LEGISLATIVE # 100270C

REGIONAL TRANSIT SYSTEM

SIGNALIZED MIDBLOCK CROSSWALK ANALYSIS

NOVEMBER 2009

RTS MISSION:
TO ENHANCE THE QUALITY OF LIFE IN OUR COMMUNITY BY PROVIDING EQUITABLE, SAFE, COURTEOUS, AND RELIABLE TRANSPORTATION SERVICES.



100 SE 10TH AVENUE
GAINESVILLE, FL 32602

INTRODUCTION

The desire to improve pedestrian safety extends to areas typically seen as being non-pedestrian-friendly, such as wide roadways with high traffic speeds. Pedestrians' ability to safely cross many roadways is affected as traffic volumes and congestion increase. Although numerous treatments exist at unsignalized crossings, there is growing concern about their effectiveness. On multilane arterials with six or more lanes, merging is occurring, lane changing increases, and there is a greater tendency for motorists to speed and slow. This creates highly complex conditions that must be interpreted by the pedestrian. At midblock locations, where vehicle speeds are high, signalization may be the only practical means of helping pedestrians to cross unless as part of a signal coordination scheme.

Figure 1: Flashing Signalized Crosswalk on Williston Road in Gainesville, FL

The following table summarizes possible crossing treatments:

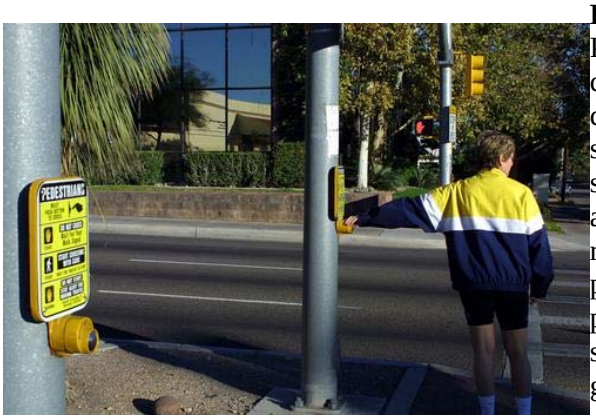
Table 1: Synopsis of Crossing Treatments

Treatment	Characteristics
Advance Signing	Provides additional notification to drivers that a crosswalk is near
Advance Stop Line and Sign	Vehicle stop line if moved back from the crosswalk
Median Refuge Island	Accessible pedestrian path within a raised median
Raised Crosswalk	Crosswalk surface elevated above driving lanes
Curb Extension	Curb adjacent to crosswalk lengthened by the width of the parking lane
Roadway Narrowing	Reduced land widths and/or number of vehicle lanes
Markings and Crossing Signs	Standard crosswalk markings and pedestrian crossing signs
In-Street Pedestrian Crossing Signs	Regulatory signs placed in the street
High-Visibility Signs and Markings	Warning devices placed at or in advance of the pedestrian crossing
In-Roadway Warning Lights	Amber flashing lights mounted flush to the pavement surface at the crossing location
Pedestrian Crossing Flags	Square flags on a stick carried by pedestrians; flags stored in sign-mounted holders on both sides of the street
Overhead Flashing Amber Beacons	Mounted on mast arms that extend over the roadway or on signposts at the roadside; pedestrian activated
Pedestrian Crosswalk Signal	Standard traffic signal at a pedestrian crosswalk; pedestrian activated
Half Signal	Standard traffic signal on major road
HAWK Beacon Signal	Combination of a beacon flasher and a traffic control signal; dwells in a dark mode; pedestrian activated
Pedestrian Beacon	Pedestrian activated
Traffic Signal	Standard traffic signal at an intersection or midblock location; pedestrian phase typically activated by a pushbutton

TYPES OF CROSSWALK SIGNALS

Traffic Signal and Red Beacon Displays

Midblock pedestrian movements across the major street are controlled by traditional pedestrian walk/don't walk signals and provide red signal indication to motorists. The steady red signal indication provides a clear regulatory message that typically receives a more uniform control response than warning signs or flashing beacons.



