CONSERVE BY BICYCLING AND WALKING

PHASE II REPORT: APPENDICES

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Prepared by:

Sprinkle Consulting
Planners+Engineers+Landscape Architects

Kittelson & Associates, Inc.
Transportation Engineering/Planning

CUTR

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APPENDIX A Steering Committee Members

NAME	AFFILIATION
Dennis Scott, FDOT Project Manager	FDOT
Mariano Berrios	FDOT
Dave Blodgett	FDOT
Jennifer Carver	Florida State University
Amy Datz	FDOT
Mike Escalante	Gainesville MTPO
Laura Hallam	Florida Bicycle Association
David Henderson	Miami-Dade MPO
Mark Horowitz	Broward MPO
Dwight Kingsbury	FDOT
Mary Anne Koos	FDOT
Daniel Parker	DOH
Pat Pieratte	FDOT
Harry Reed	Capital Region TPA
Marlie Sanderson	Gainesville MTPO
Melanie Simmons	Florida State University
Ruth Steiner	University of Florida
Karl Welzenbach	Volusia County MPO
Sandra Whitehead	DOH

APPENDIX B Benefits Calculator User Guide

Bicycle and Pedestrian Facility Benefits Calculator: User Guide

Florida Department of Transportation

Safety Office: Tallahassee, FL

Introduction

This User Guide is a work product of two major Florida Department of Transportation (FDOT) Projects: the District 7 “Predicting Non-Motorized Trips at the Corridor/Facility Level” research project and the Conserve by Bicycling and Walking project. The information contained herein serves as a guide to your analysis of alternative bicycle and pedestrian facilities within a roadway corridor. It also serves as a companion to the user estimation spreadsheet that assists you in this corridor/facility analysis. The following sections describe the background of the research project (purpose, development, model specifications, and potential applications), definitions and data collection guidelines for the necessary variables, and notes for employing the user estimation spreadsheet. It is highly important for readers to recognize that the user estimation spreadsheet is the final step in a process; it is a tool that facilitates trip prediction, but can only be used correctly subsequent to other activities. Specifically, users of the spreadsheet must be aware of the appropriate applications, collect numerous data items, and prepare these data for spreadsheet entry, as described later in this User Guide.

Project Background

The FDOT and other transportation agencies are frequently faced with deciding how to best accommodate bicyclists and pedestrians in a roadway corridor and what type(s) of bicycle and pedestrian facilities to construct. One of the considerations in this decision-making process is the question of how many people would ride bicycles or walk on the new facility, the perennial question of how many users there would be if something were constructed. The trip prediction method developed by this project enables transportation professionals to answer this critical question for their particular corridors of interest. It also assists in the selection of the most appropriate facility type for their situation.

While there may be bicyclists and pedestrians along any roadway,[1] adding sidewalks and/or bike facilities is likely to increase the number of these non-motorized users. Within a

[1] Except those roadways where they are legally prohibited.

roadway corridor, this increase would consist of two primary user groups. One group is people currently making utilitarian trips (commuting to work, shopping, running errands, etc.) who would switch from the auto mode to the bicycle or pedestrian mode (i.e., the "mode shift" group). The second group is those who live nearby who would decide to walk or ride a bicycle for recreation/exercise because a new facility was provided in the roadway corridor. Because these non-motorized trips would not have been made at all if the facility were not constructed, this second group is called "*induced* recreational trips." Understanding the factors that motivate these two user groups to travel within a roadway corridor is the key to creating a reliable method of predicting non-motorized trips; the creation of this method is the primary focus of this project.

Applications

There are numerous immediate applications of this methodology that answer the question of how many people will use a bicycle or pedestrian facility. For example, transportation planners and engineers often must decide whether to add a multi-use pathway along a roadway corridor (i.e., a "sidepath"). If the results of this analysis indicate that a relatively high number of users would use the sidepath facility in the given setting, that design and/or construction project might be assigned a higher priority relative to other potential projects. In another example, the type of on-street bicycle facility to be provided in a particular corridor may be under consideration. If the number of predicted users for a low-cost bike lane in a particular setting is nearly the same as the predicted number of users for a much higher cost shared use path that requires additional right of way, the bike lane may be then deemed more cost-effective. Another application of this user prediction technique is that it will help practitioners evaluate the effects of providing sidewalks within a corridor. This is accomplished by showing variations in the number of people walking as a result of providing different qualities/characteristics of pedestrian facilities. Better estimates of non-motorized trips allows for more informed decisions regarding the provision of bicycle and pedestrian facilities within a corridor.

User estimation should not be used as the sole basis for facility decisions. It is also important to consider the level of accommodation provided to the non-motorized modes.

Accordingly, the bicycle and pedestrian levels of service models, which provide a measure of how safe and/or comfortable bicyclists and pedestrians feel in a roadway corridor, are part of the user estimation process itself and are also reported separately for the analyst's review.

The user estimation process and spreadsheet are not applicable in all settings. It is important to note that this is a *corridor-level* application. While a methodology for predicting areawide (or network-wide) non-motorized users may ultimately supplement this technique, it is currently designed to predict the number of non-motorized users for a single corridor. In addition, the technique is most appropriate for evaluating arterial and collector roads. As an example, the models are not sensitive to evaluating the impact of closing a small sidewalk gap on a local street.

Model Development

This project's research focused on the development of predictive models, specifically a mode shift model and an induced recreational model or models, to reflect the potential trip activity of the aforementioned user groups. The models were developed based on data collected as part of an extensive data collection effort. This effort included three components for each of 28 study roadway corridors: 1) an intercept survey of travelers along the corridor to identify their trip characteristics (all modes); 2) field work to measure relevant roadway (and bicycle and pedestrian facility) geometric elements and key characteristics of the surrounding transportation network; and 3) research to measure surrounding corridor demographics.

Model Specifications and Descriptions

The mode shift model takes the form of a multinomial logit model. It quantifies the utility (appeal of using) of each of the four travel modes (motor vehicle, bicycle, walk, and transit) based on certain characteristics of the travel corridor and the surrounding area. The variables that determine modal utility within a corridor include the quality of accommodation (level of service) for each of the modes, the average trip length of travelers along the corridor, the population and employment density surrounding the corridor, the income of nearby residents, and the quality of nearby bicycle and pedestrian connections.

Separate induced recreational models have been developed for the bicycle mode and the pedestrian mode. Each of these induced recreational travel models is a linear regression model that predicts the number of mode-specific induced recreational trips within the study corridor. In the case of the bicycle model, the statistically significant explanatory variables are the following:

- the corridor's bicycle level of service;
- the length of the bicycle facility;
- the number of people living within ten miles of the midpoint corridor;
- the quality of aesthetics within the corridor; and
- the prevalence of significant points of interest along the corridor.

The explanatory variables for the pedestrian model consist of factors:

- the corridor's pedestrian level of service;
- the number of people living within a half-mile of the midpoint of the corridor; and
- the quality of aesthetics within the corridor.

Detailed specifications of the models, including variable names, coefficients, and statistics, are available in the Final Report (forthcoming Appendix).

Variable Definitions and Data Collection Guidelines

As described above, many data elements are necessary to employ the process described herein. Each of the variables needed to use one or more of the models is defined in the following text. In addition, guidelines for collecting the data are offered, including any simplifying assumptions that can be made. The first item described, the determination of the analysis zone, is not a variable itself, but is needed to establish the geographic boundaries within which many of the data items are collected.

Determination of the Analysis Zone

Project research has shown that each study corridor has an area of influence, referred to herein as the “analysis zone.” This is an important concept because the benefits provided by a corridor improvement depend on both the corridor and the characteristics of the nearby area. Many of the variables defined and discussed in this section are related not to the study corridor itself, but rather to its surrounding area. These types of variables include demographics of the surrounding population and the characteristics of the surrounding roadway network, which effectively constitutes a “mini-network evaluation.” Characteristics of the surrounding network matter most when the trip length is short and the functional classification is low, and least when the trip length is long and the functional classification is high. As an example, a person traveling from Tampa to Atlanta along Interstate 75 is not generally concerned with the modal characteristics of minor streets near the interstate. In contrast, someone traveling a short distance from one neighborhood to an adjacent neighborhood becomes far more interested in the modal characteristics of all streets that could be used to make the trip. The shape of the analysis zone is an ellipse centered on the midpoint of the corridor.[2] The radii of the ellipse are determined based on the average corridor trip length (defined later in this document) and the functional classification of the roadway. The following calculations are used to determine the radii of the ellipse:

<u>Arterial</u>
Length $r = 0.25\ t$
Width $r = 0.05\ t$

<u>Collector</u>
Length $r = 0.225\ t$
Width $r = 0.125\ t$

where:
r = radius of the ellipse
t = average corridor trip length

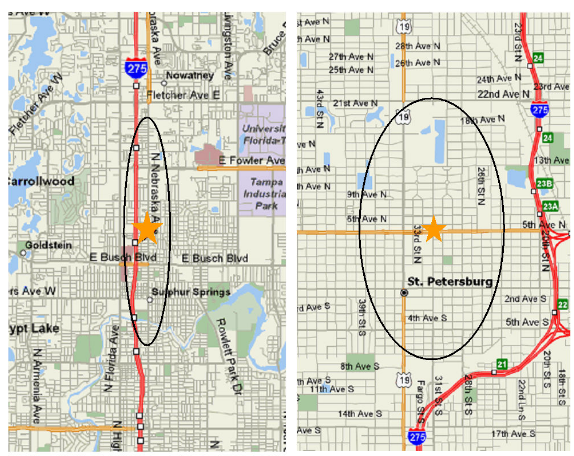

FIGURE 1 Arterial and collector analysis zones

[2] If the study corridor is angular or curvilinear, the analyst should rotate the ellipse to approximate the general path of the roadway.

Bicycle Level of Service of the Corridor

Definition: the level of accommodation provided to bicyclists within the study corridor; improved bicycling conditions lead to increased potential bicycle use along the corridor

Data Collection Guidelines: As discussed in FDOT's 2009 *Quality/Level of Service Handbook*, bicycle level of service can be evaluated at an operational level, conceptual planning level (ARTPLAN), or generalized planning level (FDOT generalized tables). It is recommended that this variable be calculated at an operational level (model inputs and calculations are shown on page 27 of the *Q/LOS Handbook).*[3] Please refer to the Spreadsheet Data Entry section of this User Guide for more information regarding how bicycle level of service data should be entered in the user estimation spreadsheet.

If the facility alternative being considered is a shared use pathway adjacent to a roadway (i.e., a sidepath), two additional data items are needed in addition to the LOS result: 1) the existing or assumed separation between the edge of the outside travel lane and the sidepath (measured in feet), and 2) the posted speed limit of the roadway.

Pedestrian Level of Service of the Corridor

Definition: the level of accommodation provided to pedestrians within the study corridor; as with the bicycle mode, improved pedestrian accommodation is associated with increased pedestrian activity

Data Collection Guidelines: Pedestrian level of service should also be evaluated at an operational level. Details of the operational level model are shown on page 29 of the *Q/LOS Handbook*. Please refer to the Spreadsheet Data Entry section of this User Guide for more information regarding how pedestrian level of service data should be entered in the user estimation spreadsheet.

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[3] Please be aware that an ARTPLAN bicycle (or pedestrian) level of service analysis will likely produce somewhat different results than an operational analysis because the ARTPLAN inputs are more generalized.

Transit Level of Service of the Corridor

Definition: the level of accommodation provided to transit users within the study corridor; better transit level of service increases the propensity of transit use

Data Collection Guidelines: In this case, the conceptual level of evaluation is described on pp. 39-41 of the *Q/LOS Handbook*, while the operational model is detailed in the *Transit Capacity and Quality of Service Manual*. The corridor transit LOS should be entered as a letter value (A-F); if the corridor is not served by transit, the transit LOS is "F."

Motor Vehicle Level of Service of the Corridor

Definition: the level of accommodation provided to motorists within the study corridor; improved motor vehicle level of service is associated with increases in the utility of both the motor vehicle mode and the transit mode, which is also related to roadway delays

Data Collection Guidelines: Operational analysis may be carried out using the procedures described in the *Highway Capacity Manual*. ARTPLAN or generalized table analyses may also be used. Regardless of the method, the motor vehicle LOS should be expressed by the A-F letter grade.

Average Corridor Trip Length

Definition: the average trip length, in miles, of all trips occurring along the study corridor; this includes motor vehicle, bicycle, pedestrian, and transit (if applicable) trips; lower corridor trip lengths lead to increased bicycling and walking, which have shorter average trip lengths, while longer corridor trip lengths make the use of non-motorized modes more impractical

Data Collection Guidelines: This variable would most likely be determined by conducting a multi-modal intercept survey along the corridor, although it could be obtained from a pre-existing source (PD&E study, corridor study, other prior survey) if available. If an intercept survey is used, it should include motorists, bicyclists, pedestrians, and (if the corridor is served by transit) transit riders who pass through the corridor sample point during the selected survey time period. The survey should ask for the trip's origin and destination to allow for determination of trip length rather than asking for the trip length directly because of the potential for respondent error.

Population/Employment Density

Definition: the density of trip ends within the analysis zone, calculated as the population multiplied by the employment (number of people employed in the area) divided by the analysis zone area; an abundance and mix of population and employment is associated with increased bicycling and walking

Data Collection Guidelines: The population density is found by calculating the population density (people per square mile) for each TAZ (or Census tract) that intersects the analysis zone. To account for the fact that some TAZs and tracts constitute a large portion of the analysis zone while others barely coincide with it, these density values are then weighted by the proportional area of each TAZ or tract to the entire area of the analysis zone. The sum of these weighted densities is the population density for the analysis zone. The same procedure is used to determine employment density (employees per square mile), except that, in the absence of TAZ-based data, zip codes are used in place of Census tracts as the geographic unit of analysis. The resulting product of population density and employment density is then divided by the area of the analysis zone and further divided by the value of 1000. An example calculation is shown below.

Tract	Population	Area (sq. mi.)	Pop. Density	Proportion	Weighted Density
110.3	6,000	1.0	6,000	0.45	2,700
110.4	7,500	0.5	15,000	0.4	6,000
118.0	4,000	2.0	2,000	0.15	300

Zip Code	Employment	Area (sq. mi.)	Emp. Density	Proportion	Weighted Density
32724	9,000	6.0	1,500	0.6	900
32720	12,000	4.0	3,000	0.4	1,200

Analysis Zone Area: 2.8 sq. mi.
Population/Employment Density = 9000*2100/1000 = 18,900

Median Household Income

Definition: the median household income within the analysis zone; a decrease in average household income is correlated with an increase in walking trips.

Data Collection Guidelines: The median household income for the analysis zone is obtained from the median household income for each TAZ (or Census tract) that intersects the analysis zone. To account for the fact that some TAZs and tracts constitute a large portion of the analysis zone while others barely coincide with it, these values are then weighted by the proportional area of each TAZ or tract to the entire area of the analysis zone. The sum of these weighted values is the median household income for the analysis zone.

Tract	Median Household Income (per family)	Intersect Area (sq. mi.)	Proportion	Contribution to Weighted Median Household Income
110.3	$45,000	1.0	0.36	$16,200
110.4	$75,000	0.5	0.18	$13,500
118.0	$62,000	1.3	0.46	$28,520
Area Weighted Median Household Income				$58,220

Analysis Zone Area: 2.8 sq. mi.

Bicycle Connectivity

Definition: the quality of the bicycle accommodation provided within the analysis zone's roadway network; a more effective bicycle network in the analysis zone increases the utility of the bicycle mode

Data Collection Guidelines:

The calculation of this variable requires several inputs: the average corridor trip length (defined previously); the mileage of arterial, collector, and local roads within the analysis zone; and the distance–weighted bicycle level of service for these classified roads (also defined previously).

Simplifying Assumptions: This analysis requires extensive field data collection for the surrounding roadways. If the user wishes to estimate bicycling conditions for these roadways, the following bicycle levels of service may be assumed for the three primary functional roadway classifications: 5.0 (“E”) for arterials, 3.0 (“C”) for collectors, and 1.0 (“A”) for local roads. These default values are based on statewide averages.

Pedestrian Connectivity

Definition: the quality of the pedestrian accommodation provided within the analysis zone’s roadway network; a more effective pedestrian network in the analysis zone increases the utility of the pedestrian mode

Data Collection Guidelines: The same inputs are needed for this variable as for bicycle connectivity, except that bicycle level of service is replaced by pedestrian level of service.

Simplifying Assumptions: The same simplifying assumptions described previously for the bicycle mode can also be applied to pedestrian level of service calculations.

Facility Length

Definition: the length, in miles, of the potential bicycle or pedestrian facility being considered; for the bicycle mode longer facility lengths lead to a greater propensity for recreational bicycle trips

Data Collection Guidelines: If the potential facility fills a gap that creates a longer overall facility, the total distance should be used. This also applies if the potential facility connects two higher level facilities (e.g., a bike lane connecting two shared use paths). If a baseline scenario is being evaluated, the existing shared lane of the roadway becomes the “facility” and the facility length is the length of the study corridor.

