Wainwright, Scott

From: Brown, Linda L.
Sent: Thursday, October 13, 2005 1:12 PM
To: Wainwright, Scott
Subject: FW: Experimental Device

Hi Scott,

MD SHA wants to experiment with purple pavement markings and purple signal heads at Toll Plazas to help guide traffic into the EZ pass dedicated lanes. This is the electronic advance copy and the hard copy will be sent separately. Please prepare a reply to this request for experimentation.

Thanks

-----Original Message-----
From: Roxane Mukai [mailto:rmukai@mdta.state.md.us]
Sent: Wednesday, October 12, 2005 5:16 PM
To: Strawder, Esther; Brown, Linda L.
Cc: Tom Hicks; Geoffrey Kolberg
Subject: Experimental Device

Esther,

As discussed yesterday, we are submitting an "E-ZPass Way-Finding" experimental request. I've attached copies of the letter and forms sent to SHA to be forwarded to you. I've also attached a copy of a presentation that was prepared.

This should be a fun one! If you or Linda have any questions, please feel free to call.

Thank you,
Roxane

Roxane Y. Mukai, PE, PTOE
Traffic Manager
Maryland Transportation Authority
Division of Engineering
300 Authority Drive
Baltimore, MD 21222

(410) 288-8484
(410) 288-8475, fax

October 11, 2005

Mr. Neil Pedersen
Administrator
Maryland State Highway Administration
707 North Calvert Street
Baltimore, MD 21203

Attention: Mr. Thomas Hicks, Director Office of Traffic and Safety

RE: Experimental Traffic Control Device Request
E-Zpass[SM] Way-Finding

Dear Mr. Pedersen:

The Maryland Transportation Authority is conducting a research study to identify and evaluate promising devices to improve way-finding for motorists at mixed-use toll plazas in Maryland, where more than one payment method (cash, tickets, electronic-toll collection) is accepted.

During Phase I of our study, we plan to test the effectiveness of purple and white pavement marking "dots" to guide *E-ZPass*[SM] customers into dedicated *E-ZPass*[SM] toll lanes at the mixed-use toll plazas. The dots initially would be installed at the Fort McHenry Tunnel and Baltimore Harbor Tunnel Thruway toll plazas. Before-and-after studies would be conducted to evaluate the effectiveness of the dots. If the experiment is found to be successful, the dots could be applied at other mixed-use toll plazas in Maryland. Future phases of this study could evaluate different sizes and colors of signal heads above *E-ZPass*[SM] lanes.

I have enclosed the completed Experimental Devices Form supplied by the Office of Traffic and Safety. In addition, a copy of a presentation regarding the proposed study is attached. If you find that the completed form is acceptable, please forward this request for an "Experimental Device" study to the Federal Highway Administration on behalf of the Maryland Transportation Authority.

Please note that we would like to expedite the approval process in order to place the pavement markings prior to the onset of winter weather. If you have questions regarding the request, please do not hesitate to contact our Traffic Manager, Ms. Roxane Y. Mukai at (410) 288-8484.

Sincerely,

Trent M. Kittleman
Executive Secretary

Attachment

Maryland State Highway Administration
Office of Traffic & Safety

MUTCD: Experimentation with New Traffic Control Device

Requestor's Name:	Trent Kittleman Executive Secretary Geoffrey Kolberg, P.E. Executive Director, Eng. and Const. Mgmt Keith A. Duerling, P.E. Director, Division of Engineering Roxane Y. Mukai, P.E., P.T.O.E. Traffic Manager, Division of Engineering	**Indicate Type of Experimentation** ☒ **Different Applications of Existing Traffic Control Device** ☐ **New Traffic Control Device**
Agency:	Maryland Transportation Authority	
Date of Request:	**October 11, 2005**	

Problem Statement: (Include information that justifies need for a new device or application)

The Maryland Transportation Authority (Authority) is responsible for constructing, managing, operating and improving toll facilities in Maryland. The Authority's seven toll facilities – a turnpike, two tunnels and four bridges – move nearly 150 million vehicles on an annual basis. As is common with high-volume toll facilities, Maryland's toll plazas experience congestion during peak travel periods. Vehicle queuing during these congested periods can make way-finding challenging for motorists, particularly for motorists who are unfamiliar with a specific toll plaza. Horizontal and vertical curves, as well as the proximity of ramps and bridge or tunnel structures to the toll plazas, also contribute to way-finding challenges.

The Authority provides lane guidance approaching the toll plaza barriers for varying toll payments and vehicle types resulting in signage addressing three major user types: cash or ticket paying customers, heavy vehicles (greater than five tons gross vehicle weight), and *E-ZPass*[SM] customers. As the percentage of *E-ZPass*[SM] customers continues to rise, it is increasingly important to provide clear guidance for *E-ZPass*[SM] customers from the approach highway lanes to the dedicated and higher-speed *E-ZPass*[SM] *Only* lanes at each toll plaza. At the same time, it is important to prevent non- *E-ZPass*[SM] customers from using the dedicated *E-ZPass*[SM] *Only* lanes. Customers who inadvertently use an *E-ZPass*[SM] lane may stop or back up, both of which adversely impact the safety and operations of the toll plaza.

Currently there is limited guidance within published documents for applying traffic control devices (TCD) at toll plazas. Toll agencies across the United States have traditionally dealt with the design and operation of toll plazas on a case-by-case basis; therefore, the method used to guide motorists through toll plazas varies from one toll facility to the next. This lack of continuity and consistency can lead to driver confusion and subsequent safety and operational deficiencies.

Motorists may have difficulty identifying the appropriate toll lane based on their payment methods as lane uses and locations may differ from one trip to the next due to highway or toll lane closures and/or operational changes. As the number of toll facilities increase and the types of toll payments accepted also increase, there is a need to develop a consistent method of providing motorists approaching toll plazas with guidance. Currently, the number of existing signs in place at most existing toll plazas is already at the minimum spacing allowed by the 2003 edition of the Manual on Uniform Traffic Control Devices (MUTCD). Signals, signing and/or pavement marking treatments, new or existing, will be experimented with as a means to improve guidance to motorists entering a toll plaza.

Problem Statement (continued):

Currently, many northeastern states use a flashing yellow light to indicate a dedicated *E-ZPass*[SM] lane. Concerns have been raised regarding the appropriateness of using a flashing yellow light above *E-ZPass*[SM] *Only* lanes as the MUTCD specifies that a flashing yellow light shall mean "proceed with caution." As the geometrics of toll plazas are refined to further separate *E-ZPass*[SM] customers from cash-paying customers, the posted speed limits of dedicated *E-ZPass*[SM] *Only* lanes will likely increase over time. Motorists in these environments are likely to focus on proceeding at the posted highway speed, not necessarily with caution.

Previously, other types of signal indications have been tested. Studies conducted by the New York State Thruway Authority indicate that use of green signal indications above the dedicated *E-ZPass*[SM] *Only* lanes attracted cash-paying customers into the lanes. There is a clear need to determine whether there is a need for signals and the appropriate color and size of overhead signals then apply them consistently across all *E-ZPass*[SM] *Only* lanes. It is also anticipated that, in the future, some highway-speed *E-ZPass*[SM] lanes may not include lane use signal indicators.

In summary, it is desired to apply and test experimental traffic control devices at toll plazas in Maryland to quantify their safety, operational, and overall effectiveness at guiding *E-ZPass*[SM] customers into dedicated *E-ZPass*[SM] *Only* lanes. There has not been a comprehensive study of this type conducted within Maryland. The results will assist the Authority in developing a standard practice for applying TCDs at its toll plazas. The knowledge gained from this research effort will be shared with other toll agencies to improve industry practice.

Proposed Change: (Indicate how it deviates from current standard)

The intention of this research effort is to test a variety of Traffic Control Devices for effectiveness in providing guidance for motorists within a mixed-use toll plaza environment. Potential TCD tests include:

(1) alternate colors for lane use control signals mounted above *E-ZPass*[SM] *Only* toll lanes on the plaza.
(2) lane use control signals (arrows and X's) versus circular signal indications of varying diameter.
(3) pavement markings and/or signs using a variety of colors, symbols or text to guide motorists to *E-ZPass*[SM] *Only* lanes.

