



Vehicle Probe Data-Driven Queue Protection System

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In Partnership With:

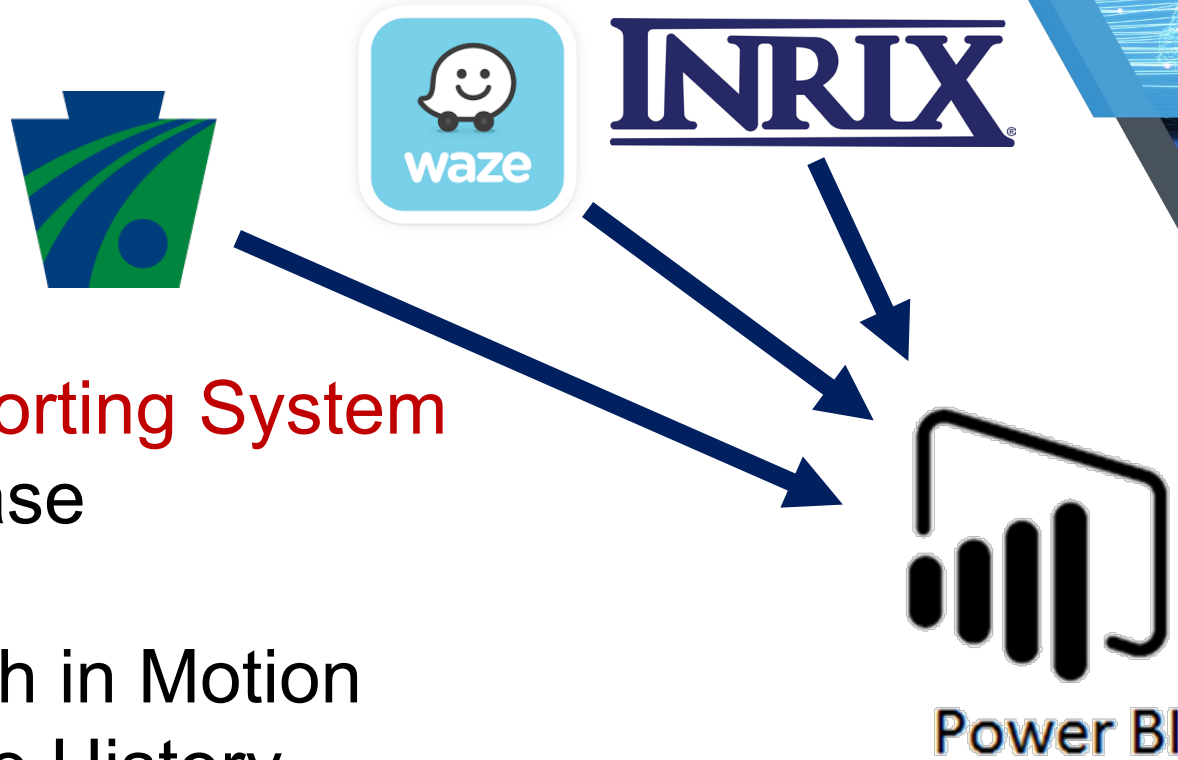


Built By:



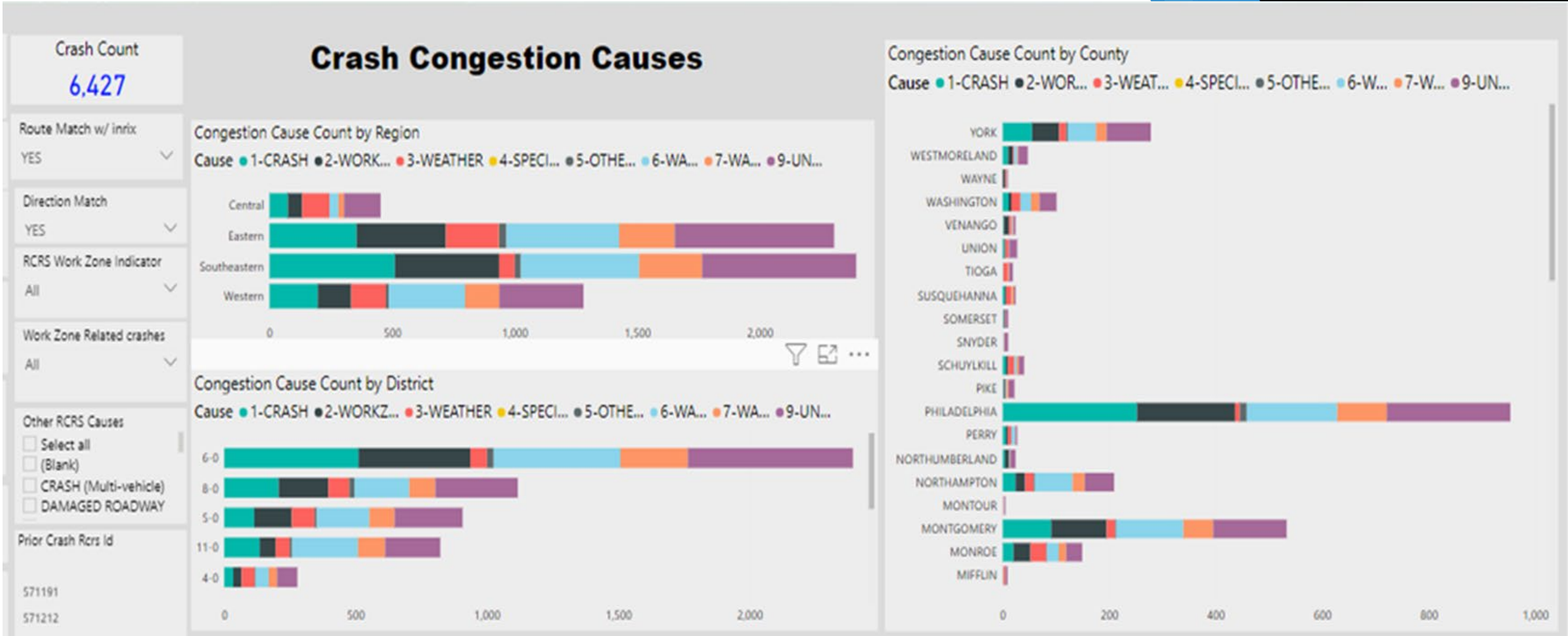
TSMO Performance Data

- Crash Records
- Road Condition Reporting System
- Maintenance Database
- Weather Stations
- Traffic Counter/Weigh in Motion
- ATMS DMS Message History
- ITS Device Locations



