

WALKABILITY ASSESSMENT



GREATER SPRING HILL COMMUNITY
DELAND, FLORIDA

Greater Spring Hill Community Walkability Assessment Report

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I. Introduction

Over one-third of the U.S population suffers from obesity, which can be attributed in-part due to lack of physical activity (CDC, 2017). Risk for developing diseases such as cancer, diabetes, hypertension, and heart disease is increased when an individual is physically inactive (Knight, 2017; CDC, 2011).

To address physical inactivity and the diseases to which it is a contributing factor, the creation of an environment that encourages individuals to walk, socialize, and exercise is important. Developing walkable areas that connect residential zones to grocery stores, farmer markets, schools, and bus stops promote physical activity among a community (Samuels et al., 2010). Studies show it is possible to increase how much an average pedestrian walks by creating a more appealing and quality route (Rodríguez et al., 2014). Particularly in low-income communities, walkability improvements are associated with increased access to and utilization of fresh produce and increased physical activity (Samuels et al., 2010). In a study of five low-income neighborhoods, proximity to a walking or biking trail was found to be positively correlated with walking more than 30 minutes per day, increased utilization of community resources such as health clinics, and negatively correlated with smoking (Pierce, Denison, Arif & Rohrer, 2006).

Urbanization and infrastructure can play a major role in the overall health of a community. Not only sidewalks and crosswalks, but characteristics like aesthetics and lighting along roads and buildings are factors that impact walkability. Without access to

a safe, walkable environment that encourages physical activity, communities can suffer negative physical and mental repercussions (Christian et al., 2017; Sarkar et al. 2017).

Even when resources are available and walking areas are favorable for community members, negative perceptions and uneven distribution of those resources can deter people from utilizing them (Steinmetz et al, 2015). The absence or lack of use of walkable pathways can result in an environment that reinforces unhealthy lifestyles. Development of infrastructure such as walkways and bikeways that are not only continuous, but also considered aesthetically pleasing, can encourage healthy behaviors, such as physical activity (Rutt, Dannenberg & Kochtitzky, 2008).

The 2016 Public Health and Community Needs Assessment conducted by Dr. Asal Johnson of Stetson University found that 71.6% of Spring Hill residents were dissatisfied with the pleasantness of walking in their community, 67% were dissatisfied by the number of sidewalks, and 71.6% were dissatisfied by the lack of street lighting (Johnson et al., 2016). Three of the top four health concerns among respondents (type II diabetes, hypertension, and heart disease) were chronic diseases related to a lack of access to nutritious foods and a lack of physical activity. The study found that 90.5% of Spring Hill residents were concerned about their lack of access to fresh produce and 89.6% of Spring Hill residents did not feel like they had adequate access to exercise options (Johnson et al., 2016)

This assessment will evaluate the walkability of the Greater Spring Hill Community. This study will determine specifically where improvements could be made and in what

particular areas of the Greater Spring Hill Community those improvements are most needed. The results of this study can be used by community, local, state, and federal agencies to determine how best to improve the walkability of DeLand and Spring Hill.

Defining Walkability

“Designing walkable environments” and “increasing walkability” are phrases that are used interchangeably. For the purpose of this assessment walkability and walkable environment are defined as a safe, aesthetically pleasing environment that is designed to promote physical activity with a focus on economic and social benefits (Forsyth, 2015). By creating or adapting environments to meet these standards, a positive change in human behavior could result from a less sedentary lifestyle (Sallis et al., 2018).

Economic and Social Benefits of Improving Walkability

The economic benefits associated with walking include an increase in economic viability of the community, increased property values, and a reduction in health expenditure (Boarnet, Greenwald, & McMillan, 2008; Zapata-Diomedes et al., 2017). Cost of illness (COI), or burden of disease (BOD), give an approximation of the costs resulted from morbidity, this includes the medical resources associated with treatment, non-medical treatment options, and loss of healthy life. Non-communicable diseases like cardiovascular disease and Type II diabetes, which are both preventable with the addition of a physical activity like walking or biking, resulted in a high economic burden. The COI estimated in 2010 for both of these diseases were \$863 billion and \$500 billion, respectively (Bloom et al. 2011; CDC, n.d). Based on these findings it would be expected

that efforts to make an environment more walkable will lead to a reduction in the overall cost expended by both individuals and the health systems.

According to a study examining the benefits of walkability improvements for a 5,000-person neighborhood, it was found that increasing the walkability score from the national 50th percentile to the national 95th percentile was associated with a \$26,221 economic benefit per capita. This was calculated as the combined benefits of decreased morbidity and mortality due to increased physical activity, increased property values, increased business proliferation in that community, increased sales at businesses, and increased employment opportunities (Boarnet, Greenwald, & McMillan, 2008).

A survey of neighborhoods in Washington DC controlling for household income levels found that homes located in communities with relatively high walkability levels were on average worth \$82 more per square foot than homes located in neighborhoods with average walkability (Leinberger and Alfonzo (2012). Another study conducted in two communities in Charlotte, North Carolina found that improving walkability scores by 17% of the overall score led to an increase in property values by 12% (Litman, 2018).

Improvement in social capital, or the shared values and relationships that are necessary for social and economic growth within a community, is also a benefit associated with walkability (Johnson, 2016). Increasing the walkability of an area creates the opportunity to interact with others within a community as well as increase networking amongst those community members (Rogers et al., 2010). The relationships people create within these communities not only influence their happiness, but also their longevity and overall health (Mineo, 2017). A recently published 80-year cohort study of adult development

found that satisfaction in relationships was the most accurate predictor of health, with those reporting the highest levels of satisfaction in their relationships at age 50 also turning out to be the healthiest at age 80 (Mineo, 2017). Among this social aspect of walkability is also the community's sense of safety. By reducing the traffic load within communities, residents are more likely to take responsibility for their streets, essentially resulting in surveillance increase and the idea of a safer community (Wright, 2018). These factors have been found to lead to a greater sense of community, increased social capital, and more people being physically active (Wright, 2018).

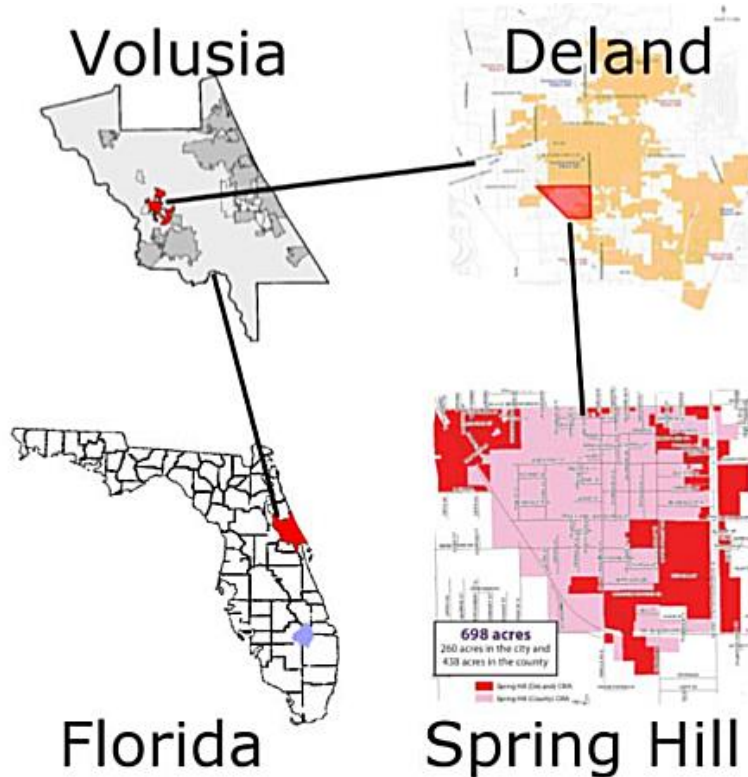
Description of Spring Hill

Spring Hill is a community in the southwest DeLand, FL that is comprised of areas that are part of the city of DeLand and areas that are unincorporated Volusia County. With a median household income of \$13,090, Spring Hill ranks 876th for income out of 887 surveyed locations by the Census Bureau in the state of Florida, making it one of the most impoverished neighborhoods in in the state (DeFeo, 2013; Sarmah, 2009). For the purpose of this assessment Spring Hill refers to the region contained within the Spring Hill Community Redevelopment Agency (Spring Hill CRA). The Spring Hill CRA is bordered by W. Beresford Ave. to the north, S. Woodland Blvd. to the east, and State Route 15 (SR-15) to the west and south with some sections to the west of SR-15 falling within the borders of the Spring Hill CRA (Volusia County, 2016).

US Census data identified 1,095 residents living in the Spring Hill community also known as the DeLand Southwest Census-Designated Place. This area is comprised of

69.4% African American, 14.4% non- Hispanic White, 14.2% Hispanic, and 2% Some Other Race with a median age of 33.3 (United States Census Bureau, 2010).

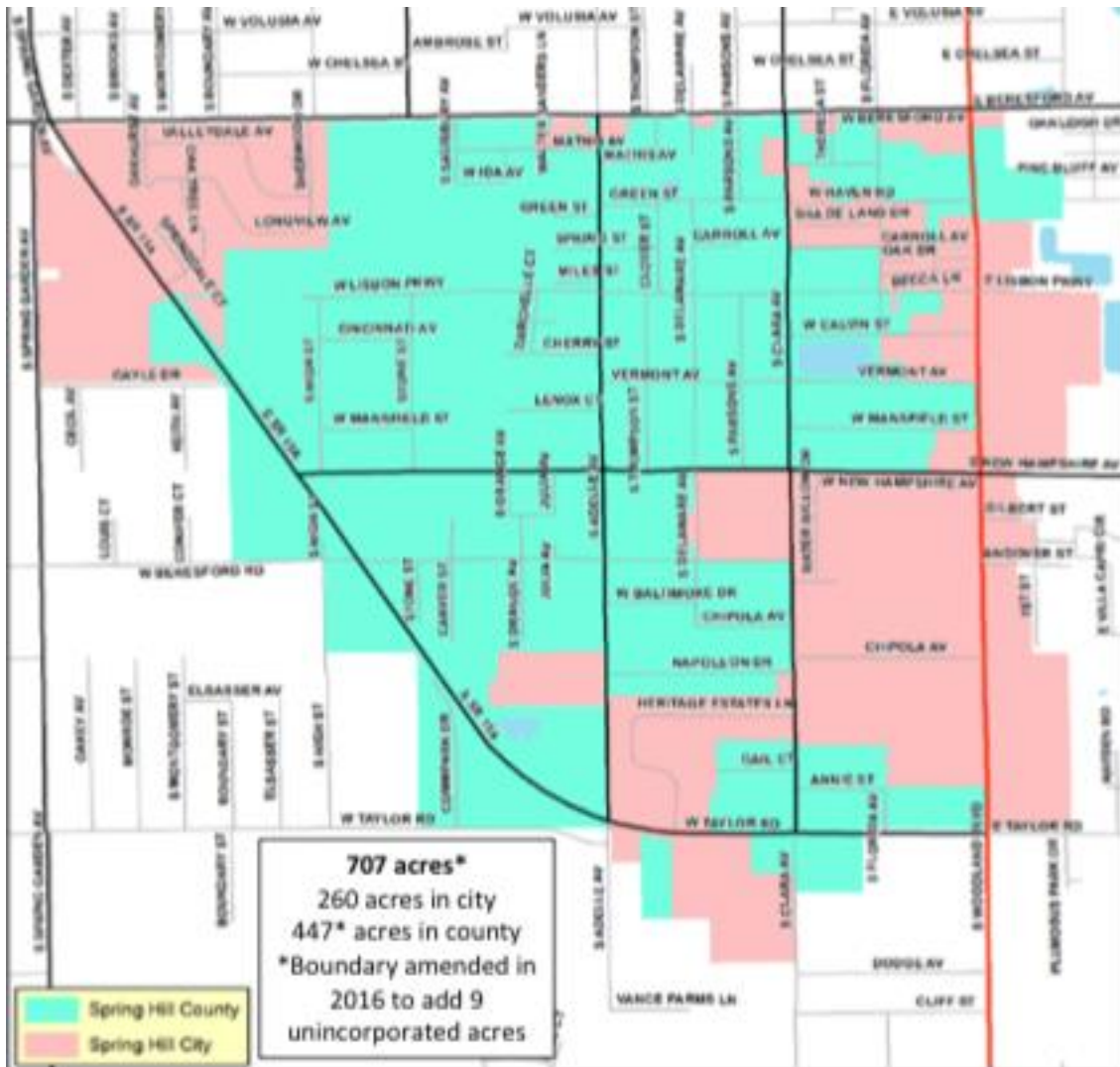
Image 1: Nested map of Spring Hill in relation to its location in the city, county, and state



(Source: Johnson et al., 2016)

There is no consensus as to the defined borders of the Spring Hill Community, but for the purpose of this study Greater Spring Hill was defined by W. New York Ave. to the north, S. Woodland Blvd. to the east, and SR-15 to the west and south. These specific parameters were included as community members should be able to walk and have access to schools, churches, farmer's markets, grocery stores, restaurants, etc. within a reasonable distance. Large portions of this region are primarily incorporated in the city of DeLand.

