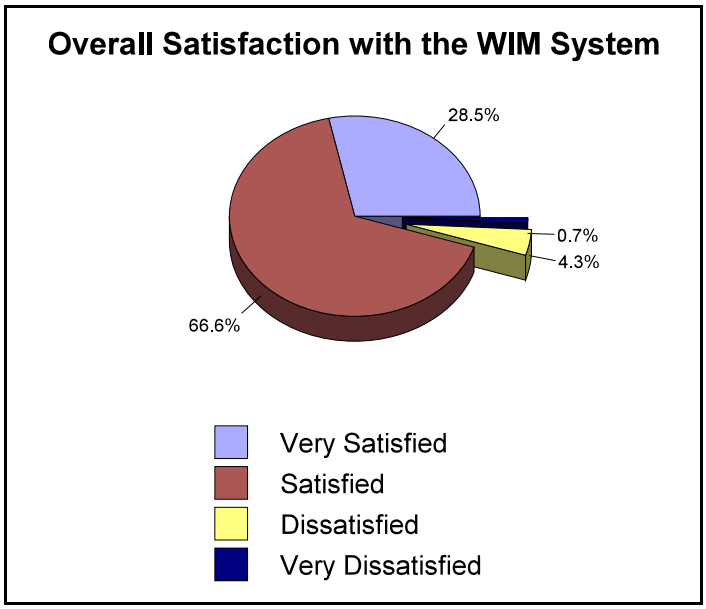
Q5E: I feel that this part of the highway is safer as a result of the new WIM system.



Most respondents strongly agree (29.7%) or agree (57.0%) that this part of the highway is safer as a result of the new WIM system.

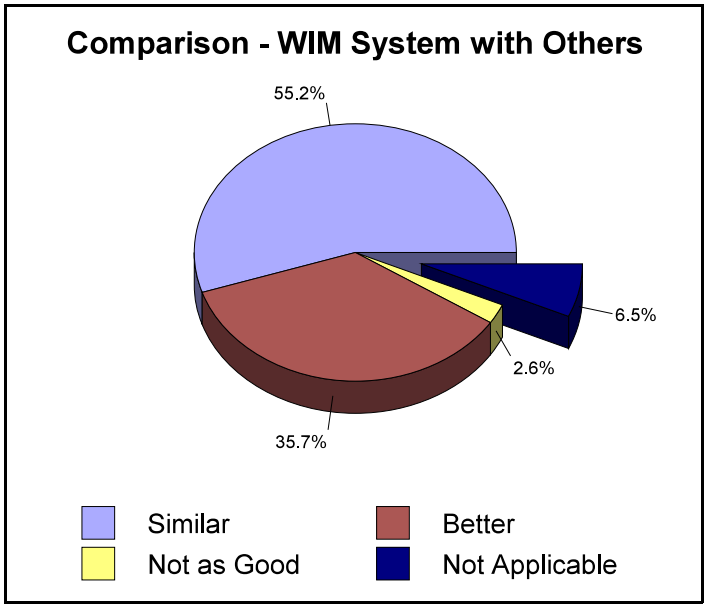
Over one in 10 respondents disagree (9.2%) or strongly disagree (2.5%) with the increased safety of this area as a result of the WIM system.

Question 6: Overall, how satisfied are you with the new weigh-in-motion system?



Overall, most respondents were very satisfied (28.5%) or satisfied (66.6%) with the new WIM system.

