

Evaluating Community Building Effectiveness of Transportation Investments: Knowledge Transfer Webinar Series

Webinar I: MOE GIS Data Preparation

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Civil, Environmental and Construction Engineering

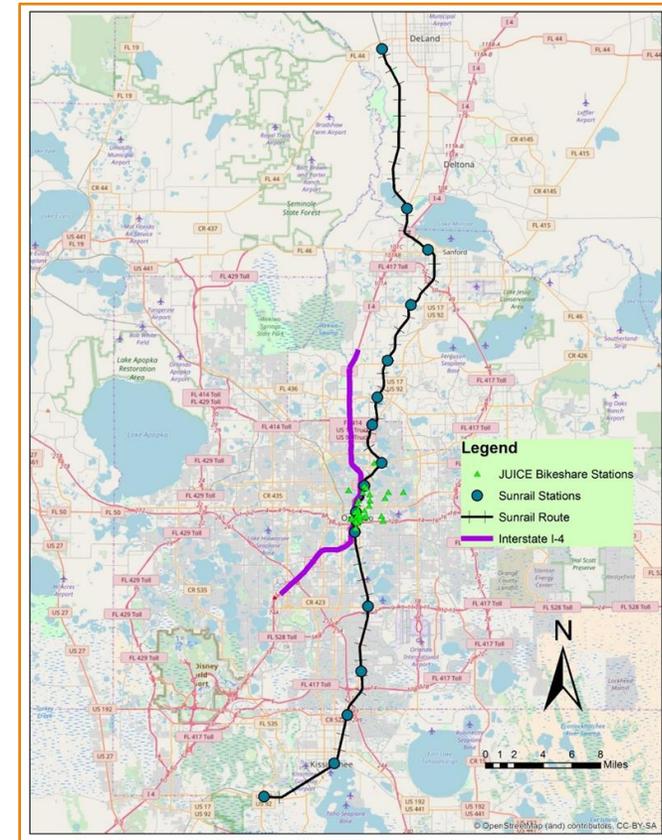
University Of Central Florida

Introduction

- Measures of Effectiveness (MOE)
 - Property value change: Disaggregate parcel level data layers will be employed to compute the change in property value
 - Changes to job accessibility: Census bureau data will be used to examine how the number of employment has varied
 - Commuting time change: American Community Survey data will be used to measure changes to commute travel times
 - Land use type change: Disaggregate parcel level data layers will be employed to identify the land use change from vacant to residential, industrial and commercial
 - Changes to travel patterns for zero car households: Census bureau data will be used to measure job accessibility around MOE

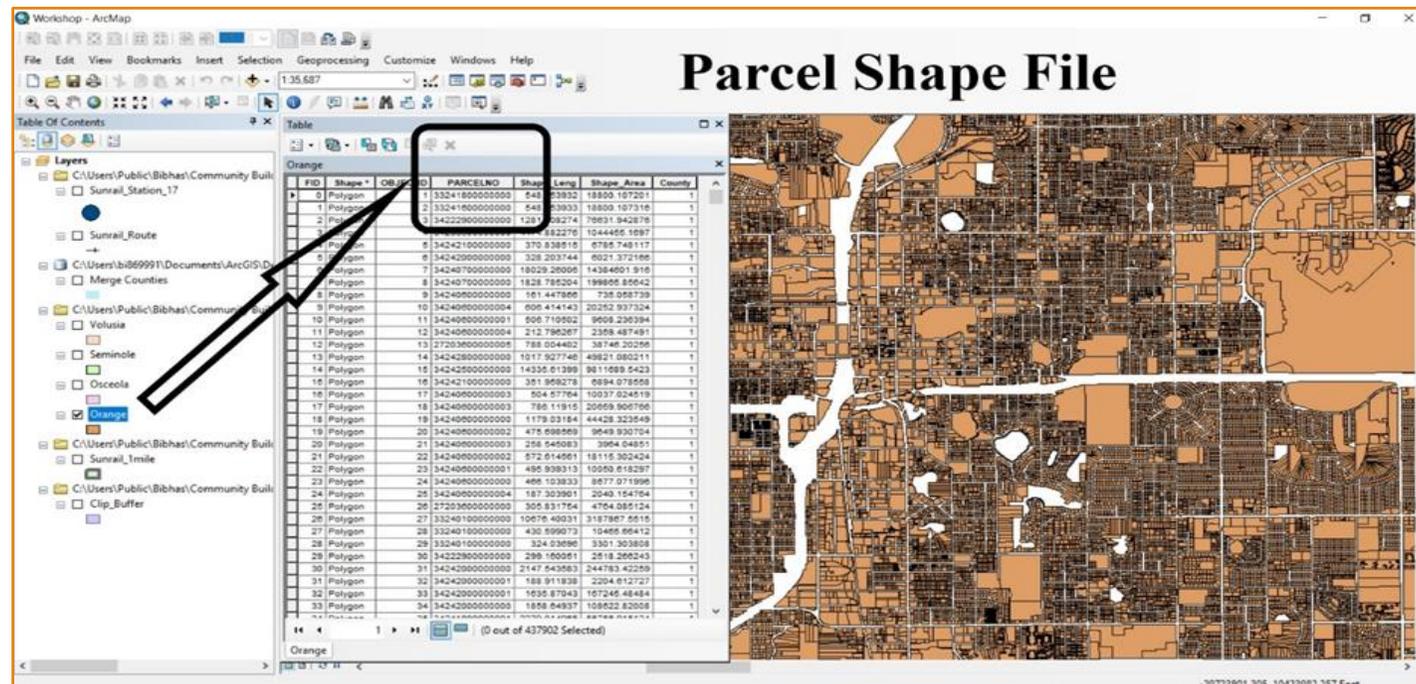
Introduction

- MOE computation process is performed using ArcGIS and SPSS for the time period 2011-2017.
- For sake of brevity, we present the layer preparation steps for 2012 and for SunRail stations only.



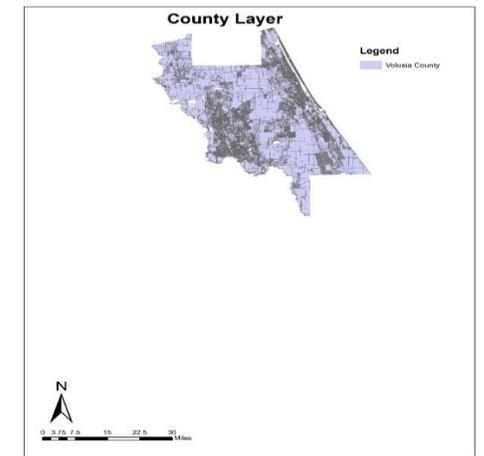
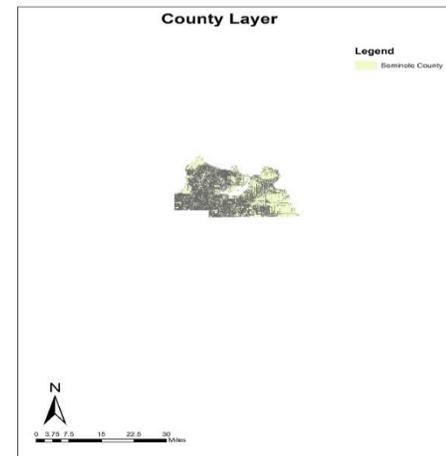
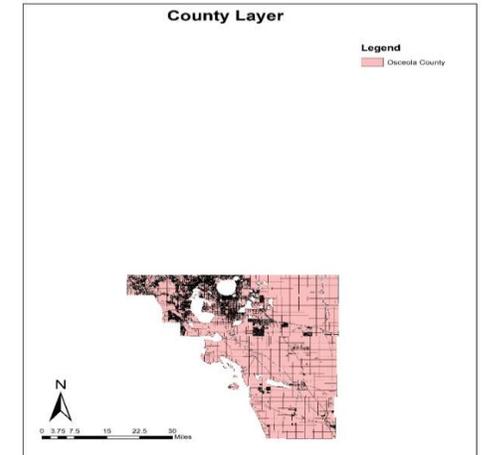
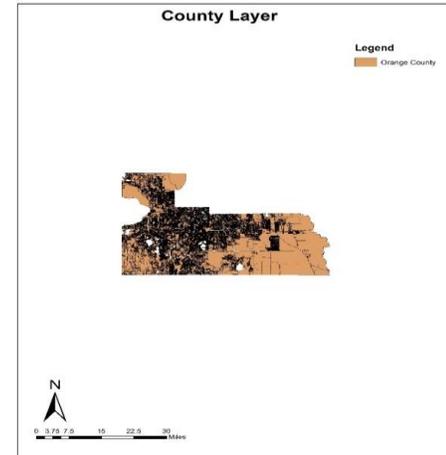
Property value

- County Parcel Shapefile is utilized in this study
 - To capture the change in property value, parcel data for (2011-2017) is obtained from Florida Department of Revenue (FDOR)
 - County parcel shapefile contains unique parcels within each county (Orange, Osceola, Seminole, Volusia)



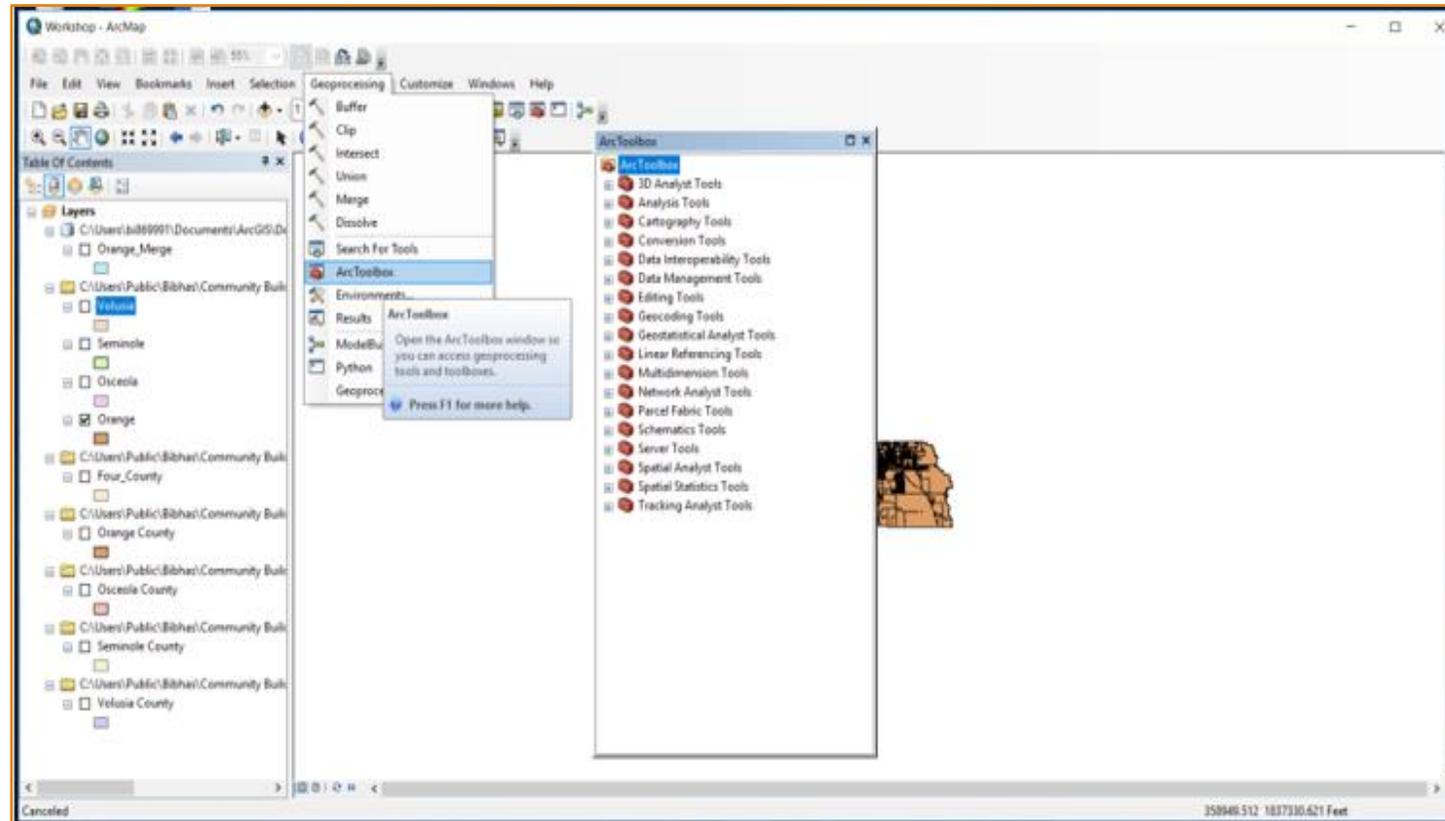
Co-ordination System Projection

- Our aim is to project all the parcel shapefile to same coordination system.
- To perform this, we need to follow several steps in ArcGIS.



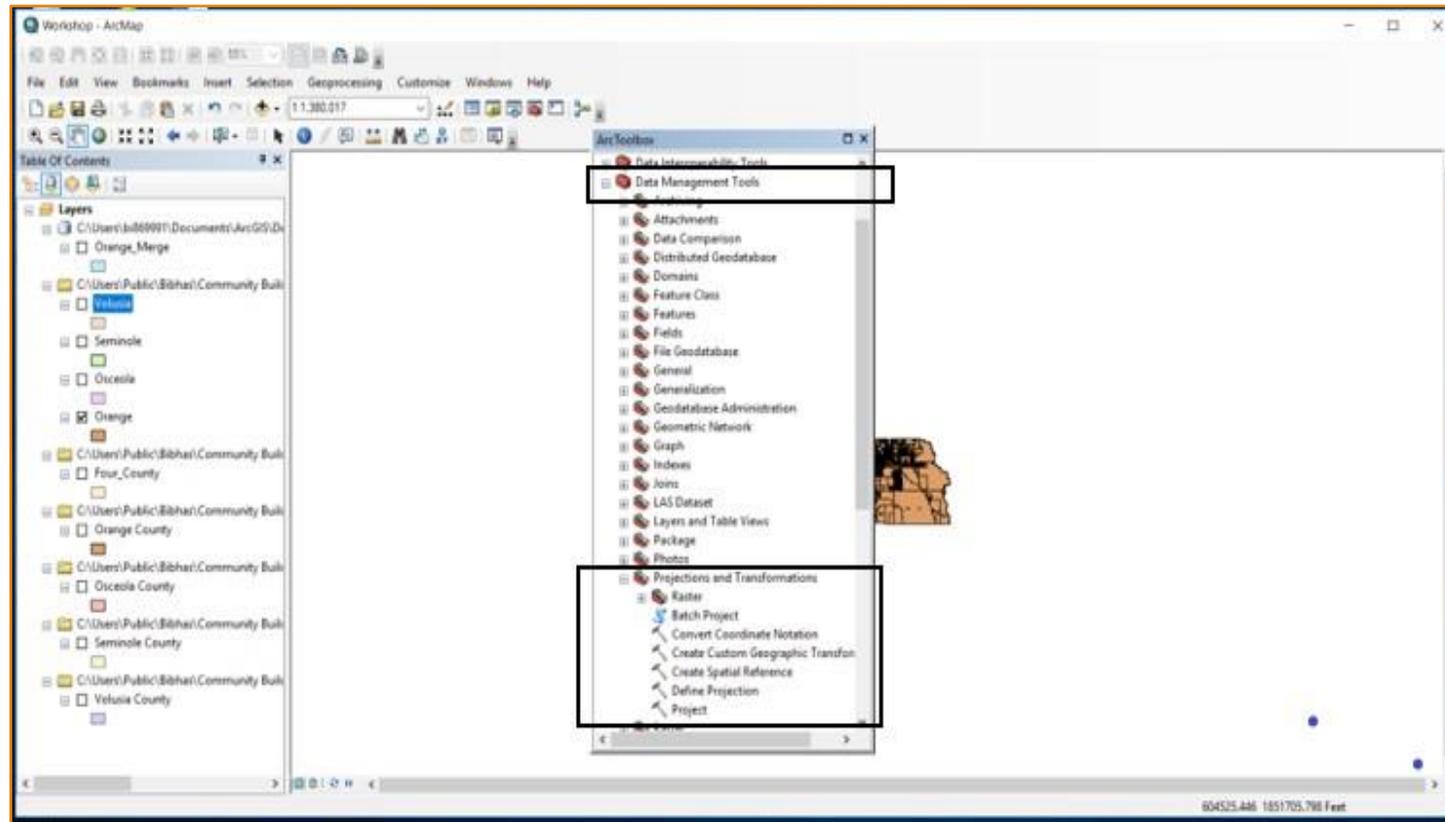
Co-ordination System Projection

- Step 1:



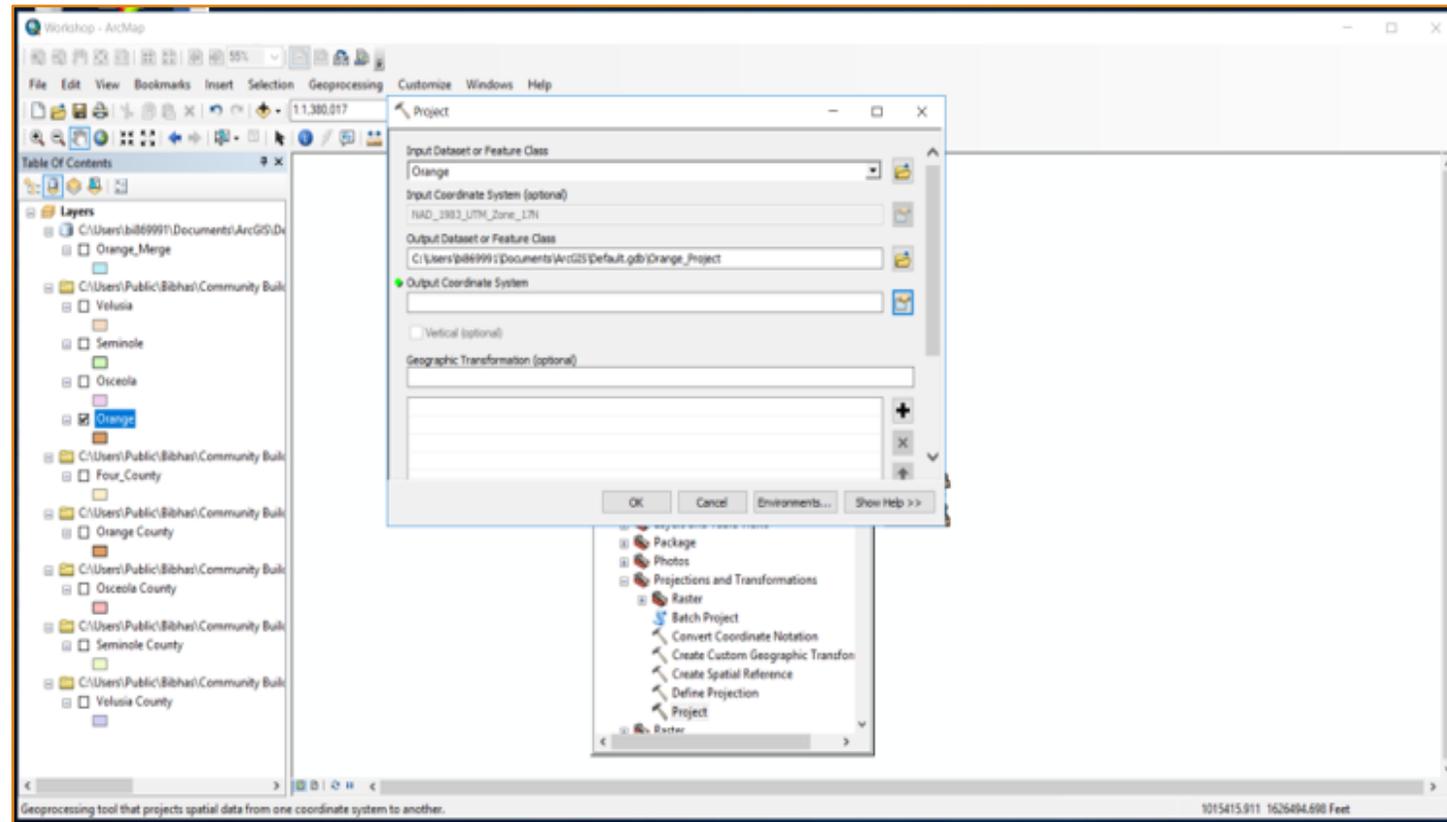
Co-ordination System Projection

- Step 2:



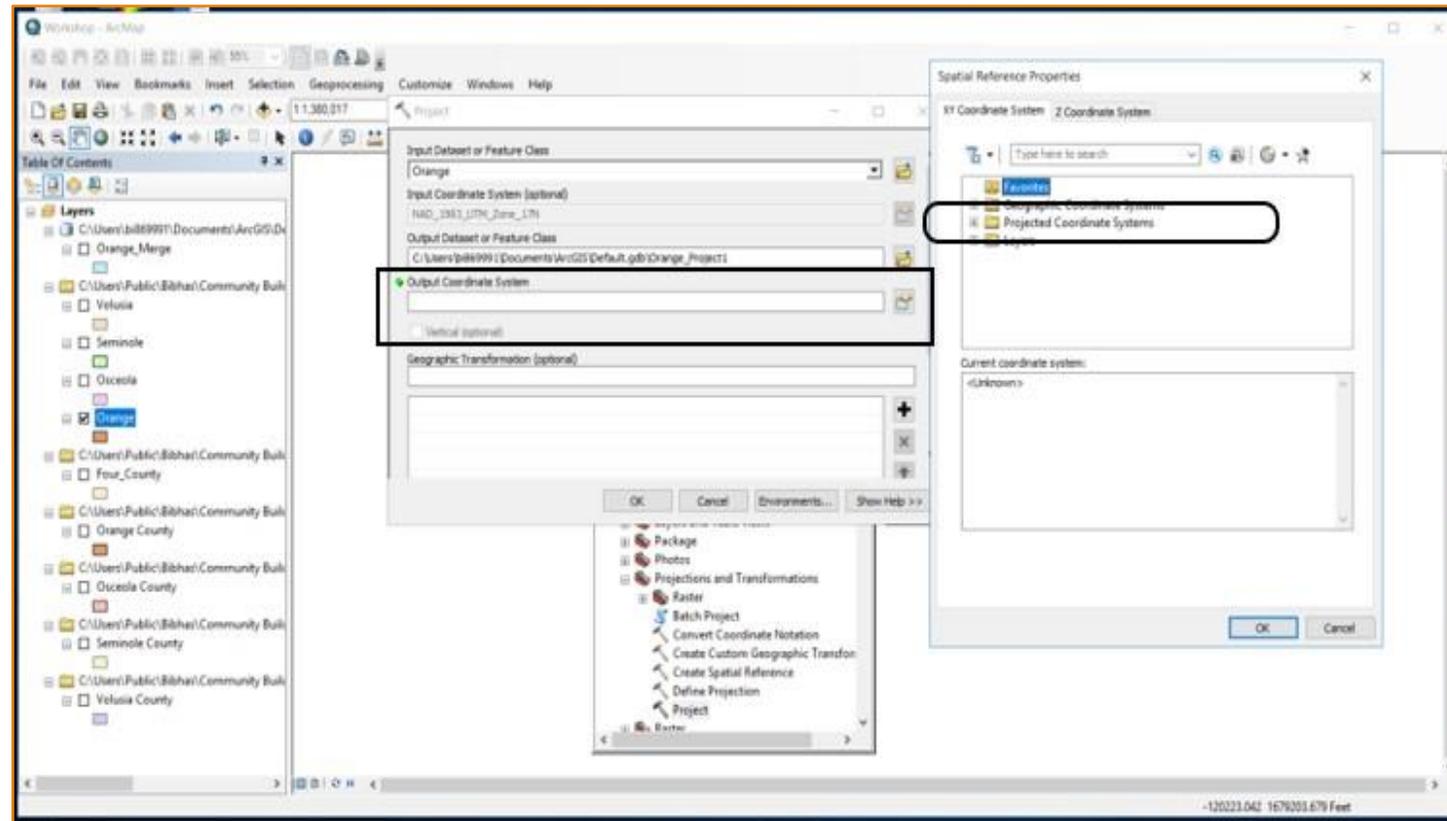
Co-ordination System Projection

- Step 3:



