December 18, 2024

Roadway Design Manual

Webinar 2: Chapters 18-23

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Agenda

- Bike & Pedestrian Updates (Chapters 18 & 19) 
- Motorcyclist Design Considerations (Chapter 20) 
- Transit Facilities (Chapter 22) 
- Temporary Traffic Control (TTC) (Chapter 23) 
- Questions

Learning Objectives

- Present key updates made to the Roadway Design Manual Chapters 18 – 23
- Previous significant Chapter updates were covered in Webinar on December 12th
- Recordings of both webinars will be posted on the DES Division Crossroads page

RDM Implementation timeline: Effective for all projects beginning with March 2026 Letting, AND if final schematic or 30% plans have not been approved by May 31, 2025.

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Bike & Pedestrian Updates

Navigate to Chapters 18 & 19

Bicycle Facilities Overview

- Comprehensive update
- Aligns and incorporates content from:
  - FHWA Bikeway Selection Guide
  - New AASHTO Bike Guide
- Incorporates Micromobility Device design considerations and new PROWAG guidelines

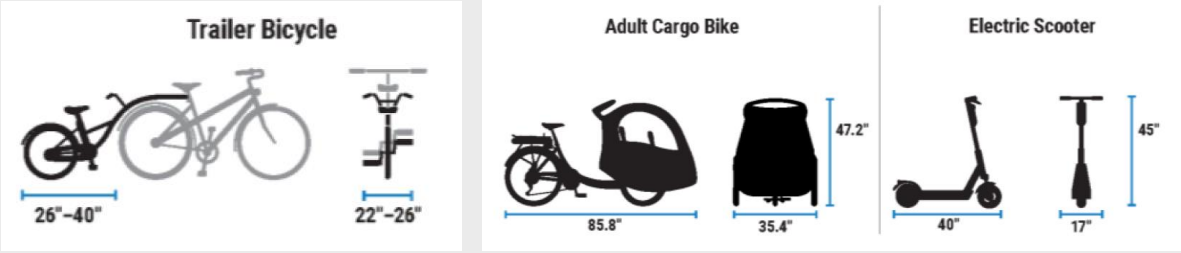


Figure 18-5

Target Bike Users

Comfort Typology of Bicyclists

Design User Profile	Non-Bicyclist	Interested but Concerned	Somewhat Confident	Highly Confident
Bicycling Preferences	Uncomfortable bicycling in any condition, have no interest in bicycling, or are physically unable to bicycle.	Often not comfortable with bike lanes, may bike on sidewalks even if bike lanes are provided; prefer off-street or separate bicycle facilities or quiet or traffic-calmed residential roads. May not bike at all if bicycle facilities do not meet needs for perceived comfort.	Generally prefer more separated facilities, but are comfortable riding in bicycle lanes or on paved shoulders if need be.	Comfortable riding with traffic, will use roads without bike lanes.
Percent of Population	31-37%	51-56%	5-9%	4-7%

Figure 18-1

Micromobility

- TTC §551.002 defines micromobility devices and how they can be operated in Texas:
  - Micromobility
  - Motor Assisted Scooter
  - Power-Driven Mobility Device
  - Shared Micromobility
- Limited to top speeds of 30 mph or less
- Bikeway design for the “Interested but Concerned Design User” (see Section 18.2.3) accommodates people using micromobility devices

Bikeway Types

- Updates per new AASHTO Bike Guide
- Updates per PROWAG

Shared Use Sidepath

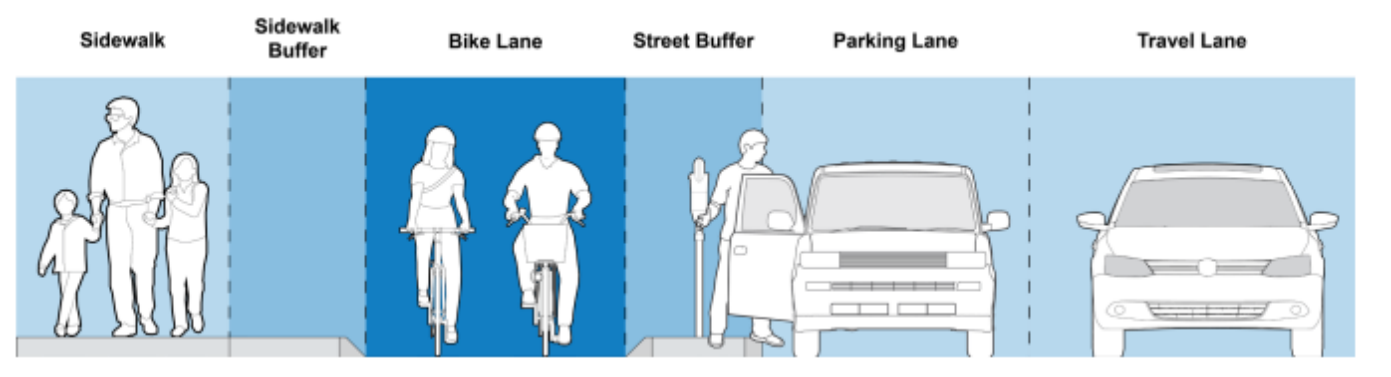
- Follows the roadway alignment and is physically separated from motorized vehicle traffic by a landscaped buffer
- Useful when roadway width is limited
- Potential conflict between pedestrians and bicyclists – a common conflict in urban areas and other locations with high pedestrian volumes
- Used by pedestrians – must meet ADA accessibility requirement of the ADA

Separated Bike Lanes

- Follows the roadway alignment and is physically separated from motorized vehicle traffic by vertical elements in the street buffer
- Vertical elements may include continuous raised medians, flexible posts, intermittent curbing, or parked vehicles.

