

# Grid Based Analysis



ISTANBUL **TECHNICAL** UNIVERSITY  
Sp. Anly. and Alg. in GIS  
Week 7

Res. Assist. Ömer AKIN

# Introduction & Aim of the Study

## *Aim of the Study:*

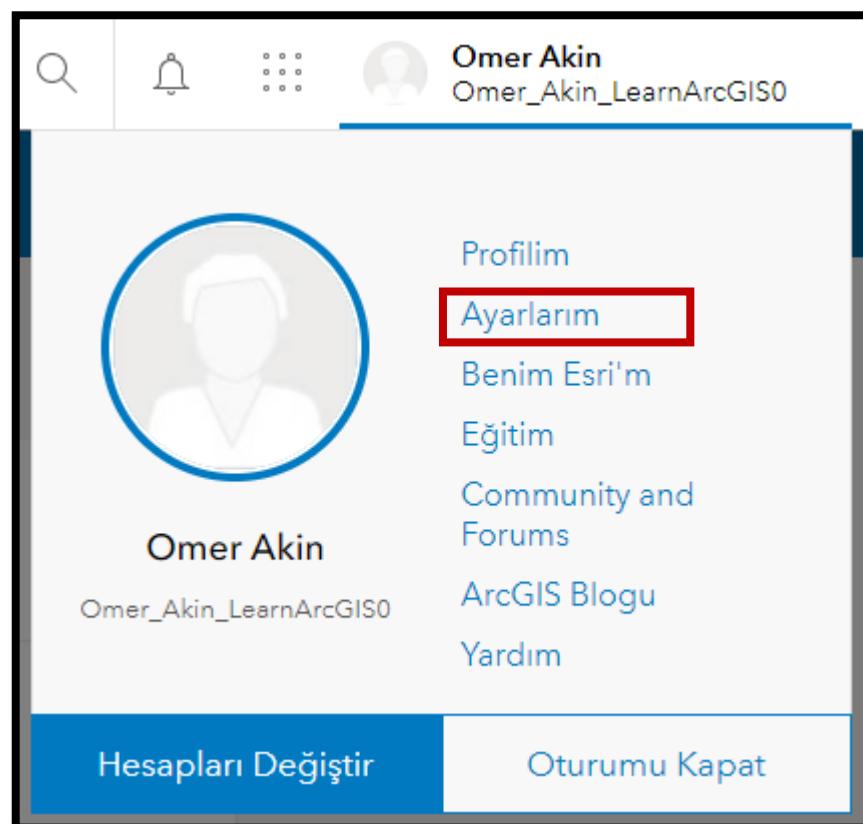
- *Is there any relationship with population, land use and transportation?*
- *If yes, is this relationship meaningful, linear or can it be described quantitatively?*
- *Could this relationship be shown spatially?*

## *Input Data:*

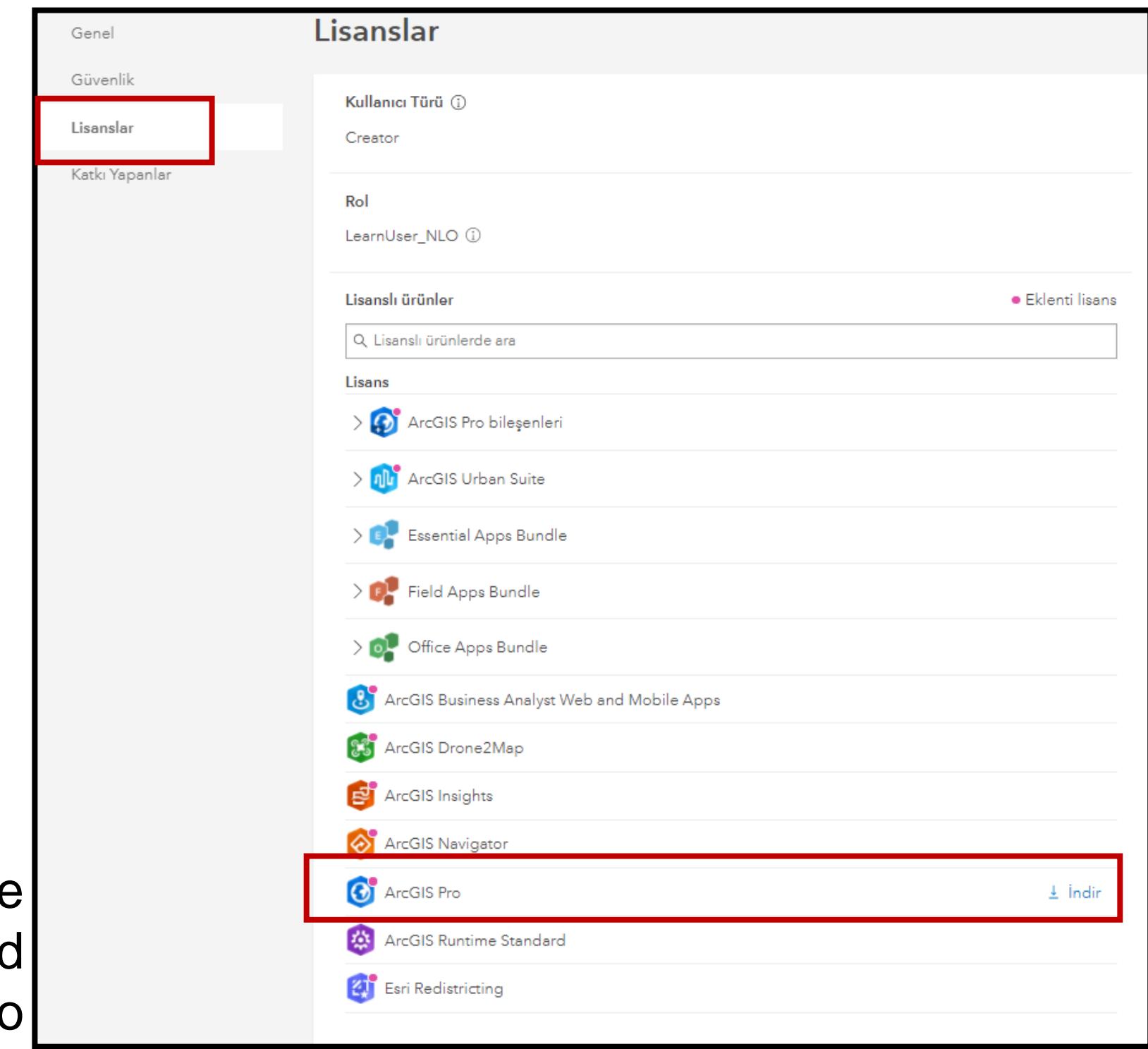
- *Road network of 2007 and 2014 (Vector-Polyline)*
- *Urban Areas from land cover/use maps of 2007 and 2014 (Vector-Polygon)*
- *1km \* 1km grid based population (Vector-Polygon)*
- *District boundaries (Vector-Polygon)*

