Houston-Galveston Area Council

Kimley»Horn
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HARRIS COUNTY
INTERSECTION SAFETY ASSESSMENTS

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Harris County intersection safety assessments were conducted by Houston-Galveston Area Council, Harris County, and Kimley-Horn. This report includes short-, mid- and long-term recommendations for improving safety at intersections within Harris County.

Prepared for:

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1 Executive Summary

A regionwide network screening was performed to determine high-crash intersections based on safety criteria (crash frequency, rate, and severity) and local preference. As a result, Intersection Safety Assessments (ISAs) were conducted at four locations within Harris County to observe safety issues and recommend improvements. ISAs were conducted in accordance with the FHWA's eight-step Road Safety Audit (RSA) process (see **Table 2-1**). This report, which briefly documents the ISA process and recommendations of the ISA team, has been prepared for Harris County's review. If requested, the project team will present ISA findings to Harris County staff, citizens, and elected officials to explain recommended improvements and receive feedback from local stakeholders.

Improvements are separated into categories based on expected implementation timeframe. For purposes of this report, short-term is defined as 1-4 years, mid-term is defined as 5-9 years, and long-term is defined as 10+ years. Improvement benefits, detailed by intersection, is provided as **Table 1-1**. Total crash reduction benefits are estimated to be approximately $12.8 Million. Further study is required to develop detailed cost estimates of corridor improvements. Most typical improvements (pedestrian facilities, signing, pavement markings, and signal improvements) are relatively low-cost and can be quantified. However, recommended geometric improvements may require drainage modifications or utility relocations which are beyond the scope of this study to quantify. A summary of recommended improvements is provided as **Table 1-2**. Additional details of benefit estimates are provided within **Chapter 3** and details of observations/improvements are provided within each intersection-specific chapter.

Table 1-1 – Summary of Improvement Benefits and Costs (by Intersection)

ISA Locations	Time	Preventable Crash Cost	Annual Savings	Safety Benefits	Project Cost [1]	B/C [2]
Barker Cypress Rd	Mid	$77,595,000	$581,963	$6,401,588	Not Estimated	## [2]
	Long	$77,595,000	$1,784,685	$19,631,535	Not Estimated	## [2]
Fry Rd	Short	$58,453,667	$438,403	$4,822,428	Not Estimated	## [2]
Springwoods Village Pkwy	Short	$5,089,667	$50,897	$559,863	Not Estimated	## [2]
Aldine Mail Rte Rd	Short	$9,257,000	$92,570	$1,018,270	Not Estimated	## [2]

Notes:
[1] Project cost not estimated; further study is required to develop detailed cost estimates
[2] B/C not calculated

Table 1-2 – Summary of Recommended Improvements

Intersection	Recommended Improvements	
Barker Cypress Rd	**Short-Term** • Install backplates with retroreflective borders • Install one signal head per approach • Review yellow change intervals • Install pedestrian push buttons (APS) • Install high-visibility pedestrian crosswalk	• Install sidewalks • Add through lane (mid-term improvement) • Close crossover **Long-Term** • Consider Diverging Diamond Interchange (DDI)
Fry Rd	**Short-Term** • Install backplates with retroreflective borders • Review yellow change intervals • Install pedestrian push buttons (APS) • Existing at US 290 • Install high-visibility pedestrian crosswalk • Install sidewalks • Reconfigure WB approach to include L+TL+TR and split phase EB/WB approaches	• Construct dual SBL turn lanes • Repurpose NBL lane as a NBT lane; restrict NBL movement; add NBT lane downstream of intersection • Modify access (hooded NBL) at commercial driveway to the north • Add NBR lane • Add WBR lane • Modify access at commercial driveways to the north
Springwoods Village Pkwy	**Short-Term** • Install backplates with retroreflective borders • Review yellow change intervals • Install pedestrian signals • Existing at HTR NBFR • Install pedestrian push buttons (APS) • Install high-visibility pedestrian crosswalk • Perform maintenance to add reflective object markers on bridge barrier	• Install sidewalks • Refresh pavement markings, install cat tracks • Install advanced lane configuration signs • Reconfigure northbound approach to include L+L+T+TR • Resurface Springwoods Village Parkway, east of IH-45 NBFR • Modify double arrow sign • Rotate yield sign

Table 1-2 – Summary of Recommended Improvements (Continued)

Intersection	Recommended Improvements	
Aldine Mail Rte Rd	**Short-Term** • Review yellow change intervals • Install pedestrian push buttons (APS) • Install high-visibility pedestrian crosswalk • Refresh pavement markings • Perform maintenance to add reflective tape on bridge radius and reflective object markers on bridge barrier	• Prohibit SBR and NBR turn on red due to sight distance limitations • Install "One Way" Signs • Add thru arrow and "Only" markings on bridge • Replace "Wrong Way" and "Do Not Enter" signs • Rotate pedestrian pole/signal/button • Remove excess concrete from sidewalk • Install oversized "Stop" sign

1.1 ISA Implementation

Implementation of ISA recommendations should be incorporated into Harris County's ongoing efforts to improve safety (such as Harris County's Vision Zero plan). Actions to implement ISA recommendations and improve intersection safety are provided as **Table 1-3**. To supplement implementation of ISA recommendations, Harris County should systemically implement low-cost countermeasures to improve safety countywide.

Table 1-3 – ISA Implementation Plan

Category	Strategy
Engineering	• Complete and submit TIP application for widening Barker Cypress Road [1] • Secure funding for design and construction of safety improvements along Fry Road, Springwoods Village Parkway, and Aline Mail Route Road [1] • Submit HSIP application to fund systemic implementation of countermeasures (such as Countywide deployment of APS pushbuttons) [1] • Update flashing yellow arrow guidance to account for school zones [1] • Consider alternative design strategies for improving intersection safety [2] • Improve pedestrian safety at intersections with high probability of crashes [2] • Increase driver awareness of intersections [2] • Conduct engineering safety audits of high frequency crash locations [3] • Implement appropriate low-cost safety countermeasures at high frequency crash locations [3]
Enforcement	• Reduce red light running [2] • Continue to expand Selective Traffic Enforcement Program grant [3]
Education	• Educate decision makers on the benefits of alternative intersection designs (such as the roundabout and diverging diamond interchange) [1] • Develop educational campaigns incorporating data analysis to improve intersection safety [2] • Launch Regional Safety Campaign focusing on intersection-related crashes [3]
Encouragement/ Empowerment	• Promote implementation of FHWA's Texas Intersection Safety Implementation Program countermeasures where appropriate [3]
Evaluation	• Continue to identify, fund, and construct improvements at locations along the Harris County High-Injury Network [1] • Improve data systems for identifying specific intersections and intersection types at high probability for serious injury crashes [2] • Continue to evaluate crash data to monitor the magnitude, frequency, and location of intersection crashes [3]

Notes:
[1] Red text denotes ISA implementation strategies
[2] State Intersection Strategy per Strategic Highway Safety Plan
[3] Regional Intersection Strategy per H-GAC Regional Safety Plan

2 Intersection Safety Assessment Process

2.1 Background

In August 2018, the Transportation Policy Council of the Houston-Galveston Area Council (H-GAC) adopted the Regional Safety Plan. This plan characterized crash history in the Houston-Galveston region and developed action plans to improve safety. Five crash categories, including intersection crashes, were identified which account for most fatalities and serious injuries within the Houston-Galveston region. On average, intersection crashes represent nearly 40% of all crashes and more than 25% of fatalities within the region. In 2022, H-GAC staff analyzed crash data and worked with local jurisdictions to identify four locations within Harris County to evaluate for this study. Kimley-Horn was contracted by H-GAC to conduct Intersection Safety Assessments (ISAs) at these locations, diagnose safety issues, and recommend short-, mid, and long-term improvements.

Within the region, nearly 40% of all crashes and more than 25% of fatalities occur at intersections.

2.2 Overview

Harris ISAs will follow Road Safety Audit (RSA) procedures per Federal Highway Administration (FHWA) guidelines (provided as an **Appendix**). An RSA is defined as "a formal safety performance examination of an existing or future road or inter-section by an independent audit team. It **qualitatively** estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users."

ISA locations and the ISA team were selected based on a network screening and collaborative efforts between H-GAC staff, Harris County representatives, and the consultant team. ISA team members attended a **pre-assessment meeting** to discuss roles, responsibilities, and logistics of ISA field reviews, as well as examine intersection characteristics (roadway, volume, and crash history) for each ISA location. **Field reviews** included walking each ISA location as a team and documenting observations. A **post-assessment meeting** was conducted shortly after the field reviews to discuss, consolidate, and prioritize ISA observations and recommendations. Pre- and post-assessment meeting notes are provided as an **Appendix**. A list of ISA process milestones is provided as **Table 2-1**.

Table 2-1 – ISA Process

Step	Milestone	Participants	Date
1	Identify **project** or road in-service to be assessed.	H-GAC & Harris	Fall 2021
2	Select **ISA team**.	H-GAC & Harris	Winter 2021
3	Conduct a **pre-assessment meeting** to review locations.	ISA Team	**1/25/22**
4	Perform **field observations** under various conditions.	ISA Team	**1/25 & 1/26**
5	Conduct **assessment analysis** and prepare report of findings.	ISA Team	**1/26/22**
6	Present **assessment findings** to Project Owner/Design Team.	Consultant Team	**6/7/22**
7	Project Owner/Design Team prepares **formal response**.	Harris County	TBD
8	Incorporate findings into **the project** when appropriate.	Harris County	TBD

2.3 Field Reviews

Field reviews included walking each ISA location and documenting observations of traffic operations, road user behavior, and intersection geometry. Observations which indicate a possible safety concern were documented using handouts or tablets. A list of ISA team members, which indicates member attendance at field reviews, is provided as **Table 2-2**. While in the field, improvements were sketched on aerials and Bluebeam Revu was used to organize photos. Field notes and photo catalogs are provided as an **Appendix**.

