

New Technologies and ORT

Introduction

Since the 1990's, when Canada's 407 project, the Melbourne CityLink, the Cross Israel highway and the toll projects in Santiago, Chile were developed, Open Road Tolling has been a technological reality. The success of these ORT Greenfield projects has caused toll agencies, including the Port Authority of New York and New Jersey, to announce studies to consider converting to ORT while the North Texas Tollway Authority has set 2010 as the year for completion of its full conversion. Similar to the application of Electronic Toll Collection many years ago, others are taking a "wait and see" attitude to the possibility of all electronic solutions.

While some questions remain to whether full ORT is a practical goal, tolling is a crucial and growing strategy in new infrastructure proposals. ORT offers the promise that toll facilities can operate with a higher level of efficiency while providing convenience and safety without the delay inherent in manual/traditional toll collection. Still to be answered is whether toll leakage increases will outweigh cost savings, will concerns over public privacy impede the adoption of ORT and what adjunct technologies could improve the chances of ORT deployment success?

ORT Defined

Before discussing ORT, its application and supporting technologies, a point of clarification is in order. When the term ORT was first coined in discussions at the International Bridge Tunnel and Turnpike Association (IBTTA), there were some conflicting ideas about its exact definition. Open Road Tolling and All-Electronic-Toll-Collection (AETC) were considered at first to be synonymous however the question of how to classify an operation that offered both high speed ORT and traditional cash collection booths proved problematic. Initially, it was decided that ORT would be applied to those installations that had some cash collections and that All-Electronic-Toll-Collection would mean just what the term implies; no cash collections. However, just as it has proven difficult for the U.S. to adopt a standard for ETC technology, the attempt by the industry to set a standard for ORT terminology has failed. Colloquially the industry has adopted the opposite of what was initially agreed and ORT has come to mean “no cash collections”. For the purposes of this discussion the industry vernacular is assumed. Another term more frequently used in Europe, “multi-lane free flow” is also incorporated into this definition of ORT.

The Toll Operator’s Holy Grail

When Electronic Toll Collection (ETC) began in the late 1980’s most toll operators were convinced there would be large savings in operational costs. In fact, that simply didn’t happen. Marginal savings did occur in the lane but there were other operational increases associated with the addition of service centers to distribute tags, the hiring of customer service representatives to set up and resolve account issues plus the cost of the system hardware and software had to be recovered.

As toll lanes were converted to accept electronic transactions only and staffing required for manual collections was reduced, the fixed costs of cash collection operations remained. Supervisory costs were not significantly reduced and plaza building maintenance, utilities, armored car contracts, bank counting and depositing costs as well as other fixed costs were still incurred. While ETC brought about a tremendous increase in convenience and improvements to driving times; it did little to reduce costs. Large savings in operational costs can really only occur when cash collections cease and those associated fixed costs are eliminated.

A general analysis of operational costs where both ETC and conventional lanes operate is revealing and should have a bearing on setting a toll operator's business strategy. A toll operation that is collecting ~60-70% electronically (a point at which ETC penetration flattens) would typically possess cost components of approximately 1/3 manual collection labor, 1/3 back office and 1/3 electronics and other costs. With a full conversion to ORT, back office costs increase mainly associated with violation enforcement processes including communications with occasional violators (many are infrequent toll customers) and prosecution of chronic violators. In the early stages of conversion, net revenue can be affected by a higher number of violations usually because there is a reduced presence of toll collection personnel and no "barrier" facility. Revenue loss from violations can be reduced with effective policies and the establishment of alternative payment methods, particularly for infrequent users. The introduction of alternative payment programs not only encourages violation recovery, it can also result in a higher level of customer satisfaction. While the initial revenue risks of converting to ORT are considerable, the potential exists to reduce the costs of collecting revenue by as much as 50%. This represents millions of dollars that can be leveraged to construct more transportation capacity. Implementing an ORT strategy can increase the rate of return on investment considerably for existing facilities and could increase the feasibility of Greenfield projects. Higher customer satisfaction and an improved public perception will also result for the introduction of alternative payment methods.

The impact of public perception on the potential for a successful ORT conversion should not be minimized. There is a fundamental difference between developing a Greenfield project and converting an existing facility to ORT. With an existing toll motorway there is a history of revenue generation and processes for handling violations. There have been instances where ORT conversions have garnered negative and misinformed media coverage on revenue losses and inferred gross inefficiency. Consequently, for self preservation, toll operators and particularly public agencies, are extraordinarily reluctant to attempt ORT conversions. Even without ORT conversions "investigative reports" are frequently produced that point out existing losses in revenue where violation percentages are very low. After all 2% of \$500 million is \$10,000,000 annually.

Toll Violations and ORT

Violation control is the critical success factor for making an ORT conversion a success. If customers understand that violations will be detected and processed, customers are less likely to violate in the first place and more likely to promptly pay when a violation notice is received. However, the toll operator has to go through a significant effort to produce the notice and follow up on payment and therefore offering alternative payment methods is an important strategy to reduce the number of transactions considered as violations.

