

Hillsborough Street (NC-54) Horne Street to Gorman/Faircloth Street

**Pedestrian Road Safety Assessment
Raleigh, North Carolina
April 21 – 22, 2009**



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1. Introduction

1.1. Objectives of Study

The objective of this study was to complete a pedestrian road safety assessment (RSA) for Hillsborough St (NC-54) between Horne Street and Gorman Street in Raleigh, North Carolina (see Figure 1). The intersection of Hillsborough Street and Enterprise Street was also reviewed as a class learning exercise, but recommendations are not included in this report as the intersection will be completely reconstructed as part of the Hillsborough Redesign Project.

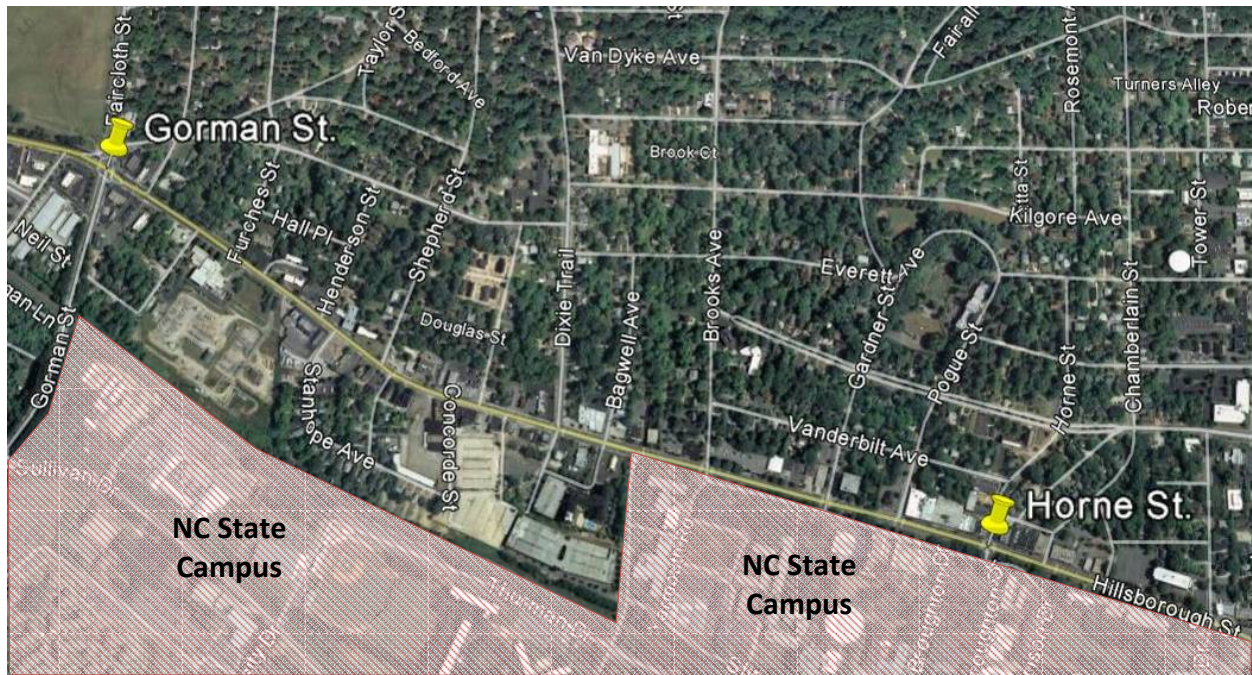


Figure 1. Study Area

1.2. Background

Hillsborough Street is a multi-lane, east-west urban arterial roadway in a mixed-use area in Raleigh, North Carolina. This road serves as a commuter route and also provides access to the North Carolina State University, residential neighborhoods, and high-density residential developments. Pedestrian and bicycle activity in this area is generated by the university, bus stops, commercial developments, residential areas, and shared-use trails.

North Carolina is a pedestrian focus state and the City of Raleigh was selected to host a course on pedestrian RSAs. The City provided the RSA team with detailed information of the study area, including crash and traffic volume data. The RSA team reviewed 25 pedestrian crashes (2004-2008) and 7 bicycle crashes (2000-2006) that were reported in the study area. The City also provided plans for future developments in the area. Specifically, the RSA team reviewed the Hillsborough Street Redesign Plan, the Stanhope Village Plan, and the Business Improvement District Plan. As part of

the Hillsborough Street Redesign Plan, Hillsborough Street between Pullen Road and Gardner Street will be converted to a two-lane, two-way roadway with a raised median. Roundabouts will replace the signalized intersection of Hillsborough Street and Pullen Road and the unsignalized intersection of Pullen Road and Oberlin Road. The purpose of this RSA was to identify safety issues that may be contributing to the reported pedestrian and bicycle crashes along this corridor, whether the contracted improvements will address these issues, and to identify potential measures to mitigate outstanding issues.

The RSA team consisted of members from the Federal Highway Administration (FHWA), NCDOT, City of Raleigh, North Carolina State University, Highway Safety Research Center at UNC-Chapel Hill, Florida DOT, Georgia DOT, New Jersey DOT, and VHB, Inc. The RSA was performed on April 21 – 22, 2009, during daytime and nighttime hours.

2. Existing Conditions

2.1. General Site Characteristics

Hillsborough Street is a multi-lane, urban arterial. The number of through lanes varies within the study corridor from three to four lanes with left-turn lanes at many of the major intersections. There are two through lanes in the westbound direction for the entire length of the study area. Traveling eastbound, there are two through lanes from Gorman St to Turner St, one through lane continues from Turner St to Dixie Trail, from which point two through lanes are carried through the remainder of the study area. Sidewalks with curb and gutter are located on both sides of the road throughout the area. The speed limit is not posted, but the roadway falls under the citywide speed limit of 35 mph in both directions. There are eight signalized intersections within the study section of Hillsborough Street, including the intersections of Horne, Pogue, Gardner, Brooks, Dan Allen, Dixie Trail, Shepherd, and Gorman. Pedestrian signals are installed for the major road at all signalized intersections, but not on all approaches. This area is served by City Area Transit (CAT), Regional Transit (Triangle Transit), and university transit (the Wolfline) as well as private transit services provided by local apartment complexes. There is one CAT and five Wolfline bus stops in the eastbound direction and one CAT and two Wolfline bus stops in the westbound direction. Triangle Transit stops are co-located with the CAT bus stops.

2.2. Traffic Data

The average daily traffic (ADT) at the east end of the study corridor is approximately 23,000 vehicles per day, which increases to nearly 30,000 vehicles per day at the west end. Pedestrians were observed during both day and night, many of whom were using transit. Bicyclists were observed during all times of the day.

2.3. Crash Analysis

The City of Raleigh provided five years of pedestrian crash summaries (2004-2008) and seven years of bicycle crash summaries (2000-2006) for Hillsborough Street between Meredith College Street and Oberlin Road. During that period there were 32 reported pedestrian crashes and 17 reported bicycle crashes (see Appendix A for crash diagram). Within the study area from Gorman Street to Horne Street, there were 25 reported pedestrian crashes and 7 reported bicycle crashes. Nearly all pedestrian and bicycle crashes occurred at or near intersections with few occurring midblock. Of the 25 pedestrian and 7 bicycle crashes reported in the study area, the majority of crashes were injury-related (80 percent for pedestrians and 86 percent for bicyclists) as shown in Figure 2. This is not surprising due to the vulnerability of pedestrians and bicyclists when involved in a crash. Figure 2 also illustrates the percentage of nighttime and wet-weather crashes involving pedestrians. It does not appear that wet-weather crashes are over-represented in the data (12 percent); however, nighttime crashes do appear to be over-represented, accounting for 44 percent of all pedestrian crashes. Based on relative exposure (i.e., pedestrian volumes and the number of daylight hours), fewer nighttime crashes would be expected. Light and weather conditions were not available for the bicycle crashes. Additional details regarding the pedestrian and bicycle crashes are provided in Tables A.1 and A.2 in Appendix A.