# Installing ArcGIS Pro

- Go to this website: <https://learn.arcgis.com/en/become-a-member/> and create an account.
- Activate your account from your e-mail and note your username and password (your username is given by ESRI. It is in the received mail)



Click your user name in the upper right corner and click “my settings”

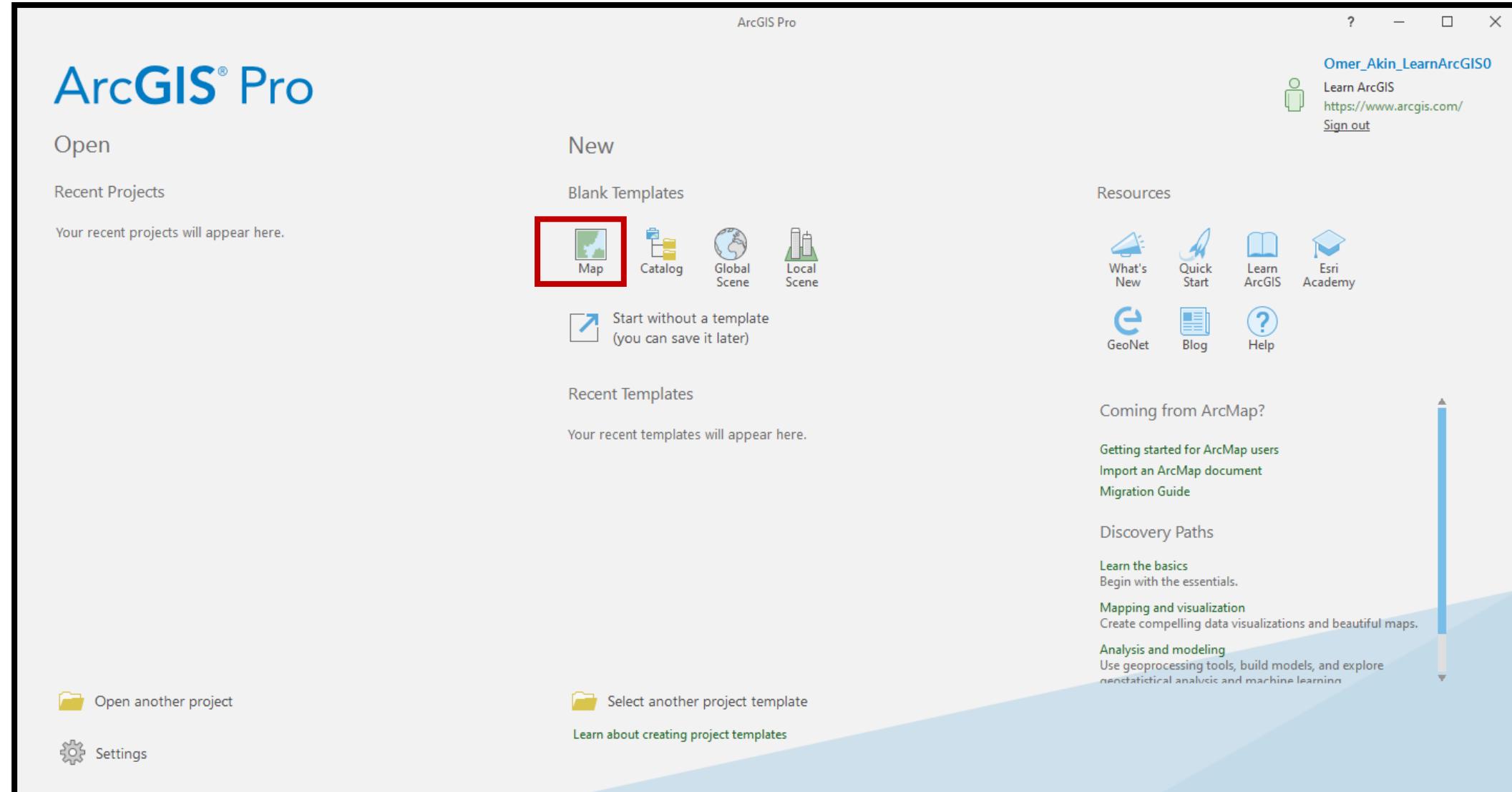
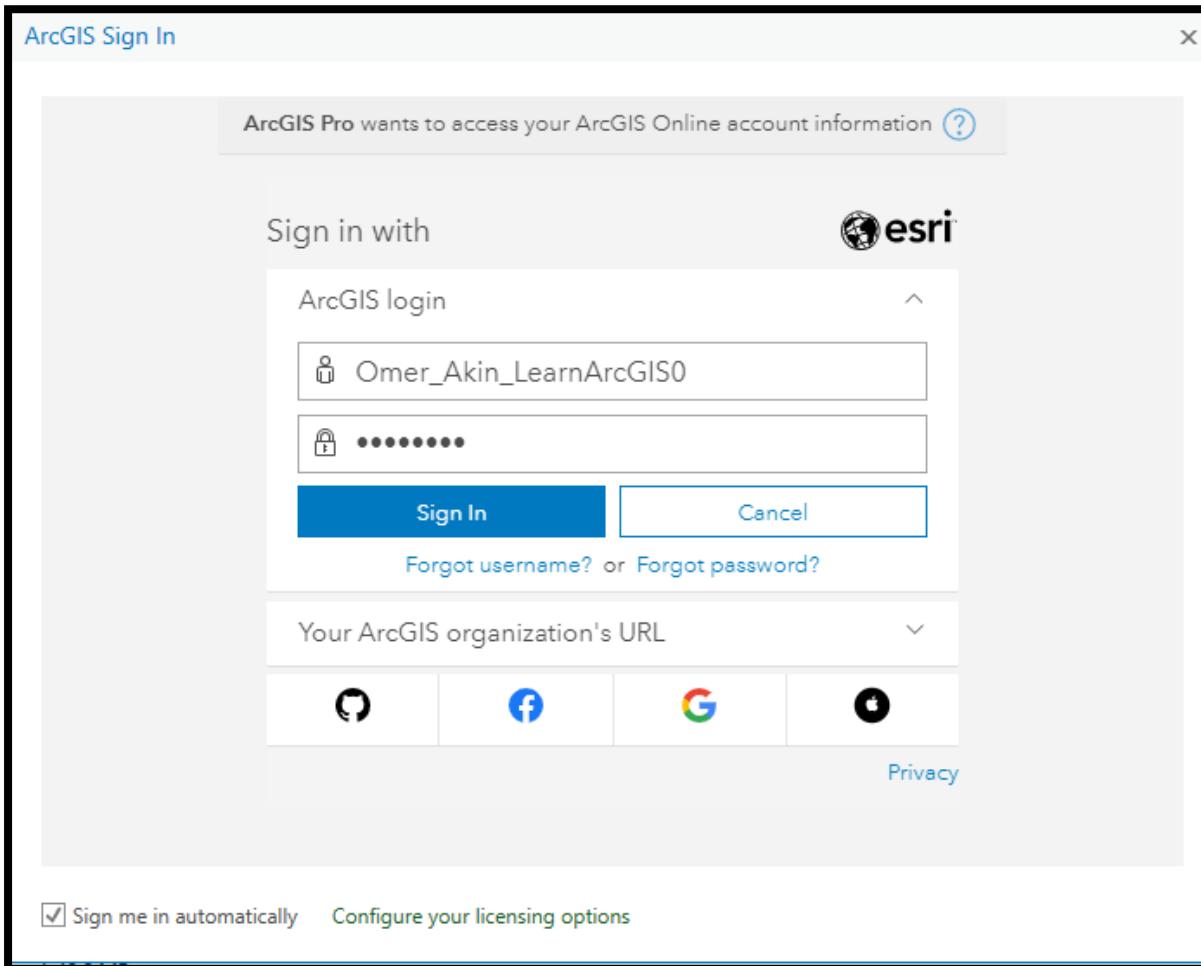


