**Publication 149 -- Reorganized and Revised with the Following Key Updates**

1. Completely reorganized and revised the Publication outline into 6 PARTS (36 chapters), as shown below, to accomplish the following*. (Note: the existing Publication is 20 chapters with no PART groupings of chapters)*:
	1. Updated content to be consistent with the latest PennDOT practices and pubs.
	2. Present a holistic traffic control signal design approach:
		* **PART I: General**
		* **PART II: Design Context** (big-picture context/constraints/considerations)
		* **PART III: Design Elements/Criteria** (specific physical & operational)
		* **PART VI: Plans, Specs & Estimates (PS&E) Package/Bid Package**.
	3. **PARTS IV & V** - Define and include other various special-use & miscellaneous traffic signals that are other than the typical R-Y-G traffic control signal.
	4. Pull together and consolidate similar subject matter material into the new individual chapter that presents this subject’s material. Example, the existing publication presents ‘Supports’ information in Chapters 5 & 20. In this revised Publication, the information has been consolidated into the new Chapter 12 Supports.
	5. Provides Chapter 10 Operations, which indicates that designers shall use the guidance in the Signal Timing Manual, 2nd Edition (STM2) for the design of operational aspects (signal timing, phasing, sequencing, etc.) of traffic control signals in Pennsylvania. If there is any Pennsylvania supplemental information to be provided for an STM2 section topic, it is presented within the individual Chapter 10 sections.

| **PARTS** | **Chapter** | **Title** |
| --- | --- | --- |
| **PART I****General** | Introduction | **1** | Introduction |
| **PART II****Design Context-****Traffic Control Signals**           | Defines the big-picture, design box (context, constraints, considerations) that a traffic control signal design needs to understand, fit into, and be attentive to.  | **2** | Network Context |
| **3** | Intersection Context |
| **4** | Operational Context |
| **5** | Traffic Control Signal Design Constraints |
| **PART III****Design Elements/Criteria-****Traffic Control Signals** | Defines the various physical and operational design elements and criteria that need addressed and pulled together for a complete traffic control signal design.Each chapter addresses a separate topic (accommodation type, individual equipment component, etc.) and provides detailed information for that topic. | **6** | Design Elements Introduction |
| **7** | Utilities |
| **8** | Pedestrians |
| **9** | Bicycles |
| **10** | Operations |
| **11** | Preemption and Priority Control |
| **12** | Supports |
| **13** | Controller Assembly |
| **14** | Systems & Communications |
| **15** | Electrical Distribution |
| **16** | Signal Heads |
| **17** | Detectors |
| **18** | Adaptive Signal Control Technology (ASCT) System |
| **19** | Pavement Markings & Signs |
| **20** | Intersection Lighting |
| **21** | Other Attachments to Traffic Signals |
| **22** | Advance Red Signal Warnings |
| **PART IV****Special-Use****Traffic Signals** | Defines various special-use traffic signals, other than the typical R-Y-G traffic control signal.Each chapter addresses a separate special-use signal type and provides detailed information for that signal. | **23** | Temporary Traffic Control Signals |
| **24** | Emergency Vehicle Access, Traffic Control Signal |
| **25** | Freeway Entrance Ramp, Traffic Control Signal (Ramp Metering) |
| **26** | One-Lane, Two-Way Facilities, Traffic Control Signal |
| **27** | Lane-Use, Control Signals |
| **28** | Toll Plaza, Traffic Signals |
| **29** | Movable Bridge, Traffic Signals |
| **PART V****Other Misc.****Traffic Signals** | Defines flashing beacons (flashing warning devices) and in-roadway warning lights.Each chapter addresses a separate signal type and provides detailed information for that signal. | **30** | Flashing Beacons (Flashing Warning Devices) |
| **31** | Hybrid Beacons |
| **32** | In-Roadway Warning Lights |
| **PART VI****Plans, Specifications & Estimates (PS&E) Package / Bid Package** | A complete design culminates in the development of Plans, Specifications & Estimates (PS&E)/Bid Package.Each chapter defines and addresses each of these components (plans, specifications, and estimates).  | **33** | Traffic Control Signal Plans |
| **34** | Other Traffic Signal Plans |
| **35** | Bid Proposal (Package) |
| **36** | Cost Estimates |

