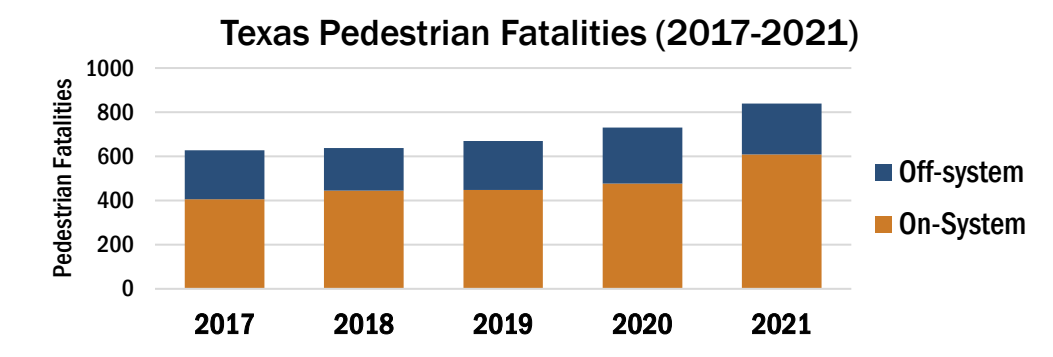
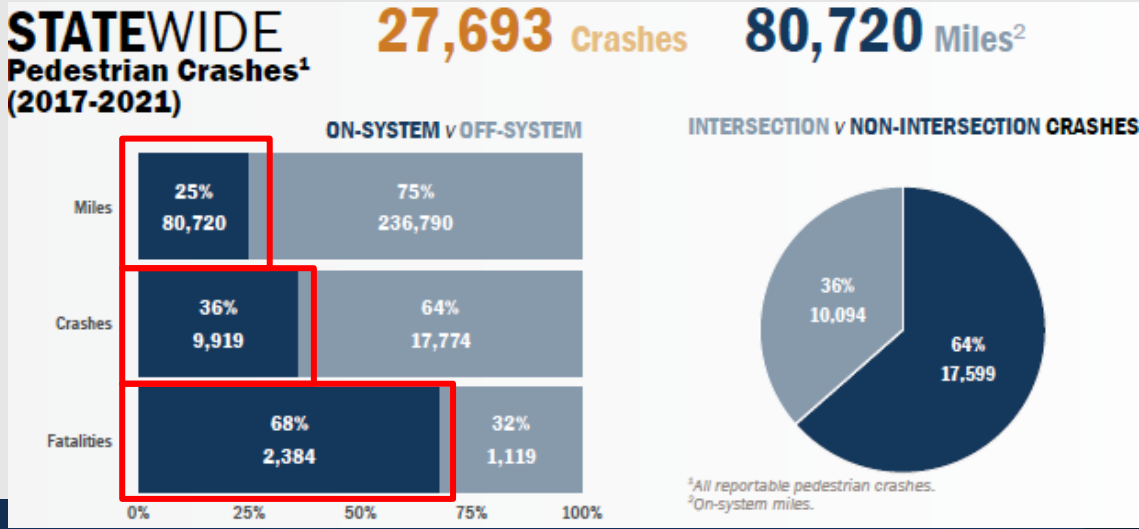
Texas Pedestrian Safety Action Plan

Texas Pedestrian Safety Forum

August 24, 2023

Pedestrian Safety in Texas

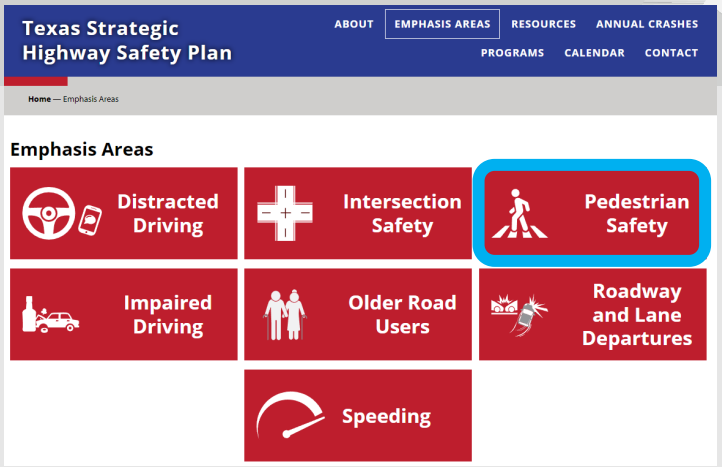


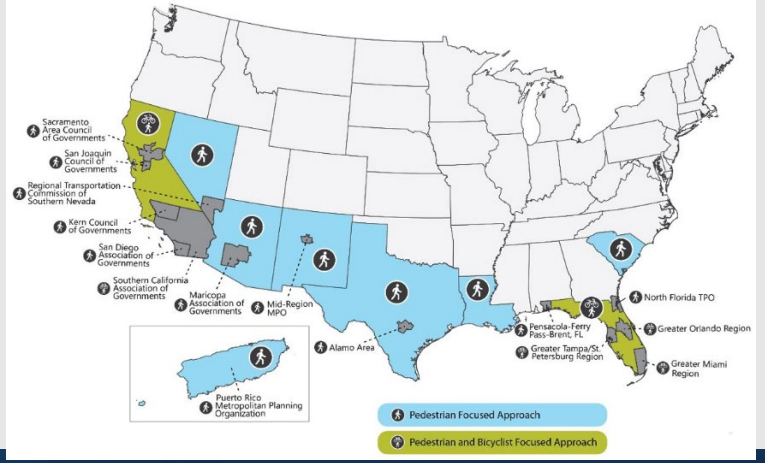


Data Source: CRIS Data (2017-2022). Extracted April 14, 2022.

Why Develop a PSAP?

- Identify locations of pedestrian safety risk and strategies to reduce frequency of pedestrian related crashes – with a focus on eliminating fatal and serious injury crash severities
- Texas Strategic Highway Safety Plan (SHSP)
  - Strategy #7 – Develop strategic pedestrian safety plans tailored to local (Texas) conditions
- Federal Highway Administration (FHWA) identified Texas as a Focused Approach State providing technical assistance
- TxDOT's Bicycle and Pedestrian Advisory recommendation





Spectrum of Crash Analysis Approaches

Most reactive → Most proactive

Targeted/Traditional

Spot Safety Approach

Makes improvements at individual sites or road segments with relatively high numbers of crashes, without regard to other sites with similar risk factors.

Corridor Retrofit Approach

Makes improvements at several adjacent locations (with possibly similar risk factors), not all of which may have experienced a high number of crashes.

Systemic

Systemic Approach

Makes improvements at locations with a high predicted crash risk or presence of key risk factors, regardless of actual crash history.

Systematic Approach

Makes improvements at all sites in an area, regardless of predicted crash risk or crash history.

Modified from FHWA slide.

PSAP used complementary analyses

- **Goal of PSAP: To provide a framework to improve pedestrian safety performance**
- Identifies locations where there is increased risk for future pedestrian crashes
- Identifies locations at a District Level

Traditional

Systemic*

*Systemic Analysis Constraints:

- Systemic analysis only features on-system roads
- Systemic analysis will not include intersections as detailed GIS intersection data does not exist for on-system roads

