VULNERABLE ROAD USERS AT TRAFFIC SIGNALS

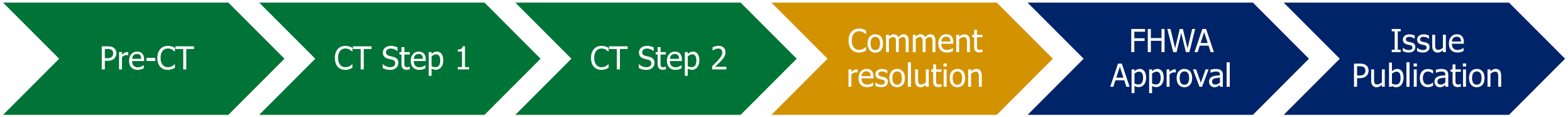
ITE MID-COLONIAL DISTRICT ANNUAL MEETING • APRIL 16, 2026

Pennsylvania Department of Transportation

PHOTO CREDIT: CITY OF PITTSBURGH

Traffic Signal Design Handbook (149)

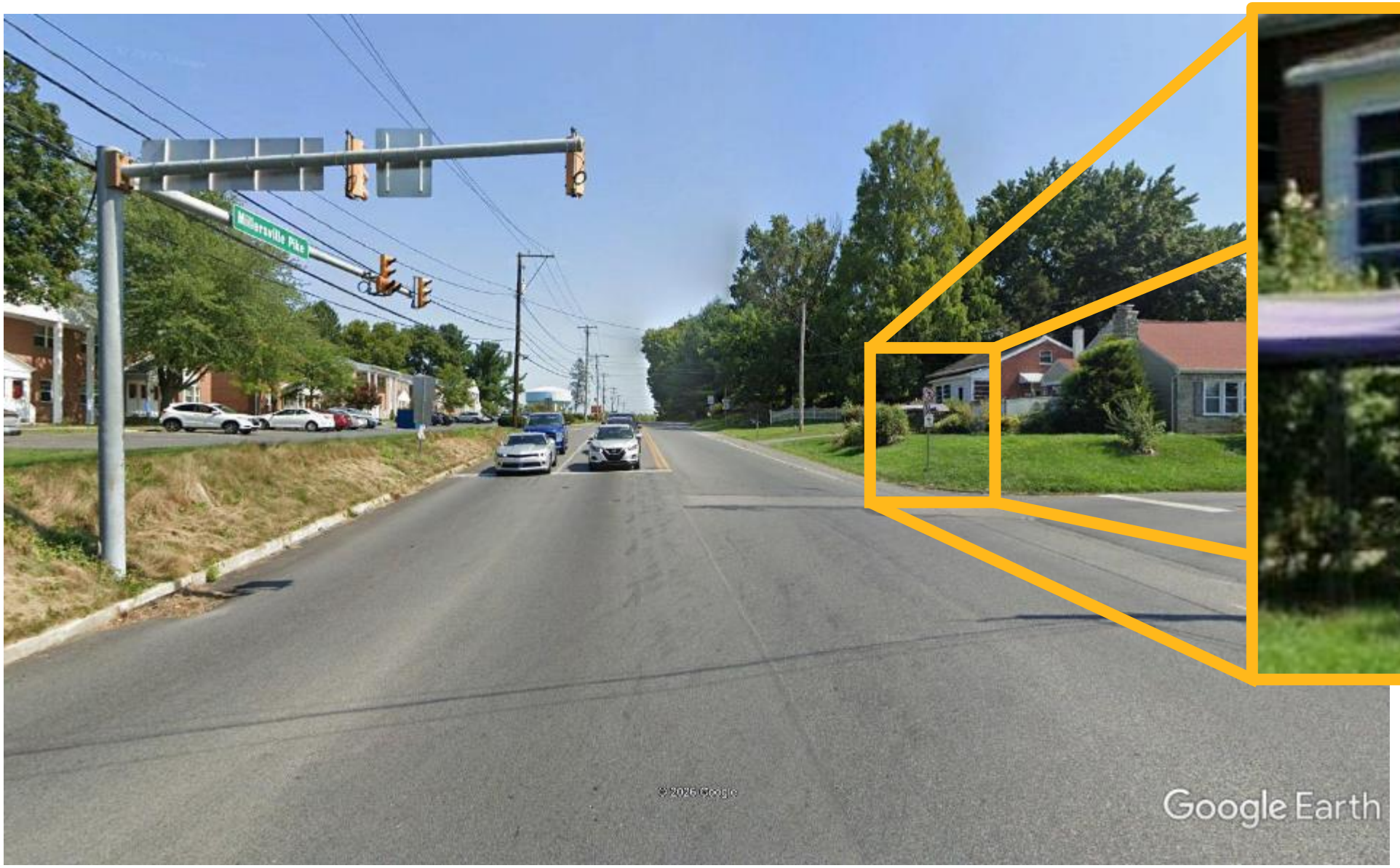
- Publication Update Status



- VRU Goals
  - Pedestrians
    - "Accommodate" → Users with designated traffic signal features
    - Align traffic signal features with anticipated pedestrian usage
  - Bicyclists
    - Incorporate bike signals in MUTCD 11th edition

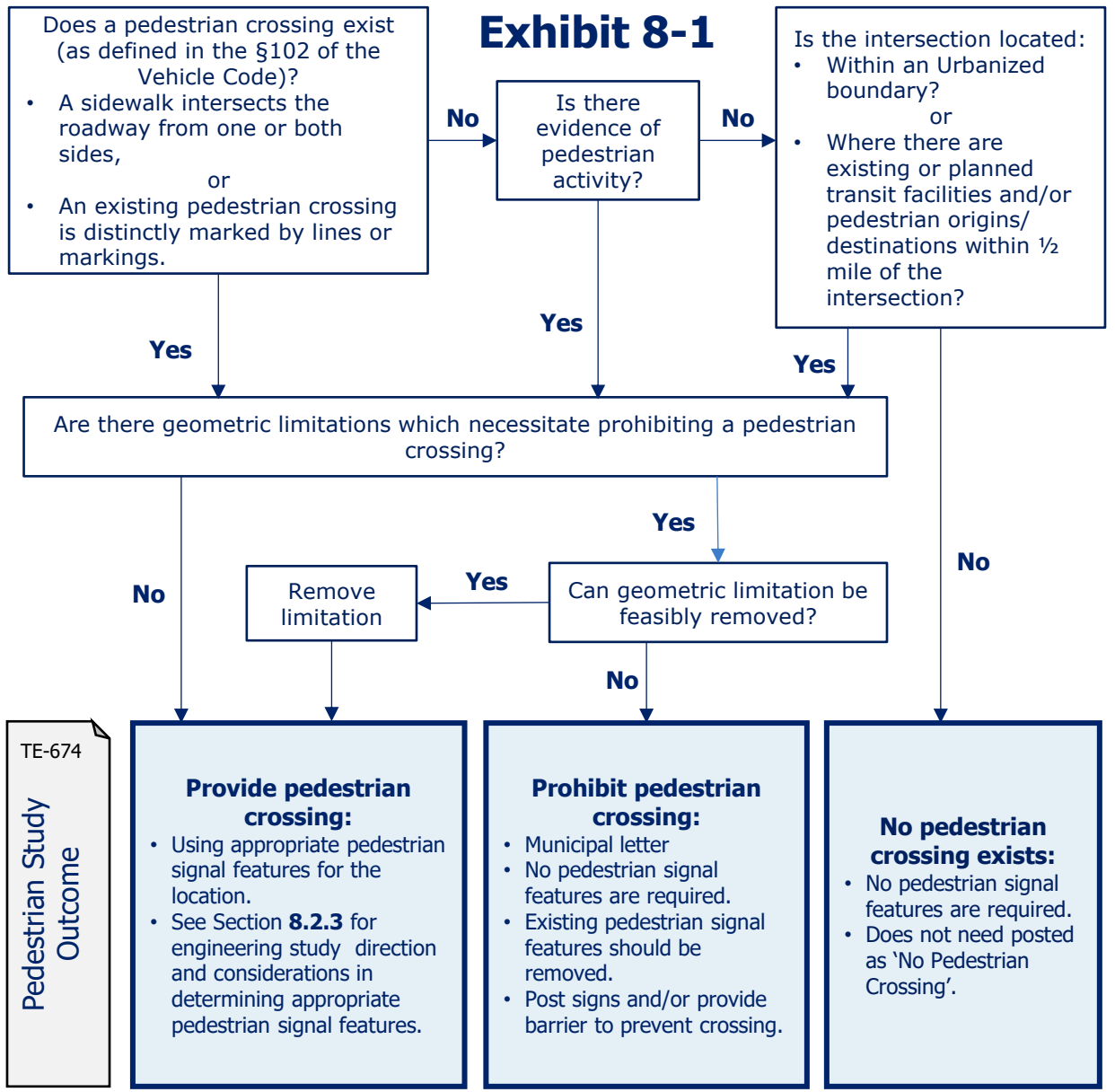
Right-Sized Pedestrian Features?

Right-Sized Pedestrian Features?