**Publication 149 -- Content Disposition Table**

| Pub 149, 2024 Edition: Location and Content | Previous Source of Information |
| --- | --- |
| 1.1 Publication Purpose | Pub 149 (5-13), Section 1.1 |
| 1.2 Publication Organization | Pub 149 (5-13), Section 1.1 |
| 1.3 PennDOT Traffic Signal Publications | Pub 149 (5-13), Section 1.1 |
| 1.4 Key External Publications & Resources | New content |
| 1.5 Traffic Signal Permit | Pub 191 (12-20), Section 1.3a |
| 1.6 PennDOT Traffic Signal Contacts | Pub 191 (12-20), Section 1.4a |
| 1.7 Definitions and References | Pub 191 (12-20), Section 1.5a |
| 1.8 Miscellaneous Reference Documents | Pub 191 (12-20), Section 1.6a |
| 2.1 Network Context – General | Pub 149 (5-13) Chapter 2 |
| 2.2 Operating Objectives | Pub 191 (12-20), Section 3.6a |
| 2.3 Traffic Control Signal Spacing | Pub 46 (3-14) section 4.5 |
| 2.4 Traffic Signal Coordination | Pub 46 (3-14), Section 4.5 |
| 2.5 Traffic Control Signal Analysis Tools | Pub 46 (3-14), Section 4.5 |
| 2.6 Roadway Approach Geometry | New content |
| 2.7 Nearby Railroad/Transit Grade Crossings | Pub 149 (5-13) Chapter 19Pub 46 (3-14) Section 4.6 pages 4-50 to 4-52a |
| 3.1 Intersection Context – General | Pub 149 (5-13) Chapter 2 |
| 3.2 Geometry and Sight Distance Controls | Pub 46 (3-14), Section 4.3 (pages 4-41 to 4-43)Pub 46 (3-14), Section 4.6 (page 4-65) |
| 3.3 Roadway and Right-of-Way Width Constraints | New content |
| 3.4 Pavement Condition Constraints | New content |
| 3.5 Utility Considerations | New content |
| 3.6 Adjacent Property Considerations | New content |
| 4.1 Operational Context – General | Pub 149 (5-13) Chapter 2 |
| 4.2 Intersection User Considerations | New content |
| 4.3 Land Use Context | New content |
| 4.4 Preemption and Priority Controls | Pub 149 (5-13) Section 19.5 |
| 4.5 Crash History | New content |
| 5.1 Traffic Control Signal Design Constraints – General | Pub 149 (5-13) Chapter 2 |
| 5.2 Federal Statutes | New content |
| 5.3 Federal Regulations | New content |
| 5.4 Pennsylvania Statutes | New content |
| 5.5 Pennsylvania Regulations | New contentPub 191 (12-20), Section 1.2.2 |
| 5.6 PennDOT Policies | New content |
| 5.7 Use of Standard Protocols-Signal Phasing and Timing | New content |
| 5.8 Project Specific Constraints | Pub 149 (5-13) Sections 18.3 and 18.4 |
| 6.1 Design Elements Introduction – General | Pub 149 (5-13) Chapter 2 and Chapter 17 |
| 6.2 Project Scope | Pub 149 (5-13) Section 18.1 |
| 6.3 Design Documentation | Pub 149 (5-13) Chapter 17 |
| 7.1 Utilities – General | New content |
| 7.2 Identifying Utility Locations | Pub 149 (5-13), Sections 12.1 and 12.2 |
| 7.3 Plans Utility Information | Pub 149 (5-13), Section 12.3 |
| 7.4 Utility Clearance for ECMS Projects | New content |
| 7.5 Utility Clearance for Non-ECMS Projects | New content |
| 7.6 Overhead Clearance Dimensions | Pub 149 (5-13), Sections 12.4 and 12.5 |
| 7.7 Design Considerations/Utility Impacts | New content |
| 7.8 Utility Service | New content |
| 8.1 Pedestrians – General | New content |
| 8.2 Pedestrian Study | New content replaces Pub 149 (5-13) Sections 4.1, 4.2, and 4.3 |
| 8.3 Americans with Disability Act (ADA) | Pub 149 (5-13) Section 4.3 |
| Chapter 9 – Bicycles | New content |
| 10.1 Operations – General | New content |
| 10.2 Signal Timings Concepts | Pub 149 (5-13) Section 3.3 |
| 10.3 Introduction to Timing Plans | Pub 149 (5-13) Sections 3.1 and 3.2 |
| 10.4 Intersection/Uncoordinated Timing | Pub 46 (3-14) Section 4.3, pages 4-36 to 4-41Pub 149 (5-13) Section 3.2Flashing Yellow Arrow Position PaperSOL 494-21-09 Leading Pedestrian Interval |
| 10.5 Flashing Operation of Traffic Control Signals | Pub 149 (5-13) Section 3.4 |
| 11.1 Preemption and Priority Control – General | New content |
| 11.2 Controller Preemption Operation | New content |
| 11.3 Emergency Vehicle Preemption | Pub 149 (5-13) Section 10.1 |
| 11.4 Railroad Preemption | Pub 149 (5-13) Sections 10.2 and 19.3 |
| 11.5 Queue Preemption | Pub 149 (5-13) Section 10.2 |
| 11.6 Transit Signal Priority | Pub 149 (5-13) Section 10.2 |
| 12.1 Supports – General | New content |
| 12.2 Location of Supports | Pub 149 (5-13) Chapter 5 |
| 12.3 Design Criteria for Fabrication | Pub 149 (5-13) Chapter 20Pub 46 (3-14) Section 4.6 page 4-59 |
| 12.4 Standard Structural Loading | Pub 149 (5-13) Section 20.3 |
| 13.1 Controller Assembly – General | New content |
| 13.2 Controller Type Selection | New content |
| 13.3 Controller Assembly Location | Pub 149 (5-13) Section 8.1 |
