Estimation Procedure of Various Measures of Effectiveness (MOE) for Transportation Investments

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Project Title: Evaluating Community Building Effectiveness of Transportation Investments: Using Traditional and Big Data Oriented Analytical Approaches

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1 BACKGROUND

1.1 Transportation Infrastructure

According to Florida Chamber of commerce, Florida ranks number one in the US in terms of transportation infrastructure rankings. It is the third largest state by population, after California and Texas with a yearly growth rate of more than 1.5%. Orlando is the most thriving city of the region; its growth being bolstered by its job creation rate (1,000 jobs are added per week). The economic and demographic trends suggest that Orlando has an expanding consumer market and these trends are set to drive increased demand for passengers and freight transportation in the coming years. To accommodate the future demand in an efficient and sustainable manner, several small and big transportation projects are underway in the region including second phase of SunRail commuter rail extension, I-4 expansion, pedestrian and bicycling facility installation, and bicycle sharing system (Juice) introduction. The proposed research effort is geared towards examining the community impacts of three transportation infrastructure investment projects: SunRail, I-4 expansion, and JUICE Orlando bikeshare system (see Figure 1).

1.2 MOE Computation

The development of the MOEs is a data intensive process. The process involves collection of appropriate data from different sources, extracting data for the geographic regions under study, and eventually combining layers of data as needed. Informed from the literature review, we propose five MOEs to evaluate the community building effects of the major transportation investment projects currently underway in the Central Florida Region. The proposed MOEs are:

- Property value change
- Changes to job accessibility
- Commuting time change
- Land use type change
- Changes to travel patterns for zero car households

The proposed changes will be evaluated for the time period 2011-2017. For sake of brevity, we present the layer preparation steps for 2012. The procedure was repeated for the entire time period of analysis. For job accessibility, commuting time and zero car household pattern based MOEs, data for 2017 was unavailable and the analysis was conducted from 2011-2016.

The development of these MOEs is a data intensive process. These indicators/measures can be developed by collating appropriate data collected from different sources using the ArcGIS platform. In this deliverable, we discuss the data preparation steps, MOE computation process.

1.3 Current Study

The development of above MOEs is a data intensive process. These indicators/measures can be developed by collating appropriate data collected from different sources using the ArcGIS platform. In this report, we discuss the data preparation steps, MOE computation process using ArcGIS and SPSS.

The proposed MOE changes will be evaluated for the time period 2011-2017 and also for all three transportation infrastructure (SunRail, I-4 ultimate and JUICE Orlando Bikeshare system). For sake of brevity, we present the layer preparation steps for 2012 and for SunRail stations only.



Figure 1: Major Transportation Investment Projects (SunRail, I-4 Expansion and JUICE Bikeshare) in Central Florida Region

2 PROPERTY VALUE ESTIMATION BY LAND USE TYPE

To estimate the property value for different use type, county 'Parcel' data were used. Several data preparation steps were followed for estimating the property value by using GIS. Here, we will give a brief description of estimation steps of property value using GIS for SunRail stations only.

2.1 Parcel Data Preparation

2.1.1 County Parcel Shapefile

- To capture the change in property value, parcel data for (2011-2017) obtained from Florida Department of Revenue (FDOR) were utilized (ftp://sdrftp03.dor.state.fl.us/Map% 20Data/).
- County parcel shapefile contains unique parcels within each county that indicated by unique 'Parcel No' together with each parcel's length and area (Figure 2).



Figure 2: Parcel Shapefile

• The transportation infrastructure projects considered in our research passes through four counties: Orange, Osceola, Seminole and Volusia (See Figure 3).



Figure 3: Counties Parcel Shapefile

2.1.2 Shapefile Co-ordination System Projection

- The 1st step among all is to project all the parcel shapefile to same coordination system.
- Following are the steps to project all parcel shapefile to same coordination system:
 - ✓ 1st select Geoprocessing
 - ✓ Choose Arc Toolbox bar in Geoprocessing (See Figure 4(a))
 - ✓ Select 'Data Management Tools' (See Figure 4(b))
 - ✓ Select 'Projections and Transformations' from 'Data Management Tools'
 - \checkmark Then click to 'Project' to select coordinate system

