

THE PATH TO OPEN ROAD TOLLING

by Timothy O. Gallagher and Harold W. Worrall, PE, Ph.D.

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Abstract

Electronic Toll Collection dramatically changed much of the foundation of modern toll collection operations and today's toll Authorities are aggressively pursuing ETC to its ultimate configuration: Open Road Tolling (ORT).

ORT is more than just a "super-sized" version of in-lane automatic vehicle identification (AVI). Much like the transformation to ETC, Authorities must understand the business, technical and customer service aspects of ORT in order to achieve a successful balance of increased mobility and customer satisfaction while successfully managing violations and enforcement, including how to effectively handle non-AVI transactions in the ORT environment.



Toll collection has been documented from the times of the ancient Roman Empire in the 4th century B.C. For the nearly 25 centuries since then, until the introduction of radio frequency identification (RFID) and electronic toll collection (ETC) in the late 1980s, it has been an inherent part of the process for customers to stop in order to pay the toll. ETC dramatically changed that paradigm as well as much of the very foundation of modern toll collection operations.

While RFID, now known as automatic vehicle identification (AVI) was originally implemented as part of the overall payment mix in existing toll lanes, today's toll authorities are aggressively pursuing the ultimate ETC configuration: Open Road Tolling (ORT). Authorities view ORT as a means to achieve maximum throughput while effectively managing or lowering per-transaction costs. Throughout the industry, significant plans are underway to convert existing facilities or build new facilities that are both free of barriers and toll collectors by exclusively accepting electronic forms of payment.

But ORT is more than just a "super-sized" version of in-lane AVI systems. Much like the transformation to ETC, authorities must understand the business, technical and customer service aspects of ORT in order to achieve a successful balance of increased mobility and customer satisfaction while successfully managing violations and enforcement.

How we arrived where we are

Transportation infrastructure is epitome of the adage, "If you build it, they will come." New thoroughfares have not only been used by the existing critical mass of population they were originally built to serve, it is a basic tenet that these facilities stimulate population and economic



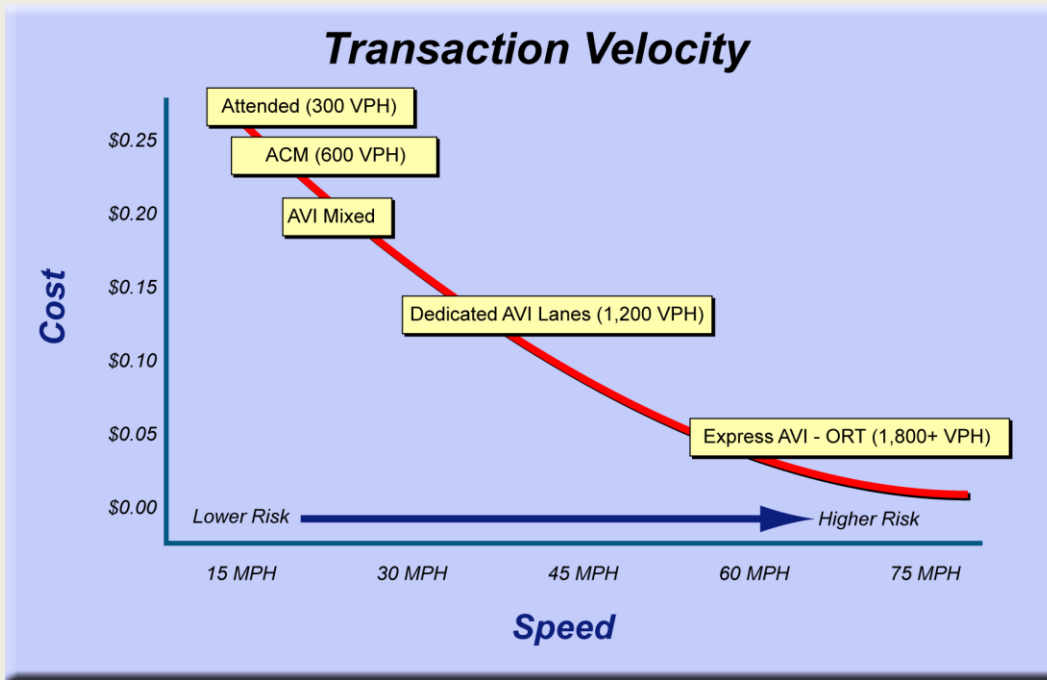
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growth in the surrounding area and attract even greater numbers of users. Therefore, toll authorities have been on a continual quest to increase throughput with structurally finite facilities while simultaneously controlling the cost of collection.