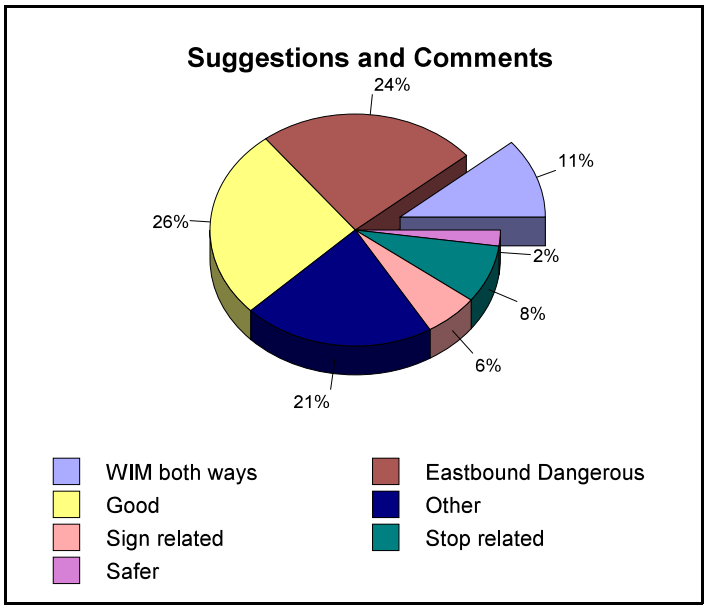
Question 7: How does this weigh-in-motion system compare with other weigh-in-motion systems that you have been through?



Over half of the respondents (55.2%) indicated that this WIM system is similar to other WIM systems that they have been through. One-third (35.7%) think that this WIM system is better than other WIM systems.

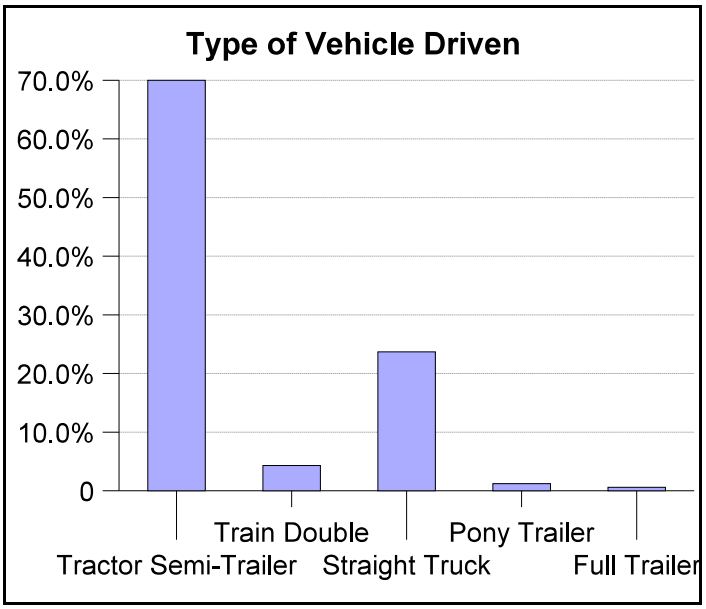
Question 8: Additional Comments

A total of 84 participants provided comments.



Almost three in 10 respondents (26%) had positive comments. Over two in 10 participants (24%) stated that the eastbound lane is dangerous, and one in 10 participants (11%) stated that there should be a WIM on both sides of the highway.

Question 9: As you approach the vehicle, please indicate the type of vehicle being driven by circling the corresponding number.



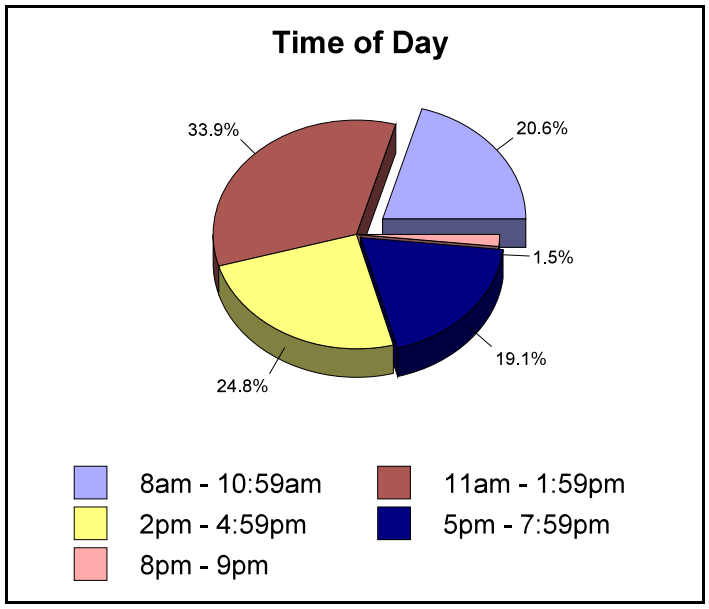
Most respondents (70.0%) were driving a four-axle (1.2%), a five-axle (27.7%), or a six-axle (41.1%) Tractor Semi-Trailer category of commercial vehicle.