Image 2: Spring Hill Redevelopment Agency Area



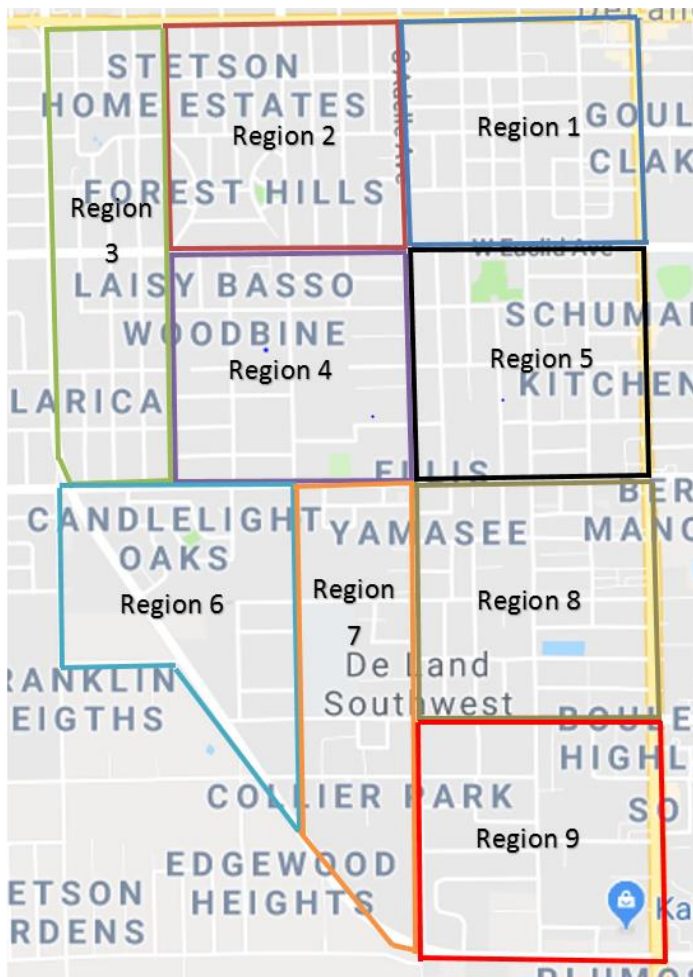
(Source: Volusia County, 2016).

II. Methods

The purpose of this project was to determine the strengths and weaknesses of the Greater Spring Hill Community walkability by identifying issues through the use of Survey123, a programmed system using ArcGIS provided by the Florida Department of Health. Using this program, we were able to create an interactive map of our findings complete with geo-tagged pictures of the area.

Data

A modified version of the Microscale Audit of Pedestrian Streetscapes (MAPS) survey was inputted into the Survey123 application, with a score attached to each response. Completing the questionnaire generated a score out of 21 possible points for each street segment, with the higher point values indicating better walkability (Sallis et al., 2015). To help minimize subjectivity of answer choices, each question had a picture of what each answer choice looks like to help the researchers differentiate between answer choices. Following the completion of selected questions, researchers were prompted to take a picture using their smartphone of an area, which supported their answer choice. The Greater Spring Hill Community was divided into nine regions in order to generate more meaningful data and create regional scores to be able to identify areas with the greatest need for walkability improvements. The borders used to identify different regions were adopted from the needs assessment asset map found in the 2016 Public Health and Community Needs Assessment Report of the Spring Hill Community (Johnson et al., 2016).

Image 3: Regional Divisions of Greater Spring Hill Community

Data Collection

The walkability of Spring Hill was surveyed by teams of three who walked the length of each street in their designated region. Each team was comprised of volunteer research assistants trained in using Survey123. In addition to Survey123, one volunteer on each team was trained to create a color-coded map of the sidewalk infrastructure in the region. Green indicated there was a sidewalk present, yellow indicated a sidewalk was present but damaged, red was used to indicate a lack of sidewalk, and black was used to identify

major impediments to walking. A rapid response team was present in case of emergency and to drive volunteers from one completed section to the start of a new section.

Data Analysis

Responses from questionnaires were inputted into a Microsoft Excel spreadsheet. Each completed questionnaire was given an identifier and a geotag based on the geographic area in which it was completed allowing for regional analysis. The Volusia County Department of Health ran frequencies for the responses and categorized the street scores into the corresponding regions. The average street scores were calculated for each region to generate a walkability score for every region. Color coded sidewalk data and geotagged completed surveys were inputted into an ArcGIS map visible at <http://healthyvolusia.org/test.html>.

The COUNT IF and COUNT A functions were utilized to determine averages for each individual variable for each region. Simple linear regression was run to determine the relationship between sidewalk connectivity and walkability score.

III. Results

Greater Spring Hill Community

Greater Spring Hill Community, as shown in Figure 1, is bordered by W New York Ave to the north, S Woodland Blvd to the east, and SR-15 to the west and south. Some streets to the west of SR-15 were also included in this border as they were a part of the Spring Hill CRA. 182 streets were surveyed for this assessment. The overall walkability score for the Greater Spring Hill Community is 4.1 out of a possible 21 points. 41.2% of streets in this region have a continuous sidewalk on at least one side of the road. 43.9 % of streets have some degree of trip hazard present. 87.4% of streets in this region have some degree of street lighting and 12.6% of streets have less than 50% of the buildings well maintained. Of this area surveyed, 95.1% of the streets did not have public transportation stops, and 94.0% of streets did not have benches present. Only 1.6% of the 182 streets were found to have a painted bike lane. Major impediments to walking tended to be clustered, with notable clusters found in Figure 1 on W Beresford Ave south of Edith I. Starke Elementary, northeast of Southwestern Middle School, and on S Orange Ave.

Figure 1. Greater Spring Hill Sidewalk Infrastructure Map

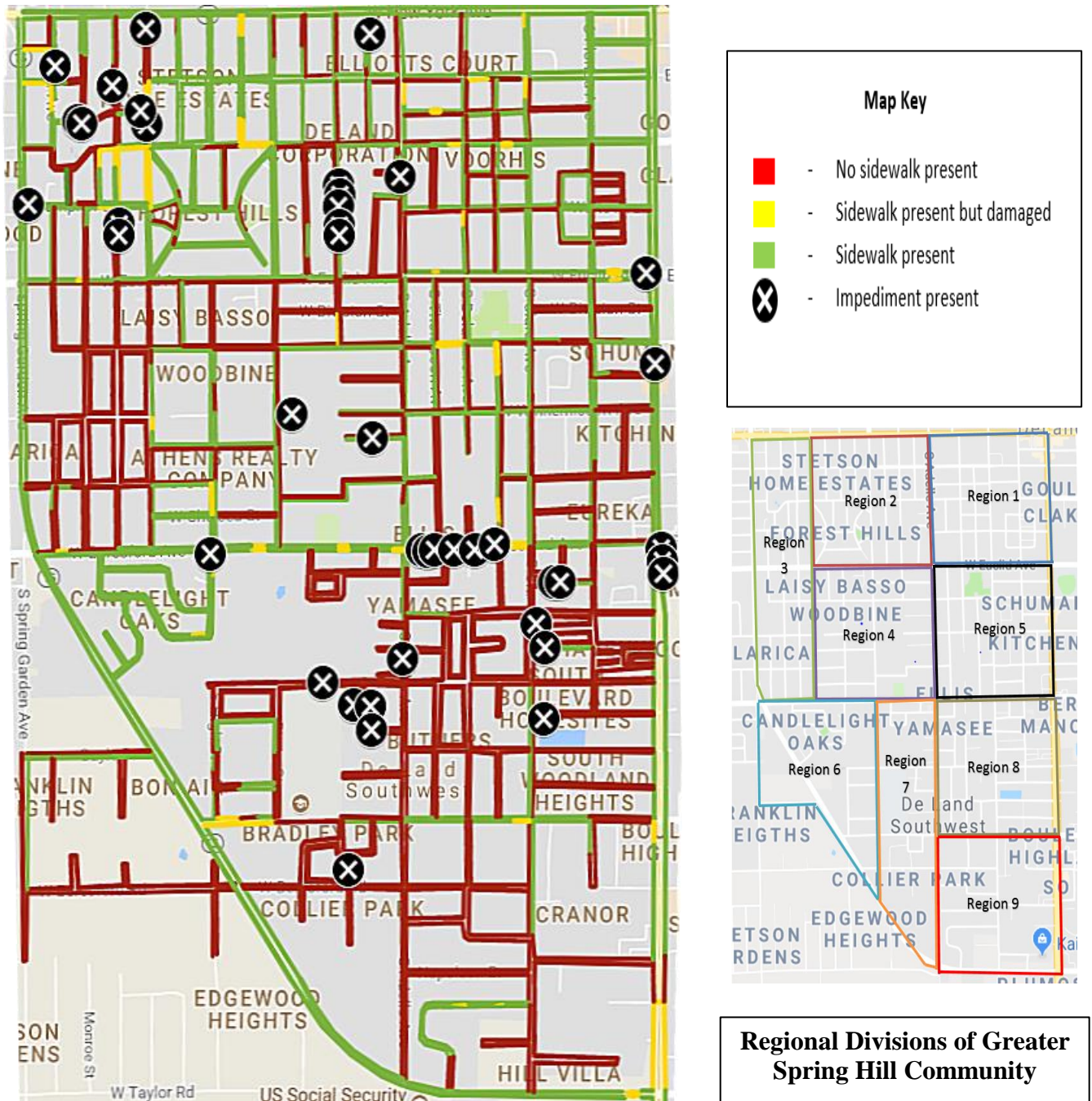


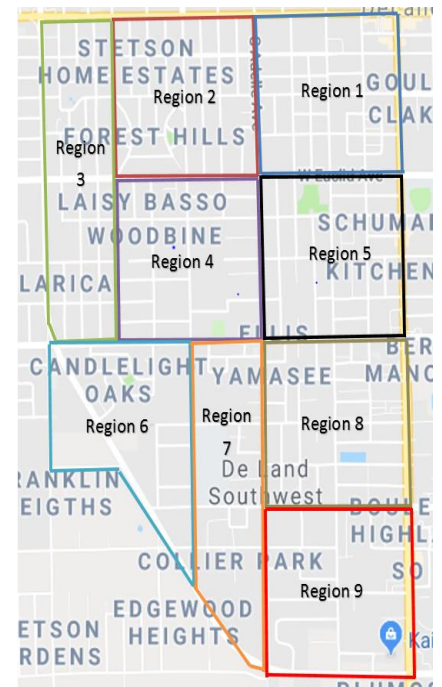
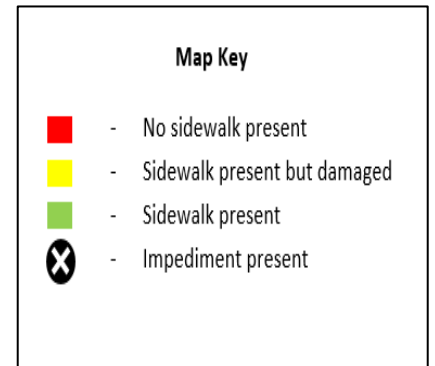
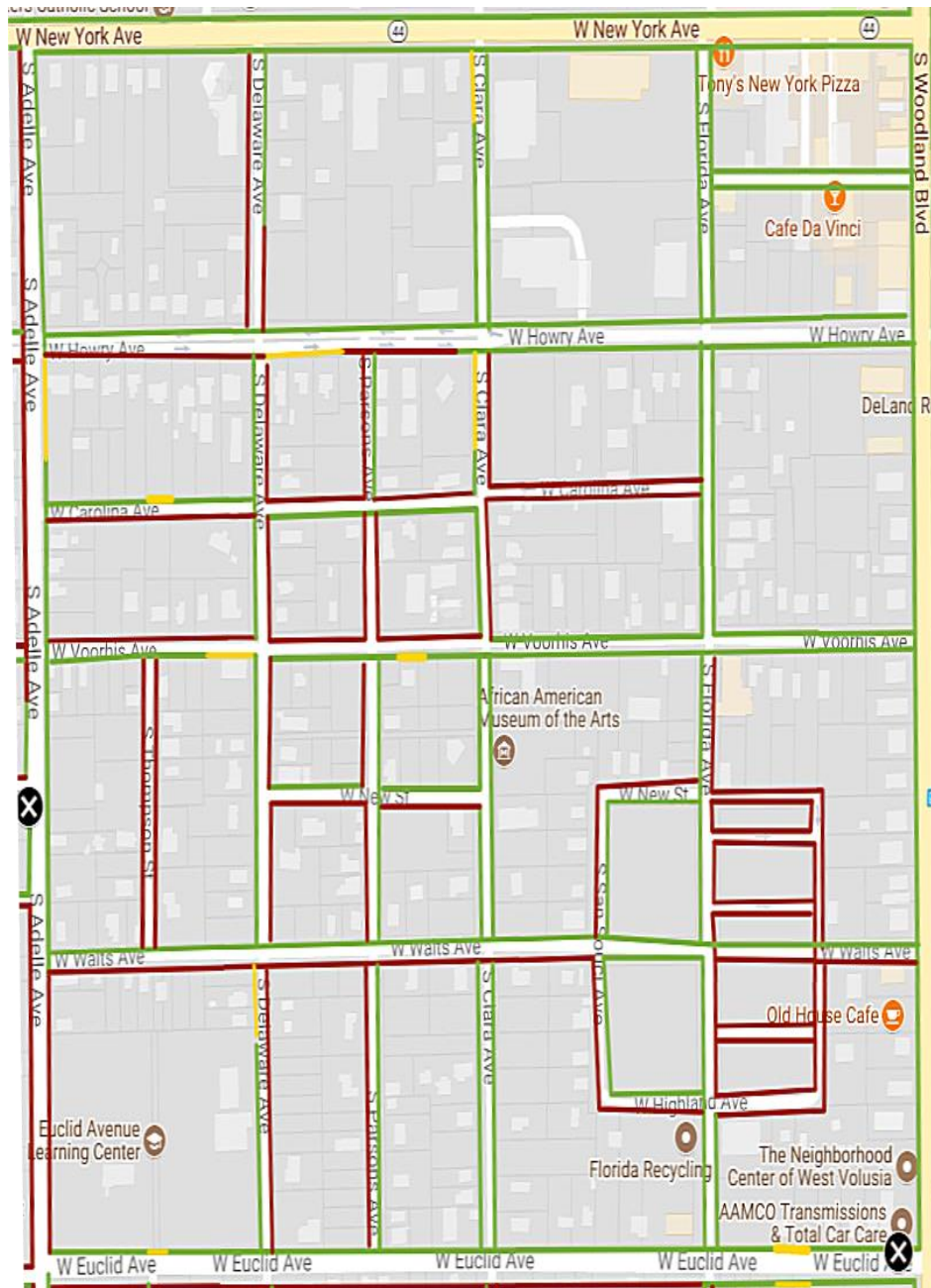
Table 1. Greater Spring Hill Community Survey Results (n=182)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	12.6
51-99%	67.6
100%	19.8
Graffiti Tagging (Not Including Murals)	
None	96.2
Some	1.6
Very Present	0.5
Bike Path	
None	98.4
Yes, painted	1.6
Sidewalk Present	
No	30.8
Yes, not continuous	28.0
Yes, continuous	41.2
Major Trip Hazards	
None	56
Some	33.5
Many	10.4
Marked Crosswalks	
None	80.8
Some	1.1
Adequate	18.1
Street Lights	
None	12.6
Some	65.4
Adequate	22.0
Transit Stops	
0	95.1
1	3.8
2 or more	1.1
Benches (Excluding Bus Stops)	
None	94.0
Some	4.9
Adequate	1.1