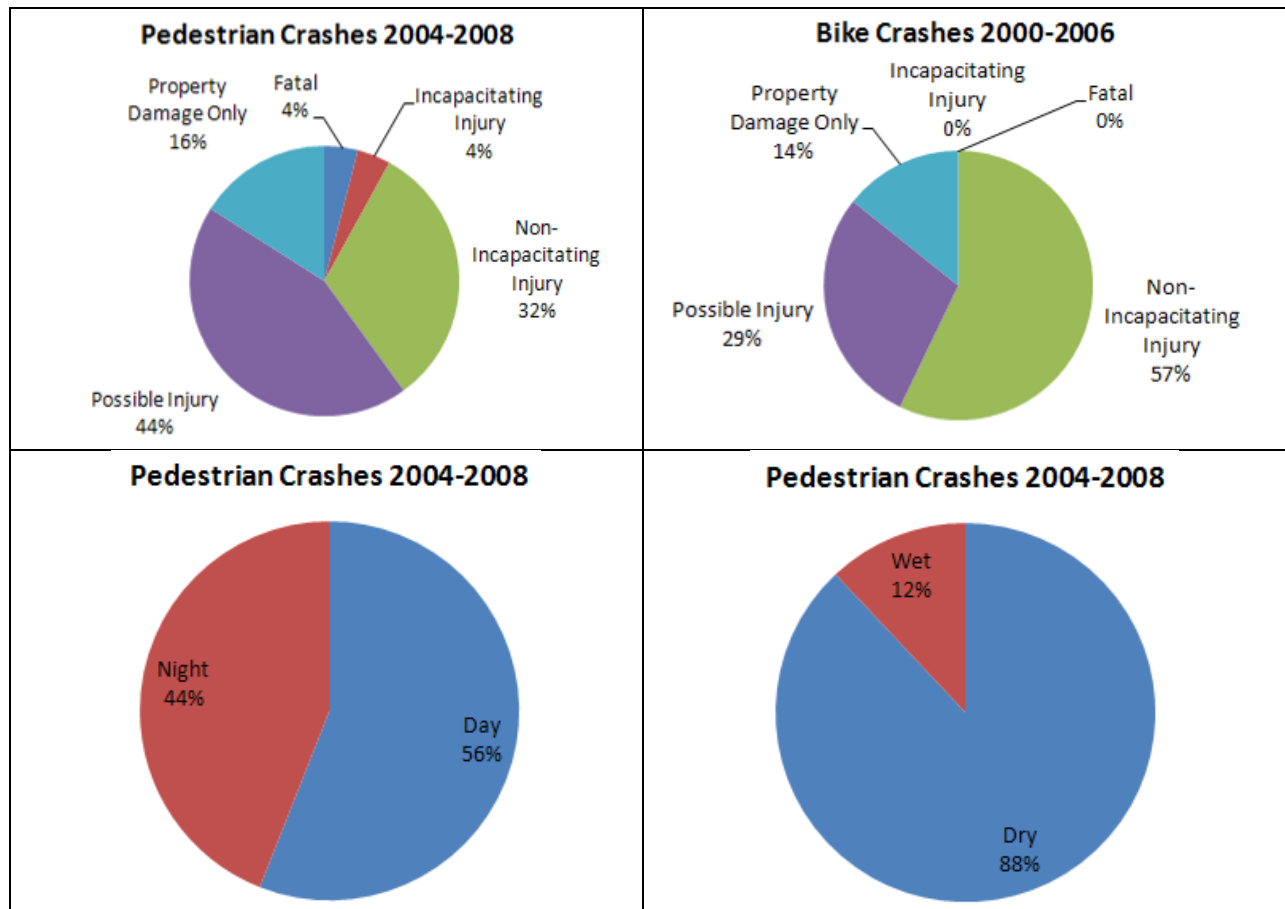


Figure 2. Disaggregate Analysis of Pedestrian and Bicycle Crashes

3. Assessment Findings

3.1. Safety Benefits of Existing Roadway Features

Based on a review of existing site conditions, there are several notable roadway features that enhance pedestrian and bicycle safety in the study area, namely:

- **Positive Attitude and Cooperation from Local Agency Staff** – Throughout the course of the RSA process, the City of Raleigh staff provided tremendous support and was very open to suggestions for improvements. This attitude will help to maintain a long-term commitment to improving pedestrian and bicycle safety throughout the city.
- **Continuous Sidewalk** – There is a continuous sidewalk along both sides of Hillsborough Street, providing continuity from one end of the study area to the other.

3.2. Safety Benefits of Planned Roadway Improvements

Figure 3 illustrates a portion of the Hillsborough Street Redesign Project. Phase 1 of the project includes the section of Hillsborough Street between Pullen Road and Gardner Street. There are several improvements planned as part of the project, including:

- **Streetscape** – A streetscape is planned for both the north and south sides of Hillsborough Street. Parking will be allowed on both sides of the street and will help to separate pedestrian traffic from vehicular traffic. The majority of the median will have no landscaping, minimizing visual obstructions between pedestrians and vehicles.
- **Continuous Light-Emitting Diode (LED) Lighting** – There is currently lighting along the study corridor, but the city plans to install continuous LED lighting. Raleigh is part of the LED City initiative, which looks to upgrade all lighting sources with LED-based fixtures. The planned improvements will fill-in existing gaps in lighting, providing a more constant level of illumination. According to the City, the LED lights will provide improved acuity and recognition compared to the typical metal halide fixtures, which is advantageous in an area with high volumes of nighttime pedestrian activity.
- **Reduction of Speed Limit and Road Diet** – Currently Hillsborough Street operates under the citywide speed limit of 35 mph. As part of the improvement project, the speed limit will be reduced to 25 mph based on the two-lane cross-section with a median and on-street parking along both sides of the street. It should be noted that this will only apply to the Hillsborough Street Redesign Project area between Horne Street and Gardner Street.
- **Access Management** – The plans to install a median will help with access management, restricting left-turns into and out of access points located at midblock locations.

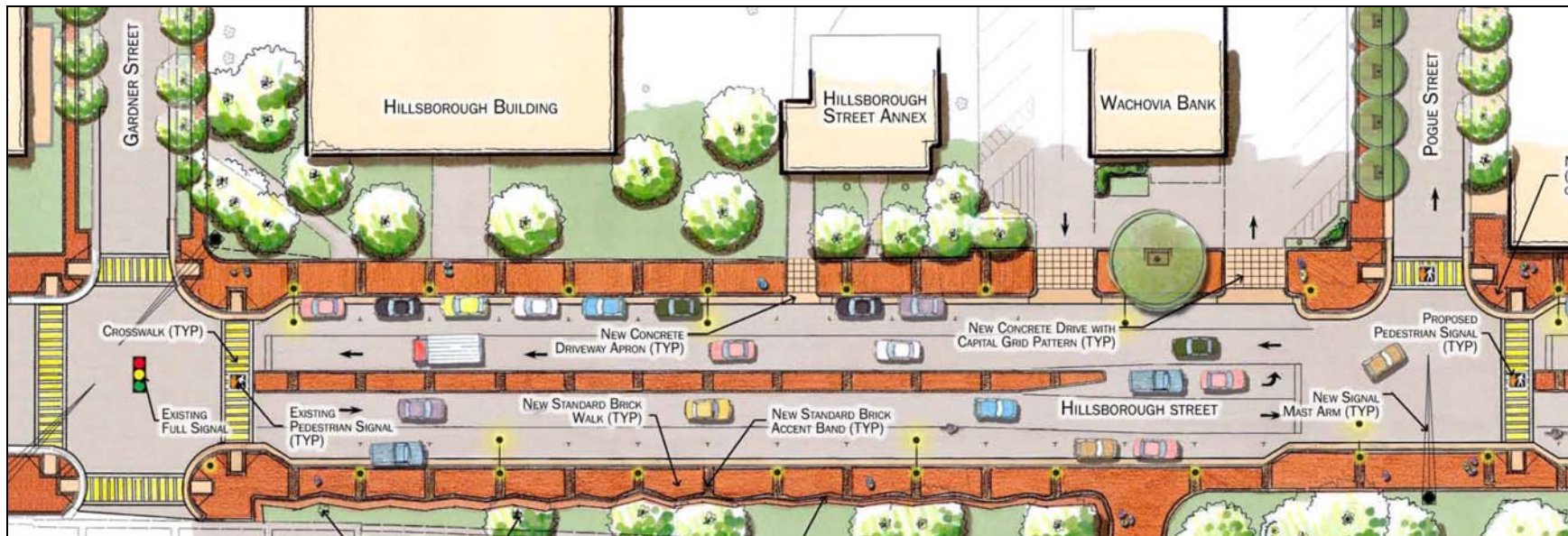






Figure 3. Rendering of Hillsborough Street Redesign Project between Pogue Street and Gardner Street.

