I-76 Corridor Management: Opening Lanes and Offering Options to Regional Mobility

Transportation Engineering and Safety Conference
The Penn Stater Hotel and Conference Center
State College, Pennsylvania
December 7, 2017
Agenda

• **Moderator:** Stan Niemczak, Jacobs

• **Policy Development; Regional & Statewide Perspectives**
  Glenn Rowe, Chief, Highway Safety and Traffic Operations, Pennsylvania Department of Transportation

• **National ICM/ATDM Perspectives**
  James Paral, Transportation Management Specialist, Federal Highway Administration

• **Traffic Operations; ITS Strategies; Regional Transportation Management Center Operations and Integration; ICM Concept of Operations**
  Manny Anastasiadis, Senior Traffic Operations Manager, Pennsylvania Department of Transportation District 6-0

• **King of Prussia Rail Extension; On-Corridor Station Improvement Projects; Traveler Information**
  Elizabeth Smith, Manager of Long Range Planning, SEPTA

• **I-76 Parallel Corridors Signal Operations; PennDOT Traffic Signal Ownership & Maintenance Pilot Program; Municipal Outreach**
  Dave Adams, Traffic Signals and Safety Manager, Pennsylvania Department of Transportation District 6-0

• **Incident Management and Emergency Responder Coordination; State Police Partnership; Peer Agency Information Sharing**
  Chris King, Manager, Office of Transportation Operations Management, DVRPC

• **Project Management and Delivery**
  Jay Roth, Transportation Group Manager, Jacobs

• **I-76 ITS Concept of Operations; ATM Strategies Development; ITS & Systems Design**
  Brian Depan, ITS Design & Construction Manager, Jacobs
Schuylkill Expressway Timeline

- 1932 – Original vision: Riverside parkway connecting Fairmount Park & Valley Forge Park
- 1949 – Construction begins on 1st section – PA Turnpike to US 1
- 1950 – Design year (1970) volume estimated at 35,000 VPD
- 1954 – 1st Section of the Schuylkill Expressway Opens
- 1956 – Designated as I-76
- 1957 – Walt Whitman Bridge opened
- 1960 – 1st Operational Study of I-76 performed – daily traffic at 70,000 VPD
- 1963 – King of Prussia Plaza opened
Schuylkill Expressway Timeline

• 1967 – Philadelphia R&B group The Soul Survivors release the single “Expressway to your Heart”
• 1981 – Daily traffic volumes approach 85,000 VPD in Montgomery County & 135,000 VPD in the City of Philadelphia
• 1982 – Schuylkill Expressway Reconstruction Project
• 1991 – Vine Street Expressway (I-676) completed
• 2002 – ITS: PennDOT & DRPA install detectors, CCTV cameras, DMS, and communications to better manage traffic
• 2010 – Daily traffic volumes exceeded 117,000 VPD in Montgomery County & approached 180,000 VPD in the City of Philadelphia
Policy Development; Regional & Statewide Perspectives

Glenn Rowe, Chief, Highway Safety and Traffic Operations
Pennsylvania Department of Transportation
Why Transportation System Management and Operations (TSMO)?

### Congestion

<table>
<thead>
<tr>
<th></th>
<th>Urban (&gt; 500,000 People)</th>
<th>Rural (&lt; 500,000 People)</th>
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</thead>
<tbody>
<tr>
<td>Annual Hours of Delay</td>
<td><strong>Pennsylvania</strong>: 73.018M</td>
<td><strong>Pennsylvania</strong>: 2.789M</td>
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<td></td>
<td><strong>Nationally</strong>: 71.990M</td>
<td><strong>Nationally</strong>: 2.651M</td>
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<tr>
<td>Annual Congestion Cost</td>
<td><strong>Pennsylvania</strong>: $1.697M</td>
<td><strong>Pennsylvania</strong>: $67M</td>
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<td><strong>Nationally</strong>: $1.649M</td>
<td><strong>Nationally</strong>: $62M</td>
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<tr>
<td>Annual Excess Fuel Consumed in Gallons</td>
<td><strong>Pennsylvania</strong>: 36.769M</td>
<td><strong>Pennsylvania</strong>: 1.408M</td>
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<td></td>
<td><strong>Nationally</strong>: 31.936M</td>
<td><strong>Nationally</strong>: 1.243M</td>
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</tbody>
</table>