Texas Pedestrian Safety Action Plan

1 Systemic Safety Analysis*

On-system Pedestrian Crash subset

Determine Focus Facilities

- Identify **Statewide** Risk factors
- Identify **District-level** Risk factors

2 Targeted (Hot-Spot) Safety Analysis

Pedestrian Crash subset

Sliding windows technique

- Identify Crash statewide hot spots
- Identify Crash hot spots by peer group

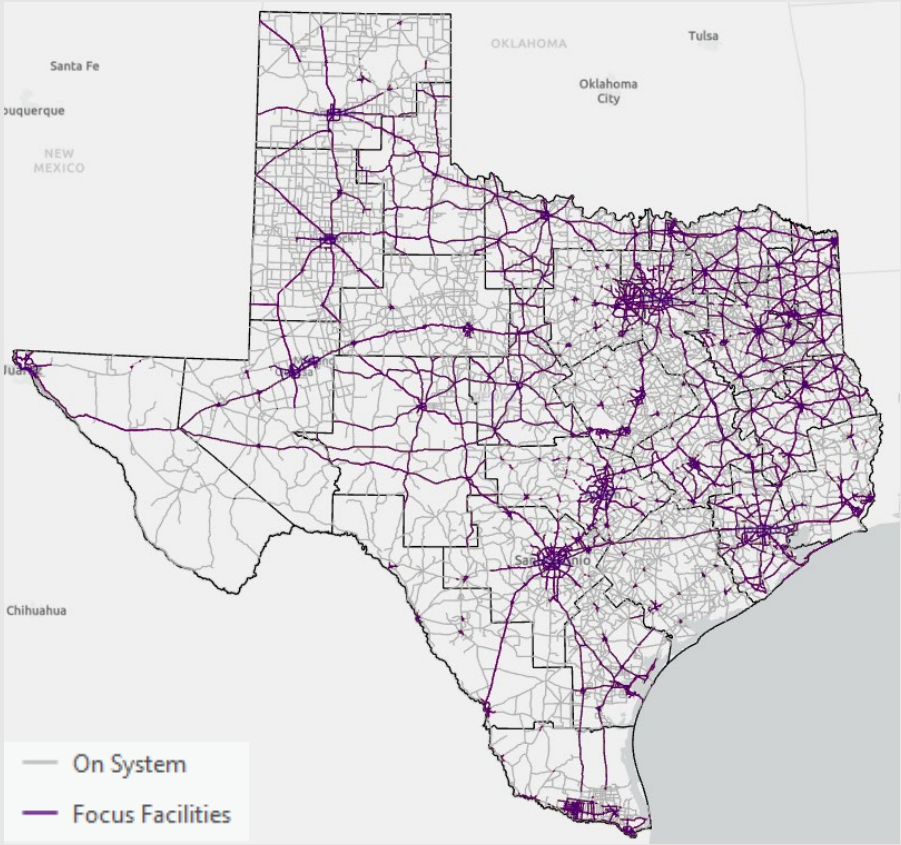
3 Identify priority corridors and potential countermeasures

- Infrastructure investments incorporating socio-economic analysis
- Policy measures

All crash analyses use a 2017 to 2021 crash dataset

** Systemic analysis only includes on-system, non-intersection, pedestrian injury and fatal crashes . All analyses only include TxDOT reportable, located crashes.*

Focus Facilities Network



Focus facilities

- Subset of roadway segments with shared characteristics and a majority of pedestrian crashes used for systemic analysis
- Only 19,045 miles (23.6%) of 80,720 on-system miles

GIS Data Source: 2020 TxDOT Roadway Network. TxDOT TPP

Statewide Risk Factors Categories

Risk Factor Category	Risk Factor Names
Pedestrian Inventory	Bus Pad Offset, Bus pad width, Crosswalk Presence, Crosswalk Width, Curb Cut Offset, Curb Cut Presence, Sidewalk Condition, Sidewalk Presence, Transit Stop Presence
Roadway Environment	Area Type, Functional Class
Roadway Geometry	Climbing Passing Overturning Lane, Curb Presence, Highway Division, Inside Shoulder Type, Inside Shoulder Use, Inside Shoulder Width, Lane Width, Median Presence, Median Type, Median Width, Minimum ROW, Number of Lanes, Outside Shoulder Use, Outside Shoulder Width, Roadbed Width, Shoulder Presence, Surface Width
Traffic Attribute	ADT, Max Speed, Truck ADT, Truck Pct

Systemic Pedestrian Safety Risk Factors Summary

Statewide

There were **32** pedestrian crash risk factors on all focus facility roads.

Interstates/Freeways

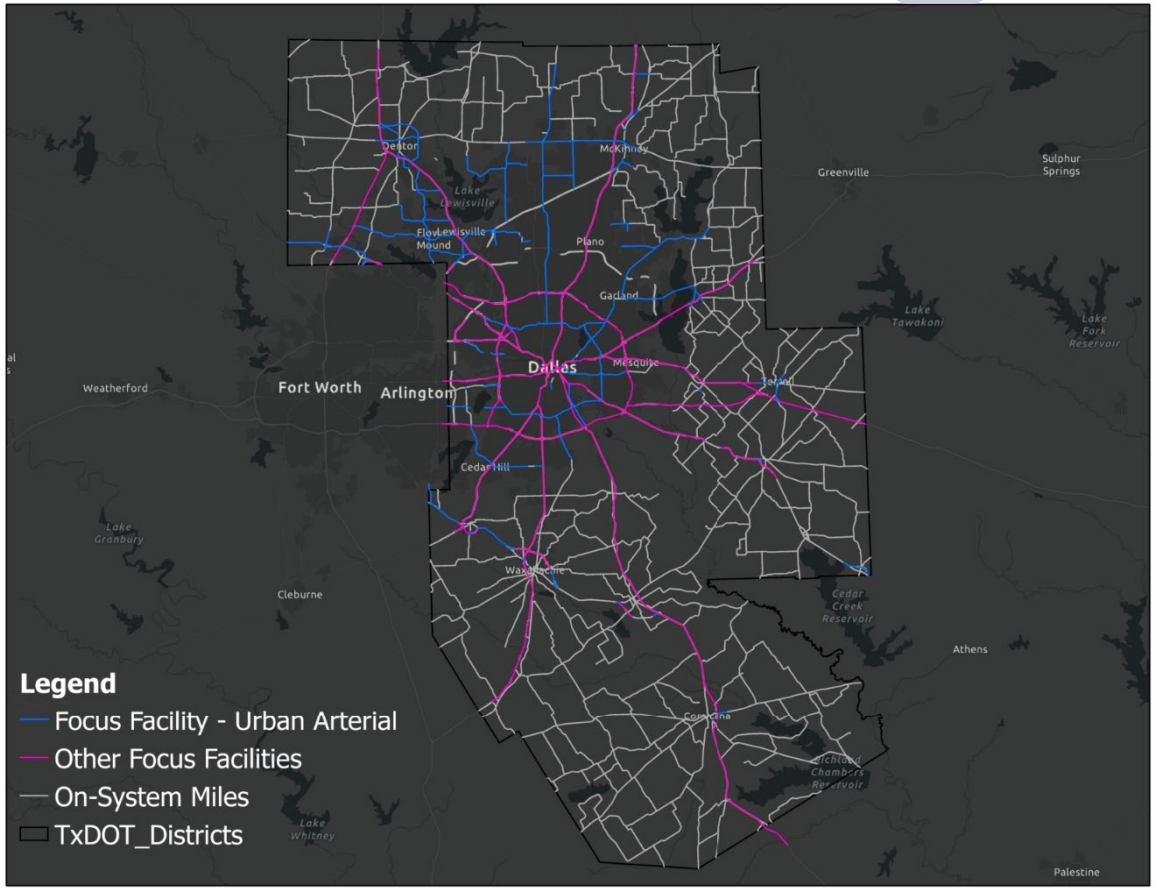
There were **20** risk factors on **urban** and **14** risk factors on **rural** interstates/freeways.

Arterials

There were **30** risk factors on **urban** and **18** risk factors on **rural** arterials.

Risk Factor Example – Urban Arterials in Dallas District

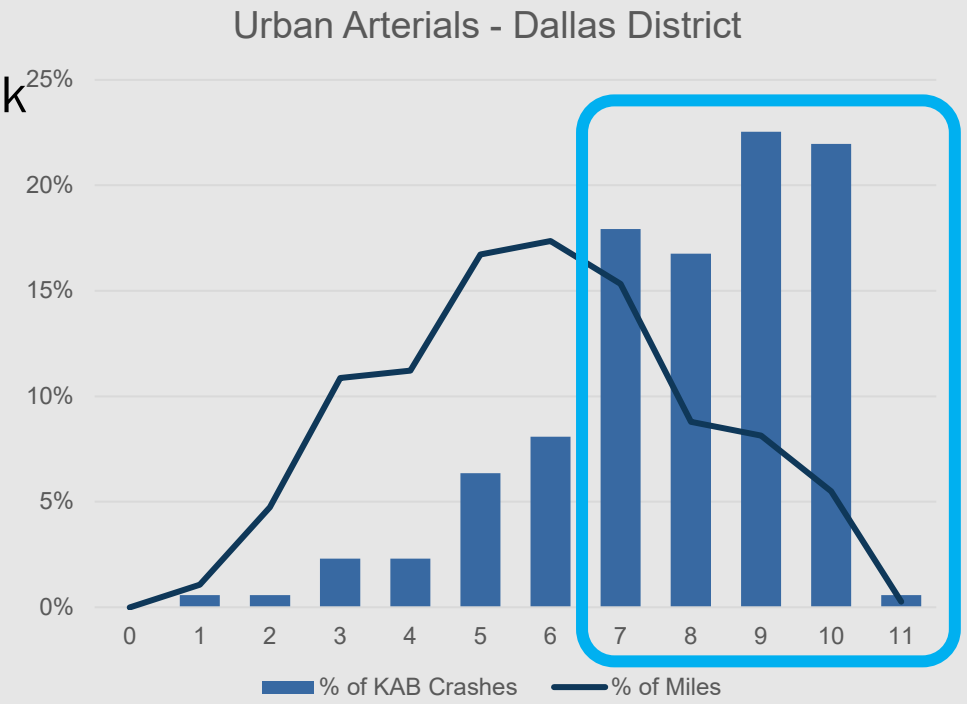
- Dallas District
  - 3,669 On-System miles
  - 739 KAB Pedestrian crashes
- Focus Facilities
  - 884 miles (24.1%)
  - 649 KAB crashes (87.8%)
- Focus Facilities – Urban Arterials
  - 363 Miles (480 segments)
    - Average length 0.76 miles
  - 173 KAB Pedestrian Crashes