The following paragraphs describe how the proposed changes deviate from current standards described in the 2003 Edition of the Manual on Uniform Traffic Control Devices (MUTCD).

Section 1A.12 of the MUTCD provides the general meaning of 12 colors:

A. Black - regulation
B. Blue - road user services guidance, tourist information, and evacuation route
C. Brown - recreational and cultural interest area guidance
D. Coral - unassigned
E. Fluorescent Pink - incident management
F. Fluorescent Yellow/Green - pedestrian warning, bicycle warning, playground warning, school bus and school warning
G. Green - indicated movements permitted, direction guidance
H. Light Blue - unassigned
I. Orange - temporary traffic control
J. Purple - unassigned
K. Red - stop or prohibition
L. White - regulation
M. Yellow - warning

As shown in the list, three of the 12 colors are unassigned (purple, light blue, and coral). Of the remaining colors, only green is given the general meaning of "indicated movements permitted." The uses of purple, yellow, white and/or black signs, pavement markings and/or signals will be investigated for their potential to increase motorist awareness of electronic tolling messages.

Within Part 4 (Highway Traffic Signals) of the MUTCD, meanings are provided for only green, yellow, and red colors. Section 4D.04(D1) states that a flashing yellow signal shall mean "vehicular traffic is permitted to proceed through the intersection or past such signal indication only with caution." Testing any other color besides green and flashing yellow for the movement of vehicles in *E-ZPass*^{SM} *Only* lanes is a deviation from the MUTCD.

Section 4D.15 of the MUTCD provides the following standard: "There shall be two nominal diameter sizes for vehicular signal lenses: 200 mm (8 in) and 300 mm (12 in)." In addition to the use of circular indications, arrow and 'X' indications are allowed for lane-use control signals as described in Chapter 4J. Section 4J.02 provides meanings for a downward green arrow, a yellow X, and a red X. Section 4J.03 states that the nominal height of each of these indications shall be 18 in for typical applications, although signal faces larger than 18 in with message recognition distances appropriate to signal spacing may be used. Applying circular signal indications with diameters other than 8 in or 12 in, or applying lane-use control signals of a different size, shape, or color than defined in Section 4J is a deviation from the MUTCD.

Section 3A.04 of the MUTCD provides the following standard: "Markings shall be yellow, white, red, or blue." Section 3B.19 goes on to state that, "Word and symbol markings shall be white, except as otherwise noted in this Section." With regard to preferential lane word and symbol markings, Section 3B.22 states, "All preferential lane word and symbol markings shall be white." Based on the standards described in MUTCD, the use of colors besides white (and black) for lane markings, words, and symbols is a deviation from the current standard.

Supporting Documents:

☒

☒
☒
☒

To be Completed by the Office of Traffic & Safety

☐ Experimentation Approved ☐ Experimentation Disapproved ☐ Conditional Approval for Experimentation

Statement:

Director **Date** **Office of Traffic & Safety**	**Division Administrator** **Date** **Federal Highway Administrator**

Terms and Conditions of Approval:

1. **The experimental site will be restored to a condition that complies with the provisions of the MUTCD and MD Supplement to the MUTCD within three (3) months of completion of the experiment.**
2. **The sponsoring agency will terminate the experiment at any time if it is determined that the experiment directly or indirectly causes significant safety hazards.**
3. **If the experiment shows safety and operational improvements, the device may be left in place if approved by the Director, Office of Traffic & Safety.**
4. **Semi-Annual progress reports for the duration of the experimentation will be provided to the Director, Office of Traffic & Safety.**

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION PLANNING/TRAFFIC ENGINEERING
36 South Charles Street, Suite 2204 • Baltimore, Maryland 21201 • (410) 347-9610 • FAX (410) 347-9611

October 3, 2005

Project #: 6065.01

Roxane Mukai
Maryland Transportation Authority
300 Authority Drive
Baltimore, MD 21222

RE: Testing Plan for Experimental Device Evaluation at Toll Plazas

Dear Roxane:

Per your request, Kittelson & Associates, Inc. (KAI) has prepared a preliminary testing plan for the evaluation of experimental Traffic Control Devices (TCD) at toll plazas. This letter describes our planned approach for collecting and testing data. The details of the testing plan will be further refined as the study proceeds.

The experimental TCDs will be evaluated through "before" and "after" observations. The following means will be factors in this collection:

- Traffic approaching toll barriers will be recorded using video cameras.
- Lane change maneuvers will be reduced from the video data and categorized by location and type.
- Additional data will be collected during the observational periods including traffic volumes and toll violations
- Statistical analyses will be performed to determine the effect that each experimental device has on lane change maneuvers at approaches to toll plazas.

The basic elements of the testing plan are described further in the subsequent sections of this letter.

Site Selection
The data collection effort will focus on toll plazas within the State of Maryland, although the study could potentially be expanded to other states that use *E-ZPass*^{SM} electronic toll collection technology.

Data will be collected at sites where way-finding for motorists has been determined to be challenging due to traffic congestion, roadway geometry, and/or closely-spaced ramps, bridges, tunnel structures, etc.

All study sites must include dedicated *E-ZPass*[SM] *Only* lanes and provide adequate vantage points to mount video cameras and record traffic approaching the toll plaza.

Data Collection Activities

A condition diagram will be prepared for the "before" and "after" conditions for each study approach. The condition diagram will feature a depiction of lane geometry and the location and type of traffic signals, signs, and pavement markings from the approach apron to the toll barrier.

We will conduct a pilot study at one of the toll plazas to test the video collection equipment and to refine the procedure for recording and reducing data prior to beginning the "before" data collection effort.

We will send the Authority an e-mail notice at least one week in advance of each date we plan to collect data. The notice will include the date, time, location, and persons who will be on site for each data collection activity. We will coordinate with local Authority staff and other agencies as needed to obtain the necessary permission and approval to set up equipment and collect video data.

Our data collection efforts will focus on the peak period as well as off-peak periods of travel at the selected toll plazas. This will likely include the morning and afternoon commuter periods during weekdays and peak weekend travel periods. Data will be collected for additional periods to evaluate the performance of the treatments under various traffic conditions. Qualitative observations will also be made under various lighting and weather conditions.

The study duration will be determined by calculating the minimum sample size needed to obtain relevant results. It is expected that between 4-8 hours of data will be collected during each observation period.

Hourly traffic volumes per toll lane, percentage of *E-ZPass*[SM] users by toll lane, and percentage of violations by toll lane will be obtained from the Authority during the "before" and "after" study periods. This data will be used to evaluate the effectiveness of the experimental TCDs.

Data Reduction and Analysis

The number, location, and type of lane changes within the approach to the toll plaza will be reduced from the video data for all "before" and "after" conditions. Statistical analyses will be performed to compare the effectiveness of the experimental TCDs with respect to lane change maneuvers, volume distribution across toll lanes, and percentage of violations by toll lane. The five specific performance measures that will be analyzed are:

1. Rate of cash paying motorists who stop in dedicated *E-ZPass*[SM] lanes;
2. Rate of *E-ZPass*[SM] customers who change lanes into a dedicated *E-ZPass*[SM] lane from a cash paying queue;
3. Percentage of time each dedicated *E-ZPass*[SM] lane is blocked by cash paying customers;
4. Vehicle lane distribution in the approach lanes and toll booth lanes; and
5. Percent of toll violations per lane.

The performance measures described in this section are intended to capture safety and operational effects of the treatments being tested. Safety performance will be evaluated through an evaluation of lane change maneuvers and conflicts. Operational performance will be evaluated through an evaluation of lane volume distribution and percentage of time a dedicated *E-ZPass*^{SM} lane is blocked.

We trust this letter sufficiently describes the planned methodology and approach for testing the experimental Traffic Control Devices. Please do not hesitate to call me at (410) 347-9610 with any questions.

Sincerely,
KITTELSON & ASSOCIATES, INC.