Table 2-2 – ISA Team

#	Organization	Name	1/25	1/26
1	Harris County	Brannan Hicks	✓ [1]	✓ [2]
2	Harris County	Tim Day	✓ [1]	✓ [2]
3	Harris County	Dominic Cridell	✓	✓
4	TxDOT	James Keener	✓	✓
5	H-GAC	David Fink	✓	✓

#	Organization	Name	1/25	1/26
6	Kimley-Horn	Payton Arens	✓	✓
7	Kimley-Horn	Scott Schmidt	✓	✓
8	Kimley-Horn	Kendall Nunez	✓	✓
9	Kimley-Horn	Chhun Hong	✓	
10	Kimley-Horn	Owen Rogers	✓	
11	Gradient	Linc Wright	✓	✓

Notes:
[1] Attendance only at pre-assessment meeting (not field reviews)
[2] Attendance only at post-assessment meeting (not field reviews)

3 Benefit-Cost Analysis

3.1 Benefit-Cost Ratio

Benefit-cost ratios (B/C) indicate the cost effectiveness of a project. Safety benefits are the monetized value of annual savings in preventable crash costs, reported in present value. Costs primarily refer to construction cost. While B/C does not establish the need (or lack of need) for a project, it can be a useful tool for comparison and prioritization of projects. B/C ratios of improvements are provided in the **Executive Summary**. The following sections briefly describe ISA methodology to estimate project benefits and costs.

3.2 Safety Benefits Methodology

For each corridor, safety benefits of ISA improvements were approximated by assuming a combined, corridor-specific crash reduction factor applied to all crashes along that corridor/intersection.

TxDOT's Highway Safety Improvement Program (HSIP) methodology[1] published September 2021 is the preferred methodology by which to determine safety benefits. However, the effort required to accurately apply HSIP methodology, which requires determining applicable work codes based on individual characteristics of the KAB-type crashes at ISA locations, is beyond the scope of this study. Therefore, a simplified methodology was employed based on FHWA and HSM guidance. For each corridor, safety benefits of ISA improvements were approximated by assuming a combined, corridor-specific Crash Reduction Factor (CRF) applied to all crashes along that corridor/intersection.

In short, the monetary benefit of a safety improvement is equal to the cost of crashes prevented by the improvement. Costs of fatal and injury crashes are monetized by the National Safety Council and include wage losses, medical expenses, motor-vehicle damage, and value of lost quality of life. These crash costs are the basis of FHWA crash costs and include values for non-injury crashes. 1,115 crashes occurred at ISA locations from years 2016-2021 resulting in a monetized value (six-year crash cost) of approximately $45 million. A summary of crash costs is provided as **Table 3-1** and crash costs for each ISA location are provided as **Table 3-2**.

Table 3-1 – Crash Cost Summary

Description	Value	Crash Count
K – Killed	$11,600,000	2
A – Incapacitating	$554,800	10
B – Non-incapacitating	$151,100	33
C – Possible Injury	$77,200	92
O – No Injury	$3,900	975
U – Unknown (Not Injured)	$159,800	3
Total Crash Cost (6-Year Period)	**$45,118,600**	**1,115**

Table 3-2 – Crash Cost (by Location)

Location	K	A	B	C	O	U	Total	Crash Cost	Cost/Crash
Barker Cypress Rd @ US 290	1	7	15	41	524	2	590	$23,278,500	$39,455
Fry Rd @ US 290	1	1	11	31	340		384	$17,536,100	$45,667
Springwoods Village Pkwy @ IH-45		1	2	6	53		62	$1,526,900	$24,627
Aldine Mail Rte Rd @ Hardy Toll Rd		1	5	14	58	1	79	$2,777,100	$35,153
Total	**2**	**10**	**33**	**92**	**975**	**3**	**1,115**	**$45,118,600**	**$40,465**

3.3 Safety Benefits

Safety benefits represent the cost of crashes prevented by recommended improvements. The primary variables impacting safety benefits are crash cost (detailed above) and CRF. A combined CRF was determined for each corridor based on all (short-, mid-, and long-term) recommended improvements. CRF values were assumed based on industry guidance (Crash Modification Factor Clearinghouse, FHWA Proven Safety Countermeasures (PSC), and TxDOT HSIP Guidance) and engineering judgement. CRF values assumed for each ISA location, including a description and source, are provided as **Table 3-3**.

[1] TxDOT's Highway Safety Improvement Program guidelines (year 2021)

Corridor improvements are expected to reduce crash frequency for 20 years (average service life of safety improvements). This reduction in the number/severity of crashes was monetized and discounted to determine safety benefits. The present value of a project's crash reduction savings decrease over time due to the time-value of money. The present worth of project benefits over its service life is the amortized sum of annual savings. Present values of safety benefits, calculated employing the methodology above, are provided as **Table 3-4**. Assuming a 20-year analysis period and corridor-specific CRF, the total (20-year) unadjusted crash cost savings at all four ISA locations are approximately $23.3 million. Discounting by 7% annually (which results in an approximately 55% reduction over 20 years), to account for the time-value of money, the present value of safety improvements at all four ISA locations is approximately $12.8 million.

The present worth of project benefits over its service life is the amortized sum of annual savings.

Table 3-3 – Crash Reduction Factor (by Location)

Location	CRF	Description	Source
Barker Cypress Rd @ US 290 (Widening)	15%	Recommended improvements, namely widening from four lanes to six lanes, are expected to reduce crashes by 15%.	CMF ID: 7924, CMF Clearinghouse
Barker Cypress Rd @ US 290 (DDI)	46%	A diverging diamond interchange is expected to have an overall crash reduction of 46% considering a 100% reduction in left-turn crashes and a 72% reduction in right-angled crashes.	Diverging Diamond Interchange Fact Sheet, FHWA
Fry Rd @ US 290	15%	Recommended improvements, namely widening from four lanes to six lanes and backplates with retroreflective borders, are expected to reduce crashes by 15%.	CMF ID: 7924, CMF Clearinghouse and Backplates with Retroreflective Borders, FHWA PSC
Springwoods Village Pkwy at IH-45	20%	Recommended improvements, namely advanced warning and guide sign installation (work code 101) and pavement markings (work code 401), are expected to reduce crashes by 20%	HSIP Work Code, TxDOT HSIP Guidance Appendix B
Aldine Mail Rte Rd @ HTR	20%	Recommended improvements, namely advanced warning and guide sign installation (work code 101) and pavement markings (work code 401), are expected to reduce crashes by 20%	HSIP Work Code, TxDOT HSIP Guidance Appendix B

Table 3-4 – Safety Benefits (by Location)

Location	6-Year Cost	20-Year Cost	CRF	Unadjusted Savings	Discount	Crash Cost Savings
Barker Cypress Rd @ US 290 (Widening)	$23,278,500	$77,595,000	15%	$11,639,250	55%	$6,401,588
Barker Cypress Rd @ US 290 (DDI)	$23,278,500	$77,595,000	46%	$35,693,700	55%	$19,631,535
Fry Rd @ US 290	$17,536,100	$58,453,667	15%	$8,768,050	55%	$4,822,428
Springwoods Village Pkwy @ IH-45	$1,526,900	$5,089,667	20%	$1,017,933	55%	$559,863
Aldine Mail Rte Rd @ Hardy Toll Rd	$2,777,100	$9,257,000	20%	$1,851,400	55%	$1,018,270
Total	**$45,118,600**	**$150,395,333**	-	**$23,276,633** [1]	-	**$12,802,148** [1]

[1] Totals only include short-term recommendations for Barker Cypress Road, not long-term DDI

3.4 Improvement Construction Cost Estimates

Further study is required to develop detailed cost estimates of corridor improvements. Most typical improvements (pedestrian facilities, signing, pavement markings, and signal improvements) are relatively low-cost and can be quantified. However, recommended geometric improvements may require drainage modifications or utility relocations which are beyond the scope of this study to quantify. Drainage, utility, and traffic control items are expected to be a high percentage of total construction cost. If requested, planning-level construction costs may be provided for short-term, non-geometric improvements.

4 Intersection Overview

4.1 Intersection Locations

Four locations within unincorporated Harris County were assessed: two in Cypress, one in Spring, and one in Aldine. Previous studies, historic traffic volumes, and signal timing plans were provided by Harris County. To supplement available data, 24-hour traffic volume counts were collected at intersection approaches on 1/12/2022. Peak hour **drone aerial videography** was also collected to provide birds-eye observations of corridors. Historic crash data was obtained from TxDOT's Crash Record Information System (CRIS) for years 2016-2021 (six-year period); key crash patterns are described in intersection-specific ISA chapters. Volume and crash data is provided as an **Appendix**. A summary of intersection crash history is provided as **Table 4-1** and an overview map is provided as **Figure 4-1**.