Risk Factor Example – Urban Arterials in Dallas District

- 11 Possible Risk Factors
- "Potential Risk" designation ≥ 7 Risk Factors
  - 80% of KAB Crashes
  - 38% of Miles

	Risk Factor	Dallas
Urban Arterials	ADT	26k to 30k
	Area Type	Large Urbanized
	Bus Pad Offset	45 to 49.9 feet
	Functional Class	Other Principal Arterial
	Inside Shoulder Width	0 ft
	Max Speed	40 & 45
	Median Presence	Median
	Outside Shoulder Use	No Designated Use
	Sidewalk Presence	Present
	Transit Stop Presence	Present
	Truck ADT	500 to 1,499



Risk Factor Example – Urban Arterials in Dallas District

- SL 12 / Great Trinity Forest Way (Southeast Dallas – Between US 175 & I-45)

★ 29,425 ADT
★ 1,023 Truck ADT
★ Other Principal Arterial
★ 45 mph Speed Limit

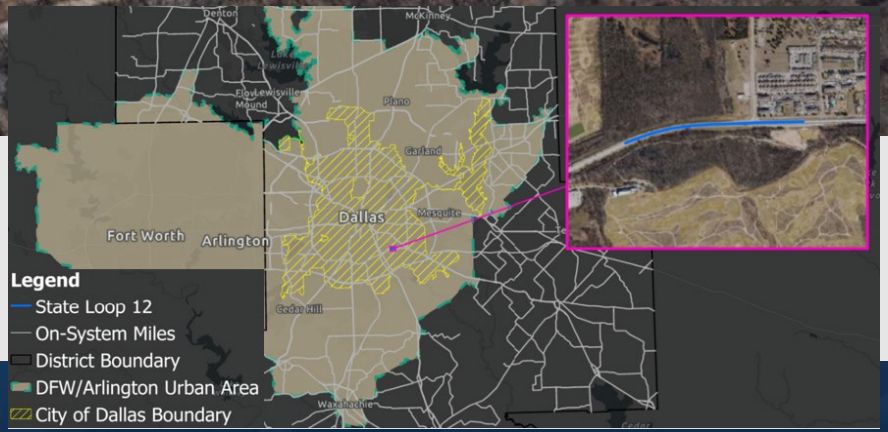
★ 47.8 ft Bus Pad Offset

★ Sidewalk Present

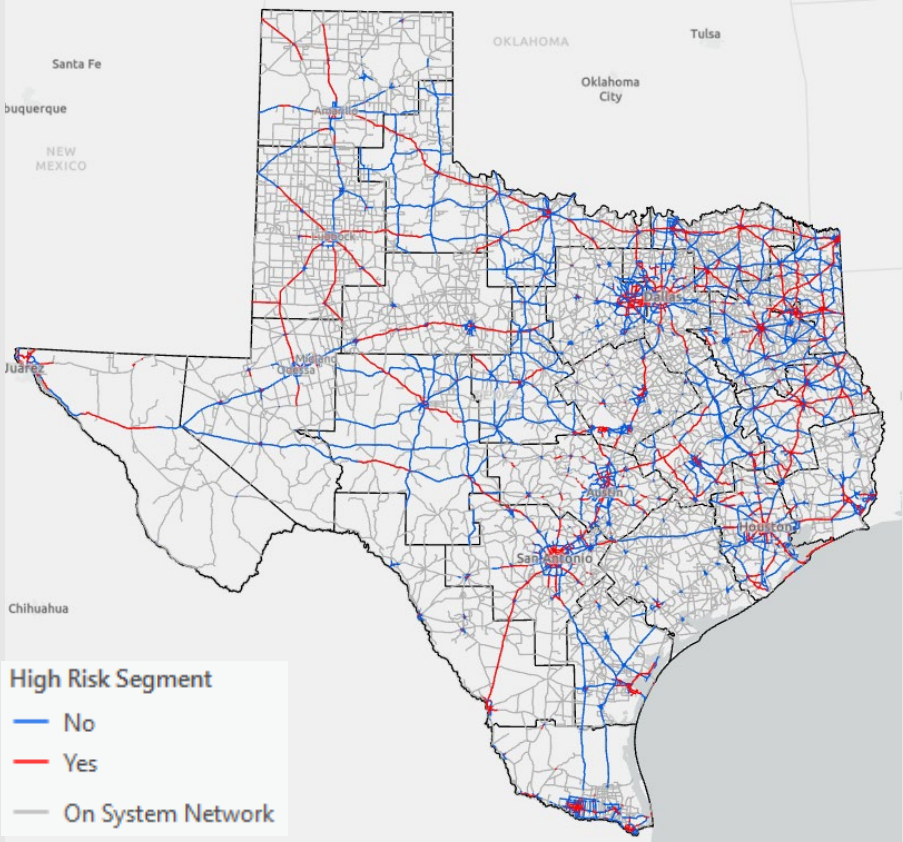
★ Transit Stop Present

★ Large Urbanized Area Type

★ Curbed Median

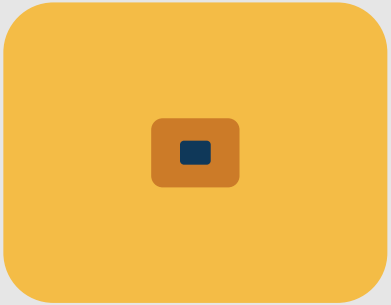


Systemic Analysis Results



Systemic Crash Risk Segments

- Subset of focus facilities with an over-representation of risk factors
- Only 6,241 miles (7.7%) of 80,720 on-system miles
- Crash dataset includes on-system, located, reportable, non-intersection, pedestrian KAB crashes



On-system miles (80,720)
Focus Facility miles (19,045)
Potential Risk miles (6,241)

GIS Data Source: 2020 TxDOT Roadway Network. TxDOT TPP

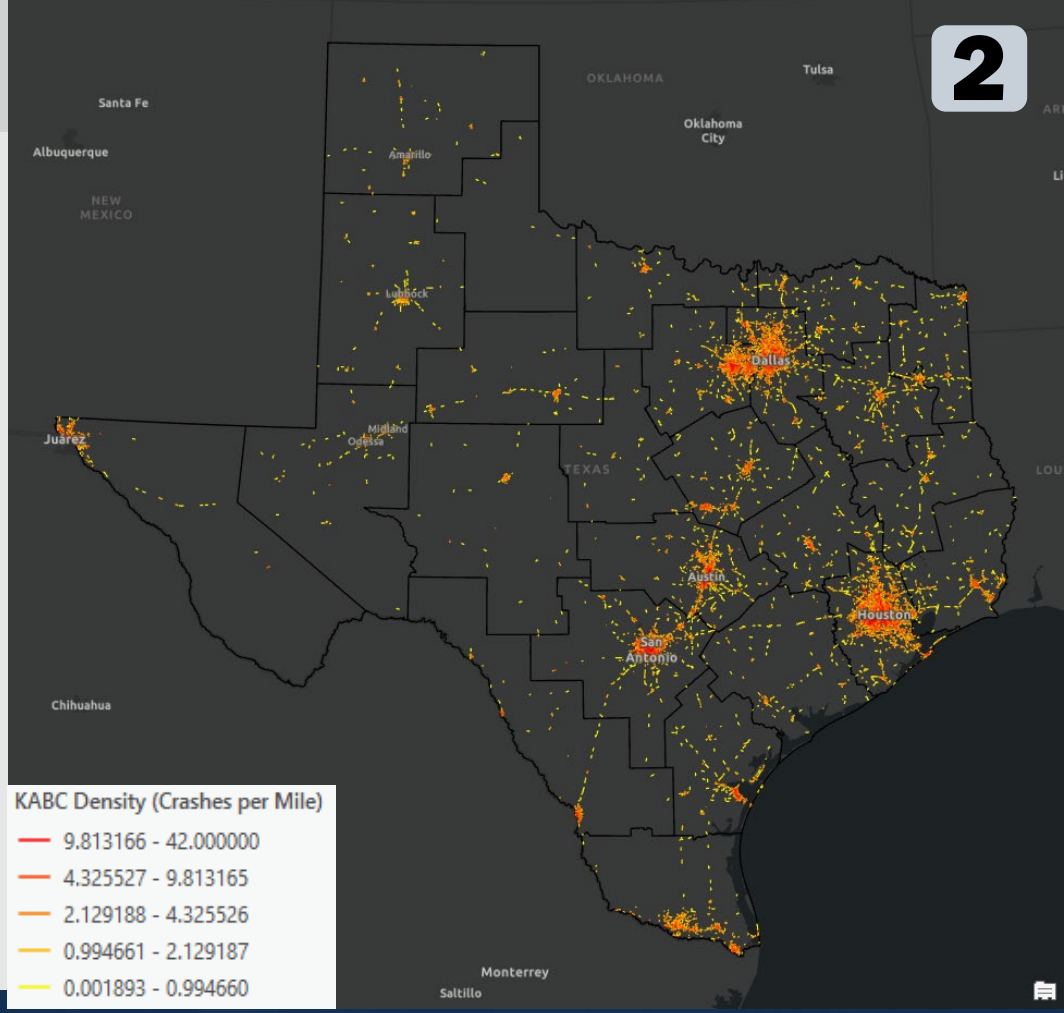
Pedestrian Crash Density Results

2

On and Off-system pedestrian crashes*

	KABC Density (Crashes per mile)
	9.81 – 42.0
	4.32 – 9.80
	2.13 – 4.31
	0.99 – 2.12
	0.002 - 0.99

* KABC Crashes > 0



GIS Data Source: CRIS Data (2017-2022). Extracted April 14, 2022.