Brandon L. Nevers, P.E.
Associate Engineer

cc: Ed Myers, KAI

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION PLANNING/TRAFFIC ENGINEERING
36 South Charles Street, Suite 2204 • Baltimore, Maryland 21201 • (410) 347-9510 • FAX (410) 347-9611

MEMORANDUM

Date September 9, 2005 **Project #:** 6065.0

To: Roxane Mukai, Maryland Transportation Authority

From: Brandon Nevers and Ed Myers

Project: Experimental Testing for *E-ZPass*^{SM} Wayfinding

Subject: Results from September 2, 2005 Field Testing

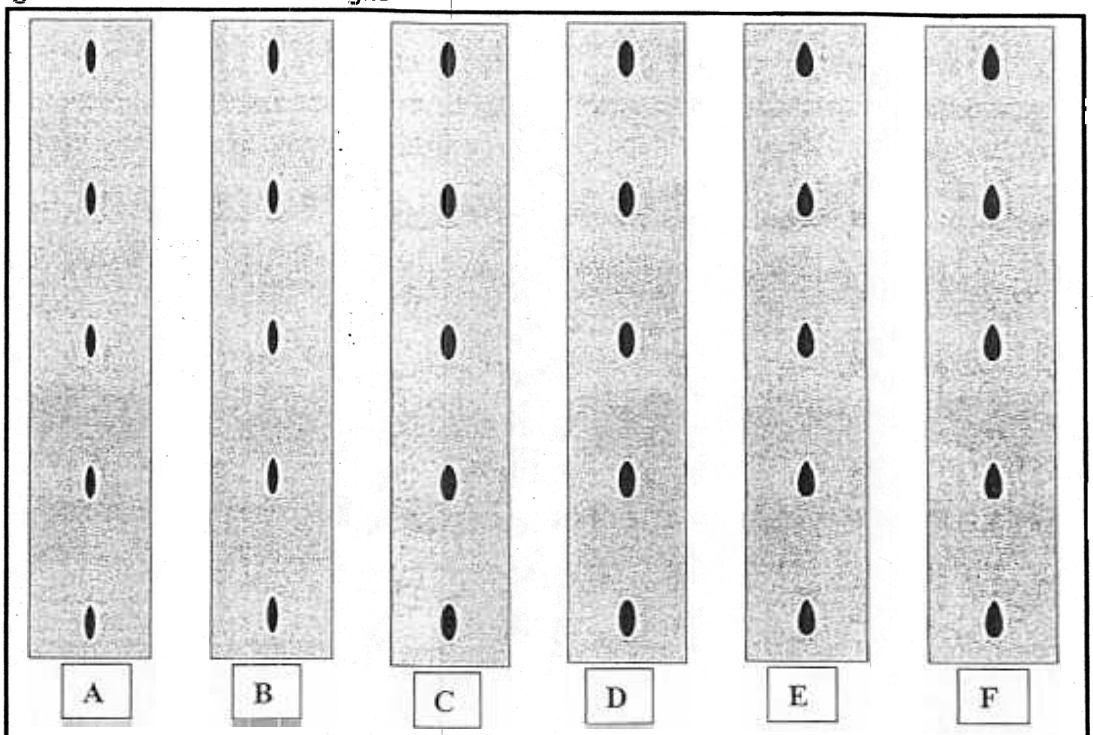
This memorandum summarizes our field evaluation of design options for the purple dot traffic control device. The purple dot is proposed to be installed on the northbound approach at the Ft. McHenry tunnel to help guide *E-ZPass*^{SM} customers to the dedicated *E-ZPass*^{SM} lanes (Lanes #3, #6, and #7).

Field testing was conducted on Friday, September 2, 2005 at the Dundalk Marine Terminal. This site was chosen because the terminal has a large section of unobstructed roadway within the terminal and a similar surface (concrete) as the Ft. McHenry toll plaza apron.

A total of six options were tested. The variations included two shapes (elliptical and teardrop), two sizes (12 inch and 18 inch width of purple), and two thicknesses of an outside white edge (2 inch and 3 inch).

Figure 1 illustrates the options

Figure 1. Candidate Dot Designs



Option	Shape	Width of purple dot	Width of white stripe
A	Ellipse	12"	2"
B	Ellipse	12"	3"
C	Ellipse	18"	2"
D	Ellipse	18"	3"
E	Teardrop	18"	2"
F	Teardrop	18"	3"

The dots for testing were plotted to scale on paper and mounted to a cardboard backing material (the actual dots installed in the field will be made of thermoplastic material). Five dots were made for each option, and each set of dots were spaced (initially) 24 feet apart measured centerline to centerline. Later in the experiment, the dots were tested at a spacing of 20 feet, 30 feet, 40 feet, and 50 feet.

Two vehicles drove over each set of dots at speeds ranging between 10-35 miles per hour and at various headways to observe the visual impact of each option.

Photos taken during the field testing are shown on the following page.

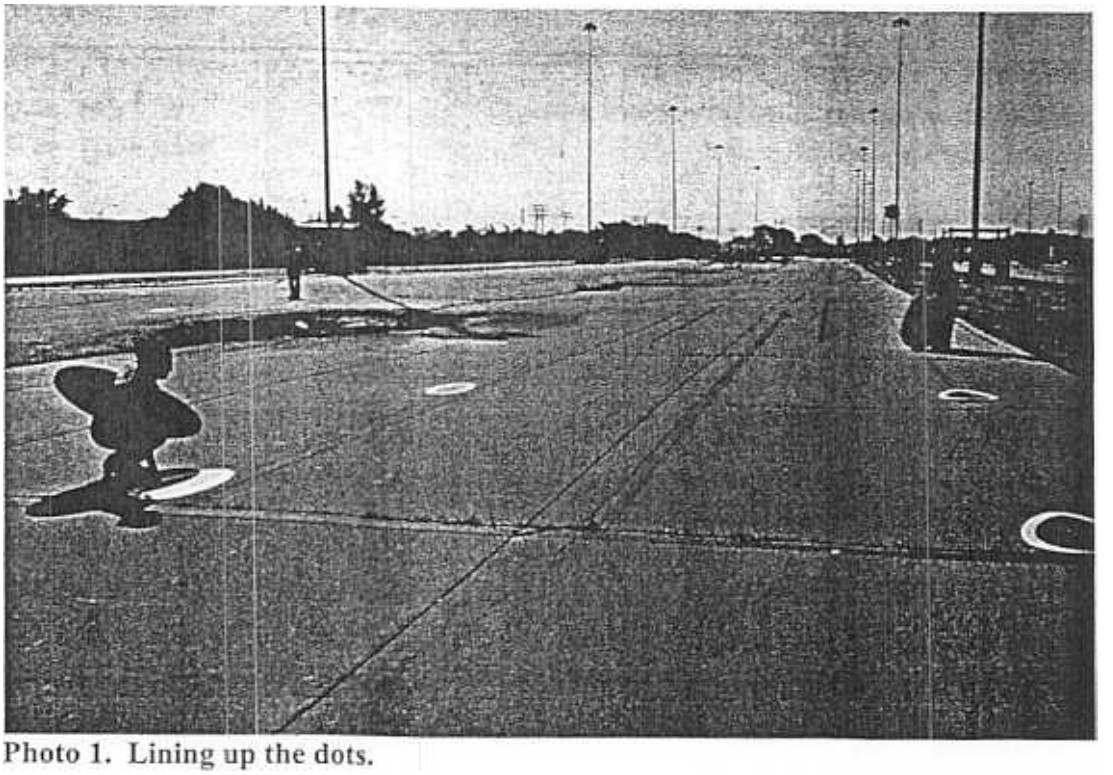


Photo 1. Lining up the dots.

