U.S. Department of Transportation
Federal Highway Administration

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May 20, 2019

In Reply Refer To:
HTA-TX

City of Houston Pedestrian and Bicycle Road Safety Audit

Mr. Jeffrey Weatherford, P.E. PTOE
Deputy Director, Transportation & Drainage Operations
Houston Public Works
City of Houston
611 Walker St.
Houston, TX 77002

Dear Mr. Weatherford:

Enclosed for your use is the City of Houston Pedestrian and Bicycle Road Safety Audit Part Two conducted by the Federal Highway Administration with assistance from the Houston Public Works and other partners. The report includes recommendations for improving pedestrian and bicyclist safety at six intersections from Mayor Turner's Safer Streets Initiative. The previous six intersections of the Safer Street Initiative were addressed in late 2018.

Once Houston Public Works has completed its response to the recommendations, please retain both documents in your associated files, and provide me with a copy. If needed, FHWA is available to provide further technical assistance to help implement the recommendations. We look forward to continuing to work with the City of Houston to advance pedestrian and bicyclist safety.

If you should have any questions or concerns, please call me at (512) 536-5924.

Sincerely yours,

STEPHEN J RATKE

Digitally signed by STEPHEN J RATKE
Date: 2019.05.20 11:11:32 -05'00'

Stephen Ratke, P.E. (NV)
Safety Engineer

cc: Ian Hlavacek, P.E., Houston Public Works
Capt. Kevin Deese, Houston Police Department
James Keener, Texas Department of Transportation

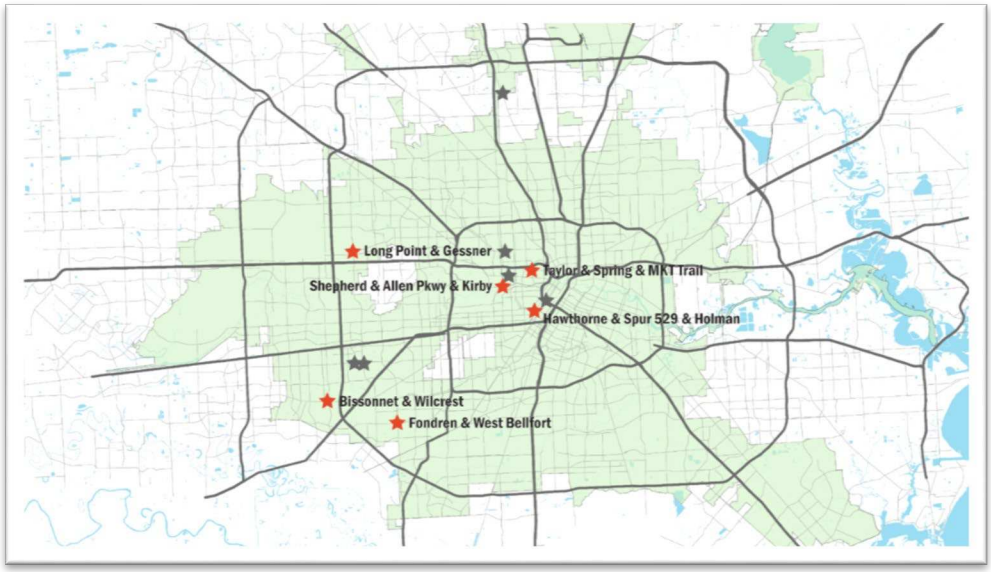
# Houston Safer Streets Initiative
# Top 12 Intersections
# Pedestrian/Bicycle Road Safety Audit
# Second Six Locations

**Conducted:**

**January 28 – February 1, 2019**

**At the Request of:**

**City of Houston**




Facilitated By:

**Stephen Ratke – Safety and Traffic Operations Specialist**

**FHWA Texas Division**

**&**

**Craig Allred - Transportation Specialist**

**FHWA Resource Center**

**Safety and Design Technical Service Team**

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# Background

At Bike to Work Day on May 18, 2018 and again at the State of Mobility address on May 24, Mayor Sylvester Turner invited BikeHouston and fellow advocates to help the City of Houston identify the ten highest priority intersections for improving pedestrian and bicyclist safety. LINK Houston partnered with BikeHouston to respond to Mayor Turner's request and provided the City with two lists of potential high priority intersections.

LINK Houston analyzed motor vehicle crashes involving pedestrians and bicyclists from January 1, 2013 to December 31, 2017 to equitably identify priority intersections across Houston. The underlying crash data was from the Texas Department of Transportation Crash Records Information System. Crash injury severity and death were weighted based on U.S. Department of Transportation Value of Statistical Life guidance (e.g., the value of preventing a death is $9.6 million) and then attributed to intersections. Intersections were ranked based on the cumulative impacts to pedestrian and bicyclists over the five-year period. Analysis of the ten highest priority intersections was presented to the City of Houston and Mayor Turner prioritized the seven bolded intersections:

1. **Fannin & Pierce**
2. **Ranchester & Bellaire**
3. Westheimer & S Dairy Ashford (TxDOT Facility)
4. **Long Point & Gessner**
5. Westpark Dr. & U.S. 59 South (TxDOT Facility)
6. Old Spanish Trail & U.S. 288 South (TxDOT Facility)
7. **Fondren & West Bellfort**
8. **Bissonnet & Wilcrest**
9. **West & Airline**
10. **Bellaire & Gessner**

BikeHouston used a member survey to ascertain where cyclists feel unsafe crossing Houston's streets. Survey findings were presented to the City of Houston and Mayor Turner prioritized the five bolded intersections:

1. Sunset & Main & Fannin*
2. **Shepherd & Allen Pkwy & Kirby**
3. **Taylor & Spring & MKT Trail**
4. **11th St & Nicholson**
5. West 610 & Woodway & Arbor Trail
6. Houston & Spring & MKT Trail*
7. **Hawthorne & Spur 527 & Holman**
8. **Patterson & Washington**
9. Waugh/Heights & Memorial
10. Weslayan & Westpark/US 59
11. Morningside & Bellaire

** The City and partners have current projects to address known safety concerns at these locations.*

In July 2018, Mayor Turner prioritized twelve intersections for the Safer Street Initiative by selecting seven intersections put forward by LINK Houston and five intersections put forward by BikeHouston.

Mayor Turner then directed City of Houston staff to investigate corrective measures at the twelve locations. Potential corrective measures were to include infrastructure repairs or improvements, but also more effective law enforcement and public education. With the recommendation of advocates, the City reached out to the Federal Highway Administration to invite their assistance to perform a multi-disciplinary Road Safety Audit (RSA). This RSA considered the first six locations of the top 12 intersections list, and the remaining six will be studied in a later effort.

The Federal Highway Administration's (FHWA) Office of Safety established RSAs to improve the overall safety performance of roadways. A RSA is a comprehensive formal safety performance evaluation on an existing or future road segment or intersection performed by an independent and multidisciplinary team. RSAs are a low-cost proactive approach to safety which considers all road users and identifies opportunities to enhance safety and reduce the number and severity of crashes. A pedestrian and bicyclist focused Road Safety Audit is a specialized type of RSA intended to focus on pedestrian and bicyclist safety issues. In addition to pedestrian and bicyclist safety, the RSAs documented here also consider safety and operational conditions for motor-vehicles, and transit vehicles and users.

