

PA Turnpike Topics



Traffic Engineering and Operations

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Facilities / Special Projects

Don Steele P.E.



Traffic Engineering & Operations

PTC Agenda

- **Traffic Operations (Mike Pack)**
 - TOC tools and technologies
 - Metrics and Dashboards
 - Incident Management
 - Connected Vehicles
- **Traffic Engineering**
 - Durable Pavement Markings (Justina Wentling)
 - Work Zone Innovations (Tom Macchione)
- **Engineering (Don Steele)**
 - Cashless Tolling

Intro to PA Turnpike

- 160 Miles / 7 Tunnels opened Oct 1, 1940
- 552 roadway miles
 - 359 Mainline I-76; 110 NE Ext; 83 Western Expansions: Beaver Valley (I-376), Amos K Hutchinson Bypass (I-66), Mon-Fayette Expwy (I-43); Southern Beltway (I-576)
- 22 Maintenance Sheds
- 68 Fare Collection Facilities
- 17 Service Plazas
- 5 Tunnels
- Approximately 200 Million vehicles per year
 - 544,000 vehicles per day
 - 86.7% passenger; 13.3% Commercial
- Annual Revenue – Over \$1 Billion

Challenges / Into the Future

- Work Zone Safety
- Responder Safety
- Staffing
- Cashless Tolling
- Autonomous Vehicles
- Hyperloop



Traffic Operations

PA Turnpike Traffic Operations Center (TOC)

- 24 – Traffic Operations Center Technicians (TOC Techs)
- 8 – Duty Officers
- PSP Corporals
- Network Control
- 24 X 7 X 365

**For Emergencies
Dial *11**



Traffic Operations Tools

Device	Existing	Design or Construction
DMS	126	75
CCTV	71 + 22 Mobile	15
RWIS	22	2
HAR	37	0



Maintenance Responders

- 27 Safety Patrol Vehicles
 - 22 – Maintenance Utility Workers – MUWs (24X7)
 - 5 – Safety Advisors (Normal business)
- Operated by Turnpike Employees
- Sponsored by State Farm
- Motorist assists, traffic control, fuel, etc.



Emergency Responders

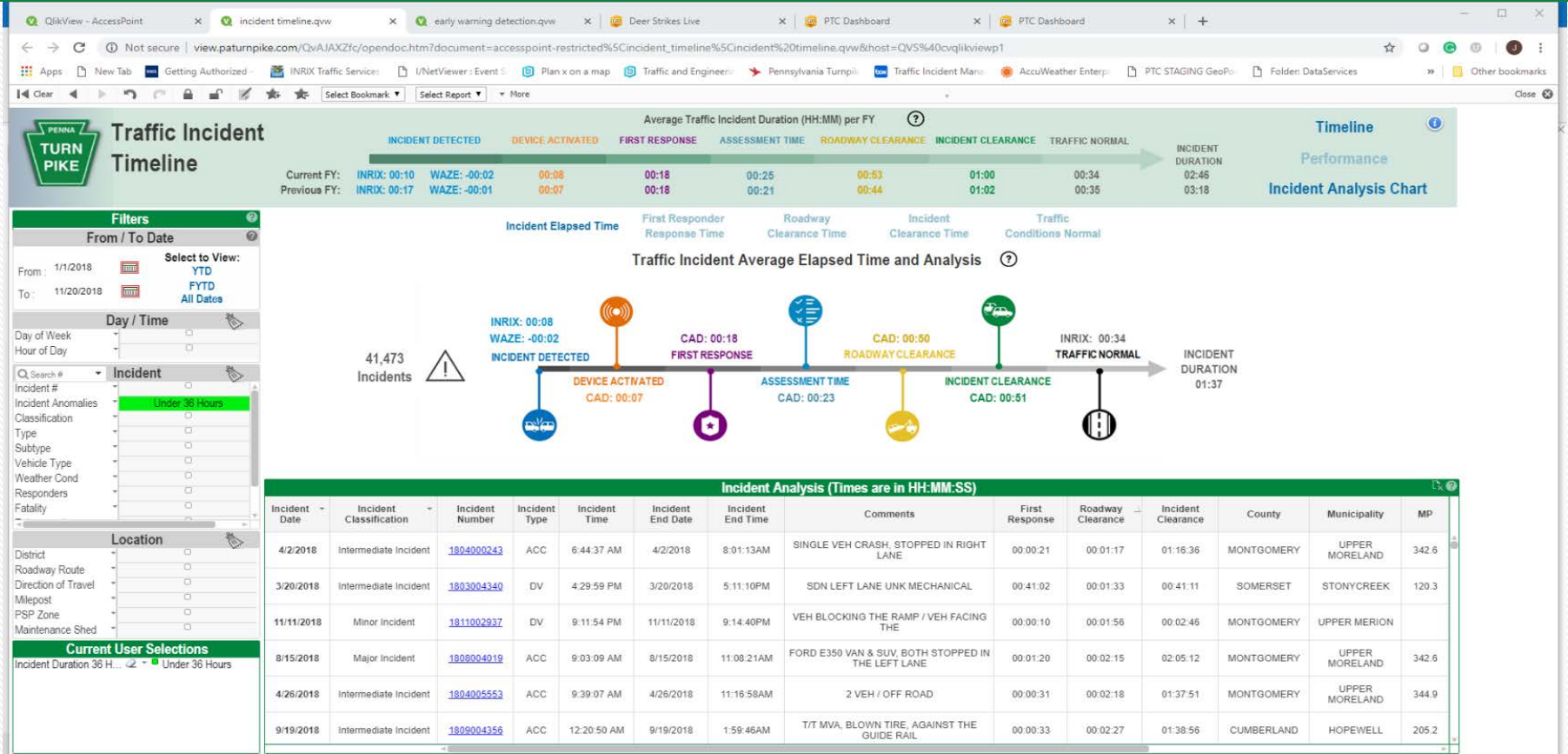
- 110 Fire Companies
- 67 EMS Companies
- 22 Contracted Towers
- 4 Contracted HAZMAT Spill Teams



Traffic Operations

- Data Analytics
 - Performance Metrics
 - Dashboards
- Traffic Management Systems
 - Situational Awareness
 - ATMS
- Incident Management Enhancements
- Connected Vehicles

Incident Management Timeline



Incident Stats – 2018 CY to date

- 43,184 CAD events (DV, ACC, HAZMAT, RO, etc.)
 - 6,200 Accidents
 - 4,560 – Adverse Weather conditions
 - 1,558 – Lane(s) Blocked
 - 10 Minutes – First Responder on-scene
 - 47 Minutes – Roadway Clearance
 - 88 Minutes – Incident Clearance
 - 141 Minutes – Traffic back to Normal
- Goal is to reduce durations of the IM timeline
 - Detection, Verification, Response, Clearance, Return to normal conditions
 - Improve efficiency of TOC to ensure timely / accurate traveler information messaging

Contracted Towing Dashboard

TURN
PIKE

Authorized Service Providers

Timeline Program Trends Financial Details

Average Time (HH:MM)



Filters

Date Range

From: 6/1/2015

To: 12/4/2018

Location

- District
- Route
- MilePost
- PSP Zone
- Shed
- Week Day
- Hour Of Day

Incident

- IncidentType
- IncidentSub Type
- Provider (ASP)
- Weather
- Vehicle Type
- Entrapment
- Operator