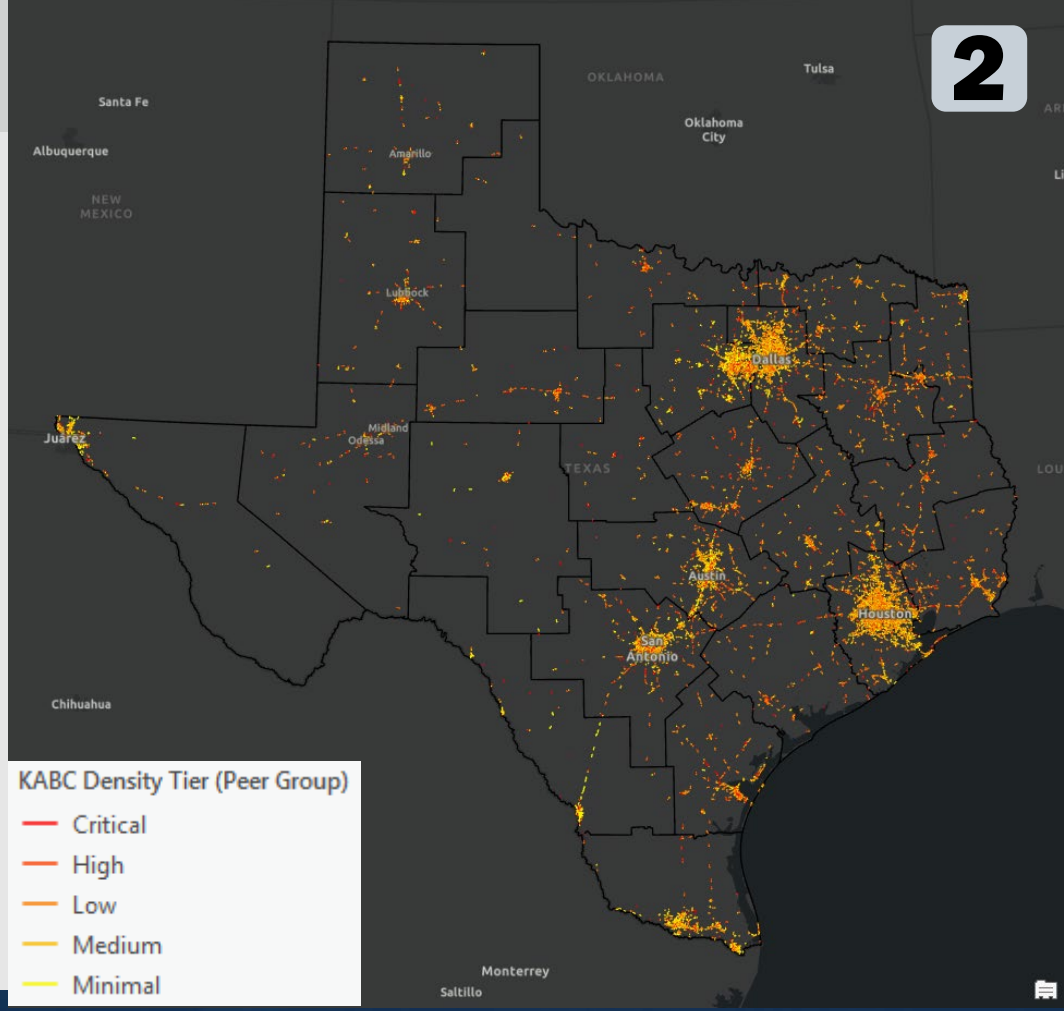
Peer Group Crash Density Results

Each roadway segment is placed into a peer group based on 4 criteria: District, simplified functional class, urban vs rural, and on- vs. off-system

On and Off-system pedestrian crashes*

Crash Density Tiers by Peer Group	Miles	Percent
Critical	1,568	11.8%
High	1,452	10.9%
Medium	3,308	24.9%
Low	4,684	35.3%
Minimal	2,273	17.1%
Total	13,285	100%

* KABC Crashes > 0



GIS Data Source: CRIS Data (2017-2022). Extracted April 14, 2022.

Countermeasure Selection Process

- ☑ Identified engineering and programmatic countermeasures
- ☑ Developed logic to support an assessment of suitable improvements using existing data
- ☑ Applied countermeasures to potential-risk and hot spot segments

Programmatic Countermeasures

- Frontage road study
- Speed limit study
- Programs to aid disabled vehicles (e.g. H.E.R.O. program)
- Education to unintended motorists
- Roadway safety audit
- Reduce speed limits
- Right-turn-on-red restrictions
- Other education programs

Engineering Countermeasures – Segment Treatments

Countermeasure	TxDOT HSIP Code	TxDOT CRF	Available CRF?	Analysis Type	Specific locations ID'd
Install School Zones	114	20%	–	Systemic	☑
Improve School Zones	133	10%	–	Both	☑
Install Median Barriers	201	75%	–	Systemic	☑
Install Raised Median	203	25%	–	Systemic	☑
Upgrade/install Safety Lighting	304	49%	–	Both	☑
Install Sidewalk	407	65%	–	Both	☑
Install Shared Use Path	–	–	–	Both	☑
Median barrier height extensions (High-speed roads)	–	–	–	--	
Traffic Calming (Lane narrowing, speed tables, chicanes, etc.)	–	–	–	Systemic	☑
SOXSOP (Safety and Operational Xross Section Optimization)	–	–	Yes	Systemic	☑

☑ = Data is available to apply countermeasures to specific locations

Engineering Countermeasures – Spot treatments

Countermeasure	TxDOT HSIP Code	TxDOT CRF	Available CRF?	Analysis Type	Specific locations ID'd
Install Traffic Signal	107	35%	–	--	
Upgrade to Pedestrian Signal	110	34%	–	--	
Install Pedestrian Hybrid Beacon (PHB)	143	15%	–	Both	☑
Install Rectangular Rapid Flashing Beacon (RRFB)	144	–	Yes	Both	☑
Install Crosswalk Markings	403	10%	–	--	
Construct Pedestrian Over/Underpass	523	95%	–	--	
Install Roundabouts	547	62%	–	--	
Install Raised Pedestrian Crosswalks	–	–	Yes	Targeted	☑
Install Pedestrian Refuge Islands	–	–	Yes	Targeted	☑
Install In-street pedestrian signs	–	–	–	Targeted	☑
Flashing Yellow Pedestrian Protection	–	–	–	–	
Stop Lines at Traffic Signals	–	–	–	–	
Leading Pedestrian Interval	–	–	–	Targeted	☑
Pedestrian Scramble	–	–	–	Targeted	☑
Curb Geometrics	–	–	–	Targeted	☑