Surrounding Population (Bicycle Mode)

Definition: a gravity-based measure of the number of people living within ten miles of the midpoint of the study corridor (people/distance^2); a greater number of people living in proximity to the corridor leads to a greater potential for recreational bicycle travel (see Figure 2)

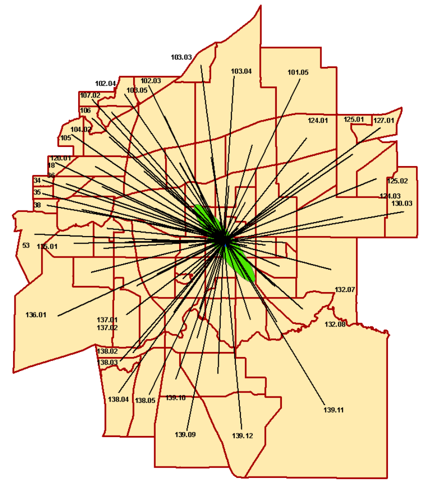

FIGURE 2 Example of GIS-based surrounding population application

Data Collection Guidelines: For each TAZ (or Census tract) within ten miles of the midpoint of the study corridor, the following steps are necessary: 1) identify the population of the TAZ or tract, 2) calculate the distance between the corridor midpoint and the centroid of the TAZ or tract, 3) square this distance, and 4) divide the population by the squared distance. The surrounding population is the sum of the values obtained in step 4 for all TAZs or tracts.

Surrounding Population (Pedestrian Mode)

Definition: the number of people living within a 0.5-mile radius of the midpoint of the study corridor; a greater number of people living in proximity to the corridor leads to a greater potential for recreational pedestrian travel (see Figure 3)

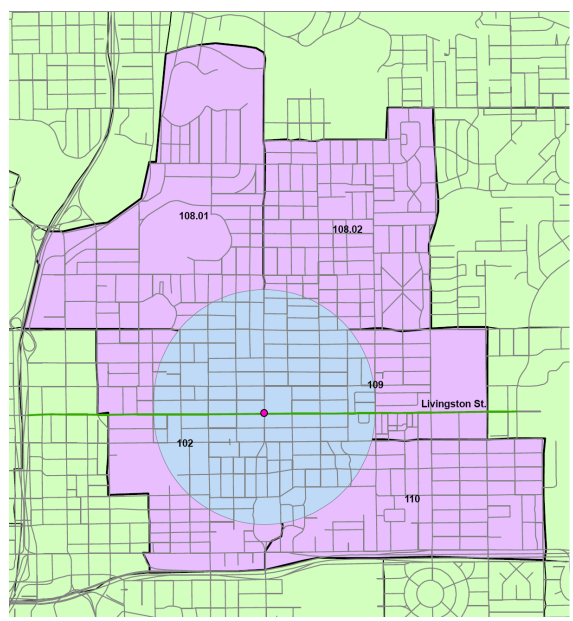

FIGURE 3 Calculating surrounding population (pedestrian mode)

Data Collection Guidelines: For each TAZ (or Census tract) that is partially or entirely located within 0.5 miles of the midpoint of the study corridor, the following steps are necessary: 1) identify the population of the TAZ or tract, 2) calculate the proportion of the TAZ or tract that is within 0.5 miles of the midpoint of the study corridor, and 3) reduce the TAZ or tract population by multiplying the population by that proportion. The surrounding population is the sum of the values obtained through this procedure for all TAZs or tracts within 0.5 miles of the midpoint.

Aesthetics/Points of Interest

Definition: a qualitative measure of the physical attractiveness of the study corridor (aesthetics); a qualitative measure of the frequency of points of interest along the study corridor (points of interest); increased recreational pedestrian activity is tied to good aesthetics along the corridor, while aesthetics and access to points of interest lead to more recreational bicycle trips

Data Collection Guidelines: The aesthetics value is assigned on a 1-5 scale with 5 representing the highest quality of aesthetics. While this value is inherently subjective, it should represent the collective viewpoint of Floridians and be graded more highly based on characteristics such as presence of trees, location adjacent to bodies of water, and absence of industrial and high-density commercial land uses (see Figure 4).

FIGURE 4 Examples of corridors with varying aesthetic values

The points of interest value is assigned on a 1-3 scale with 3 representing the greatest prevalence of points of interest. Points of interest should include (at a minimum) state and regional parks, beaches, regional tourist attractions, colleges/universities, and multi-use trails.[4] While some degree of subjectivity should be allowed in the determination of what other attractions constitute individual points of interest, the corridor should generally be assigned one of the following values:

- "3" if there are two or more adjacent designated points of interest;
- "2" if there is one adjacent designated point of interest; or
- "1" if there are no adjacent designated points of interest.

The aesthetics/points of interest variable included in the induced recreational bicycle model is the product of the aesthetics and points of interest values.

Spreadsheet Data Entry

Once all of the above data have been collected and/or compiled, the data are ready to be input into the user estimation spreadsheet. Upon opening the spreadsheet, the following data fields are empty and must be filled in by the user to complete the analysis.

Roadway Information (for characteristics that change within the study corridor, enter the predominant condition)

- Roadway Name
- Jurisdiction (owner of road)
- State Road designation (if applicable)
- U.S. Highway designation (if applicable)
- Functional classification of the roadway (choose "Arterial," "Collector," or "Shared Use Path")
- Number of through lanes on the roadway

[4] Because shared use paths fall into this last group, any shared use path corridor is considered a point of interest itself, and should have a minimum value of "2" assigned to it.

- Annual Average Daily Traffic (if this value changes along the corridor, the analyst should use the value at the midpoint)
- Number of signals along the study corridor (if the corridor begins and ends at signalized intersections, include the last signal but not the first signal)
- Presence of median (choose “Divided” or “Undivided”)
- One- or two-way (select either “One-way” or “Two-way)
- Area type (select “CBD” for central business district or “other” for all other areas)
- Speed limit
- Percentage of Heavy Vehicles
- Motor Vehicle LOS (enter letter grade as determined through ARTPLAN or generalized tables analysis)
- Pavement Condition (enter numeric value from 5 to 1 as defined in Figure 5; half-point grades, such as 3.5, may be used); FDOT’s Roadway Characteristics Inventory (RCI) includes this variable for state roads

RATING	PAVEMENT CONDITION
5.0 (Very Good)	Only new or nearly new pavements are likely to be smooth enough and free of cracks and patches to qualify for this category.
4.0 (Good)	Pavement, although not as smooth as described above, gives a first class ride and exhibits signs of surface deterioration.
3.0 (Fair)	Riding qualities are noticeably inferior to those above; may be barely tolerable for high-speed traffic. Defects may include rutting, map cracking, and extensive patching.
2.0 (Poor)	Pavements have deteriorated to such an extent that they affect the speed of free-flow traffic. Flexible pavement has distress over 50 percent or more of the surface. Rigid pavement distress includes joint spalling, patching, etc.
1.0 (Very Poor)	Pavements that are in an extremely deteriorated condition. Distress occurs over 75 percent or more of the surface.

FIGURE 5 FHWA pavement surface condition rating guidelines

Corridor Characteristics

- Average traveler trip length (includes motorists, bicyclists, pedestrians, and, if applicable, transit users; this information would most commonly be obtained through an intercept survey); ATTENTION: The value placed in this box has a significant impact on the size of the analysis zone in which data must be collected. Changing this average traveler trip length requires the network bicycle and pedestrian LOS data to be updated for the new network area.
- Aesthetics (1-5 scale; enter as defined previously)
- Points of interest (1-3 scale; enter as defined previously)
- Auto occupancy (This is the average number of individual travelers per vehicle [excluding transit vehicles] on the corridor measured in persons per motor vehicle. A value of 1.71 is assumed as a statewide average. This value may be changed if local data are available.)
- Bicycle/pedestrian facility length (length of proposed bicycle and/or pedestrian facility in miles; refer to data collection guidelines for more detail)
- Independent alignment trail? (select “Yes” if the proposed facility is a shared use path in its own alignment [i.e., not on the right-of-way of a parallel roadway]; otherwise select “No”)
- Corridor study length (this is the length of the study corridor; as opposed to the facility length, which may include other existing connected facilities, this length is only what is being studied/considered)

Transit Service

- Buses per hour (during peak hour service; must stop along the study corridor)
- Bus occupancy – the average number of individual travelers per bus on the corridor measured (peak hour persons per bus), as provided by the local transit agency or observed from field surveys
- Trains per hour (during peak hour service; must stop along the study corridor)
- Transit LOS (as determined using FDOT methodology)

Influence Area Demographics

- Pop_10 (distance-weighted population within ten miles, as defined previously)
- Pop_0.75 (population within 0.75 miles as defined previously)
- Population density (population density within the analysis zone ,as defined previously)
- Employment density (employment density within the analysis zone, as defined previously)

Roadway Geometry (for characteristics that change within the study corridor, enter the predominant condition)

- Outside lane width (width of the outside general travel lane in feet)
- Shoulder/bike lane width (width of the paved shoulder or bike lane if present)
- On-street parking width (width of striped parallel on-street parking area)
- On-street parking occupancy (peak hour occupancy level of above parking area estimated to the nearest 25%)
- Buffer width (width of area between the edge of the roadway and the sidewalk/sidepath if present)
- Tree spacing (spacing of trees located in the buffer area measured in feet on center, if present)
- Sidewalk? (enter “Yes” if a sidewalk is present or “No” otherwise)
- Sidepath? (enter “Yes” if the sidewalk is designed for bicycle use; enter “No” if there is no sidewalk or the sidewalk is not designed for bicycle use)
- Sidewalk/sidepath width (width of the sidewalk/sidepath in feet; record only the sidepath width if both are present)

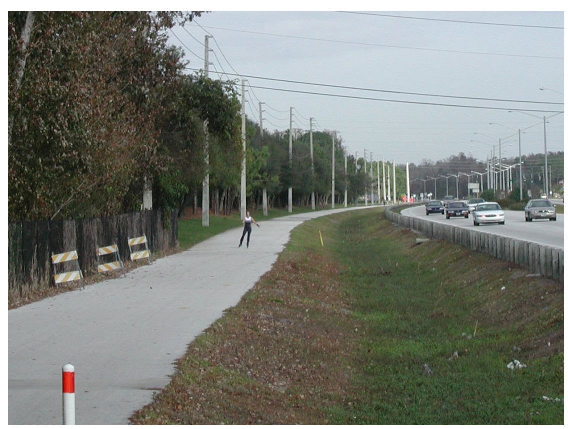

Figure 6. A Florida sidepath

Analysis Zone Bicycle and Pedestrian LOS Data

The pedestrian and bicycle connectivity measures that are calculated within the spreadsheet are based in part on the pedestrian and bicycle level of service scores of all of the roadways within the analysis zone. These level of service calculations require data entry on a separate tab of the spreadsheet and are not stand-alone inputs. To enter these data, either click on the “Enter Ped and Bike LOS Data” link or click on the “Ped_Bike LOS Entry” tab. The first data line of this screen represents the study corridor itself and has been calculated automatically based on the other data entered as described previously. Unless defaults are used, each other roadway segment in the analysis zone and its associated characteristics are entered on a separate row.

Unless highly detailed analysis is desired, it is recommended that all local roads be assigned a pedestrian and bicycle level of service of 1 (LOS “A”). This is a reasonable default value; local roads routinely have good non-motorized levels of service because of their low traffic volumes. If this option is pursued, the road name should be listed as “All Local Roads” and the total mileage should be entered in the “Length within the study ellipse” field. While this same strategy can be used for collector and arterial roads as well by applying default values of 3 (LOS “C”) and 5 (LOS “E”), respectively, this simplifying assumption is not recommended because of the more widely varying characteristics of higher class roadways.

Assuming that individual roads are entered, the required characteristics must be field measured and entered for each collector and arterial within the analysis zone using the variable definitions described previously.

Interpreting the Results

Output Fields

The output fields of the Corridor-level Mode Shift and Induced Recreational Travel Estimation/Prediction Spreadsheet are provided in the yellow cells at the bottom of the input screen. These output fields provide two sets of values: the forecast mode splits for the study roadway corridor and the predicted daily non-motorized recreational trips along the corridor.

Mode Splits The mode split output cells (B55:G59) provide three sets of values. The first column shows the number of person trips forecast to use each of the four considered travel modes.[5] These values represent the number of individual travelers who would choose each travel mode. Vehicle and pedestrian volumes are shown in the next column. For motorists and transit users, these values are based on the application of vehicle or bus occupancy rates to the person trip volumes. The third column, the number of facility users, shows the total number of utilitarian users forecast to use any portion of the facility in one day. This “facility” value includes the application of extrapolation factors to account for the effects of the facility length and the average bicycle and pedestrian trip lengths.

Induced Recreational Users The induced recreational use cells (J55:K59) provide two measures for the number of non-motorized recreational users forecast for the study roadway corridor. The first column displays the number of trips forecast to pass over the midpoint of the corridor per day. As with the mode splits, the value in the “facility” column is the total number of users forecast to use any portion of the facility in one day, not only the number of daily users at the midpoint.

Total Users For the motor vehicle and transit modes, the “Total Users” column (M55:M59) is simply the calculated mode split volumes with vehicle occupancy rates applied. For the bicycle and pedestrian modes, the sum of the mode split facility users and the induced recreational trip facility users is calculated to show total daily non-motorized along the corridor.

Benefit Fields – The benefits fields (P55:S59) provide information on three benefits realized from providing for bicycle trips:

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[5] It is assumed that sufficient transit capacity exists to handle the forecast transit volume.

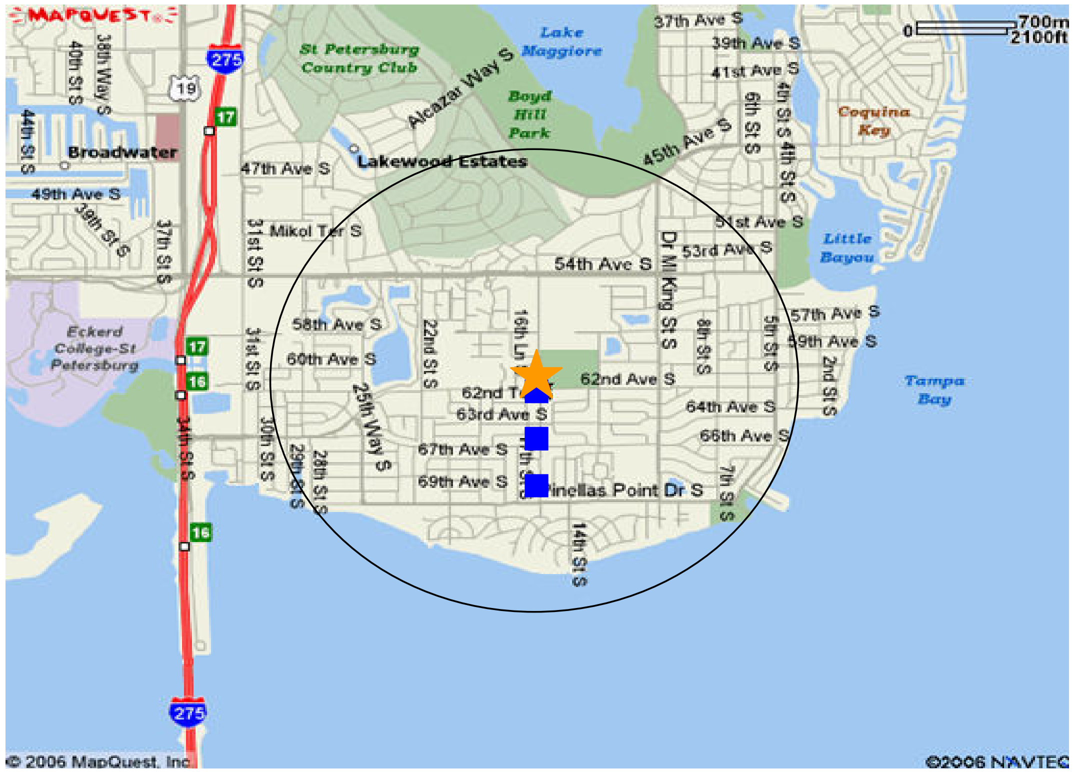
- Fuel savings – This an estimate of the fuel savings realized from people using bicycles or walking for trip as opposed to driving. This benefit is calculated based on the number of utilitarian trips taken.
- CO^2 reductions -- This an estimated reduction in CO^2 emissions that would be realized from people using bicycles or walking for trips as opposed to driving. This benefit is calculated based upon the number of utilitarian trips taken.
- Fuel cost benefits – This is a conversion of the fuel savings into a cost value, assuming a cost of $2.50 per gallon.
- Health benefits – This is an estimated health benefit that would result from more people bicycling and walking. This benefit is calculated for both recreational and utilitarian trips taken.

There are numerous assumptions that go into calculating these benefits. These include average fleet miles per gallon, average emissions for a one mile car trip, average emissions for a three mile car trip, and health costs savings per recommended daily unit of exercise. Values for these assumptions are shown on the “Benefits” tab of the calculator.

