



Multimodal Design Guidance

October 23, 2018
ITE Fall Meeting

Introductions

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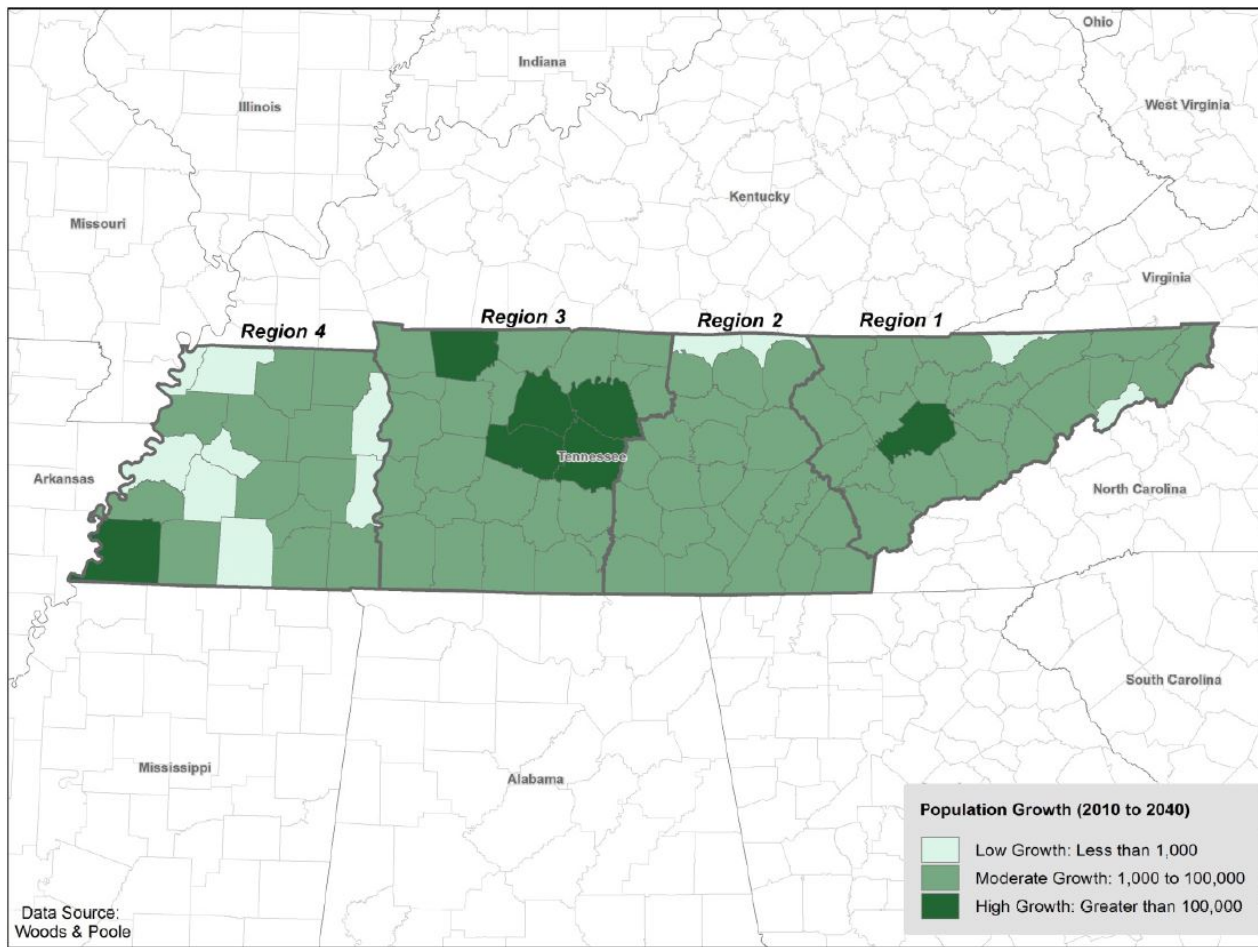
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By 2040, TN population expected to add over 2.1 million people. Over 70% of growth will occur in existing urban counties.



Changing Needs



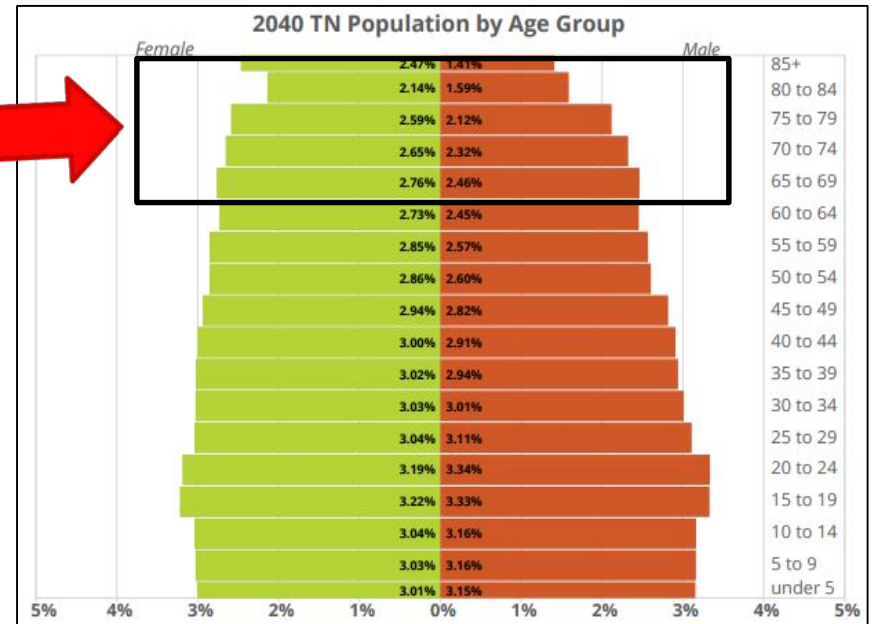
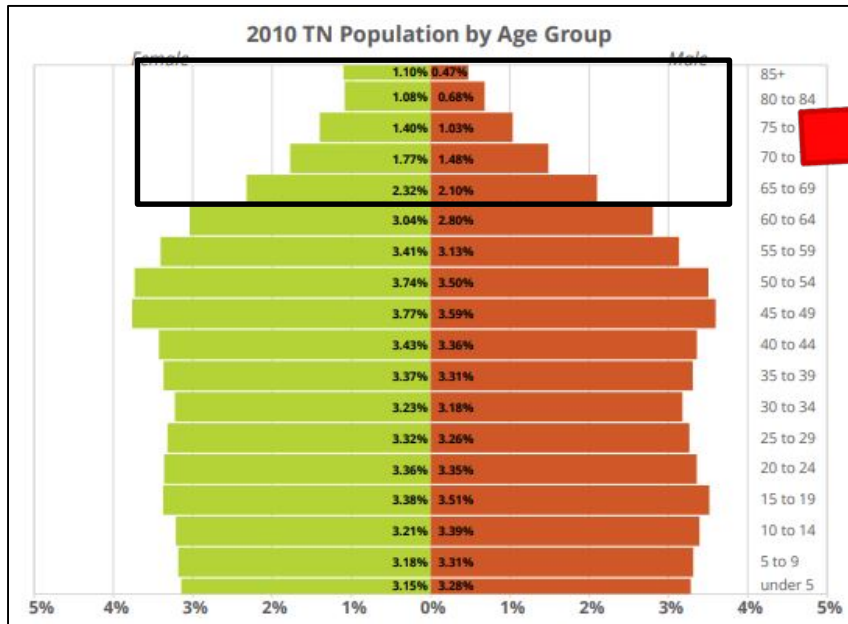
Photo by George Walker IV, Tennessean