☑ = Data is available to apply countermeasures to specific locations

Systemic Countermeasure: Install Sidewalk

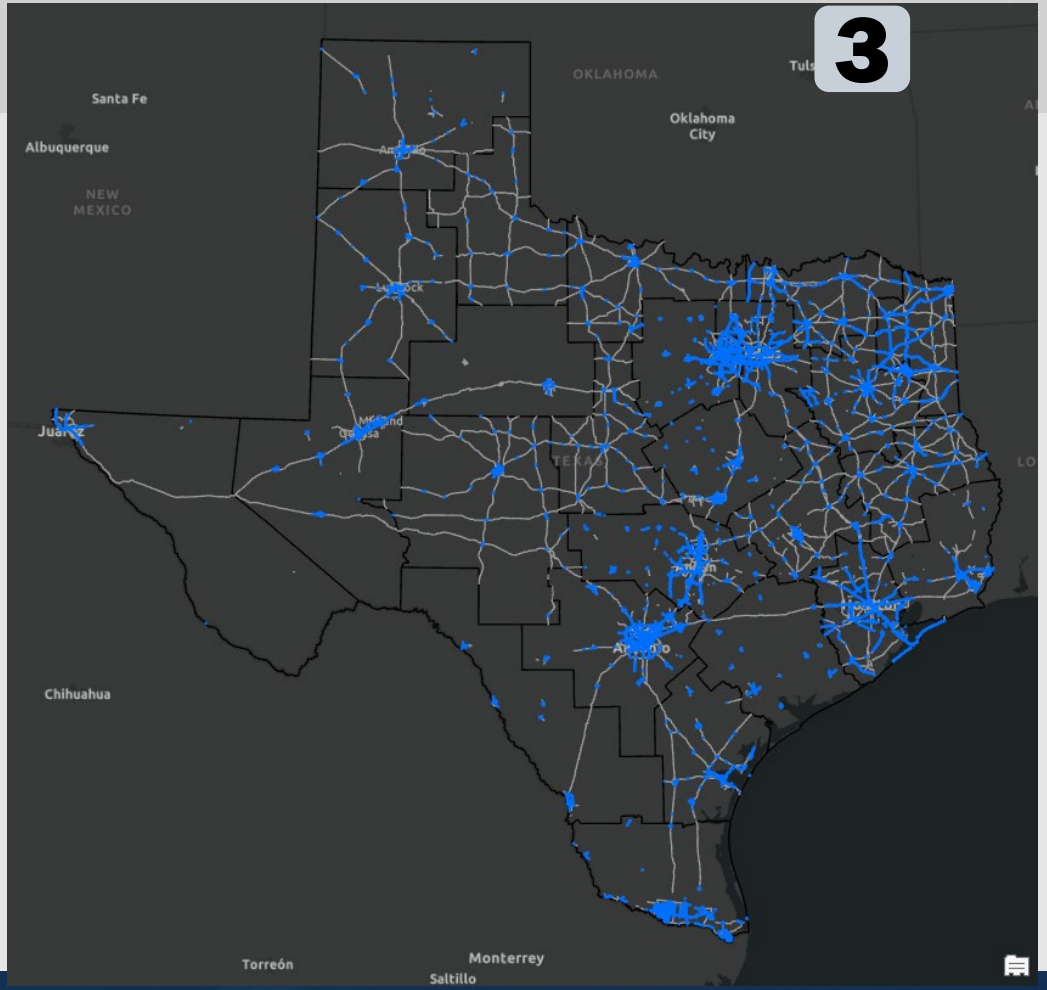
- Approximately 5,961 miles
- Sidewalk Countermeasure suggested if:

Criteria #1

- Sidewalk Coverage = Mostly Present to None Present
- Functional Classification
  - Other Principal Arterial
  - Minor Arterial
  - Major Collector
  - Minor Collector
  - Local
- Posted Speed Limit ≤ 55 mph

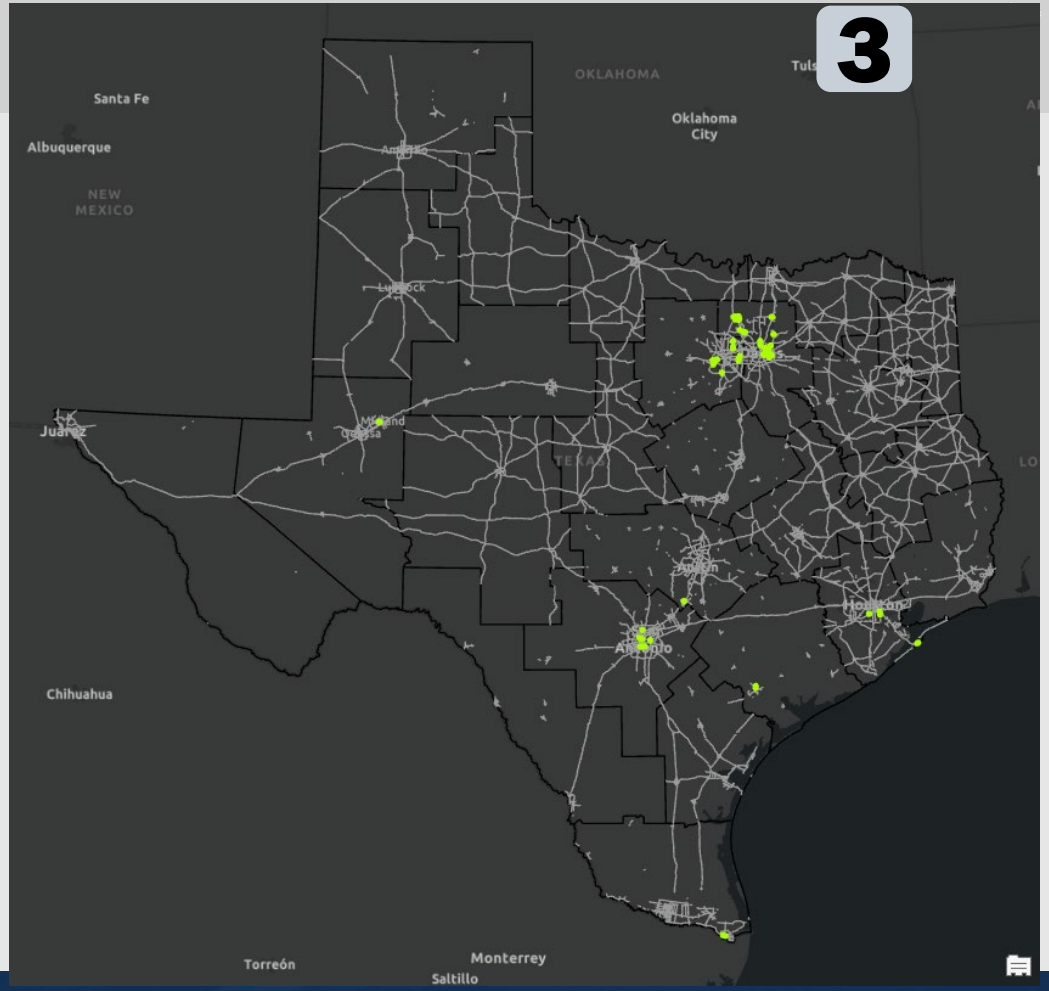
Criteria #2

- Sidewalk Coverage = Mostly Present to None Present
- Functional Classification
  - Interstate
  - Other Freeway and Expressway
- Area Type = Urban



Systemic Countermeasure: Install Pedestrian Hybrid Beacon

- Approximately 44 miles
  - 81 segments/locations
- Ped Hybrid Beacon Countermeasure suggested if:
  - Sidewalk Coverage
    - Mostly to Fully Present
  - Speed Limit ≤ 40 MPH
  - Number of Lanes = 6