## Road Safety Audit Team:

- Houston Public Works (HPW)
  - Ian Hlavacek, P.E.
- Houston Police Department
  - Cmdr. Kevin Deese
- Houston METRO
  - Gary Scott
- Texas Department of Transportation (TxDOT)
  - James Keener
- LINK Houston
  - Jonathan Brooks
- BikeHouston
  - Jessica Wiggins
  - Clark Martinson
- Federal Highway Administration (FHWA)
  - Stephen Ratke, P.E. (TX Division Office)
  - Craig Allred (Resource Center)

# RSA Project Location:

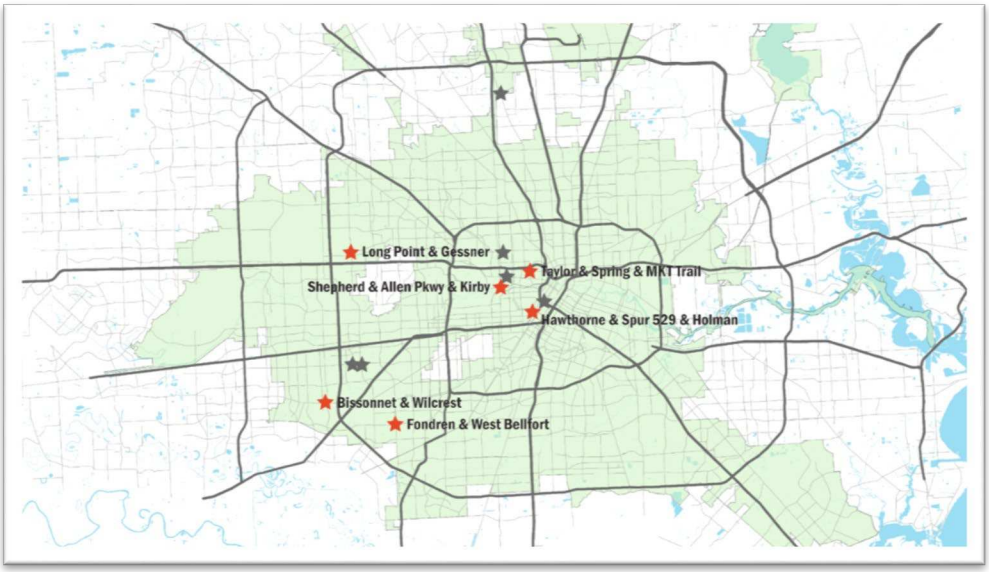


**Figure 1: Top 12 Pedestrian and Bicycle Intersections. Selected locations for this RSA are highlighted with red stars.**

# Kick Off Meeting

The RSA kickoff meeting was held at the Houston TranStar office on January 28th. The kick off meeting included City of Houston Planning and Development Department staff, TxDOT Houston District staff, FHWA staff, LINK Houston, BikeHouston, and the RSA team (see Appendix A for a list of attendees). After initial introductions Ian Hlavacek presented an overview of Mayor Turner's Safer Streets Initiative and the six locations chosen for this RSA. The meeting concluded with comments from attendees for the team to consider while conducting the review.

# Site Visits

The RSA team visited the intersections on the following days and times:

- Long Point at Gessner:
  - 1/29, 8:30 – 9:30am (AM peak)
  - 1/29, 6 – 7pm (PM Peak, night)
- Taylor at Spring and MKT Trail:
  - 1/29, 7 – 8am (AM Peak, School arrival)
  - 1/29, 5:30-6pm (PM Peak)
  - 1/30, 7:30 – 8pm (night)
- Shepherd at Allen Parkway and Shepherd at Memorial Parkway:
  - 1/29, 4 – 5pm (PM peak)
  - 1/29, 7 – 7:30pm (night)
  - 1/30, 7:30 – 8:30am (AM Peak, school arrival)
- Hawthorne at Spur 527 and Holman:

    - 1/28, 3 – 4pm (mid-day and PM peak)
    - 1/28, 7 – 8pm (night)
- Fondren at West Bellfort:
    - 1/28, 6 – 7pm (PM peak / night)
    - 1/30, 8 – 9:30am (AM peak)
- Bissonnet at Wilcrest:
    - 1/30, 9:45 – 10:30am (AM Peak)
    - 1/30, 3 – 4:30pm (PM peak, school dismissal)
    - 1/30, 6 – 7pm (night)

## Close Out Meeting

A close out meeting was held with City of Houston Planning and Development Department staff, City of Houston Public Works staff, TxDOT Houston District staff, and the RSA team (see Appendix B for a list of attendees) on February 1st at Houston TranStar. The RSA team presented initial findings from the previous four days' work and received feedback from attendees. Conclusions from the close out meeting along with additional information received after the RSA work are reflected in this report.

## The Positives

The RSA team observed many positive features at the six intersection sites. Street lighting was present at all six locations, and the street lighting placement at the recently reconstructed location of Gessner and Long Point is a noticeable improvement compared to older designs used by the city. At five of the locations, frequent transit usages and connections reflected good service by Houston METRO, supporting biking and walking near the intersections. The three locations in the city's core reflect the growing desire for walkable and bike-able infrastructure and connections to the city's expanding bicycle network, and the concerns frequently were about serving the increasing number of cyclists and reflecting the priorities of all road users in the area. All the locations had frequent walking and biking activity, and the team recognizes the potential for improvements in comfort and safety could facilitate additional short trips to area destinations rather than continuing to add to single occupant motor vehicle trips.

# Primary Concerns

The six locations studied by this RSA team represent a diverse set of conditions throughout the City of Houston from core neighborhoods to more suburban areas further away from the city's core. All six of the locations were identified as having some concern over the safety and ease of use for pedestrians and bicyclists, using a combination of crash data, feedback from BikeHouston and LINK Houston, and other sources. Most of the sites have frequent bus routes with strong bus ridership, along with the associated need to cross the street for access to transfers, businesses, schools, or residences nearby. Most of the locations had nearby commercial developments that generated additional pedestrian and bicycle use, particularly between the commercial activity and the bus stops. Many of the locations had noted concerns with motor vehicle travel speeds. Three of the locations were considered critical points of crossing as part of regional bicycle networks or planned networks or access to regional trails. Three locations had nearby schools that affected the operations and the type of roadway users during the before and after school periods of each day. Motor vehicle drivers were frequently aggressive in making turning movements including entering the intersection on yellow (and red) and making right turns without yielding to pedestrians. Pedestrians observed during the study rarely used the pushbuttons and frequently crossed to a median during left turn phases that don't conflict with the half of the roadway being crossed. Bicyclists routinely rode on the sidewalk, and even at the locations with bicycle facilities it was necessary to use the sidewalk to complete movements through the intersection.

# General Recommendations

## Sidewalks

Sidewalks were generally present at all locations, but the condition, width, and placement of sidewalks varied. Many sidewalks in Houston have been located directly at the back of the curb, which has several disadvantages to pedestrian safety and comfort. Sidewalk placed adjacent to the back of curb isn't comfortable for people walking due to the lack of separation from high speed traffic, and roadways with higher operating speeds benefit from increased separation. The lack of a buffer between the curb and sidewalk also makes it a challenge to locate street accessories, such as light poles, trees, signs, street furniture, and other items. At corners, lacking a setback also makes it harder to locate ADA accessible ramps, landing pads, and push buttons. At driveways, a setback enables the cross slope to be maintained through the sidewalk and more clearly defines the driveway beginning and ending. Sidewalk condition also varied greatly throughout the locations reviewed. Several corners had updates for new ramps, but sidewalk away from the corner had cracked slabs, dirt or vegetation covering the sidewalk, or lips between slabs that were tripping hazards. Many of the older sidewalk segments were narrow at 4' wide or less. New sidewalks should be at least 5' wide matching City of Houston standards, with additional width provided in high usage areas.

- Recommendation: Update design guidance around sidewalk setback from the back of curb (See Figure 2).
- Recommendation: Include sidewalk segments in regular evaluations for ADA improvements to address cross slopes at driveways, lips and gaps to be corrected, and to clear obstructions from the sidewalk.

