



Has the Time Come for a US RFID Standard, 5.9?

By Harold W. Worrall, Ph.D., P.E.

Transportation in the US is at a crossroads. Long the envy of many nations, the transport systems of the US are in need of rehabilitation and expansion, just when the costs of doing so have increased and the funds available have decreased. A major component of US transportation is the Interstate highway system. It connects major metropolitan urban centers, airports, seaports, and inland waterways, into a seamless, flexible, door-to-door passenger and freight system. The Interstate system was a bold undertaking and has been the foundation of US transportation in the last century. What will be the foundational transportation concept for this century?

The issue of what the next US transportation plan should look like has been studied by several national commissions and industry groups. Some areas of agreement are surfacing. It is generally agreed that the present methods of funding, predominantly fuel taxes, are inadequate in terms of the dollars generated and as a sustainable mechanism of taxation. In its place, some are advocating a system based upon Vehicle Miles Traveled (VMT) charging. VMT will not only generate more revenue but will require users of the system to pay directly for the transportation benefit derived, perhaps affecting the

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decision to overuse the transportation resource. VMT would also support congestion charging for time of day use. Such a funding mechanism may also affect modal choice and result in a more efficient transportation system. Furthermore, safer travel is a priority that will amplify as congestion increases. Many believe that we need to be more strategic in planning the transportation systems of tomorrow and that we should not simply produce more of the same capacity. Whatever is contemplated, it must provide a lift and support to the economy.

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The next transportation system will require timely and accurate information and should create a choice system where all users will pay for the marginal benefit derived. To accomplish VMT and other high priority items on the transportation policy agenda, the electronic infrastructure must be defined. Electronic payment systems will provide the mechanism for implementing congestion pricing, express lanes, HOT lanes and other innovative direct payment processes. At the

core will be a backbone of electronic infrastructure that might include Radio Frequency Identification (RFID), Global Positioning Satellite (GPS), Global System for Mobile communications (GSM) and perhaps other technologies yet unknown.

The technologies chosen must then fit into a larger electronic infrastructure that supports safety applications, navigational support, traveler information and other applications defined in the ITS architecture of the United States. These applications may develop independently based on proprietary technology or through adherence to established standards wherein the applications support one another. As agencies convert to Open Road Tolling (ORT) and exclusive electronic payment, it becomes increasingly evident that these payment systems must be interoperable. Yet the US is the most prominent example worldwide of a patchwork quilt of electronic standards resulting from proprietary implementations. As Europe can attest, electronic infrastructure standards do not guarantee electronic payment interoperability. Standards are a prerequisite to addressing contractual and procedural challenges to interoperable ETC in the European Union.

If the US is to modify the funding mechanism, a method of collecting electronic payments nationally must be determined and the solutions arrived

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at must be capable of supporting other electronic transportation applications. That infrastructure is not the existing 915 MHz system modified specifically for ETC applications.

Regardless of the technology used to implement VMT tolling, the investment in existing electronic toll collection (ETC) systems must be addressed. These systems account for 50-80% of the tolls collected by US toll agencies and the readers and transponders represent a significant investment. The technology that is selected must be capable of operating in parallel with existing 915 MHz equipment. This gives agencies the option of maintaining 915 MHz equipment for local travel or of converting to the national standard in total.

Paying tolls nationally based on miles travelled assumes that daily interstate travel is a common occurrence. But toll facilities in the US are typically regional urban expressway networks or intercity Turnpikes within a single state. With the exception

of some local toll bridges and minor roadways, most of these expressways and turnpikes are creations of the state and it is common to find that toll interoperability within a state has been accomplished. However, because of the proximity of toll facilities in the Northeastern US, state toll agencies were faced with interstate interoperability from the inception of ETC. The four agencies around New York City found it necessary to cooperate on ETC standards and the Interagency Group (IAG) was founded. Ironically, that standard is a proprietary standard. The IAG has since extended its membership to 23 agencies, as far west as Illinois and as far south as Virginia. Other than the Northeast, most states are not able to process ETC tags from another state. California established an open standard that is still predominantly applied in California only.

Other than the Northeastern states and the occasional road trip most passenger travelers have little need for a national interoperable ETC system. However, the interstate tractor trailer

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combination is frequently faced with toll road interoperability and must carry numerous RFID tags to pay tolls. This is especially significant from a US transportation perspective since 90% of the value of all freight in the US is shipped by truck.¹ If VMT is implemented on all or a major portion of the Interstate system, every Interstate segment on which VMT is assessed must be interoperable with the adjoining state. It is immediately clear that toll interoperability takes on new importance.

Technology and National Toll Interoperability

On first glance one would assume that GPS would be a likely candidate technology to implement VMT tolling in the US. Several factors conspire to make it less than ideal. First, the cost of the GPS on board unit is significantly higher than that of current devices because of the inherent functionality of the GPS unit versus an RFID device. Further, GPS so far has been used only in truck tolling schemes as opposed to

a mix of traffic where it may be difficult to segregate vehicles for the purpose of recording toll payment.

Perhaps the most difficult issue to resolve will be that of privacy. It is invasive of personal privacy when you are tracked such that small increments in movement are discernible. To the trucking company, this degree of tracking is commercially valuable for planning the actual time required for various routings. But to the ordinary citizen, it is a flagrant violation of the right of privacy. Most GPS based tolling applications today use RFID as a means of enforcement and validation. Just as 915 MHz seemed the most logical technology for ETC when it was first implemented, GPS seems most logical for truck operations. The key challenge, however, is to establish an electronic infrastructure that will satisfy both freight trucking and passenger vehicle environments long term.