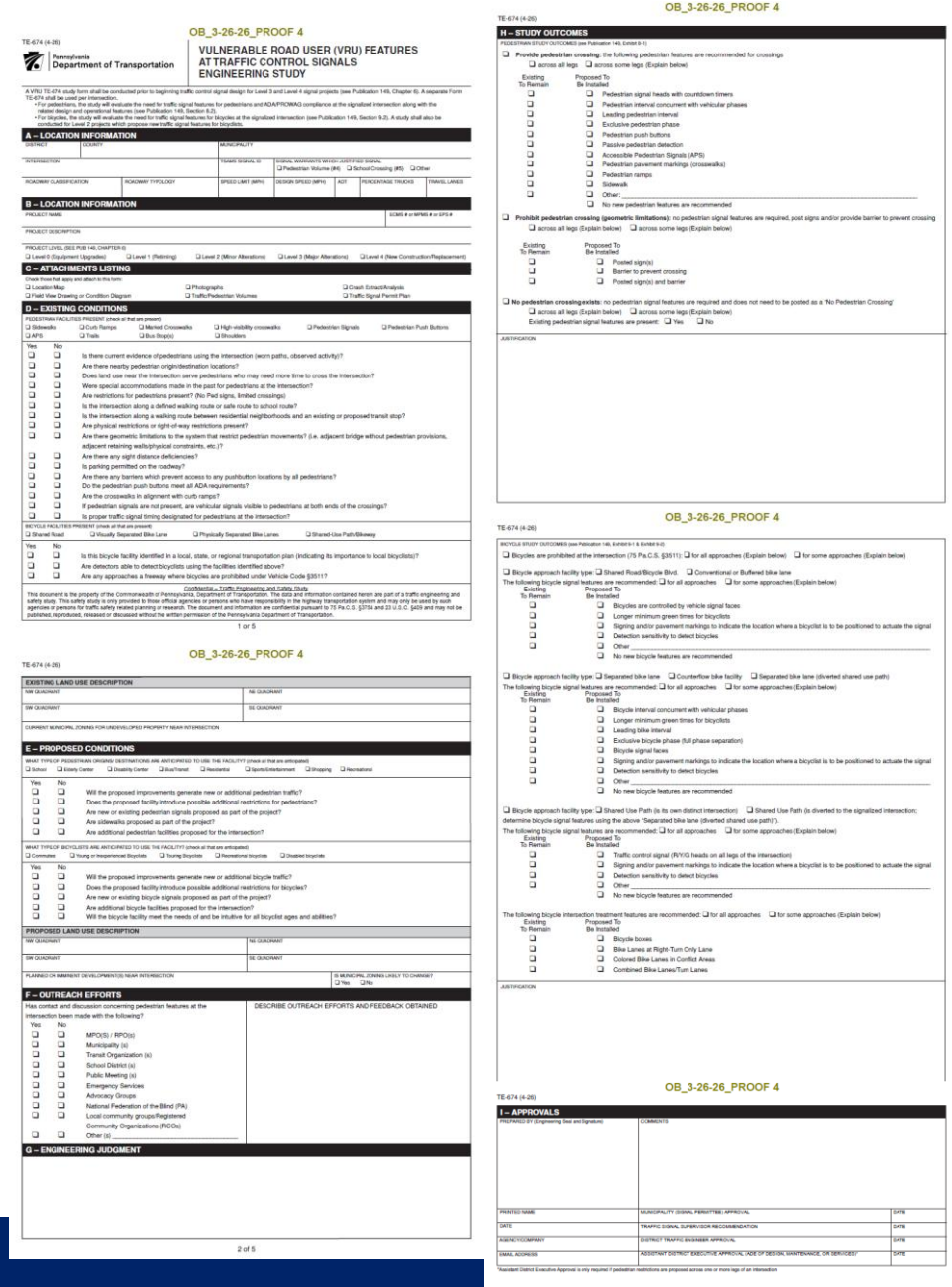


PEDESTRIANS AT SIGNALS

- Clarify engineering study requirements
  - Required for Level 3 and Level 4 projects (see Chapter 6)
  - Evaluate the need for pedestrian amenities
  - Evaluate ADA compliance
  - Approval by DTE
  - ADE must also approve if restrictions recommended
- New Form TE-674
- Pedestrian amenities
  - Pedestrian signal heads
  - Pedestrian detectors
  - Accessible Pedestrian Signals (APS)
  - Pedestrian pavement markings (crosswalks)
  - Pedestrian ramps
  - Sidewalks
  - Lighting



New TE-674: VRU Engineering Study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TE-674 (4-26)

Pennsylvania Department of Transportation

VULNERABLE ROAD USER (VRU) FEATURES AT TRAFFIC CONTROL SIGNALS ENGINEERING STUDY

A VRU TE-674 study form shall be conducted prior to beginning traffic control signal design for Level 3 and Level 4 signal projects (see Publication 149, Chapter 6). A separate Form TE-674 shall be used per intersection.
- For pedestrians, the study will evaluate the need for traffic signal features for pedestrians and ADA/PROWAG compliance at the signalized intersection along with the related design and operational features (see Publication 149, Section 6.2).
- For bicycles, the study will evaluate the need for traffic signal features for bicycles at the signalized intersection (see Publication 149, Section 9.2). A study shall also be conducted for Level 2 projects which propose new traffic signal features for bicyclists.

A – LOCATION INFORMATION

DISTRICT | COUNTY | MUNICIPALITY

INTERSECTION | TIMMS SIGNAL ID | SIGNAL WARRANTS WHICH JUSTIFIED SIGNAL ☐ Pedestrian Volume (#6) ☐ School Crossing (#5) ☐ Other

ROADWAY CLASSIFICATION | ROADWAY TYPOLOGY | SPEED LIMIT (MPH) | DESIGN SPEED (MPH) | ADT | PERCENTAGE TRUCKS | TRAVEL LANES

B – LOCATION INFORMATION

PROJECT NAME | SCMS # or MPMS # or EPS #

PROJECT DESCRIPTION

PROJECT LEVEL (SEE PUB 148, CHAPTER 6)
☐ Level 0 (Equipment Upgrades) ☐ Level 1 (Retiming) ☐ Level 2 (Minor Alterations) ☐ Level 3 (Major Alterations) ☐ Level 4 (New Construction/Replacement)

C – ATTACHMENTS LISTING

Check those that apply and attach to this form:
☐ Location Map ☐ Photographs ☐ Crash Extract/Analysis
☐ Field View Drawing or Condition Diagram ☐ Traffic/Pedestrian Volumes ☐ Traffic Signal Permit Plan

D – EXISTING CONDITIONS

PEDESTRIAN FACILITIES PRESENT (check all that are present)
☐ Sidewalks ☐ Curb Ramps ☐ Marked Crosswalks ☐ High-visibility crosswalks ☐ Pedestrian Signals ☐ Pedestrian Push Buttons
☐ APS ☐ Trails ☐ Bus Stop(s) ☐ Shoulders

Yes	No	
☐	☐	Is there current evidence of pedestrians using the intersection (worn paths, observed activity)?
☐	☐	Are there nearby pedestrian origin/destination locations?
☐	☐	Does land use near the intersection serve pedestrians who may need more time to cross the intersection?
☐	☐	Were special accommodations made in the past for pedestrians at the intersection?
☐	☐	Are restrictions for pedestrians present? (No Ped signs, limited crossings)
☐	☐	Is the intersection along a defined walking route or safe route to school route?
☐	☐	Is the intersection along a walking route between residential neighborhoods and an existing or proposed transit stop?
☐	☐	Are physical restrictions or right-of-way restrictions present?
☐	☐	Are there geometric limitations to the system that restrict pedestrian movements? (i.e. adjacent bridge without pedestrian provisions, adjacent retaining walls/physical constraints, etc.)?
☐	☐	Are there any sight distance deficiencies?
☐	☐	Is parking permitted on the roadway?
☐	☐	Are there any barriers which prevent access to any pushbutton locations by all pedestrians?
☐	☐	Do the pedestrian push buttons meet all ADA requirements?
☐	☐	Are the crosswalks in alignment with curb ramps?
☐	☐	If pedestrian signals are not present, are vehicular signals visible to pedestrians at both ends of the crossings?
☐	☐	Is proper traffic signal timing designated for pedestrians at the intersection?

BICYCLE FACILITIES PRESENT (check all that are present)
☐ Shared Road ☐ Visually Separated Bike Lane ☐ Physically Separated Bike Lanes ☐ Shared-Use Path/Bikeway

Yes	No	
☐	☐	Is this bicycle facility identified in a local, state, or regional transportation plan (indicating its importance to local bicyclists)?
☐	☐	Are detectors able to detect bicyclists using the facilities identified above?
☐	☐	Are any approaches a freeway where bicycles are prohibited under Vehicle Code §3511?

Confidential – Traffic Engineering and Safety Study
This document is the property of the Commonwealth of Pennsylvania, Department of Transportation. The data and information contained herein are part of a traffic engineering and safety study. This safety study is only provided to those official agencies or persons who have responsibility in the highway transportation system and may only be used by such agencies or persons for traffic safety related planning or research. The document and information are confidential pursuant to 75 Pa.C.S. §3754 and 23 U.S.C. §409 and may not be published, reproduced, released or discussed without the written permission of the Pennsylvania Department of Transportation.