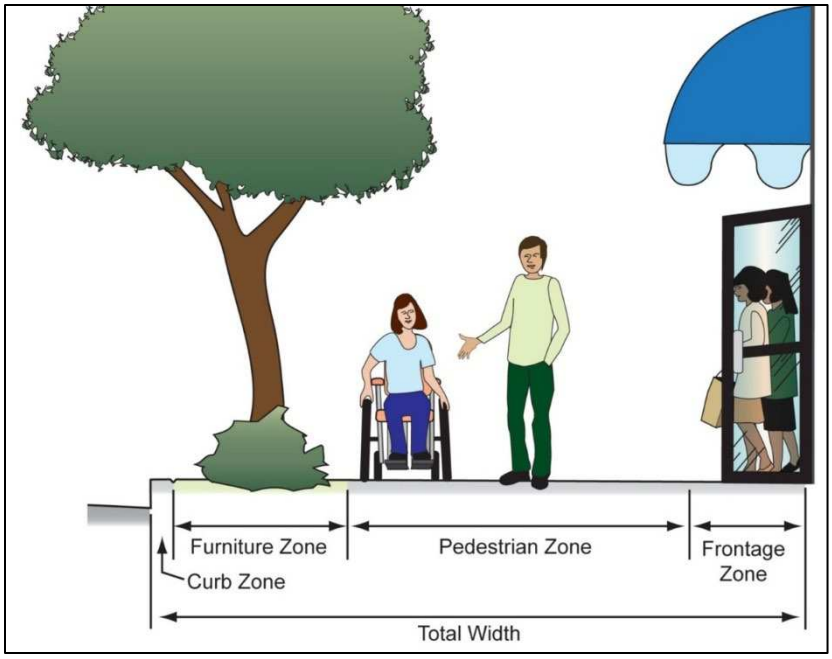


**Figure 2: FHWA Designing for Pedestrian Safety Zone System - for considering and creating sidewalk setbacks from the curb.**

## Americans with Disabilities Act (ADA)

Multiple concerns with accessibility were noted at each of the locations. Pedestrian push buttons were a mix of older and newer devices and should be upgraded over time to include accessible pedestrian signals (APS) and pushbuttons should be relocated to meet ADA/Texas Accessibility Standards (TAS) accessibility guidelines. Most frequently pushbutton locations were not within the proper reach distance of a level landing pad. Signal timing and phasing should be reviewed and adjusted to ensure that adequate crossing times are given. Curb ramps were a mixture of single and dual ramp designs, even though dual ramp designs are preferred for their ability to direct pedestrians who are blind or visually impaired in the desired direction. Ramp alignment and width could be improved in most locations, and many locations lacked level landing pads. At the recently reconstructed location of Gessner and Long Point, it was noted that the ramps were located on curved portions of the sidewalk along the curb radius, and single ramp design were used throughout. New designs should use dual-ramp design whenever possible, and the use of sidewalk setbacks from the curb would allow for better placement of ramps and push buttons.

- Recommendation: All signal timings should be verified to ensure adequate Texas Manual on Uniform Traffic Control Devices (TMUTCD) recommended pedestrian crossing times.
- Recommendation: Update design guidance to clearly state that dual-ramp corner designs are preferred, and single ramp designs should be justified on a case by case basis (See Figure 3).
- Recommendation: Upgrade intersections for ADA/TAS compliance (See Figure 3):
    - curb ramp alignment and level landing pads,
    - pedestrian pushbutton location,

- additional ramp width.

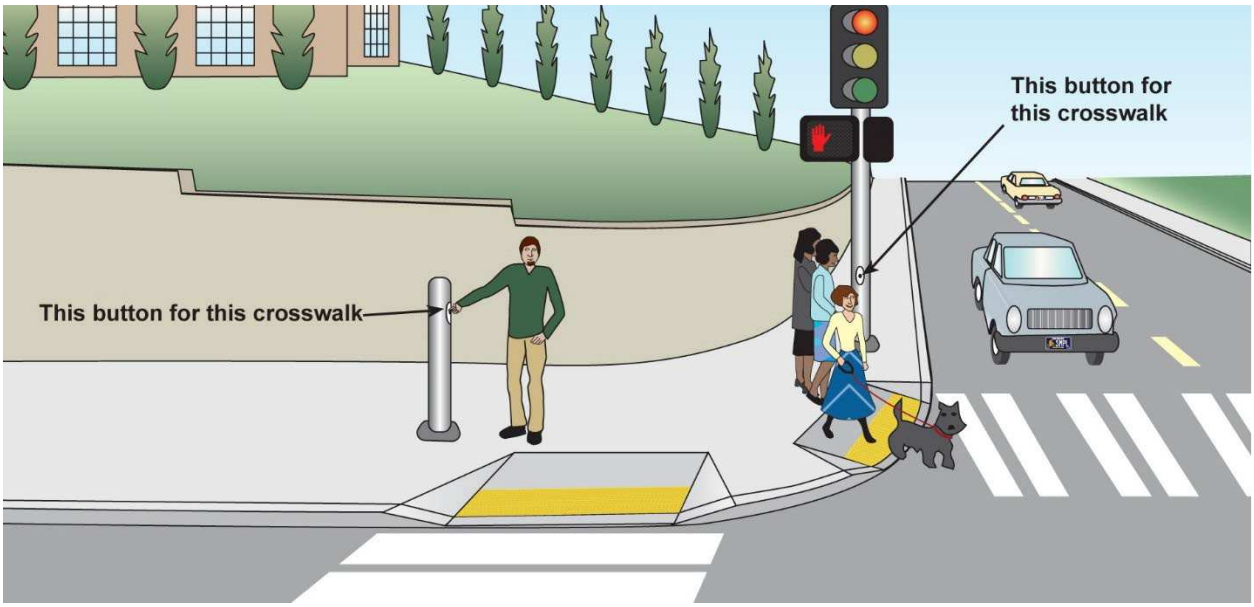


**Figure 3: FHWA guidance on ramp and push button locations and alignment.**

## Crosswalks

No locations included high-visibility crosswalk markings, and markings were faded under wheel paths or throughout the crosswalk in most locations. Several locations were missing any crosswalk markings. High-visibility crosswalk markings provide additional information for where drivers should expect to see people walking and are more visible under all conditions. Pavers or other aesthetic treatments in crosswalks tend to fade over time and provide little information to drivers in dark conditions, and therefore cannot be used in place of proper pavement markings.

- Recommendation: All signalized crosswalks should be marked per the TMUTCD.
- Recommendation: The City of Houston should develop a policy on using high visibility cross walk markings related to safety concerns, rather than the current practices which only considers locations of schools.

## Aggressive Driving and Speed Management

Like the team's observations in the first RSA, aggressive driving and vehicle speeds was a noted concern at all locations reviewed. For additional discussion and recommendations related to aggressive driving and speed management, please refer to the first RSA report.

# Location Specific Issues and Recommendations

## Location: Long Point at Gessner

Observations and Issues:

The intersection of Long Point and Gessner had a previous history of pedestrian and bicycle crashes, but was recently reconstructed. There have not been any pedestrian or bicycle crashes since construction started. The review team used this as an opportunity to review current design standards and practices by the City of Houston to identify possible improvements for future projects under development. Long Point is a commercial center to the east of Gessner, and is more residential to the west. A bus route along Long Point turns south along Gessner at this intersection, along with north/south service on Gessner. The local improvement district is developing a plan for a road diet along Long Point to change from a four-lane cross section to three-lane cross section, and the review team generally supports this proposed change.

The new lighting installed around the intersection provides excellent night time visibility and is a marked improvement over older designs reviewed at the other intersection locations (See Figure 4). While other items are newly constructed, the team did identify several improvements that could be made. The intersection used an aesthetic pattern within the crosswalks and the interior of the intersection. Unfortunately, crosswalk markings had not been installed, and the aesthetic pattern alone is not visible at night to help people cross the intersection on foot. The pattern also used the same brick pattern in paths leading to the middle of the intersection, which may lead to confusion about the desired pedestrian crossing of the intersection. Aesthetic patterns within a crosswalk and elsewhere in the intersection should be different to prevent any confusion. There was also a concrete circle in the middle of the intersection, and the team witnessed several drivers who drove around the circle. Aesthetic patterns used should avoid patterns that suggest paths that are not intended by overall intersection design and control.


**Figure 4: Lighting and missing crosswalks.**

In one corner, the area behind the sidewalk had tripping hazards and new junction boxes that were not level with brand new asphalt. The sidewalk treatment at the corner has several aspects that would improve accessibility and provide additional comfort for walking and biking. All corners utilize a single

ramp design, with ramp slopes that are concurrent with the curb radius. ADA ramps should be straight, and dual-ramp designs are preferred for new locations. The pushbutton locations are also located in such a way that out-of-direction travel is required for some walking movements, and not all the push buttons are near level landing pads or within a reach distance of a level landing pad. The use of a buffer between the back of curb and the sidewalk would alleviate several of these issues, such as space to put in ramps in both directions, better places to put push buttons next to level landing pads, and be more comfortable for users by being further away from motor vehicles.