TN Senior Population Will Double by 2040

13.43% of Population 65 or Older

22.51% of Population 65 or Older



All too common...



Headlines....

Father of Memphis pastor killed in pedestrian crash

Yolanda Jones, USA TODAY NETWORK – Tennessee Published 8:02 p.m. CT Oct. 2, 2017

NewsChannel 5
NETWORK

WEATHER TRAFFIC ALL SECTIONS +

Pedestrian Hit, Killed In Clarksville Wreck

POSTED: 6:46 AM, Mar 18, 2018
UPDATED: 2:36 PM, Mar 18, 2018

Pedestrian hit on Magnolia Ave dies from injuries sustained Friday

USA TODAY NETWORK - Tennessee Published 10:00 p.m. ET Jan. 12, 2018 | Updated 2:51 p.m. ET Jan. 15, 2018

WKRN.COM

Nashville

48°

NEWS WEATHER & TRAFFIC SPECIALS WATCH SPORTS COMMUNITY PERFECT HOME PERFECT HEALTH

615-867-8170

MMC
PODIATRY

Pedestrian killed along Lebanon Pike in Hermitage

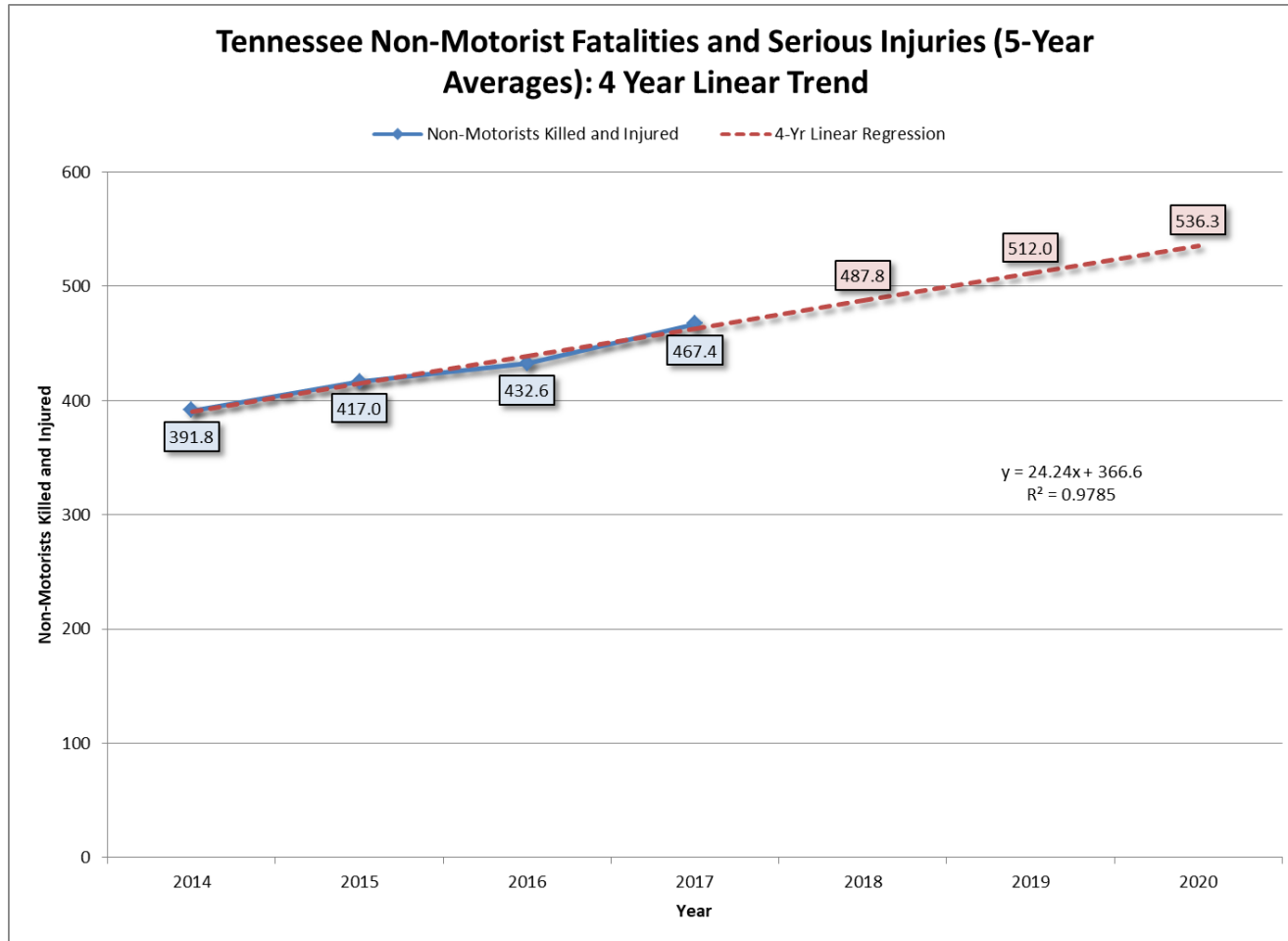
By: Brittney Baird

Updated: Dec 22, 2017 09:45 AM CST

TN



Safe Transportation for Every Pedestrian



2015 Multimodal Access Policy



Why does TDOT need Multimodal Design Guidelines?



What is covered?

