

4

YORK REGION TRANSIT COMPUTER AIDED DISPATCH/AUTOMATIC VEHICLE LOCATION SYSTEM FOR CONVENTIONAL TRANSIT BUSES - UPDATE

The Transit Committee recommends:

- 1. The presentation by Rajeev Roy, Manager, Transit Management Systems be received; and**
- 2. The recommendations contained in the following report, June 6, 2006, from the Commissioner of Transportation and Works be adopted:**

1. RECOMMENDATIONS

It is recommended that:

1. The Region enter into a contract with INIT Inc., for the installation, integration and testing of a Computer Aided Dispatch and Automatic Vehicle Location system for conventional York Region Transit buses, with a total expenditure of up to \$8.091 million, plus applicable taxes, phased over a three year implementation period, subject to approval in subsequent annual budgets (i.e. for 2007 and 2008) and pursuant to the sole source provisions of the Purchasing By-law.
2. The Regional Chair and Regional Clerk be authorized to sign the above contract, subject to review by Legal Services.

2. PURPOSE

The purpose of this report is to seek Regional Council authorization to enter into a contract with INIT Inc., vendor of the Computer Aided Dispatch (CAD) and Automatic Vehicle Location (AVL) system currently installed on the Viva bus rapid transit service, for the installation of CAD/AVL on conventional York Region Transit (YRT) buses.

3. BACKGROUND

INIT's CAD/AVL system has been in operation in York Region on Viva buses since the initial launch in September, 2005. The INIT in-vehicle system and other components are installed on 85 Viva buses and are operated and maintained by Connex, the Region's contractor. INIT's integrated central system consolidates the various functionalities and other software solutions for analyzing, planning, implementing and improving internal operating processes with the mobile system in the vehicle. The performance of the INIT CAD/AVL system has been very satisfactory and widely appreciated by customers.

On April 20, 2006 YRT staff submitted a report to Transit Committee seeking authorization to enter into negotiations with INIT Inc., for the installation, integration and testing of a CAD/AVL system for conventional York Region Transit buses pursuant to the sole source provisions of the Purchasing By-Law. The following functionalities were recommended to be installed as part of the CAD/AVL system:

- CAD/AVL system for real-time tracking of vehicles at the transit control centre.
- Voice and data communication with vehicles.
- In-vehicle variable message sign (VMS) and audio announcement.
- Driver public address (PA) system and a covert microphone and emergency switch.
- Automatic passenger counters (APC) on 30% of the conventional transit buses.
- Central data processing and analysis software.
- Integration of existing Viva variable message sign (VMS) at stops to display conventional transit buses on a common/intersecting route.
- Pre-wiring of buses for a future transit signal priority (TSP) at signalized intersections.

Transit Committee and Regional Council directed YRT staff to report back to the June, 2006 Transit Committee on the following matters:

- The outcome of negotiations with INIT Inc.;
- The cost of implementing transit signal priorities at additional locations within the Region of York;
- The cost for purchasing new expansion buses in 2007 given the provincial subsidy programs available; and
- The results of investigating alternative products by consulting with other suppliers and transit authorities.

4. ANALYSIS AND OPTIONS

4.1 Negotiations with INIT Inc.

YRT hired an independent consultant, LEA Consulting Ltd. to facilitate negotiations with INIT Inc. LEA were sub-consultants to Marshall Macklin Monaghan, the Region's engineer responsible for the implementation of Viva. The purpose was to have an independent third party review and oversee the negotiations and bring transparency and fairness to the process.

INIT's negotiated costs for CAD/AVL hardware, software, and services have been compared with Viva costs. INIT was selected to supply CAD/AVL system for Viva through a competitive process undertaken by the Viva design build contractor. Siemens, a well-known transit CAD/AVL vendor was amongst the other vendors that bid on the project. INIT, being the lowest bidder for the CAD/AVL system, was selected by KED,

design-build contractor for Viva. INIT's proposal was technically evaluated by IBI Group, a member of York Consortium, and considered to meet all technical requirements.