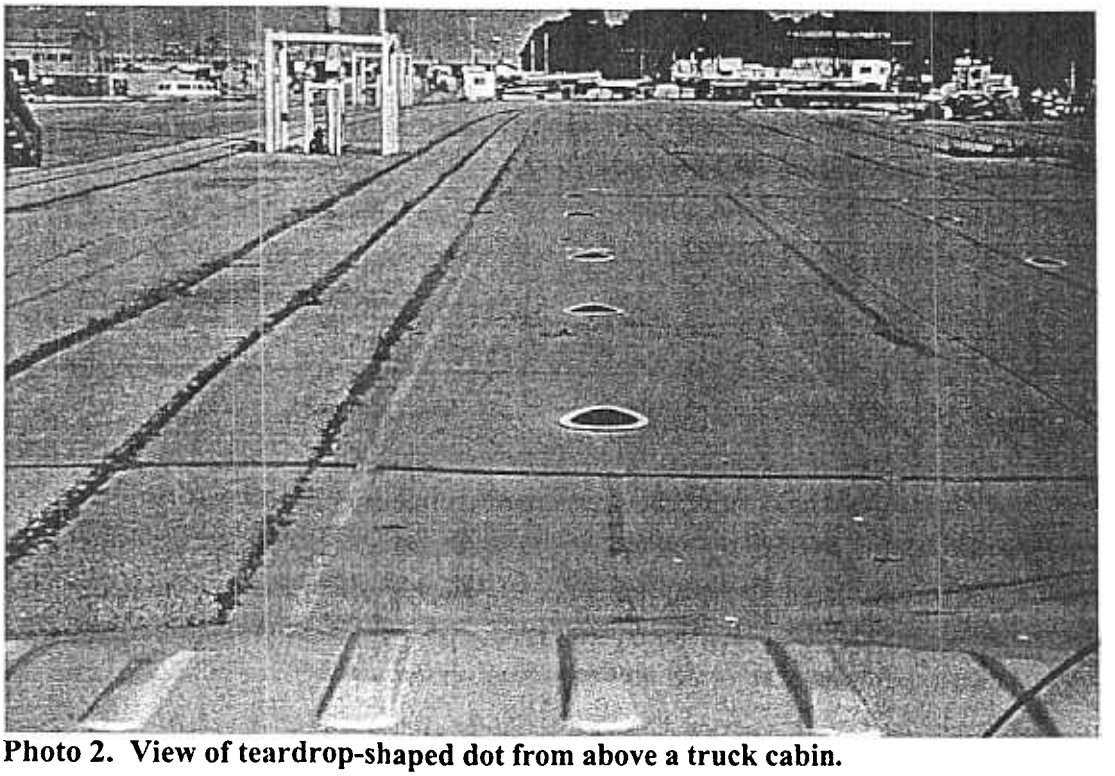


Photo 2. View of teardrop-shaped dot from above a truck cabin.

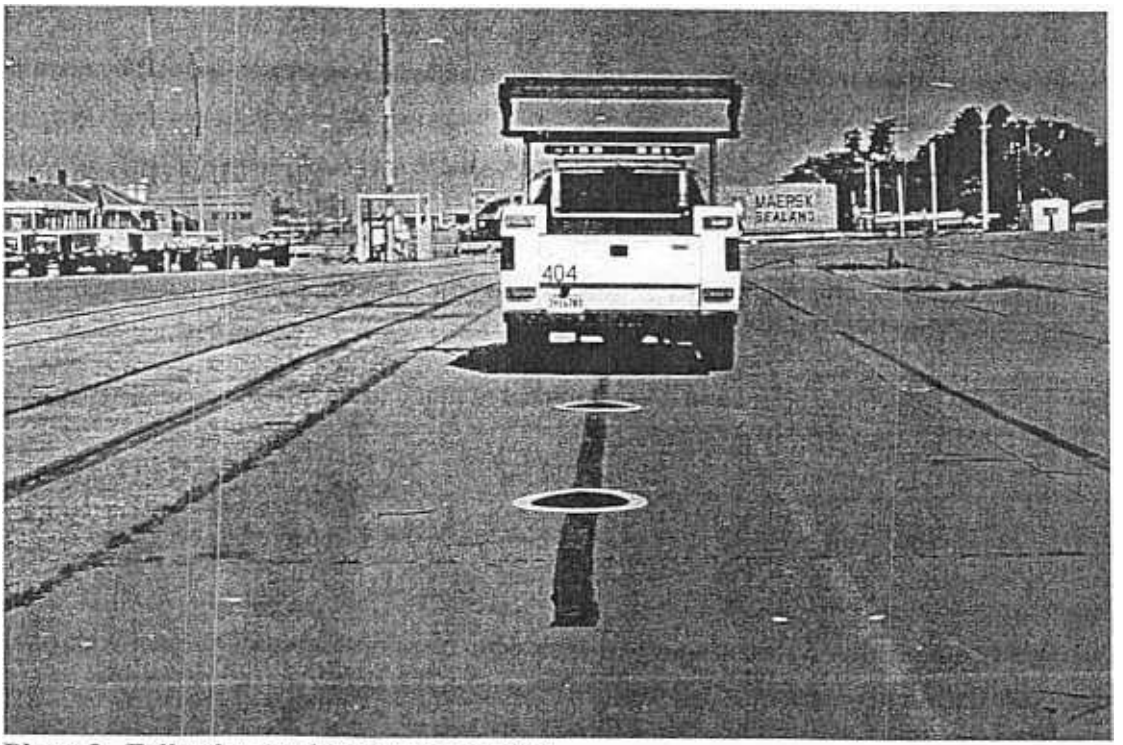


Photo 3. Following a vehicle at low speeds.

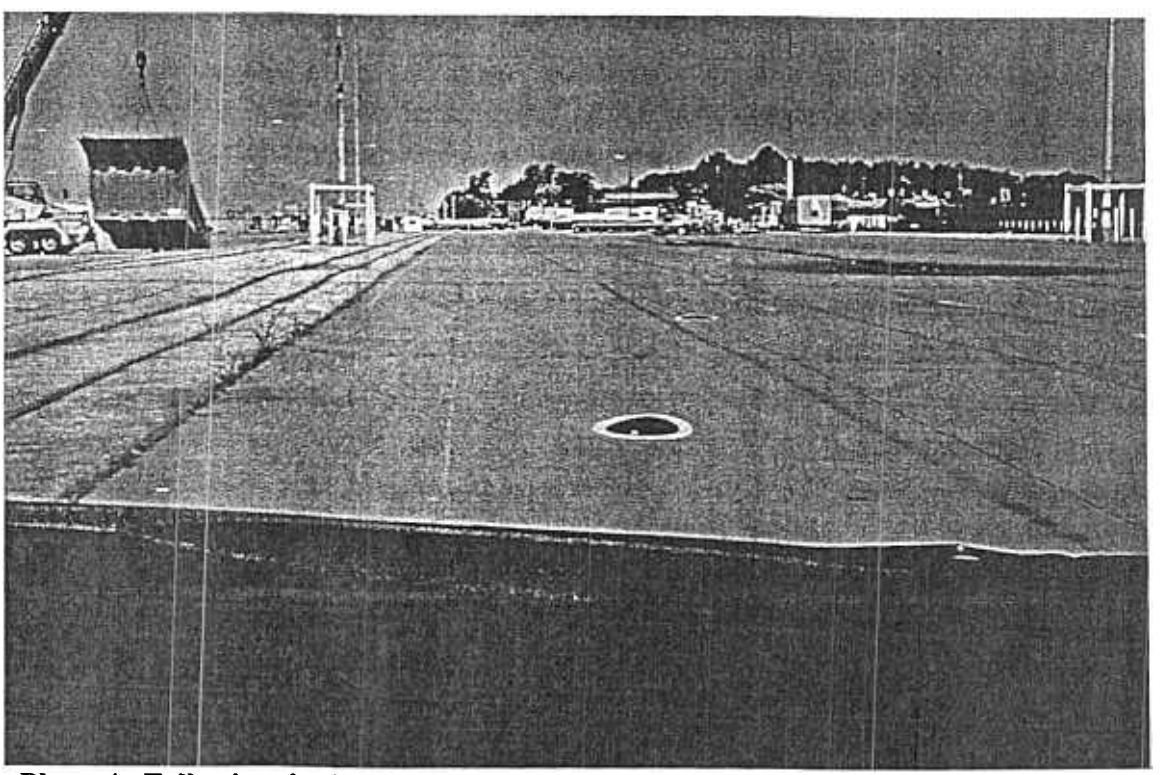


Photo 4. Following the dots around a curve.