- Multimodal Roadway Design Process
- TDOT Accessibility Guidance
- Pedestrian Facilities
- Bicycle Facilities
- Shared-Use Paths
- Transit Facilities
- Vehicle Facilities Supporting Multimodal Accommodations
- Additional Considerations



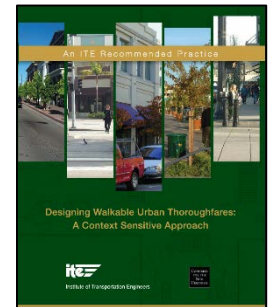
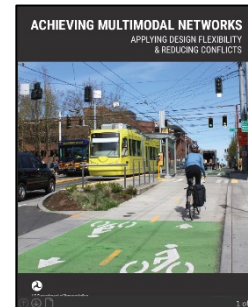
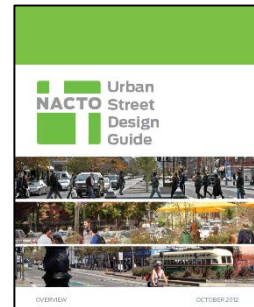
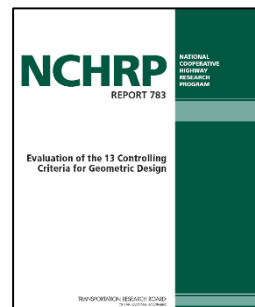
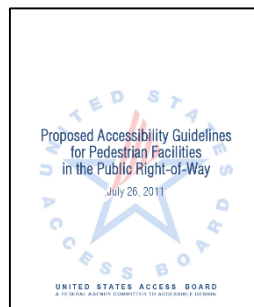
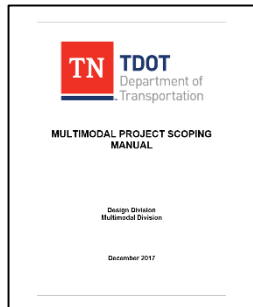
TDOT Multimodal Policy Implementation

- Commissioner Schroer signs TDOT Multimodal Policy } July 31, 2015
- Statewide MPO, RPO, Municipal and Transit Agency outreach } July '16
May '17
Dec. '17
March '18
- Conducted internal Steering Committee Meetings throughout project
- Two primary documents:
 - *Multimodal Project Scoping Manual*
 - New Section in TDOT's *Roadway Design Guidelines*} Finalized April 2018
- Multimodal Design Deviation Request Form
- Training } June 2018



Multimodal Project Scoping Manual

- 160 Pages of national best practices
- Over 40 source documents
- Guidance from US Access Board, FHWA, AASHTO, NACTO, NCHRP, ITE, US EPA, internal TDOT sources, and other state and city DOTs
- Target audience is those involved in project initiation and scoping
- Available on TDOT's *Roadway Design Additional Resources* website



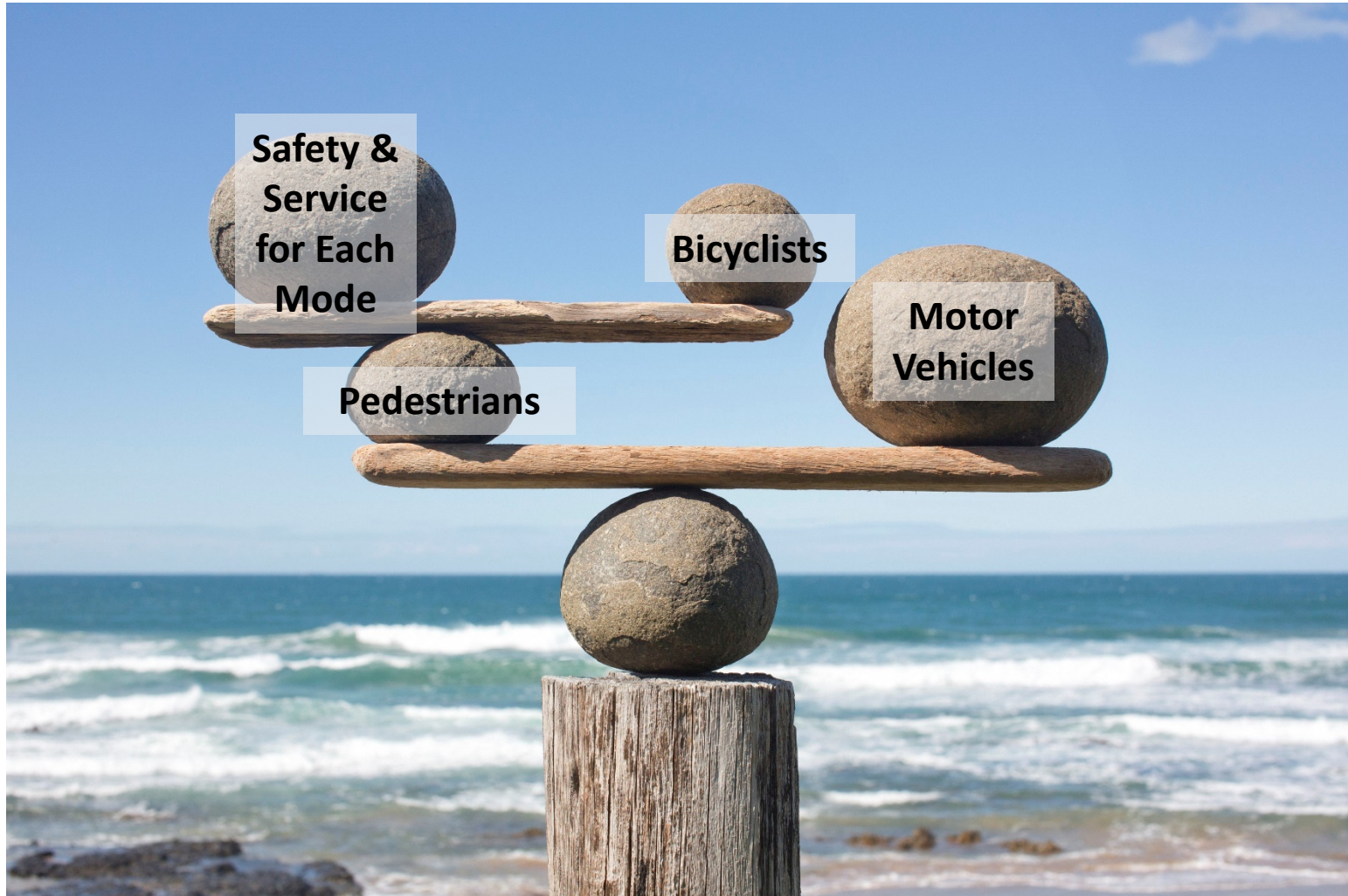


TDOT's Roadway Design Guideline Multimodal Guidance (New Section 9)

- 70 pages compared to the *Multimodal Project Scoping Manual's* 160 pages
- Target audience is roadway designers
- Consolidates the national guidance in the *Multimodal Project Scoping Manual* and makes it "TDOT's"

