

Carl Bulger presided.



Robert C. Jordan, Jr., P.E., MD Transportation Authority (Photo by Dennis Edgington)

Robert Jordan is a Professional Engineer who manages the toll system and electrical engineering for Maryland's Transportation Authority. Most of the states in the Northeast now have the EZPass system which provides for cashless toll collection. Each state is responsible for its own system but most states coordinate toll collections so that a vehicle with an EZPass transponder can use it in any of those states. The EZPass Electronic Tolls Collection logo is controlled by an Interagency Group. Mr. Jordan represents the MD Transportation Authority in that group. There is no national standard for Electronic Tolls Collection. The EZPass website:

<https://www.ezpassmd.com>. Service Center phone number: 1-888-321-6824

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Submitted by Barry Hammond

# Cashless Toll Collection

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# Cashless Tolls

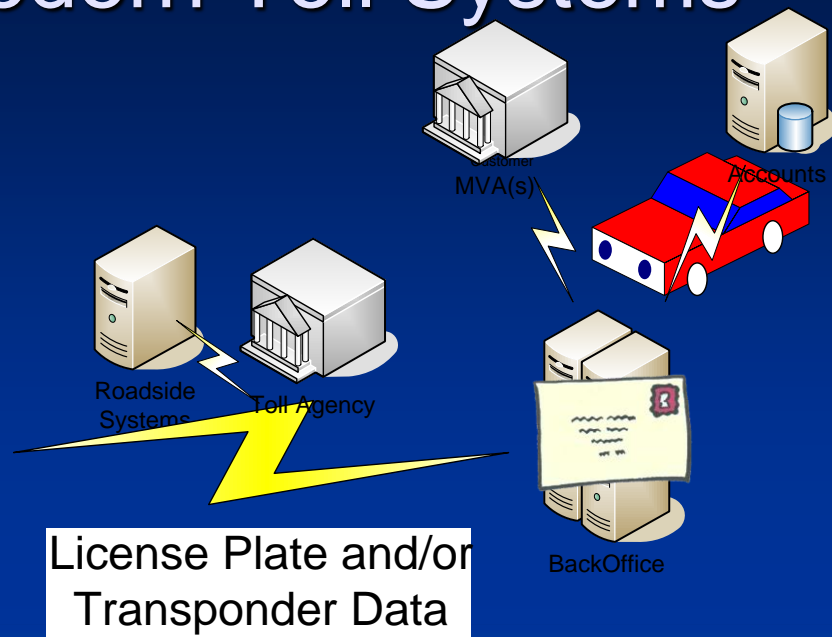
- Cashless Tolls means that there are no manual methods to collect tolls on the road.
  - It really refers to a movement to unmanned collection.
- In modern systems, on-road activities involve customer identification, not an actual payment.
- All payment processing is a back-office effort.
  - Transactions from lanes “posted” to accounts.
  - Set up account, handle violations, handle video toll accounts and payment.
  - Customers may pay cash at the back office.
    - Not cashless, cash accepted at office.
    - Check payments also accepted.
  - Prefer credit or debit cards for auto-replenishment of funds.

The newly opened Intercounty Connector (ICC) new opened between I-95 and I-270 in Montgomery County depends entirely on EZPass toll collection. There are no toll booths. A vehicle without EZPass traveling on the ICC will be charged at a higher rate to both encourage the driver to set up an EZPass account and to cover the extra charges involved in billing him based on video of his license plates and car.