Data Flag

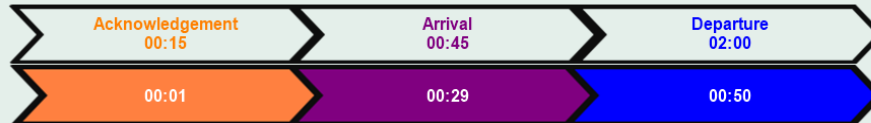
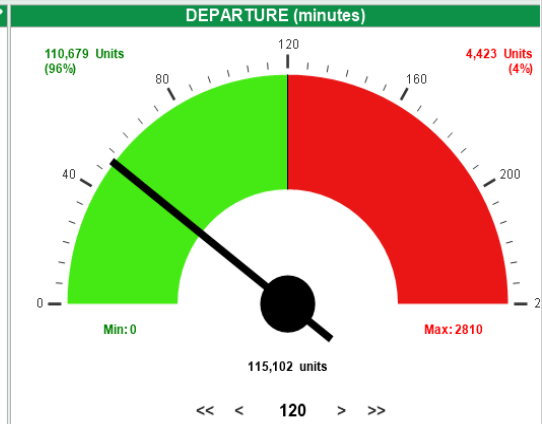
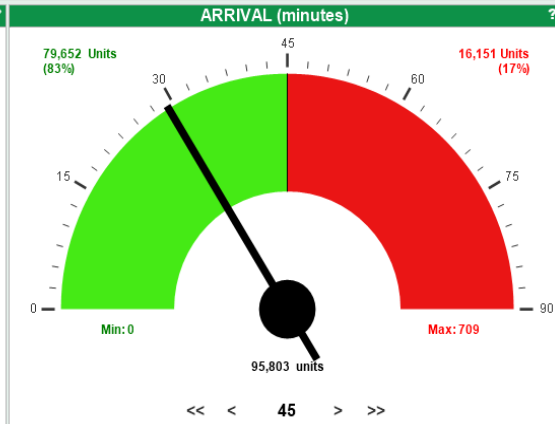
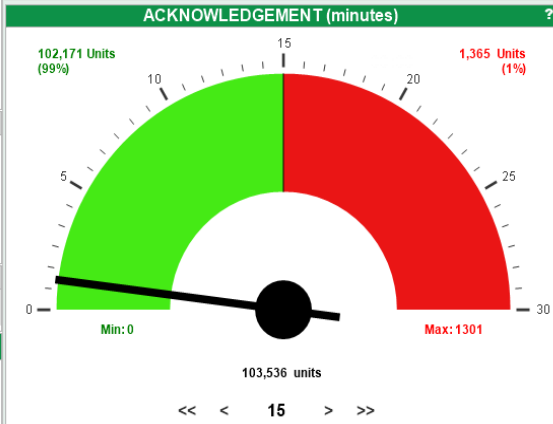
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Valid

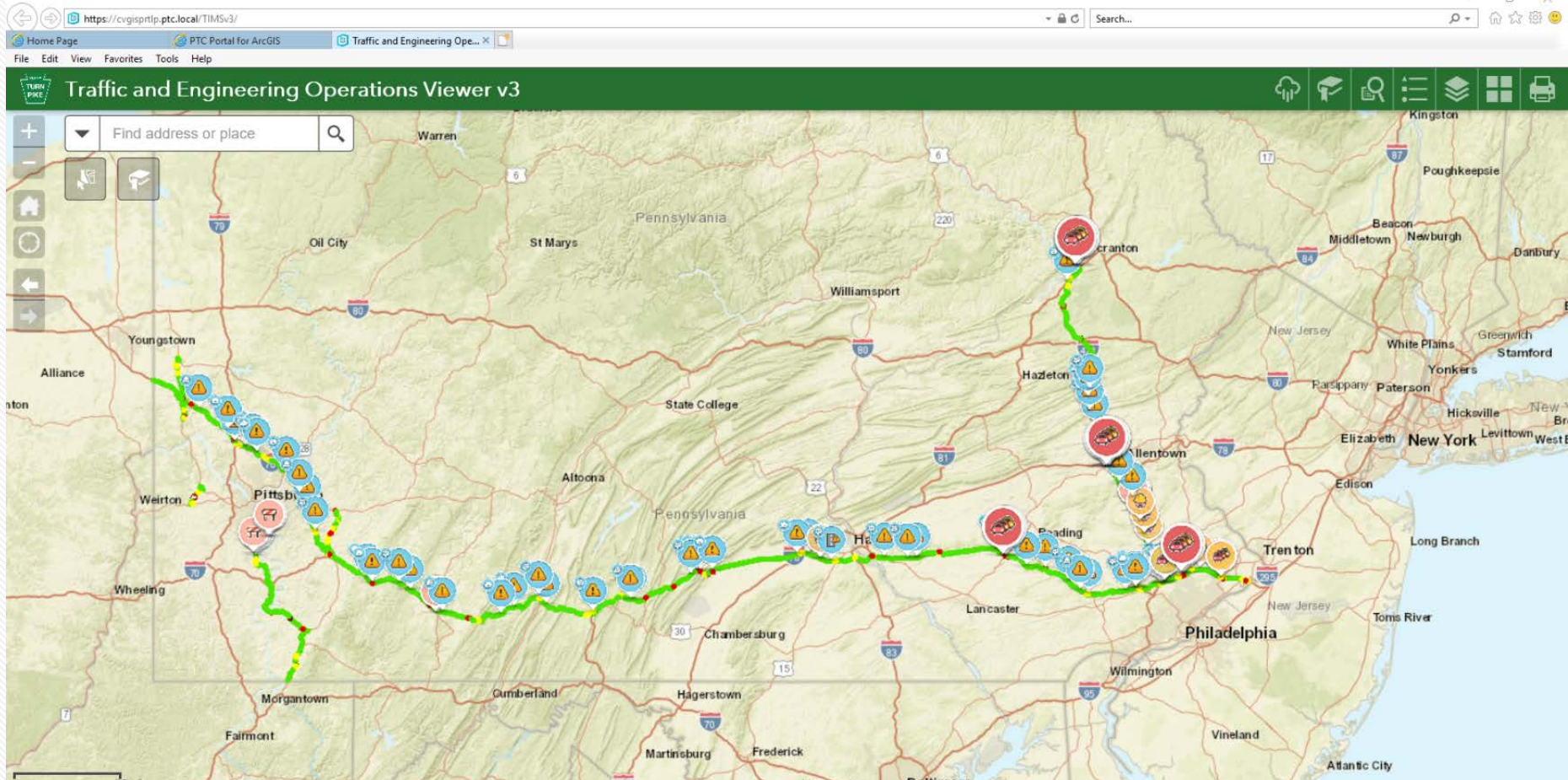
Current Selections

EventDate: >=6/1/2015<=12/4/2018

103,536 units



Situational Awareness



Waze Dashboard

Waze Weather/Hazard Reports

WEATHERHAZARD | I-76 W
HAZARD_ON_SHOULDER_CAR_STOPPED
11/20/2018, 2:39:07 PM
T 313.1 WB
Rating: 2 Confidence: 0 Reliability: 5

WEATHERHAZARD | I-76 W
HAZARD_ON_SHOULDER_CAR_STOPPED
Big Beaver, PA
11/20/2018, 2:38:08 PM
T 012.3 EB
Rating: 2 Confidence: 0 Reliability: 5

WEATHERHAZARD | I-76 E
HAZARD_ON_SHOULDER_CAR_STOPPED
11/20/2018, 2:37:46 PM
T 252.8 EB
Rating: 2 Confidence: 0 Reliability: 5

WEATHERHAZARD | I-476 S
HAZARD_ON_SHOULDER_CAR_STOPPED
South Whitehall, PA
11/20/2018, 2:37:44 PM
A 059.2 SB
Rating: 2 Confidence: 0 Reliability: 5

Last update: a few seconds ago

Weather / Hazards



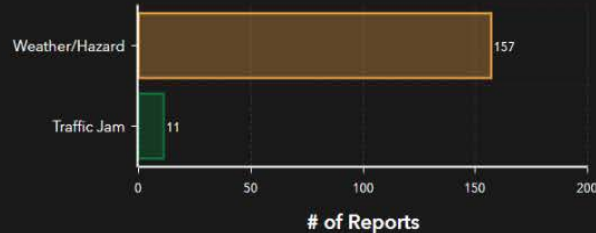
INRIX | HERE | Social Media | CAD (Active) | Deer Strikes | SkyGuard | Windy | NOAA Radar | Accuweather Feed