The screenshot shows a 'Lisanslar' (Licenses) page. On the left, there are tabs: Genel, Güvenlik, Lisanslar (which is highlighted with a red box), and Katkı Yapanlar. The main area displays license information for a user named 'LearnUser\_NLO'. It includes sections for 'Kullanıcı Türü' (Creator), 'Rol' (LearnUser\_NLO), and 'Lisanslı ürünler' (Available products). A search bar is present for finding products. The products listed include ArcGIS Pro bileşenleri, ArcGIS Urban Suite, Essential Apps Bundle, Field Apps Bundle, Office Apps Bundle, ArcGIS Business Analyst Web and Mobile Apps, ArcGIS Drone2Map, ArcGIS Insights, ArcGIS Navigator, ArcGIS Pro (which is highlighted with a red box and has a download button labeled 'İndir'), ArcGIS Runtime Standard, and Esri Redistricting. A note at the bottom right indicates an 'Eklenti lisans' (Add-on license).

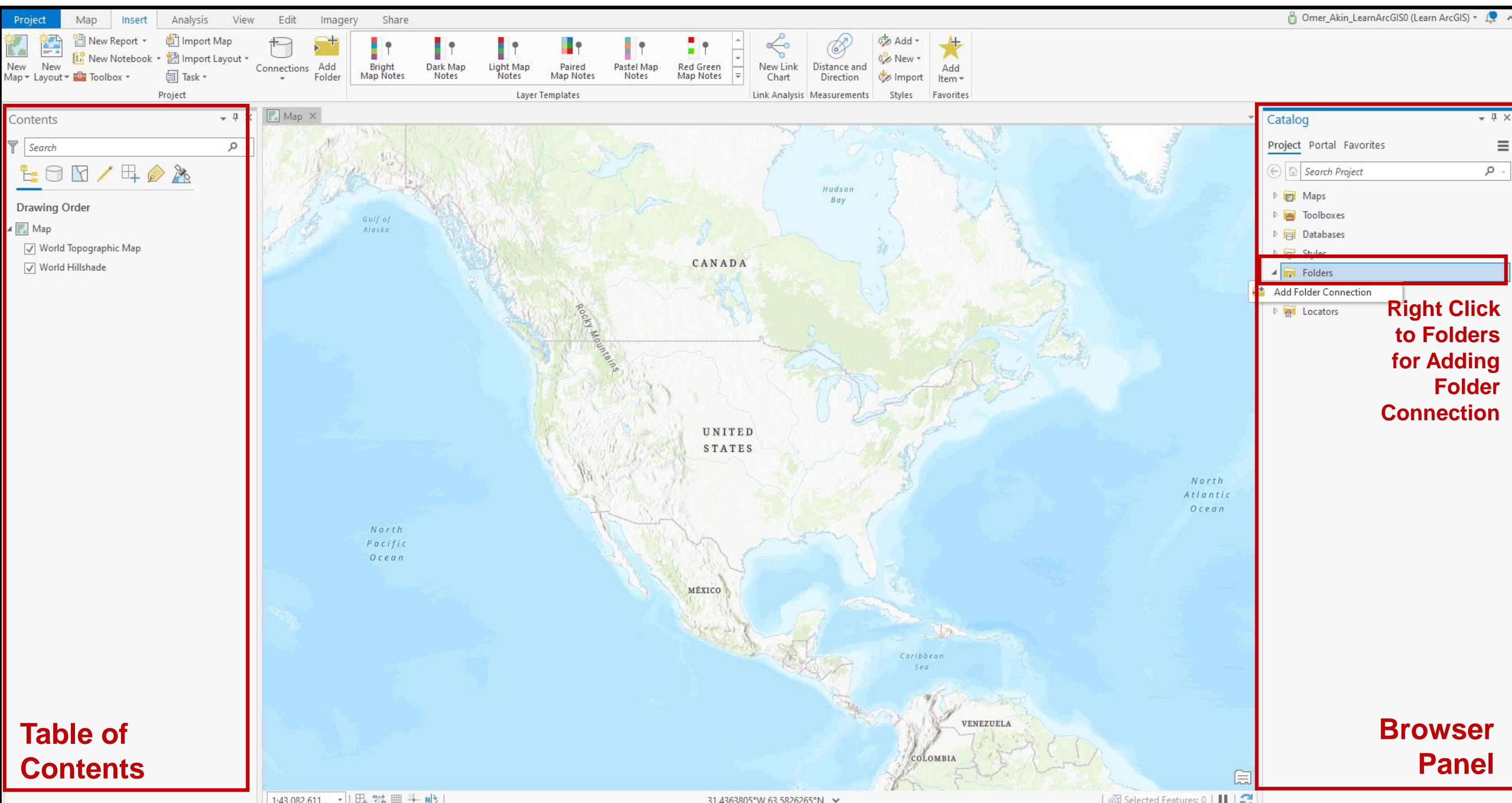
Click licenses from the menu on left side and download ArcGIS Pro

# Activating/Opening ArcGIS Pro

After installing ArcGIS Pro, login with your username and password to activate 60-day free trial