1 of 5

OB_3-26-26_PROOF 4

TE-674 (4-26)

EXISTING LAND USE DESCRIPTION

NW QUADRANT | NE QUADRANT

SW QUADRANT | SE QUADRANT

CURRENT MUNICIPAL ZONING FOR UNDEVELOPED PROPERTY NEAR INTERSECTION

E – PROPOSED CONDITIONS

WHAT TYPE OF PEDESTRIAN ORIGINS/ DESTINATIONS ARE ANTICIPATED TO USE THE FACILITY? (check all that are anticipated)
☐ School ☐ Elderly Center ☐ Disability Center ☐ Bus/Transit ☐ Residential ☐ Sports/Entertainment ☐ Shopping ☐ Recreational

Yes	No	
☐	☐	Will the proposed improvements generate new or additional pedestrian traffic?
☐	☐	Does the proposed facility introduce possible additional restrictions for pedestrians?
☐	☐	Are new or existing pedestrian signals proposed as part of the project?
☐	☐	Are sidewalks proposed as part of the project?
☐	☐	Are additional pedestrian facilities proposed for the intersection?

WHAT TYPE OF BICYCLISTS ARE ANTICIPATED TO USE THE FACILITY? (check all that are anticipated)
☐ Commuters ☐ Young or Inexperienced Bicyclists ☐ Touring Bicyclists ☐ Recreational bicyclists ☐ Disabled bicyclists

Yes	No	
☐	☐	Will the proposed improvements generate new or additional bicycle traffic?
☐	☐	Does the proposed facility introduce possible additional restrictions for bicycles?
☐	☐	Are new or existing bicycle signals proposed as part of the project?
☐	☐	Are additional bicycle facilities proposed for the intersection?
☐	☐	Will the bicycle facility meet the needs of and be intuitive for all bicyclist ages and abilities?

PROPOSED LAND USE DESCRIPTION

NW QUADRANT | NE QUADRANT

SW QUADRANT | SE QUADRANT

PLANNED OR IMMINENT DEVELOPMENT(S) NEAR INTERSECTION | IS MUNICIPAL ZONING LIKELY TO CHANGE? ☐ Yes ☐ No

F – OUTREACH EFFORTS

Has contact and discussion concerning pedestrian features at the intersection been made with the following?

Yes	No		DESCRIBE OUTREACH EFFORTS AND FEEDBACK OBTAINED
☐	☐	MPO(S) / RPO(s)	
☐	☐	Municipality (s)	
☐	☐	Transit Organization (s)	
☐	☐	School District (s)	
☐	☐	Public Meeting (s)	
☐	☐	Emergency Services	
☐	☐	Advocacy Groups	
☐	☐	National Federation of the Blind (PA)	
☐	☐	Local community groups/Registered Community Organizations (RCOs)	
☐	☐	Other (s) _____	

G – ENGINEERING JUDGMENT

2 of 5

OB_3-26-26_PROOF 4

TE-674 (4-26)

H – STUDY OUTCOMES

PEDESTRIAN STUDY OUTCOMES (see Publication 149, Exhibit 6-1)

☐ **Provide pedestrian crossing:** the following pedestrian features are recommended for crossings
☐ across all legs ☐ across some legs (Explain below)

Existing To Remain	Proposed To Be Installed	
☐	☐	Pedestrian signal heads with countdown timers
☐	☐	Pedestrian interval concurrent with vehicular phases
☐	☐	Leading pedestrian interval
☐	☐	Exclusive pedestrian phase
☐	☐	Pedestrian push buttons
☐	☐	Passive pedestrian detection
☐	☐	Accessible Pedestrian Signals (APS)
☐	☐	Pedestrian pavement markings (crosswalks)
☐	☐	Pedestrian ramps
☐	☐	Sidewalk
☐	☐	Other: _____
	☐	No new pedestrian features are recommended

☐ **Prohibit pedestrian crossing (geometric limitations):** no pedestrian signal features are required, post signs and/or provide barrier to prevent crossing
☐ across all legs (Explain below) ☐ across some legs (Explain below)

Existing To Remain	Proposed To Be Installed	
☐	☐	Posted sign(s)
☐	☐	Barrier to prevent crossing
☐	☐	Posted sign(s) and barrier

☐ **No pedestrian crossing exists:** no pedestrian signal features are required and does not need to be posted as a 'No Pedestrian Crossing'
☐ across all legs (Explain below) ☐ across some legs (Explain below)
Existing pedestrian signal features are present: ☐ Yes ☐ No

JUSTIFICATION

OB_3-26-26_PROOF 4

TE-674 (4-26)

BICYCLE STUDY OUTCOMES (see Publication 149, Exhibit 9-1 & Exhibit 9-2)

☐ Bicycles are prohibited at the intersection (75 Pa.C.S. §3511): ☐ for all approaches (Explain below) ☐ for some approaches (Explain below)

☐ Bicycle approach facility type: ☐ Shared Road/Bicycle Blvd. ☐ Conventional or Buffered bike lane
The following bicycle signal features are recommended: ☐ for all approaches ☐ for some approaches (Explain below)

Existing To Remain	Proposed To Be Installed	
☐	☐	Bicycles are controlled by vehicle signal faces
☐	☐	Longer minimum green times for bicyclists
☐	☐	Signing and/or pavement markings to indicate the location where a bicyclist is to be positioned to actuate the signal
☐	☐	Detection sensitivity to detect bicycles
☐	☐	Other _____
	☐	No new bicycle features are recommended

☐ Bicycle approach facility type: ☐ Separated bike lane ☐ Counterflow bike facility ☐ Separated bike lane (diverted shared use path)
The following bicycle signal features are recommended: ☐ for all approaches ☐ for some approaches (Explain below)

Existing To Remain	Proposed To Be Installed	
☐	☐	Bicycle interval concurrent with vehicular phases
☐	☐	Longer minimum green times for bicyclists
☐	☐	Leading bike interval
☐	☐	Exclusive bicycle phase (full phase separation)
☐	☐	Bicycle signal faces
☐	☐	Signing and/or pavement markings to indicate the location where a bicyclist is to be positioned to actuate the signal
☐	☐	Detection sensitivity to detect bicycles
☐	☐	Other _____
	☐	No new bicycle features are recommended

☐ Bicycle approach facility type: ☐ Shared Use Path (is its own distinct intersection) ☐ Shared Use Path (is diverted to the signalized intersection; determine bicycle signal features using the above 'Separated bike lane (diverted shared use path)').
The following bicycle signal features are recommended: ☐ for all approaches ☐ for some approaches (Explain below)

Existing To Remain	Proposed To Be Installed	
☐	☐	Traffic control signal (R/Y/G heads on all legs of the intersection)
☐	☐	Signing and/or pavement markings to indicate the location where a bicyclist is to be positioned to actuate the signal
☐	☐	Detection sensitivity to detect bicycles
☐	☐	Other _____
	☐	No new bicycle features are recommended

The following bicycle intersection treatment features are recommended: ☐ for all approaches ☐ for some approaches (Explain below)

Existing To Remain	Proposed To Be Installed	
☐	☐	Bicycle boxes
☐	☐	Bike Lanes at Right-Turn Only Lane
☐	☐	Colored Bike Lanes in Conflict Areas
☐	☐	Combined Bike Lanes/Turn Lanes

JUSTIFICATION

OB_3-26-26_PROOF 4

TE-674 (4-26)

I – APPROVALS

PREPARED BY (Engineering Seal and Signature) | COMMENTS

PRINTED NAME	MUNICIPALITY (SIGNAL PERMITTEE) APPROVAL	DATE
DATE	TRAFFIC SIGNAL SUPERVISOR RECOMMENDATION	DATE
AGENCY/COMPANY	DISTRICT TRAFFIC ENGINEER APPROVAL	DATE
EMAIL ADDRESS	ASSISTANT DISTRICT EXECUTIVE APPROVAL* (ADE OF DESIGN, MAINTENANCE, OR SERVICES)*	DATE

*Assistant District Executive Approval is only required if pedestrian restrictions are proposed across one or more legs of an intersection

- Location Information
- Attachments Listing
- Existing Conditions
- Proposed Conditions
- Outreach Efforts
- Engineering Judgment
- Study Outcomes
  - Pedestrian Facilities
  - Bicycle Facilities
- Approvals