Separated Bike Lanes

- Separates pedestrians from bicycle and vehicle traffic as shown in Figure 18-19:



Separated Bike Lanes

- Table 18-10 modified per the new AASHTO Bike Guide:
  - Updated location descriptions
  - Added "Adjacent to One Vertical Curb" location and values
  - Updated Practical Minimums

Peak Hour Directional Bicyclist Volume	One-Way Separated Bike Lane Width (ft) Recommended Values		
	Between Vertical Curbs without Gutter	Adjacent to One Vertical Curb	Between Sloped Curb, at Sidewalk Level, or Adjacent to Curb with Gutter
<150	6.5 - 8.5	6 - 8	5.5 - 7.5
150-750	8.5 - 10	8 - 9.5	7.5 - 9
>750	≥10	≥9.5	≥9
Practical Minimum*	4.5	4	4

*Peak Hour Directional Bicyclist Volume not applicable

Buffered Bike Lanes

- One-way bike lane separated from vehicle traffic by striped buffer area
- Need more significant roadway width or reduce vehicle travel lanes to accommodate bike lane
- Minimum width of 4 ft. exclusive of the buffer (5 to 7 ft. desirable)
- Buffer width is dependent on speed
- Hatching guidance included

Bike Lanes

- One-way bike lane with no physical buffer, but identified by signage, striping, or other pavement markings
- Should only be used in locations with speeds of 45 mph or less

Bike Lanes

- Table 18-13 was modified per the new AASHTO Bike Guide:
  - Increased constrained width for side-by-side bicycling or passing to 7.5-ft
  - Included guidance on where a bike lane is measure from in notes

One-Way Standard Bike Lane Width Criteria		
Bike Lane Description	**Desired Width (ft)**	**Constrained Width (ft)**
Adjacent to curb[1] or edge of pavement	5 - 7	4
Between travel lanes or buffers	5 - 7	4
Adjacent to parking[2]	6 - 7	5
Intermediate or sidewalk level raised bike lane[2,3]	5.5 - 7.5	5
To allow side-by-side bicycling or passing	8 - 10	7.5

[1] The usable width of the bike lane which is measured from the outside lane stripe to either the gutter joint or 1' from the nominal face of a monolithic curb.

[2] Raised bike lanes adjacent to parking should have a minimum width of 7 feet

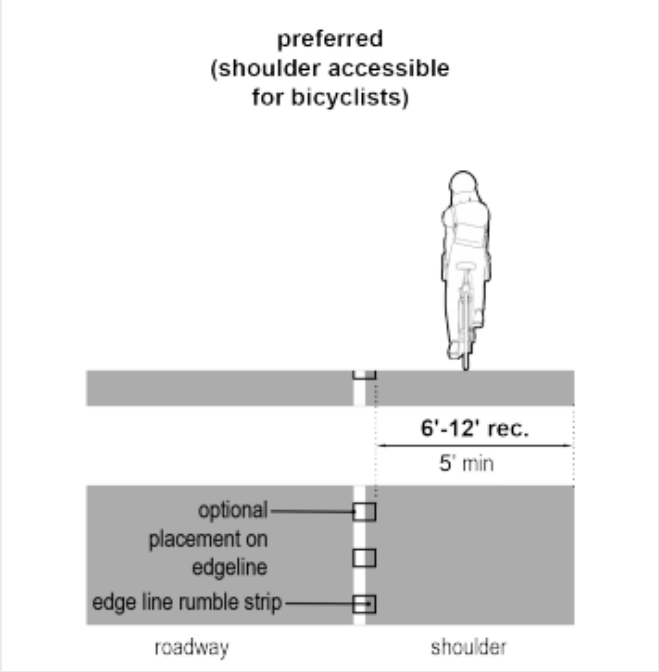
[3] Usable width of raised bike lane is measured from back of curb alongside travel lane to edge of bike lane pavement

Bike Accessible Shoulder

- Bike accessible shoulders are one-way facilities on a roadway that carry bicycle traffic in the same direction as adjacent motor vehicle traffic
- Bicycles are able to leave the shoulder to pass other cyclists or avoid debris
- 4 ft. min width (low speed); 5 ft. (high speed)
- Bicycle Tourism Trails Network: 8 ft. min.; 10 ft. + desirable

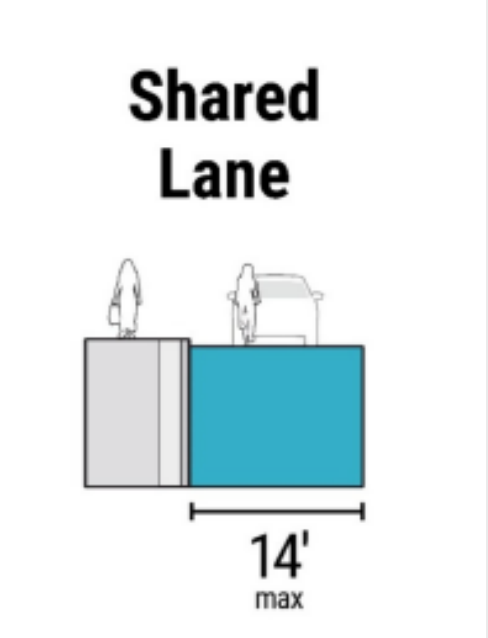
Rumble Strips

- Rumble strips are used to warn the driver that they are leaving the travel way and therefore may have a beneficial effect on the safety of bicycles using the shoulder.
- Per TRF edgeline rumble strip standards, are only allowed in high-speed applications.



Shared Lanes

- Lanes that allow compatibility of operation for both motorized vehicles and bicycles
- In urbanized contexts should only be used in locations with low volumes and low speeds
  - 3,000 ADT or lower
  - 35 mph or less