| 13.4 Controller Assembly Mounting Type | New content |
| 14.1 Systems and Communications – General | Pub 46 (3-14) Section 4.6 pages 4-61 to 4-63 |
| 14.2 Coordination Methods | Pub 149 (5-13) Section 11.1 |
| 14.3 System/Coordination Timing | New content |
| 14.4 Communication Systems | Pub 149 (5-13) Section 11.3 |
| 15.1 Electrical Distribution – General | New content |
| 15.2 Controller Assembly Location/Placement | Pub 149 (5-13) Section 8.1 |
| 15.3 Conduit | Pub 149 (5-13) Section 8.2 |
| 15.4 Junction Boxes | Pub 149 (5-13) Section 8.3 |
| 15.5 Cable and Wiring | Pub 149 (5-13) Section 8.4Pub 46 (3-14) Section 4.6 page 4-58 |
| 15.6 Electric Service | Pub 149 (5-13) Section 8.5 |
| 15.7 Backup/Emergency Power | New content |
| 15.8 Luminaires | New content |
| 15.9 Solar Power | New content |
| 16.1 Signal Heads – General | New content |
| 16.2 Vehicular Signals | Pub 149 (5-13) Chapter 6Pub 149 (5-13) Appendix A, Figure A-1Pub 46 (3-14) Section 4.6 page 4-66 – Strobes |
| 16.3 Pedestrian Signals | Pub 149 (5-13) Chapter 6 |
| 16.4 Lane-Use Signal Heads | Pub 149 (5-13) Chapter 6, page 6-16 |
| 17.1 Detectors – General | New content |
| 17.2 Vehicular Detection | Pub 149 (5-13) Section 7.1 |
| 17.3 Pedestrian Detection | Pub 149 (5-13) Section 7.2 |
| 18.1 ASCT Systems – General | Pub 46 (3-14) Section 4.12Pub 149 (5-13) Section 11.1 |
| 18.2 ASCT Systems Engineering Process | SOL 494-19-04 TE-153 Pennsylvania Adaptive Signal Control Evaluation |
| 18.3 ASCT Measurement & Payment | New content |
| 19.1 Pavement Markings and Signs – General | New content |
| 19.2 Typical Pavement Markings – Signalized Intersection | Pub 149 (5-13) Section 13.1 |
| 19.3 Typical Signs – Signalized Intersection | Pub 149 (5-13) Sections 13.2, 13.3, and 19.5 |
| 19.4 Typical Applications – Signing & Pavement Markings at Signalized Intersections | New content |
| Chapter 20 Intersection Lighting | Pub 149 (5-13) Chapter 9 |
| 21.1 Other Attachments to Traffic Signals – General | New content |
| 21.2 Traffic-Related Equipment (non-Traffic Signal) | New content |
| 21.3 Third-Party Equipment and Attachments | New content |
| Chapter 22 Advance Red Signal Warnings | Pub 46 (3-14) Section 4.3 pages 4-23 to 4-30 |
| 23.1 Temporary Traffic Control Signals – General | Pub 46 (3-14) Section 4.6 pages 4-63 to 4-64Pub 149 (5-13) Section 14.1Pub 149 (5-13) Sections 14.2 to 14.7 (via Pub 213 cross-reference in new 23.1) |
| 23.2 Pedestal-Mounted Portable | New content |
| 23.3 Trailer-Mounted Portable | New content |
| 23.4 Fixed Supports | New content |
| 23.5 Existing Signalized Intersections/Corridors | New content |
| Chapter 24 Emergency Vehicle Access, Traffic Control Signal | Pub 149 (5-13) Section 6.2 page 6-15 |
| Chapter 25 Freeway Entrance Ramp, Traffic Control Signal (Ramp Metering) | Pub 149 (5-13) Section 6.2 page 6-16 |
| Chapter 26 One-Lane, Two-Way Facilities, Traffic Control Signal | Pub 149 (5-13) Section 6.2 page 6-16 |
| Chapter 27 Lane-Use Control Signals | Pub 149 (5-13) Section 6.2 page 6-16 |
| Chapter 28 Toll Plaza, Traffic Signals | Pub 149 (5-13) Section 6.2 page 6-16 |
| Chapter 29 Movable Bridge, Traffic Signals | Pub 149 (5-13) Section 6.2 page 6-16 |
| 30.1 Flashing Beacons – General | New content |
| 30.2 Intersection Control Beacon | Pub 149 (5-13) Section 15.1 |
| 30.3 Warning Beacon | Pub 149 (5-13) Section 15.2 |
| 30.4 Stop Beacon | Pub 149 (5-13) Section 15.4 |
| 30.5 Speed Limit Sign Beacon | Pub 149 (5-13) Section 15.5 |
| 30.6 Rectangular Rapid Flashing Beacon (RRFB) | SOL 494-18-07 |
| 30.7 Flashing LED Border Sign System | SOL 494-22-05 |
| 30.8 Speed Display Signs | Unofficial policy letter from 2011 |
| Chapter 31 Hybrid Beacons | Pub 149 (5-13) Section 6.2 page 6-15 |
| Chapter 32 In-Roadway Warning Lights | Pub 46 Section 4.3 page 4-31 |
| 33.1 Traffic Control Signal Plans – General | New content |
| 33.2 Traffic Signal Plan – Types (Construction & Permit) | Pub 46 (3-14) Section 4.6 pages 4-52 to 4-54 |
| 33.3 Traffic Signal Plan Sheet – Intersection Layout | Pub 149 (5-13) Section 16.1 |
| 33.4 Traffic Signal Plan Sheet – Charts & Diagrams | Pub 149 (5-13) Sections 16.2 and 19.4 |
| 33.5 Traffic Signal Tabulation Sheet | Pub 149 (5-13) Sections 16.1 and 16.2 |
| Chapter 34 Other Traffic Signal Plans | New content |
| 35.1 Standard Specifications | New content |
| 35.2 Publications/Bulletins | New content |
| 35.3 Special Provisions | Pub 149 (5-13) Section 18.2 |
| Chapter 36 Cost Estimates | New content |