# Exploring ArcGIS Pro



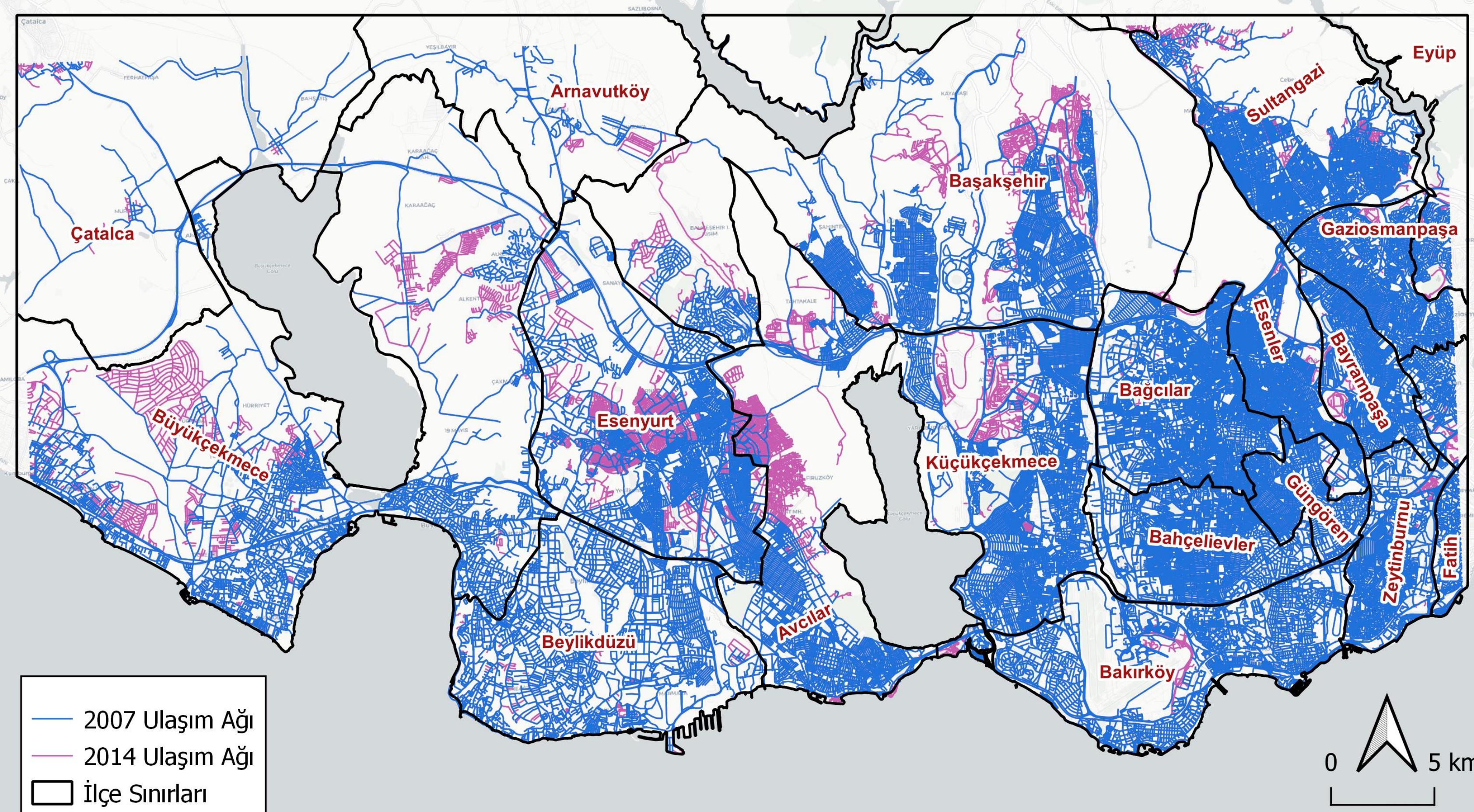
The screenshot displays the ArcGIS Pro application window with several panels:

- Table of Contents (Left Panel):** Contains a search bar and a list of items under "Drawing Order". Under "Map", two items are checked: "World Topographic Map" and "World Hillshade". A red box highlights this panel.
- Map (Center Panel):** Shows a map of North America and parts of South America, Canada, and Mexico. Labeled features include the Gulf of Alaska, Hudson Bay, Rocky Mountains, United States, México, and Venezuela. A red box highlights this panel.
- Catalog (Right Panel):** Shows a hierarchical tree view of project items. The "Folders" node is expanded, and a red box highlights this panel.

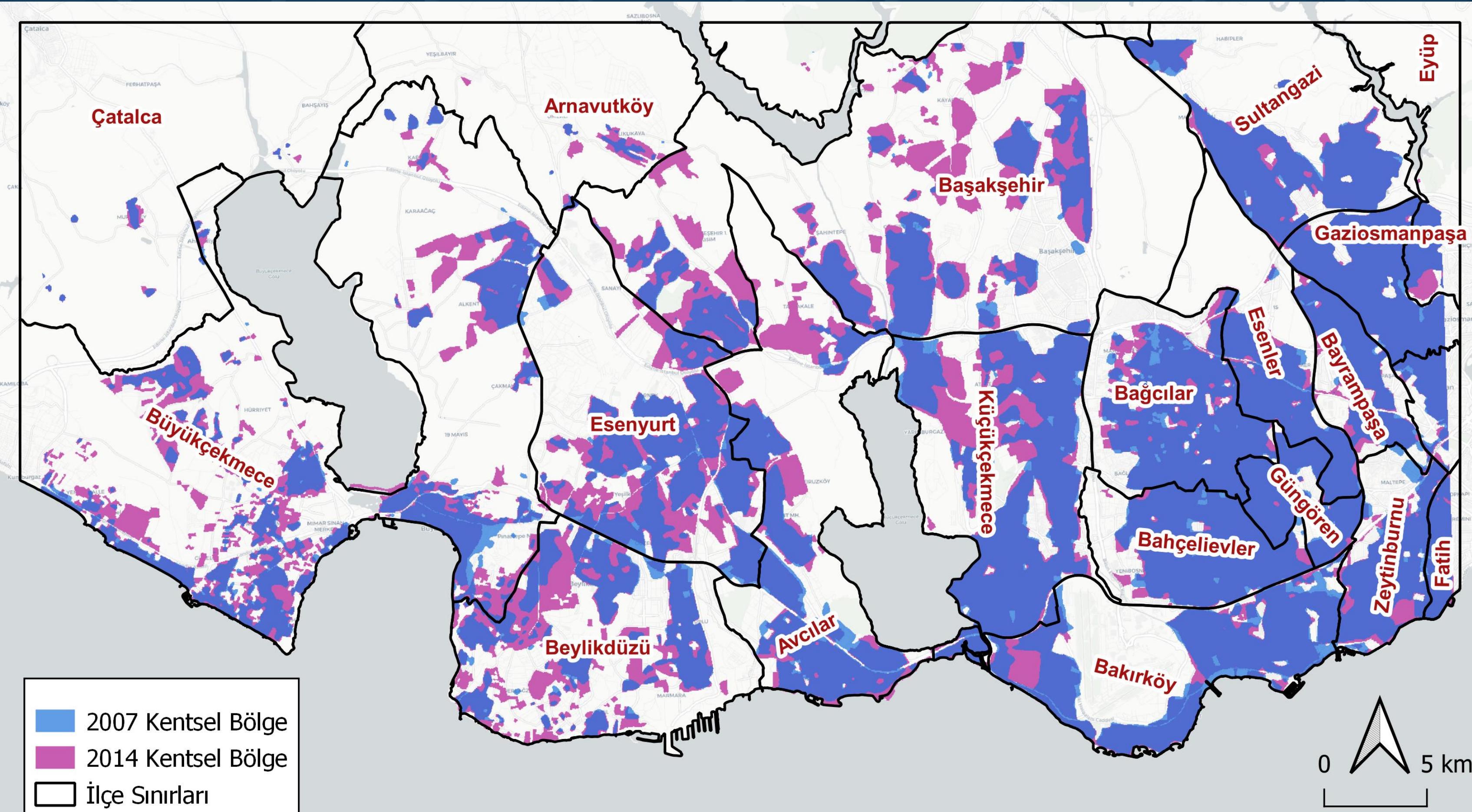
**Annotations:**

- Table of Contents:** A red box surrounds the left panel, and the text "Table of Contents" is written below it.
- Browser Panel:** A red box surrounds the right panel, and the text "Browser Panel" is written below it.
- Right Click to Folders for Adding Folder Connection:** A red box surrounds the "Folders" node in the Catalog tree, and the text "Right Click to Folders for Adding Folder Connection" is written to its right.