APPENDIX C Network Analysis Zones

Network Analysis Zone

#1 - 16th St S from 62nd Ave S to Pinellas Point Dr S, St. Petersburg



Local

Length r = 0.2*5.68 = 1.14 mi

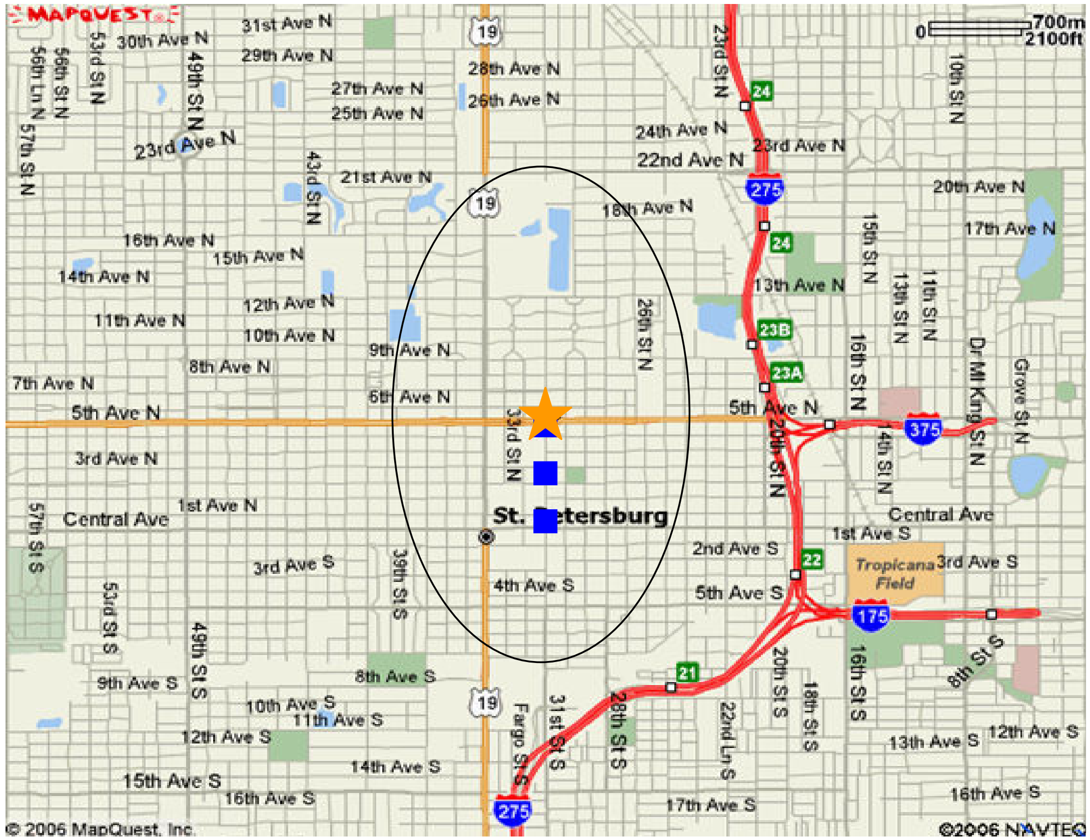
Width r = 0.2*5.68 = 1.14 mi

Study Corridor

Survey Location

Network Analysis Zone

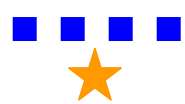
#2 and #22 - 31st St N from Central Ave to 5th Ave N, St. Petersburg



Collector

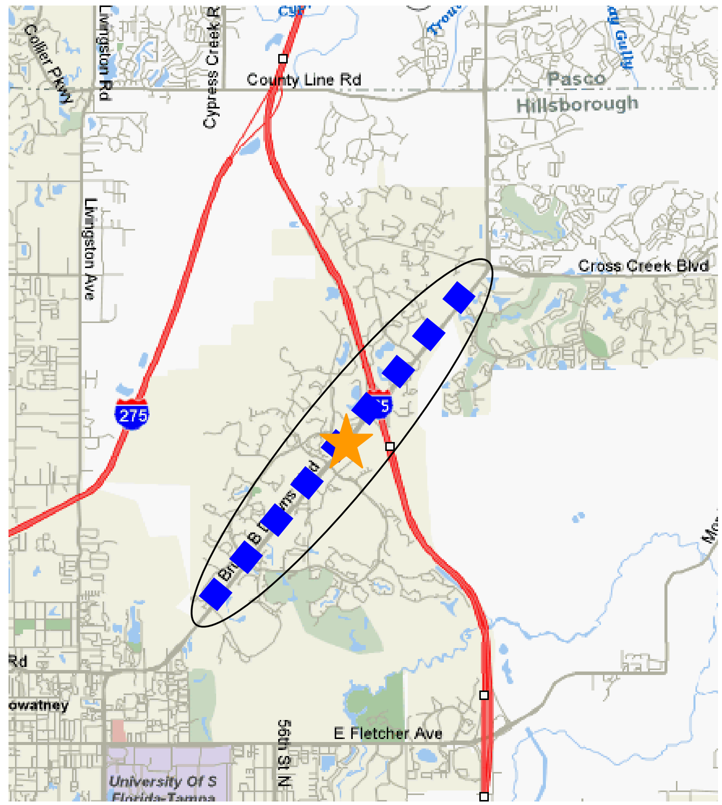
Length r = 0.225*5.05 = 1.14 mi

Width r = 0.125*5.05 = 0.63 mi



Network Analysis Zone

#3 – C.R. 581 from Amberly Dr to Hunter's Green Dr, New Tampa

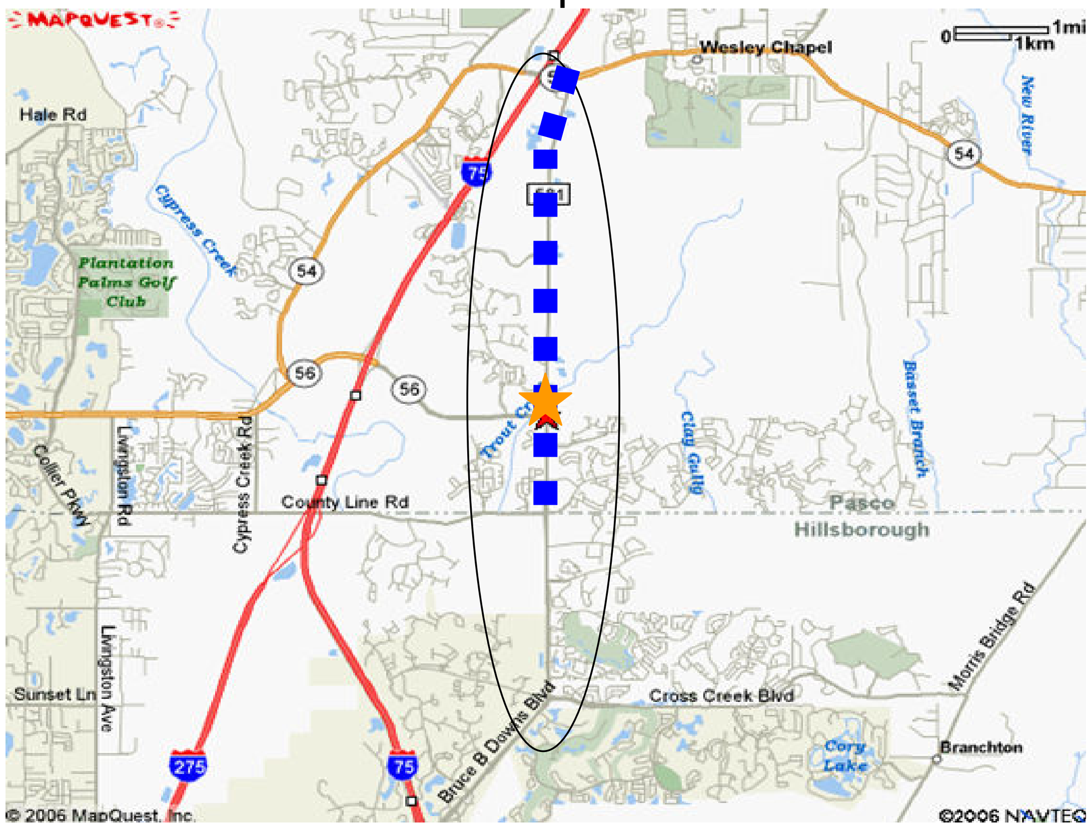


Arterial
Length r = 0.25*11.09 = 2.77 mi
Width r = 0.05*11.09 = 0.55 mi

Study Corridor
Survey Location

Network Analysis Zone

#4 – S.R. 581 from Hillsborough County Line to S.R. 54, Wesley Chapel



Arterial

Length r = 0.25*16.13 = 4.03 mi

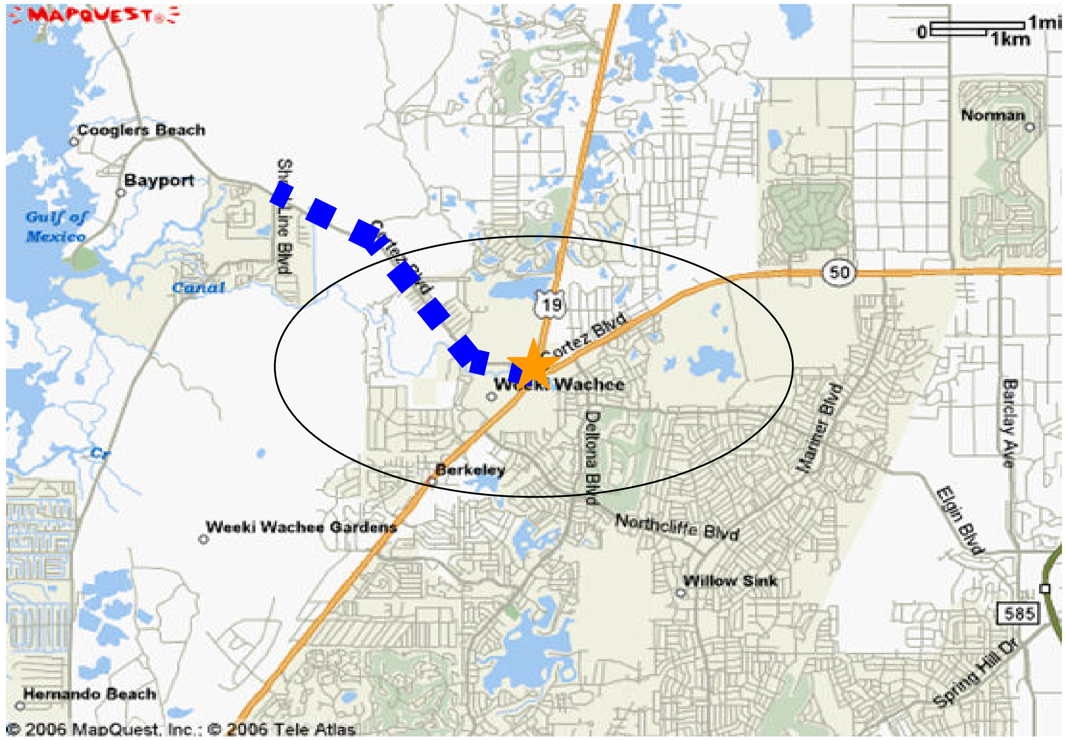
Width r = 0.05*16.31 = 0.81 mi

Study Corridor

Survey Location

Network Analysis Zone

#5 – C.R. 550 from Shoal Line Blvd to U.S. 19, Weeki Wachee



Collector

Length r = 0.225*12.34 = 2.78 mi

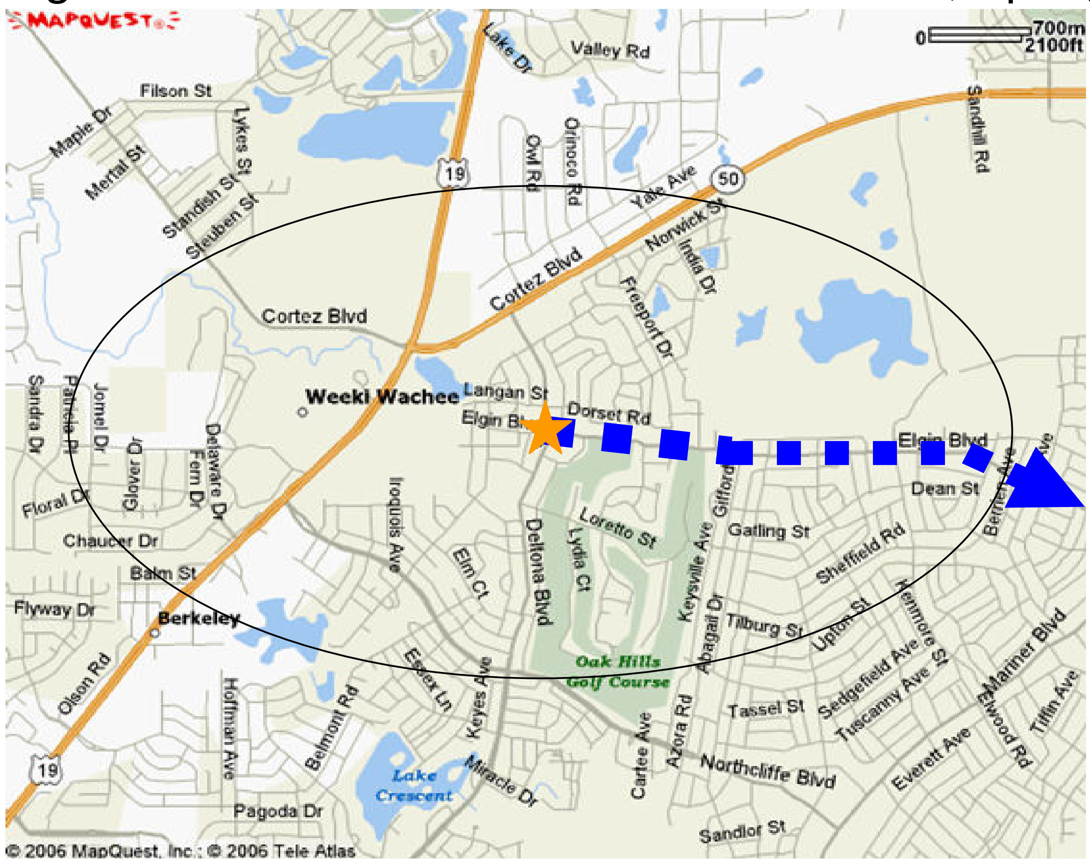
Width r = 0.125*12.34 = 1.54 mi

Study Corridor

Survey Location

Network Analysis Zone

#6 - Elgin Blvd from Deltona Blvd to Mariner Blvd, Spring Hill



Collector

Length r = 0.225*8.92 = 2.01 mi

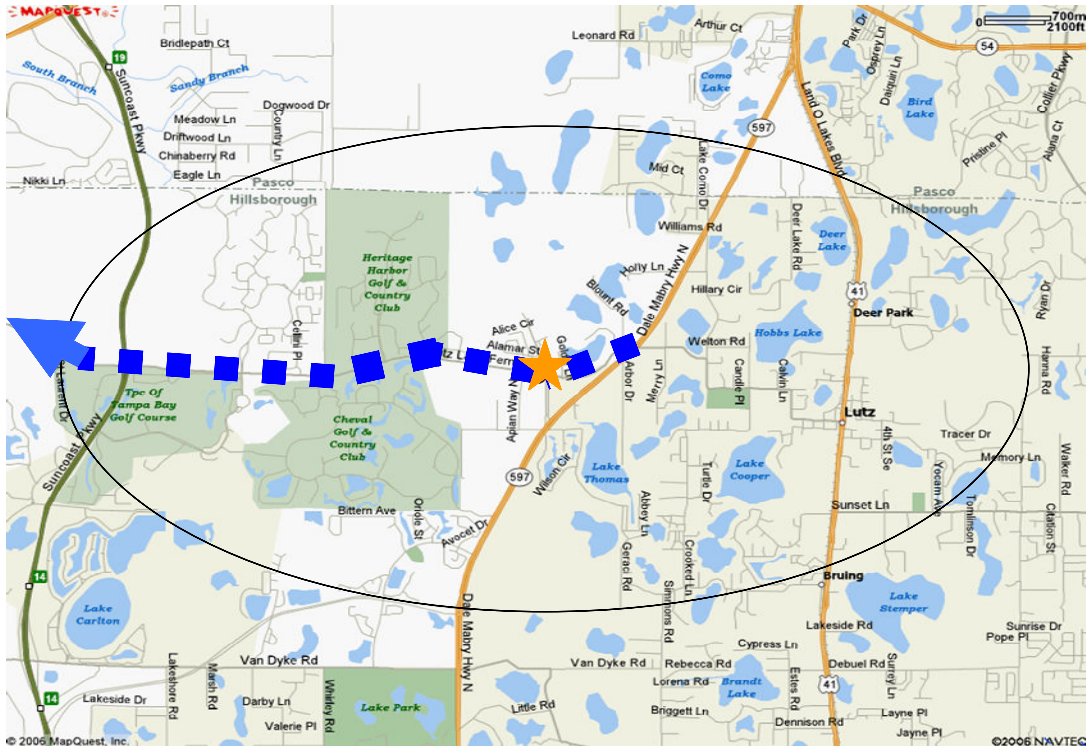
Width r = 0.125*8.92 = 1.11 mi

Study Corridor

Survey Location

Network Analysis Zone

#7 - Lutz-Lake Fern Rd from Gunn Hwy to Dale Mabry Hwy, Lutz



Collector

Length r = 0.225*14.56 = 3.28 mi

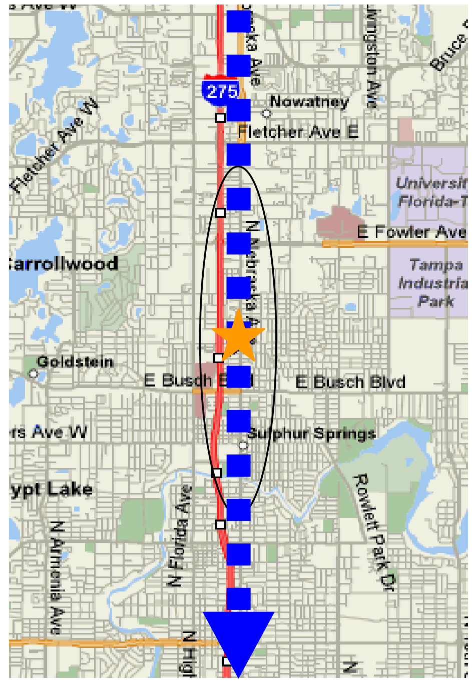
Width r = 0.125*14.56 = 1.82 mi

Study Corridor

Survey Location

Network Analysis Zone

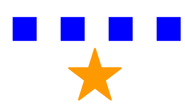
8 – U.S. 41 from Kennedy Blvd to Bearss Ave, Tampa