Region 1

Region 1, as shown in Figure 2, is bordered by W New York Ave to the north, S Woodland Blvd to the east, W Euclid Ave to the south, and S Adelle Ave to the West. The area within Region 1 is fully incorporated into the city of DeLand. The overall walkability score for this region is 5.72 out of a possible 21 points. 83.3% of streets in this region have a continuous sidewalk on at least one side of the road. 41.7% of streets have some degree of trip hazard present. 100% of streets in this region have some degree of street lighting and 100% of streets have more than 50% of the buildings well maintained. Additionally, no graffiti tagging was found in this region. There are no designated bike paths in this region, but 2.8% of streets did have at least one transit stop present with both stops found along S Woodland Blvd. As shown in Figure 2, two major impediments were found along the sidewalk in Region 1. One on W. Euclid Ave near S Woodland Blvd and one on S Adelle Ave. between W Voorhis Ave and W Watts Ave. In Region 1, 4 churches and 1 school (Tabernacle of Praise Academy) were found. Other points of interest that are within these boundaries are the Historic Wright's Corner located at the intersection of S Clara Ave and W Voorhis Ave, the Watts Amphitheater, and the African American Museum of the Arts, both located just south of Wright's Corner on S Clara Ave. The Police Athletic League is also located in Region 1, on S Delaware Ave between W Watts Ave and W Euclid Ave.

Figure 2. Region 1 Sidewalk Infrastructure Map



Regional Divisions of Greater Spring Hill Community

Table 2. Region 1 Survey Results (n=36)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	0
51-99%	88.9
100%	11.1
Graffiti Tagging (Not Including Murals)	
None	100
Some	0
Very Present	0
Bike Path	
None	100
Yes, painted	0
Sidewalk Present	
No	8.3
Yes, not continuous	8.3
Yes, continuous	83.3
Major Trip Hazards	
None	58.3
Some	41.7
Many	0
Marked Crosswalks	
None	69.4
Some	0
Adequate	30.6
Street Lights	
None	0
Some	66.7
Adequate	33.3
Transit Stops	
0	97.2
1	2.8
2 or more	0
Benches (Excluding Bus Stops)	
None	91.7
Some	5.5
Adequate	2.8

Region 2

Region 2, as shown in Figure 3, is bordered by W New York Ave to the north, S Adelle Blvd to the east, W Euclid Ave to the south, and S Boundary Ave to the West. The area within region 2 is fully incorporated into the city of DeLand. The overall walkability score for this region is 5.08 out of a possible 21 points. 70.1% of streets in this region have a continuous sidewalk on at least one side of the road. 25.0% of streets have some degree of trip hazard present. 95.9% of streets in this region have some degree of street lighting and 8.3% of streets have less than 50% of the buildings well maintained. There was no graffiti found in this region. None of the streets in this region were found to have bike paths or transit stops present. As shown in figure 3, a large cluster of impediments was found along the sidewalk of S Orange Ave between W Voorhis Ave and W Euclid Ave. These impediments could potentially limit the functionality of the sidewalk on that segment of the street and contribute to limiting sidewalk connectivity and the walkability of the environment. In Region 2, 1 church and 1 Park (Highland Park and Playground) can be found within the boundaries.

Figure 3. Region 2 Sidewalk Infrastructure Map

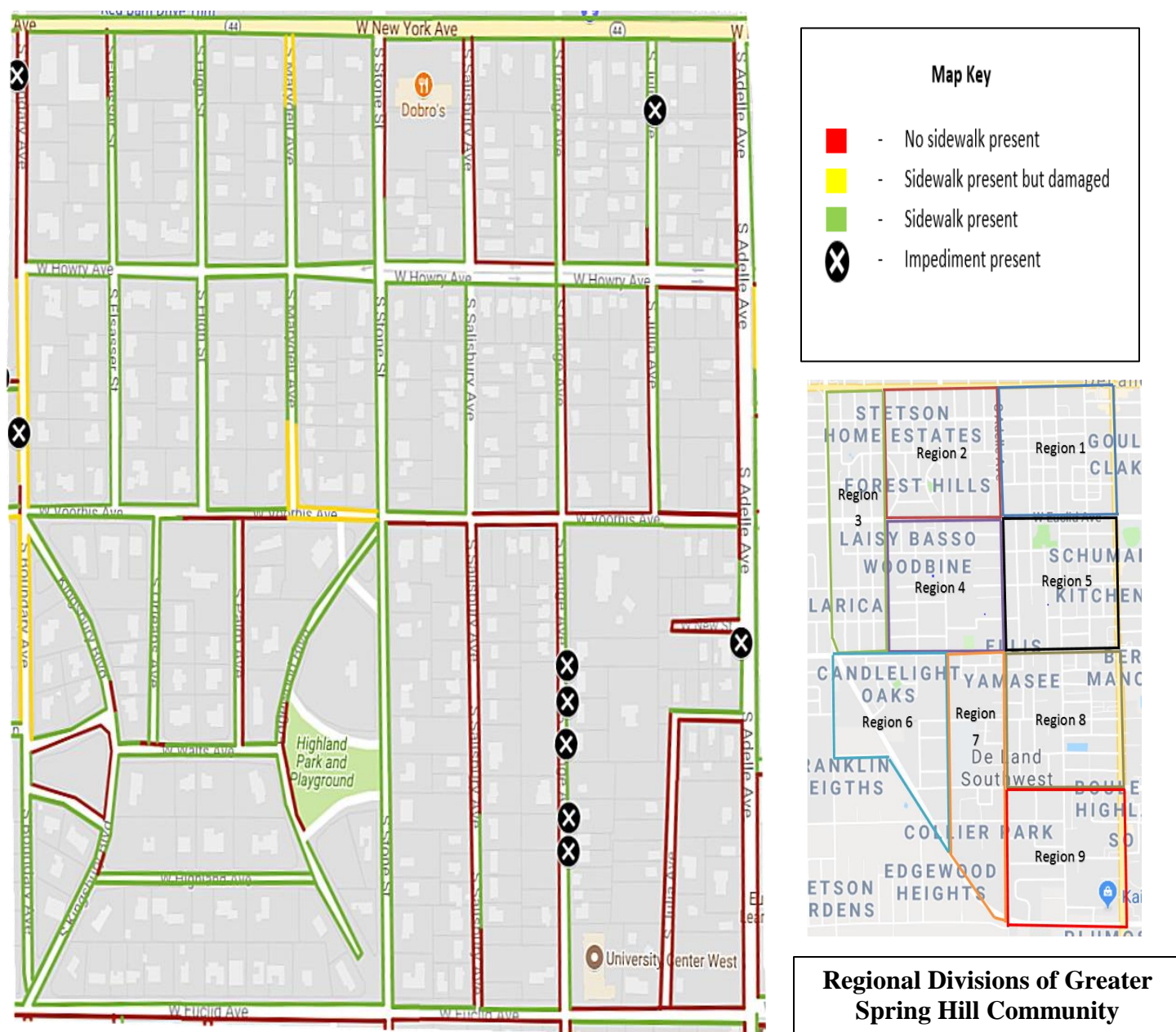


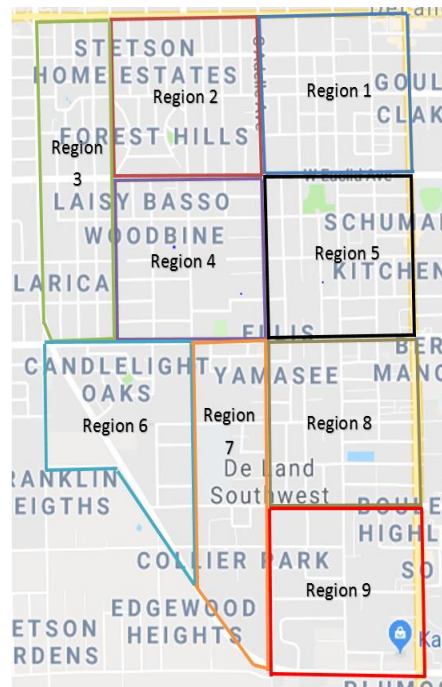
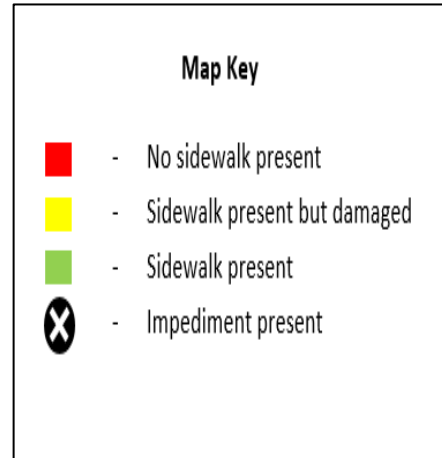
Table 3. Region 2 Survey Results (n=24)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	8.3
51-99%	41.7
100%	50.0
Graffiti Tagging (Not Including Murals)	
None	100
Some	0
Very Present	0
Bike Path	
None	100
Yes, painted	0
Sidewalk Present	
No	4.2
Yes, not continuous	25.0
Yes, continuous	70.8
Major Trip Hazards	
None	75.0
Some	25.0
Many	0
Marked Crosswalks	
None	91.7
Some	0
Adequate	8.3
Street Lights	
None	4.1
Some	91.7
Adequate	4.2
Transit Stops	
0	100
1	0
2 or more	0
Benches (Excluding Bus Stops)	
None	95.8
Some	4.2
Adequate	0

Region 3

Region 3, as shown in Figure 4, is bordered by W New York Ave to the north, S Boundary Ave to the east, W Euclid Ave to the south, and SR-15 to the West. The area within Region 3 is fully incorporated into the city of DeLand. The overall walkability score for this region is 3.95 out of a possible 21 points. 40.0% of streets in this region have a continuous sidewalk on at least one side of the road. 80.0% of streets have some degree of trip hazard present. 70.0% of streets in this region have some degree of street lighting and 10.0% of streets have less than 50% of the buildings well maintained. There was no graffiti tagging found in this region. None of the streets in this region were found to have bike paths or transit stops present. As shown in Figure 4, there are a number of impediments to walking found in the northern half of Region 3. Only one of these impediments, located on SR-15, was found along a sidewalk that was not otherwise damaged. While Region 3 does not have any churches, schools, or parks present there are many businesses located along SR-15 where sidewalk is present.