RFID is the likely choice for implementing VMT or other versions of nationwide tolling. The ITS archi-

ecture is based on an open 5.9 GHz bandwidth that is specifically reserved for ITS applications. Considerable effort has gone into the design and definition of the various applications. The inherently more robust capabilities of 5.9 GHz over 915 MHz systems make the implementation of ORT, HOT lanes and other electronic payment applications less dependent upon application software for proper functionality. Higher data rates, much longer read ranges and other technical advantages of 5.9 GHz technology make it more adaptable for other related applications. In the short term it may seem most reasonable to continue to use 915



MHz systems specifically tailored for an application like ETC. In the long term, however, we must choose a system that serves multiple purposes with one technology and provides the electronic

infrastructure needed to support transportation in the future.

Electronic Payment Interoperability

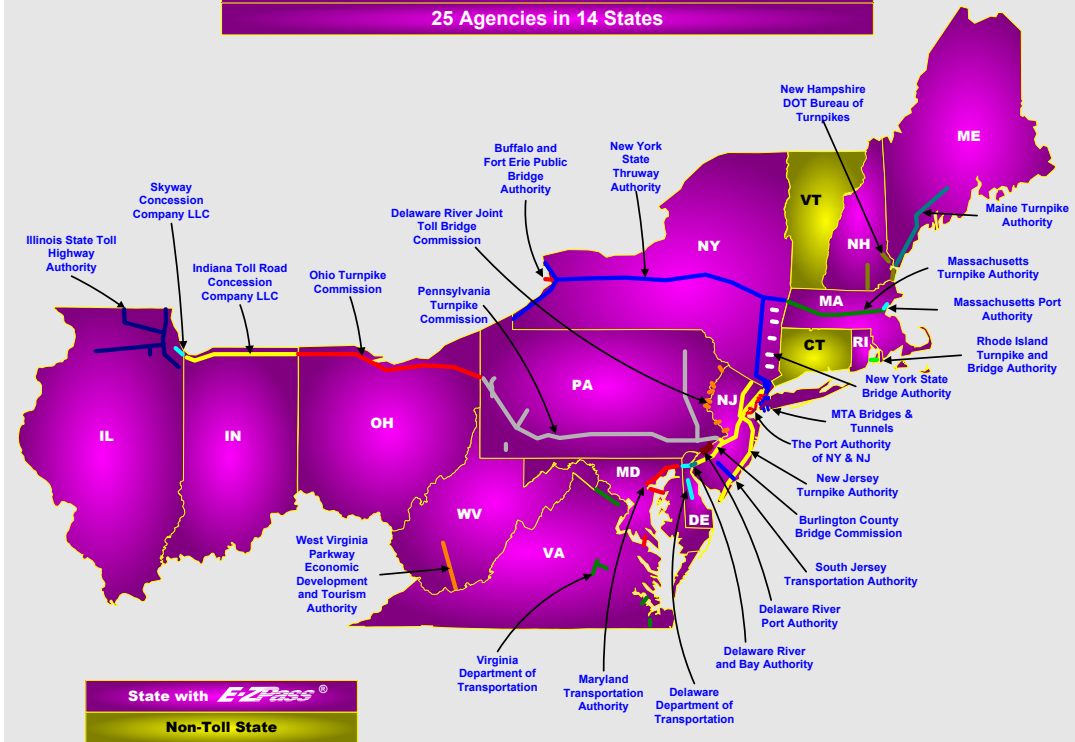
Electronic payment systems considerations extend beyond just ETC. Though ETC has been the most deployed electronic payment system in transportation, there are many other valuable applications for the RFID on board unit. Early in the history of ETC, airport parking was seen as a natural extension of the use of ETC tags. Airports also saw value in using ETC tags to control the arrival and departure of taxis, shuttles, and other groundside

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operations. These approaches could be extended to private parking facilities, hospitals, government facilities, and even metered parking. RFID technology can also be applied on other modes of transportation, like public transportation and seaports. The arrival and departure fee collection at major

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seaports and the information generated by RFID technology will improve the efficiency of international freight as it transfers to landside modes of transportation. Commercial applications like fueling could also begin to emerge once a standard is set for open architecture and multiple account structures from one device.

The establishment of a single technology that will support a full range of electronic payment systems will allow for intermodal back office operations and increased efficiency in the collection process.

What Needs to Happen?

It is conceivable that 5.9 GHz technology will prevail as the agreed upon standard for electronic infrastructure in the US. However, it is much more likely to come about through some national legislation or regulation in the interests of transportation as a whole. On October 1, 2009 SAFETEA-LU (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users) is due for reauthorization. This process, which occurs every six years, is a time for rethinking national transportation

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policy. The bandwidth for 5.9 GHz was reserved for transportation in 2002 and a national architecture has been developed. The deployment of 5.9 GHz will serve as a foundation for many applications but, most importantly, it can serve as a new beginning for the way transportation is funded and incentivized in the US.

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Endnote

- 1 Bureau of Transportation Statistics, USDOT, Freight Shipments in America 2004, Table 1. <http://www.bts.gov>.