Arterial

Length r = 0.25*8.07 = 2.02 mi

Width r = 0.05*8.07 = 0.40 mi

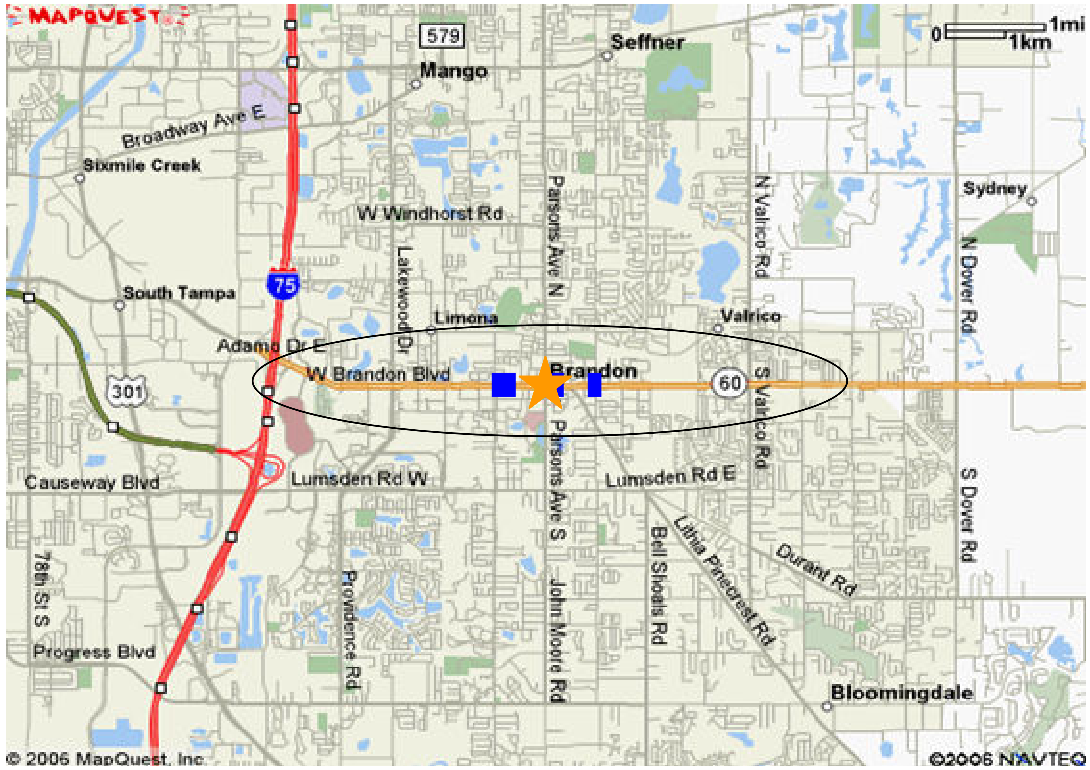


Study Corridor

Survey Location

Network Analysis Zone

#9 – S.R. 60 from Kings Ave to Kingsway Rd, Brandon



Arterial

Length r = 0.25*12.08 mi = 3.02 mi

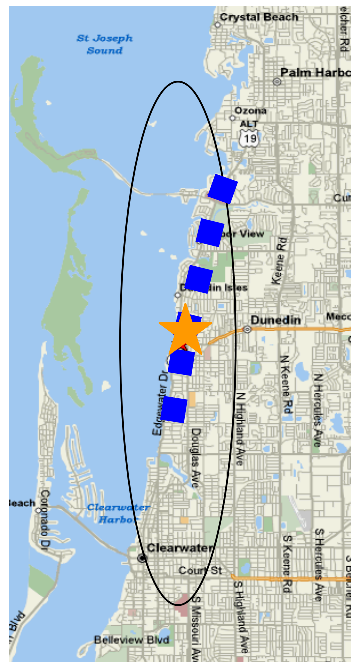
Width r = 0.05*12.08 mi = 0.60 mi

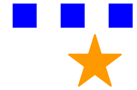
Study Corridor

Survey Location

Network Analysis Zone

#10 – U.S. Alt. 19 from Union St to Orange St, Dunedin (Pinellas Trail)





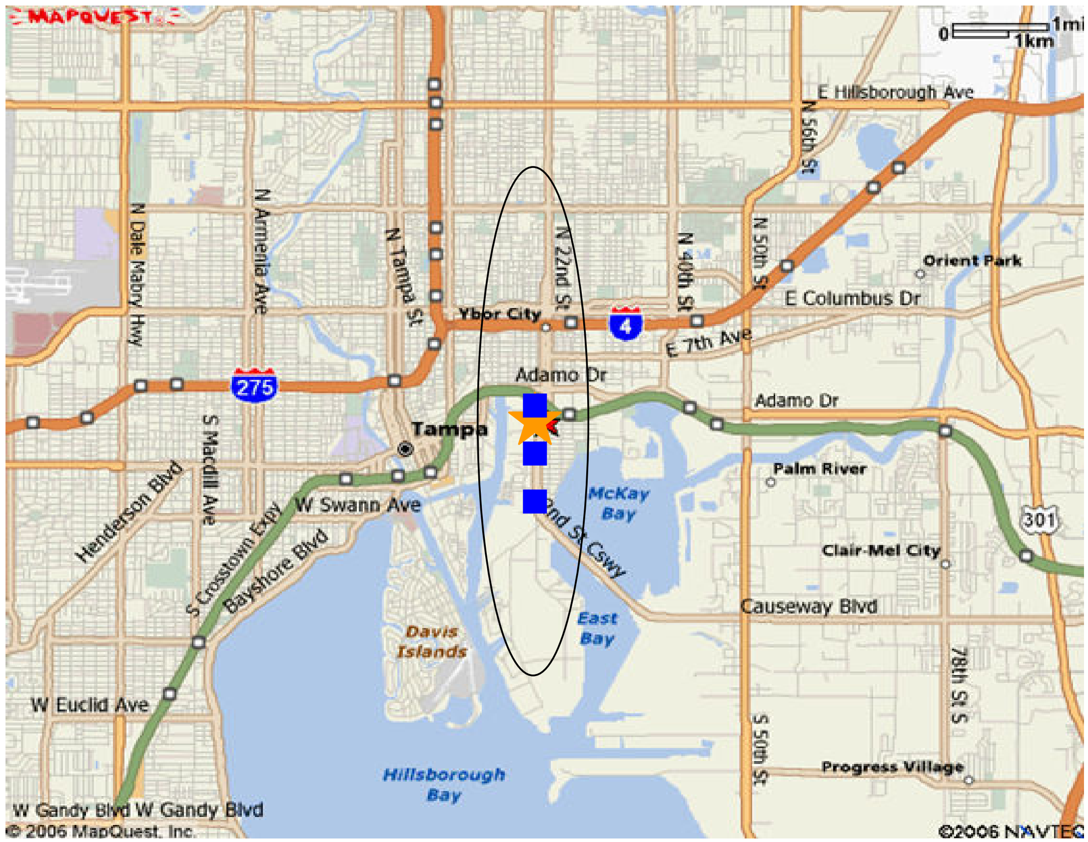
Arterial

Length r = 0.25*12.47 = 3.12 mi

Width r = 0.05*12.47 = 0.62 mi

Network Analysis Zone

11 - S 20th St from Adamo Dr to Bermuda Blvd, Tampa



Arterial

Length r = 0.25*11.55 = 2.89 mi

Width r = 0.05*11.55 = 0.58 mi

Study Corridor

Survey Location

Network Analysis Zone

#12 – U.S. 1 from I-95 to SW 67th Avenue, Miami (M Path)