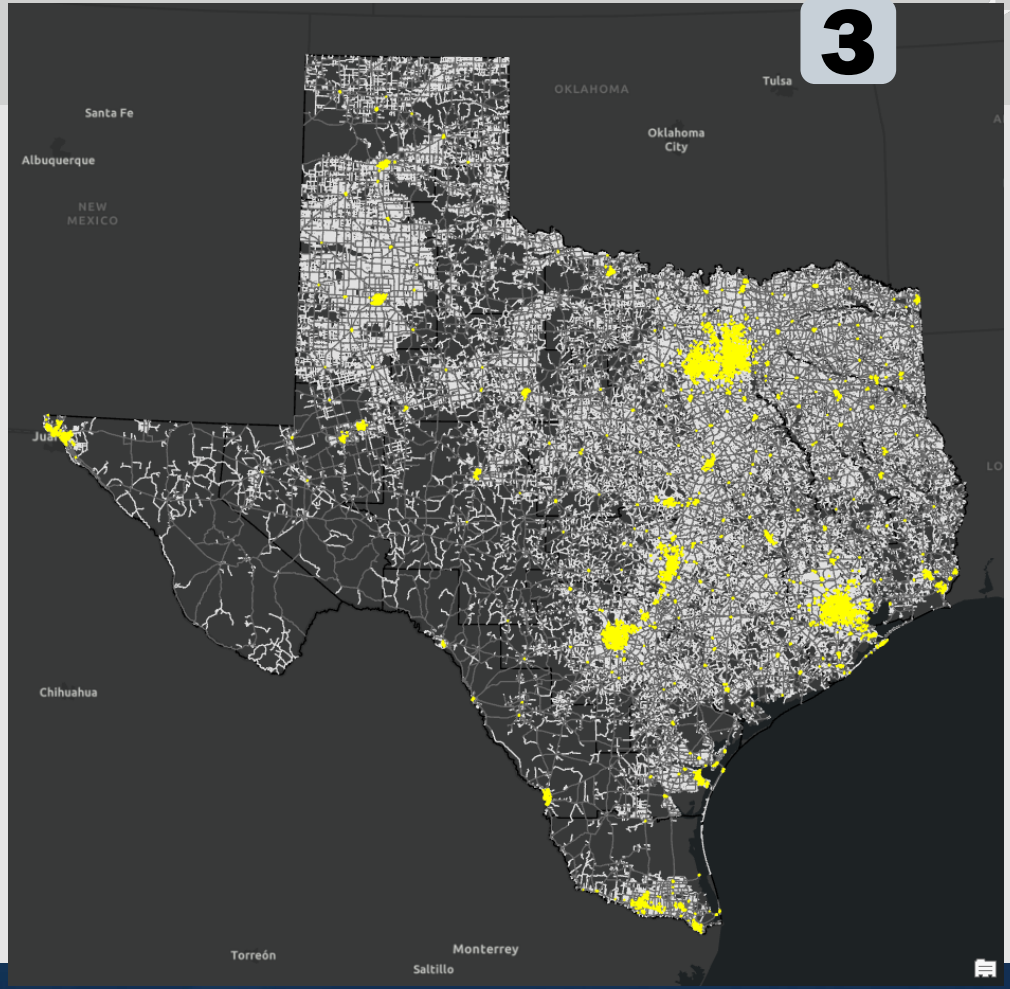


Criteria based on TxDOT RRFB & PHB 2018 Memo

Targeted Countermeasure: Install In-Street Pedestrian Signs

- In-Street Pedestrian Signs Countermeasure suggested if:
  - Traffic Volume < 10,000 vpd
  - Number of Lanes < 4
  - Speed Limit ≤ 30 MPH
  - Signal Related Crashes = 0
  - KABCO > 0

In-Street Ped Signs	Miles	Locations
On-System	40	164
Off-System	4,009	20,007



* Criteria based on STEP: Crosswalk Visibility Enhancements Fact Sheet

PSAP Products

TxDOT Deliverables:

- One, 4-page tabloid set for each District (25 total)
  - Page 1 - Statewide and District pedestrian safety profile
  - Page 2 - District-level systemic safety analysis results
  - Page 3 - District-level targeted safety analysis results
  - Page 4 - District-level prioritized corridors and countermeasure results
- Statewide Summary Report

District/MPO Deliverable:

A statewide interactive Pedestrian Crash Screening Tool Dashboard

- Features all PSAP results (systemic potential-risk segments, targeted safety analysis hot spots, prioritized corridors, and suggested countermeasures)

Interactive Dashboard Walk-through

- Live demo of PSAP interactive dashboard

PEDESTRIAN SAFETY ACTION PLAN

Summary Statistics

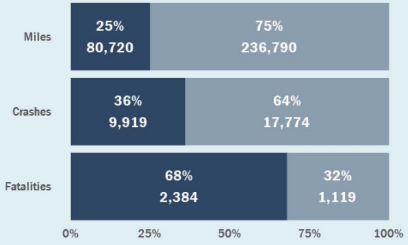
San Antonio District

STATEWIDE Pedestrian Crashes[1] (2017-2021)

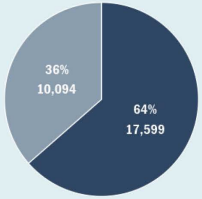
27,693 Crashes

80,720 Miles[2]

ON-SYSTEM v OFF-SYSTEM



INTERSECTION v NON-INTERSECTION CRASHES



[1]All reportable pedestrian crashes.
[2]On-system miles.

DISTRICT WIDE Pedestrian Crashes (2017-2021)

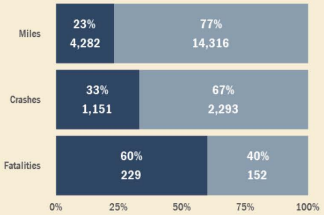
3,444 Crashes

12% of statewide crashes

18,598 Miles

6% of statewide miles

ON-SYSTEM v OFF-SYSTEM



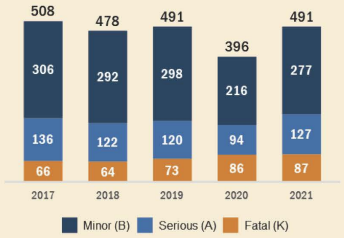
376 Pedestrian Fatalities

26% of district fatalities

618 PEDESTRIAN Serious Injuries

9% of district serious injuries

PEDESTRIAN CRASHES BY INJURY SEVERITY



FACTORS AND CONDITIONS[3] FOR ALL PEDESTRIAN CRASHES

53% *Low light conditions*

37% *Pedestrian failed to yield to vehicle*

36% *Driver or pedestrian inattention*

[3]As reported by the investigating police officer at the time of the crash.

VULNERABLE POPULATIONS

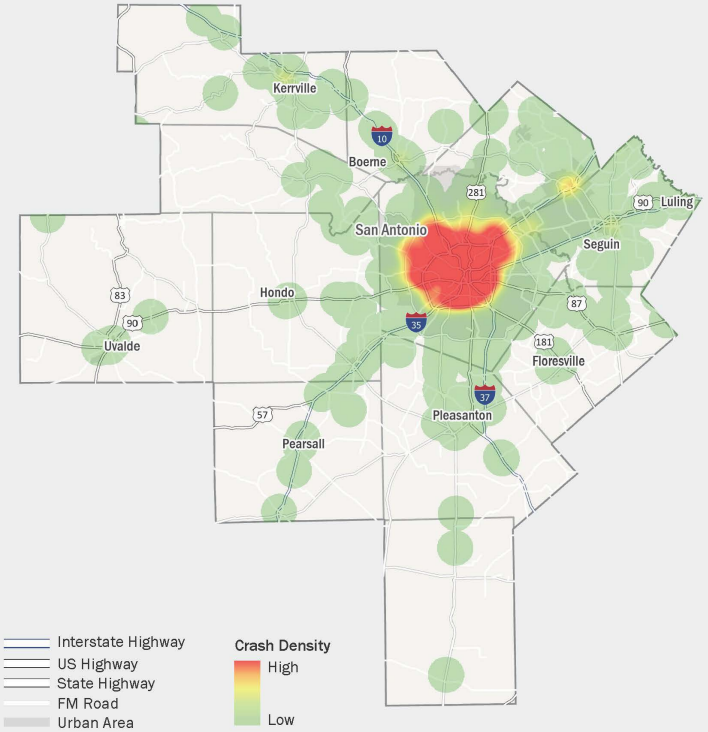
12% *Involved a child pedestrian aged 16 and younger*

11% *Involved an adult pedestrian aged 65 and older*

Data Filters

This summary includes pedestrian reportable crashes.

District-wide Pedestrian Crash Heatmap



FOCUS FACILITIES

A subset of facilities (focus facilities) was used to narrow the crash analysis to roadways where most crashes are occurring in each District. Four primary roadway attributes were considered to identify the focus facilities using District-specific criteria: area type (urban v rural), functional class, roadway division type, and speed limit.

RISK FACTORS

Risk Factors are the roadway attributes and traffic characteristics present where crashes were reported. Risk factors are not necessarily contributing factors and may or may not have contributed to any/all crashes at an individual site. They may indicate a greater potential for severe focus crashes to occur at the site or similar sites.

Types of Risk Factors

- Directly actionable
- Actionable but not easily
- Not actionable but important indicators

Methods

Overrepresentation analysis is data-driven, flexible and ensures analysis will have meaningful results. It is documented in FHWA's Systemic Safety Project Selection Tool (SSPST).