Based on our observations and testing, we offer the following findings and recommendations:

The teardrop-shaped dot appeared more discernable as a way-finding device compared to the elliptical-shaped dot.

- The 18-inch wide dots stood out more clearly than the 12-inch wide dots, yet did not appear too wide or as a distraction.

  There was little observable difference between the 2-inch and 3-inch white edges around the dots from the vantage point of the driver.

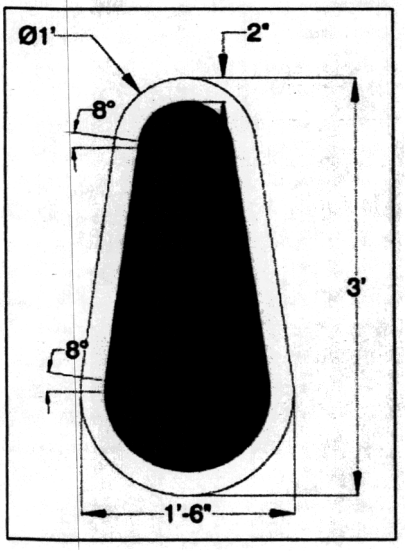
- The dots spaced at 20 feet and 24 feet appeared much to close to one another.

  The dots spaced at 50 feet seemed appropriate for speeds approaching a toll plaza.

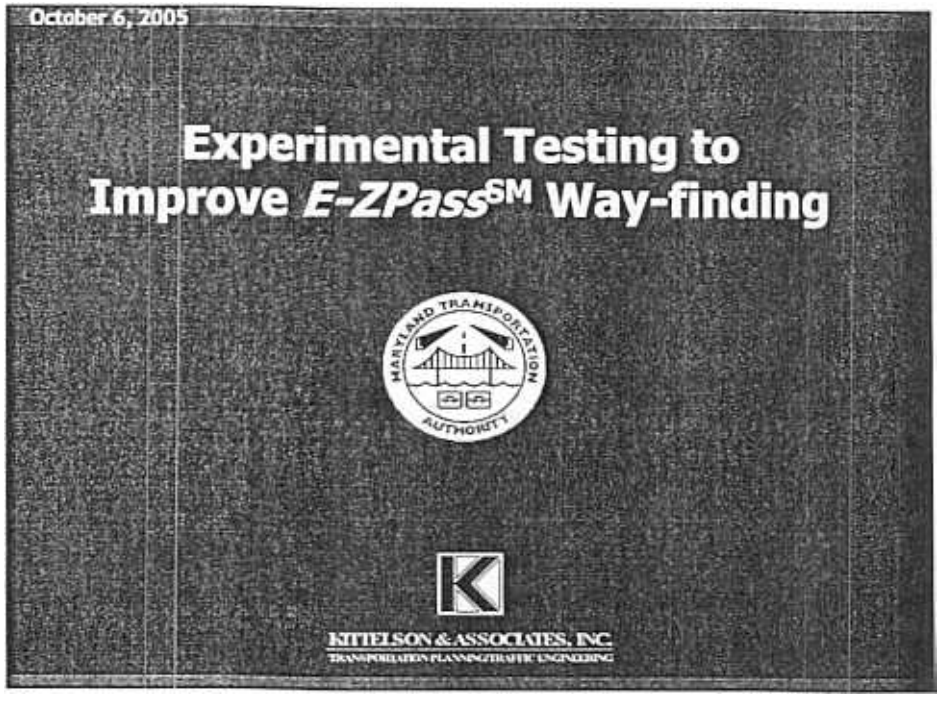
- Reducing the spacing of the dots in increments of 10 feet appeared to be a good technique for indicating that drivers should reduce their speeds.

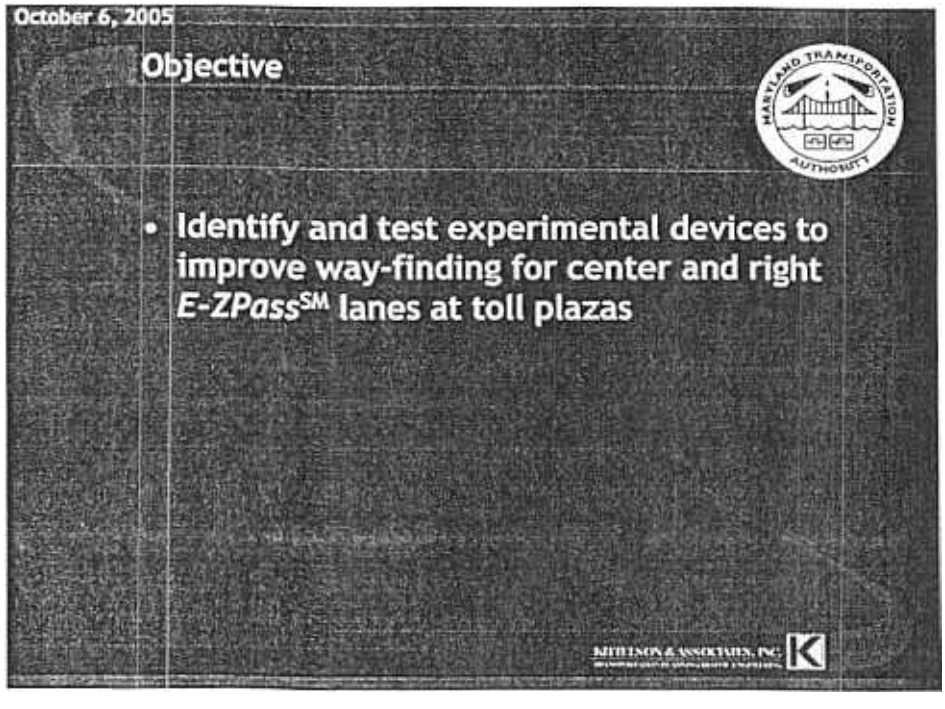
- We recommend implementing an 18-inch wide teardrop-shaped purple dot with a 2-inch wide white edge stripe (Option E in Figure 1, see also below). The dots should be spaced at 50-feet at the point the driver first encounters the dots, then reduce to 40 feet and 30 feet as the driver approaches the tollbooth.

Figure 1
Recommended Purple Dot Specification



We trust this memorandum summarizes the results and findings from our field testing of the purple dots. Please do not hesitate to call us at (410) 247-9610 with any questions.


October 6, 2005
Experimental Testing to Improve E-ZPass℠ Way-finding
MARYLAND TRANSPORTATION AUTHORITY
KITTELSON & ASSOCIATES, INC.
TRANSPORTATION PLANNING/TRAFFIC ENGINEERING


October 6, 2005
Objective
MARYLAND TRANSPORTATION AUTHORITY
• Identify and test experimental devices to improve way-finding for center and right E-ZPass℠ lanes at toll plazas
KITTELSON & ASSOCIATES, INC.

October 6, 2005

Presentation Outline

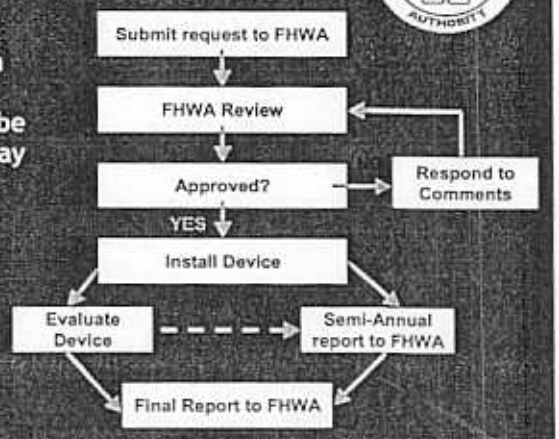
- Process
- Observed Conditions
- Traffic Control Devices and Treatments
- Testing Plan
- Cost and Schedule
- Next Steps

October 6, 2005

Manual on Uniform Traffic Control Devices (MUTCD)

"Requests for any interpretation, permission to experiment, interim approval, or change shall be sent to the Federal Highway Administration (FHWA)."