<https://www.penndot.gov/ProjectAndPrograms/operations>

Crashes in Congestion

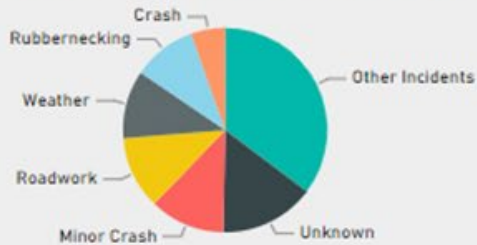


Data-Driven Congestion

Inrix Congestion Cause

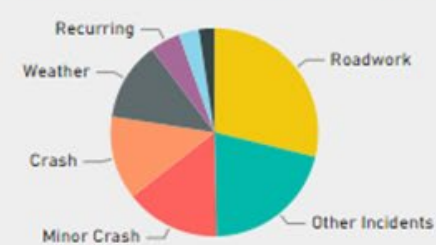
Percentage of incidents by Cause

Cause Other Incidents Unknown Minor Crash Roadwork Weather Rubbernecking Crash



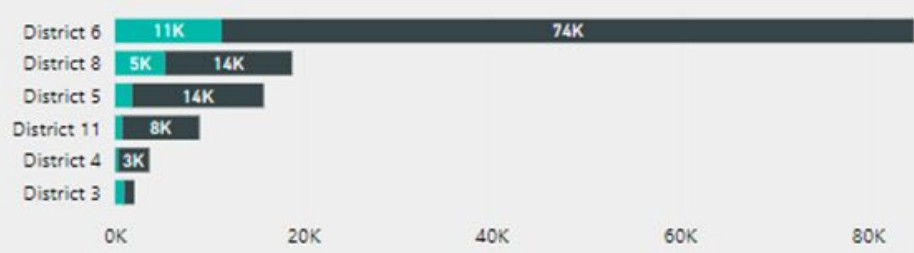
Percentage of incidents by Congestion Impact

Cause Roadwork Other Incidents Minor Crash Crash Weather Recurring Rubbernecking Unknown



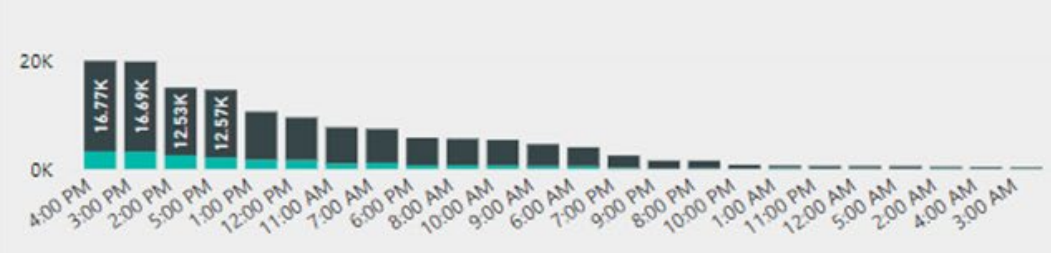
Incident Count by Cause

Cause Unknown All Other Causes



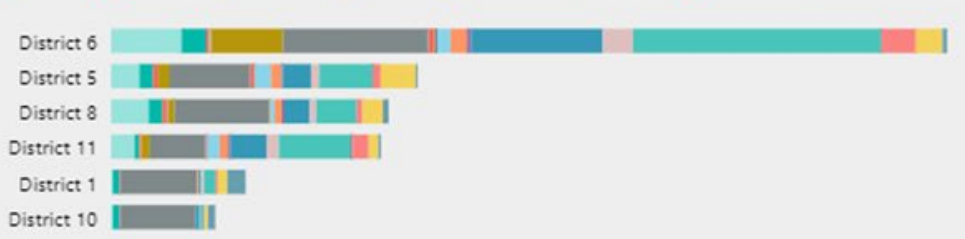
Incident Count by Time of Day

Cause Unknown All Other Causes



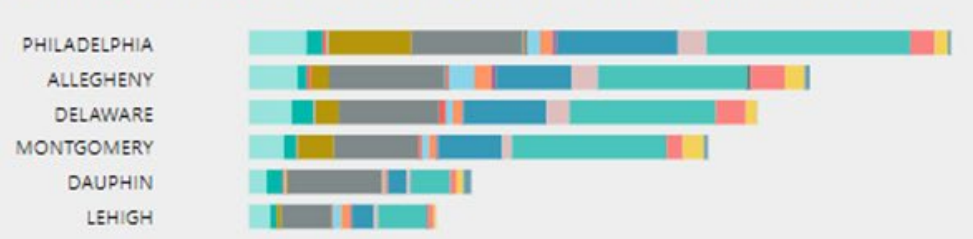
Congestion Impact by District

Cause CRASH CRASH R... CRASH ... CRASH ... RECURRI... ROADW... RUBBER... RUBBER...