- ✓ Select county shapefile in as input features (See Figure 4(c))
- ✓ Click 'Output Coordinate System'
- ✓ There are two coordinate systems available in Output Coordinate System Geographic and Projected Coordinate System (See Figure 4(d))
- ✓ Select NAD 1983 within Universal Transverse Mercator (UTM) bar (See Figure 4(e))
- ✓ Finally Select NAD 1983 UTM Zone 17N that represents the infrastructure zone (See Figure 4(f))



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(f) Figure 4: Projected Coordination System

2.1.3 Parcel Data Layer Preparation

- The Name-Address-Legal (NAL) file for 2011-2017 was used together with parcel level county shapefile to get the property value information for parcel level (<u>ftp://sdrftp03.dor.state.fl.us/Tax%20Roll%20Data%20Files/</u>).
- NAL file has unique parcel ID with equivalent parcel level attribute information such as property/feature value, land value, land area in square feet, land use codes (DOR-UC), owner name, owner address, physical address, physical zip code, building details and so on (Figure 5).
- Please note that Just Value (land just value, building value, and special feature value) of a property includes: present cash value; use; location; quantity or size; cost; replacement value of improvements; condition; income from property; and net proceeds if the property is sold. The net proceeds equal the value of the property minus 15% of the true market value. This accounts for the cost of selling the property. In calculating the change in property values, we consider Just Value reported by DOR as a surrogate measure for direct property value and in the following sections, we will refer to this value as the property value for simplicity.

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5	58	27200100000043	R	2012	1	1	2	1	1		134149			134149	134149	
6	58	27200100000046	R	2012	1	1	2	1	1		163818			162905	162905	
7	58	27200100000047	R	2012	5	8	1	99	0		117365			117365	117365	
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11	58	27200100000051	R	2012	1	1	2	2	0		141961			141961	141961	
12	58	27200100000052	R	2012	1	1	1	2	0		63643			50553	50553	
13	58	27200100000053	R	2012	5	8	2	99	0		570172			570172	570172	
14	58	27200100000054	R	2012	1	1	3	1	0		268653			130216	130216	
15	58	27200100000055	R	2012	4	8	2	0	1		98464			98464	98464	
16	58	27200100000056	R	2012	5	8	5	99	0		51343			51343	51343	
17	58	27200100000057	R	2012	3	8	5	68	1		61036			11706	11706	
18	58	27200100000058	R	2012	3	8	1	69	30		64027			33629	33629	
19	58	27200200000014	R	2012	3	8	1	61	0		605459			207274	207274	
20	58	27200200000015	R	2012	3	8	5	61	0		226494			3330	3330	
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Figure 5: Name-Address-Legal (NAL) File

2.1.4 Merging NAL File Information

- Parcel No from county parcel shapefile contains unique parcels within each county file linking it with equivalent parcel level attribute information contained in the Name-Address-Legal (NAL) file.
- Following are the steps to linking parcel shapefile with NAL file information:
 - ✓ 1^{st} click right cursor
 - ✓ Select 'Join and Relates' button
 - ✓ Double click on 'Join' bar (See Figure 6(a))
- There are three options in Join tool 1 and 3 is the joining field option based on these options NAL file information were added to Parcel shapefile while 2 is the option where NAL file must be included (See Figure 6(b))
 - ✓ Select 'Parcel No' from Parcel shapefile in option 1
 - ✓ Choose 'Parcel ID' from NAL file in option 3

- ✓ Select NAL file for corresponding year for option 2 $\,$
- ✓ Finally click Ok

00

- From Figure 6(c), it is clearly seen that property value (JV) and land use type value (DOR_UC) was added to shape file attributes table.
 - ✓ Select shapefile and click on right side of mouse
 - ✓ Select 'Open Attribute Table' to see the new variables



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Figure 6: Adding NAL Information to Parcel Shapefile

2.2 Create Appropriate Information

To continue further estimation, we categorized few land use types from DOR_UC (Land use value) information and area was transformed into acres unit also.