Arterial

Length r = 0.25*10.40 = 2.60 mi

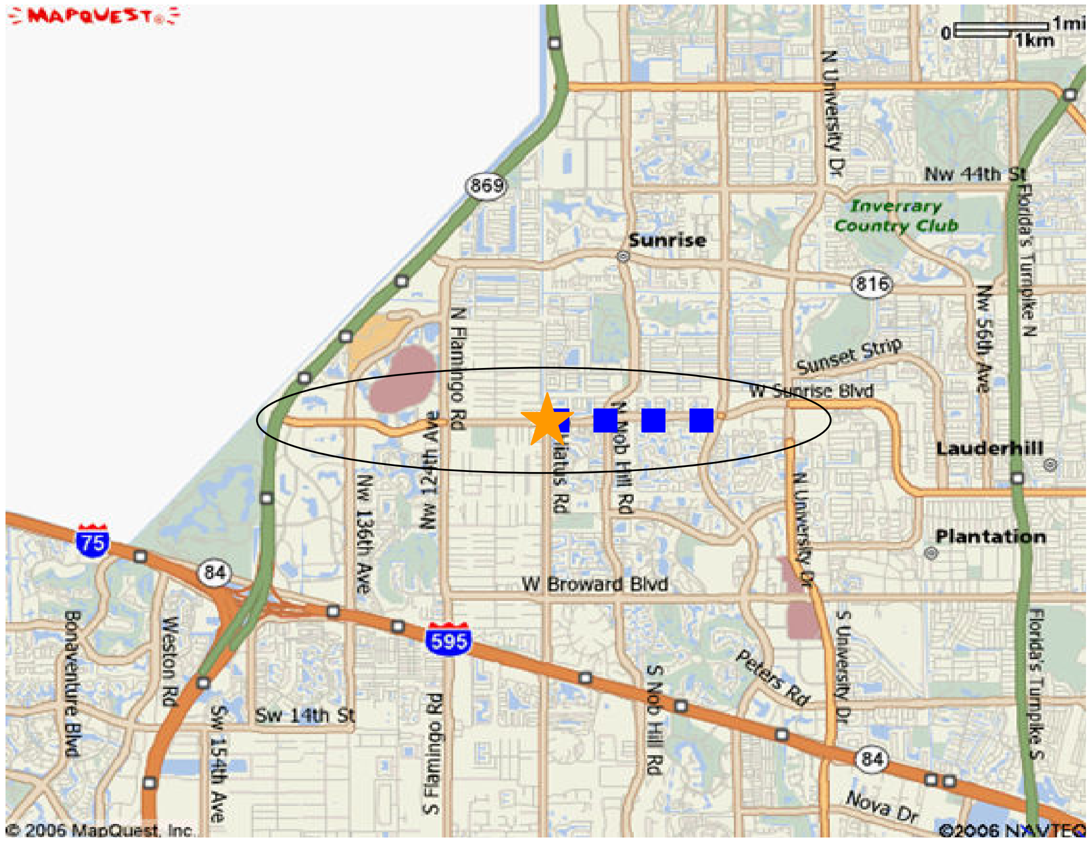
Width r = 0.05*10.40 = 0.52 mi

Study Corridor

Survey Location

Network Analysis Zone

#13 - Sunrise Blvd from Hiatus Rd to Pine Island Rd, Plantation



Arterial

Length r = 0.25*12.07 = 3.02 mi

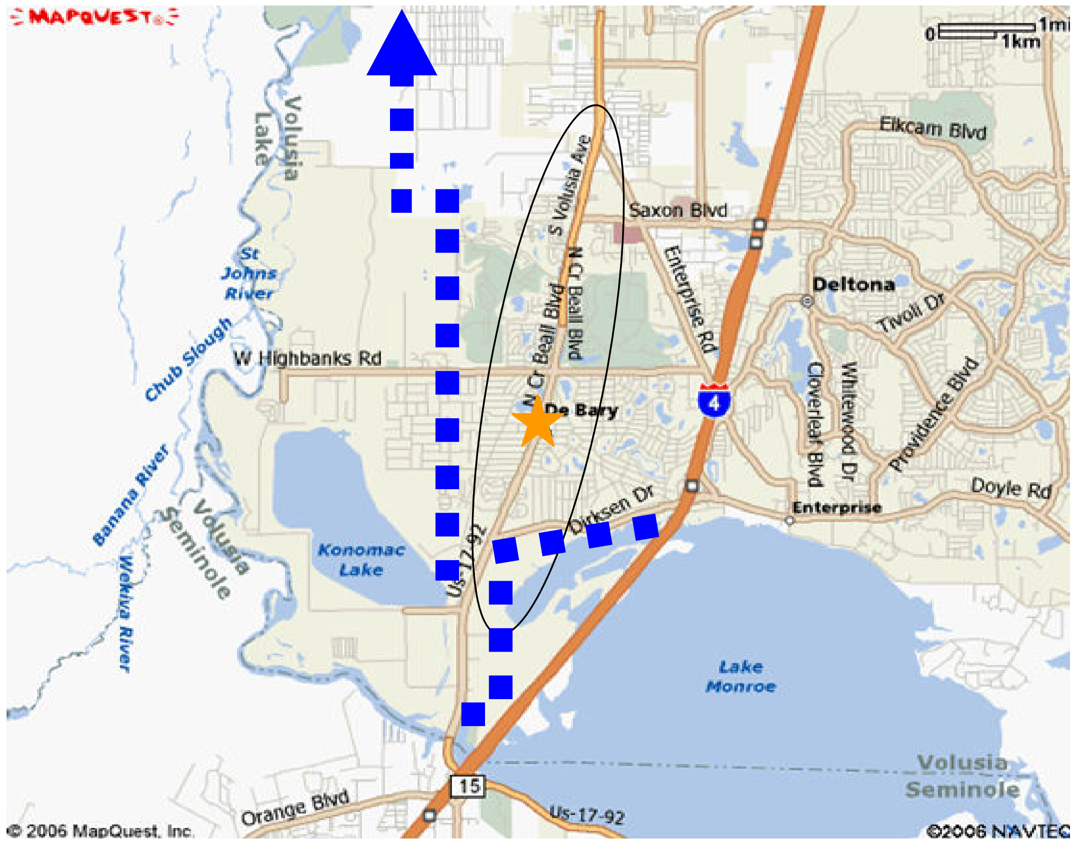
Width r = 0.05*12.07 = 0.60 mi

Study Corridor

Survey Location

Network Analysis Zone

#14 - Spring to Spring Trail, Orange City



Arterial

Length r = 0.25*12.23 = 3.06 mi

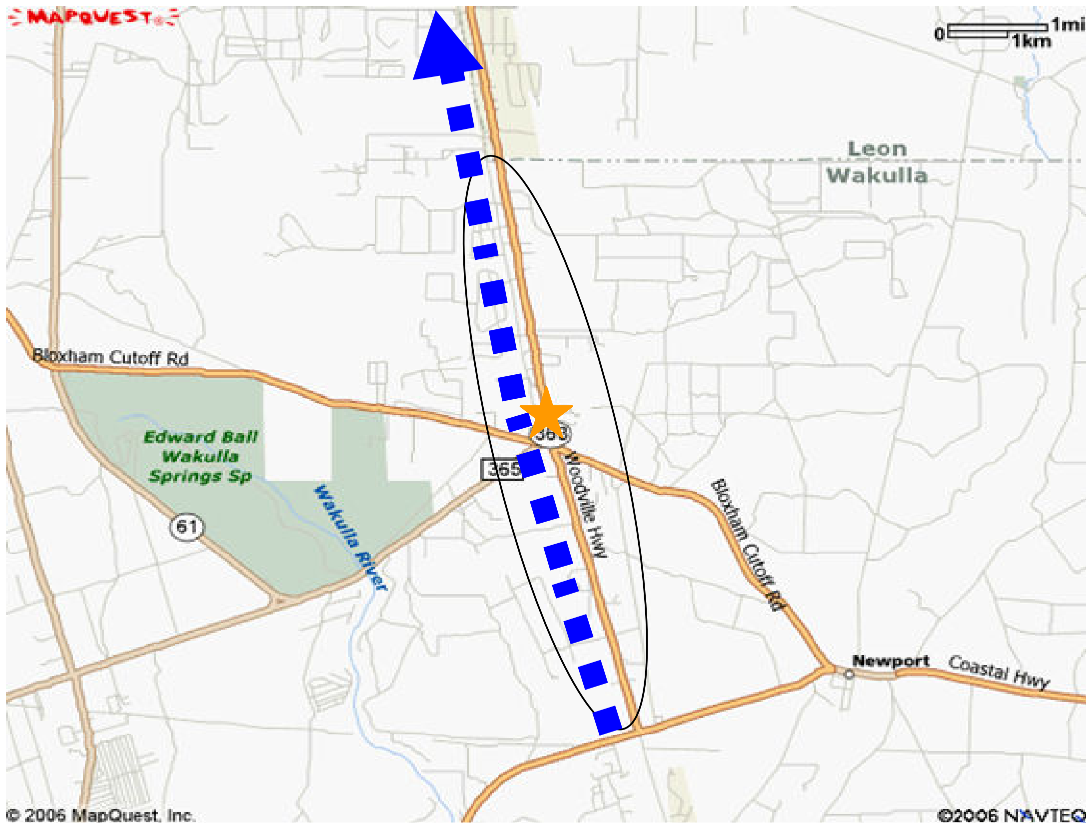
Width r = 0.05*12.23 = 0.61 mi

Study Corridor

Survey Location

Network Analysis Zone

#15 - St Marks Trail, Wakulla



Arterial

Length r = 0.25*13.62 = 3.40 mi

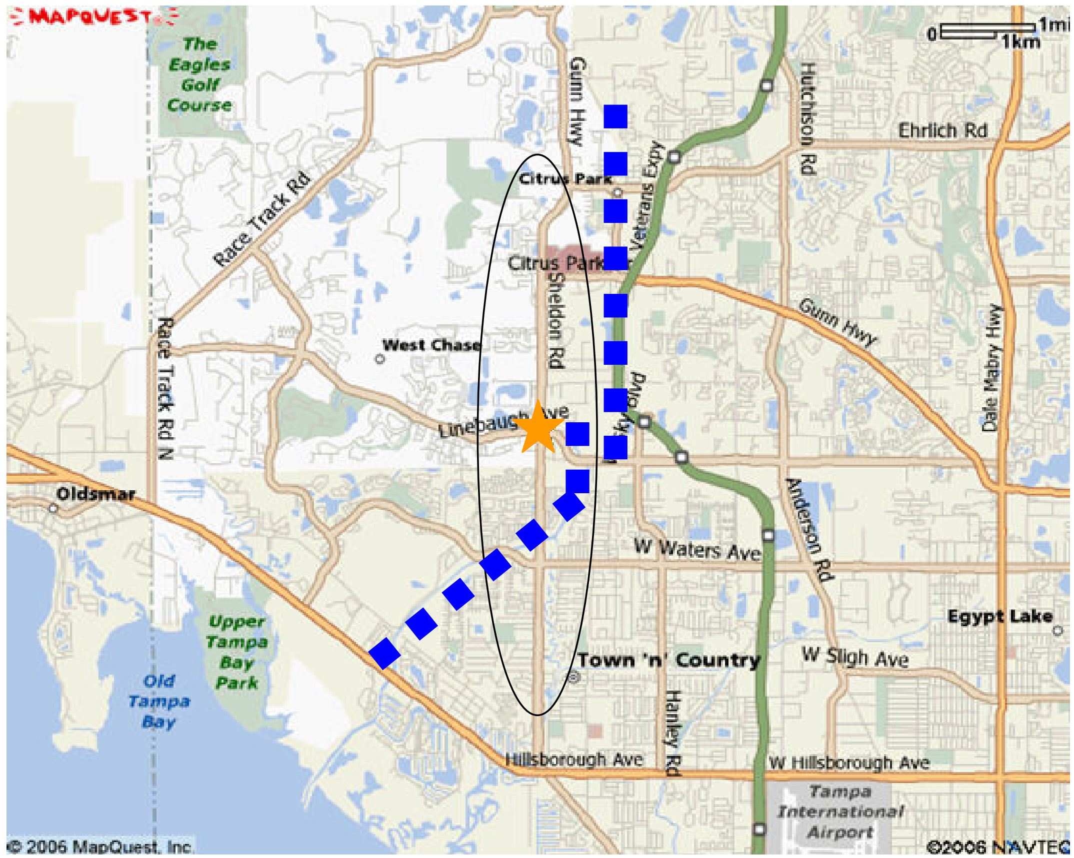
Width r = 0.05*13.62 = 0.68 mi

Study Corridor

Survey Location

Network Analysis Zone

#16 - Upper Tampa Bay Trail, Tampa



Arterial

Length r = 0.25*12.54 = 3.13 mi

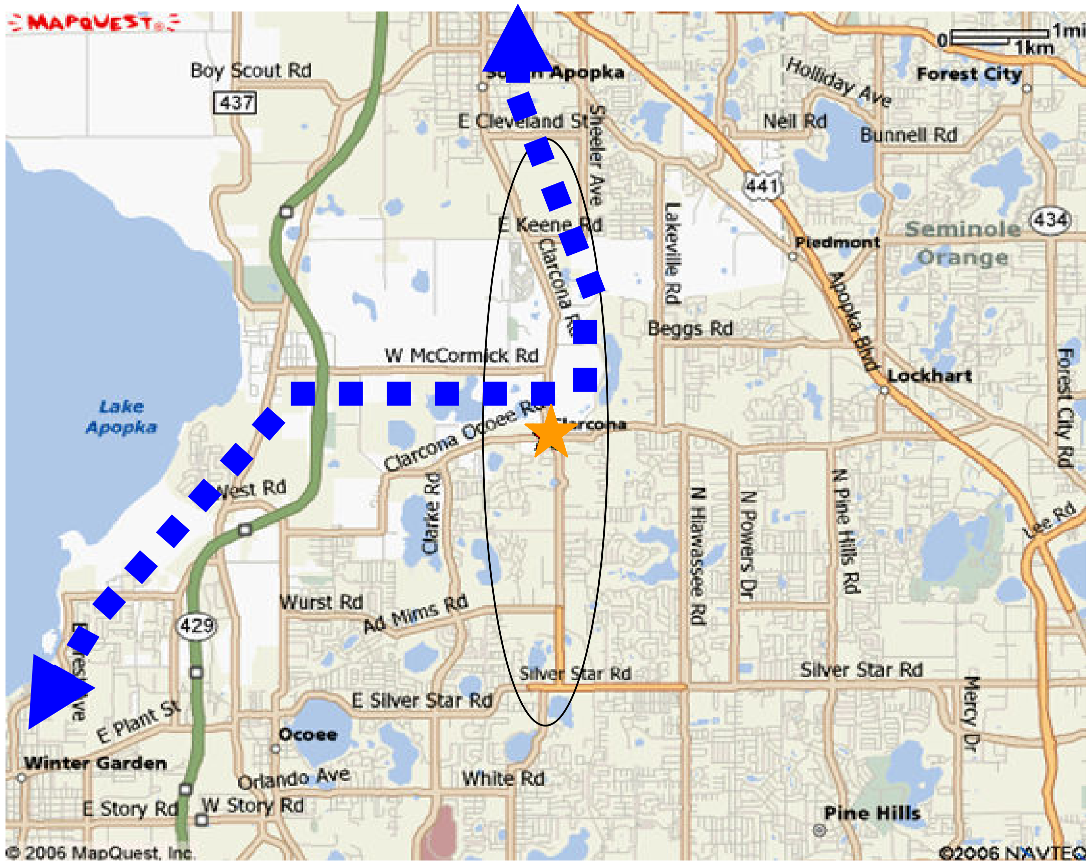
Width r = 0.05*12.54 = 0.63 mi

Study Corridor

Survey Location

Network Analysis Zone

#17 - West Orange Trail, Apopka



Arterial

Length r = 0.25*13.08 = 3.27 mi

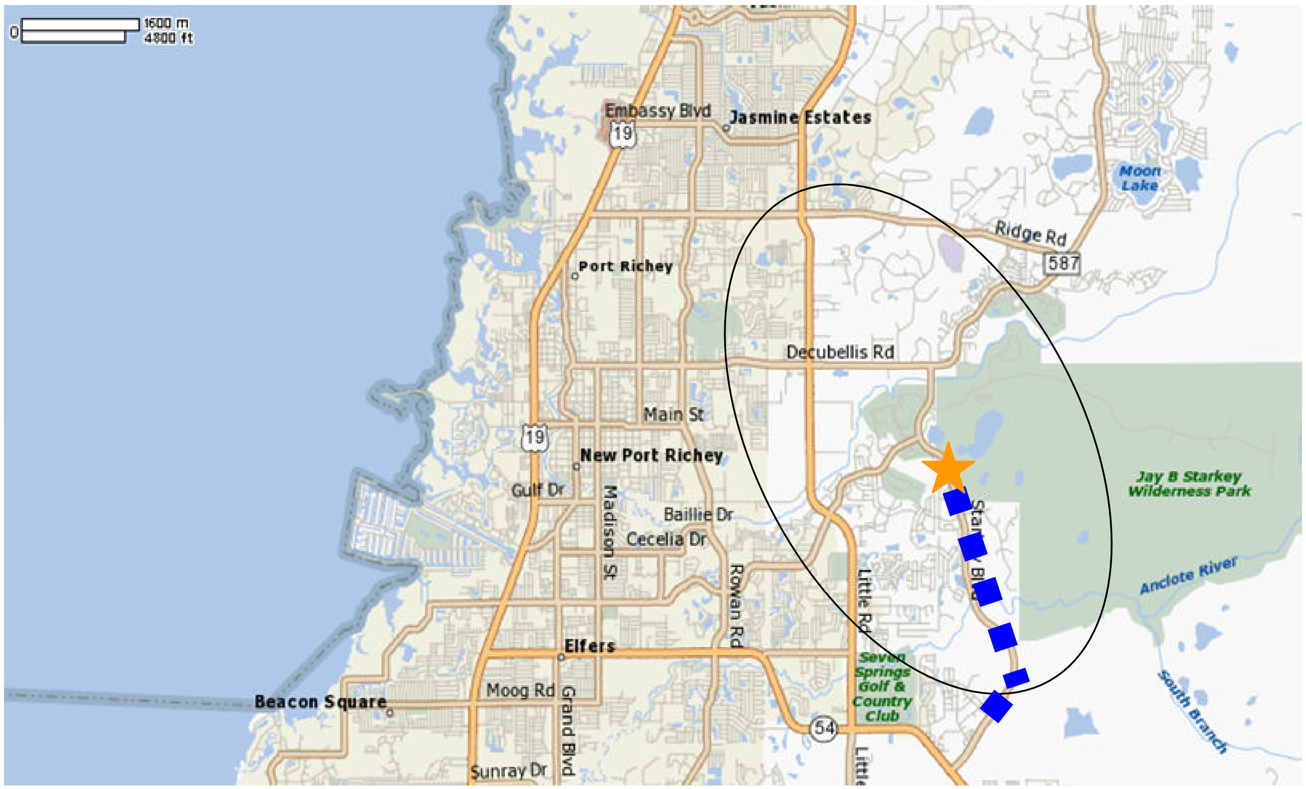
Width r = 0.05*13.08 = 0.65 mi

Study Corridor

Survey Location

Network Analysis Zone

#18 – Starkey Boulevard, New Port Richey



Collector

Length r = 0.225*18.26 = 4.11 mi

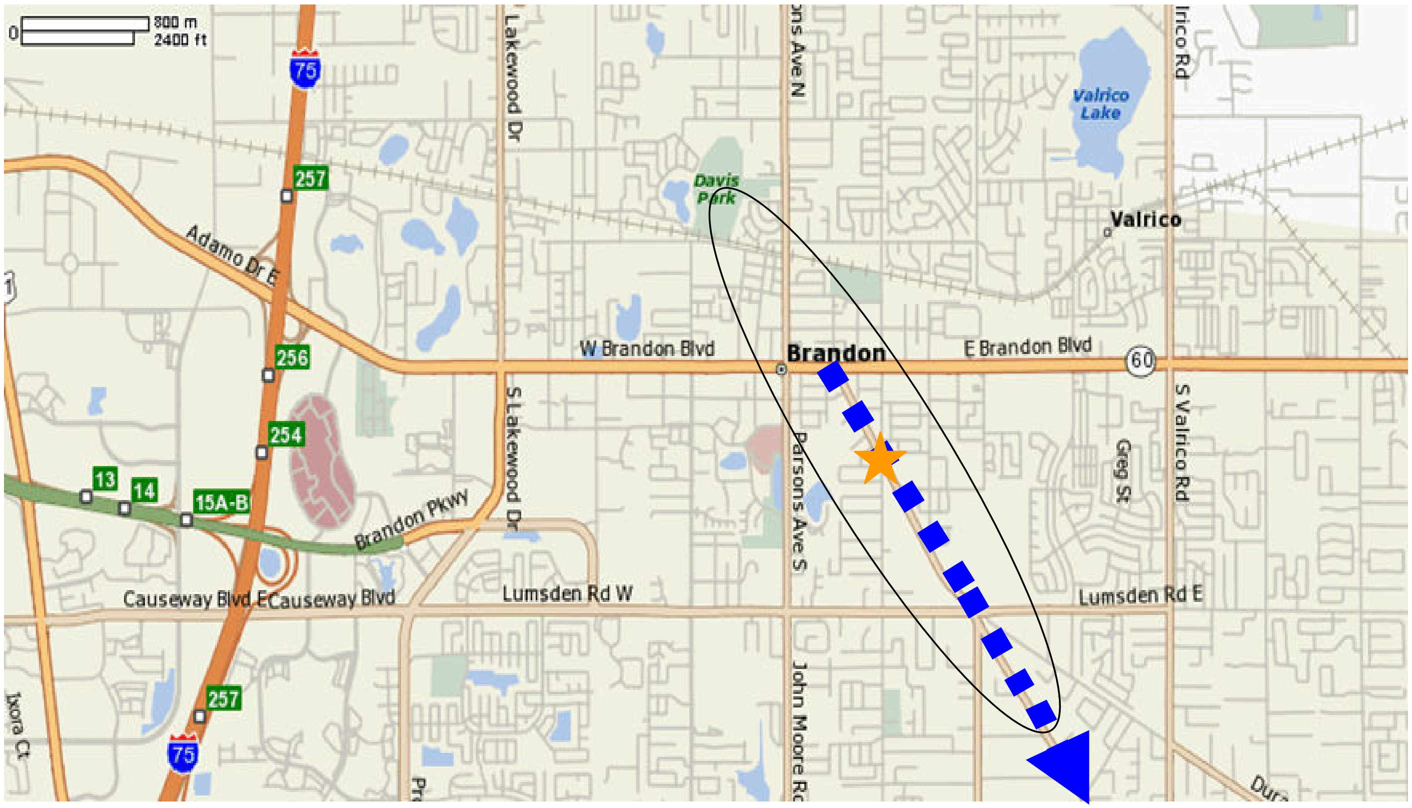
Width r = 0.125*18.26 = 2.28 mi

Study Corridor

Survey Location

Network Analysis Zone

#19 – Lithia-Pinecrest Road, Brandon



Arterial

Length r = 0.25*9.63 = 2.41 mi

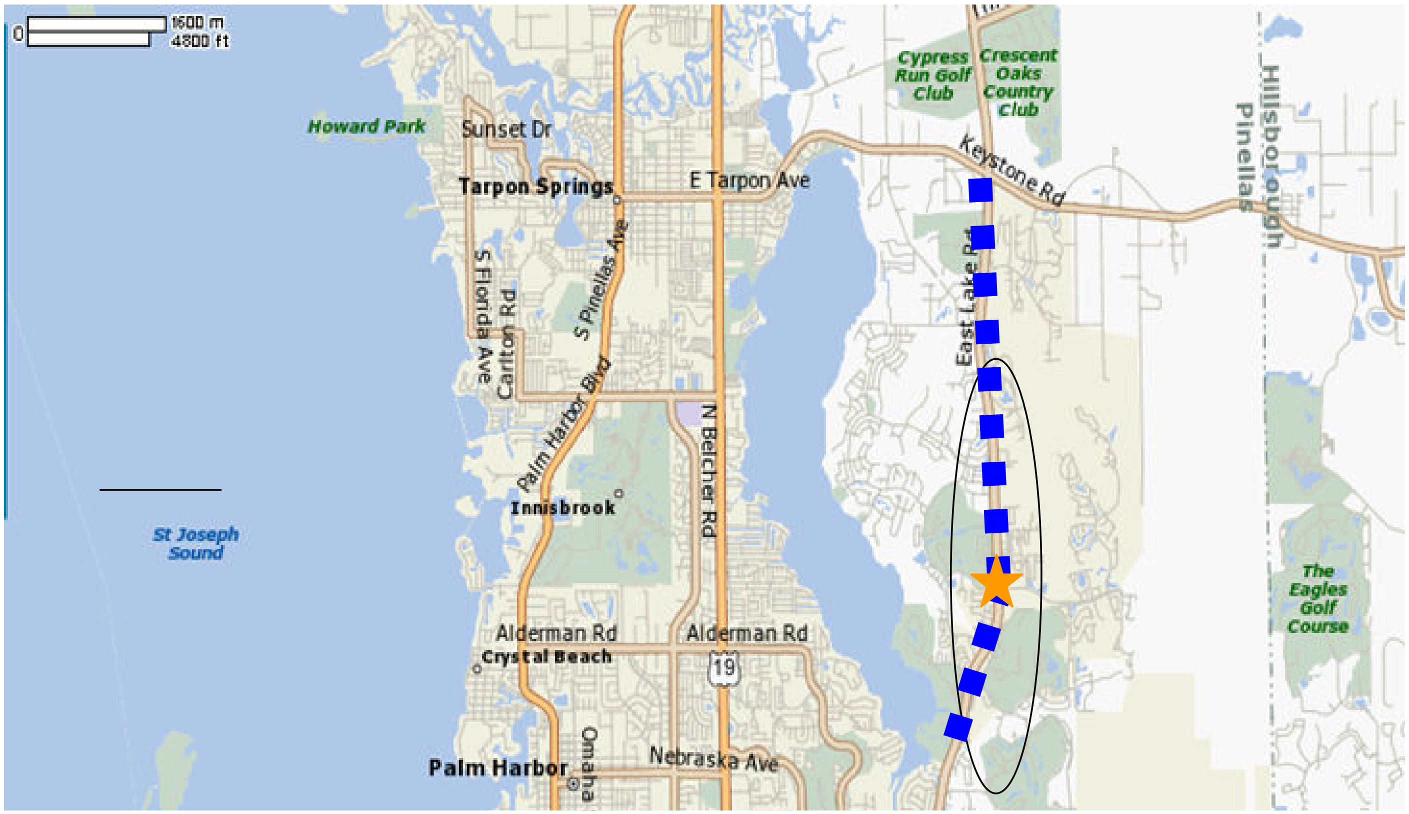
Width r = 0.05*9.63 = 0.48 mi

Study Corridor

Survey Location

Network Analysis Zone

#20 – East Lake Drive, Palm Harbor



Arterial

Length r = 0.25*13.57 = 3.39 mi

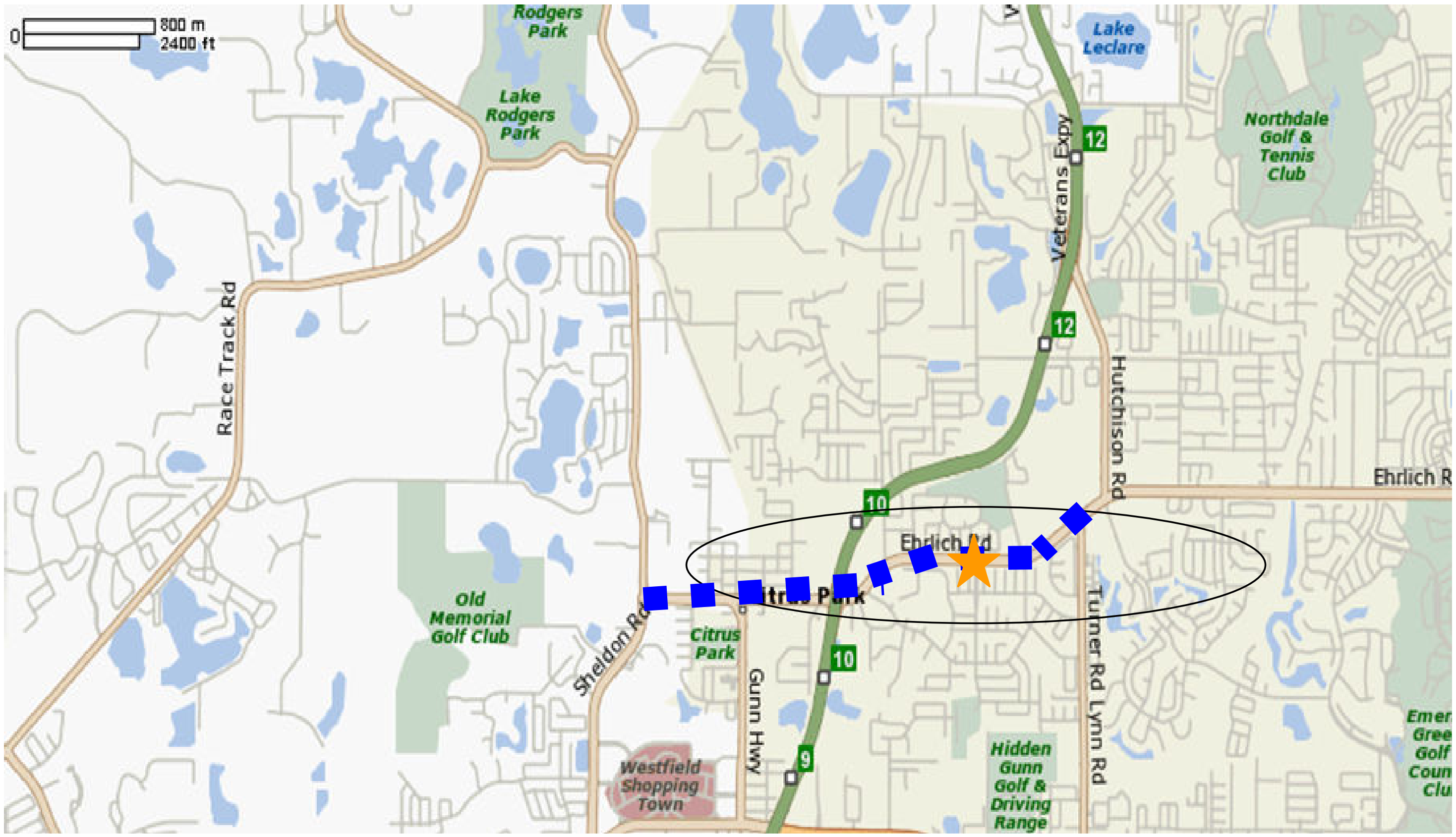
Width r = 0.05*13.57 = 0.68 mi

Study Corridor

Survey Location

Network Analysis Zone

#21 – Ehrlich Road, Tampa



Arterial

Length r = 0.25*9.25 = 2.31 mi

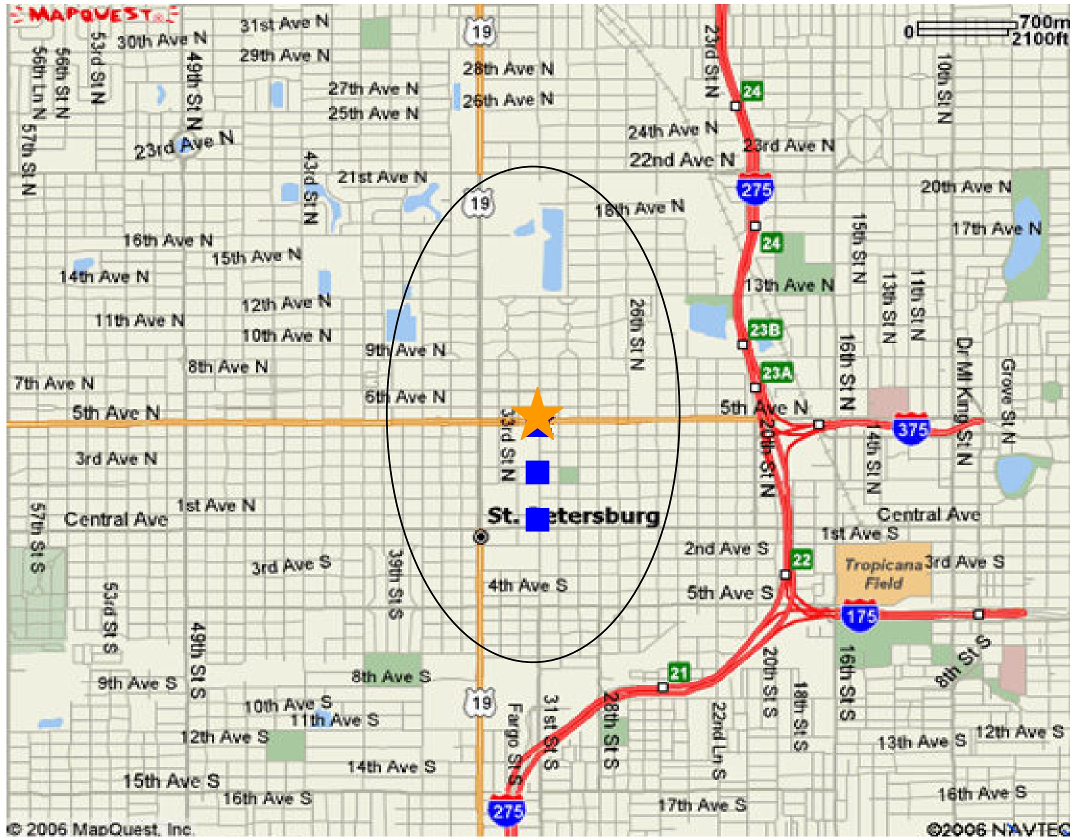
Width r = 0.05*9.25 = 0.46 mi

Study Corridor

Survey Location