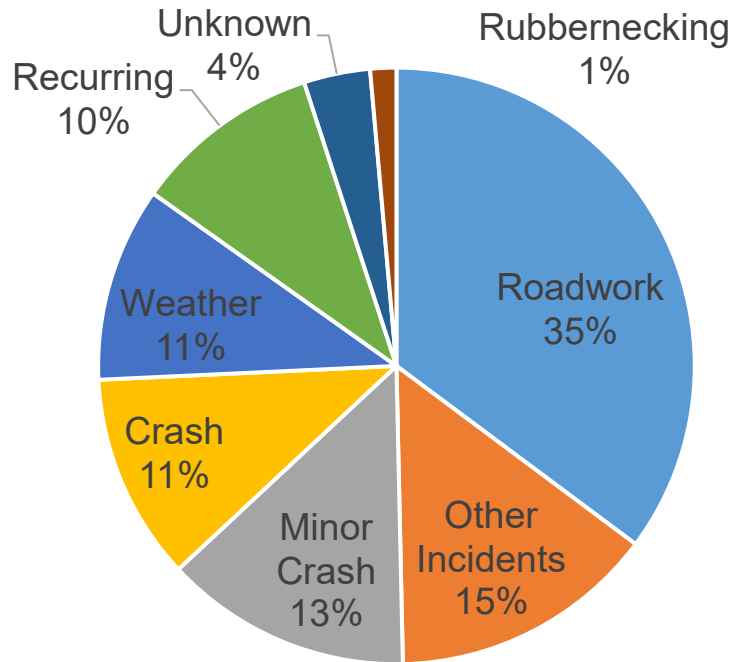
Congestion Impact by County

Cause CRASH CRASH R... CRASH ... CRASH ... RECURRI... ROADW... RUBBER... RUBBER...

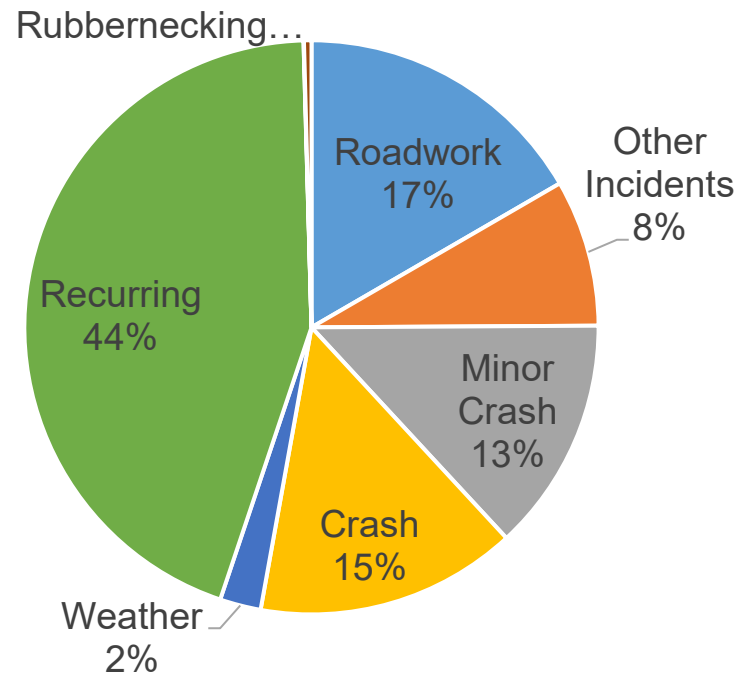


Data-Driven Congestion Pie Chart

Pennsylvania



I-95 in Philadelphia



Work Zone Crash Risk

Carnegie Mellon University study found that **work zones more than 1.8 miles in length on heavily traveled roads** can increase likelihood of crash

- Sources: <https://engineering.cmu.edu/news-events/news/2022/07/15-safer-work-zones.html>
- <https://www.govtech.com/fs/pennsylvania-study-looks-at-work-zone-crashes-risk-factors>

Queue warning systems have been shown to reduce crashes by **18% to 45% in Work Zones**