- MUTCD Section 1A.10



October 6, 2005

Maryland Vehicle Law

- **Article 25-104**

  "The State Highway Administration shall adopt a manual and specifications for a uniform system of traffic control devices, consistent with the provisions of the Maryland Vehicle Law, for use on highways in this State. This uniform system shall correlate with and, as far as possible, conform to the system set forth in the most recent edition of the Manual on Uniform Traffic Control Devices for Streets and Highways."

- **Article 25-106**

  "On every highway under its jurisdiction, a local authority shall place and maintain those traffic control devices that it considers necessary to carry out the provisions of the Maryland Vehicle Law or local traffic ordinances or to regulate, warn, or guide traffic. Each of these traffic control devices shall conform to the manual and specifications of the State Highway Administration."

October 6, 2005

SHA Experimental Form

- **Study Goals:**
  - Improve consistency of TCD applications
  - Improve way-finding for *E-ZPass*℠ customers at mixed use toll plazas.

October 6, 2005

Observed Conditions

- Way-finding challenging when horizontal or vertical curves are present

Northbound Fort McHenry Tunnel Toll Plaza

KITTELSON & ASSOCIATES, INC.

October 6, 2005

Observed Conditions (cont.)

- Drivers intentionally cut across dedicated *E-ZPass*SM lanes from one cash lane to another.

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October 6, 2005

Observed Conditions (cont.)

- Cash-paying customers stop in dedicated *E-ZPass*[SM] lanes.

October 6, 2005

Observed Conditions (cont.)

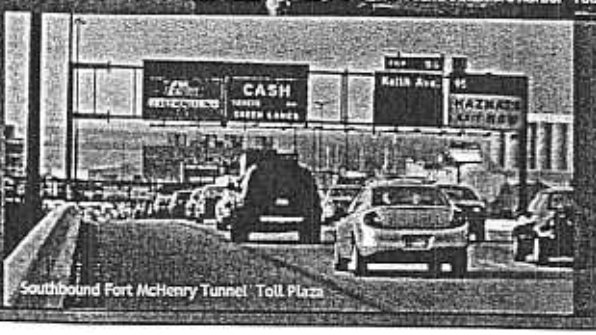
- *E-ZPass*[SM] customers change to dedicated lanes from cash paying lanes.

October 6, 2005

Observed Conditions (cont.)

- Excessive queuing during peak periods

Northbound Baltimore Harbor Toll Plaza



Southbound Fort McHenry Tunnel Toll Plaza

October 6, 2005

Observed Conditions (cont.)

- Ramps immediately adjacent to toll plazas

Northbound Baltimore Harbor Toll Plaza

October 6, 2005

Sample Data Collection

Location: Northbound FMT Toll Plaza Lanes 6 & 7
Date: Thursday June 23, 2005
Time Period: 2:30pm - 3:00pm
Summary:

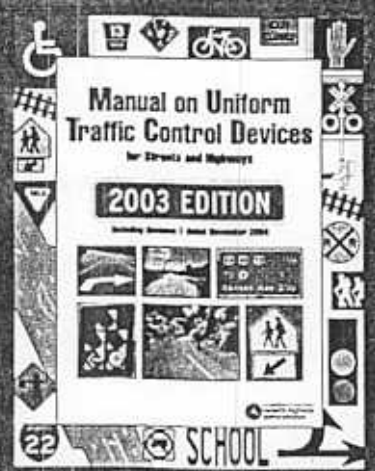
Time	Cash Customers Stop in E-Z Pass™ Lanes	E-ZPass℠ Customers Maneuver into E-Z Pass™ from Cash Lane	Duration Lane 6 was blocked	Duration Lane 7 was blocked
0:00 - 0:10	6	11	9:58	1:47
0:10 - 0:20	7	11	10:00	4:30
0:20 - 0:30	1	9	5:51	1:26
Total	14	31	25:49	7:43
Percent	31%	69%	*86.0%	*25.7%

*Blocking occurs due to aggressive cash paying customers, extensive queues from cash lanes, heavy traffic flows, tollbooth operations, and other factors not correctable through wayfinding improvements.

KITTELSON & ASSOCIATES, INC.

October 6, 2005

Traffic Control Devices

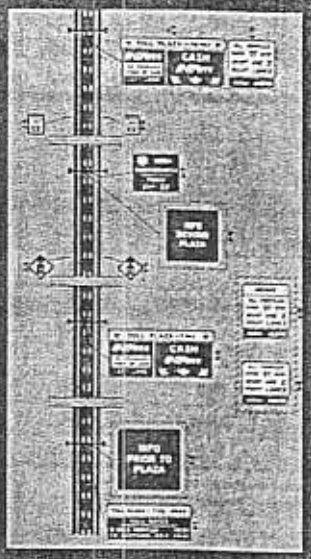


- Three major categories:
  - Signs
  - Pavement Markings
  - Traffic Signals

KITTELSON & ASSOCIATES, INC.

October 6, 2005

Signs



- **Existing Conditions:**
  - Standard toll plaza signing plan developed
  - Toll plaza signing upgrade under way
  - Minimum spacing level reached
- **Characteristics:**
  - Conveys permanent operating conditions
  - Limited flexibility for variable lane operations
  - Cannot provide guidance by lane unless sign placed directly over each lane or designated position

MEILSON & ASSOCIATES, INC.

October 6, 2005

Pavement Markings

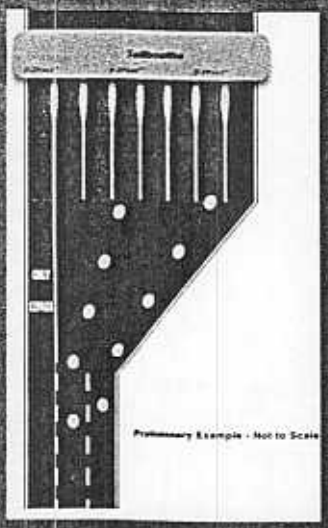
- **Existing Conditions:**
  - "*E-ZPass*℠ Only" lane markings used to mark dedicated *E-ZPass*℠ lanes on left side
- **Characteristics:**
  - Functions well for dedicated *E-ZPass*℠ lanes
  - Creates restrictive conditions
  - Prohibits non *E-ZPass*℠ vehicle use of marked lane

Northbound Fort McHenry Tunnel Toll Plaza

MEILSON & ASSOCIATES, INC.

October 6, 2005

Pavement Markings



- **Proposed Experimental Treatment:**
  - Purple Pavement Markings ("Dots" or "Bread Crumbs")
  - White outline for contrast
  - Size and spacing ratio per MUTCD guidance for dashed extension lines
- **Expected Benefits:**
  - Provide continuous guidance through toll plaza without restricting movements

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- Why not just dotted line extensions to E-Z lane instead ? (w/ "E-Z lane only" sign
- Not flexible for assigning diff. lanes to E-Z lane ?

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Pavement Markings

- **Similar treatment tested by Pennsylvania DOT, different application**
  - PennDOT's goal: increase following distance on two-lane highways
  - Did not increase following distance of aggressive drivers
  - Study used solid white dots

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Traffic Signals

- **Existing Conditions:**
  - Flashing yellow used for dedicated *E-ZPass*℠ lanes
- **Characteristics:**
  - Flashing yellow ball is defined as a caution/hazard light in the MUTCD
  - Flashing yellow arrow is not defined in the MUTCD
  - New York study reported an increase in the percentage of cash-paying customers when green bulb was used over dedicated *E-ZPass*℠ lanes*

Northbound Baltimore Harbor Toll Plaza

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Traffic Signals

- **Experimental Treatment:**
  - Purple balls in place of green balls
  - Fourth head needed for optional cash lanes
  - Do not use flashing yellow
  - Install purple lenses in existing signal heads (8" incandescent)
- **Installation Challenges**
  - Need to achieve proper color contrast and brightness
  - Purple lenses suitable for incandescent and/or LED lights are scarce
- **Expected Benefits:**
  - Meet driver expectancies
  - Consistent use of the color purple for dedicated *E-ZPass*℠ lanes

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Carl Anderson w/ Issues Purple ??
- Color Vision
- Conspicuity
- Wording diff. for other color ?