Figure 4. Region 3 Sidewalk Infrastructure Map



Regional Divisions of Greater Spring Hill Community

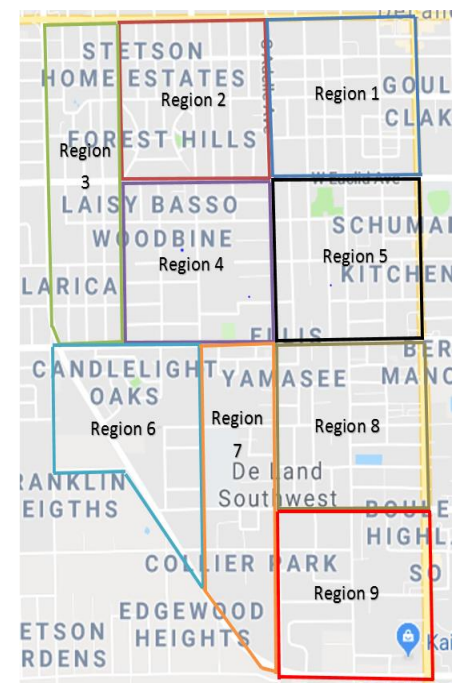
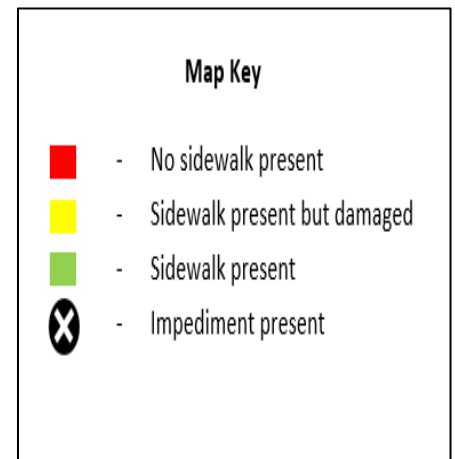
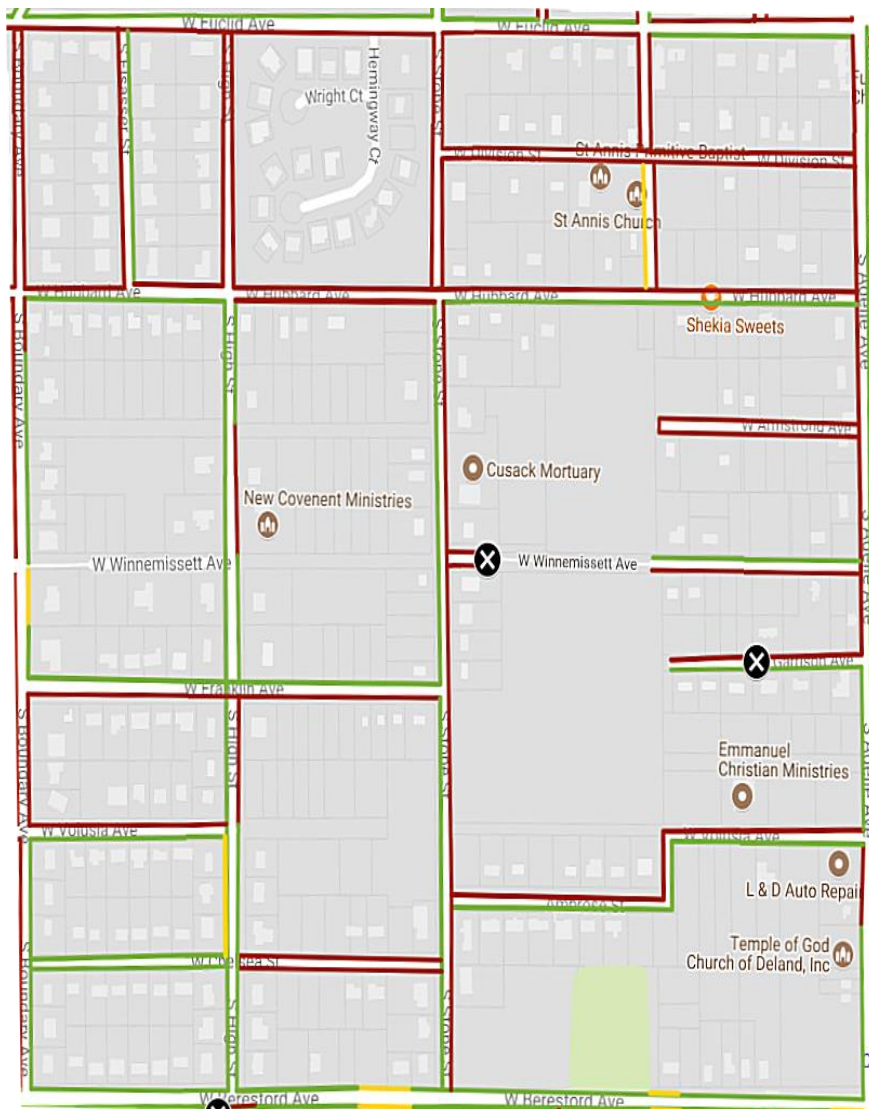
Table 4. Region 3 Survey Results (n=10)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	10
51-99%	70
100%	20
Graffiti Tagging (Not Including Murals)	
None	100
Some	0
Very Present	0
Bike Path	
None	100
Yes, painted	0
Sidewalk Present	
No	30
Yes, not continuous	30
Yes, continuous	40
Major Trip Hazards	
None	20.0
Some	40.0
Many	40.0
Marked Crosswalks	
None	60.0
Some	0
Adequate	40.0
Street Lights	
None	30.0
Some	60.0
Adequate	10.0
Transit Stops	
0	100
1	0
2 or more	0
Benches (Excluding Bus Stops)	
None	100
Some	0
Adequate	0

Region 4

Region 4, as shown in Figure 5, is bordered by W Euclid Ave to the north, S Adelle Ave to the east, W Beresford Ave to the south, and S Boundary Ave to the West. The area within Region 4 is fully incorporated into the city of DeLand. The overall walkability score for this region is 4.42 out of a possible 21 points. 40.0% of streets in this region have a continuous sidewalk on at least one side of the road. 80.0% of streets have some degree of trip hazard present. 70.0% of streets in this region have some degree of street lighting and 10.0% of streets have less than 50% of the buildings well maintained. No graffiti tagging was found in this region. None of the streets in this region were found to have bike paths or transit stops present. As shown in figure 5, an impediment was found on W Winnemissett Ave. This impediment prevented access to the rest of the street and serves as a significant barrier to walking east along W Winnemissett Ave from S Stone St to S Adelle Ave. There are 3 major points of interest in Region 4, all of which are churches.

Figure 5. Region 4 Sidewalk Infrastructure Map



Regional Divisions of Greater Spring Hill Community

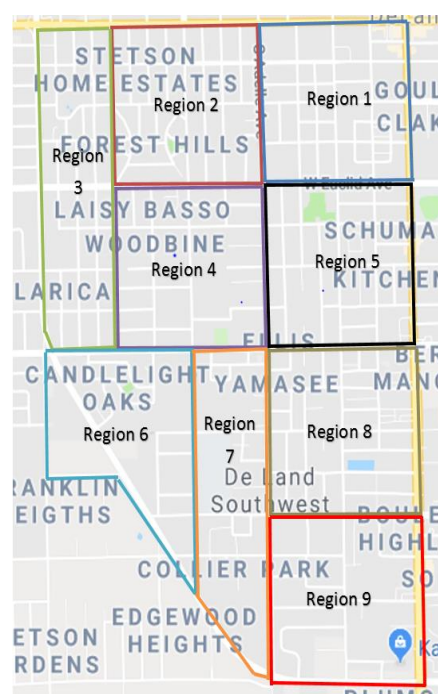
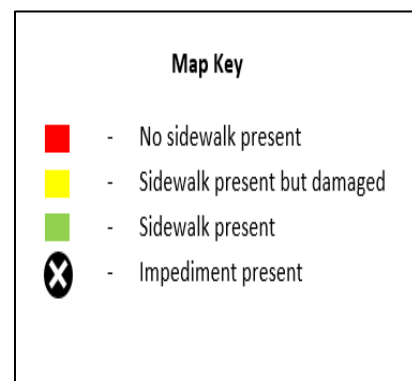
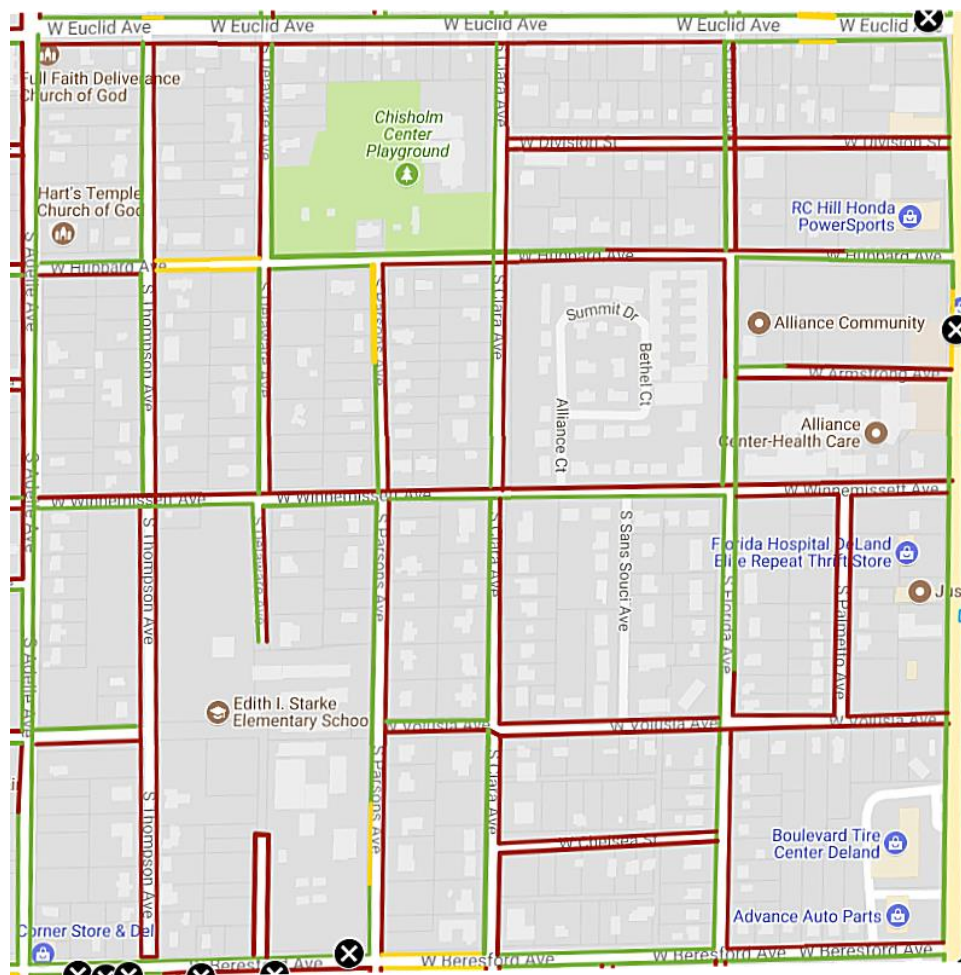
Table 5. Region 4 Survey Results (n=18)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	5.6
51-99%	50.0
100%	44.4
Graffiti Tagging (Not Including Murals)	
None	100
Some	0
Very Present	0
Bike Path	
None	100
Yes, painted	0
Sidewalk Present	
No	1.1
Yes, not continuous	44.4
Yes, continuous	44.4
Major Trip Hazards	
None	50.0
Some	27.8
Many	22.2
Marked Crosswalks	
None	83.3
Some	16.6
Adequate	16.7
Street Lights	
None	11.1
Some	50.0
Adequate	38.9
Transit Stops	
0	100
1	0
2 or more	0
Benches (Excluding Bus Stops)	
None	94.4
Some	5.6
Adequate	0

Region 5

Region 5, as shown in Figure 6, is bordered by W Euclid Ave to the north, S Woodland Blvd to the east, W Beresford Ave to the south, and S Adelle to the West. The area within Region 5 is fully incorporated into the city of DeLand. The overall walkability score for this region is 3.55 out of a possible 21 points. 20.0% of streets in this region have a continuous sidewalk on at least one side of the road. 35.0% of streets have some degree of trip hazard present. 85.0% of streets in this region have some degree of street lighting and 25.0% of streets have less than 50% of the buildings well maintained. No graffiti was found in this region. None of the streets in this region were found to have bike paths, but 5% of streets did have at least one transit stop present. As shown in figure 6, a large cluster of impediments were found on W Beresford Ave south the entrance to Edith I. Starke Elementary. In Region 5, 6 churches, 1 school (Starke Elementary) and one park (Chisolm Community Center) can be found. Other major points of interest include the Spring Hill Community Garden, the Delta House, and the Electrolytes Club. All of which are located just behind the Chisholm Community Center on S Delaware Ave between W Euclid Ave and W Hubbard Ave.