3.3. Identified Safety Issues and Suggestions for Improvements

Despite the measures to improve pedestrian safety throughout the RSA corridor, 10 general issues were identified. The RSA team members prioritized the issues based upon their perceived importance in the study area and developed suggestions to correct or mitigate the safety concerns. The issues and suggestions are summarized in Tables 1 and 2, which correspond to existing conditions and planned improvements, respectively. The issues and suggestions are illustrated on an aerial of the study area in Appendix B as well as on the schematic of planned improvements in Appendix C. While specific examples are provided for each safety issue identified, this report is not considered as an exhaustive list of locations where each issue is present. It was beyond the scope of this RSA to identify each specific location for every issue (e.g., ADA compliance issues). Instead, this report provides a list of specific safety issues, as identified by the RSA team, along with suggestions to mitigate the issues. The findings apply, in general, to the study area, but the City should look for opportunities to identify similar issues elsewhere and implement improvements as appropriate.

TABLE 1. Summary of Safety Issues and Suggestions for Existing Facilities

SAFETY ISSUE	SUGGESTED IMPROVEMENTS	EXAMPLES OF ISSUES
1. Potentially Harmful Behaviors		
<p>Midblock crossings—pedestrians are crossing Hillsborough St. midblock during day and night, particularly along the NC State campus and at night west of Dixie Trail between a bar and a convenience store. There were four midblock pedestrian crashes between Daisy St and Dixie Trail and five midblock crashes between Horne St and Dan Allen Dr during the study period.</p> <p>The campus transit service (the Wolfline) stops at two midblock locations along Hillsborough St.:</p> <ul style="list-style-type: none"> - Between Brooks and Gardner St. - Between Gardner and Pogue St. <p>There are also several access points from campus leading to Hillsborough St. at midblock locations between Brooks St. and Horne St. These include two access points between Horne St and Pogue St, 1) near the east wing of the D.H. Hill Library (see photo, right) and, 2) near Patterson Hall. There is also a midblock access point from Kilgore Hall to the Brooks parking lot between Brooks St and Gardner St. Another midblock access point is located between Pogue St and Gardner St, near the west wing of the D.H. Hill Library.</p>	<p><i>Short-term</i> – Consider improving existing crossings to attract pedestrians. This will be addressed during the Redesign Project from Horne St. to Gardner St. through the use of bulb-outs and new pavement markings.</p> <p>Work with local business owners to promote safer practices by patrons.</p> <p><i>Intermediate</i> – Consider relocating midblock bus stops and campus access points to coincide with crossing locations.</p> <p>Consider restriping lanes to provide median area for pedestrians between Dixie Trail and Daisy St.</p> <p>Increase lighting between Dixie Trail and Daisy St.</p> <p>Consider installing a median island between Dixie Trail and Daisy St. Island could have fencing to channel pedestrians to the crossing at the intersection of Hillsborough St and Dixie Trail.</p>	 <p>Example of a student crossing midblock between Pogue St. and Horne St. after descending the stairs that provide access between Hillsborough Street and campus.</p>

<p>Crossing against the signal—the RSA team observed several pedestrians not waiting for the walk indication and crossing against the signal.</p>	<p><i>Short-term</i> – Consider aggressive educational campaigns to increase awareness of proper pedestrian behavior. The university provides an opportunity for targeted education for college students. Educational messages could be posted at bus stops, in buses, etc.</p> <p><i>Intermediate</i> – Consider reducing cycle lengths to minimize the wait time for pedestrians. This should be balanced so as not to increase delays substantially for vehicle traffic.</p>	 <p>The photo shows an example of a pedestrian crossing Hillsborough Street against the signal.</p>
<p>Failure to yield—the team observed drivers failing to yield the right-of-way to pedestrians when turning.</p>	<p><i>Short-term</i> – Consider enhancing conspicuity of pedestrian crossings through use of signs (see turning vehicle warning sign in photo, top right) and high-visibility pavement markings at signalized intersections.</p> <p><i>Intermediate</i> – Install bulb outs to enhance the conspicuity of crosswalks and reduce the crossing distance for pedestrians. This will be addressed during the Redesign Project from Horne St. to Gardner St.</p>	 <p>The photo shows an example of a sign to alert motorists to the presence of pedestrians and instructs them to yield to pedestrians when turning.</p>  <p>The photo shows an example of a left-turning driver encroaching on the crosswalk where pedestrians are crossing.</p>

2. Sight Restrictions at Intersections

Sight obstructions—sight restrictions are created by unmaintained vegetation, retaining walls, and intersection geometry (i.e., skew). For example:

- A pedestrian signal is hidden by a tree on the NW corner of Dixie Trail and Hillsborough St.
- There is limited visibility of a crosswalk at the north leg of the intersection of Hillsborough St and Faircloth St. (see photo, right).

Short-term – Maintain or remove vegetation to enhance visibility of sight triangles at intersections. Vegetation should be low-lying so as to not obstruct visibility of someone using a wheelchair. Relocate crosswalk on the north approach closer to the intersection and ensure the crosswalk is parallel to Hillsborough St.

Long-term – Identify opportunities to improve sight triangles at intersections during future construction projects.



Vegetation and a traffic control cabinet on the northwest corner of Gorman Street and Hillsborough Street create sight obstructions between vehicles turning right and pedestrians crossing in the crosswalk. This situation is confounded by the placement of the crosswalk away from the intersection where drivers may be less likely to expect pedestrians.

3. Lack of Access Management



Wide access points—there are access points, particularly along the western end of the study area, that are wide and uncontrolled, allowing vehicles to make high-speed turns from Hillsborough St.



Intermediate – Consider developing an access management plan to support decisions to close or reduce access points.



Consider making Wolf mart access a right-in near Dan Allen Dr. and right-out to the west. Parking along the storefronts would be converted to pull-in angle parking and a buffer placed on each side of the sidewalk to separate pedestrians from traffic.





Photo shows a wide access point at the Wolf Mart near the intersection of Hillsborough St. and Dan Allen Dr. Vehicles can cross the sidewalk almost unrestricted through this area.

		 <p>Photo shows the access point at the Wolf Mart at night. There are two vehicles entering at the same time and a pedestrian walking in the driveway.</p>
<p>Left-turning traffic—vehicles turning left between Dan Allen Dr. and Brooks St. conflict with other access points and pedestrians crossing the road.</p>	<p><i>Intermediate</i> – Consider installing a median from Dan Allen Dr. to Brooks St. as part of the Hillsborough Redesign Project. The median will restrict turning movements to right-in-right-out along Hillsborough St, which will reduce the number of potential conflict points. The median island will also provide a pedestrian refuge for pedestrians that choose to cross midblock.</p>	 <p>View from Dan Allen Dr. facing northbound. Photo shows the conflicting movements from the Wolf Mart as well as pedestrians crossing Hillsborough St.</p>

<p>Lack of delineation between pedestrian and vehicle facilities—delineation for pedestrians (e.g., Credit Union and Wachovia) is insufficient to separate pedestrian and vehicle facilities.</p>	<p><i>Intermediate</i> – Consider driveway enhancements to designate pedestrian paths and separate the intended uses as previously described.</p>	 <p>Photo illustrates the lack of delineation to designate and separate pedestrian facilities. A truck is parked on the sidewalk making a delivery to a local business.</p>
<p>4. Inconsistency at Crossings</p>		
<p>Unmarked and misaligned crosswalks— all unsignalized intersections are missing marked crosswalks across the side street. Several crosswalks are not aligned with curb ramps (or vice versa) at signalized intersections.</p>	<p><i>Short-term</i> – Consider installing crosswalks with continental style markings across all side streets.</p> <p>Consider providing high-visibility, continental style markings at signalized intersections.</p> <p><i>Intermediate</i> – Ensure curb ramps align with crosswalks and sidewalks.</p> <p>Ensure that crosswalks are properly aligned with sidewalks and curb ramps and follow direct paths.</p> <p>Missing and misaligned crosswalks will be addressed during the Redesign Project from Horne St. to Gardner St. However, the west crosswalk at Pogue St. will be removed (see Table 2 – Issue 1).</p>	 <p>The photo illustrates a misaligned crosswalk and curb ramp at Hillsborough Street and Brooks Avenue. Pedestrians using the curb ramp must enter the road behind the STOP bar before accessing the crosswalk, creating the potential for conflict with vehicles.</p>