Notes:

aContent will also remain in the other source

**Publication 149 – CT Review Items of Interest – Major Policy Changes**

**Section 6.2 Project Scope**

**New Pub 149 Content:** Five levels of projects are defined in Exhibit 6-1 based on the scope of work. Exhibit 6-1 describes the level of detail required for permit updates. Section 6.2.1 describes other elements of traffic signal plans required for each level. Section 6.2.2 further describes each project level and limitations on requirements to avoid scope creep. These levels are referenced in other sections of the publication, including Sections 8.2 (Pedestrian Study), 9.2 (Bicycle Study), 16.2.5 (Location of Vehicular Signal Faces), 16.2.6 (Visibility, Aiming, and Shielding of Signal Faces), and 19.3.4 (Street Name Signs)

**Reasons for the policy change:**

* The requirement for fully engineered plans using CADD may discourage municipalities from applying to make smaller upgrades or retime their signals.
* Fully engineered plans require additional review effort by PennDOT staff, which delays permit issuance and is not aligned with the project scope for smaller projects.
* Disproportionate time spent reviewing smaller projects may result in missing things on reviews of larger projects due to limited resources.
* Because the requirements aren’t currently documented in policy, municipalities may assume a smaller level of effort for less complex projects. This has been an issue on grant funded projects where the grant funding is not able to accommodate a larger effort for plan updates.
* Categorizing smaller scope projects which do not include earth disturbance may lead to reduced environmental requirements to expedite project delivery.
* Projects which are only attaching things to existing structural supports do not require a surveyed plan.