The first step in violation processing occurs in the toll lane. Current violation processing practice is to take an image of the license plate, convert it to a digital representation, access registration and address information and send the violation notice to the customer. Clearly, the technology involved must be accurate at several stages. In order to send the violation notice to the correct customer, there must be a quality image of the license plate, a correct interpretation of the plate number through optical character recognition (OCR) and an accurate determination of registration. All of these steps are crucial to mailing a notice to the correct customer and to the ultimate success of collection efforts. There have been a number of image capture equipment improvements since ETC was first introduced including increased camera resolutions, more accurate camera triggers and more precise lighting adjustments. Likewise, OCR software has improved significantly, however, the desire to eliminate incorrect toll violation notices (since these are generally considered “newsworthy” especially if a violation is sent to someone who has never used the toll road) has caused back office operations to increase the statistical confidence levels on OCR. To accomplish this higher level of confidence, more human intervention is necessary to review the results produced by OCR software. Though OCR accuracy is generally boasted to be in the 85% range with today’s software, high confidence level settings may significantly reduce this.

Some toll operators and software providers have taken a new approach to license plate recognition. In addition to recording an image of the license plate, a larger image of the rear of the vehicle is taken. This larger image is digitized and a “fingerprint” of the vehicle is recorded. This additional information supports a much greater percentage of high confidence matches and significantly reduces labor intervention costs.

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This is particularly true as violation percentages increase when converting an existing toll operation to ORT. The response by many toll agencies has been to tighten the business rules on allowable violations rather than simply providing alternative electronic payment options thereby reducing the number of violations. Data from recent toll roadway studies indicate that 2% of customers generate 33% of the total trips on an annual basis due to frequent and repeated use of the tollway. Further, 11% of the customer base generates 60% of the total trips. This data was collected on a motorway that has both urban-high-volume and rural-low-volume sections and can therefore be deemed typical to most tollways. Since there is a remaining 40% of trips attributed to infrequent users, clearly there is a need to offer alternatives to ETC in an ORT environment. It is astounding that the remaining 40% of trips is generated by 89% of the unique customers annually. This data also implies that a strategy to convert the majority of customers to ETC and then collect the remainder through the use of low cost on board units and stringent violations processing, will be costly and likely to fall short of satisfying both the agency and the customer. Such an approach is like using one tool to build an entire house.

Some of the options which are being deployed to accommodate the infrequent customer are day passes, rental car toll payment and pre-registered user agreements. Day passes charge a set fee for the amount of travel that occurs in one day. In some cases, this approach has been expanded to multiple days, a week or even a month. When the license plate provided at the time of purchase appears on the tollway, the violation is discarded. Recently, companies have begun to offer services to collect tolls for rental cars in a similar manner. The third party vendor pays the toll based on license plate recognition information and then collects from the rental car agency. A promising new technique is to extend the rental car collection process to all customers who do not wish to purchase an ETC transponder. This is especially attractive to infrequent customers who are willing to pay slightly more for a toll but forgo the cost and inconvenience of purchasing a transponder and initially depositing funds to cover tolls. Some have termed these pre-registered accounts.

To establish a pre-registered account the customer contacts the agency before using the toll road and provides payment information along with the license plate number and minimal other information. This program can be extended to customers even after a violation has occurred. The customer is given a specified period of time to contact the service center and set up the account. Once the program is established, all future tolls are charged to the customer's account. This program is similar to the ETC account but requires much less enrollment data allowing customers to establish the account via phone or the Internet. Toll charges are usually at a slight premium over ETC toll charges to recover the costs of video identification and processing.

In instances where a customer refuses to set up an ETC account, pre-registered account or fails to respond to violation notices, the process to collect outstanding tolls, administrative fees and penalties can be a time consuming and labor intensive process. Since the focus for a toll agency is the collection of toll revenue, some toll operators have begun to contract with private companies and law firms to carry out the collections function in exchange for paying the tolls that would have been collected in the lane. This is similar to discounting receivables for a business. Again, the information collected in the toll lane must be accurate enough for the private collector to accept the risk of recovery.

Is Electronic Vehicle Registration the ORT Answer?

Electronic Vehicle Registration (EVR) is the process of affixing a permanent, passive RFID tag to a vehicle for the purpose of registering the vehicle. The tag is placed on the vehicle at the time of registration and is a means of preventing either counterfeiting of license plates or the movement of license plates between vehicles. The tag contains minimal registration information and the VIN number. As homeland security grows in importance, interest in EVR technology will accelerate. Great potential exists to use RFID to identify and track vehicles of interest either with fixed reading points or with mobile units. Design features of EVR ensure that tags remain with the vehicle from the time of initial registration and if removed will cease to operate with the result that the vehicle is then considered to be an unregistered vehicle. The application of radio frequency identification (RFID) to vehicle registration has developed independent of the consideration of its use in toll collection but the potential for use in conjunction with tolling is evident.

