BDV31-977-106
Final Report

Applying Gap Modeling to Inform Improvement of Transportation Services for Vulnerable Populations at the Local and Regional Levels

February 2021

Prepared by:

UF UNIVERSITY of FLORIDA

Florida Department of Transportation
FDOT Contract BDV31-977-106

Applying Gap Modeling to Inform Improvement of Transportation Services for Vulnerable Populations at the Local and Regional Levels

FINAL REPORT

Prepared by:
University of Florida

February 2021

DISCLAIMER

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the State of Florida Department of Transportation.

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated under the sponsorship of the U.S. Department of Transportation's University Transportation Centers Program, in the interest of information exchange. The U.S. Government assumes no liability for the contents or use thereof.

METRIC CONVERSION CHART

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	Km
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
NOTE: volumes greater than 1000 L shall be shown in m^3				

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
Applying Gap Modeling to Inform Improvement of Transportation Services for Vulnerable Populations at the Local and Regional Levels	February 2021
	6. Performing Organization Code
7. Author(s) I. Bejleri, S. Noh, I. Lee, R. Steiner	8. Performing Organization Report No.
9. Performing Organization Name and Address University of Florida 418 Architecture Building Gainesville, FL 32611	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. BDV31-977-106
12. Sponsoring Agency Name and Address Florida Department of Transportation 605 Suwannee Street, MS 30 Tallahassee, FL 32399	13. Type of Report and Period Covered Final Report March 2019 – February 2021
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

One of Florida Department of Transportation's goals is to provide equitable transportation for vulnerable populations such as older adults, people with disabilities, and low-income families. The Find-a-Ride Florida (findarideflorida.org) is a platform that provides transportation service information for these populations. Yet, gaps still exist in transportation services for vulnerable populations. In previous research, University of Florida has developed a geospatial model that can be used to identify such gaps. The purpose of this research was to apply and evaluate the gaps model, with input from agencies at the local and regional scales, to understand its ability and effectiveness to inform and support policy and decision making for improvement of transportation options of vulnerable populations. To accomplish these objectives, the research team gathered insights from experts by conducting a series of meetings with selected local and regional transportation planning agencies. The findings show that the model can be useful to support funding application process and transportation planning at the local and regional level regarding transportation needs of vulnerable populations. The model would benefit from using more accurate service boundaries and more accurate travel demand estimation based on income levels and travel behavior of older adults, adjusting estimation of individuals with disabilities by considering eligibility for services based on type of disability, and by differentiating destinations based on frequency of use and target users. Based on experts' input, the research team makes the following recommendations. First, more research is required to improve travel demand estimation of vulnerable populations. Second, the model can benefit from including service fees into the accessibility score calculation. Third, an interactive web-based system would be the most effective method to visualize and share the location of transportation service gaps with the relevant stakeholders. Fourth, develop a formalized process to engage agencies to utilize the gap maps in their planning process to ensure a consistent method statewide.

17. Key Word	18. Distribution Statement
mobility, transportation options, older adults, aging road users	No restrictions

19. Security Classify. (of this report)	20. Security Classify. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	159	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

ACKNOWLEDGEMENTS

The research team would like to thank project manager Gail M. Holley, Safe Mobility for Life Program and Research Manager, for her leadership, guidance, assistance, encouragement, and support provided throughout this research. We wish to also thank co-project manager Gabrielle Matthews, Transit Planning Research Administrator of State Traffic Engineering and Operations Office, for her input and directions provided to the research team.

We would like to express our special thanks to meeting participants for their thoughtful insights and valuable feedback to our research: Edward Griffin (General Manager of MV transportation, Alachua County), Millie Crawford (RTS ADA coordinator, Alachua County), Dr. Hatem Abou-Senna (Transportation Division, Orange County), Mimi Reggentin (Office on Aging, Orange County), Virginia Whittington (Director of Regional Partnerships, MetroPlan Orlando), and Michael Woods (Executive Director of Lake-Sumter County MPO).

The authors are grateful to the FDOT research office for providing the funding support to make this research possible.

EXECUTIVE SUMMARY

The Florida Department of Transportation (FDOT)'s Safe Mobility for Life Program has been working extensively to improve the safety and accessibility of all road users, and especially those of Florida's growing aging population. One such effort is the Find-a-Ride Florida website (https://www.findarideflorida.org), which provides information about available transportation services for Florida residents. Utilizing the Find-a-Ride database, the University of Florida has developed a geospatial model that can be used to determine the spatial gaps in transportation services for vulnerable populations such as older adults, individuals with disabilities, and low-income populations. Both the Find-a-Ride website and the gaps model have created opportunities for a broader comprehensive framework (the Find-a-Ride framework) to provide the stakeholders with the necessary information to take targeted steps and plan resource distribution to address service gaps and maximize the transportation services for Florida's vulnerable populations.

However, while the gaps model was tested in selected areas, the previous gap modeling research did not work directly with local or regional agencies to assess the model's application to support planning and policy at the local and regional levels. Having the local and regional agency input is necessary to assist FDOT in deciding how to proceed with dissemination and operation of the model within the broader context of the Find-a-Ride framework.

The purpose of this research was to apply and evaluate the gaps model at the local and regional scales to understand its ability and effectiveness to inform and support policy and decision making for improvement of transportation options of vulnerable populations. More specifically the input from the agencies would provide the necessary understanding on how the gaps model can be used, how it can be accessed by local and regional agencies, how the results can be utilized, and if the model would need to be modified to meet their improvement efforts. The input from agencies would also help refine any data availability and/or needs at the local and regional level that can improve the model and the results.

To accomplish these objectives, the research team proceeded with a methodology that included two steps. First, the research team conducted a review of the framework, including the Find-a-Ride website, the geospatial model, and the transportation services database. While both the website and the geospatial model utilize the database, currently, stakeholders do not have access to the gap maps that are produced by the geospatial model. Thus, we proposed several options to disseminate the results with relevant stakeholders, including static PDF maps, ArcGIS online, and an interactive website. Additionally, we provided the specific tasks and necessary skills to operate and maintain the revised framework.

Second, the research team conducted a series of meetings with local agencies of Alachua County and Orange County and regional agencies of MetroPlan Orlando and Lake-Sumter MPO.

In these meetings, participants provided input on the validity of the data, the methodological approach, the results of the geospatial model for their area, the usefulness of the model for their work, the areas of model improvement to better meet their needs, and the most suitable methods to access the gaps maps that represent the model results.

The findings, based on the input from the local and regional agency participants, show that the model can be useful to support funding application process, transportation planning at the local and regional level, nonprofit organizations in supporting vulnerable populations, and the MPO Long-Range Transportation Planning regarding transportation needs of Transportation Disadvantaged (TD) populations.

Positive aspects of the model identified by the participants included the method for estimation of transportation supply, the use of census block group as the analysis unit, ability to customize the maximum travel time threshold, ability of the model to work both at the local and the regional level, and the use of the supply-demand matrix to prioritize the gaps for planning purposes. Participants recommended updating the gap maps annually as well as on-demand to support various planning activities and ad hoc changes of transportation services, especially changes of the public transit services. Participant were unified in their preference of accessing the gap maps through a Web-based interactive system.

On the other hand, the participants indicated that the model results would benefit by increased detail level of input data and especially by a more accurate travel demand estimation, especially for older adults and individuals with disabilities. Recommendations included working with local stakeholders to obtain the exact service boundaries, accurate numbers of eligible individuals with disabilities, and ridership information. Additional recommendations included considering TD income level, sub-categorizing the older adults by three age ranges (65-74, 75-84, and over 85) and considering their living locations and income status, considering property parcel and TAZ levels for the analysis unit, and differentiating destinations based on frequency of use and target users. Further research would be needed to address these aspects of the model.

Finally, we found that coordinating the application of the gaps models at the local and regional levels with the relevant agencies ensures the completeness of the available information on transportation services especially those offered by the local and regional governments, in particular the paratransit, the micro transit or similar services that connect residences to the fixed or flexible route services.

Based on the findings from this research, we recommend the following follow-up research and implementation activities.

First, develop a formalized process to engage agencies to utilize the gap maps in their planning process to help create consistency across the state in the planning process and serve as a standard resource to provide the necessary evidence of gaps statewide. Additionally, it is imperative to maintain close communication with agencies, stakeholders, and transportation service providers to ensure that the data are accurate and up to date and that the modeling results can be validated and confirmed by the relevant stakeholders.

Second, it is critical to evaluate the proposed framework and recommend the best implementable solution for the long-term deployment, dissemination, and maintenance of the Find-a-Ride framework. This could be achieved by assessing various implementation scenarios while considering multiple aspects of the maintenance, operations, cost, and roles and responsibilities of the identified stakeholders.

Third, more research is required to improve travel demand estimation for TD populations. When adjusting the assumptions and the model methodology, considerations should be given to trip behaviors of older adults, sub-categorization of older adults by three age groups, examination of concentrated locations of older adult populations, inclusion of income levels and other demographical characteristics of TD populations, adjusted estimation of individuals with disabilities considering eligibility for services based on type of disability.

Fourth, the gaps model can benefit from several improvements including refinements and customizations to use other local and regional data that agencies may provide, improved demand estimation, improved accessibility score based on service fees, and to support comparison of proposed transportation services improvement alternatives.

Fifth, develop an interactive Web-based system to show the gap maps as the most effective way to present and share the gap maps to relevant stakeholders.

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Problem statement

The Florida Department of Transportation (FDOT)'s Safe Mobility for Life Program and Coalition (SMFL) have been working extensively to improve the safety, access, and mobility needs for Florida's growing aging population through the implementation of Florida's Aging Road User Strategic Safety Plan (ARUSSP). The goal of the ARUSSP is to reduce the number of aging road user fatalities, serious injuries, and crashes, while maintaining their safe mobility and connection to the community (Safe Mobility for Life Coalition, 2017). Transitioning from Driving is a focus area within the ARUSSP charged with developing resources and information to empower individuals considering transitioning away from driving through identification of viable transportation options. One such effort is the Find-a-Ride Florida website (https://www.findarideflorida.org), which provides information about available transportation services for Florida residents (Florida Department of Elder Affairs, 2020). Utilizing the Find-a-Ride database, the University of Florida has developed a geospatial model that can be used to determine the spatial gaps in transportation services for vulnerable populations such as older adults, individuals with disabilities, and low-income populations. Both the Find-a-Ride website and the gaps model have created opportunities for a broader comprehensive framework (the Find-a-Ride framework) to provide the stakeholders with the necessary information to take targeted steps and plan resource distribution to address service gaps and maximize the transportation services for Florida's vulnerable populations.

However, while the gaps model was tested in selected areas, the previous gap modeling research did not work directly with local or regional agencies to assess the model's application to support planning and policy at the local and regional levels. Having the local and regional agency input is necessary to assist FDOT in deciding how to proceed with dissemination and operation of the model within the broader context of the Find-a-Ride framework.

Therefore, more research is needed to help FDOT decide how to improve the current Find-a-Ride framework, the service providers database, and the gaps model and its results and to inform the efforts to reduce the transportation service gaps for the vulnerable populations. The research will provide a platform to communicate such transportation gaps to state, local, and regional partners, as well as other relevant stakeholders to address the issue at various geographic levels.

1.2 Project objectives

The overall objective of this research was to apply and assess the gaps model and the gaps maps at local and regional levels to gain input on the accuracy of the model, the validity of its data and its results, the suitability of the spatial gaps' resolution, and the most suitable methods to access the gap maps.

More specifically, this research focused on the following objectives: (1) review and refine the Find-a-Ride framework (2) apply and evaluate the gaps model and assess its applicability at the local and regional level, and (3) determine how to improve the gaps model and the gap maps.

The findings would provide several benefits: a) contribute to model validation and improvement to inform planning and policy making; b) inform the long-term operation and maintenance of the Find-a-Ride Framework and its related components; c) provide the stakeholders with the necessary information to take targeted steps and plan resource distribution to address service gaps and maximize the transportation services for Florida's vulnerable populations.

1.3 Report organization

Chapter 2 contains a review of the Find-a-Ride framework including the Find-a-Ride Florida website, its database, the gaps model, and the gap maps. It also includes a summary of the tasks and the required skills to operate and improve the Find-a-Ride framework. Chapter 3 provides a summary of the meetings with local and regional agencies. Chapter 4 synthesizes the feedback from the meetings on how to improve the gaps model and how to distribute/share the gap maps. Chapter 5 provides conclusions of this research, and the final chapter provides recommendations for implementation and future research.

2 Review and refine the Find-A-Ride framework

The purpose of this chapter is to conduct a review of the Find-A-Ride framework including the gaps model and gap maps, and their corresponding data, and the related Find-a-Ride Florida website in order to determine the skills needed to operate it and to explore options for dissemination of the gap maps.

2.1 Overview of Find-A-Ride Florida

This overview outlines the current status of the Find-a-Ride Florida website, the Find-a-Ride database, and the gaps model. It starts with the review of the current status followed by a more detailed review of the proposed Find-a-Ride Framework including the potential methods to disseminate the gap maps.

2.1.1 Status of the website, database, gaps model, and gap maps

2.1.1.1 Find-a-Ride Florida website

The Find-a-Ride Florida website (https://www.findarideflorida.org/) provides alternative transportation service information to general public and vulnerable populations such as older adults, individuals with disabilities, and low-income. Find-a-Ride is supported by FDOT's Safe Mobility for Life Program.

Figure 2-1 illustrates the landing page of the Find-a-Ride Florida Website (hereafter "Website"). End-users can search for transportation options by entering parameters such as 'traveling from', 'traveling to', 'purpose of trip', and any other special needs (e.g., escort, wheelchair).

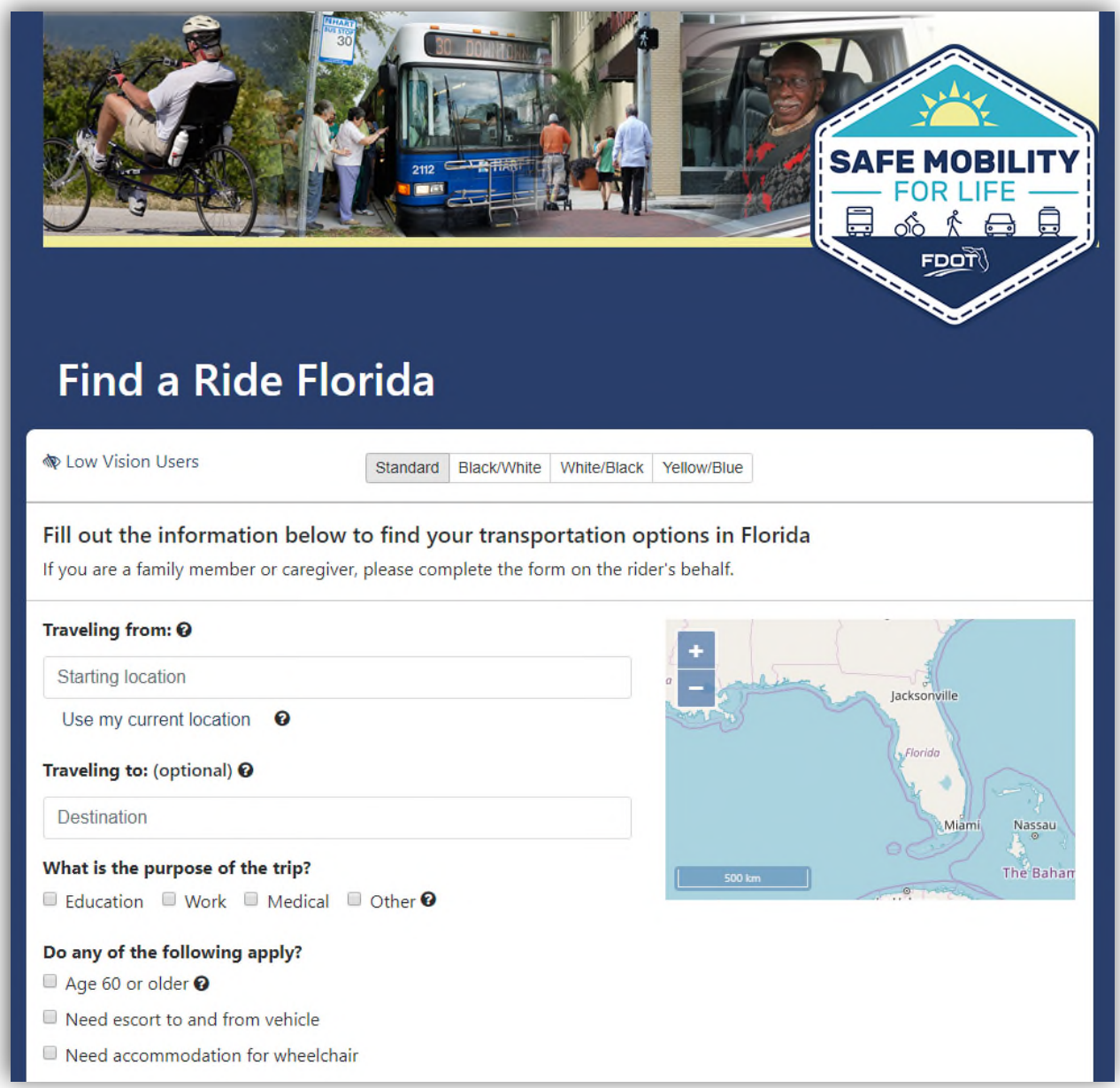


Figure 2-1. The landing page of the Website

Figure 2-2 illustrates the search results. It lists the transportation service providers that match the search criteria. Detailed information about the available services is displayed by clicking on the 'More Info' icon.

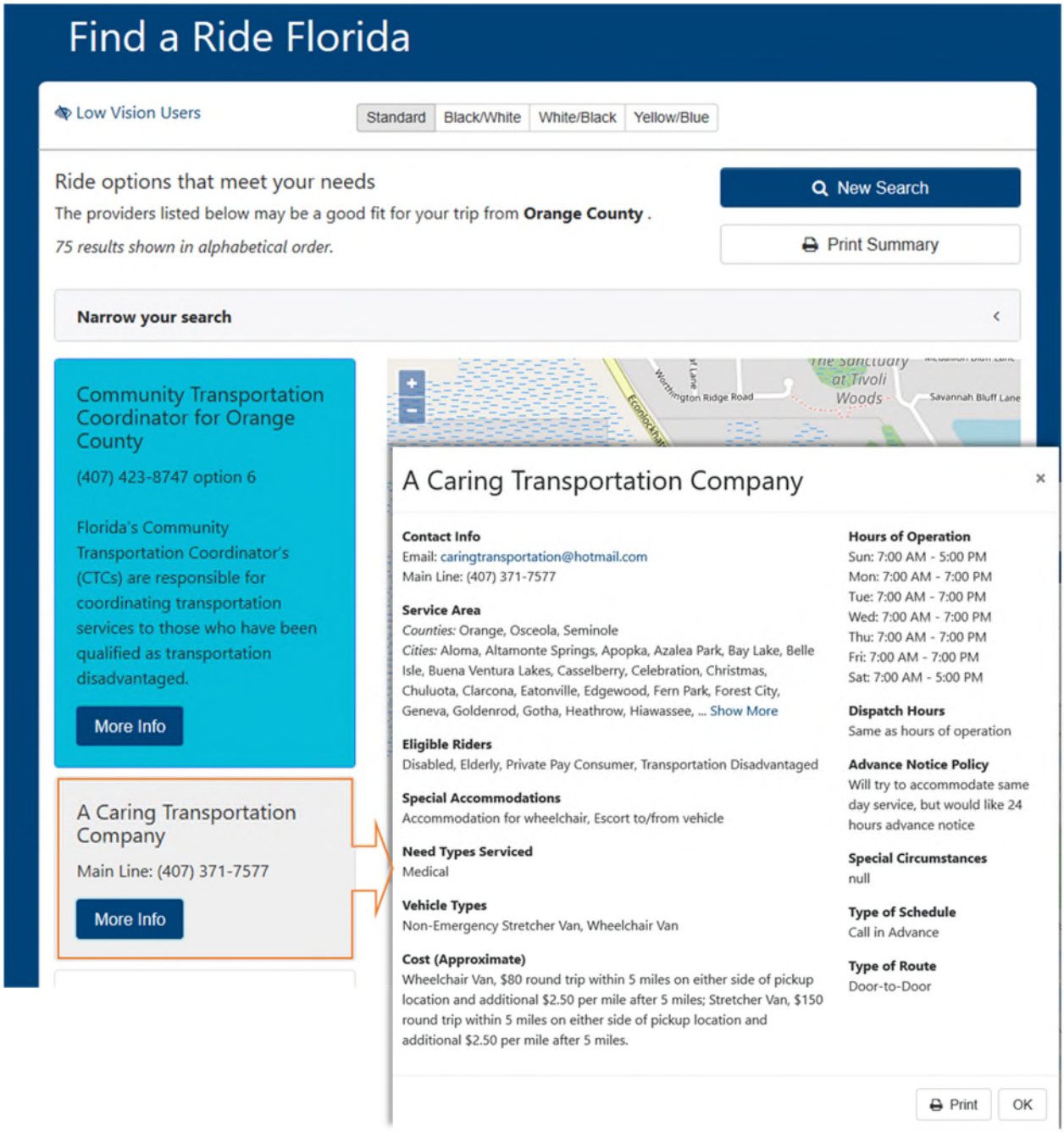


Figure 2-2. Illustration of the Search Results

2.1.1.2 Find-a-Ride Florida database

The Find-a-Ride website is supported by a database of service providers maintained by the University of Florida. Figure 2-3 illustrates the Find-a-Ride database (hereafter "Database") structure and data attributes. For each service provider, the database stores the service type, the schedule type, and the route type. The available service type depends on user eligibility,

type of destination, and any accommodations for special needs. The sections below describe the main parts of the database.

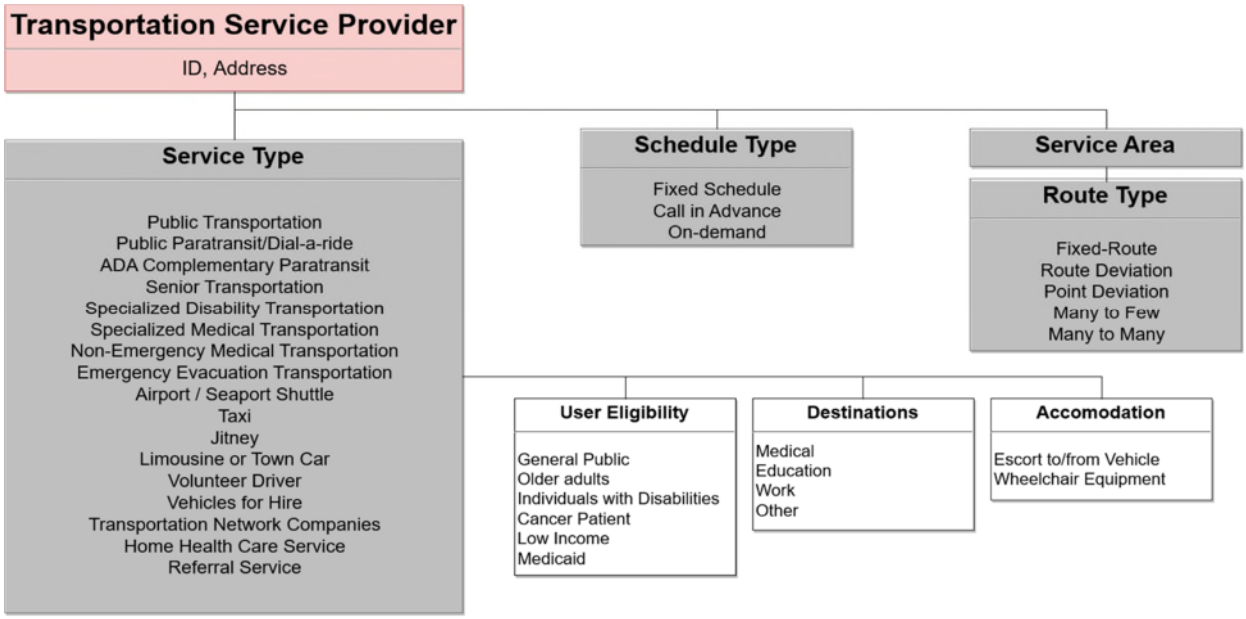


Figure 2-3. The Structure of the Database

2.1.1.2.1 Service type

The database stores a variety of service types such as public transportation, paratransit, various types of senior transportation, taxi, transportation network companies etc.

2.1.1.2.2 User eligibility

While several services provide mobility options for the general public, some services serve only the vulnerable populations, including older adults, individuals with disabilities, and low-income households. Some providers serve cancer patients, Medicaid recipients, and veterans. User eligibility is necessary to determine the available transportation options and to identify the geospatial gaps of transportation accessibility for these populations.

2.1.1.2.3 Destinations

While some transportation services provide service to a broad range of destinations, others specify or limit the destinations. Currently, the website uses four destination categories: medical, education, work, and other, which are characterized below:

- Medical: This destination category includes medical, dental, mental health treatment or other similar professional services. Hospitals, primary care providers, outpatient clinics, and dialysis treatment centers are included in this category. Also, this destination category includes medically related destinations, such as pharmacies, labs, and physical therapy locations.

- Education: This destination category includes schools, libraries, day care facilities, and before and afterschool care.
- Work: This destination category includes a place to work or volunteer.
- Other: This category includes recreation, social, meal, and shopping destinations. Recreational and social subcategory covers places to engage in exercise, places for social events, places to take vacations, and places for entertainment (e.g., theater, sports venue, and bar), historical sites, museums, parks, and places to attend religious activities. Meal-related destination subcategory includes places to get a meal, snack, or drink. Shopping destination subcategory includes places to buy goods (e.g., groceries, clothing, hardware store), places to buy services (e.g., dry cleaning, post office, car service, bank, and pet care), gas stations, and shopping malls.

2.1.1.2.4 Accommodation

2.1.1.2.5 Several transportation services provide special accommodations such as wheelchair services of an escort to or from a vehicle.Schedule type

- Fixed Schedule: The provider sets the times when customers can board or get off the vehicles. The schedule is established and published by the transportation agencies.
- Call-in-advance: Service is requested in advance for a single trip to occur at a specific time e.g., 24 to 48 hours in advance of the time of the trip. The customer has control of the pickup time within a specified arrival window with the advance request option but must know complete trip details in advance. (As this is not always possible, this requirement constrains the responsiveness of the service).
- On-demand: Service is requested through a central control or dispatcher for a single trip to be made as soon as possible. Requests are made by telephone or smartphone apps. The responsiveness of this option is affected by the availability of a telephone or other means of communication, the availability of a vehicle to make the trip, and the availability of space in the vehicle.

2.1.1.2.6 Route type

- Fixed Route: This type of service has predefined routes and stops. To use the service, users need to be at the designated stop.
- Flexible Route: This service has basic set routes but provides flexibility to deviate from the route based on user requests.
- Door-to-door: Upon request, the service picks users up at the front door and drops off at the destination.

2.1.1.3 Gaps model

The research conducted prior to this study has developed a model that can identify gaps in transportation services for vulnerable populations. The model (hereafter "gaps model") can be used to develop gap maps that can serve as a resource to inform decision makers of potential improvements that can be made to increase transportation accessibility for Florida's vulnerable populations and, ultimately, help narrow the gaps.

Figure 2-4 presents the conceptual framework of the gaps model. Transportation supply for the vulnerable populations is computed by quantifying the transportation accessibility of each analysis unit (e.g., census block group) using a gravity model. The model calculates the accessibility scores by considering total opportunities (e.g., total number of destinations) and the travel impedance (e.g., network travel time using OD matrix) to them within each service area by route type (fixed route, flexible route, and door-to-door). Transportation demand is computed by calculating the volume of the target population. Using the calculated supply and demand scores, each analysis unit is categorized by the level of supply and demand. Finally, spatial gaps, defined as areas of lower supply and higher demand, are determined by a supply-demand matrix. For more details regarding how the model works, please refer to Chapter 4, "Development of the Geospatial Model for Gap Identification" from (Bejleri, Noh, Steiner, Winter, & Gu, 2018) (click this link to access the report).

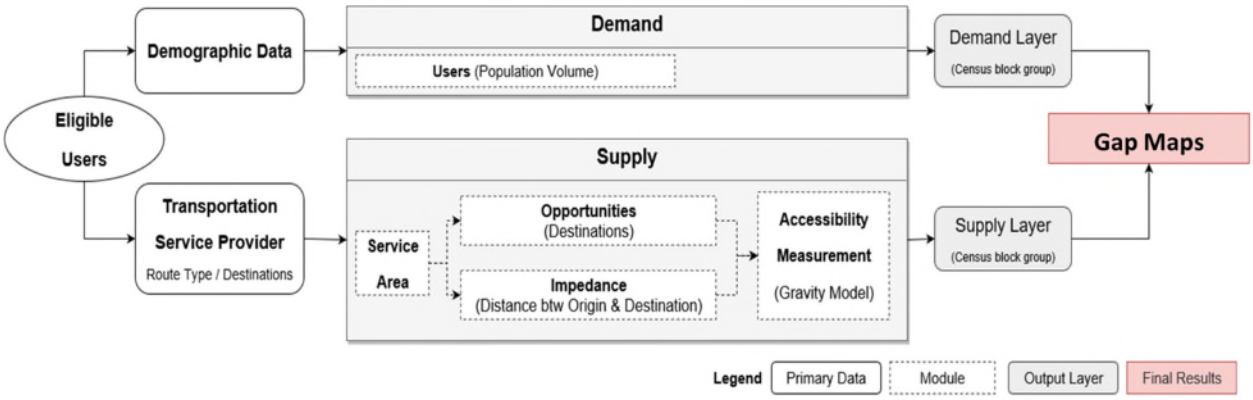


Figure 2-4. Conceptual Framework of the gaps model

The user interface of the model is designed to allow users to select the input parameters as desired. Figure 2-5 shows an example of the user interface.

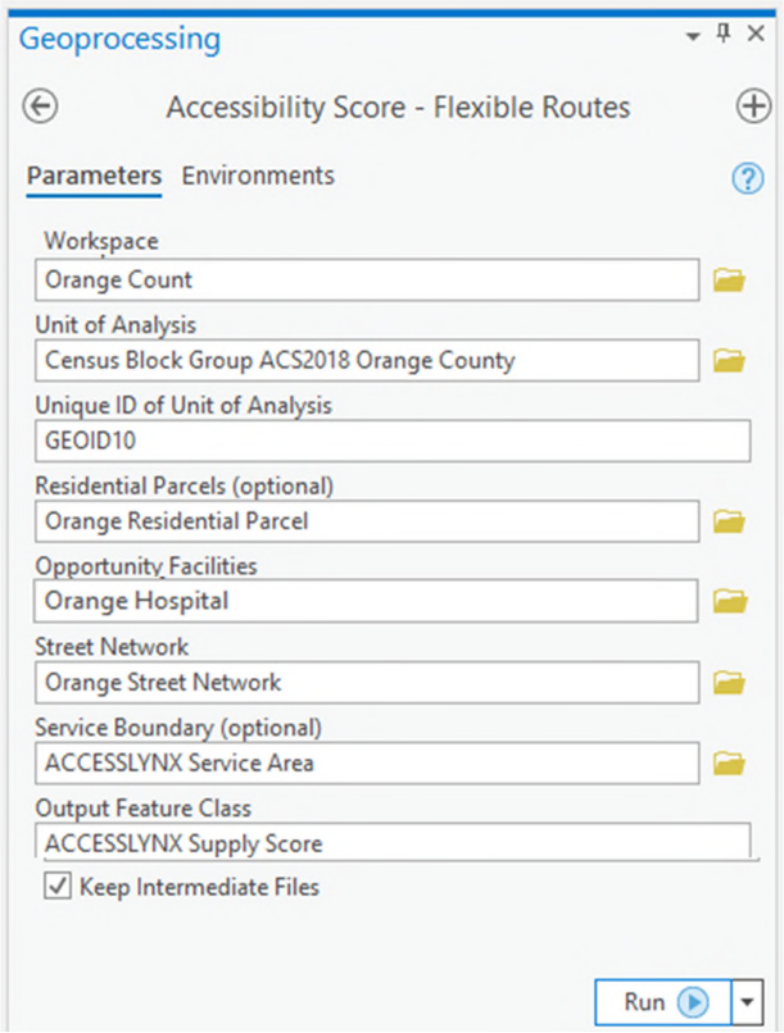


Figure 2-5. User Interface of the gaps model (Flexible Routes example)

The interface consists of several parameters—geographic extent by county, population type (i.e., users of transportation service), destination type, and route type. After selecting four parameters (county, user, destination, and route type), the interface shows the available transportation providers in case users are interested in selecting one or more service providers from the list. Finally, the user can set maximum walking distance or travel distance as an option.

2.1.1.4 Gap maps

This part illustrates some results from the gaps model. Input variables selected were: Orange County, older adults, all destinations, and the door-to-door service provider, Diamond Cab. The supply and demand are determined as follows:

2.1.1.4.1 Supply

To create the door-to-door supply layer, the model uses the Diamond Cab company (Service area: Orange), the Orange County street network, destinations point data, and census block groups as input data. Figure 2-6 and Table 2-1 show the spatial distribution of transportation supply (door-to-door) and populations impacted in the study area. The results show that 26.93% (33,007 people) of older adults in Orange County have poor accessibility (categories 'very low' and 'low').

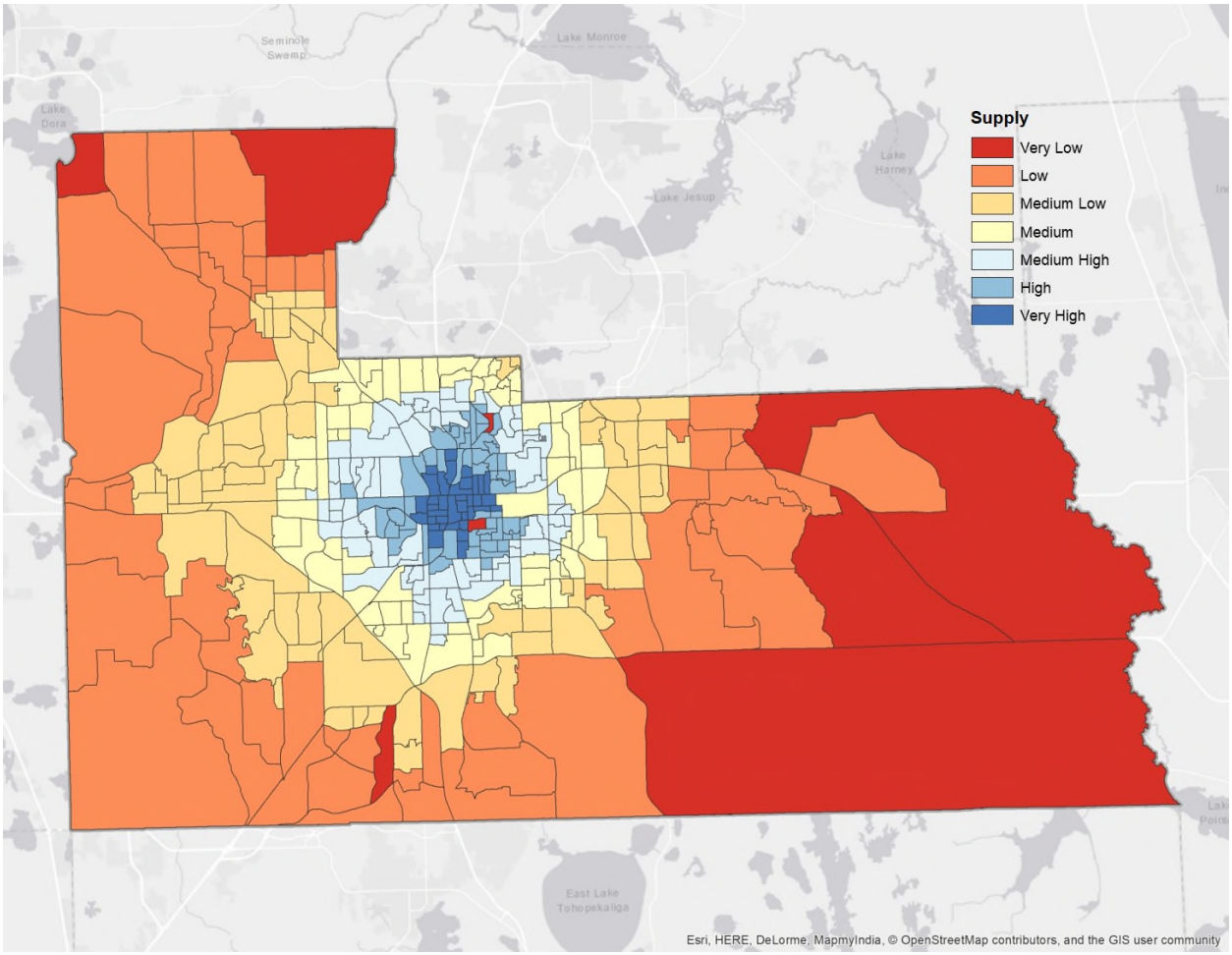


Figure 2-6. Supply Layer (Door-to-door Service)

2.1.1.4.2 Demand

Figure 2-7 and Table 2-1 show the spatial distribution of transportation demand and populations impacted. The results show that 29.68% (36,375 people) of older adults in Orange County have high transportation needs (categories 'very high' and 'high').

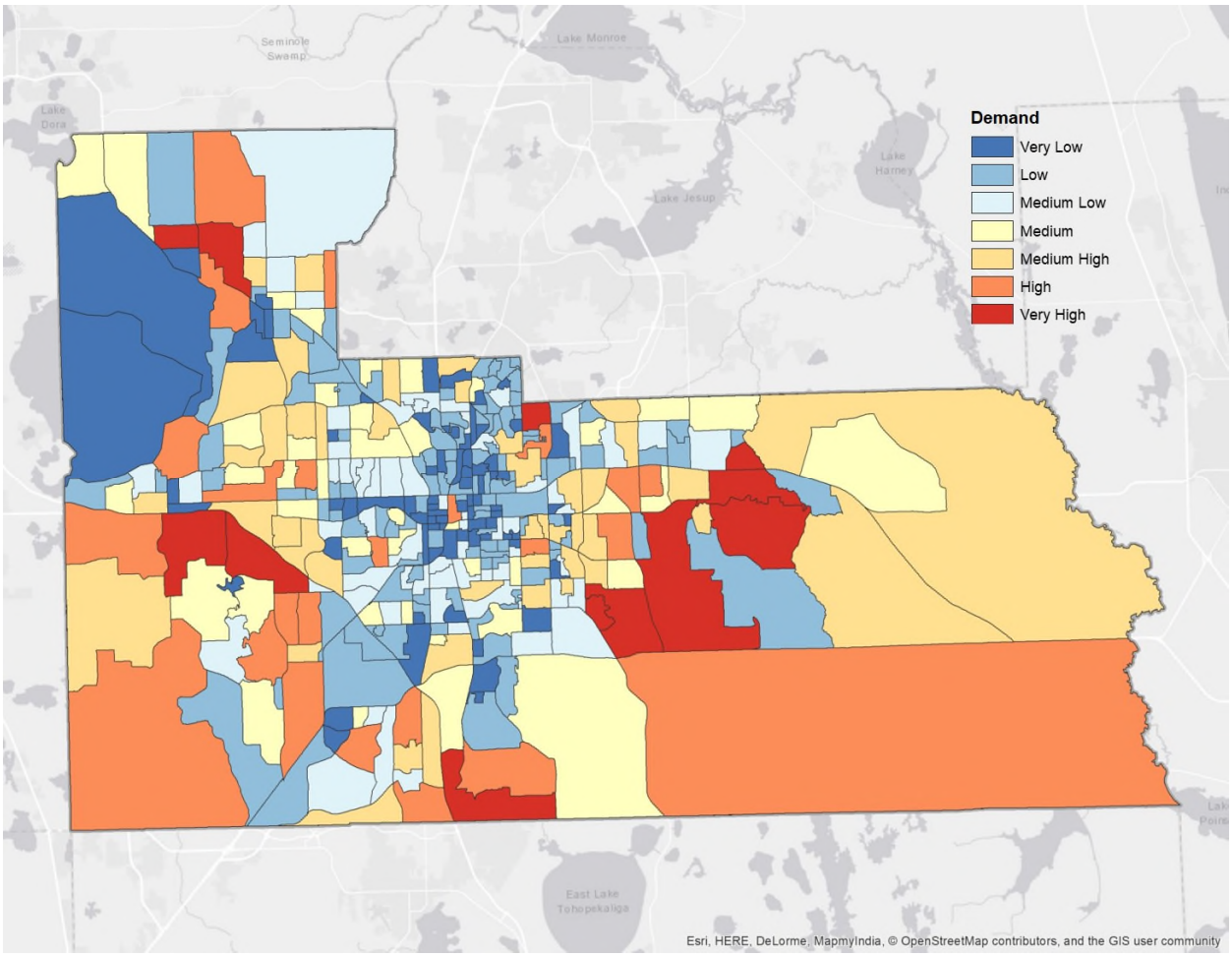


Figure 2-7. Demand Layer (Older Adults)

2.1.1.4.3 Gap maps

Based on the matrix (Table 2-1), we can see one census block group located in areas with 'very low' supply and 'high' demand. This census block group has 928 older adults. The other deficient areas contain 17 census block groups with 'low' supply but 'very high' and 'high' demand. They comprise 18,995 older adults. Figure 2-8 illustrates the spatial distribution of flexible route service gaps for older adults.

Table 2-1. Supply-Demand Matrix: Door-to-door for Older Adults

Demand \ Supply		Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Older Adults		**10,978**	3,296	1,268				15,542
	block group(s)		**8**	3	1				12
High	Older Adults	**928**	**8,017**	7,616	1,041	2,486		745	20,833
	block group(s)	**1**	**9**	9	1	3		1	24
Medium High	Older Adults	1,346	3,871	8,063	8,272	4,626			26,178
	block group(s)	2	7	13	14	8			44
Medium	Older Adults	373	2,880	6,104	4,516	2,589	759	396	17,617
	block group(s)	1	7	14	10	6	2	1	41
Medium Low	Older Adults	546	1,748	2,628	2,987	7,579	1,853	1,043	18,384
	block group(s)	2	6	9	10	25	6	4	62
Low	Older Adults	138	1,804	3,150	4,112	3,809	3,752	2,124	18,889
	block group(s)	1	11	19	25	24	24	12	116
Very Low	Older Adults	38	340	714	722	887	1,447	947	5,095
	block group(s)	1	5	10	10	10	22	18	76
Grand Total	Older Adults	3,369	29,638	31,571	22,918	21,976	7,811	5,255	122,538
	block group(s)	8	53	77	71	76	54	36	375

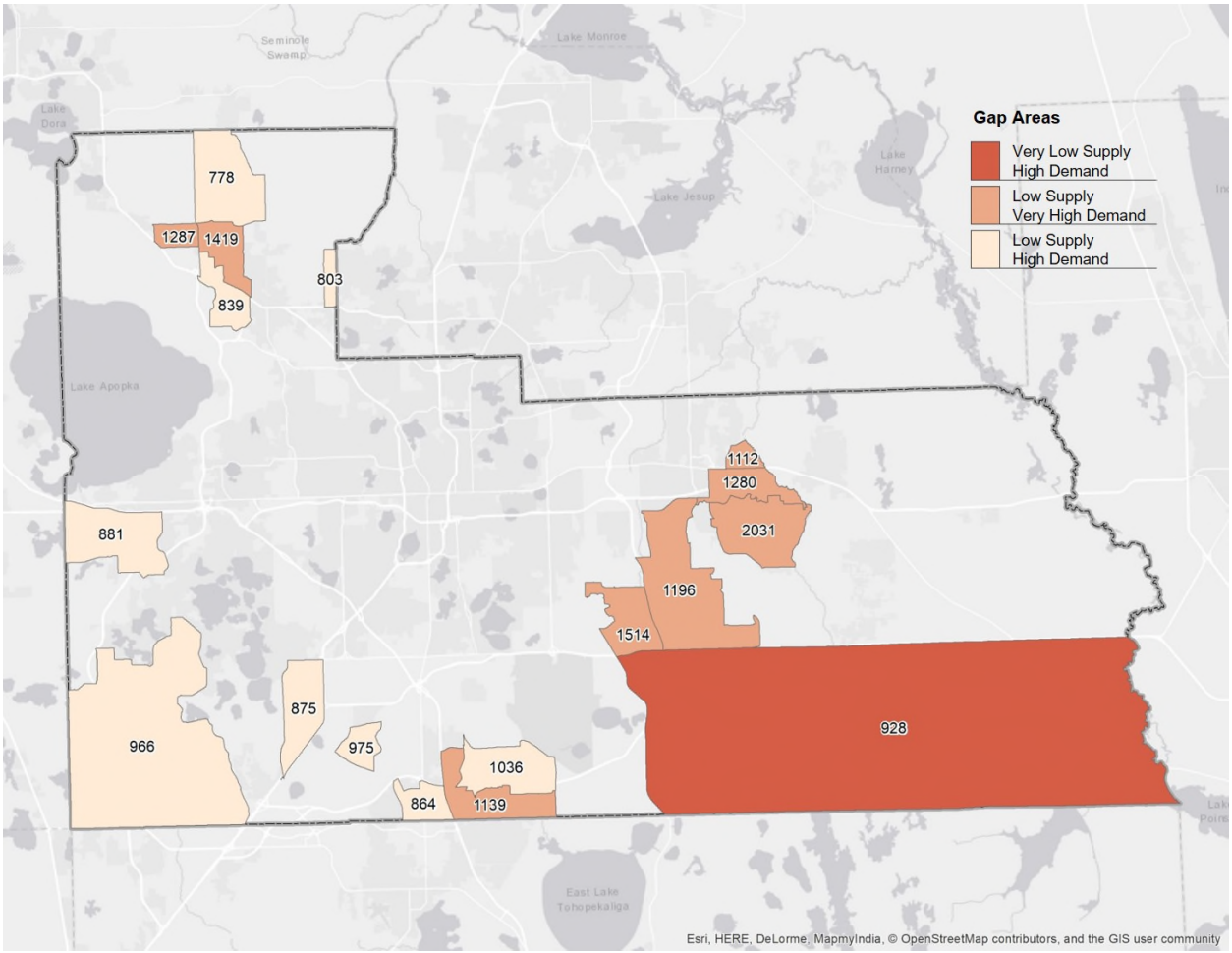


Figure 2-8. Gap map: Door-to-door Service Gaps for Older Adults

2.1.2 Find-a-Ride framework

Figure 2-9 illustrates the current status of the website, the database, and the gaps model. Using the data, the website provides relevant transportation information to the users. The gaps model creates the Gaps Maps to find transportation gaps for selected Transportation Disadvantaged (TD) population.