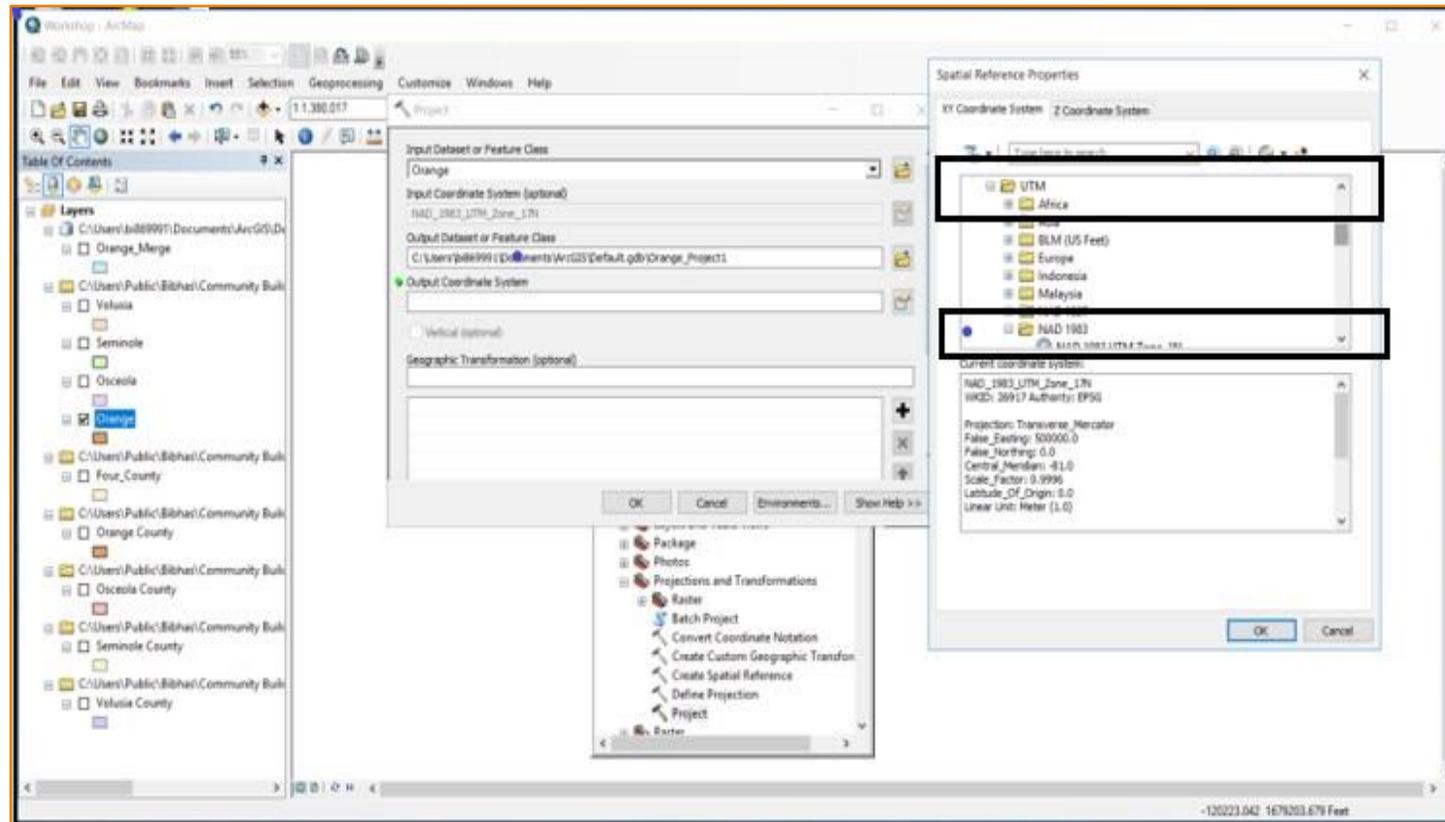
Co-ordination System Projection

○ Step 4:



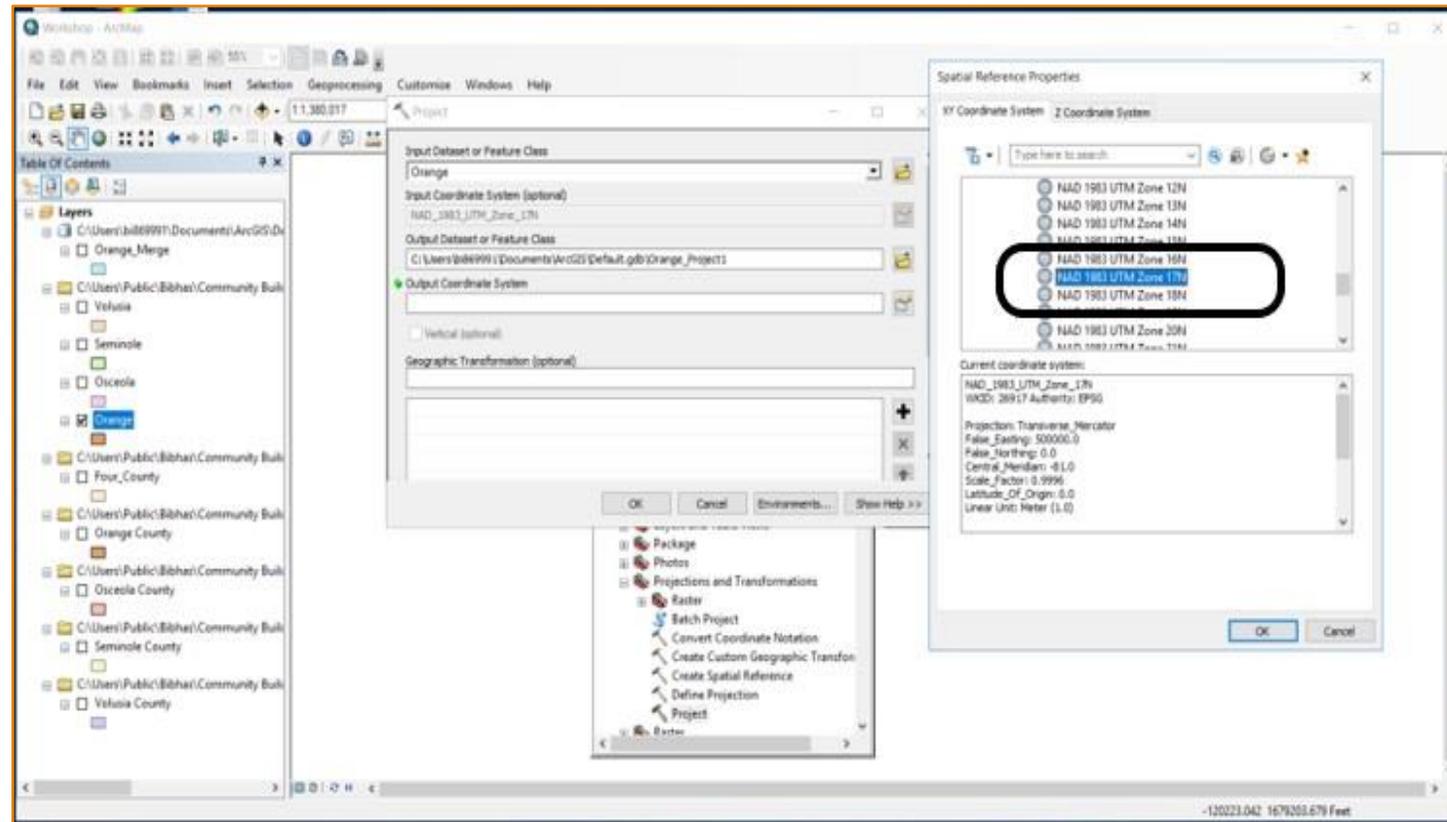
Co-ordination System Projection

- Step 5:



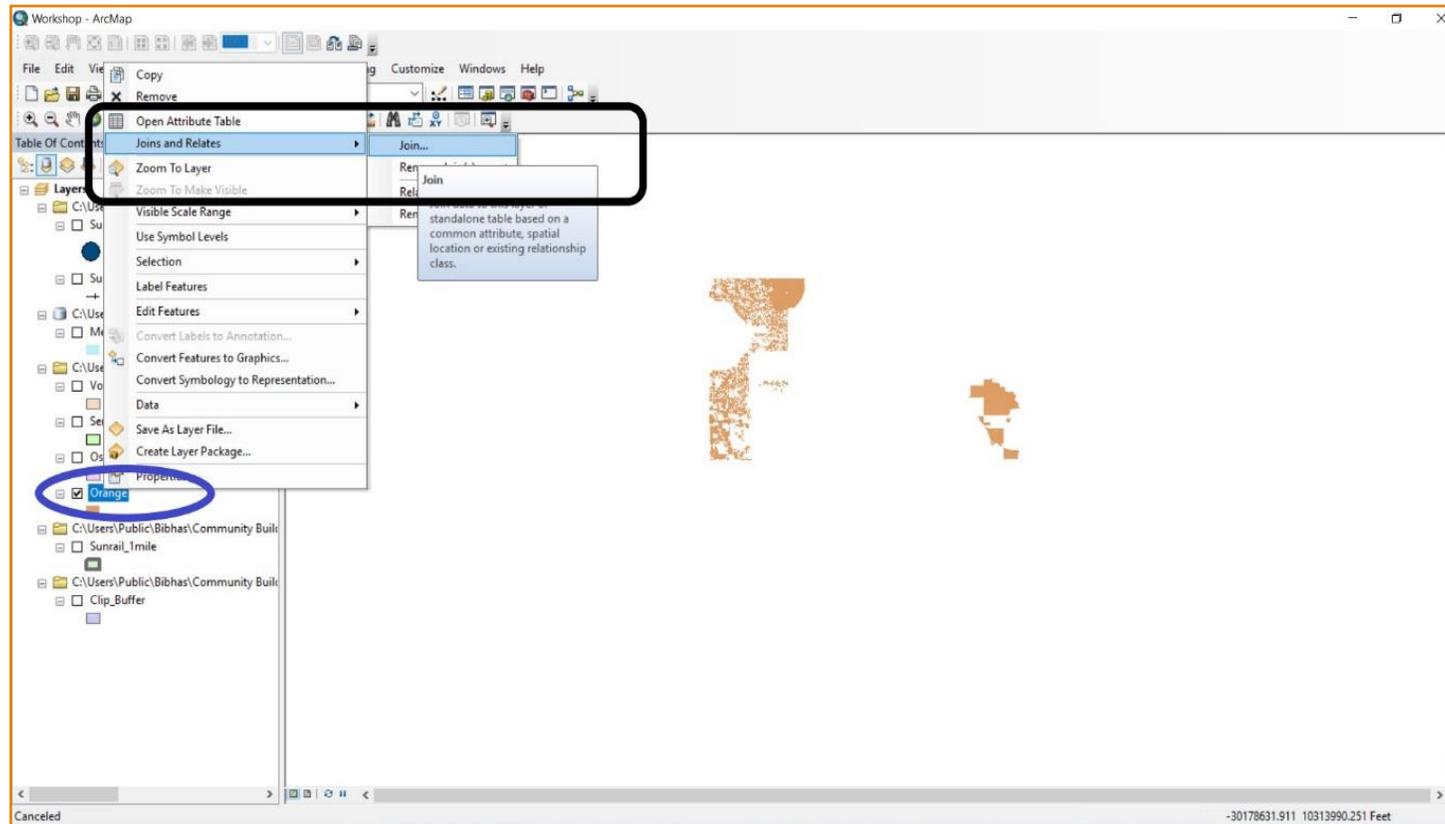
Co-ordination System Projection

- Step 6:



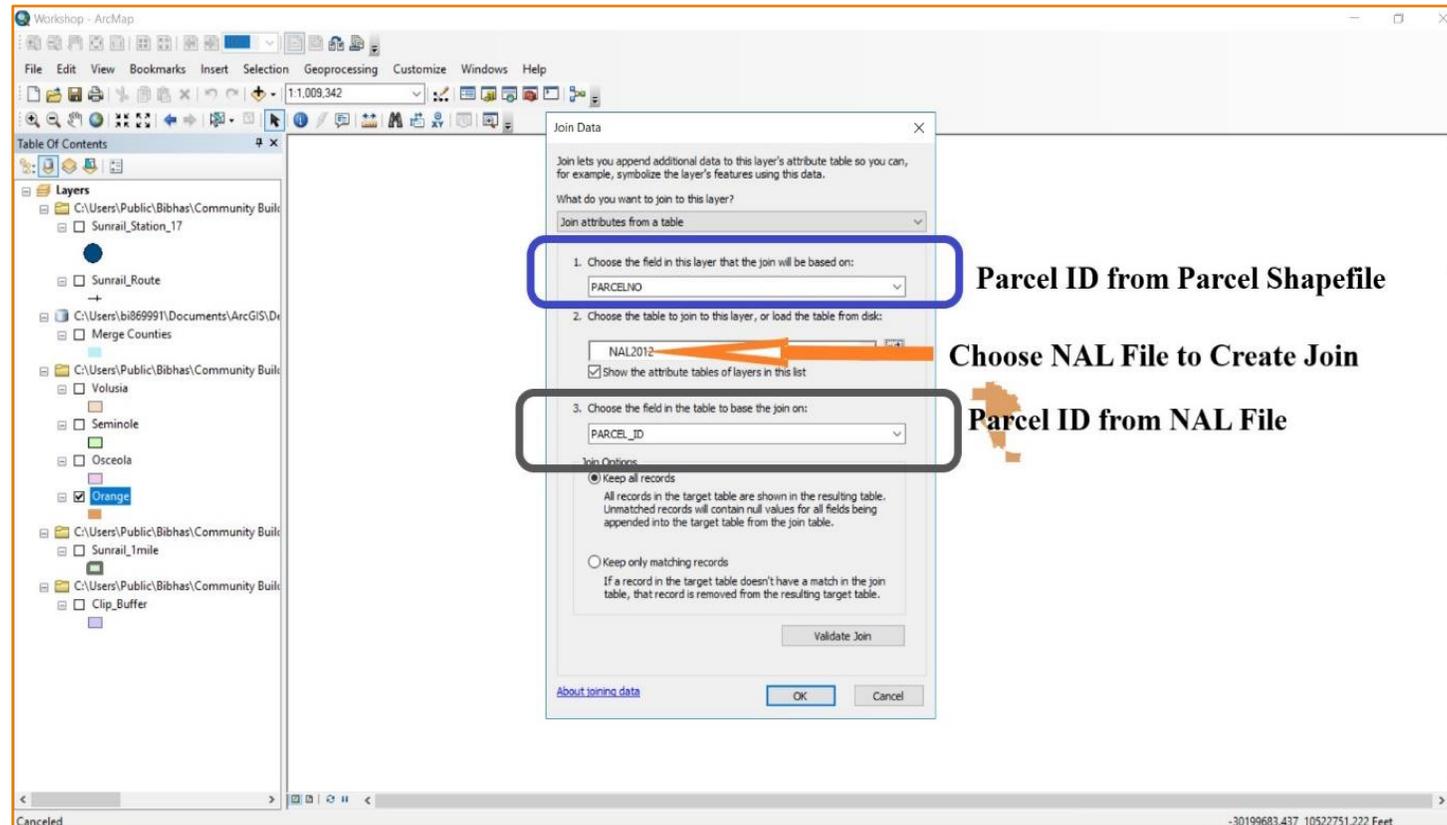
Parcel Data Layer Preparation

- Step 1:



Parcel Data Layer Preparation

○ Step 2:



Parcel Data Layer Preparation

- Information after joining:

Information Added after Joining NAL File

Parcel File:

- 1) Parcel ID
- 2) Shape Area

Added Information from NAL File:

- 1) JV - Property Value
- 2) DOR_UC - Land Use Code

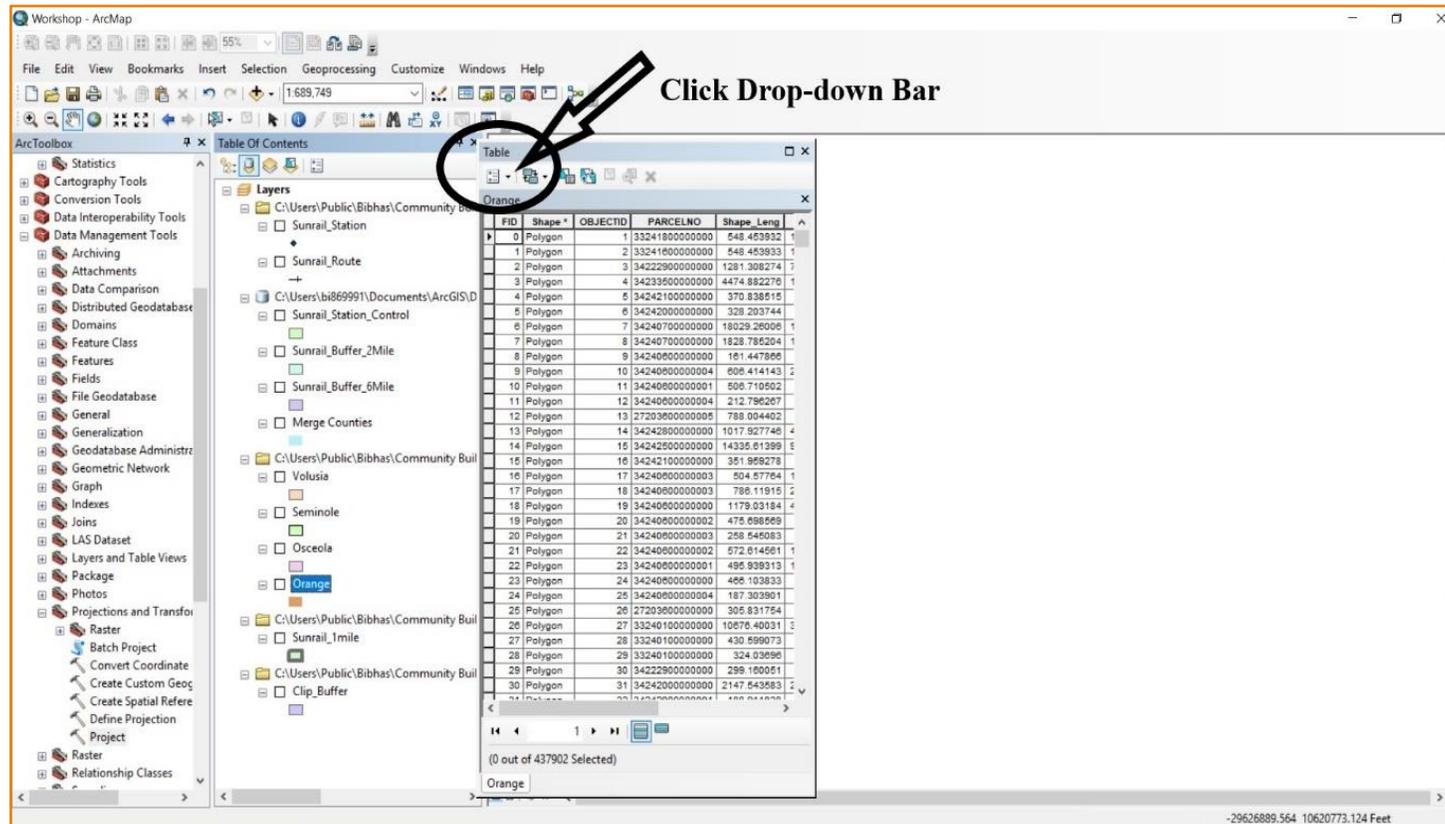
Parcel ID	Shape Area	JV (Property Value)	DOR_UC (Land Use Code)
29223537720218	19646	1	0768.684851
29223537720215	20003	1	0769.881494
29223537720214	31158	8	0770.313574
29223537720213	27295	8	0770.6931
29223491881806	22205	1	3279.199883
29223491881807	30285	8	0347.448709
29223491881805	24308	8	3198.903255
29223487380001	2601573	87	314967.49268
29223491881804	20390	1	3198.974742
29223491881704	8898	0	3199.552763
29223491881702	21670	1	3199.732254
29223491881701	100	80	399.952812
29223491881700	8898	0	2999.461418
29223491881809	5598	1	519.790822
29223491881810	11211	0	3511.024344
29223491881811	24480	1	3506.012507
29223491881812	11211	0	3500.987751
29223491881813	11211	0	3496.921411
29223491881814	2000	0	3490.909997
29223491881815	43783	1	6966.685082
29223491881709	33219	1	3466.983907
29223491881713	26678	1	3877.299103
29223491881809	8898	0	2999.284997
29223491881508	14948	0	7312.439095
29223491881506	21832	1	3652.501508
29223491881505	19185	1	3650.027682
29223491881504	11211	0	3647.562492
29223491881503	20895	1	3646.074062
29223491881502	11211	0	3642.697454
29223491881501	11211	80	3590.142752
29223491881507	79296	1	3585.815393
29223491881509	11211	0	3567.588314

Create Appropriate Information

- Now we need to create appropriate information in parcel layer in ArcGIS
- At first, we need to create land use type based on DOR_UC in the parcel data
- Secondly, we need to calculate area of the parcels in reasonable unit (square miles in our study).