Half Signals

Pedestrian-actuated half signals allow pedestrians to cross each section of the street separately. Two-stage crossings involve pedestrians who cross one side of the street, take refuge in a median, and then cross the other side of the street. A pedestrian activates the first signal and proceeds to the median once the traffic light turns red and the walk signal is displayed. At the median, the pedestrian activates the second signal and once again proceeds once the traffic light turns red and the walk signal is displayed. The half signal system remains green unless activated.

Figure 2: Pedestrian at Half Signal in Tucson, AZ

Half signals of varying types are used in cities such as Seattle, Portland, and Vancouver, Los Angeles, and Tucson. Some half signals are located at intersections, while others are located midblock. Half signals have been documented as successful in encouraging approximately 90 to 100% of motorists to yield to pedestrians along high-volume and/or high-speed streets. RTS particularly supports use of the two-stage angled crossing, as shown in Figure 3.

Figure 4: Half Signal

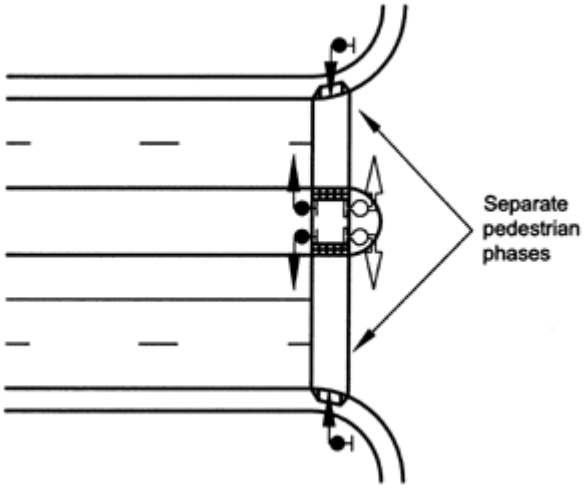
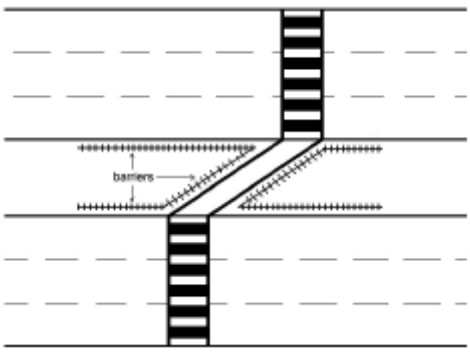
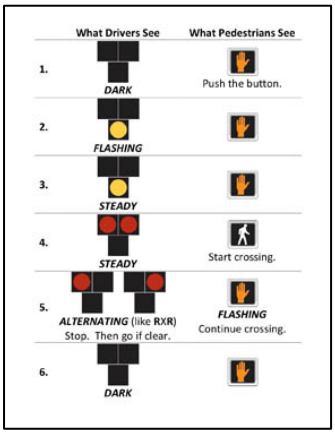


Figure 3:
Two-Stage Signalized Pedestrian Crossing



Two-Stage Angled Pedestrian Crossing



HAWK Pedestrian Flasher

The High-Intensity Activated Cross Walk (HAWK) is based on a European design and resembles the American school bus "children present" warning. The HAWK consists of a Red-Yellow-Red signal format for motorists. The signals remain off until a pedestrian activates the system by pressing a button. Red signal or beacon treatments consistently perform well, with compliance rates above 94 percent. Driver education has been an active component in those communities using a HAWK signal. Confusion may result from the dark beacon signal display, as drivers may interpret it as a power outage; however, that has not been a problem where implemented.