Figure 2-9. Current Status

The gap maps can serve as a useful resource to inform decision makers of potential improvements that can help narrow the gaps. However, currently there are no methods to disseminate the gap maps to stakeholders. In this context, we see the website, the database and the gaps model as components of a larger framework that we are referring to here as the Find-a-Ride Framework. It should be noted that this does not create an entirely new system but rather serves to identify a larger framework that adds or integrates the website, database, and gaps model together. Figure 2-10 illustrates the new components and functions of the framework. The difference compared to the current status (Figure 2-9) is the addition of a new webpage to visualize gap maps within current website. The newly added gap maps webpage could serve as a broad resource for planning and policy actions to examine specific users and transportation options in a local context.

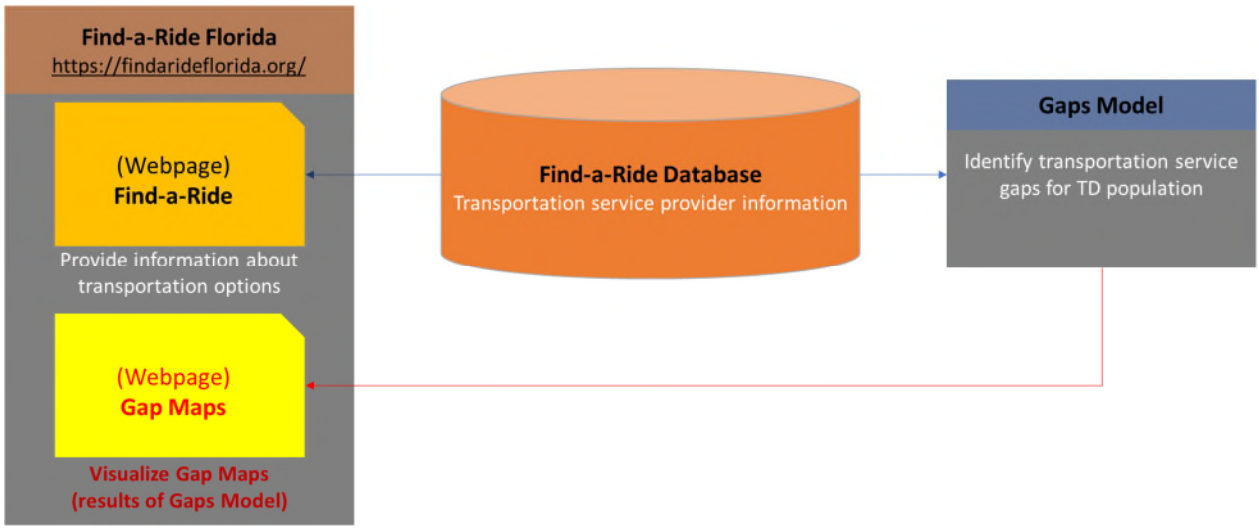


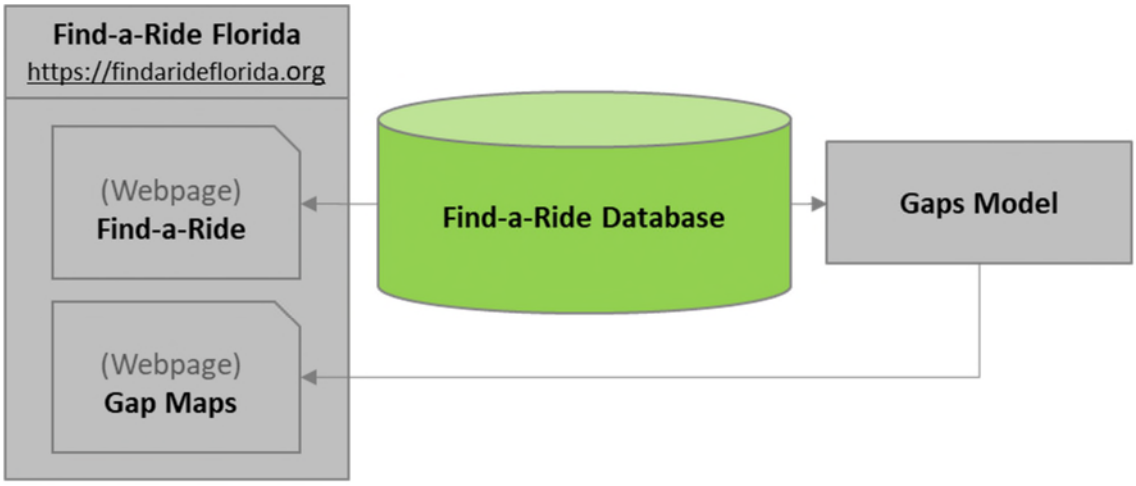
Figure 2-10. Proposed Find-a-Ride Framework

2.1.3 Tasks and skills required to support Find-a-Ride framework

This section presents the expected tasks and the necessary skills required for the long-term operation and maintenance of each component of the proposed framework.

2.1.3.1 Find-a-Ride database

Figure 2-11 shows the necessary tasks and the required skills to maintain and operate the database. The main tasks involve managing and updating transportation service provider information. It also requires maintaining the information update portal to allow service providers to update their information as well as giving them the ability to communicate and educate service providers when it is necessary. The staff who works with the database should possess operational knowledge of the web-based database update interface and database management.

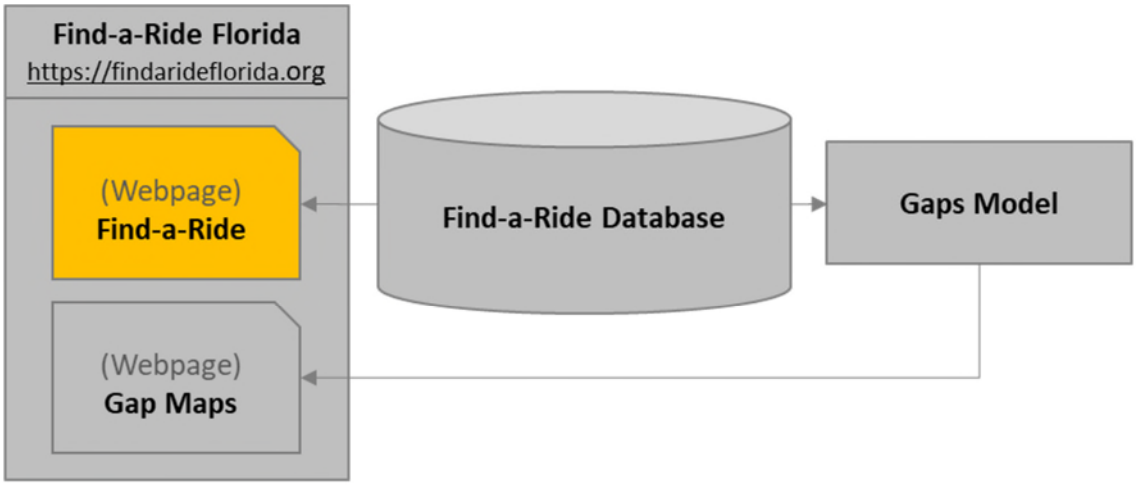


Tasks	• Maintain / update service provider information to support the Find-a-Ride website • Maintain portal to allow service providers to update their information such as eligible users, destinations, operation hours, and other relevant information • Manage accounts of service providers • Educate and communicate with service providers • Communicate with users
Skill Requirements	• Operational knowledge of web-based database update interface and database management

Figure 2-11. Tasks and necessary skills for the database

2.1.3.2 Find-a-Ride webpage

Figure 2-12 describes the necessary tasks and the required skills to maintain and operate the Find-a-Ride webpage. The main tasks are managing and updating the webpage to visualize transportation options to users as well as communicating with end users when it is necessary. The staff who works with the webpage should have operational knowledge in application development and maintenance including map-based applications. It is also required to have operational knowledge of ArcGIS and ability to link GIS and service provider data and maintain the database.



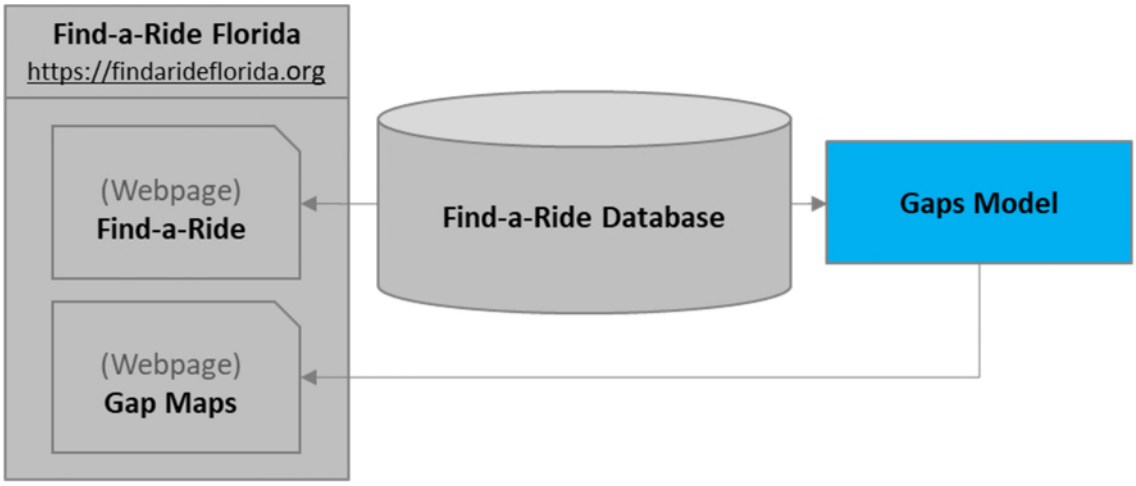
Tasks	• Display transportation options to users • Maintain / update the webpage • Communicate with users
Skill Requirements	• Operational knowledge of application development and maintenance • Operational knowledge of map-based application development and maintenance • Operational knowledge of ArcGIS and ability to link GIS and service provider data, and maintain database

Figure 2-12. Tasks and necessary skills for the Find-a-Ride webpage

2.1.3.3 Gaps model

Figure 2-13 illustrates the necessary tasks and the required skills to maintain and operate the gaps model. The main tasks involve running the model and creating gap maps. Other tasks include performing updates of GIS data and the gaps model. The staff who works with the gaps model database should possess operational knowledge of ArcGIS and ability to process and manage GIS data. It is also necessary to have the skills needed to maintain the gaps model with extensive experience and knowledge of Model Builder and Python scripting for ArcGIS. In

addition to practical skills, it is essential to have theoretical knowledge of transportation accessibility modeling.



Tasks	• Maintain / Update GIS data • Run the Model as needed • Create Gap Maps • Store / Update Gap Maps • Maintain / Update the Gaps Model
Skill Requirements	• Theoretical knowledge of transportation accessibility modeling • Operational knowledge of ArcGIS and ability to process and manage GIS data • Skills to maintain the Gaps Model with extensive experience and knowledge of model builder and Python scripting for ArcGIS

Figure 2-13. Tasks and necessary skills for the gaps model

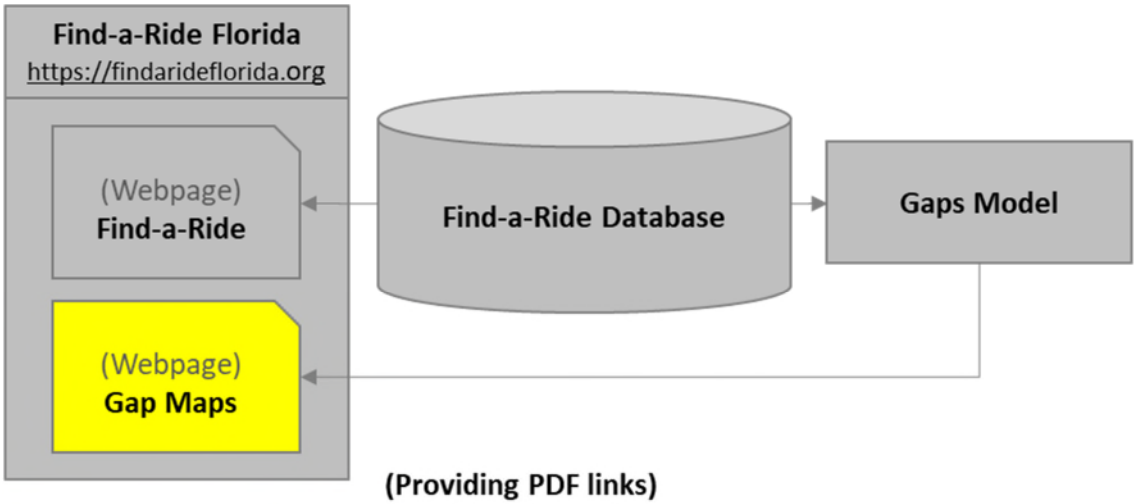
2.1.3.4 Gap maps

Several options should be considered for dissemination of the gap maps: webpage with PDF links, ArcGIS online, and interactive webpage. The section below provides more details for each option:

2.1.3.4.1 PDF links

This webpage would provide PDFs of gap maps produced for the interested agencies and geographic areas. The end users could simply download these PDFs from the webpage. This option, although simple to develop and maintain, would require preparation and posting of a wide range of gap maps for various geographic extents and population types in order to cover a wide diversity of needs of various stakeholders. Figure 2-14 shows the necessary tasks and the

required skills to maintain and operate the gap maps webpage using PDF links. The main tasks are creating and updating gap maps in PDF. It also necessary to communicate and manage user accounts when it is necessary. The staff who works with the gap maps webpage with PDF links should possess operational knowledge of ArcGIS and ability to process and manage GIS data. It is also required to have skills to prepare the gap maps in PDF and post them to the webpage.

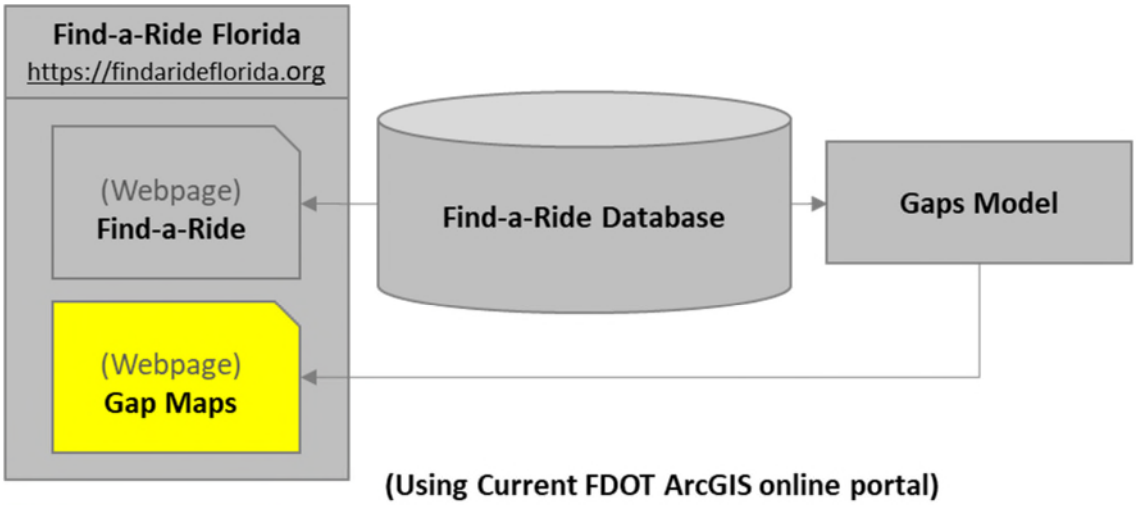


Tasks	• Create/update Gap Map PDFs and post them on the webpage • Manage user accounts (if applicable) • Communicate with users
Skill Requirements	• Operational knowledge of ArcGIS and ability to process and manage GIS data • Skills to prepare the Gap Maps as PDF format and post to the webpage

Figure 2-14. Tasks and necessary skills for the gap maps (PDF links)

2.1.3.4.2 ArcGIS Online

Another option is to publish the gap maps using FDOT ArcGIS Online portal, which offers interactive tools for map viewing, data export, and printing. Figure 2-15 illustrates the necessary tasks and the required skills to maintain and operate the gap maps webpage using ArcGIS online. The main tasks for this option involve managing and updating GIS layers associated with the gap maps. It also necessary to communicate and manage user accounts if the Gaps Maps are posted for specific users. The staff who works with the gap maps webpage using ArcGIS online should have operational knowledge of ArcGIS and ability to process and manage GIS data. It is also required to have the skills needed to prepare the gap maps layers and post them on ArcGIS online.

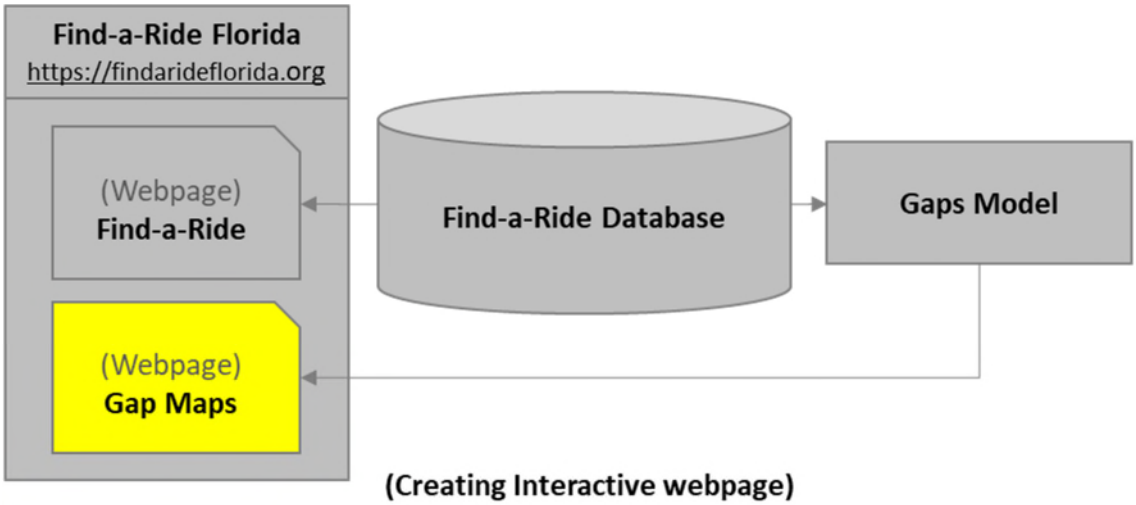


Tasks	• Setup the ArcGIS Online webpage • Update the GIS layers for the Gap Maps • Manage user accounts (if applicable) • Communicate with users
Skill Requirements	• Operational knowledge of ArcGIS and ability to process and manage GIS data • Ability to create ArcGIS Online webpage • Skills to prepare the Gap Maps layers and post them on ArcGIS Online

Figure 2-15. Tasks and necessary skills for the gap maps (ArcGIS Online)

2.1.3.4.3 Interactive webpage

A new interactive webpage could be added to the website. Compared to the PDF links page or ArcGIS Online, this option would take a bigger effort to develop, but in return would allow much more flexibility in content customization and usability. Figure 2-16 describes the necessary tasks and the required skills to maintain and operate the gap maps webpage using interactive webpage. The main tasks are developing and updating an interactive map-based webpage and supporting the database, managing and updating GIS layers associated with the gap maps, and communicating with and managing user accounts when it is necessary. The staff member who works with the gap maps interactive webpage should possess operational knowledge of both interactive map-based application development and process and manage GIS data. It is also required to have the skills to prepare the gap maps, including charts and tables.



Tasks	• Develop an interactive map-based webpage and supporting database • Update the GIS layers and supporting database • Maintain/update map services for the Gap Maps • Manage user account (if applicable) • Communicate with users
Skill Requirements	• Operational knowledge of ArcGIS and ability to process and manage GIS data • Operational knowledge of interactive map-based application development and maintenance • Skills to prepare Gap Maps, charts, and tables, and post them to the interactive map page

Figure 2-16. Tasks and necessary skills for the gap maps (Interactive webpage).

2.2 Find-A-Ride refinements and improvements

This section presents relevant upcoming refinements/improvements to the Find-A-Ride database and the website that could affect the direction of the next steps in this project.

2.2.1 Find-a-Ride webpage refinements

Based on feedback from users and stakeholders, several points of improvements/refinements have been identified for the find-a-ride website and database:

1. When a user inputs “traveling from” and “traveling to”, the choices should be limited to the extent of the state of Florida.

2. In the results page, place the public transportation service providers at the top of the list of matching providers, below the Community Transportation Coordinator (CTC), mobility manager, and travel trainer.
3. A better way to handle long distance providers (i.e., Amtrak, Greyhound) is to show results only when it is an inter-city trip between locations serviced by one of these providers, or perhaps within a certain distance.
4. The transportation service providers' information should be updated regularly (e.g. twice/year).
5. Add more options to sort the results (e.g., by cost, by operation hours, and so on).
6. Use service provider's general email instead of emails of individual persons
7. Consider changing "Accommodation for wheelchair" under Special Accommodations to "ADA Compliance".

2.2.2 Refining geographic boundaries of service providers

Findings from the previous research project and the experience of the Find-A-Ride thus far point to the need for more accurate geographic boundaries of service transportation providers. These boundaries can be improved by using zip codes of service areas. Figure 2-17 shows an example of a tool that can be used by the service providers for this purpose. The zip code-based approach will require changes to the Find-A-Ride database to support the more refined geographic boundaries. Once available, the Find-A-Ride searches will produce more accurate results for Florida users.

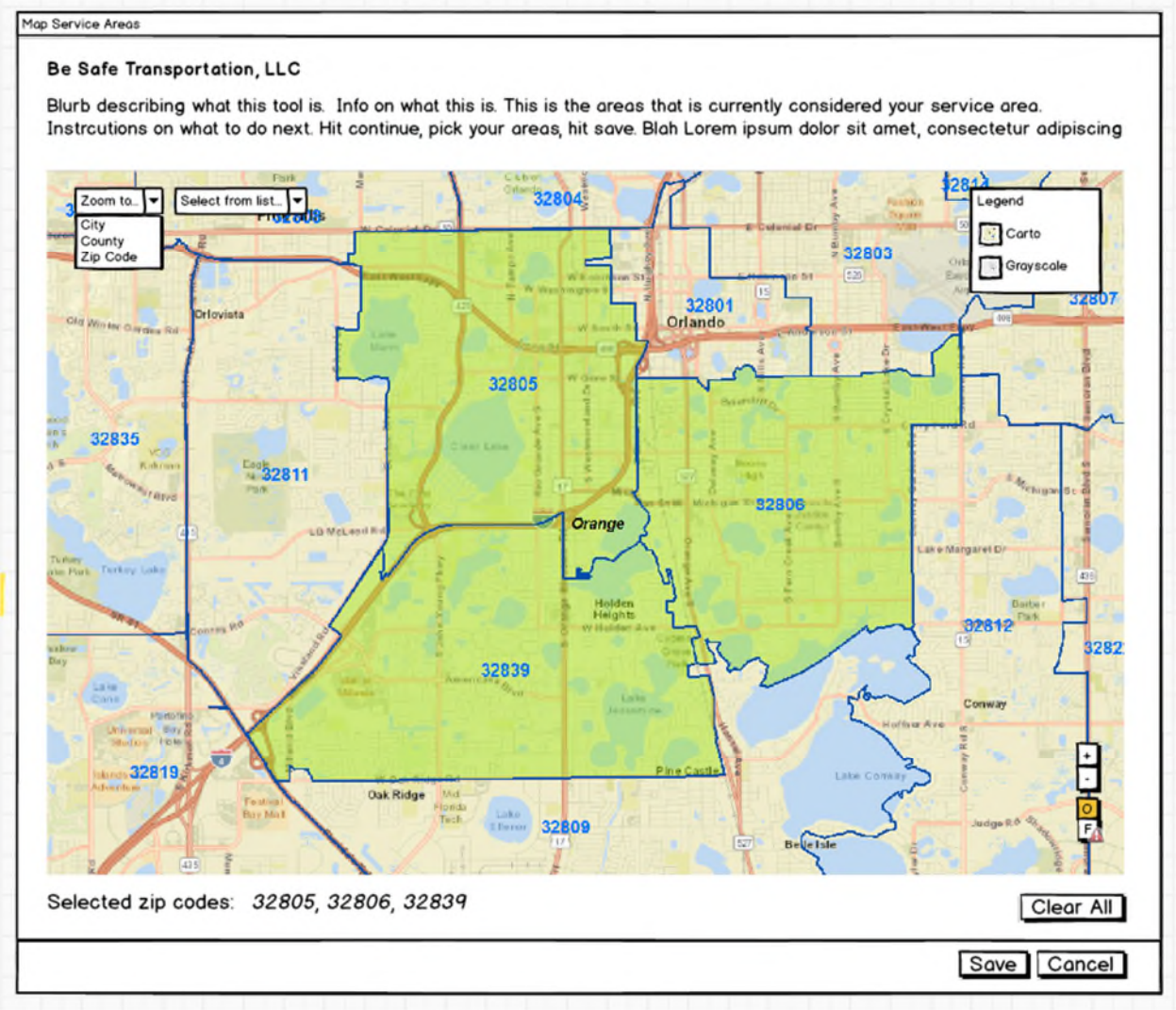


Figure 2-17. Protype example of interactive service area tool

Additional refinements based on feedback from service providers include:

- An option to import into the database service provider data such as routes and service areas.

Options to allow service providers to determine default service areas as a set of all zip codes in one or more counties.

3 Evaluate the gaps model and the gap maps

In this research, we explored the application and evaluation of the gaps model at the local and regional scales to understand its ability and effectiveness to inform and support policy and decision making for improvement of transportation options of vulnerable populations.

In this context, the research team aimed to apply and assess the gaps model and the gap maps to assist planners and policymakers at both local and regional levels in their efforts to enhance transportation options and reduce the gaps in service for the vulnerable population in their area. The input from the agencies can provide the necessary understanding on how the gaps model will be used, how it will be accessed by local governments, how the results will be utilized, and if the model will need to be modified to meet their improvement efforts. The input from agencies can also help refine any data availability and/or needs at the local and regional level that can improve the model and the results.

3.1 Meetings with local and regional agencies

To obtain input from local agencies, the research team met with Alachua County and Orange County. For input from regional agencies the research team met with MetroPlan Orlando, and Lake-Sumter MPO.

- Alachua County: The meeting was held online on July 30, 2020. Participants from Alachua County included General Manager Edward Griffin from MV transportation representing paratransit services and RTS ADA coordinator, Millie Crawford, representing the ADA Complementary Paratransit Service. Please refer Appendix A for meeting material.
- Orange County: The meeting was held online on September 8, 2020. Participants from Orange County included Dr. Hatem Abou-Senna from Orange County Transportation Division and program manager Mimi Reggentin representing Orange County Office on Aging. Please refer Appendix B for meeting material.
- MetroPlan Orlando and Lake-Sumter MPO: The meeting was held online on October 27, 2020. Participants from MetroPlan Orlando included the Director of Regional Partnerships, Virginia Whittington, and the Executive Director from the Lake-Sumter County MPO, Michael Woods. Please refer Appendix C for meeting material.

The meetings set four objectives: first, to describe the model and share with participants the results showing the gaps between the available transportation services and the needs of the vulnerable population in their area. The UF team presented two scenarios using both fixed-

route bus service and flexible/door-to-door service for each agency. The second objective of the meeting was to obtain feedback from the experts on the model results in their area. The third objective was to seek their input on the usefulness of this model to help improve transportation services at the local and regional levels and seek input on how the model could be improved to better meet their needs. Finally, we were interested in learning about their preferred method of accessing the gap maps to support their work for improving transportation services in their areas.

3.2 Comments and feedbacks

This section summarizes the findings from the comments and feedback during the meetings organized in 5 groups: transportation services and service areas, TD populations, ridership, demand estimation and expected challenges.

3.2.1 Service area

In addition to fixed route services (RTS-Alachua county, Lake Xpress-Lake county, and LYNX-MetroPlan Orlando including Orange county), each agency provides complimentary ADA paratransit service, which typically operates within a three-quarter mile of fixed routes.

3.2.1.1 Alachua County

Alachua county ADA paratransit serves area within ¾ mile of fixed routes (Figure 3-1). However, the Alachua County ADA coordinator commented that ADA paratransit service covers the City of Gainesville, which is broader than the typical service boundary. Unlike the ADA paratransit service, MV Transportation provides door-to-door service that covers the entire County boundary (Regional Transit System, 2020).

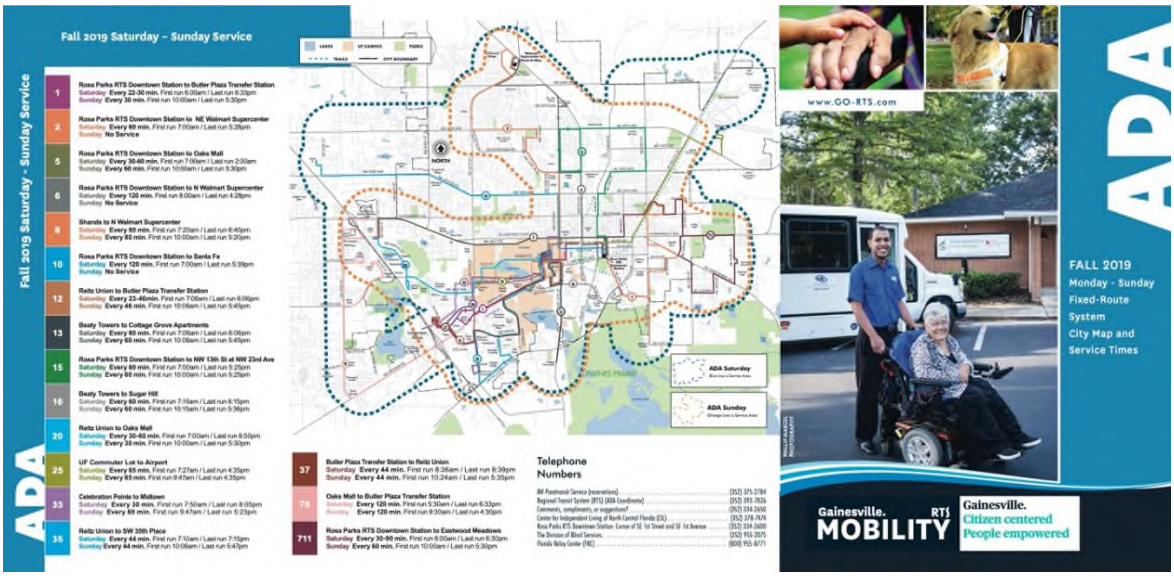


Figure 3-1. Alachua county: ADA paratransit Service area boundary

3.2.1.2 Lake County

Lake County Connection is the County's complementary ADA and TD public transportation service for qualified individuals. The service provides transportation service within a three-quarter mile buffer from the fixed-route bus service (Lake Xpress, Figure 3-2). In addition, it offers service to Orlando and to Gainesville areas at different fare only for medical appointments within a certain time schedule.

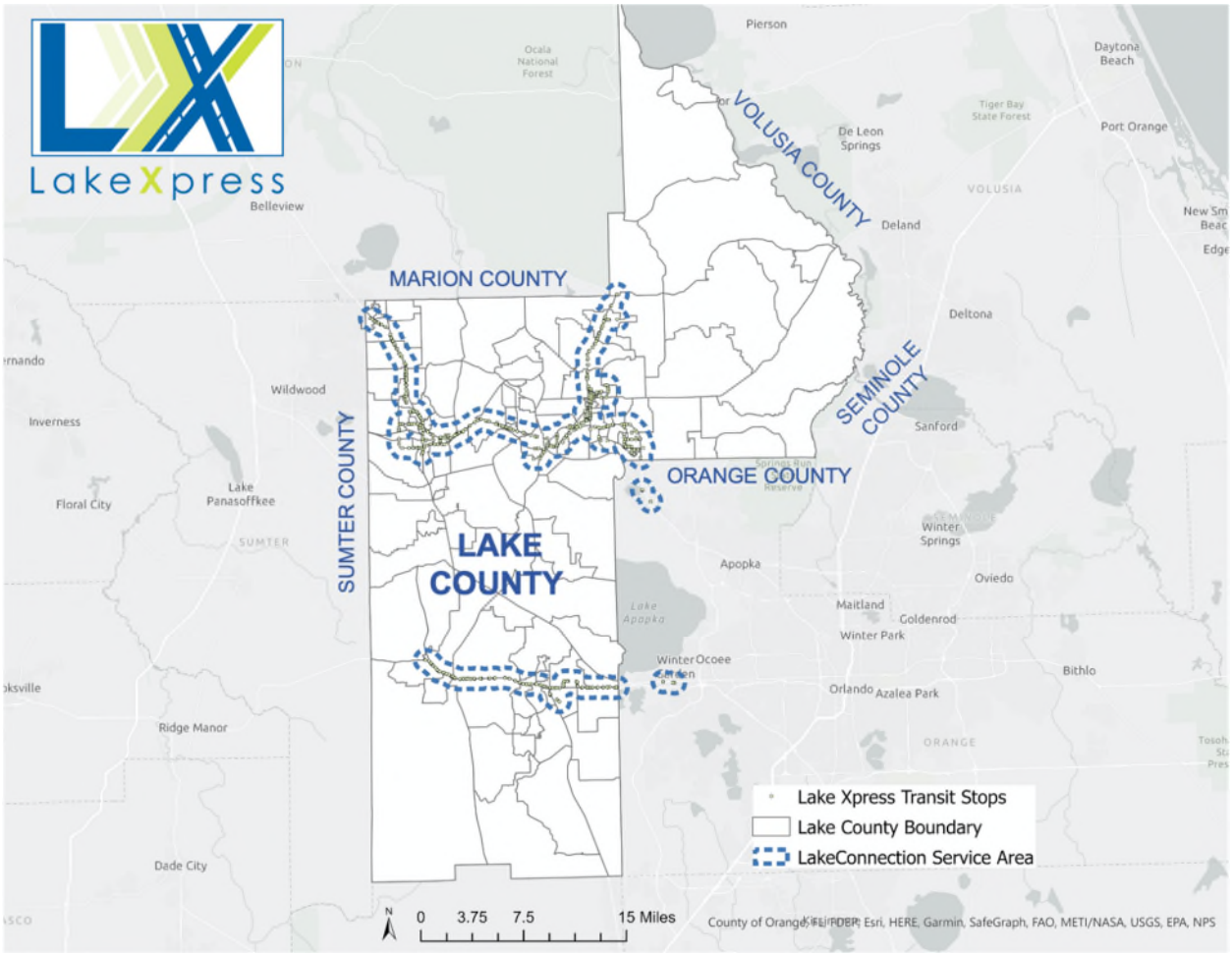


Figure 3-2. Lake County: Lake Xpress Service area boundary

3.2.1.3 MetroPlan Orlando

The Central Florida Regional Transportation Authority (LYNX) offers two specialized transportation services complementary to the fixed-route bus service in the MetroPlan Orlando area: Access LYNX and Neighbor Link.

Neighbor Link, which is shown in Figure 3-3, is a flexible service that takes passengers from their home to the LYNX bus SuperStops. This service also provides transportation from the SuperStops back to the passenger's home, but the service is not 24/7 and there is a fee. The co-pay is for a one-way trip based on mileage from the passenger's home to the SuperStop or vice versa.

Access LYNX is a 24/7 on-demand and door-to-door paratransit service that serves all of Osceola, Orange, and Seminole counties. Passengers that may file an application with a doctor's note to be eligible for service use include seniors, individuals with disabilities, and patients in need of transportation to life-sustaining treatment. Passengers can be picked up either within a

¾ mile buffer from the LYNX fixed route for a $4 co-pay one way, or outside of the ¾ mile buffer area for a $7 co-pay one way. Costs are not covered by medical insurance, even if the passenger's trip purpose is medical.

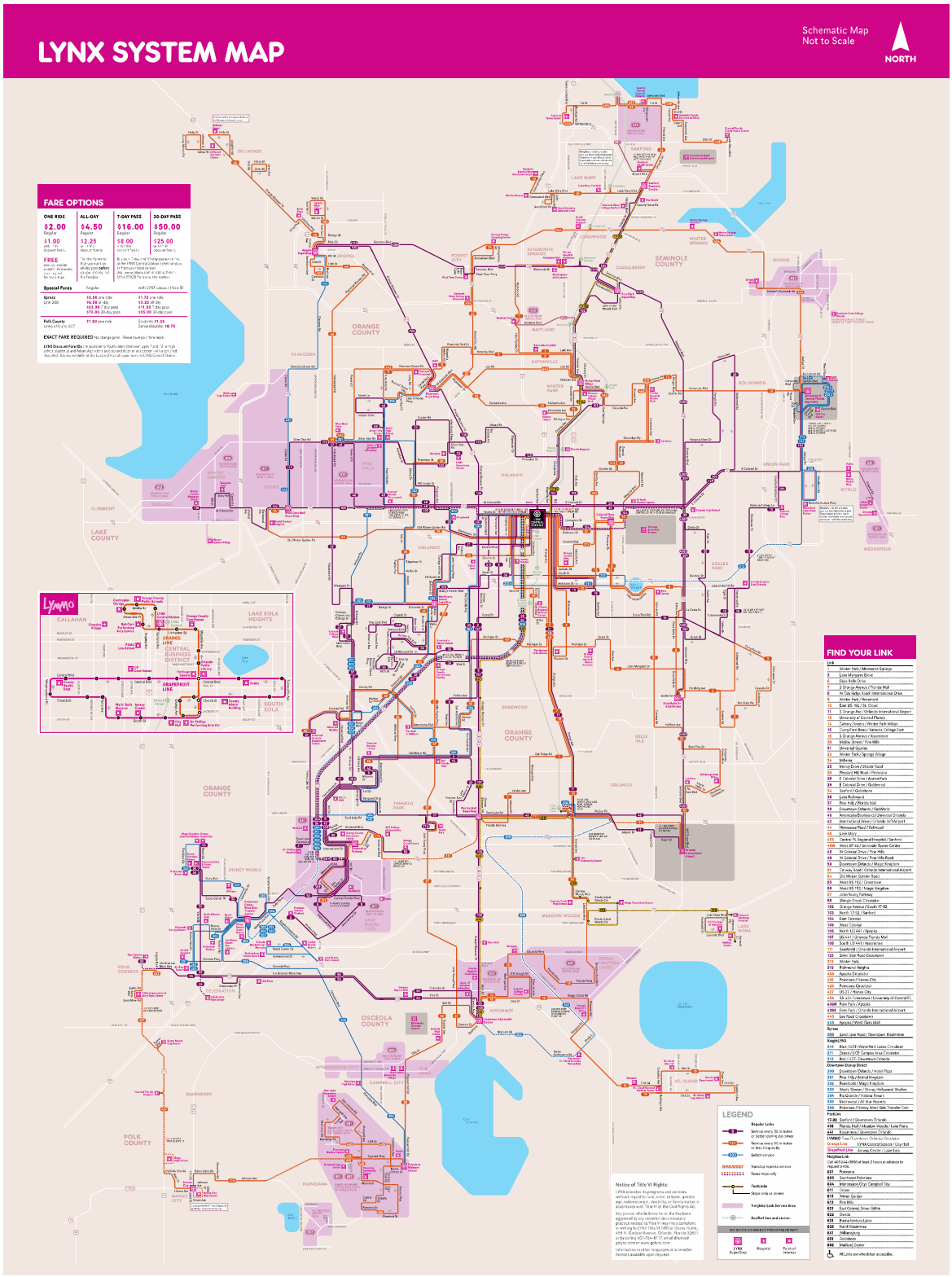


Figure 3-3. MetroPlan Orlando: Neighbor Link Service area boundary

3.2.2 TD population

3.2.2.1 Older Adults

3.2.2.1.1 Trip behavior of older adults

Many older adults would not use a fixed route system unless they live in a community where other residents are also using them. One reason is long headway (amount of wait time) at transit stops is challenging. Especially when they have medical appointments, older adults do not want to wait outside a quarter mile from home because the waiting time could be more than they can handle. Another reason is that typically the routes do not go to the destinations where older adults want to go.

3.2.2.1.2 Age classification and living location

It would be useful if the model could break the age groups down to more specific age groups instead of using population age above 65 as one group. This would give a better understanding of the older adult population who live in assisted living, nursing homes, and the Department of Housing and Urban Development (HUD) housing[1]. Particularly, if the applicants are age 62 and above, they could apply to the HUD housing. However, due to a long waiting list, it would take about four to five years to get into HUD housing. That is, older adults who are less than 70 years old typically do not live in HUD housing. This could explain why Downtown Orlando has a large older adult population. It is because of the location of HUD housing. However, most of HUD housing provides either bus services or carpool service for residents, and although these areas show as 'high demand', transportation supply might already meet the needs of the residents.

3.2.2.1.3 Income

Even among older adults, income could be a very high predictor for identifying actual users. Because low-income older adults may not have access to a private vehicle, they are more likely to use public transit services than older adults with higher incomes.

3.2.2.2 People with disabilities

It was suggested that the model should distinguish people with disabilities and TD populations based on transportation eligibility requirements. For example, Access LYNX provides services for eligible individuals who have disabilities defined by the ADA guidelines, severe disabilities such as physical or mental impairments, and who are not able to use regular transit services (North Central Florida Regional Planning Council, 2017). The calculation of TD population

[1] Department of Housing and Urban Development (HUD) provides Federal aid to support eligible low-income families, older adults, and persons with disabilities. To qualify for HUD subsides, the residents must be over the age of 62 (U.S. Department of Housing and Urban Development, 2020).

demand should consider people with disabilities, as well as low-income, older adults, and children at high-risk.[2]

3.2.3 Ridership data

It was suggested that if the research team can get some of the travel origins from the agency and identify any correlation with the distribution of riders. Also, it would be helpful to look at ridership data by age group from fixed route service provider such as LYNX.

3.2.4 Demand estimation

3.2.4.1 Income

The results of the Orange County model show that the higher supply is mostly in the central area of Orange County when in reality the high demand areas are in the fringes. Low-income people tend to live within the core of the city whereas high-income residents live in the fringes and might not need the public transportation. Therefore, if the gaps model were to consider the income level for demand estimation, the gap maps may represent more realistically the distribution of the demand.

[2] In the 2020 Florida Statutes Chapter 411 Handicap or High-risk condition prevention and early childhood assistance defined high-risk as follows.

(9) "High-risk child" or "at-risk child" means a preschool child with one or more of the following characteristics:
- (a) The child is a victim or a sibling of a victim in a confirmed or indicated report of child abuse or neglect.
- (b) The child is a graduate of a perinatal intensive care unit.
- (c) The child's mother is under 18 years of age, unless the mother received necessary comprehensive maternity care and the mother and child currently receive necessary support services.
- (d) The child has a developmental delay of one standard deviation below the mean in cognition, language, or physical development.
- (e) The child has survived a catastrophic infectious or traumatic illness known to be associated with developmental delay.
- (f) The child has survived an accident resulting in a developmental delay.
- (g) The child has a parent or guardian who is developmentally disabled, severely emotionally disturbed, drug or alcohol dependent, or incarcerated and who requires assistance in meeting the child's developmental needs.
- (h) The child has no parent or guardian.
- (i) The child is drug exposed.
- (j) The child's family's income is at or below 100 percent of the federal poverty level or the child's family's income level impairs the development of the child.
- (k) The child is a handicapped child as defined in subsection (8).
- (l) The child has been placed in residential care under the custody of the state through dependency proceedings pursuant to chapter 39.
- (m) The child is a member of a migrant farmworker family.

3.2.4.2 People with disabilities

Because the gaps model uses Census data, the travel demand estimation shows an unexpected high number of people with disabilities. To address this issue, the attendees suggested to investigate classifying people with disabilities based on the eligibility requirements of each transportation service.