2.2.1 Land Use Type

2.2.1.1 Adding New Field

Several steps were followed to categorize DOR_UC to various land use types as follows:

- Select shapefile and click on right cursor
- Select 'Open Attribute Table'
- Click drop-down bar as shown in Figure 7(a)
- Click on 'Add Field' (See Figure 7(b))
- Choose a new name as 'NAL2012 LA'
- Select variable type (See Figure 7(c))
- Select 'String' as a variable type since land use type is a string variable (See Figure 7(c))







(b)



(c)

Figure 7: New Field Adding Procedure

- 2.2.1.2 Selection of Land Use Category
 - For our analysis purpose, we consolidated the land use categories reported by DOR into 12 land use categories. These are Single Family Residential, Multi-Family Residential, Retail/Office, Industrial/Manufacturing, Agriculture, Institutional/Infrastructure, Public, Recreational, Water, Vacant, and Others (see Table 1). See Appendix A for DOR land use code.
 - However, we will be reporting values for the following 5 out of the 12 categories: (1) Single family residential, (2) Multiple family residential, (3) Retail/Office area, (4) Institutional, and (5) Industrial.

Land Use Category	DOR Land Use Code
Single Family Residential	1
Multi-Family Residential	3,8
Other Residential	2,4-7,9
Retail/Office	11-39
Industrial	41-49
Agricultural	50-69
Institutional	71-79, 81, 84
Public	83, 85-91
Recreational	82, 97
Water	95
Vacant	0, 10, 40, 70, 80
Others	92-96, 98, 99, 100, 995, 999

Table 1: Land Use Category Based on DOR Land Use Codes

2.2.1.3 Land Use Type Conversion Technique from DOR Land Value

Following steps were used to convert DOR_UC land value to selected 12 land use categories.

- Select new added variable 'NAL2012_LA' and click on right cursor
- Select 'Field Calculator' (See Figure 8(a))



- (a)
- One can select either Visual Basic (VB) Script or Python option
- VB Script was selected for conversion of land use type category (See Figure 8(b))
- A code was written within the box to convert DOR land value (See Table 2)



Figure 8: Land Use Type Conversion Technique from DOR Land Value

Table 2: VB Script for Land Use Type Conversion

```
Dim x
If [DOR\_UC] \ge 1 and [DOR\_UC] \le 9 Then
x="Residential"
elseif [DOR_UC] >= 11 and [DOR_UC] <= 39 Then
x="Retail/Office"
elseif [DOR_UC] >= 41 and [DOR_UC] <= 49 Then
x="Industrial"
elseif [DOR UC] \geq= 50 and [DOR UC] \leq= 69 Then
x="Agricultural"
elseif [DOR_UC] >= 71 and [DOR_UC] <= 79 Then
x="Institutional"
elseif [DOR UC] = 81 Then
x="Institutional"
elseif [DOR\_UC] = 84 Then
x="Institutional"
elseif [DOR_UC] >= 85 and [DOR_UC] <= 91 Then
x="Public"
elseif [DOR\_UC] = 83 Then
x="Public"
elseif [DOR UC] \geq= 92 and [DOR UC] \leq= 96 Then
x="Other"
elseif [DOR\_UC] = 98 Then
x="Other"
elseif [DOR_UC] = 99 Then
x="Other"
elseif [DOR\_UC] = 82 Then
x="Recreational"
elseif [DOR_UC] = 97 Then
x="Recreational"
elseif [DOR\_UC] = 95 Then
x="Water"
elseif [DOR\_UC] = 0 Then
x="Vacant"
elseif [DOR\_UC] = 10 Then
x="Vacant"
elseif [DOR\_UC] = 40 Then
x="Vacant"
elseif [DOR_UC] = 70 Then
x="Vacant"
elseif [DOR\_UC] = 80 Then
x="Vacant"
else x=0
end if
```

2.2.2 Area Unit Conversion

2.2.2.1 Adding New Field

Several steps were followed to categorize DOR_UC to various land use types as follows (See Figure 9).

- Select shapefile and click on right cursor
- Select 'Open Attribute Table'
- Click drop-down bar
- Click on 'Add Field'
- Choose a new name as 'Area_Acres'
- Select variable type
- Select 'Double' as a variable type since area is a numeric variable



Figure 9: Area Unit Conversion

2.2.2.2 Area Unit Conversion

Following steps were used to convert shape area to new area unit such as acres.