Table 4-1 – Crash History Summary

Corridor	From	To	Length (mi)	ADT	Crash Count	Crash Rate [1]	K-Crash Count	A-Crash Count	MVM [2]
Barker Cypress Rd	Dundee Rd	Queenston Blvd	0.91	38,147	590	776	1	7	34,714
Fry Rd	Walmart Dwy	Mound Rd	0.83	25,158	384	840	1	1	20,881
Springwoods Village Pkwy	IH-45 SBFR	HTR NBFR	0.24	14,016	62	842		1	3,364
Aldine Mail Rte Rd	HTR SBFR	Luthe Rd	0.18	16,081	79	1,246		1	2,895

Notes:
[1] Crash Rate is expressed as crashes per 100 million vehicle miles traveled (over a six-year period)
[2] MVM is Million Vehicle Miles based on 2022 AADT and segment length

4.2 Roadway and Volume

Roadway and volume attributes include intersection functional classification, speed, average daily traffic (ADT), and peak hour volume (PHV), as well as intersection lane assignments and traffic control. Field conditions, including traffic signs, intersection geometry, lighting, and land uses, were confirmed during field review. Available data sources such as TxDOT's Roadway Inventory Database, TxDOT's Traffic Count Database System, and H-GAC's Activity Connectivity Explorer were reviewed for available information. Raw traffic data is provided as an **Appendix**. As-built construction plans, maintenance logs, previous studies, roadway plans were requested from the maintaining agency.

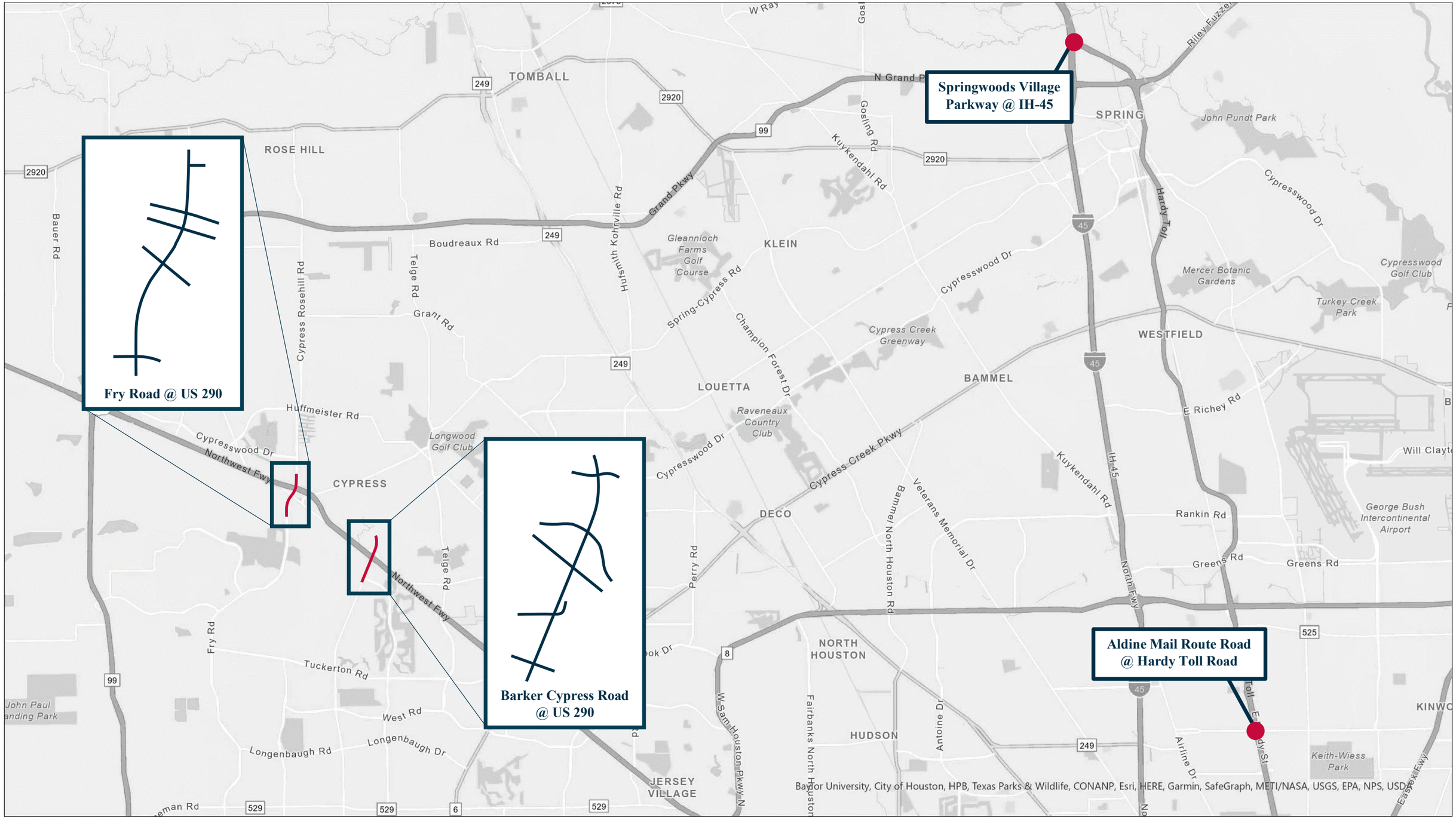


Figure 4-1 – Intersection Locations

4.3 Crash History

Historic crash data was obtained from TxDOT's Crash Record Information System (CRIS) for years 2016-2021 (six-year period). Only crashes that occurred within 250' of the intersection's center were considered as part of this analysis.[2] Crashes of all severities were considered and reported using the KABCO scale (standard classification of crash severity). Detailed crash history characteristics are provided as **Table 4-2**. Intersection-specific crash data summary figures and tables (crash severity, first harmful event, manner of collision, weather condition, lighting condition, etc.) are included as an **Appendix**; key crash patterns are described in intersection-specific ISA chapters.

CRIS data was obtained for years 2016-2020. Only crashes that occurred within 250' of the intersection's center were considered.

Table 4-2 – Crash History Details (Part 1 of 3)

Attribute Category	Attribute	Barker Cypress Rd @ US 290	Fry Rd @ US 290	Springwoods Village Pkwy @ IH-45	Aldine Mail Rte Rd @ Hardy Toll Rd
What: Stats	Crash Count	590	384	62	79
	Death Count	1	1	0	0
What: Severity	(K) Killed	1	1	0	0
	(A) Incapacitating Injury	7	1	1	1
	(B) Non-Incapacitating Injury	15	11	2	5
	(C) Possible Injury	41	31	6	14
	(O) Not Injured	524	340	53	58
	(O) Unknown	2	0	0	1
When: Date	2016	94	71	10	16
	2017	120	75	9	6
	2018	103	36	15	16
	2019	94	64	12	14
	2020	85	62	14	13
	2021	94	76	2	14
Who/How: Collision Event	Motor Vehicle In Transport	568	372	56	68
	Pedestrian	1	0	0	0
	Pedalcyclist	0	2	0	0
	Fixed Object	18	10	5	8
	Overturned	0	0	0	3
	Parked Car	1	0	1	0
	Other Object	2	0	0	0

[2] For atypical intersections such as diamond interchanges, crashes that occurred within 250' of the imaginary line which connects the intersections' centers were considered; crashes occurring within 250' but along other roadways (such as limited access facilities) were not considered.

Table 4-2 – Crash History Details (Part 2 of 3)

Attribute Category	Attribute	Barker Cypress Rd @ US 290	Fry Rd @ US 290	Springwoods Village Pkwy @ IH-45	Aldine Mail Rte Rd @ Hardy Toll Rd
Who/How: Collision Event	Angle - Both Going Straight	54	92	22	19
	Angle - One Left Turn-One Stopped	1	0	0	0
	Angle - One Right Turn-One Left Turn	0	1	0	0
	Angle - One Right Turn-One Stopped	0	1	0	1
	Angle - One Straight-One Left Turn	15	26	0	4
	Angle - One Straight-One Right Turn	42	19	0	1
	One Motor Vehicle - Going Straight	15	11	3	3
	One Motor Vehicle - Turning Left	5	0	3	6
	One Motor Vehicle - Turning Right	2	1	0	2
	Opposite Direction - Both Going Straight	1	1	0	1
	Opposite Direction - Both Left Turns	1	0	0	0
	Opposite Direction - One Backing-One Stopped	1	2	0	3
	Opposite Direction - One Right Turn-One Left Turn	4	1	0	0
	Opposite Direction - One Straight-One Backing	4	0	0	2
	Opposite Direction - One Straight-One Left Turn	21	27	5	3
	Opposite Direction - One Straight-One Stopped	1	0	0	0
	Same Direction - Both Going Straight-Rear End	110	55	0	9
	Same Direction - Both Going Straight-Sideswipe	56	32	3	7
	Same Direction - Both Left Turn	5	9	6	1
	Same Direction - Both Right Turn	51	0	0	0
	Same Direction - One Left Turn-One Stopped	0	1	0	0
	Same Direction - One Straight-One Left Turn	7	11	8	0
	Same Direction - One Straight-One Right Turn	78	1	1	2
	Same Direction - One Straight-One Stopped	116	93	11	15
Why: Contributing Factor	Failed to Control Speed	213	118	8	28
	Changed Lane When Unsafe	53	30	6	3
	Driver Inattention	47	35	4	5
	Failed to Yield Right of Way - Private Drive	41	49	0	1
	Failed to Drive in Single Lane	55	14	7	7
	Disregard Stop and Go Signal	22	14	17	13
	Disregard Turn Marks at Intersection	53	4	5	0
	Failed to Yield Right of Way - Turning Left	21	32	2	1
	Turned Improperly - Wide Right	44	2	0	1
	Failed to Yield Right of Way - Open Intersection	6	28	0	1
Why: Additional Factor	One Vehicle Leaving Driveway	57	89	0	1
	Slowing/Stopping - For Officer, Flagman, Or Traffic Control	54	55	10	14
	Slowing/Stopping-For Traffic	70	33	0	3
	Vehicle Changing Lanes	48	32	3	4
	Attention Diverted from Driving	32	17	4	2
	Construction - Within Posted Road Construction Zone (Not Related to Crash)	18	17	0	0
	One Vehicle Entering Driveway	10	19	0	1
	Slowing/Stopping-Reason Not Specified	14	5	0	2
	Lost Control or Skidded (Icy or Slick Road, Etc.)	7	1	0	1
	Slowing/Stopping-To Make Left Turn	6	1	1	1