3.2.4.3 Other demand data sources

For travel demand data, the Central Florida Regional Planning Model (CFRPM) would be a good source because the model considers socio-economic data including population in housing unit, employment, the number of vehicles, and income level. The CFRPM has an upgraded version of Orlando Urban Area Transportation Study (OUATS), which has been used by MetroPlan Orlando area. The new CFRPM model has been integrated with the OUATS model for better understanding of the travel demand.

Additionally, Lake-Sumter MPO referred us to a paratransit demand forecasting model, which is used to forecast TD Population at the county level (National Center for Transit Research (NCTR), 2013), developed by the Center for Urban Transportation Research (CUTR). We requested TAZ level sample datasets from Lake-Sumter MPO and plan to review them when received to better understand opportunities of using TAZ data.

3.2.5 Challenges

3.2.5.1 Funding

The participants indicated that availability of funding has been an issue for the paratransit program (Programs 5310 and 5311 for TD [3]). For example, although MV Transportation has operated services in Alachua County, this service did not last long because of funding deficiency.

3.2.5.2 Partnership with TNC

The city of Gainesville has partnered with Transportation Network Companies (TNCs) such as Uber, and the city has provided $30,000 in funds per year. However, there are issues in providing transportation services with TNCs. Under the regulation of the U.S. Department of

[3] Programs 5310 and 5311 for Transportation Disadvantaged: The 5310 Program in Alachua includes purchasing one replacement vehicle and five wheelchair securement systems, provide demand response trips for elderly and disabled residing in the Gainesville urban area, and purchase one minivan and one sedan. The 5311 program includes providing demand response trips and operate the regional transit system (North Central Florida Regional Planning Council, 2017).

Transportation (US DOT), the ADA requires that every driver should have background checks and drug tests, as well as inspected vehicles. However, the lack of background check of Uber drivers[4] has led users to raise safety concerns of drivers as well as vehicles. In addition to safety concerns, since this partnership is not part of the ADA accessible project, the City cannot receive federal funding. Therefore, the local government paid the service cost from their budget[5].

3.2.6 Suggestions for future meetings

We were able to have follow up meetings with CTC member Myles O'Keefe and his team that work at LYNX. The input from that meeting has already been included in this report. Additional follow suggestions included to contact Gustavo Castro, the Transportation Project Manager at City of Orlando. Another source could be data related with AARP Livable Community[6] process. Since City of Orlando is in the process of the community survey, Paul Lewis, the chief of planning at the City of Orlando, would be a point of contact. Additionally, participants suggested to talk to Laura Cantwell, the Associate State Director in AARP Florida and the AARP representation on the Safe Mobility for Life Coalition, since they have looked at some of their transportation needs.

[4] DOT's Drugs and Alcohol Rules apply to recipients and subrecipients of 5307, 5309, and 5311 funds, as well as their contractors and subcontractors. Even though TNC is not exempt from the rule, there is an exception from the Taxicab exception rule. When a public randomly chooses the service providers from a number of taxicab companies, the drug and alcohol testing do not apply. Drug and alcohol rules do not apply when a public transit agency has a contract with two or more TNCs (Graves, 2018).

[5] FTA funds may be used to fund to assist the operation of shared rides for the general public or group of people by age disability or low-income. Most TNCs are exclusive ride service which is not eligible for FTA funds. However, under the Americans with Disabilities Act (ADA), ADA applies regardless of Federal funding (Graves, 2018).

[6] AARP Livable Communities provides support to help make communities great places for all ages. AARP community survey was developed to capture information about where people age 50 and above live (https://www.aarp.org/livable-communities/info-2014/aarp-community-survey-questionnaire.html).

4 How to improve the gaps model and the gap maps

In the previous chapter, we summarized the discussions from the local and regional agencies on how to apply the gaps model in a way that will assist their planning and policy efforts to improve transportation options for vulnerable populations in their area.

In this chapter we synthesize their feedback to improve the model focusing on model usefulness, the data, the analysis approach as well effective ways to share the gap maps including validation of the gap maps, sharing of gap maps, and update frequency.

4.1 Gaps model

4.1.1 Usefulness of the model

Overall, the participants indicated that the model can be useful to support funding application process, transportation planning, and non-profit organization supporting vulnerable population.

First, the gap maps would be useful to support applications for funding for the TD programs. The model would allow agencies to show visible results, and can be a reliable tool to support and justify the application whenever an agency develops new transportation programs or plans. Additionally, the CTC could use the gap maps to enhance their services by identifying gaps in their service area.

Second, the gaps model would be useful to apply when MPOs update their Long-Range Transportation Plans. For example, this model can expand its usage for the Central Florida Metropolitan Planning Organization Alliance (CFMPOA)[7], which is a coalition of transportation and government organizations committed to addressing transportation challenges in the larger Central Florida area including Lake-Sumter MPO, Ocala/Marion County TPO, MetroPlan Orlando, Polk County TPO, Space Coast TPO, and River to Sea TPO. This would allow the CFMPOA to develop Long-Range Transportation Plans that encompass the entire Central Florida region.

Third, the results can also provide supportive material to help with the Environmental Justice Focus Area, which evaluates equity for the transportation services in low-income and minority populations (MetroPlan Orlando Organization, 2018).

Fourth, it would be useful if the model can be used as a planning tool to generate different alternative scenarios. These scenarios would be useful to show the changes in service gaps when planner explore new development plans, or when transportation providers need to see

[7] Central Florida Metropolitan Planning Organization Alliance (MetroPlan Orlando Organization, 2020).

changes in service coverage after adjusting operation hours. For example, MV Transportation in Alachua County can use different operation hour scenarios based on the travel demand changes by time of the day. Also, Orange County requires that developers provide mitigation or improvements to other modes of transportation such as adding transit stops/shelters or bike lanes in Alternative Mobility Area (AMA). This tool can help Orange County in identifying locations where the agency could ask the developers to improve the transit services.

Last, some of the nonprofit organizations providing services for older adults might use the gap maps to determine the location of underserved communities. For example, a nonprofit group like Seniors First[8] offers a delivery meal program to aid the nutrition for older adults. Including income data with the results helps them to justify purchasing another van to expand the service.

4.1.2 Data

4.1.2.1 Travel demand

Regional transportation agencies such as FDOT and MPO compile data to estimate the transportation demand. Such data should be considered to improve the gaps model, specifically the demand calculation method. Another source for demand data would be Commission for the Transportation Disadvantaged (CTD). Since they provide a transportation disadvantage service plan for the 5-Year/20-Year period and update annually (North Central Florida Regional Planning Council, 2017), they might have useful resources regarding travel demand for vulnerable populations. Particularly, Lake-Sumter MPO also has data about passengers who meet eligibility requirements by TAZ level which could improve the model.

4.1.2.2 Destination

It has been suggested to investigate the destinations such as dialysis clinics and grocery stores further. Dialysis clinics should be considered as major destinations because the clinics are frequently used destinations by MV transportation riders. Second, grocery stores need to be classified in detail with various target users. For example, apart from traditional grocery stores (e.g., supermarket), non-traditional grocery stores (e.g., Dollar General, Second Harvest, and Asian market) should be considered for low-income people.

[8] Seniors First is the social services organization in the city of Orlando providing services for community's vulnerable older adults. Meals on Wheels is a program that offers delivery meals to those who lost mobility due to aging. To be eligible for this program, older adults must be 60 years or older and have a physical disability that prevents grocery shopping or cooking.

4.1.2.3 Ridership Data

The ridership data can be useful information to improve the gaps model. The potential data sourced can be categorized in two groups. First, it would be helpful to know the number of riders that use the fixed route service at each stop including demographic information such as age, gender, income, and disability. For example, Lake-Sumter MPO has GIS ridership and trip data for every service route. This data was used to justify and develop a new fixed route by cross-referencing the number of trips with the location of eligible populations. This data can help improve the gaps model results especially to better estimate the travel demand. Second, it would be helpful to know the origin and the destination of the riders of the flexible or door-to-door services.

4.1.2.4 Find-a-Ride Florida User Data

It was also suggested to review the usage of the Find-a-Ride Florida website to learn more about the age range or gender of the users. Also, it would be beneficial to know where frequent destinations are.

4.1.3 Analysis

4.1.3.1 Unit of analysis

The current analysis unit – the census block group – was determined to be sufficient for the purposes of the model.

The attendees suggested that it would be more useful for transportation agencies if the model were to use parcels-level data to show the travel demand. The parcel-level results may allow agencies to distribute services more effectively. In addition, it was suggested to look at small areas such as at the community level. This would help agencies to identify how TD population use transportation services for daily activities.

Considerations should be given using the TAZs as one of the analysis units for the gaps model because MPOs requires the use of TAZ level GIS data for the Efficient Transportation Decision Making (ETDM) process.

4.1.3.2 Maximum travel time threshold

Setting the maximum travel time to reach destinations using public transit is an important parameter in determining the transportation service supply. For example, for the Lake County fixed route transit service, bus stops have about an hour headway. Therefore one-hour travel

time is a good maximum travel time threshold. It would be of interest to analyze a thirty-minute travel time threshold.

4.2 Gap maps

4.2.1 Model validation

While the model estimation of the transportation supply works well, the attendees indicated that the travel demand estimation need improvement. The research team should consider a combination of various demographic variables and ridership information from various transportation agencies and potential user surveys to improve the TD travel demand estimation.

To fully capture the extent of transportation service gaps across the entire region, the research team ran the model by expanding the analysis area to include all five counties of both MPOs. However, the attendees indicated that, while the two MPOs try to coordinate when possible, it is advisable to run the gaps model separately for each MPO until they have better understanding and usage of this model.

4.2.2 Accessing gap maps

The participants consistently indicated that an interactive web-based map would be the best method for accessing the Gap Map results. This would not only allow the map to be shared, but also provide access to other attribute information associated with the map. Web-based interactive maps can let users who are unfamiliar with using GIS browse the spatial data and the related socio-economic attributes. Additionally, the interactive map can be setup to allow addition of more GIS layers from the users. Finally, interactive maps can allow users to download the model data to Excel and other common formats.

4.2.3 Update frequency

Creating the gaps maps on an annual basis would be desired. However, it would be beneficial to also generate results on demand for specific circumstances. For the fixed route service, agencies would like the option to run the model whenever an agency changes the schedule. For flexible or door-to-door service, it would be useful to update the gap maps regularly, as well as on-demand.

5 Conclusions

In this research, we applied the gaps model at the local and regional levels to determine the gaps in transportation services for TD populations. We presented the results and sought input from local and regional agencies on the model validity, applicability, and usefulness to support their efforts to address service gaps and maximize the transportation services for Florida's vulnerable populations.

The findings, based on the input from the local and regional agency participants, show that the model can be useful to support funding application process, transportation planning at the local and regional level, non-profit organizations activities in supporting vulnerable populations, and the MPO Long-Range Transportation Planning to address the transportation needs of TD populations.

Positive aspects of the model identified by the participants include the method for estimation of transportation supply, the use of census block group as the analysis unit, ability to customize the maximum travel time threshold, ability of the model to work both at the local and the regional level, and the use of the supply-demand matrix to prioritize the gaps for planning purposes. Participants recommended updating the gap maps annually as well as on-demand to support various planning activities and ad-hoc changes of transportation services, especially changes of the public transit services. Participant were unified in their preference of accessing the gap maps through web-based interactive maps.

On the other hand, the participants indicated that the model results would benefit by increased detail level of input data and especially by a more accurate travel demand estimation especially for older adults and individuals with disabilities. Recommendations included working with local stakeholders to obtain the exact service boundaries, accurate numbers of eligible individuals with disabilities, and ridership information. Especially, it is recommended to work more closely with each CTC and follow up with the CTD. Additional recommendations included considering TD income level, sub-categorizing the older adults by three age ranges (65-74, 75-84 and over 85) and considering their living locations and income status, considering property parcel and TAZ levels for the analysis unit, and differentiate destinations based on frequency of use and target users. Further research would be needed to address these aspects of the model.

Finally, we found that coordinating the application of the gaps models at the local and regional levels with the relevant agencies ensures the completeness of the available information on transportation services, especially those offered by the local and regional governments, in particular paratransit, micro transit or similar services that connect residences to the fixed or flexible route services.

6 Recommendations

Based on the findings from this research we recommend the following follow up research and implementation activities.

6.1 Examine the options for implementation and operation of the Find-a-Ride framework

6.1.1 Identify process for implementation and agency coordination

Going forward it is important to consider how to setup and formalize a process that can use the model to produce the gap maps annually or on-demand and engage agencies to utilize them, ideally as a standard part of their planning process. Utilization of the model helps create consistency across the state in the planning process and serves as a standard resource to provide the necessary evidence of gaps. Such evidence can be used in support of efforts to target resources to address service gaps and maximize the transportation services for Florida's vulnerable populations. Management of such process should be considered when determining the resources and the stakeholders for the long-term operation and maintenance of the entire Find-a-Ride framework.

Additionally, it is imperative to maintain close communication with agencies, stakeholders, and transportation service providers to ensure that the data is accurate and up to date, and that the modeling results can be validated and confirmed by the relevant stakeholders.

It also is recommended to work more closely with each CTC to ensure the availability of efficient and quality transportation services for TD persons. Under the contract with the CTD, each CTC plans, administers, monitors, coordinates, arranges, and delivers coordinated TD services originating in their designated service areas (Florida CTD, 2020). Close communication would be beneficial because CTC can use the gap maps to develop TD service plans with a local coordinating board and to prepare annual operating reports. An additional benefit is that the gaps model can be improved using CTC's rider eligibility guidelines and trip prioritization data.

6.1.2 Provide recommendations for the most viable solution for the long-term operation of the Find-a-Ride Framework

This research reviewed and refined the tasks and skills required to support Find-a-Ride framework, but it did not get into a detailed analysis due to the limited scope primarily focused on the application and evaluation of the gaps model. Thus, as the next step it is necessary to assess the proposed framework and recommend the best implementable solution for the long-

term deployment, dissemination, and maintenance of the Find-a-Ride framework. This could be achieved by evaluating various implementation scenarios while considering various aspects of the maintenance, operations, cost, and roles and responsibilities of the identified stakeholders which may include FDOT, MPOs, County, Safe Mobility for Life Coalition members, and CTD.

6.2 Improve the gaps model and develop the gap maps webpage

6.2.1 Demand estimation for TD populations

More in-depth research is required to develop better estimation of travel demand for TD populations. The current method used in the model is too generic and incorrectly assumes that all TD populations need transportation services. Existing methods in the literature (Goodwill & Joslin, 2013) estimate the TD demand at the county level which is not suitable for determining transportation service gaps at the census block group level required by the gaps model. In adjusting the assumptions and model methodology, considerations should be given to trip behaviors of older adults, sub-categorization of older adults by three age groups, concentrated locations of older adult populations, inclusion of the income levels and other demographical characteristics of TD populations, adjustment of estimation of individuals with disabilities by considering the eligibility for services based on the type of disability.

6.2.2 Increasing accuracy of supply

First, the gaps model needs to be refined and customized to make use of other data provided by local or regional agencies especially for the demand estimation. Second, the gap model would need refinements to compute accessibility scores. Currently, the model only considers travel time as an impedance to access destinations. However, the fare rate of each transportation service and eligibility requirement of the services can affect impedance calculation and subsequently the accessibility score. Therefore, in the future, the model could be improved by increasing the accuracy of accessibility calculations by considering the fare rate and eligibility of each transportation service for vulnerable populations. Finally, additional functions should be added to allow agencies to create different planning scenarios and compare alternatives of proposed improvements.

6.2.3 Dissemination of service gaps using interactive web-based maps

As established by previous research, it is important to share the gap maps with the relevant stakeholders including the Safe Mobility for Life Coalition members, FDOT, MPOs, county, city, and the broader community of stakeholders. The attendees were in consensus that an interactive webpage that includes dynamic maps would be the best option to share the gap maps with stakeholders instead of PDFs or limited ArcGIS online maps. The interactive webpage can: 1) provide a platform to communicate up to date transportation gaps to state, local and regional partners, and other relevant stakeholders to address these issues at various geographic levels; 2) ensure that the data is up to date and the results can be validated; 3) allow stakeholders to evaluate the effectiveness of their improvements by comparing their impact to the improved accessibility after the improvements has been applied; 4) serve as a broad resource for other planning, policy, and research activities to examine specific users and transportation options.

References

Bejleri, I., Noh, S., Steiner, R., Winter, S., & Gu, Z. (2018). Geospatial Model for Identifying Transportation Service Availability Gaps for Florida's Vulnerable Population (FDOT Report DBV31-977-67). Gainesville, Florida: In University of Florida. Retrieved from https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/fdot-bdv31-977-67-rpt.pdf

Florida Commission for the Transportation Disadvantaged (2020). TD 101 – A Comprehensive Overview of the Transportation Disadvantaged Program. Retrieve from https://ctd.fdot.gov/docs/AboutUsDocs/TD101-AnIntrotoFlaCoordSystem09172019.ppt

Florida Department of Elder Affairs (2020). DOEA Programs and Services-Transportation. Retrieved from http://elderaffairs.state.fl.us/doea/transportation.php

Graves, B. (2018). Shared Mobility and TNCs – Legal Considerations for Public Transit.

MetroPlan Orlando Organization. (2018). Title VI Program : Nondiscrimination & Language Plan. Orlando, Florida: MetroPlan Orlando Organization. Retrieved from https://metroplanorlando.org/wp-content/uploads/Title-VI-Program-Nondiscrimination-and-Language-Plan-2018-FINAL.pdf

MetroPlan Orlando Organization. (2020). Central Florida MPO Alliance. Orlando, Florida: MetroPlan Orlando Organization. Retrieved November 12, 2020, from Orlando, Florida website: https://metroplanorlando.org/board-committees/central-florida-mpo-alliance/

National Center for Transit Research (NCTR). (2013). Forecasting Paratransit Services Demand: Review and Recommendations. Report No. CUTR-NCTR-RR-2011-06, Center for Urban Transportation Research, University of South Florida. https://doi.org/https://doi.org/10.5038/CUTR-NCTR-RR-2011-06

North Central Florida Regional Planning Council. (2017). Alachua County Transportation Disadvantaged Service Plan. Gainesville, Florida: North Central Florida Regional Planning Council. Retrieved from http://www.ncfrpc.org/mtpo/publications/TD/SignedTitlePageAlachua201718ServicePlan.pdf

Regional Transit System. (2020). ADA Accessible Service Info. Retrieved August 24, 2020, from Gainesville, Florida website: http://go-rts.com/ada/

Safe Mobility for Life Coalition. (2017). Aging Road User Strategic Safety Plan. Retrieved from http://safemobilityfl.com/pdfs/FDOT_Aging_SafetyPlan_FINAL.pdf

U.S. Department of Housing and Urban Development. (2020). HUD's public housing program. Retrieved September 15, 2020, from Washington, D.C. website: https://www.hud.gov/topics/rental_assistance/phprog

Appendices

- Appendix A: Alachua county meeting material
- Appendix B: Orange county meeting material
- Appendix C: MetroPlan Orlando and Lake-Sumter MPO meeting material

Appendix A: Alachua county meeting material

FDOT Research Project (BDV31 TWO 977-106)

Applying Gap Modeling to Inform Improvement of Transportation Services for Vulnerable Populations at the Local and Regional Levels

Project managers: Gail M. Holley and Gabe Matthews (FDOT)

Principal Investigators: Ilir Bejleri and Ruth Steiner (UF)

JULY 30, 2020

Outline

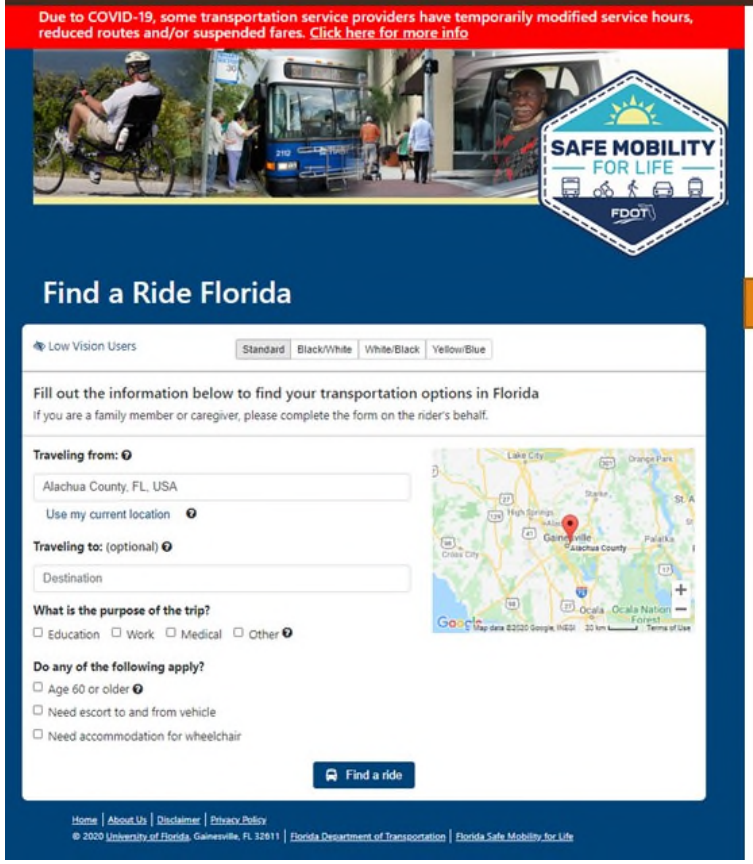
- Meeting Goal
- Briefing on Find-a-Ride Florida
- The GIS Model
  - The concept and how it works
  - Application examples
- Discussion

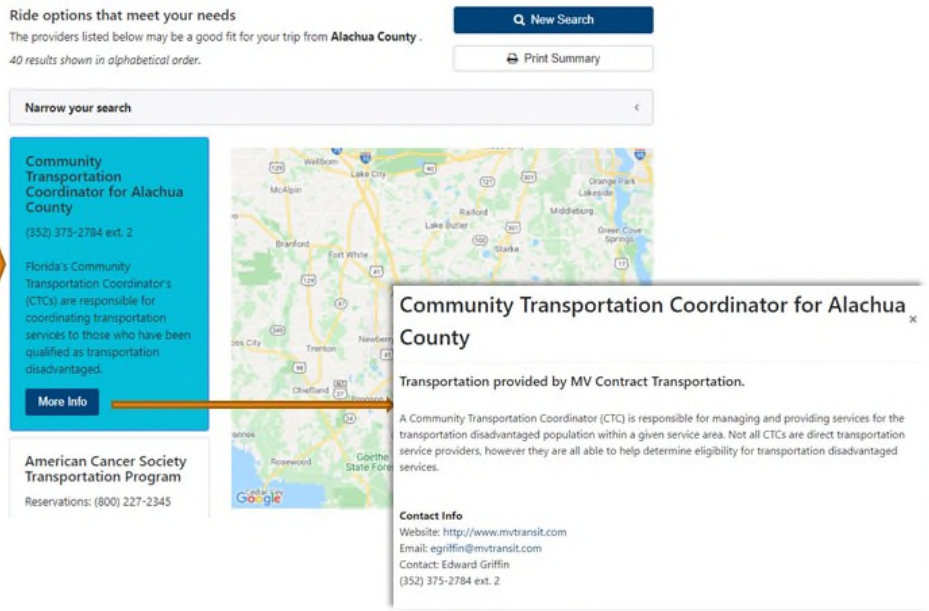
Meeting Goal

- Describe the work we have done
- Show you the model results
- Get your feedback on the findings
- Seek your input on usefulness of this model

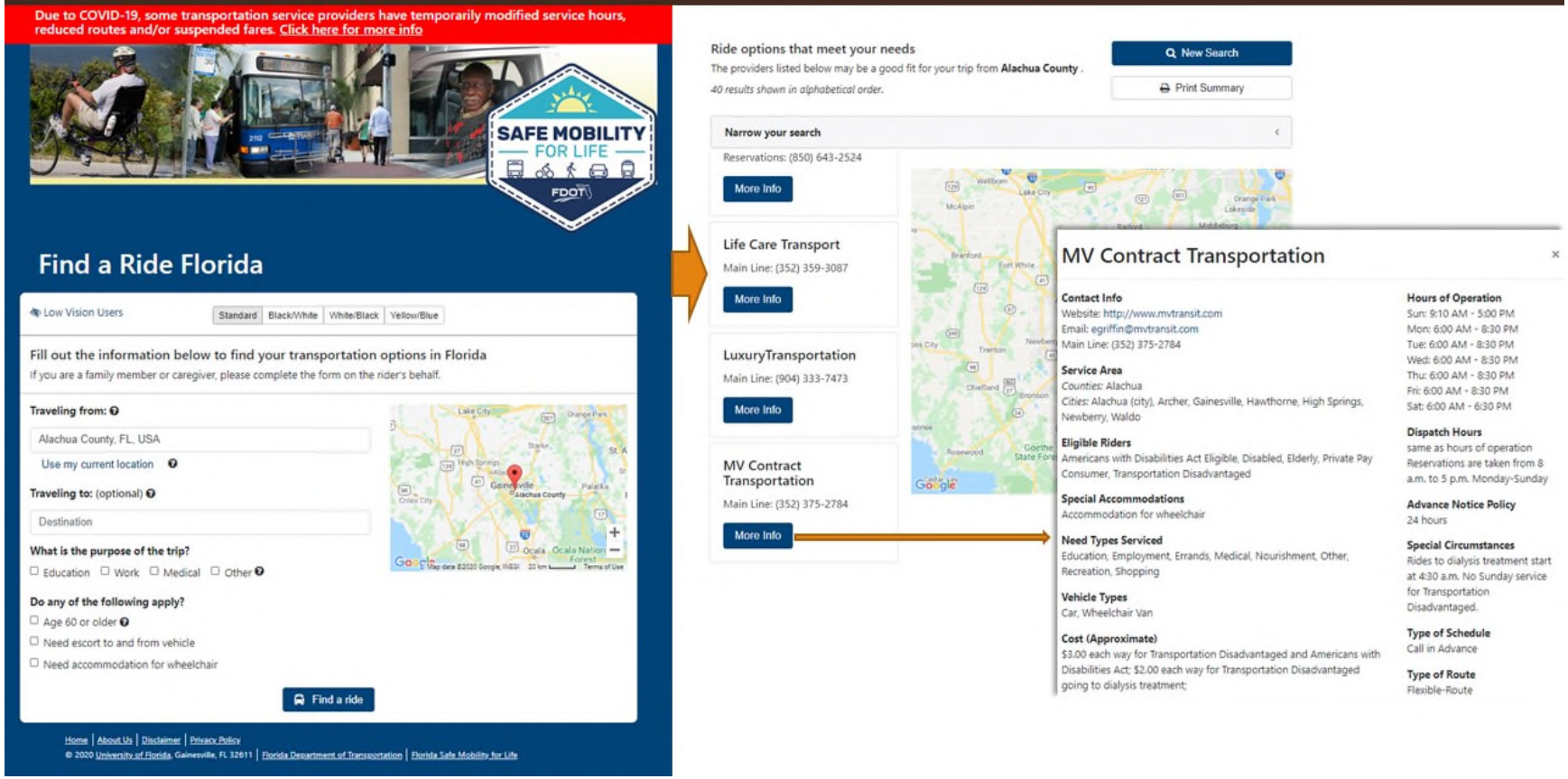
  - to help inform your efforts to identify or improve transportation services for vulnerable populations in your area.

Find a Ride Florida Website: www.findarideflorida.org

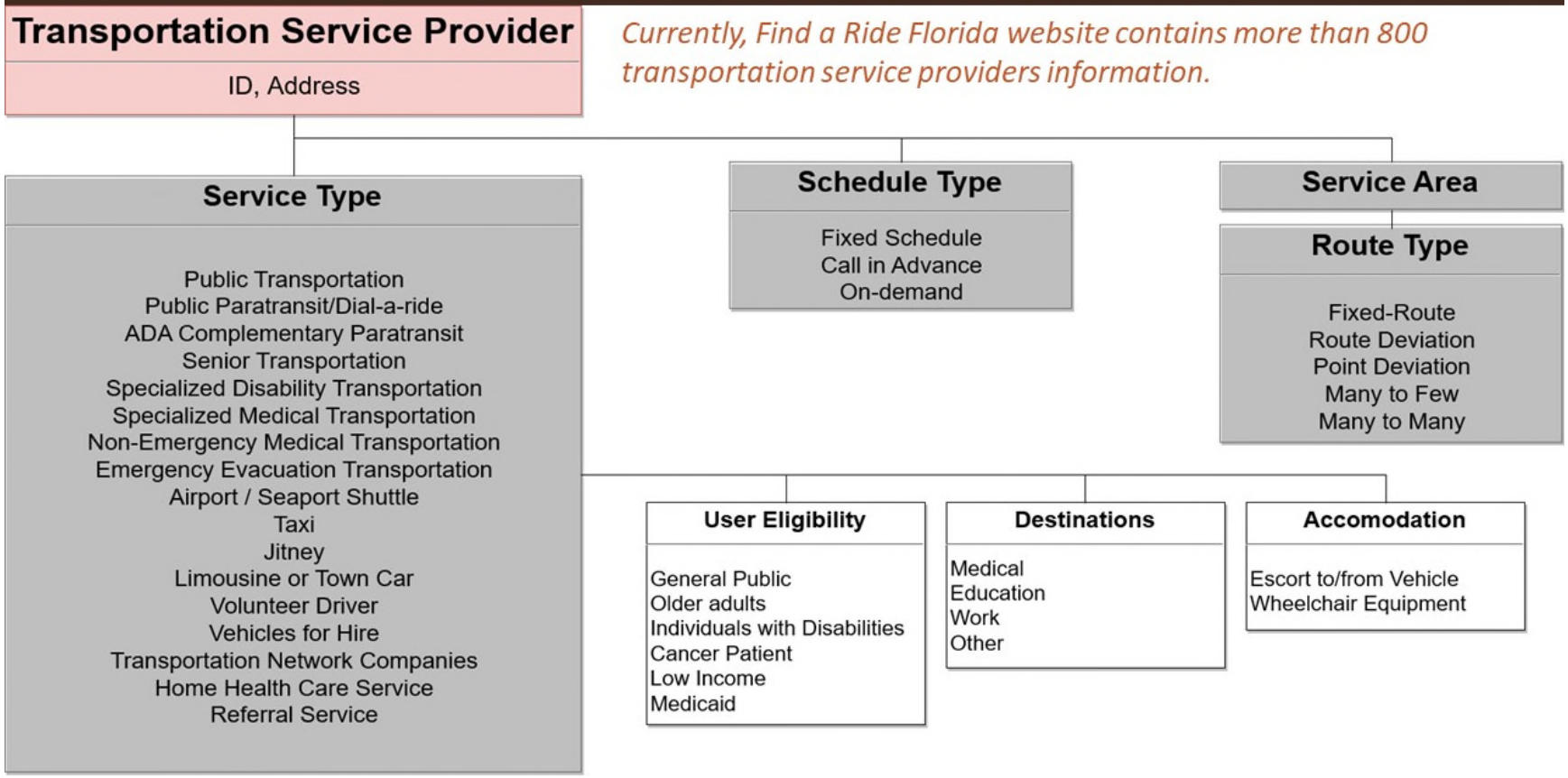




Find a Ride Florida Website: www.findarideflorida.org

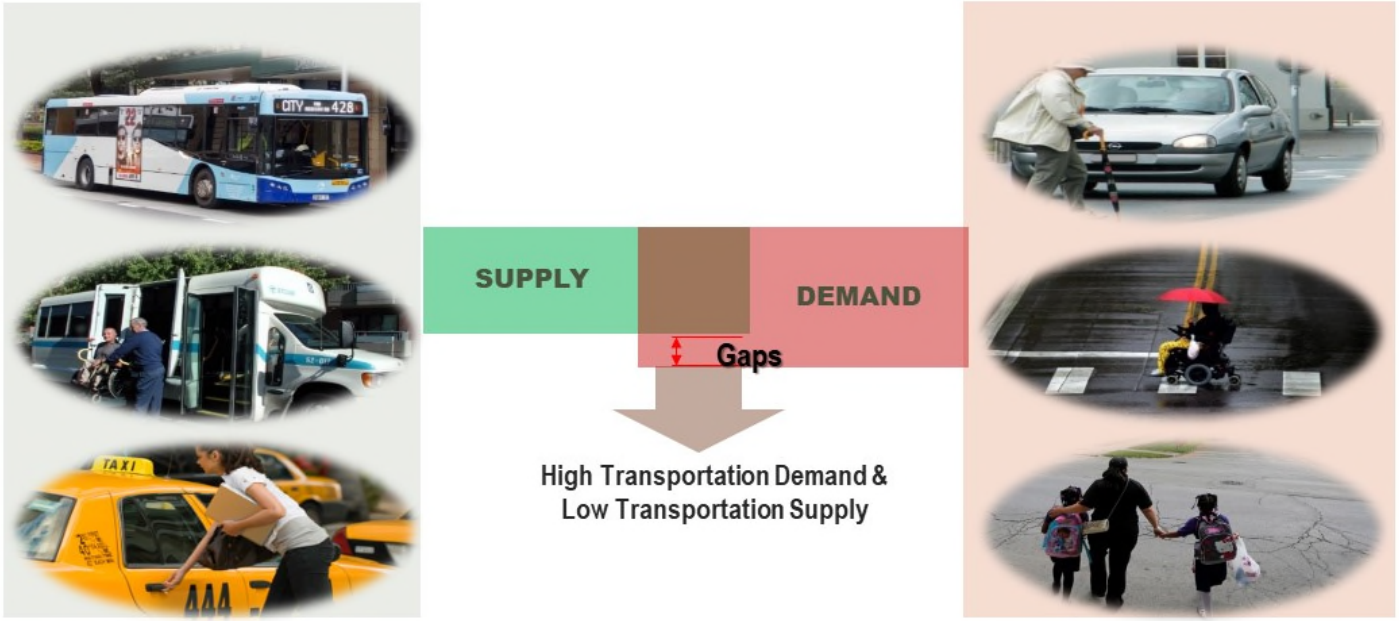


Database Structure to Support Find-a-Ride Florida

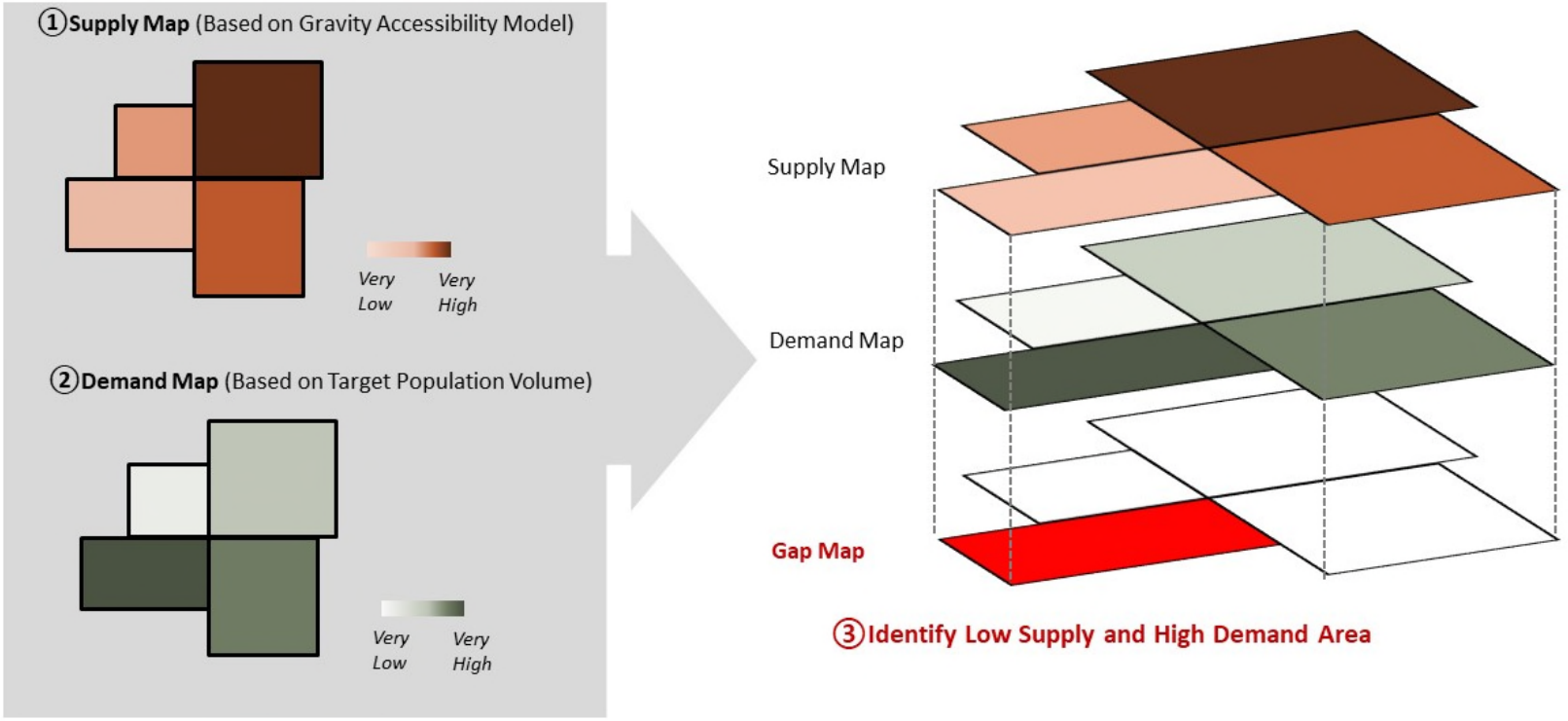


GIS Model

Purpose: Identify transportation gaps for Florida's vulnerable population



How the GIS Model Works



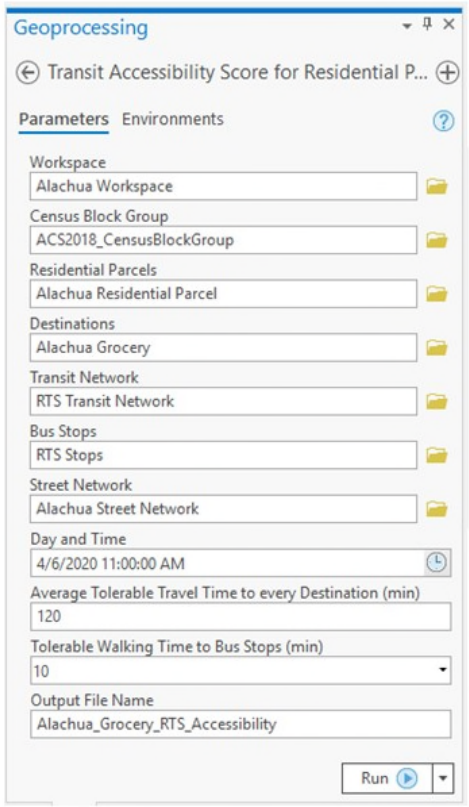
RTS Application Example

DESTINATIONS: **GROCERY**

DEMAND: **OLDER ADULTS**

TRANSPORTATION: **FIXED ROUTE - RTS**

Input Data



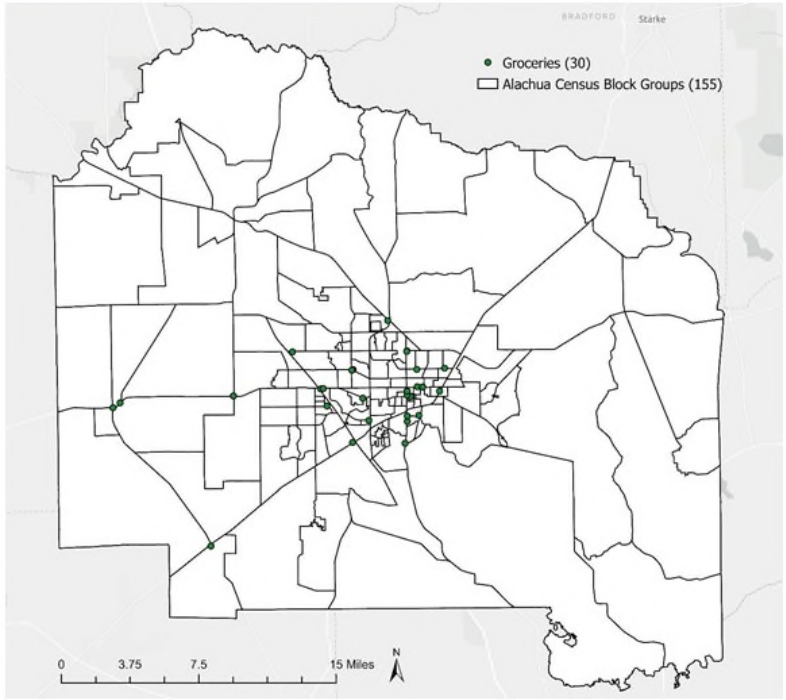
Spatial Data: Census Block Group, Residential Parcel, Destinations

Transportation Data: Transit Network, Street Network, and Bus Stops

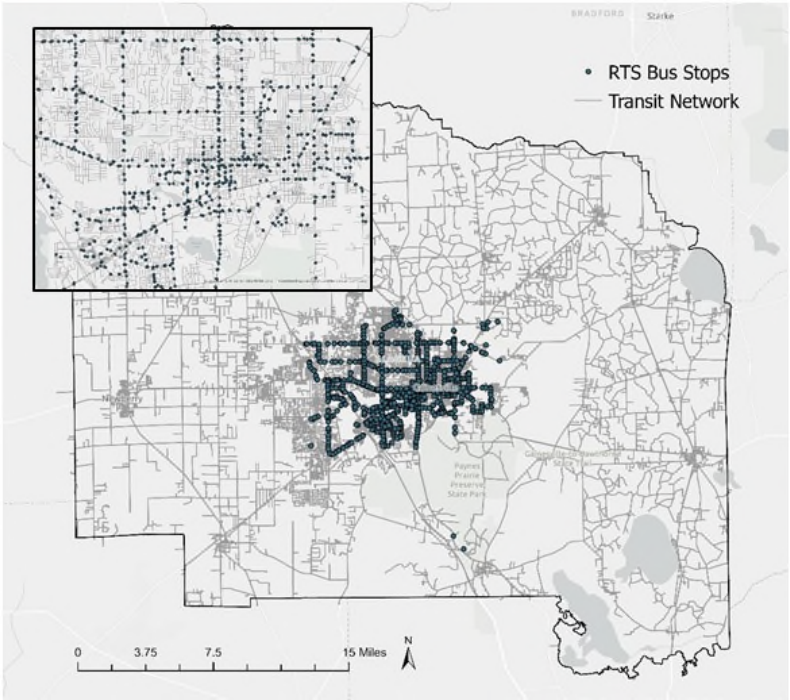
Customizable Data : Day and Time, Travel Time and Walking Time