Figure 5: HAWK Signal Operation

Summary

Critics of the concept have suggested that vehicle crashes will increase because of signalization on the major street or conflicting control messages from the signal and Stop sign. However, crash analyses in the city of Seattle have documented that, with consistent operation, the half signals can actually reduce vehicle-vehicle crashes and pedestrian vehicle conflicts. Furthermore, critics may argue that a signalized crosswalk may provide a false sense of security for pedestrians. In the case of HAWK signals, however, a study revealed that all pedestrians stopped to observe the presence of oncoming traffic (Transportation Research Board, 2006).

In summary, devices with a red signal indication show promise as a pedestrian-crossing treatment for high-volume, high-speed arterial streets. The field studies conducted in this project indicated that these red signal or beacon devices were most effective at prompting motorist yielding (all sites had motorist compliance greater than 90 percent) on high-volume, high-speed streets. It may be necessary to determine the most effective signal indication display sequence, as well as the traffic conditions that would accommodate the use of minor street Stop sign control and major street signal control.

Figure 6: HAWK Signal

Flashing Beacons

The use of flashing beacons for pedestrian crossings is prevalent in the United States. In some instances, there are concerns that the overuse of flashing beacons or the continuous flashing at specific locations has diluted their effectiveness in warning motorists of conditions.

Flashing beacons have been installed in numerous ways:

- At the pedestrian crossing, both overhead and side mounted;
- In advance of the pedestrian crossing, both overhead and side mounted;
- In conjunction with or integral within other warning signs; and
- In the roadway pavement itself (see next section on in-roadway warning lights).

The operations for flashing amber beacons may also vary, including the following:

- Continuous flash mode;
- Pedestrian activated using manual pushbuttons;
- Passive pedestrian detection using automated sensors (e.g., microwave or video); and
- Different flash rates, sequences, or strobe effects.

The experience with flashing beacons has been mixed, as would be expected when they have been installed in numerous different ways. Several studies have shown that intermittent (typically activated using a manual pushbutton or automated sensor) flashing beacons provide a more effective response from motorists than continuously flashing beacons (*36, 37*).

These beacons do not flash constantly; thus, when they are flashing, motorists can be reasonably sure that a pedestrian is crossing the street. With pedestrian activation, special signing may be necessary to ensure that pedestrians consistently use the push-button activation. Alternatively, automated pedestrian detection has been used with some success, but typically requires extra effort in installation and maintenance.

Figure 7: Flashing Beacon

Summary

Overhead flashing beacons appear to have the best visibility to motorists, particularly when used both at and in advance of the pedestrian crossing. Many installations have used both overhead and side-mounted beacons. The effectiveness of the flashing beacons in general, however, may be limited on high-speed or high-volume arterial streets. For example, overhead flashing beacons have produced driver yielding behavior that ranges from 30 to 76 percent, with the median values falling in the mid-50 percent range.

ADDITIONAL GUIDANCE FOR MIDBLOCK CROSSWALKS

Caution must be provided for signalized midblock locations. Pedestrians feel frustrated if a signal is holding them back from crossing when there is an ample gap. Many will choose to cross away from the crossing, while others will dutifully push the activator button, not get an immediate response, and cross when there is a sufficient gap. A few seconds later, the approaching motorists must stop at a red signal for no reason, which can encourage motorist disrespect for the signal in the future.

Thus, the best signal setup for a midblock crossing is a hot (nearly immediate) response. As soon as the pedestrian call actuator button is pushed, the clearance interval should be activated. This minimal wait time is a strong inducement for pedestrians to walk out of their way to use the crossing. Hot responses can often be used if the nearby signals are not on progression, or else a hot response may be permitted in off-peak hours. If a midblock signal system is used, it is important to place pedestrian pushbuttons in the median.

Figure 8: Half Signal

MUTCD GUIDANCE

The FHWA Manual of Uniform Traffic Control Devices (MUTCD) specifies that pedestrian signals can be applied in situations where traffic a major street is so heavy that pedestrians experience excessive delay in crossing the major street. According to Section 4C.05 Warrant 4, the need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that both of the following criteria are met:

- The pedestrian volume crossing the major street at an intersection or midblock location during an average day is 100 or more for each of any 4 hours or 190 or more during any 1 hour; and
- There are fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic.