Over 2 in 10 respondents (23.7%) were driving a two-axle (12.5%), a three-axle (10.3%), or a four-axle (0.9%) Straight Truck.

None of the respondents drove a category 13 vehicle - Tandem Steering Axle Truck - Full Trailer.

Time of Day

Surveyors were asked to provide the time of day responses were gathered for comparison with other measures of the weigh-in-motion evaluation.



Overall, one-third of the data (33.9%) were collected between 11:00 a.m. and 2:00 p.m. Almost one-quarter (24.8%) were collected between 2:00 p.m. and 5:00 p.m., and 20.6% were collected between 8:00 a.m. and 11:00 a.m.

The above numbers reinforce the numbers shown in question 3 (see page 20). This part of the highway appears to be busiest between 6:00 a.m. and 2:00 p.m. It is also important to note that commercial vehicles travel during all times of the day on this part of the highway.

Appendix B: Survey Questionnaire

Department of Transportation and Public Works
2007 Trucking Satisfaction Survey

Hello, my name is _____ and I work for Mackenzie Security and we are conducting a survey for the Department of Transportation and Public Works. The Department of Transportation and Public Works is responsible for the management of the provincial highway system in Nova Scotia. A roadway weigh-in-motion (WIM) system was installed in the eastbound lane of the Trans-Canada Highway (TCH) 104 at Aulds Cove in the Fall of 2005. We need your help to determine if we are meeting your needs and how we can improve. Your response is important to us. Your answers will be kept confidential and will be combined with those of other respondents. Can I take a few minutes of your time to go over the questions with you?

If no, explain that it will only take a couple of minutes; if still not interested thank them and allow them to proceed.
❑ Refused to participate in survey.

1. Do you travel in the eastbound track of TCH 104 at Aulds Cove? ❑ Yes ❑ No

2. How often do you make return trips in the section of the TCH 104 at Aulds Cove?
❑ 1) One pass/day ❑ 2) Two passes/day
❑ 3) Other, please specify:_____

3. What part of the day do you use the eastbound lane of the TCH 104 at Aulds Cove?
❑ 1) 6 am - 1:59 pm ❑ 2) 2 pm - 9:59 pm
❑ 3) 10 pm - 5:59 am ❑ 4) All of the above

4. What time of the year do you use this route? (Check all that apply.)
❑ a) April-June ❑ b) July-September ❑ c) October-December
❑ d) January-March ❑ e) Year round ❑ f) Spring Weight Restricted Times

5. Please indicate the response that best describes how much you agree or disagree with the following general statements about the WIM system. (1 is strongly agree, 2 agree, 3 disagree, and 4 strongly disagree)	**1: Strongly Agree 2: Agree 3: Disagree 4: Strongly Disagree 5: No Opinion**
a) The new weigh-in-motion system accurately measures the weight of my truck.	1 2 3 4 5
b) The signage for the weigh-in motion system provides me with the direction I need.	1 2 3 4 5
c) The new weigh-in-motion system has decreased the time that I spend at the weigh station.	1 2 3 4 5
d) My fuel efficiency has increased as a result of the new weigh-in-motion system.	1 2 3 4 5
e) I feel that this part of the highway is safer as a result of the new weigh-in-motion system.	1 2 3 4 5

6. Overall, how satisfied are you with the new weigh-in-motion system?
❑ 1) Very Satisfied ❑ 2) Satisfied ❑ 3) Dissatisfied ❑ 4) Very Dissatisfied