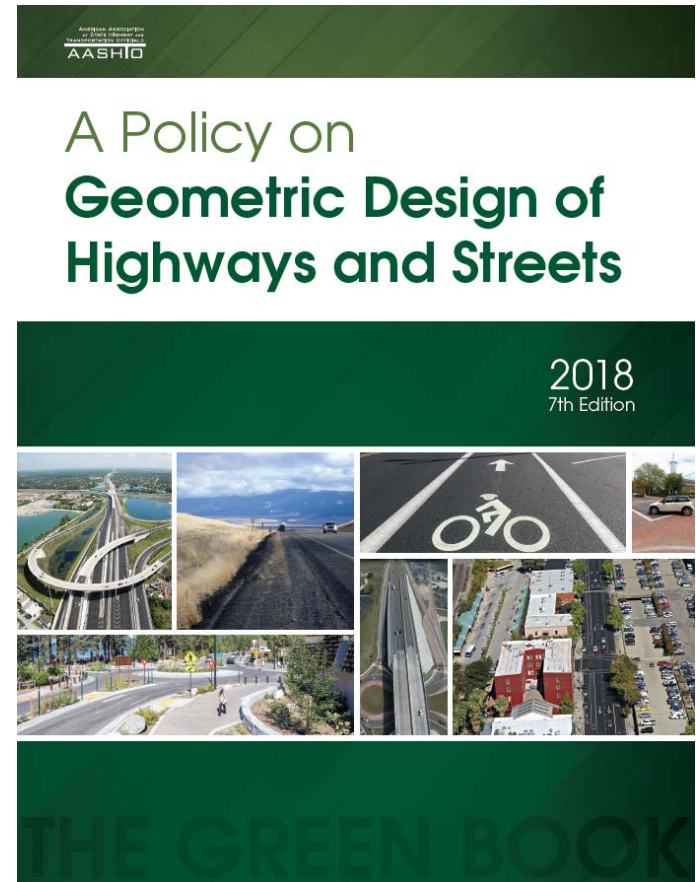


Balancing MM Safety, Level and Quality of Service



Design Flexibility

- The Green Book emphasizes the need for a holistic design approach and the use of engineering judgment
- Design speeds ≤ 45 mph have considerable design flexibility



Land Use Context

SUBURBAN LOW TRAFFIC, LOW-SPEED, MODE-SHARED RESIDENTIAL STREET



Land Use Context

RURAL HIGHWAY WITH PAVED SHOULDER



Land Use Context

RURAL ROAD WITH SEPARATED SHARED-USE PATH



Land Use Context

LOW-DENSITY SUBURBAN STREET



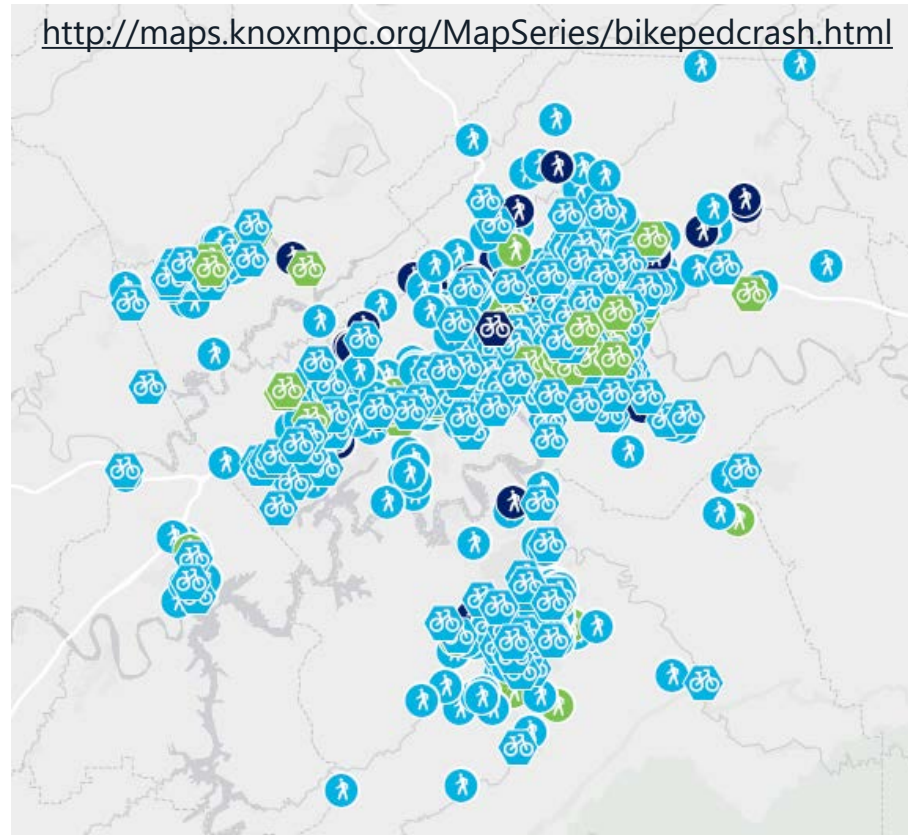
Land Use Context

URBAN MAIN STREET



Safety

- For non-motorized users note the high rate of injury & fatal crashes:



Legend:

Green = Non Injury

Light Blue = Injury

Dark Blue = Fatality



Safety

- For non-motorized users note the high rate of injury & fatal crashes:

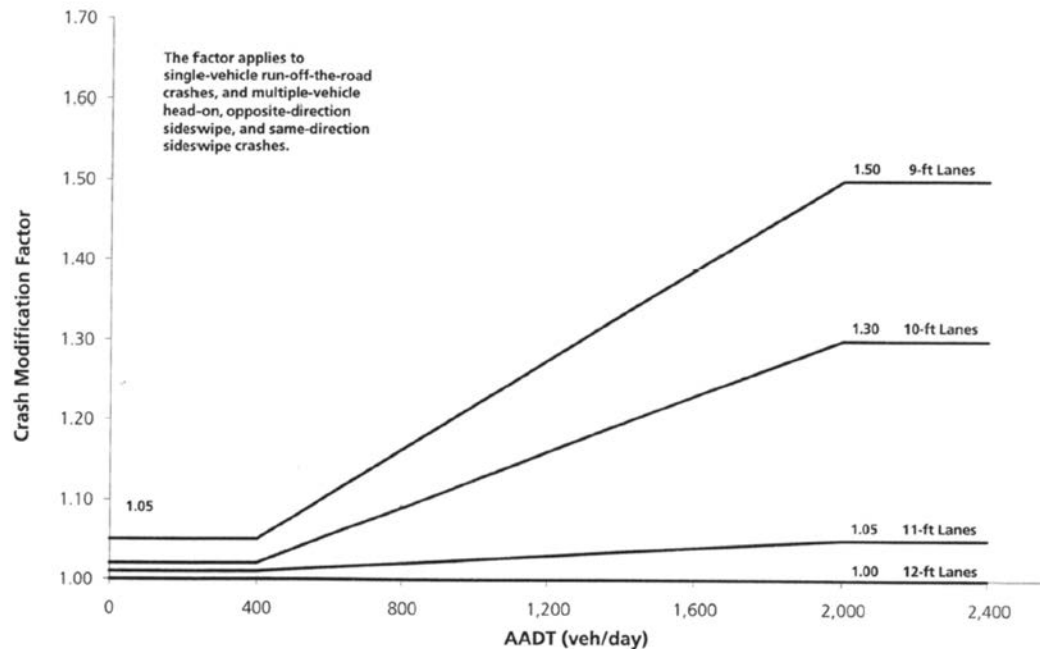


Compiled by Walk Bike Nashville



Safety

- On high-speed roadways, the HSM notes:
 - 9-foot wide travel lanes have up to a 50% increase in crashes compared to 12-foot lanes
 - 10-foot wide lanes have up to a 30% increase in crashes.



Safety

However:

- There is no statistical difference in motor vehicle safety performance for urban and suburban arterials with lane widths ranging from 10 to 12 feet and speeds ≤ 45 mph.
- **AND** for non-motorized users....



Lane Widths

Travel Lane Widths (ft)					
Context / Roadway	Rural	Rural (Town)	Suburban	Urban	Urban (Core)
Principal Arterial	11 to 12	11 to 12	11 to 12	10 to 12	10 to 12
Minor Arterial	11 to 12	10 to 12	10 to 12	10 to 12	10 to 12
Collector	11 to 12	10 to 12	10 to 12	10 to 12	10 to 12
Local	9 to 12	9 to 12	9 to 12	10 to 12	9 to 12

- Minimum 11-foot lanes are required for design speeds of 45 mph or greater. The values assume rural areas have design speeds of 45 mph or greater, except on local streets.
- Curbside lanes with fixed-route transit service should be 11 feet wide (min.).



Median Refuge Islands

Median refuge islands are a proven safety countermeasure and have demonstrated a 46% reduction in pedestrian crashes

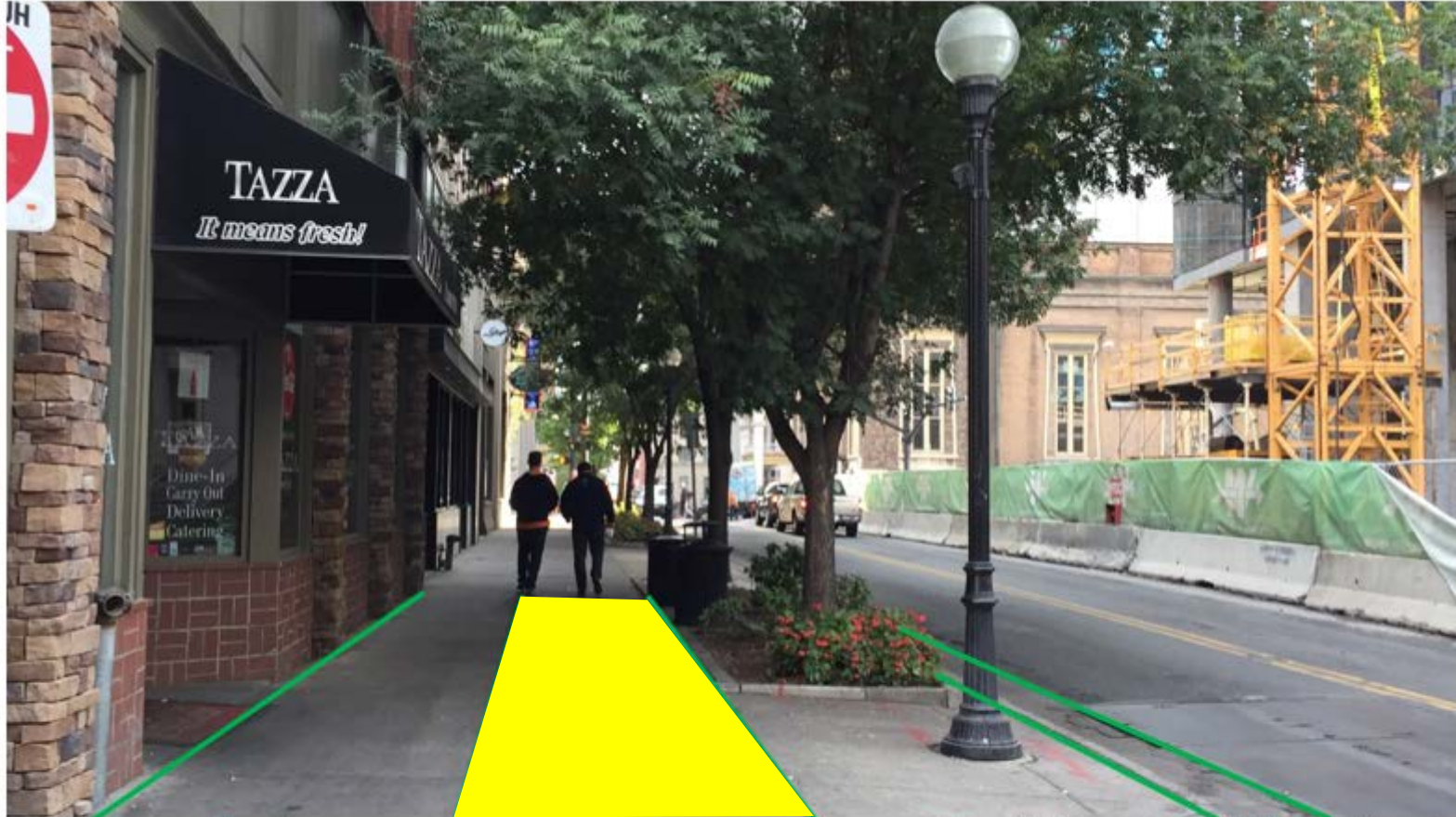


Resurfacing Projects

- Curb ramps shall be installed/retrofitted where they are missing or are not compliant with ADA/PROWAG guidance, to the maximum extent feasible.
- Additionally, TDOT promotes that when the existing shoulders are adequate, resurfacing projects provide a good opportunity to incorporate pavement markings for bicycle lanes.