**Section 8.2 Pedestrian Study**

**New Pub 149 Content:** A new Traffic Engineering (TE) form is proposed, the Vulnerable Road User Accommodation at Traffic Control Signals Engineering Study. This form is intended to replace the use of existing form TE-672 to determine the appropriate pedestrian amenities at signalized intersections. The engineering study is required prior to beginning design for Level 3 and 4 signal projects (projects which include one or more new traffic signal supports).

**Reasons for the policy change:**

* The existing form is focused on complying with ADA requirements. The proposed form is intended to consider the needs of all pedestrians as legal users of the signalized intersection.
* The existing form leads to a binary answer of whether pedestrians should be permitted to cross the roadway at the intersection. The proposed form is intended to lead an engineer to determine and document what types of amenities should be provided to facilitate pedestrian crossing.
* Existing policies have made it unclear when pedestrian signal heads should be used. This had led to overuse of pedestrian signal heads in rural areas where pedestrians can legally cross but are very rare.
* Existing policies have often led to prohibiting all pedestrian crossings where a crossing does not otherwise exist. The proposed section and flowchart in Exhibit 8-1 address that situation more clearly.
* Accessible Pedestrian Signals (APS) are required whenever pedestrian signal heads are provided in accordance with the PROWAG Final Rule issued in 2023. The proposed policy will ensure Pennsylvania is in compliance with this when it is adopted by USDOT and USDOJ.

**Chapter 9 Bicycles**

**New Pub 149 Content:** A new chapter is added to Publication 149 which addresses bicyclists as users of signalized intersections. Similar to Chapter 8 for pedestrians, the determination of amenities for bicyclists is to be based on an engineering study using a TE form. Bicycle signal faces are adopted for use in accordance with the 11th edition of the MUTCD.

**Reasons for the policy change:**

* Although bicycle amenities have been implemented at signalized intersections in Pennsylvania, there has not been a source of information and guidelines for signal designers. The proposed chapter fills this gap.
* Bicycle signal faces have been implemented under interim approval in the 2009 edition of the MUTCD, but there has been no statewide guidance for their use. The proposed chapter references the requirements in the MUTCD.

**Section 10.3.3 Left Turn Phasing**

**New Pub 149 Content:**

* Define how to determine sight distance for left turn movements to determine if full-time protected-only mode is needed
* Protected-only mode should only be used where permissive left turns are always inappropriate.
* Variable-mode left turn phasing should be considered when permissive left turn are inappropriate during only certain times of day.
* Revised conflict factor thresholds.

**Reasons for the policy change:**

* Although sight distance has been a criteria for using protected-only mode, it was not defined how to measure sight distance and what minimum value to compare with. The proposed criteria was developed collaboratively at the 2024 statewide signal meeting.
* The prior conflict factor approach to choosing between protected/permissive and protected-only phasing resulted in 24-hour protected-only mode even if the conflict factor was only met for 1 hour per day. With four-section left-turn signal faces, variable mode can be used to provide protected-only operation only during the times of day with high conflicts.
* Conflict factor thresholds were aligned to match NCHRP Report 812, Signal Timing Manual, 2nd Edition.

**Section 10.4.3 Pedestrian Intervals**

**New Pub 149 Policy Language:** "When the signalized intersection is operating in coordination with other adjacent signals, the pedestrian phase time should be incorporated into the background cycle if the pedestrian phase is expected to be served 25% or more of the cycles on average while the coordinated timing pattern is in effect. When pedestrian actuation is rare (less than 25% of the cycles), the split time may be set below the necessary pedestrian time, and the signal may go into “free” operation to serve the pedestrian phase and then transition back to coordination."

**Reasons for the policy change:**

* When pedestrian times are not accommodated within the split time during coordination, each cycle when pedestrians are served will cause the signal coordination to go into transition. The transition typically takes 3-4 cycles to return to synchronized coordination. Therefore, if pedestrians are served more than 1 in every 4 (25%) of cycles, the signal will effectively be in transition all the time and the benefits of coordination will not be achieved.