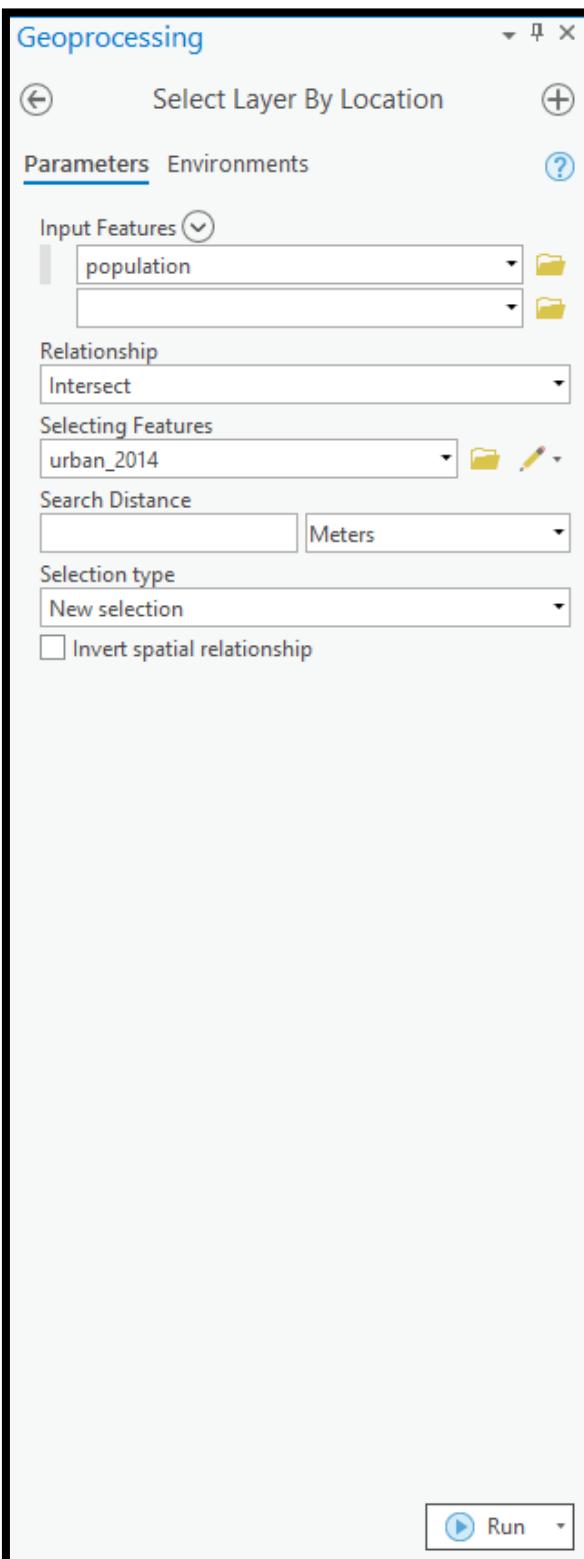
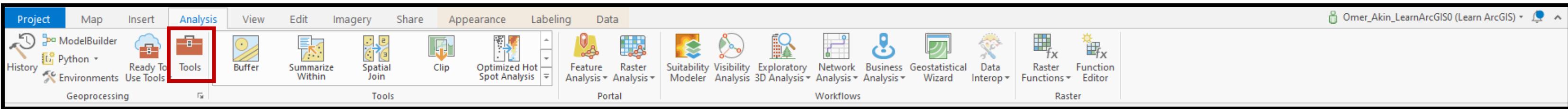
# Study Area & Data