Figure 6. Region 5 Sidewalk Infrastructure Map



Regional Divisions of Greater Spring Hill Community

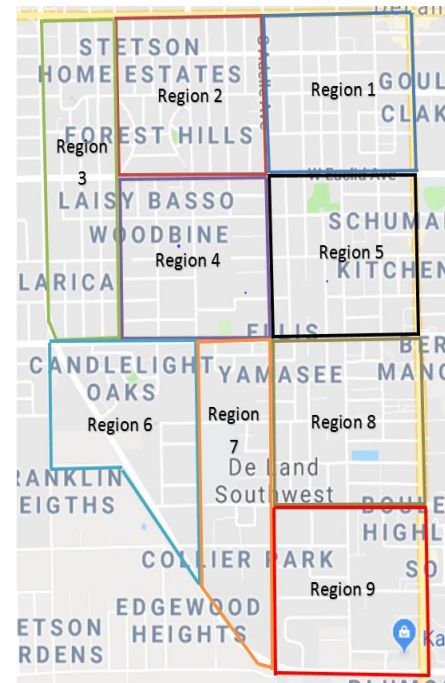
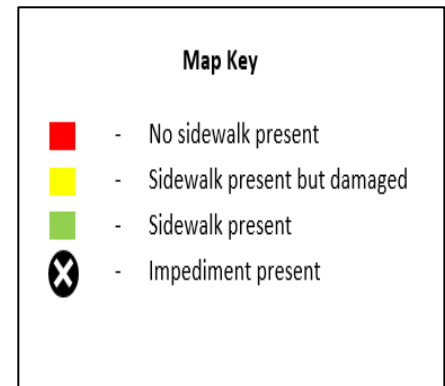
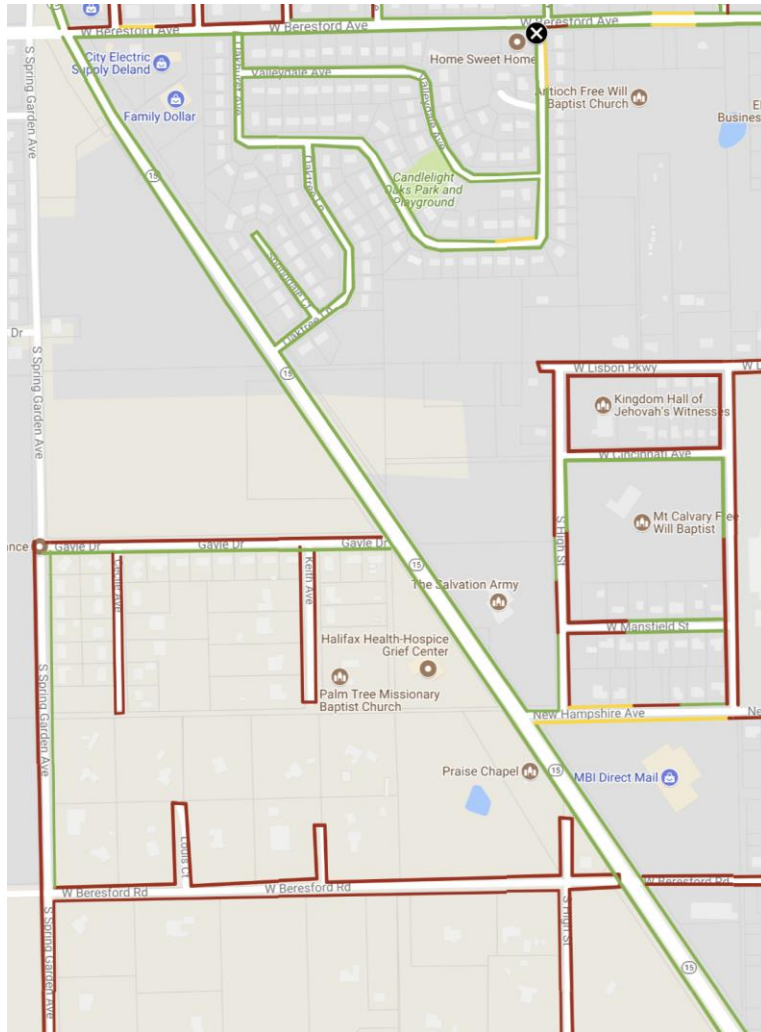
Table 6. Region 5 Survey Results (n=20)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	25.0
51-99%	55.0
100%	20.0
Graffiti Tagging (Not Including Murals)	
None	100
Some	0
Very Present	0
Bike Path	
None	100
Yes, painted	0
Sidewalk Present	
No	35.0
Yes, not continuous	45.0
Yes, continuous	20.0
Major Trip Hazards	
None	65.0
Some	25.0
Many	10.0
Marked Crosswalks	
None	75.0
Some	0
Adequate	25.0
Street Lights	
None	15.0
Some	60.0
Adequate	25.0
Transit Stops	
0	95.0
1	5.0
2 or more	0
Benches (Excluding Bus Stops)	
None	95.0
Some	5.0
Adequate	0

Region 6

Region 6, as shown in Figure 7, is bordered by W Beresford Ave to the north, Stone St to the east, SR-15 to the south, and S Spring Garden Ave to the West. Some streets beyond SR-15 were included in this region because they fall within the Spring Hill CRA boundaries. The area within region 6 is part of unincorporated Volusia County. The overall walkability score for this region is 4.28 out of a possible 21 points. 33.3% of streets in this region have a continuous sidewalk on at least one side of the road. 77.8% of streets have some degree of trip hazard present. 88.9% of streets in this region have some degree of street lighting and 0% of streets have less than 50% of the buildings well maintained, however 11.1% of streets were found to have some graffiti tagging present. None of the streets in this region were found to have bike paths or transit stops present. As shown in figure 7, one major impediment was found along the sidewalk on W Beresford Ave. The other major points of interest in Region 6 include 5 churches.

Figure 7. Region 6 Sidewalk Infrastructure Map



Regional Divisions of Greater Spring Hill Community

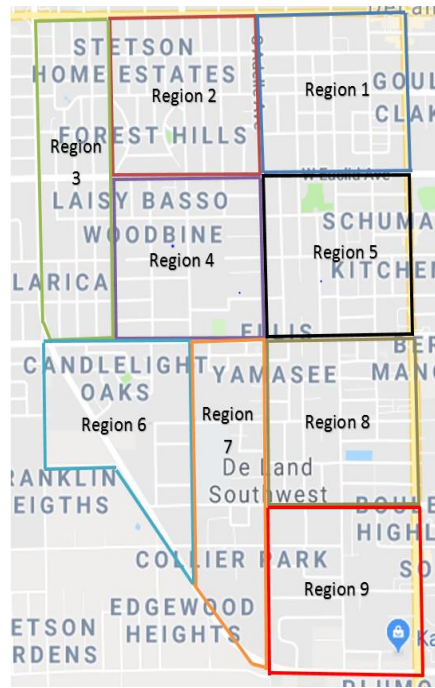
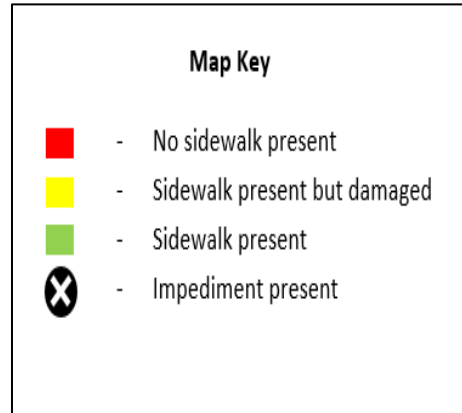
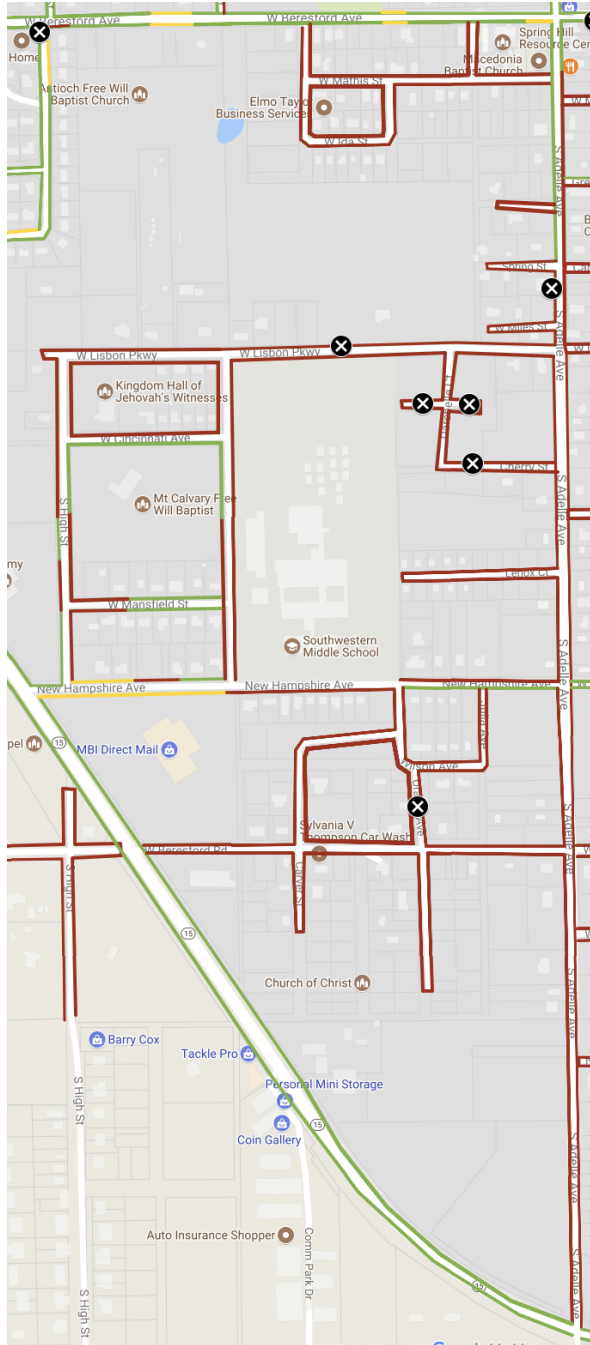
Table 7. Region 6 Survey Results (n=9)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	0
51-99%	100
100%	0
Graffiti Tagging (Not Including Murals)	
None	88.8
Some	11.1
Very Present	0
Bike Path	
None	100
Yes, painted	0
Sidewalk Present	
No	11.1
Yes, not continuous	55.6
Yes, continuous	33.3
Major Trip Hazards	
None	22.2
Some	77.8
Many	0
Marked Crosswalks	
None	88.8
Some	0
Adequate	11.1
Street Lights	
None	11.1
Some	77.8
Adequate	11.1
Transit Stops	
0	100
1	0
2 or more	0
Benches (Excluding Bus Stops)	
None	100
Some	0
Adequate	0

Region 7

Region 7, as shown in Figure 8, is bordered by W Beresford Ave to the north, S Adelle Ave to the east, SR-15 to the south, and SR-15 to the West. The area within region 7 is part of unincorporated Volusia County. The overall walkability score for this region is 2.90 out of a possible 21 points. 4.8% of streets in this region have a continuous sidewalk on at least one side of the road. 42.9% of streets have some degree of trip hazard present. 85.7% of streets in this region have some degree of street lighting and 23.8% of streets have less than 50% of the buildings well maintained. Additionally, 14.3% of streets were found to have graffiti tagging present. While conducting the assessment some residents of W Ida St expressed concern for their safety when outside due to regular drag racing that occurs there. None of the streets in this region were found to have bike paths or transit stops present. As shown in figure 8, a large cluster of impediments was found northeast of Southwestern Middle School with an additional impediment being found southeast of the school. In Region 7, 2 churches and 2 schools (Southwestern Middle School and Lighthouse Christian Preparatory Academy) can be found. The Spring Hill Resource Center is one major point of interest and can be found on the corner of S Adelle and W Beresford Ave.

