PENNDOT’S Traffic Signal Roadmap

Transportation Engineering and Safety Conference

Session 6E: “Preparing Engineers for Future Innovation”

December 7, 2017
Pennsylvania Facts

- 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
## Traffic Signal Operations Approach

### Goals:
- Reducing delay, emissions, and fuel consumption
- Reducing crashes and fatalities
- Focus impacts on the economy and job creation
- Standardizing traffic signal equipment
- Establishing regional and multi-jurisdictional collaboration

<table>
<thead>
<tr>
<th>Currently</th>
<th>Moving Towards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated</td>
<td>Coordinated</td>
</tr>
<tr>
<td>Jurisdictional</td>
<td>System</td>
</tr>
<tr>
<td>Project Focus</td>
<td>Customer Focus</td>
</tr>
<tr>
<td>Local</td>
<td>Regional</td>
</tr>
<tr>
<td>Reactive</td>
<td>Proactive</td>
</tr>
<tr>
<td>Piecemeal</td>
<td>Comprehensive</td>
</tr>
<tr>
<td>Historical info</td>
<td>Real-Time Information</td>
</tr>
<tr>
<td>8/5 operations</td>
<td>24/7 operations</td>
</tr>
<tr>
<td>Output oriented</td>
<td>Performance-based</td>
</tr>
</tbody>
</table>

*Source: Coordinated Freeway and Arterial Operations Handbook, FHWA*
**Traffic Signal Roadmap**

**Standardization**
- Pub. 191 (1 Signal Publication)
- Product Approvals
- E-Permitting System
- Signal Permit Plans

**Asset Management**
- Asset Inventory
- Maintenance Records
- Municipal Budgeting

**Performance Management**
- EDC-4 High Resolution Data
- Arterial Probe Performance Metrics
- Pooled Fund Study (TPF-1453)

**Maintenance and Operations**
- Communications
- Command & Control
- Signal Mgmt. Plan
- Maintenance Strategies

**Technology and Innovation**
- Adaptive Signals
- Communication & DSRC Deployments
- CAV Applications

**Sustainability and Funding**
- Grants
- Ownership
- Systematic Statewide Improvements

**Research and Training**
- HSTOD Training Committee
- Identify Needs/Gaps

**Project Planning**
- Life Cycle Evaluation
- Project Planning
Standardization

- **Publication 191 (1 – Electronic Signal Publication)**
  - Rolls up all publication except 408
  - Searchable document with additional training materials (figures, design lists, tutorials, and connect with relevant national publications)

- **Intersection Control Evaluation (ICE)**
  - Standard scalable approach to properly evaluating and documenting the appropriate control at intersections.

- **Electronic Traffic Signal Submissions through E-Permitting**
  - Get all traffic signal submissions electronically through one system regardless as to whether it’s a Department project, HOP, or Local project.
  - Ensure coordination and seamless interaction between other Department established systems.
Standardization

Traffic Signal Management Plan
- FHWA initiative to clarify and improve on Maintenance and Operations by identifying the Goals, Objectives, Strategies, and Tactics needed on key facilities.
- Clarify by roadway the main objectives so they are clear from project to project (i.e. smooth flow & progression versus optimal local operations)

Traffic Signal Products
- Refreshing Traffic Signal Standards and Specifications with a focus on new technology and the most reliable and effective operation
- Traffic Signal Procurement

Standardization of Documentation and Standards
- Traffic Signal Permit Plans
- Traffic Signal Signal Processes
Traffic Signal Software Solutions

- Standardization
- Asset Management
- Traffic Analysis Tools
- Approval Process
- Project Delivery
- Green Light-Go Funding Program
- Unified Traffic Signal Command and Control
- Probe Vehicle Arterial Performance Metrics
- Management, Operations, and Performance Metrics
- Other DTE Approved HCM Software
- TSAMS (Traffic Signal Asset Management System)
- PTV VISTRO
- dotGrants
- McTrans
- Synchro 10
- Traffic Signal Command and Control
- Traffic Analysis Tools
- Green Light-Go
- Funding Program
- ECMS (Engineering and Construction Management System)
Asset Management
https://www.dot17.pa.gov/tsams/

- Inventory
- Maintenance
- Electronic Files
- GIS Enhancements
- Work Flow
- ITS Assets
- Reporting
- Project Management
- Modelling & Analytics
- Mobile
Maintenance and Operations
Remote Traffic Signal Communications Policy

Strike-off Letter (SOL) 494-16-02
(Effective: February 12, 2016)

- Local/Master Controller
- Adaptive System
- Preemption System
- Detection System
- MMU/Conflict Monitor
- Transit Priority
- Modem & Router

Note: PennDOT IP address assignment is required. Coordinate with IT prior to project PS&E.