### Safety

**Increase in Pennsylvania Congested-Related Crashes**

- Rear-End Crashes on Limited Access Highways

**Years**

- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
TSMO: Bang for your buck!
I-76 Corridor Management: Opening Lanes and Offering Options to Regional Mobility

Capability Maturity Model

PENNDOT CMM SELF-ASSESSMENT COMPARED TO OTHER STATES

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Level 1 Performed</th>
<th>Level 2 Managed</th>
<th>Level 3 Integrated</th>
<th>Level 4 Optimizing</th>
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</thead>
<tbody>
<tr>
<td>Business Processes</td>
<td>11</td>
<td>10</td>
<td>2</td>
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<tr>
<td>Systems and Technology</td>
<td>7</td>
<td>12</td>
<td>3</td>
<td>1</td>
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<tr>
<td>Performance Measurement</td>
<td>9</td>
<td>11</td>
<td>3</td>
<td>0</td>
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<tr>
<td>Culture</td>
<td>8</td>
<td>11</td>
<td>4</td>
<td>0</td>
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<tr>
<td>Organization and Staffing</td>
<td>8</td>
<td>9</td>
<td>6</td>
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<tr>
<td>Collaboration</td>
<td>4</td>
<td>12</td>
<td>6</td>
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</tbody>
</table>

**Business Processes** – formal scoping, planning, programming, and budgeting
**Systems and Technology** – systems architecture, interoperability, standardization, and documentation
**Performance Measurement** – measures definition, data acquisitions, analysis, and utilization
**Culture** – understanding, leadership, policy commitment, outreach, and program authority
**Organization and Staffing** – organizational structure, staff capacity development, and retention
**Collaboration** – relationships with public safety agencies, local governments, MPOs/RPOs, and private sector

**LEVEL 1 PERFORMED**
- Activities and relationships ad hoc
- Champion-driven

**LEVEL 2 MANAGED**
- Process developing
- Staff training
- Limited accountability

**LEVEL 3 INTEGRATED**
- Process documented
- Performance measured
- Organization and partners aligned
- Programs budgeted

**LEVEL 4 OPTIMIZED**
- Performance-based improvement
- Formal program
- Formal partnerships
<table>
<thead>
<tr>
<th>TSMO Solution</th>
<th>Causes of Congestion</th>
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<tr>
<td></td>
<td>Bottlenecks</td>
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<tr>
<td>Integrated Corridor Management</td>
<td>X</td>
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<tr>
<td>Hard Shoulder Running</td>
<td>X</td>
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<tr>
<td>Managed Lanes</td>
<td>X</td>
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<tr>
<td>TIM Teams</td>
<td>X</td>
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<tr>
<td>Freeway Service Patrols</td>
<td>X</td>
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<tr>
<td>Smart Work Zones</td>
<td>X</td>
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<tr>
<td>Traffic Signal Enhancements</td>
<td>X</td>
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<td>Transit Signal Priority</td>
<td>X</td>
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<tr>
<td>Traveler Information</td>
<td>X</td>
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<tr>
<td>Ramp Metering</td>
<td>X</td>
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<tr>
<td>Bridge De-icing</td>
<td></td>
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<tr>
<td>Commercial Vehicle Operations</td>
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<tr>
<td>Dynamic Lane Assignment</td>
<td>X</td>
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<tr>
<td>Junction Control</td>
<td>X</td>
</tr>
<tr>
<td>Queue Warning</td>
<td>X</td>
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<tr>
<td>Variable Speed Displays</td>
<td>X</td>
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<td>Dynamic Rerouting</td>
<td>X</td>
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<td>RWIS</td>
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<td>Dynamic Curve Warning</td>
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<tr>
<td>Traffic Management Center Operations</td>
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<tr>
<td>Traffic Incident Detection</td>
<td>X</td>
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<tr>
<td>DMS</td>
<td>X</td>
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<td>CCTV</td>
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Integrated Corridor Management
What is Integrated Corridor Management?