Historically, the slowest and most costly forms of toll collection have been cash based. The components of traditional cash collection are numerous and include: toll attendants, plaza staff, plaza administration buildings and infrastructure, armored car services, and coin counting operations. The current vision among 21st century toll authorities to build cash-free ORT facilities would eliminate the initial costs to implement these components as well as the substantial costs to operate and maintain them on an ongoing basis. By comparison, the costs of sophisticated computer systems and trained customer service staffs, particularly when amortized over significantly greater numbers of transactions, make ORT a fiscally attractive proposition.

The following graph in Figure 1 demonstrates the migration path of toll collection operations from fully attended cash lanes to express and ORT collection. Each technology milestone – from implementing automatic coin machines (ACM) through today's ORT operations – has resulted in higher throughput while delivering lower overall per-transaction costs.

Figure 1, Speed-Cost Analysis



However, ORT is a complex matter that presents both challenges and opportunities in the technology, in customer service operations, and in the business policies and legislation that support toll collection.

Technology Architecture

When AVI is implemented in a static-lane environment, it is a fairly straight-forward process to define an accurate AVI read zone within the lane – whether slow-moving, mixed-use lanes, or even quickly moving express lanes. In fact, much of early ETC architecture was engineered and physically positioned to replicate the operation of manual cash and ACM modes of collection. Further it was designed to frame discreet lanes and minimize cross-lane reads – a



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new concept and artifact of RFID. ORT requires a very different configuration with AVI overlapping all lanes, specifically creating cross-lane reads, to ensure continuous capture of transactions at any position within the multi-lane ORT zone. ORT further features vehicle image systems overlapped with continuous coverage across the zone to capture images of vehicles that are not equipped with AVI transponders. Vehicles can move at speeds that range from extremely slow to highway speeds. Additionally, in an ORT environment, vehicles are at liberty to cross any and all lanes of traffic at the tolling point. These variable speed and lateral free-flow aspects of the ORT environment create challenges for traditional solutions built for discrete lane systems and adds complexity to correctly associate all the various components that comprise an ETC transaction.

The ORT solution must resolve multiple RFID reads and/or images to the correct vehicle regardless of where it travels within the toll zone.

The complexity of correctly formulating each and every ORT transaction is a function of congestion, speed and the width of the ORT zone as measured in lanes. The toll collection zone must be correctly covered from edge-to-edge with a tightly-integrated solution to increase the accuracy and reliability of the system, and decrease the risk of revenue leakage.

Revenue Velocity

A critical part of toll operations, both to the authorities and their bonding and rating agencies, can be termed revenue velocity: how quickly the revenue is collected. Related to this concept are the costs and risks associated with revenue collection.

During the era of manual collection when people stopped and paid tolls, traffic moved slowly, but revenue recognition was relatively fast, and there were few risks involved. At the point the driver paid the attendant or dropped money in a machine, the authority had possession



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of the funds. Within a few days, the funds were deposited and posted as revenue - except for leakage through attendant dishonesty, this method of collection was relatively low risk. Today, faced with ever rising wages and growing traffic, manual collection is the most costly and least efficient mode of payment.