Connection Type
- Twisted-Pair
- Ethernet
- Fiber Optic
- Cellular
- Radio

Note: VPN access to PennDOT Network will be used to access signal(s). Internet accessibility is required and will be the responsibility of the signal owner. See “VPN Authorization Process” for further details.

Isolated Signal with Local Controller.

Signal System with Master Controller.

Field Connection (PennDOT/Municipal Project)

PennDOT Network Connection.
## Maintenance and Operations

### Statewide Unified Traffic Signal Command and Control

<table>
<thead>
<tr>
<th>ID</th>
<th>Sector</th>
<th>Suite</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td></td>
<td>5. Traffic Signal Controller Interface</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td></td>
<td>1. The Software must interface to the existing controllers using the protocols identified within this specification.</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td></td>
<td>a. Any devices which will require hardware upgrades or cannot be interfaced with must be clearly identified.</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
<td>2. The Software must support other controllers using the NTCIP Center-to-Field (C2F) communications protocol.</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td></td>
<td>a. The NTCIP C2F protocol must be NTCIP 1202 and 1202 based using custom-MIBS when available from the controller manufacturer.</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td></td>
<td>b. The Vendor must describe their C2F capabilities and controller brands supported with their Software.</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td></td>
<td>c. The system must be capable of using custom MIBS when available from the controller manufacturer.</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td></td>
<td>d. For each device type identified, Vendors shall indicate if the controller can be integrated out of the box, integrated after some custom code is written, or if integration with the device is not possible.</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Why is this needed?**

- Successfully deployed in other state and regional deployments
- Inter-operability is critical to maximizing the existing capacity
- PennDOT and Municipal situational awareness and seamless operations
- Connected and Automated Vehicle applications
- Integrated Corridor Management (ICM)
Maintenance and Operations

Traffic Signal Ownership

I-76 Parallel Corridor Ownership Pilot (160 Signals in 9 municipalities)

- Unified Command and Control
- Maintenance Service Contracts
- Maintenance Agreement and Process
- PennDOT Operations Staffing Needs
- Performance Reporting Expectations
- Sustainable Municipal Engagement
- Traffic Signal Concept of Operations
- Equipment Requirements and Standards
Performance Management
High Resolution Data/ Automated SPMs

http://docs.lib.purdue.edu/jtrpaftdocs/3/

http://docs.lib.purdue.edu/jtrpaftdocs/24/
Performance Management
High Resolution Data/ Automated SPMs

Signal Selection

Signal ID
3177 Dickerson Road - PECO Driveway @ Sumneytown Pike

Signal List

Signal Map
Region
District 6
Metric Type
Purdue Coordination Diagram

Chart Selection

Metrics List
- Purdue Phase Termination
- Split Monitor
- Pedestrian Delay
- Preemption Details
- Turning Movement Counts
- Purdue Coordination Diagram
- Approach Volume
- Approach Delay
- Arrivals On Red
- Approach Speed

Purdue Coordination Diagram Options
- Y-axis Max
  - 150
- Secondary Y-axis Max
  - 2000
- Volume Bin Size
  - 15
- Dot Size
  - Small
- Show Plans
- Show Volumes

Date Selection

Start Date
06/13/2017 12:00 AM

May 2017
Performance Management
High Resolution Data/ Automated SPMs

Red Light Monitoring
Use for identifying safety trends and engineering countermeasures

Approach Speeds
Use for Traffic Studies, Severe Weather Timing Plans, and Calculating Yellow and Red Clearance Intervals

Purdue Coordination Diagram
Evaluating progression quality – Are vehicles arriving on green or red?