Recommendations:

**Short Term (up to 12 months)**

- Recommendation: Install crosswalk markings.
- Recommendation: Move newspaper boxes near the bus stop to make an accessible path.

**For future design standards and design considerations**

- Recommendation: Update design guidance to more strongly favor dual ramp designs for corners.
- Recommendation: Consider the use of sidewalks with a buffer from the back of curb (See Figure 2).
- Recommendation: Update design guidance to avoid the use of ramps along curved portions of sidewalk.
- Recommendation: Update design guidance on push button placement and use of level landing pads.

## Location: Taylor at Spring and MKT Trail

Observations and Issues:

The MKT Trail crosses Taylor parallel to Spring and represents an opportunity to improve a key crossing in the wider Houston bicycle network. The MKT Trail connects to downtown Houston to the east and to the White Oak Bayou and Heights trails to the west, offering high comfort, off-street facilities for medium to long distance biking trips. The immediate area includes commercial developments, an elementary school, and residential developments. Taylor provides access to I-10 just north of the intersection. The trail west of Taylor crosses several driveways as part of the commercial development where the trail ramps up and down and feels more like an intersection than a driveway crossing, which may lead to confusion about who has the right of way and allows for higher vehicle speeds. The city has created a leading pedestrian interval to help cyclists cross Taylor in the north leg crosswalk, which is activated by using the pedestrian push button.

On the east leg, the two-way bicycle trail ends at a large open paved area just before arriving at Taylor (See Figure 5). There are bollards between the street and the trail, but the bollards end in such a way that vehicles can cut across the area to turn right when one vehicle is at the signal queued to go straight or turn left (See Figure 6). This area is ambiguous for use, and at times is used by vehicles to turn right

on red, particularly in the morning from traffic that has dropped off children to the nearby Crocket Elementary school. The area does not allow access for bicycles to push the pedestrian push button without dismounting a bicycle, and most bicyclists did not push the button when heading west, although most did when heading east, since the button is in a more accessible location. In the afternoon and evening, there are major turning movements leaving the shopping center and proceeding north towards I-10. The northeast quadrant has a planned new development, and the city should address that development and how it interacts with the trail and possible improvements than can be made to the intersection in coordination with the development work.

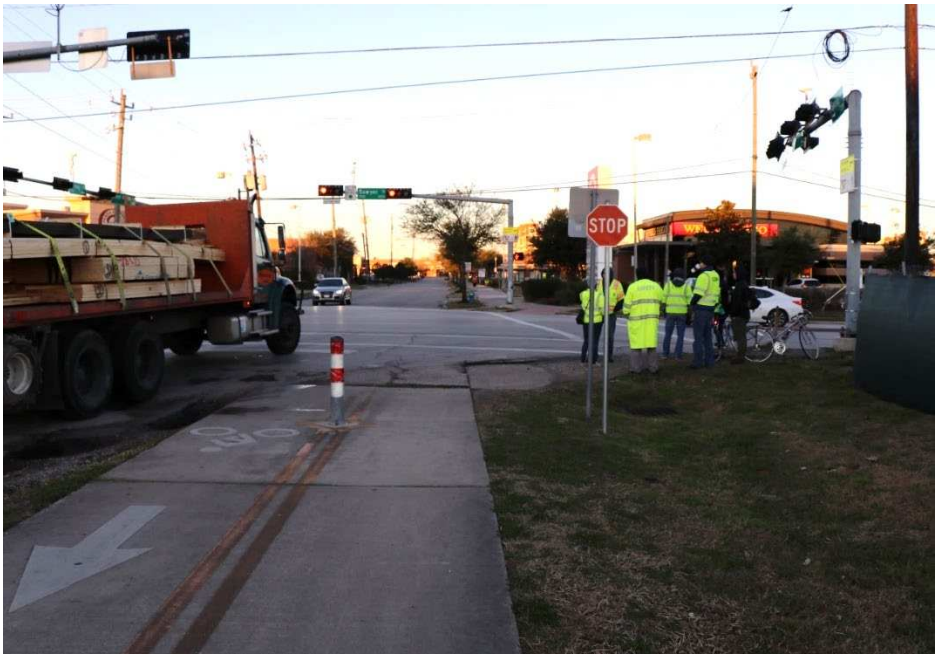


**Figure 5: Westbound path approach to Taylor Street.**

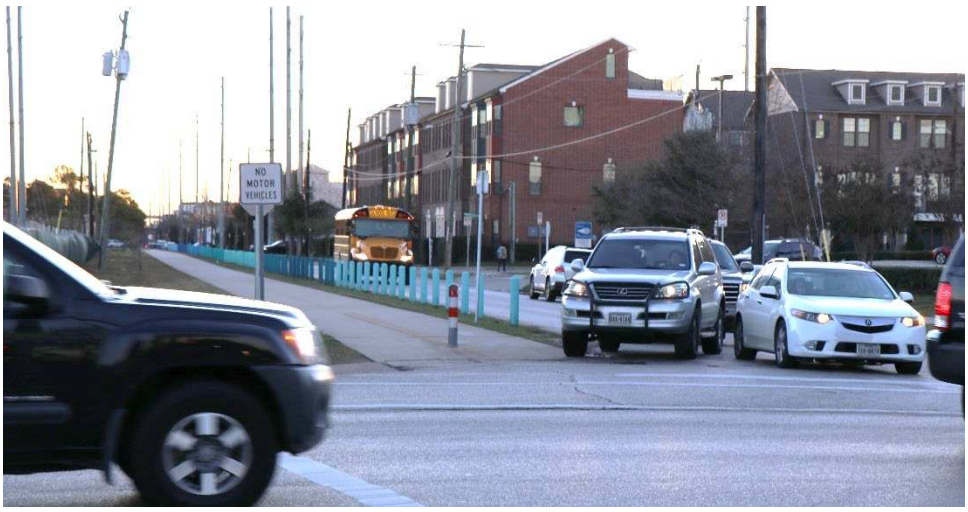


**Figure 6: Turning vehicle using bicycle path to get around a waiting vehicle.**

Recommendations:

**Short Term (up to 12 months)**

- Recommendation: Use additional physical delineators to keep cars out of the bicycle queueing area in the northeast corner (See Figure 5 and Figure 6).
- Recommendation: Provide temporary asphalt to smooth over the area in the northeast corner and provide access to the existing push button location.
- Recommendation: Investigate signal phasing changes to reduce turning conflicts with trail users. An east/west split phase may make sense, and running the bicycle/pedestrian phase with the minor split should reduce conflicts (eastbound in the morning, westbound in the afternoon).
- Recommendation: Improve driveway crossings through the shopping center:
    - Dual-use white and green crosswalk markings across driveways.
    - Work with property owners to install stop signs, stop bars, and trail crossing signage

**Medium to Long Term (1+ years)**

- Recommendation: Implement bicycle signal heads with separate phase from the pedestrian movement.
- Recommendation: Implement a cycle track crossing of Taylor consistent with newer design guides that separates bicycle traffic from pedestrian movements (See Figure 7).
- Recommendation: For future development and reconstruction of this area, consider design standards that leave the trail/sidewalk raised and patterned as a sidewalk across driveways so that walking and biking right of way is implied through design.