**Section 10.5.3 Emergency Flash**

**New Pub 149 Policy Language:** “Signals previously approved with yellow flashing on the mainline approaches prior to the effective date of this publication should be changed to all-red flashing with the next permit update.”

**Reasons for the policy change:**

* Some drivers don't know the difference between the meaning of a flashing yellow signal and a flashing red signal.
* Driver expectation. If some signals flash red and others yellow, the expectation is not consistent and can be confusing.
* Drivers can't see all signal indications and don't know if everything is flashing yellow or red. Therefore, the driver on a side street who has a flashing red may assume that the main line has a flashing red as well whereas it may be a flashing yellow and they are not stopping.
* Good Samaritan Factor: If the mainline has a flashing yellow and the side street has a flashing red, some drivers may stop and wave the side street through. This can be problematic, especially along multi-lane roads where one driver stops and blocks the view to let the side street through and a driver in another lane does not stop.
* Unequal Service Demand: At busy times of day, it may be difficult or impossible with a flashing red to get a turn to cross if the main street has flashing yellow and is over saturated.
* Multi-Way Stop Applications of the MUTCD. Section 2B.07 Paragraph 04 Part A indicates a Multi-Way stop is an interim measure for a justified traffic signal.
* All red permits safer crossing for pedestrians.
* Technicians perceive greater safety when repairing the issue that caused signal to go into flash.

**Section 16.2 Vehicular Signal Indications**

**New Pub 149 Policy Language:** This section is written to indicate it supplements the referenced MUTCD sections by providing one or more of the following types of information:

* Showing the allowed signal head configuration for use in Pennsylvania
* Modifying certain MUTCD figures for use in Pennsylvania
* Not allowing certain MUTCD figures for use in Pennsylvania
* Providing additional requirements

The four-section left turn signal face with flashing yellow arrow will be required for protected/permitted phasing unless it is a shared lane or for retrofits where the project scope does not include mast arm replacement and the existing mast arm cannot accommodate the flashing yellow arrow signal face (see Exhibit 16-14).

Section 16.2.4 requires non-compliant signal arrangements to be brought into compliance when the overall signal is otherwise modified.

In Section 16.2.5, the minimum number of primary signal faces per approach is modified from the MUTCD to apply to all intersections regardless of speed and upgraded to a standard (“shall”) instead of guidance (“should”). Post-mounted signals will only be permitted on roadways with one through lane and a speed limit of 25 mph or lower.

MUTCD Figure 4D-2 is modified in Exhibit 16-4 to remove references to 8” inch faces being allowed as primary signal faces and to exclude the parking lane when determining the center of the approach.

Section 16.2.6 provides guidelines for use of cut-away vs. tunnel visors, with cut-away visors being preferred unless certain criteria are met for use of tunnel visors.

Section 16.2.7 allows permittees to change circular red protected/prohibited left turn indications to red arrow indications without a permit revision. The LEFT TURN SIGNAL (R10-10L) sign may also be removed when the circular red indication is replaced with a red arrow signal indication.

Section 16.2.8 introduces the ability to use flashing yellow arrow for permissive right turn movements. This section also clarifies that a red right arrow does not prohibit right turn on red in Pennsylvania based on existing language in the Vehicle Code.

**Reasons for the policy change:**

* All traffic signal designs must comply with the MUTCD, except where modified by Pennsylvania regulation. This chapter provides Pennsylvania-specific guidance on the application of the MUTCD to traffic control signals in Pennsylvania, including situations where applications permitted in the MUTCD are not used in Pennsylvania.
* Flashing yellow arrow was first used in Pennsylvania beginning in 2016. Due to safety research indicating benefits with this signal face, it will be the default rather than the older five-section signal face design.
* Requiring signal arrangements to be brought into compliance will help eliminate “blind” left turn phases, which have sometimes been left in place even when other upgrades are made to the traffic signal.
* Requiring overhead signals for approaches with more than one through lane and higher speeds will increase conspicuity for the signal heads and reduce visibility issues due to side occlusion by adjacent vehicles.
* Without prior guidance on the use of cut-away vs. tunnel visors, there were cases where tunnel visors were specified when unnecessary. Use of cut-away visors can reduce start-up lost time when there isn’t a geometric need for tunnel visors.
* Removing the permit revision barrier can help to expedite the conversion of circular red to red arrow indications for protected/prohibited left turn signal faces to improve MUTCD compliance.
* PennDOT conducted a safety evaluation of FYA for a right-turn movement at a pilot location in Bethlehem, PA as part of the [SMART Intersections](https://www.penndot.pa.gov/ProjectAndPrograms/Planning/Research-And-Implementation/Documents/Smart%20Intersections.pdf%27) project in 2022 and found there was a reduction in the critical events with implementation of the FYA right-arrow compared with the prior circular green indication during the walk interval.