SkyGuard Road Segment Warnings

Not fully configured

Road Warnings | Area Warnings

Waze Reports - Summary



Last update: a few seconds ago

Traffic Summary | Traffic Details

CCTV-I-76-T001.20-EB



Last update: a minute ago

Not fully configured

Early Warning Detection

QlikView - AccessPoint | early warning detection.qvw | Deer Strikes Live | PTC Dashboard | PTC Dashboard

view.paturnpike.com/QvAJAZZfc/opendoc.htm?document=accesspoint-restricted%5Cearly_warning%5Cearly%20warning%20detection.qvw&host=QV5%40cvqlikview1

Apps | New Tab | Getting Authorized | INRIX Traffic Services | I/NetViewer : Event 5 | Plan x on a map | Traffic and Engineer | Pennsylvania Turnp | Traffic Incident Mana | AccuWeather Enter | PTC STAGING GeoPo | Folder: DataServices | Other bookmarks

Clear | Select Bookmark | Select Report | More

PENNA TURN PIKE

Early Warning Detection

as of: 11/20/2018 2:44:36 PM

District | **Roadway**

- District 1
- District 2
- District 3
- District 4
- District 5

- A. Hutchinson
- Beaver Valley
- RS
- Mainline
- Mon Fayette
- NE Ext.
- Southern Gateway

Waze Type | **Waze Sub Type**

- Accident
- Jam
- Weather hazard

- Road Construction
- Shoulder Car Stopped
- Moderate Traffic
- Shoulder Animals

TOOL BOOTHS

- Exclude Tollbooth

Speed Threshold: -10

-56 -53 -50 -47 -44 -41 -38 -35 -32 -29 -26 -23 -20 -17 -14 -11 -8 -5 -2

Waze Rating Minimum: 3

0 1 2 3 4 5

Waze Confidence Minimum: 2

0 1 2 3 4 5

Waze Reliability Minimum: 5

0 1 2 3 4 5 6 7 8 9 10

Visibility Threshold: 0.5

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5

Wind Speed Threshold: 30

0 5 10 15 20 25 30 35 40 45 50

Current Selections

- RouteDescription: NE Ext.
- TollboothDesc: Exclude Tollbooth

2 Active Watch Points

District	Segment	Conditions	Speed Differential	Waze Alerts	Visibility/Radar	Wind Speed
District 5	NE Ext., Northbound : 69.9-70.4	Cloudy (42.52F)	-2.1	0	9.00	11.1 (W)
District 5	NE Ext., Southbound : 71.2-72.1	Cloudy (42.2F)	-3.8	0	9.00	9.4 (W)

Speed (Last Hour)

Speed Differential
-8
3
-4
-4
-15
-9
-12
-6
-4

Accidents (Waze)

District	Accident Type	Segment
-	-	-

JAM (Waze)

District	Segment
-	-

Event Monitor

Status	P	Time	5 - Events	Type	Location
H	5	04:30:55	18110957091	TRBL	@DISTRICT 4 TRADES
A	3	00:38:08	1811095367	DV	@A59.2S
A	2	00:35:10	1811095368	RO	@T343.4E
P	3	00:06:18	1811095374	DV	@FT. WASHINGTON IC
P	3	00:05:04	1811095375	DV	@FORT WASHINGTON INTER.

Items: 3,340 | Unread: 2 | Reminders: 1

All folders are up to date. | Connected to: Microsoft Exchange | Display Settings

2:44 PM | 11/20/2018

Traffic Management System Enhancements

Existing Function	Existing Tool	Future Integration	Added functionality with ATMS
DMS Control	MIST	ATMS	DMS / HAR Decision Support
	Vanguard		Plan X Decision and Implementation Support
	JamLogic		Complete Event Management
HAR Transmitters	Platinum		GIS Based Mapping with Layers
HAR Beacons			Data Sharing (ie PennDOT)
Permanent CCTV	Genetec		Performance Metrics
Mobile CCTV			Asset Management Integration
Weather information			Data Feed
CAD Event Viewing	CADS		Work Zone Conflict Monitoring
Events to Public	ENS		Smart Work Zones
RWIS	Vaisala		Weather Decision Support
Fog Warning System	MIST		Connected Vehicles
HERE Data Viewing	iPeMS		Truck Parking
WAZE Events	WAZE Map & Email Alerts		Other Social Media Monitoring

Incident Management Enhancements

- Training
 - SHRP2 classroom training
 - Trained over 2,000 responders over past 2 years
 - PTC Maintenance, PSP, Fire, EMS, towing, PennDOT, etc.
 - SHRP2 eLearning on TRAIN PA coming soon
- PennTIME
 - Announced interagency agreement August 2018
 - DOH, PennDOT, PTC, PEMA, PSP
 - Legislative, Technology, Training, Public education and outreach, TIM Task Force, Towing & Recovery

Connected Vehicles

- Connected Work Zone Pilot
 - Finalizing evaluation
 - DSRC OBU and Waze / TripTalk feed
- Harrisburg Connected Corridor
 - Starting Conops and requirements
 - Device install and integration starting mid-2019
 - DSRC RSU's / OBU's from Carlisle to Harrisburg East



Durable Pavement Markings

Durable Pavement Markings

Types of Pavement Markings

Polyurea



Tape



Durable Pavement Markings

Benefits of Durable Pavement Markings

- Longer life span
- Less work zones
- Eliminate SRPMs
- Improved retroreflectivity, specifically wet retroreflectivity
- Supports AV infrastructure



Durable Pavement Markings



Durable Pavement Markings

Lessons Learned

- Diamond saw blades required
- Polyurea vs. Epoxy
- Groove Depth
- Composite pavement vs. Full Depth Asphalt
- Tape adhesive required

Durable Pavement Markings

Next Steps

Boots off
the ground

Test deck

Temporary
Uses

Durable Pavement Markings



Boots off
the ground



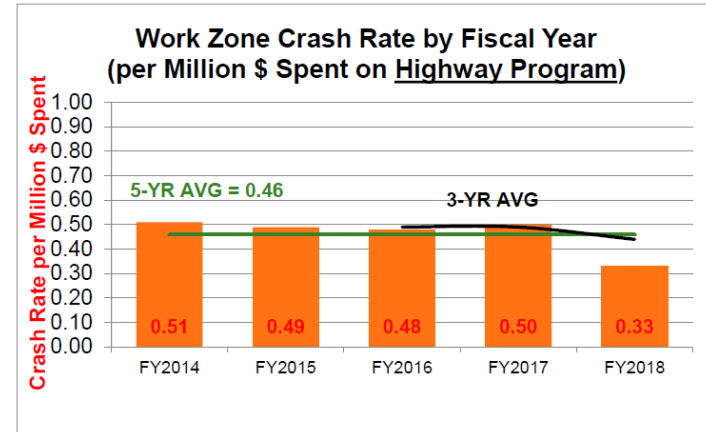


Work Zone Innovations

Work Zone Safety Subcommittee

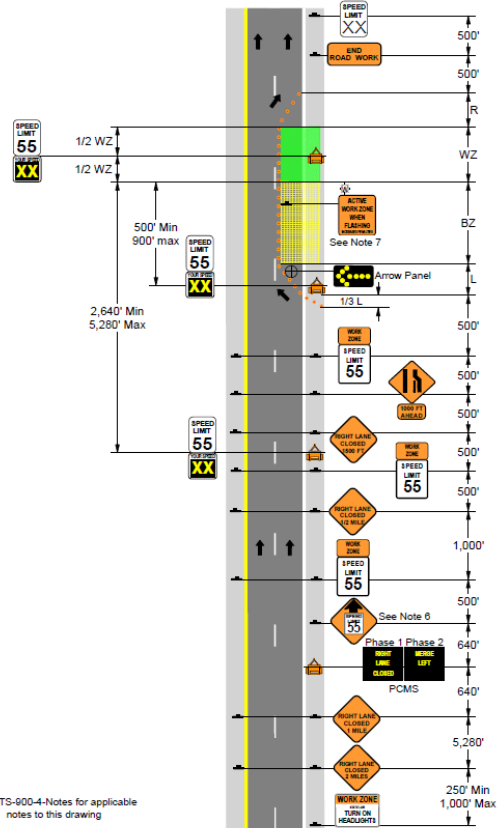
Impacts of Committee

- Standardization of Work Zones
- Elimination of Median Signs
- Spot Treatments
- More Efficient - Working Hours
- Additional Advertising
- Partnerships – WAZE and PSP