Input Data Maps

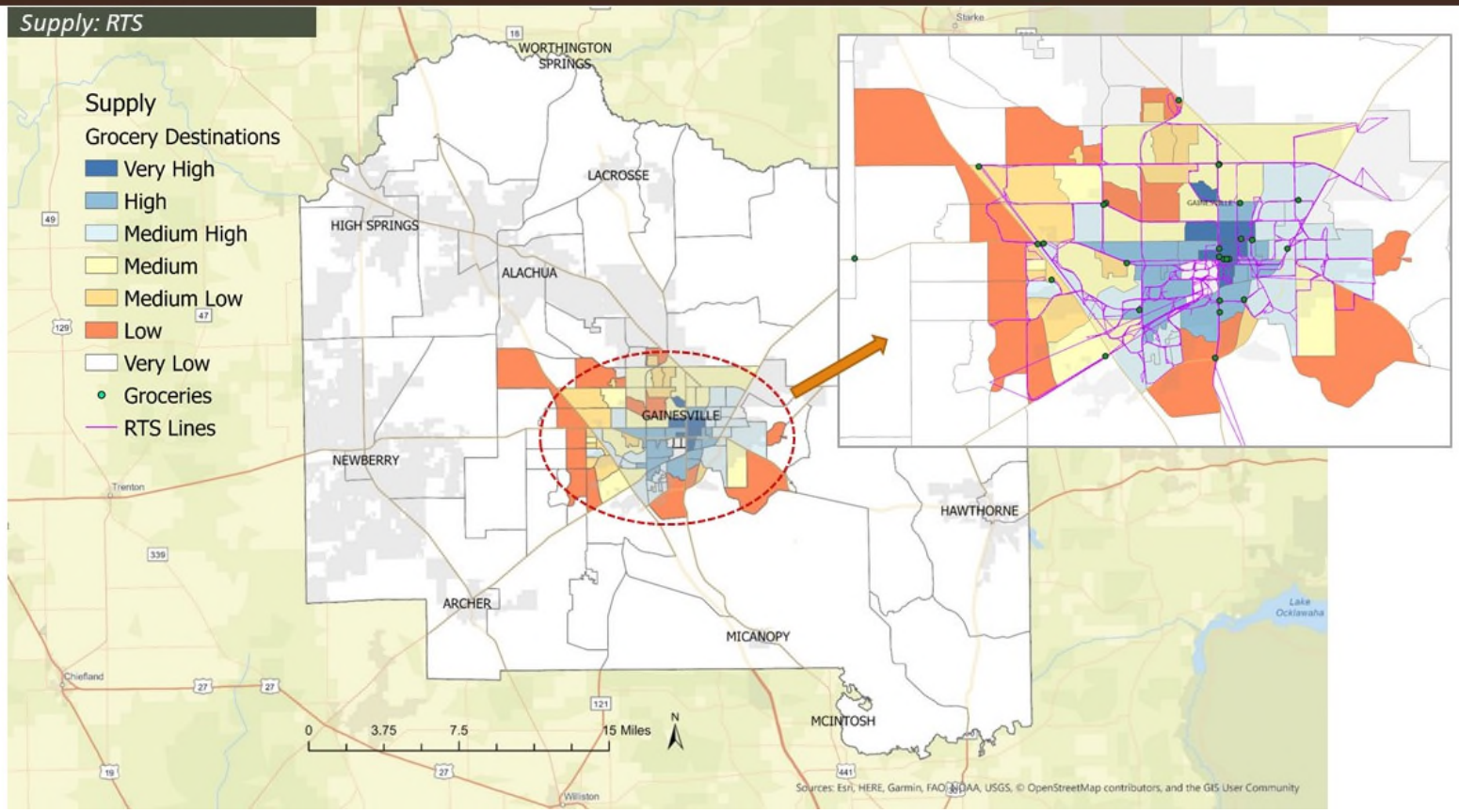
Analysis Unit and Opportunities



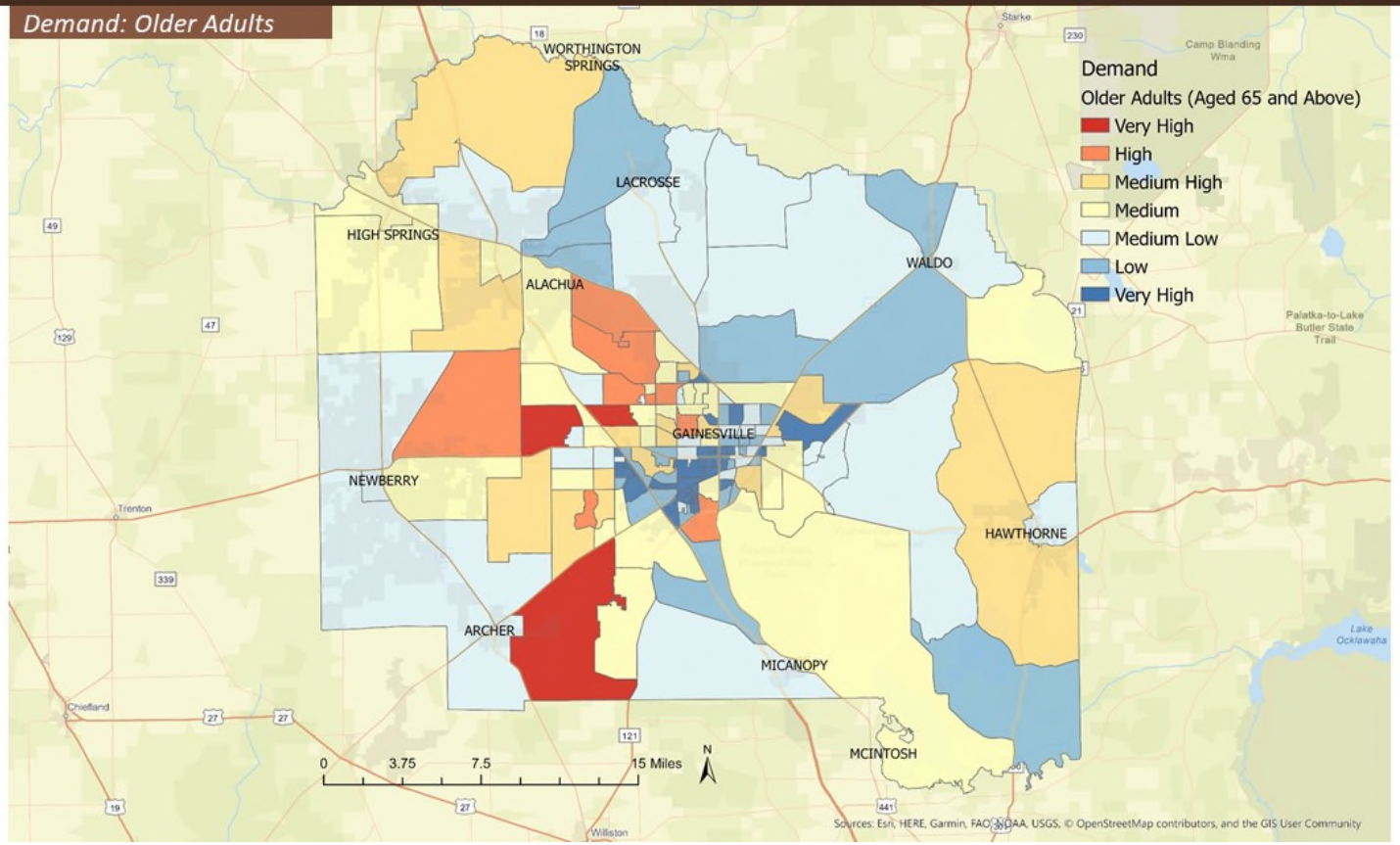
Transportation Network Data



Output Supply Map

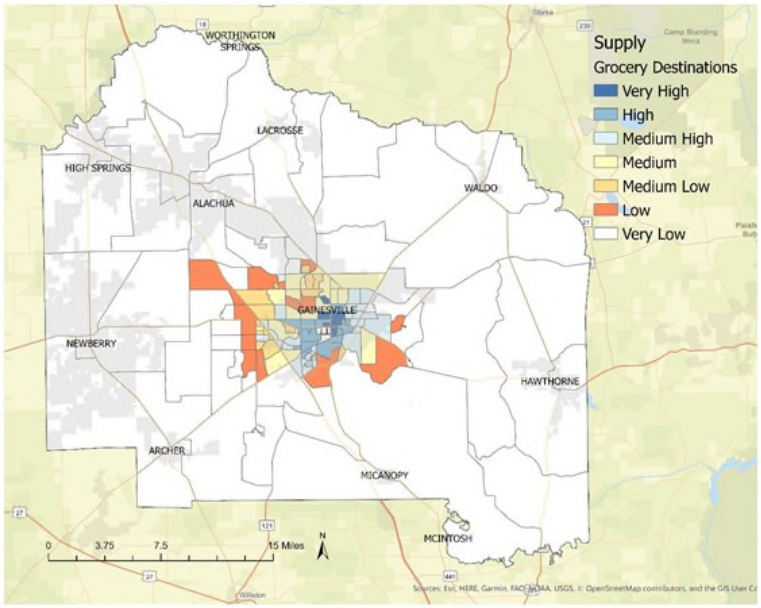


Output Demand Map

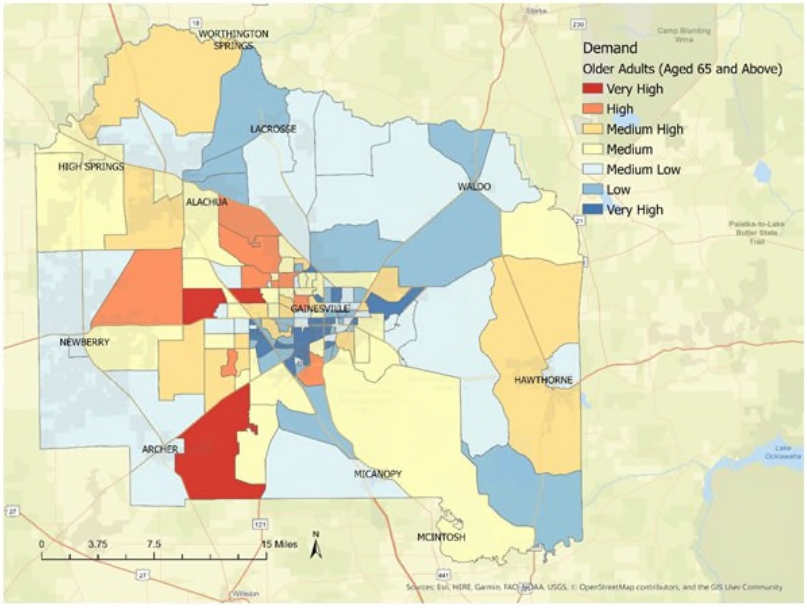


Output Supply & Demand Maps Side by Side

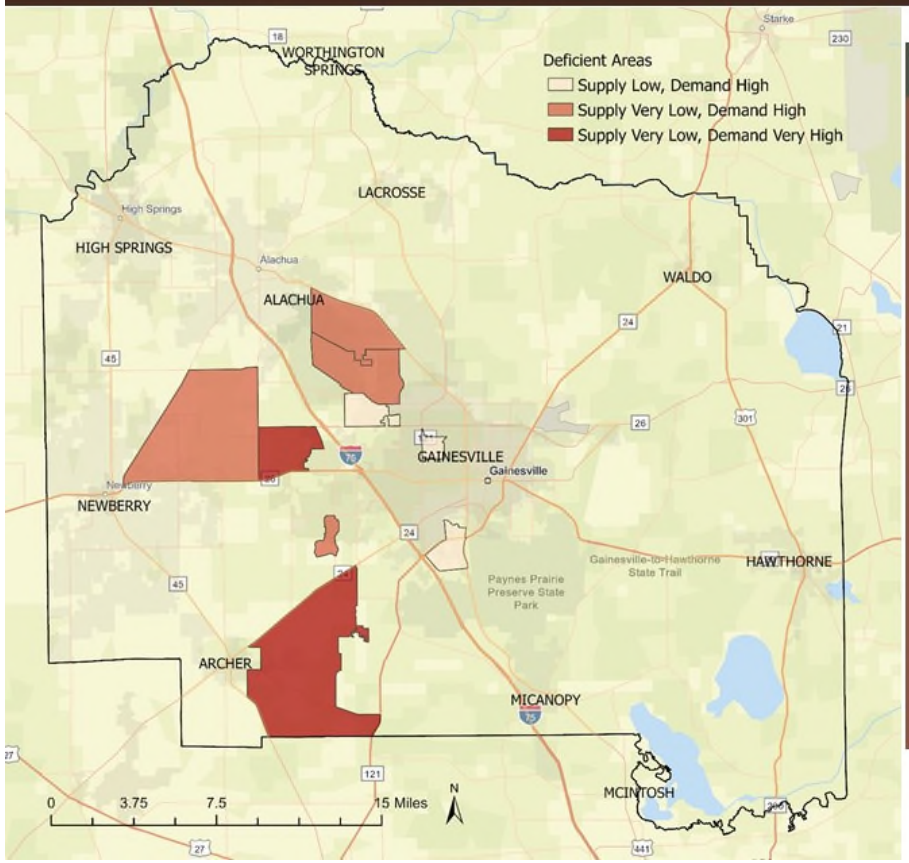
Supply: RTS



Demand: Older Adults

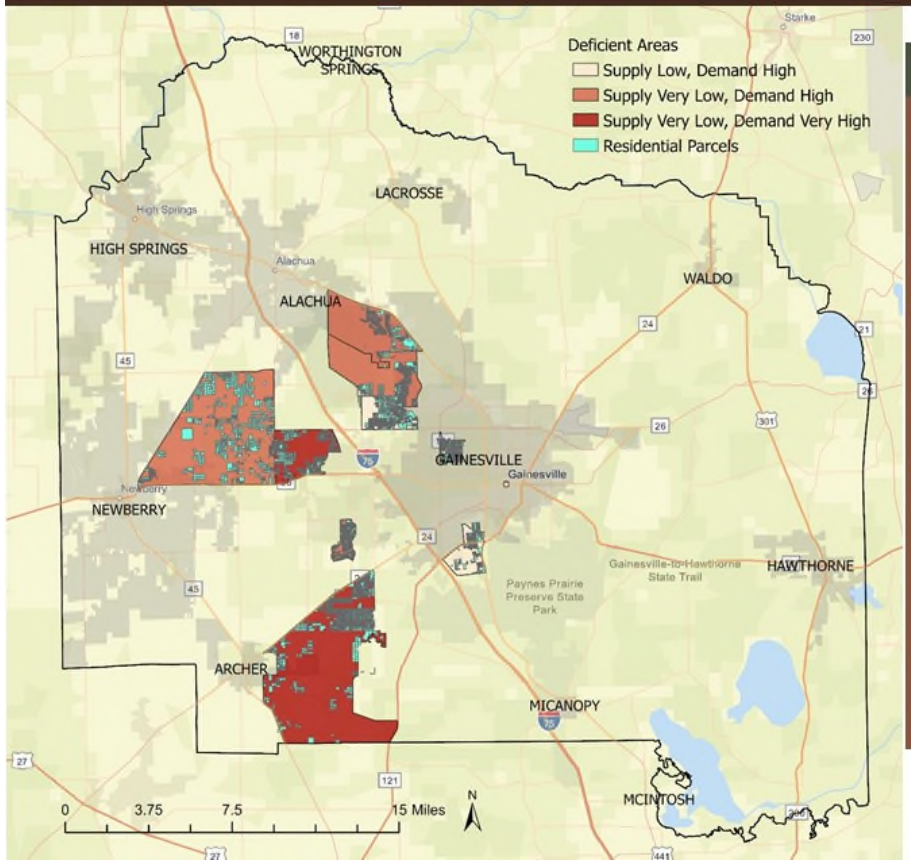


Gap Maps : Low Supply and High Demand Areas



Demand		Supply: Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Older Adults	2,145		1,122					3,267
	block group(s)	2		1					3
High	Older Adults	2,485	2,114		691				5,290
	block group(s)	4	3		1				8
Medium High	Older Adults	3,048	1,926	476	1,343	401			7,194
	block group(s)	7	4	1	3	1			16
Medium	Older Adults	4,449	1,190	1,159	1,537	554	285	298	9,472
	block group(s)	14	4	4	5	2	1	1	31
Medium Low	Older Adults	3,654	389	145	610	1,028	695		6,521
	block group(s)	20	2	1	4	6	4		37
Low	Older Adults	804	84	329	292	628	265	103	2,505
	block group(s)	8	1	4	3	7	3	1	27
Very Low	Older Adults	29		36	61	167	129	133	555
	block group(s)	5		3	2	9	7	7	33
Grand Total	Older Adults	16,614	5,703	3,267	4,534	2,778	1,374	534	34,804
	block group(s)	60	14	14	18	25	15	9	155

Gap Maps: Low Supply and High Demand Areas



Demand		Supply: Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Older Adults	2,145		1,122					3,267
	block group(s)	2		1					3
High	Older Adults	2,485	2,114		691				5,290
	block group(s)	4	3		1				8
Medium High	Older Adults	3,048	1,926	476	1,343	401			7,194
	block group(s)	7	4	1	3	1			16
Medium	Older Adults	4,449	1,190	1,159	1,537	554	285	298	9,472
	block group(s)	14	4	4	5	2	1	1	31
Medium Low	Older Adults	3,654	389	145	610	1,028	695		6,521
	block group(s)	20	2	1	4	6	4		37
Low	Older Adults	804	84	329	292	628	265	103	2,505
	block group(s)	8	1	4	3	7	3	1	27
Very Low	Older Adults	29		36	61	167	129	133	555
	block group(s)	5		3	2	9	7	7	33
Grand Total	Older Adults	16,614	5,703	3,267	4,534	2,778	1,374	534	34,804
	block group(s)	60	14	14	18	25	15	9	155

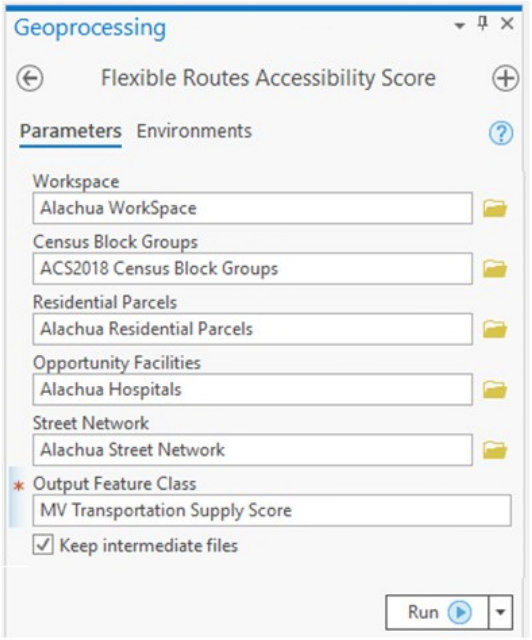
MV Transportation Example

DESTINATIONS: **HOSPITALS**

DEMAND: **PEOPLE WITH DISABILITIES** (20-64 YEARS OLD)

TRANSPORTATION: **FLEXIBLE ROUTE – MV TRANSPORTATION**

Input Data

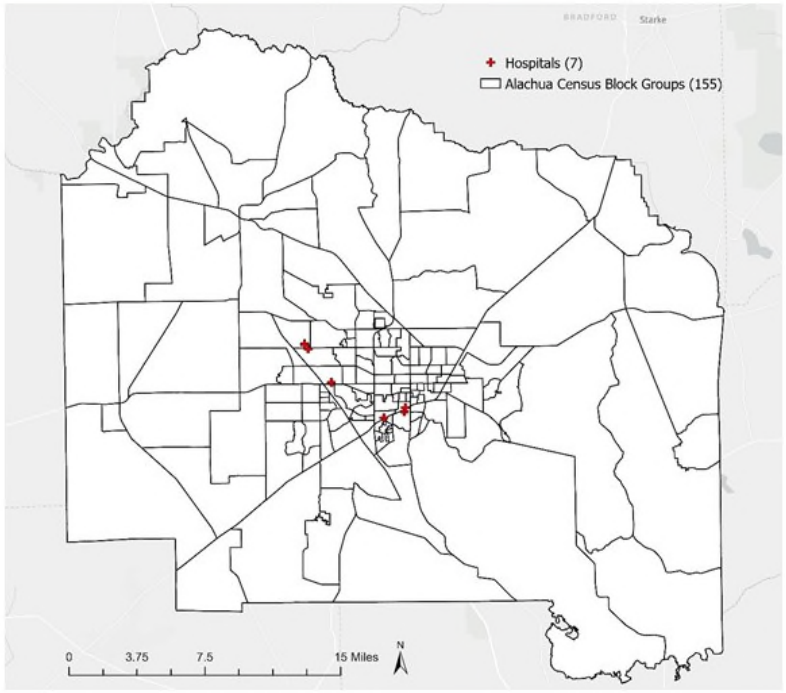


Spatial Data: Census Block Group, Residential Parcel, Destinations

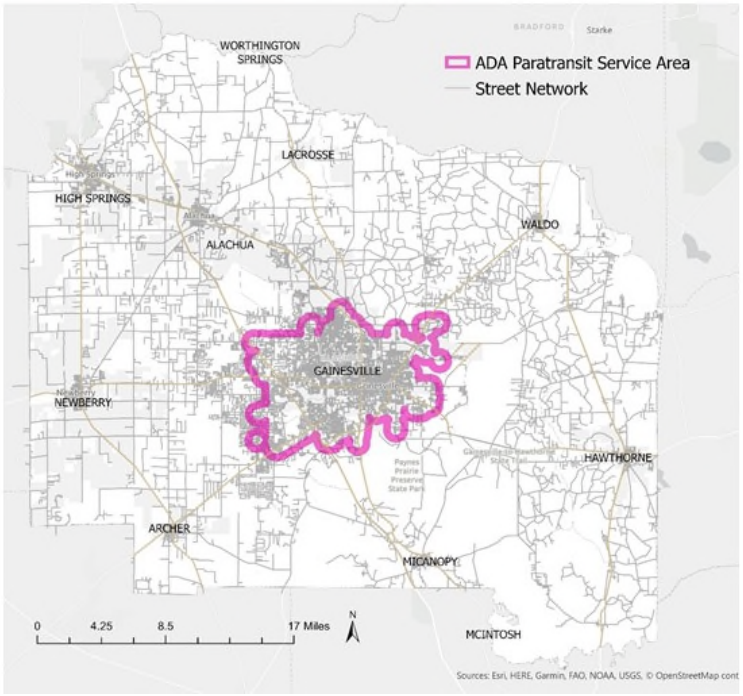
Transportation Data: Street Network

Input Data Maps

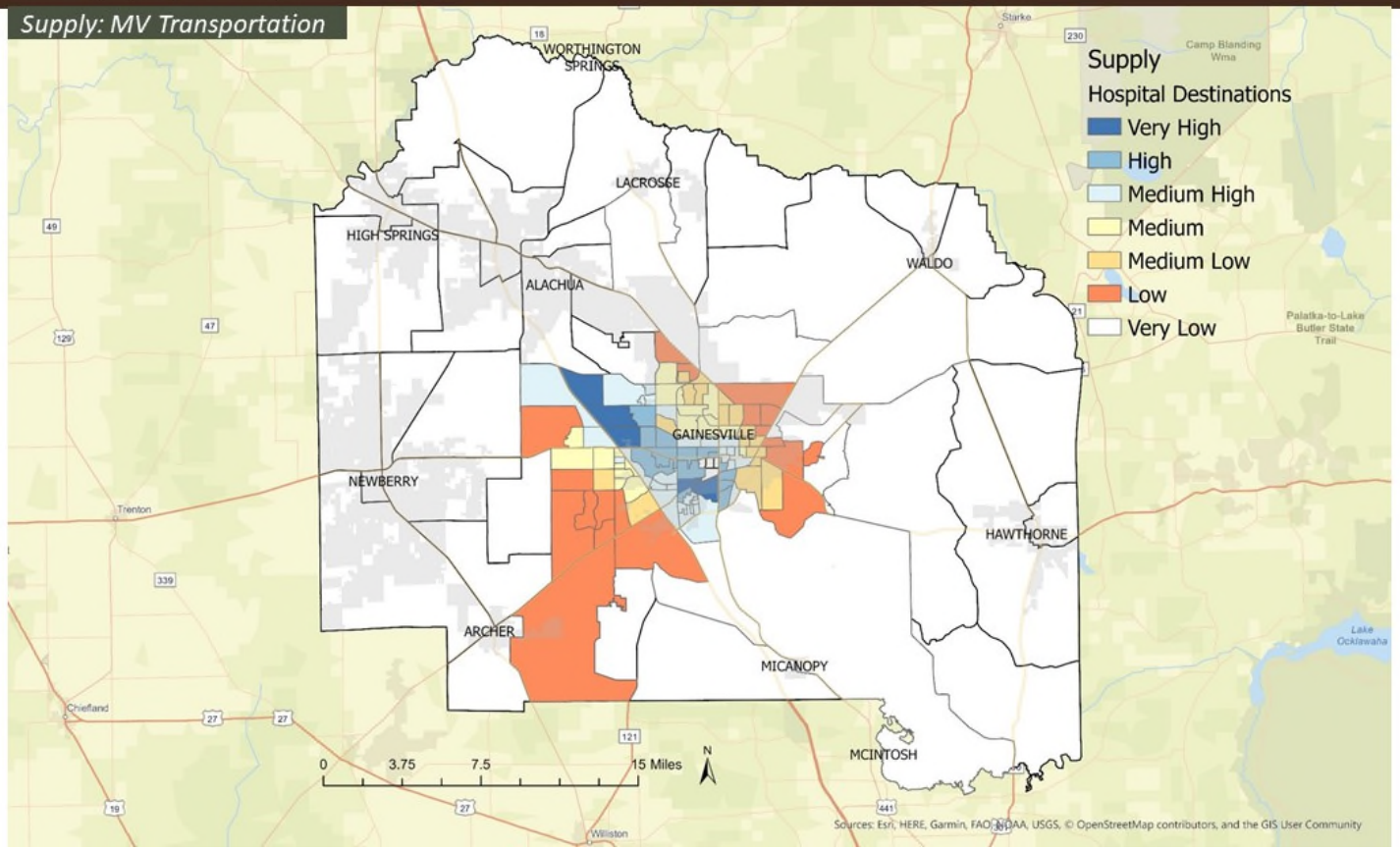
Analysis Unit and Opportunities



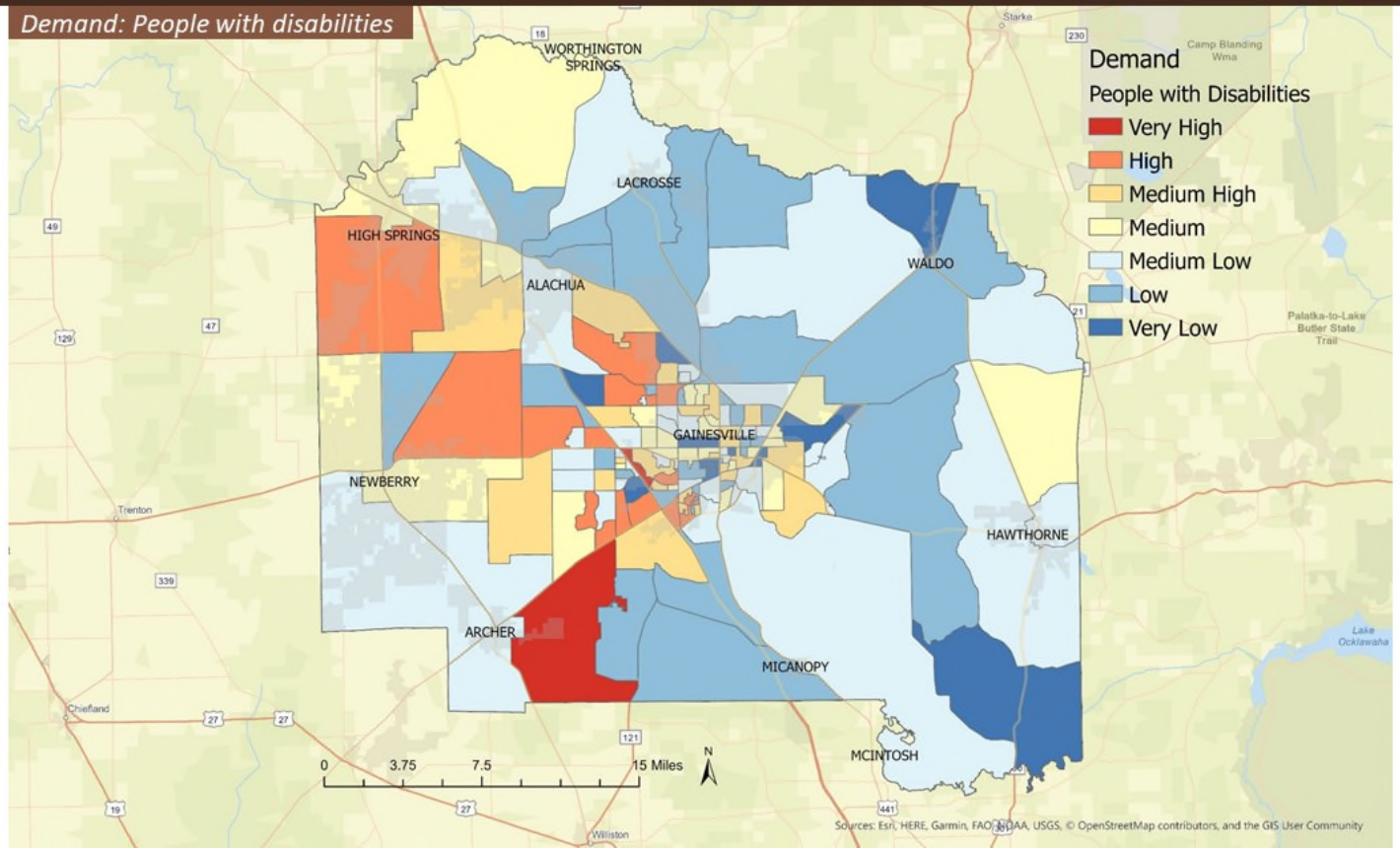
Transportation Data



Output Supply Map

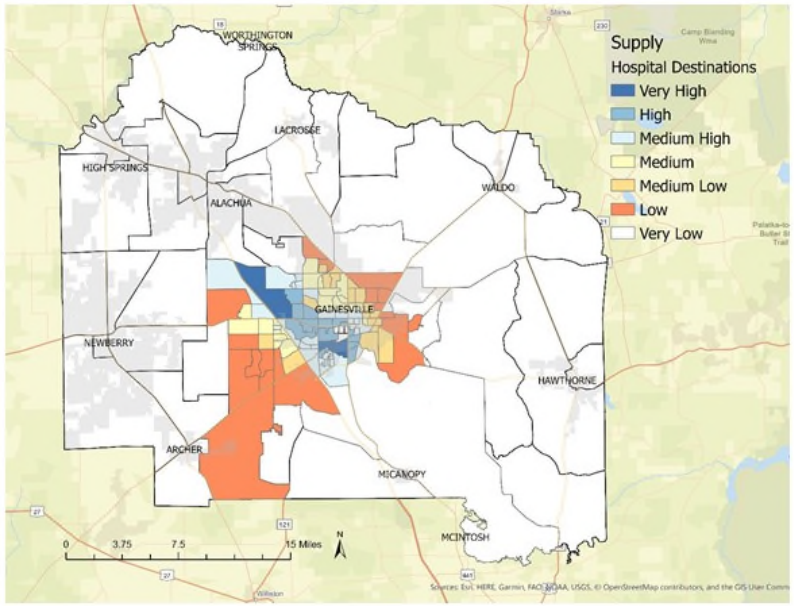


Output Demand Map

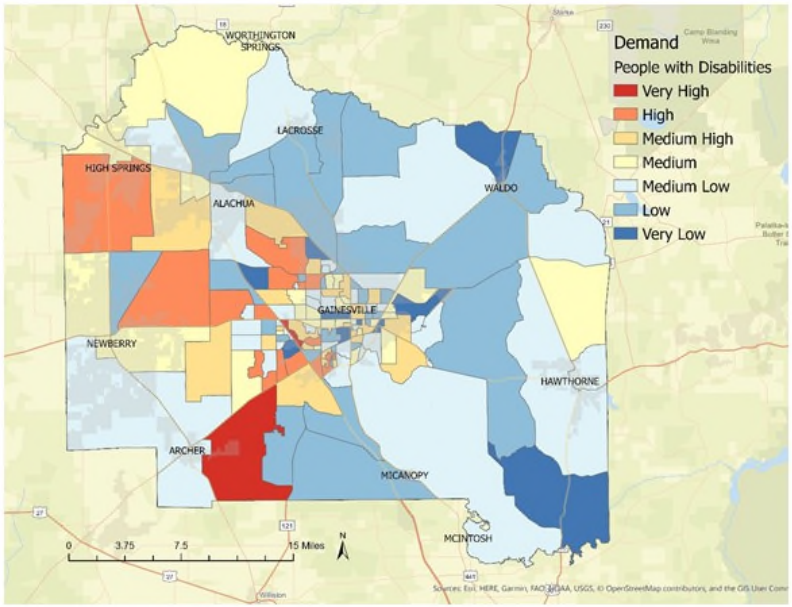


Output Supply & Demand Maps Side By Side

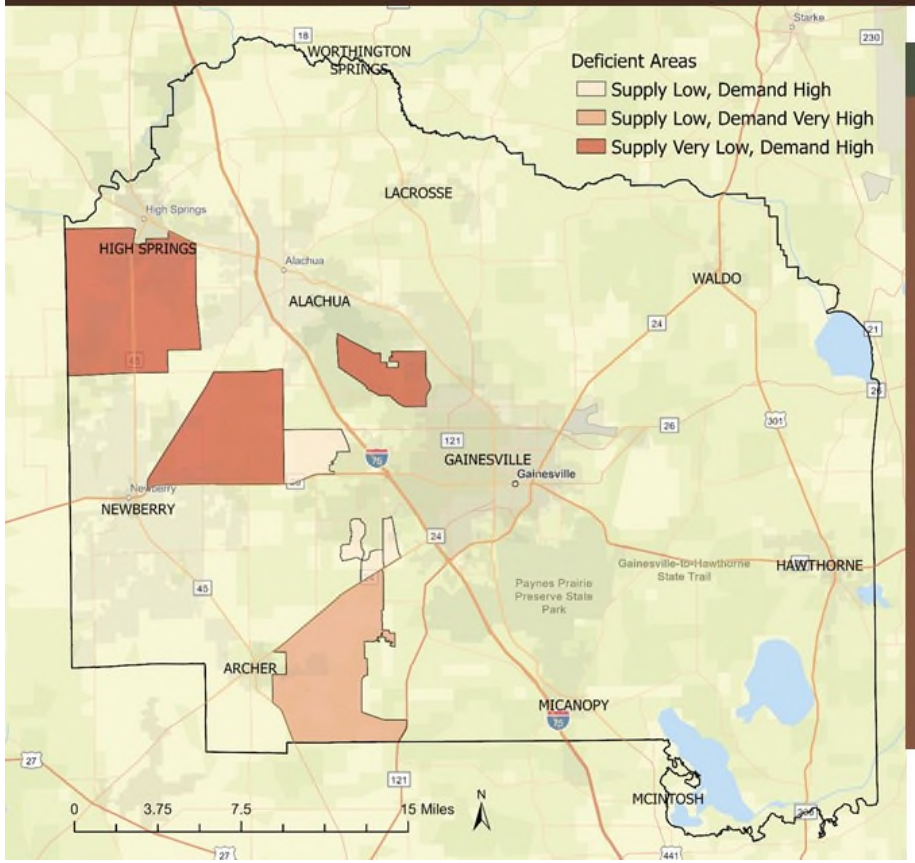
Supply: MV Transportation



Demand: People with disabilities



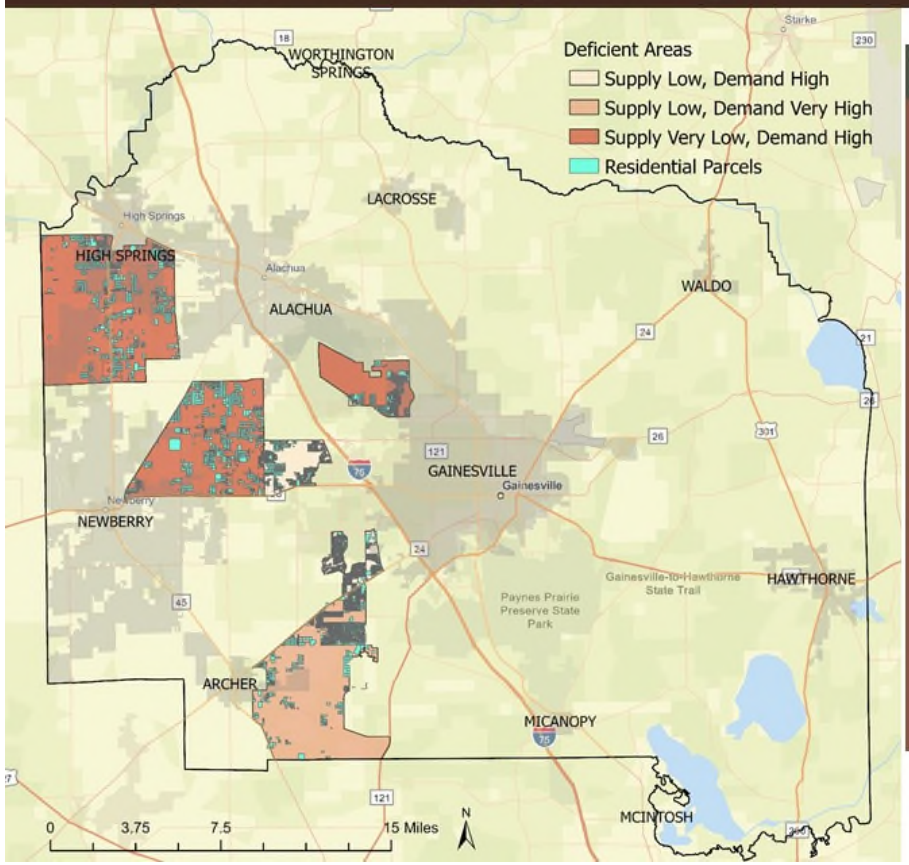
Gap Maps: Low Supply and High Demand Areas



Supply

Demand		Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Disabilities		**3,595**			3,756			7,351
	block group(s)		**1**			1			2
High	Disabilities	**6,622**	**9,377**		4,188	14,800			34,987
	block group(s)	**3**	**4**		2	6			15
Medium High	Disabilities	4,498	5,938	1,521	6,528	9,525	6,108	3,414	37,532
	block group(s)	3	4	1	4	6	4	2	24
Medium	Disabilities	10,112	2,147	4,488	3,416	2,233	8,116		30,512
	block group(s)	9	2	4	3	2	7		27
Medium Low	Disabilities	9,553	4,137	4,853	3,292	5,841	1,419	2,390	31,485
	block group(s)	12	5	6	4	7	2	3	39
Low	Disabilities	7,014	1,014	2,446	2,028	2,351	1,559	547	16,959
	block group(s)	13	2	5	4	5	3	1	33
Very Low	Disabilities	774	179	549	221	783		167	2,673
	block group(s)	7	1	2	1	3		1	15
Grand Total	Disabilities	38,573	26,387	13,857	19,673	39,289	17,202	6,518	161,499
	block group(s)	47	19	18	18	30	16	7	155

Gap Maps: Low Supply and High Demand Areas



Demand		Supply: Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Disabilities		**3,595**			3,756			7,351
	block group(s)		**1**			1			2
High	Disabilities	**6,622**	**9,377**		4,188	14,800			34,987
	block group(s)	**3**	**4**		2	6			15
Medium High	Disabilities	4,498	5,938	1,521	6,528	9,525	6,108	3,414	37,532
	block group(s)	3	4	1	4	6	4	2	24
Medium	Disabilities	10,112	2,147	4,488	3,416	2,233	8,116		30,512
	block group(s)	9	2	4	3	2	7		27
Medium Low	Disabilities	9,553	4,137	4,853	3,292	5,841	1,419	2,390	31,485
	block group(s)	12	5	6	4	7	2	3	39
Low	Disabilities	7,014	1,014	2,446	2,028	2,351	1,559	547	16,959
	block group(s)	13	2	5	4	5	3	1	33
Very Low	Disabilities	774	179	549	221	783		167	2,673
	block group(s)	7	1	2	1	3		1	15
Grand Total	Disabilities	38,573	26,387	13,857	19,673	39,289	17,202	6,518	161,499
	block group(s)	47	19	18	18	30	16	7	155

Discussion

GIS Model

Overall experience:

Are the results useful to inform transportation planning scenarios for improvement of services?

Data:

Is there any data that the gaps model could use (e.g., demand estimation)?

Analysis:

GIS model uses Census Block Group as an analysis unit. Is this unit adequate size to support your work for decision and policy making? What do you think about the seven categories approach to find gap area?

GIS Model Results

Model validation:

Do the results of GIS model match with your knowledge of the area or experience?

Sharing:

How would you like to access the results of GIS model?

For example: PDF, GIS file, Interactive web page

Update frequency:

What is the most useful frequency for running model and updating the data? E.g. regular schedule (e.g. once/year etc), as needed, or both?

Appendix B: Orange county meeting material

FDOT Research Project: BDV31 TWO 977-106

Applying Gap Modeling to Inform Improvement of Transportation Services for Vulnerable Populations at the Local and Regional Levels

Project managers: Gail M. Holley and Gabe Matthews (FDOT)

Principal Investigators: Ilir Bejleri and Ruth Steiner (UF)

SEPTEMBER 8, 2020

Meeting Goal

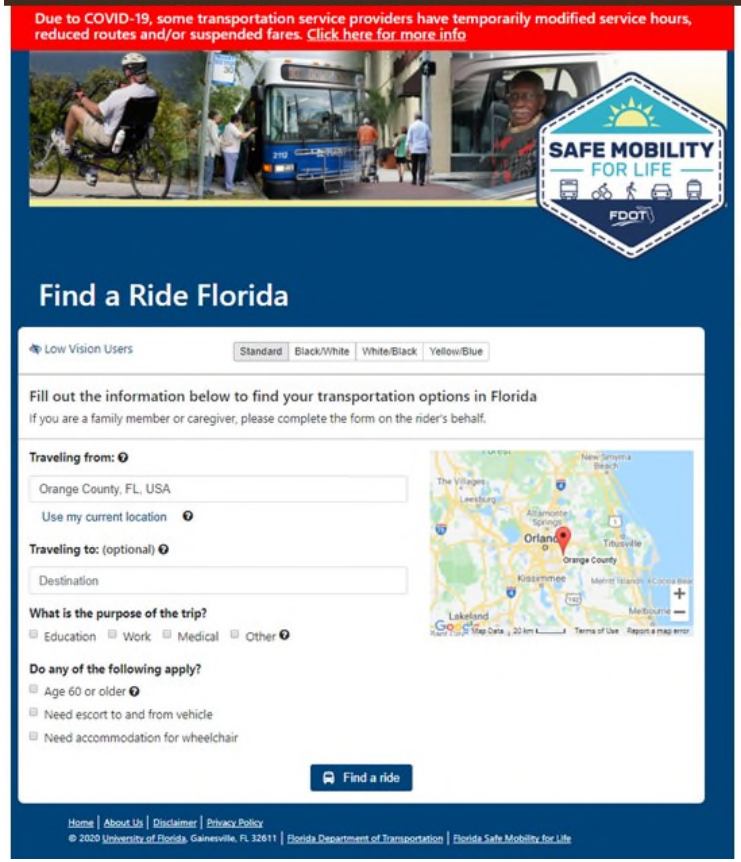
- Describe the work we have done
- Share some examples of the results
- Seek input on usefulness of this model

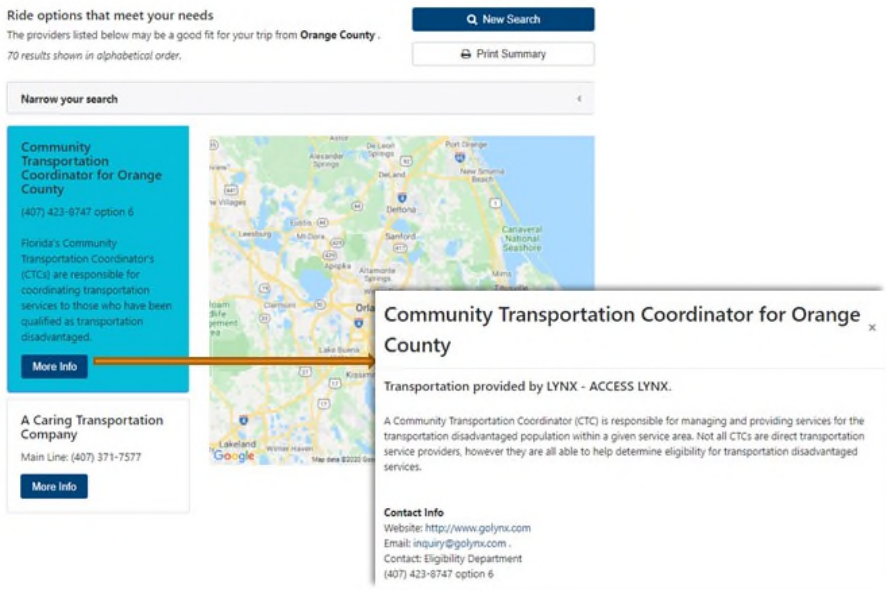
  - to help inform local efforts to identify or improve transportation services for vulnerable populations in your area.