Approach Volumes
When to Take a Lane for Maintenance Activities, Directional Splits, Traffic Models
3 Interactive Web Dashboards

- **Travel Time Comparison Tool**
  - Travel times for user specified date ranges
  - CFD’s for before/after comparison

- **Arterial Ranking Tool**
  - Ranks the corridors based on performance measures
  - Normalized median and IQR

- **Travel Delay Monitor**
  - Cumulative miles of a corridor operating under a particular speed
Technology and Innovation

Connected and Automated Vehicle Efforts at Traffic Signals

- Identify and Deploy appropriate Pilots
- Understand the Connected and Automated Vehicle Terminology
- Understanding how DSRC Works
- Understand Inter-operability between the Road Side Units (RSUs) and On-Board Units (OBUs)
- Monitor the FHWA Connected Vehicle and Smart City Deployments
- Understand the needed Map Message and updates
- Understand the Applications and Pilot
- Preparing for a Security Certificate System
- Monitor the DSRC and 5G debate
- Collaborate and Innovate with Other Agencies and Practitioners
**Sustainability and Funding**

*Up to $40 Million Annually*

- **Local Grant Element**
  - Annual Program
  - Counties, Municipalities, and Planning Partners Eligible
  - All Existing Traffic Signals
  - 20% Match and Municipal Managed unless otherwise identified

- **Statewide Systematic Improvements**
  - Statewide TSAMS data collection
  - Unified Command and Control
  - ATSPM mapping and communications
  - Improve Communications and Data Structure

- **PennDOT Management Element**
  - PennDOT ownership [Pilot Evaluation is 160 signals in 9 municipalities that parallel I-76 (Schuylkill Expressway)]
  - Focus on Key Super Critical (AADT > 25,000) and Emergency Detour Routes
  - Prepare for Connected Traffic Signals
Research and Training

- **Highway Safety and Traffic Operations (HSTO) Training Committee**
  - Signals/ITS Subcommittee
  - Identify, program, and develop necessary training to improve and establish a sustainable workforce
  - Improve the current state of the Practice of Signals in PA

- **International Municipal Signal Association (IMSA)**
  - Get the boundary to be the entire state and not split into 2 regions
  - Rebuild relationships to get appropriate and sustainable technical training

- **Leverage Other State Best Practices**
  - Continue to work closely with lead states as well and participate in the leading pool fund studies.
  - Utilize FHWA to assist with training needs
Identifying systematic needs so that Projects can be planned. Bridge has SD, Pavement has IRI, what do we have for Signals to compete for funding?

- Utilizing and Leveraging TSAMS
- Using GIS-IQ to evaluate needs
- Develop evaluation methodology
- Identify projects or potential projects for TIP and other Grant Programs
- If we don’t do it then who is going to do it?
Questions

www.dot.state.pa.us/signals

2017 - Green Light-Go Program (Year 4) Program Updates and Application Period

PennDOT will be accepting applications for the 2017 Green Light-Go Funding Program (Year 3) from September 2 through November 9, 2017. The 2017 Green Light-Go Program has up to $40 million for the competitive application and reimbursement grant program for existing traffic signal improvements such as: light-emitting diode technology and intelligent transportation applications, such as autonomous and connected vehicle-related technology, performing regional operations such as retiming, developing special event plans and monitoring traffic signals and for maintaining and operating traffic signals.

Municipalities are strongly encouraged to work with their PennDOT District Traffic Signal Unit representatives to define project scopes in a manner consistent with the program goals and requirements, which will allow PennDOT to assist applicants with refining the scope to ensure a successful project (e.g. equipment compatibility, appropriateness of project for location, etc.). A new project scoping form has been developed (see Appendix III of the Program Guidelines) to assist in this process, and the PennDOT contacts are identified in Appendix IV.

Please visit the PennDOT Traffic Signal Portal’s Green Light-Go page for more information:

The 2017 program continues the following updates enacted in Act 101 of 2016 (Enhancing Pennsylvania’s Green Light-Go Program):
- Reduction of the Municipal Hatch from 50% to 20%

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