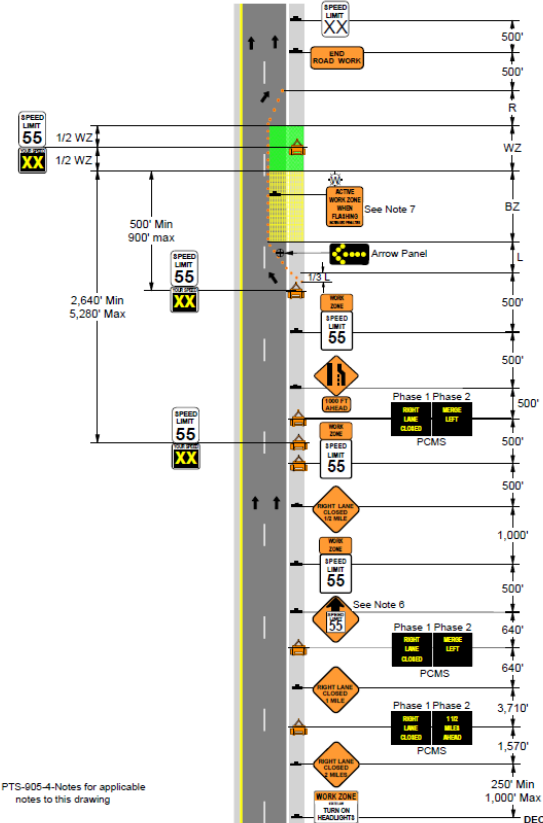
Standardization of Work Zones

PTS 900-4
Single Lane Traffic Pattern For Work Zones



See PTS-900-4-Notes for applicable notes to this drawing

PTS 905-4
Single Lane Traffic Pattern For Work Zones



See PTS-905-4-Notes for applicable notes to this drawing



Spot Treatments

Additional Advertising

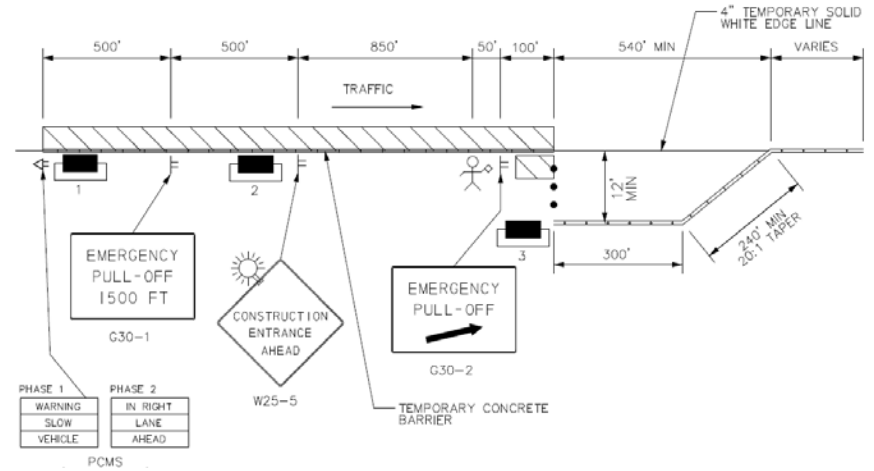


Work Zone Innovations

Sequential Lane Lights



Smart Construction Vehicle Entrance



Work Zone Innovations

Temporary SNAPs



Full Matrix PCMS

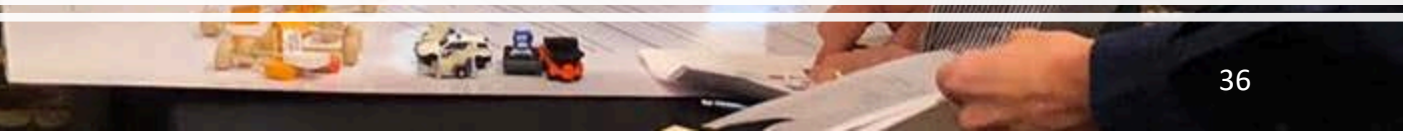


Improved Delineation/Pavement Markings





Table Top Training





Cashless Tolling



The Future is Now: Cashless Tolling on the Pennsylvania Turnpike

Transportation Engineering & Safety Conference | December 7, 2018

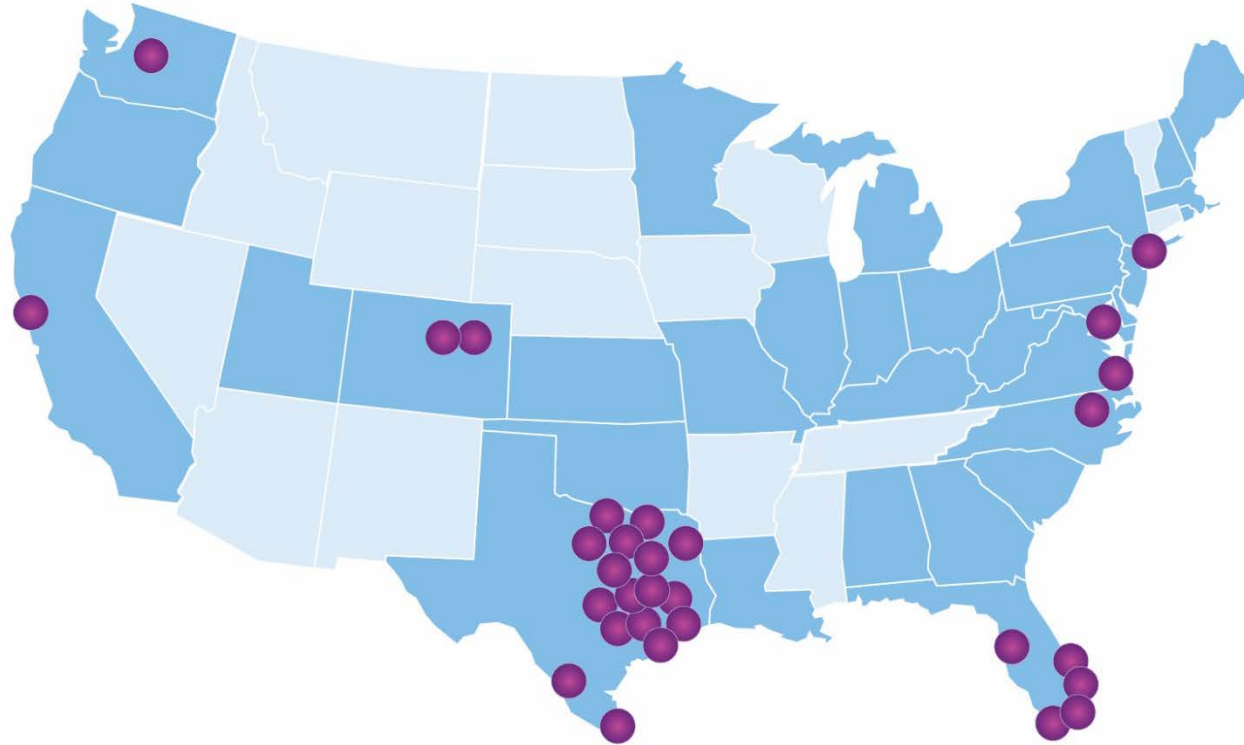
NO CASH

NO STOPPING

NO WORRIES



Cashless Tolling in 2013



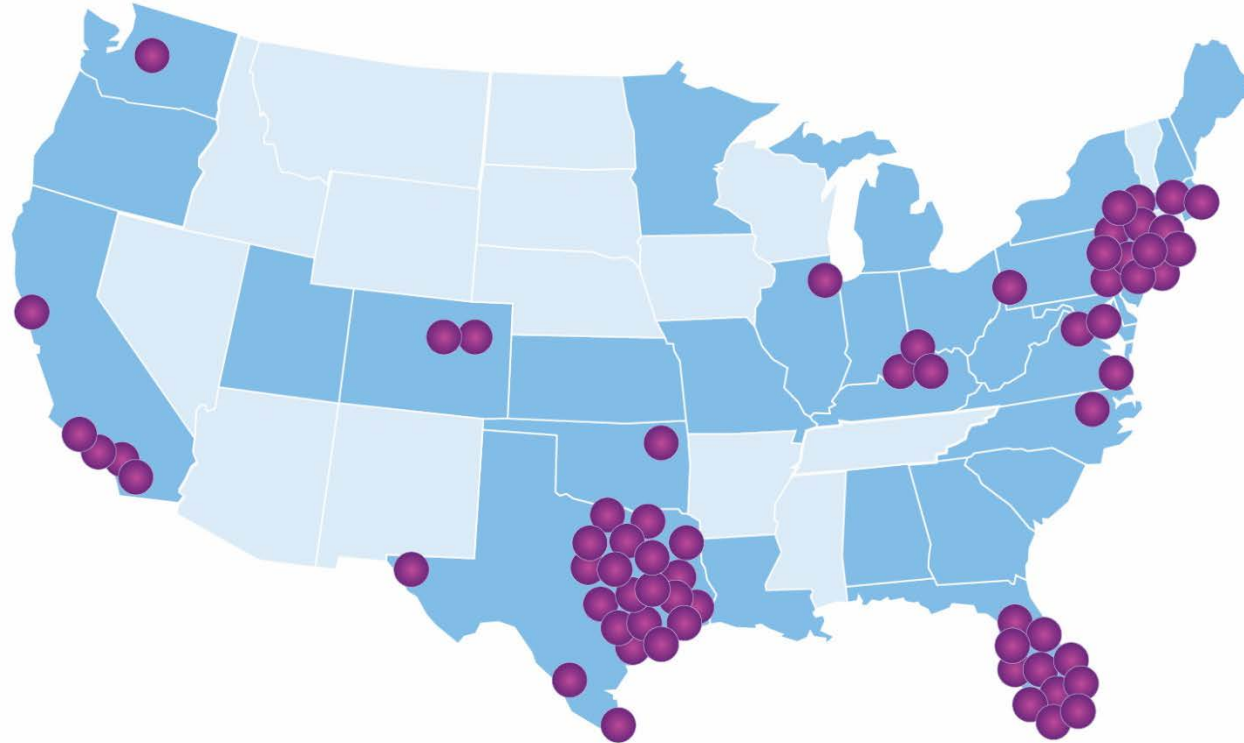
NO CASH

NO STOPPING

NO WORRIES



Cashless Tolling in 2018



NO CASH

NO STOPPING

NO WORRIES



WHY?

NO CASH

NO STOPPING

NO WORRIES

SAFETY



“Toll authorities nationwide experience rear-end collision rates that exceed other types of collisions, in part because toll plazas interrupt the flow of high-speed traffic to intermittently collect tolls.”

- National Transportation Safety Board

NO CASH

NO STOPPING

NO WORRIES



REDUCED CONGESTION & TRAVEL TIMES



NO CASH

NO STOPPING

NO WORRIES

ENVIRONMENTAL BENEFITS



*Carlisle Interchange
Existing Condition*



*Carlisle Interchange
Proposed Post-Conversion*

NO CASH

NO STOPPING

NO WORRIES

EXPANDED INTERCHANGE OPTIONS



NO CASH

NO STOPPING

NO WORRIES

SYSTEM ACCESS & EXPANSION

- *Virginia Drive Slip Ramps*
- *Street Road Slip Ramps*
- *Lansdale Slip Ramps*
- *State Route 29 Interchange*
- *State Route 903 Interchange*
- *Lafayette Street Interchange (future)*



NO CASH

NO STOPPING

NO WORRIES

LOWER LONG-TERM CAPITAL COSTS



Neshaminy Falls Toll Plaza

Vs.