**Section 16.2.8 Signal Indications for Right-Turn Movements (Channelized Right Turns)**

**New Pub 149 Content:** A new section is added describing traffic control alternatives for channelized right-turn movements. Channelized right turns can operate as part of the traffic signal operation, with yield control, or uncontrolled with an acceleration lane.

**Reasons for the policy change:**

* Questions often arise regarding acceptable traffic control for channelized right turn movements. The intent of this section is to provide a resource which resolves the issue.

**Section 16.3 Pedestrian Signal Indications**

**New Pub 149 Policy Language:** Accessible pedestrian signals (APS) will be required where pedestrian signal heads are provided. Permit revisions will not be required for updating pedestrian signals heads to include countdown timers or to add APS, but the District Signal Unit should be notified and the changes should be documented in TSAMS.

**Reasons for the policy change:**

* This requirement is included in the 2023 PROWAG Final Rule. Although PROWAG has not yet been adopted by USDOJ or USDOT, beginning to apply this requirement now will reduce the backlog of non-compliant intersections in Pennsylvania when it is adopted.
* APS technology has matured and multiple vendors offer the products and are already approved on Bulletin 15.
* Eliminating the permit revision requirement will reduce a barrier to compliance.

**Section 17.2.2 Detection Zone Function and Location**

**New Pub 149 Policy Language:** Detection zones are classified by type, and the acceptable detector technologies for each type of zone are established.

**Reasons for the policy change:**

* Over-roadway detectors (video, thermal imaging, and radar) are limited due to occlusion caused by the distance and angle between the sensor and the detection zone. Therefore, limitation on the use of these detectors for advance zones and conditions on use for other zone types depending on location are established.
* There are differences in capabilities of radar detection as it relates to capturing presence of stopped vehicles. Therefore, conditions on the use of radar for stop line zones are established.

**Section 19.2 Pavement Markings**

**New Pub 149 Policy Language:** Section 19.2 clarifies the application of pavement markings to help designers apply the standards from Publication 111, TC-8600. The following requirements are established:

* Stop lines shall be 24” width for signalized intersections (Pub 111 allows for 12” min and 24” optional).
* Solid white lane lines shall be used for 150 feet measured from the stop line before transitioning to broken white lines for movements in the same direction.
* Dotted white extension lines should be used in the taper of turn bays to provide positive guidance and to discourage use of the turn bay by through vehicles.
* Type A (parallel) crosswalks are the default crosswalk type unless otherwise identified in the VRU engineering study.
* The ONLY word pavement marking is required for turn bays longer than 300 feet and for lane drops.
* Clarified length of turn bay tapers to be 50’ min. for < 40 mph and 75’ min for > 45 mph

**Reasons for the policy change:**

* 24” stop lines have been used at practically all signalized intersections, but this was never formal policy. This change is intended to establish policy based on existing practice.
* Although solid white lane lines are typically used on the approach to a signalized intersection, the distance has not been standardized in policy. This change is intended to establish policy based on existing practice.
* Pub 111 indicates the solid white lane line is only used for two-thirds of the storage length of a turn bay. Adding a dotted extension line will provide positive guidance to distinguish the turn bay from the through lane.
* Although Pub 111 and the MUTCD provide different crosswalk types, the selection of the crosswalk type at individual intersections has been applied inconsistently. The policy is intended to promote consistency for protection of vulnerable road users.
* The use of the ONLY word pavement marking for lane drops is required by the MUTCD. The use for long turn bays is proposed to provide consistency across districts and provide extra clarity that a long lane is a turn bay.
* The minimum turn bay taper length in Pub 111 is based on the turn bay length. The proposed language in Pub 149 will provide a consistent design aligned with current typical practice.