- the coordination of individual network operations between adjacent facilities that creates an interconnected system capable of cross-network travel management

ICM combines two fundamental concepts:

- active management
- integration
(j) Special pilot program for department-managed signals.—The following apply:

(1) The department shall develop a pilot program for department-managed signals to implement on one or more critical corridors at the department's discretion as specified under this subsection.

(2) After implementation and evaluation of the pilot program, but no later than January 1, 2022, the secretary shall certify in the Pennsylvania Bulletin that the pilot program is ended and indicate whether or not the pilot program has been successful. If successful, the department may maintain and expand the department management of signals. This subsection shall expire January 1, 2022.
National ICM/ATDM Perspectives

James Paral, Transportation Management Specialist
Federal Highway Administration
Integrated Corridor Management

Local Jurisdiction 1 — Traffic Signal System

Regional Rail Agency — Train Management System

State DOT — Freeway Management System

Bus Company — AVL System

Local Jurisdiction 2 — Traffic Signal System
US DOT ICM Website

• Clearinghouse for ICM knowledge and technology transfer
• Publications, briefs, videos, webinars, lessons learned, external resources, etc.
• Click link below for more information

https://www.its.dot.gov/research_archives/icms/knowledgebase.htm
ICM & ATDM

I-76 Corridor Management: Opening Lanes and Offering Options to Regional Mobility
What is Active Management?

The fundamental concept of taking a dynamic approach to a performance-based process.
Active Management in a Corridor
Moving Towards Active Management

Transportation Agency Operators: Moving from Static to Proactive Management

- High complexity, high reward
- Emerging

- Low risk
- Proven

Proactive Management
- Respond to predicted changes in supply & demand
- Ability to delay or eliminate breakdowns

Responsive Management
- Respond to current conditions
- Account for traffic impacts due to conditions
- Reduce time of degraded operation

Static Management
- Time of day
- Set-it and forget it
- Will work when there is limited variability

Actively Managing Operations

I-76 Corridor Management: Opening Lanes and Offering Options to Regional Mobility
ATDM approach provides travelers with choices throughout the trip chain leading to network performance optimization and increased efficiency.
Examples of Active Management Strategies

- **Active Demand Management**

- **Active Traffic Management**

- **Active Parking Management**
Active Traffic Management Example: VA I-66’s Active Traffic Management System

NOVA’s I-66 Active Traffic Management System:

- Intended to improve safety and incident management.
- Includes new sign gantries, shoulder and lane control signs, speed displays, incident and queue detection, and increased traffic camera coverage.

http://www.virginiadot.org/projects/northernvirginia/i-66_atms.asp
Examples of ATM Benefits in US

- I-5 Seattle (DSpL / DLA)
  - 4.1% reduction in crashes
  - 4.4% increase in crashes on SB segment of I-5 (no ATM)

- Minneapolis (DSpL/DLA/DShL)
  - 20+% decrease in PDO crashes
  - 17% less congestion during AM peak

- LA Junction Control
  - NB SR-110 to NB I-5
  - Average ramp delay decreased from 20 minutes to 5 minutes
  - 30% decrease in crashes

- Chicago Bus on Shoulder
  - On-time performance from 68% to 92%
  - No adverse impact on safety
Active Parking Management Example: San Francisco’s SFpark System

**SFpark:**

- Periodically adjusts meter and garage pricing to match demand.
- Reduces demand in overused areas by encouraging drivers to park in underused areas and garages.
- Readjusts parking patterns throughout San Francisco to make parking easier to find.