Delaware River Bridge Toll Zone

NO CASH

NO STOPPING

NO WORRIES

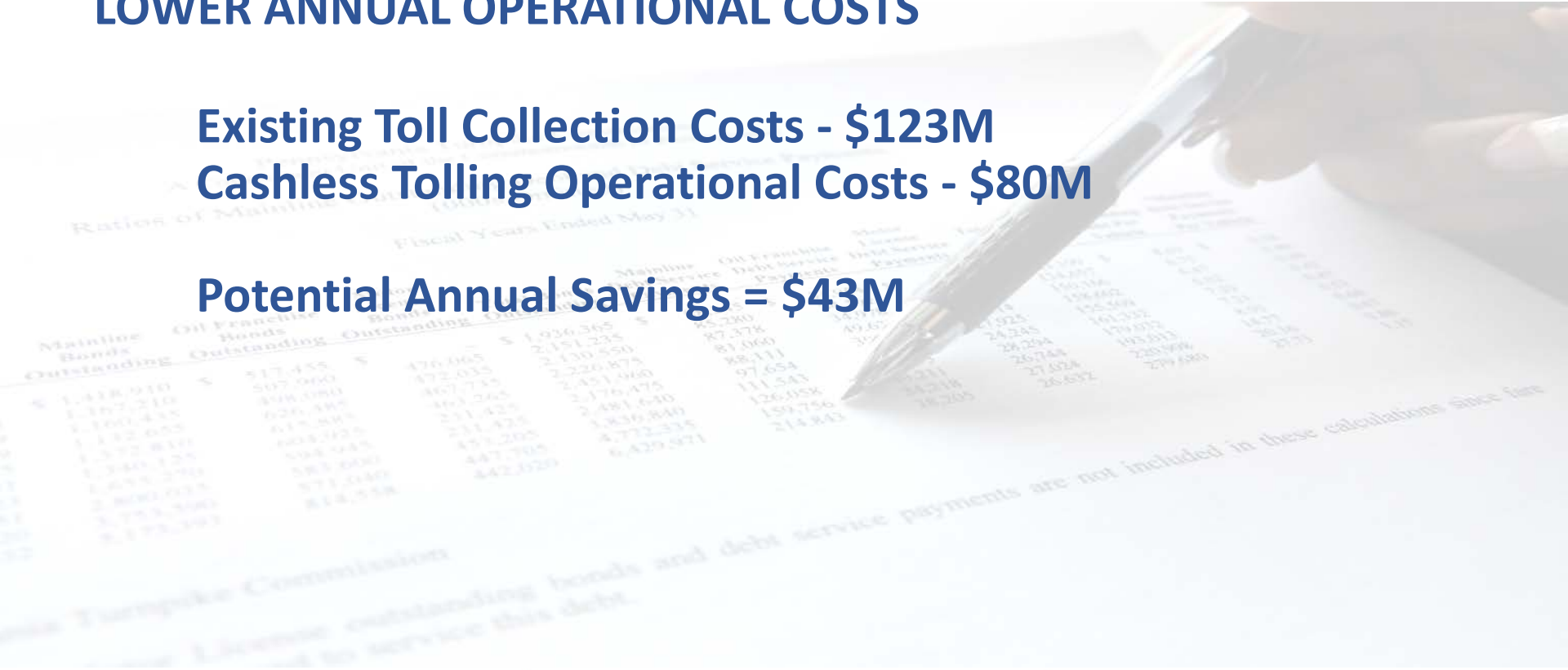


LOWER ANNUAL OPERATIONAL COSTS

Existing Toll Collection Costs - \$123M

Cashless Tolling Operational Costs - \$80M

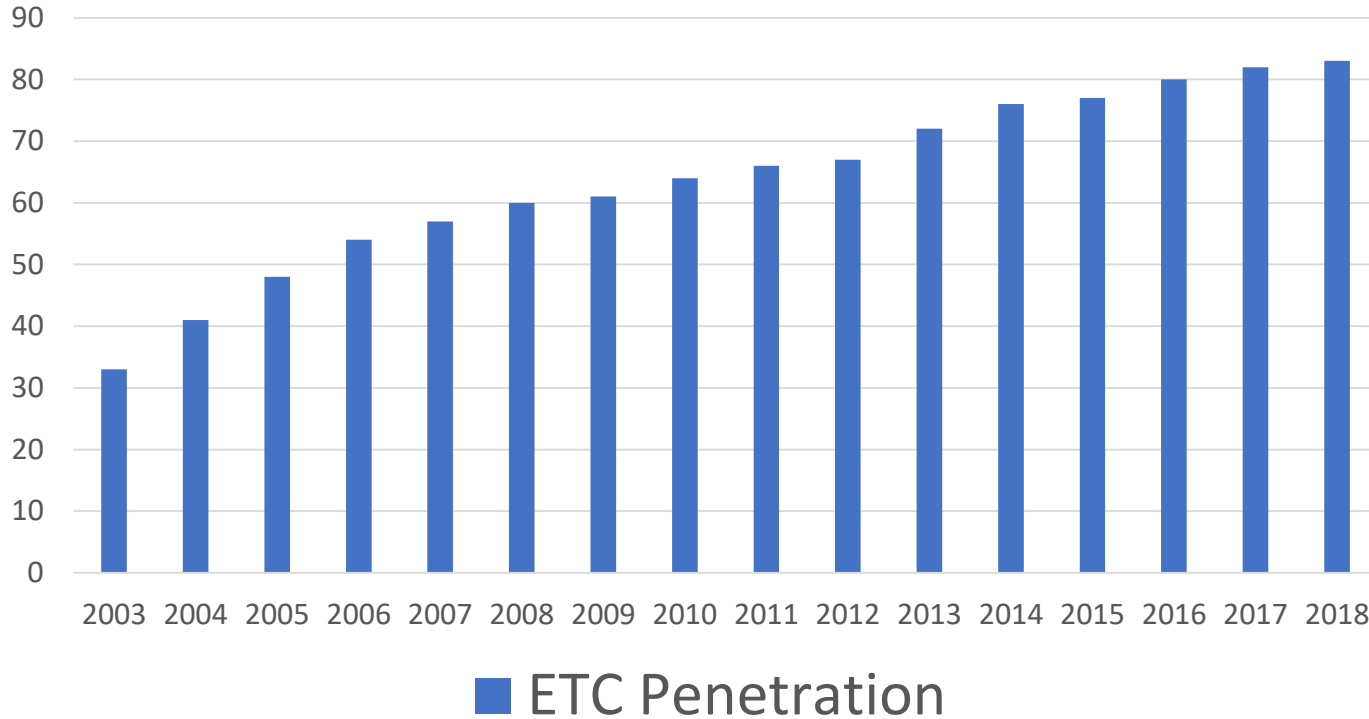
Potential Annual Savings = \$43M



NO CASH NO STOPPING NO WORRIES



CUSTOMER EXPECTATIONS



NO CASH

NO STOPPING

NO WORRIES



Delaware River Bridge

Converted January 2016



NO CASH

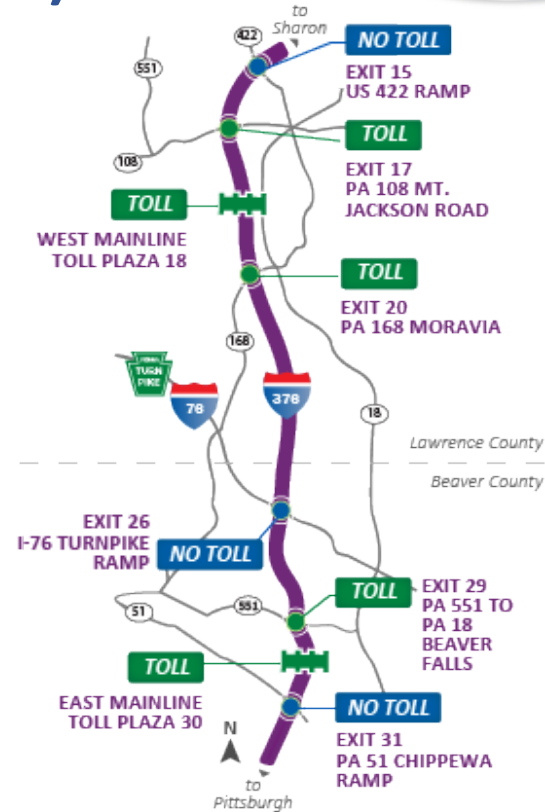
NO STOPPING

NO WORRIES



Beaver Valley Expressway (Toll 376)

Converted April 2017



NO CASH

NO STOPPING

NO WORRIES

Clarks Summit & Keyser Avenue

Converted April 2018



NO CASH

NO STOPPING

NO WORRIES

Findlay Connector (Toll 576)

Converted June 2018



























NO CASH

NO STOPPING

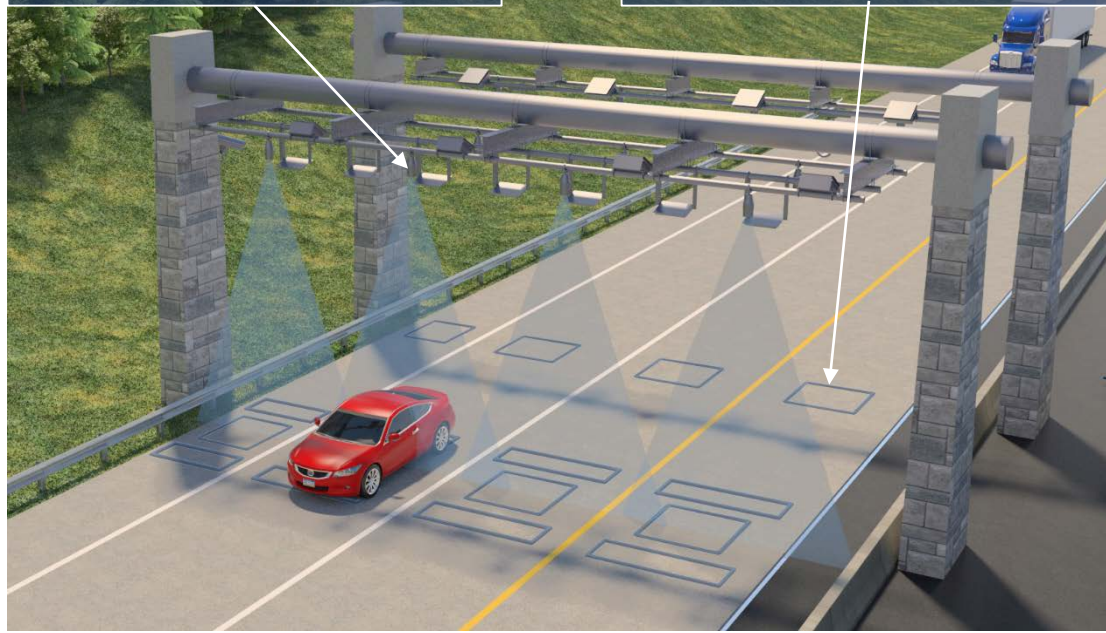
NO WORRIES

Automated Vehicle Classification

1	2 axle, low profile	Car (2-axle: motorcycle, sport utility, minivan, van, pick-up)	
2	3 axle, low profile	Class 1 with 1-axle trailer	
3	4 axle, low profile	Class 1 with 2-axle trailer	
4	5 axle, low profile	Class 1 with 3-axle trailer	
5	6+ axle, low profile	Class 1 with 4+ axle trailer	
6	2 axle, high profile	2-axle motor home	
	2 axle, high profile	2-axle transit bus	
	2 axle, high profile	2-axle conventional school bus	
	2 axle, high profile	2-axle single unit truck	
7	3 axle, high profile	3-axle motor home/trailer combination	
	3 axle, high profile	3-axle coach bus (i.e. Intercity bus)	
	3 axle, high profile	3-axle single unit truck	
	3 axle, high profile	3-axle single trailer truck	
8	4 axle, high profile	4-axle motor home/trailer combination	
	4 axle, high profile	4-axle single unit truck	
	4 axle, high profile	4-axle single trailer truck	
9	5 axle, high profile	5-axle motor home/trailer combination	
	5 axle, high profile	5-axle single trailer truck	
	5 axle, high profile	5-axle multi-trailer truck	
10	6 axle, high profile	6-axle motor home/trailer combination	
	6 axle, high profile	6+ axle single unit truck	
	6 axle, high profile	6-axle multi-trailer truck	
11	7+ axle, high profile	7+ axle motor home/trailer combination	
	7+ axle, high profile	7+ axle multi-trailer truck	