The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic. If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads conforming to requirements set forth in Chapter 4E.

SUMMMARY TABLES

The type of signalized crosswalk reveals differences in levels of compliance among drivers. Red signals and beacons (midblock, half, and HAWK signals) achieved the highest level of motorist compliance—95% to 99%. Other types of signals were less successful. Figure 6 demonstrates an overview of motorist compliance rates among the different types of signals.

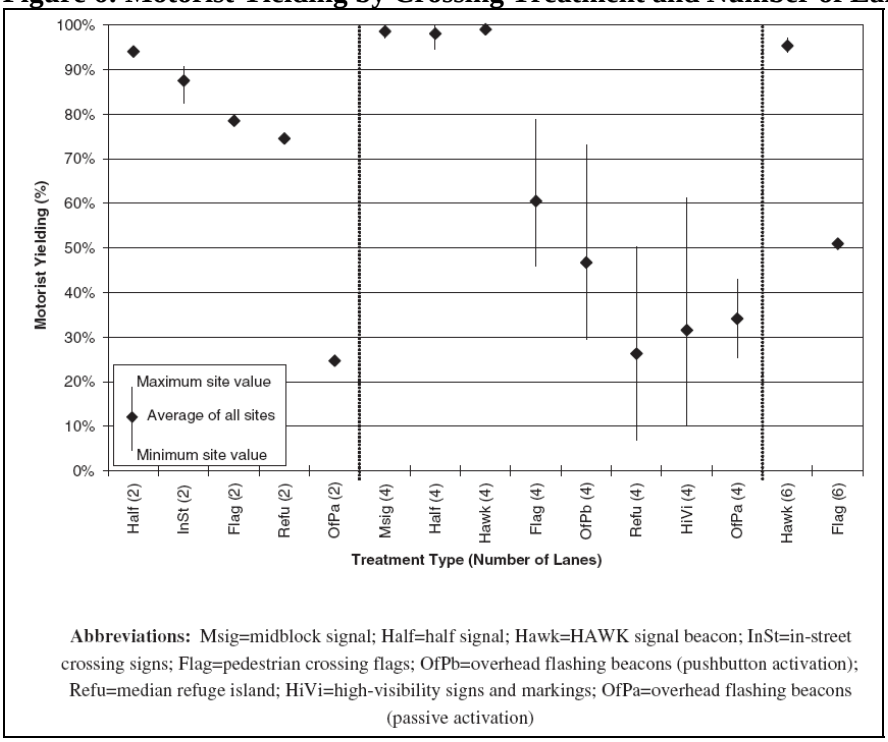
Table 2: Summary of Motorist Yielding Compliance

Motorist Yielding Compliance by Crossing Treatment	
Crossing Treatment	**Average Compliance**
Midblock Signal	95%
Half Signal	98%
HAWK Signal	99%
In-Roadway Warning Lights	66%
Overhead Flashing Beacon (Push-button Activation)	49%
Overhead Flashing Beacon (Passive Activation)	67%
Pedestrian Crossing Flags	74%

Source: Transportation Research Board, 2006

The number of travel lanes also plays a role in motorist compliance. A compliance rate above 94 percent exists for red signal or beacon devices, regardless of the number of lanes on the facility. The half signal treatment had statistically the same compliance rate for both two and four lanes. The same result was true for the HAWK treatment on four- and six-lane roads. For four-lane highways, the red devices have a much higher compliance rate than the other non-red devices. Figure 7 demonstrates compliance rates by number of travel lanes.

Figure 6: Motorist Yielding by Crossing Treatment and Number of Lanes



Source: Transportation Research Board, 2006

CONCLUSION

Treatments that show a red signal indication to the motorist have a statistically significant different compliance rate from devices that do not show a red indication.