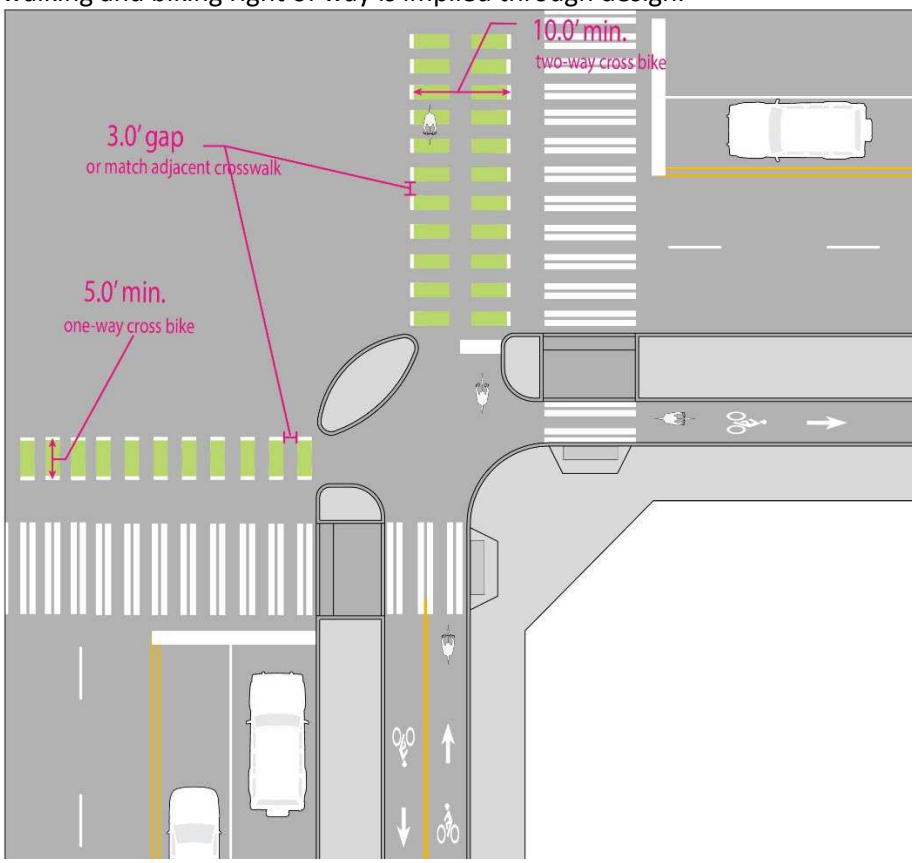


**Figure 7: Seattle DOT example of two-way cycle track intersection crossing. (From: https://streetsillustrated.seattle.gov/design-standards/bicycle/bike-intersection-design/).**

## Location: Shepherd at Allen Parkway and Shepherd at Memorial Parkway

Observations and Issues:

This pair of intersections serves several busy roadways to connect to downtown Houston and functionally acts as a barrier between the multi-use paths along Buffalo Bayou and the neighborhoods to the north, south, and west. There are also frequent bus routes along Shepherd and Memorial, a high school in the northeast corner, and a pending major development in the southeast corner. The existing intersections have little to no pedestrian and bicycle accommodations, with missing ramps, sidewalks, pedestrian indications, and other related issues. There is a dedicated pedestrian and bicycle bridge beneath the Shepherd overpass that also serves as a trail turnaround for the trails that proceed east from Shepherd along the bayou. City of Houston staff stated that signal modifications/improvements would be more expensive here than other locations due to the age of the infrastructure and collapsed conduits.

At the intersection of Kirby, Allen Parkway, and Shepherd the city is already coordinating with a developer for changes in the southeast quadrant of the roadway. The team supports the intent to remove the high speed free flow right turn lane for a more conventional right turn configuration that would support slower speeds. The remainder of the intersection requires that pedestrian signal indications, accessible ramps and sidewalks, and related basic infrastructure be installed. The proposed pedestrian elements should connect as directly as possible to the existing trails and bridge underneath the Shepherd overpass. Any reconfiguration should also be evaluated to allow for a northbound to westbound left turn movement.

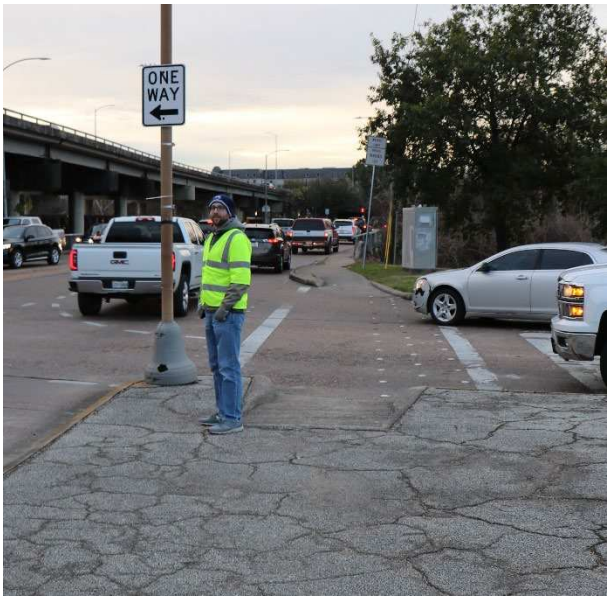


**Figure 8: West of Memorial and Shepherd intersection with sidewalk that leads on to bridge area.**

At the intersection of Memorial Parkway and Shepherd the existing configuration of the Shepherd overpass, Memorial underpass, and bus transfer and high school related walking and biking traffic presents several challenges. The west side sidewalk is relatively wide, but there is no pedestrian crossing across the south leg of Shepherd which currently has signal phasing that does not allow for a pedestrian movement. It also connects to a narrow sidewalk arrow along the west side of Shepherd over Buffalo Bayou, which should be closed and redirected to the new wider structure underneath the Shepherd overpass (See Figure 8).

Along the east side, there are no pedestrian ramps, and an area that is less than 3.5’ wide near the Shepherd overpass support, and a low barrier over the drop off to Memorial Parkway below. This low barrier area should be corrected with a pedestrian appropriate height railing and may need to be temporarily closed off in the interim.

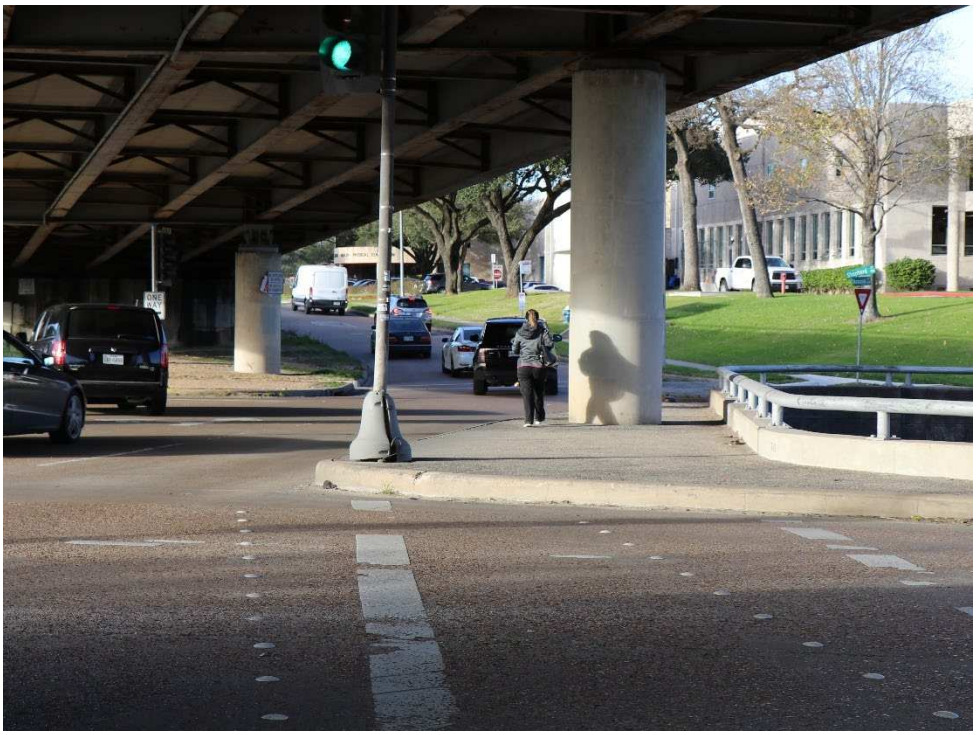

**Figure 9: East side of Memorial and Shepherd intersection with missing ramps, narrow walkway, and low railing.**

In the longer term, full pedestrian movements with accessible ramps and pedestrian indicators and associated improvements must be made. This may require modifying the existing islands and signal head locations on the bridge over Memorial. One option may be to change the inside northbound lane to a left turn only lane and to move it to the west of the west Shepherd overpass pillar. With only one lane passing between the Shepherd overpass pillars, the island on the east side could then be widened to provide a full width pedestrian area and improved with new ramps. A second option would be to place a new pedestrian/bicycle use bridge over Memorial just to the east of the existing bridge. As changes are made, the signal phasing should be adjusted to allow for pedestrian crossings of all four legs of the intersection. The sidewalks leading to the west narrow sidewalk along Shepherd over Buffalo Bayou should also be permanently closed such that pedestrians are never directed to that area.