Sidewalks - Throughway Zone



Roadway

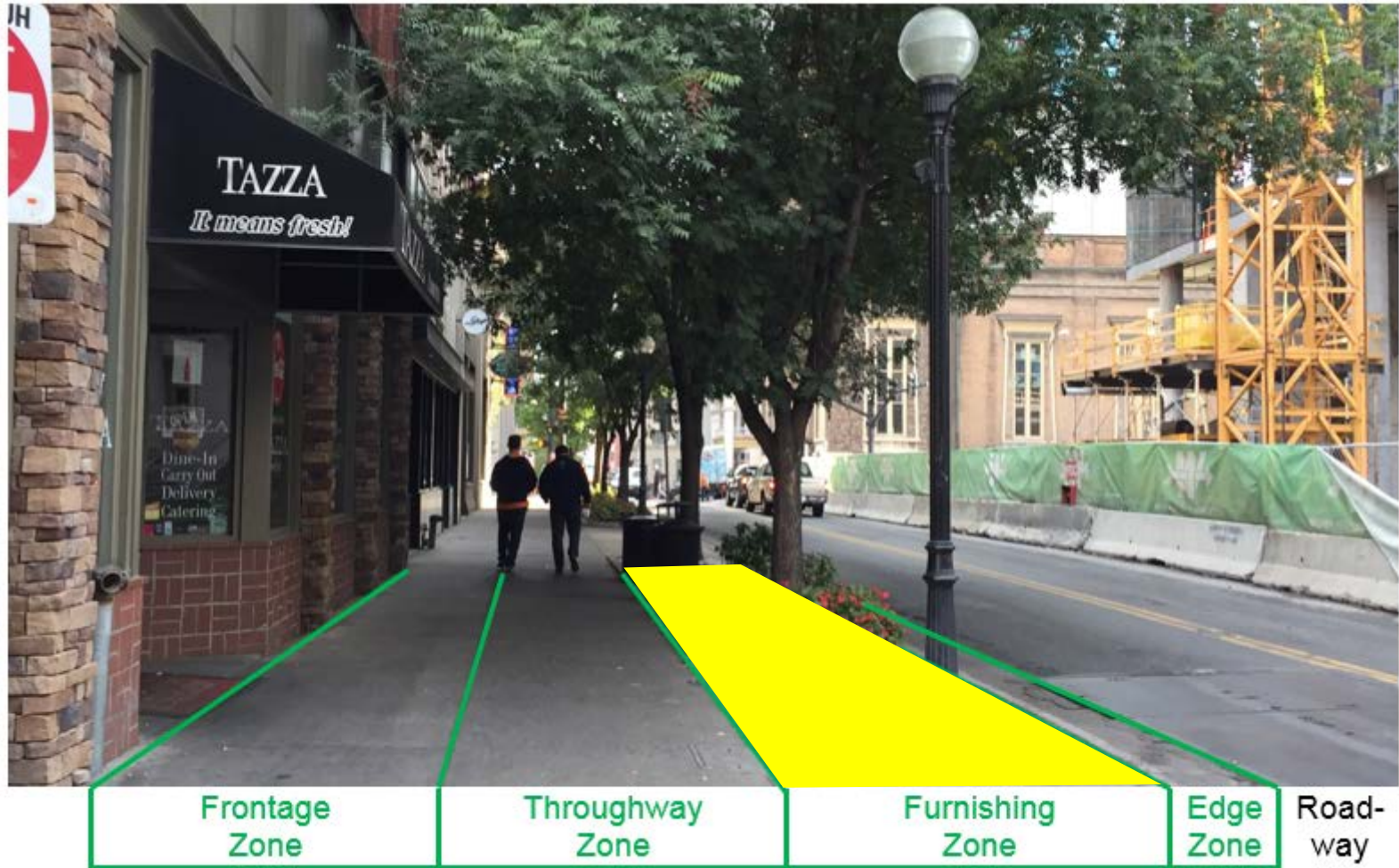


Throughway Zone - Widths

Minimum Pedestrian Facilities Design Guidelines (When Provided)		
Roadway Classification / Context	Sidewalk / Walkway	Width
Rural Roadways ($< 2,000$ ADT)	Sidewalks on both sides	SW (5 ft)
	Shared-Use Path	SUP (10 ft)
Rural Roadways ($> 2,000$ ADT)	Sidewalks on both sides	SW (5 ft)
	Shared-Use Path	SUP (10 ft)
Suburban Roadways	Sidewalks on both sides	SW (5 ft)
	Sidewalk + Shared-Use Path	SUP (10 ft)
Major Arterials (Residential)	Sidewalks on both sides	SW (6 ft)
Minor Arterial and Urban Collector (Residential)	Sidewalks on both sides	SW (5 ft)
All Commercial Area Urban Streets	Sidewalks on both sides	SW (6 ft)
All Industrial Area Streets	Sidewalks on both sides	SW (5 ft)
SW = Sidewalk, SUP = Shared-Use Path		



Furnishing Zone



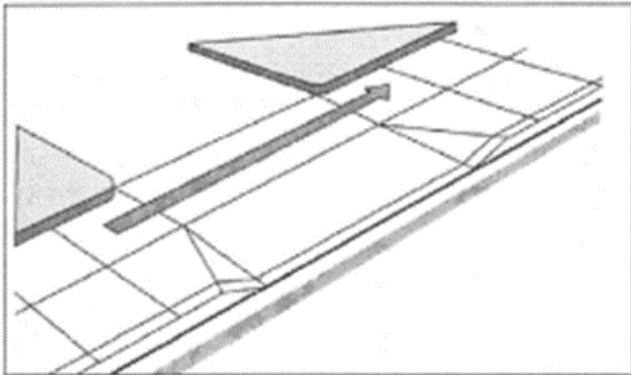
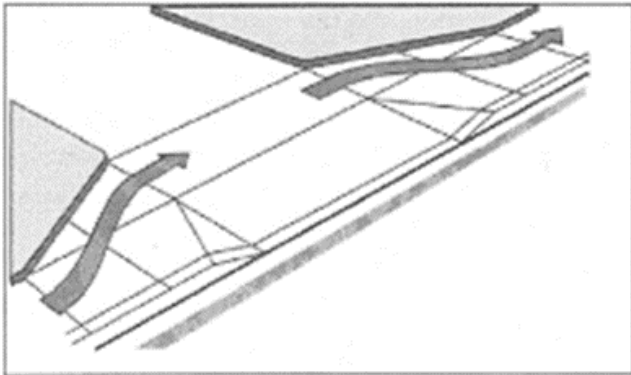
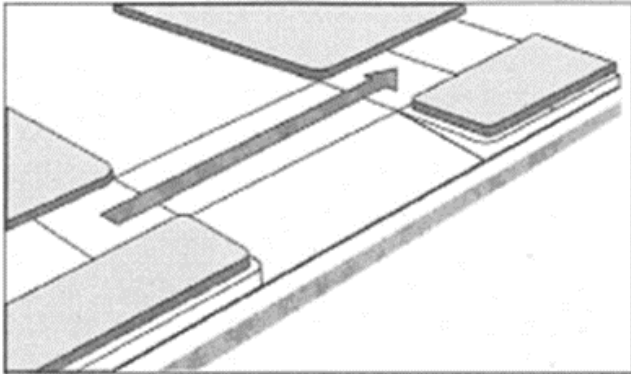
Furnishing Zone/Buffers