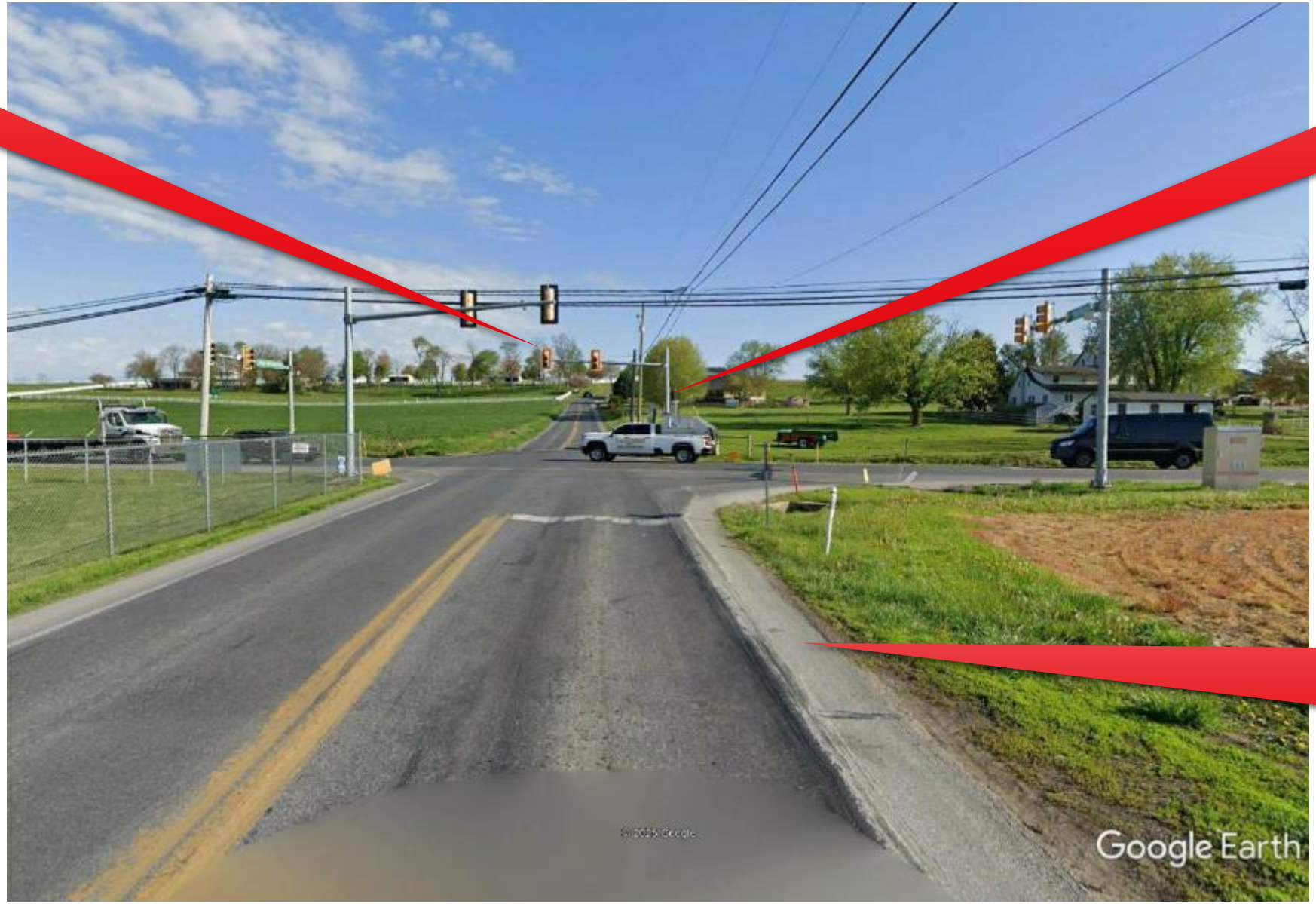
Pedestrian Crossings

- Unless geometric limitations, pedestrian crossing **should** be provided if any of the following
  - Pedestrian crossing exists as defined in the Vehicle Code (marked or unmarked crosswalk)
    - Sidewalk intersects the roadway from one or both sides on any approach to the intersection OR
    - Existing pedestrian crossing is distinctly marked by lines or markings
  - Evidence of pedestrian activity
    - One or more peds in traffic count OR
    - Physical evidence such as worn path
  - Presumed pedestrian activity
    - Intersection located inside urbanized area on Functional Classification Map
    - Existing or proposed transit facilities and/or pedestrian generators within ½ mile
    - Pedestrian origins/destinations within ½ mile (any land use with residents, employees, or guests who could travel as a pedestrian, and pedestrian facilities within property)

Sidewalk: That portion of a street between the curb line, or the lateral line of a roadway, and the adjacent property line or on the easements of private property that is paved or improved and intended for use by pedestrians

No Pedestrian Crossing Exists

Vehicle signals visible to pedestrians



No pedestrian amenities, but peds not prohibited

Not a sidewalk, but pedestrians permitted to travel here

Geometric Constraints

- Pedestrian crossing may be prohibited if there are geometric constraints that limit safe pedestrian movements at one or both ends of a crossing area.
- Examples (not all-inclusive):
  - Underground structures
  - Elevation differences requiring structures such as bridges or retaining walls
  - Lack of shoulder with a physical barrier (guide rail, concrete barrier, etc.)
  - Uncorrectable sight distance limitations for any feasible crossing location
- Prohibition requirements, ped circulation path must be either:
  - Separated from roadway with landscaping or other non-prepared surface at least 24 inches wide
  - Separated from roadway by detectable vertical edge treatment with a bottom no more than 15 inches above the ped circulation path
- No Ped Sign (R9-3) shall not be used alone without separating ped circulation path, unless approved on Technically Infeasible Form
- Lack of ADA compliance is not justification to prohibit ped crossings

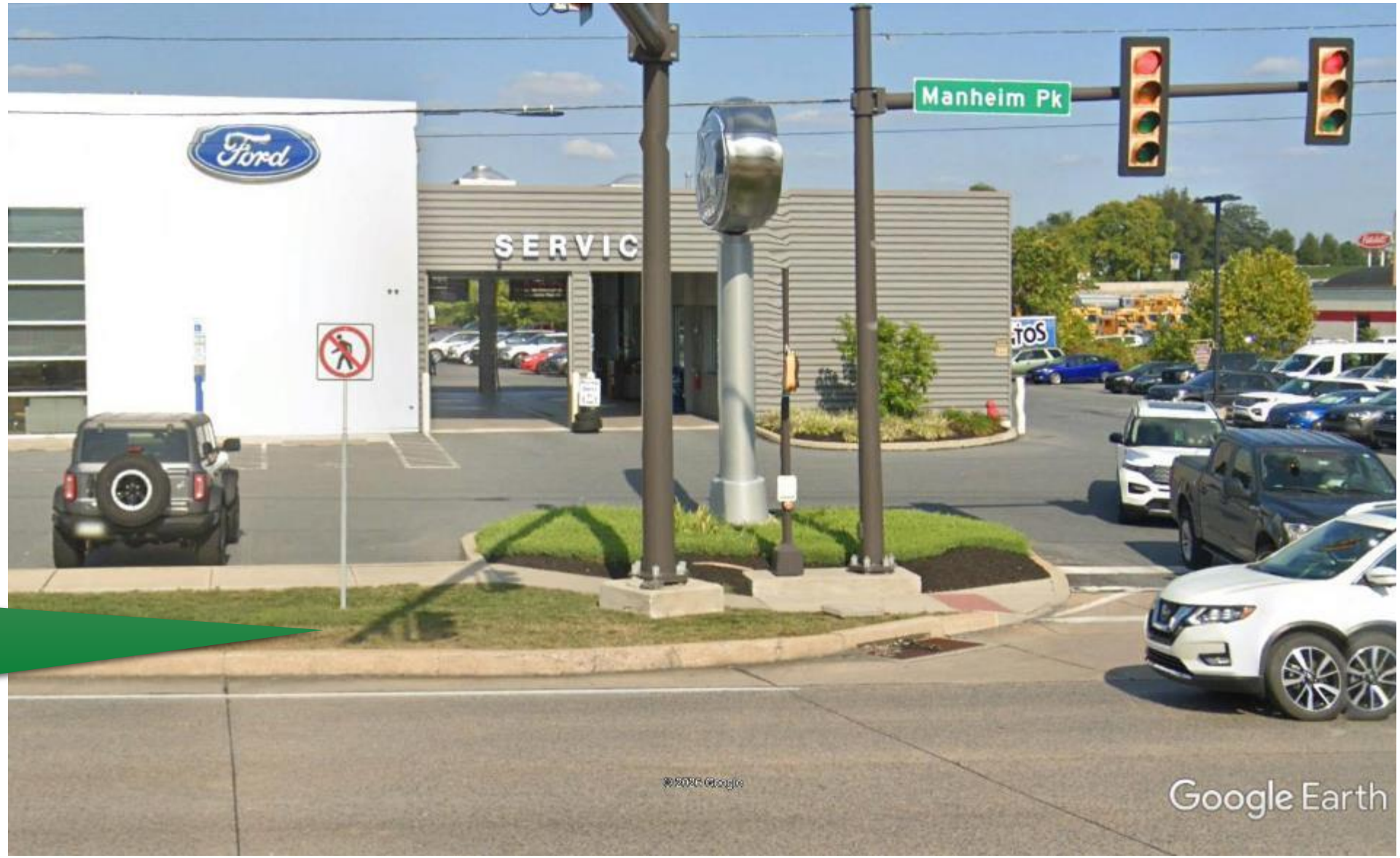
Infeasible Crossing: Prohibit

Underground structure

Should allow peds to cross here with no amenities (lack of ADA is not justification to prohibit peds)