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Summary of Treatments

- **Two treatments proposed for Phase 1:**
  - Purple dots
  - Flashing or steady purple balls
- **Can be tested independently or in combination**

Phase 2:

Testing could examine size, type, and shape of signals for dedicated *E-ZPass*℠ lanes where lane use control signals are applied

John F. Kennedy Toll Plaza

October 6, 2005

Public Relations

- **Potential mechanisms to provide advanced notice to the public:**
  - Media advisory/news release to Baltimore area media
  - Meeting(s) or conversation(s) with Baltimore area traffic reporters
  - News media event and/or on-site interviews
  - Notice on Authority's website
  - Notice on *E-ZPass*℠ website (potentially)
  - E-mail distribution (potentially)
  - Two-line message on *E-ZPass*℠ statement (potentially)
  - Ten second traffic report spot on WBAL and sister stations (potentially)

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Testing Plan

- ☑ Select Test Site
- ☑ Preliminary Field Test
- ☑ Finalize Specifications and Design
- ☑ Select Performance Measures
- ☐ Install Treatment
- ☐ Collect Data
- ☐ Perform Statistical Analysis

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Test Site

Northbound Fort McHenry Tunnel Toll Plaza

October 6, 2005

Field Test

- Location: Dundalk Marine Terminal
- Date: September 2, 2005

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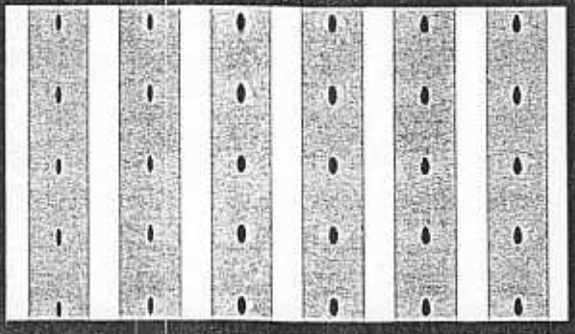
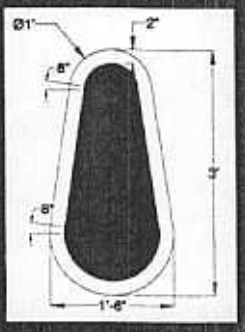
Dot Specifications

Test Options



Preferred Choice



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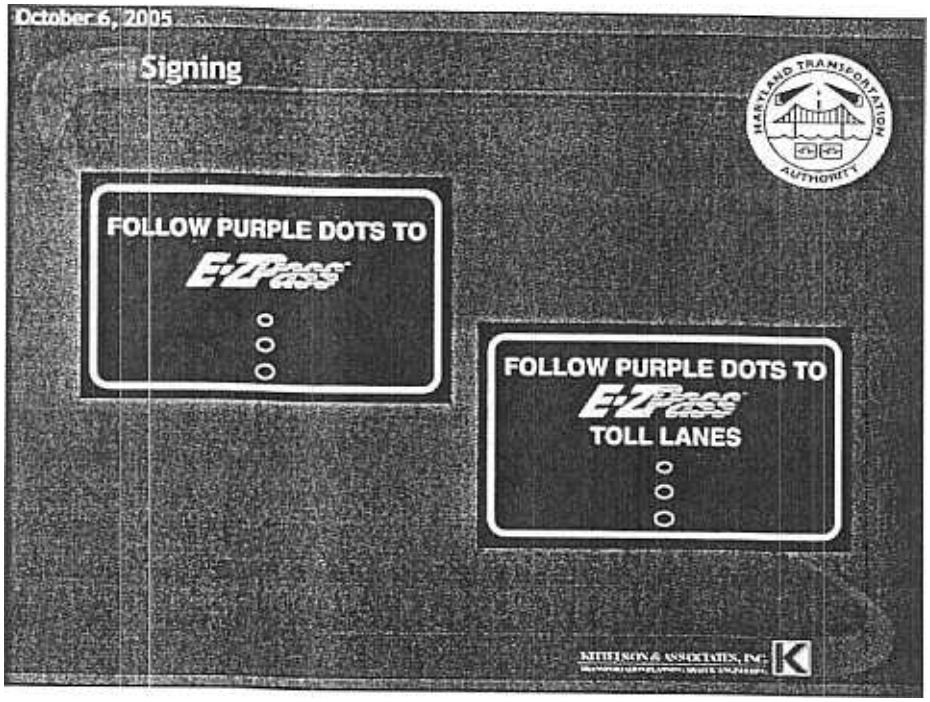
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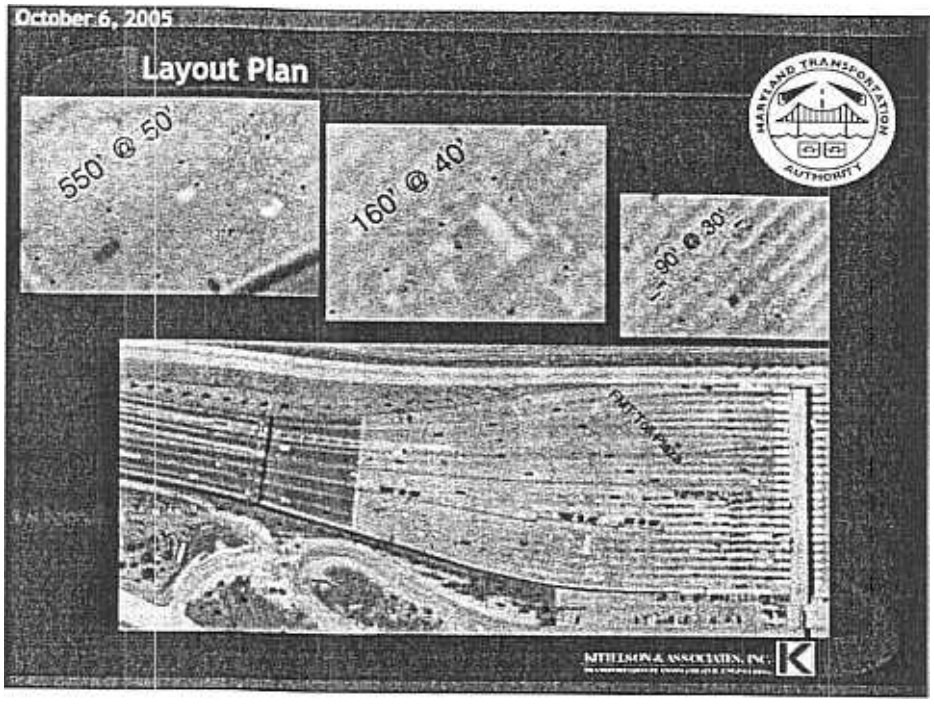
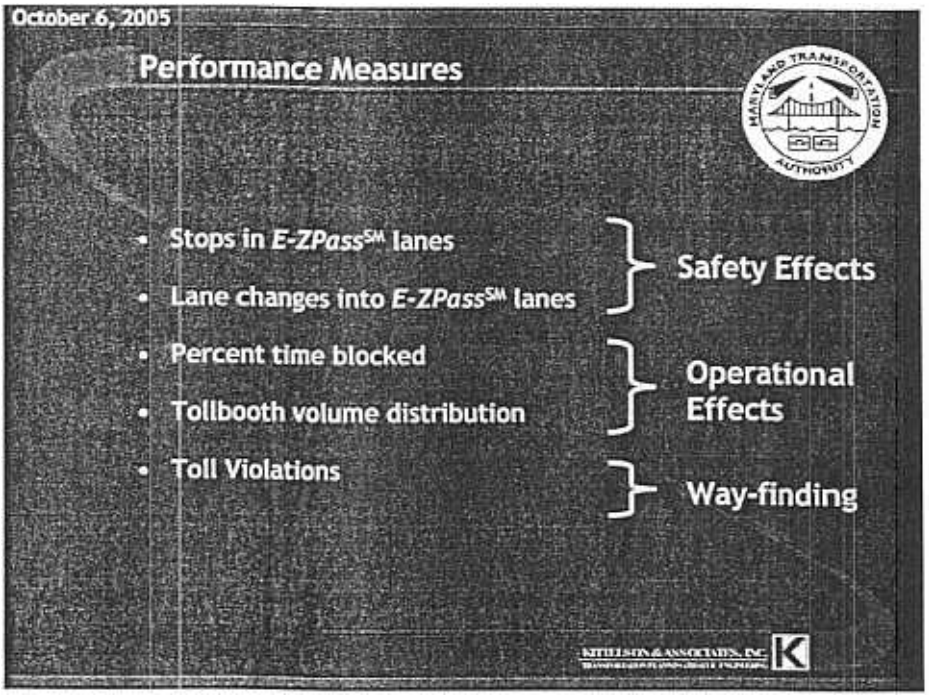
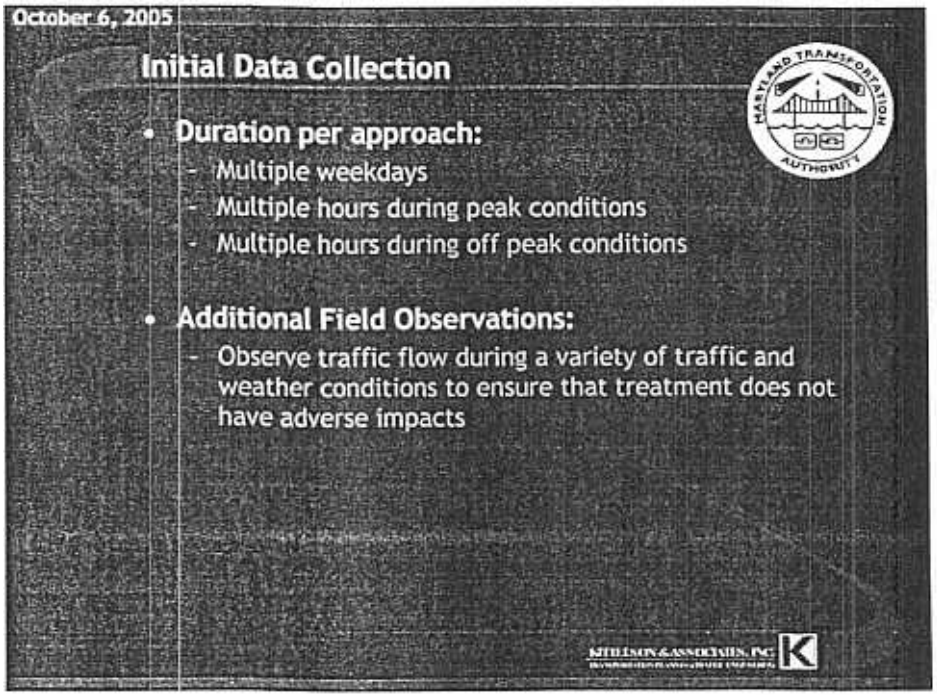
Signing
FOLLOW PURPLE DOTS TO
E-ZPass
FOLLOW PURPLE DOTS TO
E-ZPass
TOLL LANES
MAYLAND TRANSPORTATION AUTHORITY
MTE/SMW & ASSOCIATES, INC.