18.5 Intersections and Crossings

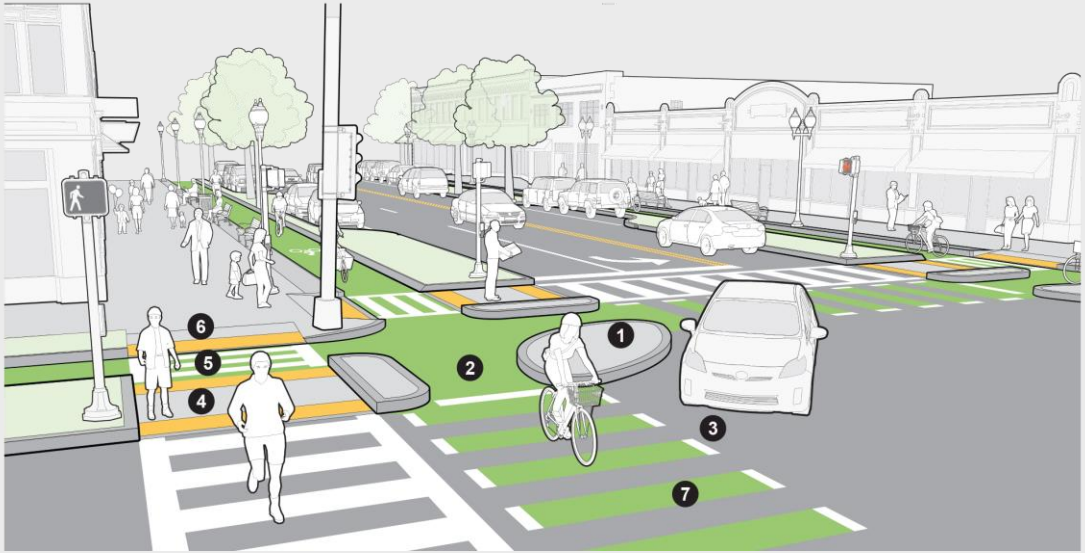


Figure 18-41 - Protected Corner Treatment – Separated Bike Lane And Intersection Design Components

1. corner island
2. forward bicycle queuing area
3. motorist yield zone
4. pedestrian refuge median
5. pedestrian crossing of the separated bike lane
6. pedestrian curb ramp
7. bicycle crossing of travel lanes
8. pedestrian crossing of travel lanes

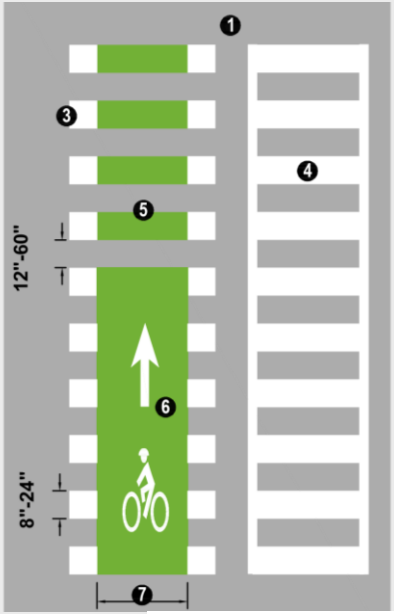
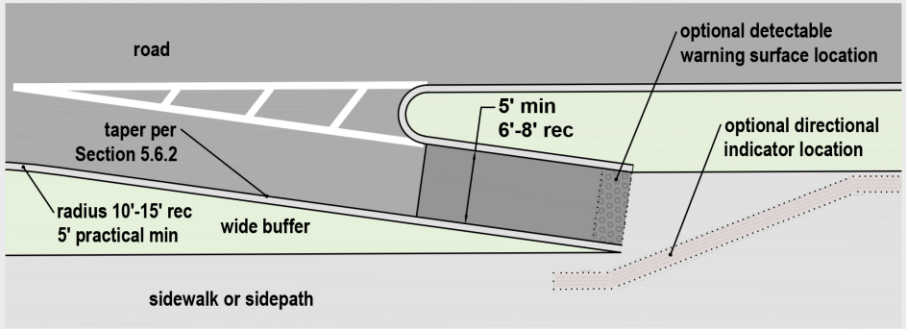


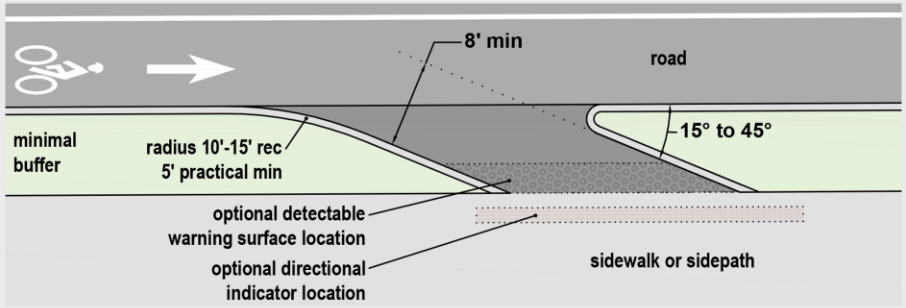
Figure 18-12

1. 1' min offset
2. no offset
3. normal or wide white dashed line
4. pedestrian crosswalk
5. optional green dotted or solid colored pavement
6. optional bicycle symbol
7. match width of bike lane
8. 4"-6" yellow centerline

Bicycle Ramps to Transition Between Bicycle Facilities



Detail 1 - preferred bicycle ramp alignment with wide sidewalk buffer



Detail 2 - lateral shift bicycle ramp alignment with minimal width sidewalk buffer

Figure 18-50

Bike Ramp – Seattle, Washington

Design Exceptions and Design Waivers

- Design Exceptions:
  - Bike Lane Width (Table A-21)
  - Bike Shared Lane Width (Table A-22)
  - Bridge Deck Clear Space (Table A-23)
- Design Waivers:
  - Shared Use Path (Table B-13)
  - Separated or Buffered Bike Lane (Table B-13)
  - Bike Accessible Shoulder (Table B-13)

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Pedestrian Updates

Navigate to Chapter 19

Pedestrian Facilities

- Comprehensive update
- Aligns and incorporates content from:
  - PROWAG
  - AASHTO Pedestrian Guide
  - NCHRP Research (e.g. - reports 562 and 926)
- Incorporates content from FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