Table 4-2 – Crash History Details (Part 3 of 3)

Attribute Category	Attribute	Barker Cypress Rd @ US 290	Fry Rd @ US 290	Springwoods Village Pkwy @ IH-45	Aldine Mail Rte Rd @ Hardy Toll Rd
Why: Lighting	Daylight	421	289	49	54
	Dark, Not Lighted	32	6	2	5
	Dark, Not Lighted	127	76	8	20
	Dark, Unknown Lighting	3	3	0	0
	Dawn	4	2	2	0
	Dusk	1	6	1	0
Why: Weather	Clear	392	252	48	61
	Cloudy	133	85	9	8
	Rain	59	41	3	8
	Sleet/Hail	0	1	0	2
	Snow	2	0	2	0
	Fog	2	2	0	0
Why: Surface	Dry	513	327	55	65
	Wet	73	51	5	12
	Standing Water	0	1	0	1
	Slush	0	0	0	1
	Ice	1	1	2	0
How: Object	Hit Concrete Traffic Barrier (Not in Median)	4	0	3	1
	Hit Curb	3	2	2	0
	Hit Retaining Wall	2	0	0	5
	Hit Other Fixed Object	2	3	0	1
	Hit Traffic Signal Pole or Post	1	4	0	1
	Hit Tree, Shrub, Landscaping	5	1	0	0
	Overturned	2	0	0	2
	Ditch	1	3	0	0
	Hit Median Barrier (Concrete or Cable)	2	1	0	1
	Hit Luminaire Pole	1	0	1	0

5 Barker Cypress Road at US 290

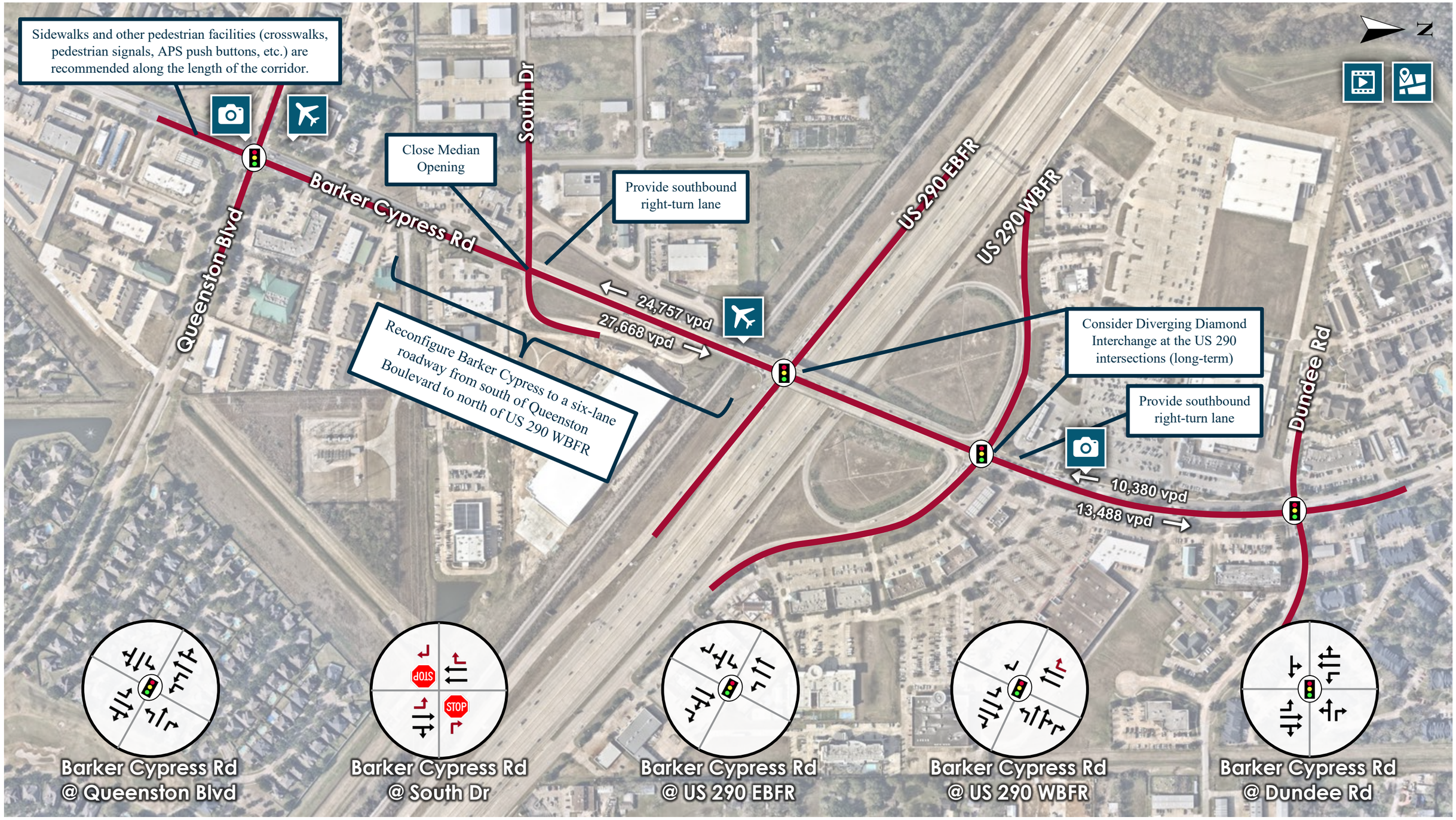


Figure 5-1 – Conditions Diagram

5.1 Existing Conditions

ISAs were conducted along Barker Cypress Road in the vicinity of US 290. The study segment (approximately 0.91 miles in length) is bounded by Queenston Boulevard to the south and Dundee Road to the north. Study intersections and associated traffic characteristics are provided as **Figure 5-1**. Field reviews were conducted during the PM peak hour on Tuesday, January 25th, 2022. Within the study area, Barker Cypress Road is a four-lane north-south divided roadway with a mix of asphalt and concrete pavement. South of US 290, the typical cross section consists of two 12' lanes in each direction divided by a 14' wide raised median. At most intersections, including unsignalized side streets, the raised median is reduced to a width of 2' to accommodate the addition of a dedicated 12' left-turn lane. Median openings are provided along the corridor at most side streets and driveways. Northbound, the speed limit along Barker Cypress Road between Cypress North Houston Road and US 290 westbound frontage road (WBFR) is 45 miles-per-hour (mph). North of US 290 WBFR the posted speed limit is 40 mph. Southbound, the speed limit along Barker Cypress Road south of Jarvis Road is 40 mph. Land use within the area is primarily commercial/retail around US 290 and residential single-family homes north of Dundee Road and south of Queenston Boulevard. Sidewalks are present north of US 290 WBFR and absent to the south. Sidewalks and other pedestrian facilities (crosswalks, pedestrian signals, APS push buttons, etc.) are recommended along the length of the corridor. Corridor crash history statistics are provided as **Table 5-1**.

Table 5-1 – Crash History

Crashes	KA Crashes	Collision Event	Conditions
Crashes: 590	KA Crashes: 8 (1%)	Fixed Object: 18	Dark, Not Lighted: 32 (5%)
Crash Rate: 776	Deaths: 1	Pedestrian: 1	Rain Weather: 59 (10%)
KA Rate: 0.11	Injuries: TBD	Bicyclist: 0	Wet Surface: 73 (12%)

5.2 Recommended Improvements

Recommended improvements were generated by the ISA team during field reviews and refined at the post-assessment meeting. Recommendations are based on field review observations, local knowledge, and intersection characteristics. A roll plot with recommended, short-term improvements is provided as an **Appendix** and a list of recommended improvements is provided as **Table 5-2**. Mid-and long-term improvement concepts are provided as **Table 5-3** (not shown on roll plot). Further documentation of improvement benefits and costs are provided as an **Appendix**.

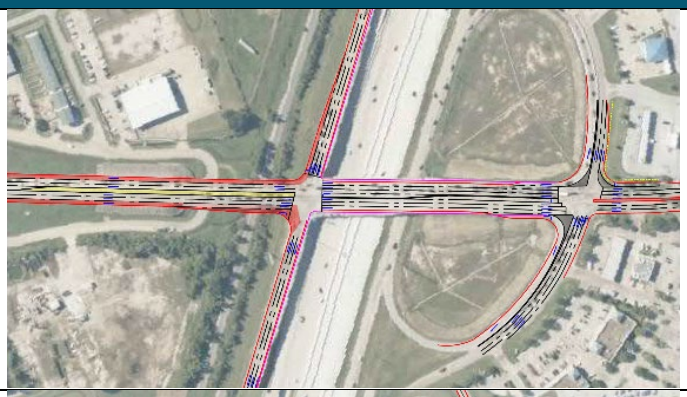
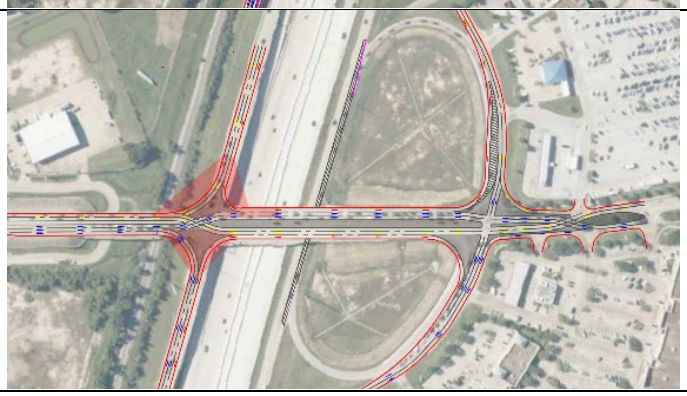
Barker Cypress Widening: As a mid-term improvement, the ISA team recommends widening Barker Cypress to a six-lane divided roadway from south of Queenston Boulevard to north of US 290 WBFR. Barker Cypress is over capacity with bi-directional traffic volumes exceeding 52,000 vehicles per day (vpd) within the bridge segment south of US 290. A capacity analysis was conducted by Stevens Technical Services, Inc. (dated 9/13/2021), on behalf of Harris County, which recommended Barker Cypress be widened to a six-lane roadway. HNTB, on behalf of Harris County, is developing a schematic for purposes of a Transportation Improvement Program (TIP) application for the year 2022 call for projects. The project, with support from Harris County and TxDOT, will include widening Barker Cypress to a six-lane roadway from south of Queenston Boulevard to north of US 290 WBFR. The widening project should include proven safety countermeasures such as installing sidewalks and one signal head per approach.