7. How does this weigh-in-motion system compare with other weigh-in-motion systems that you have been through?
❑ 1) Similar ❑ 2) Better ❑ 3) Not as Good ❑ 4) Not Applicable

8. Additional Comments:

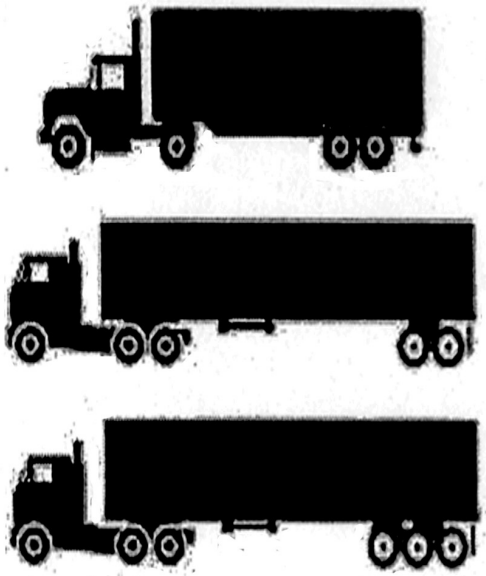
Thank You !

Date:_____ Initials: _____ Time:_____AM or PM

(Did you indicate the type of vehicle on the reverse side of this form/ Offer a repeat trip poster)

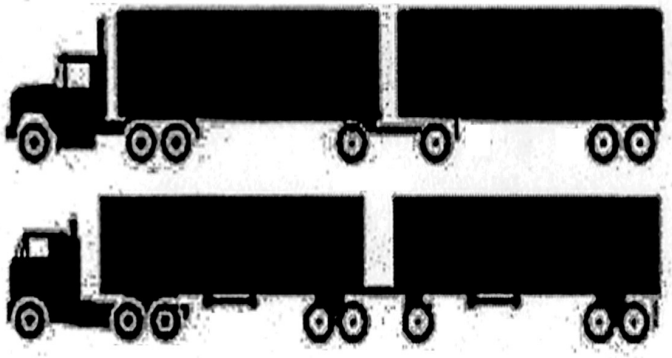
9. As you approach the vehicle, please indicate the type of vehicle being driven by circling the corresponding number.

5 - Tractor Semi Trailer

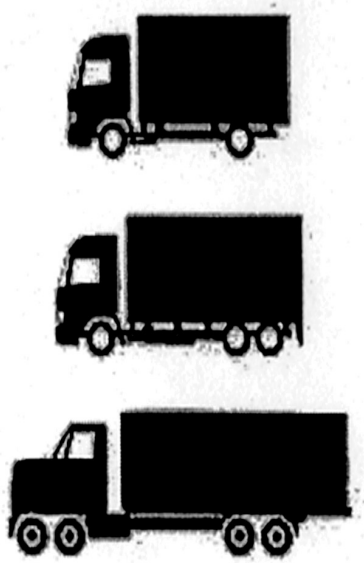


7 - B Train Double

6 - A Train Double, 8 - C Train Double



9 - Straight Truck



10 - Truck - Pony Trailer

12 - Truck - Full Trailer

11 - Tandem Steering Axle Truck - Pony Trailer

13 - Tandem Steering Axle Truck - Full Trailer

Appendix C: Data Tables

Weigh-In-Motion Evaluation

Number of Vehicles Reporting to the Vehicle Compliance Station at Aulds Cove 2007 - Eastbound Lane of Trans-Canada Highway 104

Month	VCS Hrs of Operation	# of Trucks Reported	% of Trucks Reporting	# of Trucks Bypassed	% of Trucks Bypassing	Total # of Trucks
January	423.6	3,377	29%	8,292	71%	11,669
February	410	2,443	28%	6,170	72%	8,613
March	412	2,815	22%	9,763	78%	12,578
April	464	2,043	19%	8,669	81%	10,712
May	480	2,415	18%	11,112	82%	13,527
June*	104	695	25%	2,105	75%	2,800
Total	2,293.6	13,788	23%	46,111	77%	59,899

* Data for this month is from June 1 - 6.