- Select new added variable 'Area_Acres' and click on right cursor
- Select 'Calculate Geometry' (See Figure 10(a))
- Then choose Area option on top and select area unit such as Acres (See Figure 10(b))







(b)

Figure 10: Area Unit Conversion

2.3 Merge Counties

After preparing parcel data layer for all four counties (Orange, Seminole, Seminole and Volusia), a merged county shapefile was created. Following steps were followed to merge all four counties.

- At first, select 'Geoprocessing' toolbar
- Then click on 'Merge' option (see Figure 11(a))
- Then put all of the counties within 'Merge' toolbar (see Figure 11(b))
- Finally, click 'Ok'

After merge all counties a new shapefile was created (see Figure 12).

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(b) Figure 11: Merging Techniques



Figure 12: Merged Counties Shapefile

2.4 SunRail Stations Layer Preparation

We divided the stations into three segments: (1) Downtown Stations¹ including Lynx Central station, Church Street station, and Orlando Health/Amtrak station; (2) Outside Downtown Stations comprised of DeBary, Sanford, Lake Mary, Longwood, Altamonte Springs, Maitland, Winter Park, Florida Hospital Health Village, and Sand Lake Road stations; (3) Phase-2 stations including northbound DeLand and Southbound Meadow Woods, Osceola Parkway, Kissimmee Amtrak, and Poinciana stations. Figure 13 represents all 17 SunRail stations along with SnRail route.



Figure 13: SunRail Staions

2.4.1 Case Area Selection

2.4.1.1 Creating Buffer

- At first, select 'Geoprocessing' toolbar
- Then click on 'Buffer' option (see Figure 14(a))
- Then put SunRail station's shapefile in 'Buffer' toolbar (see Figure 14(b))
- In 'Linear Unit' option put the numeric value such as 1 and choose mile as unit
- Select default buffer type 'Round'
- Finally, click 'Ok'

A new buffer map was created around SunRail stations (see Figure 14(c)).

¹Downtown Stations are fixed based on the downtown area projected at 'I-4 Ultimate Project' construction map at <u>https://i4ultimate.com/construction-info/construction-map/#constructionAlerts</u>







(b)



Figure 14: 1 mile Buffer Around SunRail Stations

- 2.4.1.2 <u>Clip from Merge Counties</u>
 - At first, select 'Geoprocessing' toolbar
 - Then click on 'Clip' option (see Figure 15(a))
 - In 'Input Features' section put Merge counties (see Figure 15(b))
 - Upload SunRail buffer created in previous step on 'Clip Features' section (see Figure 15(b))
 - Finally, a new buffer layer was created contains corresponding parcel level information such property value, land use type, area etc. (see Figure 15(c))



(a)



(c) Figure 15: Case Area Selection

2.4.2 Overlapping Problem

2.4.2.1 <u>Theoretical Approach</u>

- A 1-mile buffer was created around each of the SunRail stations. Please note that the nearness of the stations, particularly in the downtown areas, cause overlapping problem.
- As a result of the overlapping, the same parcel might be part of two different stations.
- ArcGIS proximity tool (Near Generate Table operation) was used to assign a parcel to a unique station. More specifically, we computed the straight line distances from each parcel to the nearest station and the parcel was assigned to the station which was the

nearest. Figure 16 demonstrates an example of the station overlapping problem in the downtown area.



Figure 16: Example of Overlapping Buffers and Proximity Analysis

2.4.2.2 Practical Overlapping Solution Technique

Three downtown stations are clear example of overlapping parcels (Figure 17(a)). Following are the steps to solve the overlapping buffer problem:

- 1st select Geoprocessing
- Choose Arc Toolbox bar in Geoprocessing (See Figure 17(b))
- Select 'Analysis Tools' (See Figure 17(b))
- Select 'Proximity' from 'Analysis Tools'

- Then click to 'Near' for the overlapping solution
- Select parcel buffer layer shapefile in as input features (See Figure 17(c))
- Then put SunRail stations as Near Features
- Click 'Ok'

After all the actions were taken, three new columns will be added in the attribute table (See Figure 17(d)). They are:

- In_FID = Parcel ID
- Near_FID = Station ID
- Near_Dist = Estimated nearest distance from parcel to each SunRail statins







(b)





Figure 17: Uses of Near Tool to Overcome Overlapping Problem on ArcGIS

2.4.3 Property Value Estimation

After allocating all parcels to their nearest stations, dbf file was converted to SPSS file for estimation of property value by land use type. Following steps were followed:

- Select 'Data' toolbar
- Click on 'Aggregate' option (See Figure 18(a))
- Put 'Land Use Type' as break variable (See Figure 18(b))
- For 'Summary of Variables' section choose JV as property value and Area (Acres)
- Also change the 'Function' option from default 'Mean' to 'Sum'

This action will give a new dataset of total property value and total area in acres for each land use type. Then average property value was estimated for each land use type by dividing the total property value by total area in acres. Please note that, property value by land use type around each SunRail station' buffer needed to be estimated, then put 'Land Use Type' and 'SunRail Station ID (Near_FID)' in 'Aggregate' section as break variables (See Figure 18(c)).

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13	292226226300020	2.9214536312		Number of cases Name: N_BREAK						
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(c)

Figure 18: Average Property Value Estimation

2.4.4 Average Property Value Estimation

- The property value evaluation was carried out for the parcels within the 1-mile buffer. These parcels are referred to as Case parcels. Figure 19-22 presents the result.
- The average property value (per acre) for all parcels for each station by 5 land use types mentioned before (see Table 3).



Figure 19: Average Property Value (DeLand, DeBary and Sanford Station)



Figure 20: Average Property Value (Lake Mary, Longwood, Altamonte Springs and Maitland Station)



Figure 21: Average Property Value (Winter Park, Florida Hospital Health Village, LYNX Central, Church Street and Orlando Amtrak Station)



Figure 22: Average Property Value (Sand Lake Road, Meadow Woods, Osceola Parkway, Kissimmee Amtrak and Poinciana Station)

	Single Family	Multi- Family	Retail/Of	Industri	Institutio			
Station	Residential	Residential	fice	al	nal			
	(USD)	(USD)	(USD)	(USD)	(USD)			
Downtown Stations								
LYNX Central	906 590	088 /01	1 700 503	630 578	1 462 136			
Station	900,390	700,471	1,790,505	030,378	1,402,130			
Church Street	981 280	2 401 727	5 214 377	281 022	4 683 842			
Station	,200	2,101,727	5,211,577	201,022	1,005,012			
Orlando								
Amtrak/Sligh Blvd	625,409	474,380	1,159,111	419,089	1,492,057			
Station								
	Phase-I Ou	tside Downtown S	tations	•	ſ			
DeBary Station	49,601		136,409	225,568	181,761			
Sanford Station	401,223.	570,141	254,061	361,616	400,609			
Lake Mary Station	288,673	337,571	673,920		81,433			
Longwood Station	345,402	344,385	599,405	413,580	564,793			
Altamonte Springs	295 864	373 609	829 133	429 185	653 548			
Station	275,001	373,007	029,133	129,105	000,010			
Maitland Station	632,226	903,955	708,436	430,167	569,418			
Winter Park	1 393 663	1 353 358	1 601 312	789.060	1 449 902			
Station	1,575,005	1,555,550	1,001,512	707,000	1,++),)02			
Florida Hospital								
Health Village	918,072	626,616	1,208,935	724,904	1,083,417			
Station								
Sand Lake Road	456.825	363,302	405,738	256.050	280.571			
Station	10 0,020	000,002	100,700	200,000	200,071			
Phase-II Stations								
DeLand Station	111,661	86,914	56,488	71,328	108,124			
Meadow Woods	534 753	351 368	75 014	387 552	159 837			
Station	554,755	551,500	75,014	307,332	157,057			
Osceola Parkway	414 276	245 964	272 880	204 007	161 955			
Station	414,270	273,704	2,2,000	201,007	101,755			
Kissimmee	255 253	406 806	693 784	317 913	1 034 599			
Amtrak Station	200,200	+00,000	075,70-	517,715	1,054,577			
Poinciana	173,863		129,603	379,231	175,979			

Table 3: Average Property Value per Station by Land Use Type for 2012

2.5 Control Area Selection

While property values in the vicinity of the stations have substantially increased it is not possible to attribute all the increase to SunRail construction without examining the other parts of the urban region. To determine if the changes in property values is truly influenced by SunRail's development, control areas were systematically selected.

We adopted the following procedure for selecting the control areas.