Figure 8. Region 7 Sidewalk Infrastructure Map



Regional Divisions of Greater Spring Hill Community

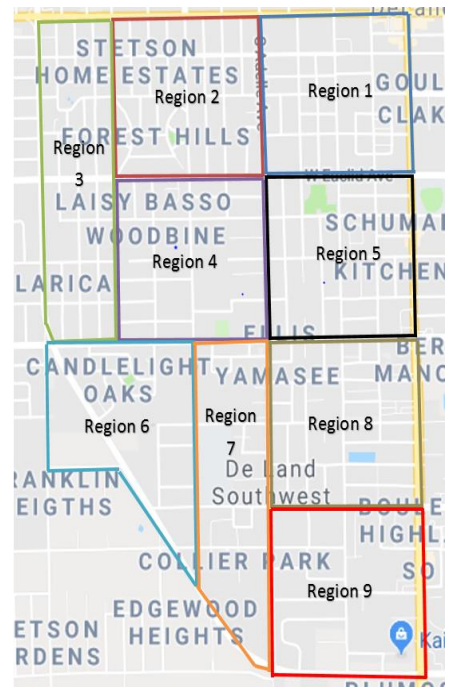
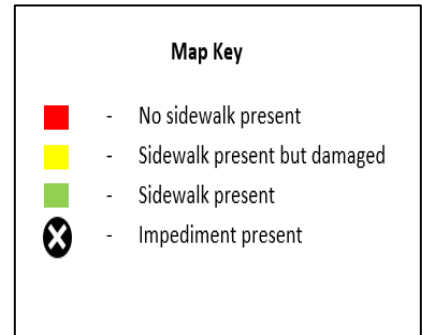
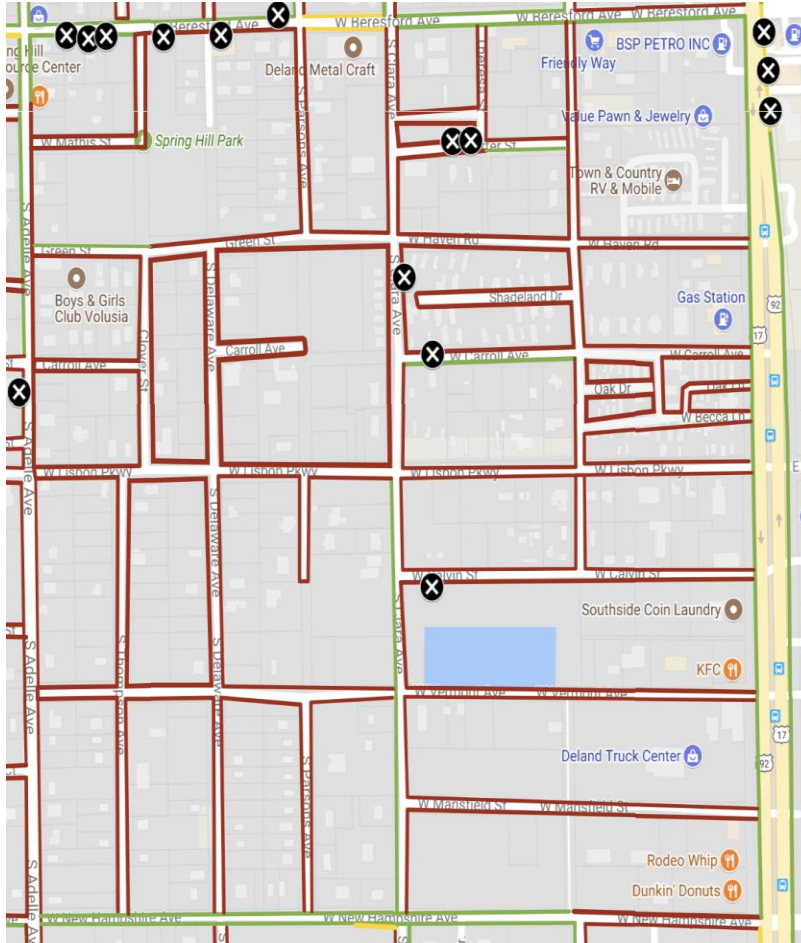
Table 8. Region 7 Survey Results (n=21)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	23.8
51-99%	71.4
100%	4.8
Graffiti Tagging (Not Including Murals)	
None	85.7
Some	9.5
Very Present	4.8
Bike Path	
None	100
Yes, painted	0
Sidewalk Present	
No	61.9
Yes, not continuous	33.3
Yes, continuous	4.8
Major Trip Hazards	
None	57.1
Some	14.3
Many	28.6
Marked Crosswalks	
None	85.7
Some	0
Adequate	14.3
Street Lights	
None	14.3
Some	76.2
Adequate	9.5
Transit Stops	
0	100
1	0
2 or more	0
Benches (Excluding Bus Stops)	
None	96.3
Some	3.7
Adequate	0

Region 8

Region 8, as shown in Figure 9, is bordered by W Beresford Ave to the north, S Woodland Blvd to the east, W New Hampshire Ave to the south, and S Adelle Ave to the West. The area within region 8 is part of unincorporated Volusia County. The overall walkability score for this region is 2.56 out of a possible 21 points. 18.5% of streets in this region have a continuous sidewalk on at least one side of the road. 18.5% of streets have some degree of trip hazard present. 88.8% of streets in this region have some degree of street lighting and 29.6% of streets have less than 50% of the buildings well maintained. Graffiti tagging was found on 3.7% of streets. None of the streets in this region were found to have bike paths, 3.7% of streets were found to have two transit stops, with both of these being found on S Woodland Blvd. As shown in figure 9, large clusters of impediments were found in this region. Impediments were found on W Beresford Ave, east of S Clara Ave, and near the corner of S Woodland Blvd and W Beresford Ave. Region 8 has 3 churches and 2 parks, including Spring Hill Park. The Lacey Family/Spring Hill Boys and Girls Club is also a major point of interest located just south of Spring Hill Park. On the other side of the intersection between S Woodland Blvd and W Haven Rd is the newly built Walmart Neighborhood Market, the first major supermarket in many years to be located within walking distance of the Spring Hill CRA.

Figure 9. Region 8 Sidewalk Infrastructure Map



Regional Divisions of Greater Spring Hill Community

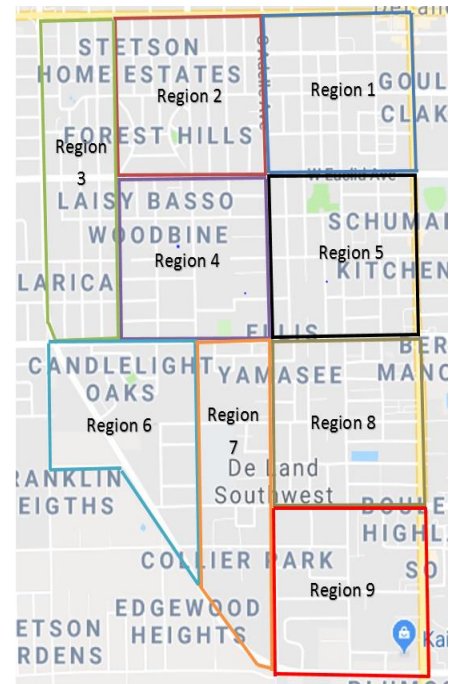
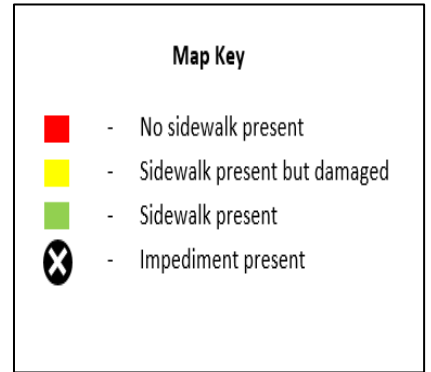
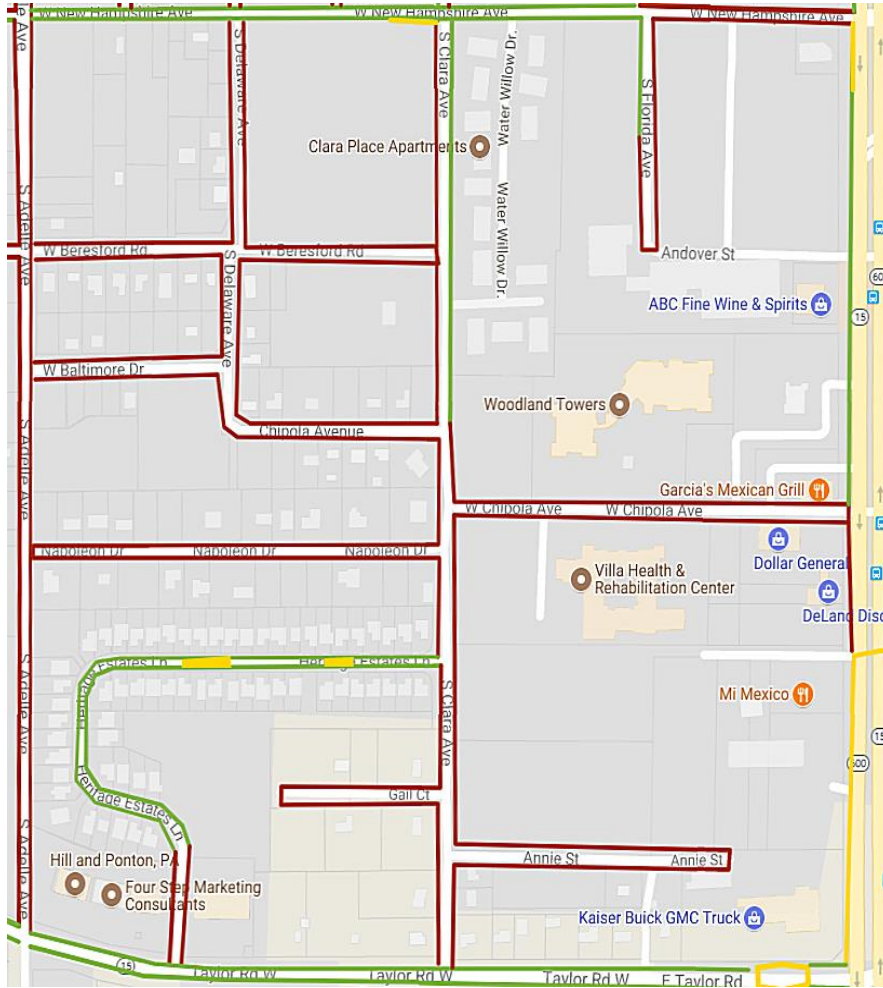
Table 9. Region 8 Survey Results (n=27)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	29.6
51-99%	70.4
100%	0
Graffiti Tagging (Not Including Murals)	
None	96.3
Some	3.7
Very Present	0
Bike Path	
None	100
Yes, painted	0
Sidewalk Present	
No	59.3
Yes, not continuous	22.2
Yes, continuous	18.5
Major Trip Hazards	
None	81.5
Some	14.8
Many	3.7
Marked Crosswalks	
None	92.6
Some	0
Adequate	7.3
Street Lights	
None	22.2
Some	59.3
Adequate	18.5
Transit Stops	
0	96.3
1	0
2 or more	3.7
Benches (Excluding Bus Stops)	
None	96.3
Some	0
Adequate	3.7

Region 9

Region 9, as shown in Figure 10, is bordered by W New Hampshire Ave to the north, S Woodland Blvd to the east, SR-15 to the south, and S Adelle Ave to the West. The area within region 9 is part of unincorporated Volusia County. The overall walkability score for this region is 4.44 out of a possible 21 points. 17.6% of streets in this region have a continuous sidewalk on at least one side of the road. 82.4% of streets have some degree of trip hazard present. 88.8% of streets in this region have some degree of street lighting and 5.9% of streets have less than 50% of the buildings well maintained. Graffiti tagging was found on 11.8% of streets. Designated bike paths were found on 17.6% of streets and 23.5% of streets were found to have a transit stop. As shown in figure 10, there were no impediments found in this region making it the only major impediment free region in Greater Spring Hill Community. Other points of interest in region 9 include 1 church.

Figure 10. Region 9 Sidewalk Infrastructure Map



Regional Divisions of Greater Spring Hill Community

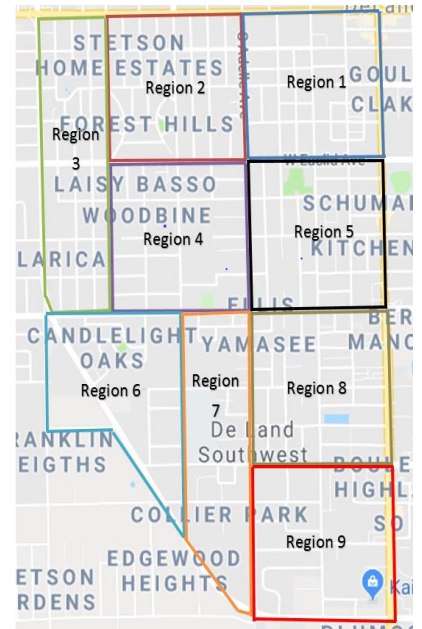
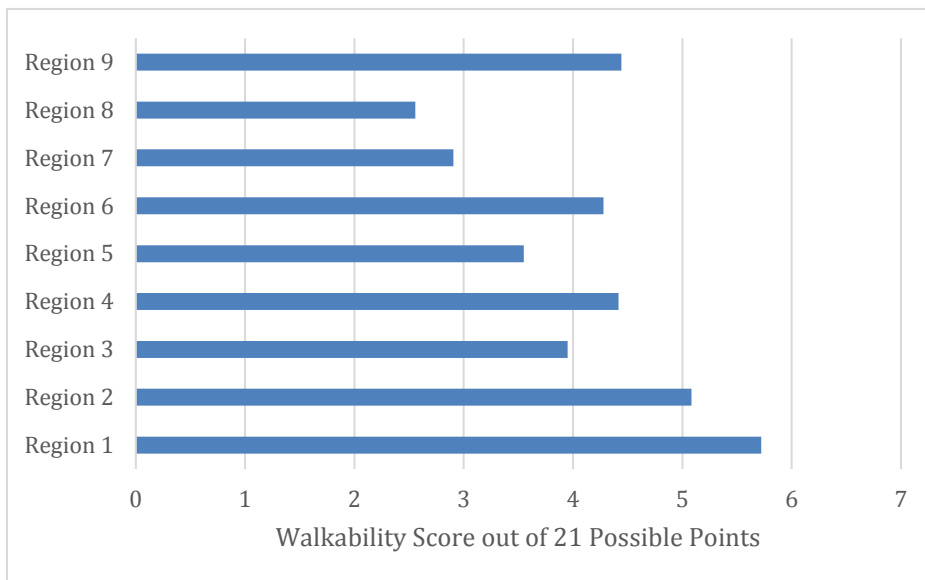
Table 10. Region 9 Survey Results (n=17)

Questions From Survey	Percent
Buildings Well Maintained	
0-50%	5.9
51-99%	64.7
100%	29.4
Graffiti Tagging (Not Including Murals)	
None	88.2
Some	11.8
Very Present	0
Bike Path	
None	82.4
Yes, painted	17.6
Sidewalk Present	
No	58.8
Yes, not continuous	23.5
Yes, continuous	17.6
Major Trip Hazards	
None	17.6
Some	70.6
Many	11.8
Marked Crosswalks	
None	76.5
Some	11.7
Adequate	11.7
Street Lights	
None	23.5
Some	41.2
Adequate	35.3
Transit Stops	
0	76.5
1	17.6
2 or more	5.9
Benches (Excluding Bus Stops)	
None	88.2
Some	5.9
Adequate	5.9