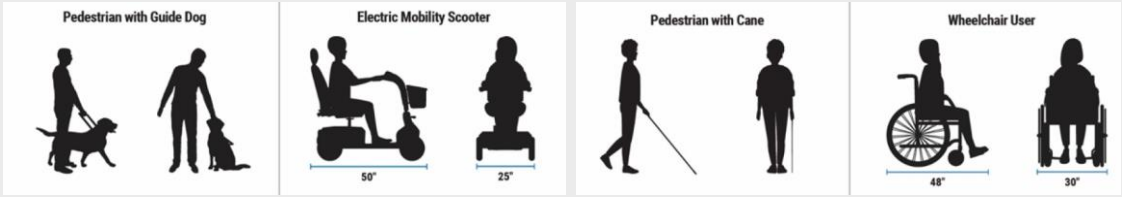


Figure 19-3

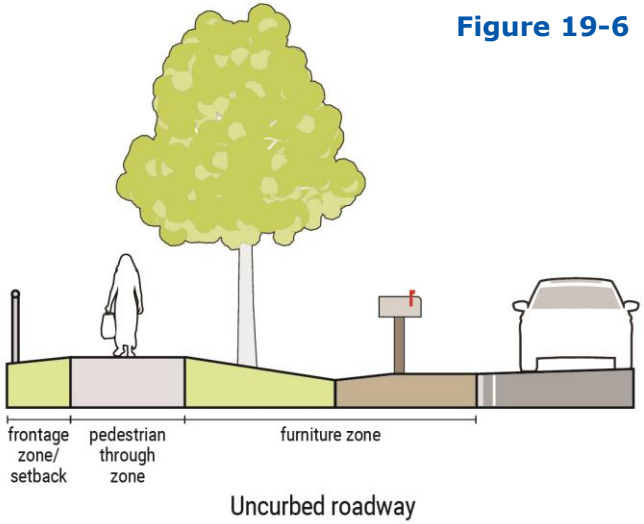
Linear Pedestrian Facilities

Pedestrian Zone

- The pedestrian zone, which is also known as the "walking zone" or pedestrian circulation path incorporates the PAR.
- The minimum pedestrian zone width is 5-ft.

Pedestrians are approximately 2.5x more likely to be involved in a crash when there is no sidewalk provided.

Figure 19-6



Accessible Pedestrian Signals

- Section R206 of PROWAG
- Where pedestrian signal heads are provided at street crossings, the **crossing must include accessible pedestrian pushbuttons** complying with R307 of PROWAG
- This applies to:
  - new projects
  - signal controller and software are altered, or
  - the signal head is added or replaced.

Figure 19-34: A Pedestrian Hybrid Beacon

Driveway Design Considerations

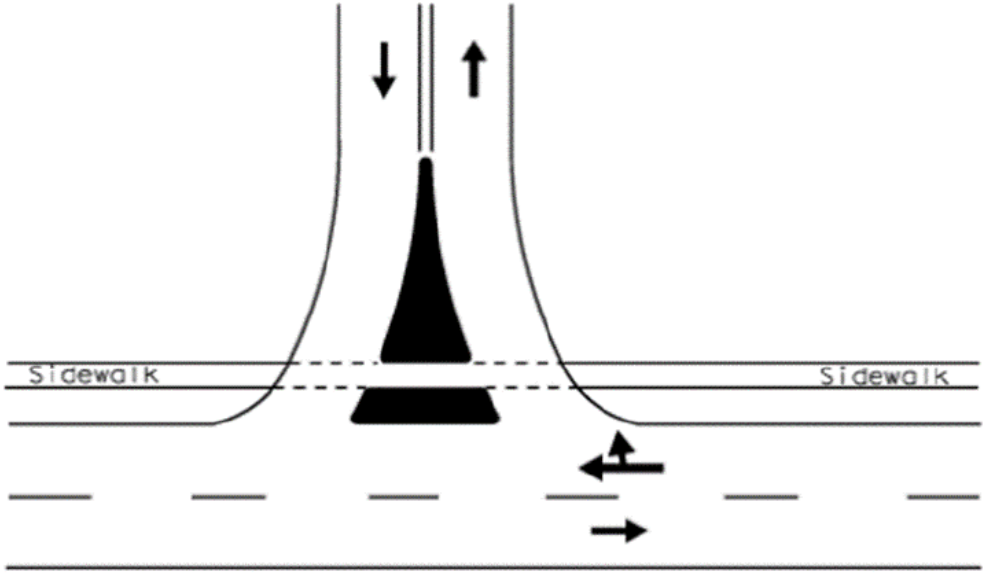


Figure 19-17: Channelizing Island Provide Pedestrian Refuge.

Detectable warnings:

- Should not provide at minor driveways
- Provide at stop and signal-controlled driveways

Separator Islands:

- Must provide 6-foot minimum width for refuge

Geometric design guidance in Chapter 16

Intersection Crossing Treatment Decision-Making Framework

Guidance incorporates FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations (STEP Guide)

Pedestrian Crash Countermeasures for Uncontrolled Crossings	Conflicts at crossing locations	Excessive vehicle speed	Inadequate conspicuity/ visibility	Drivers not yielding to pedestrians in crosswalks	Insufficient separation from traffic
Crosswalk visibility enhancement	●	●	●	●	●
High-visibility crosswalk markings	●		●	●	
Parking restriction on crosswalk approach	●		●	●	
Improved nighttime lighting*	●		●		
Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line*	●		●	●	●
In-Street Pedestrian Crossing sign*	●	●	●	●	
Curb extension*	●	●	●		●
Raised crosswalk	●	●	●	●	
Pedestrian refuge island	●	●	●		●
Pedestrian Hybrid Beacon	●	●	●	●	
Rectangular Rapid-Flashing Beacon	●		●	●	●

*These countermeasures make up the STEP countermeasure "crosswalk visibility enhancements." Multiple countermeasures may be implemented at a location as part of crosswalk visibility enhancements.