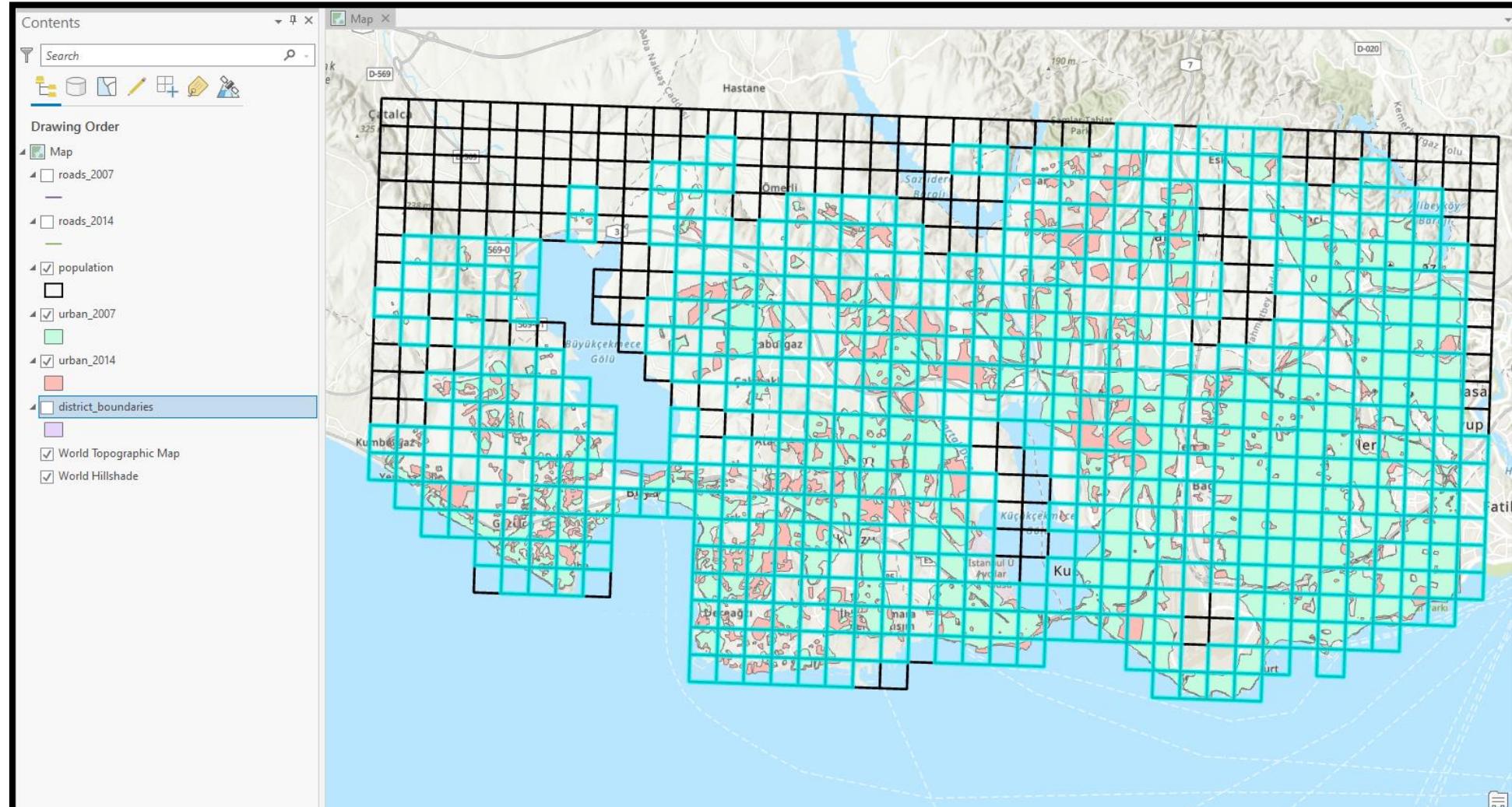
# Study Area & Data



# Geoprocessing Tools ArcGIS Pro

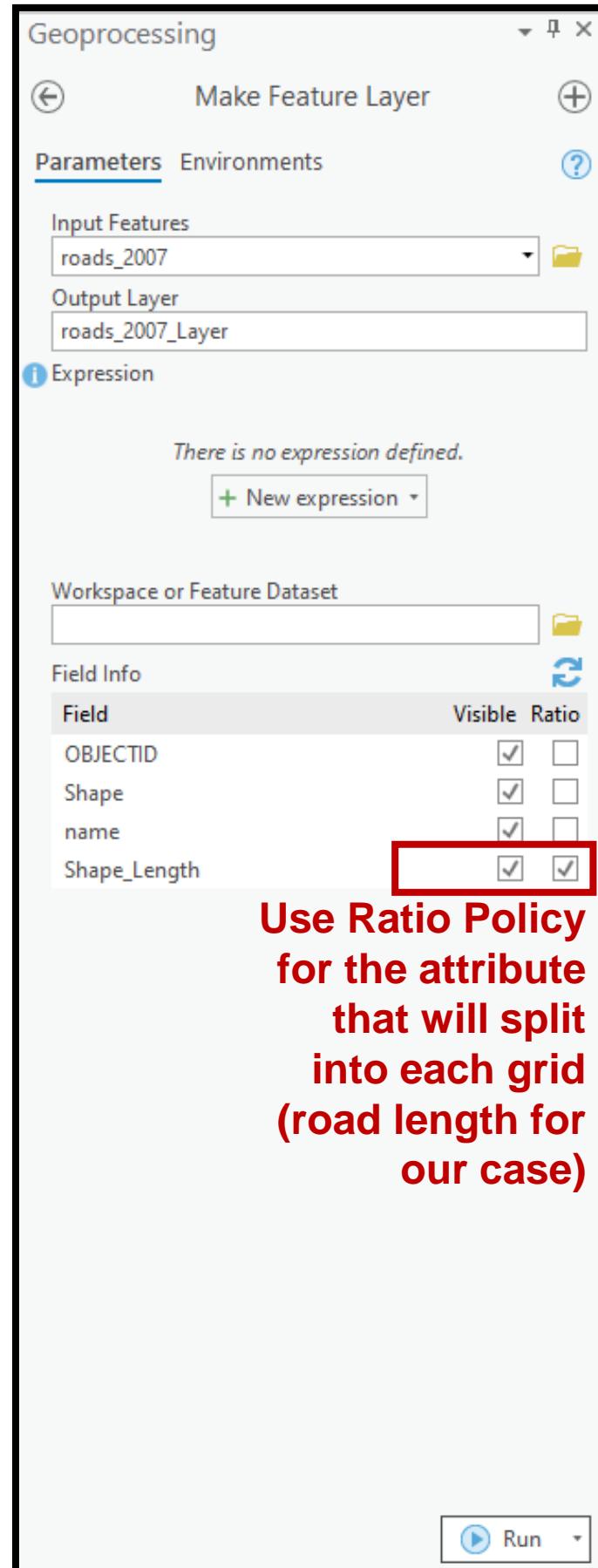


- First we need to find the population grids that intersects with the urban areas.
- By this way we'll ensure that every grid have urban area, road length and population values within for further processes.

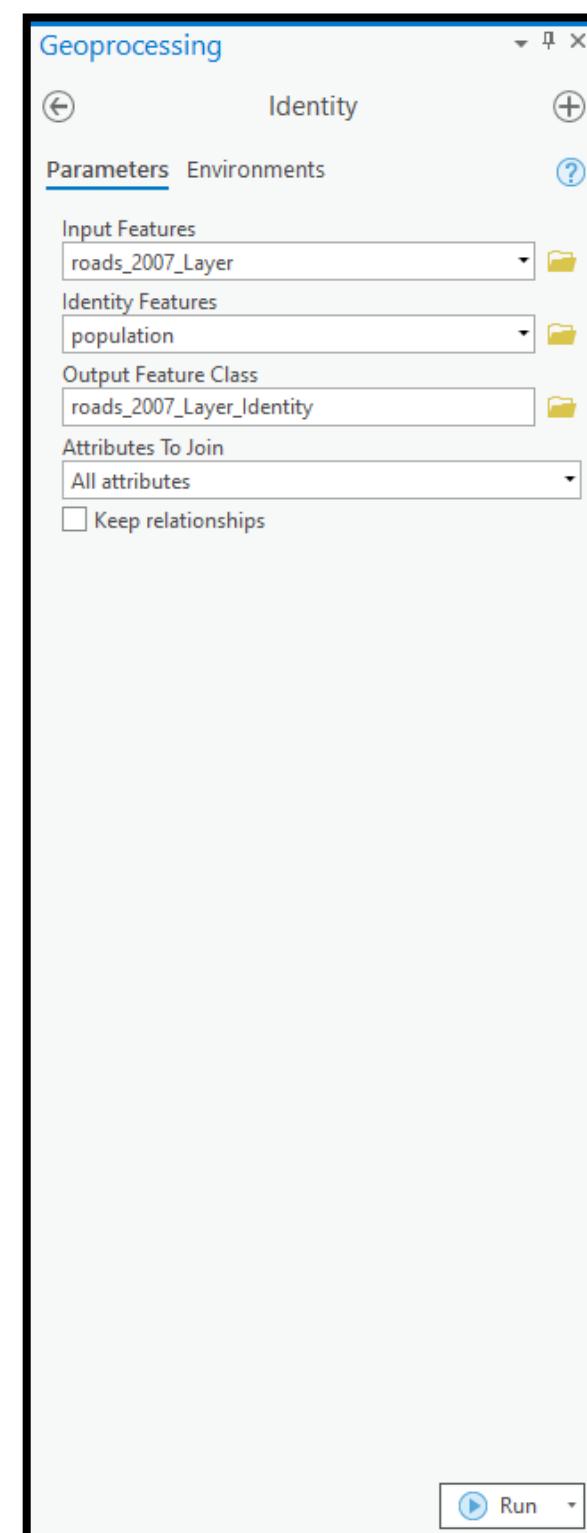


Right click to selected feature and “Make Layer from Selected Features” to extract selected values