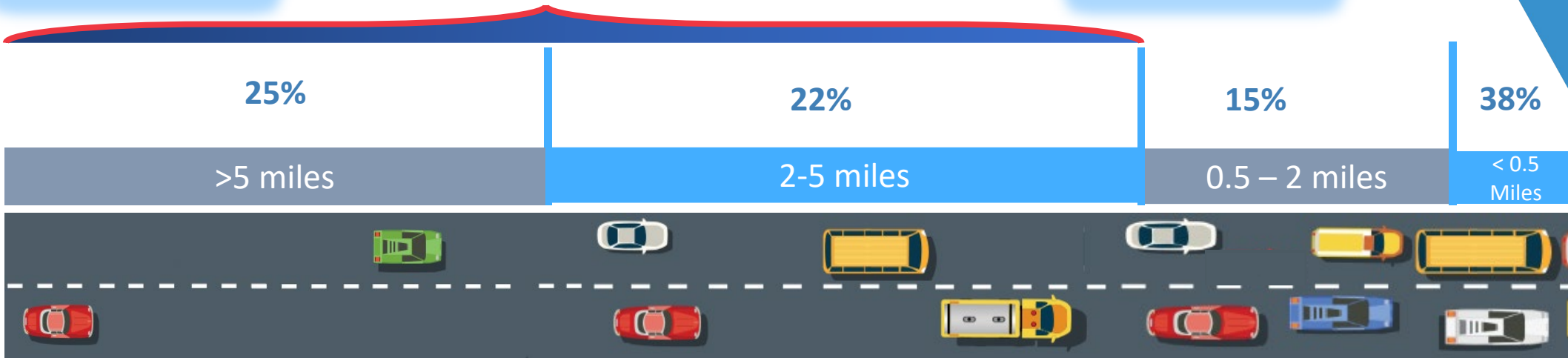
- Source: <https://www.itskrs.its.dot.gov/node/209197>

Congestion-Related WZ Crashes

956 Crashes in Work Zone Congestion
(Core Network in 2022)



47%

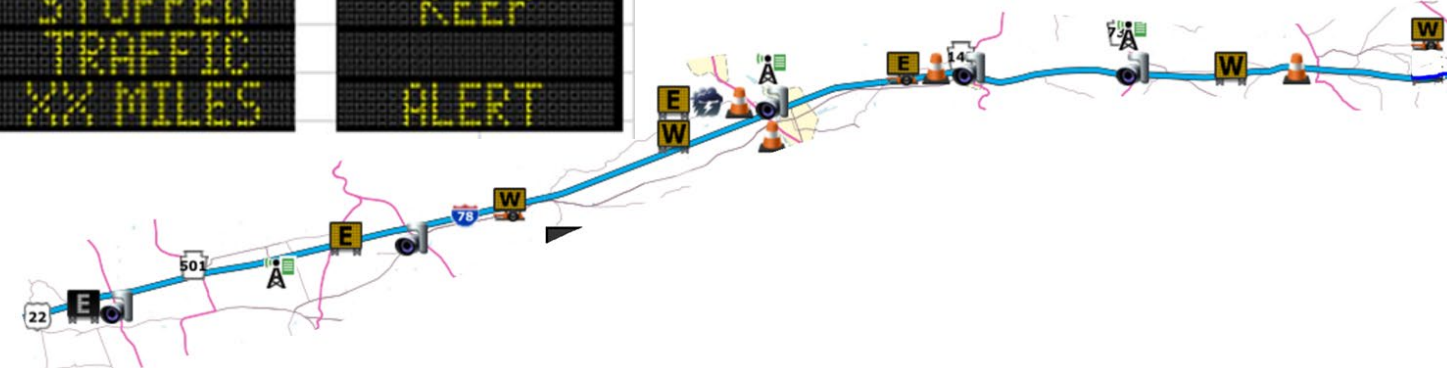


Project Requirements

- **Limited Access Route** or **Higher ADT Route Equivalent**
- Duration of Project **6 months** or greater*
 - *Exceptions will be considered on a project-by-project basis
- Message Boards that are **on Commonwealth Network** OR have **Modems to accept Verizon SIM**
 - Permanent and Portable Boards Ready
 - FHWA State Transportation Innovation Council Approved Initiative
- Initial **Request** Should be Facilitated through the **PennDOT District Traffic Unit**
 - Prompt Kick-Off and Requirements Gathering
- Current Turnaround Time is approximately **1-2 Months** Start to Finish