<u>Recommendations:</u>

**Short Term (up to 12 months)**

- Recommendation: Work with developer of southeast quadrant parcel to program pedestrian and bicycle accessible improvements to the intersection of Kirby/Allen Parkway/Shepherd.
- Recommendation: Close off the area over Memorial Parkway with the existing low railing.

**Medium to Long Term (1+ years)**

- Recommendation: At Kirby/Allen Parkway/Shepherd implement basic pedestrian infrastructure upgrades to add accessible ramps, marked crosswalks, pedestrian signal indications, and associated improvements.
- Recommendation: At Shepherd and Memorial Parkway determine preferred configuration to provide for pedestrian movements in all corners including a plan for 5' minimum width sidewalks, ramps, railings, and pedestrian signal indications.
    - Option 1: Create left-turn only lane on northbound Shepherd and modify existing islands and signal head placement (See Figure 10).
    - Option 2: Add a new pedestrian/bicycle bridge just east of the existing bridge over Memorial Parkway.

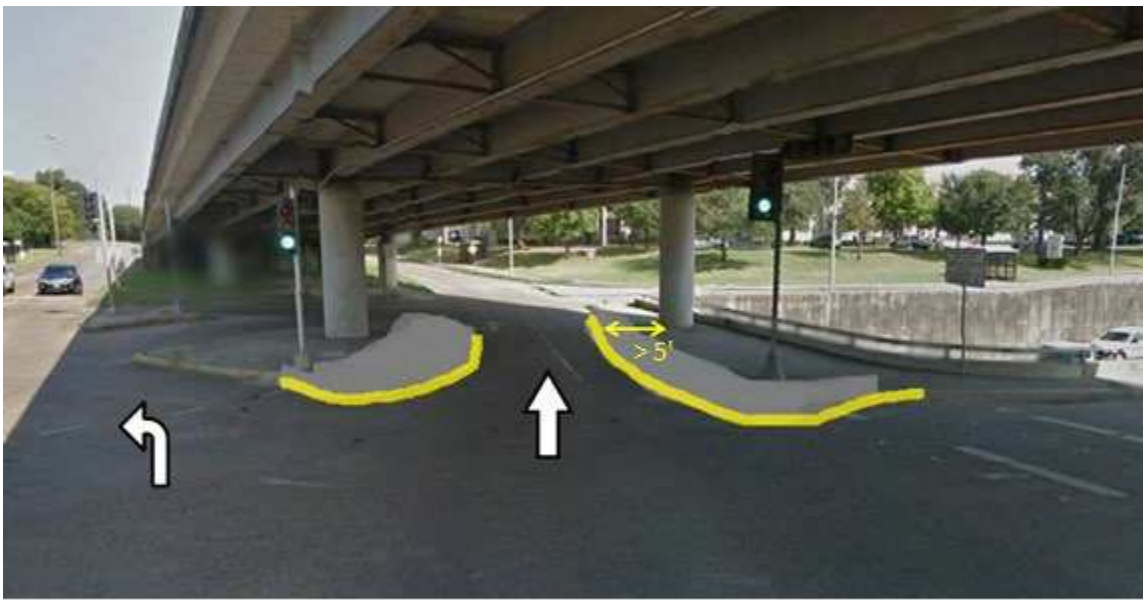


Figure 10: RSA Team drawing for realignment of lanes for Option 1.

## Location: Hawthorne at Spur 527 and Holman

Observations and Issues:

This intersection serves multiple purposes for a diverse set of roadway users. Hawthorne and Holman create a major east-west bicycle network corridor, with slow speed streets with higher levels of comfort both east and west of the intersection. However, the Spur 527/Smith/Bagby intersections presents a complicated crossing between the more comfortable segments. Smith and Bagby connect from downtown one-way grid system streets to the north and a freeway spur to the south that serves heavy commuter traffic consisting of both vehicles and transit activity, and many drivers are increasing speeds up to freeway speeds as they traverse the intersection.

As Smith Street proceeds south towards the intersection, it gradually transitions from a standard downtown 5 lane, one-way cross section to two lanes that continue onto Spur 527. Currently there is a dedicated left turn only lane at Elgin, two blocks of on street parking south of Elgin, and a dedicated left-turn lane at Holman. A right-side transit lane ends just north of Holman. The right-side curb is constructed to allow a right turn to Hawthorne, however this movement was blocked at some time in

the past. The dedicated left turn lane at Holman was observed to have low volumes, and the majority of

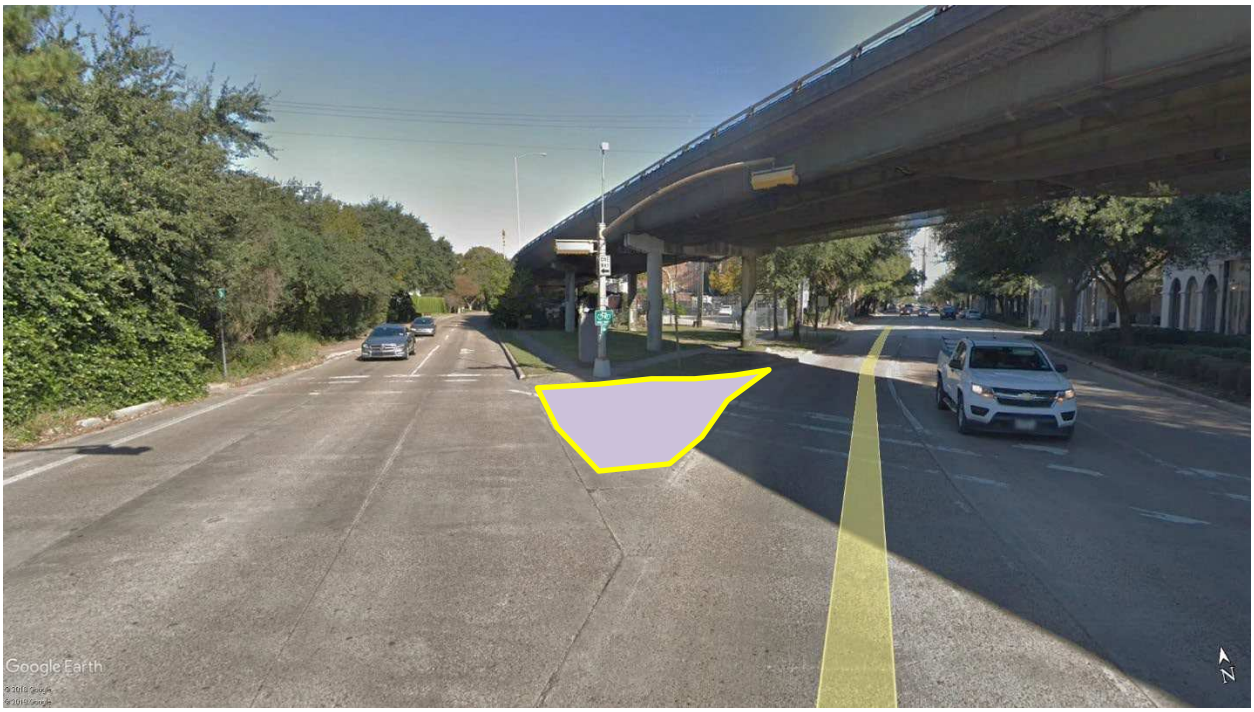


**Figure 11: Area between Smith and Bagby for possible curb extensions (Google Earth).**

vehicle traffic in that lane merged into the adjacent through-lane at the intersection. The current configuration allows for higher speeds and late merges, both of which may affect the safety and comfort for other roadway users, and there is a potential to reconfigure how the lanes are dropped in the few blocks approaching the intersection to provide enhanced walking and biking comfort and to possibly extend the bicycle network north along Smith. Additionally, the right-side curb along Smith can be reconstructed to fit the currently allowed movements, which would provide a larger waiting area for bicycles attempting to cross Smith and Bagby, where the current waiting area is narrow and not adequate for more than one or two bicycles at a time.