Diverging Diamond Interchange: As a long-term improvement, Harris County should consider a Diverging Diamond Interchange (DDI) at the US 290 intersections because of the proven safety benefits. The DDI and Barker Cypress widening can be implemented together; they are not mutually exclusive alternatives. The capacity analysis conducted by Stevens Technical Services, Inc. (dated 9/13/2021) considered a Diverging Diamond Interchange (DDI) at the US 290 intersections. A traditional DDI, which restricts the westbound thru movement at the US 290 WBFR, paired with widening Barker Cypress to six-lanes, should be considered as a long-term improvement. Improvements along Barker Cypress between US 290 WBFR and Dundee Road would be necessary to restore access/connectivity to nearby commercial properties. A traditional DDI (no WBT), as compared to the previously-analyzed DDI, is expected to improve safety and reduce intersection delay.

Table 5-2 – Recommended Improvements

Location	Observation	Improvement	Code
Barker Cypress Rd Corridor	29 disregard signal crashes	Install backplates with retroreflective borders *(TxDOT signals only)*	610
		Install one signal head per approach	610
		Review yellow change intervals	616
	One pedestrian crash; missing sidewalks	Install pedestrian push buttons (APS)	131
		Install high-visibility pedestrian crosswalk	403
		Install sidewalks	407
	Missing/damaged object markers	Perform maintenance to add reflective object markers on bridge barrier	-
	Corridor is over capacity; previous study (by others) recommended widening	Add through lane *(Mid-Term Improvement)*	517
US 290	High left-turn volume; low E-W through volume	Consider diverging diamond interchange (DDI) *(Long-Term Alternative)*	-
South Dr	Due to queue spillback from US 290, vehicles are not able to cross Barker Cypress Rd at South Dr	Close crossover	516

Table 5-3 – Mid-and Long-term Improvement Concepts

Application	Improvement Description	Concept (linework by Harris County)
Mid-term recommendation	Widen Barker Cypress to a six-lane divided roadway from south of Queenston Boulevard to north of US 290 WBFR.	
Long-term alternative	Construct Diverging Diamond Interchange (DDI) at the US 290 intersections without westbound thru movement (and resultant traffic signal) at the US 290 WBFR	

6 Fry Road @ US 290

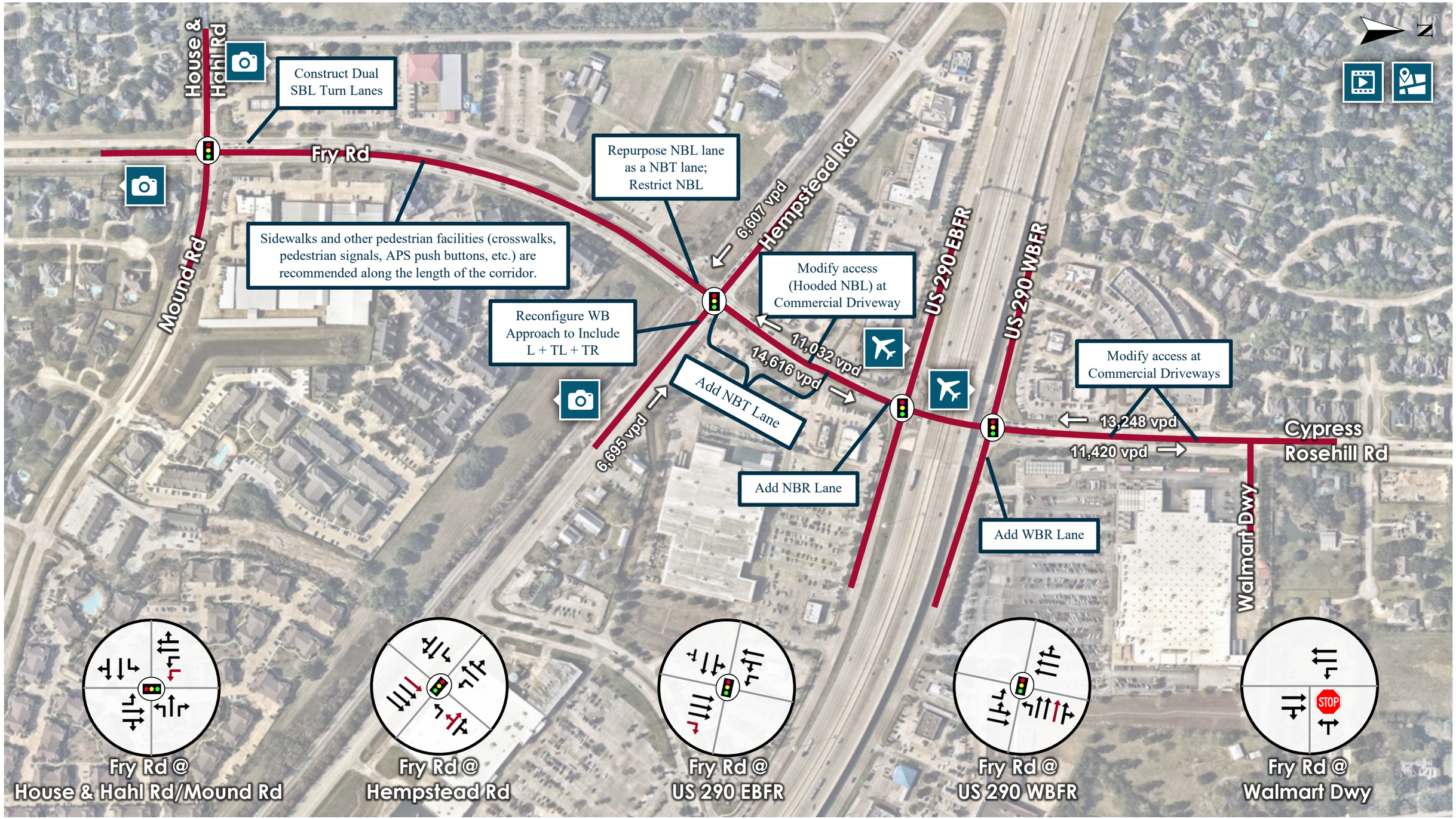


Figure 6-1 – Conditions Diagram

6.1 Existing Conditions

ISAs were conducted along Fry Road, in the vicinity of US 290. The study segment (approximately 0.83 miles in length) is bounded by Mound Road/House & Hahl Road to the south and the north Walmart Driveway to the north. Study intersections and associated traffic characteristics are provided as **Figure 6-1**. Field reviews were conducted during the PM peak hour on Tuesday, January 25th, 2022.

Within the study area, Fry Road is a four-lane north-south divided roadway with asphalt pavement. South of Hempstead Road, the typical cross section consists of two 12' lanes in each direction with a 7' paved shoulder and open ditch drainage divided by a 32' wide raised median. North of Hempstead Road, the outside pavement edge transitions to curb and gutter with no shoulder. At most intersections, the raised median is reduced to a width of 20' to accommodate the addition of a dedicated 12' left-turn lane. Median openings are provided along the corridor at most side streets and driveways. The speed limit in the vicinity of the study area is 45 mph. North of US 290, Fry Road becomes Cypress Rosehill Road but the cross section and speed limit is maintained. Land use within the area is primarily commercial/retail with residential single-family homes north of the Walmart Driveway and south of Mound Road/House & Hahl Road. No sidewalks are present in the vicinity of the study area. Sidewalks and other pedestrian facilities (crosswalks, pedestrian signals, APS push buttons, etc.) are recommended along the length of the corridor. Corridor crash history statistics are provided as **Table 6-1**.

Table 6-1 – Crash History

Crashes	KA Crashes	Collision Event	Conditions
Crashes: 384	KA Crashes: 2 (1%)	Fixed Object: 10	Dark, Not Lighted: 6 (2%)
Crash Rate: 840	Deaths: 1	Pedestrian: 0	Rain Weather: 41 (11%)
KA Rate: 0.04	Injuries: TBD	Bicyclist: 2	Wet Surface: 52 (14%)

6.2 Recommended Improvements

Recommended improvements were generated by the ISA team during field reviews and refined at the post-assessment meeting. Recommendations are based on field review observations, local knowledge, and intersection characteristics. A roll plot with recommended geometric improvements is provided as an **Appendix** and a list of recommended improvements is provided as **Table 6-2**. Further documentation of improvement benefits and costs are provided as an **Appendix**.