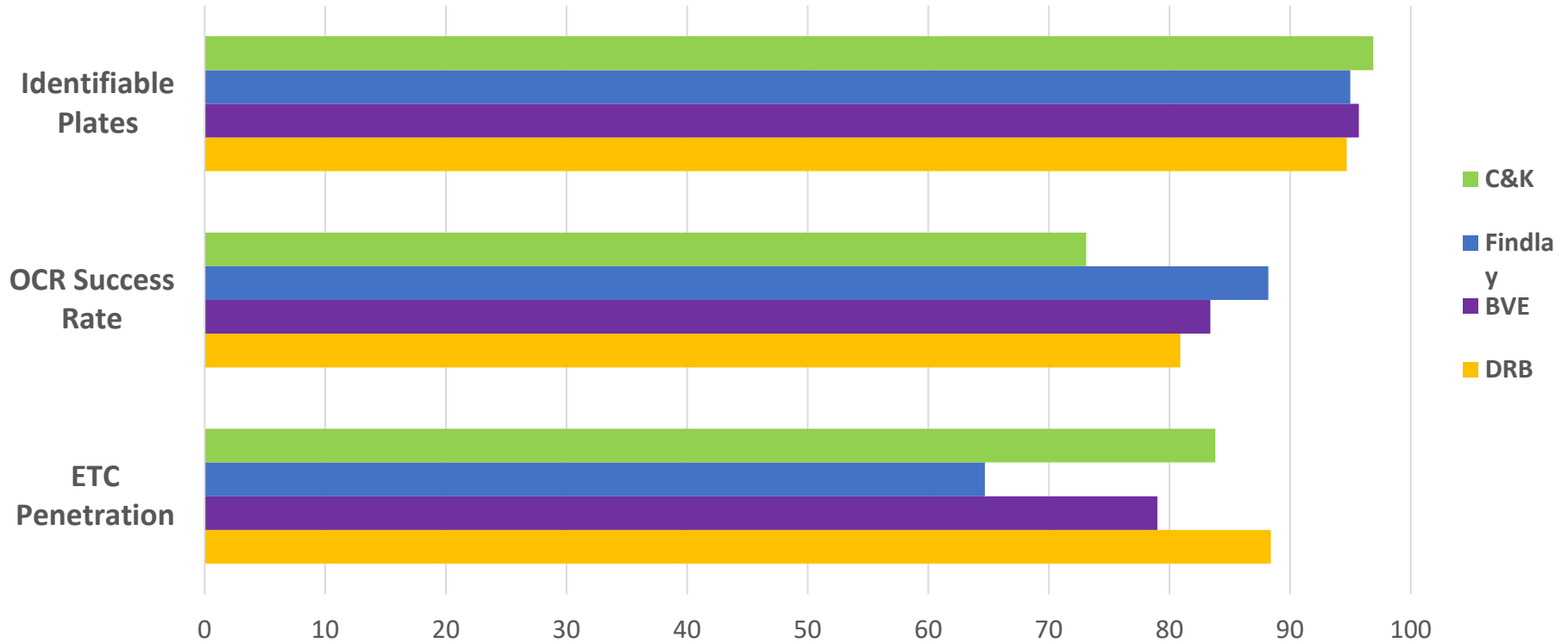
Overhead lasers measure the height of the vehicle