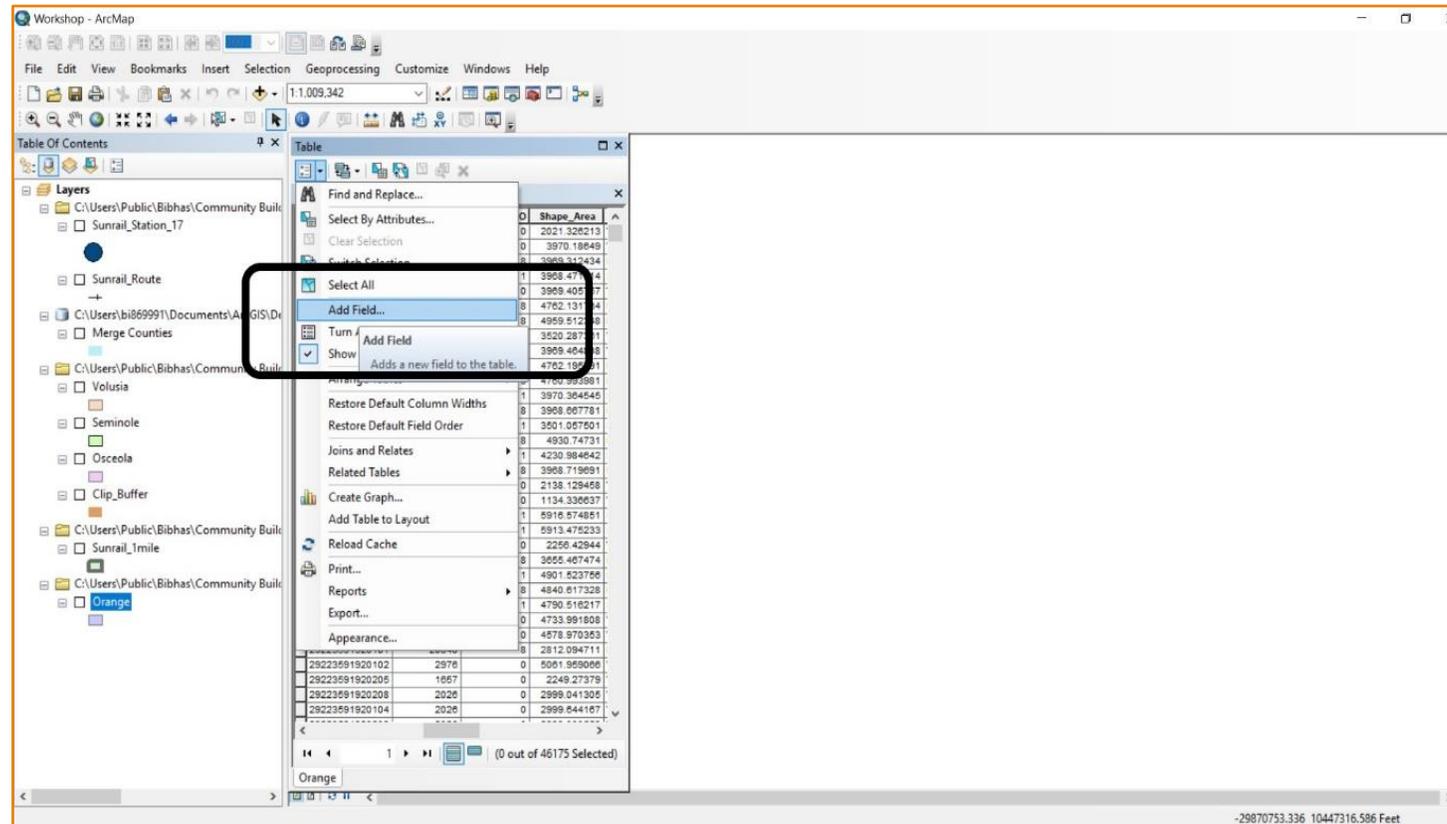
Create Appropriate Information

- Land use type (Step 1):



Create Appropriate Information

- Land use type (Step 2):



Create Appropriate Information

- Land use type (Step 3):

The screenshot displays the ArcMap interface with a data table for the 'Orange' layer. The table has four columns: NAL2012_PA, NAL2012_JV, NAL2012_DO, and Shape_Area. The 'Add Field' dialog box is open, showing the 'Name' field set to 'NAL2012_LA' and the 'Type' dropdown menu set to 'Double'. The 'Field Properties' section is also visible, showing 'Precision' and 'Scale' options.

Set a Name

Select New Variable Type;
Numeric - Double
String - Text

NAL2012_PA	NAL2012_JV	NAL2012_DO	Shape_Area
29223530920207	100	0	2021.326213
29223530920213	11927	0	3970.18649
29223530920212	26311	8	3969.312434
29223530920211	23708	1	3968.471714
29223530920303	11927	0	3969.405767
29223530920304	32902	8	4762.131734
29223530920306	29259	8	4969.612348
29223530920313	11927	0	3520.287961
29223530920312	11927	0	3969.404808
29223530920311	28118	8	4762.195791
29223530920309	27366	8	4760.992981
29223530920502	30636	1	3970.364545
29223530920504	36160	8	3968.667781
29223530920505	18836	1	3501.067501
29223530920505	28458	8	4930.74731
29223530920505	64639	1	4230.984642
29223530920511	49506	8	3968.719691
29223530920509	6068	0	2138.129458
29223530920508	3969	0	1134.336637
29223519280103	45318	1	5916.674851
29223519280105	27248	1	5913.475233
29223519280106	7085	0	2256.42844
29223519280106	22390	8	3656.467474
29223519280111	46074	1	4901.623766
29223519280110	41362	8	4840.617328
29223519280109	45864	1	4790.616217
29223519280108	2000	0	4733.991808
29223519280107	14229	0	4578.970353
29223591920101	20840	8	2812.094711
29223591920102	2976	0	5061.869006
29223591920205	1667	0	2249.27379
29223591920208	2026	0	2999.041305
29223591920104	2026	0	2999.644167

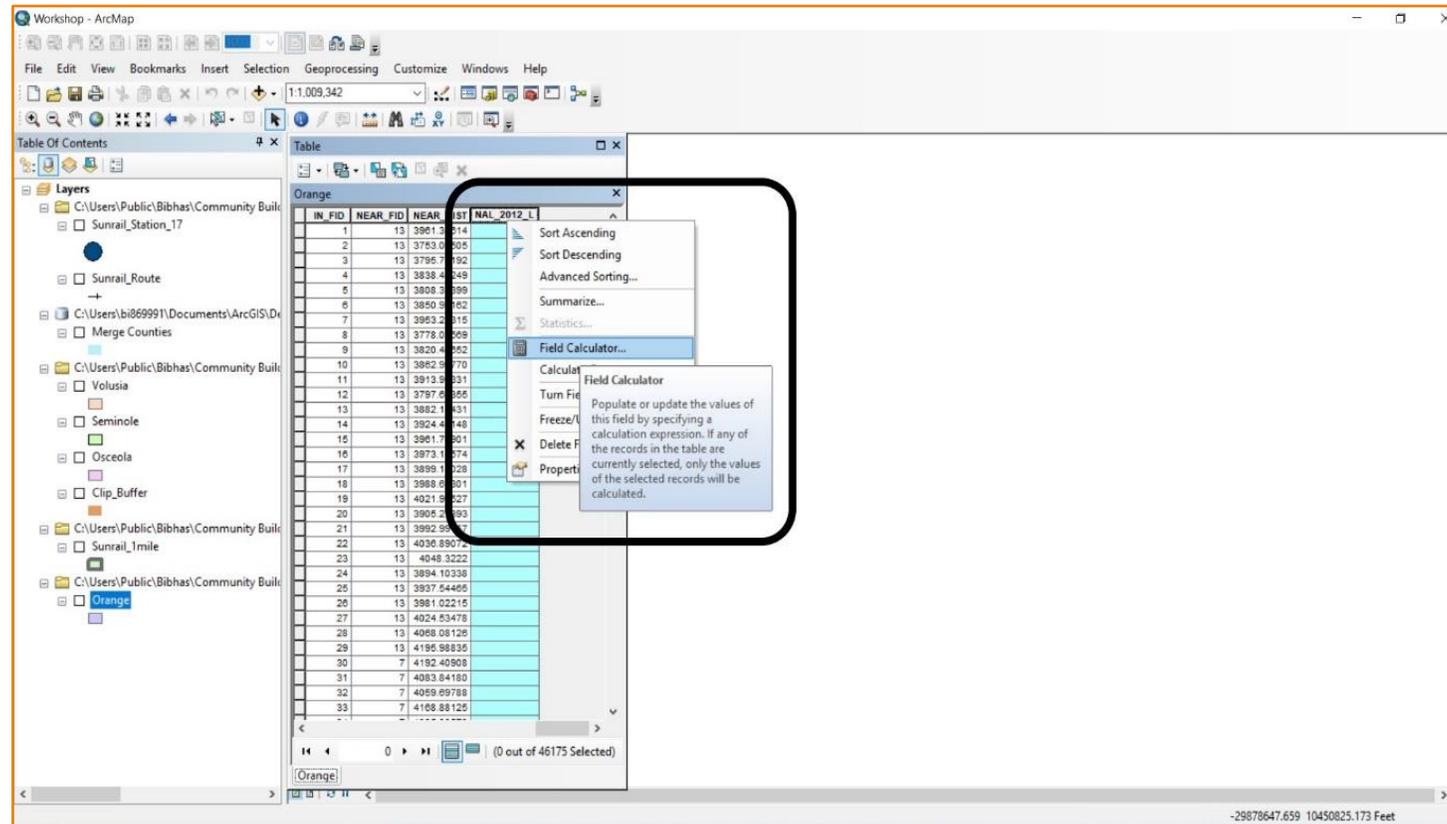
Create Appropriate Information

- Land use type (Step 4):
 - Selection of Land Use Category

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

Create Appropriate Information

- Land use type (Step 5):



Create Appropriate Information

- Land use type (Step 6):

The screenshot shows the ArcMap interface with a data table and a Visual Basic Script dialog box. The data table has the following columns: IN_FID, NEAR_FID, NEAR_DIST, and NAL_2012_L. The Visual Basic Script dialog box is open, showing the 'Parser' tab with 'VB Script' selected. The script text is as follows:

```
NAL_2012_L =  
Dim x  
If [DOR_UC] >= 1 and [DOR_UC] <= 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] >= 50 and [DOR_UC] <= 69 Then  
x="Agricultural"  
elseif [DOR_UC] >= 71 and [DOR_UC] <= 79 Then  
x="Institutional"  
elseif [DOR_UC] = 81 Then
```

The dialog box also includes a 'Functions' list on the right and buttons for 'Clear', 'Load...', 'Save...', 'OK', and 'Cancel'.

Create Appropriate Information

- Area Unit Conversion (Step 1):

The screenshot shows the ArcMap interface with a data table open. The table has columns for various identifiers and a 'Shape_Area' column. An 'Add Field' dialog box is overlaid on the table, showing the process of adding a new field named 'Area_Acres'. The dialog box has a 'Name' field containing 'Area_Acres', a 'Type' dropdown menu set to 'Short Integer', and a 'Precision' dropdown menu set to 'Double'. The 'Field Properties' section is also visible, showing 'Short Integer', 'Long Integer', 'Float', 'Text', and 'Date' options. The 'Add Field' dialog box is highlighted with a black border. To the right of the dialog box, there are two blue text annotations: 'Set a Name' and 'Select Double for Numeric Value'. The 'Table Of Contents' on the left shows a layer named 'Orange' selected. The status bar at the bottom indicates '(0 out of 46175 Selected)' and the coordinate system is '-29878647.659 10103474.987 Feet'.

29223530920207	NAL2012_PA	NAL2012_JV	NAL2012_DO	Shape_Area
29223530920213	100	11927	0	2021.3282
29223530920212	26311	8	3969.31	34
29223530920211	23768	1	3968.47	114
29223530920303	11927	0	3969.40	57
29223530920304	32902	8	4762.13	34
29223530920306	28259	8	4959.51	48
29223530920313	11927	0	3520.28	91
29223530920312	11927	0	3969.46	98
29223530920311	28118	8	4762.19	91
29223530920309	27356	8	4760.99	91
29223530920502	30836	1	3970.36	46
29223530920904	36160	8	3968.66	51
29223530920505	18835	1	3501.05	01
29223530920505	28458	8	4930.7	31
29223530920509	64639	1	4230.98	42
29223530920511	49506	8	3968.71	91
29223530920509	6058	0	2138.12	58
29223530920508	3969	0	1134.33	37
29223519280103	46318	1	5916.57	51
29223519280105	27248	1	5913.47	33
29223519280106	7085	0	2266.4	44
29223519280106	22390	8	3655.46	74
29223519280111	46074	1	4901.523	
29223519280110	41352	8	4840.917328	
29223519280109	45864	1	4790.516217	
29223519280108	2000	0	4733.991808	
29223519280107	14229	0	4578.970353	
29223591920101	20840	8	2812.094711	
29223591920102	2976	0	5061.869006	
29223591920205	1657	0	2249.27379	
29223591920208	2026	0	2999.041305	
29223591920104	2020	0	2999.644167	

Set a Name

Select Double for Numeric Value

Create Appropriate Information

- Area Unit Conversion (Step 2):

Right Click on New Variable

Select Calculate Geometry

IN_FID	NEAR_FID	NEAR_DIST	Area_Acre
1	13	3901.4614	0
2	13	3753.4614	0
3	13	3795.74192	0
4	13	3838.48249	0
5	13	3808.37399	0
6	13	3850.97162	0
7	13	3953.23315	0
8	13	3778.03569	0
9	13	3820.48952	0
10	13	3852.94770	0
11	13	3913.91331	0
12	13	3797.68365	0
13	13	3882.16431	0
14	13	3824.41148	0
15	13	3901.70901	0
16	13	3973.18574	0
17	13	3899.14028	0
18	13	3888.67301	0
19	13	4021.98527	0
20	13	3905.27393	0
21	13	3992.99157	0
22	13	4036.89072	0
23	13	4048.3222	0
24	13	3894.10338	0
25	13	3937.54465	0
26	13	3981.02215	0
27	13	4024.52478	0
28	13	4058.08126	0
29	13	4195.98835	0
30	7	4152.40908	0
31	7	4083.84180	0
32	7	4059.69788	0
33	7	4168.88125	0

Calculate Geometry

Calculate Geometry
Populate or update the values of this field to be geometric values derived from the features that the table represents, such as area, perimeter, length, etc. The dialog that appears lets you choose whether all the records will be calculated or just the selected records. This command is disabled if the table is not the attribute table of a feature class or shapefile.

Create Appropriate Information

- Area Unit Conversion (Step 3):

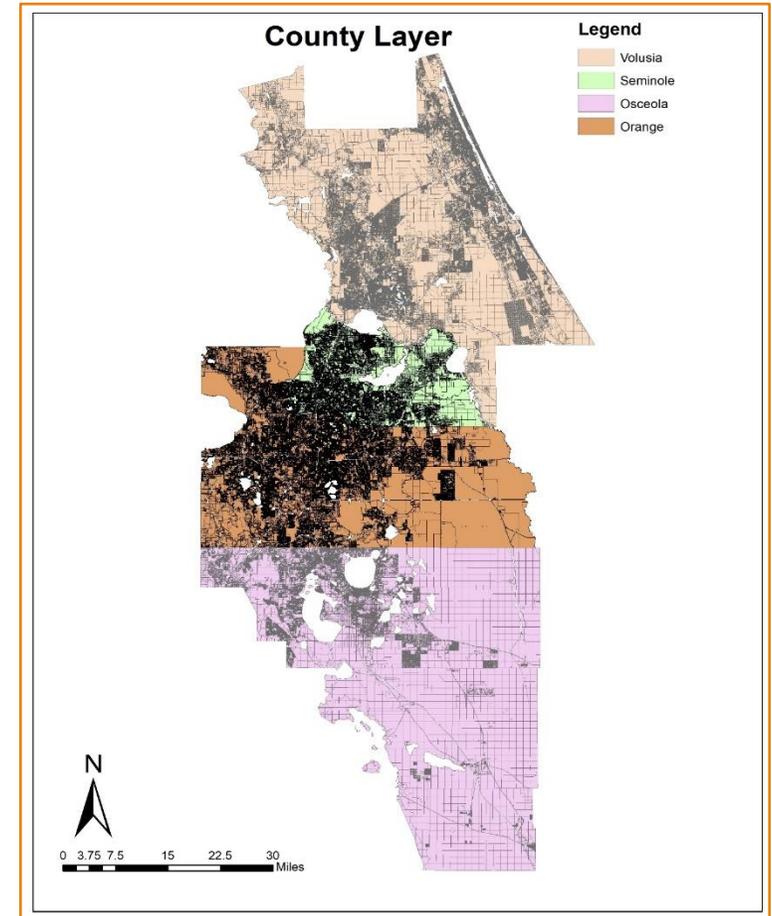
The screenshot displays the ArcMap interface. The 'Table' window shows a table with the following columns: IN_FID, NEAR_FID, NEAR_DIST, and Area_Acres. The 'Calculate Geometry' dialog box is open, showing the 'Property' set to 'Area'. The 'Units' dropdown is open, showing a list of units including 'Square Feet US [sq ft]', 'Acres US [ac]', 'Hectares [ha]', 'Square Decimeters [sq dm]', 'Square Feet US [sq ft]', 'Square Kilometers [sq km]', 'Square Meters [sq m]', and 'Square Miles US [sq mi]'. The 'Coordinate System' section is also visible, with 'Use coordinate system of the data source' selected.

Select Area

Select Unit for Area Calculation from Given List

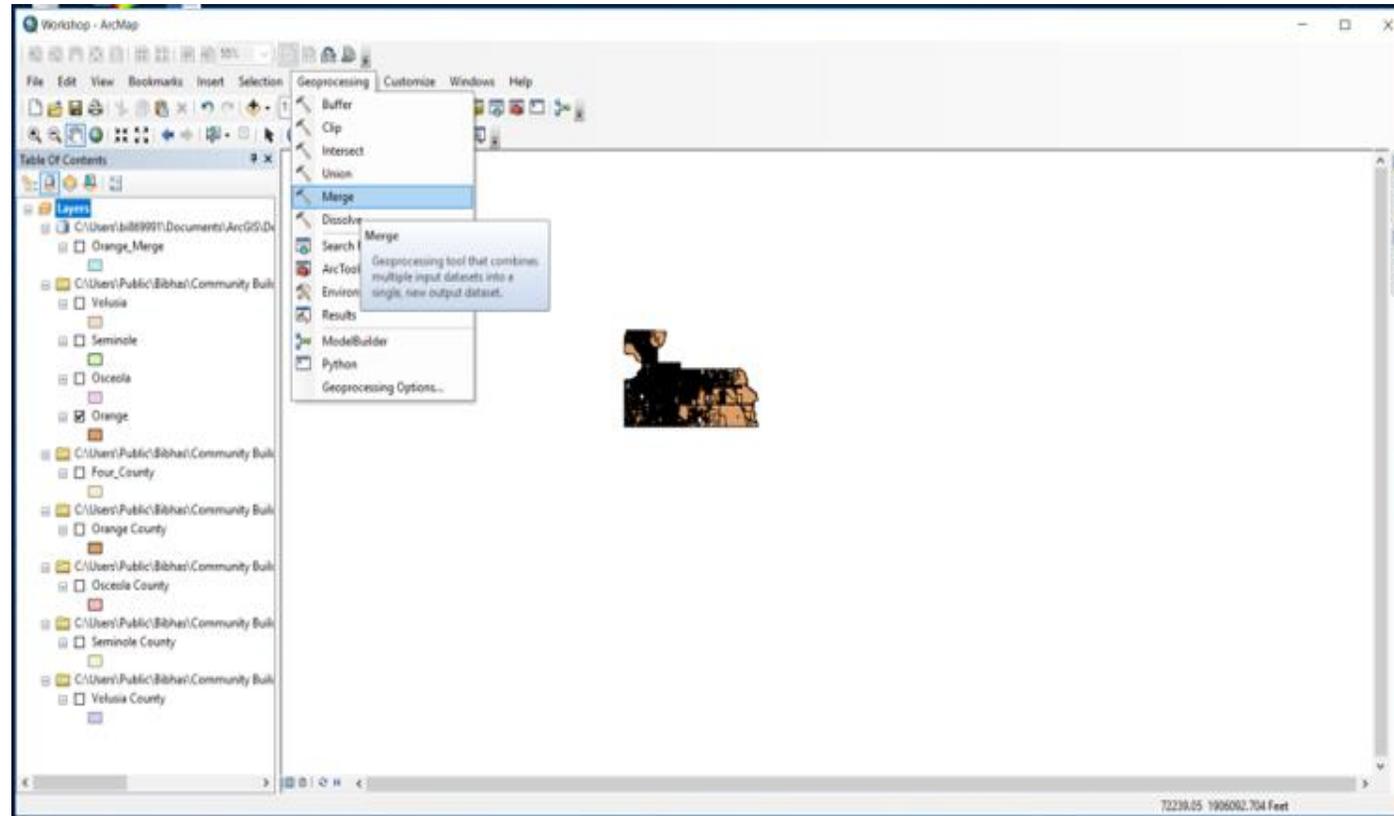
Merging Counties

- 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
 - Then put all of the counties within 'Merge' toolbar
 - Finally, click 'Ok'



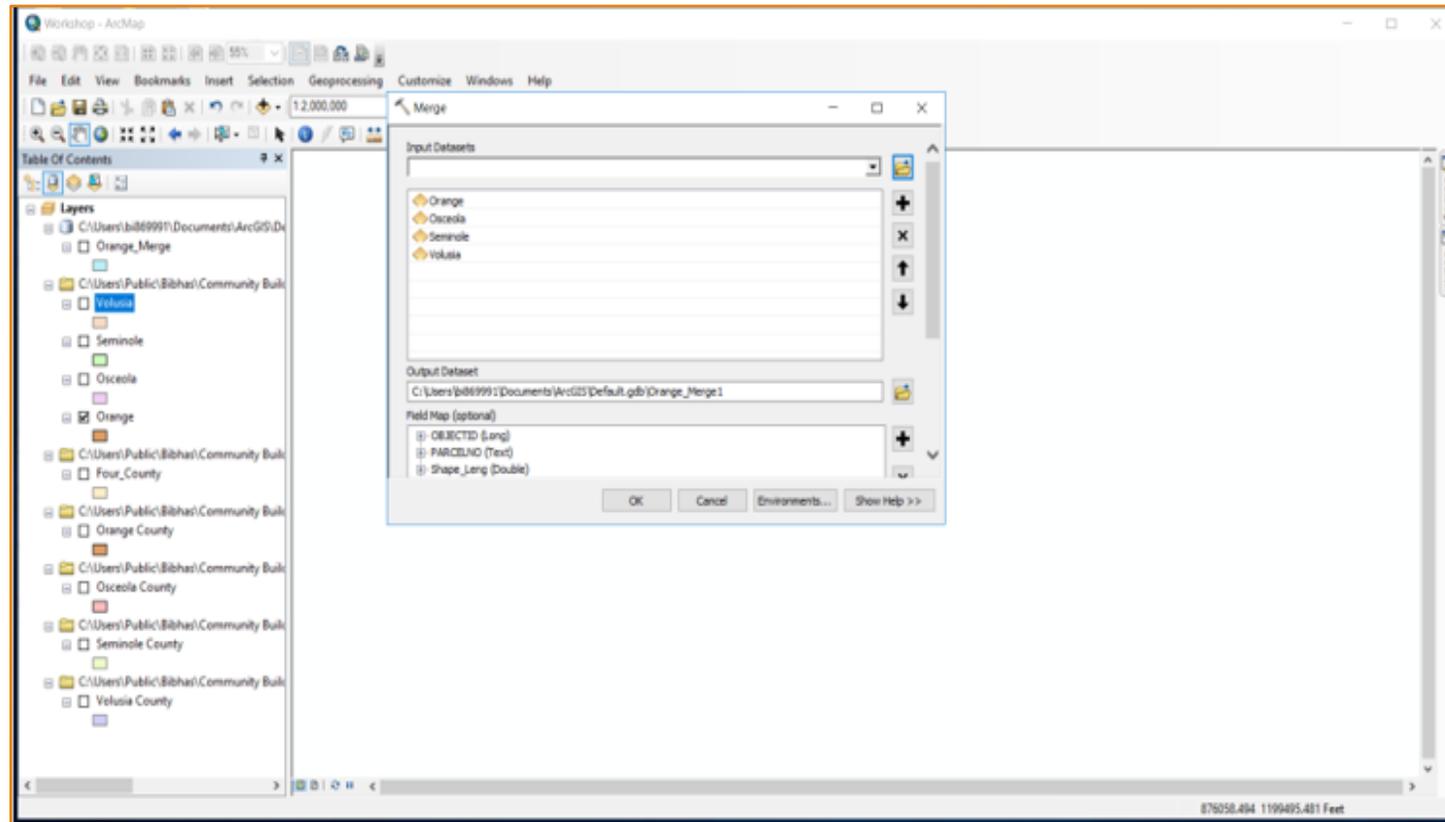
Merging Counties

- Step 1:



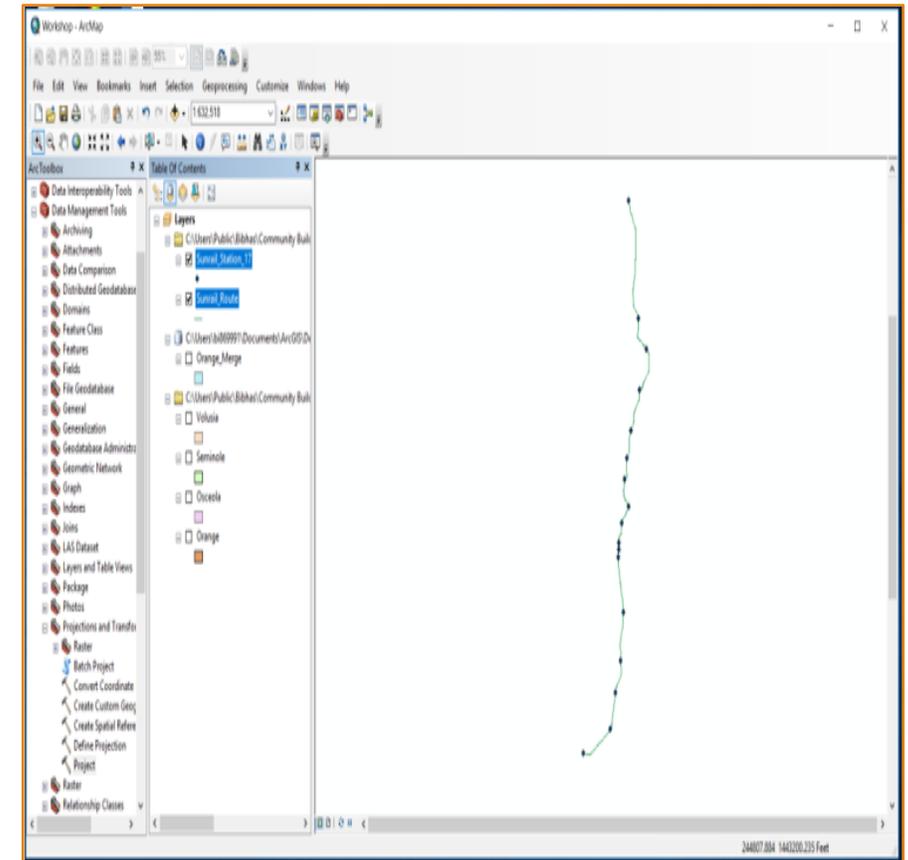
Merging Counties

- Step 2:



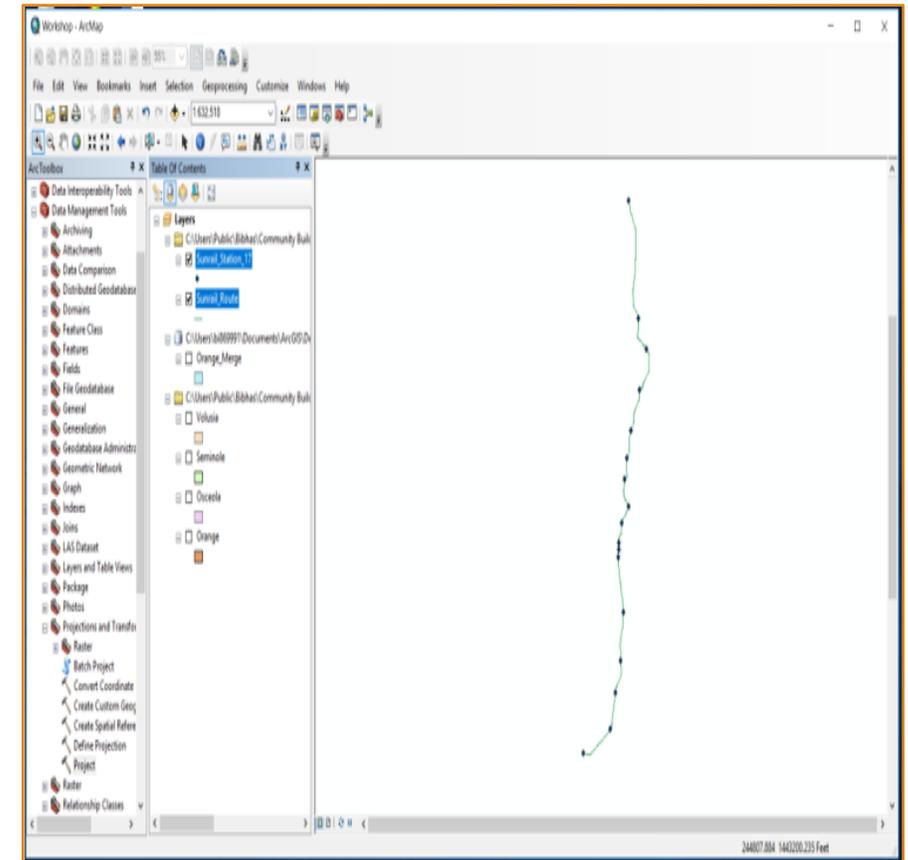
Layer Preparation

- We divided the stations into three segments:
 - Downtown Stations including Lynx Central station, Church Street station, and Orlando Health/Amtrak station
 - Outside Downtown Stations comprised of DeBary, Sanford, Lake Mary, Longwood, Altamonte Springs, Maitland, Winter Park, Florida Hospital Health Village, and Sand Lake Road stations
 - Phase-2 stations including northbound DeLand and Southbound Meadow Woods, Osceola Parkway, Kissimmee Amtrak, and Poinciana stations



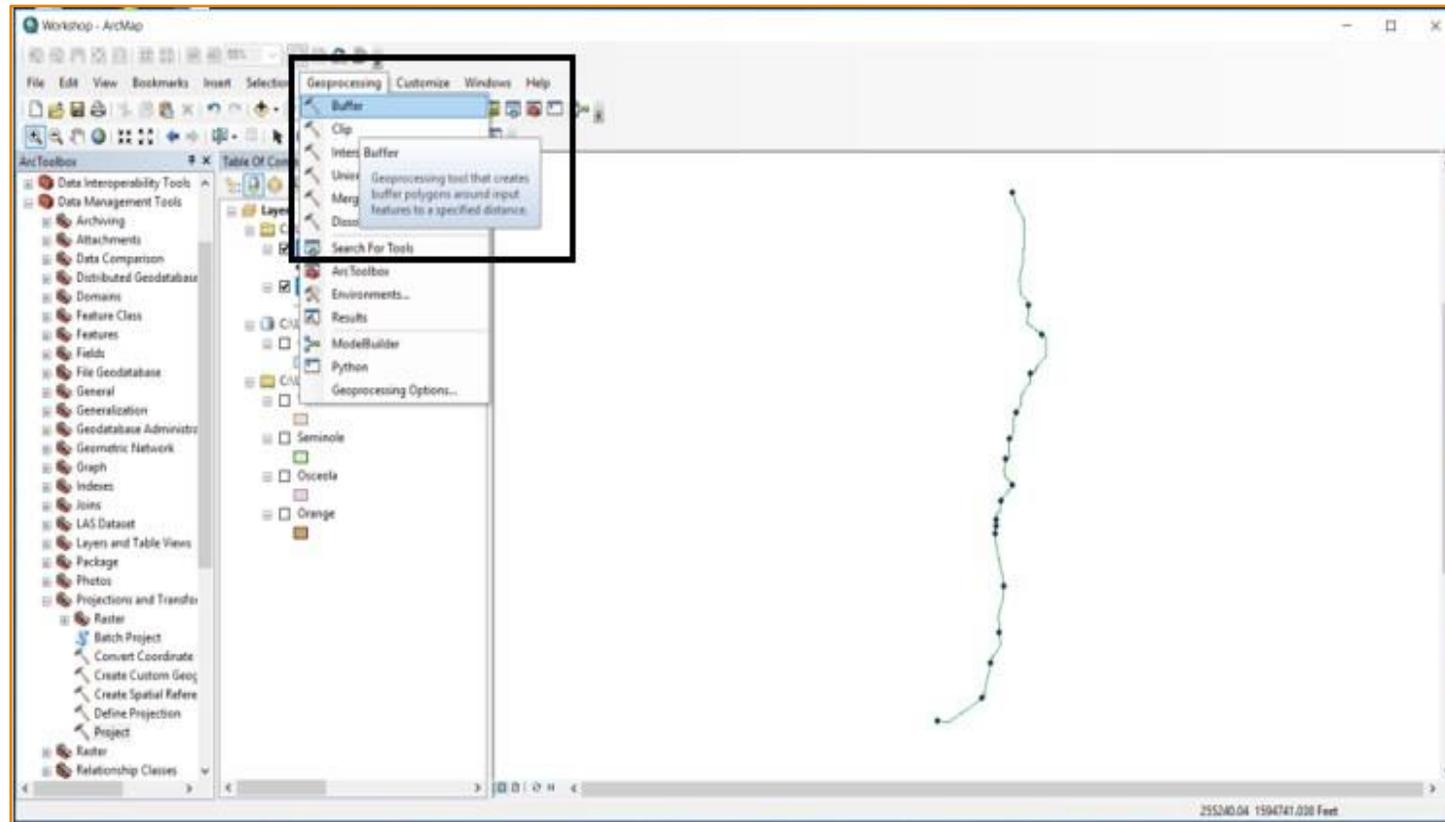
Case Area Selection

- Step 1: Creating Buffer
 - At first, select 'Geoprocessing' toolbar
 - Then click on 'Buffer' option
 - Then put SunRail station's shapefile in 'Buffer' toolbar
 - In 'Linear Unit' option put the numeric value such as 1 and choose mile as unit
 - Select default buffer type 'Round'
 - Finally, click 'Ok'



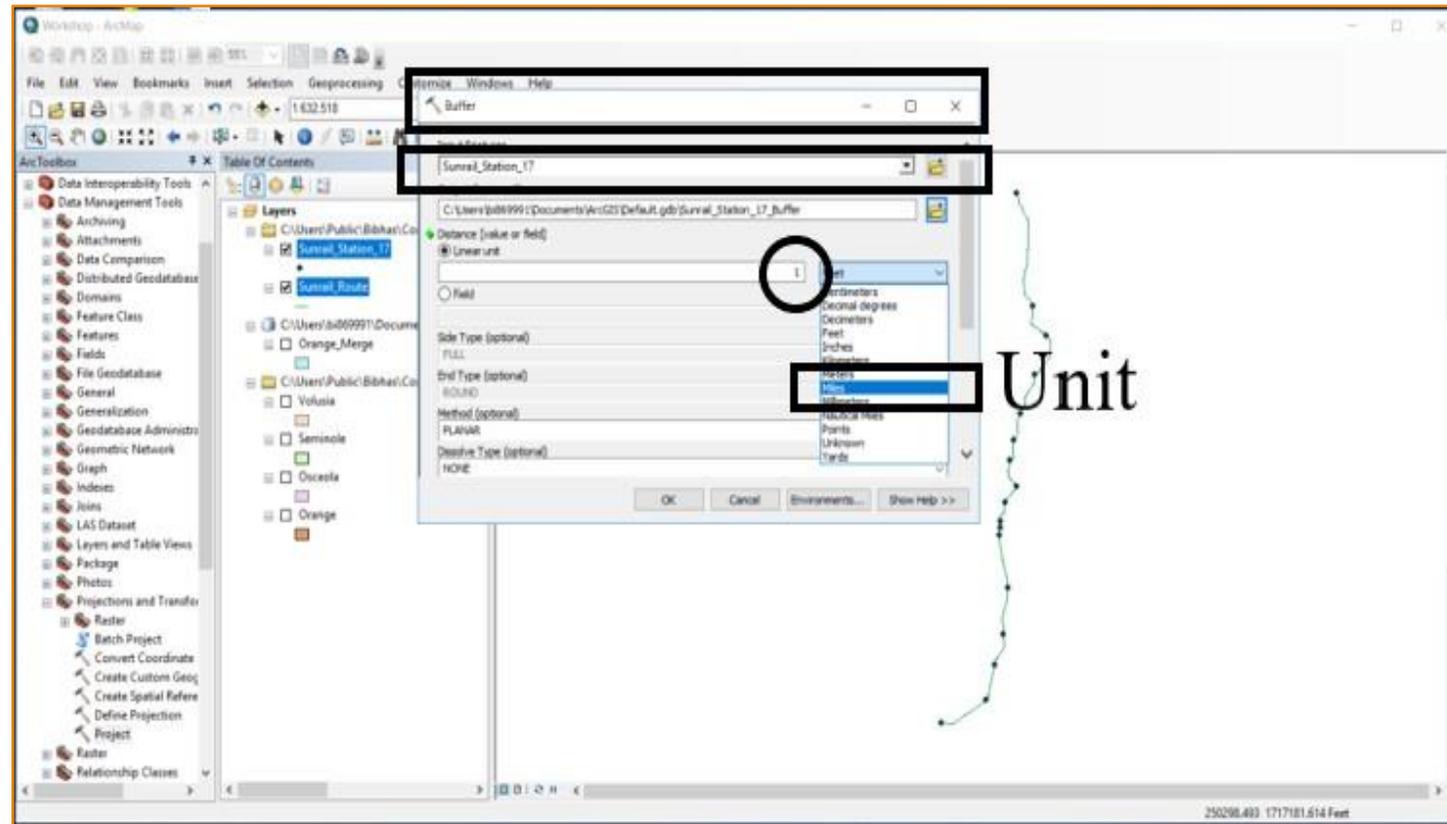
Case Area Selection

- Creating buffer area (Step 1):



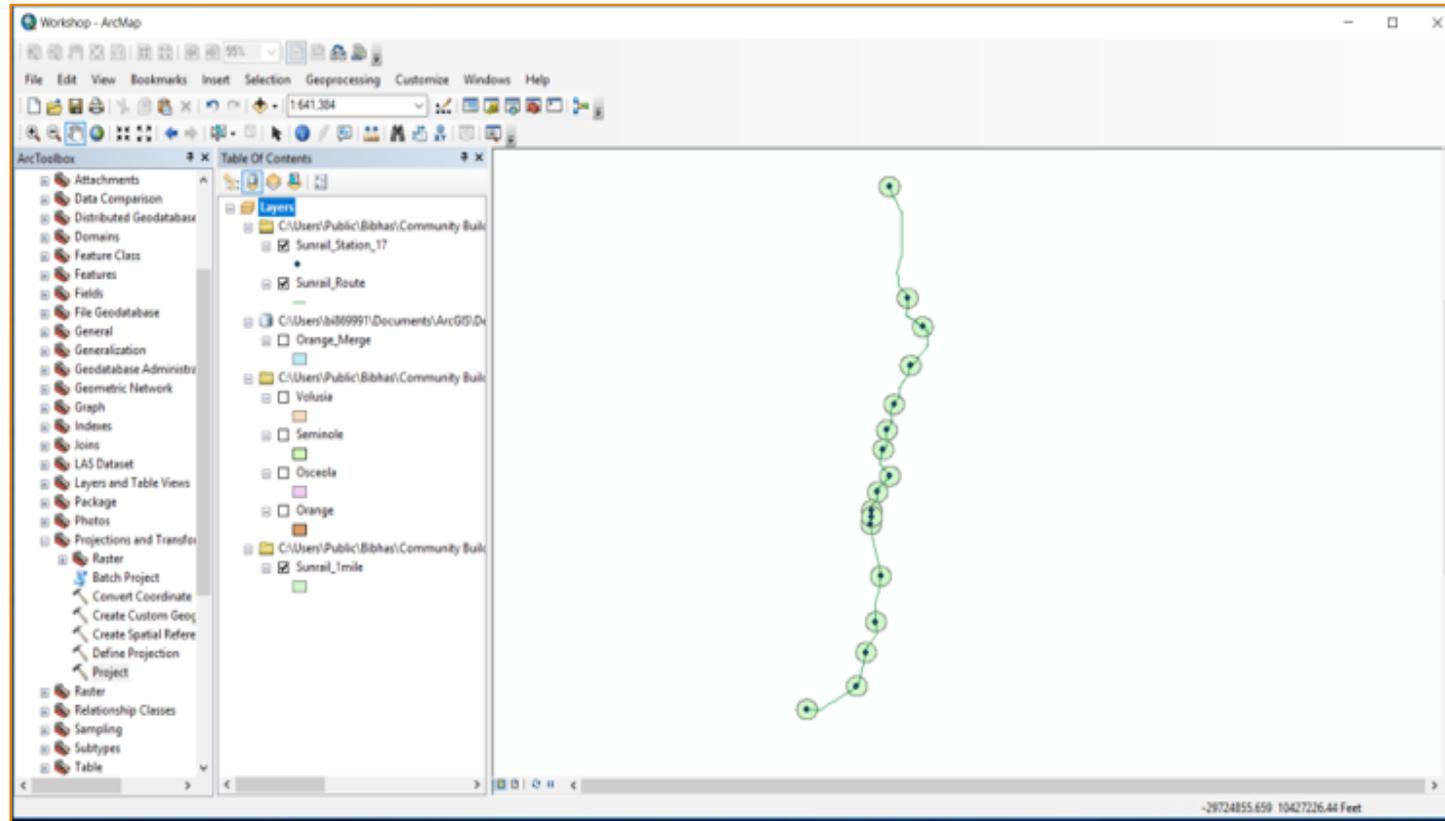
Case Area Selection

- Creating buffer area (Step 2):



Case Area Selection

- Creating buffer area (Step 3):

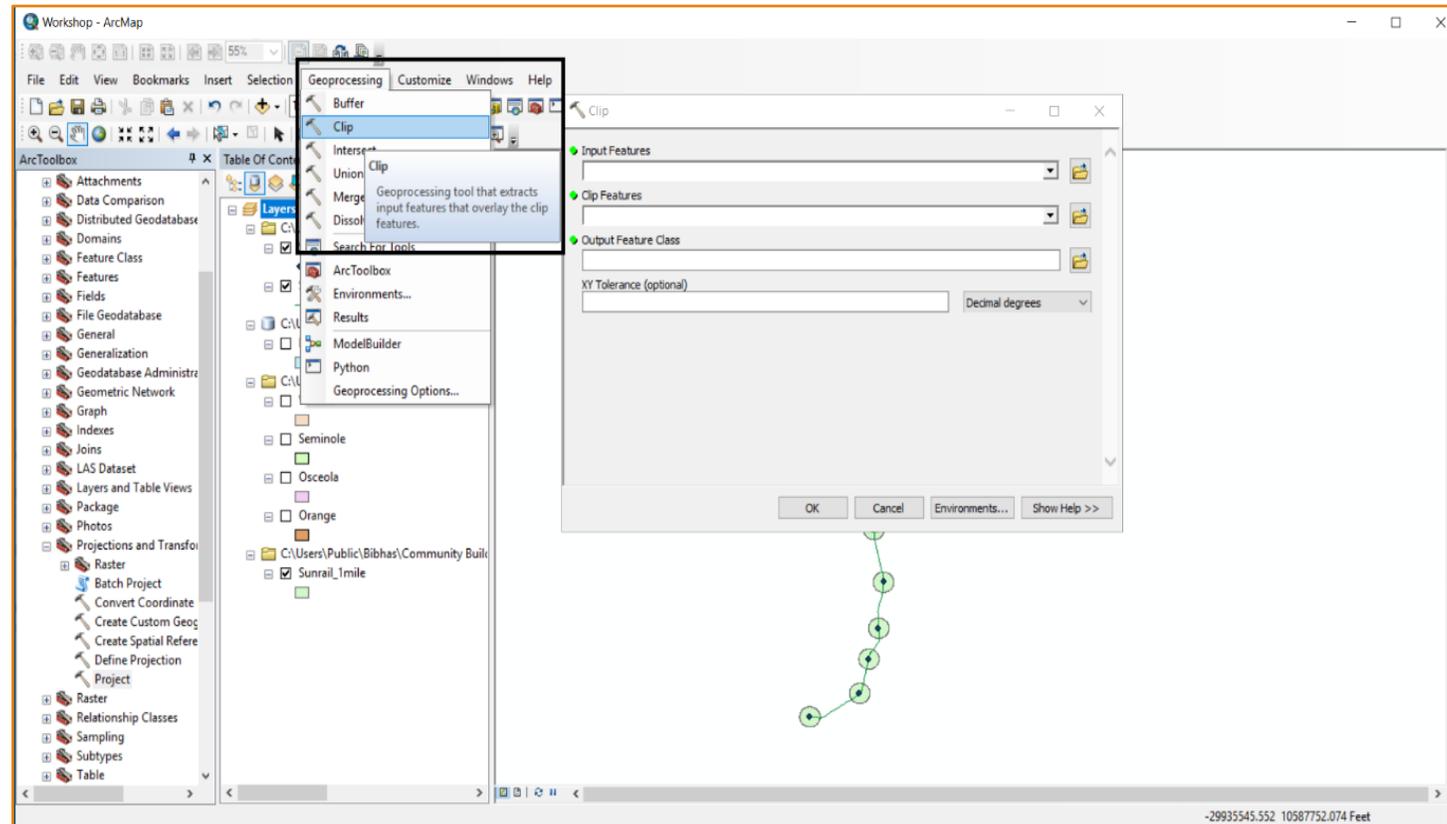


Case Area Selection

- Step 2: Clip the buffers with merge counties
 - At first, select 'Geoprocessing' toolbar
 - Then click on 'Clip' option
 - In 'Input Features' section put Merge counties
 - Upload SunRail buffer created in previous step on 'Clip Features' section
 - Finally, a new buffer layer was created contains corresponding parcel level information such property value, land use type, area etc.