Table 6-2 – Recommended Improvements

Location	Observation	Improvement	Code
Fry Rd Corridor	19 disregard signal crashes	Install backplates with retroreflective borders *(TxDOT signals only)*	610
		Review yellow change intervals	616
	Two bicycle crashes	Install pedestrian push buttons (APS) *APS existing at US 290*	131
		Install high-visibility pedestrian crosswalk	403
		Install sidewalks	407
House & Hahl Rd	SBL volume warrants additional left-turn capacity	Construct dual SBL turn lanes	519
Hempstead Rd	WBL volume warrants additional left-turn capacity	Reconfigure WB approach to include L+TL+TR and split phase EB/WB approaches	519
	Additional capacity required	Repurpose NBL lane as a NBT lane; restrict NBL movement; add NBT lane downstream of intersection	517
	Hooded left-turn lanes reduce conflict points while maintaining access	Modify access (hooded NBL) at commercial driveway to the north	516
US 290	Additional capacity required	Add NBR lane	521
		Add WBR lane	521
	Hooded left-turn lanes reduce conflict points	Modify access at commercial driveways to the north	516

7 Springwoods Village Parkway at IH-45

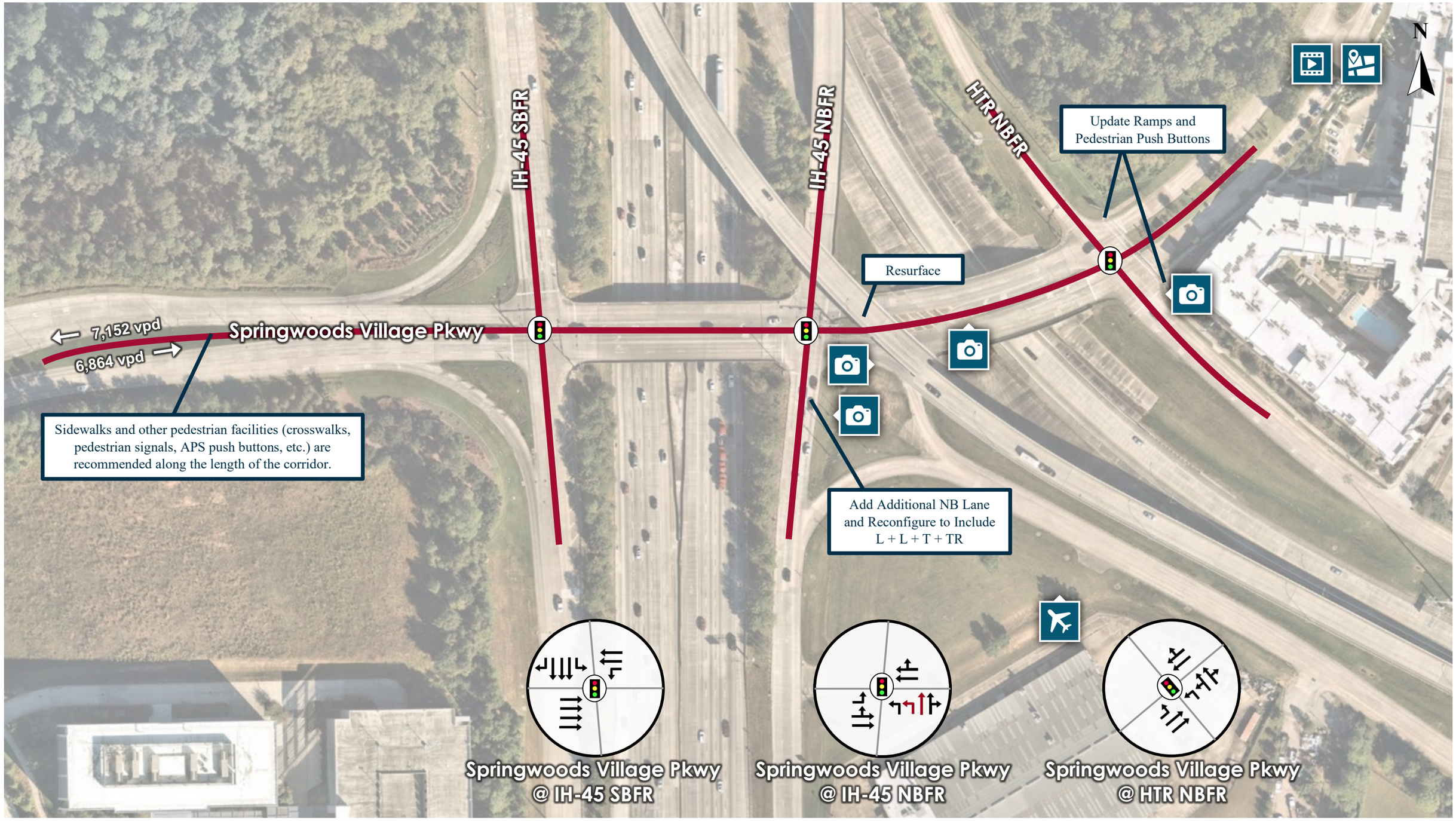


Figure 7-1 – Conditions Diagram

7.1 Existing Conditions

ISAs were conducted along Springwoods Village Parkway, in the vicinity of IH-45. The study segment (approximately 0.24 miles [1,267 feet] in length) is bounded by IH-45 SBFR to the west and Hardy Toll Road NBFR to the east. Study intersections and associated traffic characteristics are provided as **Figure 7-1**. Field reviews were conducted during the AM peak hour on Wednesday, January 26th, 2022. Within the study area, Springwoods Village Parkway is an east-west divided roadway with concrete pavement and curb and gutter drainage. West of IH-45, the typical cross section consists of two 12' travel lanes in each direction divided by a 42' wide raised median. East of IH-45, the raised median is reduced to a width of 30'. Median openings are provided along the corridor at most side streets and driveways. The speed limit along Springwoods Village Parkway is 40 mph in the vicinity of the study area. Land use immediately surrounding the study intersections is vacant, with single and multi-family residential to the east and office to the west. No sidewalks are present in the vicinity of the study area. Sidewalks and other pedestrian facilities (crosswalks, pedestrian signals, APS push buttons, etc.) are recommended along the length of the corridor. Corridor crash history statistics are provided as **Table 7-1**.

Table 7-1 – Crash History

Crashes	KA Crashes	Collision Event	Conditions
Crashes: 62 Crash Rate: 842 KA Rate: 0.14	KA Crashes: 1 (2%) Deaths: 0 Injuries: TBD	Fixed Object: 5 Pedestrian: 0 Bicyclist: 0	Dark, Not Lighted: 2 (3%) Rain Weather: 3 (5%) Wet Surface: 5 (8%)

7.2 Recommended Improvements

Recommended improvements were generated by the ISA team during field reviews and refined at the post-assessment meeting. Recommendations are based on field review observations, local knowledge, and intersection characteristics. A roll plot with recommended geometric improvements is provided as an **Appendix** and a list of recommended improvements is provided as **Table 7-2**. Further documentation of improvement benefits and costs are provided as an **Appendix**.

Table 7-2 – Recommended Improvements

Location	Observation	Improvement	Code
Springwoods Village Pkwy Corridor	21 disregard signal crashes	Install backplates with retroreflective borders *(TxDOT signals only)*	610
		Review yellow change intervals	616
	No sidewalks or pedestrian infrastructure observed	Install pedestrian signals *Existing at HTR NBFR*	110
		Install pedestrian push buttons (APS)	131
		Install high-visibility pedestrian crosswalk	403
		Install sidewalks	407
	No object markers observed	Perform maintenance to add reflective object markers on bridge barrier	-
	Pavement markings faded	Refresh pavement markings, install cat tracks	401
	No lane configuration signs	Install advanced lane configuration signs	101
IH-45 NBFR	Additional NBL capacity required	Reconfigure northbound approach to include L+L+T+TR	517
	Pavement deteriorated	Resurface Springwoods Village Parkway, east of IH-45 NBFR	303
HTR SBFR	Double arrow sign incorrect, should be single arrow	Modify double arrow sign	101
	Yield sign rotated	Rotate yield sign	101