INIT is a US based vendor and they convert their unit rates from US dollars (USD) to Canadian dollars (CAD) using a very conservative rate so they do not lose money in the event of any unfavourable fluctuation in the conversion rate. The Viva system cost was priced in Canadian dollars in 2004 using an exchange rate of \$1.3767 CAD = \$1 USD. This was set conservatively high by INIT at that time to protect against possible fluctuation. During the negotiations, it has been agreed between INIT and YRT that products and services will be purchased directly in US Dollars. The Supplies and Services branch has confirmed that the purchase order can be issued in US dollars.

4.1.2 Software Costs

During the Viva project deployment, an End User License Agreement (EULA) was signed between INIT and York Region in order to define the rights that YRT was granted with respect to INIT software usage. Licenses are required for all INIT software that operates on servers, workstations, and in-vehicle systems to provide the required CAD/AVL functionality. In addition to defining usage rights, the EULA also defines an agreed upon price in US dollars for the purchase of additional software licenses in the future, whereby a discount is provided to the Region for additional purchases. Discounts are proportional to the number of software licenses purchased and for volume purchases over 100 licenses (i.e. when equipping over 100 vehicles with INIT systems), discounts of 50% have been given for each additional license purchased. Given that YRT plans to equip 270 vehicles, 50% discounts can be realized on an additional 170 software licenses. Therefore, in relation to Viva, costs for new software licenses are significantly lower based on the already agreed discounted rates.

4.1.3 Hardware Costs

The CAD/AVL system deployment on conventional transit buses includes in-vehicle hardware components only. It has been decided that the central equipment (servers, workstations, networking equipment, etc.) will be purchased by York Region to ensure that they meet Region's IT standards.

The negotiated costs of in-vehicle hardware components have been compared with Viva costs. Overall, negotiated hardware prices are lower by an average of approximately eleven percent. As an example, costs of Mobile Data Terminals are lower by 32% (approximate savings of \$575 per vehicle). When spread over 270 vehicles this accounts for significant savings.

4.1.4 Services Costs

Given the differences in the scope and structure between the Viva project (with many additional contractor resources) and the YRT managed deployment of INIT systems on the conventional fleet, it is difficult to exactly compare the service costs between the two. For example, services such as vehicle equipment installation are not similar since Viva buses were delivered new with in-vehicle wiring and provisions were made to install

INIT equipment at the factory, while YRT conventional bus installation will be an extensive retrofit process onto older, non-wired, in-service vehicles.

As another example, large scale services such as software configuration, costing over \$550,000 for Viva, are greatly reduced in the current proposal, given that the bulk of the YRT specific software configuration was done for Viva and can be used for future YRT deployments. As such, the cost for software installation and configuration in the current proposal is less than \$70,000.

The costs for the following services, of similar scope in both the Viva project and the current proposal, have been compared to obtain a sense of any differences and quantified as a cost per vehicle:

- Project Management
- Testing – including both Factory Acceptance Testing and Field Testing
- Training – including dispatcher and operator training

Table 1 provides a summary of the INIT negotiated costs as compared to the Viva costs.

Table 1
Summary of Services Costs

	Viva costs per vehicle	Negotiated Costs per vehicle
Project Management	\$3600	\$1000*
Testing	\$1650	\$550*
Training	\$330	\$380*

* An exchange rate of \$1.15 CAD = \$1USD has been used for the negotiated rates for comparison purposes.

The training makes up a relatively small percentage (less than 2%) of the overall budget and this cost increase does not make a considerable impact. The increase may be justified given that three separate YRT operations and maintenance contractors will have to be trained as opposed to one for Viva.

4.1.5 Summary of Costs

Table 2 provides a summary of the INIT negotiated costs as compared to the Viva costs.

Table 2
Summary of Negotiated Costs

INIT Cost Item	Negotiated Costs Versus Viva Costs
Software	• 50% discounts on majority of the software
Hardware	• Average 11% savings
Services	• In general, for similar services, costs are significantly reduced • Large scale cost reductions for services such as Software Configuration that leverage work done during Viva project

4.2 Other Suppliers and Transit Authorities

A group of transit CAD/AVL projects and studies were reviewed and investigated as a reference for costs incurred by other transit agencies for CAD/AVL deployment projects involving similar components. These examples provide a sense of approximate costs for transit CAD/AVL systems and have assisted in determining a level of comfort in the pricing provided by INIT. The intent of this review was to have a general reference for comparison purposes (in Canadian Dollars) because the scope of CAD/AVL projects varies to a great extent between different agencies.