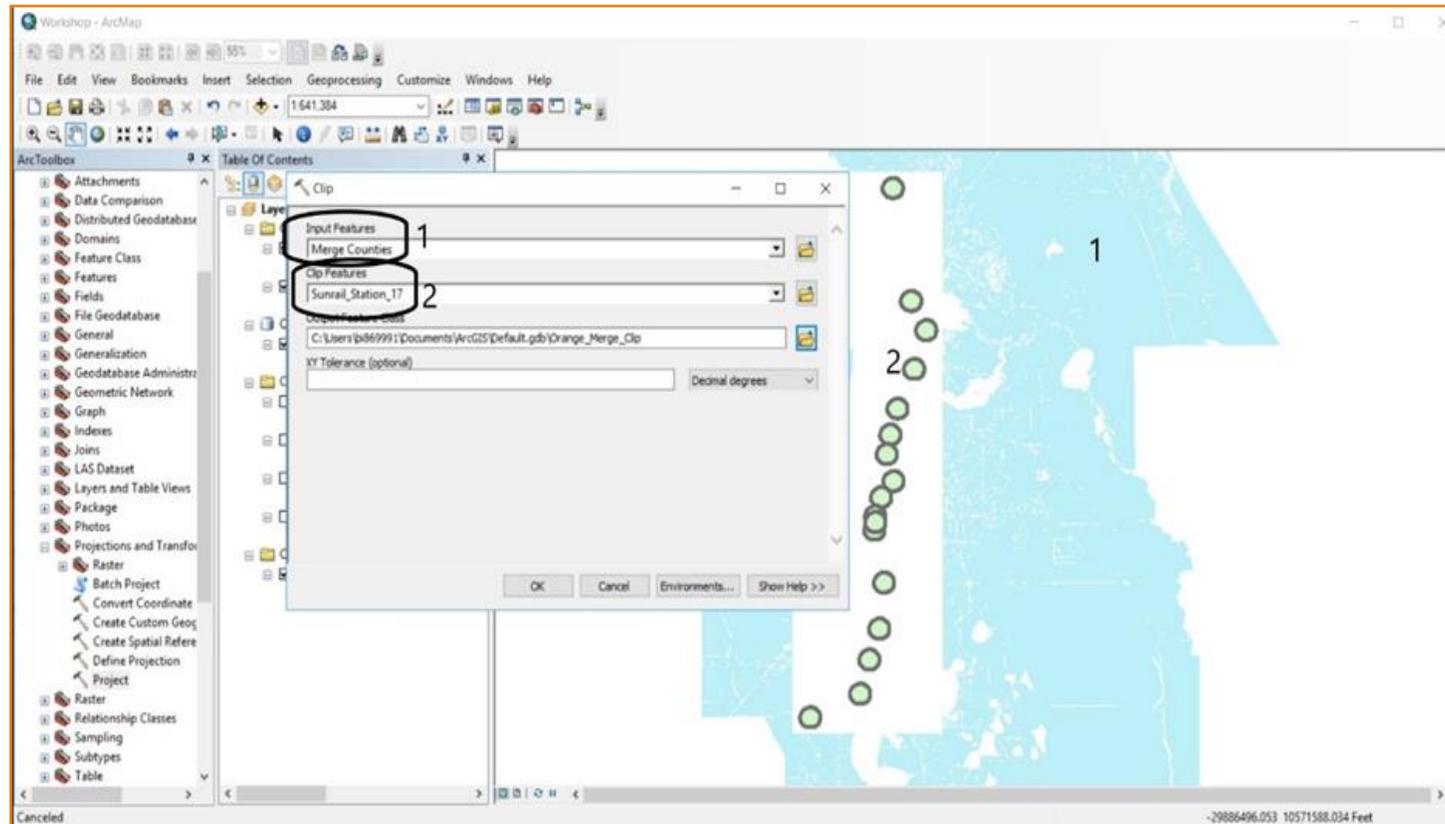
Case Area Selection

- Clip from merge counties (Step 1):



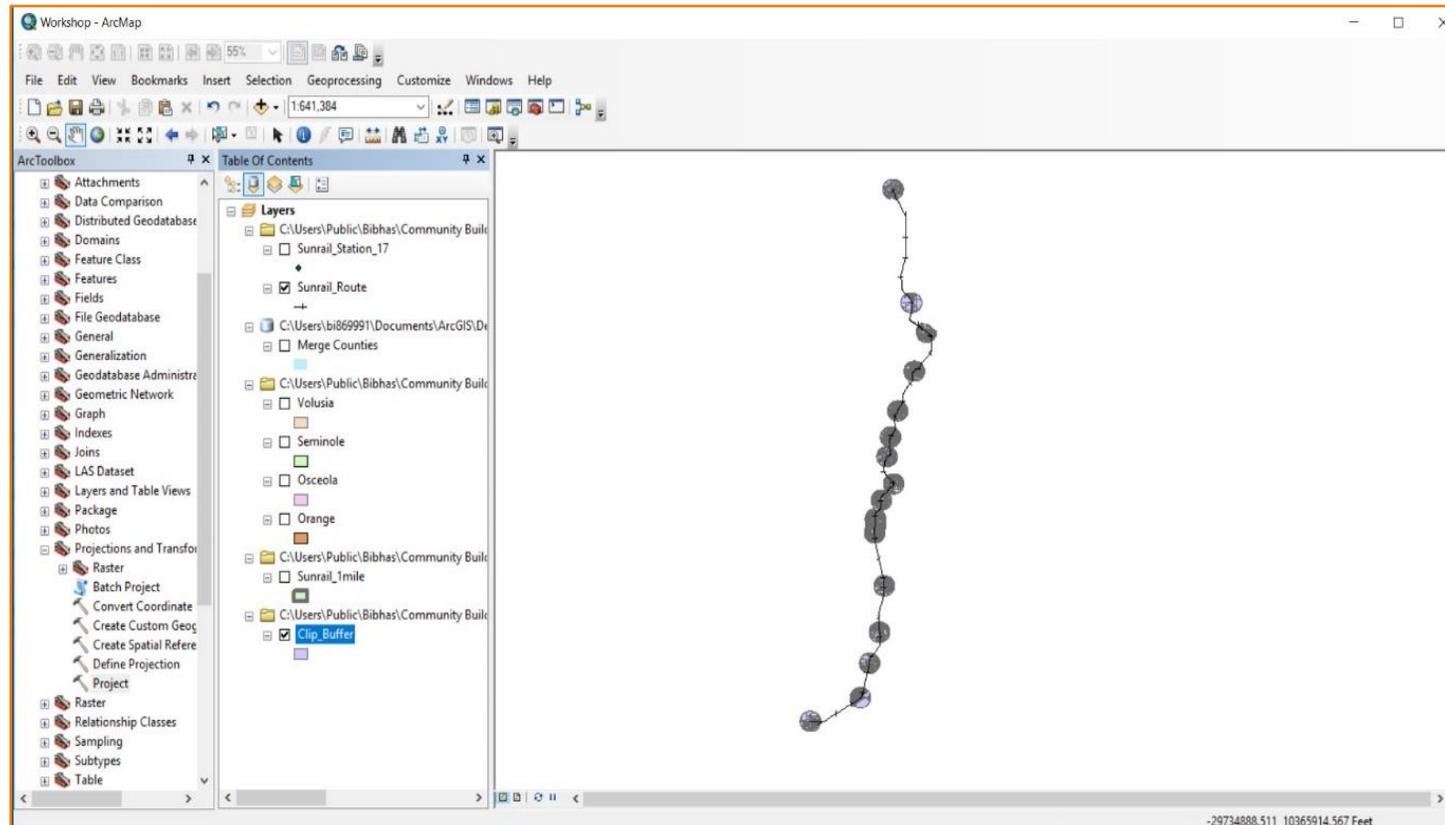
Case Area Selection

- Clip from merge counties (Step 2):



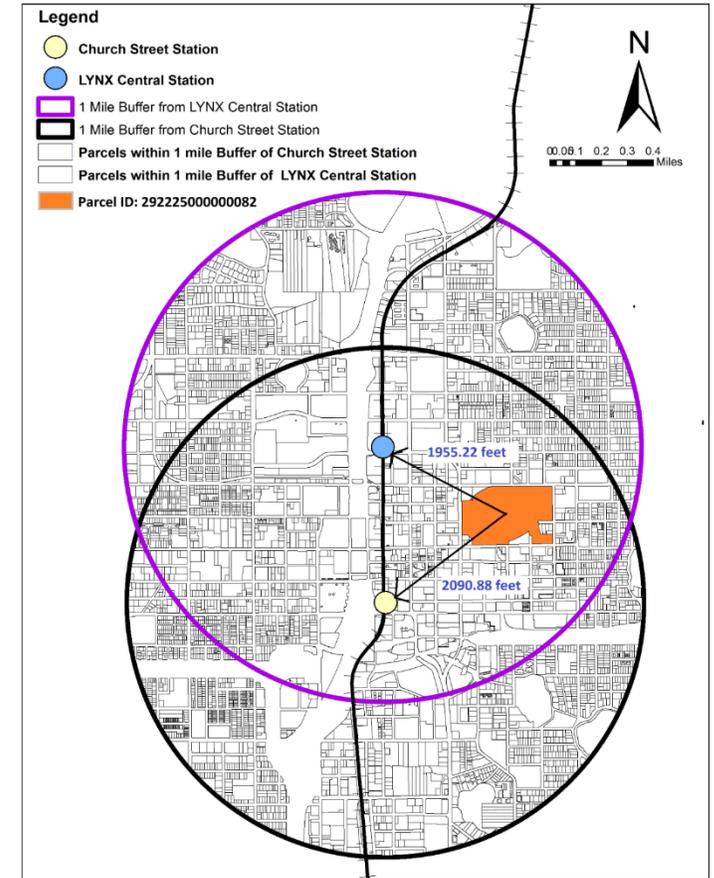
Case Area Selection

- Clip from merge counties (Step 3):



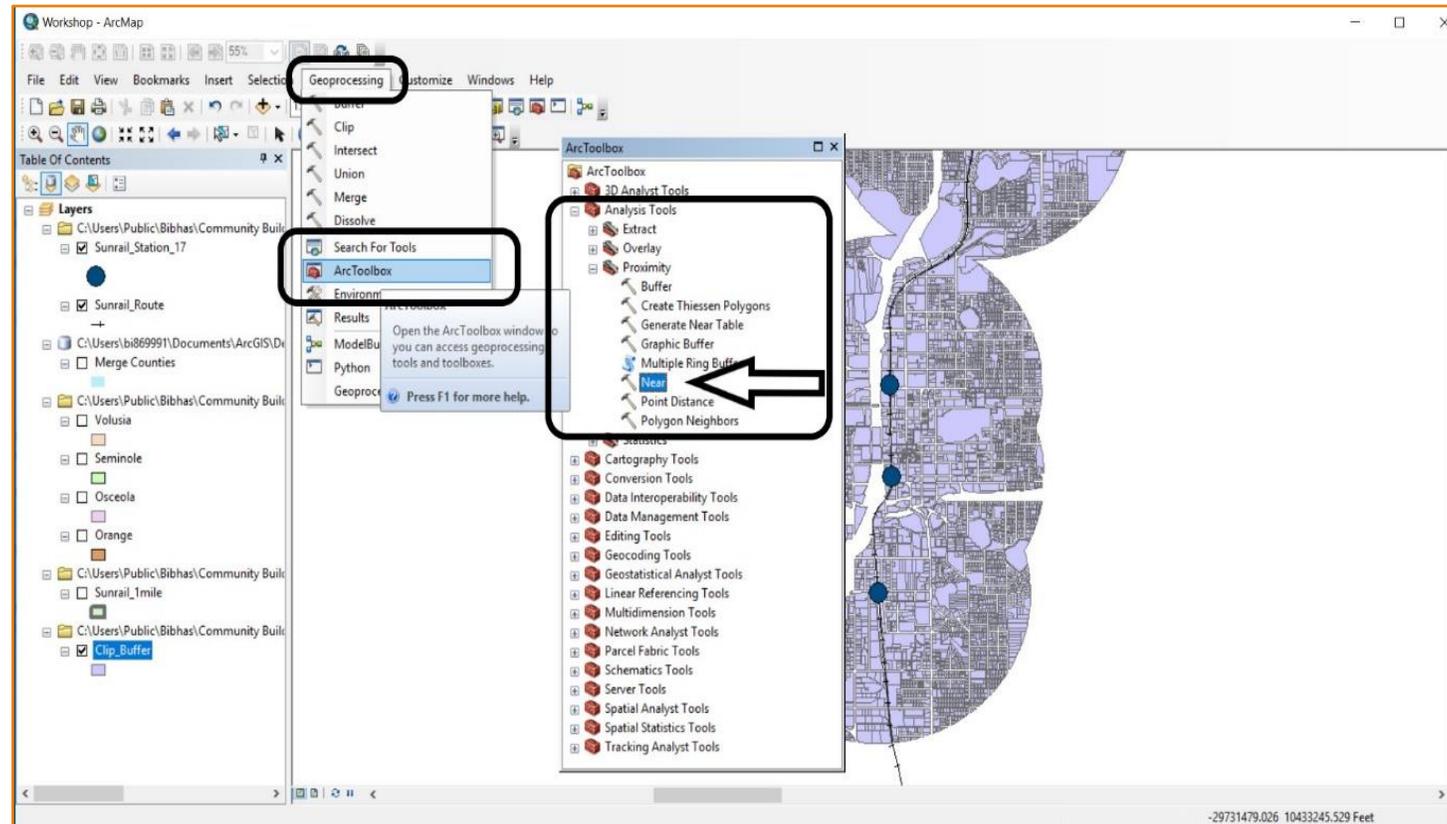
Proximity Analysis

- Clip the buffers with merge counties
 - 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.



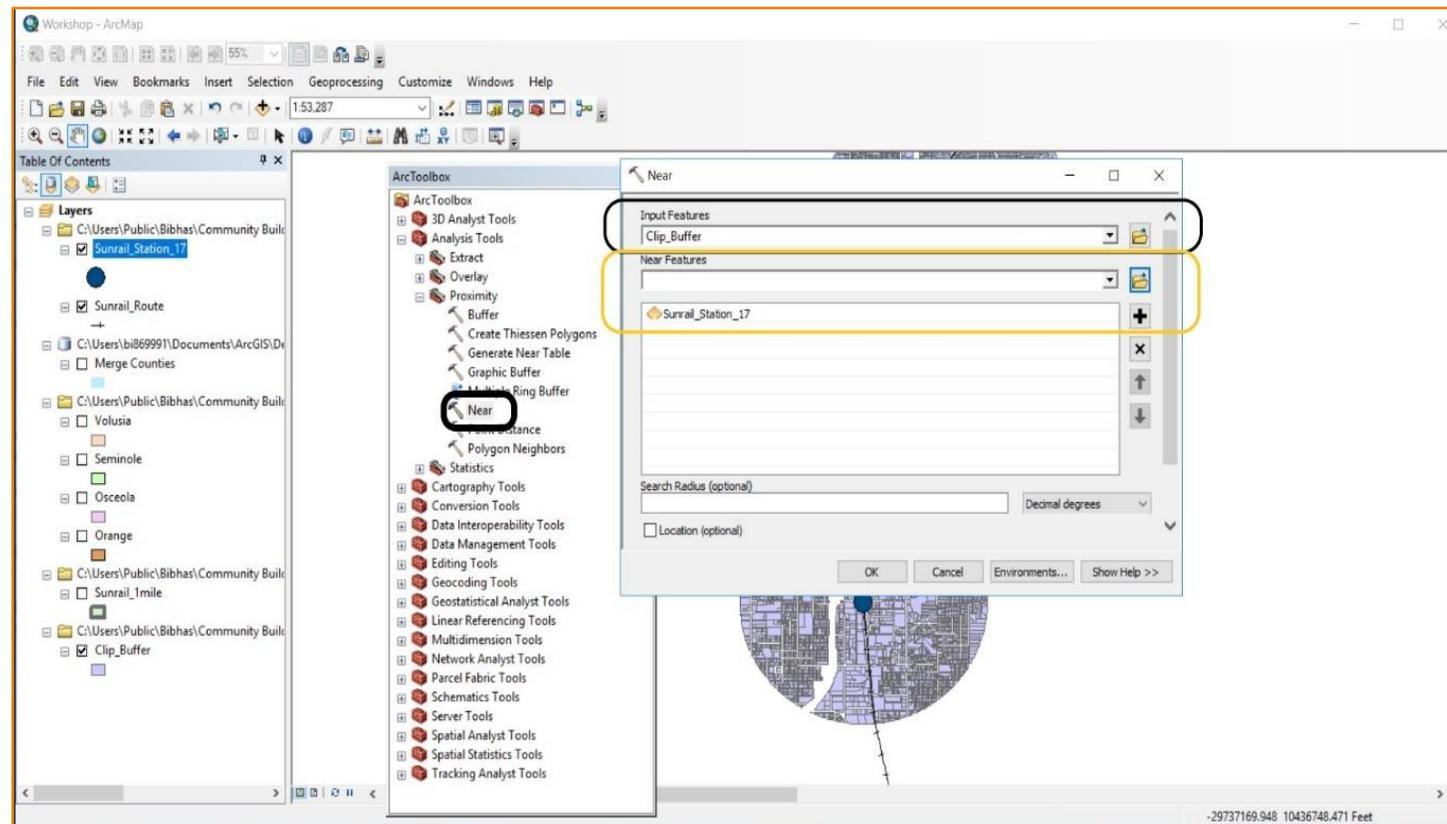
Proximity Analysis

- Finding nearest station (Step 1):



Proximity Analysis

- Finding nearest station (Step 2):



Proximity Analysis

- Finding nearest station (Step 3):

IN_FID = Parcel/Object ID
NEAR_FID = Station ID
NEAR_DIST = Estimated Nearest Station Distance from Parcel

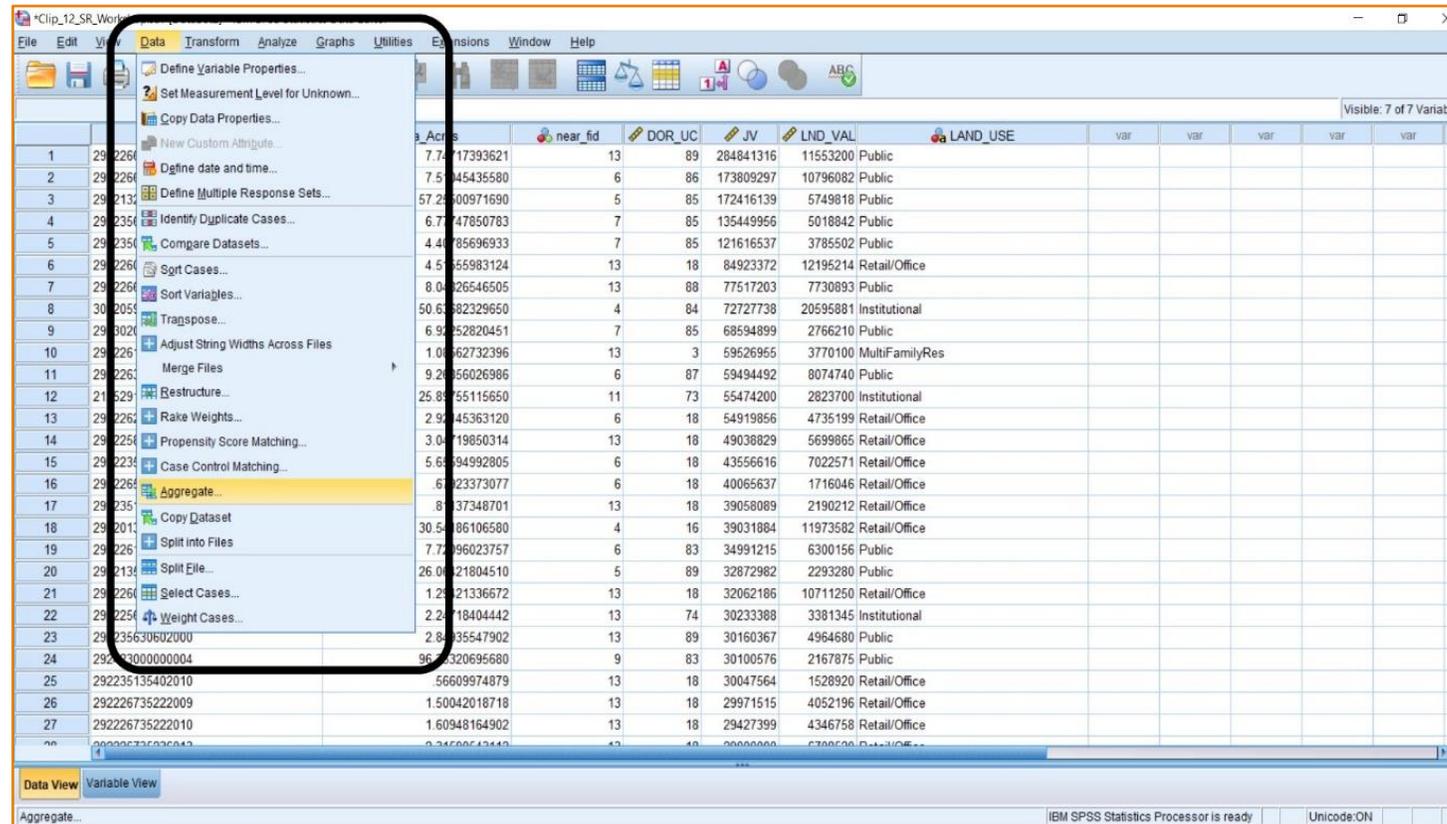
Shape_Leng	Shape_Area	OBJECTID	IN_FID	NEAR_FID	NEAR_DIST
200.69041	2021.326213	1	1	13	3961.34614
270.883203	3970.18049	2	2	13	3753.00505
270.842836	3969.312434	3	3	13	3795.74192
270.803496	3968.471714	4	4	13	3838.48249
270.845045	3969.405757	5	5	13	3808.37399
287.962611	4762.131734	6	6	13	3850.97162
292.169737	4959.512348	7	7	13	3953.23315
270.885451	3520.287361	8	8	13	3778.03669
270.846401	3969.464808	9	9	13	3820.48652
287.96358	4762.195791	10	10	13	3862.94770
287.916646	4760.993981	11	11	13	3913.91331
270.88707	3970.364545	12	12	13	3797.68355
270.807975	3968.667781	13	13	13	3882.15431
260.67523	3501.057501	14	14	13	3924.41148
281.716966	4930.74731	15	15	13	3961.70901
271.964403	4230.984642	16	16	13	3973.18574
270.809369	3968.719691	17	17	13	3899.14028
195.583344	2138.129458	18	18	13	3988.67301
135.622498	1134.336637	19	19	13	4021.99627
352.691451	5916.574851	20	20	13	3905.27393
352.553291	5913.475233	21	21	13	3992.99157
190.270482	2256.42944	22	22	13	4036.89072
252.353178	3655.467474	23	23	13	4048.3222
307.891295	4901.523756	24	24	13	3894.10338
304.962617	4840.617328	25	25	13	3937.64456

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
 - Put 'Land Use Type' as break variable
 - For 'Summary of Variables' section choose JV as property value and Area (Acres)
 - Also change the 'Function' option from default 'Mean' to 'Sum'

Property Value Estimation

- Property Value Estimation (Step 1):



Property Value Estimation

- Property Value Estimation (Step 2):

Estimate Total Land Use Value and Acres by Land Use Type

ParcelNo	Area_Acres
292226630501000	7.7471735
292226621900010	7.5104543
292213278001000	57.2550097
292235640300010	6.7774785
292235019700010	4.4078565
292226002700050	4.5155596
292226631700010	8.0482654
302205940063010	50.6368232
292302030000010	6.9225282
292226133500020	1.0856273
292226308404010	9.2685602
2125291874000100	25.8975511
292226226300020	2.9214536
292225814600021	3.0471985
292223564001001	5.6559495
292226509101000	.6792337
292235135402030	.8113734
292201366401001	30.5418610
292226160605011	7.7209602
292213513200001	26.0642180
292226002700030	1.2942133
292225617101000	2.2471840
292235630602000	2.8493554
292423000000004	96.3532065
292235135402010	.5660997
292226735222009	1.5004201
292226735222010	1.60948164902

Property Value Estimation

- Property Value Estimation (Step 3):

The screenshot displays the IBM SPSS Statistics Data Editor interface. The main window shows a data table with columns 'ParcelNo' and 'Area_Acres'. The 'Aggregate Data' dialog box is open, showing the following configuration:

- Break Variable(s):** LAND_USE, near_fid (indicated by a black arrow pointing to the 'near_fid' variable).
- Aggregated Variables:** Summaries of variables(s): JV_sum = SUM(JV), Area_Acres_sum = SUM(Area_Acres).
- Save:** Create a new dataset containing only the aggregated variables. Dataset name: b.
- Options for Very Large Datasets:** File is already sorted on break variable(s), Sort file before aggregating.

The dialog box also includes buttons for 'OK', 'Paste', 'Reset', 'Cancel', and 'Help'. The status bar at the bottom indicates 'IBM SPSS Statistics Processor is ready' and 'Unicode:ON'.