[http://sfpark.org/about-the-project/](http://sfpark.org/about-the-project/)
FHWA ATDM Website

- Clearinghouse for ATDM knowledge and technology transfer
- Publications, briefs, videos, webinars, lessons learned, external resources, etc.
- Click link at right for more information

http://ops.fhwa.dot.gov/atdm/about/program.htm

Welcome to Active Transportation and Demand Management

The Active Transportation and Demand Management (ATDM) program is intended to support agencies and regions considering moving towards an active management approach. Through customized workshops, tools, guidance documents, resources, and peer exchanges, the program can assist with technical support to implement ATDM strategies. Importantly, ATDM is not an exclusive program restricted to specific agencies. Every agency that is considering moving towards active and dynamic capabilities can benefit from the ATDM program’s efforts.

WHAT’S NEW

- Guide for Highway Capacity and Operations Analysis of Active Transportation and Demand Management Strategies (FHWA-HCP-13-042)
- ATDM Analysis Brief: Example Application (MOV to MOT) of ATDM Capacity and Operations Analysis (FHWA-HCP-13-036)
- ATDM Analysis Brief: Example Application (Ramp Metering and Demand Management) of ATDM Capacity and Operations Analysis (FHWA-HCP-13-037)
Federal Highway Administration

Jim Paral

james.paral@dot.gov

717.221.3465
Traffic Operations; ITS Strategies; Regional Transportation Management Center Operations and Integration; ICM Concept of Operations

Manny Anastasiadis, Senior Traffic Operations Manager
Pennsylvania Department of Transportation
District 6-0
Congestion Reduction and Traffic Planning Solutions for the I-76 Corridor
Built It, Renew It and Operate It

Delivering the system’s benefits to our customers

Photo: © iStockphoto.com/ben yong yau (137958298)
Benefits of Operations

National Causes of Delay

Benefits of Operations Initiatives

- Region-wide impact
- Prompt implementation
- High benefit and low cost
- Positive public response
Active Traffic Management/ICM

Operate Efficiently
1. Real Time Monitoring/Performance Measures
2. Real Time Incident Mitigation
3. Real Time Signal Management
4. Real Time Partner Coordination

Manage Demand and Strategically Add Capacity
1. Real Time Parking Information
2. Real Time Traffic and Transit Vehicle Information
3. Real Time Lane Management
4. Ramp Metering

Enhance Safety
PennDOT District 6 – Active Traffic Management

Part-Time Shoulder Use – District 6-0 Projects Underway or Being Considered for Development

- I-76 (Schuylkill Expressway) from US 202 to I-476 (Blue Route), and I-76 WB from US 1 to Belmont Avenue
- I-467 (Blue Route) from West Chester Pike to I-95, plus I-95 SB to US 322
- US 422 from PA 29 to US 202
- US 30 Reconstruction from Coatesville to Downingtown
I-76 ICM – Project Focus/Limits
Active Traffic Management Strategies

- Variable Speed Limits
- Queue Detection / Warning
- Proactive Management of Traffic Signals
- Ramp Metering
- Dynamic Lane Assignments and Junction Control
- Multimodal Transit Improvements
Part-Time Shoulder Use
Increased Expressway Service Patrol Coverage
Benefits of Part-Time Shoulder Use

- Smaller operational footprint requiring less R/W
- Less environmental impacts
- Faster project delivery
- More economical
- Scope is scaled to fit the traffic demand
Congestion Management – Traffic Management/Arterials

- Traffic Signal Upgrade
- Public safety agency collaboration
- Local government/MPO/RTPA cooperation
- Trail Improvement and end trail connections to transportation facilities
- Transit Improvements—Real Time Headway Improvements (Bus/Rail)
  - Additional Train Cars, Buses in Real Time
  - Additional Bus Service and Employer Shuttles
  - Parking Garages, Park And Ride Lots and Real Time Parking Information
- Corridor Intelligent Transportation Systems Expansion
  - Camera/Travel Time Detectors
  - Dynamic Message Signs on Arterials
  - Software
  - Transit Priority
Traveler Information –
Transit Real Time Vehicle Information

Beginning at 10pm on Wednesday, 11/15.