For east – west bicycle travel, the current configuration includes a narrow sidewalk connecting to Hawthorne (See Figure 12), the use of two crosswalks (See Figure 13), and then a connection to a short


Figure 12: Hawthorne "window" connection to Holman.


Figure 13: Existing Crosswalk across Smith and Bagby.

stretch of two-way cycle track proceeding east on Holman (See Figure 14). The crossings of Smith and Bagby are made in two stages with the walk indication. At the time of the review there was a conflicting stop sign facing approaching bicycles moving westbound into the intersection. The crossings of Smith and Bagby would benefit from modifications that maintained the cycle track appearance through the intersection (See Figure 7) and the connection to Hawthorne, including wider paths and dual use green and white crosswalk markings.

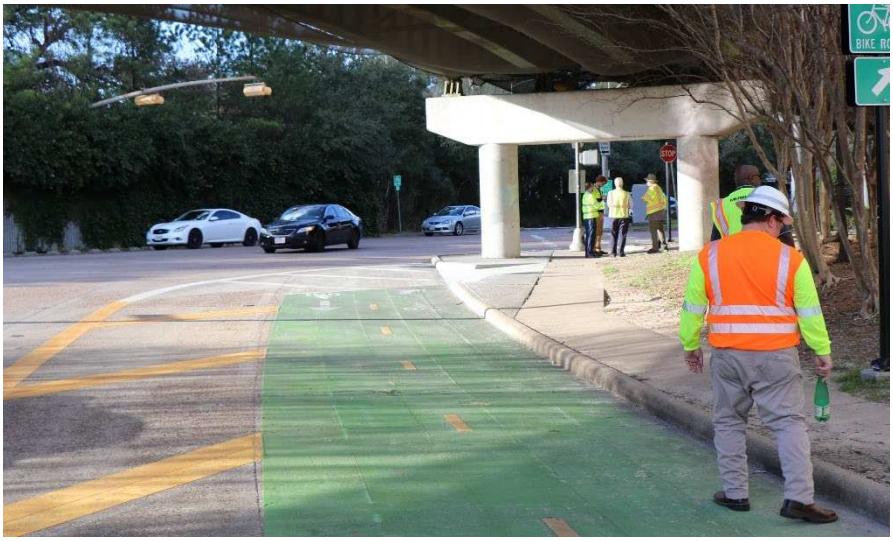

Figure 14: Cycle track approach to intersection.

Recommendations:

**Short Term (up to 12 months)**

- Recommendation: Change the visibility of the Smith and Bagby facing signal heads such that conflicting indications can no longer be seen from the wrong approach.
- Recommendation: Add signal ahead warning signs on Smith and Bagby.
- Recommendation: Move guide sign on Bagby with directions to Hawthorne to be south of the intersection with Courtland.
- Recommendation: Evaluate lighting around the intersection when trees have full leaves to determine impacts of existing vegetation.

**Medium to Long Term (1+ years)**

- In Conjunction with the Brazos bridge work, if possible include:
    - Recommendation: Improve lighting beneath Brazos street bridge in coordination with the bridge rehabilitation project.
    - Recommendation: Widen the sidewalk/path between Holman and Hawthorne for pedestrian/bicycle use (10' minimum, 14' or more desired) (See Figure 12).
    - Recommendation: Adjust the curb between to Bagby and Smith to place a wider refuge area using unused pavement (See Figure 11).
    - Recommendation: Place combined crosswalk / cycle track markings that better links the end of the cycle track to the east and the path to Hawthorne on the west (See Figure 14 and Figure 7).
    - Recommendation: Eliminate the left-turn only lane from Smith to Holman
- Recommendation: Install bicycle signal faces for the east-west bicycle movements instead of using the pedestrian indications.
- Recommendation: Evaluate and consider adding a two-way cycle track along Smith between Holman and Tuam, taking advantage of lanes on Smith that need to be reduced anyway to connect to the two lanes on Spur 527.

## Location: Fondren at West Bellfort

Observations and Issues:

This intersection in southwest Houston is surrounded by strip mall style commercial development, with many apartment complexes along both roads, and single-family homes in interior parts of the neighborhood. Both streets have frequent bus service, and a large amount of walking traffic is related to bus connections for transfers and access to the commercial spaces (See Figure 15). Both streets have six though lanes and left turn lanes at the intersection. Bellfort alternates between six-lane and four-lane sections east and west of this location, and the current AADT was in a range that a reduction to four lanes would be acceptable in this location. Fondren is four lanes north of this intersection, but remains six lanes proceeding south, and also has a current AADT that may allow a reduction to four lanes through the intersection. Reducing both streets to four lanes would allow for the installation of bicycle lanes and/or wider medians. While neither street is identified in the Houston bike plan, having bicycle facilities along both streets would enable higher comfort short trips between area apartment buildings and homes and the commercial buildings, which may eliminate short motor vehicle trips. It would also reduce off-peak motor vehicle speeds, and allow for easier and shorter crossings of the street.

Figure 15: Bus stop and crossing activity at narrow median.

The team observed many pedestrian crossings away from the intersection that appeared to be primarily related to bus stop placement and access to the commercial developments (See Figure 15). As shown above, the people walking used the narrow (~ 2'wide) median to cross in stages despite the exposure to vehicular traffic in doing so. In the medium to long term, the city should work with Houston METRO and local businesses to consider adjusting the locations of the bus stops and possible driveway consolidation that would allow for bus stops to be placed closer to the intersection. There were also issues with median bull noses intruding into the crosswalk (See Figure 16), and several areas with cracks in the sidewalk rendering the sidewalk inaccessible to wheel chair users and presenting a trip hazard.


Figure 16: Angled crosswalk and bull nose median.

Recommendations:

**Short Term (up to 12 months)**

- Recommendation: Assess pedestrian phase timing to ensure adequate clearance.
- Recommendation: Modify median noses and straighten crosswalks.
- Recommendation: Use high visibility crosswalk markings based on crash history at this location.

**Medium to Long Term (1+ years)**

- Recommendation: Reconfigure Bellfort and Fondren to widen median (See Figure 15), provide bicycle facilities, and encourage slower speeds by reducing the cross section from six lanes to four.

- Recommendation: Evaluate and adjust bus stop placements, possibly in conjunction with driveway closure/consolidations.

## Location: Bissonnet at Wilcrest

Observations and Issues:

The intersection in southwest Houston also has nearby commercial development along with multifamily residential development along the arterial streets and single-family homes in the neighborhood interiors. Bissonnet has relatively high volumes for a four-lane cross section and frequent bus service with high ridership. It is identified for a long-term transit project to improve capacity and frequency for transit service. Wilcrest has slightly lower frequency bus routes, and many transfers happen between the routes. There is an elementary school east of the intersection along Bissonnet, and in the afternoon pick up queues blocked a westbound lane of Bissonnet leading up the school.

**Figure 17: Broken curb, vehicle off-tracking, and sidewalk condition.**

All the quadrants had sidewalks in need of maintenance to fix uneven surfaces, vegetation that was blocking part of the sidewalk, and curbs that had crumbled under turning traffic paths (See Figure 17). Around the intersection several signal heads for vehicles and pedestrians were not aligned with traffic that was intended to see that head. Two streets lights mounted on the signal mast arms were present, but one was not working, and the other was not an LED fixture consistent with other roadway lighting in the area. The signal hardware in general was dated and may benefit from an upgrade to modern equipment. The east bound bus stop on Bissonnet is pulled back from the intersection because of driveways closer to the intersection, which contributes to many crossings occurring away from the intersection. The bus stop location, in conjunction with peak hour traffic congestion on Bissonnet (See

Figure 18), resulted in many bus riders crossing lanes midblock that were moving at different speeds, which may be related to the crash history of this location.