Walkability score by Region

Table 11 shows the average walkability score for each of the designated regions which is based on a 21-point scale. Region 1 had the highest score with an average of 5.72. Region 2 had a score of 5.08. The walkability score for Region 3 was 3.95. The score for Region 4 was 4.42 out of 21. Region 5 had a walkability score of 3.55. The average walkability score for Region 6 was 4.28. Region 7 had a walkability score of 2.90. Region 8 had the lowest walkability score amongst all the other regions, with an average of 2.56 out of 21 points. Region 9 had a score of 4.44

Figure 11: Walkability Score by Region

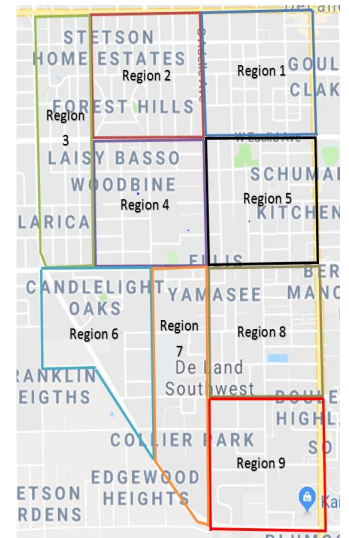
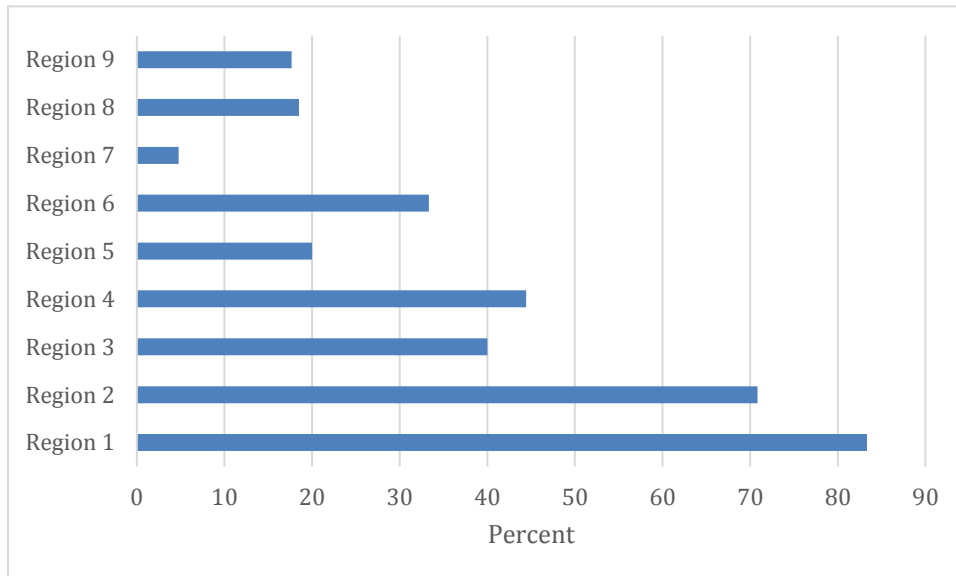


Regional Divisions of Greater Spring Hill Community

Streets with Continuous Sidewalks on at Least One Side of the Road, By Regions

Figure 12 portrays the connectivity of sidewalks on at least one side of the road. About 83.3% of the streets in Region 1 had continuous sidewalks on at least one side of the road. 70.8% of the streets in Region 2 had continuous sidewalks. In Region 3, 40% of the sidewalks were continuous and in Region 4 44.4% of the sidewalks were continuous on at least one side of the road. 20% of the streets in Region 5 have a continuous sidewalk. In Region 6, 33.3% of the streets were continuous on at least one side of the road. Region 7 had the lowest connectivity amongst sidewalks when compared to the other with only 4.8% streets being continuous. Region 8 and Region 9 had 18.5% of streets and 17.6% of streets with continuous sidewalks on at least one side of the road, respectively.

Figure 12. Streets with Continuous Sidewalks on at Least One Side of the Road, by Region

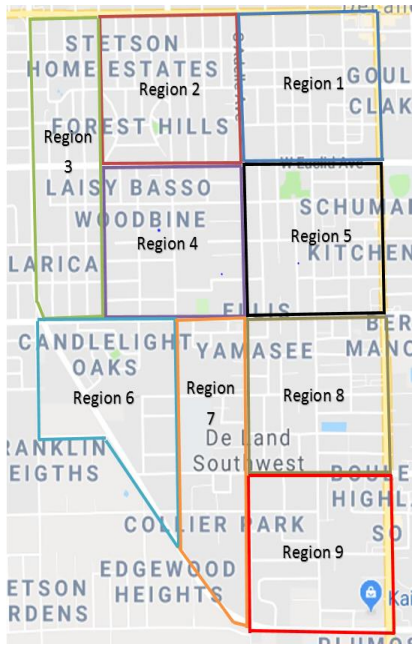
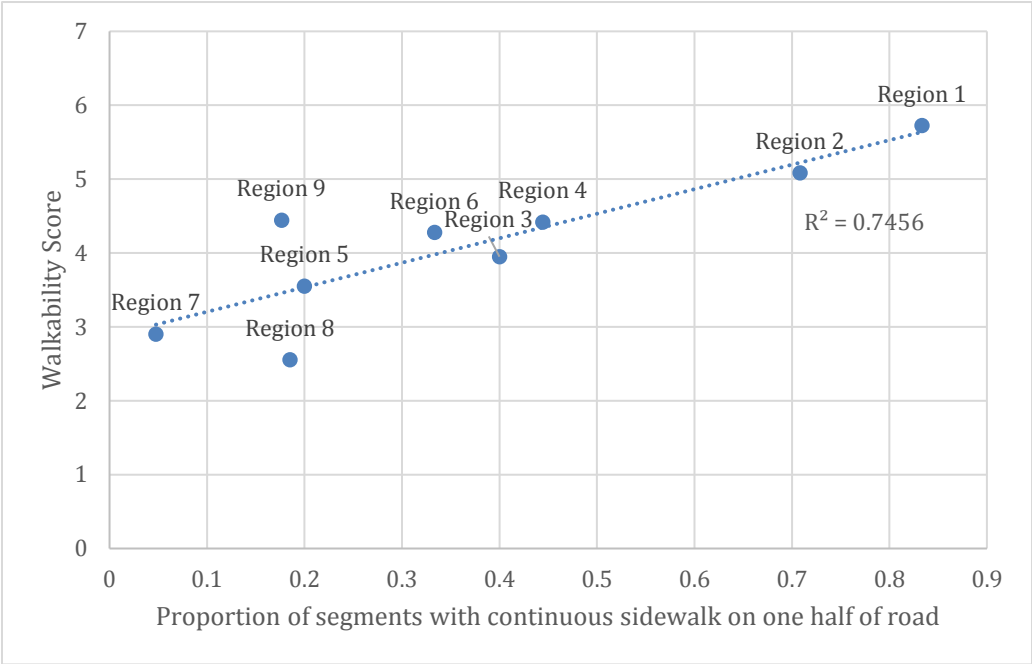


Regional Divisions of Greater Spring Hill Community

Walkability Score Proportion of Continuous Sidewalks By Region

Figure 13 shows a linear regression conducted to determine the relationship between sidewalk connectivity and walkability score between regions. The results found that increased percentage of continuous sidewalk on at least one half of the road is positively correlated with an increased overall walkability score ($r=0.863$).

Figure 13. Relationship of Walkability Score to Proportion of Continuous Sidewalk Within each Region



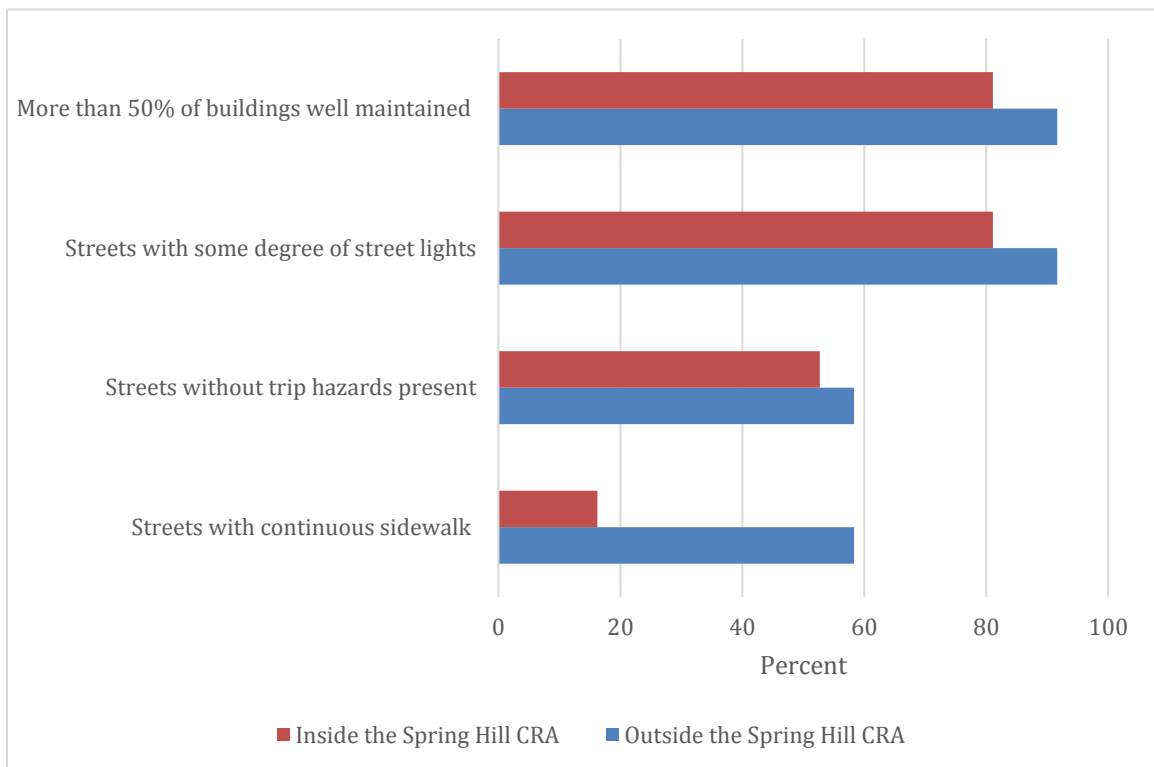
Regional Divisions of Greater Spring Hill Community

Comparison of Select Walkability Variable Inside the Spring Hill CRA and Outside the Spring Hill CRA

Figure 14 shows the comparison of variables effecting walkability inside the Spring Hill CRA (defined by regions 6-9) and outside the Spring Hill CRA (defined by regions 1-5). Within 91.7% of streets outside the CRA were found to have more than 50% of the buildings well maintained, while 81.1% of streets inside the CRA were found to have more than 50% of the buildings well maintained. The same numbers were found for streets that have some degree of streetlights with 91.7% inside the CRA and 81.1% outside the CRA. 58.3% of streets outside the CRA were found to be free of trip hazards while 52.7% of streets inside the CRA were found to be free of trip hazards. The number of streets with a continuous sidewalk on at least one half of the road was found to be 58.3% in outside the CRA, while 16.2% of streets inside the CRA were found to have continuous sidewalk on at least one half of the road.

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Figure 14. Comparison of Select Walkability Variables in Regions Outside the Spring Hill CRA (1-5) vs. Inside the Spring Hill CRA (6-9)



IV. Discussion and Recommendations

Differences exist between the overall walkability of regions located within the Greater Spring Hill Community north of Beresford Ave (1-5), referred to as outside the Spring Hill CRA, and areas of the Greater Spring Hill Community south of W Beresford Ave (6-9), referred to as the Spring Hill CRA.

Overall walkability among all regions was found to be very low, ranging from 5.72 out of a possible 21 points in region 1 to 2.55 out of a possible 21 points in region 8. Regions 6-9 within the Spring Hill CRA were found to generally have lower walkability scores (average of 3.54) than regions 1-5 found outside the Spring Hill CRA (average of 4.54).

Graffiti tagging as well as poorly maintained buildings have been found to have a negative association with physical activity and walkability within the areas where they are visible, particularly with elderly individuals (Michael, Beard, Choi, Farquhar & Carlson, 2006). Graffiti tagging was not found on any streets outside the Spring Hill CRA, but was found in every region within the Spring Hill CRA. The prevalence of streets where graffiti tagging is present is around 9.5% (n=7) of the total number of streets within the Spring Hill CRA (n=74) with the largest proportion of graffiti tagging being found in Region 7 at 14.3% (n=3) of all streets. The proportion of streets with less than 50% of buildings being considered well maintained is also disproportionately distributed, at 23.8% (n=5), 25.0% (n=4), and 29.6% (n=8) in regions 7, 5, and 8 respectively. For the same measure, all other regions had rates between 0-8.3%.