# Attribute Assignment to Grids – Make Feature Layer / Identity

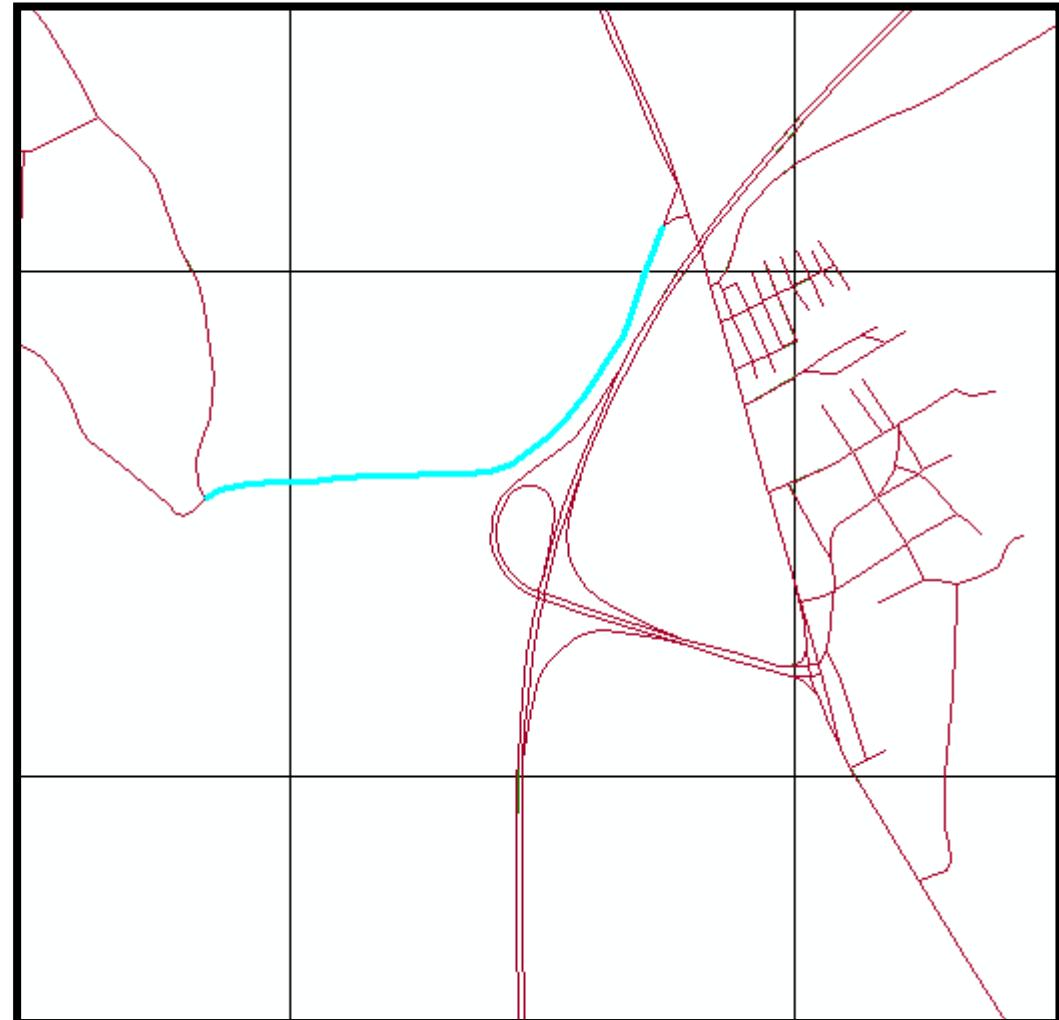


Assigning road length and urban areas that falls into each population grid to further analyze the relationship between these features.



Use Identity tool to split the road feature into each grid by using ratio policy to specified attribute

# Inspect the Result of Identity



Table

roads\_2007

	OBJECTID	Shape	id	name	Shape_Length
▶	91402	Polyline	914		1184.952347

(1 out of 97021 Selected)

roads\_2007\_Identity | roads\_2007



Table

roads\_2007\_Identity

	OBJECTID *	Shape *	FID_roads_2007	id	name	FID_population	Id	pop_2007	pop_2014	Shape_Length
▶	99789	Polyline	91402	914		479	0	32	108	917.864761

(1 out of 105855 Selected)

roads\_2007\_Identity | roads\_2007

# Find Each Grid's Attribute

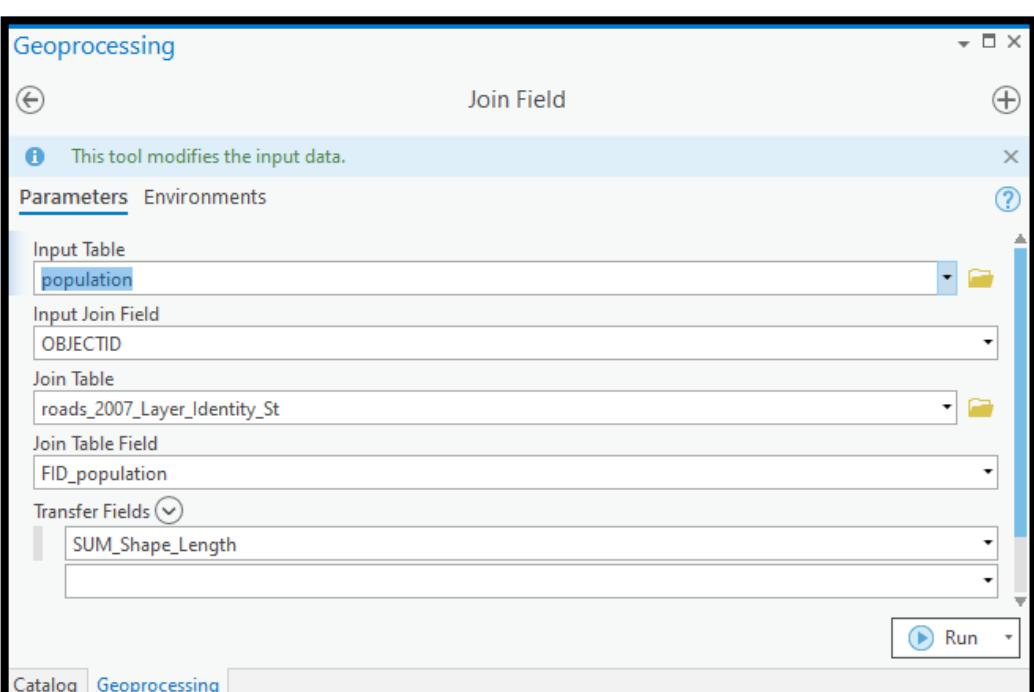
OBJECTID *	Shape *	FID_roads_2007	name	FID_population	Length
1	Polyline	608		-1	3822
2	Polyline	609		-1	3358
3	Polyline	612		-1	3063
4	Polyline	613		-1	7992
5	Polyline	618		-1	1393
6	Polyline	619		-1	3064
7	Polyline	682		-1	3639
8	Polyline	811		-1	3872
9	Polyline	812		-1	3122
10	Polyline	813		-1	2189
11	Polyline	814		-1	2507
12	Polyline	815		-1	3833
13	Polyline	872		-1	37963
14	Polyline	906	Yeniköy Halkalı Caddesi	-1	36296164
15	Polyline	910		-1	56.09282
16	Polyline	919		-1	34.684381
17	Polyline	920		-1	139.379255
18	Polyline	922		-1	34.799929