8 Aldine Mail Route Road at Hardy Toll Road

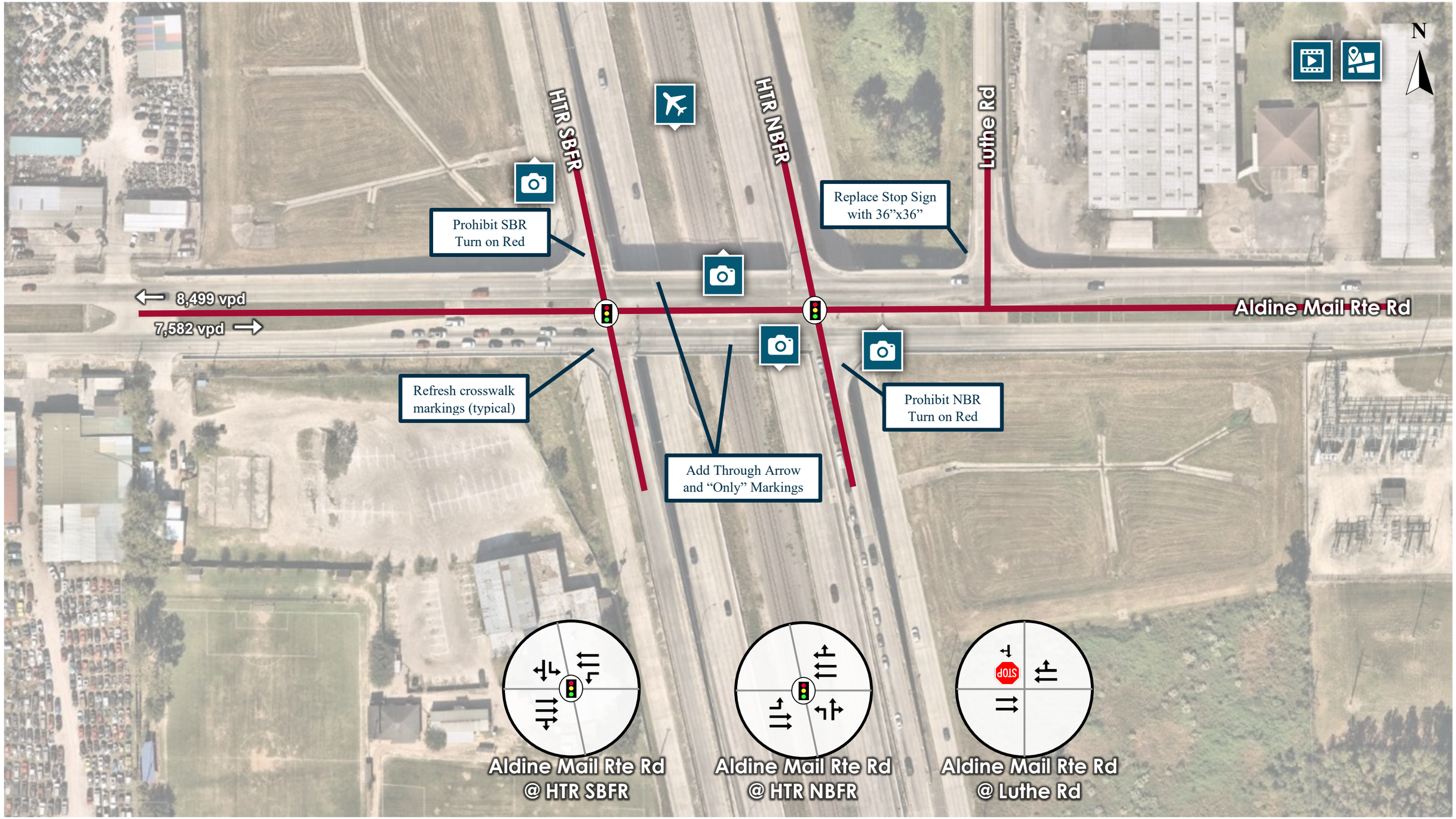


Figure 8-1 – Conditions Diagram

8.1 Existing Conditions

ISAs were conducted along Aldine Male Route Road, in the vicinity of Hardy Toll Road (HTR). The study segment (approximately 950 feet in length) is bounded by HTR SBFR to the west and Luthe Road to the east. Study intersections and associated traffic characteristics are provided as **Figure 8-1**. Field reviews were conducted during the AM peak hour on Wednesday, January 26th, 2022. Within the study area, Aldine Mail Route Road is a four-lane east-west divided roadway with concrete pavement and curb and gutter drainage. The typical cross section consists of two 12' travel lanes in each direction divided by a 27' wide raised median. At most intersections, the raised median is reduced to a width of 20' to accommodate the addition of a dedicated 12' left-turn lane. The speed limit on Aldine Mail Route Road is 35 mph. Land use within the area is primarily industrial, with a park on the southwest corner of Aldine Mail Route Road at Hardy Toll Road. Sidewalks are present on both the north and south sides of Aldine Mail Route Road in the vicinity of the study area; crosswalk markings should be refreshed. Corridor crash history statistics are provided as **Table 8-1**.

Table 8-1 – Crash History

Crashes	KA Crashes	Collision Event	Conditions
Crashes: 79	KA Crashes: 1 (1%)	Fixed Object: 8	Dark, Not Lighted: 5 (6%)
Crash Rate: 1,246	Deaths: 0	Pedestrian: 0	Rain Weather: 8 (10%)
KA Rate: 0.16	Injuries: TBD	Bicyclist: 0	Wet Surface: 13 (16%)

8.2 Recommended Improvements

Recommended improvements were generated by the ISA team during field reviews and refined at the post-assessment meeting. Recommendations are based on field review observations, local knowledge, and intersection characteristics. A roll plot with recommended geometric improvements is provided as an **Appendix** and a list of recommended improvements is provided as **Table 8-2**. Further documentation of improvement benefits and costs are provided as an **Appendix**.

Table 8-2 – Improvement Benefits and Costs

Location	Observation	Improvement	Code
Aldine Mail Rte Rd Corridor	16 disregard signal crashes	Review yellow change intervals	616
	Pedestrian infrastructure not to current standards	Install pedestrian push buttons (APS)	131
		Install high-visibility pedestrian crosswalk	403
	Faded pavement markings	Refresh pavement markings	401
	No object markers	Perform maintenance to add reflective tape on bridge radius and reflective object markers on bridge barrier	-
HTR Frontage Rds	Bridge structure restricts view for right-turn on red	Prohibit SBR and NBR turn on red due to sight distance limitations	-
	Correctly placed "One Way" signs and "Only" markings may discourage wrong-way driving	Install "One Way" Signs	101
		Add thru arrow and "Only" markings on bridge	401
	Faded signs	Replace "Wrong Way" and "Do Not Enter" signs	101
	Pedestrian pole rotated	Rotate pedestrian pole/signal/button	-
	Excess concrete observed	Remove excess concrete from sidewalk	-
Luthe Rd	Substandard size of "Stop" sign	Install oversized "Stop" sign	101

9 Implementation Plan

9.1 Implementation Plan

ISA Process

As described in **Section 2: Intersection Safety Assessment Process**, Harris ISAs were conducted in accordance with the FHWA's eight-step process. Short-, mid-, and long-term safety improvements have been identified at ISA locations. Next steps in the ISA process are provided as **Table 9-1**. This report, which briefly documents the ISA process and recommendations of the ISA team, has been prepared for Harris County's review (**Step 6**). If requested, the project team will present ISA findings to Harris County. If desired, Harris County can prepare a formal response (**Step 7**) to this report to comment on ISA recommendations and implementation plan. Ultimately, Harris County may fund recommended improvements as stand-alone safety projects or incorporate ISA findings into future projects (**Step 8**).

Table 9-1 – ISA Process Next Steps

Step	Milestone	Participants	Date
6	Present **assessment findings** to Project Owner/Design Team.	Consultant Team	**6/7/22**
7	Project Owner/Design Team prepares **formal response**.	Harris County	TBD
8	Incorporate findings into **the project** when appropriate.	Harris County	TBD

ISA Implementation

Implementation of ISA recommendations should be incorporated into Harris County's ongoing efforts to improve safety (such as Harris County's Vision Zero plan). Actions to implement ISA recommendations and improve intersection safety are provided as **Table 9-2**. To supplement implementation of ISA recommendations, Harris County should systemically implement low-cost countermeasures to improve safety countywide.

Table 9-2 – Harris ISA Implementation Strategies

Category	Strategy
Engineering	• Complete and submit TIP application for widening Barker Cypress Road [1] • Secure funding for design and construction of safety improvements along Fry Road, Springwoods Village Parkway, and Aline Mail Route Road [1] • Submit HSIP application to fund systemic implementation of countermeasures (such as Countywide deployment of APS pushbuttons) [1] • Update flashing yellow arrow guidance to account for school zones [1] • Consider alternative design strategies for improving intersection safety [2] • Improve pedestrian safety at intersections with high probability of crashes [2] • Increase driver awareness of intersections [2] • Conduct engineering safety audits of high frequency crash locations [3] • Implement appropriate low-cost safety countermeasures at high frequency crash locations [3]
Enforcement	• Reduce red light running [2] • Continue to expand Selective Traffic Enforcement Program grant [3]
Education	• Educate decision makers on the benefits of alternative intersection designs (such as the roundabout and diverging diamond interchange) [1] • Develop educational campaigns incorporating data analysis to improve intersection safety [2] • Launch Regional Safety Campaign focusing on intersection-related crashes [3]
Encouragement/ Empowerment	• Promote implementation of FHWA's Texas Intersection Safety Implementation Program countermeasures where appropriate [3]
Evaluation	• Continue to identify, fund, and construct improvements at locations along the Harris County High-Injury Network [1] • Improve data systems for identifying specific intersections and intersection types at high probability for serious injury crashes [2] • Continue to evaluate crash data to monitor the magnitude, frequency, and location of intersection crashes [3]
Notes: [1] Red text denotes ISA implementation strategies [2] State Intersection Strategy per Strategic Highway Safety Plan [3] Regional Intersection Strategy per H-GAC Regional Safety Plan	

9.2 Funding Sources

Local and State Funding Sources

Funding sources for safety projects include TxDOT's HSIP, H-GAC's Transportation Improvement Program (TIP), and Transportation Department. A brief description of available funding sources is provided as **Table 9-3**.