- First, we created 2 and 8 mile buffer, respectively around the stations. The parcels located within that 6 mile buffer were selected to be the candidate control areas.
- Next, based on land use type and property value range (within 15% of the mean property value found for each land use type for case areas), control areas for analysis were identified. The same number of control parcels were selected for each land use type. Second, the control parcels were assigned to a unique station by using the nearest distance analysis.
- Third, the same procedure as case area is followed to estimate average property price per land use category type for downtown, outside downtown, and Phase-2 stations.

2.5.1 1st Step Technique

- 2.5.1.1 Draw 2 and 8 mile Buffer
 - 2 and 8 mile buffer around each SunRail station was created using similar technique as case area selection
- 2.5.1.2 Erase Inner 2 Miles
 - 1st select Geoprocessing toolbar
 - Choose Arc Toolbox bar in Geoprocessing (See Figure 23(a))
 - Select 'Analysis Tools' (See Figure 23(a))
 - Select 'Overlay' from 'Analysis Tools'
 - Then click to 'Erase' for the overlapping solution
 - Select 8 mile buffer layer shapefile in as input features (See Figure 23(b))
 - Then put 2 mile buffer layer shapefile as Erase Features
 - Click 'Ok'

Figure 23(c) represents the control area where 6 mile area was accounted after 2 mile inner radius from each SunRail station.



(a)



(c) Figure 23: Control Area Selection

3 ACCESSIBILITY TO EMPLOYMENT

Job accessibility can be defined as number of jobs accessible from a desirable point. To capture the change in number of jobs around the chosen investment projects, the employment (number of workers in the labor force) data for the years 2011-2016 was drawn from American Community Survey (ACS). This data contains information on total employment of individuals aged 20 through 64 years. These data were merged with the Florida census tract shapefile using the unique ID created by concatenating county and census tract IDs.

3.1 Case Area Selection

Job accessibility was computed using jobs accessible within a particular driving distance. Several travel time values are potentially used in literature to identify job. In our study, we used 10 minutes' drive time from our origin of interest as the appropriate threshold. The driving distance was computed using weekday peak period (8am on Tuesday). Street network of Florida has been used to draw driving area for both driving time and driving distance. 2011-2016 street network of 'NAVSTREET' data was used.

3.1.1 Driving Network Area

10 minutes driving network area around all SunRail stations was created to select case area for 'Job Accessibility' estimation. This procedure can be divided into two parts.

3.1.1.1 <u>Road Network</u>

- At first, a street network must need to be created to draw a driving area around SunRail stations.
- 'NAVSTREET' street network shapefile was used to create street network.
- Please note that, to estimate driving time, we need speed limit of the corresponding street. We define a fixed speed for a street from variable called 'Speed Category'. Conversion of speed from defined speed limit range is shown in Table 4.

Speed Category	Definition (MPH)	Speed, V (MPH)
1	Above 80	80
2	65-80	70
3	55-64	60
4	41-54	50
5	31-40	40
6	21-30	30
7	6-20	20
8	Below 6	6

Table 4: Speed Definition

- Since driving area was estimated based on time, so travel time need to be calculated on street network file.
- Travel time (in minutes) needed to travel the corresponding street was estimated by using equation, T = (L/V) *60 where T is travel time needed to travel the total length of street in minutes, L is total length in miles and V is speed in mph (as mentioned Table 4).

• Three new variables as Speed, length and minutes need to be created by using similar to 2.1.2.1.



Figure 24: Travel Time Added

Several steps were followed to create 'Road Network' by using Network Analyst tool on ArcGIS (See Figure 25 (a) -25 (m)).²

- Select 'Catalog' from 'Windows' toolbar (See Figure 25 (a))
- Select Road Network shapefile by using 'Catalog' (See Figure 25 (b))
- Click on the 'New Network Dataset' from 'Road Network' file
- Follow all the steps shown in Figure 25 (d) to Figure 25 (l)
- All the above steps will create a new road network with 'junction' and 'edges'

² How to create a road network in ArcGIS can be found on this YouTube link (<u>https://www.youtube.com/watch?v=IcETd6oHZtQ</u>)



(a)



(b)



(c)



(d)



(f)

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(g)



(h)



(j)



(l)



(m) Figure 25: Road Network Create in ArcGIS

3.1.1.2 Driving Area

Several steps were followed to create a 10 minutes driving area by using road network in ArcGIS³.