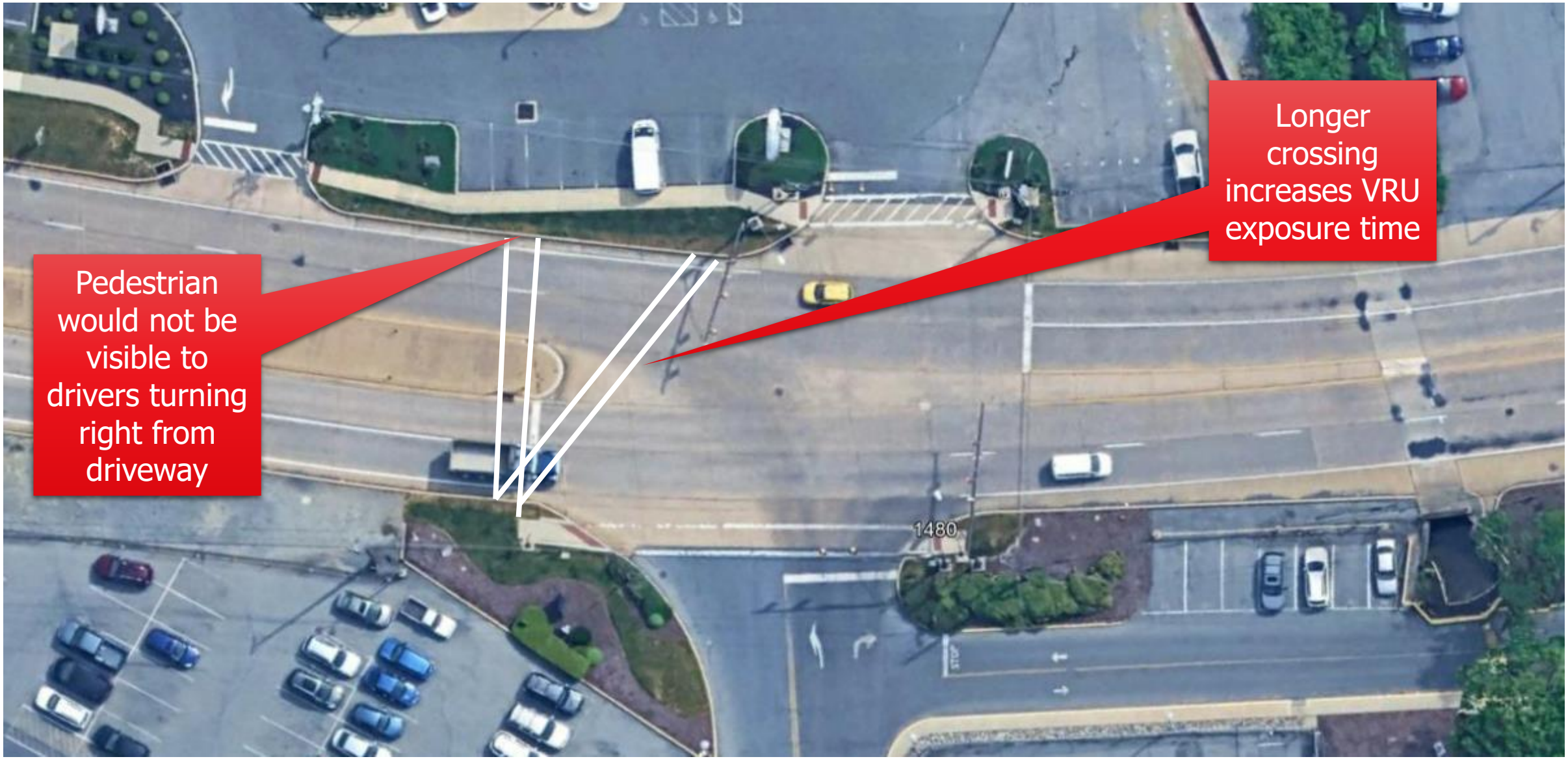
Lack of shoulder with physical barrier (guiderail)

Ped. Circulation Path Separation



Landscaped area separating sidewalk (ped. circulation path) in the direction where crossing is prohibited

Infeasible Crossing to Prohibit?



Pedestrian Signal Heads

- Install where required by MUTCD Section 4D.02
- Additional, PA-specific requirements
  - Define "established school crossings"
    - Intersection adjacent to school property which meets definition of school zone in Title 67, Chapter 212
    - School crossing is an official school crossing designated by school and/or traffic officials responsible for school safety
  - Where pedestrian crossings regularly occur and the normal vehicle clearance time (yellow + red clear) is less than the calculated pedestrian clearance time
- When calculated ped clearance time is less than the normal vehicle clearance time (yellow + red clear), such as very short crossings, pedestrian signal heads not required regardless of ped volume
- All new and replaced ped signal heads shall contain pedestrian change interval countdown timer and provide Accessible Pedestrian Signals.
- If ped signal heads not recommended, a vehicular signal head must be visible to a pedestrian within crosswalk

Restored old language from 1988 edition of Pub 149

Pedestrian Detectors

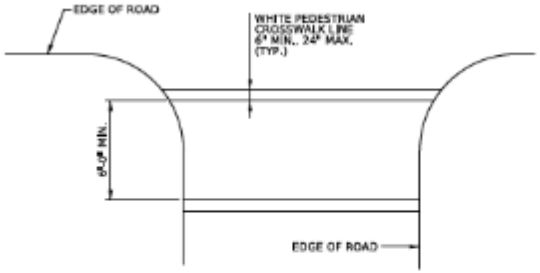
- Detection required when pedestrian signal heads are provided and the walk indication is not provided every cycle
- Detection may be used without ped heads to call and extend green interval to provide sufficient green time for peds to cross
- Types of detection:
  - Push buttons
  - Passive pedestrian detection

Accessible Pedestrian Signals (APS)

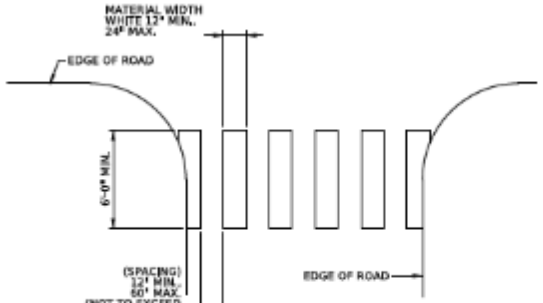
- Use criteria in MUTCD Chapter 4K
- Required elements
  - Push button locator tone
  - Vibrotactile walk indication
  - Audible walk indication at beginning of crosswalk (during walk interval only)
    - Percussive tone
    - Speech message (only if <10 feet from another APS)
  - Speech push button information message

CROSSWALKS

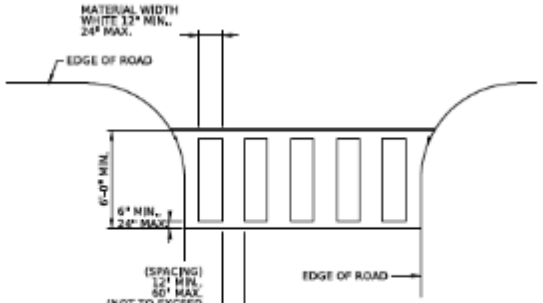
- Design in accordance with Pub 111, TC-8600 Sheets 5 and 6
- Type A (transverse) crosswalks are typical for signalized intersections
- High-visibility crosswalks (Type B, C, or D) may be used if either:
  - Study identifies need for high-visibility crosswalks to provide additional emphasis to the pedestrian crossing
  - Municipality systematically uses high visibility crosswalks
- Crosswalks with aesthetic surface treatments should only be used when requested by the municipality and accompanied by maintenance agreement



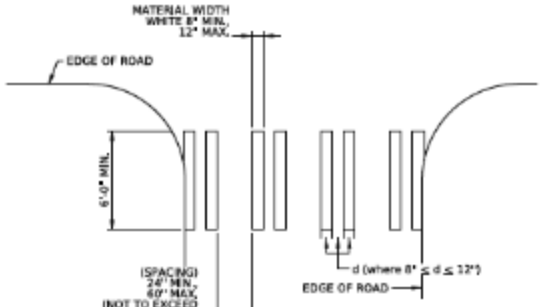
TYPE A - TRANSVERSE



TYPE B - LONGITUDINAL BAR (HIGH-VISIBILITY)