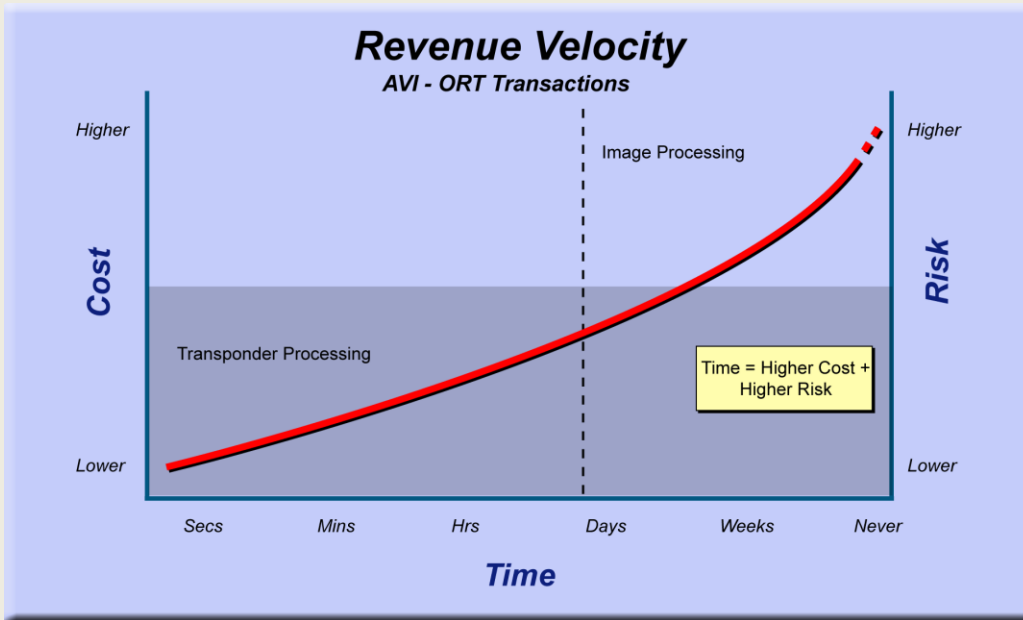
The advent of ETC, the extensive use of prepaid accounts, and revenue recognition became almost instantaneous. The authority already had the revenue, it was simply a matter of debiting it from the patron's account when a toll transaction was processed. Thus, an AVI transaction presented both the lowest cost to collect revenue and the fastest time to actually realize the revenue. However, for ORT use, AVI must be complemented by vehicle image systems for capturing non-AVI use whereby payment is sought through the process currently known as violation enforcement.

Violation processing by far yields the slowest revenue recognition, and currently holds the distinction as one of the highest costs of collection. The removal of barriers from the tolling point provides opportunity for violation – regardless of whether an attended lane, ACM, express ETC or ORT lane. Today, violation enforcement is generally processed through image processing which has become an integral part of toll collection back-office operations.

While sophisticated and reliable technologies and processes are available to streamline image processing, each step from image capture, optical character recognition (OCR), manual review, verification, to collection and even enforcement efforts, adds considerable time and cost to the revenue recognition process. Image transactions are clearly more costly than AVI transactions and also carry a higher risk of nonpayment. Nonetheless, many Authorities are pleased by their ability to cover the financial risk of ETC and ORT through well run violation enforcement programs.

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Figure 2, Revenue Velocity



This concept is important to ORT operations because the same complexities of speed and lateral movement that create challenges for AVI, create similar challenges for image capture. While it is simply easier to get a clear image from slow moving traffic in a lane at a toll plaza than it is from rapidly moving traffic at an ORT tolling point, the good news is that technology continues to advance, offering efficient and cost-effective solutions, including sophisticated systems for capturing high-resolution digital imagery and sophisticated OCR processing.

An important consideration of ORT is that as authorities evaluate implementing all-electronic operations, they are contemplating use of image processing beyond “violation enforcement” and other means to widen acceptance of “all-electronic” toll roads for non-AVI customers. Video tolling or pay-by-plate concepts are emerging as a more customer friendly alternative payment method than violation enforcement that augments an ETC solution.



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When evaluating image transactions, besides ensuring robust technology and well composed business processes, authorities should consider the factors that can positively impact their revenue recognition results. Authorities can influence the percentage of non-AVI or image transactions through effective public education programs. Positive marketing of AVI as the most economical payment option while offering higher rates for pay-by-plate transactions can provide consumers with choice and decision making power. Driver behavior can be influenced through rate variation and ultimately a strong enforcement program, and other direct and indirect measures.

A critical component of recognizing revenue from image tolling is ensuring that the proper legislation and legal processes are in place to support the collection and enforcement efforts. These must cover not only violations, but also other image-based toll transactions considered by the authority. What legally constitutes a toll transaction and the authority's rights to pursue collection for that toll can be a complex matter that should be carefully and deliberately pursued.

Understanding the Market

The potential benefits of implementing ORT are directly proportional to the percent of users adopting the technology. In simple terms, the more people who use ORT, the greater the benefits, including ROI, higher throughput, decreased pollution, increased customer satisfaction, and a positive public image for the authority. When considering the move to ORT, it is important Authorities clearly understand the driving patterns and needs of their market in order to set realistic expectations and plan their operations effectively. This is key to determining whether ORT may best be implemented as part of an overall mix of toll collection options, or can effectively be offered as the sole form of payment.