Table 9-3 – Local and State Funding Sources

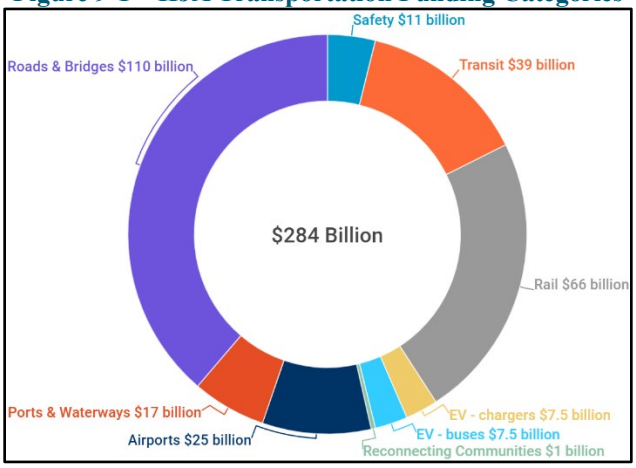
Funding Source	Description
Harris County Road and Bridge Department [1]	Harris County budgets for maintenance and projects within the Road and Bridge Department funded primarily by County road and bridge tax.
H-GAC TIP call for projects [1]	The Transportation Improvement Program (TIP) is a fiscally constrained financial plan of transportation projects approved to receive federal funding over the next four-years. Locally sponsored projects compete for funding based on preestablished evaluation criteria (including safety).
Harris County Certificates of Obligation [2]	Certificates of Obligation (COs) are issued for terms of up to 40 years and usually are supported by property taxes or other local revenues. COs often are associated with emergency spending, but their use isn't restricted to such purposes. They can be used to fund public works as part of standard local government operations.
County Assistance Districts [2]	Any county may adopt this sales tax, in all or part of the county, if the new combined local sales tax rate would not exceed 2 percent at any location within the district. The commissioners court serves as the board of directors. County assistance district funds can be used for safety and roadway projects.
Developer-funded Improvement Projects (381 Agreements) [2]	Chapter 381 of the Local Government Code allows counties to provide incentives encouraging developers to build in their jurisdictions. A county may administer and develop a program to make loans and grants of public money to promote state or local economic development and to stimulate, encourage and develop business location and commercial activity in the county. The county also may develop and administer a program for entering into a tax abatement agreement. This tool allows counties to negotiate directly with developers and businesses.
TxDOT Selective Traffic Enforcement Program (STEP) Grants [3]	Funding for overtime activities by local law enforcement to reduce the incidences of speeding, driving while intoxicated, failure to use occupant restraint systems, intersection traffic control violations and enforcement of state and local ordinances on cellular and texting devices.
TxDOT TA and SRTS Program [3]	TxDOT administers Transportation Alternatives Set-Aside (TA) and Safe Routes to School (SRTS) Program funds for locally sponsored bicycle and pedestrian infrastructure projects in communities less than 200,000.
National Safety Council (NCS) Drug Impairment Training for Texas Employers (DITTE) [3]	Four-hour program for Texas employers funded by a grant from TxDOT. Managers and supervisors will learn 1) how to educate their employees on traffic safety, 2) how to identify the signs and symptoms of impairment, and 3) how to develop or improve a resource guide for drug policies, programs and practices within their organization.
TxDOT HSIP [4]	Formulaic funds for safety related projects based on crash history. Formulaic funds safety projects that are consistent with the State's strategic highway safety plan (SHSP) and that correct or improve a hazardous road location or feature or address a highway safety problem.
NHTSA Highway Safety Programs [4]	Formulaic funds for programs for improving driver behavior and safety. These include programs to reduce injuries and death from crashes, improve driver education, provide proficiency testing and physical and driving examination, and improve pedestrian performance and bicycle safety.

Source:
[1] Local or regional funding source
[2] Texas Comptroller
[3] Texas Strategic Highway Safety Plan, Programs and Projects
[4] Infrastructure Investment and Jobs Act Eligible Activities (formulaic federal funds administered by the state)

Federal Funding Sources

On November 15, 2021, the Infrastructure Investment and Jobs Act (IIJA) was signed into law which provides $973 billion over five years from FY 2022 through FY 2026, including **$550 billion in new investments**. IIJA reauthorized and increased funding to legacy nationwide transportation programs, while also funding new and innovative infrastructure programs. Ultimately, the IIJA will fund improvements to **transportation systems ($284 billion)**, energy systems, broadband networks, water and wastewater systems, environmental programs, and resiliency.

Figure 9-1 – IIJA Transportation Funding Categories



As shown in **Figure 9-1**, the IIJA provides a total of $284B above baseline (additional funds) toward all modes of transportation for roads & bridges, rail, transit, **safety ($11 billion)**, and others[3]. Harris County can access IIJA transportation funds through competitive grants, suballocations based on population (such as STBG), and federal formulas (such as HSIP). Competitive federal grant programs, such as RAISE and INFRA, with additional funds are provided as **Table 9-4**.

Table 9-4 – Competitive Federal Grant Programs

Funding Source	Description
Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant	The RAISE grant program (previously known as BUILD and TIGER grants) funds projects which: (1) support transportation projects that focus on creating good-paying jobs, improving safety, applying transformative technology, and explicitly addressing climate change and advancing racial equity; (2) build, repair, rebuild, and revitalize freight and passenger transportation networks; and/or (3) improve access to reliable, safe, and affordable transportation
Infrastructure for Rebuilding America (INFRA) grant	The INFRA grant program funds projects which improve the safety, efficiency, and reliability of the movement of freight and people in and across rural and urban areas (emphasis on freight-related projects).
Consolidated Rail Infrastructure and Safety Improvement (CRISI) Program	Deployment of railroad safety technology, capital projects that address congestion challenges, facilitate ridership growth, and increase multimodal connections, railway and roadway safety improvements such as signals and barriers, safety programs, corridor service development plans, and workforce development activities.
Railroad Crossing Elimination Program	Highway-rail and pathway-rail grade crossing improvement projects involving grade separation or closure, providing track relocation, improving or installing protective devices and signals, and improving the safety and mobility of people and goods at highway-rail grade crossings.
FMCSA Motor Carrier Safety Assistance Program	Projects to mitigate crashes and hazardous materials incidents involving commercial motor vehicles (CMVs).
Safe Streets and Roads for All Program (SS4A)	Developing "Vision Zero" action plans and other improvements to reduce crashes and fatalities, especially for cyclists and pedestrians.
Crash Data / State Electronic Data Collection Program	Modernize data collection systems to enable them to more efficiently share data with the National Highway Traffic Safety Administration.
Wildlife Crossing Pilot Program	Projects that seek to achieve a reduction in the number of wildlife-vehicle collisions, or those that improve habitat connectivity.
Immobilization Grant Program	For the immobilization or impoundment of passenger-carrying commercial motor vehicles that are determined to be unsafe or fail inspection.
Stopping Threats on Pedestrians	Bollard installation projects designed to prevent pedestrian injuries and acts of terrorism in areas used by large numbers of pedestrians.

[3] IIJA transportation funding categories figure and amounts are sourced from NACo

9.3 Systemic Approach

The systemic approach, which varies greatly from the traditional (ISA) approach, should be implemented to supplement ISAs.

Harris ISAs employed a traditional approach to safety assessments which included a network screening to identify high-crash locations, site-specific crash data analysis, and field reviews which led to short-, mid- and long-term recommendations. To supplement ISAs, Harris County should systemically implement low-cost countermeasures at intersections to improve safety countywide. In short, a systemic approach implements safety improvements systemwide based on crash types (such as pedestrian crashes) or facility characteristics (such as urban, signalized intersections) which account for a disproportionate amount of fatal and injury crashes. At the state-level, TxDOT has determined overrepresented crash types and facilities and approved specific countermeasures for systemic implementation (**Table 9-5**). Descriptions of the systemic approach to safety are provided by FHWA (**Figure 9-2**) and TxDOT (**Figure 9-3**) in boxes below.

Table 9-5 – HSIP-Approved Systemic Countermeasures (Intersection-Related)

Over-represented	Countermeasure	Work Code
Urban Intersection	Install Warning/Guide Signs, Install Flashing Yellow Arrow (FYA), Install Advanced Warning Signs (Intersection), Install Advanced Warning Signals and Signs (Intersection)	101, 138, 128, 124
Pedestrian	Install Warning/Guide Signs, Install Pedestrian Crosswalk, Install Pedestrian Signal, Improve Pedestrian Signals/ Install Leading Pedestrian Interval, Safety Lighting at Intersection, Channelization, Install RRFB, Pedestrian Hybrid Beacon, Pedestrian Crossing Deterrent	101, 403, 110, 131, 305, 509, 144, 143, 225

Figure 9-2 – FHWA Description of the Systemic Approach to Safety

The systematic approach is the reverse of the conventional highway safety improvement program approach. The conventional approach starts with the identification of high-crash intersections and then selects countermeasures to impact crash patterns at the intersections. The systematic approach starts with defining a set of specific low-cost countermeasures and searches the crash data base to identify intersections where they can be deployed.

Source: FHWA-SA-09-020, Low-Cost Safety Enhancements for Stop-Controlled and Signalized Intersections

Figure 9-3 – TxDOT Description of the Systemic Approach to Safety

A systemic approach involves widely implementing improvements based on high-risk roadway features correlated with specific severe crash types. This approach provides a more comprehensive method for safety planning and implementation. It is an approach that broadens traffic safety efforts by considering risk and crash history when identifying where to make low-cost safety improvements. A systemic approach helps to identify sites for potential safety improvements that typically would not be identified using a traditional site analysis approach.

- Identifies a "problem" based on systemwide data, such as a rural lane departure crashes, urban pedestrian crashes, or rural unsignalized intersection crashes. These crashes are often spread across the network with few or no locations experiencing a "cluster" of crashes during a given period of 3-5 years, but which still present a safety risk to the travelling public.
- Looks for characteristics (i.e. geometry, volume, or location) frequently present in severe crashes. These characteristics are referred to as risk factors.
- Focuses on promptly deploying one or more low-cost countermeasure to address the underlying circumstance contributing to crashes on most roads sharing a set of risk factors. By addressing crash types experiencing low densities (crashes per intersection or mile) but high aggregate numbers, program funds can be dedicated toward low-cost solutions deployed across the system, affecting many locations.
- Identifies and prioritizes locations across the roadway network for implementation. Systemic projects should be widely implemented across the system. Projects should be along a roadway corridor/segment or at multiple locations throughout a region.

Source: TxDOT HSIP guidance (year 2021)