Owner Setup Information

	A	B	C	D	E	F
1	DMS ID	Being Mile Marker	End Mile Marker		Congestion Message	
2	I-78 eastbound				<45 MPH	
3	VMS 5	10	17		SLOW TRAFFIC	
4	DMS 67	17	27		XX MILES AHEAD	
5	DMS 37	27	33.5		KEEP ALERT	
6	CMS 203	33.5	45			
7	I-78 westbound				SLOW TRAFFIC	KEEP
8	CMS 212	48	42.5		TRAFFIC	
9	DMS 35	42.5	29		XX MILES	ALERT
10						
11					<25 MPH	
12					STOPPED TRAFFIC	
13					XX MILES AHEAD	
14					KEEP ALERT	
15						
16					STOPPED TRAFFIC	KEEP
17					TRAFFIC	
18					XX MILES	ALERT



Geofence



Building the Corridor

Speed
>25 mph

Speed
>25 mph

1 Mile
Segments



Preliminary Safety Facts: I-78

Same 6 Months in 2021 BEFORE

COLLISION TYPE			CRASH SEVERITY LEVEL			SEVERITY COUNT	
	CRASHES	PCT		CRASHES	PCT		PERSONS
HIT FIX OBJ	54	45%	FATAL	2	2%	FATALITIES	2
REAR END	30	25%	SUSP SERIOUS	4	3%	SUSPECTED SERIOUS	5
SAME DIR SS	16	13%	SUSP MINOR	36	30%	SUSPECTED MINOR	49
ANGLE	12	10%	POSSIBLE INJURY	4	3%	POSSIBLE INJURY	8
NON COLL	3	2%	UNK SEVERITY	2	2%	UNK SEVERITY	9
OPP DIR SS	2	2%	UNK IF INJURED	3	2%	UNK IF INJURED	7
OTHER	2	2%	PDO	70	58%		
HEAD ON	1	1%	TOTAL	121	100%		
PEDESTRIAN	1	1%					
TOTAL	121	100%					

Same 6 Months in 2022 AFTER

COLLISION TYPE			CRASH SEVERITY LEVEL			SEVERITY COUNT	
	CRASHES	PCT		CRASHES	PCT		PERSONS
HIT FIX OBJ	37	35%	FATAL	1	1%	FATALITIES	1
REAR END	29	27%	SUSP SERIOUS	3	3%	SUSPECTED SERIOUS	3
SAME DIR SS	18	17%	SUSP MINOR	29	27%	SUSPECTED MINOR	42
ANGLE	8	8%	POSSIBLE INJURY	2	2%	POSSIBLE INJURY	3
OTHER	8	8%	UNK SEVERITY	4	4%	UNK SEVERITY	7
NON COLL	2	2%	UNK IF INJURED	4	4%	UNK IF INJURED	6
OPP DIR SS	2	2%	PDO	63	59%		
PEDESTRIAN	2	2%	TOTAL	106	100%		
TOTAL	106	100%					

- **12% decrease** in crashes
- **23% decrease** in number of injury possible or worse
- **24% decrease** in a possible injury or worse crashes

Status and Feedback

- **25+** Probe Data-Driven Queue Protection Corridors deployed during 2021 and 2022

- **Responsiveness is fast enough** for motorist reaction times
- Included in construction project **safety plans now**
- **Costs savings** and **increased safety** on projects who **couldn't budget** traditional queue protection
- **Expanding** API Data-Driven Virtual Operations Solutions

Probe-Data Queue Protection: System Requirements

- Statewide or Regional **ATMS**
- **Vehicle Probe Data** Subscription ingested into your ATMS
- Probe-Data Road **Segmentation Tool (Travel Times)**
- **Corridor Module** or a way to associate devices to data being ingested into your ATMS (ICM)
- **Business Rules Engine** (advanced capability but highly recommended)



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