If the market is saturated with those who utilize the facility on a frequent basis – commuters and businesses – the move to ORT presents a feasible option rich in benefits. A highly successful example of this concept is Harris County Toll Road Authority's (HCTRA) Westpark Tollway. The nation's first all-electronic toll road, Westpark is a 14-mile-long toll road constructed in the middle of one of the most concentrated populations of HCTRA's EZ TAG users in the region. Westpark provides an important connecting link between the rapidly-growing western part of the metroplex and the heart of Houston and provides EZ TAG users with an exclusive and much-needed alternate east-west route. During March 2005, Westpark averaged over 66,000 daily transactions, a number anticipated to grow as the final phases of the project are completed. In the Westpark example, both the need for the road and the transponder user base to support it were clearly in place.

The demographics enjoyed by HCTRA in the Westpark corridor, however, are very different than those in, for example, southern California or Florida, both of which have exceptionally high levels of visitor traffic. As an example, in 2003 the metropolitan area of Orlando, Florida alone hosted 45 million visitors¹ – equivalent to the entire state populations of Texas, Michigan, and Illinois coming to visit. The vast majority of these visitors either drove their own out-of-state vehicles or rented a vehicle for their visit. This type of transient population is a formidable factor in these markets.

In other regions, cultural, privacy or economic factors may present customer unwillingness to provide credit card and/or personal information, creating obstacles to traditional prepaid ETC accounts.

¹ Orlando Convention and Visitor's Bureau, 2004 Annual Research Report, http://www.orlandoinfo.com/b2b/research/annual_report.cfm



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In areas of new facility construction, there will probably be resistance to tolls in general as well as a specific public-education curve about electronic toll collection.

As the industry moves forward to more fully deploy ORT, technology and creative business processes will emerge and be employed to address these issues. Solutions are already being discussed that will form the blueprint of future ORT operations. However, these solutions will require sound business rules along with back-office and customer service operations support.

The All-Electronic Philosophy – Customer or Violator?

One of the most significant questions for modern toll authorities is not how to provide service to the ETC account holder. It's how to handle the non-ETC transactions. This is an important philosophical question that drives business rules and operational standards.

When the all-electronic Westpark Tollway opened, HCTRA's public awareness campaign centered on the slogan, "No cash, no coins, no exceptions." It was clear that Westpark was intended as a thoroughfare for EZ TAG users and that all others would be treated as violators. Even though Westpark is a totally open road, it experiences a violation rate only slightly higher than the rest of HCTRA's toll system which is equipped with barriers and supports cash payment options.

When trying to influence customer behavior, some authorities have adopted a "not a violator, simply a new customer" approach in order to proactively collect the toll while holding out incentives to become an ETC customer.

In either case, when implementing ORT, dealing with the non-AVI customer (*aka*, image customer and/or violator) is an important issue, and one that must be clearly addressed in order to ensure prompt and cost-effective revenue recognition. These non-AVI transactions may be



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processed through imaging and billing processes – likely an outgrowth of existing systems.

Transformation to ORT may require expansion of the customer service processes to encompass new categories of users and, concurrently, a deeper integration between both internal and external systems. Customer service has clearly moved from the lane to the back office.

Summary

More change and innovation have occurred in the last 20 years of toll collection than the past 2,000 years. Toll collection, and specifically, electronic toll collection is ready to embrace the 21st century and the level of technical innovation has enabled our industry to travel at highway speeds.

Open Road Tolling is a reality today in Australia, Canada, South America, the Middle East and in the United States. The question is not if all-electronic tolling will occur, it is how quickly it will promulgate the industry and how the industry will address its impacts to operations.

Looking forward, the next 20 years will provide even greater advancement. A significant percentage of new transportation projects will be funded by toll collection and a large number of existing toll facilities will be retrofit with new technology to increase throughput. While manual and ACM collection may continue to be required, the vast majority of tolls will be collected electronically – either through AVI or image capture/recognition. This trend will deliver tremendous benefits to Authorities through maximized throughput (via ORT or express lanes), the ability to implement variable pricing, improved accounting and reporting visibility, and realizing the cost efficiencies inherent with electronic transactions. Advancements in tolling and



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the transportation infrastructure we build over the next 20 years will surely touch the majority of the motoring public, and provide unfettered access with far greater mobility than free roads.