- These red signal or beacon devices had compliance rates greater than 95 percent and include midblock signals, half signals, and HAWK signal beacons. Nearly all the red signal or beacon treatments evaluated were used on busy, high-speed arterial streets.
- Pedestrian crossing flags and in-street crossing signs also were effective in prompting motorist yielding, achieving 65 and 87 percent compliance, respectively. However, most of these crossing treatments were installed on lower-speed and lower-volume, two-lane roadways.

Finally, the number of lanes being crossed and posted speed limit were other factors in addition to type of treatment influencing the effectiveness of the crossing treatments (Transportation Research Board, 2006).

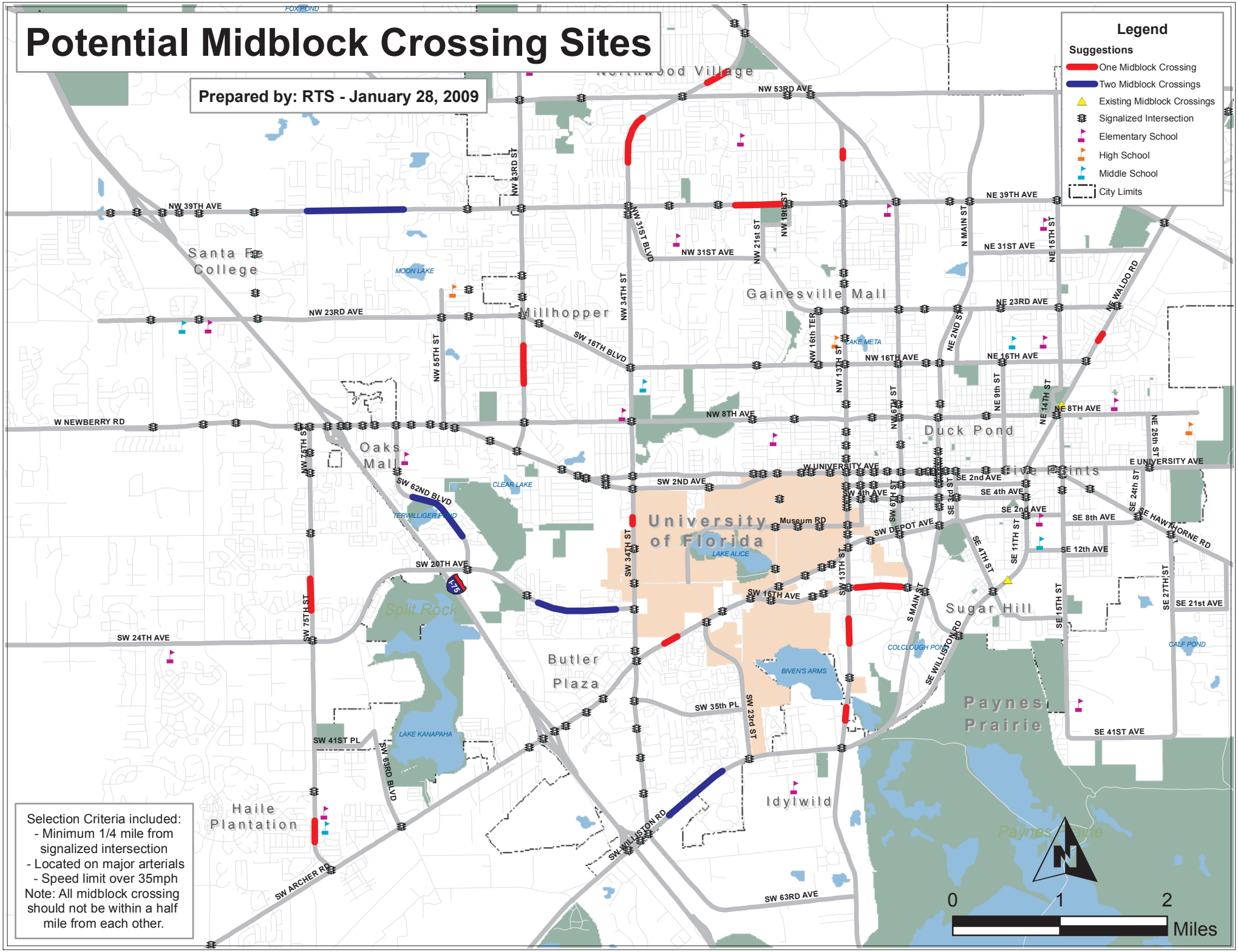
RTS RECOMMENDATION

Archer Road in Gainesville, FL is a 6-lane arterial with heavy traffic flows and a 45-mph speed limit. These conditions are not conducive to pedestrians—especially when trying to cross at unsignalized intersections. ***RTS recommends installation of a signalized two-stage angled crosswalk treatment*** with a hot response to link the Surge Area bus stop to apartments lining Old Archer Road. A crosswalk would greatly enhance pedestrian safety in this area, especially since large numbers of bus passengers attempt to cross Archer Road at this location every day. RTS recommends the two-stage angled signal sinstead of a HAWK crossing due to the width of Archer Road. The two-stage angled signal crossing—in which pedestrians cross one side of the street, take refuge in a median, and then cross the other side of the street—would better facilitate automobile movement while still enhancing pedestrian safety.

SOURCES