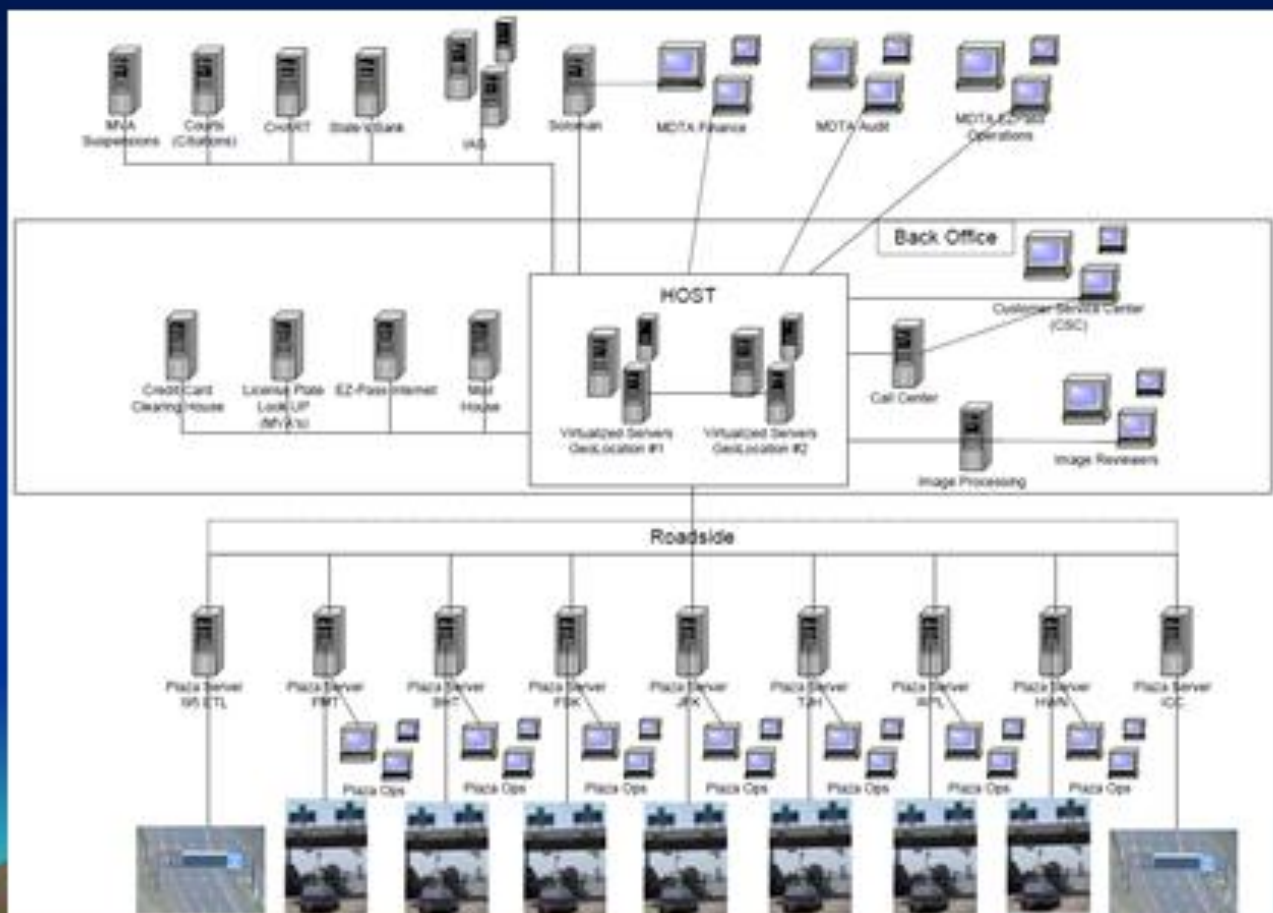
# How is it accomplished?

- **Transponders**
  - Traditionally thought of as electronic toll collection
    - Ie: E-ZPass®
  - Video for enforcement and violation processing
- **New Paradigm**
  - Electronic Toll Collection includes any method of using electronics to automatically and at highway speed identify customers.
    - Includes transponders and video toll options.

# Modern Toll Systems



# SYSTEM DIAGRAM



# What is Video Toll Collection?

- A system that captures a picture of the license plate(s) of passing vehicles so tolls can be charged based on the information on the plate.
  - Why don't we call it picture tolling?
    - Goes back to the fact that original systems used a video camera and a frame grabber.
- Naturally, this system relies on being able to associate the plate with a responsible owner.
  - MVA look up and associated enabling legislation.
- Video collection takes the violation enforcement system and makes it a payment system.

# What is the customer experience Unregistered video toll

- Just drive through
- Agency determines vehicle owner through MVA look up.
- Bill generated and mailed to registered owner.
- Customer may pay via internet, stop-in center, or mail in a payment.
- Toll rate higher than E-ZPass® rate.
  - Cover extra costs of video processing and MVA lookups.