Outline

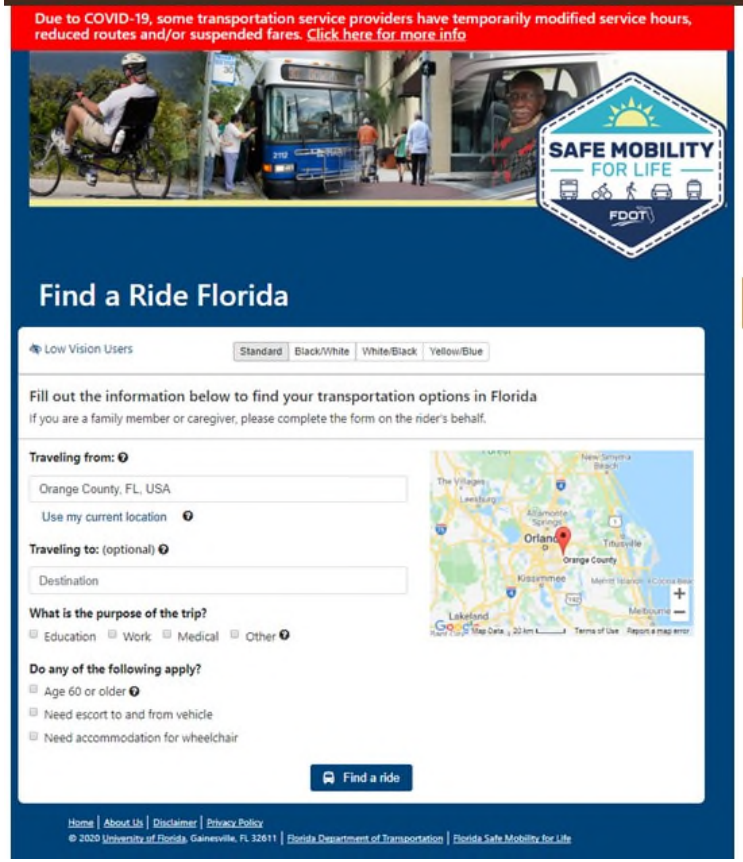
- Briefing on the Find-a-Ride Florida
- The GIS Model
  - The concept and how it works
  - Application examples
- Discussion

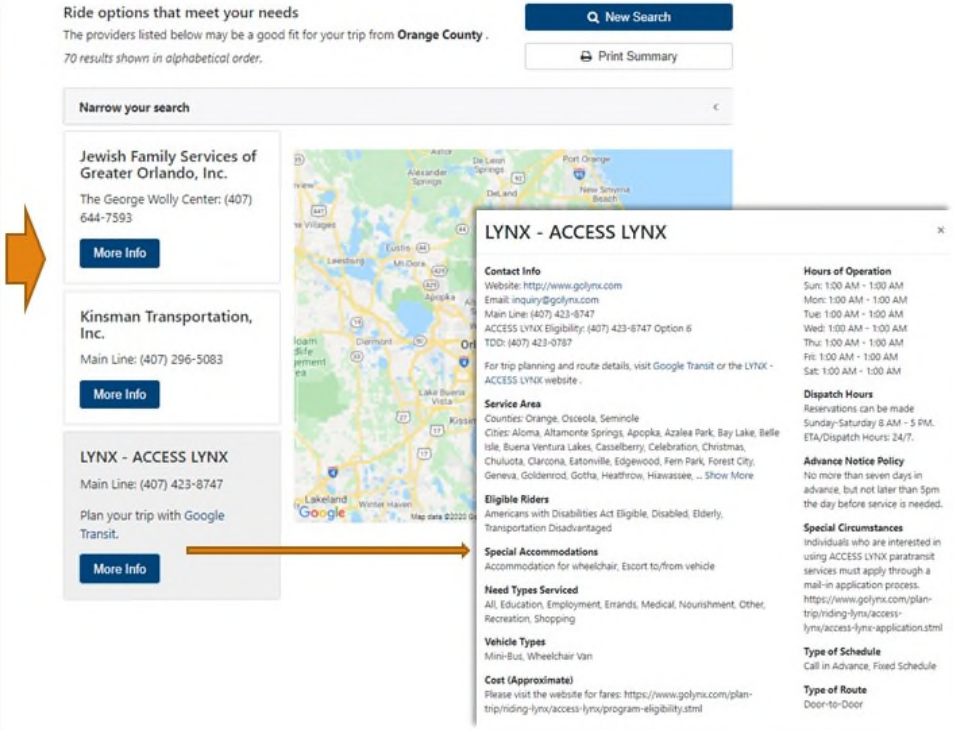
Find a Ride Florida Website: www.findarideflorida.org





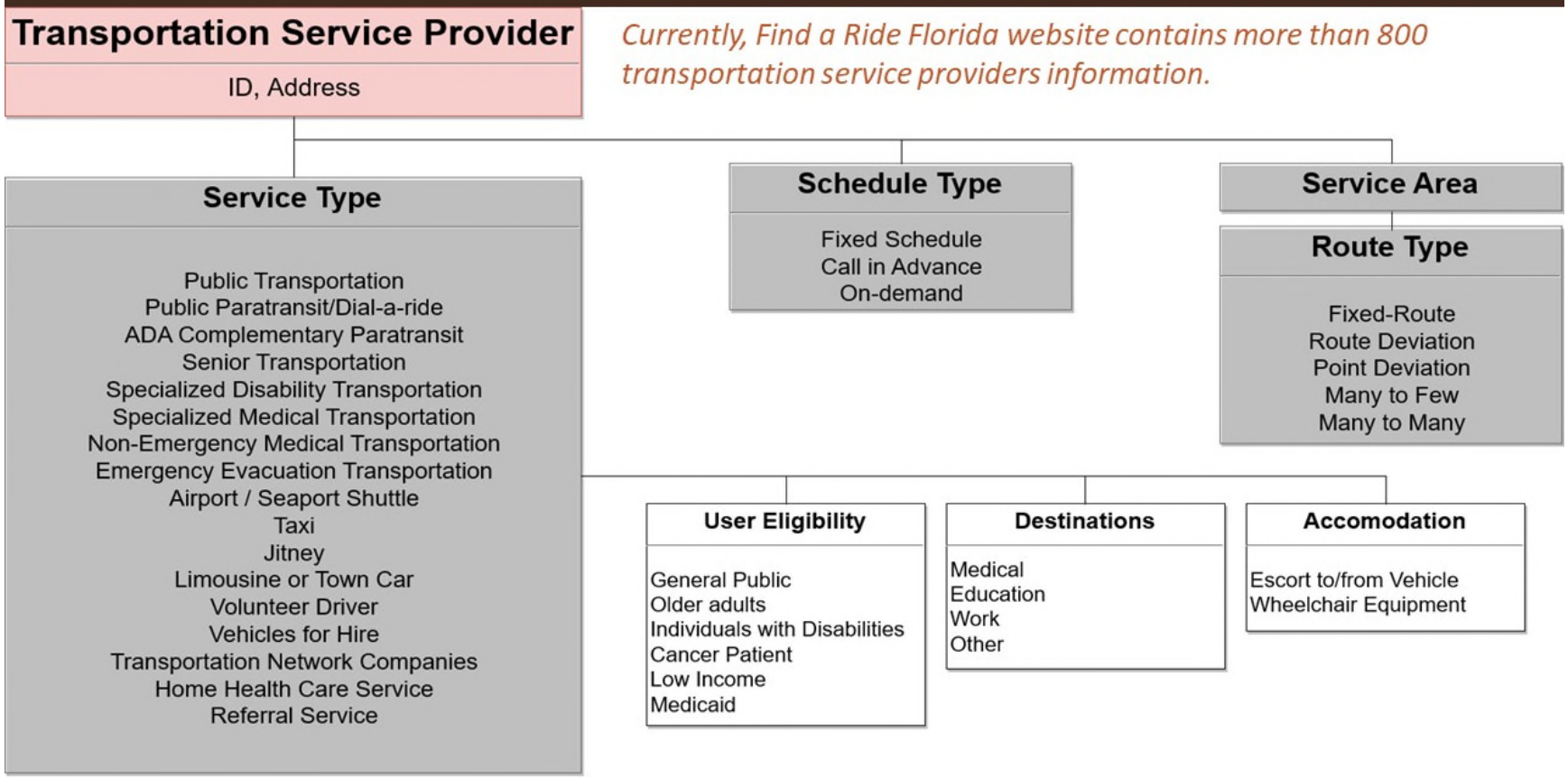
Find a Ride Florida Website: www.findarideflorida.org





Database Structure to Support Find-a-Ride Florida

Currently, Find a Ride Florida website contains more than 800 transportation service providers information.

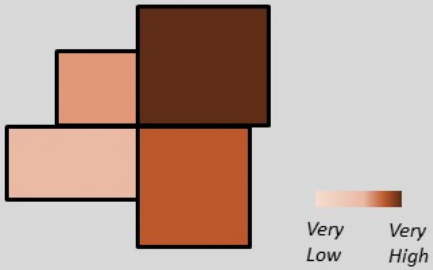


GIS Model

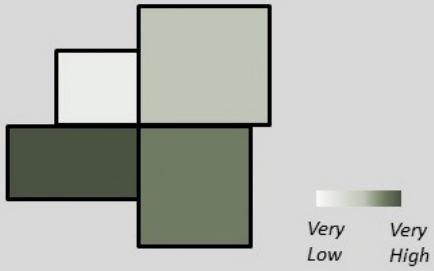
Purpose: Identify transportation gaps for Florida's vulnerable population

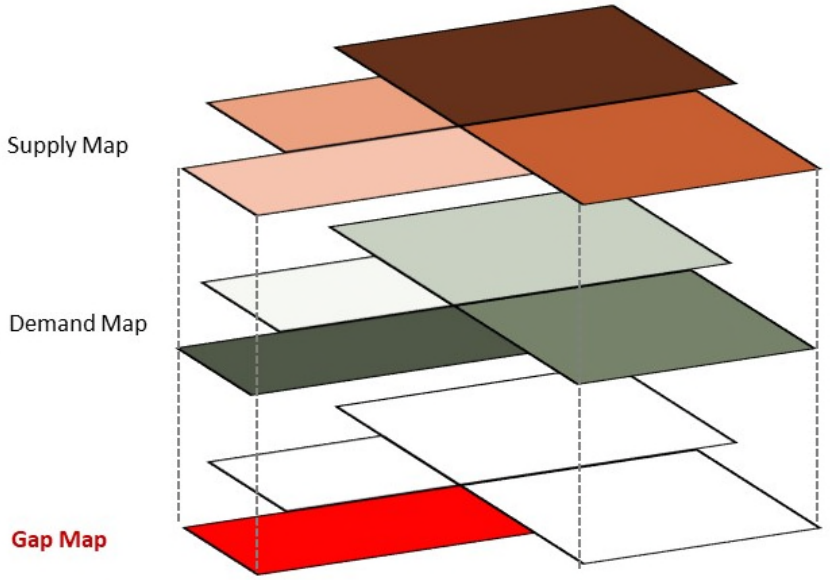
How the GIS Model Works

①**Supply Map** (Based on Gravity Accessibility Model)



②**Demand Map** (Based on Target Population Volume)





③**Identify Low Supply and High Demand Area**

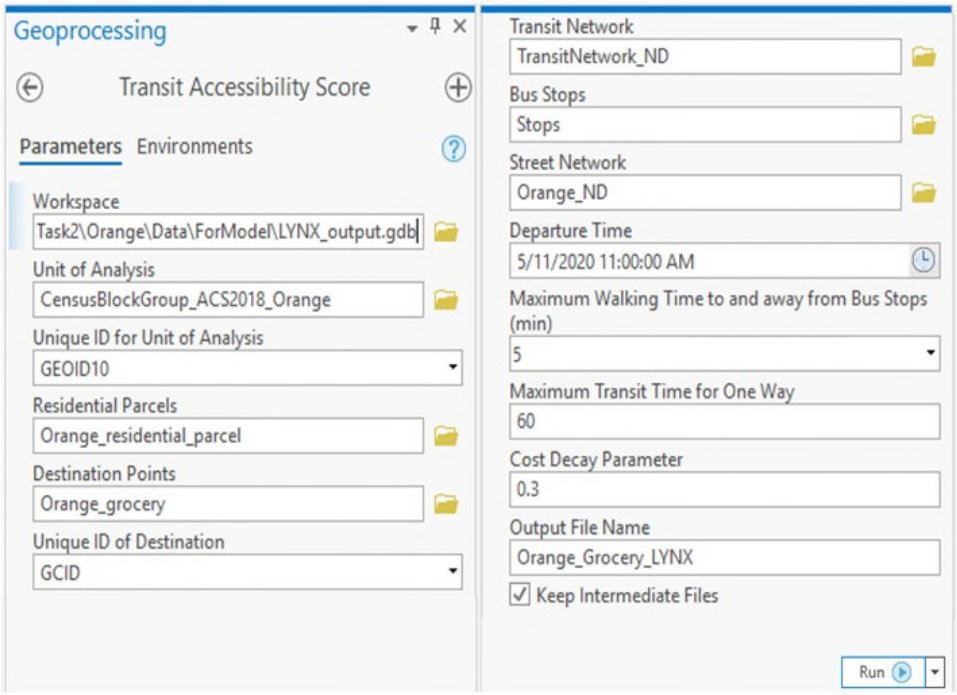
LYNX

DESTINATIONS: **GROCERY**

DEMAND: **OLDER ADULTS**

TRANSPORTATION: **FIXED ROUTE - LYNX**

Input Data



Spatial Data: Census Block Group, Residential Parcel, Destinations

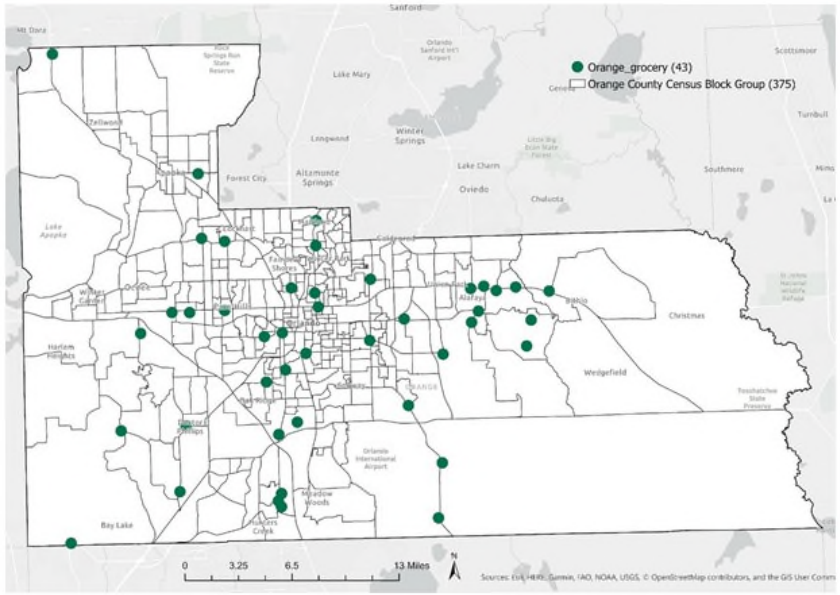
Transportation Data: Transit Network, Street Network, and Bus Stops

Customizable Data : Day and Time, Travel Time and Walking Time

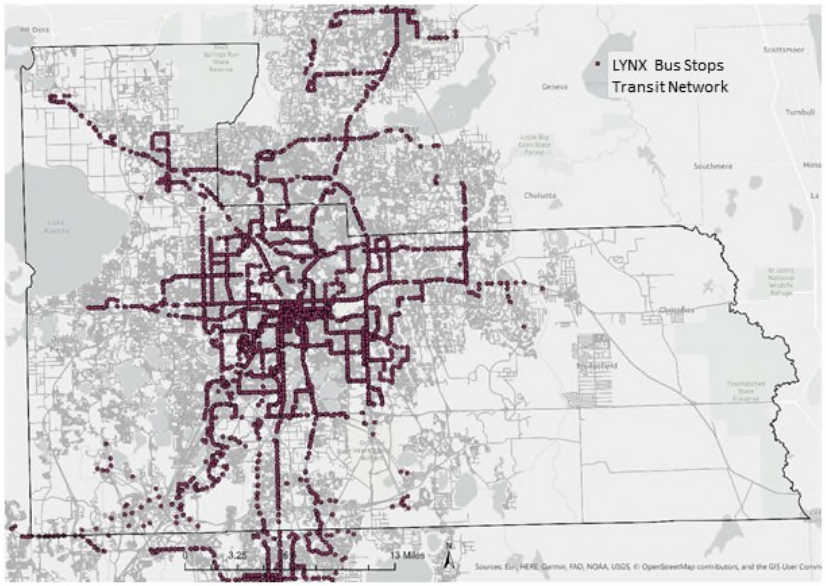
Data sources: FGDL, FDOT ARBM, 2018 ACS, FTIS/FTDE

Input Data Maps

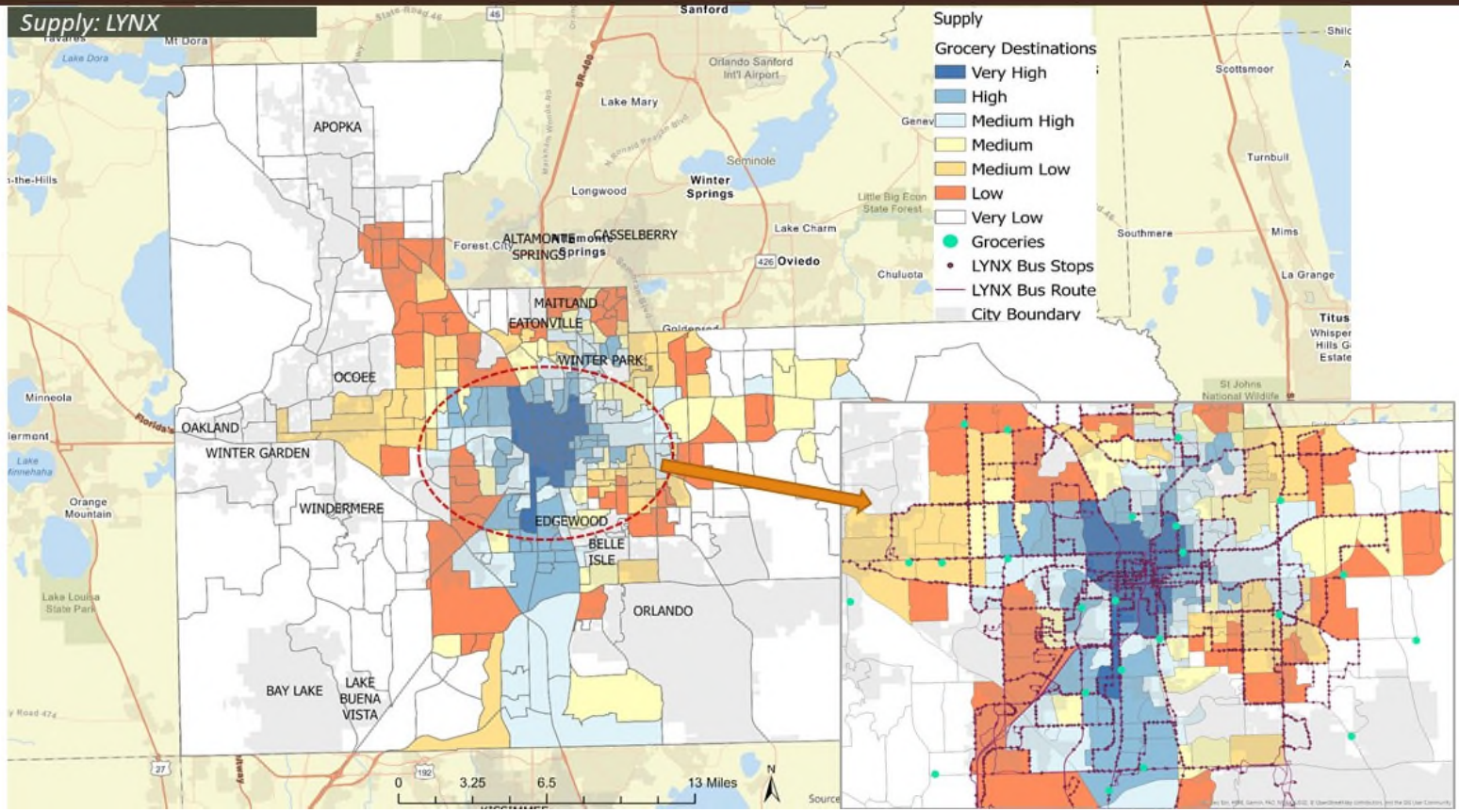
Analysis Unit and Opportunities



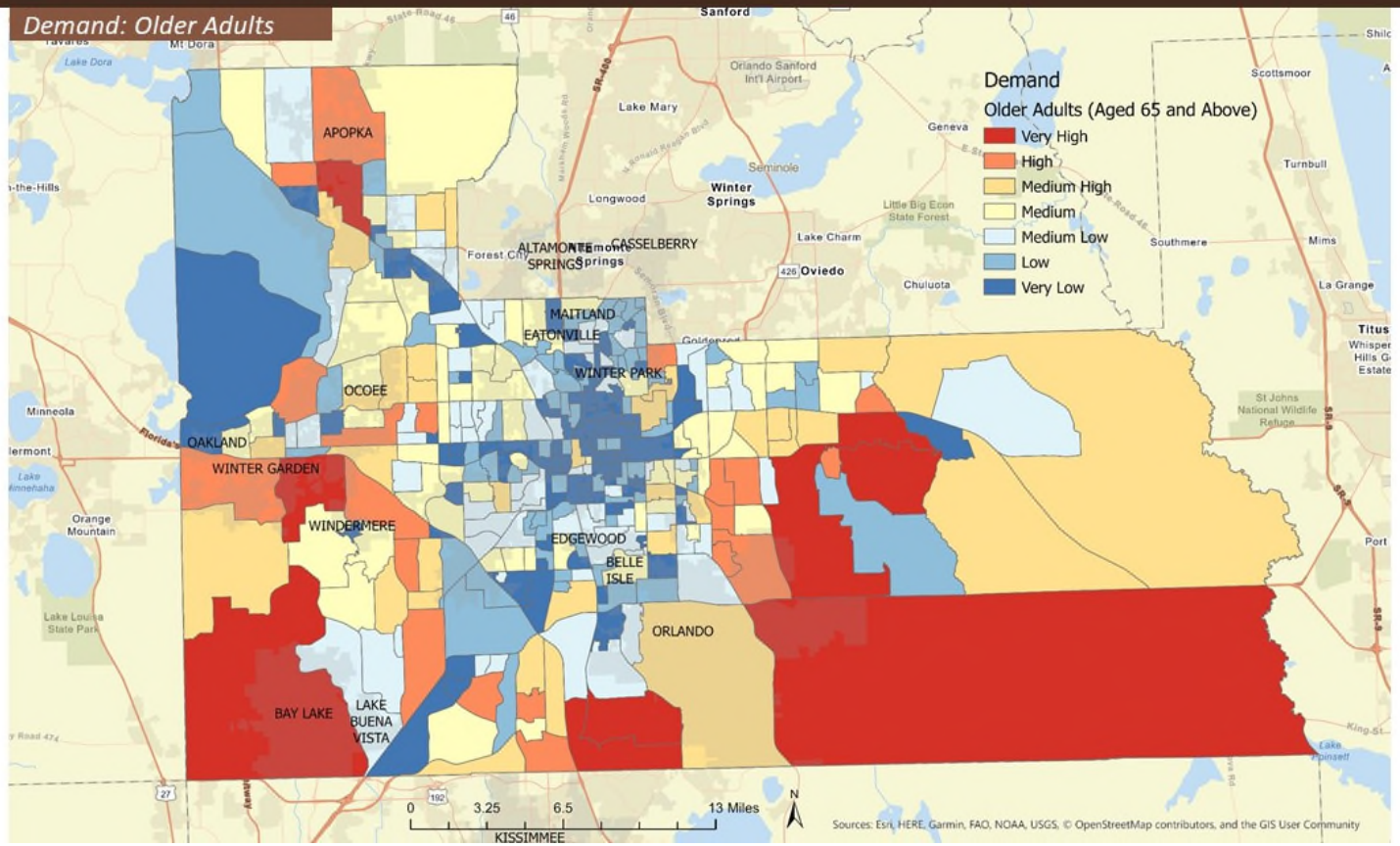
Transportation Network Data



Output Supply Map

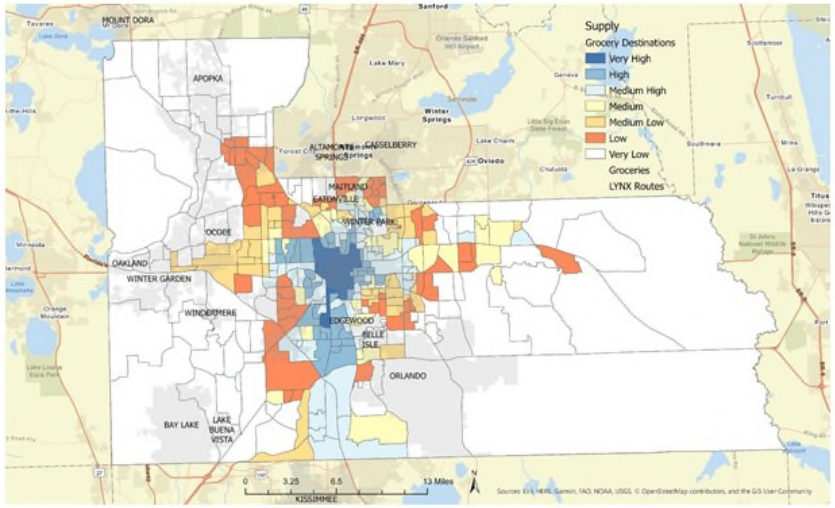


Output Demand Map

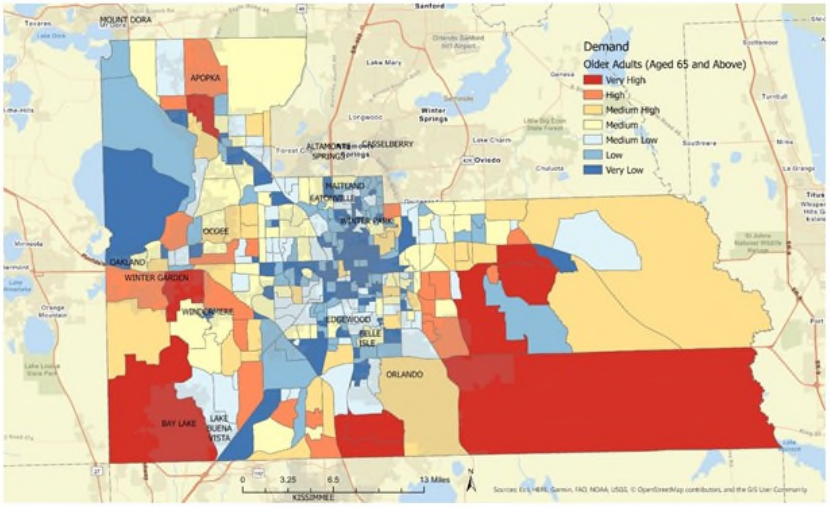


Output Supply & Demand Maps Side by Side

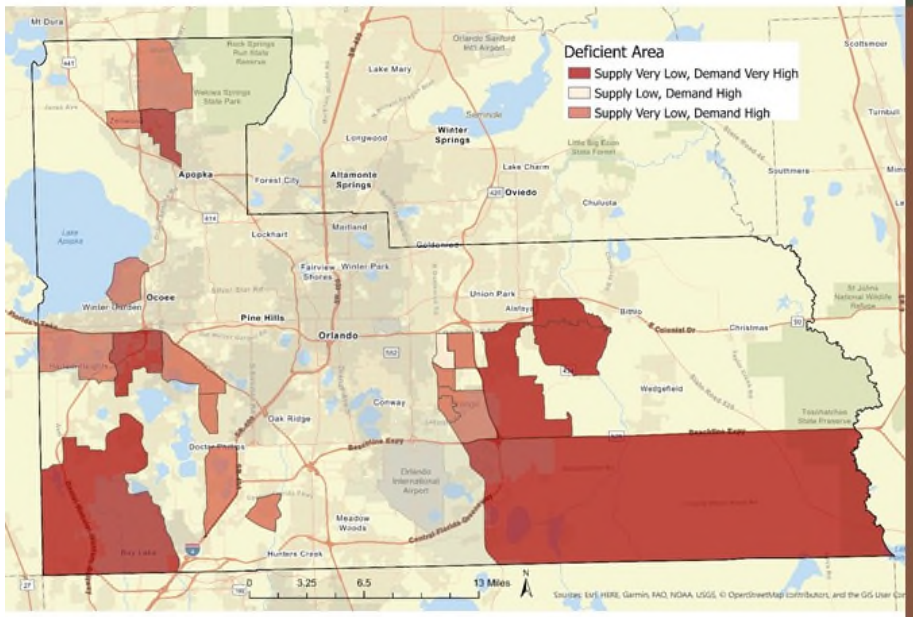
Supply: LYNX



Demand: Older Adults

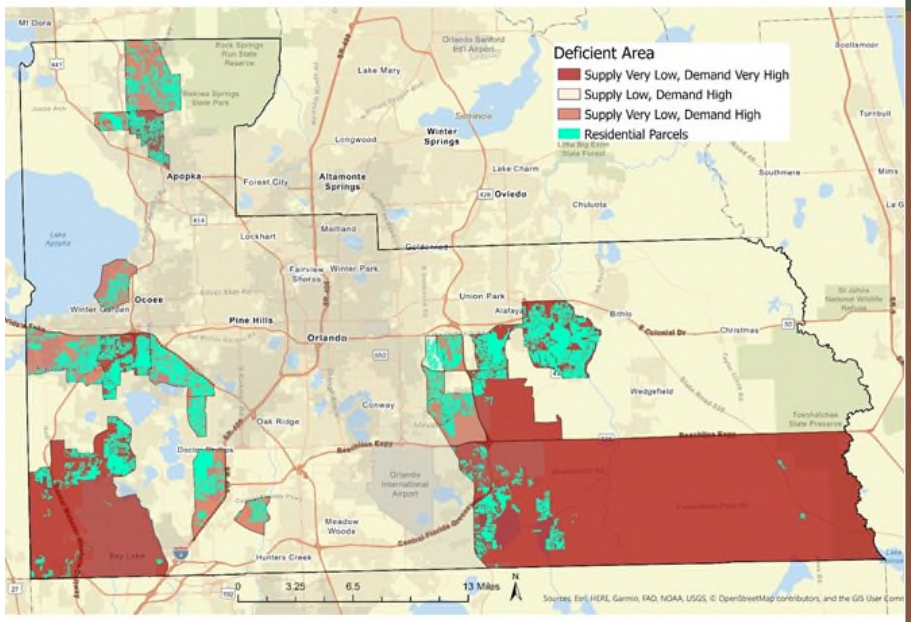


Gap Maps : Low Supply and High Demand Areas



Demand		Supply: Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Older Adults block group(s)	**13,763 7**			1,762 1	1,822 1			17,347 9
High	Older Adults block group(s)	**13,595 12**	**1,146 1**	3,713 3	989 1	3,265 3			22,708 20
Medium High	Older Adults block group(s)	11,684 14	3,299 4	5,043 6	3,142 4	1,830 2	797 1	759 1	26,554 32
Medium	Older Adults block group(s)	13,893 25	6,529 12	2,878 5	3,437 6	3,163 6	2,425 5		32,325 59
Medium Low	Older Adults block group(s)	7,019 19	5,104 14	2,837 9	2,300 7	4,115 12	2,583 7	1,367 4	25,325 72
Low	Older Adults block group(s)	1,377 6	2,648 13	2,834 14	2,279 11	3,155 15	2,701 12	1,091 5	16,085 76
Very Low	Older Adults block group(s)	1,427 15	1,007 9	1,159 10	733 7	2,312 26	1,613 19	1,669 21	9,920 107
Grand Total	Older Adults block group(s)	62,758 98	19,733 53	18,464 47	14,642 37	19,662 65	10,119 44	4,886 31	150,264 375

Gap Maps: Low Supply and High Demand Areas



Demand		Supply: Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Older Adults block group(s)	**13,763 7**			1,762 1	1,822 1			17,347 9
High	Older Adults block group(s)	**13,595 12**	**1,146 1**	3,713 3	989 1	3,265 3			22,708 20
Medium High	Older Adults block group(s)	11,684 14	3,299 4	5,043 6	3,142 4	1,830 2	797 1	759 1	26,554 32
Medium	Older Adults block group(s)	13,893 25	6,529 12	2,878 5	3,437 6	3,163 6	2,425 5		32,325 59
Medium Low	Older Adults block group(s)	7,019 19	5,104 14	2,837 9	2,300 7	4,115 12	2,583 7	1,367 4	25,325 72
Low	Older Adults block group(s)	1,377 6	2,648 13	2,834 14	2,279 11	3,155 15	2,701 12	1,091 5	16,085 76
Very Low	Older Adults block group(s)	1,427 15	1,007 9	1,159 10	733 7	2,312 26	1,613 19	1,669 21	9,920 107
Grand Total	Older Adults block group(s)	62,758 98	19,733 53	18,464 47	14,642 37	19,662 65	10,119 44	4,886 31	150,264 375

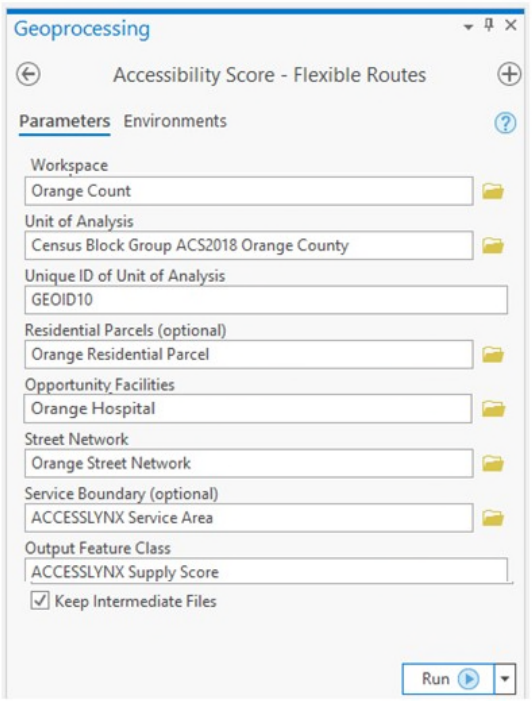
ACCESS LYNX

DESTINATIONS: **HOSPITALS**

DEMAND: **PEOPLE WITH DISABILITIES** (20-64 YEARS OLD)

TRANSPORTATION: **FLEXIBLE ROUTE – ACCESS LYNX**

Input Data



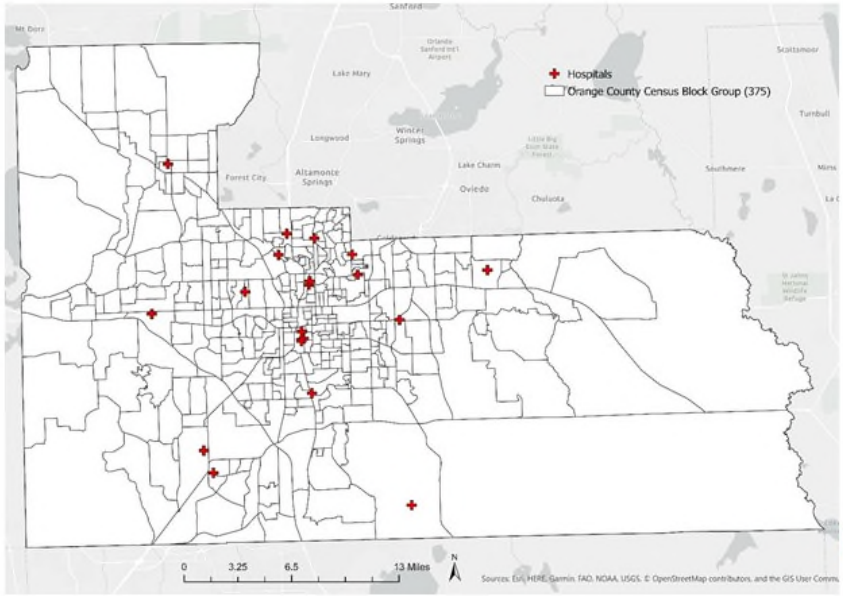
Spatial Data: Census Block Group, Residential Parcel, Destinations

Transportation Data: Street Network

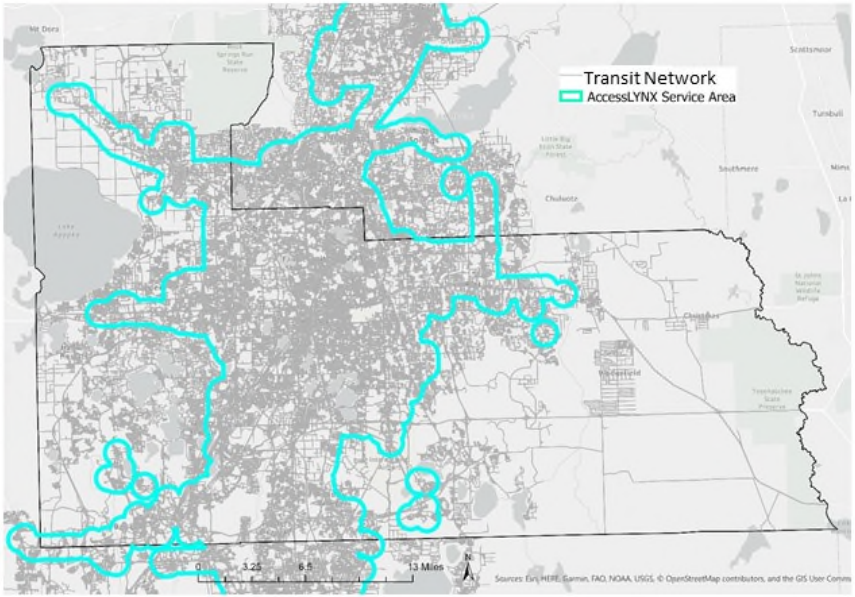
Data sources: FGDL, FDOT ARBM, 2018 ACS, FTIS/FTDE

Input Data Maps

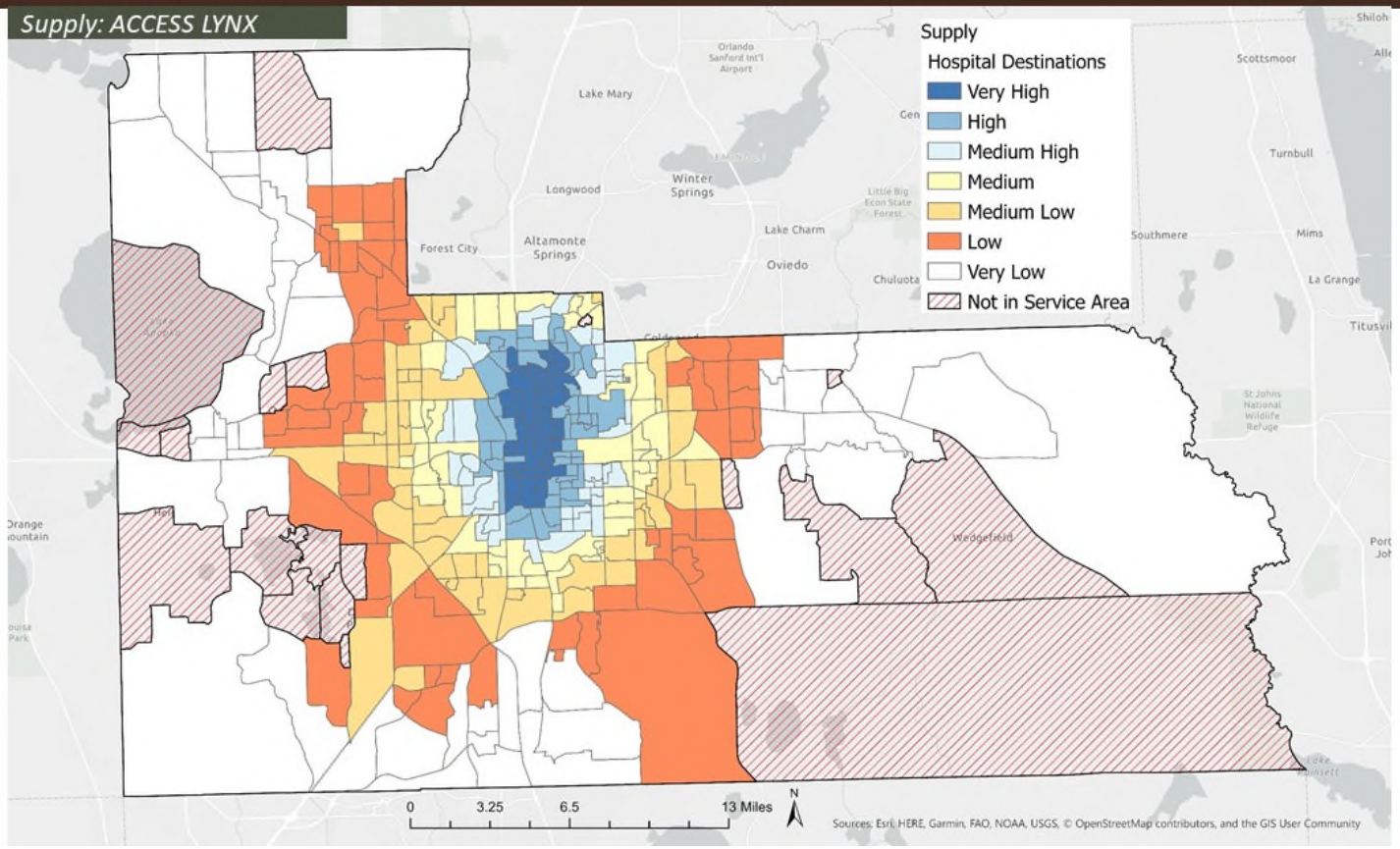
Analysis Unit and Opportunities



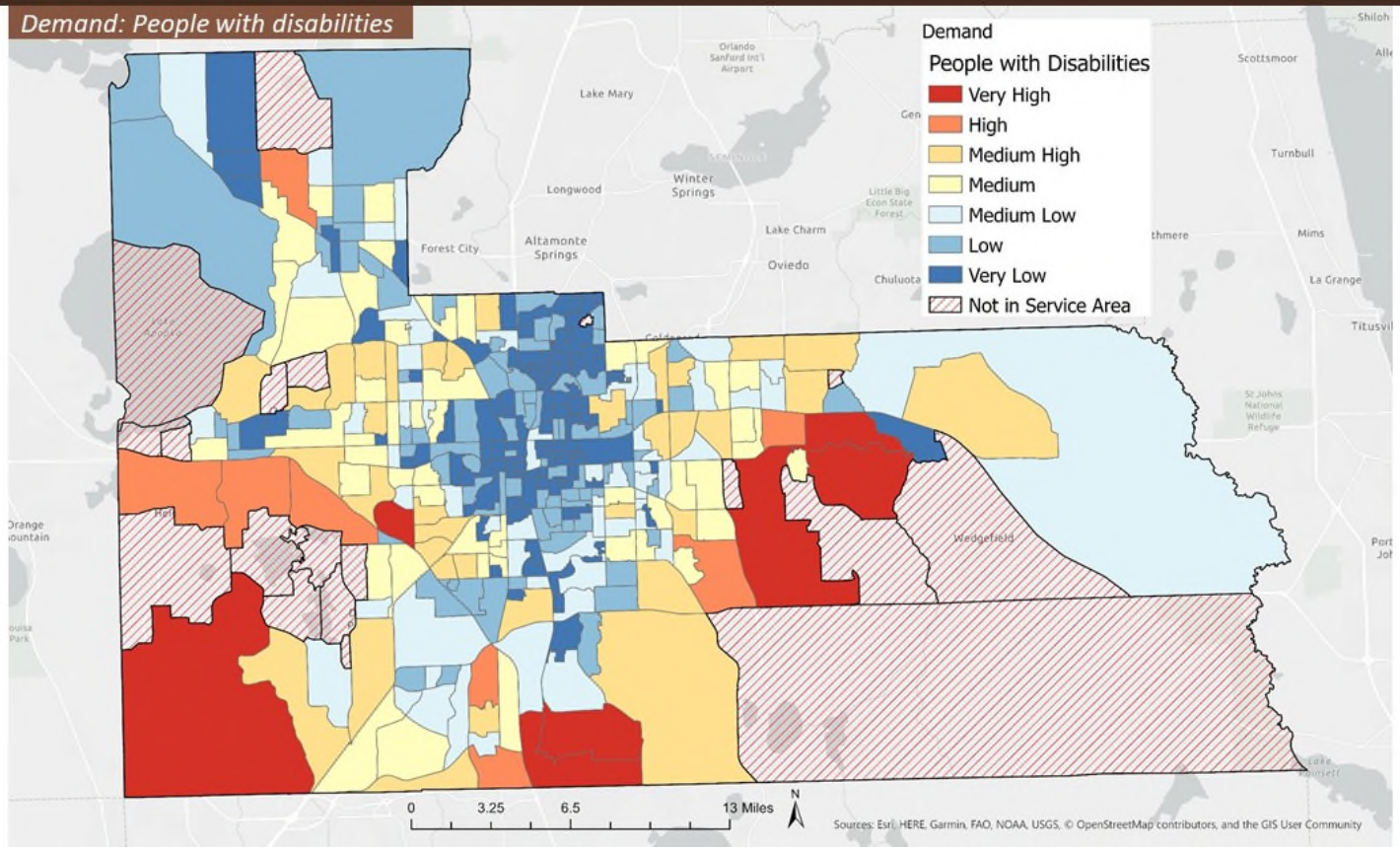
Transportation Data



Output Supply Map

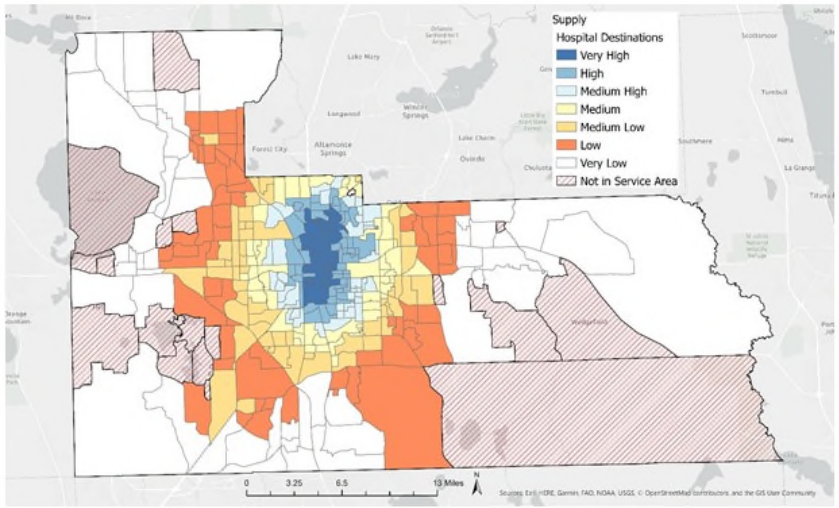


Output Demand Map

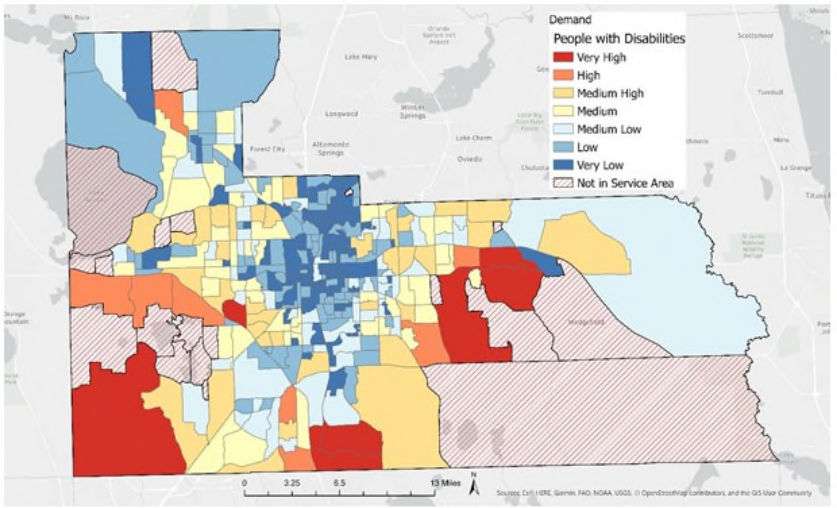


Output Supply & Demand Maps Side By Side

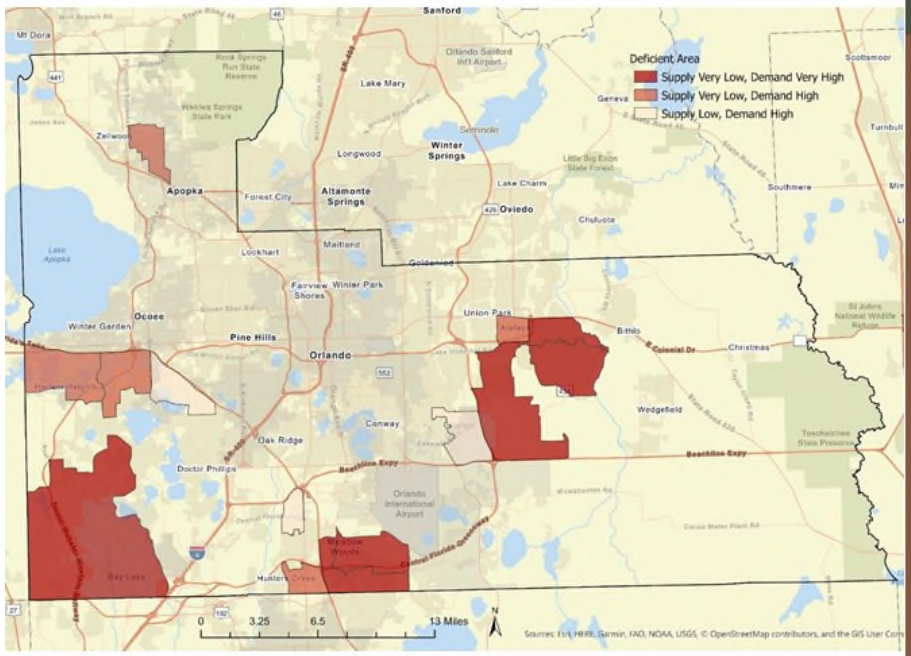
Supply: ACCESS LYNX



Demand: People with disabilities



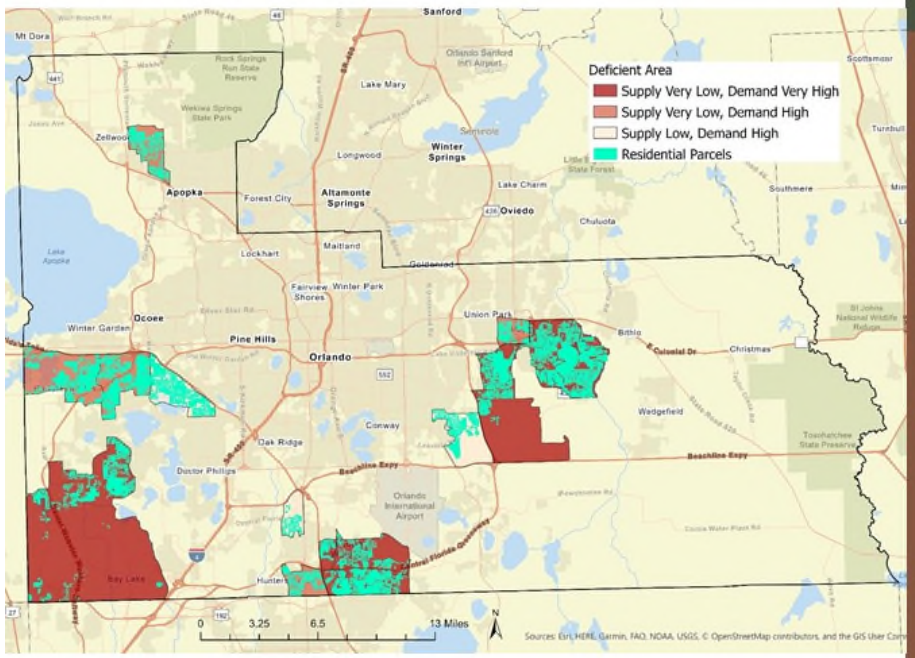
Gap Maps: Low Supply and High Demand Areas