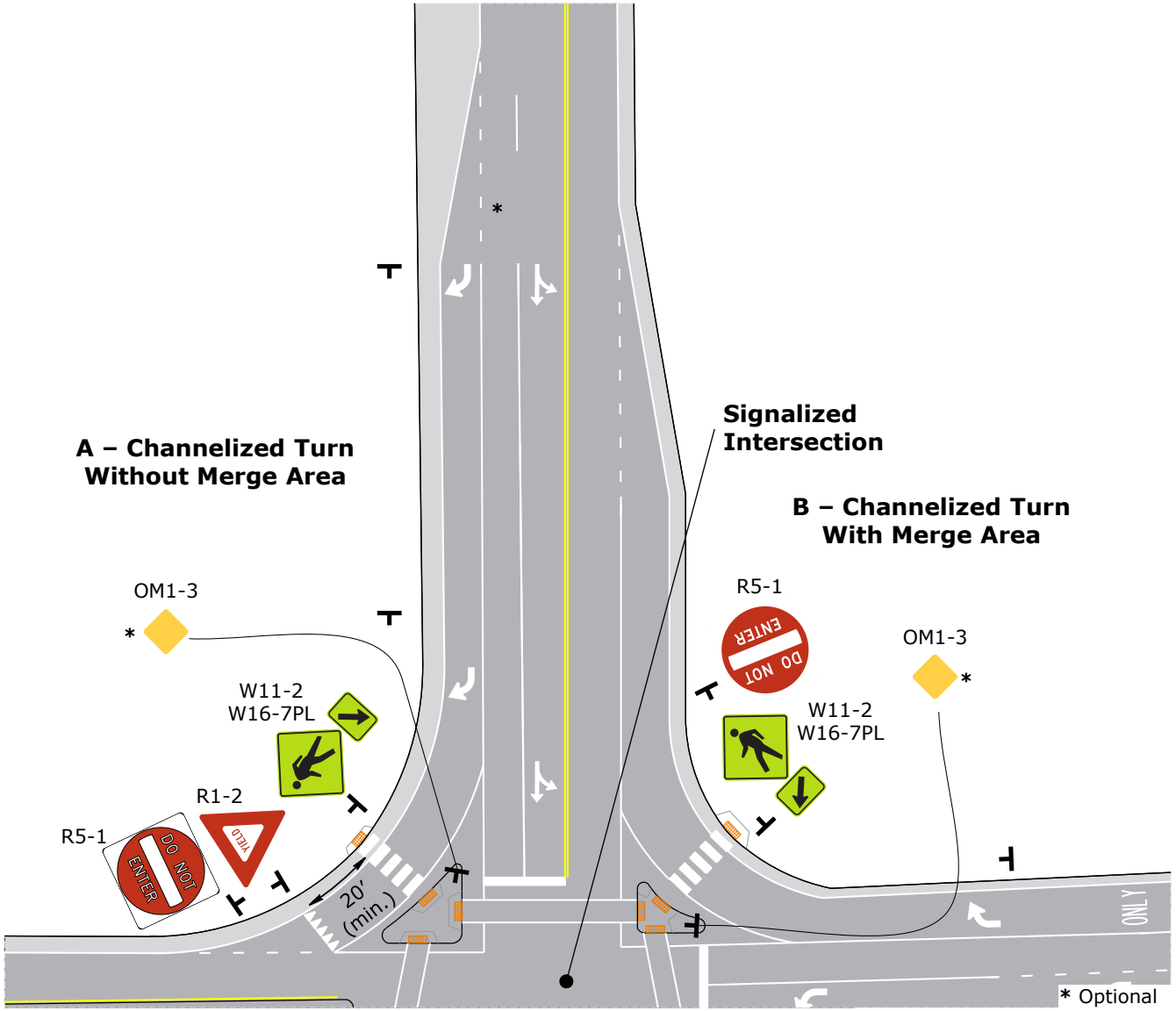
TYPE C - LADDER (HIGH-VISIBILITY)



TYPE D - BAR PAIR (HIGH-VISIBILITY)

Crosswalks for Right-Turn Yield

- Must use high-visibility crosswalks for uncontrolled pedestrian crossings
- Locate crosswalks to provide optimum sight distance for both pedestrian and driver involved

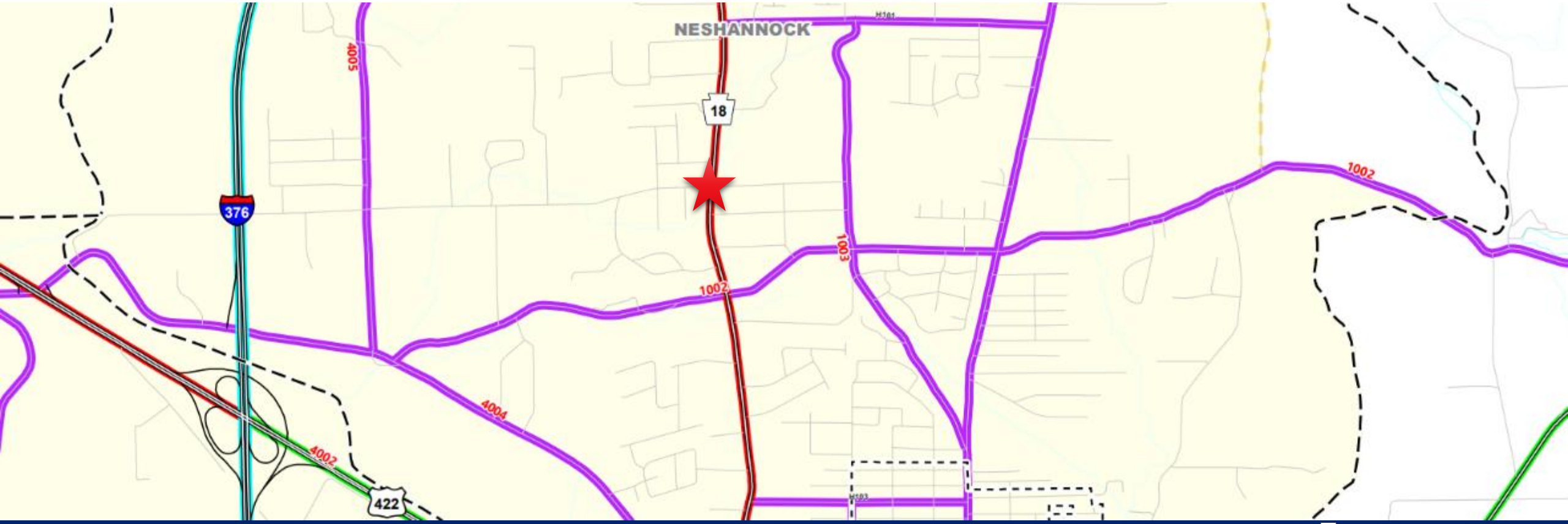


Case Study: New Traffic Signal

- Is there evidence of pedestrian activity?
- Does a pedestrian crossing exist per Vehicle Code?

Case Study: New Traffic Signal

- Is the intersection located:
  - Within an Urbanized boundary?
  - Where there are existing or planned transit facilities and/or pedestrian generators within ½ mile of the intersection?

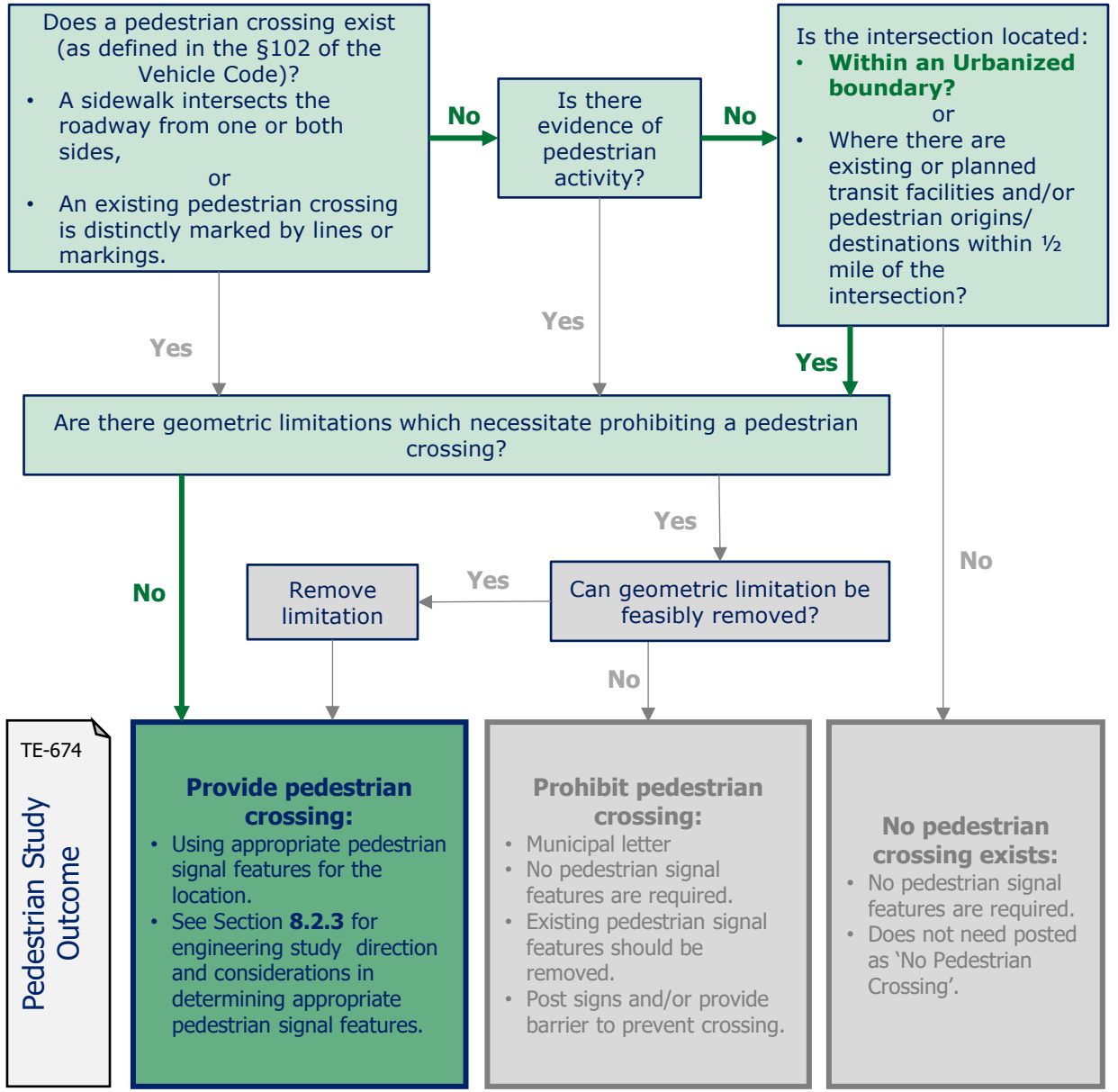


Case Study: New Traffic Signal

- Are there geometric limitations which necessitate prohibiting a crossing?