- Select 'Network Analysts'
- Click on 'New Service Area' (See Figure 26 (a))
- Click Network Analyst Window (See Figure 26 (b))
- Within Network Analyst toolbar, select 'Facilities'
- Click 'Load Locations' in Facilities (See Figure 26 (c))
- Put 'SunRail Stations' in Load Locations (See Figure 26 (d))
- Click 'Service Area' in Layers and select 'Properties' (See Figure 26 (e))
- Click on 'Analysis Settings' in Properties menu bar (See Figure 26 (f))
- In Impedance option, select 'Travel Time (Minutes)'
- In 'Default Breaks' option, put 10 for creating10 minutes driving area
- For the time of the day 8 am was selected
- Tuesday was selected as 'Day of Week'
- Click on 'Solve' as shown in Figure 26 (g) and new 10 minute driving area was created
- For further estimation procedure, 10 minute driving area data need to be export (See Figure 26 (h))
- Figure 27 represents the 10 minutes case area around all SunRail stations

³ Create drive time areas in ArcGIS (<u>https://doc.arcgis.com/en/arcgis-online/analyze/create-drive-time-areas.htm</u>)







(b)



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(h) Figure 26: Network Driving Area



Figure 27: Driving Network Area Across SunRail Stations

3.1.2 Control Area Selection

- To examine the economic impact of SunRail commuter system with respect to number of employed persons, control areas were selected using following procedure: First, we draw a 10 minutes car driving area around the stations.
- We select 20-30 minutes car driving time as our control threshold. Second, the census tracts located within this 10 minute threshold area (between 20 and 30 minutes) were selected to be the candidate control.
- Control area selection procedure is almost same as case area. We put 20 and 30 minutes in 'Default Breaks' option instead of 10 for case area (see Figure 28).
- Figure 29 represents the control area around all SunRail stations.



Figure 28: Control Area



Figure 29: Control Area Across SunRail Station

3.1.3 Accessible Job Estimation

After case and control area selection, all other procedure is quite similar to property value estimation. The employment (number of workers in the labor force) data was drawn from American Community Survey (ACS) was used instead of parcel data for property value.

4 COMMUTING TIME

The whole procedure is similar to property value estimation except average commuting time data (journey to work in minutes) per census tract of Florida drawn from American Community Survey (ACS) were used as an alternative of parcel data.

5 LAND USE CHANGE

The same parcel data similar to property value was used to estimate land use change. After case and control area selection, SPSS file was used to estimate the total area change from vacant to various land use type.

6 TRAVEL PATTERN FOR ZEO CAR HOUSEHOLDS

The means of transportation to work by household vehicle fleet size data at the census tract level for 2011-2016 was extracted from American Community Survey (ACS) was used to estimate the percentage of trip number by various modes for zero car households. The estimation procedure is similar to property value estimation.

APPENDIX A: DOR BASED LAND USE CODE

- 001 = Single Family Residential
- 002 = Mobile Homes
- 003 = Multi-family 10 units or more
- 004 = Condominiums
- 005 =Cooperatives
- 006 = Retirement Homes not eligible for exemption.
- 007 = Miscellaneous Residential (migrant camps, boarding homes, etc.)
- 008 = Multi-family less than 10 units
- 009 = Residential Common Elements / Areas
- 010 = Vacant Commercial
- 011 = Stores One-Story
- 012 = Mixed use store and office or store and residential or residential combination
- 013 = Department Stores
- 014 = Supermarkets
- 015 = Regional Shopping Centers
- 016 = Community Shopping Centers
- 017 = Office buildings, non-professional service buildings, one story
- 018 = Office buildings, non-professional service buildings, multi-story
- 019 = Professional Service Buildings
- 020 = Airports (private or commercial), bus terminals, marine terminals, piers, marinas.
- 021 =Restaurants, Cafeterias
- 022 = Drive-in Restaurants
- 023 = Financial institutions (banks, saving and loan companies, mortgage companies,

credit services)

- 024 = Insurance Company Offices
- 025 = Repair service shops (excluding automotive), radio and T.V. repair, refrigeration service, electric repair, laundries, laundromats.