Network Analysis Zone

#2 and #22 - 31st St N from Central Ave to 5th Ave N, St. Petersburg



Collector

Length r = 0.225*5.05 = 1.14 mi

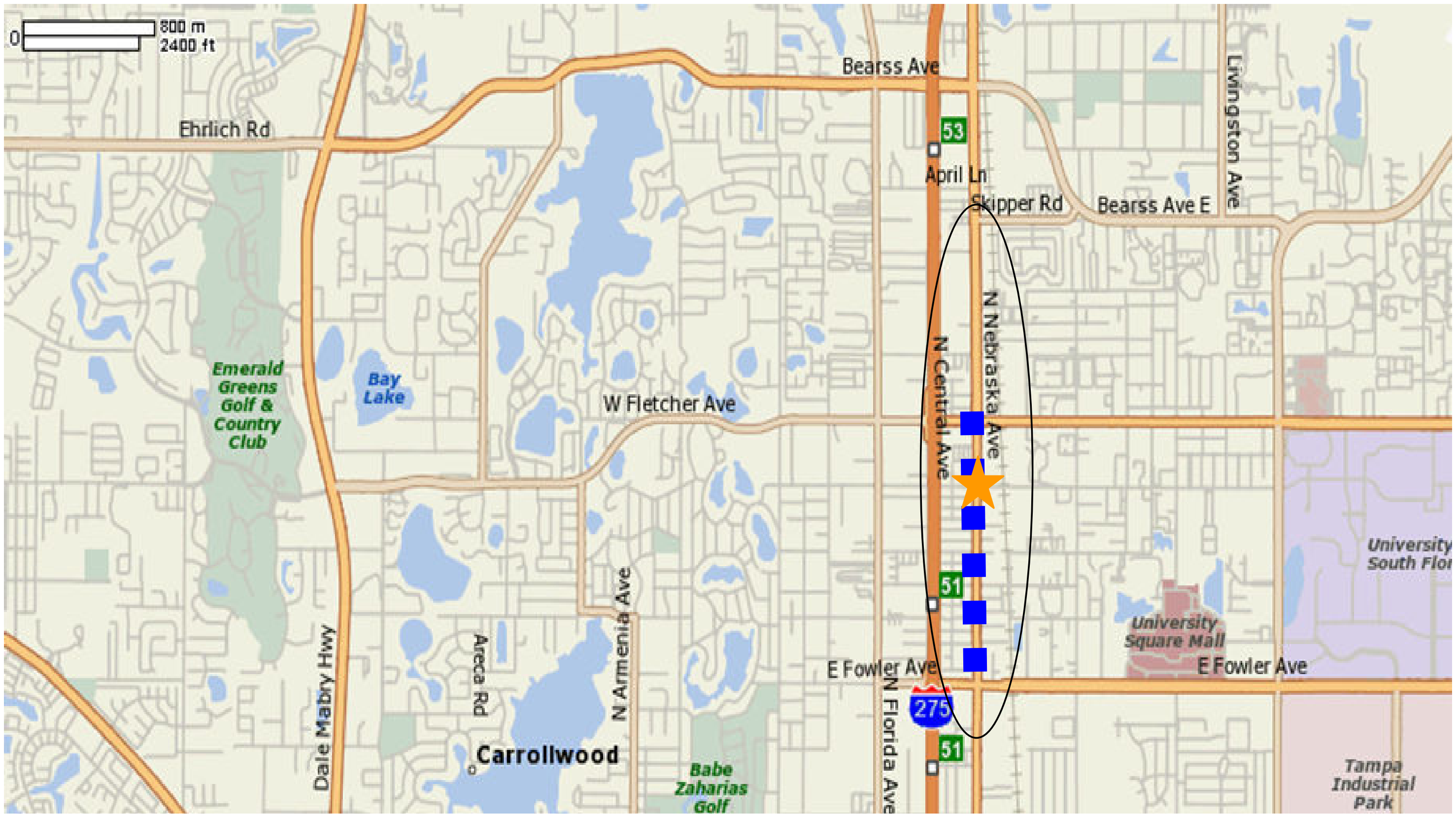
Width r = 0.125*5.05 = 0.63 mi

Study Corridor

Survey Location

Network Analysis Zone

#23 – Nebraska Avenue, Tampa



Arterial

Length r = 0.25*8.07 = 2.02 mi

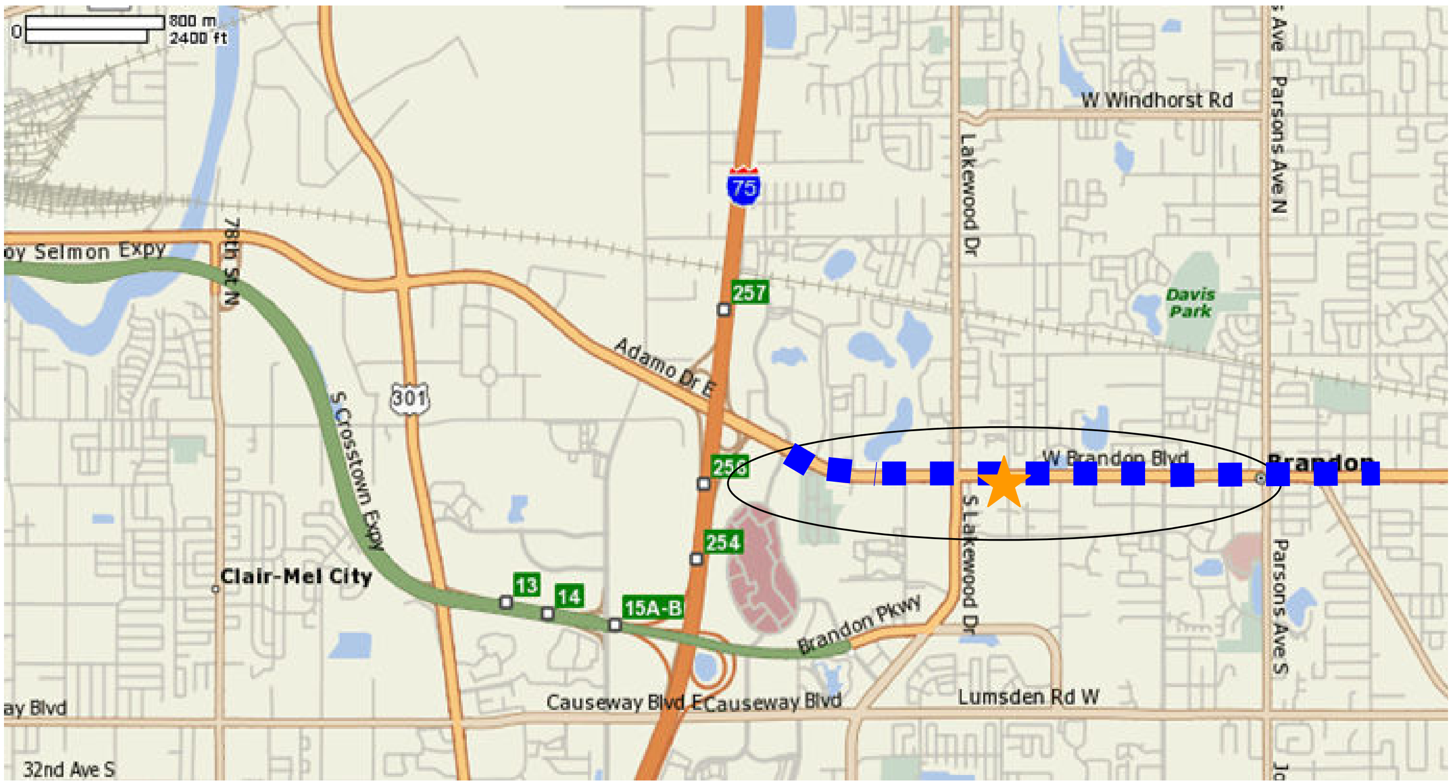
Width r = 0.05*8.07 = 0.40 mi

Study Corridor

Survey Location

Network Analysis Zone

#24 – S.R. 60, Brandon



Arterial

Length r = 0.25*8.33 = 2.08 mi

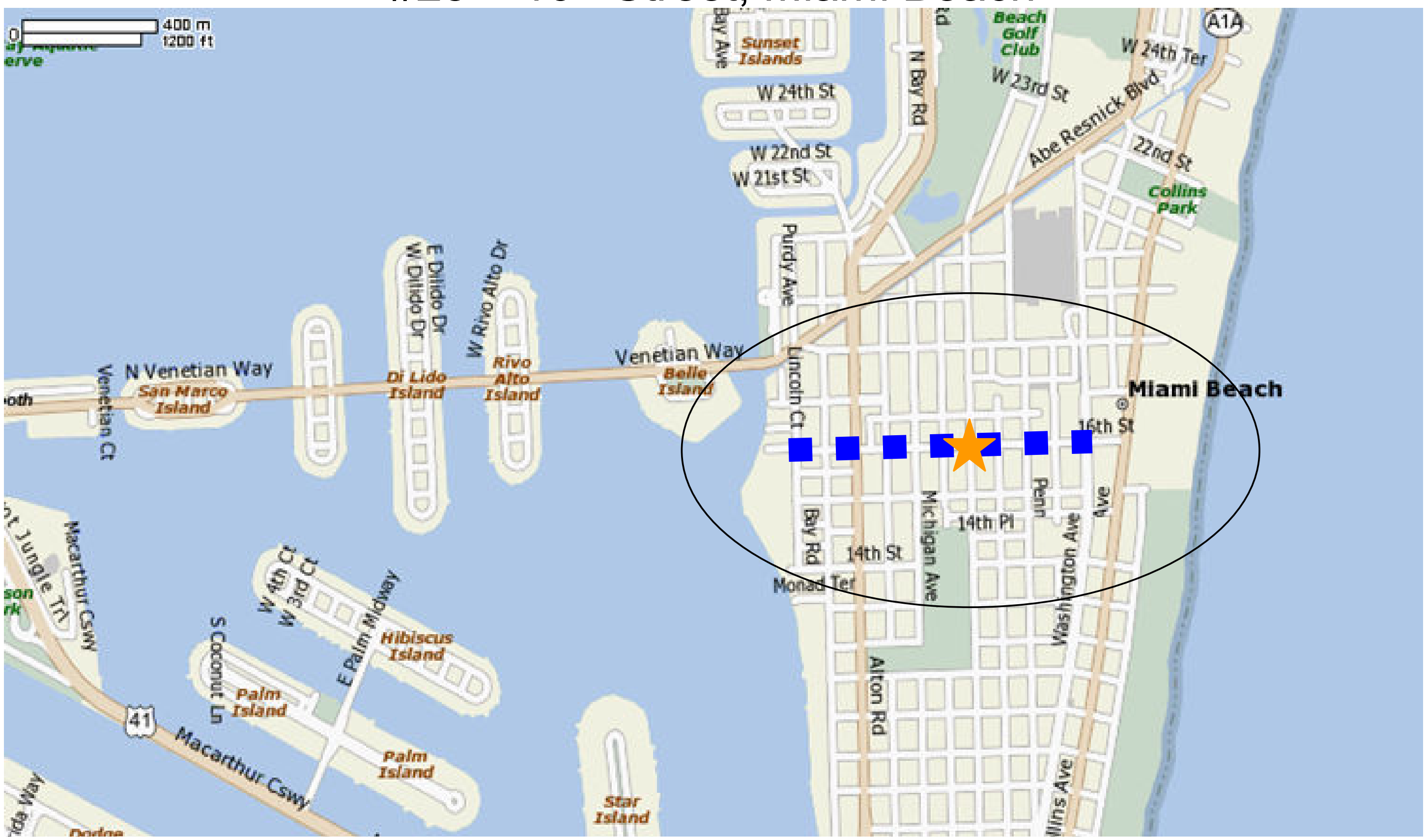
Width r = 0.05*8.33 = 0.42 mi

Study Corridor

Survey Location

Network Analysis Zone

#25 – 16th Street, Miami Beach



Collector

Length r = 0.225*4.69 = 1.06 mi

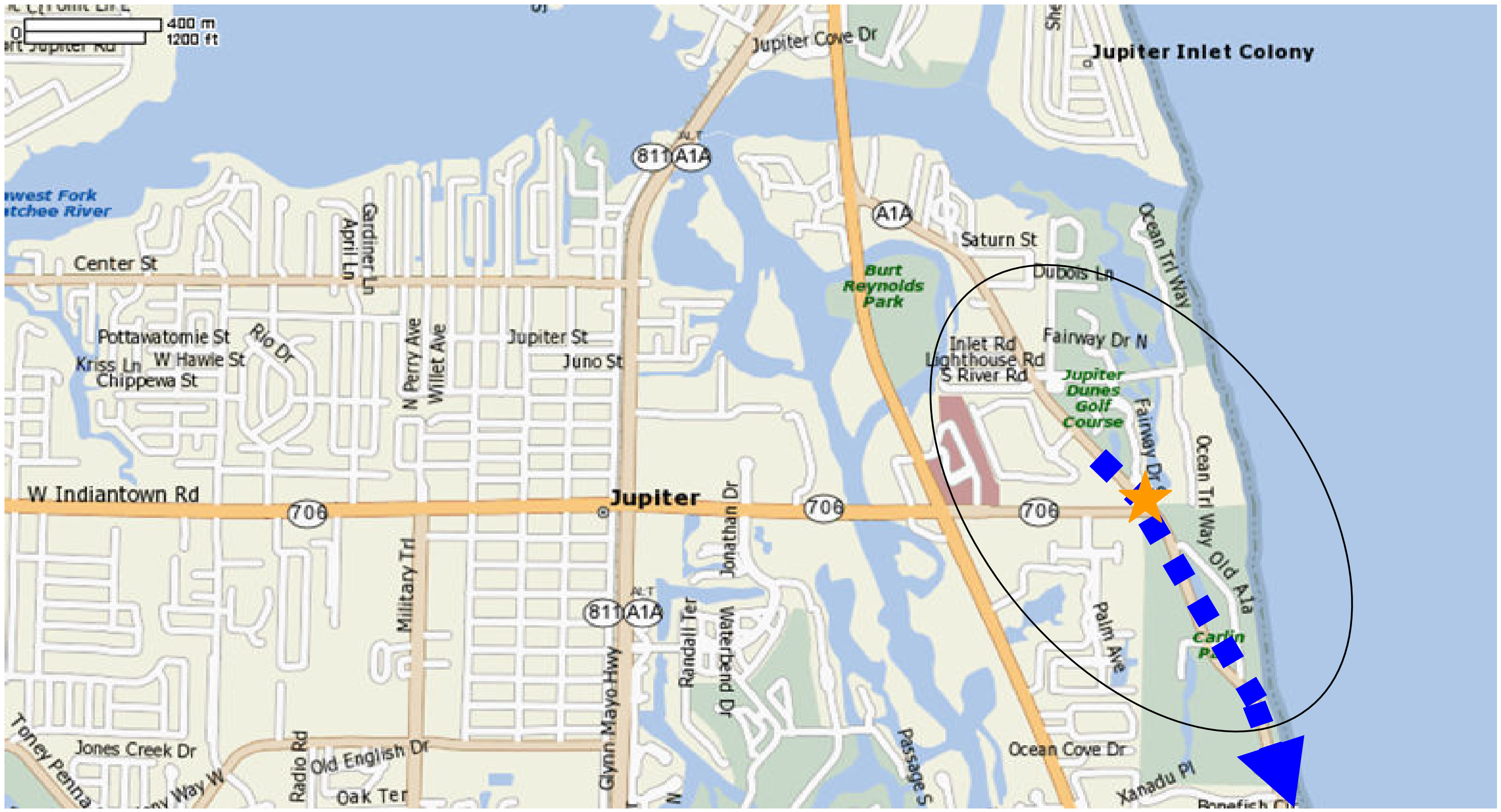
Width r = 0.125*4.69 = 0.59 mi

■ ■ ■ ■ Study Corridor

★ Survey Location

Network Analysis Zone

#26 – Ocean Boulevard, Jupiter



Collector

Length r = 0.225*4.10 = 0.92 mi

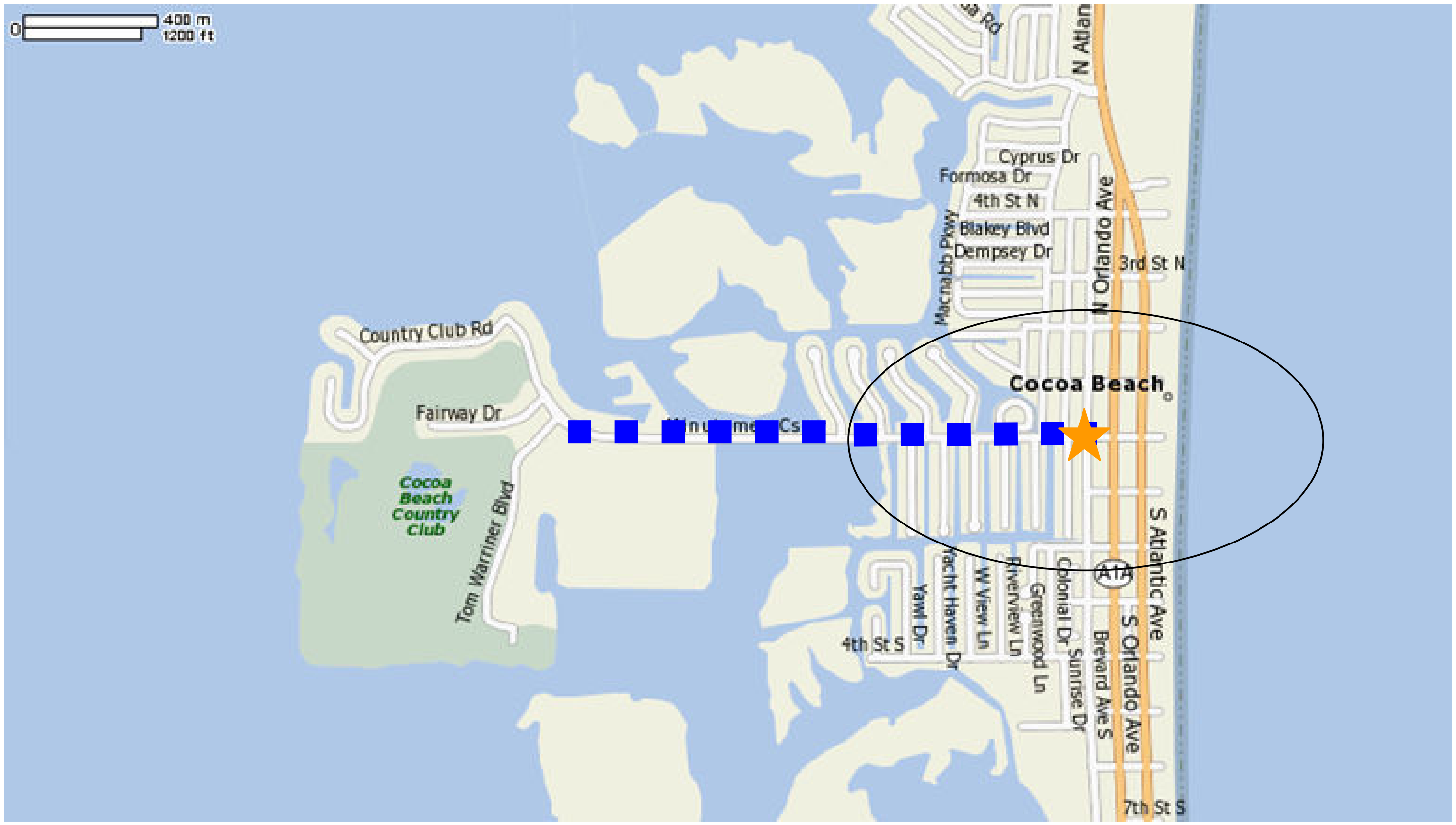
Width r = 0.125*4.10 = 0.51 mi

Study Corridor

Survey Location

Network Analysis Zone

#27 – Minutemen Causeway, Cocoa Beach



Collector

Length r = 0.225*3.25 = 0.73 mi

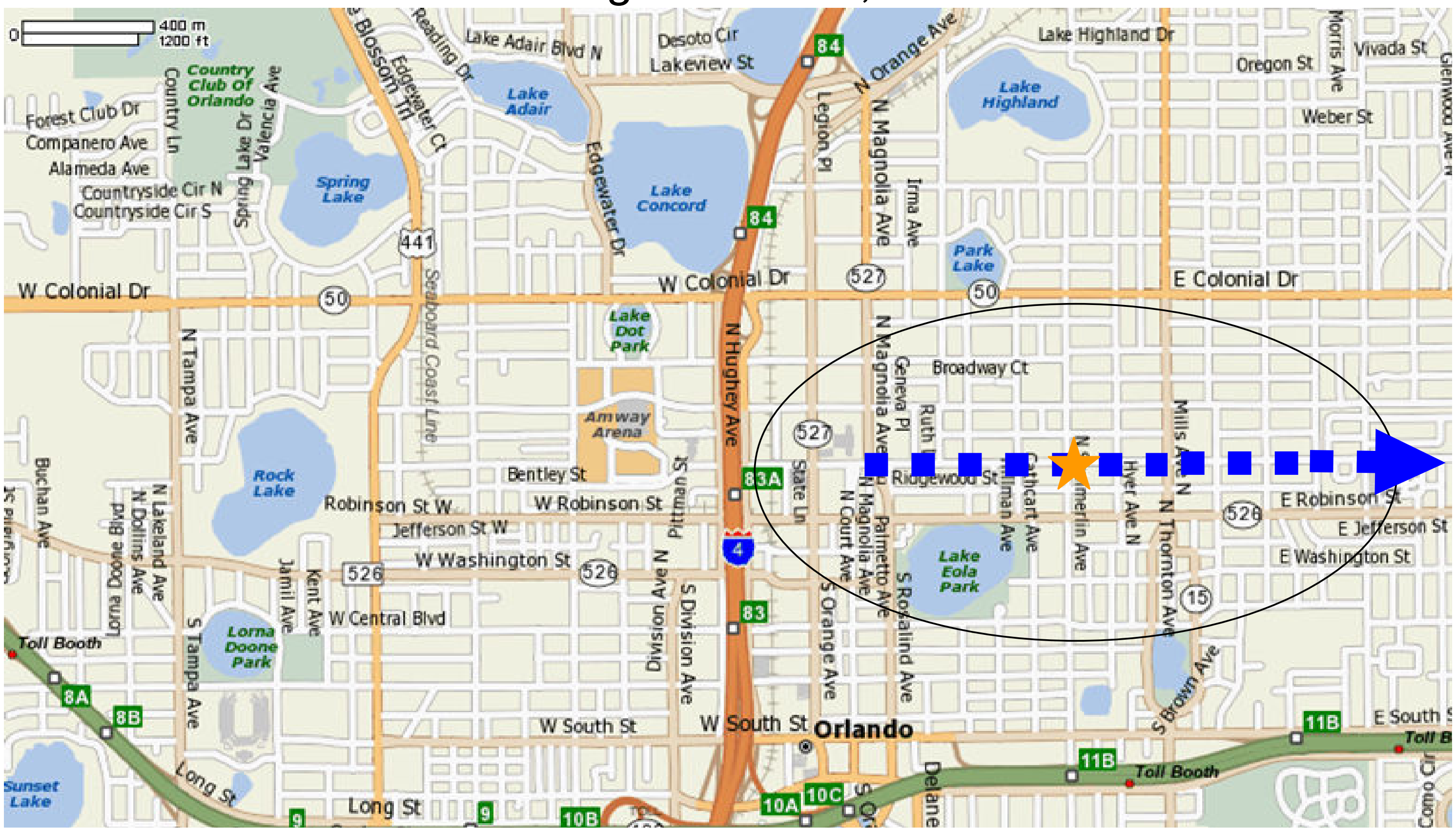
Width r = 0.125*3.25 = 0.41 mi

Study Corridor

Survey Location

Network Analysis Zone

#28 – Livingston Street, Orlando



Collector

Length r = 0.225*5.53 = 1.24 mi

Width r = 0.125*5.53 = 0.69 mi

Study Corridor

Survey Location

APPENDIX D Development of the Network Friendliness Measure

Introduction

The Florida Department of Transportation is developing a corridor-level mode shift model. This model will predict the degree to which the construction of a non-motorized facility along a corridor will induce a shift from the motor vehicle mode to the bicycle mode. It is expected that many variables could play a role in the mode shift. The three major categories of these variables are demographic characteristics of the travelers (*i.e.*, age and income), trip characteristics (*i.e.*, length and purpose), and corridor characteristics. One of the corridor characteristics expected to significantly affect mode shift is the measure of connectivity and/or the travel quality continuity (also known as network friendliness) of the transportation network surrounding the corridor.

The first question to be addressed when determining this network-based measure is what defines a "transportation network" for a particular mode. While the most basic definition of network refers to the extent and interconnectedness of streets and roadways, such a viewpoint does not capture the function of networks, particularly for bicycling, walking, and transit, because it fails to include how well travelers are *accommodated* on the network's facilities. Regardless of the type of accommodation provided by the different modes (capacity for motor vehicles, safety and comfort for bicycles and pedestrians, and headways for the transit mode), accommodation is always a factor in how well the network serves travelers. For example, a corridor may provide a connection to the surrounding transit network, but if the connected routes have buses running only once a week, not much is gained by that connection. In this sense, one might question whether a network beyond the corridor in question truly exists.

Connectivity and Continuity

In the traditional sense, network connectivity has simply referred to the degree to which streets and roadways connect to each other. A high degree of connectivity has traditionally been characterized by tightly spaced facilities that intersect each other frequently and rarely end in a cul-de-sac. A grid street network is an example of a network with good "connectivity." In contrast, a street network with many cul-de-sacs which all feed into a low number of collectors and arterials has much poorer "connectivity." It is generally believed that networks with good "connectivity" are conducive to bicycle travel because they reduce the distance (and thus the time) required to bike or walk to and from origins and destinations by creating more direct routes.