**Section 19.3 Signs**

**New Pub 149 Policy Language:** Section 19.3 clarifies the application of signs to help designers apply the standards from Publication 236, Handbook of Approved Signs. The following requirements are established:

* Clarifies when lane control signs should be post-mounted or overhead-mounted.
* Eliminates the use of the Right Turn Signal (R10-10R) sign.
* Updates No Turn on Red signs, eliminating the use of the red circular symbol version of the sign.

**Reasons for the policy change:**

* The requirements for post-mounted vs. overhead-mounted signs are intended to formalize existing practices which are not documented in policy.
* The Right Turn Signal sign has been used incorrectly throughout Pennsylvania. The sign would only apply when a signal face displays a circular red for right turns while adjacent signal faces display a circular green for through traffic. The Right Turn Signal sign was not intended to be used with five-section shared signal faces where the circular indications are the same as adjacent signal faces. The Right Turn Signal sign has caused confusion because drivers may mistake the meaning as No Turn on Red.
* The 11th edition of the MUTCD changed the usage of No Turn on Red signs. The situation described in the MUTCD for use of the R10-11a symbol sign would not exist in Pennsylvania. Therefore, only the word message signs will be used.

**Section 33.4 Traffic Signal Plan Sheet Charts & Diagrams**

**New Pub 149 Policy Language:** The Movement, Sequence, and Timing Chart is split into a Movement and Sequence Chart and several tables for phase timing, overlaps, preemption, and coordination.

**Reasons for the policy change:**

* The previous MST was designed for interval-based controller rather phase-based controllers.
* The previous MST format showed combinations of phases but didn’t clearly indicate the sequence.
* The previous MST format did not provide a way to use different timing settings for phases which operate together. For example, if the approaches for Phases 4 and 8 have different speed limits, the clearance times could not be set correctly for both approaches. It was also difficult to tell when different maximum times applied to different left turn phases.
* The previous MST did not clearly connect which signal faces are controlled by phases and which are controlled by overlaps. The use of overlaps required complex operational notes.
* The proposed format is more closely aligned with how modern controllers are programmed, which will facilitate easier inspection of timings to ensure compliance with the approved plan/permit.
* Better alignment between the design phase and construction/implementation of timings is more likely to prevent a designer from developing a phasing sequence which cannot be implemented or would be difficult to program into a controller.

**Section 35.3 Special Provisions**

**New Pub 149 Policy Language:** "For PennDOT-let projects, all project-specific special provisions relating to traffic signals must be reviewed and approved by the Chief of the TSMO Arterials and Planning Section prior to advertisement in ECMS."

**Reasons for the policy change:**

* Standard specifications for traffic signals in Publication 408 were significantly updated in October 2021 after a multi-year process including input from each district to incorporate specifications which were frequently leading to special provisions. Prior to these changes, almost all traffic signal items statewide were non-standard items with special provisions. These changes should have eliminated the majority of special provisions related to traffic signals.
* Bidding projects using standard items reducing risk for contractors, which will lead to more competitive bidding and better prices.
* Use of standard items provides for better cost estimates since ECMS Item Price History can be used to compare the same items.
* Review time for source of supply will be reduced since Bulletin 15 approval means a detailed review of the product against the specifications is not required for each project.

**Publication 149 – Future Changes**

The items described below are being developed under separate efforts and will be the subject of future clearance transmittals.

**Chapter 12 Supports**

The design criteria for traffic signal supports is currently based on the 2001 AASHTO “Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals” with the 2002, 2003, and 2006 interim updates. PennDOT is developing alternative design standards using the AASHTO “LRFD Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.” When the LRFD design criteria are established, Chapter 12 of Pub 149 will be updated along with Publication 148, TC-8800 Series.

**Chapter 18 Adaptive Signal Control Technology (ASCT) Systems**

PennDOT proposed changes to Section 3.3 and Chapter 11 to implement the Traffic Signal System Solution Toolbox in CT #T-24-010 issued on June 18, 2024. Updates to Publication 149 based on the comments received through that CT will either be incorporated into the final version of the publication under this CT or through a later change depending on the magnitude of comments.

**Section 33.2.3 Digital Model**

PennDOT is developing updates to signal plan presentation using digital models as the design of record for traffic signals under a separate effort. The digital model requirements will be incorporated into Section 33.2.3 at the conclusion of that effort. The plan presentation styles developed under that effort are included in Section 33.2.2 of this edition.