Pedestrian Facility Separation Requirements (ft.)		
Posted Speed	Buffer (Min.)*	Buffer Preferred
≤ 35 mph	0	5
40 mph	4.5	8
45 - 55 mph	12	16.5
≥ 60 mph	16.5	24

*A 5-foot buffer (min.) shall be provided between the back of curb and a shared-use path



Furnishing Zone Benefit



Purpose	Dimension
To serve as a pedestrian buffer	3 ft.
To locate mailboxes	3 ft.
To benefit driveway slopes	4 ft.
To plant trees	5 ft.
To place street furniture	Varies
To place utilities	Varies

Sidewalk Buffer with Rural Cross Section

- The minimum pedestrian facility buffer is either 5 feet from the edge of the paved shoulder or the dimensions listed in previous table.
- Where a ditch is present, the sidewalk should be placed on the far side of the ditch.



Midblock Crosswalks

C: Candidate Location P: Possible Location
 N: Not Recommended without other features

Recommendations for Installing Midblock Crosswalks*

Vehicle ADT	Speed Limit**	Roadway Type (Number of Travel Lanes and Median Type)			
		Two lanes	Three lanes	Multilane (four or more lanes) with raised median***	Multilane (four or more lanes) without raised median
≤ 9,000	30 mi/h	C	C	C	C
	35 mi/h	C	C	C	P
	40 mi/h	P	P	P	N
>9,000 to 12,000	30 mi/h	C	C	C	P
	35 mi/h	C	P	P	P
	40 mi/h	P	P	N	N
>12,000 to 15,000	30 mi/h	C	P	P	N
	35 mi/h	C	P	P	N
	40 mi/h	N	N	N	N
> 15,000	30 mi/h	C	P	N	N
	35 mi/h	P	N	N	N
	40 mi/h	N	N	N	N



Bicycle Facilities

Types of bicycle facilities:

- On-street shared-use lanes
- Bicycles on shoulders
- Striped on-street bicycle lanes
- Buffered on-street bicycle lanes
- Separated bicycle lanes
- Shared-use paths / sidepaths

Least Separation



Signed Routes (No Pavement Markings)

A roadway designated as a preferred route for bicycles.



Shared Lane Markings

A shared roadway with pavement markings providing wayfinding guidance to bicyclists and alerting drivers that bicyclists are likely to be operating in mixed traffic.



On-Street Bike Lanes

An on-road bicycle facility designated by striping, signing, and pavement markings.



On-Street Buffered Bike Lanes

Bike lanes with a painted buffer increase lateral separation between bicyclists and motor vehicles.



Separated Bike Lanes

A separated bike lane is an exclusive facility for bicyclists that is located within or directly adjacent to the roadway and that is physically separated from motor vehicle traffic with a vertical element.



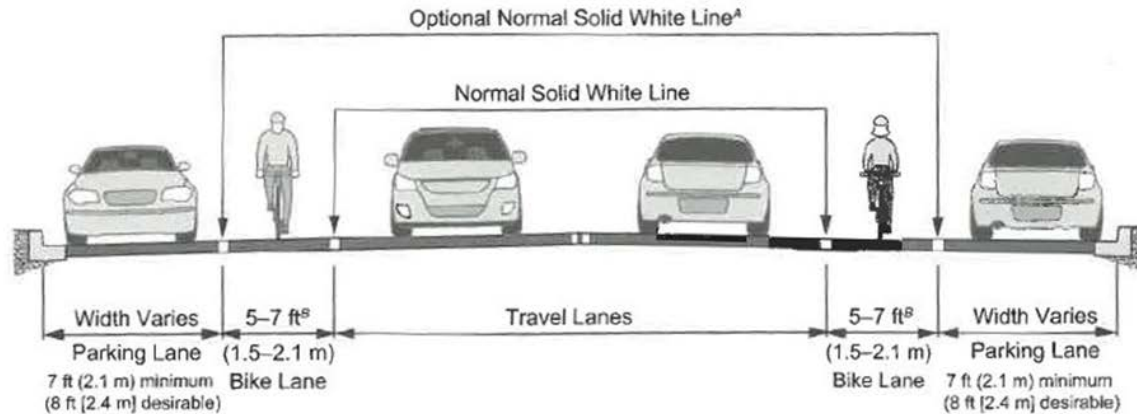
Off Street Trails / Sidepaths

Bicycle facilities physically separated from traffic, but intended for shared uses by a variety of groups, including pedestrians, bicyclists, and joggers.

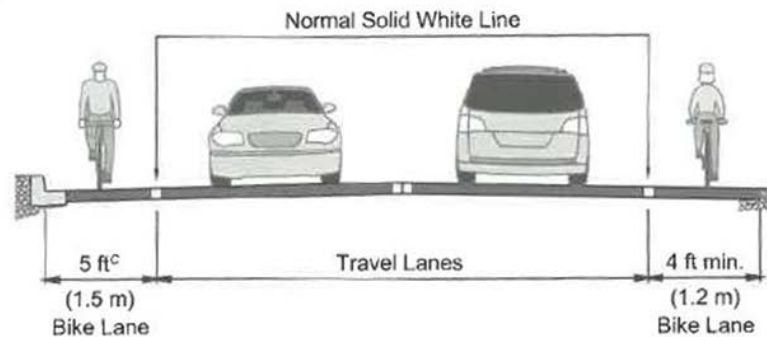
Most Separation



Striped On-Street Bicycle Lanes



On Street Parking



Parking Prohibited

Notes:

- ^A An optional normal (4-6-in./100-150-mm) solid white line may be helpful even when no parking stalls are marked (because parking is light), to make the presence of a bicycle lane more evident. Parking stall markings may also be used.
- ^B Bike lanes up to 7 ft (2.1 m) in width may be considered adjacent to narrow parking lanes with high turnover.
- ^C On extremely constrained, low-speed roadways (45 mph [70 km/h] or less) with curbs but no gutter, where the preferred bike lane width cannot be achieved despite narrowing all other travel lanes to their minimum widths, a 4-ft (1.2-m) wide bike lane can be used.

Bicycle Facility Guidance (Rural X-Sect.)