Figure 19-24B: Countermeasure Effectiveness for Common Safety Issues

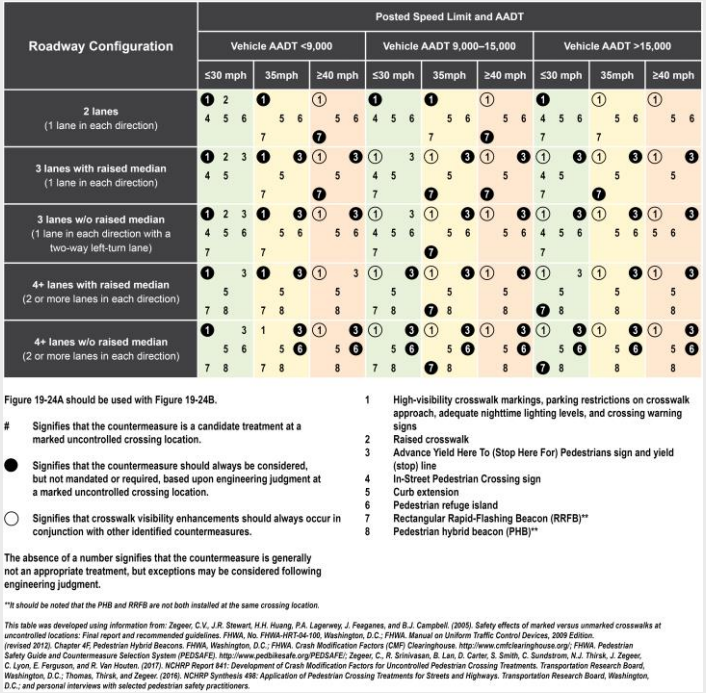


Figure 19-24A: Pedestrian Safety Countermeasures

Uncontrolled Crossing Safety Countermeasures

- Marked crosswalks indicate optimal or preferred locations for pedestrians to cross and remind motorists to stop and yield the ROW to crossing pedestrians.
- Pedestrian traffic warning signs should be used at and in advance of a marked or unmarked crosswalk to notify motorists of the crossing and improve visibility of the crossing.

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Motorcyclist Design Considerations

Navigate to Chapter 20

Pavement Features

- **Metal Covers** – metal has less friction factor especially when wet
- **High Friction Surfacing** – do not begin or end in areas where the motorcycle might still have side force
- **Removal of Pavement Markings** – repeated striping without removal, or removal of pavement under markings, can create uneven surfaces or standing water
- **Pavement Markings** – too much in the wrong place can cause skidding or confusion

Roadside Features

- **Vegetation** – small trees that are frangible for cars may be an increased risk to a motorcycle rider
- **Signs and Other Road Furniture** – small sign mounts frangible for cars can be a greater risk to a motorcycle rider
- **Longitudinal Barriers** – vertical posts under guardrail can present risks to a motorcycle rider that slides under. Consider the addition of rub rail
- **Shoulders** – wider shoulders
- **Clear Zones** – look at the entire roadside for smaller hazards

Highway Features

- **Horizontal Curves** – WYLIWYG: "where you look is where you go"
- **Intersections** – eliminate obstructions in sight triangle
- **Signs Related to Motorcyclists** – MUTCD does not cover all possible needs

Motorcycle Safety During Construction

- **Pavement** – clearly sign longitudinal drop-offs during asphalt pavement construction. Use fine teeth for asphalt surface milling.
- **Construction Maintenance** – temporary steel plates with smooth surface are a possible risk.

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Transit Facilities

Navigate to Chapter 22

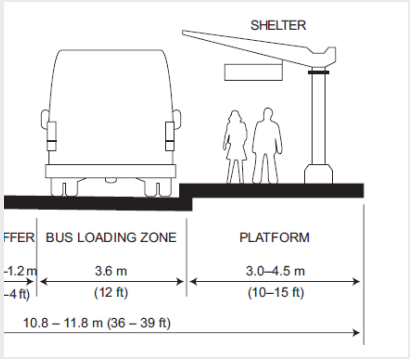
Background

- Modern technology supporting bus systems that behave like rail – GPS real time location tracking, transit signal priority, wireless ticket vending machines
- Design should accommodate transit or the potential for transit – consider how passengers get to and from transit locations

Right of Way Needs

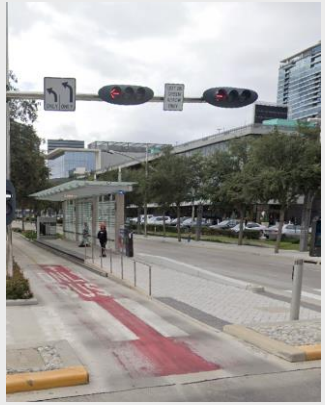
- **Passenger Platforms** – loading/unloading facilities require more room than traditional bus stops
- **Intersections** – extra width for turn lane storage and increased U-turns
- **Transit Centers** – increase in typical section width and connection to park and ride areas
- **Dedicated Transitways** – more ROW required if keeping same number of general purpose lanes is a requirement

(As a general policy, TxDOT does not purchase ROW for Transit or Bus Stops)



Roadway Design

- **Lane Widths** – min 11-ft for buses, 12-ft preferred
- **Profiles** –max 1.5% in areas where passenger platforms are planned, 5% max preferred for pedestrian approaches
- **Vertical Clearances** – double decker buses or overhead electric feed may increase clearance need



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Temporary Traffic Control (TTC or TCP)