<p>Crossings not ADA-compliant—several intersections, both signalized and unsignalized, have features that are not ADA-compliant, including:</p> <ul style="list-style-type: none"> - Missing curb ramps - Missing tactile warnings - No level landing area - Inconsistent placement of pedestrian signing 	<p><i>Short-term</i> – Conduct a formal ADA evaluation, checking for curb ramps, tactile warnings, slopes, and level landings. Address non-compliant designs through maintenance efforts or in coordination with future development projects.</p> <p>Provide consistent signing and push-buttons for pedestrian crossings (height, orientation, etc.).</p> <p>Missing curb ramps and tactile warnings will be addressed during the Redesign Project from Horne St. to Gardner St.</p>	 <p>This photo shows a crossing where a crosswalk is provided, but there is no curb ramp to provide access to those with mobility restrictions.</p>
<p>5. Issues with Traffic Control Devices</p>		
<p>Lack of guidance for pedestrians crossing side streets—pedestrian signals are provided at signalized intersections to cross Hillsborough St., but not for the side street crossings. Pedestrians crossing the side street would typically use the traffic signal as an indication, but the traffic signals are mounted on span wires, which make it difficult for pedestrians to see the signal indication.</p>	<p><i>Long-term</i> – Install pedestrian signals on side streets at signalized intersections.</p> <p>Install post-mounted LED traffic signals as part of Hillsborough Redesign Project.</p>	
<p>Inconsistent use of pedestrian signals—pedestrian signals are provided at signalized intersections for those crosswalks across Hillsborough St., but not all are countdown heads.</p>	<p><i>Intermediate</i> – Upgrade to countdown signals when pedestrian signals are replaced during future stages of the Hillsborough Redesign Project.</p>	

<p>Absence of stop bars on side streets—stop bars were not applied on several side streets at unsignalized intersections.</p>	<p><i>Short-term</i> – Install stop bars on side streets to reinforce the stop condition.</p>	 <p>Photo shows an example at the intersection of Hillsborough St and Stanhope Ave where there is no stop bar. Also, the STOP sign is placed too far from the intersection, creating sight distance issues.</p>
<p>Inaccessible push-buttons— Inaccessible and inconspicuous push-buttons were noted in the study area including push-buttons located on the back side of poles. Throughout the study area, push-buttons are inconsistent; some are activated by palm (current ADA approved) while others must be depressed by finger (not currently ADA compliant).</p>	<p><i>Intermediate</i> – Consider upgrading push-buttons with palm-activated buttons and relocating inaccessible push-buttons to more accessible and conspicuous locations. Also consider installing pushbuttons that confirm the press.</p>	 <p>Photos show examples of push-buttons where the placement makes them inaccessible to those with mobility restrictions.</p>

6. Inconsistent Pedestrian Zone and Obstructions on Sidewalk

Insufficient pedestrian zone—there are several locations along Hillsborough Street, particularly along the north side, where the pedestrian zone is insufficient due to inconsistent sidewalk width and obstructions, including:

- Hydrants
- Vegetation
- Traffic control cabinets
- Street furniture/restaurant seating

Short-term – Maintain vegetation and relocate street furniture where possible to provide a wider pedestrian zone.

Enforce zoning laws to ensure that restaurants are not encroaching on pedestrian zones.

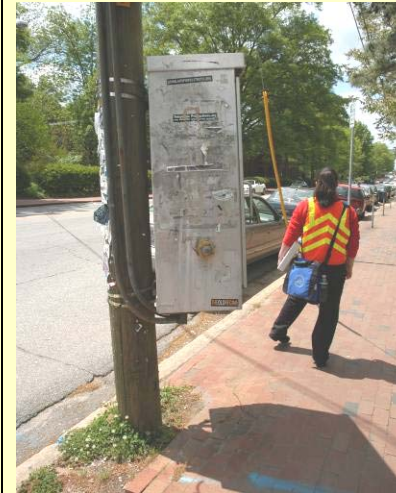
Intermediate– Relocate traffic control cabinets and remaining street furniture.

Consider widening sidewalk to provide an unobstructed minimum 5-ft pedestrian zone. Features such as hydrants, traffic control cabinets, utility poles, etc, should be placed outside of this zone in the furniture zone or buffer zone between the pedestrian zone and the curb.


Long-term – Relocate hydrants or curb ramps and crosswalks to provide unobstructed access between the sidewalk and crosswalk.






Photo shows where a hydrant is located in the middle of the curb ramp, obstructing access between the sidewalk and crosswalk.



This traffic control cabinet protrudes into the sidewalk which presents a hazard to pedestrians with vision impairments who use a cane for guidance.

<p>Lack of buffer—limited or no buffer along sections of existing sidewalk provides little separation between pedestrians and fast moving traffic.</p>	<p><i>Intermediate</i> – Consider increasing the buffer where existing right-of-way permits. It is desirable to maintain a minimum of 2-foot between the sidewalk and edge of roadway. For future pedestrian facility upgrades, consider streetscaping as described previously and coordinate improvements with future development.</p>	 <p>Photo shows a location near Dan Allen Dr. where the sidewalk width is limited by adjacent vegetation and there is no buffer provided between the edge of the sidewalk and the travel lane.</p>
<p>7. Bus Stop Locations and Markings</p>		
<p>Blocked crosswalk—far side bus stops are obstructing crosswalks at the following locations:</p> <ul style="list-style-type: none"> - Hillsborough St. and Horne St. - Hillsborough St. and Shepherd St. 	<p><i>Short-term</i> – While far side crosswalks may be desirable from an operations standpoint, they are obstructing crosswalks in certain locations. Driver training should be employed to ensure that drivers stop at a proper location so as to not obstruct crosswalks.</p> <p><i>Intermediate</i> – Monitor the obstruction of crosswalks by buses and if the problem persists, consider relocating the bus stop signs slightly further downstream.</p>	
<p>Blocked garage—westbound bus stop near Hillsborough St. and Gardner St. blocks the access to a parking garage.</p>	<p><i>Short-term</i> – Driver training should be employed to ensure that drivers stop at a proper location so as to not interfere with parking garage operation.</p>	



<p>Capacity issues at bus stops—bus stop locations create capacity issues for pedestrians where queuing passengers block the sidewalk for through pedestrians.</p>	<p><i>Intermediate</i> – Create a wider pedestrian zone or separate waiting area to reduce the queue blocking the sidewalk.</p>	
<p>8. Maintenance and Drainage Issues</p>		
<p>Insufficient drainage and maintenance—locations along the sidewalk and edge of the roadway present hazards for pedestrians and bicyclists. Hazards include:</p> <ul style="list-style-type: none"> - Uneven sidewalks - Debris on sidewalks - Ponding at crosswalk locations - Longitudinal ridge, created by resurfacing projects when the pavement is not extended all the way to the curb. This creates a longitudinal channel between the edge of pavement and curb. 	<p><i>Short-term</i> – Clear debris from sidewalks and inlets through regular maintenance practices.</p> <p><i>Intermediate</i> – Incorporate improvements during Hillsborough Redesign Project, including:</p> <ul style="list-style-type: none"> - Replace sidewalks. - Eliminate longitudinal ridges by extending pavement to the face of the curb during resurfacing projects. - Install drop inlets at low points and consider installing/relocating inlets to reduce run-off/ponding at curb ramps. 	 <p>Photo shows a crosswalk at Hillsborough St. and Gardner St. where insufficient drainage led to ponding.</p>
<p>9. Gaps in Bicycle Network</p>		
<p>Insufficient bicycle connections—the bike route along Clark St. has no designated access to Hillsborough St. The team observed several bicyclists riding on sidewalks throughout the corridor.</p> <p>There is also no direct crossing from Clark St. to the bicycle trail that continues from the intersection of Hillsborough St. and Faircloth St. toward Meredith College.</p>	<p><i>Short-term</i> – Identify and designate appropriate bicycle connector(s) from Clark St. to Hillsborough St. to encourage biking on Clark St.</p> <p>Install bike route signs along designated bicycle routes.</p> <p>Consider tools to promote proper use of bicycle facilities, including way-finding and education.</p> <p>At the intersection of Hillsborough St and Faircloth St:</p> <ul style="list-style-type: none"> - Shift the crosswalk on the north approach closer to the intersection as discussed previously. The crosswalk should be wide enough to accommodate 	 <p>Example of trail crossing sign to alert drivers to the presence of pedestrians and bicyclists.</p>