Minimum Bicycle Facility Guidance for Rural (Shoulder and Ditch) Cross Sections				
ADT		< 2,000	2,000 - 10,000	> 10,000
Posted Speed Limit	≤ 35 mph	SL or WOL	SL or WOL	WOL
	40 - 45 mph	PS (4 ft)	PS (4-6 ft)	PS (6-8 ft)
	> 45 mph	PS (4-6 ft)	PS (6-8 ft)	PS (10 ft)
SL = Shared Lane, PS = Paved Shoulder, WOL = Wide Outside Lane/Sharrow				

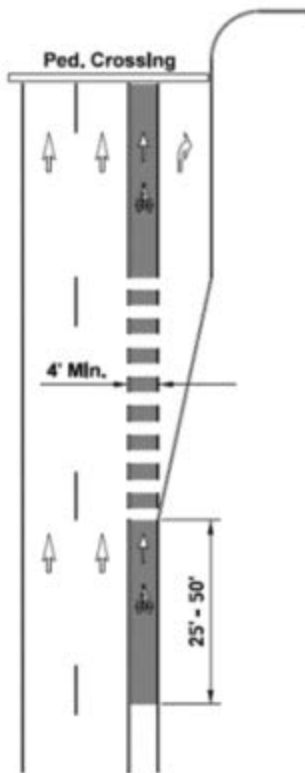


Bicycle Facility Guidance (Urban X-Sect.)

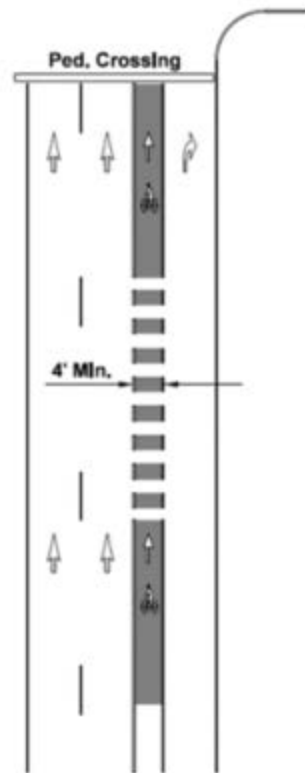
Minimum Bicycle Facility Guidance for Urban (Curb and Gutter) Cross Sections				
ADT		< 2,000	2,000 - 10,000	> 10,000
Posted Speed Limit	≤ 35 mph	SL or WOL	SL or WOL	WOL or BL (5 ft)
	40 - 45 mph	BL (5 ft)	BL (5 ft) or BBL (4 ft*)	BL (5 ft) or BBL (4 ft*) or SBL (4 ft*)
	50 - 55 mph	BBL (4 ft*) or SBL (5 ft*)	BBL (4 ft*) or SBL (5 ft*)	BBL (4 ft*) or SBL (5 ft*)
	> 55 mph	SUP	SUP	SUP
SL = Shared Lane		BBL = Buffered Bike Lane		SUP = Shared-Use Path
PS = Paved Shoulder		SBL = Separated Bike Lane		
BL = Conventional Bike Lane		WOL = Wide Outside Lane		
* Add buffer a minimum of 3 feet in width; buffered bike lanes are preferred when on-street parking is present regardless of the speed				



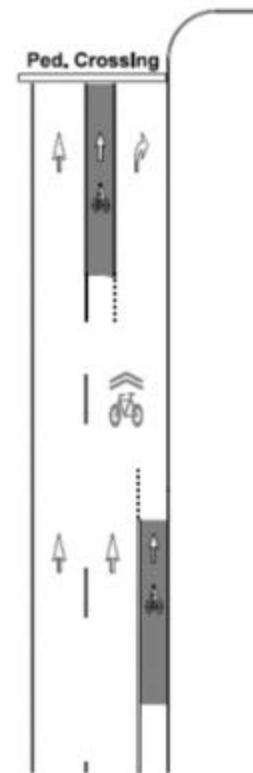
Bicycle Lanes at Intersections



Right-Turn-Only Lane



Parking Area Becomes
Right-Turn-Only Lane



Right Lane Becomes
Right-Turn-Only Lane



Striped On-Street Bicycle Lanes

- Why all these requirements?
- Because no one wants this:



Shared-Use Paths

Design Criteria:

- Shared-use paths must meet all applicable ADA/PROWAG requirements to the maximum extent feasible or to the extent it is not structurally impracticable
- 5% max grade (unless adjacent roadway is steeper)
- 18 mph min. Design Speed
- Min. horizontal curve radius is 60 feet
- Min. width is 10 feet
- Min. width can be reduced to 8 feet when severe constraints are present



Multimodal Design Deviation Request Form

- TDOT understands the need for flexibility in design
- Simple 3-page form to document why need to deviate from TDOT standards
- Request more likely to be approved if meet design standards from AASHTO, NACTO, NCHRP, ITE, other DOT

The image displays three overlapping copies of the 'Multimodal Design Deviation Request Form' (November 22, 2017). The top-most form is tilted and shows the following sections:

- Title:** Multimodal Design Deviation Request Form
- Introduction:** This form shall be completed when deviations are requested from the minimum design standards related to multimodal facilities. The minimum design standards are typically found in Chapter 16 of the TDOT Design Guidelines and TDOT's Strategic Design. Designing a multimodal facility roadway & not a one-size-fits-all approach. It requires an analysis of various site conditions to determine appropriate treatments and solutions. Some constraints from economics, terrain, and dimensions may not be possible in these contexts that are often in contravention of right-of-way. Applying flexibility in the geometric design process is often justified.
- Project Data:** A table with fields for PIN, County, Federal Project No., State Project No., Facility Type, and Local Program Project.
- Requester Data:** Fields for Name, ADP, Design Service, Project Location, Functional Class, and Access Control.
- Request Type:** Radio buttons for New Alignment, Reconstruction, Rehabilitation, and Other Maintenance.
- Design Features Checklist:** A list of features with checkboxes: Shared Use Path, Mid-block crossing, RRFS or II-AWK, Bike lane, Bike lane buffer, Route, Lane at intersection, Separated bike lane, and Utility/stop.
- Justification Section:** A series of horizontal lines for describing the deviation and its justification.

The bottom-most form is also tilted and shows the 'Requester Data' section and the 'Request Type' section.



Training

- June 2018- Training held in all TDOT regions (Jackson, Nashville, Chattanooga, Knoxville & Kingsport)
- 255 Attendees from 47 different agencies/firms- Mix of TDOT staff, consultants, local government employees



Next Steps

- Continue to update Guidelines as needed- intended to be a living document
- Continue to offer training
- Lead by example:



TDOT Resources



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