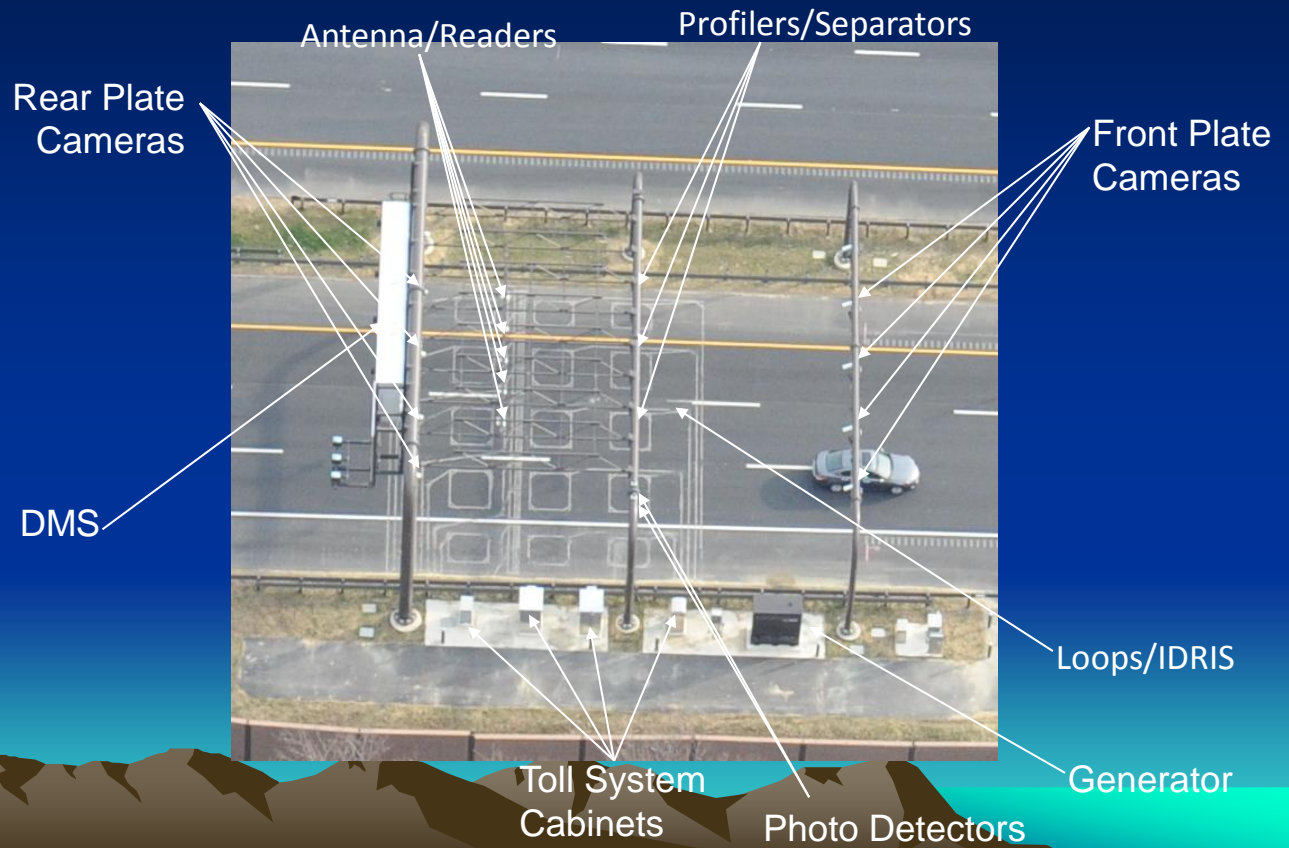


# How does it work

- Cameras are mounted over the lane(s).
- Triggers, loops or laser scanners, cause images to be captured.
  - Special “purpose built” camera systems used
    - Progressive scan
    - High resolution
    - Usually B&W with IR sensitivity and IR illumination.
    - On board computers and processing capabilities
- Where a valid payment is not found (ie: EZPASS) images forwarded to host system for processing.
- It Does NOT rely solely on OCR.
  - Uses ‘picture’ finger print technology to increase accuracy and automation.



# Toll Gantry Close Up



# Why capture front and rear

- Not all states require front plates
  - So we need rear.
- Rear plates on trucks are not usually useful.
  - So we need front.
- Decreases obscured plate issues.
  - Much less likely to have both plates obscured.
  - Trailers, cargo, etc...



# Transponders

- The current transponders operate at 915.75MHz
- Sites are licensed. Transponder is low power and unlicensed.
- Transponder is “active”.
  - It has a battery.
  - Battery retains memory in the ASIC.
  - Battery powers the transaction
  - Loss of power erases data rendering transponder useless.

These transponders cost about \$9.00. If the windshield has a thin metallic coating that attenuates the signal too much, a transponder costing \$33.00 can be embedded in a license plate holder. Passive transponders, which don't transmit as much information, cost only \$3.00. Some states currently use them; Maryland may do so in the future.

# Transponder Transaction

- Requires a RPV cycle.
- Lanes continuously send polls in each lane.
  - A wake up signal
- READ
  - Transponder responds with unique serial number and data payload.
- Program
  - The reader receives the transponder information, updates the payload with lane, plaza ID, and other information.
  - Writes new data to transponder
- Verify
  - Transponder sends new data back to reader. If transponder memory does not match what the reader sent, transaction fails and is retried.
- In controlled tests at speed this cycle is over 99.9% likely to succeed.
  - Proper mounting, no interference, no multiple tags in lane.

# Passive Transponders

- Have no battery
- RF energy is stored and used to generate transmission.
- Transmits serial number only.
  - No write capability.
- Used in many systems. EZ-Pass may allow these in the future.
- Same frequency. Different protocol.

A passive transponder costs about \$3.00. Maryland may transition from active to passive transponders.

# Questions, Comments?



The electronic toll system is not used for surveillance, pursuit, or capture of criminals. State Police have their own systems. Information about your tolls is protected and can only be accessed toll system employees for processing of tolls or by court order.

EZPass transponders are usually attached by Velcro to the front window. The installer must first test your windshield to determine whether the relatively low power signals can be transmitted through the glass. Some windshields have a thin metallic coating which attenuates the signal too much. In those cases a special transponder is embedded in a license plate holder.

If you wish, you can keep the transponder somewhere in the vehicle until you pass a toll area. You then hold it up at the required angle.