The greatest discrepancies in variables contributing to overall walkability scores were found in sidewalk connectivity. Percent of streets with continuous sidewalk on at least one half of the road, defined in the survey as “continuous sidewalk”, ranged from 83.3% (n=30) in region 1 to 4.8% (n=1) in region 7. Continuous sidewalk was found in 58.3% (n=63) of streets outside the Spring Hill CRA, while only 16.2% (n=12) of streets in the Spring Hill CRA were found to have a continuous sidewalk. Percent of continuous sidewalk in a region was found to have a positive correlation with walkability score ($r=0.863$), meaning that regions with more sidewalk connectivity were also generally found to have higher walkability scores.

Region 7 and 8 were found to have the most need for walkability improvements. Both overall walkability scores were less than 3, and sidewalk connectivity in regions 7 and 8 was found to be 4.8% (n=1) and 18.5% (n=5) respectively. The two largest cluster of impediments within the Greater Spring Hill Community were found in Region 7 just northeast of Southwestern Middle School and in Region 8 just south of Edith I. Starke Elementary. These impediments, as well as the lack of walking infrastructure, serve as significant impediments to walking to and between the schools. Improving walkability around schools has been found to significantly increase physical activity among children zoned for those schools as well as significantly decrease school aged pedestrian related injuries (Stewart, Moudon & Claybrooke, 2014; DiMaggio & Li, 2013). While the impediments around Southwestern Middle School and Starke Elementary decrease the walkability of those areas, the identification of those impediments may be used to support grant and fundraising efforts for walkability improvement projects. For example, through the national SafeRoutes to School grant program, communities with a need for

walkability improvements around schools can apply to have construction projects designed to increase sidewalk and bike path connectivity coordinated and fully funded by SafeRoutes to School (DiMaggio & Li, 2013).

While there are features that were variable between sections, some themes were generally constant throughout most regions. In the case of biking infrastructure, 98% (n=179) of streets were found to be completely lacking designated bike paths. The only region where bike paths were found was in Region 9. By improving biking infrastructure with either painted lanes or built infrastructure, communities become more attractive not only for bikers, but also for pedestrians (Walljasper, 2016.). In addition to improving walkability, biking infrastructure improvements and initiatives are significantly less expensive than vehicle infrastructure. Just one mile of urban highway in the US can cost upwards of several million dollars, while fitting roads with biking infrastructure as well as launching biking promotion programs costs on average a few thousand dollars per mile (Gardner, 2010). With more bicycles utilized, fewer cars are on the roads which contributes to improved air quality, a greater sense of community safety, and an increase in physical activity (EPA, 2018; Wright, 2018).

Walking and cycling habits have also been found to positively correlate with accessibility of public transportation, and public transportation itself has been found to increase the health of communities through increased physical activity. Additionally, these services can result in the reduction of external costs associated with congestion of traffic, risk of accidents, and the pollution resulting from vehicle emissions (Litman, 2018). Within the Greater Spring Hill Community, 3.8% (n=7) of streets had bus stops present, with all of

those routes being along S Woodland Blvd. This leads to some residents living more than two miles from the nearest bus stop, which can be problematic if a particular individual relies on public transportation as their primary mode of transit outside of the Greater Spring Hill Community.

While benches at transit stops were not included in the benches variable, our results showed a similarly low percentage of them. Of the area surveyed 94% (n=171) of streets did not have benches present. Having benches available for the public makes the environment more accommodating which results in people staying outside longer. Benches not only become objects of accommodation, but destinations where individuals walk to and socialize. In doing so, benches also increase physical activity in communities (Sallis et al., 2015). This is also beneficial for mental health as it allows individuals to build strong relationships within their community through the social interactions that a bench facilitates (Sheffield University, 2015).

Marked crosswalks have also been found to improve walkability of communities through decreasing unsafe pedestrian crossings and reducing the number of cars traveling above the speed limit. However, these figures are most representative of the impact of marked crosswalks at high traffic intersections (Schultz, et al. 2015). While over 80% (n=147) of streets in the Greater Spring Hill Community do not have marked crosswalks, many of those streets are not high traffic areas. Therefore, it is unlikely that installing or improving a marked crosswalk will have a significant impact on increasing safe pedestrian habits or decreasing speeding cars in those areas. Marked crosswalks would make the most impact in high traffic areas such those around schools, the intersection at

Adelle and Beresford, on S Woodland Blvd, and SR-15 (Schultz, et al. 2015). Following the completion of the roundabout and installation of marked crosswalks on S Woodland Blvd connecting parts of the Spring Hill CRA to the new Walmart Neighborhood Market, researchers tested the crosswalks and found that while those on the north end of the roundabout work well, the crosswalks on the south end of the roundabout did not function. In a study of a road and neighborhood very similar to S Woodland Blvd and the Spring Hill CRA, researchers found that installations of a crosswalk reduced speeding cars by 10% and reduced risky pedestrian behavior such as traffic dodging by 40% (Schultz, et al. 2015).

Street lights are also significantly correlated with increased physical activity. It is theorized that street lights improve feelings of safety and security at night, which encourage physical activity such as walking, running, and biking at night (Sallis et al., 2015). This could be important in Florida, particularly during the summer months due to the high heat index during the day. An association exists between age and a decreased capacity for heat loss, which may make those 40 years and older decrease their daytime physical activity in temperatures with a heat index of 95 degrees Fahrenheit or greater (Larose, Boulay, Sigal, Wright & Kenny, 2013). This same age group is also most at risk of developing cardiovascular disease, and therefore could also be considered one of the most in need of infrastructure that facilitates physical activity (Cunningham & Michael, 2004).

In a study which compared communities using the Mini-MAPS walkability assessment tool, overall walkability score as well as sidewalk presence, street lights, and the presence

of benches were all found to be significantly correlated with increased physical activity (Sallis et al., 2015). Through relatively inexpensive improvements such as bench and bike path installations, the availability of grant funding for street light improvement and sidewalk connectivity projects, and strategic partnerships, positive changes to the Greater Spring Hill Community can be made without the need to increase taxes or draw significant funds away from other local government initiatives.

Limitations

This assessment is a valuable tool as it identifies areas of the Greater Spring Hill Community most in need of walkability improvements along with providing a detailed map of the sidewalk infrastructure. However, this assessment did encounter some limitations. Some streets located west and south of SR-15, part of Spring Hill CRA, were not covered as they were not included in the regional map used. Because the streets that were walked had multiple blocks and curbs, question 14 of the survey, “Is there a ramp at the curb?” was not able to be answered fully, as the question did not allow for researchers to properly input how many ramps were or weren’t on each curb. There was one error in the data collection that was discovered. When surveying Region 7 volunteers erroneously labeled a stop sign as a transit stop. Upon review of the data set for errors, we subsequently discovered and corrected this mistake. However, it is possible that researchers missed additional errors in data collection. In hindsight, we came to the agreement that more categories in the “buildings well maintained” question would have been beneficial. Unfortunately, as this determination was made after data collection, researchers could not further differentiate the data for that question. Another limitation to

note is that sidewalks were counted as continuous even if there was an impediment since our survey did not have a way to differentiate between sidewalks that are continuous with an impediment present and sidewalks that end, therefore making it non-continuous. This potentially could have led to some regions having slightly higher walkability scores.

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VI. Appendices

Walkability Assessment

Walkability Matters

- Physical activity can substantially improve the nation's public health. Due to America's high obesity rates, it is important to keep the population active and healthy. Walking is one of the easiest and cheapest ways to stay physically fit. Areas that provide good pedestrian networks also offer social, economic, and environmental benefits to the community.

Assessment Process

- It helps local governments to determine their town's walkability status. The questionnaire will provide questions related to evaluating the walkability of an area or specific neighborhood. Such questions will include the condition and maintenance of walking facilities, pedestrian services, safety, among others. The results from this assessment will be analyzed and potential changes will be taken into consideration in order to improve the overall walkability the area/region being studied.

Survey

1. Is this primarily a residential or commercial segment?

Residential (0)
Commercial (1)

Decide whether the segment **predominantly** consists of residential housing or commercial buildings. If the segment is evenly split, choose 'commercial'.

2. How many public parks are present?

- 0 (0)
- 1 (1)
- 2 or more (2)



A public park should only be counted if they can be accessed along the route walked. Do not count parks beyond the route even if they can be seen from the route.

3. How many public transit stops are present?

- 0 (0)
- 1 (1)
- 2 or more (2)

One Stop

Transit stops located across the street from each other may be counted as '1' stop, as long as they service the same transit line. If the stops are far enough away that a transit user could not quickly run across the street to catch a bus, count '2'.

Two Stops

4. Are there any benches or places to sit (excluding bus stop benches)?

- None (0)
- Yes, some (0.5)
- Yes, ample (1)



Tables or benches outside of restaurants/cafés (see picture) do not count as a places to sit. These must be public seating areas.

5. Are street lights installed?

None (0)
Some (1)
Ample (2)

None:



Some (e.g., overhead street lights on utility poles with wide



Ample (e.g., regularly spaced pedestrian lamp posts)



6. Are the building well maintained?

0-50% (0)
51-99% (0.5)
100% (1)

Buildings not well maintained (one or more buildings like this)

100% of buildings well maintained



Buildings do not need to be brand new to get a 100% rating. They just need to be well kept and maintained.



7. Is graffiti/tagging present (do not include murals)?

None (0)

Yes, some (0.5)

Yes, very present (1)



8. Is there a designated bike path?

No (0)

Yes, painted bike lane (1)

Yes, bike lane separated from traffic with physical barrier (2)

Painted bike lane



Bike lane separated from



9. Is a sidewalk present?

No (0)

Yes, present but not continuous
(0.5)

Yes, present and continuous (1)

A sidewalk need not be nicely paved walking path. As long as it is paved, asphalt or concrete; it will count as a sidewalk. Count any sidewalk along a segment, whether short or long.

10. Are there poorly maintained sections of the sidewalk that constitute major trip hazards?

(e.g., heaves, misalignment, cracks, overgrowth, incomplete sidewalk)

Yes, ample (or no sidewalk present) (0)

Yes, some (0.5)

No (1)

Examples of major trip hazards

Major Trip Hazard: An increased likelihood of tripping due to a raising or lowering in the walkway. A hazard could be due to plants, tree roots, or general erosion. A major trip hazard would require pedestrians to look down to avoid

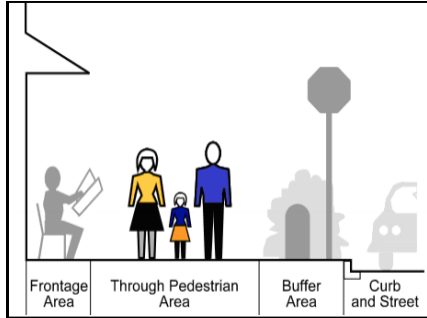
11. Is there a buffer space present between the road and sidewalk?

No/no sidewalk present (0)

Yes, some (0.5)

Yes, ample (1)

Buffer

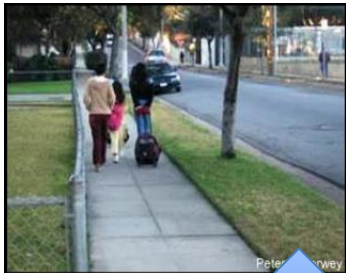


No Buffer



Buffer: Separates vehicular and pedestrian zones parallel to the edge of paved roads. They often occupy space between traffic lanes and walking paths that is not intended for either vehicle traffic or walkers. Any buffer on a segment, no matter how long, will be counted

Grass Buffer



Tree Buffer



Shrub Buffer



- Tree plantings, telephone poles or parking meters should not be considered as a buffer if there is, on average, more than 20 feet between them along the street segment.
- A bike lane does not count as a buffer.
- Brick alone next to a sidewalk would not be counted as a buffer because it is not inhibiting cars from coming onto the sidewalk.

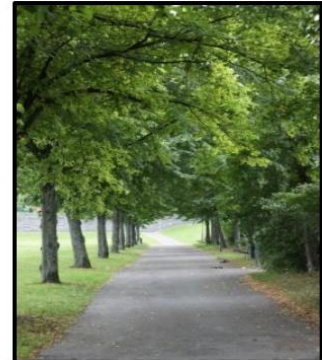
12. What percentage of the length of the sidewalk/walkway is covered by trees, awnings, or other overhead coverage?

0-25% no sidewalk/walkway (0)
 26-75% (1)
 76-100% (2)

0-25% coverage

26-75% coverage

76-100%



"Coverage" is the percent of the length of walkway covered by trees, awnings, or other structures providing shade. It need not cover the entire width of the sidewalk. Depending on the time of the year, trees may lose their leaves, so make sure to visualize the trees with their full foliage, in the middle of the day.

13. Is a pedestrian walk signal present?

No (0)
 Some (0.5)
 Yes, ample (1)



Pedestrian walk signals: Some indication for pedestrians to know when to walk or don't walk.

14. Is there a ramp at the curb?

No (0)

Yes, at one curb only (1)

Yes, at both pre- and post-crossing curbs (2)

Even if there is no marked crosswalk,
there is still a crossing

No Ramp



Ramp



15. Is there a marked crosswalk?

No (0)

Some (0.5)

Yes (1)

Marked crosswalk: A crosswalk is a designated point on a road at which some means are employed to assist pedestrians wishing to cross. They are designed to keep pedestrians together where they can be seen by motorists, and where they can cross most safely with the flow of vehicular traffic. Pedestrian crossings are often at intersections, but may also be at other points on busy roads that would otherwise be