INIT's negotiated technology costs (not including any services) per vehicle for the supply of all hardware and software (including required central system software) is approximately \$19,500 per vehicle. This does not include the service costs which have been compared in Table 1 above.

A summary of the costs incurred by other agencies and different suppliers is provided in Table 3.

Table 3
Summary of Negotiated Costs

Transit Agency	Average CAD/AVL Costs	Comments
Translink - #98 B-Line	Approx \$18,000 per vehicle for on-board equipment.	\$2.8 million for central system, \$500,000 for supply and installation of vehicle-mounted hardware in 28 buses.
	Approx \$118,000 per vehicle for on-board equipment and share of central AVL system.	Additional \$600,000 for radio communications and project management.
Halifax Regional Municipality (Metro Transit)	Approx \$4,500 - \$13,800 per vehicle for on-board equipment.	AVL and traveler information system. System does not include APC, on board announcements, etc. Central system costs range from \$200,000 to \$1,200,000 (not including installation or other services)
U.S. Federal Highway Administration Study	Approx \$21,000* per vehicle	Six Transit Agencies with AVL- equipped buses included in study.
Antelope Valley Transit Authority Report	Approx \$25,500* per vehicle	Costs based on research from 46 transit agencies and various studies.
Other ITS Costs (Canadian Dollars)		Comments
Calgary Transit	APC Costs: Approx \$5,000 per vehicle	System consists APC sensors and GPS receivers components only.
Winnipeg Transit	APC Costs: Approx \$4,000 per vehicle	System consists of APC sensors and GPS receivers and a data-logging computer.

* An exchange rate of \$1.15 CAD = \$1USD has been used for the negotiated rates for comparison purposes.

4.3 Transit Signal Priority at Other Intersections

The Viva system provides the buses with priority (green extension or red truncation) at signalized intersections, depending on how late the bus is operating. The bus transmits a wireless infrared signal which is detected at the intersection, and traffic signal controllers

installed at each intersection provide the priority. The traffic signal controller must be designed for this feature to work.

Transit Committee had requested YRT staff to investigate the approximate incremental cost of upgrading an existing intersection already providing priority to emergency services vehicles. YRT staff was also requested to investigate the total cost of modifying traffic signal controllers on the transit routes in the Region to provide priority to the transit buses.

Emergency vehicles and transit buses are provided different levels of priority at signalized intersections, with emergency vehicles being provided a higher priority than the transit vehicles. The emitter on the emergency vehicles is switched on as soon as the lights are turned on and remains on until the vehicle is parked at the site of the emergency. Transit buses switch on their emitter only when the bus is running behind schedule and are provided different levels of priority depending how late the bus is operating. The frequency of infrared signals sent by emergency vehicles and transit buses are different to be recognized by the traffic signal controller and provide appropriate priority.

The difference in the cost for upgrading an intersection already providing priority to emergency vehicles and an intersection not equipped at all is in the cost of the traffic signal controller. Also, not all controllers providing priority to the emergency vehicles can be intelligent enough to provide priority to transit buses as designed on Viva routes. The cost which is common in both upgrades includes the following:

- Additional detectors for transit buses
- Discriminator for differentiating between different types of emitter signals
- Wiring for additional equipment
- Traffic signal parameters setting

The experience on Viva indicates the following:

- Total signalized intersections on Viva routes – 140
- Number of signalized intersections requiring replacement of traffic signal controller – 83 (60% of the total intersections)
- Approximate unit cost per intersection (requiring replacement of traffic signal controller) – \$15,000 - \$17,000
- Approximate unit cost per intersection (not requiring replacement of traffic signal controller) – \$12,000 - \$14,000

Table 4 provides estimated costs of upgrading existing signalized intersections on the transit routes in the Region to provide priority to the transit buses. There are approximately 370 signalized intersections on transit routes in addition to Viva routes.