	<p>pedestrians and bicyclists.</p> <ul style="list-style-type: none"> - Install trail crossing warning signs (see photo, top right) for northbound and southbound drivers at the crosswalk on the north approach. For the southbound approach, an additional sign should be installed at the north end of the median island for those bicyclists traveling from Clark St toward to the trail. - Consider restriping the right-turn lane along Faircloth St (at Clark St) as a bicycle lane to provide access from the crosswalk to the designated bike route on Clark St. This will likely help to keep bicyclists from riding on the sidewalk along Faircloth St. This option should only be considered if right-turn volumes do not warrant the right-turn lane. <p><i>Intermediate</i> – Consider widening the median and providing a cut-through for bicyclists. The median should be wide enough to provide refuge for a bicyclist. If this option is implemented, the trail crossing signs should be moved to the location of the median cut-through. This option would provide a direct path across Faircloth St. from Clark St. to the trail. If this option is pursued, consider adding an extension to the trail from the existing trail to Faircloth St., aligning with the median cut-through to Clark St.</p>	 <p>View from existing trail traveling from Meredith College to Clark St. A raised median prevents direct crossing from the trail to Clark St.</p>
10. Inconsistent Lighting		
<p>Gaps in lighting—there are a few locations where unlit bulbs and uneven spacing of street lights create noticeable gaps in lighting.</p>	<p><i>Short-term</i> – Maintain existing lighting by replacing unlit bulbs.</p> <p><i>Intermediate</i> – Consider installing lighting to</p>	

	<p>eliminate gaps. Install consistent level of lighting along the corridor through Hillsborough Redesign Project.</p>	
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Table 2 identifies safety issues that are not addressed by the Hillsborough Street Redesign Project from Horne Street to Gardner Street. Many of the suggestions are relatively low-cost and could be incorporated with the Redesign Project. It should be noted that many of the safety issues identified in Table 1 will be addressed, at least in part, from Horne St. to Gardner St. during the Redesign Project. Planned improvements will address issues related to ADA-compliance, inconsistency at crossings, inconsistent pedestrian zone, and inconsistent lighting.

TABLE 2. Summary of Safety Issues and Suggestions to Incorporate with Hillsborough Redesign Project

SAFETY ISSUE	SUGGESTED IMPROVEMENTS	EXAMPLES OF ISSUES
1. Potentially Harmful Behaviors		
<p>Midblock crossings—There is currently a crosswalk located on the west side of the intersection at Pogue St., but this crosswalk will be removed during the Hillsborough Redesign Project. It is likely that pedestrians will continue to cross at this location based on existing crossing patterns and pedestrian desire lines.</p>	<p>Consider installing a pedestrian crossing on the west side of the intersection at Pogue St. as part of the Hillsborough Redesign Project. Consider the option of providing a midblock crossing along Hillsborough St. between Brooks St. and Gardner St. There is an access point to campus at this location and the distance between Brooks St and Gardner St is relatively long (625 ft) compared to the distance between other intersections in the study area. At 4 ft/sec, a pedestrian would have to walk 2.5 minutes out of their way to cross at an intersection rather than crossing midblock. Another option is to relocate the access point to NCSU campus as discussed previously.</p>	 <p>Aerial shows the relatively long distance between Brooks St and Gardner St compared to the adjacent intersections.</p>
2. Lack of Access Management		
<p>Lack of delineation between pedestrian and vehicle facilities—delineation for pedestrians (e.g., Parking Garage Entrance and Wachovia) is insufficient to separate pedestrian and vehicle facilities. There are no markings to distinguish the pedestrian zone from the driveway out of the garage and other facilities.</p>	<p>Consider driveway enhancements to designate the sidewalk as a pedestrian area. A stop bar could be placed inside the garage and the brick sidewalk continued across the driveway. Consider installing a mirror to provide better visibility for drivers exiting the garage.</p>	 <p>Photo shows a vehicle exiting the parking garage and</p>

		crossing the sidewalk. Currently, the driveway crosses the sidewalk as an extension of the garage, rather than the sidewalk crossing the driveway with designated markings for pedestrians.
3. Issues with Traffic Control Devices		
Inconsistent use of pedestrian signals—pedestrian signals are provided at signalized intersections for all crosswalks, but the conceptual design does not show countdown heads.	The host agency indicated that countdown signals will be installed when pedestrian signals are replaced during the Redesign Project. Ensure that countdown signals are installed.	
Missing stop bars—stop bars are not indicated for the side streets at Horne St. and Gardner St.	Ensure stop bars are used to separate conflict points between motorists and pedestrians.	

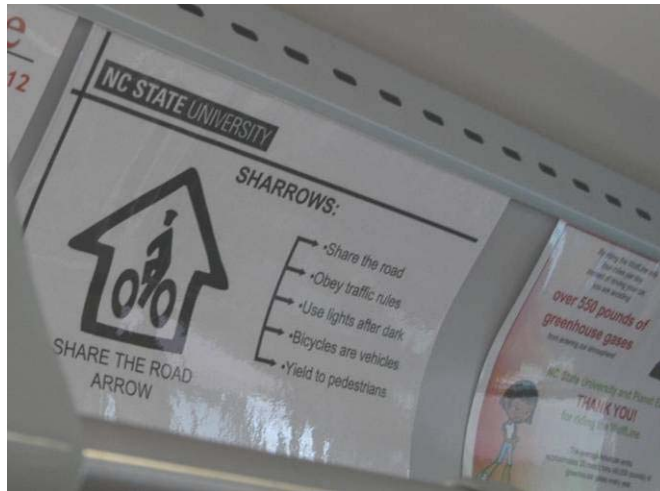
Opportunities Beyond Engineering

Public safety can be improved through education and enforcement measures as well as engineering. There are at least two opportunities to improve safety through these measures.

1. Public Outreach

Transit Operation and Ridership: There are several bus stops along this corridor, which is one of the major pedestrian generators. The RSA team observed several potential safety issues related to bus stop locations, operation, and rider behavior. There is an opportunity to provide education through the local transit agency to help mitigate some of these issues as described in the report. The photo on the left illustrates a current educational message that is placed among the advertisements on the bus. There are similar opportunities to provide education related to rider behavior and pedestrian behavior in general. The photo on the right illustrates unsafe crossing behaviors where the pedestrians are darting out from in front of the bus and crossing outside of the crosswalk. Vehicles traveling in adjacent lanes may not see pedestrians darting from in front of the bus and may not expect pedestrians to be crossing prior to the crosswalk. However, this behavior may be influenced by the stopping location of the bus; if the bus stopped at the location of the bus stop sign (at the STOP bar), the pedestrians would be more likely to use the crosswalk.

There is also an opportunity to educate the bus drivers. The RSA team observed several buses blocking crosswalks along Hillsborough St when stopping at far side bus stops. The drivers should pull forward so as not to block the crosswalks.



2. Enforcement

Raleigh Police Department: The Raleigh Police Department was not represented on the RSA team, but one member of the team was a retired law enforcement officer. Enforcement was not identified as a primary measure for any of the safety issues; however, there may be an opportunity to provide spot enforcement west of Dixie Trail to mitigate midblock crossings at night.

Consider education and enforcement opportunities at local businesses as well. Educate the business owners about their responsibility to maintain a safe environment for their customers. Several pedestrians were observed crossing midblock during dark conditions at the location west of Dixie Trail; the pedestrians were running from a bar to a convenience store and back to the bar. The owner of the establishment should be informed of the liability issues if a pedestrian is under the influence, leaves the bar, and is subsequently involved in an accident. Several locations were also noted where businesses were using a portion of the sidewalk for outdoor seating. While the businesses are allowed to use a portion of the sidewalk for outdoor seating, the zoning should be enforced to minimize intrusion into the pedestrian zone. Enforce violations with fines to encourage compliance with regulations.

For more information, look at the education and enforcement measures included in the following publications:

How to Develop a Pedestrian Safety Action Plan (FHWA-SA-05-12)

<http://drusilla.hsrb.unc.edu/cms/downloads/howtoguide2006.pdf>

A Resident's Guide for Creating Safe and Walkable Communities (FHWA-SA-07-016)

http://safety.fhwa.dot.gov/PED_BIKE/ped/ped_walkguide/residentsguide.pdf

4. Conclusions

The objective of this study was to complete a pedestrian RSA for Hillsborough Street between Horne Street and Gorman Street in Raleigh, North Carolina. The RSA team investigated existing issues within the study corridor, but also examined improvements planned as part of the Hillsborough Redesign Project. The team noted several positive safety features throughout the study area, and 10 safety issues were identified for existing conditions in this in-service RSA. The review of planned improvements for the Hillsborough Redesign Project identified 3 safety issues, similar to those identified for existing conditions, but not addressed on the improvement plans. Based on a review of crash data and field observations, 'Potentially Harmful Behaviors' was determined to be the most critical issue in the study area. The remaining safety issues are ranked below 'Potentially Harmful Behaviors' from most to least critical, although many were considered nearly equal in importance. Suggestions for mitigating issues have been identified and are described in this report. Beyond engineering measures, road safety can be improved through education and enforcement. These measures are also discussed in the report.

