



The evolving tolling landscape

Improving toll revenue collection in electronic tolling

Executive summary

The techniques used to levy tolls on roads, bridges, and tunnels have changed dramatically in the last 30 years. With new technologies that permit traffic to flow freely as toll authorities collect payments digitally, current roadways should be at peak efficiency. Yet current estimates indicate that US toll authorities are unable to collect at least \$2.24 billion annually due to various breakdowns in the collection process.¹

The electronic revolution in tolling

For centuries, governments have used toll revenue to fund both new roadway construction and the maintenance of existing infrastructure. Tolling entered the computer age in 1989 with the

introduction of electronic toll collection (ETC) on the Dallas North Tollway, an advancement that increased operational efficiency and largely eliminated the need for cash transactions. In the years since, ETC has become the dominant method of toll collection in the United States.²

In the 1990s, the introduction of transponder-based tolling paved the way for gateless, free-flow lanes that allow ETC transactions to be captured at highway speeds.³ In 1993, the Oklahoma Turnpike and Georgia's State Road and Tollway Authority both introduced the nation's first purpose-built free-flow tolling systems, commonly called open-road tolling (ORT).

ORT allows the customer to pay automatically via a transponder without having to stop.⁴ This eliminates the need for toll booths altogether, allowing vehicles to pass under toll plazas at high speeds while their payment and vehicle information is captured and improving safety since vehicles don't need to slow down.⁵ While ORT is highly efficient, safer, and widely embraced by the public, it also creates opportunities for revenue loss. Across the top 40 toll authorities by revenue, over \$20 billion in revenue is owed each year, but an estimated \$2.24 billion goes uncollected due to ineffective account conversion processes and paper-based invoicing.

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Today, toll authorities collect payments primarily through three different methods: transponders, “toll by plate,” and third-party vendor systems (often used through mobile apps). While the latter two options increase customer choice, both pose challenges for toll systems.⁶

Transponders

Most tolls collected on US roads today are captured through a vehicle-mounted transponder.⁷ It’s by far the most popular way to pay tolls, and most drivers know the devices through regional brand names, such as E-ZPass in the Northeast, SunPass in Florida, I-Pass in Illinois, and FasTrak in California. Since transponders are linked to driver accounts and are compatible with the technical infrastructure at toll plazas, they’re highly effective at collecting tolls.

Unfortunately, not all drivers have adopted transponders. At top-performing tolling authorities, an average of 82% of drivers use the local transponder system; the industry considers 73% to 85% a high adoption rate.⁸ In some of the most mature US tolling markets, transponder adoption has stalled at around 85% even after roughly 30 years of use and promotion.⁹ In addition, anecdotal evidence suggests that certain groups, such as unbanked and underbanked persons, are challenged by the prepaid deposits and fees required to open a transponder account, creating a further barrier to universal adoption.¹⁰

ORT systems also face interoperability challenges. Specific transponder protocols are read only in certain areas of the nation (such as E-ZPass, used along most of the East Coast, and FasTrak in California)—a situation that may discourage greater user adoption and creates a significant, ongoing expense for tolling authorities that maintain interoperability hubs (technical systems that allow for seamless travel across different tolling jurisdictions).