October 6, 2005
Layout Plan
550' @ 50'
160' @ 40'
90' @ 30'
MAYLAND TRANSPORTATION AUTHORITY
MTE/SMW & ASSOCIATES, INC.


October 6, 2005
Performance Measures
Stops in E-ZPass℠ lanes
Lane changes into E-ZPass℠ lanes
Safety Effects
Percent time blocked
Tollbooth volume distribution
Operational Effects
Toll Violations
Way-finding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Initial Data Collection
Duration per approach:
- Multiple weekdays
- Multiple hours during peak conditions
- Multiple hours during off peak conditions
Additional Field Observations:
- Observe traffic flow during a variety of traffic and weather conditions to ensure that treatment does not have adverse impacts

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Material Costs

- Assumes installation for three lanes at the northbound FMT toll plaza

Item	Estimated Quantity	Unit Cost	Cost
Purple Dots	57	$29.90	$1,705

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Data Collection and Analysis Cost

- Does not include direct expenses or time for meetings and presentations
- Does not include fabrication or installation costs

Task	Staff Description	Estimated Task Cost
0	Research & Testing Plan	$28,000
1	Collect "Before" Data	$12,000
2	Implement TCD's	$6,000
3	Collect "After" Data	$12,000
4	Statistical Analysis	$18,000
5	Final Report	$10,000
TOTAL		$86,000

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Schedule

* Contingent upon early November installation

TASK	APR 05	MAY 05	JUNE 05	JUL 05	AUG 05	SEPT 05	OCT 05	NOV 05	DEC 05	JAN 06	FEB 06	MAR 06
1- Field and Office Review	X	X										
2 - Identify Experimental TCD's		X	X									
3 - Develop Testing Plan			X	X	X	X						
4 - Collect "Before" Data							X					
5 - Implement Experimental TCD's								X				
6 - Collect "After" Data								X	X			
7 - Statistical Analysis										X	X	
8 - Final Report											X	X
9 - Meetings/Coordination	X	X	X	X	X	X	X	X	X	X	X	X

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- Should we proceed with the experiment?

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Next Steps
• Approval of locations for testing:
- Initial test: FMT (Northbound)
- Future tests: FMT (Southbound)
BHT (Northbound and Southbound)
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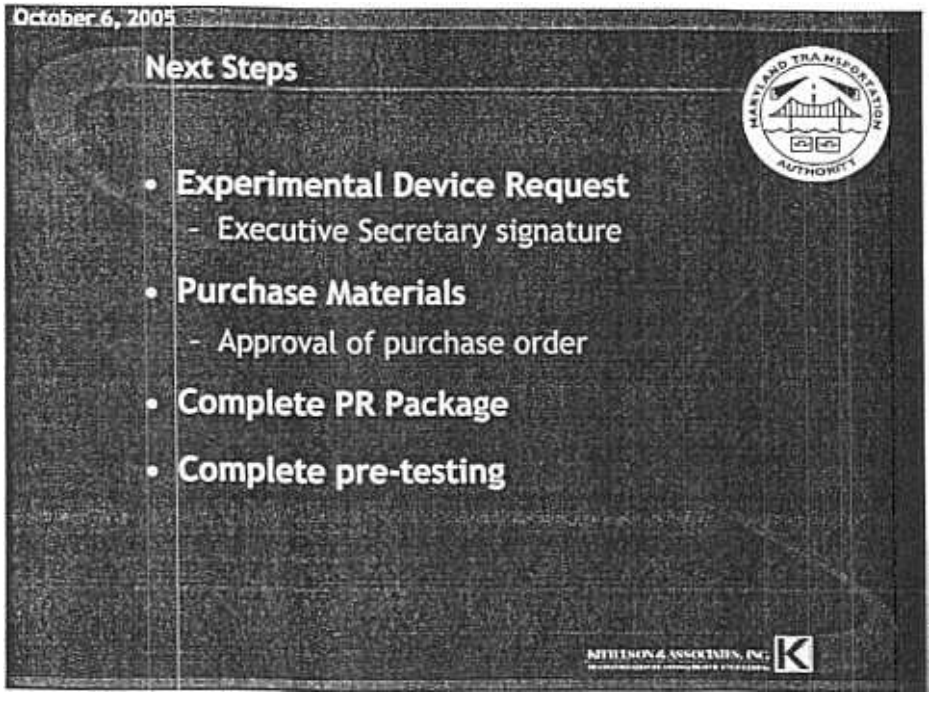
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Next Steps
• Experimental Device Request
- Executive Secretary signature
• Purchase Materials
- Approval of purchase order
• Complete PR Package
• Complete pre-testing
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