The owners are invited to consider the suggested changes. To complete the RSA process, the owners may prepare a short written response to the issues and options outlined in this report.

Appendix A: Locations of Crashes Involving Pedestrians and Bicyclists within the Corridor

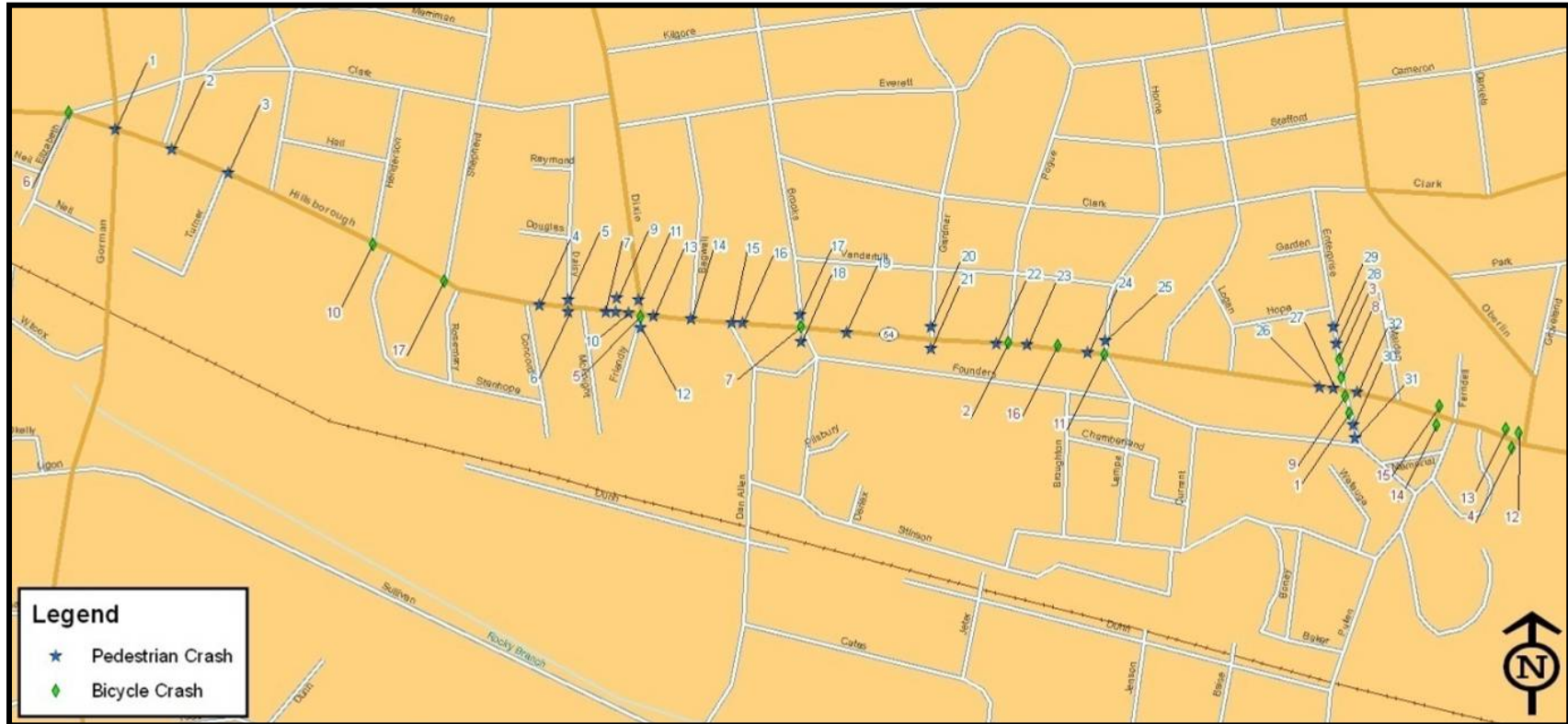


Table A.1. Reported Pedestrian Crashes in the Study Area (2004-2008)

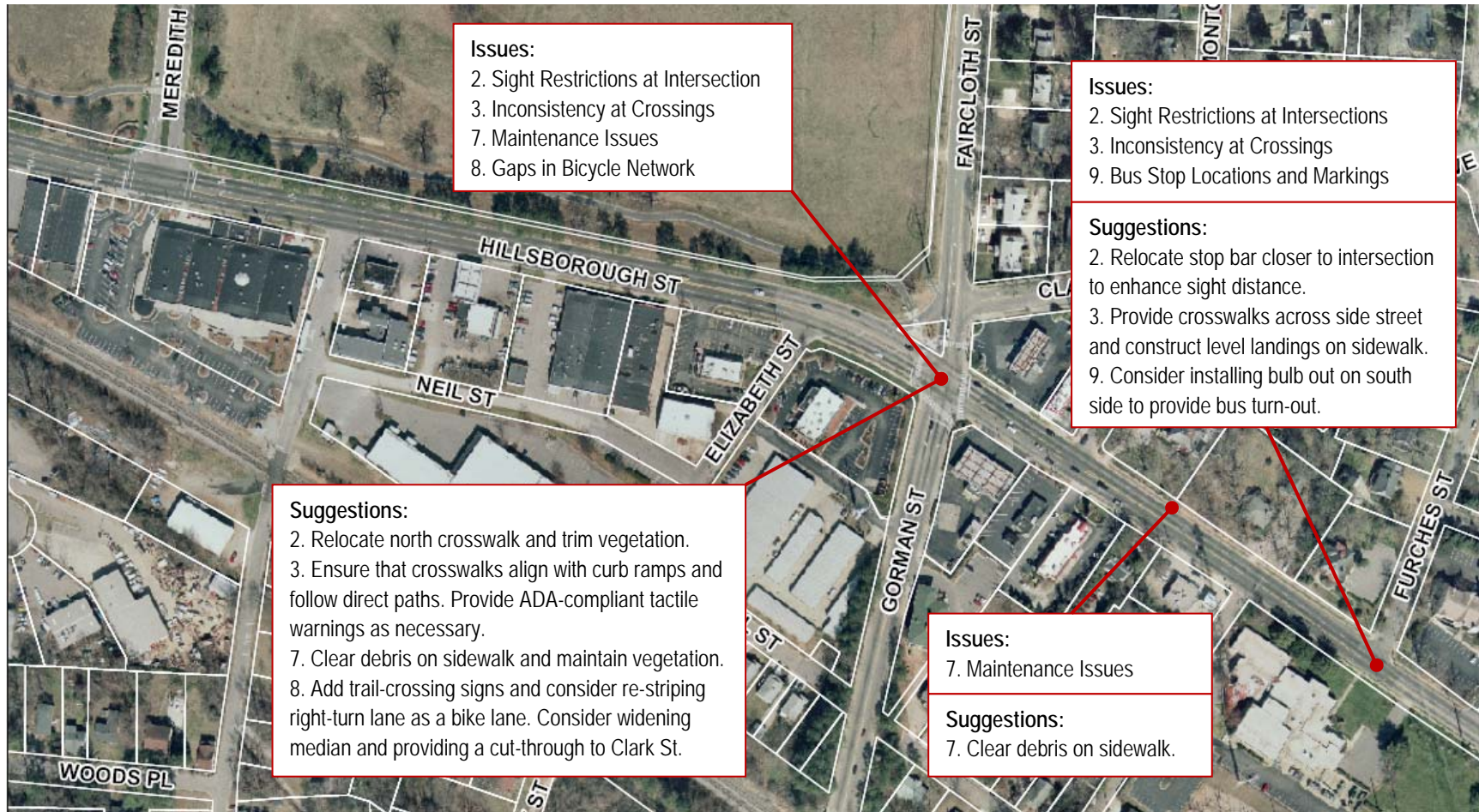
Pedestrian Crash #	Date	Time	Severity	Roadway	Light	Vehicle Action
1	4/21/2004	6:23 AM	PDO	Dry	Daylight	Right turn
2	9/13/2005	10:01 AM	B-inj	Dry	Daylight	Left turn
3	8/7/2006	5:14 PM	C-inj	Wet	Daylight	Straight
4	11/1/2008	2:00 AM	C-inj	Dry	Dark - Lit	Straight
5	9/4/2004	11:55 PM	C-inj	Dry	Dark - Lit	Straight
6	4/12/2006	2:31 AM	B-inj	Dry	Dark - Lit	Straight
7	10/25/2005	8:15 PM	B-inj	Dry	Dark - Lit	Straight
8	5/17/2008	11:37 PM	PDO	Dry	Dark - Lit	Left turn
9	3/6/2005	1:34 AM	B-inj	Dry	Dark - Lit	Straight
10	5/10/2008	7:01 PM	C-inj	Dry	Daylight	Straight
11	8/31/2004	8:53 AM	C-inj	Dry	Daylight	Left turn
12	11/8/2007	7:48 AM	C-inj	Wet	Daylight	Left turn
13	7/30/2006	8:47 PM	PDO	Dry	Dark - Lit	Stopping
14	2/14/2005	3:59 PM	C-inj	Wet	Daylight	Right turn
15	10/31/2004	4:19 PM	A-inj	Dry	Daylight	Left turn
16	3/29/2007	1:00 PM	C-inj	Dry	Daylight	Unknown
17	6/4/2004	9:43 AM	PDO	Dry	Daylight	Right turn
18	7/6/2004	1:18 PM	C-inj	Dry	Daylight	Right turn
19	11/12/2007	12:47 PM	B-inj	Dry	Daylight	Left turn
20	1/31/2005	9:53 AM	B-inj	Dry	Daylight	Straight
21	12/8/2006	12:21 PM	B-inj	Dry	Daylight	Straight
22	9/15/2006	1:32 AM	B-inj	Dry	Dark - Lit	Straight
23	2/1/2008	11:46 PM	C-inj	Dry	Dark - Lit	Straight
24	11/22/2004	6:04 PM	C-inj	Dry	Dark - Lit	Straight
25	11/3/2007	9:59 PM	Fatal	Dry	Dark - Lit	Straight
26	10/5/2007	3:12 PM	C-inj	Wet	Daylight	Straight
27	11/15/2007	12:30 PM	B-inj	Dry	Daylight	Left turn
28	2/2/2008	6:32 PM	C-inj	Dry	Dark - Lit	Left turn
29	10/24/2005	1:25 PM	C-inj	Dry	Daylight	Right turn
30	11/9/2006	10:18 PM	B-inj	Dry	Dark - Lit	Left turn
31	5/7/2007	5:19 PM	PDO	Dry	Daylight	Stopping
32	9/17/2004	9:36 PM	B-inj	Wet	Dark - Lit	Straight