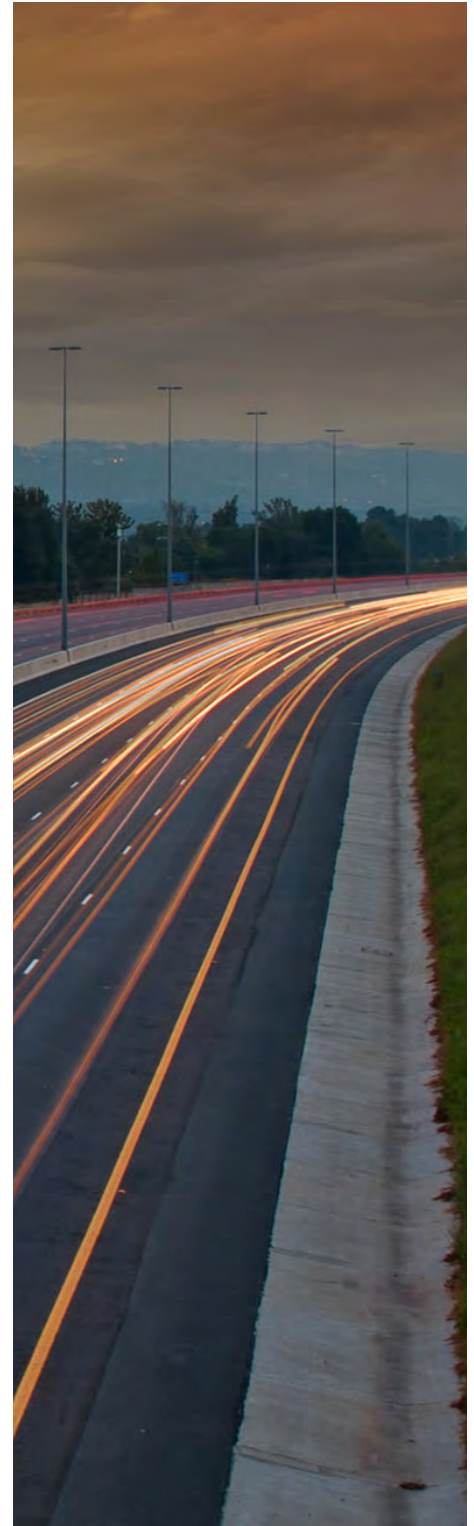
Therefore, despite the effectiveness of transponder technology, toll authorities have turned to additional collection methods.

Toll-by-plate systems

Originally designed to identify and bill evaders of transponder-based systems, the toll-by-plate process has become the industry’s second most widely used revenue collection tool. This process uses a camera-based license plate reader to capture an image of each vehicle’s license plate as it passes under a toll gantry.¹¹ The system converts the image to text via optical character recognition and cross-references the plate against a database of known toll accounts, which ensures that drivers with transponders aren’t charged twice—and that, if a transponder fails to activate under the toll gantry, the driver still is charged. If a plate number isn’t associated with a known toll account, the system tries to match the number to an address acquired via state databases so that a paper invoice can be mailed to the driver.

The toll-by-plate process, however, is subject to multiple failure points that can lead directly to uncollected revenue. Breakdowns in the process occur in four main areas:

- **Information capture:** The license plate reader may fail to capture a readable picture of a license plate due to old hardware with inadequate resolution or a variety of other issues, such as tailgating, trailer hitches, bike racks, light refraction, and weather conditions, all of which can obscure the camera’s view of the plate.
- **Data access and reliability:** After license plate data is captured, the toll collection system seeks to acquire address data from a state’s department of motor vehicles (DMV) to bill the driver. In many cases, however, the data are inaccurate or obsolete since many US residents move from place to place without updating their addresses with the DMV.



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Aside from this challenge, a DMV may be unable to share data for certain vehicles, the toll authority data provided to the DMV may be incomplete, or the DMV information may be inaccessible in a timely manner.

- **Invoicing and payment:** Even if accurate address data can be located, some tolling authorities are unwilling to send bills out due to the high cost of paper invoicing versus the amount of the owed toll. Because of this cost, many toll authorities set a billing threshold for cost effectiveness, and lower unpaid toll bills are likely to remain uncollected. Even if a driver *does* receive a paper bill, some are unable to pay due to a lack of funds or accepted payment methods, while others simply forget to pay.
- **Willful nonpayment:** Some drivers purposely attempt to evade the tolling system—for example, by obscuring their license plates with light-reflecting covers. In other cases, toll agencies find it difficult to enforce penalties against out-of-state drivers since not all states have reciprocity agreements.

Such breakdowns cause tolling authorities to lose out on substantial amounts of owed revenue. Research shows that almost 40% of revenue that passes through the toll-by-plate process remains uncollected by tolling authorities.¹²

Third-party payment vendors

To make toll payment easier for drivers, many third-party payment options have entered the market. On some toll roads, mobile apps such as PayTollo, GoToll, and Uproad allow drivers to skip the transponder or toll-by-plate process entirely and pay through the app instead. In addition, some auto manufacturers have begun testing toll payment via connected vehicle technology or other onboard devices.¹³ Compared to transponders, the use of third-party toll payment solutions is significantly lower, but the use of these



applications is expected to increase as the adoption of connected devices and vehicles increases.