• **SEPTA Hopes to Make Commutes Smoother with Launch of Newest App.**
• Is your train’s arrival time a mystery? SEPTA’s hoping to fix that once again.
• The transit authority launched the latest version of its app for iPhone and Android users Wednesday night, promising the most up-to-date information on travel times and easier-to-understand navigation as well as alerts to improve the commuting experience for SEPTA’s often-frustrated customers.
• SEPTA’s app was built with customer feedback in mind, the agency **said in an announcement**. The feedback likely wasn’t to difficult to locate—customers’ complaints are easily found on social media. Inaccurate travel times are a recurring theme.
• **Philadelphia Inquirer**
Floor Operations

- Implementing incident timings
  - Monitor Arterials and coordinate response similar to Freeways.
  - Strive to Maximize throughput of the entire system through travel time, incident notification posted on DMS and coordination with partners.

Other Every Day Activities

- Ensure complete communications with corridor’s and proper function of system components.
  - Determine what the timings should be and download to signal systems.
  - Coordinate repair needs with partners.
RTMC: Real Time Operations (Workforce)

Overall TSMO PROGRAM
- Operations Monitoring
- System Management
- Incident/Event Response
- Reporting

- Arterial/Signal System Floor Supervisor
  - Municipal Coordination
  - Performance Metric Reporting
  - Arterial Incident Management - Event Programs
  - Managed & Reversible Lanes - Arterials

- Managed Lanes - Freeway - Specialist
- Device & Communication System Maintenance - Specialist

- Freeway & PSP Operations
- Incident Management - Freeway

- RTMC Floor Supervisor - Freeway
Thank You

- Rendering of Proposed RTMC
- Capital Authorization In Place (Funds Already In Place on the TIP)
King of Prussia Rail Extension;
On-Corridor Station Improvement Projects;
Traveler Information

Elizabeth Smith, Manager of Long Range Planning
SEPTA
I-76 Transit Snapshot

• Currently have 5 bus routes that utilize I-76 as part of their route, with combined route ridership of over 9,000 riders per day.

• Few parallel alternative routes available between Center City and Main Line/KOP

• Due to congestion and uncertainty in trip times, these bus routes are low performers in terms of on-time performance
Short Term Transit Projects

• Nearby station improvements and enhanced parking capacity
  – Conshohocken Station

• Potential for variable message signing to alert drivers to alternate SEPTA service
  – Next to arrive trains
  – Total trip time
  – Parking availability
Long Term Transit Projects

• King of Prussia Rail
Long Term Transit Projects

- 4.5 miles in length, 5 stations, almost 10,000 riders per day
- Total capital cost of $1.2 B
- Significant travel time savings – 30 minutes each way
I-76 Parallel Corridors Signal Operations; PennDOT Traffic Signal Ownership & Maintenance Pilot; Municipal Outreach

Presented by
David L. Adams, PE, Traffic Signals Manager
PennDOT District 6-0
I-76 Parallel Corridors - Traffic Signal Operations

• What’s the problem?

Traffic Signal Breakdown

- 1,200 municipal signal owners
- 14,000 signals in Pennsylvania
- 75% own less than 10 signals
- 80%+ maintained by contractors
- 10,500 (77%) on state highways
I-76 Parallel Corridors - Traffic Signal Operations

• How did we get here?
• How did we get here?
I-76 Corridor Management: Opening Lanes and Offering Options to Regional Mobility

I-76 Parallel Corridors - Traffic Signal Operations

- How did we get here?

Lester Wire
Salt Lake City Police Department

William Potts
Detroit Police Department
How did we get here?

• Act 403 of 1929
• Act 360 of 1937
• Late 1940s
  – Earliest records of Department of Highways issuing signal permits
  – Engineering District performed study with Central Office issuing permit
• 1970s – Engineering District performs study AND issues permit
I-76 Parallel Corridors - Traffic Signal Operations
Pennsylvania Act 101 (2016)

• Act 101 (2016) updated Act 89 of 2013 which created Title 75, Section 9511(e.1) - new funding program for signalized corridors.
• Gives PennDOT the authority to install, replace, synchronize, time, own, operate or maintain traffic signals
• Authorized for state highways or local roadways
• Allows Secretary of Transportation to identify a Pilot Program for PennDOT managed traffic signals, with notification in PA Bulletin
• Pilot Program Evaluation completed by January 2022