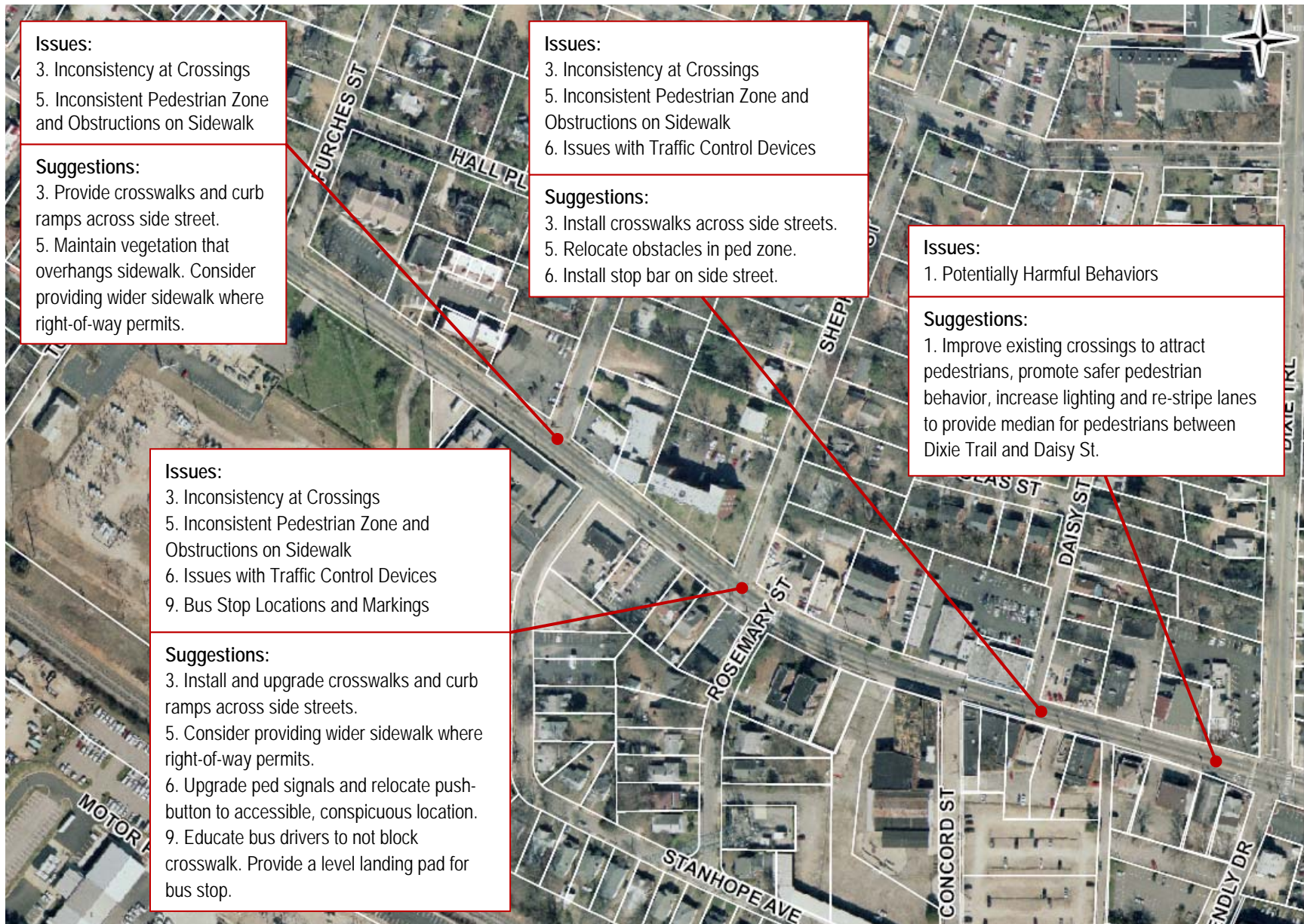
Table A.2. Bicycle Crashes within Study Area (2000-2006)

Bike Crash #	Location	Date	Severity
1	ENTERPRISE ST	8/22/2000	B-inj
2	POGUE ST	2/18/2001	B-inj
3	ENTERPRISE ST	4/19/2001	Fatal
4	OBERLIN RD	9/17/2001	C-inj
5	DIXIE TR	9/16/2003	B-inj
6	ELIZABETH ST	6/8/2005	B-inj
7	BROOKS AVE	9/1/2005	C-inj
8	ENTERPRISE ST	5/16/2006	C-inj
9	ENTERPRISE ST	11/16/2006	C-inj
10	HENDERSON ST	12/13/2006	B-inj
11	LAMPE DR	4/17/2006	B-inj
12	OBERLIN RD	1/19/2001	C-inj
13	OBERLIN RD	10/22/2005	C-inj
14	PULLEN DR	12/21/2003	C-inj
15	PULLEN RD	10/12/2005	B-inj
16	BROUGHTON DR	Unknown	C-inj
17	SHEPHERD ST.	Unknown	PDO

Appendix B: Issues and Suggestions for Existing Locations

The following aerials provide an overview of the study area as well as the safety issues and suggestions identified by the RSA team. The issues and suggestions are numbered in reference to the issues identified in Table 1. For example, the following aerial shows the intersection of Hillsborough St. and Gorman St. with four issues, numbered 2, 3, 7, and 8. These issues correspond to the respective issues (2, 3, 7, and 8) in Table 1 and the suggestions are labeled to correspond with the appropriate issue.





Issues:

- 3. Inconsistency at Crossings
- 5. Inconsistent Pedestrian Zone and Obstructions on Sidewalk

Suggestions:

- 3. Provide crosswalks and curb ramps across side street.
- 5. Maintain vegetation that overhangs sidewalk. Consider providing wider sidewalk where right-of-way permits.

Issues:

- 3. Inconsistency at Crossings
- 5. Inconsistent Pedestrian Zone and Obstructions on Sidewalk
- 6. Issues with Traffic Control Devices

Suggestions:

- 3. Install crosswalks across side streets.
- 5. Relocate obstacles in ped zone.
- 6. Install stop bar on side street.