Case Study: Ped Study Outcomes

- Provide pedestrian crossing
  - Within urbanized boundary
  - Assume pedestrians even if no specific generators were identified



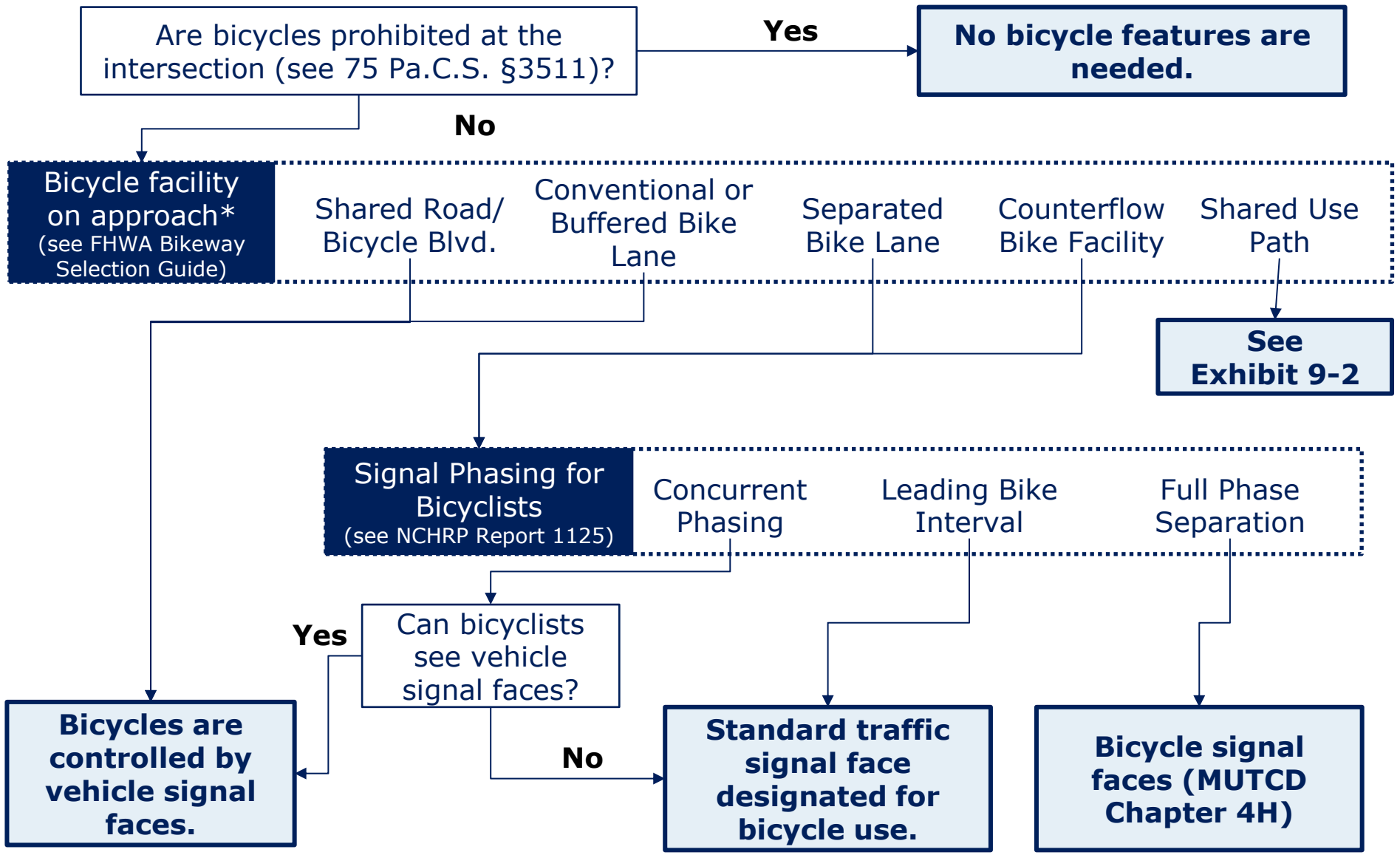
Case Study

- Old method
  - No right-of-way for amenities
  - Ped/bike checklist completed
    - Determined no ped generators
    - Prohibited peds on all legs
- Customer outreach
  - Outraged that PennDOT made it illegal for pedestrians to cross the intersection and noted he didn't have a car

Bicycles at Signals

- Bicycles operating on Pennsylvania roadways are considered vehicles
- Bicycles should be expected at all signalized intersections
- Signal design shall provide for safe and efficient operation of bicyclists
- Traffic signal features to accommodate bicyclists
  - Traffic signal indications
  - Signal phasing
  - Bicyclist detection
  - Controller signal timing
  - Intersection treatments
  - Shared-use pathway crossings
- Pub 149 focuses on signal design for bicyclists
- For bicycle facilities approaching the intersection, see DM-2 Chapter 14

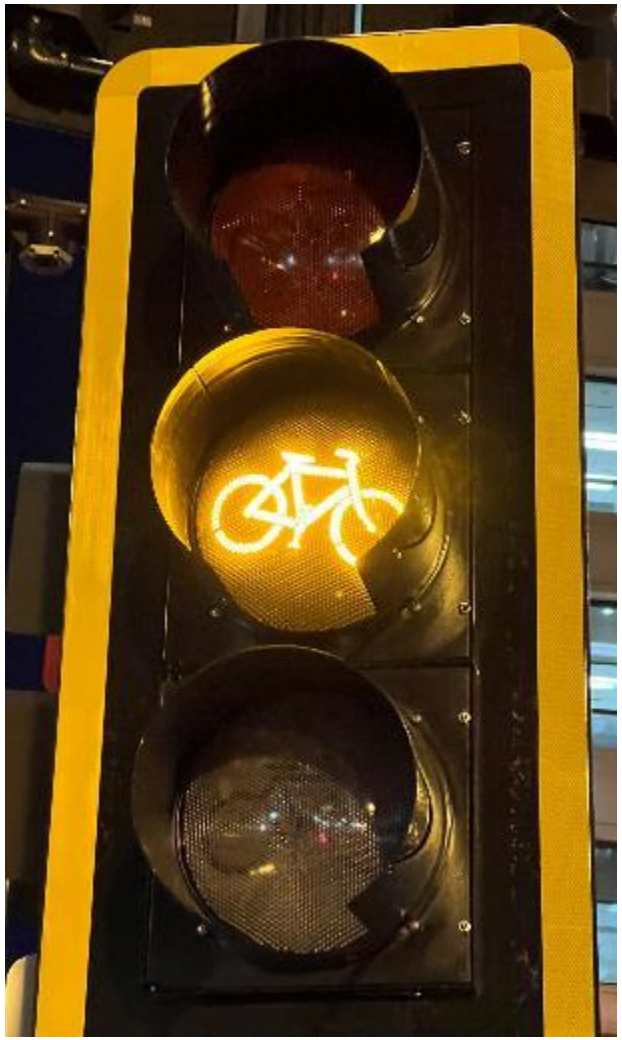
Traffic Signal Indications for Bikes



*When bicyclists approach the intersection on one type of bicycle facility and depart the intersection on another type of bicycle facility, engineering judgment shall be used to determine traffic signal indications and phasing

Bicycle Signal Faces

- MUTCD Chapter 4H + Pennsylvania-specific requirements
- Post-mount when:
  - Bicycle lane adjacent to curb
  - Shared path
  - Far-side bicycle signal face within 5’ from edge of bicycle facility/shared path
  - Near-side bicycle signal face (min. 4’ from stop line)
- Mount overhead when motor vehicle or parking lane between bicycle facility and curb
- Provide two primary bicycle signal faces if:
  - Crossing > 10 ft (perpendicular to crossing)
  - Heavy ped or bike activity within a shared crossing
  - Bike facility is separated from roadway or separated from ped crossing
- Different color signal housing vs. motor-vehicle signals when mounted overhead on same structure