The critical corridors adjacent to I-76 were identified as candidates for this Pilot Program
I-76 Parallel Corridors - Traffic Signal Operations
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I-76 Corridor Management: Opening Lanes and Offering Options to Regional Mobility
I-76 Parallel Corridors - Traffic Signal Operations
I-76 Parallel Corridors - Traffic Signal Operations
Municipal Feedback & Concerns

- Generally positive feedback regarding PennDOT Signal Ownership & Maintenance transfer
- Define roles and responsibilities in emergency response
- Concern regarding Outages and Response Times
- Local Project Coordination
- Existing In-house municipal signal maintenance staff
- PennDOT maintenance contracts & staffing
- Liability transfer to PennDOT
<table>
<thead>
<tr>
<th>Regional Traffic Signal Operations and Management Plan</th>
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<tbody>
<tr>
<td>Command and Control Software Requirements</td>
</tr>
<tr>
<td>Maintenance Contracts</td>
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<tr>
<td>Municipal Cooperative Maintenance Agreements</td>
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<tr>
<td>PennDOT Traffic Signal Operations Staffing</td>
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<tr>
<td>Performance Measures Reporting</td>
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<tr>
<td>Sustainable Municipal Partnership &amp; Engagement</td>
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<tr>
<td>Signal System Concept of Operations</td>
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<tr>
<td>Equipment Requirements and Standards</td>
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## I-76 Parallel Corridors - Traffic Signal Operations

### Advancing the Program - Next Steps

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>2017</td>
<td>Municipal &amp; Stakeholder Engagement (Program Input &amp; Goal Setting; Concurrent Project Coordination; Incident Management Subcommittee)</td>
</tr>
<tr>
<td>2018</td>
<td>Project Delivery (Phased Deployments) - Design and Construction of Traffic Signal Improvements</td>
</tr>
<tr>
<td>2019</td>
<td>Development and Deployment Traffic Signal Command and Control Software</td>
</tr>
<tr>
<td>2020</td>
<td>Ownership Transfers / PennDOT Begins Maintenance Responsibility</td>
</tr>
<tr>
<td>2021</td>
<td>PennDOT Active Management of Corridors</td>
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<td></td>
<td>Pilot Program Monitoring and Evaluation</td>
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*A full assessment and evaluation of this Pilot Program is due to the Secretary of Transportation in January 2022.*
Incident Management and Emergency Responder Coordination; State Police Partnership; Peer Agency Information Sharing

Chris King, Manager, Office of Transportation Operations Management, DVRPC
I-76/I-476 Crossroads Traffic Incident Management Task Force (IMTF)

- Established in 1999
- 1st Corridor TIM Team in Pennsylvania
- Includes portions of Philadelphia, Montgomery and Delaware Counties
- Covering portions of I-76, I-476, US 202, US 422, PA Turnpike
- Stakeholders include PennDOT, PA State Police, PA Turnpike, Montgomery County, local fire, police, EMS, towing and other applicable agencies
- Successes
  - Traffic Incident Operating Guidelines
FHWA Part Time Shoulder Use Peer Exchange

- June 7, 2016
- FHWA’s Viewpoint
  - National Shoulder Use Overview
  - A Local Perspective
- Peer Panel Discussion of Shoulder Use and Across the Country
  - Virginia
  - Washington State
  - Minnesota
  - Michigan
- Opportunity for responders to express any issues and concerns
Additional Outreach

Virginia DOT / I-66 HSR Scanning Tour
- September 20-21, 2016
- Representatives from PA State Police, PennDOT Central Office, District 6 and Lower Merion Township Fire Department
- Firsthand look at their I-66 Part Time Shoulder Use Lanes and Virginia DOT Traffic Management Center in Fairfax
  – Discuss with Virginia DOT and local responders about operation and emergency response

I-76 ICM – Emergency Responders Meeting
- September 19, 2017
- Provide I-76 ATM Updates, Scope and schedule and discuss in detail responder concerns and issues
Identified Concerns by Local Emergency Responders