Several measures have been developed in recent years that attempt to quantify the somewhat abstract idea of connectivity, generally for the auto mode. In an effort to identify the level of connectivity in the metropolitan area of Portland, Oregon, Dill[1] defines and tests several of these measures. Among the most noted of these measures are:

- the Link-Node Ratio, which is measured by dividing the number of links (segments between nodes) in a study area by the number of nodes (intersections plus cul-de-sac termini);
- the Connected Node Ratio, which is a ratio of the number of street intersections to intersections plus the number of cul-de-sacs, thus capturing the number of connected nodes relative to the total number of nodes; and
- Intersection Density, which is simply the number of street intersections per unit of area.

While all of these measures (and other similar ones) provide some method for quantifying connectivity, they fail to take into account the *quality of the accommodation* provided by the network facilities, an aspect particularly important for the bicycle mode. Without an accommodation factor, the true "network" of facilities is not being taken into account. All other characteristics being equal, it is intuitively apparent that an improved corridor surrounded by roads with good bicycle accommodation (level of service) is more likely to induce mode shifts than one surrounded by roads with poor bicycling conditions. In other words, construction of an attractive and safe bicycle facility will not attract many bicyclists if all of the connecting roads are perceived as being hazardous. It is proposed that this potential measure be referred to as "network friendliness." [Note: The subsequent discussion and measure refer specifically to the bicycle mode for illustrative purposes.]

[1] Dill, Jennifer. *Measuring Connectivity for Bicycling and Walking* In *TRB 2004 Annual Meeting*. CD-ROM. Transportation Research Board, National Research Council, Washington, D.C., 2004.

In developing this measure, the question arises of whether to include all roads within the defined analysis zone. While local streets tend to provide better levels of service to bicyclists because of their relatively low motor vehicle volumes, they are frequently less appealing to motorists contemplating a shift to the bicycle mode because they do not offer the fastest or most direct route of travel. Because virtually all travelers, regardless of mode, are sensitive to travel time considerations, this can be an important point. Nonetheless, local streets are viable travel routes and are part of the network that motorists take into account when deciding whether to shift modes. Therefore, part of the difficulty in determining an appropriate measure involves the decision whether to all classes of roadways and, if they are all included, whether some weighting system should exist.

The approach described below offers a method to quantify the network friendliness measure.

The Measurement

The following formula represents the proposed method for calculating the network friendliness measure:

Network Friendliness Measure =

$$f_A(T)\frac{\sum\left(D_A\frac{1}{LOS_A}\right)}{\sum LOS_A}\frac{\sum D_A}{\sum D_{ACL}} + f_C(T)\frac{\sum\left(D_C\frac{1}{LOS_C}\right)}{\sum LOS_C}\frac{\sum D_C}{\sum D_{ACL}} + f_L(T)\frac{\sum\left(D_L\frac{1}{LOS_L}\right)}{\sum LOS_L}\frac{\sum D_L}{\sum D_{ACL}} \qquad \textbf{Eq. 1}$$

Or

$$\frac{1}{\sum D_{ACL}}\left(f_A(T)\sum\left(D_A\frac{1}{LOS_A}\right)+f_C(T)\sum\left(D_C\frac{1}{LOS_C}\right)+f_L(T)\sum\left(D_L\frac{1}{LOS_L}\right)\right) \qquad \textbf{Eq. 2}$$

where:

T = average trip length along the study corridor

D = length of roadway

A = Arterial roadways

C = Collector roadways

L = Local roadways

ACL = sum of the lengths of all arterial, collector, and local roadways

LOS = Bicycle Level of Service

and:

$$f_A(T) = \frac{1.6}{1+e^{-0.5T+3}} + 0.8 \quad \textbf{Eq. 3}$$

$$f_C(T) = 1.1 - \frac{0.8}{1+e^{-0.5T+3}} \quad \textbf{Eq. 4}$$

$$f_L(T) = 1.2 - \frac{1}{1+e^{-0.5T+3}} \quad \textbf{Eq. 5}$$

The score resulting from this equation represents the sum of three components (shown in Eq. 1), each of which represents the role of one of the three functional classifications of roadway (arterial, collector, and local). In turn, each of these components is comprised of three factors: 1) the weighting of the functional roadway class as determined by the average trip length of motorists traveling along the corridor; 2) the proportion of the network that the functional class represents; and 3) the level of accommodation (*i.e.,* Bicycle LOS) provided by the network facilities within that particular functional class. When all three functional roadway classes are summed, an accurate representation of the overall network that motorists take into account when contemplating a mode shift away from the automobile emerges.

The first of these factors is important because it determines how much each of the functional roadway classes is weighted in the overall equation. As trip length increases, the likely attractiveness of, or likelihood that motorists will consider, lower-class roadways decreases relative to higher-class roadways. Therefore, in the equation, the exponent of the trip length in the denominator increases as the functional classification shifts from arterial down to local, and local roads receive far less emphasis as trip length increases. Conversely, local roads are given more emphasis as trip length approaches zero and local roads are more likely to be part of the motorist's trip.

While the first factor considers the importance of the classes in relation to *trip length*, the second factor considers the *prevalence* of the classes. Even if trip lengths are long (which would indicate motorists' reliance primarily on arterial roadways), arterials cannot play an important role if they are not prevalent within the network. The proportion of the class to the overall network allows for the inclusion of prevalence in the overall equation.

The third factor reflects the role that the quality of bicycle accommodation on the surrounding network plays. More specifically, it uses the FDOT-adopted *Bicycle Level of Service* measure[2] (*2*) to incorporate, at a fundamental level, the perceived degree of safety and comfort provided to bicyclists. Through the inclusion of this level of service measure for each of the classes, the attractiveness of the facilities plays a role in the determination of the network's level of accommodation.

On a hypothetical network wherein all streets have a bicycle level of service of A (Bicycle LOS=1.0) and the roadway classes have an equal share of the total study network, travel quality continuity is 1, regardless of the average trip length of the motorists within the corridor. This scenario is used as the "base case" by which the network friendliness measure has been normalized (the minimum value for the measure is "0"). The three components in this scenario demonstrate the impact of the roadway classes at different trip lengths, with the impact of local and collector streets decreasing as trip length increases, while the impact of arterials becomes greater before leveling off at a very high average trip length.

[2] FDOT, *2009 Quality / Level of Service Handbook*, Florida Department of Transportation, 2009.

This network friendliness measure shows promise as a variable to be included in the mode shift model. It provides quantification of network friendliness such that all facilities are incorporated proportionally to their importance to the potential mode shift, and that the accommodation level of the facilities themselves (as opposed to their mere existence) is taken into consideration. It is proposed that the measure be used in the model development stage as a way to incorporate the important effects of network connectivity and continuity on travelers' decisions to shift modes.

Ellipse Shape of the Analysis Zone

In addition to the formulation described previously, the shape of the analysis zone for the improved corridor must be defined in some manner. The trip direction will be defined as the direction of the corridor being improved (or along extensions of the facility being improved) and will therefore be used to define the length of the analysis zone. In addition, there will be some area of influence to either side of the corridor, some width of the study corridor. To represent the area of influence, the researchers defined the analysis zone by an ellipse shape around the improvement section under consideration, with the shape of that ellipse dependent upon the average motorist trip length along the facility. Higher trip lengths would lead to more "stretched" ellipses, while shorter trip lengths would result in more spherical shapes.

APPENDIX E Long Term Effects Interview Form (Bicycle Mode)

1. Do you consider bicycling to be a regular activity in your life?
Yes________ No_______ (If "Yes," skip to question 3.)

2. If you answered "No" to question 1, name and rank three reasons why you do not bike regularly.
____

(Skip to Question 5.)

3. If you answered "Yes" to question 1, how long has this been a regular activity for you?

_________Years

4. Name and rank up to three factors that prompted you to begin riding regularly.
____

5. People ride bicycles for numerous purposes. These purposes include:

- **Commuting:** Trips from home to a regular destination where you spend more than two hours. Examples: to work, to school, providing care to a friend or relative, or to some other regular commitment.
- **Errands/Appointments:** Trips from home or work to conduct some business or for a social visit, with a stay of less than two hours. Examples: shopping, dining out, visiting friends, entertainment.
- **Recreation:** Trips primarily for the purpose of riding, with no particular destination. Examples: a training or "workout" ride, a ride around the neighborhood with family and friends.

5A.Over the past two years how often would you say you rode a bike for these purposes?

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commuting									
Errands/Appointments									
Recreation									

5B. What was your average trip length for these trips?

_______________ miles

6. The questions below ask about the types of facilities (bike lanes, shared roadways, trails) you use during your bicycle trips.

Which of these facilities do you use on your bicycle trips?

If you commute on a bicycle, think about your **typical commuting trip**. In the first column, please indicate the facility type on which you spend the **greatest amount of time** during your bicycle commute trip (primary facility type). In the second column, please indicate **all facility types** you use on that trip (other facilities encountered).

6A: Typical Commuting Trip		
	Primary facility type (check only one)	**Other facilities encountered (check all that apply)**
Neighborhood streets, in roadway		
Neighborhood streets, on sidewalk		
Major roads, in roadway		
Major roads, on bike lane or shoulder		
Major roads, on sidewalk		
Paths or trails along major roads		
Paths or trails, away from roads (rail-trails, park trails, etc.)		

Please answer the same questions for errand and recreational trips, if you make them.

6B: Typical Errand/Appointment Trip		
	Primary facility type (check only one)	**Other facilities encountered (check all that apply)**
Neighborhood streets, in roadway		
Neighborhood streets, on sidewalk		
Major roads, in roadway		
Major roads, on bike lane or shoulder		
Major roads, on sidewalk		
Paths or trails along major roads		
Paths or trails, away from roads (rail-trails, park trails, etc.)		

6C: Typical Recreational Trip		
	Primary facility type (check only one)	**Other facilities encountered (check all that apply)**
Neighborhood streets, in roadway		
Neighborhood streets, on sidewalk		
Major roads, in roadway		
Major roads, on bike lane or shoulder		
Major roads, on sidewalk		
Paths or trails along major roads		
Paths or trails, away from roads (rail-trails, park trails, etc.)		

7. Where do you live now?
City___________ State___________ Zip________

8. How old are you?

Under 13	**13-18**	**19-25**	**26-35**	**36-45**	**46-55**	**56-65**	**Over 65**

9. What is your gender?

☐ Male
☐ Female

If you are under 13 years old, you're finished. Otherwise, please try to recall your bicycling activity from different periods of your life.

10A. Please indicate how often you rode when you were **under 13** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

10B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

10C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the bicycling habits you identified above.)

City___________ State___________ Zip_______

10D. Are there any factors that you think affected how frequently you rode a bike at that time?

____

11A. Please indicate how often you rode when you were **13-18** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

11B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

11C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the bicycling habits you identified above.)

City____________ State___________ Zip________

11D. Are there any factors that you think affected how frequently you rode a bike at that time?

____

12A. Please indicate how often you rode when you were **19-25** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

12B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

12C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the bicycling habits you identified above.)

City_______________ State______________ Zip_____________

12D. Are there any factors that you think affected how frequently you rode a bike at that time?

____

13A. Please indicate how often you rode when you were **26-35** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

13B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

13C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the bicycling habits you identified above.)

City_____________ State___________ Zip___________

13D. Are there any factors that you think affected how frequently you rode a bike at that time?

____

14A. Please indicate how often you rode when you were **36-45** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

14B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

14C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the bicycling habits you identified above.)

City_____________________ State__________ Zip_____________

14D. Are there any factors that you think affected how frequently you rode a bike at that time?

____

15A. Please indicate how often you rode when you were **46-55** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

15B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

15C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the bicycling habits you identified above.)

City____________ State_______________ Zip__________________

15D. Are there any factors that you think affected how frequently you rode a bike at that time?

____

16A. Please indicate how often you rode when you were **56-65** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

16B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

16C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the bicycling habits you identified above.)

City_____________ State____________ Zip_____________

16D. Are there any factors that you think affected how frequently you rode a bike at that time?

____

17A. Please indicate how often you rode when you were **Over 65** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

17B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

17C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the bicycling habits you identified above.)

City________________ State_____________ Zip_____________

17D. Are there any factors that you think affected how frequently you rode a bike at that time?

____

APPENDIX F Long Term Effects Interview Form (Pedestrian Mode)

1. Do you consider walking to be a regular activity in your life?
Yes________ No_______ (If "Yes," skip to question 3.)

2. If you answered "No" to question 1, name and rank three reasons why you do not walk regularly.

____
(Skip to Question 5.)

3. If you answered "Yes" to question 1, how long has this been a regular activity for you?

_________Years

4. Name and rank up to three factors that prompted you to begin walking regularly.

____

5. People walk for numerous purposes. These purposes include:

- **Commuting:** Trips from home to a regular destination where you spend more than two hours. Examples: to work, to school, providing care to a friend or relative, or to some other regular commitment.
- **Errands/Appointments:** Trips from home or work to conduct some business or for a social visit, with a stay of less than two hours. Examples: shopping, dining out, visiting friends, entertainment.
- **Recreation:** Trips primarily for the purpose of walking, with no particular destination. Examples: a training or "workout" walk, a ride around the neighborhood with family and friends.

5A.Over the past two years how often would you say you walked for these purposes?

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commuting									
Errands/Appointments									
Recreation									

5B. What was your average trip length for these trips?

________________ miles

6. The questions below ask about the types of facilities (bike lanes, shared roadways, trails) you use during your walking trips.

Which of these facilities do you use on your walking trips?

If you walk to work, think about your **typical commuting trip**. In the first column, please indicate the facility type on which you spend the **greatest amount of time** during your walking commute trip (primary facility type). In the second column, please indicate **all facility types** you use on that trip (other facilities encountered).

6A: Typical Commuting Trip		
	Primary facility type (check only one)	**Other facilities encountered (check all that apply)**
Neighborhood streets, in roadway		
Neighborhood streets, on sidewalk		
Major roads, in roadway		
Major roads, on bike lane or shoulder		
Major roads, on sidewalk		
Paths or trails along major roads		
Paths or trails, away from roads (rail-trails, park trails, etc.)		

Please answer the same questions for errand and recreational trips, if you make them.

6B: Typical Errand/Appointment Trip		
	Primary facility type (check only one)	**Other facilities encountered (check all that apply)**
Neighborhood streets, in roadway		
Neighborhood streets, on sidewalk		
Major roads, in roadway		
Major roads, on bike lane or shoulder		
Major roads, on sidewalk		
Paths or trails along major roads		
Paths or trails, away from roads (rail-trails, park trails, etc.)		

6C: Typical Recreational Trip		
	Primary facility type (check only one)	**Other facilities encountered (check all that apply)**
Neighborhood streets, in roadway		
Neighborhood streets, on sidewalk		
Major roads, in roadway		
Major roads, on bike lane or shoulder		
Major roads, on sidewalk		
Paths or trails along major roads		
Paths or trails, away from roads (rail-trails, park trails, etc.)		

7. Where do you live now?
City___________ State___________ Zip________

8. How old are you?

Under 13	**13-18**	**19-25**	**26-35**	**36-45**	**46-55**	**56-65**	**Over 65**

9. What is your gender?

	Male
	Female

If you are under 13 years old, you're finished. Otherwise, please try to recall your walking activity from different periods of your life.

10A. Please indicate how often you walked when you were **under 13** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

10B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

10C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the walking habits you identified above.)

City___________ State___________ Zip________

10D. Are there any factors that you think affected how frequently you walked at that time?

____

11A. Please indicate how often you walked when you were **13-18** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

11B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

11C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the walking habits you identified above.)

City____________ State___________ Zip________

11D. Are there any factors that you think affected how frequently you walked at that time?

____

12A. Please indicate how often you walked when you were **19-25** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

12B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

12C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the walking habits you identified above.)

City_______________ State______________ Zip_____________

12D. Are there any factors that you think affected how frequently you walked at that time?

____

13A. Please indicate how often you walked when you were **26-35** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

13B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

13C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the walking habits you identified above.)

City_____________ State___________ Zip___________

13D. Are there any factors that you think affected how frequently you walked at that time?

____

14A. Please indicate how often you walked when you were **36-45** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

14B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

14C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the walking habits you identified above.)

City_____________________ State__________ Zip_____________

14D. Are there any factors that you think affected how frequently you walked at that time?

____

15A. Please indicate how often you walked when you were **46-55** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

15B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

15C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the walking habits you identified above.)

City____________ State_______________ Zip__________________

15D. Are there any factors that you think affected how frequently you walked at that time?

____

16A. Please indicate how often you walked when you were **56-65** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

16B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

16C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the walking habits you identified above.)

City_____________ State____________ Zip_____________

16D. Are there any factors that you think affected how frequently you walked at that time?

____

17A. Please indicate how often you walked when you were **Over 65** years old:

	Daily	3-5 times/week	Weekly	2 times/month	Monthly	6-10 times/year	1-5 times/year	Less than once/year	Never
Commute									
Errand/ Appointment									
Recreational									

17B. Please indicate the **primary facility** type you used at that time:

	Neighborhood Streets	Neighborhood Sidewalks	Major Roads (in roadway)	Bike Lanes or Shoulders	Sidewalks on Major Road	Paths or Trails Along Roads	Paths or Trails Away from Roads
Commute							
Errand/ Appointment							
Recreational							

17C. Where did you live then? (If you lived more than one place, identify the place which you would most strongly associate with the walking habits you identified above.)

City_________________ State______________ Zip______________

17D. Are there any factors that you think affected how frequently you walked at that time?

____