**Figure 18: Distance from corner to bus stop, driveway openings near the intersection and queues along Bissonnet.**

Recommendations:

**Short Term (up to 12 months)**

- Recommendation: Realign signal heads and pedestrian heads for each approach.
- Recommendation: Fix broken light fixture and consider additional new fixtures for better lighting.
- Recommendation: Pull bull nose medians out of the crosswalks.

**Medium to Long Term (1+ years)**

- Recommendation: Improve lighting and upgrade signal hardware to modern equipment and indications.
- Recommendation: Improve landing areas and ramps for each corner (See Figure 17 and Figure 18).
- Recommendation: Work with planned future transit improvements to incorporate pedestrian safety improvements.
- Recommendation: Close southwest corner driveway and move bus stop closer to the intersection (See Figure 18).
- Recommendation: Due to the congestion along Bissonnet and crash history, consider the use of median fencing or other treatments to direct pedestrian crossings to the intersection.

# Appendix A

Kick Off - Sign in list of attendees

# TDO

## Sign-In-Sheet

| | | | | | |
|---|---|---|---|---|---|
| Meeting: | RSA Phase 2 Kick Off Meeting | | Date: | Monday 28, 2019 | |
| Location: | Houston TranStar 6922 Katy Road -Rm.216 | | | 1:00P.M. | |
| | Name | | | | |
| | Last | First | Email | Phone | Company |
| 41 | Ratke | Stephen | stephen.ratke@dot.gov | 512-536-5924 | FHWA |
| 42 | Wiggins | Jessica | JWiggins@bikehouston.org | 713-775-1565 | BikeHouston |
| 43 | Noshkasan | Dian | diann@rice.edu | 713-348-4471 | Kinder Inst Rice Univ. |
| 44 | ~~Lau~~ Grove | Lauren | Lauren.Grove@houstontx.gov | 8323936550 | City of Houston Planning & Dev. |
| 45 | Hatter | Kimberly | Kimberly.hatter@houstontx.gov | 713-249-8757 | Mayor's Office |
| 46 | Deese | Kevin | kevin.deese@houstonpolice.org | (281) 382-7257 | City of Houston P.D. |
| 47 | Allred | Craig | CRAIG.ALLRED@DOT.GOV | 303.434.3366 | FHWA Resource Center |
| 48 | Clark | Johana | johana.clark@houstontx.gov | 832.395.6685 | City of Houston - Public Works |
| 49 | Keener | James | james.keener@txdot.gov | (713)802-5185 | Texas Department of Transportation |
| 50 | VanDusen | Mike | mvandusen@sbcglobal.net | 713-818-2980 | Super Neighborhood Alliance |
| 51 | ~~Gary Scott~~ | | | | |
| 52 | Scott | Gary | garyscott8452@comcast.net | 832 746 0595 | Houston Metro |
| 53 | Martinsen | Clark | cmartinsen@bikehouston.org | 713 824 6808 | Bike Houston |
| 54 | Brady | Jonathan | jonathan.brooke.brady@uhcl.edu | 8064402862 | UHV Houston |
| 55 | Raschke | Mariana | mraschke@thegoodmancorp.com | 2254391878 | The Goodman Corporation |
| 56 | Delaughter | Gail | gdelaughter@houstonpublicmedia.org | (713) 743-8432 | Houston public media |
| 57 | AbdulKareem | Omar | omar.abdulkareem@houstontx.gov | 832-395-~~3007~~ 3016 | COH / TDO |
| 58 | Deleon | Matt | matthew.deleon@txdot.gov | 713-802-5177 | TxDOT - Traffic Safety |
| 59 | Hlavacek | Ian | ian.hlavacek@houstontx.gov | 832-395-3002 | Cat I TDO |
| 60 | | | | | |

*NOTE* Please scan all sign-in-sheets: Joyce Broussard

# Appendix B

Close Out - Sign in list of attendees

# TDO

## Sign-In-Sheet

| | | | |
|---|---|---|---|
| Meeting: | RSA Phase 2 Close out Meeting | Date: | Friday, 2/1/2019 |
| Location: | Houston TranStar 6922 Katy Road-Rm.120A | | 1:00P.M. |

| | Name Last | First | Email | Phone | Company |
|---|---|---|---|---|---|
| 41 | Keener | James | james.keener@txdot.gov | 713 802 5185 | TxDOT |
| 42 | DeLeon | Matt | matthew.deleon@txdot.gov | 713802-5177 | TXDOT |
| 43 | Scott | GARY | GARY.SCOTT@ridemetro.org | 832 492-9342 | Houston Metro |
| 44 | Deese | Kevin | Kevin.Deese@houstonpolice.org | (8)382 7057 | HPD |
| 45 | Abdulrazzak | Mazen | Mazen.Abdulrazzak@houstontx.gov | (713) 881-3179 | COH |
| 46 | NGUYEN | KHANG | | | COH |
| 47 | JONES | ERIN | erin.jones@houstontx.gov | 832-395-2530 | COH |
| 48 | ~~[illegible]~~ Sigel | Ines | inessigel@[illegible] | | UNK Houston |
| 49 | Tangen | Matt | matt.tangen@hcp1d.org | 713 274 3676 | Harris County |
| 50 | Alejandro | Perez | alexlivesinnorthline@gmail.com | 713-894-2978 | Melrose Civic Club |
| 51 | ~~Lauren~~ Grove | Lauren | Lauren.Grove@houstontx.gov | 832 3936550 | COH Planning |
| 52 | ECCLES | PETER | PETER.ECCLES@HOUSTONTX.GOV | 832 393 6591 | COH PLANNING |
| 53 | Ostlind | Jennifer | Jennifer.Ostlind@houstontx.gov | 832 393 6549 | COH Planning |
| 54 | Clark | Johana | johana.clark@houstontx.gov | 832.395.6685 | COH HPW Traffic |
| 55 | Martinson | Lisa | d.lisamartinson@gmail.com | 7136865170 | Euclid Studio |
| 56 | McManus | Clint | clint.mcmanus@h-gac.com | 832-681-2513 | H-GAC |
| 57 | Noshkasan | Dian | dianm@rice.edu | 713 348 4471 | Kinder Inst- Rice University. |
| 58 | Hurtado | Natali | nhurtado@haweshill.com | 7136798717 | International MD |
| 59 | Clark Martinson | cmartinson | @bikehouston.org | 713 824 0808 | Bike Houston |
| 60 | Pickens | Auburn | auburn.pickens@ridemetro.org | 713-739-4846 | METRO |

*NOTE* Please scan all sign-in-sheets: Joyce Broussard

# TDO

## Sign-In-Sheet

| | |
|---|---|
| **Meeting:** | RSA Phase 2 Close out Meeting |
| **Location:** | Houston TranStar 6922 Katy Road-Rm.120A |
| **Date:** | Friday, 2/1/2019 |
| | 1:00P.M. |

| | Name Last | First | Email | Phone | Company |
|---|---|---|---|---|---|
| 61 | Ramirez | Ana | Ana.RamirezHuerta@txdot.gov | 713-802-5810 | TxDOT |
| 62 | Brooks | Jonathan | jonathanbrooks@linkhoustonorg | | LINK Houston |
| 63 | Holzer | Robin | holzer@mindspring.com | 713.361.5716 | COH BAC |
| 64 | Allred | Craig | Craig.Allred@Dot.Gov | 303.434.3566 | FHWA Resource Center |
| 65 | Rake | Stephen | stephen.rake@txdot.gov | 512-536-5924 | FHWA TxDOT |
| 66 | Hlavacek | Ian | — | — | — |
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*NOTE* Please scan all sign-in-sheets: Joyce Broussard