Supply

Demand		Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Disabilities block group(s)	**78,661 6**		10,813 1					89,474 7
High	Disabilities block group(s)	**41,793 5**	**22,246 3**						64,039 8
Medium High	Disabilities block group(s)	33,273 7	45,759 9	64,594 13	21,019 4	4,202 1	4,987 1		173,834 35
Medium	Disabilities block group(s)	26,021 8	51,452 15	43,941 13	32,820 10	6,888 2			161,122 48
Medium Low	Disabilities block group(s)	23,202 11	28,574 14	21,128 11	25,689 12	12,777 6	3,798 2	4,108 2	119,276 58
Low	Disabilities block group(s)	7,971 7	15,661 13	15,553 13	10,036 9	15,822 15	14,970 13	13,788 14	93,801 84
Very Low	Disabilities block group(s)	2,566 5	3,316 7	2,869 5	8,579 16	10,156 18	15,132 33	15,625 31	58,243 115
Grand Total	Disabilities block group(s)	213,487 49	167,008 61	158,898 56	98,143 51	49,845 42	38,887 49	33,521 47	759,789 355

Gap Maps: Low Supply and High Demand Areas



Demand		Supply: Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Disabilities block group(s)	78,661 6		10,813 1					89,474 7
High	Disabilities block group(s)	41,793 5	22,246 3						64,039 8
Medium High	Disabilities block group(s)	33,273 7	45,759 9	64,594 13	21,019 4	4,202 1	4,987 1		173,834 35
Medium	Disabilities block group(s)	26,021 8	51,452 15	43,941 13	32,820 10	6,888 2			161,122 48
Medium Low	Disabilities block group(s)	23,202 11	28,574 14	21,128 11	25,689 12	12,777 6	3,798 2	4,108 2	119,276 58
Low	Disabilities block group(s)	7,971 7	15,661 13	15,553 13	10,036 9	15,822 15	14,970 13	13,788 14	93,801 84
Very Low	Disabilities block group(s)	2,566 5	3,316 7	2,869 5	8,579 16	10,156 18	15,132 33	15,625 31	58,243 115
Grand Total	Disabilities block group(s)	213,487 49	167,008 61	158,898 56	98,143 51	49,845 42	38,887 49	33,521 47	759,789 355

Discussion

GIS Model

Usefulness:

Is the utilization of this model useful to inform transportation planning scenarios for improvement of services?

Data:

Is there any data that the model could use (e.g., demand estimation, services)?

Analysis:

GIS model uses Census Block Group as an analysis unit

- Is this unit adequate size to support your work for decision and policy making?

- Is the approach of using the seven categories desirable to help prioritize the gap areas?

GIS Model Results

Model validation:

Do the results of the model match with your knowledge of the area?

Sharing:

How would you like to access the results of GIS model?

For example: PDF, GIS file, Interactive web page

Update frequency:

What is the most useful frequency for running model and updating the data? E.g. regular schedule (e.g. once/year etc.), as needed, or both?

Appendix C: MetroPlan Orlando and Lake-Sumter MPO meeting material

FDOT Research Project: BDV31 TWO 977-106

Applying Gap Modeling to Inform Improvement of Transportation Services for Vulnerable Populations at the Local and Regional Levels

Project managers: Gail M. Holley and Gabe Matthews (FDOT)

Principal Investigators: Ilir Bejleri and Ruth Steiner (UF)

OCTOBER 27, 2020

Meeting Goal

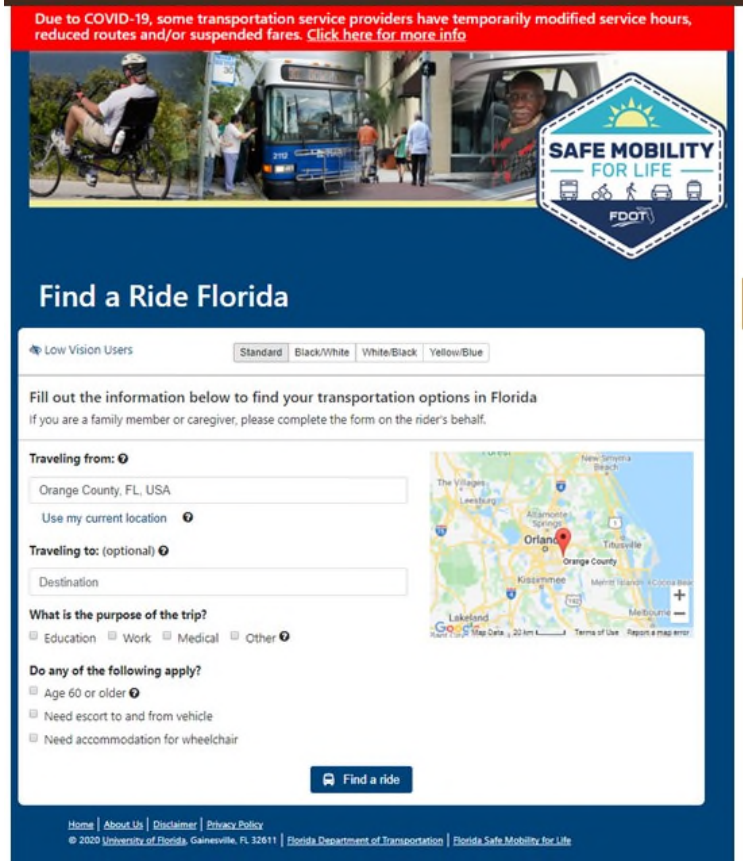
- Describe the work we have done
- Share some examples of the results
- Seek input on usefulness of this model

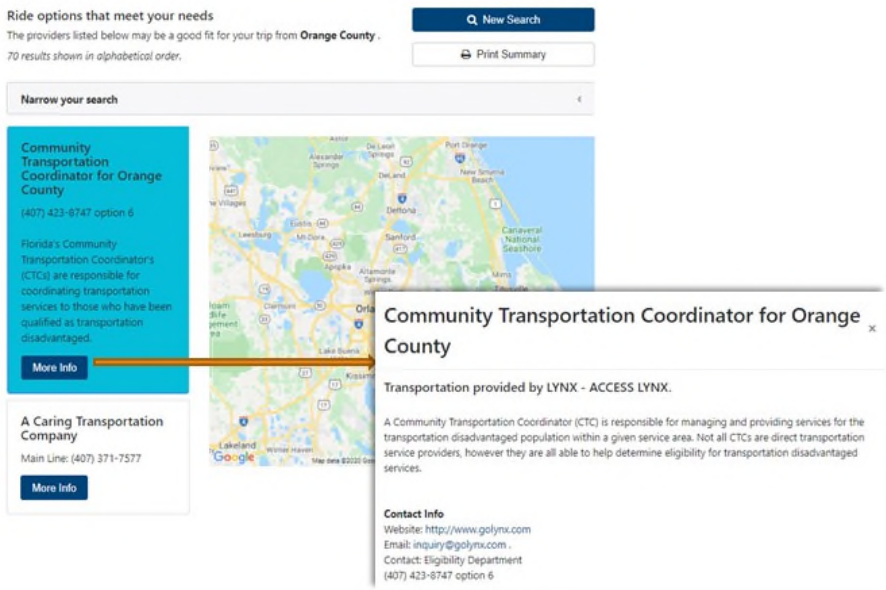
  - to help inform local efforts to identify or improve transportation services for vulnerable populations in your area.

Outline

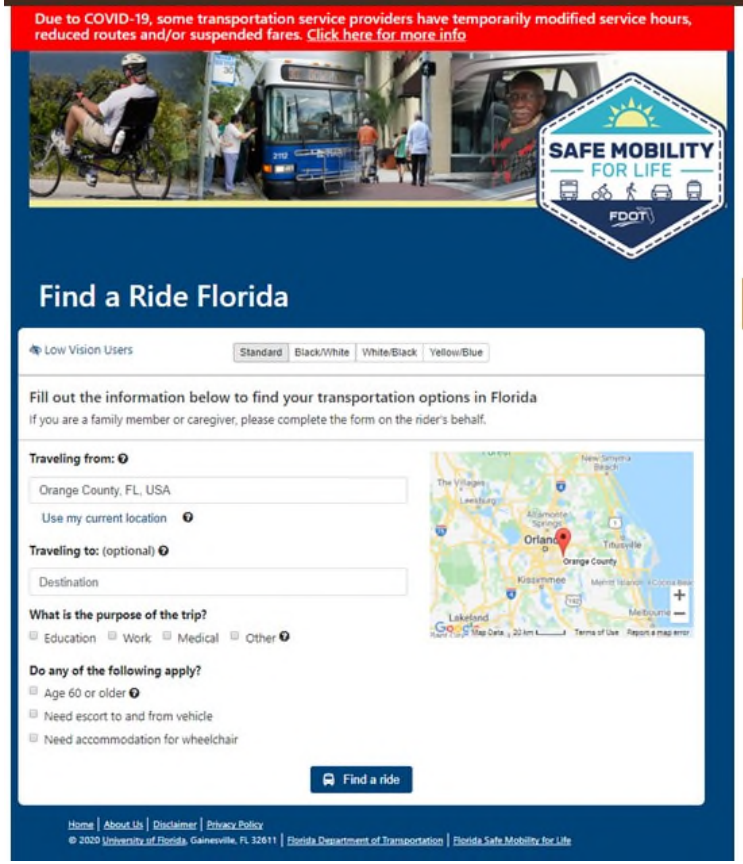
- Briefing on the Find-a-Ride Florida
- The GIS Model
  - The concept and how it works
  - Application examples
- Discussion

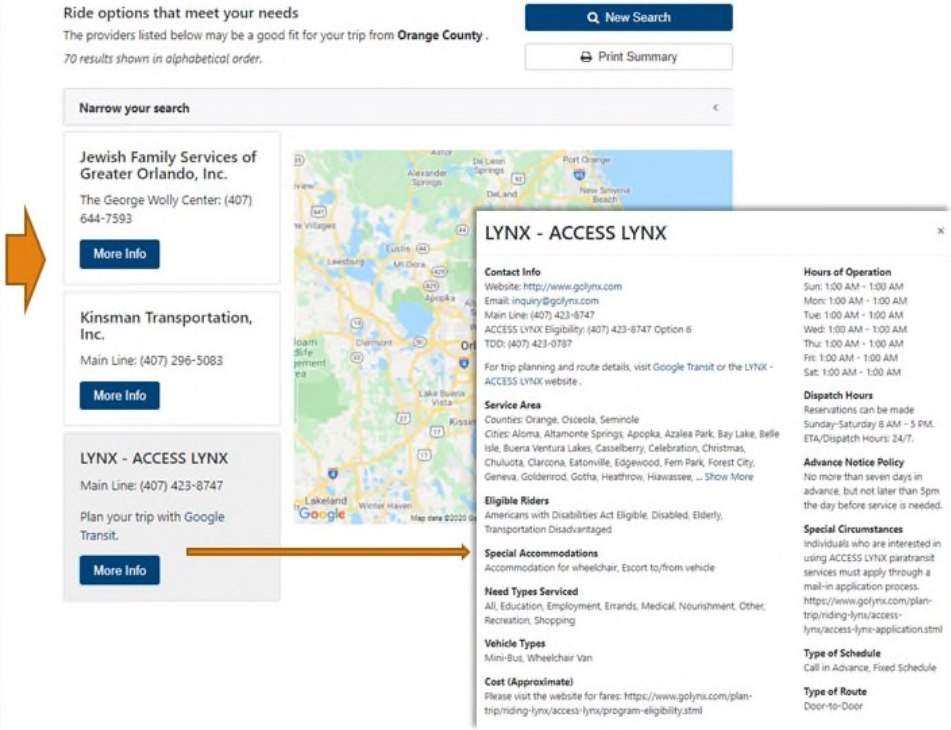
Find a Ride Florida Website: www.findarideflorida.org



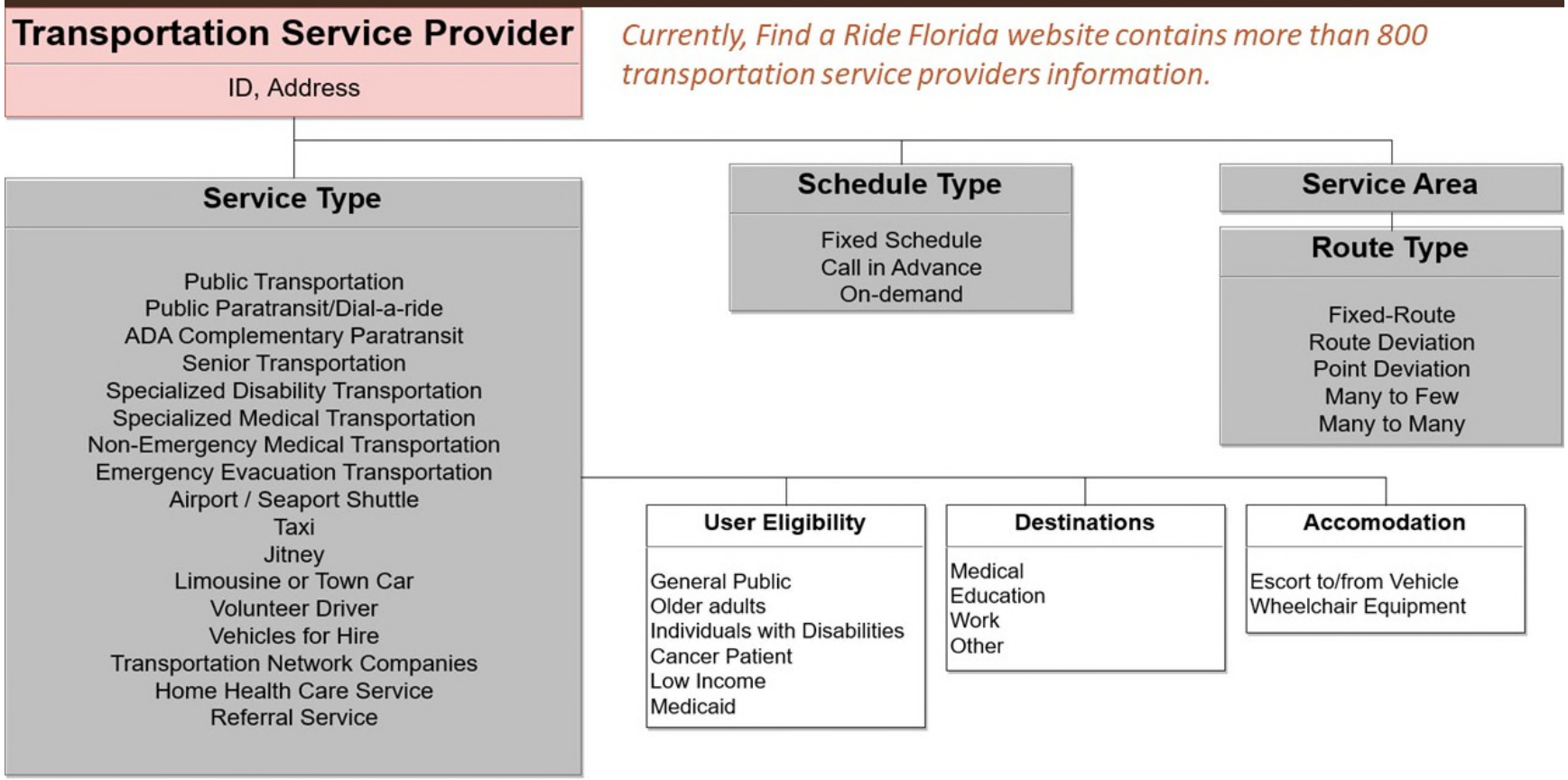


Find a Ride Florida Website: www.findarideflorida.org





Database Structure to Support Find-a-Ride Florida

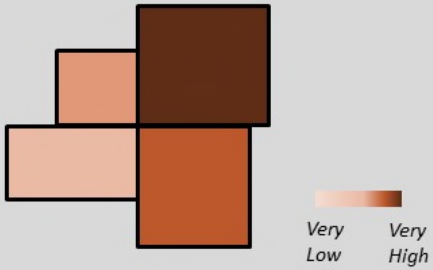


GIS Model

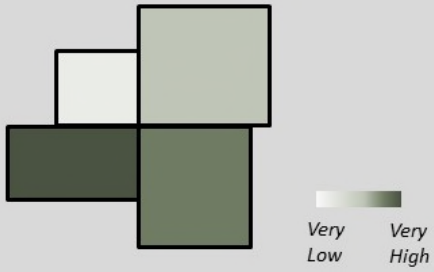
Purpose: Identify transportation gaps for Florida's vulnerable population

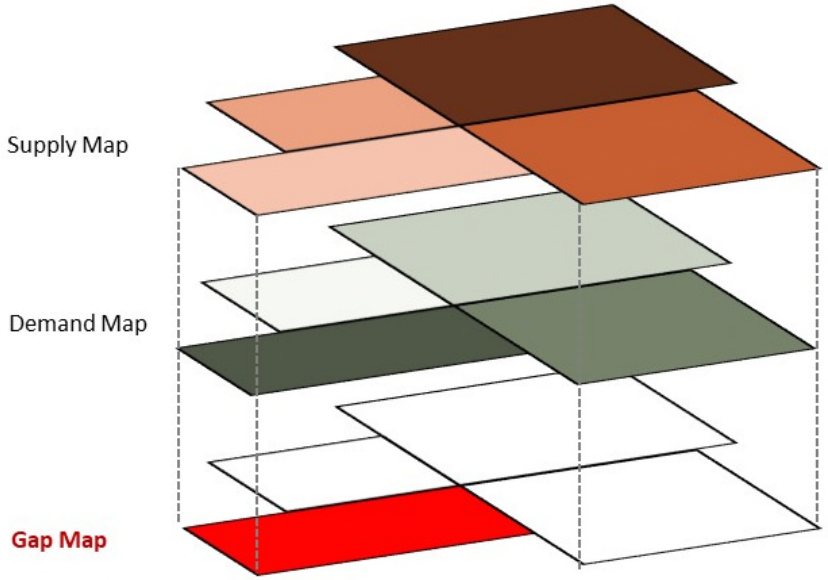
How the GIS Model Works

①**Supply Map** (Based on Gravity Accessibility Model)



②**Demand Map** (Based on Census Data)

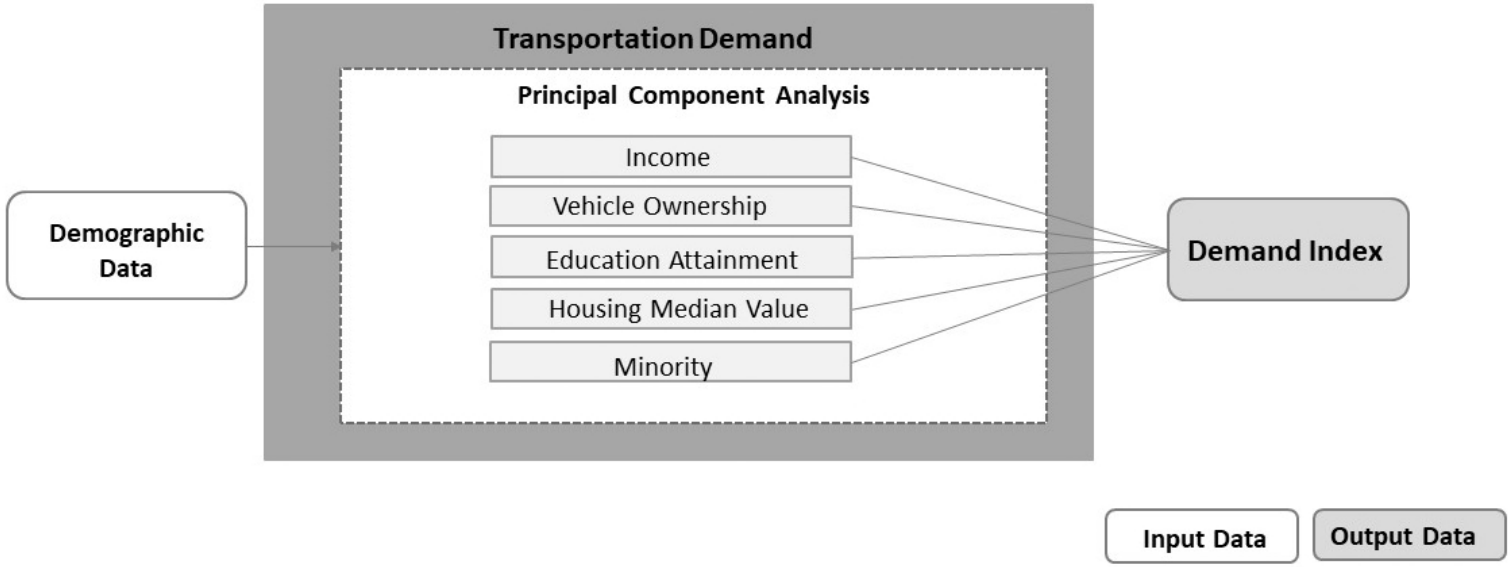




③**Identify Low Supply and High Demand Area**

Demand Index Method

Single Demand Index For Transportation Advantaged Population (Based on Principal Component Analysis)



Application Example

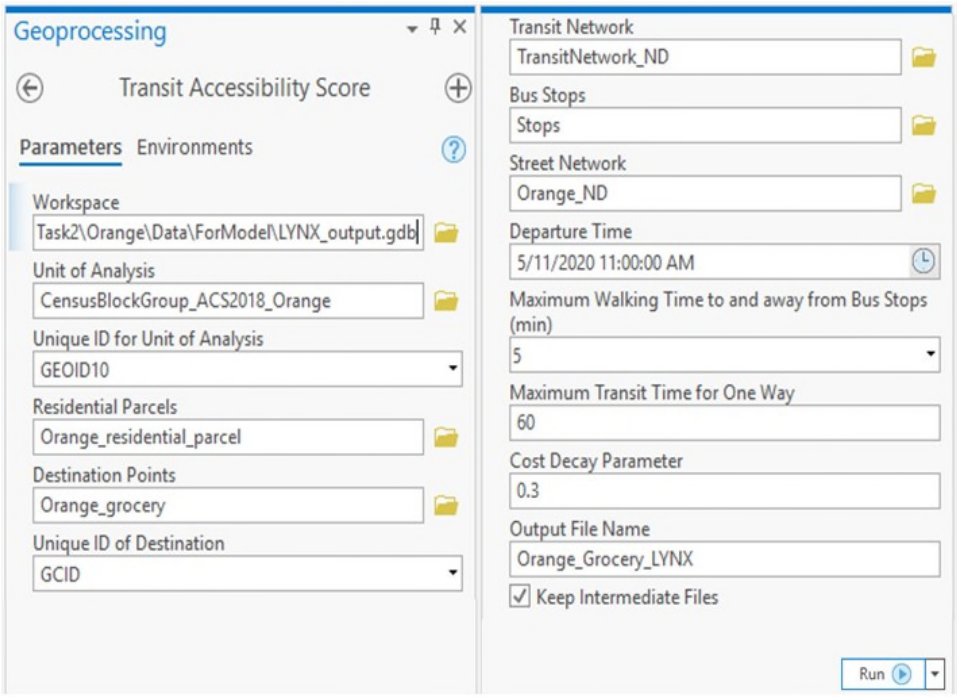
MetroPlan Orlando

TRANSPORTATION: **FIXED ROUTE - LYNX**

DESTINATIONS: **GROCERIES**

DEMAND: **TRANSPORTATION DISADVANTAGED POPULATION**

Input Data



Spatial Data: Census Block Group, Residential Parcel, Destinations

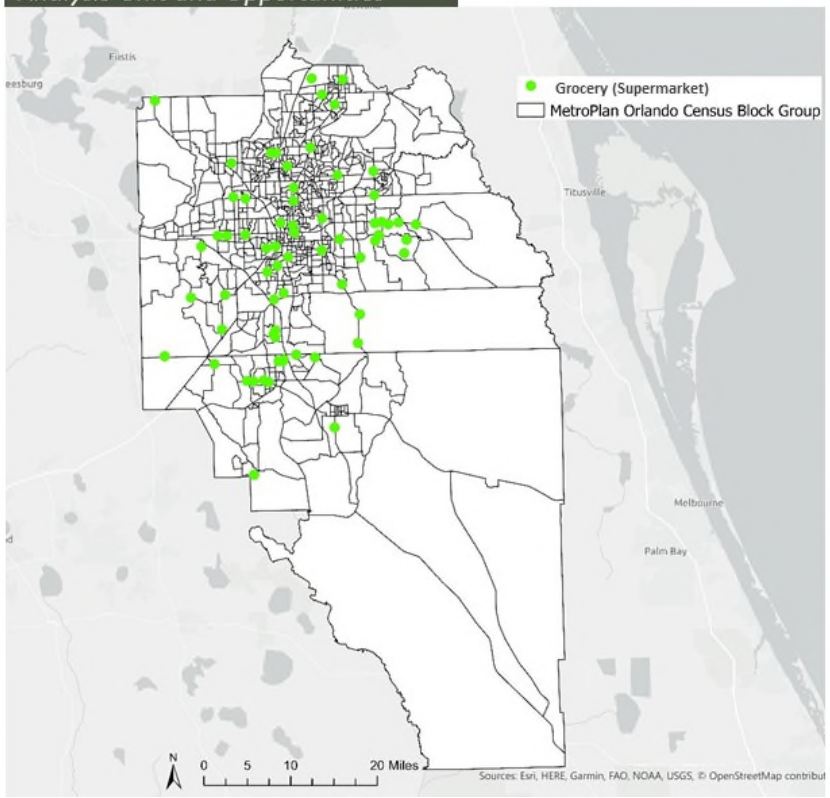
Transportation Data: Transit Network, Street Network, and Bus Stops

Customizable Data : Day and Time, Travel Time and Walking Time

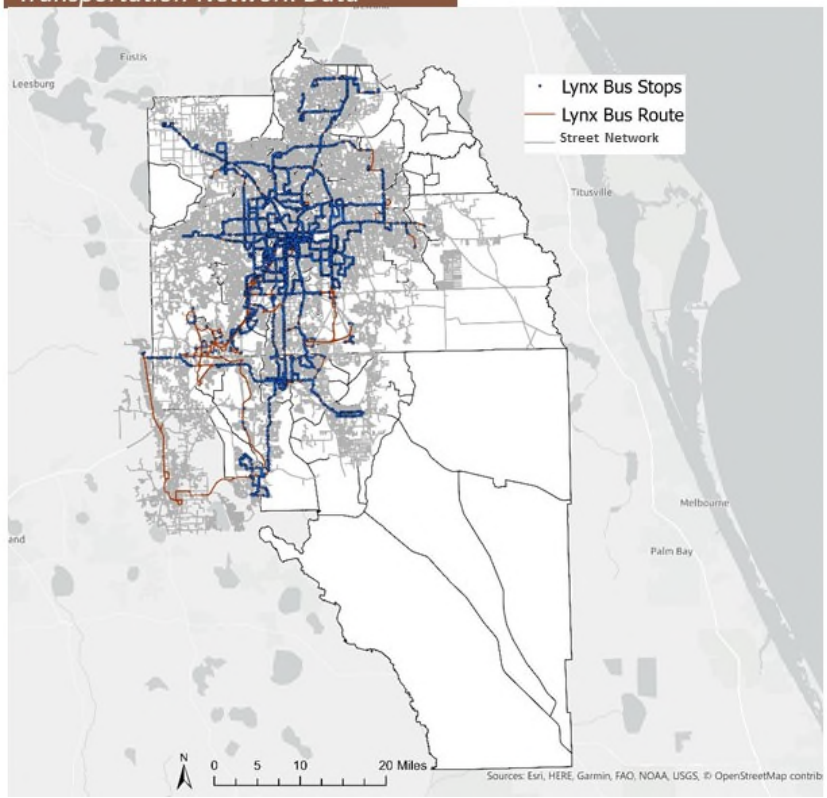
Data sources: FGDL, FDOT ARBM, 2018 ACS, FTIS/FTDE

Input Data Maps

Analysis Unit and Opportunities

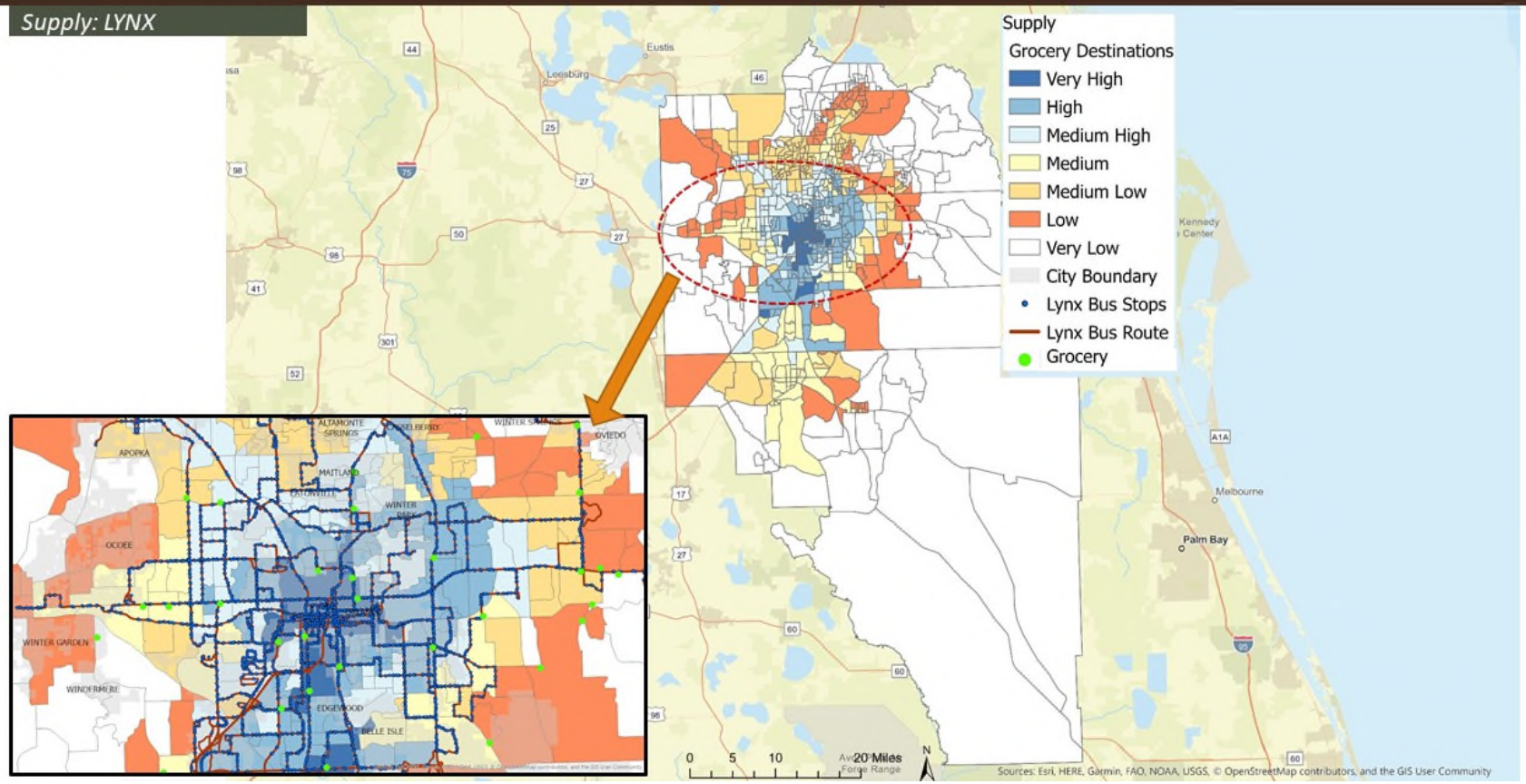


Transportation Network Data



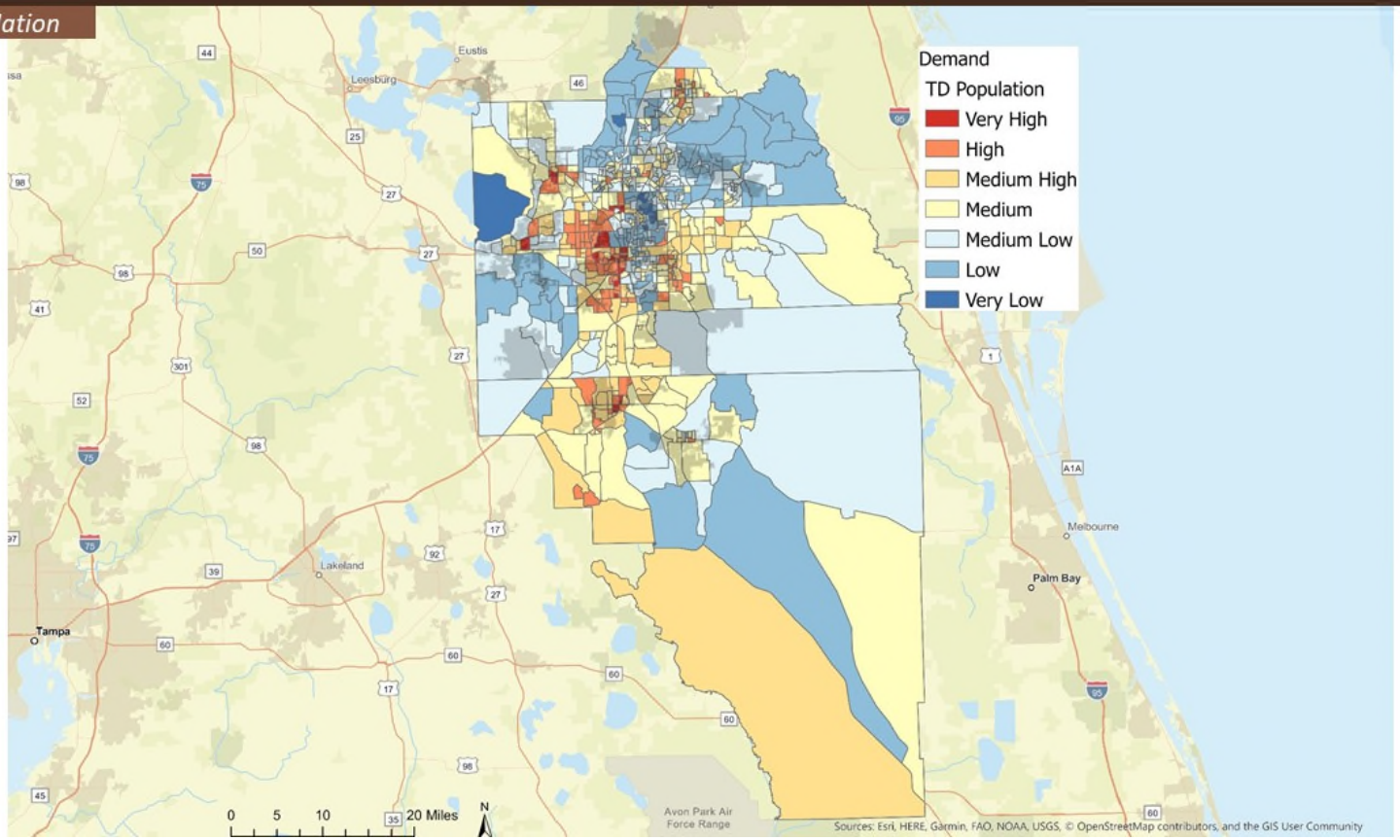
Output Supply Map

Supply: LYNX



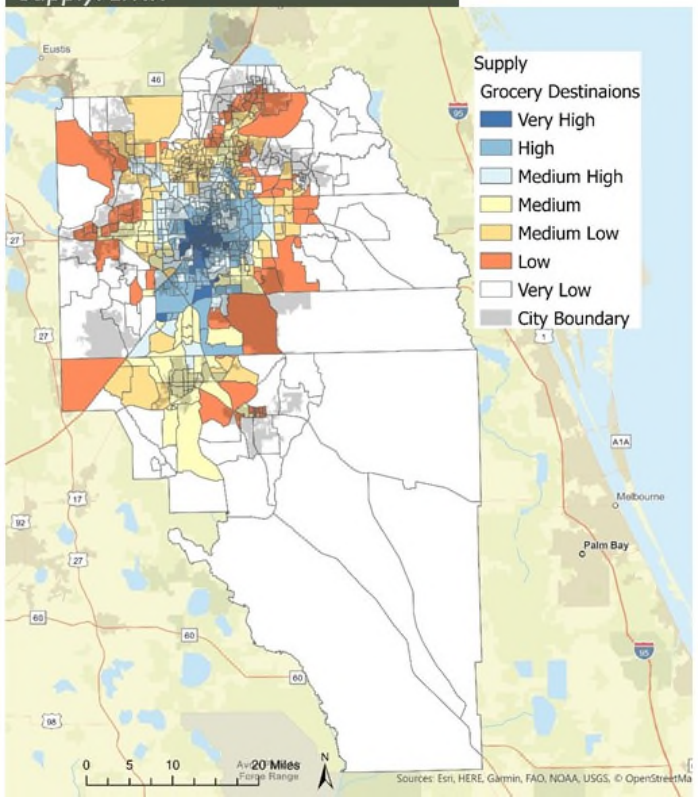
Output Demand Map

Demand: TD Population

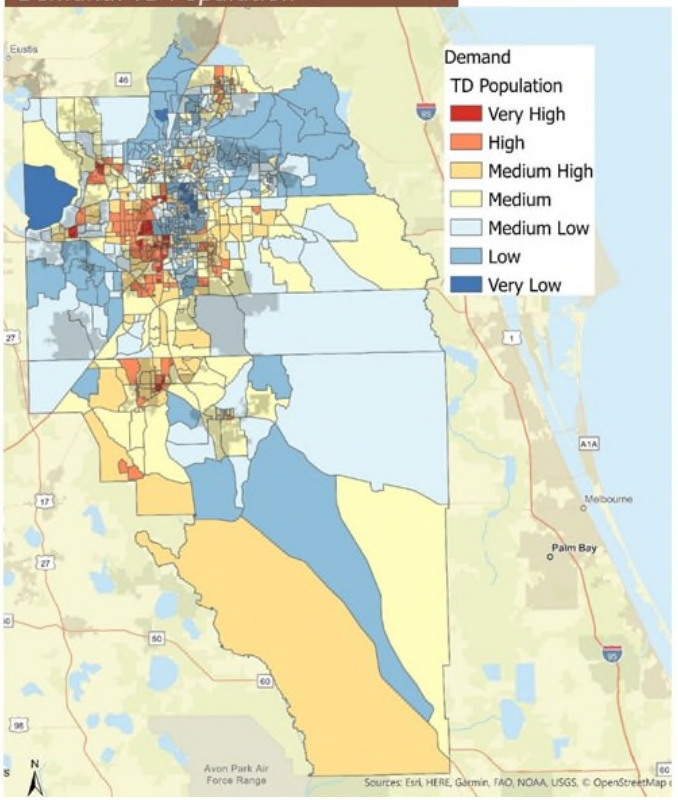


Output Supply & Demand Maps Side by Side

Supply: LYNX

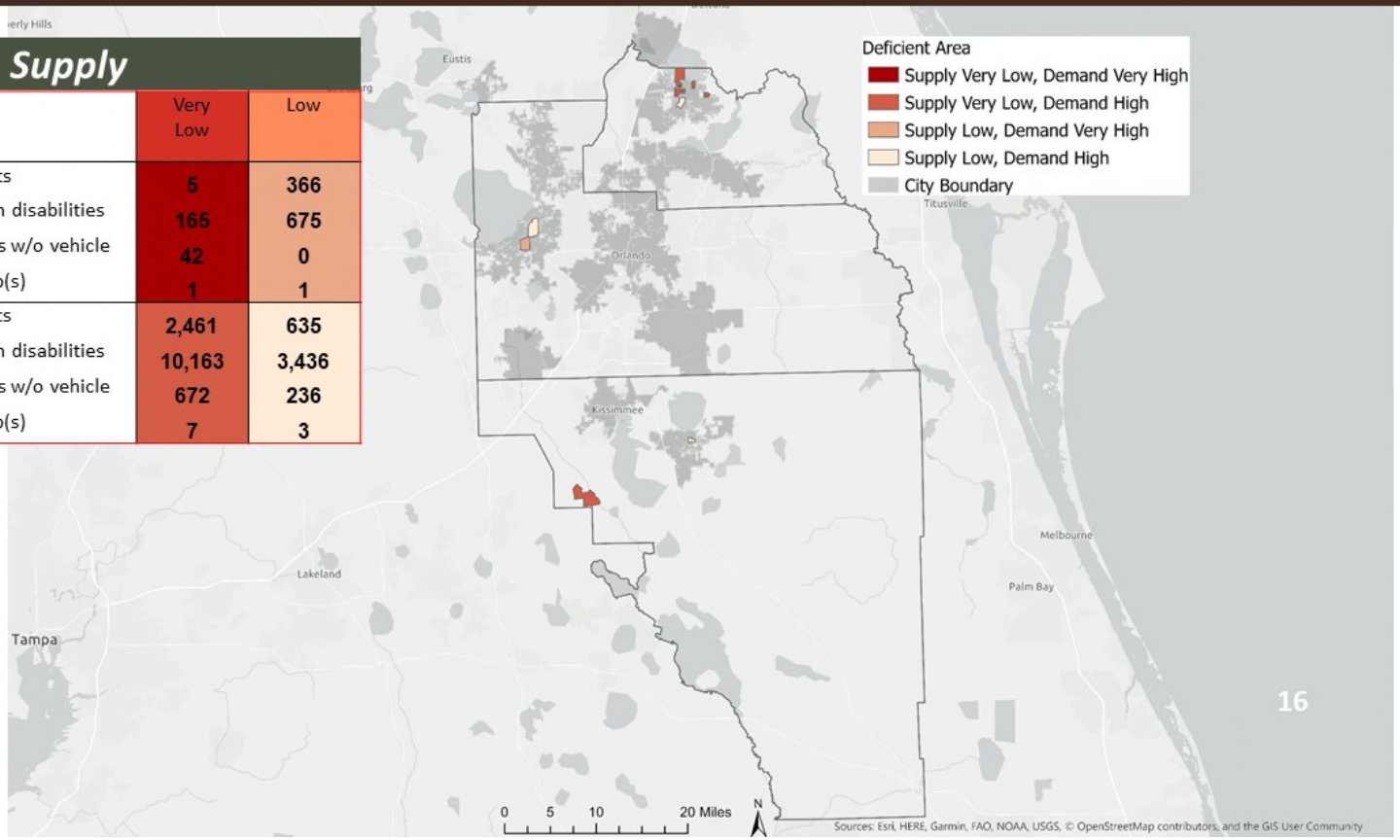


Demand: TD Population



Gap Maps : Low Supply and High Demand Areas

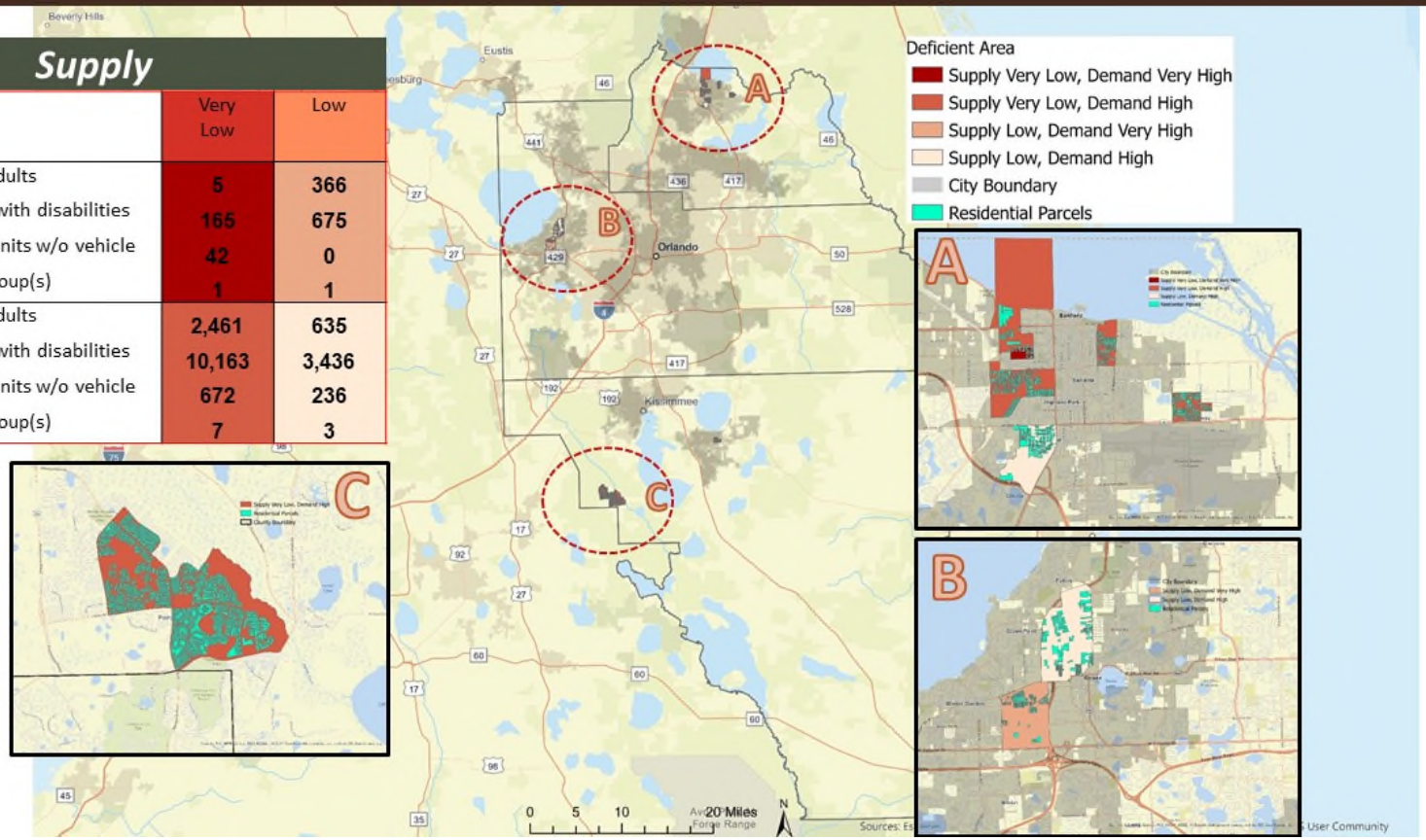
Demand		Supply: Very Low	Supply: Low
Very High	Older Adults	5	366
	People with disabilities	165	675
	House units w/o vehicle	42	0
	block group(s)	1	1
High	Older Adults	2,461	635
	People with disabilities	10,163	3,436
	House units w/o vehicle	672	236
	block group(s)	7	3