026 = Service Stations

- 027 = Auto sales, auto repair and storage, auto service shops, body and fender shops,
- commercial garages, farm and machinery sales and services, auto rental, marine

equipment, trailers and related equipment, mobile home sales, motorcycles, construction vehicle sales.

- 028 = Parking lots (commercial or patron) mobile home parks.
- 029 = Wholesale outlets, produce houses, manufacturing outlets.
- 030 = Florist, greenhouses
- 031 = Drive-in theaters, open stadiums
- 032 = Enclosed theaters, enclosed auditoriums
- 033 = Nightclubs, cocktail lounges, bars
- 034 = Bowling alleys, skating rinks, pool halls, enclosed arenas

035 = Tourist attractions, permanent exhibits, other entertainment facilities, fairgrounds (privately owned).

036 = Camps

037 =Race tracks; horse, auto or dog

038 =Golf courses, driving ranges

039 = Hotels, motels

040 = Vacant Industrial

041 = Light manufacturing, small equipment manufacturing plants, small machine shops, instrument manufacturing printing plants.

042 = Heavy industrial, heavy equipment manufacturing, large machine shops, foundries,

steel fabricating plants, auto or aircraft plants

043 = Lumber yards, sawmills, planing mills

044 = Packing plants, fruit and vegetable packing plants, meat packing plants

045 = Canneries, fruit and vegetable, bottlers and brewers distilleries, wineries

046 = Other food processing, candy factories, bakeries, potato chip factories

047 = Mineral processing, phosphate processing, cement plants, refineries, clay plants, rock and gravel plants

048 = Warehousing, distribution terminals, trucking terminals, van and storage warehousing

049 = Open storage, new and used building supplies, junk yards, auto wrecking, fuel

storage, equipment and material storage

- 050 = Improved agricultural
- 051 = Cropland soil capability Class I
- 052 = Cropland soil capability Class II
- 053 = Cropland soil capability Class III
- 054 = Timberland site index 90 and above
- 055 = Timberland site index 80 to 89
- 056 = Timberland site index 70 to 79
- 057 = Timberland site index 60 to 69
- 058 = Timberland site index 50 to 59
- 059 = Timberland not classified by site index to Pines
- 060 = Grazing land soil capability Class I
- 061 = Grazing land soil capability Class II
- 062 = Grazing land soil capability Class III
- 063 = Grazing land soil capability Class IV
- 064 = Grazing land soil capability Class V
- 065 = Grazing land soil capability Class VI

066 = Orchard Groves, Citrus, etc.

- 067 = Poultry, bees, tropical fish, rabbits, etc.
- 068 =Dairies, feed lots
- 069 = Ornamentals, miscellaneous agricultural
- 070 =Vacant, with or without extra features
- 071 =Churches
- 072 = Private schools and colleges
- 073 = Privately owned hospitals
- 074 = Homes for the aged

075 = Orphanages, other non-profit or charitable services

076 = Mortuaries, cemeteries, crematoriums

077 = Clubs, lodges, union halls

078 = Sanitariums, convalescent and rest homes

079 = Cultural organizations, facilities

080 = Vacant Governmental

081 = Military

082 = Forest, parks, recreational areas

083 = Public county schools - include all property of Board of Public Instruction

084 = Colleges

085 = Hospitals

086 = Counties (other than public schools, colleges, hospitals) including non-municipal government.

087 = State, other than military, forests, parks, recreational areas, colleges, hospitals

088 = Federal, other than military, forests, parks, recreational areas, hospitals, colleges

089 = Municipal, other than parks, recreational areas, colleges, hospitals

090 = Leasehold interests (government owned property leased by a non-governmental lessee)

091 = Utility, gas and electricity, telephone and telegraph, locally assessed railroads, water and sewer service, pipelines, canals, radio/television communication

092 = Mining lands, petroleum lands, or gas lands

093 = Subsurface rights

094 = Right-of-way, streets, roads, irrigation channel, ditch, etc.

095 = Rivers and lakes, submerged lands

096 = Sewage disposal, solid waste, borrow pits, drainage reservoirs, waste land, marsh, sand dunes, swamps

097 = Outdoor recreational or parkland, or high-water recharge subject to classified use assessment.

098 = Centrally assessed

099 = Acreage not zoned agricultural with or without extra features

100 = Parcels with no values.

995 = No Data Available (Water)

999 = No Data Available