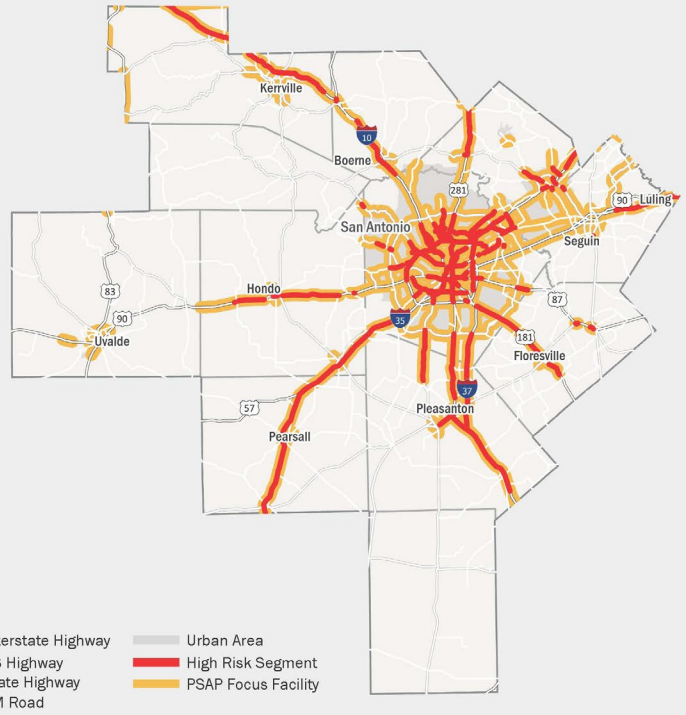
District Risk Factors

San Antonio Risk Factors	Rural		Urban	
	Interstate/Freeway	Arterial	Interstate/Freeway	Arterial
ADT	25k to 30k	10k to 14k	125k to 175k	15k to 35k
Area Type				Large Urbanized
Bus Pad Offset		40 ft to 45 ft		
Bus Pad Width				
TWLTL Presence				
Crosswalk Presence				
Crosswalk Width		95 in to 100 in		
Curb Cut Offset	80 ft to 85 ft	25 to 35 & 40 to 45 ft		
Curb Cut Presence				Present
Curb Presence				Present - Both Sides
Functional Class		Other Principal Arterial		Other Principal Arterial
Highway Division		Divided		
Inside Shoulder Type				
Inside Shoulder Use				
Inside Shoulder Width		3 to 4 & 13 to 14 ft		
Lane Width				11 ft to 12 ft
Max Speed	75	55	60 & 65	40 & 45
Median Presence	Median			
Median Type			Positive Barrier Rigid	
Median Width				
Minimum ROW			300 ft to 325 ft	100 ft to 125 ft
Number of Lanes		4	6 & 8	6
Outside Shoulder Use				
Outside Shoulder Width				
Roadbed Width	80 ft to 85 ft			70 to 75 & 80 to 85 ft
Shoulder Presence				
Sidewalk Condition				
Sidewalk Presence				
Surface Width			75 to 80 & ≥100 ft	
Transit Stop Presence				
Truck ADT	8k to 9k		≥15k	1k to 2k
Truck Pct	30% to 33%	3% to 9% & 12% to 15%	3% to 6%	<3% & 6% to 9%

Data Filters

The systemic pedestrian crash analysis includes pedestrian KAB crashes that were located, non-intersection related, on-system, and reportable.

Systemic Safety Analysis Results:
High Risk Segments on Focus Facilities



TARGETED ANALYSIS

"Sliding Windows" technique that creates uniform crash densities to identify historic hot spots for pedestrian crashes.

- Subset of network into peer groups
- Split roads into chains of short segments of equal length, compute a smoothed crash density for each segment
- Assign a crash density tier (minimal to critical) to each short segment based on its smoothed crash density relative to the rest of the peer group.

Inputs

- All located pedestrian crashes in Texas (2017-2021).
- All Texas roadway segments (2020 TxDOT Roadway Inventory).

Outputs

- Roadway segments with assigned tier based on pedestrian crash density relative to peer group.

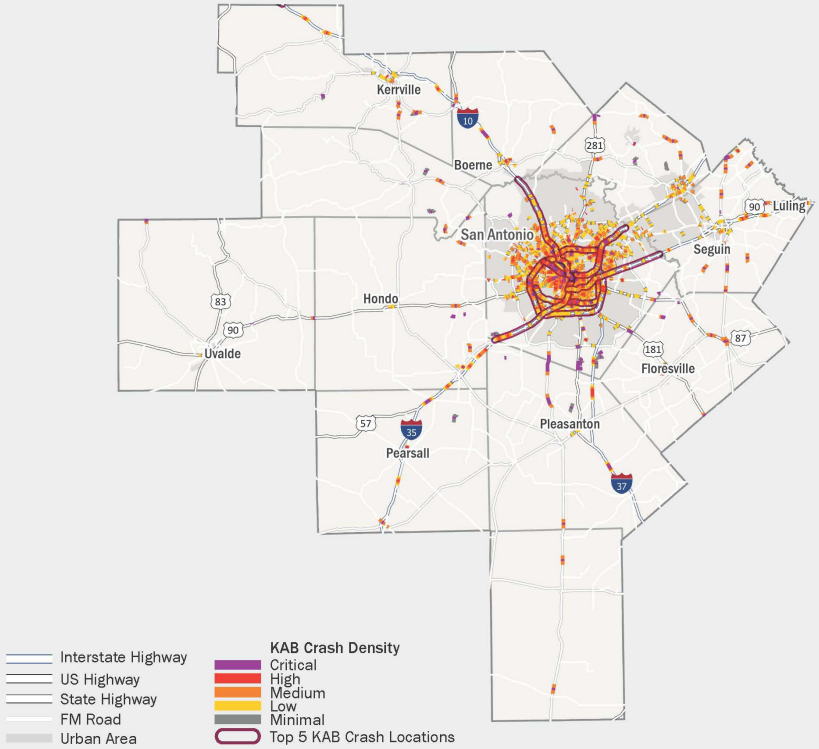
District Targeted (KAB Crashes)

Crash Density Tier	District On-system Miles	Percent	District Off-system Miles	Percent
Minimal	3,266	89.1%	14,024	96.5%
Low	171	4.7%	264	1.8%
Medium	136	3.7%	171	1.2%
High	43	1.1%	48	0.3%
Critical	50	1.4%	31	0.2%
Total	3,666	100%	14,538	100%

Top 5 Crash Corridors (Total KAB Pedestrian Crashes within County Limits)

1. State Loop 13 in Bexar County (89 crashes)
2. Interstate 410 in Bexar County (85 crashes)
3. Interstate 35 in Bexar County (74 crashes)
4. State Spur 421 in Bexar County (67 crashes)
5. State Loop 368 in Bexar County (37 crashes)

Targeted Analysis Results:
Historically Crash-Dense Segments by Peer Groups



Data Filters
The pedestrian crash targeted analysis includes located pedestrian crashes.

SUGGESTED COUNTERMEASURES

Corridor Prioritization Method

Suggested safety improvements resulted from a review of TxDOT's HSIP Guidelines document, industry best practices, and the CMF Clearinghouse. Countermeasures were then assigned along segments and near intersections identified during the systemic targeted analyses. Nineteen countermeasures were assigned using individualized data-driven logic. The top risk-based and targeted locations were prioritized based on three primary characteristics; 1) Identified as a high risk/ presence of crash history. 2) Accumulation of Fatal and Serious Injury crashes, 3) the CDC's Social Vulnerability Index (SVI). Additional countermeasures were considered including traffic operational or programmatic safety improvements were considered; however these were not directly applicable to specific locations. For a more detailed description of this process, please click on the link to the White Paper on the right side of the page.

District Prioritized Segments and Recommended Countermeasures

Rank	Segment Name	County	Length	Countermeasure
S1	Interstate 35	Bexar	2.0	Install Sidewalk, Shared Use Path, Install/ Upgrade Lighting
S2	Interstate 410	Bexar	2.0	Install Sidewalk, Shared Use Path, Install/ Upgrade Lighting
S3	Interstate 410	Bexar	2.0	Install Sidewalk, Shared Use Path, Install/ Upgrade Lighting
S4	Interstate 35	Bexar	2.0	Install Sidewalk, Shared Use Path, Install/ Upgrade Lighting
S5	US Highway 281	Bexar	2.5	Install Sidewalk, Shared Use Path, Install/ Upgrade Lighting