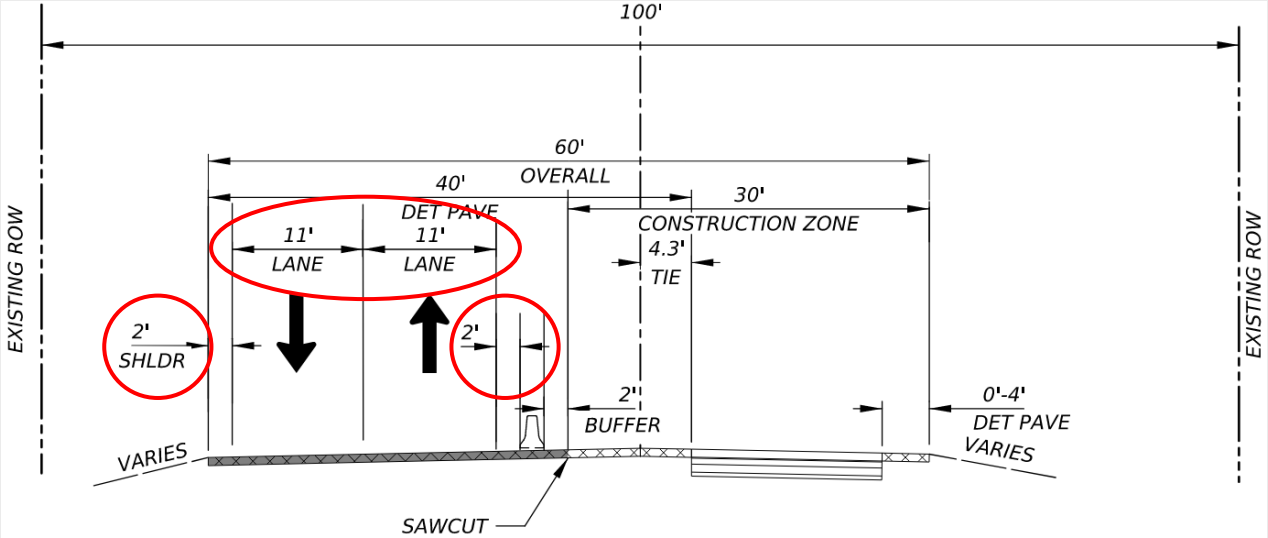
Navigate to Chapter 23

TTC/TCP Design Considerations

- Work durations are defined by the TMUTCD and by the TxDOT Traffic Control Plan Selection Worksheet. TCP of 3 days or less may be implemented by the contractor using the TxDOT Traffic Control Plan Standards
- An engineered (signed & sealed) traffic control design shall be required and provided to the contractor in the construction plans for Long Term Stationary work
- Unique project conditions, such as detours of major arterials or rapid bridge replacement involving higher risk to the travelling public, may justify TCP plans of 3 days or less to be designed as part of the construction plans.

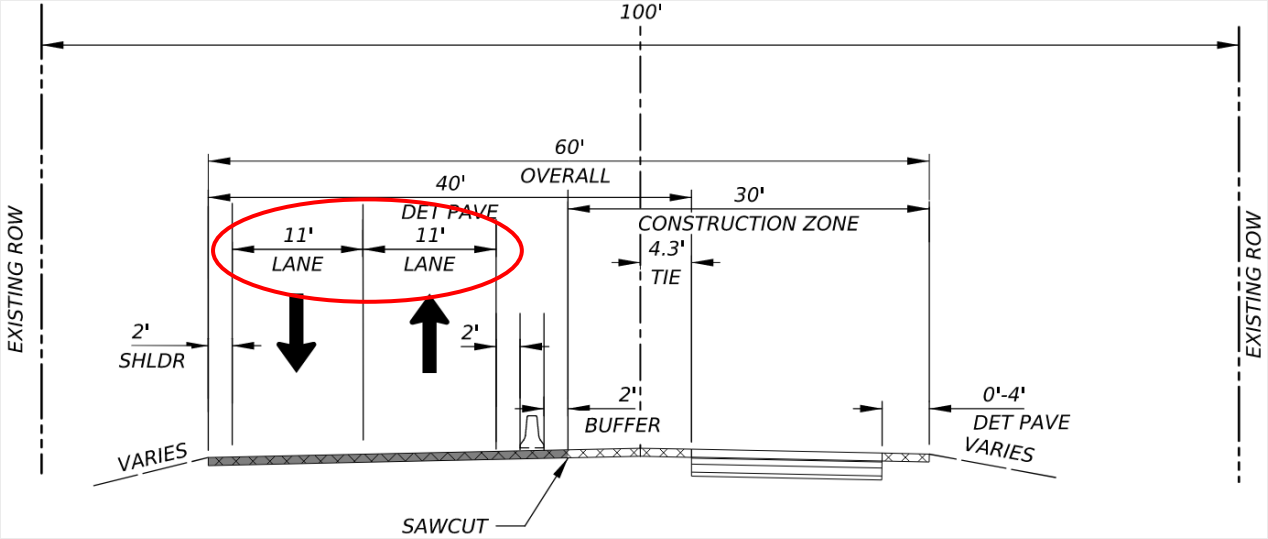
Typical Sections

- More restrictive than permanent typical sections



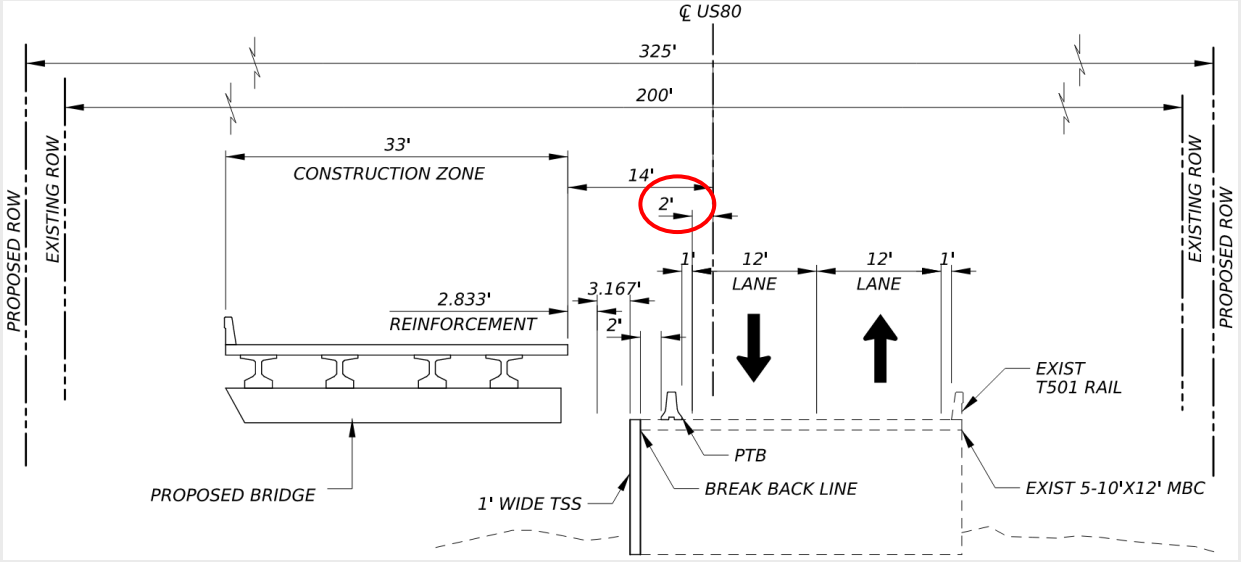
Lane Widths

- Lanes should not be less than one foot narrower than the lane widths for the permanent design
- If a design exception is used, lane width should not decrease any further



Shoulder Widths

- Typically, a shoulder width of 2 ft. or greater is desirable
- Emergency pull-offs should be considered