Federal Highway Administration. (2006). *Midblock Crossings*. Retrieved from http://www.tfhrc.gov/safety/pedbike/pubs/05085/chapt12.htm.

Transportation Research Board. (2006). *Improving Pedestrian Safety at Unsignalized Crossings.* Retrieved from http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_562.pdf.


Potential Midblock Crossing Sites
Prepared by: RTS - January 28, 2009
Legend
Suggestions
One Midblock Crossing
Two Midblock Crossings
Existing Midblock Crossings
Signalized Intersection
Elementary School
High School
Middle School
City Limits
Selection Criteria included:
- Minimum 1/4 mile from signalized intersection
- Located on major arterials
- Speed limit over 35mph
Note: All midblock crossing should not be within a half mile from each other.
0
1
2
Miles
Santa Fe College
Millhopper
Gainesville Mall
Oaks Mall
University of Florida
Duck Pond
Sugar Hill
Butler Plaza
Split Rock
Haile Plantation
Idylwild
Paynes Prairie
NW 53RD AVE
NW 39TH AVE
NW 23RD AVE
NW 8TH AVE
W NEWBERRY RD
NW 31ST AVE
NE 39TH AVE
NE 31ST AVE
NE 23RD AVE
NE 16TH AVE
NE 8TH AVE
W UNIVERSITY AVE
E UNIVERSITY AVE
SW 2ND AVE
SE 2nd AVE
SE 4th AVE
SE 8th AVE
SE 12th AVE
SW 20TH AVE
SW 24TH AVE
SW 16TH AVE
SW 35th PL
SW 41ST PL
SW 63RD AVE
SE 41ST AVE
SE 21st AVE
SW 62ND BLVD
SW 16TH BLVD
SW 63RD BLVD
SW ARCHER RD
SW WILLISTON RD
SE WILLISTON RD
SE HAWTHORNE RD
Museum RD
SW DEPOT AVE
NW 43RD ST
NW 31ST BLVD
NW 34TH ST
NW 55TH ST
NW 75TH ST
NW 21st ST
NW 19th ST
NW 16th TER
NW 13TH ST
NW 6TH ST
N MAIN ST
NE 15TH ST
NE WALDO RD
NE 2ND ST
NE 9th ST
NE 14TH ST
NE 25th ST
SE 24th ST
SE 27TH ST
SE 15TH ST
SE 11TH ST
SE 4TH ST
SE 3rd ST
SW 6TH ST
SW 13TH ST
SW 34TH ST
SW 23rd ST
S MAIN ST
FOX POND
MOON LAKE
LAKE META
CLEAR LAKE
TERWILLIGER POND
LAKE ALICE
LAKE KANAPAHA
BIVEN'S ARMS
COLCLOUGH POND
CALF POND
I-75