Table 4
Transit Signal Priority – Upgrade Costs

	Estimated Number of Signalized Intersections/Bus	Approximate Unit Cost per Intersection/Bus	Total Cost
Estimated signalized intersections requiring controller replacement (60% of total)	222	\$16,000	\$3,552,000
Estimated signalized intersections not requiring controller replacement (40% of total)	148	\$13,000	\$1,924,000
Additional equipment on buses	270	\$2,500	\$675,000
TOTAL			\$6,151,000

Considering the total estimated cost, it is not proposed to install transit signal priority equipment on the conventional buses at this time. New buses will be pre-wired for the installation of traffic signal priority equipment and, in the future, if a decision is made to upgrade the traffic signal controllers, installation of equipment on buses could be achieved in a cost effective manner.

4.4 Funding for New Buses

The Provincial Ministry of Transportation has been providing subsidies for the purchase of new transit buses for both replacement and expansion. The province has now indicated that starting in 2007, this subsidy will be available only for replacement buses. The province is in the process of developing a new funding program for replacement buses.

Transit Committee had requested YRT staff to provide the estimated impact of the change in provincial subsidy policy. Table 5 provides estimated costs for the purchase of new transit buses for expansion in the next two years.

Table 5
New Buses for Expansion

Estimated Cost	
Year 2007	\$21.4M
Year 2008	\$9.0M
Total =	\$30.4M

One-third of the estimated total cost (\$10.1million) will no longer be available as provincial subsidy.

Table 6 provides a summary of actual and projected federal and provincial gas tax funding provided to the Region.

Table 6
Gas Tax Revenues – Actual and Projected (\$million)

	2005	2006	2007	2008	2009
Provincial	7.7	9.1	11.3	11.3	*
Federal	7.1	7.1	9.5	11.8	23.7
Total	14.8	16.2	20.8	23.1	-

* Information not available at this time.

The additional funding required for the purchase of new expansion buses may be provided through the gas tax funding.

4.5 Sole Source Justification

The following sections provide justification for the award of contract to INIT Inc. for the installation, integration, testing and training of a CAD/AVL system for the Region's conventional transit services.

4.5.1 Cost Savings

It is expected that the Region will achieve significant savings in terms of cost and time, based on experience with INIT on the Viva project, for the following reasons:

- Approved System Design Documentation (SDD) and testing procedures from the Viva project can be used.

- All proposed in-vehicle hardware and software have been vigorously tested and accepted through the Viva project; hence the Region will save significant time in system testing and acceptance.
- One set of spare parts could be used which will ensure consistency of components throughout the system.
- Savings in terms of project management costs as INIT and YRT teams are familiar with each other.
- Any future upgrades will need to be done on one system only.
- Overall savings in the terms of tendering, contract negotiations, etc.

4.5.2 Operations and Staff Training

The Viva CAD/AVL system has been in operation since September, 2005. Installation of a CAD/AVL system on conventional buses will have the following operational advantages:

- YRT staff are very well acquainted with the system features, capabilities and issues.
- The existing transit control centre could also be used by YRT operations staff.
- YRT staff are fully trained in troubleshooting software and hardware related issues.

Some additional training may be required for the conventional transit operations and maintenance contractors, but no additional training will be required for others using the system.

4.5.3 Proven Technology

By extending the technology already installed on Viva to conventional transit services, the Region will be taking advantage of proven state-of-the-art ITS technology. Adding additional buses with up-to-date technology on conventional transit buses will allow the Region's conventional transit services to provide a consistent and reliable service to its customers.

4.5.4 Existing Interfaces

The CAD/AVL system is required to have an interface with the scheduling system in order for changes in the schedules to be easily implemented. Significant effort has been invested in developing the interface between the Viva CAD/AVL system and the scheduling software used by YRT, which is provided by Trapeze. It is advantageous to procure the INIT CAD/AVL system as the interface has been thoroughly tested and proven, and meets YRT's specific needs.

4.5.5 Traveler Information System

The Viva service provides real-time information about the next bus arrival through a variable message sign (VMS) installed at each stop. These VMSs can be used to display real-time information about the conventional transit buses if the CAD/AVL system is provided by INIT. It will be impossible to use the existing Viva infrastructure if the CAD/AVL system is provided by a vendor other than INIT.