Pedestrian & Bicycle Requirements

- TTC/TCP should consider the needs of all users
- Pedestrians – consider all types of pedestrians and the safest route for them through construction (see Section 23.3.3.1)
- Bicycle – consider alternative routes when bike lanes cannot be accommodated (see Section 23.3.3.2)

Temporary Geometry Requirements

- Geometric alignment should be similar to the permanent design
- Horizontal geometry
  - Short duration, short term stationary and intermediate term stationary, use TMUTCD and TxDOT Traffic Control Plan Standards
  - Long term stationary, one lane shifts may used
  - Long term stationary, greater than one lane shifts should have a designed horizonal curvature. (Table 23-1, next slide)
- Vertical geometry
  - K values used from Chapter 4

Table 23-1

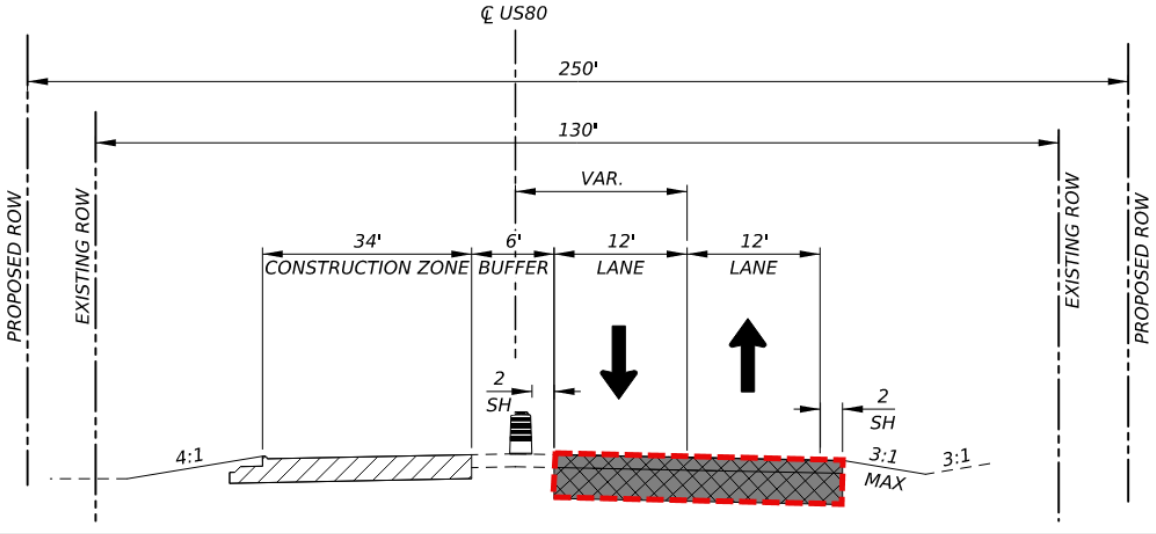
- Minimum Radii for combinations of TCP design speed and cross slope
- Expanded Method 2 from AASHTO Greenbook
- The designer has the option of using a more conservative superelevation methodology
- Permanent Conditions must use superelevation methodology from Table 4-3.

Table 23-1: Minimum Radii for Horizontal Curvature of TCP Geometry on Existing or Temporary Pavement

	TCP Design Speed								
Cross Slope	f_{max} 20%	f_{max} 18%	f_{max} 16%	f_{max} 15%	f_{max} 14%	f_{max} 13%	f_{max} 12%	f_{max} 11%	f_{max} 10%
	30 mph R (ft)	35 mph R (ft)	40 mph R (ft)	45 mph R (ft)	50 mph R (ft)	55 mph R (ft)	60 mph R (ft)	65 mph R (ft)	70 mph R (ft)
-8%	500	817	1,334	1,929	2,778	4,034	6,000	9,389	16,334
-7%	462	743	1,186	1,688	2,381	3,362	4,800	7,042	10,889
-6%	429	681	1,067	1,500	2,084	2,881	4,000	5,634	8,167
-5%	400	629	970	1,350	1,852	2,521	3,429	4,695	6,534
-4%	375	584	889	1,228	1,667	2,241	3,000	4,024	5,445
-3%	353	545	821	1,125	1,516	2,017	2,667	3,521	4,667
-2%	334	511	762	1,039	1,389	1,834	2,400	3,130	4,084
-1%	316	481	712	965	1,283	1,681	2,182	2,817	3,630
0%	300	454	667	900	1,191	1,552	2,000	2,561	3,267
1%	286	430	628	844	1,112	1,441	1,847	2,348	2,970
2%	273	409	593	795	1,042	1,345	1,715	2,167	2,723
3%	261	389	562	750	981	1,261	1,600	2012	2,513
4%	250	372	534	711	926	1,187	1,500	1,878	2,334
5%	240	356	508	675	878	1,121	1,412	1,761	2,178
6%	231	341	485	643	834	1,062	1,334	1,657	2,042
7%	223	327	464	614	794	1,009	1,264	1,565	1,922
8%	215	315	445	587	758	961	1,200	1,483	1,815

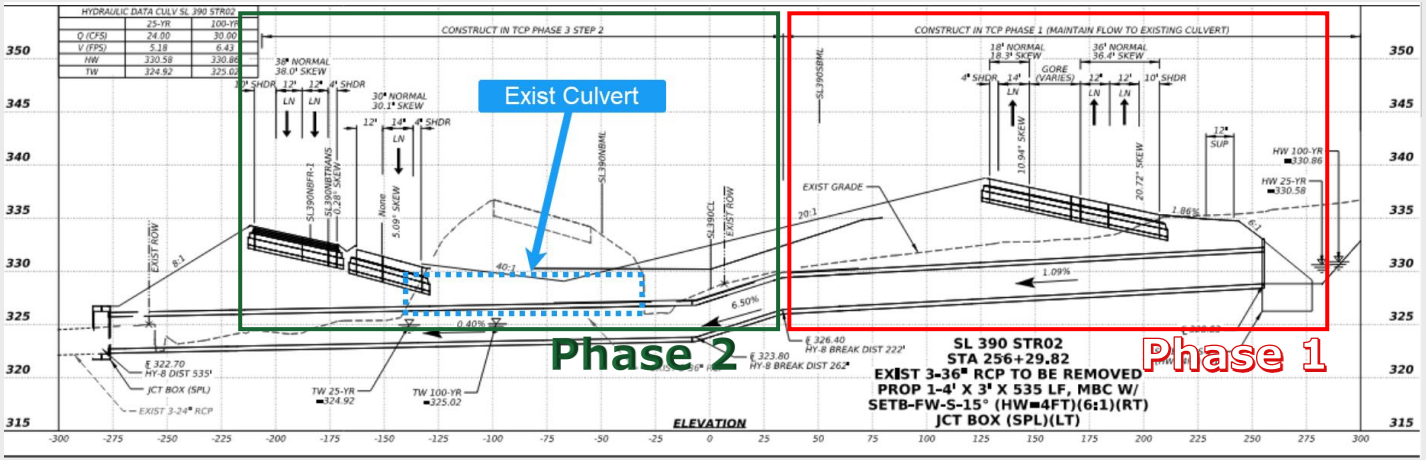
Temporary Pavement Structure Requirements