Issues:

- 1. Potentially Harmful Behaviors

Suggestions:

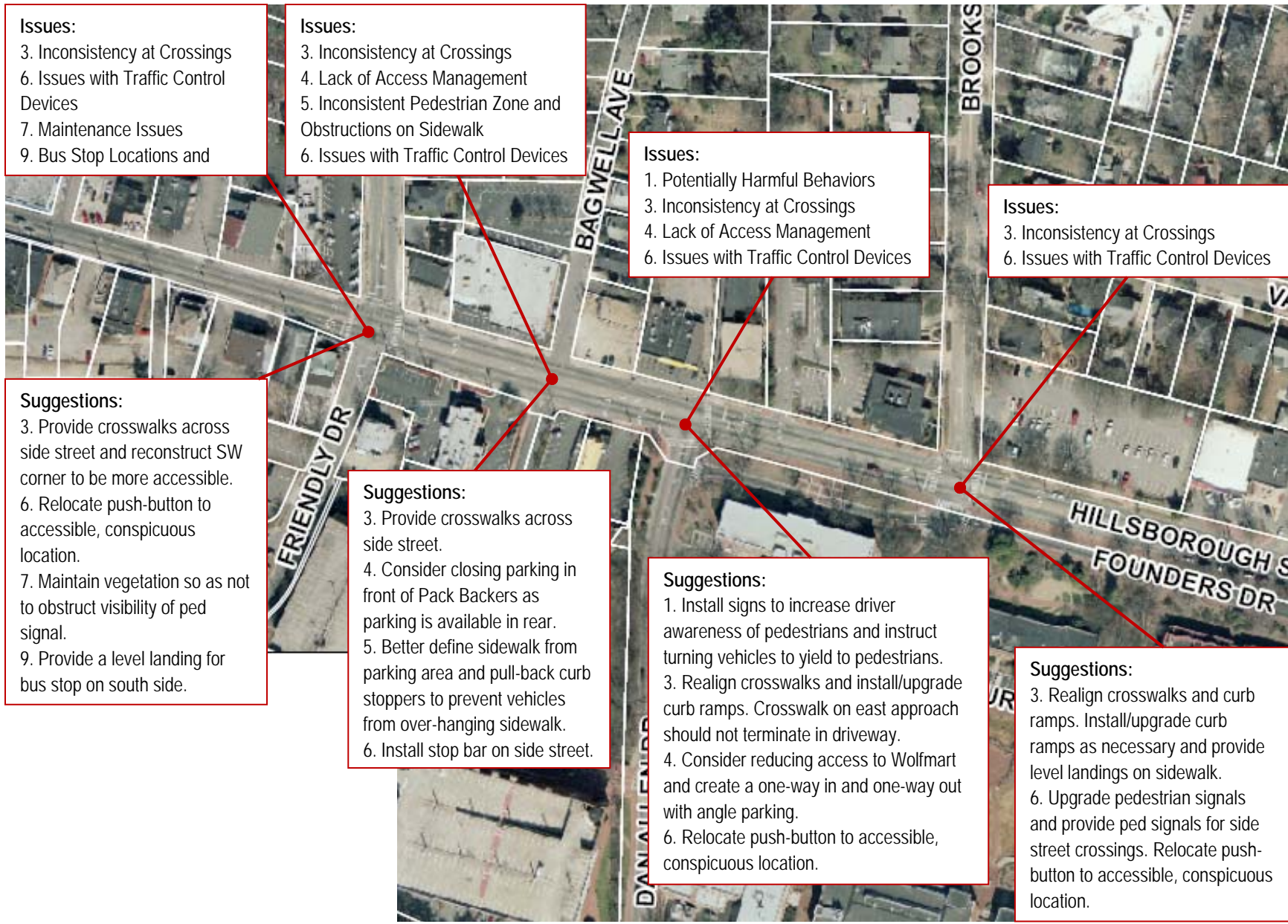
- 1. Improve existing crossings to attract pedestrians, promote safer pedestrian behavior, increase lighting and re-stripe lanes to provide median for pedestrians between Dixie Trail and Daisy St.

Issues:

- 3. Inconsistency at Crossings
- 5. Inconsistent Pedestrian Zone and Obstructions on Sidewalk
- 6. Issues with Traffic Control Devices
- 9. Bus Stop Locations and Markings

Suggestions:

- 3. Install and upgrade crosswalks and curb ramps across side streets.
- 5. Consider providing wider sidewalk where right-of-way permits.
- 6. Upgrade ped signals and relocate push-button to accessible, conspicuous location.
- 9. Educate bus drivers to not block crosswalk. Provide a level landing pad for bus stop.



Issues:

- 3. Inconsistency at Crossings
- 6. Issues with Traffic Control Devices
- 7. Maintenance Issues
- 9. Bus Stop Locations and

Issues:

- 3. Inconsistency at Crossings
- 4. Lack of Access Management
- 5. Inconsistent Pedestrian Zone and Obstructions on Sidewalk
- 6. Issues with Traffic Control Devices

Issues:

- 1. Potentially Harmful Behaviors
- 3. Inconsistency at Crossings
- 4. Lack of Access Management
- 6. Issues with Traffic Control Devices

Issues:

- 3. Inconsistency at Crossings
- 6. Issues with Traffic Control Devices

Suggestions:

- 3. Provide crosswalks across side street and reconstruct SW corner to be more accessible.
- 6. Relocate push-button to accessible, conspicuous location.
- 7. Maintain vegetation so as not to obstruct visibility of ped signal.
- 9. Provide a level landing for bus stop on south side.

Suggestions:

- 3. Provide crosswalks across side street.
- 4. Consider closing parking in front of Pack Backers as parking is available in rear.
- 5. Better define sidewalk from parking area and pull-back curb stoppers to prevent vehicles from over-hanging sidewalk.
- 6. Install stop bar on side street.

Suggestions:

- 1. Install signs to increase driver awareness of pedestrians and instruct turning vehicles to yield to pedestrians.
- 3. Realign crosswalks and install/upgrade curb ramps. Crosswalk on east approach should not terminate in driveway.
- 4. Consider reducing access to Walmart and create a one-way in and one-way out with angle parking.
- 6. Relocate push-button to accessible, conspicuous location.

Suggestions:

- 3. Realign crosswalks and curb ramps. Install/upgrade curb ramps as necessary and provide level landings on sidewalk.
- 6. Upgrade pedestrian signals and provide ped signals for side street crossings. Relocate push-button to accessible, conspicuous location.



Issues:

- 3. Inconsistency at Crossings
- 5. Inconsistent Pedestrian Zone and Obstructions on Sidewalk
- 6. Issues with Traffic Control Devices
- 9. Bus Stop Locations and Markings

Issues:

- 7. Maintenance Issues
- 9. Bus Stop Locations and Markings

Issues:

- 3. Inconsistency at Crossings
- 6. Issues with Traffic Control Devices
- 7. Maintenance and Drainage Issues

Suggestions:

- 3. Ensure crosswalks, curb ramps, and level landings are provided for all crossings.
- 6. Provide ped signals for side street crossings. Relocate push-button to accessible, conspicuous location.
- 7. Repair pavement within crosswalks to provide traversable surface. Install ADA-compliant drop inlets to minimize ponding issues at crossings.

Issues:

- 3. Inconsistency at Crossings
- 5. Inconsistent Pedestrian Zone and Obstructions on Sidewalk
- 6. Issues with Traffic Control Devices
- 9. Bus Stop Locations and Markings

Suggestions:

- 7. Clear debris on sidewalk and eliminate longitudinal edge drop between travel lane and curb.
- 9. Provide a level landing for bus stop on north side near Brooks.

Suggestions:

- 3. Ensure crosswalks, curb ramps, and level landings are provided for all crossings.
- 5. Relocate hydrant that obstructs crosswalk.
- 6. Provide ped signals for side street crossings. Relocate push-button to accessible, conspicuous location. Ensure pedestrian signs are pointing in correct direction.
- 9. Educate bus drivers so as not to block parking garage. Increase the capacity of the waiting area.

Suggestions:

- 3. Ensure crosswalks, curb ramps, tactile warnings, and level landings are provided for all crossings.
- 5. Traffic control cabinet obstructs sidewalk—relocate or provide extension to the sidewalk to provide warning for visually impaired. Enforce zoning laws to minimize encroachment of restaurants into the pedestrian zone.
- 6. Provide ped signals for side street crossings.
- 9. Educate bus drivers so as not to block crosswalk and ensure the loading area is free of obstructions.

Appendix C: Issues and Suggestions for Planned Improvements

The following concept drawing illustrates the planned improvements for the Hillsborough Redesign Project at the intersection of Hillsborough St. and Pogue St. While the first phase of the Hillsborough Redesign Project overlapped with the RSA study area from Horne St. to Gardner St., only one section is shown because the planned improvements are similar at the other intersections. The identified safety issues are illustrated on this section along with suggestions for potential improvements. The issues and suggestions are numbered in reference to the issues identified in Table 2.