Sensors in the pavement count the number of axles





Pilot Project Performance To Date



NO CASH

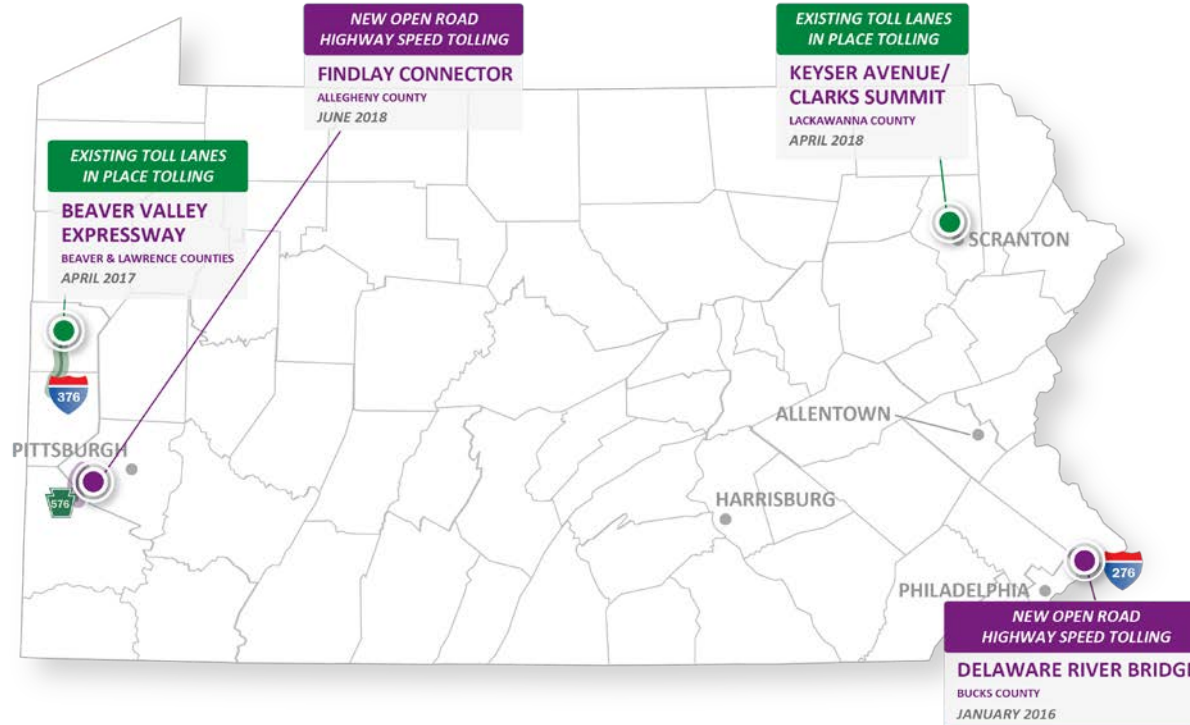
NO STOPPING

NO WORRIES



PTC Cashless Tolling: Current Locations

DRAFT | August 2017



NO CASH

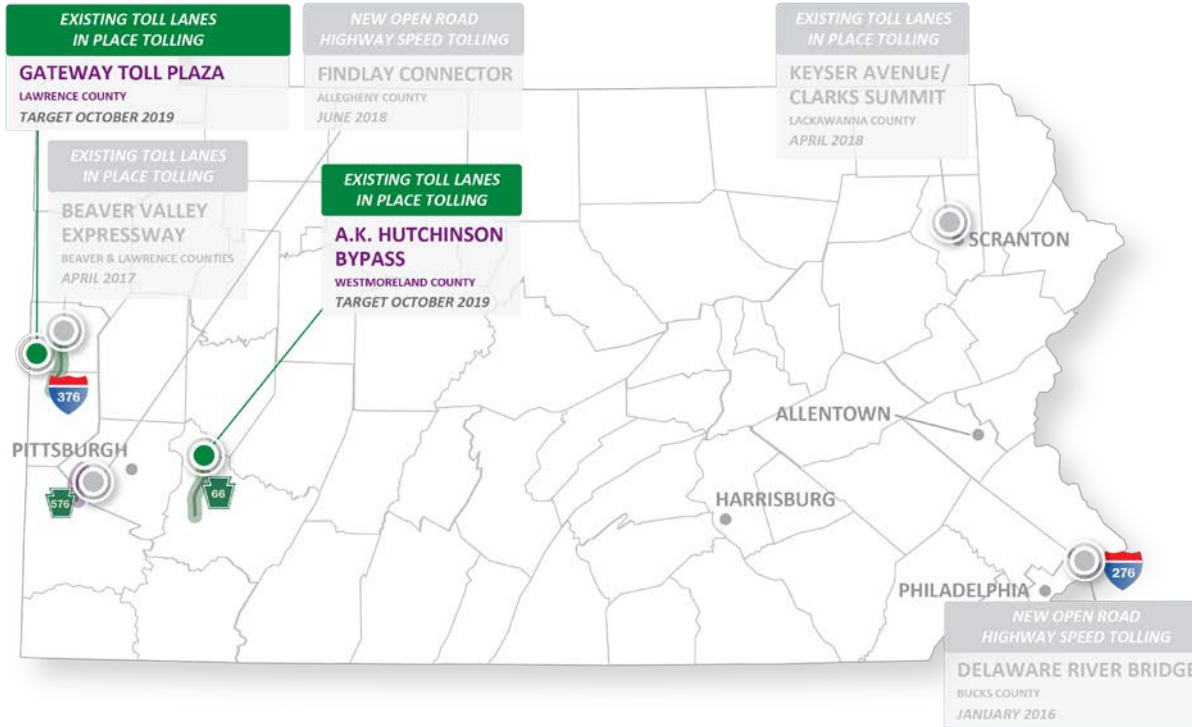
NO STOPPING

NO WORRIES



PTC Cashless Tolling: 2019 Conversion Schedule

DRAFT | August 2017

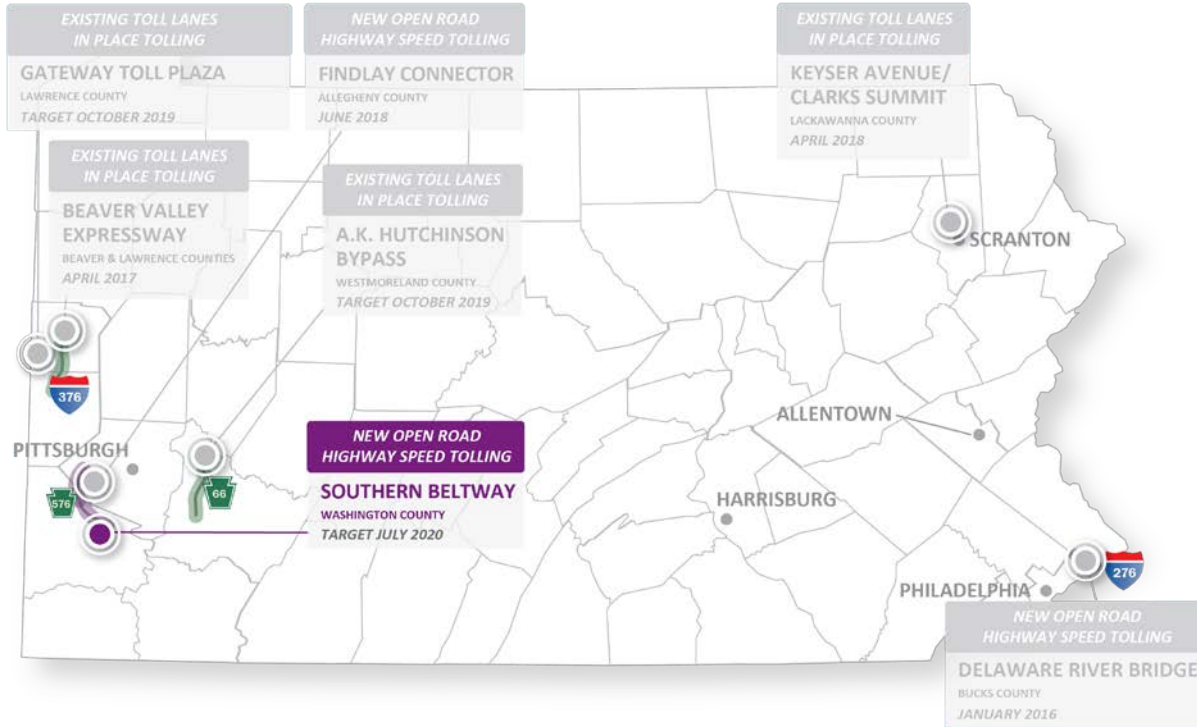


NO CASH NO STOPPING NO WORRIES



PTC Cashless Tolling: 2020 Conversion Schedule

DRAFT | August 2017



NO CASH

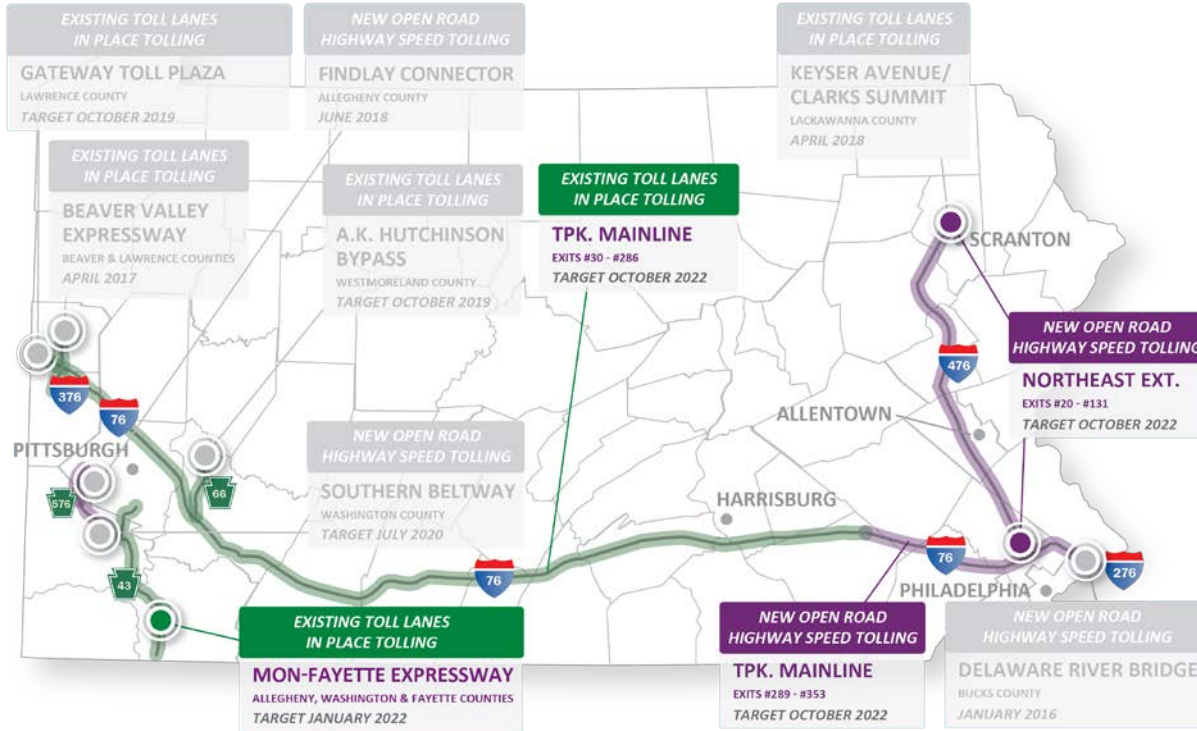
NO STOPPING

NO WORRIES



PTC Cashless Tolling: 2022 Conversion Schedule

DRAFT | August 2017



NO CASH

NO STOPPING

NO WORRIES



Team PTC