- Designers should perform a cost analysis between the use of temporary pavement and alternate construction phasing that uses either existing or permanent pavement



Temporary Drainage Requirements

- Temporary design should be based on expected conditions through the duration of construction
  - 50% Annual Exceedance Probability or 2-year Annual Recurrence Intervals
- Design should be coordinated with the SWP3

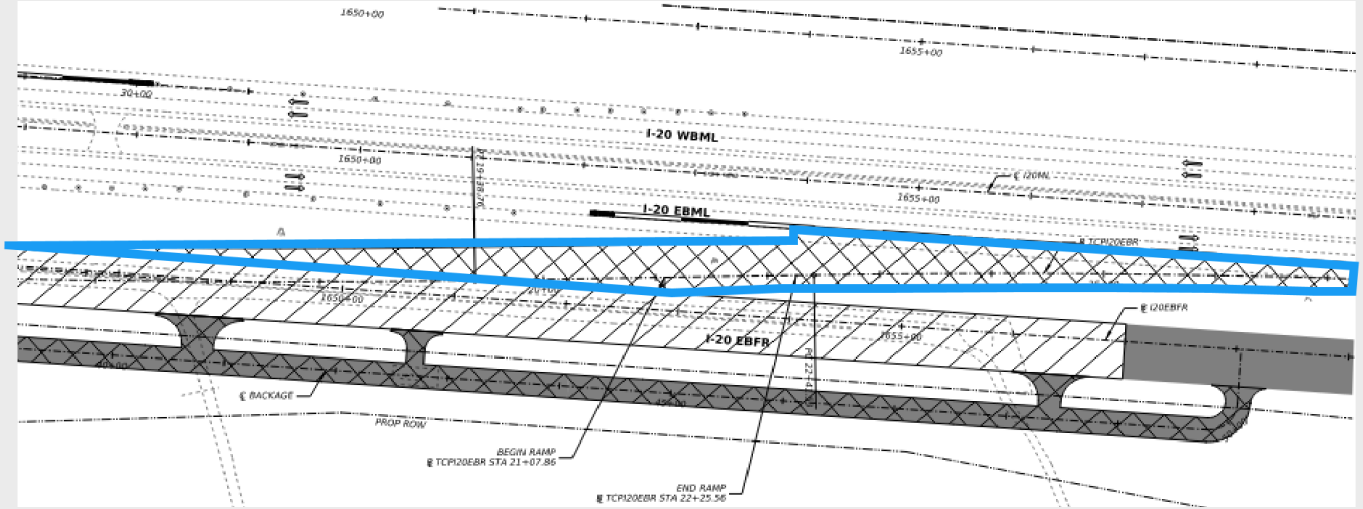


Temporary Clearance Requirements

- Clear Width for Controlled-Access Highways (see Section 23.3.8.1)
- Clear Width for Non-Access Controlled Roadways (see Section 23.3.8.2)
- Considerations for Texas Highway Freight Network (THFN) or Equivalent Routes (see Section 23.3.8.3)
- Vertical Clearance on Controlled Access Highways (see Section 23.3.8.4)
  - At a minimum, bridge vertical clearances must be 14’-6” (15’ preferred) during construction

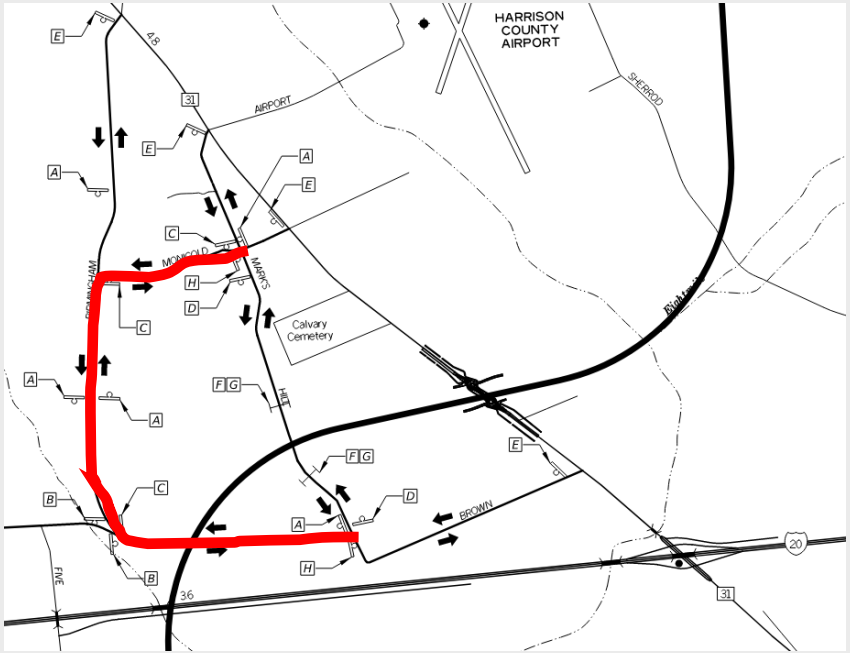
Temporary Ramp Design

- Ramps must accommodate acceleration and deceleration lanes in designs when possible



Emergency Vehicle Access

- Alternate routes should be planned and communicated to emergency responders



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Thank You and will now go through Questions in chat.