16

Gap Maps: Low Supply and High Demand Areas

Demand		Supply: Very Low	Supply: Low
Very High	Older Adults	5	366
	People with disabilities	165	675
	House units w/o vehicle	42	0
	block group(s)	1	1
High	Older Adults	2,461	635
	People with disabilities	10,163	3,436
	House units w/o vehicle	672	236
	block group(s)	7	3



Application Example

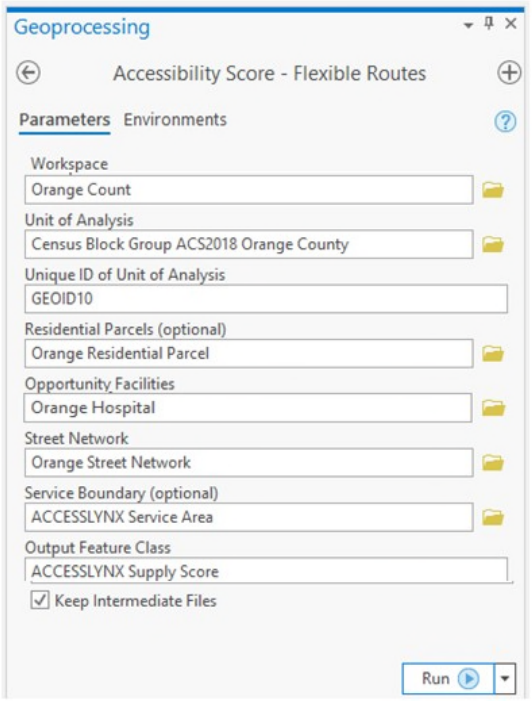
MetroPlan Orlando

TRANSPORTATION: **FLEXIBLE ROUTE – ACCESS LYNX**

DESTINATIONS: **HOSPITALS**

DEMAND: **PEOPLE WITH DISABILITIES** (20-64 YEARS OLD)

Input Data



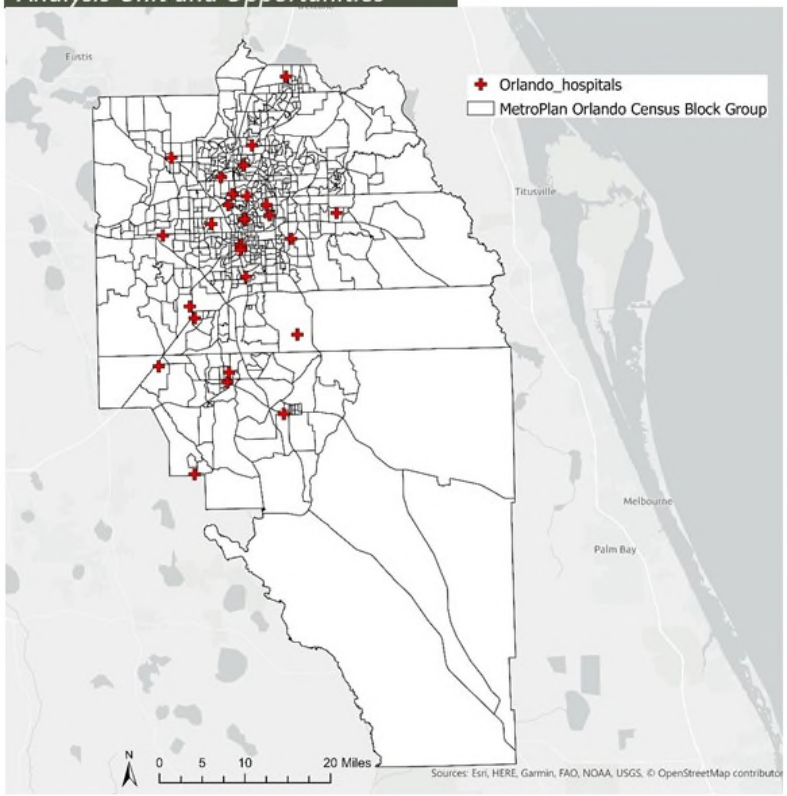
Spatial Data: Census Block Group, Residential Parcel, Destinations

Transportation Data: Street Network

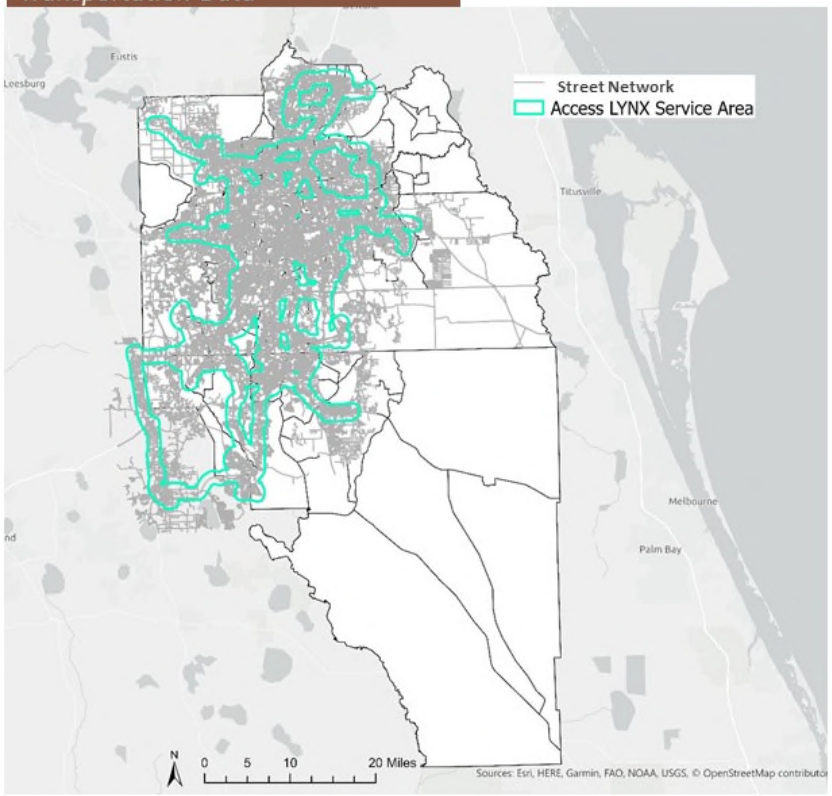
Data sources: FGDL, FDOT ARBM, 2018 ACS, FTIS/FTDE

Input Data Maps

Analysis Unit and Opportunities

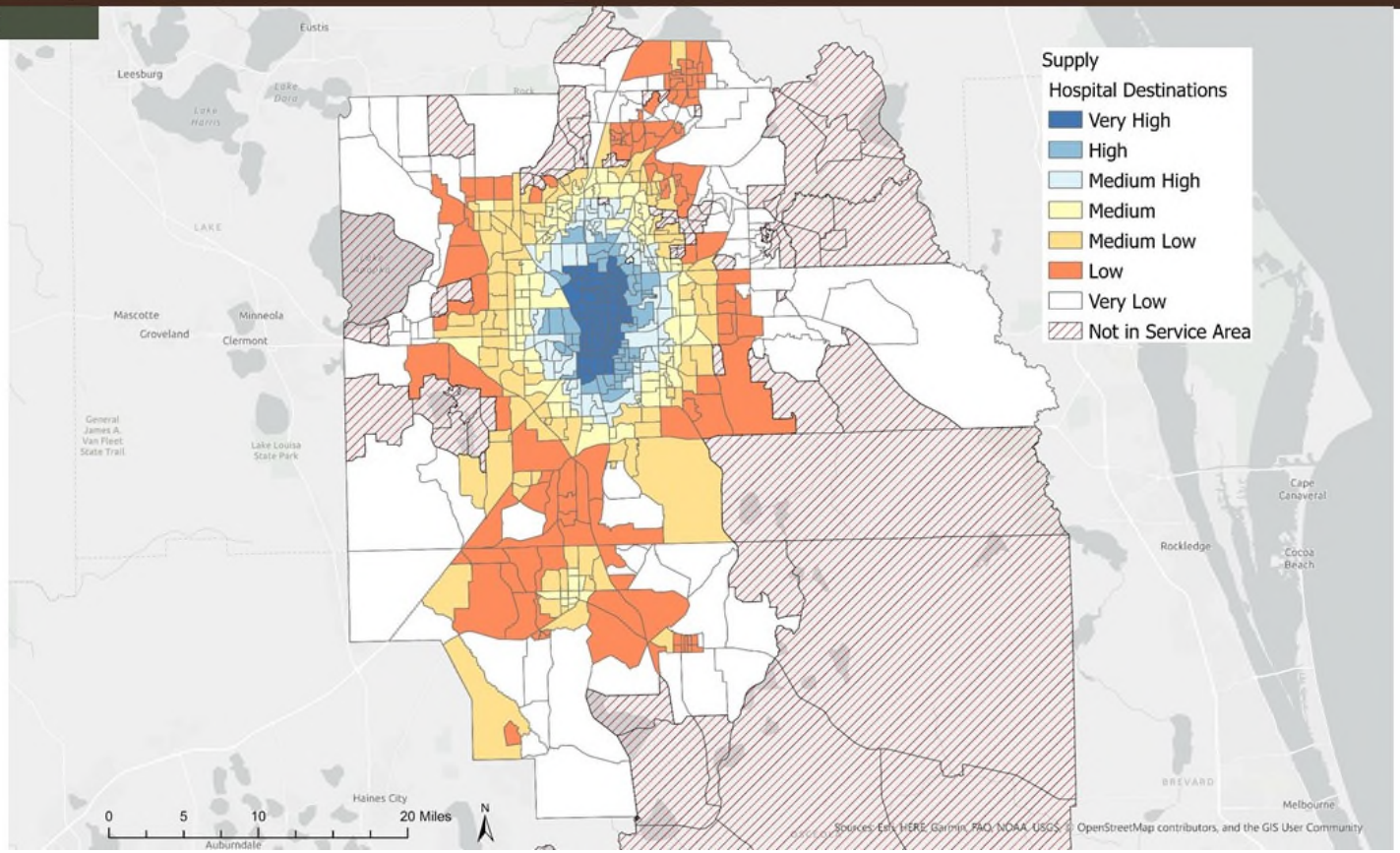


Transportation Data



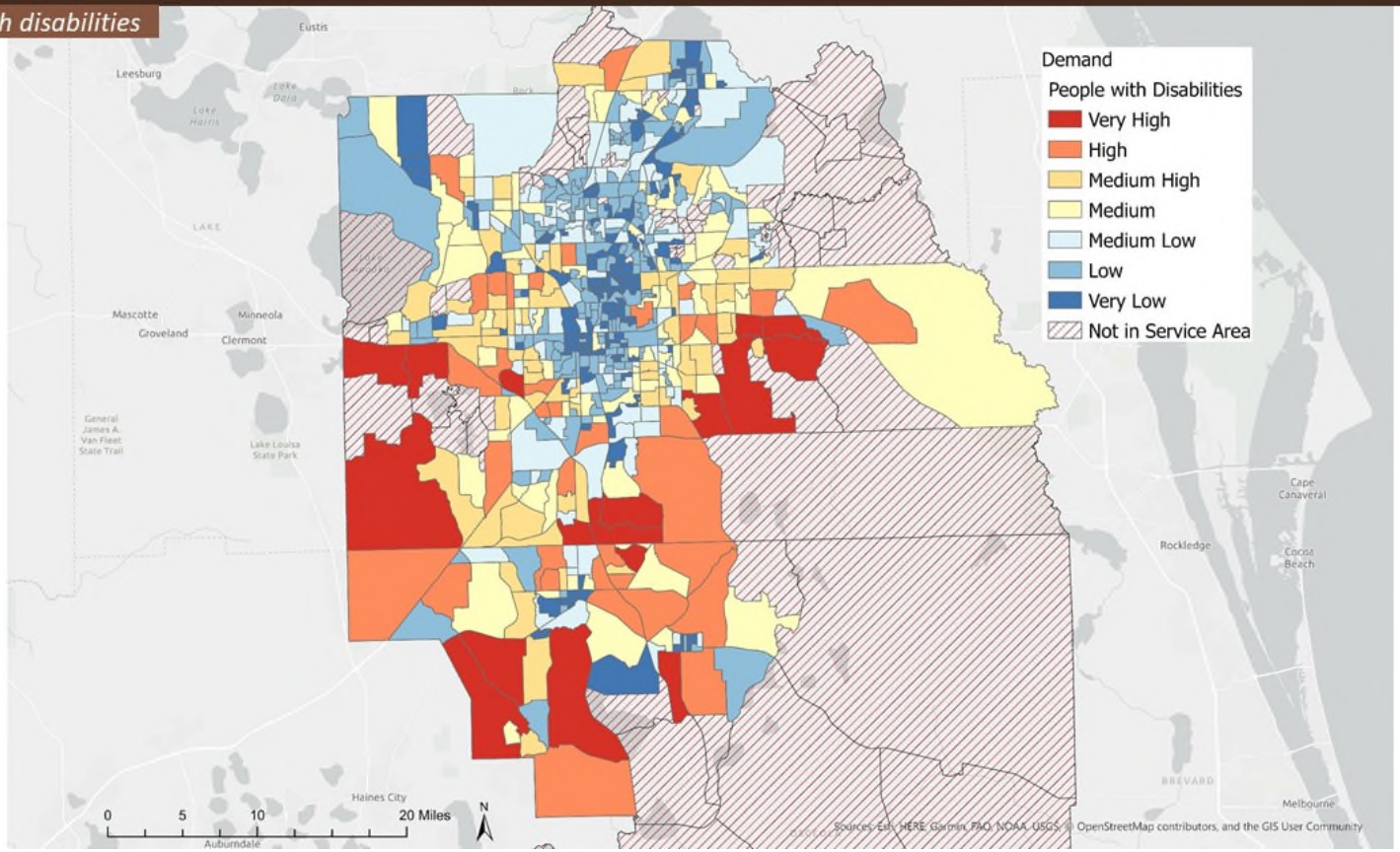
Output Supply Map

Supply: Access LYNX



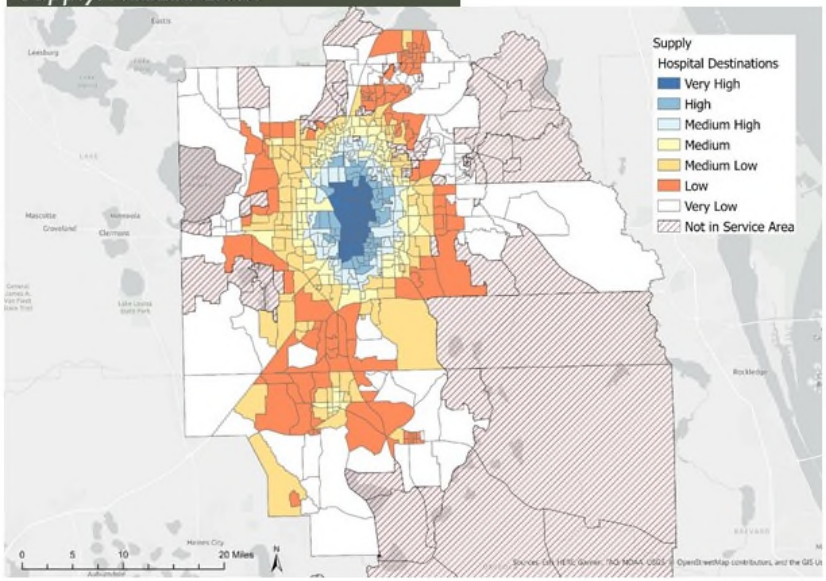
Output Demand Map

Demand: People with disabilities

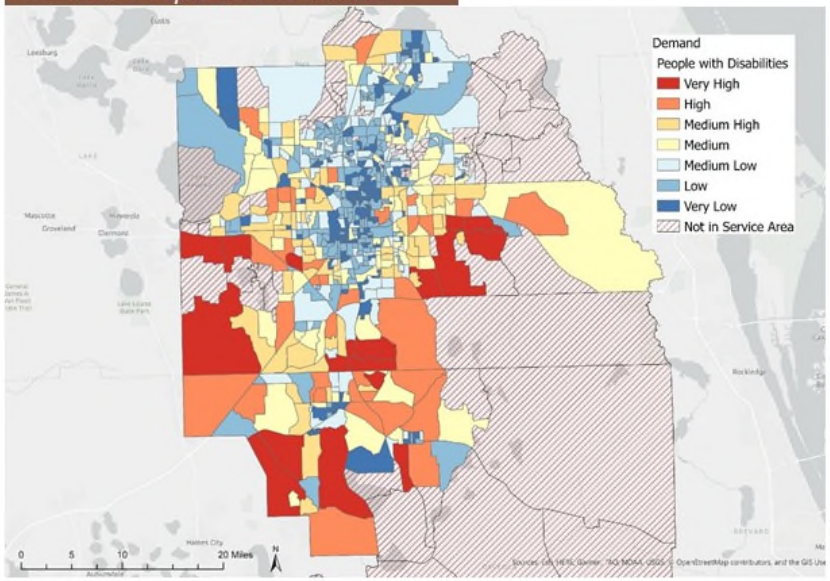


Output Supply & Demand Maps Side By Side

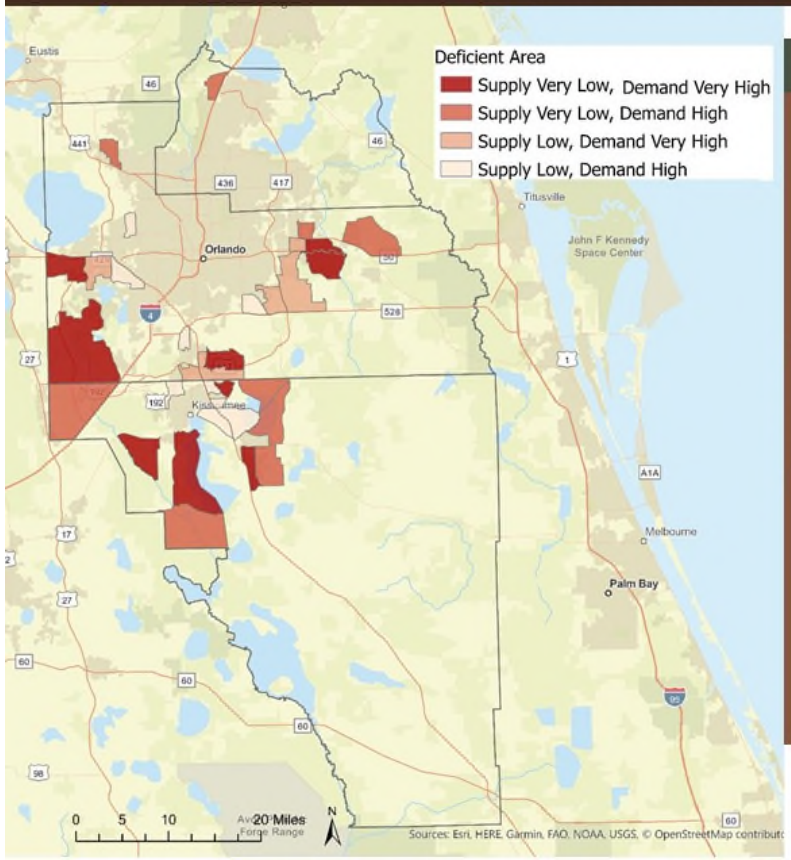
Supply: ACCESS LYNX



Demand: People with disabilities

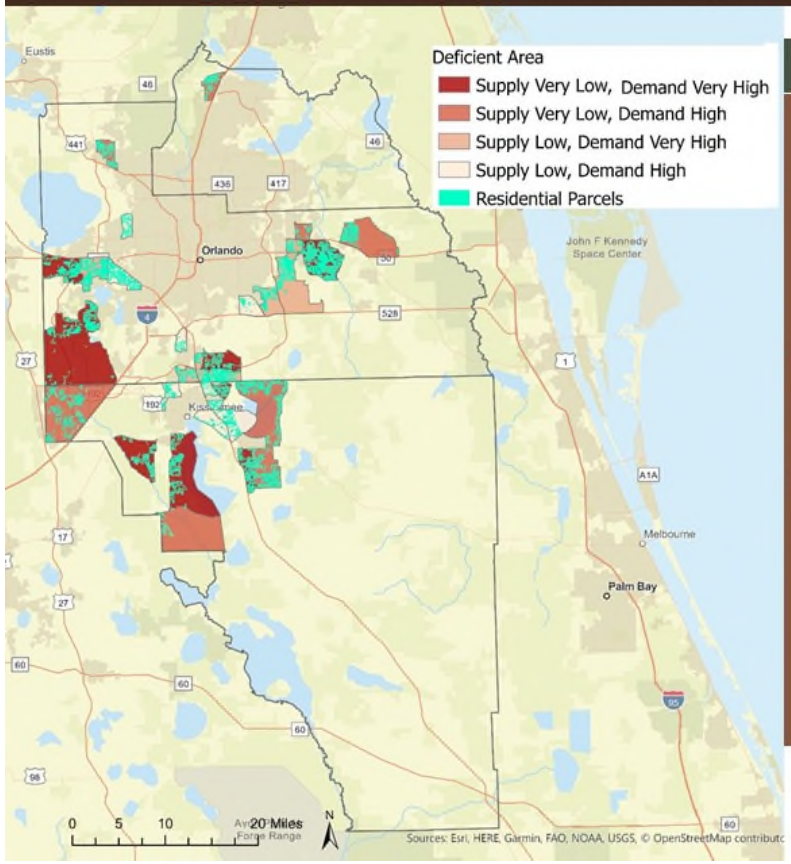


Gap Maps: Low Supply and High Demand Areas



Demand		Supply: Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Disabilities	**100,466**	**58,674**	19,407					178,547
	block group(s)	**9**	**6**	2					17
High	Disabilities	**52,269**	**54,679**	58,036	28,440	6,195	4,987		204,606
	block group(s)	**9**	**9**	11	5	1	1		36
Medium High	Disabilities	46,712	63,469	53,636	44,841	27,884	3,813		240,355
	block group(s)	12	17	14	12	8	1		64
Medium	Disabilities	49,362	33,239	41,699	32,838	27,988	2,101	4,470	191,697
	block group(s)	22	14	18	14	12	1	2	83
Medium Low	Disabilities	23,509	27,277	40,868	32,764	23,867	7,087	9,679	165,051
	block group(s)	16	18	28	22	16	5	7	112
Low	Disabilities	16,049	19,830	15,324	24,479	24,954	18,708	26,377	145,721
	block group(s)	18	24	17	28	30	21	31	169
Very Low	Disabilities	3,584	9,933	4,832	10,504	4,495	8,695	14,295	56,338
	block group(s)	8	26	10	24	10	21	37	136
Grand Total	Disabilities	291,951	267,101	233,802	173,866	115,383	45,391	54,821	1,182,315
	block group(s)	94	114	100	105	77	50	77	617

Gap Maps: Low Supply and High Demand Areas



			Supply							
Demand			Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
	Very High	Disabilities block group(s)	100,466 9	58,674 6	19,407 2					178,547 17
	High	Disabilities block group(s)	52,269 9	54,679 9	58,036 11	28,440 5	6,195 1	4,987 1		204,606 36
	Medium High	Disabilities block group(s)	46,712 12	63,469 17	53,636 14	44,841 12	27,884 8	3,813 1		240,355 64
	Medium	Disabilities block group(s)	49,362 22	33,239 14	41,699 18	32,838 14	27,988 12	2,101 1	4,470 2	191,697 83
	Medium Low	Disabilities block group(s)	23,509 16	27,277 18	40,868 28	32,764 22	23,867 16	7,087 5	9,679 7	165,051 112
	Low	Disabilities block group(s)	16,049 18	19,830 24	15,324 17	24,479 28	24,954 30	18,708 21	26,377 31	145,721 169
	Very Low	Disabilities block group(s)	3,584 8	9,933 26	4,832 10	10,504 24	4,495 10	8,695 21	14,295 37	56,338 136
	Grand Total	Disabilities block group(s)	291,951 94	267,101 114	233,802 100	173,866 105	115,383 77	45,391 50	54,821 77	1,182,315 617

Application Example

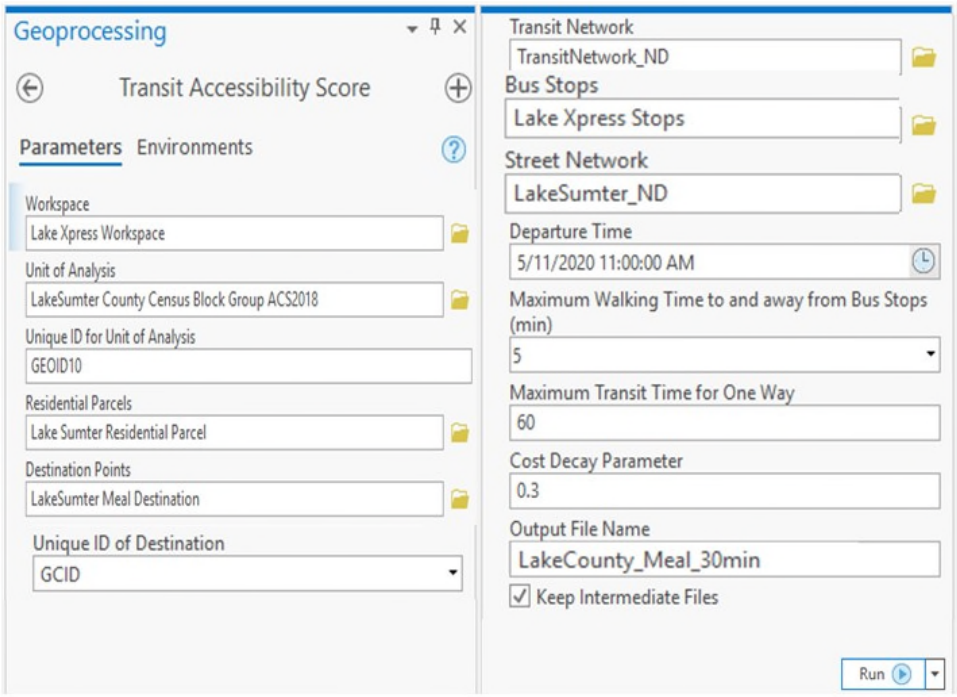
LAKE-SUMTER MPO

TRANSPORTATION: **FIXED ROUTE – LAKE XPRESS**

DESTINATIONS: **MEAL DESTINATIONS**

DEMAND: **TRANSPORTATION DISADVANTAGED POPULATION**

Input Data



Spatial Data: Census Block Group, Residential Parcel, Destinations

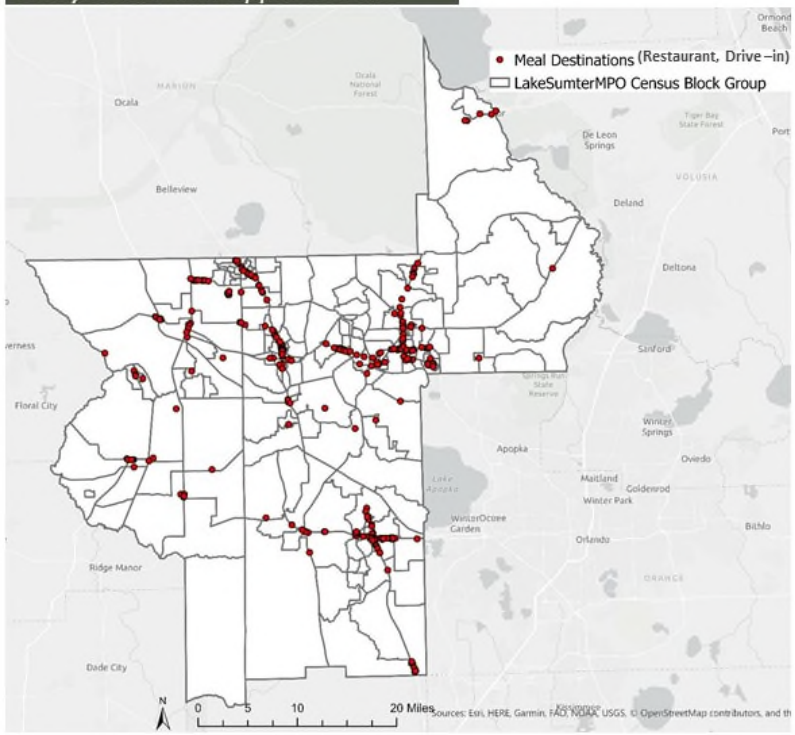
Transportation Data: Transit Network, Street Network, and Bus Stops

Customizable Data : Day and Time, Travel Time and Walking Time

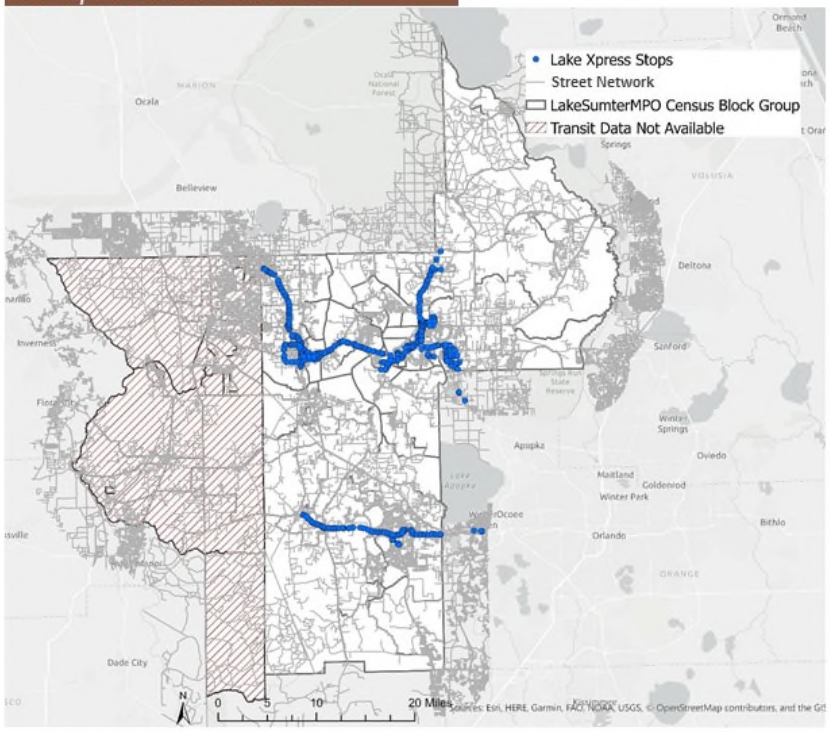
Data sources: FGDL, FDOT ARBM, 2018 ACS, FTIS/FTDE

Input Data Maps

Analysis Unit and Opportunities

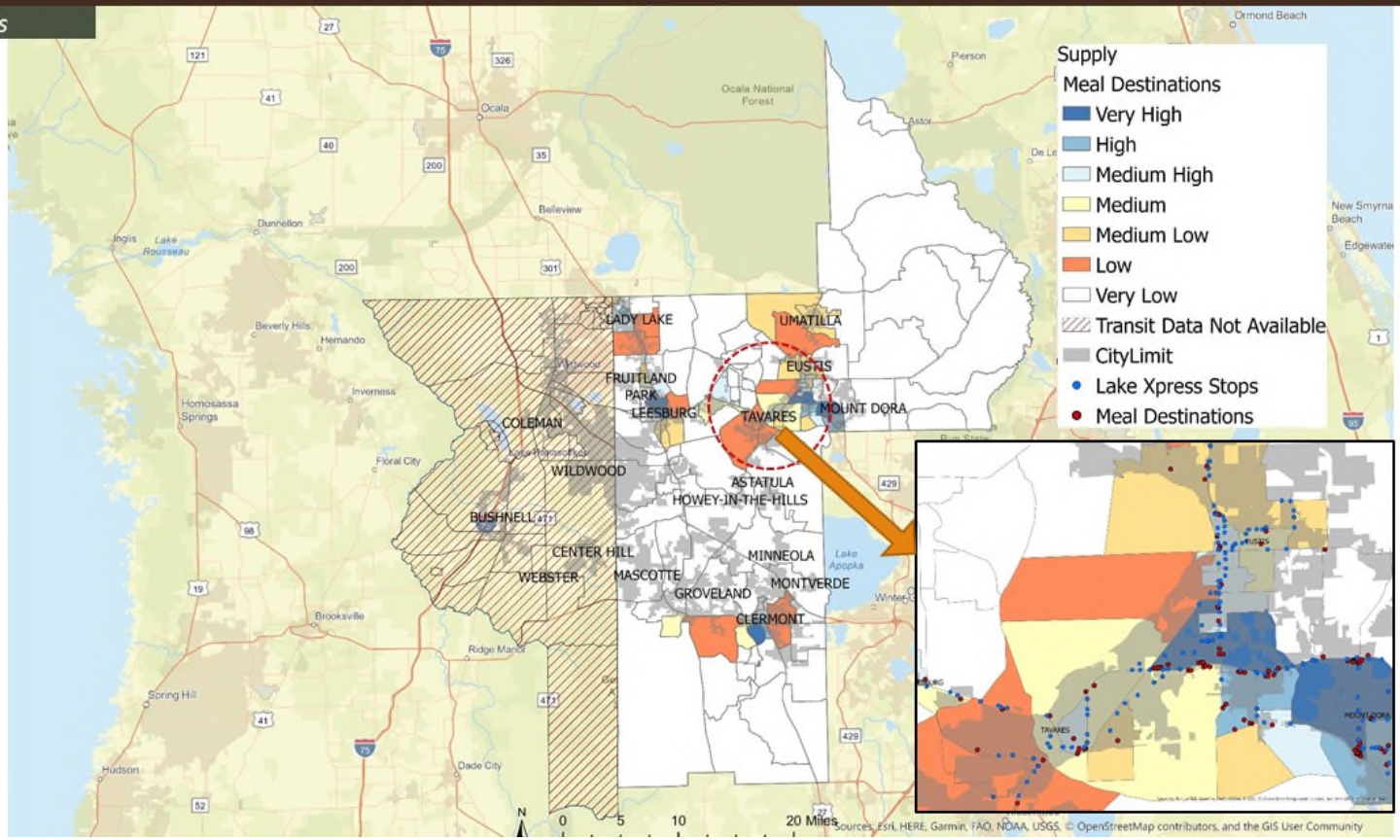


Transportation Network Data



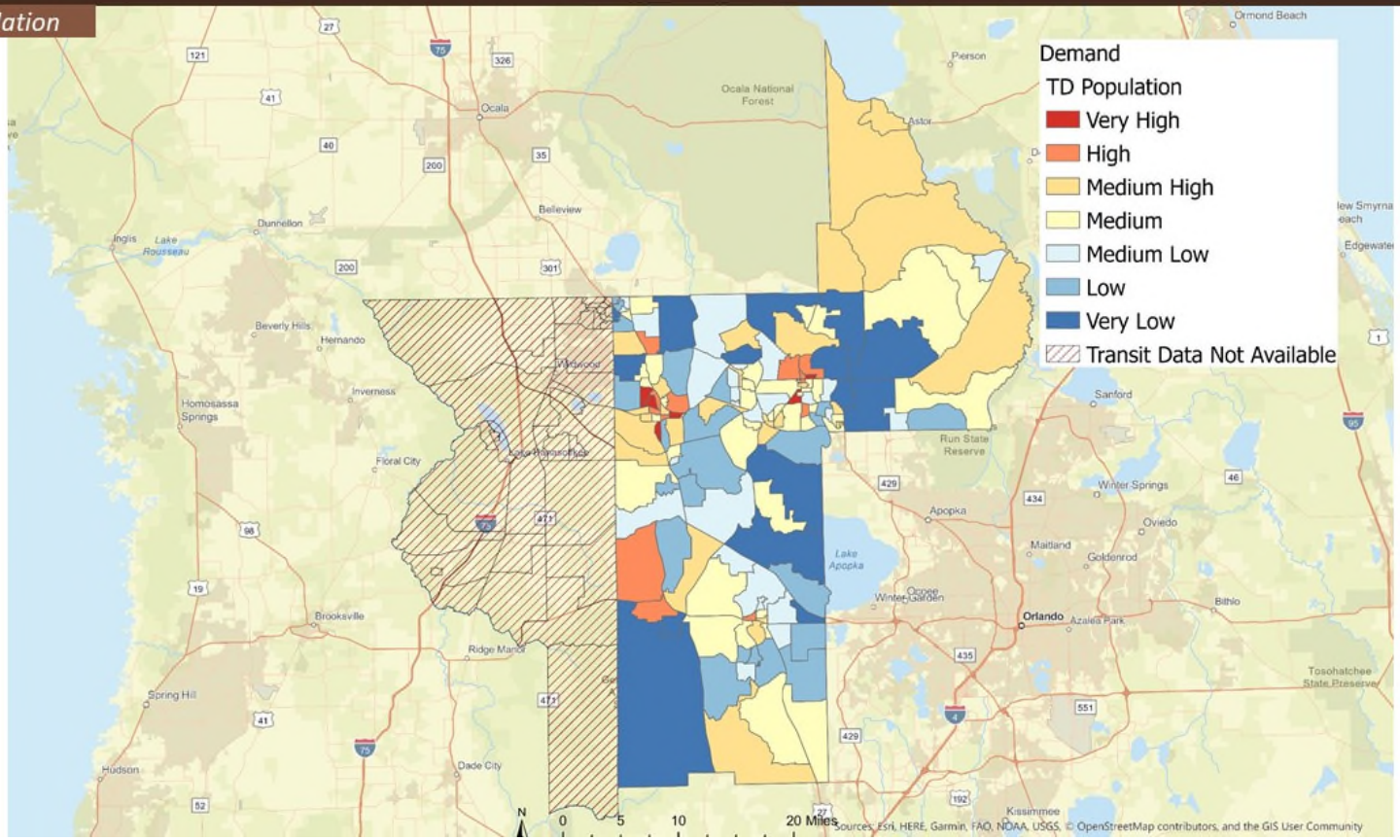
Output Supply Map

Supply: Lake Xpress



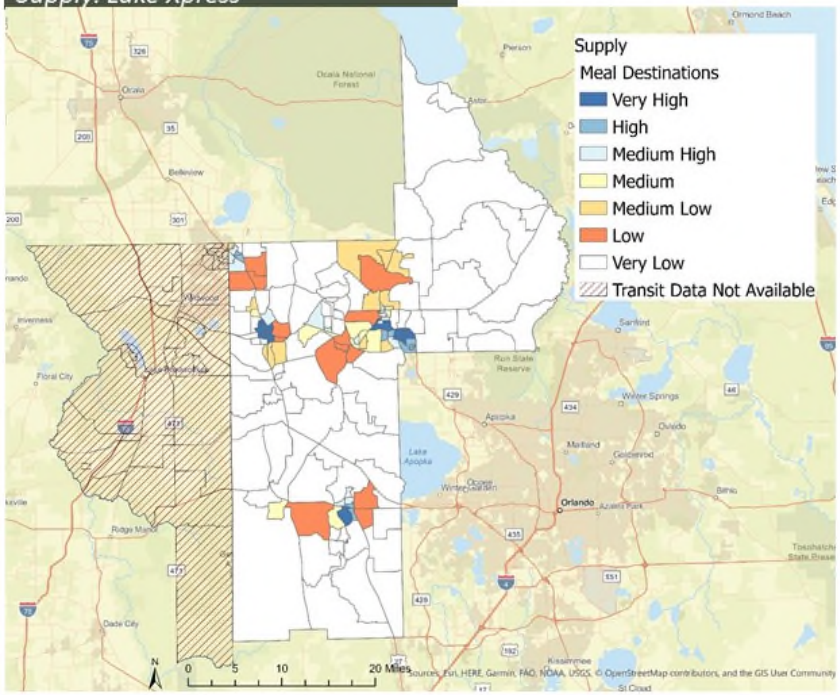
Output Demand Map

Demand: TD Population

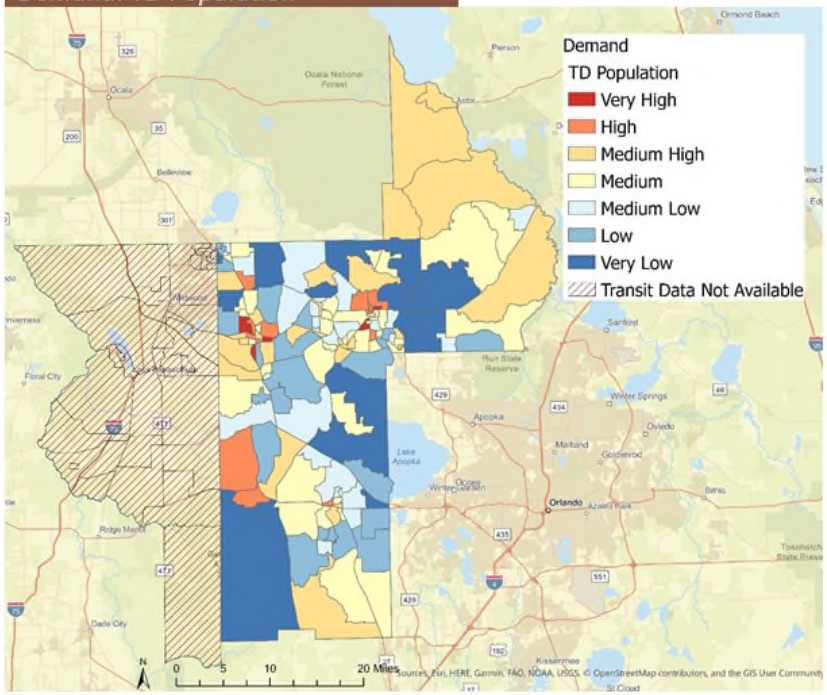


Output Supply & Demand Maps Side by Side

Supply: Lake Xpress

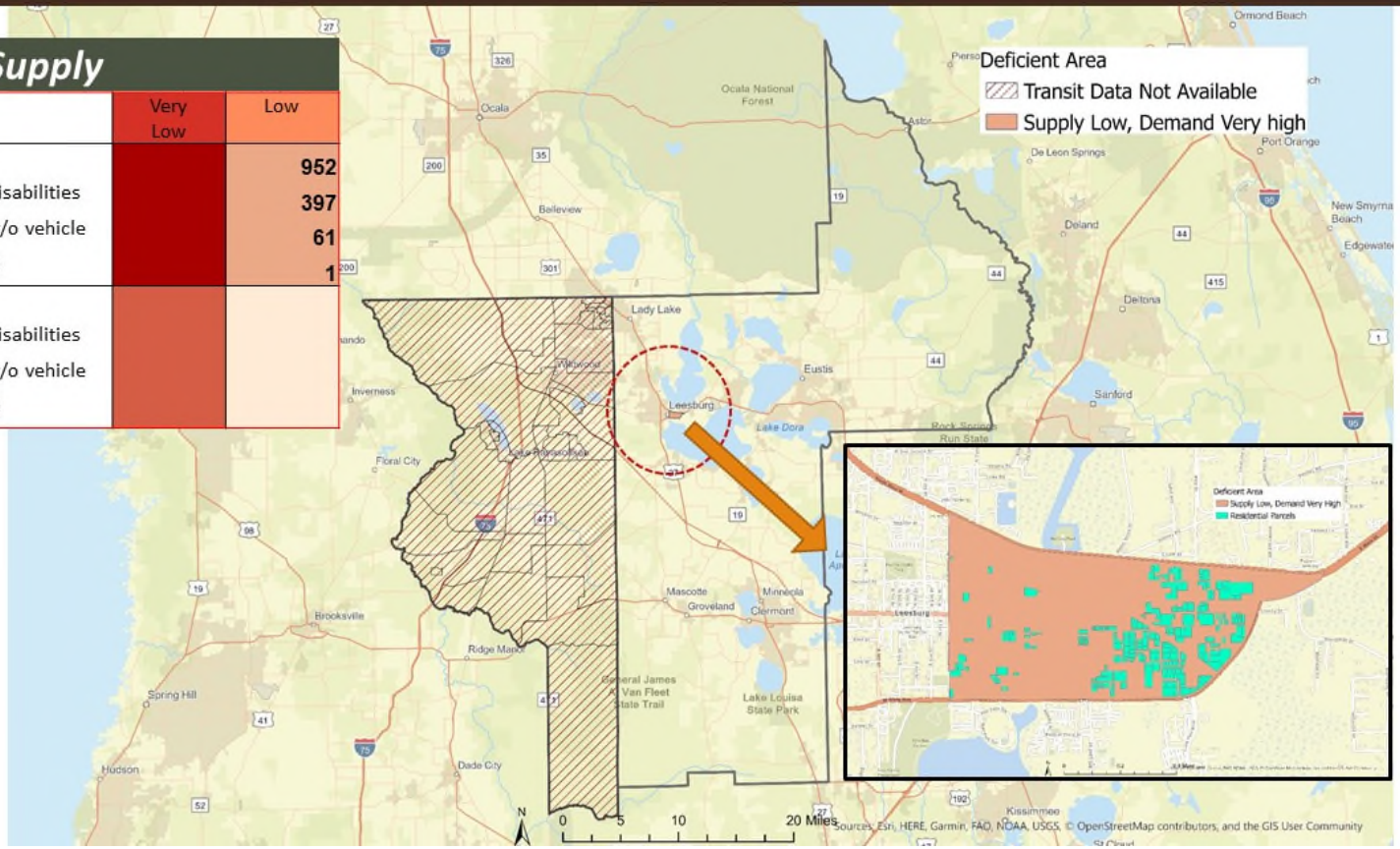


Demand: TD Population



Gap Maps : Low Supply and High Demand Areas

Demand			Supply: Very Low	Supply: Low
Very High		Older Adults		952
		People with disabilities		397
		House units w/o vehicle		61
		block group(s)		1
High		Older Adults		
		People with disabilities		
		House units w/o vehicle		
		block group(s)		