- Communications
- Response
- Pre-Planning
- Traffic Management
Identified Concerns by Local Emergency Responders

Communications
• Incident verification and getting correct information to responders
• Responders need direct communication with PennDOT and PSP
• CAD integration is needed...overcoming technological and institutional barriers

Response
• How do we get there in gridlock?
• Limited space – “splitting” traffic not an option in large parts of project area
• What about debris? What about abandoned vehicles?
• Swing gates, turnarounds
Identified Concerns by Local Emergency Responders

Pre-Planning
• Potential response strategies may be against longstanding procedures.
• First responder needs must be included in the planning phase (i.e. accessibility for responder vehicles)
• Adjacent access areas must be identified, developed, and maintained

Traffic Management
• Responders don’t always have the manpower to close lanes, manage traffic, etc.
• Vehicles restrictions on shoulder lanes? No trucks?
Looking Ahead

• Operational Scenarios
• Opportunity to use IMTF as a forum and outreach
• Discussion to form subcommittee of IMTF to regarding Traffic Signals to gain more municipal input to the operation of signals during incident when PennDOT takes ownership.
Project Management and Delivery

Jay Roth, Transportation Group Manager
Jacobs
## I-76 ICM = Operational Improvement Program

<table>
<thead>
<tr>
<th>Traditional Improvements</th>
<th>Operational Improvements</th>
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<tbody>
<tr>
<td>Standard Highway Design Approach (capacity &amp; criteria)</td>
<td>Performance Based, Practical Design (flexibility &amp; metrics)</td>
</tr>
<tr>
<td>Expand by adding lanes with full width shoulders</td>
<td>More effectively utilize existing geometry with minimal expansion</td>
</tr>
<tr>
<td>Larger Project Footprint</td>
<td>Little Widening Required. Limited Right of Way</td>
</tr>
<tr>
<td>Significant Environmental Clearance &amp; Permitting Required</td>
<td>Limited Environmental Impacts</td>
</tr>
<tr>
<td>Significant Construction Impacts and Duration (approx. 10-15 years)</td>
<td>Reduced Construction Impacts and Duration (approx. 4-6 years)</td>
</tr>
<tr>
<td>High Construction Cost – More Difficult to Fund</td>
<td>Required Funding Available for Programming</td>
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Project Limits and Scope
## Approach & Execution

<table>
<thead>
<tr>
<th>Performance Based Practical Design</th>
<th>Civil Design Track</th>
<th>ITS Design Track</th>
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<tbody>
<tr>
<td>• Launch website &amp; social media</td>
<td>• Survey and mapping</td>
<td>• Systems engineering analysis</td>
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<tr>
<td>• Initial stakeholder meetings</td>
<td>• Baseline infrastructure assessment</td>
<td>• DVRPC model coordination</td>
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<tr>
<td>• IMC visioning</td>
<td>• Utility, ROW, and environmental investigations</td>
<td>• Traffic and safety analysis</td>
</tr>
<tr>
<td>• Establish design criteria and line &amp; grade</td>
<td>• Survey and mapping</td>
<td>• Preliminary device layout</td>
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### ATM Gate 1: Project Alternative Selection

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<th>Alternative Development</th>
<th>Civil Design Track</th>
<th>ITS Design Track</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Public meeting #1 (progress and input)</td>
<td>• Continue field work and base plans</td>
<td>• Develop software requirements</td>
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<tr>
<td>• SEPTA and multimodal outreach</td>
<td>• Determine primary bid package composition</td>
<td>• Ramp metering site analysis</td>
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<tr>
<td>• IMC tabletop exercises</td>
<td>• Overhead bridge CEE and design field view</td>
<td>• Coordinate arterial corridor enhancements</td>
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</tbody>
</table>