While these third-party payment solutions may be convenient for drivers, they have certain drawbacks. For instance, each vendor must complete a costly process to integrate with the back-end data and payment systems of individual toll authorities. Some back-end solutions are proprietary, and legal agreements can restrict app use to certain highways, bridges, or tunnels. While drivers seem open to new payment options, downloading and using “one more app” can be tedious. In addition, marketing these solutions is expensive, and ads to promote their use may not reach the entire population of drivers.

Better electronic tolling

Toll authorities have several options to improve the toll-by-plate and third-party payment processes to collect more of their \$2.24 billion in owed revenue. Simply put, it's easier to attract customers by making payment as seamless and accurate as possible. More options for paying tolls can reduce reliance on toll by plate and its related paper bills.

Behavioral economics says consumers are more likely to make payments when doing so is easy.¹⁴ With time and appropriate investment in IT infrastructure, a free market of user-friendly, third-party payment options will emerge, all of them able to handle transactions for any toll facility. As these alternative payment options enter the market and begin to scale, a “middleware” layer will be required

to connect data and payments arriving from third parties with tolling authority systems. Features such as data processing, standard application programming interfaces, and near-real-time ledgers will streamline back-end processes and allow toll authorities to integrate with third parties in a seamless, cost-efficient manner.

With streamlined access to new payment options and better customer data, tolling authorities will spend less time and money chasing down customers and should be able to reduce reliance on the toll-by-plate process.

Looking ahead

As the industry continues to adopt innovative new technologies, it's essential for toll authorities to remain nimble. While they've leaned on the toll-by-plate process to capture non-transponder revenue, process breakdowns require a different approach. The emerging industry of third-party apps promises customers easier payment methods and may convert some non-transponder drivers into known customers. But current adoption rates are low, and integration challenges persist.

Toll authorities should continue¹⁵ to seek opportunities to streamline the integration between new payment options and their back-office systems, and over time the market will continue to develop new ways to capture customer information and payments. In this future, toll authorities will be able to go back to focusing on what they do best: keeping roadways safe and free flowing while fulfilling their fiduciary duties to collect tolls as efficiently as possible.

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Endnotes

1. Deloitte analysis supplemented by interviews with former toll operations leaders.
2. North Texas Tollway Authority (NTTA), "[Milestones: History and mission for the North Texas Tollway Authority](#)," accessed October 13, 2022.
3. A transponder is a vehicle-mounted device that can receive and emit radio signals.
4. Shutoko, "[Electronic Toll Collection System \(ETC\)](#)," accessed October 13, 2022.
5. Michael J. Davis, "[Open road tolling: Safer with less congestion](#)," *ITS International*, January 30, 2012.
6. Luz Lazo, "[People are driving less and skipping the toll roads, leaving less money for local projects](#)," *Washington Post*, July 4, 2020.
7. E-ZPass Interagency Group, "[About us: Overview](#)," accessed October 13, 2022.
8. Illinois State Toll Highway Authority, "[Chapter 1: Background](#)," *Comprehensive traffic and toll revenue study* (Boston, MA: CDM Smith, November 2021), pp. 1–18; Thomas J. Tinlin, "[All-electronic tolling update](#)," Massachusetts Department of Transportation Highway Division, November 18, 2015.
9. As a case in point, note that in the mature New York/New Jersey market—29 years after its introduction—E-ZPass adoption still hovered at 87.6% (per trip utilization, weighted average). See Port Authority of New York and New Jersey, "[Traffic & Volume](#)."
10. JJ Eden, "[Toll roads must to serve unbanked customers far into the future](#)," *Traffic Technology International*, July 2, 2017.
11. Illinois Tollway, "[Pay By Plate](#)," accessed October 13, 2022.
12. Deloitte analysis supplemented by interviews with former toll operations leaders.
13. PYMTS, "[More automakers join trend of factory-installed toll-payment system](#)," October 26, 2021.
14. See, for instance, Ofer Zellermyer, "[The pain of paying](#)," Carnegie Mellon University PhD dissertation, December 1996.

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