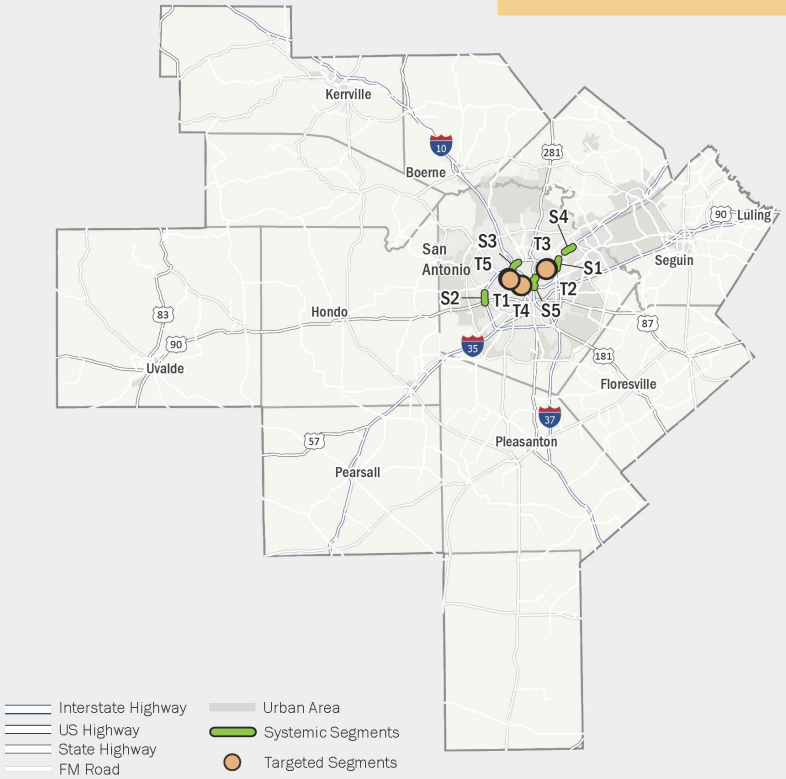
Rank	Segment Name	County	Length	Countermeasure
T1	State Spur 421	Bexar	0.2	Install Pedestrian Hybrid Beacon, Install/ Upgrade Lighting, Modify Curb Geometrics, Implement Leading Pedestrian Interval
T2	State Loop 368	Bexar	0.2	Install Sidewalks, Install/Upgrade Lighting, Modify Curb Geometrics, Implement Leading Pedestrian Interval
T3	State Loop 368	Bexar	0.2	Install Sidewalks, Install/Upgrade Lighting, Modify Curb Geometrics, Implement Leading Pedestrian Interval, Implement Pedestrian Scramble
T4	State Spur 421	Bexar	0.2	Install Shared Used Path, Install Pedestrian Hybrid Beacon, Install/Upgrade Lighting, Modify Curb Geometrics
T5	State Spur 421	Bexar	0.2	Install Pedestrian Hybrid Beacon, Install/ Upgrade Lighting, Modify Curb Geometrics

Disclaimer

Countermeasures presented here were developed from a statewide planning perspective and are suggestions rather than recommendations. TxDOT staff is encouraged to review locations and apply local knowledge when implementing safety improvements.

Prioritized Segment Locations

Countermeasure Selection Methodology White Paper



Steps toward implementation

Distribute

- FHWA workshop for TxDOT staff (May 2023)
- Conference presentations
- Interactive dashboard publicly accessible
- Periodically check-in to determine usage and improvements

Safety Planning and Programming

- SHSP Vulnerable Road User Assessment
- District Safety Plans
- MPO Safety Plans

Project Development

- Project scoring
- Safety project identification
- Roadway project scoping and design

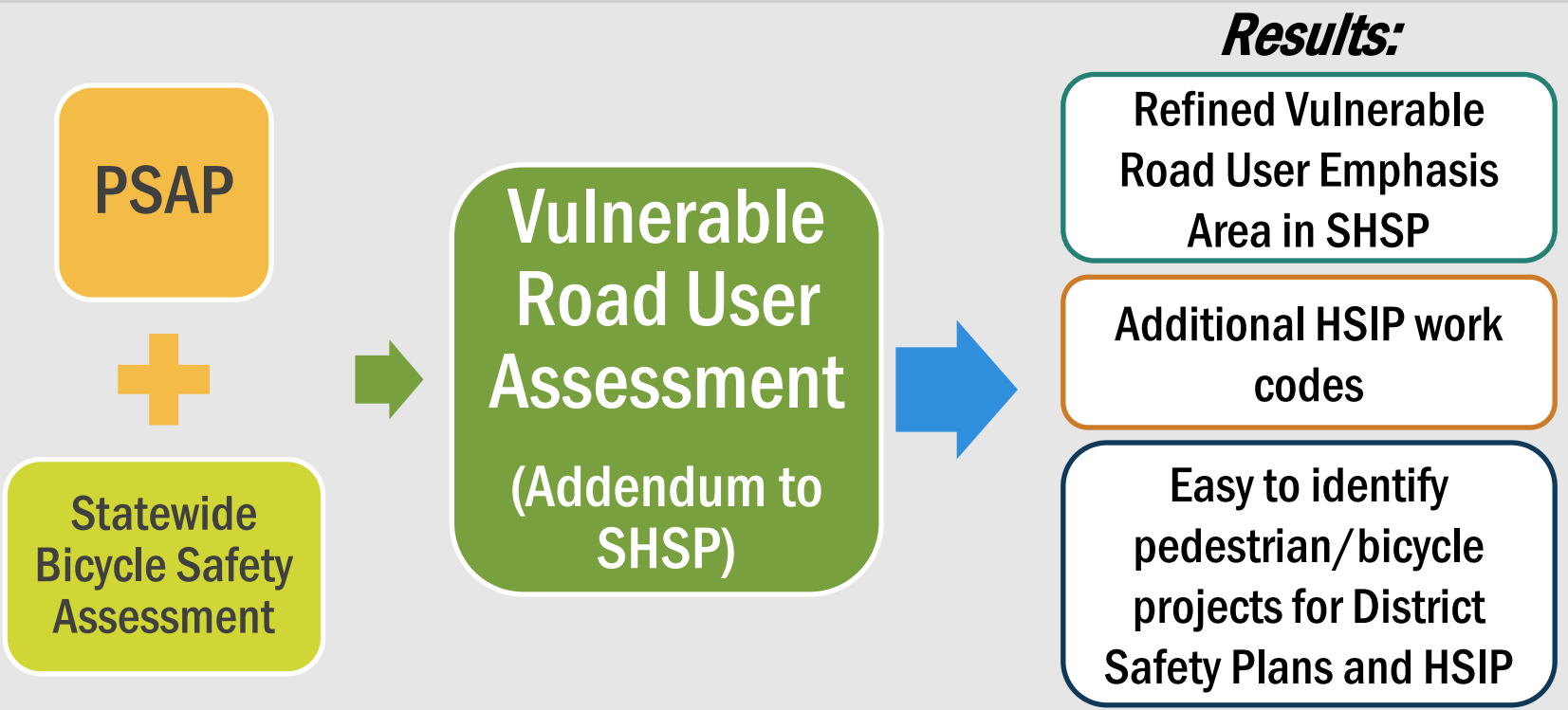
Funding

- Highway Safety Improvement Program
- Transportation Alternatives
- Traditional funding sources
- Discretionary grants – Safe Streets for All

Major Funding Sources

- Federal Funds
  - Transportation Alternatives (Category 9)
  - Highway Safety Improvement Program (Category 8)
  - Discretionary grants – Safe Streets for All
- State and Local Funds
- Health Agencies
- Private Funding

Next Steps – Texas VRU

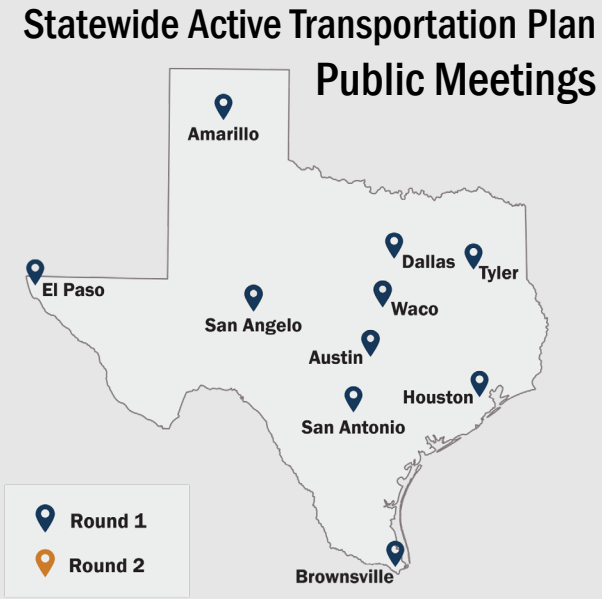


PSAP influences other current, on-going, planning documents

- **Statewide Multimodal Transit Plan**
  - First Steering Committee meeting - Sept 2023
  - Public survey launches - Oct 2023
  - Robust public awareness campaign

- **Statewide Active Transportation Plan**
  - In-person public meetings- Oct and Nov 2023
  - Future: Virtual Public Meeting and Survey

- **District Bike Plans**
  - Bryan, Pharr, Laredo, and San Antonio Districts
    - Virtual Public Meeting Sept 7 – Oct 8
    - TxDOT's Hearing and Meetings page
    - https://www.txdot.gov/projects/hearings-meetings/public-transportation/090723.html



Thank you!

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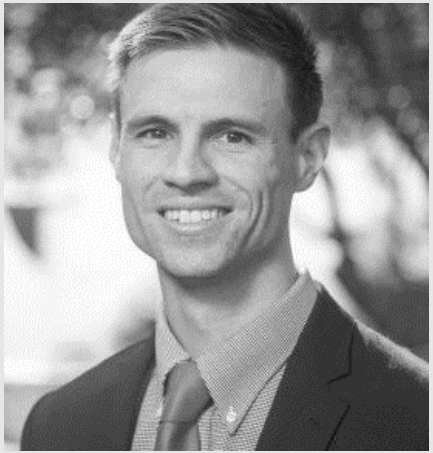

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