### ATM Gate 2: Identify Early Action Projects and Final Design Scope

<table>
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<tr>
<th>Design Field View and Early Action Deployment</th>
<th>Civil Design Track</th>
<th>ITS Design Track</th>
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<tbody>
<tr>
<td>• Public meeting #2 (early action areas and ATM education)</td>
<td>• Overhead bridge final design</td>
<td>• Preliminary ITS design</td>
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<tr>
<td>• Stakeholder meetings and coordination</td>
<td>• Pull-off and access ramp design</td>
<td>• Final design for early action ITS</td>
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<tr>
<td>• IMC early action project approval</td>
<td>• Mainline sections preliminary design and NEPA clearances</td>
<td>• Develop ITS continuity plan</td>
</tr>
</tbody>
</table>

### ATM Gate 3: Complete Early Action Design and Main Section Design Field View Approval

<table>
<thead>
<tr>
<th>Final Design and Early Action Implementation</th>
<th>Civil Design Track</th>
<th>ITS Design Track</th>
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<tbody>
<tr>
<td>• Public meeting #3 (early action and final design)</td>
<td>• Construct early action bridges</td>
<td>• Implement early action ITS</td>
</tr>
<tr>
<td>• Stakeholder updates and SEPTA messaging</td>
<td>• Construct early action pull-offs and ramps</td>
<td>• Complete ITS design for shoulder running and junction control</td>
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<tr>
<td>• IMC mainline project approval</td>
<td>• Mainline sections final design, clearances, and permits</td>
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### ATM Gate 4: Final Design Complete – Early Action Complete/Ongoing and Major Project Let
## Overall Schedule

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<td>Systems Engineering</td>
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<td>Mapping/Alternative Dev.</td>
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<td>Mainline Construction</td>
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</table>
Program-Wide Coordination
Stakeholder & Public Outreach

- Meeting regularly with the I-76 ICM Executive Stakeholders, Advisory Committee and Emergency Responders
- Website & Project Branding Underway
  - Website URL: www.TRANSFORM76.com
- Provide a clearinghouse for educational and public outreach materials, as well as cover all ongoing corridor enhancement projects
- Developing Social Media Accounts in line with an overall communications plan
- Go Live – Before start of Early Action (VSL / QW) contractor activities on the corridor in Spring 2018
I-76 ITS Concept of Operations; ATM Strategies Development
ITS & Systems Design

Brian DePan, ITS Design & Construction Manager
Jacobs
Variable Speed Limit and Queue Warning Early Action

- Primary Goal – Reduce Rear-End Crashes and Harmonize Flow
- Overall Status
  - Design Nearing Completion
  - Project Let Date – February, 2018
  - Construction Start Date – April, 2018
  - Construction Complete – December, 2018
  - Go-Live – March, 2019
- Project Elements
  - 73 Variable Speed Limit Signs
  - Nine(9) Dynamic Message Signs
  - New ATMS Software Module
Systems Engineering/Preliminary ITS Scoping

• Validating Concept of Operations
• Developing Systems Requirements
• Emergency Response Scenarios
• ITS Architecture Conformance
• Developing ATM/ICM Design Criteria
  – Gantry Spacing, Layout, Configuration
  – Junction Control & Lane Use Concepts
  – Emergency Pull-off and Access Needs/Constraints
  – Ramp Metering Warrants
  – Communications/Power Redundancy
Traffic Modeling

I-76 Westbound Existing AM Travel Time

- Existing AM Travel Time (Min)
- Free Flow Travel Time (Min)
- Lower Bound
- Upper Bound
Safety Analysis

I-76 Eastbound Interchange Crash Rates by Collision Types

- Toll Booth Plaza Major Movements
- Interstate Junction Major Movements
- Stopped Traffic Recurrent Congestion

Crash Rates

Interchange

- 327 - N. Gulph Road
- 328 - US 202/422
- 330 - Gulph Mills
- 331 - I-476 / Conshohocken (EB Ent.)
- 332 - Rt 23 Conshohocken (EB Ent.)
- 337 - Gladwyne (EB Ent.)
- 338 - Belmont/Green Lane
- 339 - US 1 City Ave
- 340 - US Rt 1 Roosevelt Blvd

Rear Ends Crash Rate
HFO Crash Rate
Rear Ends Statewide Average -0.23
HFO Statewide Average -0.21