Bicycle Signal Faces

Bicycle signal mounted overhead on same structure → Use different housing color

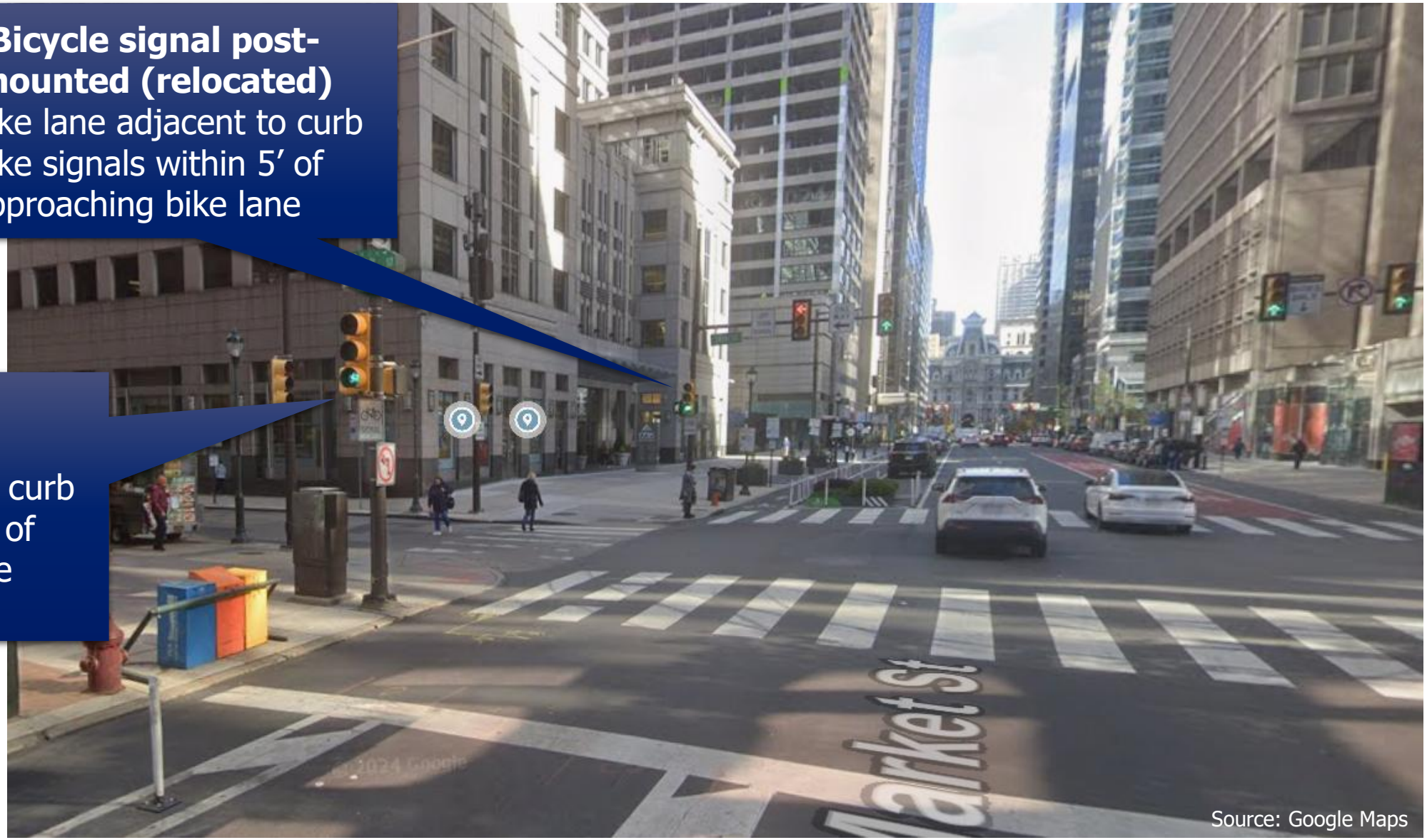
Bicycle Signal Faces

Bicycle signal post-mounted (relocated)

- Bike lane adjacent to curb
- Bike signals within 5’ of approaching bike lane

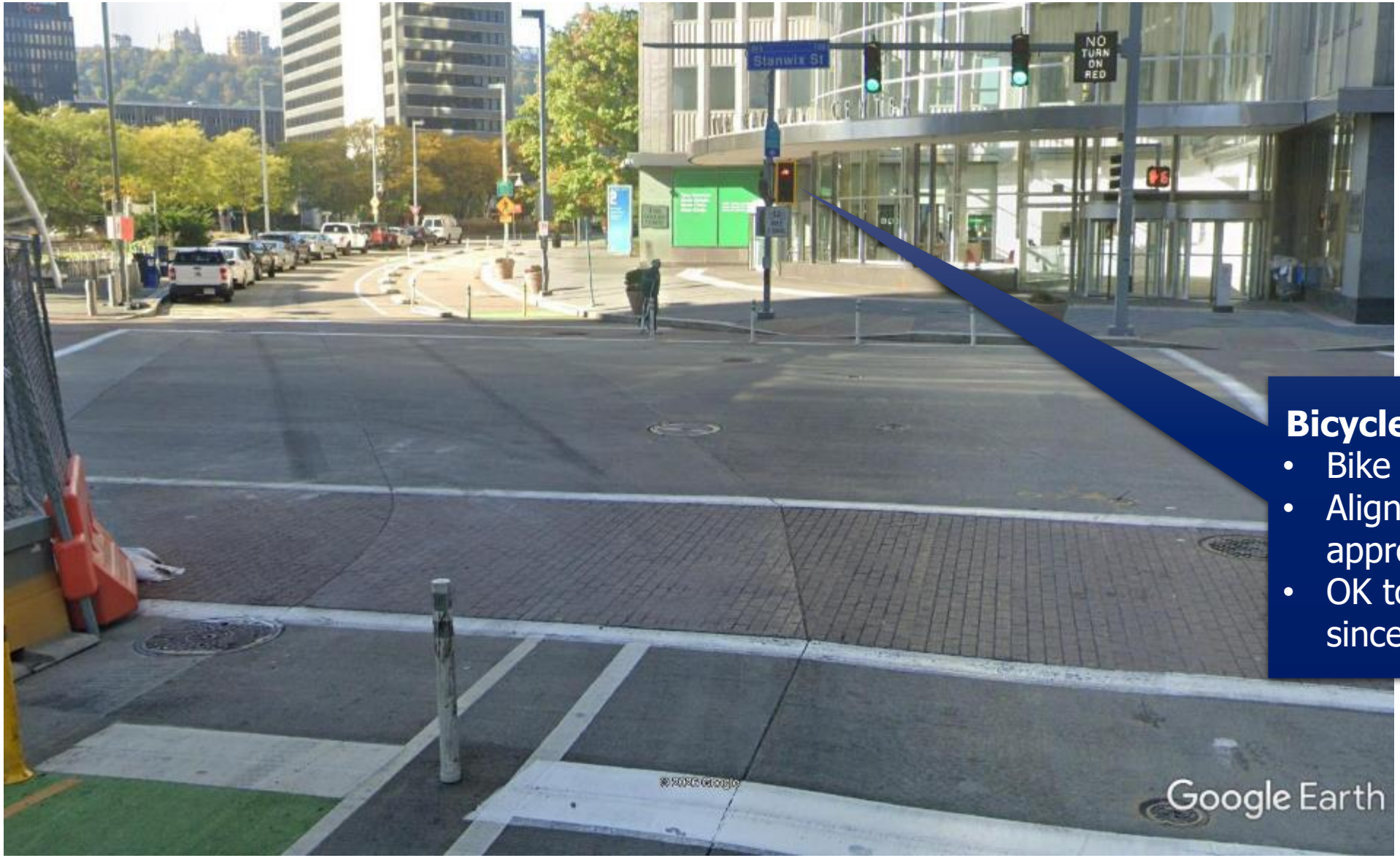
Bicycle signal post-mounted

- Bike lane adjacent to curb
- Bike signals within 5’ of approaching bike lane
- Near-side



Source: Google Maps

Bicycle Signal Faces



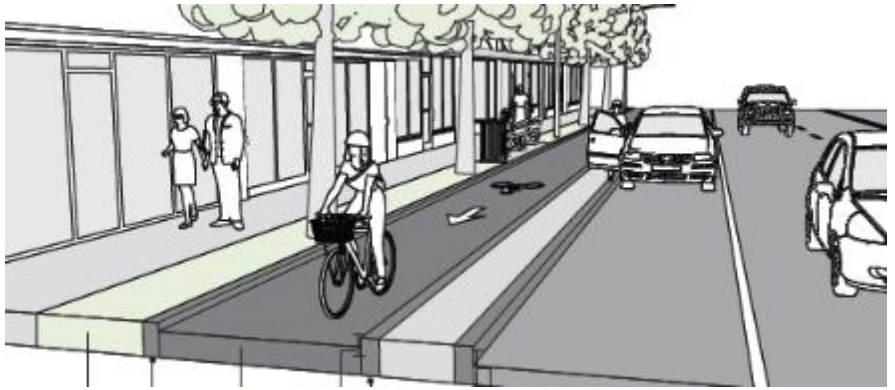
Bicycle signal post-mounted

- Bike lane adjacent to curb
- Aligned with 5’ of approaching bike lane
- OK to be same color housing since post-mounted

Types of Bikeways

- Shared Use Path

- Separated Bicycle Lanes



- Bicycle Lanes

- Bicycle Boulevards

Intersection Treatments

- Bicycle box
  - Designated area at head of a traffic lane
  - Bicyclists wait in front of queues motor vehicles during red phase
- Green colored pavement
  - Increases visibility of bicycle facility and reinforces bicycle priority in conflict areas