Application Example

LAKE-SUMTER MPO

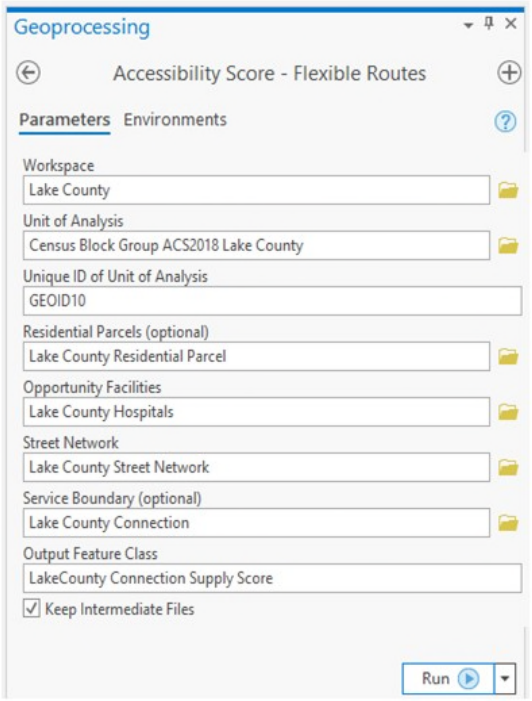
TRANSPORTATION: **FLEXIBLE ROUTE**

LAKE CONNECTION / SUMTER COUNTY FLEXIBLE SERVICE

DESTINATIONS: **HOSPITALS**

DEMAND: **PEOPLE WITH DISABILITIES** (20-64 YEARS OLD)

Input Data



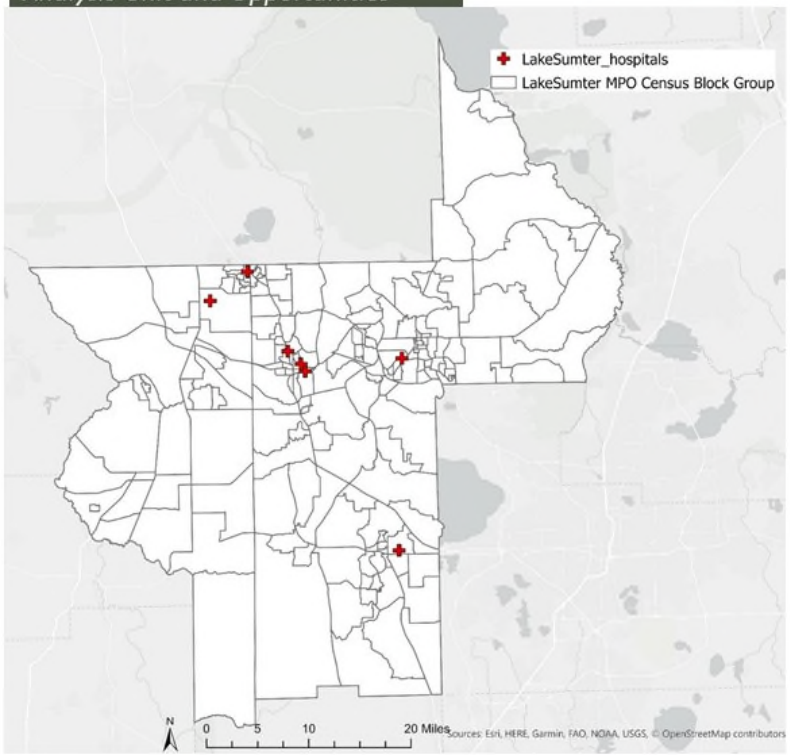
Spatial Data: Census Block Group, Residential Parcel, Destinations

Transportation Data: Street Network

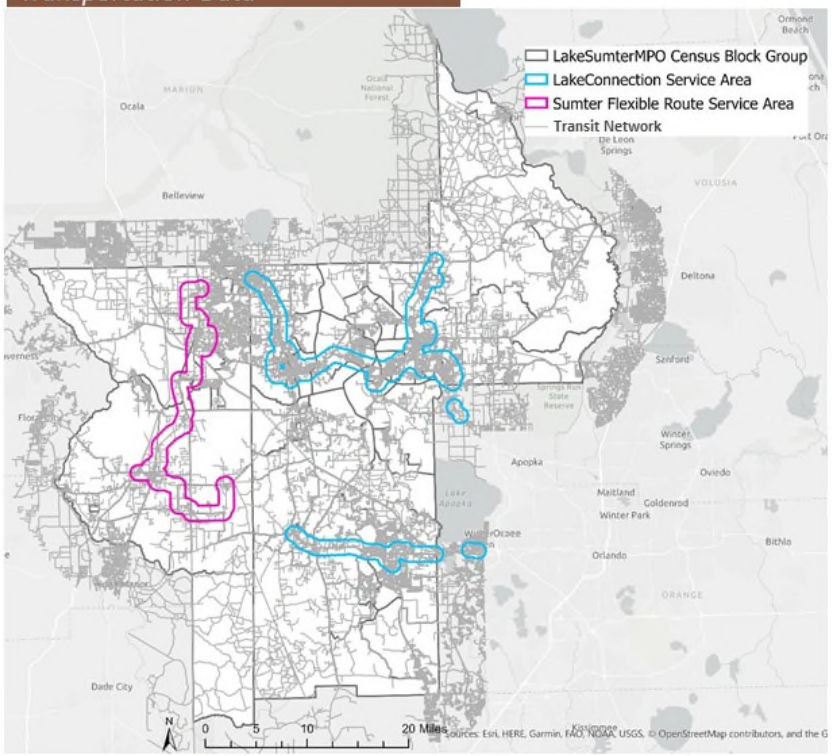
Data sources: FGDL, FDOT ARBM, 2018 ACS, FTIS/FTDE

Input Data Maps

Analysis Unit and Opportunities



Transportation Data



Input Data: Sumter County

Currently, Sumter County does not provide GTFS file.

ORANGE / SOUTH SUMTER ROUTE

Location	Arrival Times	
CENTER HILL - AA Discount Convenience Store	7:45	12:00
WEBSTER - Apartments I& II	8:00	12:15
WEBSTER - Beulah Baptist	8:10	12:25
Bushnell Health Department & Bus Shelter 301	8:20	12:35
Bushnell Family Practice/ Dollar General	8:30	12:45
Walmart Supercenter	8:40	12:55
Bushnell Garden Apartments Jumper Drive South	8:55	1:00
Bushnell Plaza	9:00	1:05
Misty Woods Apartments & Jumper Drive North	9:05	1:10
Winn Dixie	9:15	1:15
Thomas Langley Clinic	9:35	1:40
LCC/Clark Maxwell Library - Wildwood Connection	9:45	1:45
Winn Dixie	10:00	2:00
Misty Wods Apartments & Jumper Drive North	10:05	2:05
Bushnell Plaza	10:10	2:10
Bushnell Garden Apartments Jumper Drive South	10:15	2:15
Walmart Supercenter	10:30	2:30
Bushnell Family Practice/ Dollar General	10:40	2:40
WEBSTER - Beulah Baptist	11:00	3:00
WEBSTER - Apartments I& II	11:10	3:15
CENTER HILL - AA Discount Convenience Store	11:20	3:30

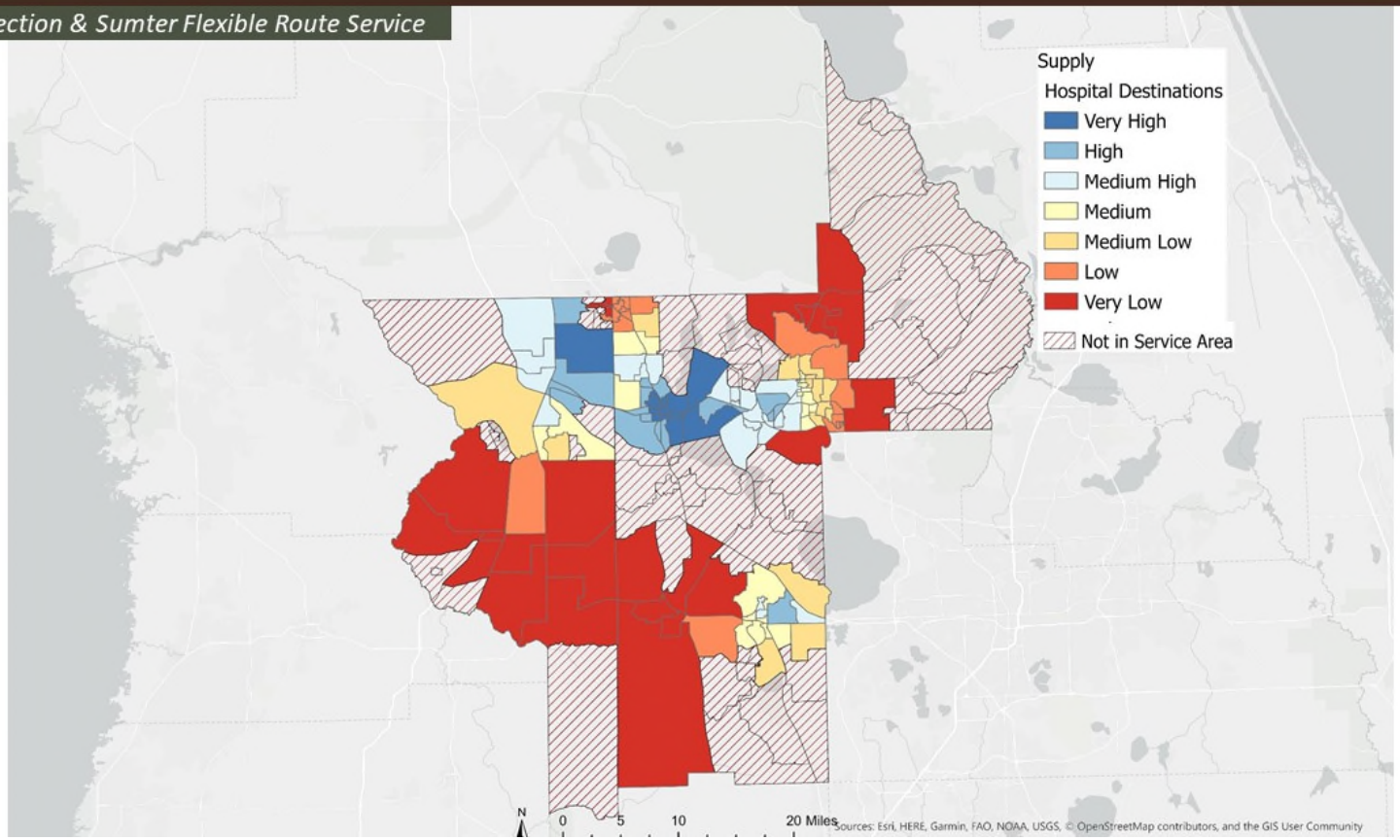
WILDWOOD CIRCULATOR P.M.

WILDWOOD CIRCULATOR A.M.

Location	Arrival Times
Parkwood	8:45
Wildwood Commons	8:55
Wildwood Terrace Apartments	9:00
Save-a-lot	9:05
Villages Sumter County Service Center	9:10
Winn Dixie Pinellas Plaza	9:15
Publix Grand Traverse	9:20
Langley Health Services	9:40
Lake-Sumter Community College - Orange Shuttle Connection	9:45
Villages Sumter County Service Center	10:10
Winn Dixie Pinellas Plaza	10:15
Publix Grand Traverse	10:20
Parkwood	10:25
Save-a-lot	10:30
Wildwood Terrace Apartments	10:35
Wildwood Commons	10:40
Moreland Park	16:48
Walmart	11:00
Publix Southern Trace Plaza	11:10

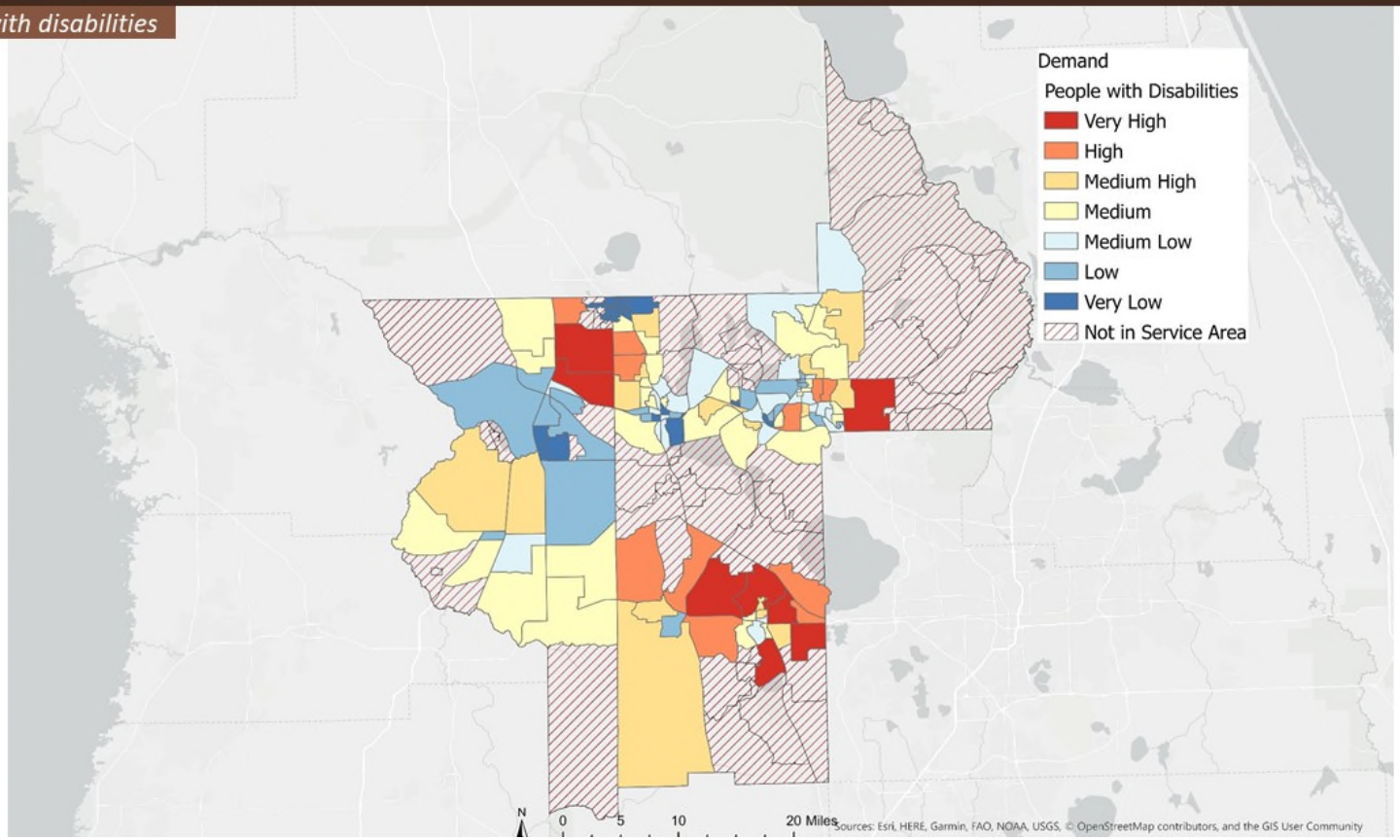
Output Supply Map

Supply: Lake Connection & Sumter Flexible Route Service



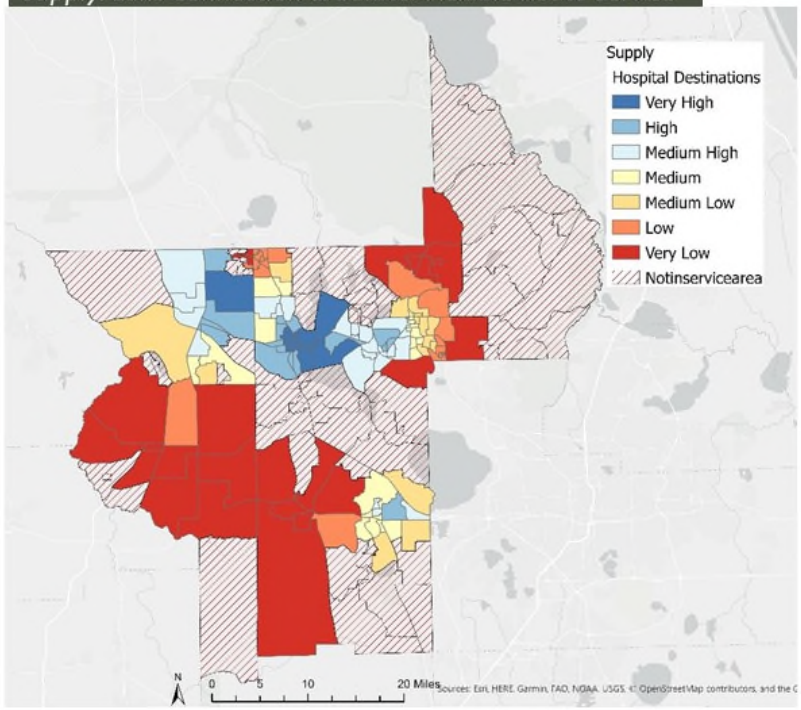
Output Demand Map

Demand: People with disabilities

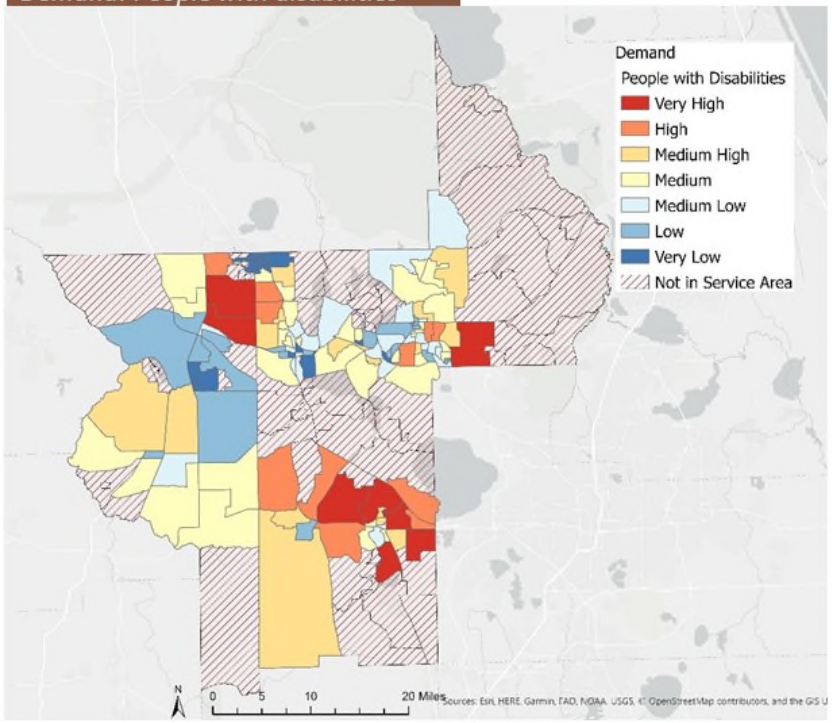


Output Supply & Demand Maps Side By Side

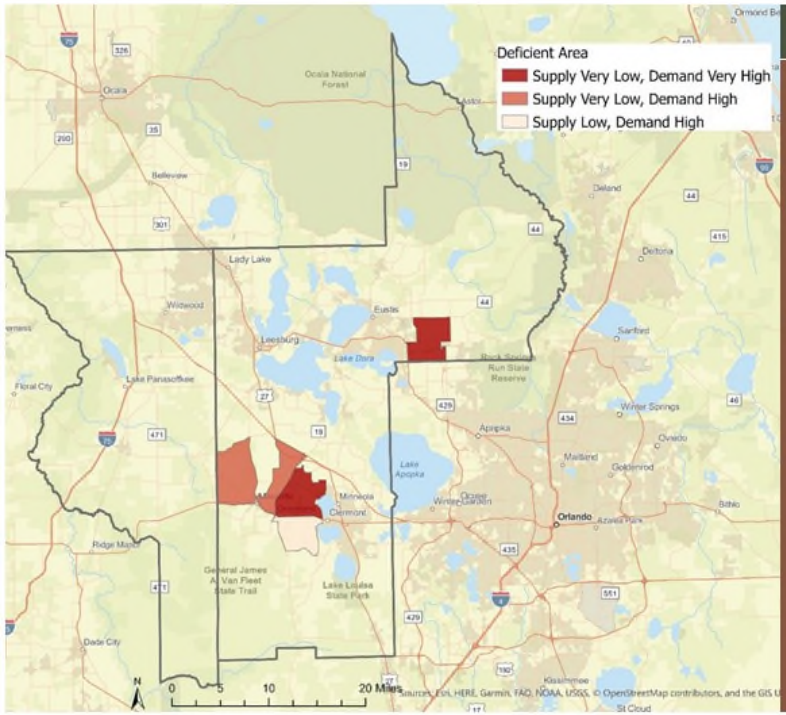
Supply: Lake Connection & Sumter Flexible Route Service



Demand: People with disabilities

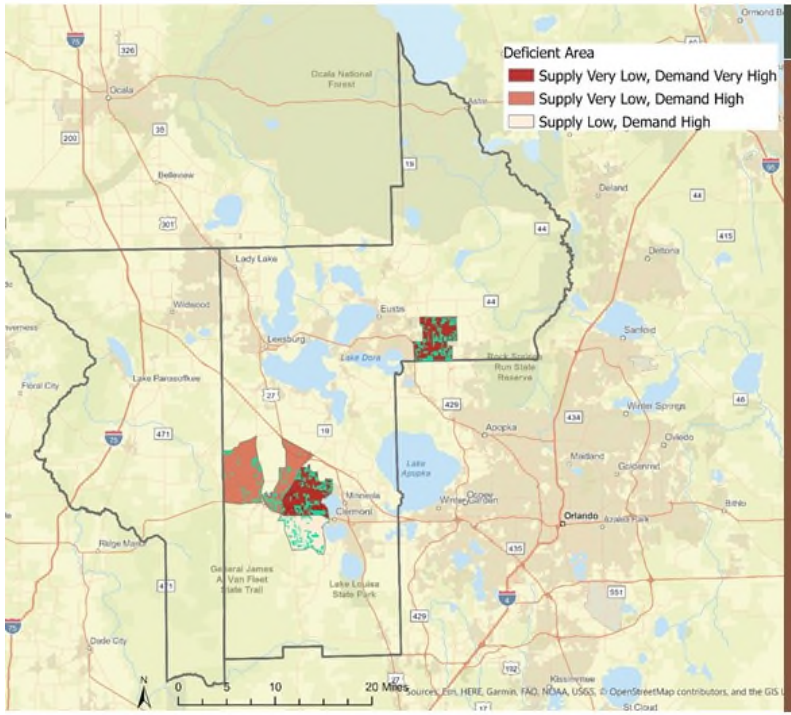


Gap Maps: Low Supply and High Demand Areas



Demand		Supply: Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Disabilities block group(s)	**9,546 2**		10,834 2	4,459 1		11,482 2	7,822 1	44,143 8
High	Disabilities block group(s)	**4,660 2**	**2,062 1**	3,904 2	4,094 2	5,977 3	1,833 1		22,530 11
Medium High	Disabilities block group(s)	4,605 3	2,634 2	4,471 3	3,855 3	5,915 4	1,433 1		22,913 16
Medium	Disabilities block group(s)	7,707 8	4,770 5	986 1	5,415 6	6,840 7	2,662 3	2,842 3	31,222 33
Medium Low	Disabilities block group(s)	1,816 3	612 1	2,534 4	2,152 3	2,812 4	3,299 5	3,203 5	16,428 25
Low	Disabilities block group(s)	1,335 3	485 1	1,011 2	1,772 4	1,402 3	2,483 6	397 1	8,885 20
Very Low	Disabilities block group(s)	376 2	1,612 8	168 1	43 1	113 1	200 1	597 3	3,109 17
Grand Total	Disabilities block group(s)	30,045 23	12,175 18	23,908 15	21,790 20	23,059 22	23,392 19	14,861 13	149,230 130

Gap Maps: Low Supply and High Demand Areas



Demand		Supply: Very Low	Low	Medium Low	Medium	Medium High	High	Very High	Grand Total
Very High	Disabilities	**9,546**		10,834	4,459		11,482	7,822	44,143
	block group(s)	**2**		2	1		2	1	8
High	Disabilities	**4,660**	**2,062**	3,904	4,094	5,977	1,833		22,530
	block group(s)	**2**	**1**	2	2	3	1		11
Medium High	Disabilities	4,605	2,634	4,471	3,855	5,915	1,433		22,913
	block group(s)	3	2	3	3	4	1		16
Medium	Disabilities	7,707	4,770	986	5,415	6,840	2,662	2,842	31,222
	block group(s)	8	5	1	6	7	3	3	33
Medium Low	Disabilities	1,816	612	2,534	2,152	2,812	3,299	3,203	16,428
	block group(s)	3	1	4	3	4	5	5	25
Low	Disabilities	1,335	485	1,011	1,772	1,402	2,483	397	8,885
	block group(s)	3	1	2	4	3	6	1	20
Very Low	Disabilities	376	1,612	168	43	113	200	597	3,109
	block group(s)	2	8	1	1	1	1	3	17
Grand Total	Disabilities	30,045	12,175	23,908	21,790	23,059	23,392	14,861	149,230
	block group(s)	23	18	15	20	22	19	13	130

APPLICATION OPTIONS

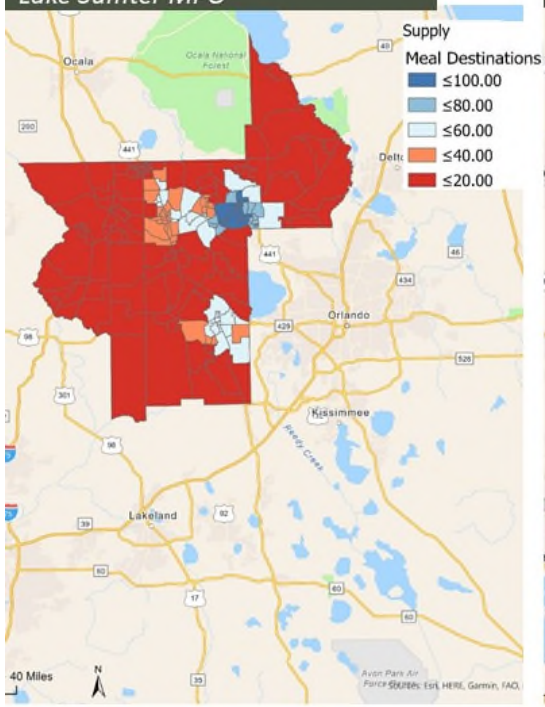
SCALE OF ANALYSIS

DESTINATIONS

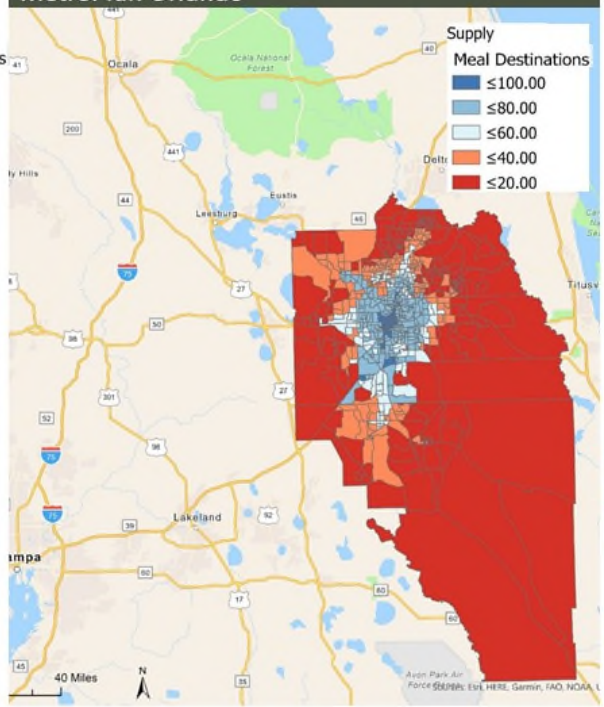
TRAVEL TIME

Scale: Individual MPO & Multiple MPOs

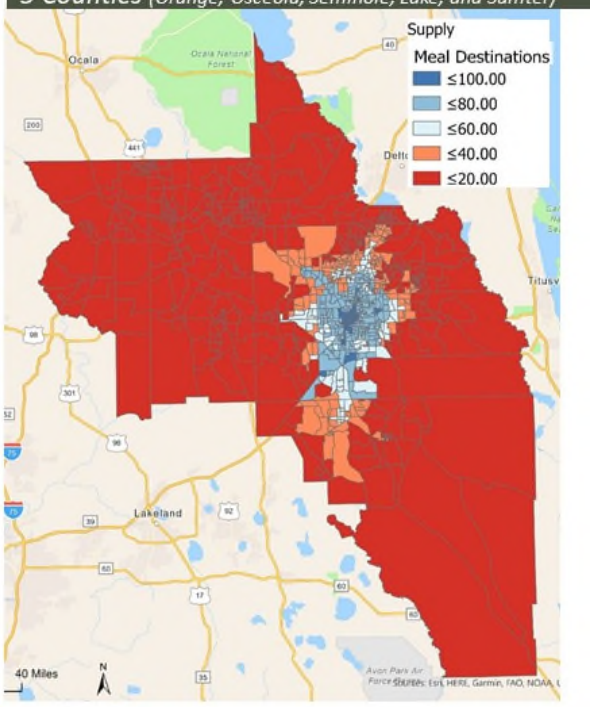
Lake Sumter MPO



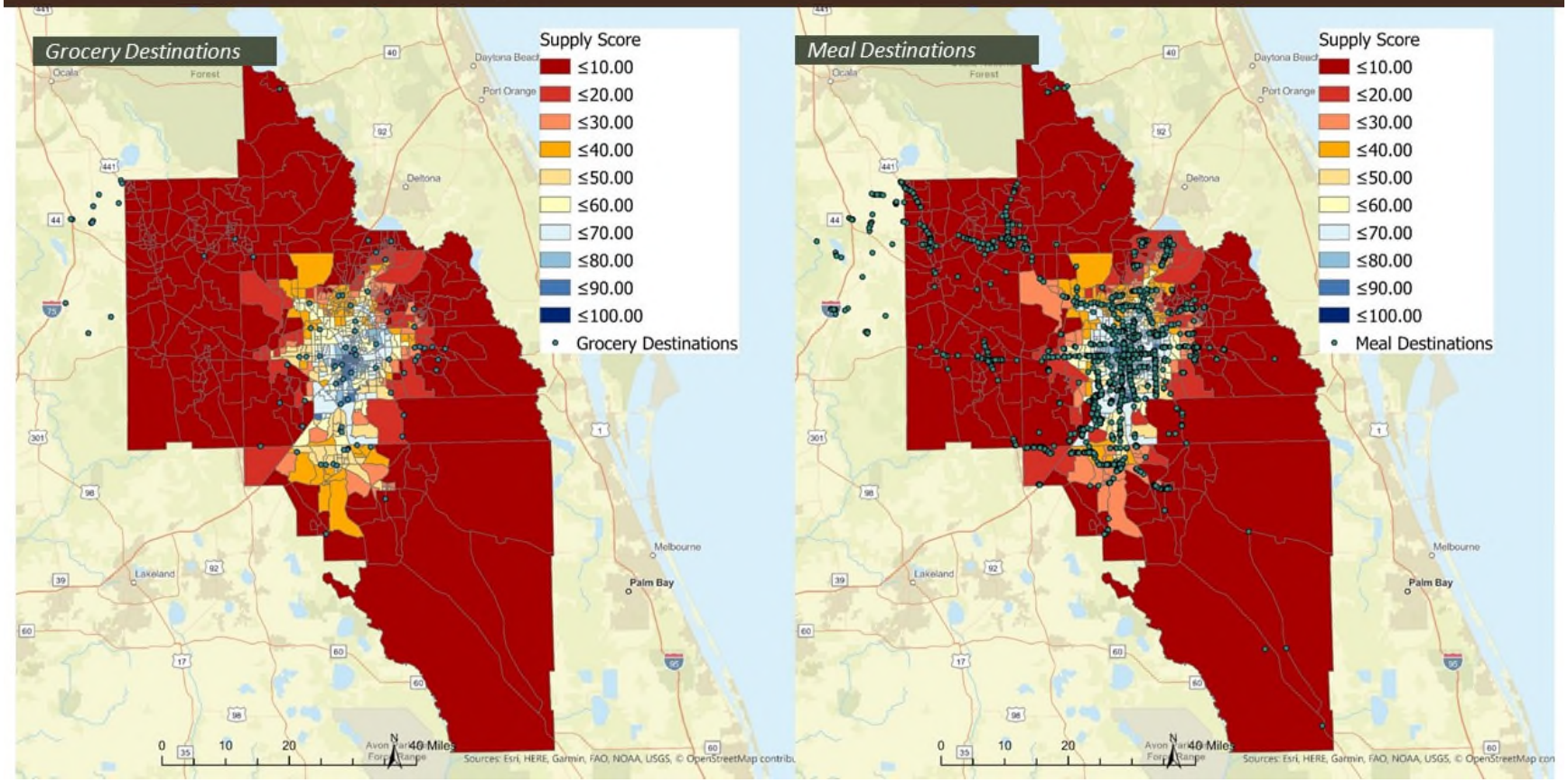
MetroPlan Orlando



5 Counties (Orange, Osceola, Seminole, Lake, and Sumter)



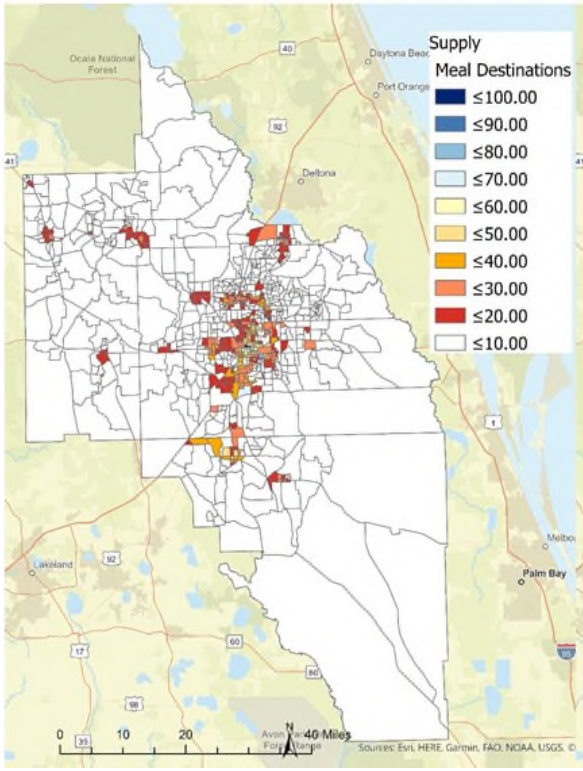
Different Destination Type



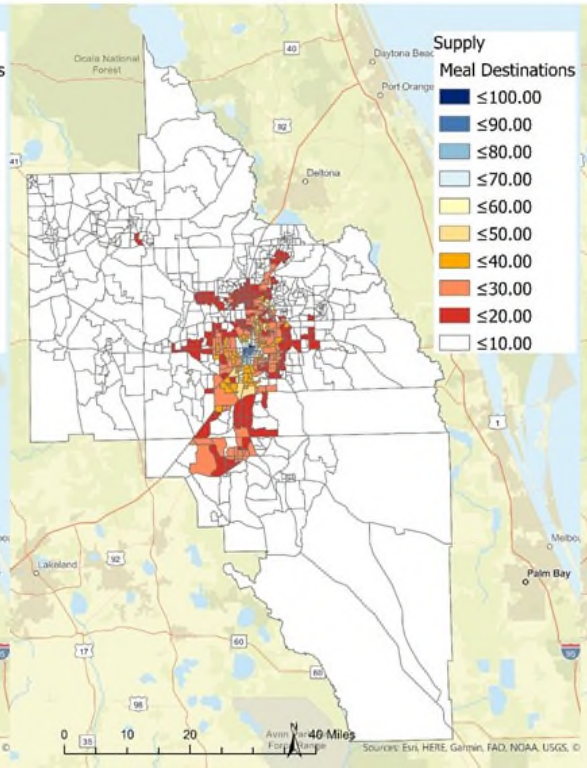
Different Travel Time Threshold

2hou

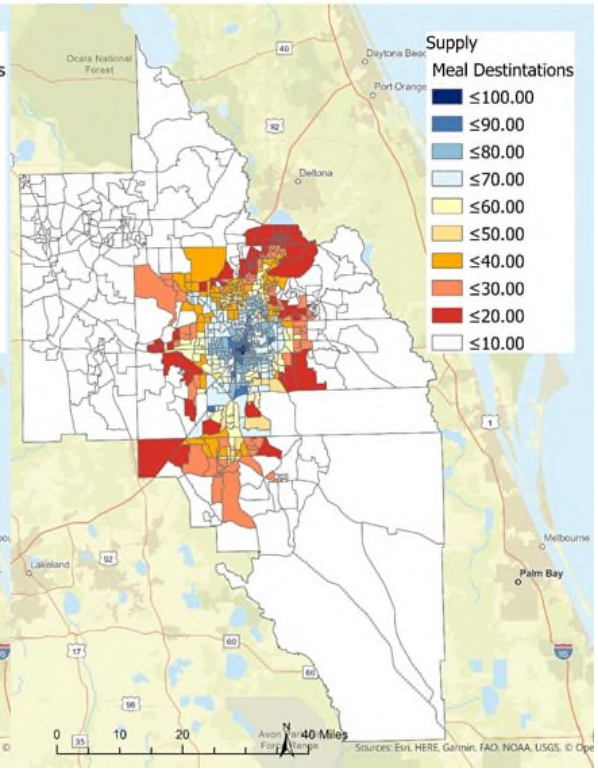
30 min



1 hour



2 hours



Discussion

GIS Model

Usefulness:

Is the utilization of this model useful to inform transportation planning scenarios for improvement of services?

Data:

Is there any data that the model could use (e.g., demand estimation, services)?

Analysis Unit:

Is this unit (Census Block Group) adequate size to support your work for decision and policy making?

Analysis Measure:

Is the approach of using the seven categories desirable to help prioritize the gap areas?

What is the good way to measure the adequate level of supply/demand?

GIS Model Results

Model validation:

Do the results of the model match with your knowledge of the area?

Sharing:

How would you like to access the results of GIS model?

For example: PDF, GIS file, Interactive web page

Update frequency:

What is the most useful frequency for running model and updating the data? E.g. regular schedule (e.g. once/year etc.), as needed, or both?