Property Value Estimation

○ Property Value Estimation:

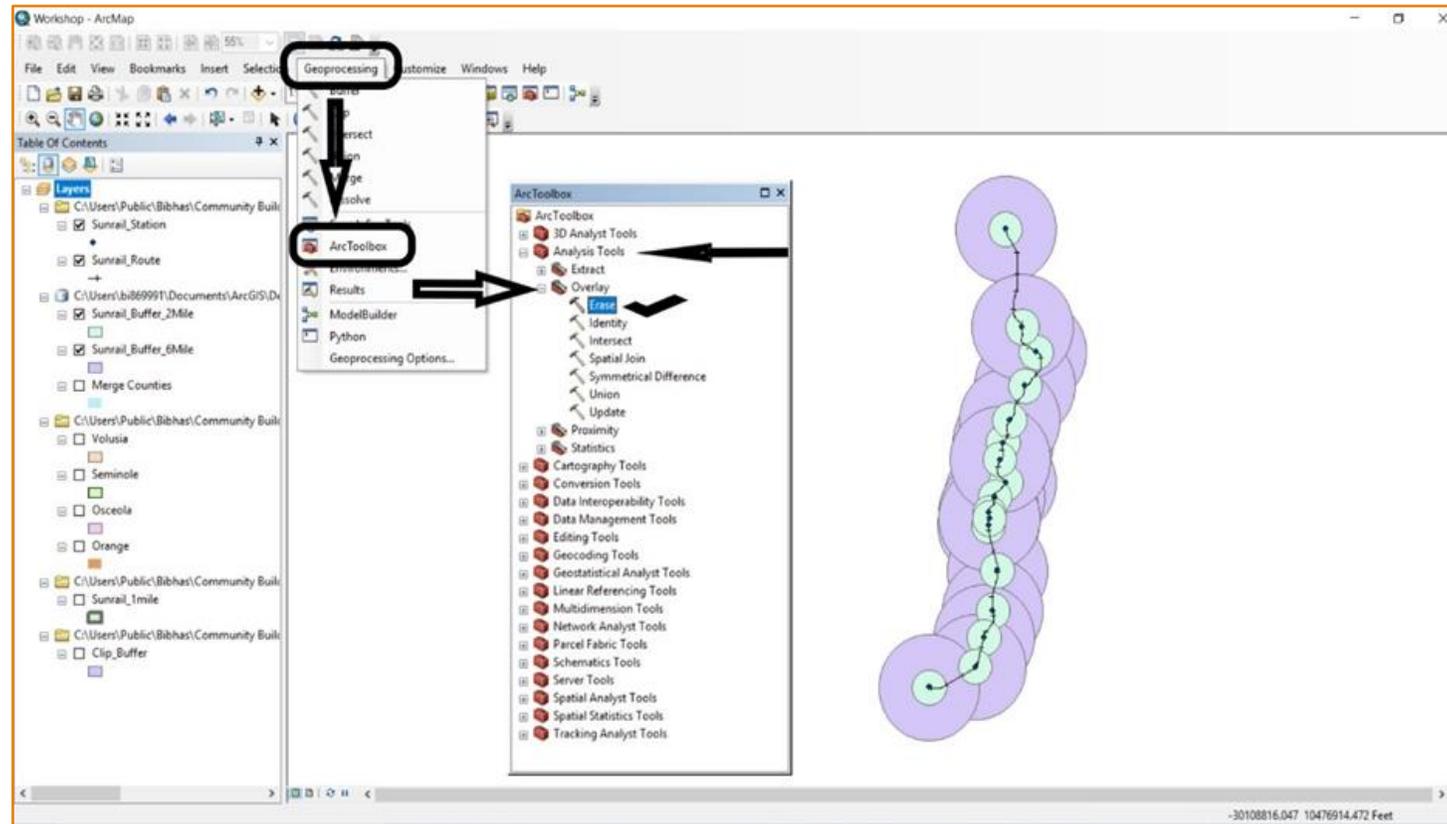
Station	Single Family Residential (USD)	Multi- Family Residential (USD)	Retail/Office (USD)	Industrial (USD)	Institutional (USD)
Downtown Stations					
LYNX Central Station	906,590	988,491	1,790,503	630,578	1,462,136
Church Street Station	981,280	2,401,727	5,214,377	281,022	4,683,842
Orlando Amtrak/Sligh Blvd Station	625,409	474,380	1,159,111	419,089	1,492,057

Control Area Selection

- 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.
- Finally, 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.

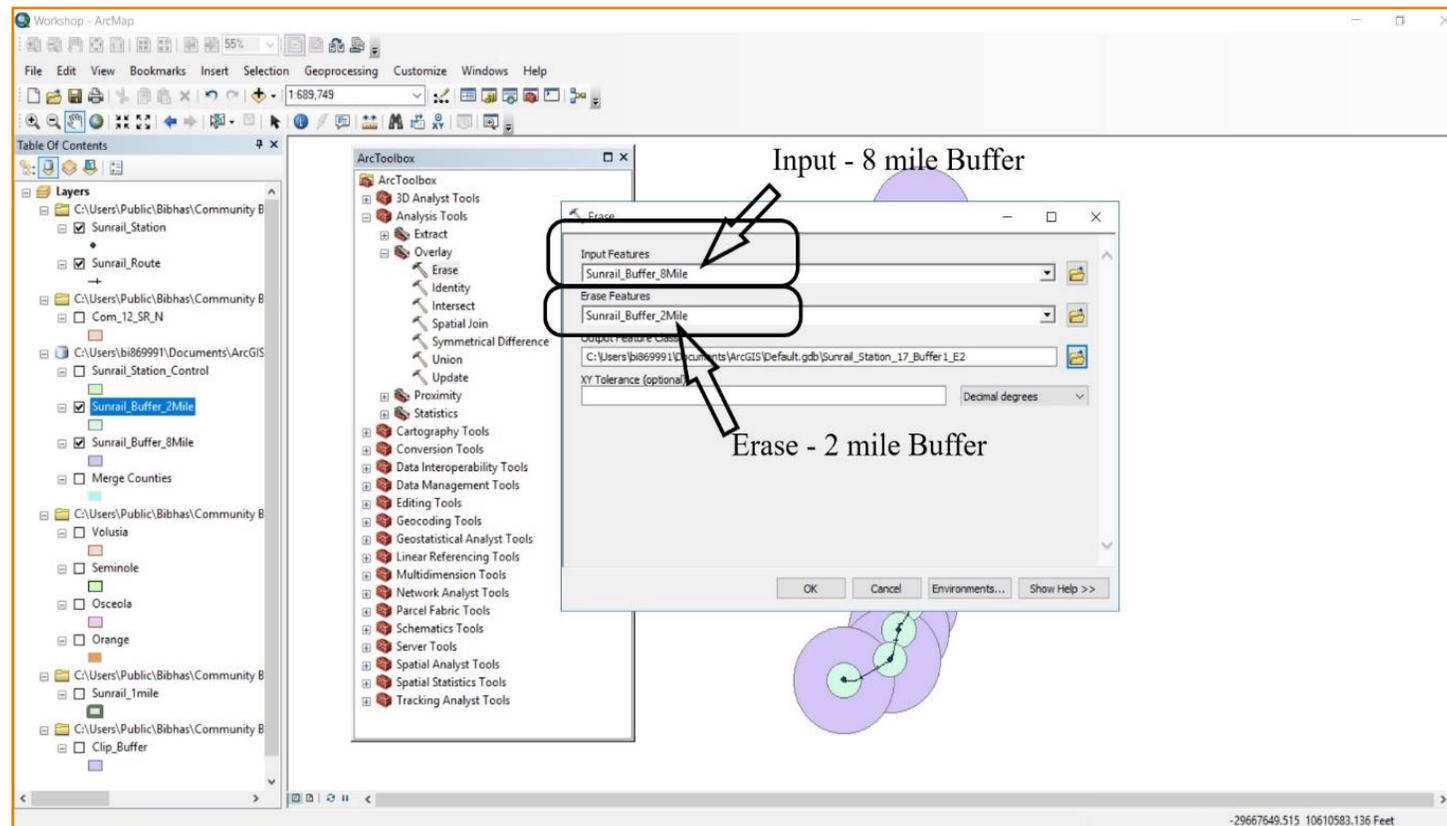
Control Area Selection

- Control Buffer Generation (Step 1):



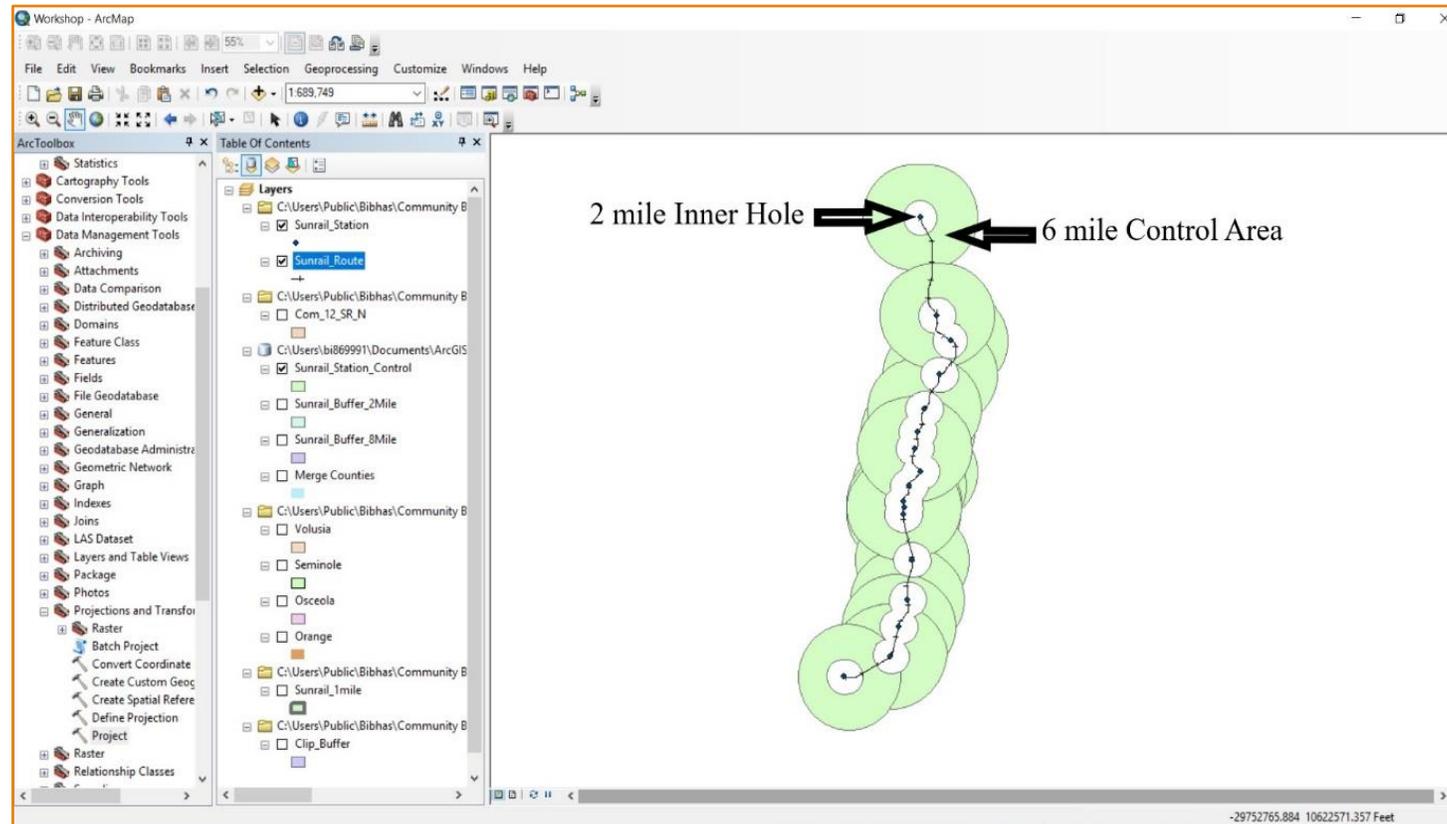
Control Area Selection

- Control Buffer Generation (Step 2):



Control Area Selection

- Control Buffer Generation:



Accessibility to Employment

- Job accessibility can be defined as number of jobs accessible from a desirable point.
- 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.

Case Area Selection

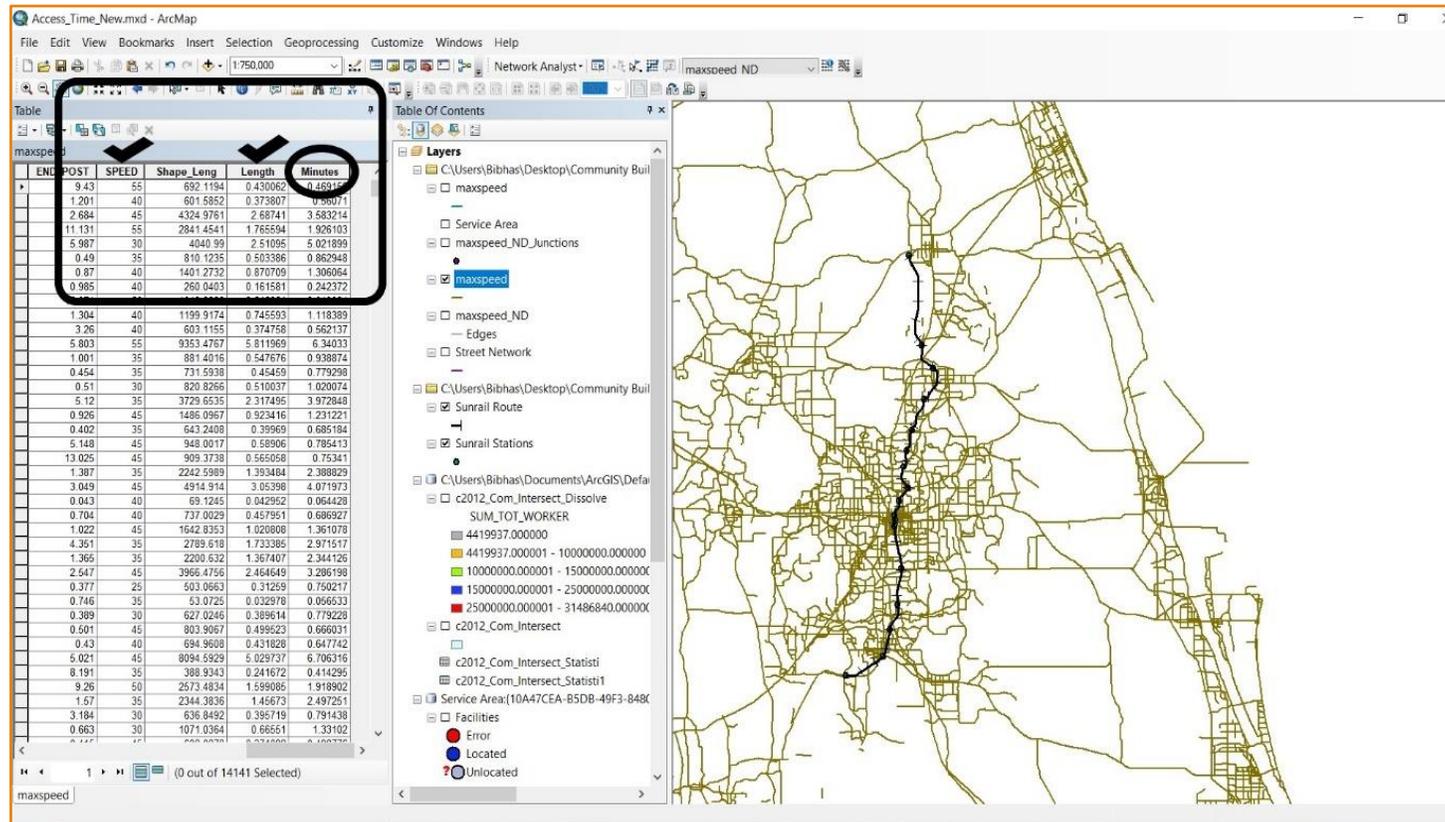
- Job accessibility was computed using jobs accessible within a particular driving distance.
- In our study, we used 10 minutes' drive time from our origin of interest as the appropriate threshold.
- The driving distance was computed using weekday peak period (8am on Tuesday).
- Street network of Florida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

Case Area Selection

- 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'.

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

Case Area Selection

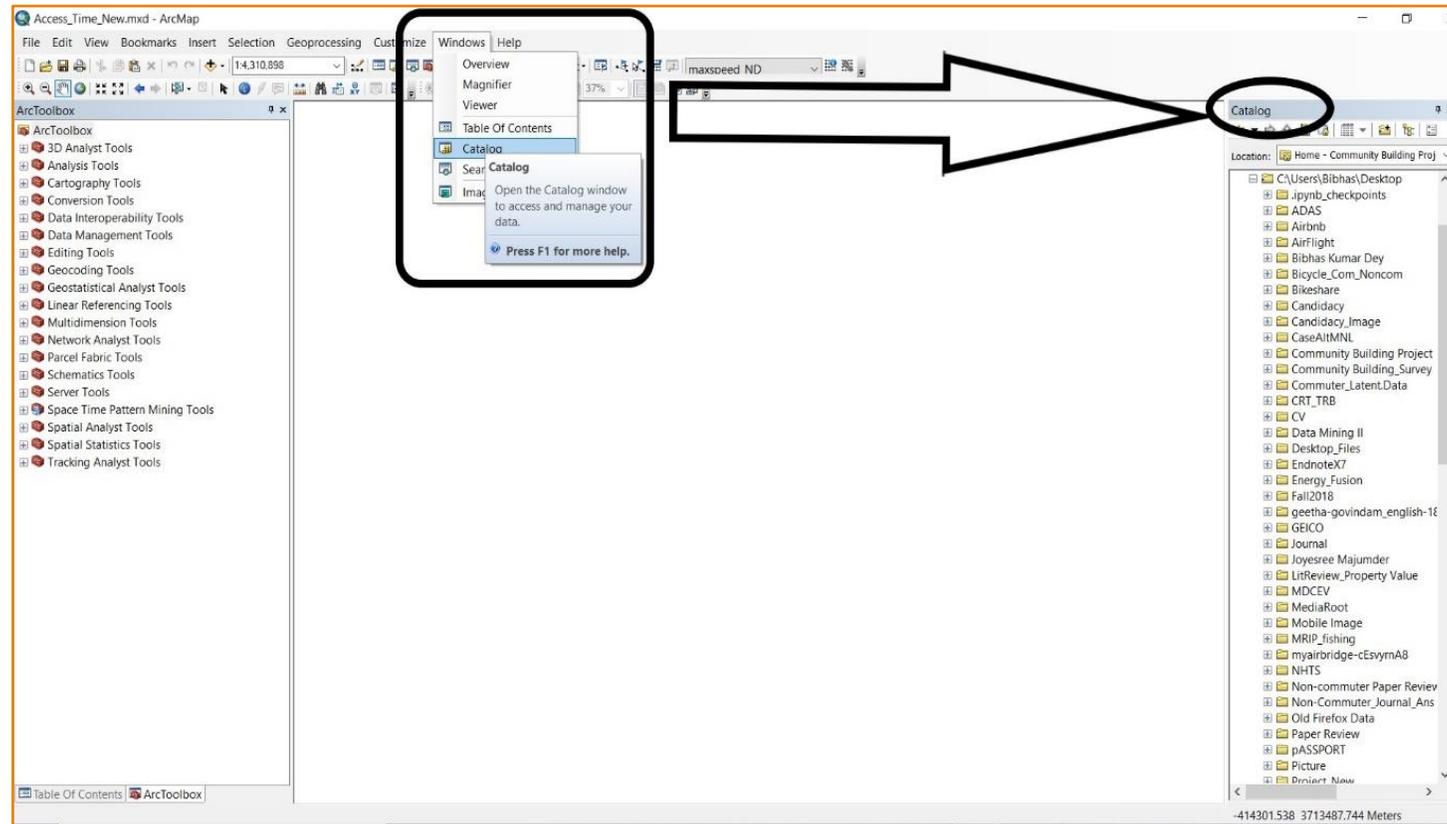


Creating Road Network

- Several steps were followed to create 'Road Network' by using Network Analyst tool on ArcGIS
 - Select 'Catalog' from 'Windows' toolbar
 - Select Road Network shapefile by using 'Catalog'
 - Click on the 'New Network Dataset' from 'Road Network' file
 - Follow all the required steps
 - All the above steps will create a new road network with 'junction' and 'edges'

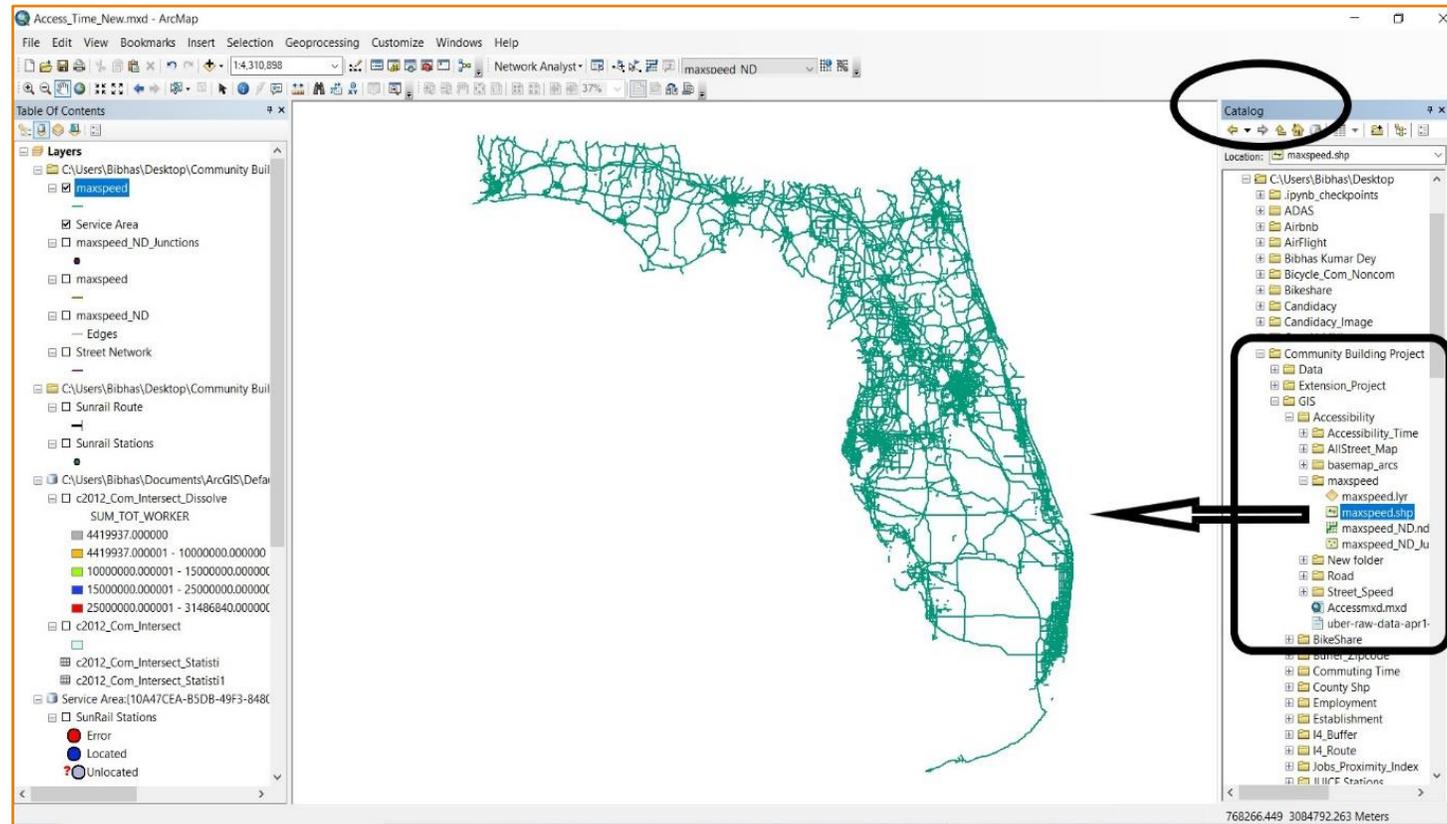
Creating Road Network

- Step 1:



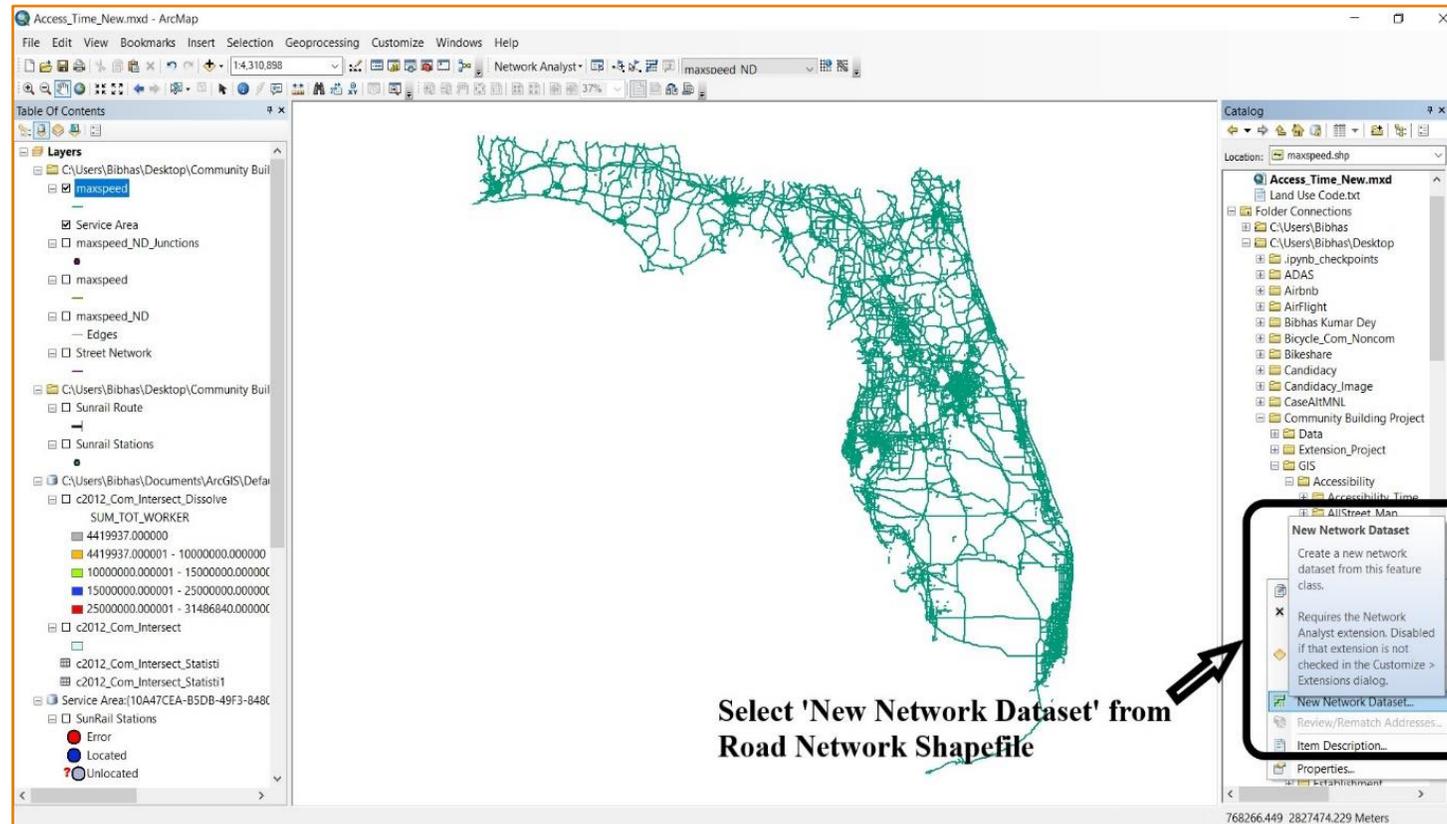
Creating Road Network

- Step 2:



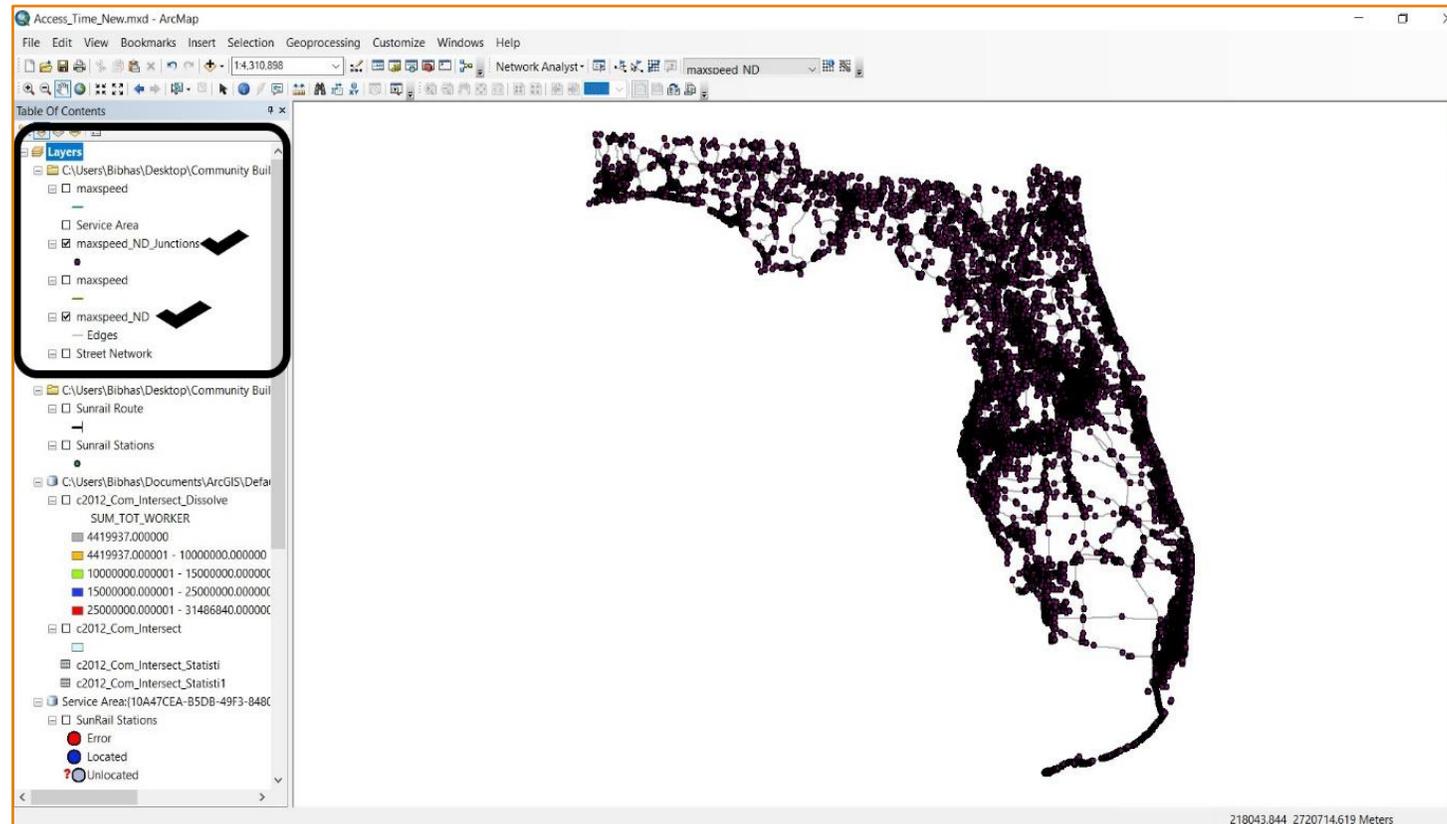
Creating Road Network

○ Step 3:



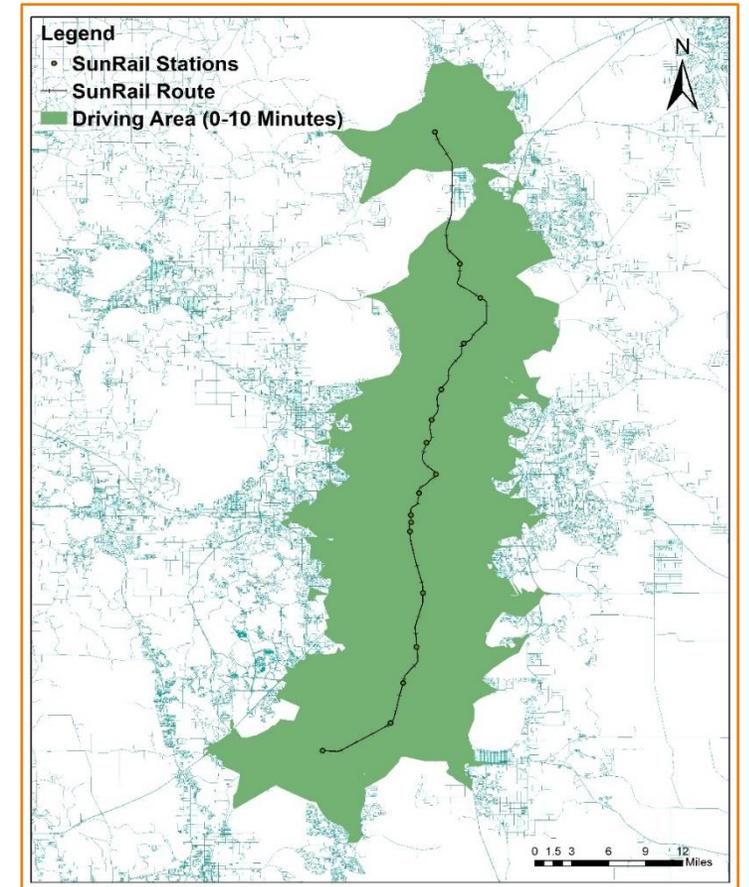
Creating Road Network

- Last Step:



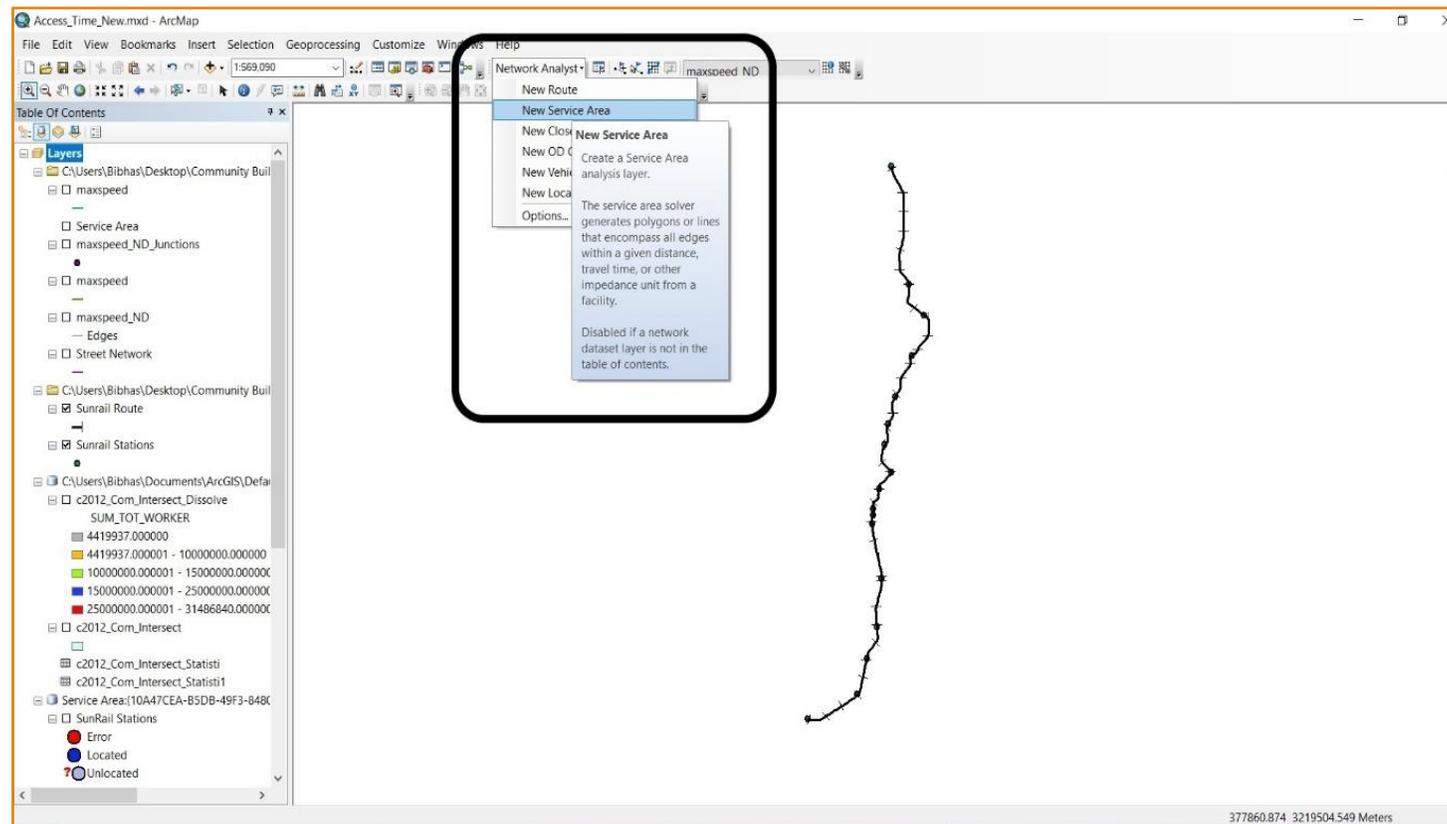
Driving Area

- Several steps were followed to create a 10 minutes driving area by using road network in ArcGIS.
- First, we need to create a new service area.
- Second, load the stations as the facilities.
- Third, we need to edit the properties of the service area.
- Finally, solve and export the 10 minute driving area from ArcGIS.



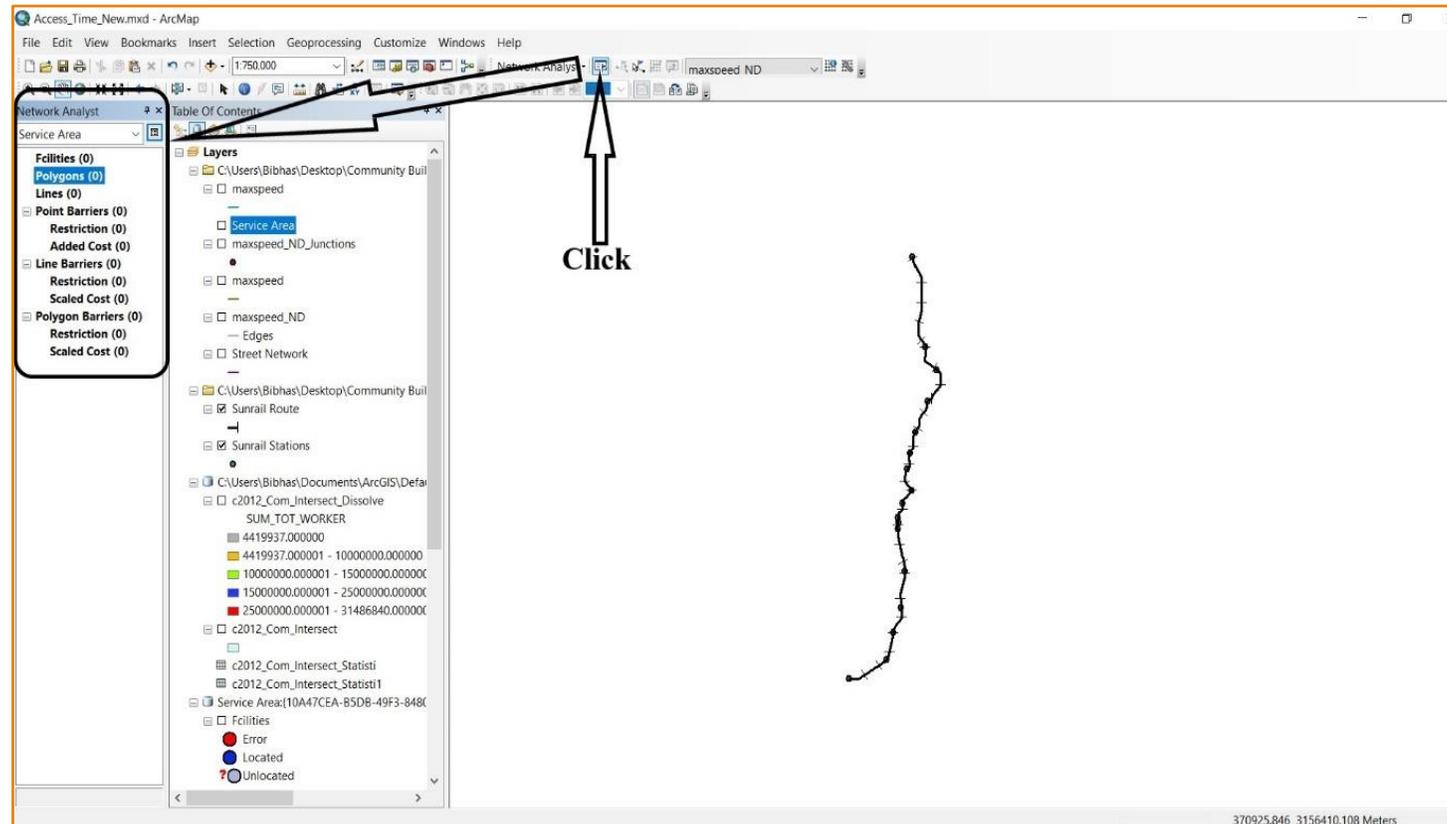
Driving Area

- Step 1:



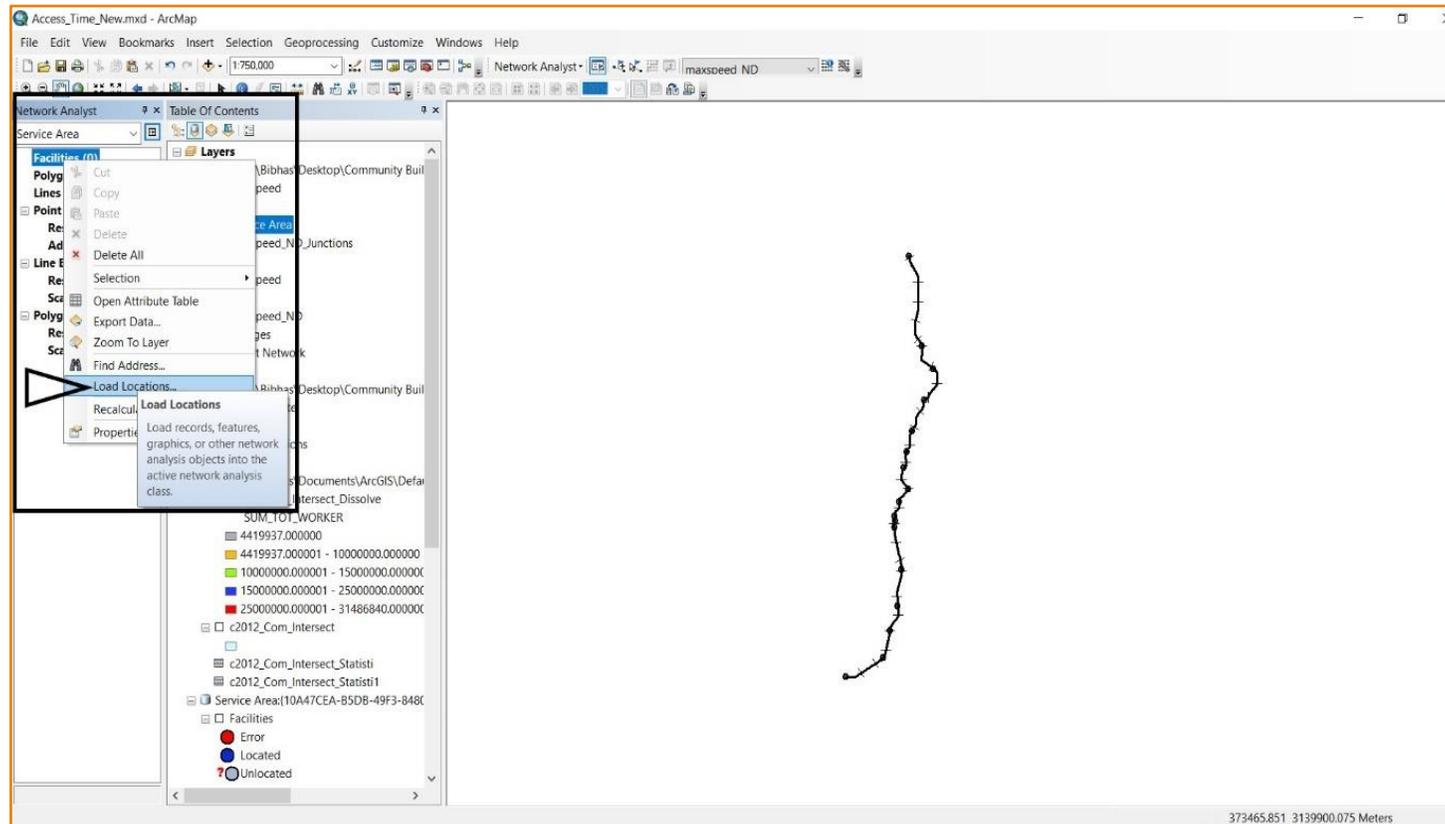
Driving Area

- Step 2:



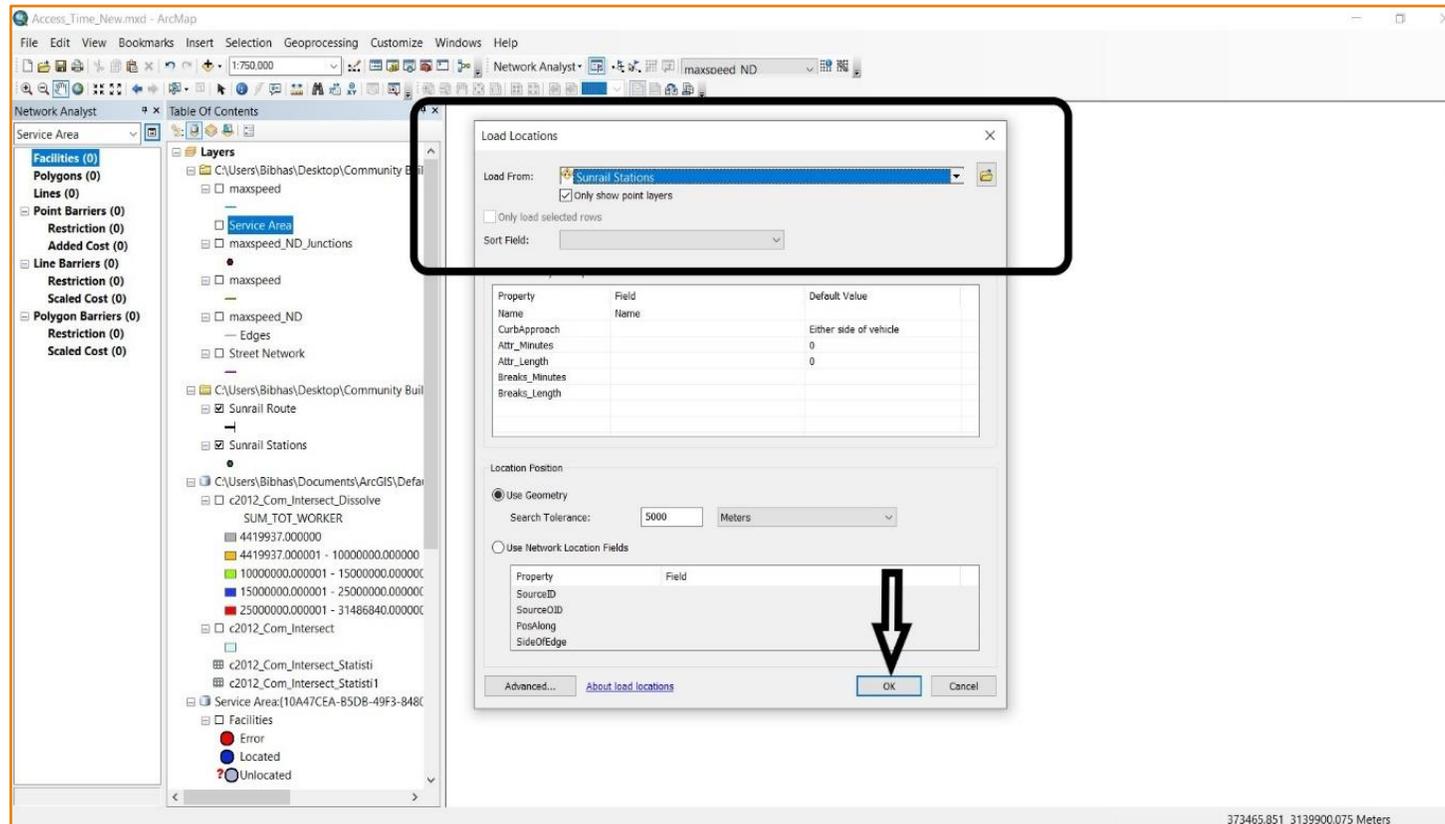
Driving Area

- Step 3:



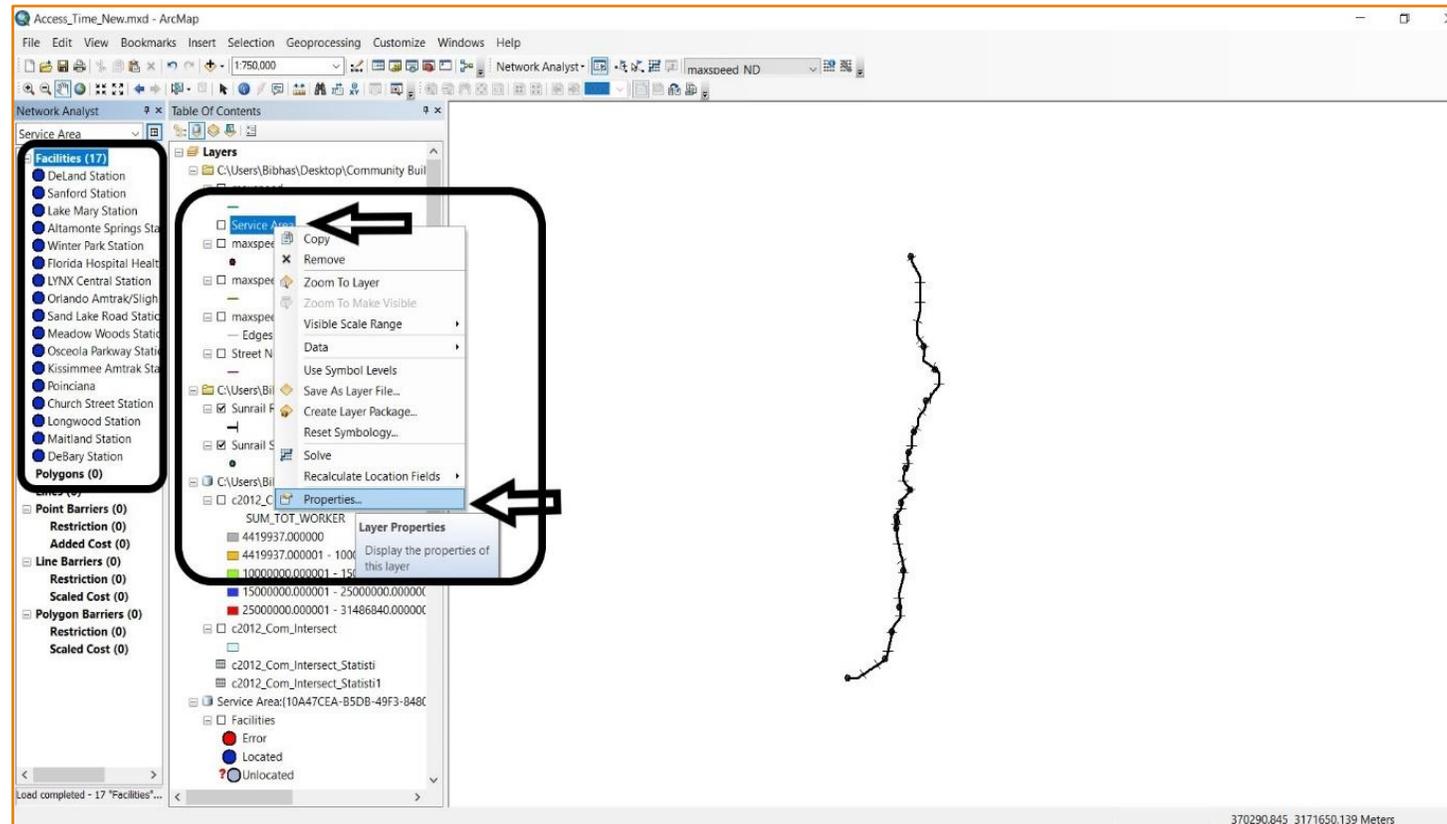
Driving Area

○ Step 4:



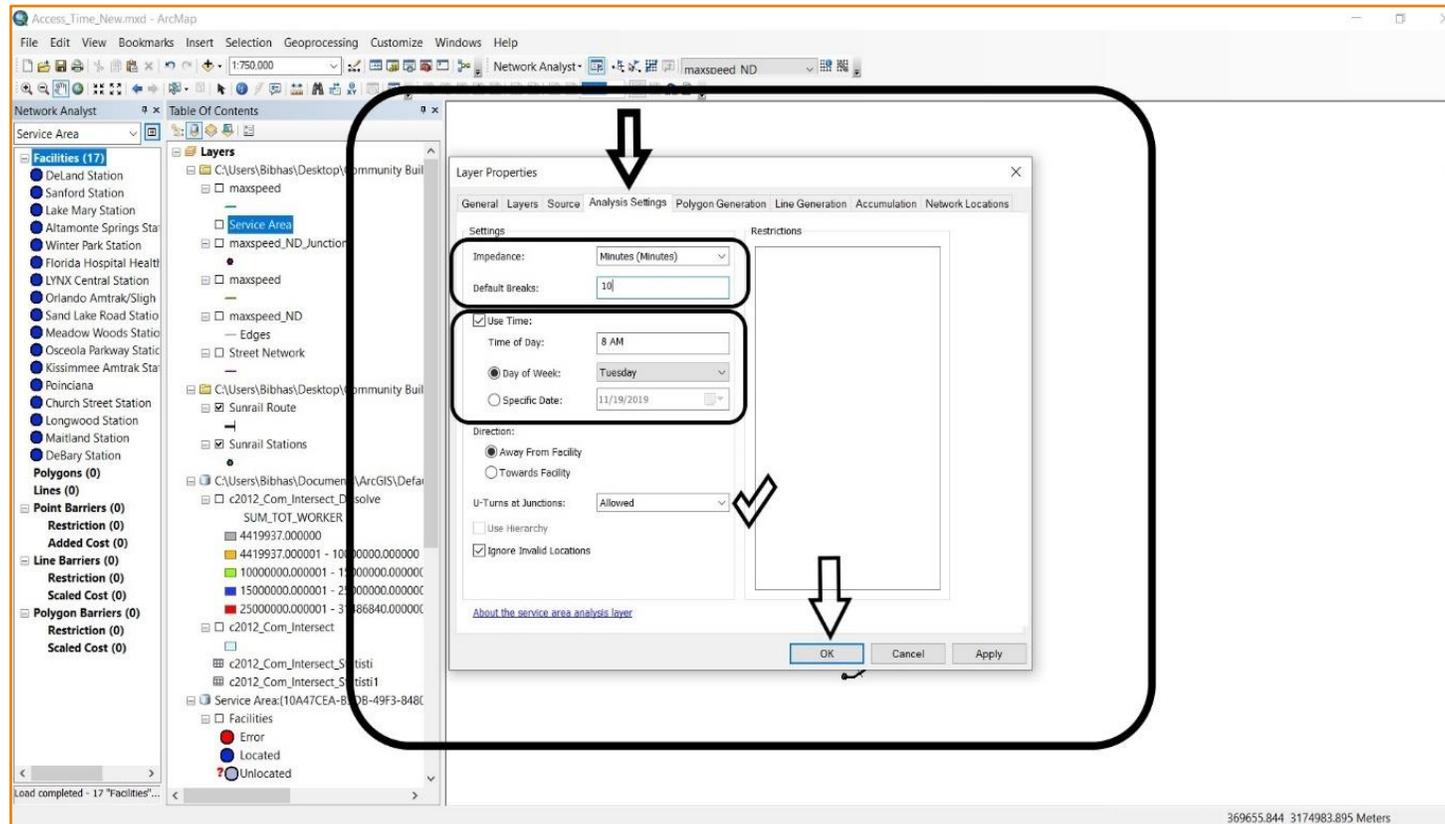
Driving Area

- Step 5:



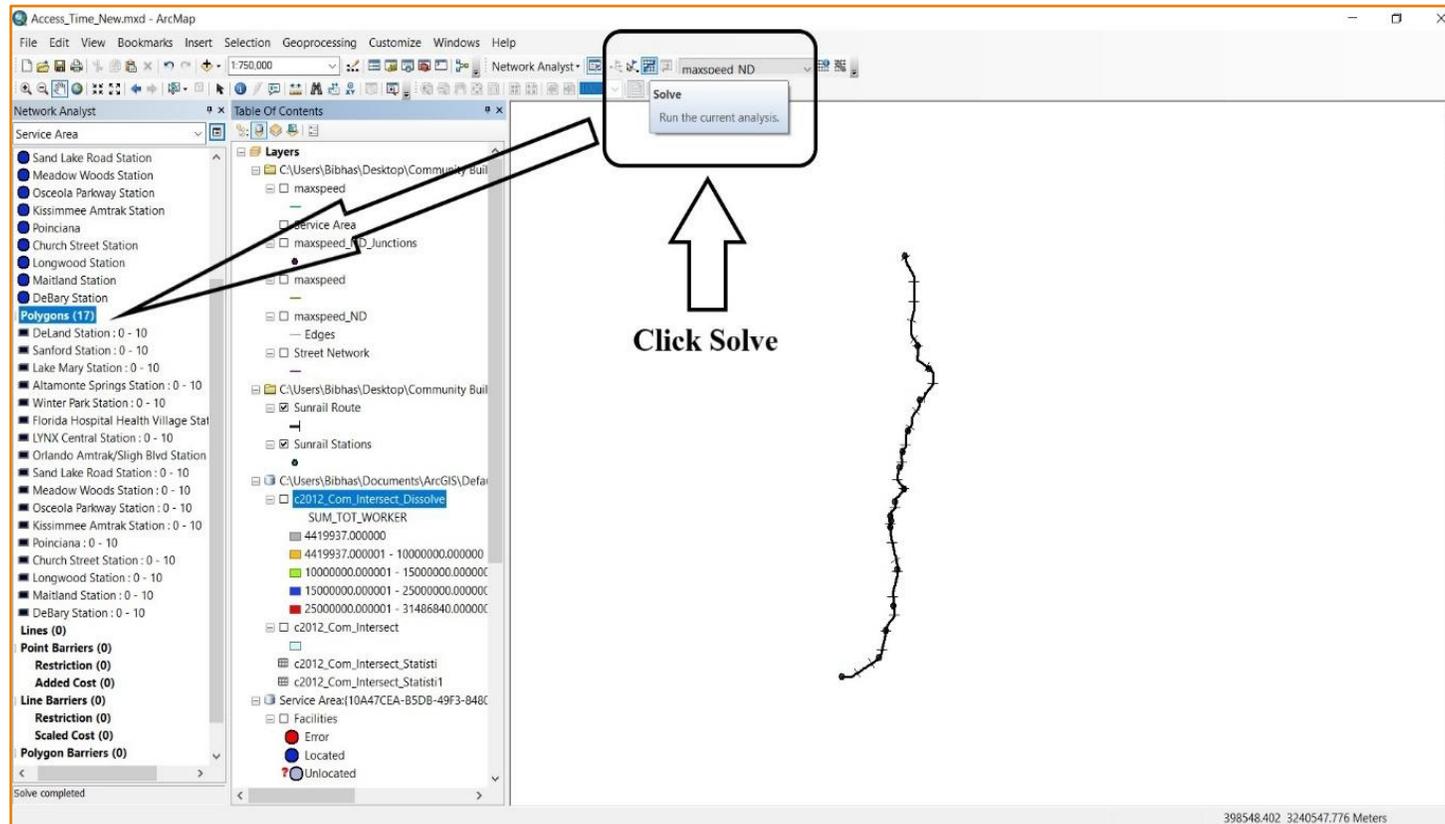
Driving Area

○ Step 6:



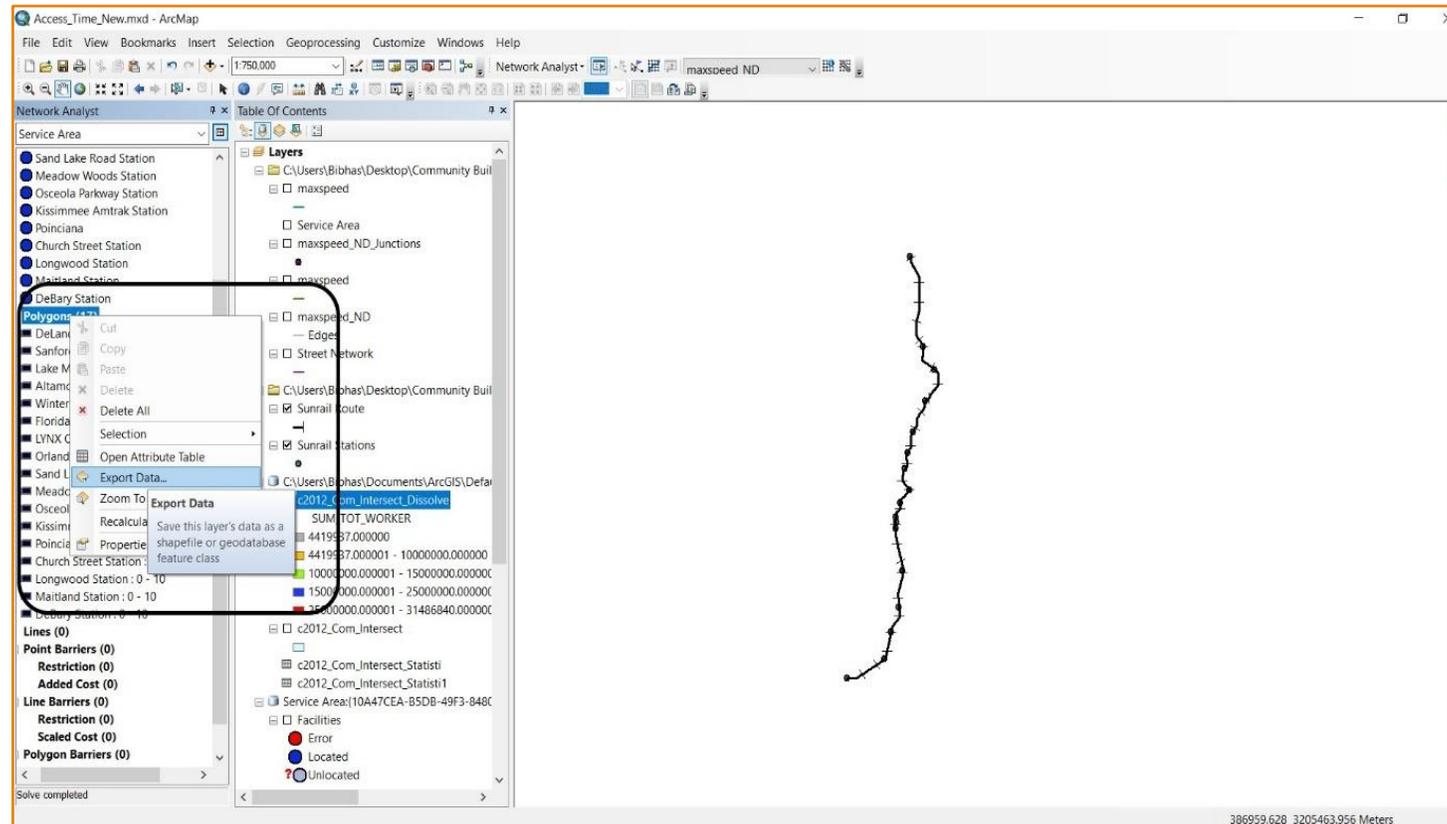
Driving Area

○ Step 7:



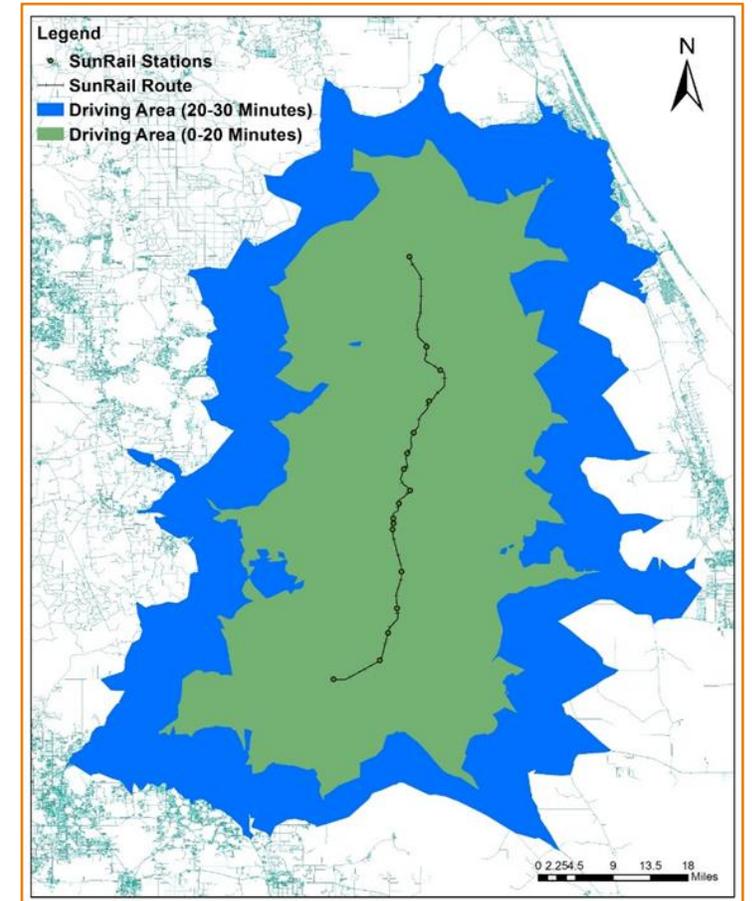
Driving Area

○ Step 8:



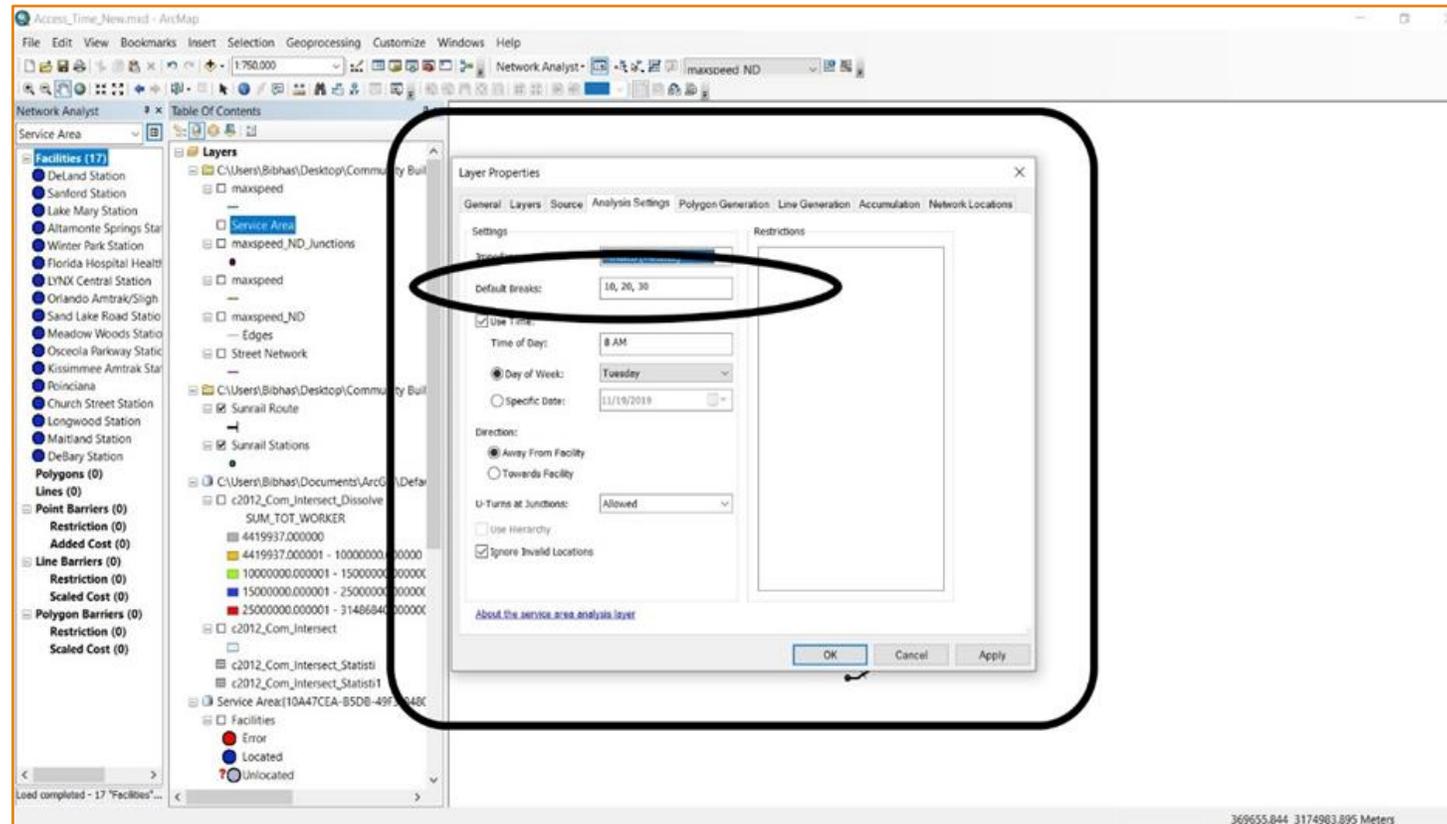
Control Area Selection

- We select 20-30 minutes car driving time as our control threshold.
- 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.



Control Area Selection

- Only Difference from Case:



Other MOEs

- 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.
- 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.
- Travel pattern for zero 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.

Questions