Tag manufacturers are now capable of producing an EVR suitable tag at a very low cost. The technology employed was adapted from that used to track freight pallets using disposable low cost tags. Historically, RFID tags used in tolling vary in cost from \$10 to \$30 depending upon whether they are passive (no battery and shorter read range) or active and the ancillary features such as lights, displays and beepers. EVR tags could be produced in large quantities for significantly less (as low as \$1 – 5). This cost structure makes the use of RFID in the application of EVR very attractive and if adopted could make it a viable solution in the reduction of toll violations.

EVR is currently being considered in South Africa, Brazil and Mexico. EVR not only provides information on registered vehicles but also identifies vehicles that are not registered. This can be determined at any point that a simple reading device is deployed, either at a fixed location or using hand held mobile readers. There is a logical case to position EVR readers at ORT points for both EVR validation and to gather vehicle registration information that is usually obtained through Automatic License Plate Recognition, ALPR technology, for use in identifying casual toll users. Knowing the VIN number provides information on the make and model of the vehicle, the year, class of the vehicle and a host of other information. As a registration mechanism and a tool in homeland security strategies, EVR could be extremely effective. However, EVR also offers some important ancillary capabilities for ORT applications.

While license plate image recognition is a proven technology, EVR offers a more direct method of identifying the vehicle and determining the registrant's address. Back office costs can magnify when converting to ORT and EVR may offer an alternative to reduce the labor costs of reviewing images. Since the infrequent customer represents a large portion of the non transponder transactions and the only alternative to ETC is commonly a violations based process, labor costs for reviewing images can be reduced considerably by EVR. The more efficient process of identifying the vehicle via RFID as opposed to a video image conversion could positively affect operational costs for a toll facility that chooses to convert to ORT.

Although there is great promise in EVR technology, it should be considered complimentary to ETC and not a replacement. ETC serves the frequent customer base and EVR is most applicable to the needs of the infrequent user. While it may be possible to develop an ETC system that requires no transponders, frequent toll road users would be denied the capabilities and payment relationships that transponder accounts provide. It is in the interests of toll operators to provide various means for the customer base to pay electronically. Frequent customers, infrequent customers and moderate users of the toll road deserve payment mechanisms that are most convenient to their needs. EVR offers the potential to bring infrequent users into a legitimate and sanctioned toll payment relationship and to do so more accurately and without human intervention.

Privacy concerns may be a factor but the increased concern for security will be a balancing element. It remains to be seen how broadly EVR technology will be implemented, but the ancillary benefits to electronic toll collection and the enhanced ability to convert to ORT will be significant factors. Such is the case in South Africa.

A Case Study in EVR

The Republic of South Africa has experienced significant license plate counterfeiting and to a lesser extent the practice of exchanging plates between vehicles. Accordingly, South Africa initiated an EVR program called Electronic License Disk or ELD. It is anticipated that the technology will be a 915 MHz passive RFID technology. This will be in addition to transponder technology used for ETC. The standard adopted for ETC in South Africa is the CEN 278 5.8 GHz ISO standard.

Because there are many low volume roads on the South African National Roads Agency, SANRAL system, ETC is in its infancy and has been implemented on only one concession. However, South Africa will be hosting the 2010 World Cup soccer and there are plans to significantly improve the transportation system in and around Johannesburg and Pretoria, the site of the games. This project will be initially developed by SANRAL is planned to be all electronic. Nearly 500 kilometers of roadway will ultimately be constructed or expanded with 240 kilometers being improved and upgraded by 2010. This will result in one of the largest, high volume ORT systems. Some of the urban sections currently carry nearly 200,000 vehicles per day. The plan is to construct the roadways in time for the World Cup soccer event and subsequently apply tolling to the network.

Because of vehicle registration challenges experienced in South Africa, it would be extremely difficult to utilize license plate image technology to enforce toll payment. While ELD and ETC have been developed separately by different agencies, the presence of ELD will significantly improve the registration accuracy and will make ALPR more practical. Therefore, SANRAL is working very closely with the national vehicle registration office to ensure that the ELD project will support the requirements for ORT.

EVR, a Solution for the U.S.?

There are certainly privacy implications of EVR and the resistance to such a concept in the U.S. could be considerable. Technologically it is possible to implement a national EVR system but the considerations for privacy must be addressed. Procedures must be implemented to ensure that privacy rights of the individual are not violated. However, privacy concerns will be balanced with the desire to have effective homeland security and the protection that such a system might afford the citizens of the country overall. Mandatory and stringent controls on the use of such information will be necessary just as controls have been developed for sensitive information that is collected today.

Summary

Technological changes such as ETC have occurred before in the toll industry where agencies and customers have had to adapt. Over time we have learned to modify and embrace ETC technology and the same can be done for ORT and the introduction of EVR. As concessions become more prominent in the U.S. and public toll agencies find ways to avert public concern for lost revenue, more conversions to ORT will occur. Clearly, EVR technology offers a viable and cost reducing alternative for the infrequent customer that is central to the business strategy of converting to ORT. While the primary purpose of EVR is more accurate vehicle registration, it is potentially the catalyst for increased ORT conversion, higher levels of customer satisfaction and a healthier toll industry.