In the near future, YRT will be installing real-time interface between the CAD/AVL system and the traveler information system to provide real-time status to customers. If there are two CAD/AVL systems, the traveler information system would have to interface with two different technologies for real-time information, which would not be feasible.

4.5.6 Central System

All of the central software and hardware is already installed and in operation. The same servers will be used for extending the CAD/AVL system to the conventional transit buses. Additional software licenses and some additional central hardware will be required for the CAD/AVL system to handle more buses. Some additional workstations for the conventional transit operators will need to be purchased. Another CAD/AVL system will require additional sets of hardware which will not only increase the installation cost, but also the maintenance cost in the long run.

All in-vehicle hardware and software have been vigorously tested and accepted by the Region, so minimal effort will be required in hardware testing.

4.6 Implementation Plan

Implementation of the CAD/AVL system on conventional buses will require an extensive time commitment from YRT Operations, Service Planning and Transit Management Systems staff. Therefore, it is proposed to phase the implementation over the next three years in order that staff resources can be properly committed to the project, and the capital investment can be staggered.

The project is planned to be implemented in accordance with the following schedule:

1. Phase 1 (Year 2006) - Division 4, Vaughan, Can-ar, approximately 110 buses
2. Phase 2 (Year 2007) - Division 1, Markham and Division 3 Richmond Hill, Miller, approximately 120 buses
3. Phase 3 (Year 2008) - Division 2, Newmarket, Laidlaw, approximately 40 buses

4.7 Relationship to Vision 2026

Vision 2026 includes a goal statement on technology relating to the transformation of communications, service delivery methods and how people will live and work in the future. Installation of the CAD/AVL system on conventional transit buses will help provide enhanced quality of service across all of York Region. The CAD/AVL system will optimize the performance of the service, increase reliability, passenger safety and the economic viability of public transit services.

5. FINANCIAL IMPLICATIONS

The cost of installation, integration and testing of the CAD/AVL system and other associated equipment and training of staff and contractors, is provided below and includes all license fees and implementation costs. This is based on the negotiated rates quoted by INIT Inc.:

1. Phase 1 (Year 2006) – Capital - \$3,829,000, Operating - \$350,000 per year
2. Phase 2 (Year 2007) – Capital - \$3,034,000, Operating - \$300,000 per year
3. Phase 3 (Year 2008) – Capital - \$1,228,000, Operating - \$150,000 per year

Negotiated prices are in US dollars and a conversion rate of \$1.15 CAD = \$1 USD has been assumed for approval purposes. The actual amount paid to the contractor will be based on the conversion rate prevailing at the time of invoice payment.

The following additional costs are estimated for the implementation of CAD/AVL system on conventional transit buses:

1. Contract administration services – YRT is currently tasked with a number of ongoing projects which include VIVA operations and maintenance, GTA Fare System, CAD/AVL for Mobility Plus, and security cameras. As such, YRT will not be able to administer and manage the project on a day-to-day basis. Since this requirement is temporary in nature it is recommended that a consultant be hired through RFP process to provide contract administration services. It is estimated that the total cost of such services will be approximately \$650,000 (8% of the negotiated costs of the project).
2. Additional central servers, workstations, networking equipment – Some additional central hardware is required to be purchased to ensure expansion of the central system. It has been decided that this equipment will be purchased by York Region to ensure that they are as per Region's standard. It is estimated that the cost of additional equipment will be approximately \$200,000.

Sufficient capital and operating funding is contained in the 2006 Business Plan and Budget to complete Phase 1 of this project. Expenditures on Phase 2 and Phase 3 are subject to the approval of subsequent budgets. An agreement with INIT would be drafted so that future expenditures on Phase 2 and Phase 3 are subject to the approval of future budgets.

6. LOCAL MUNICIPAL IMPACT

There is no direct municipal impact associated with this project. It is anticipated that the quality of transit services will significantly improve as a result of the project.

7. CONCLUSION

It is recommended that the Region enter into a contract with INIT Inc., for the installation, integration and testing of a Computer Aided Dispatch and Automatic Vehicle Location system for conventional York Region Transit buses in the amount of \$8.091 million pursuant to the sole source provisions of the Purchasing By-law.

The Senior Management Group has reviewed this report.