Summary Statistics

Input Table	roads_2007_Layer_Identity
Output Table	roads_2007_Layer_Identity_St
Statistics Field(s)	Shape_Length
Field	Sum
Case field	FID_population

OK

FID\_population field shows which grid contains the corresponding road segment. To write the total length that falls in each grid, we need to use “summarize” for this information

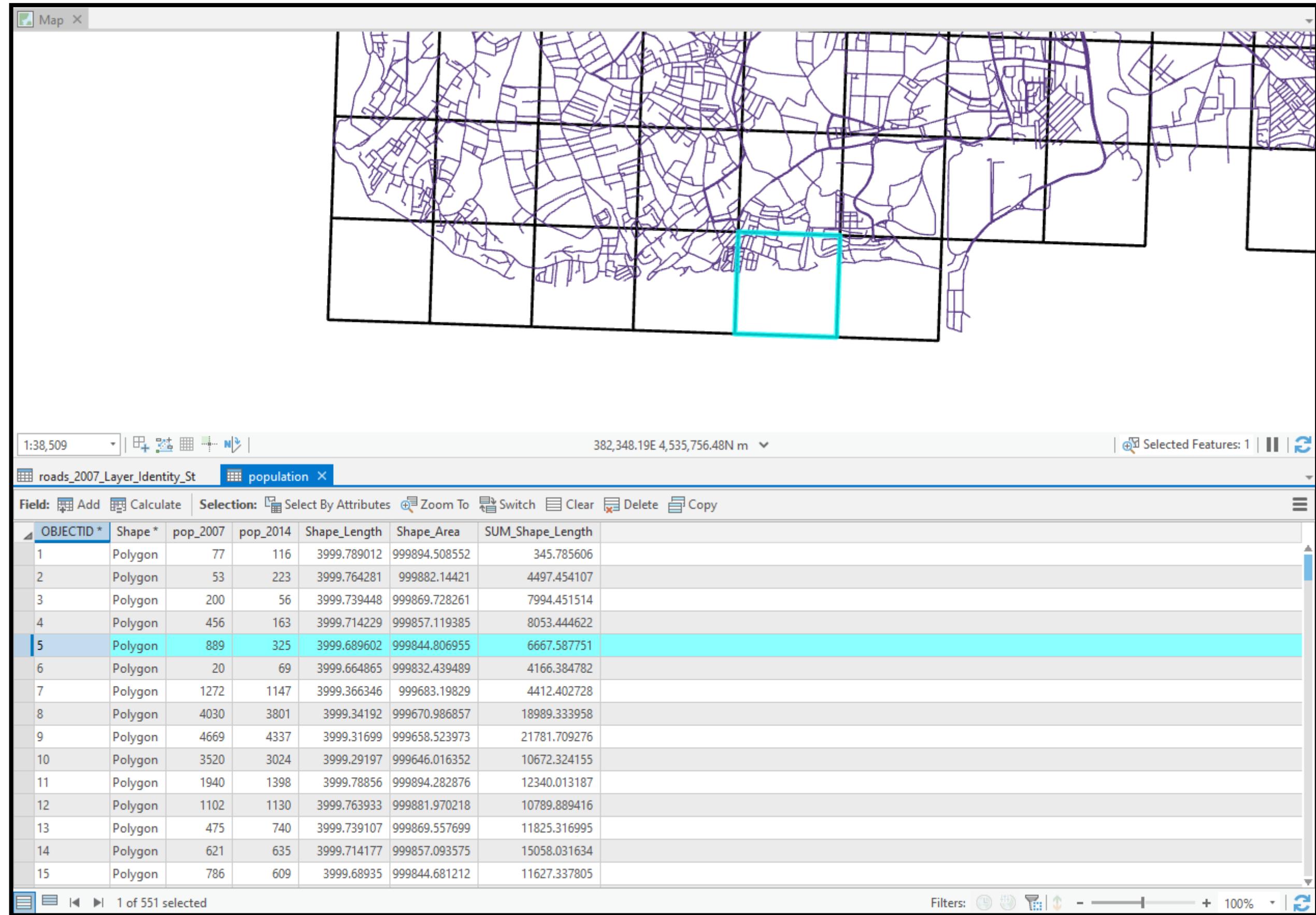


Total road length that falls in each grid is summarized as a table. To use this in spatial data, we need to perform a table join by using FID\_population column

OBJECTID *	FID_population	FREQUENCY	SUM_Shape_Length
1	-1	1620	277680.904028
2		3	345.785606
3		43	4497.454107
4		79	7994.451514
5	4	112	8053.444622
6	5	81	6667.587751
7		43	4166.384782
8		71	4412.402728
9		281	18989.333958
10		393	21781.709276
11		176	10672.324155
12		138	12340.013187
13		124	10789.889416
14		110	11825.316995
15		189	15058.031634

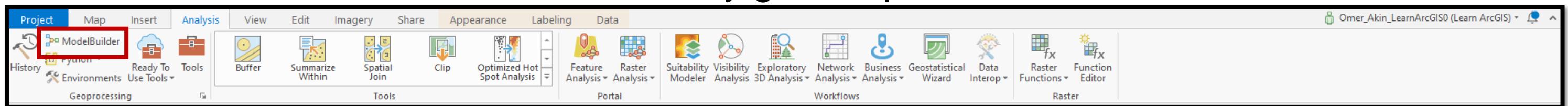
# Inspect the Result

Total road length that falls in each grid is calculated by using these processes.

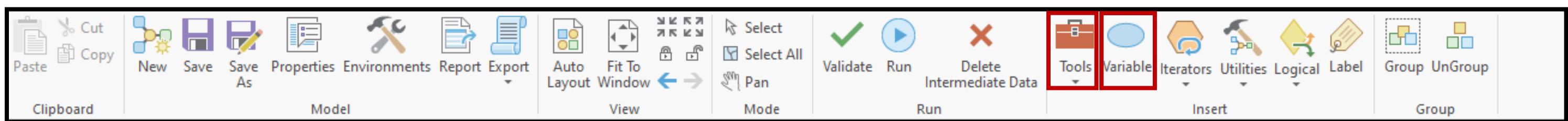


# Introduction to Model Builder

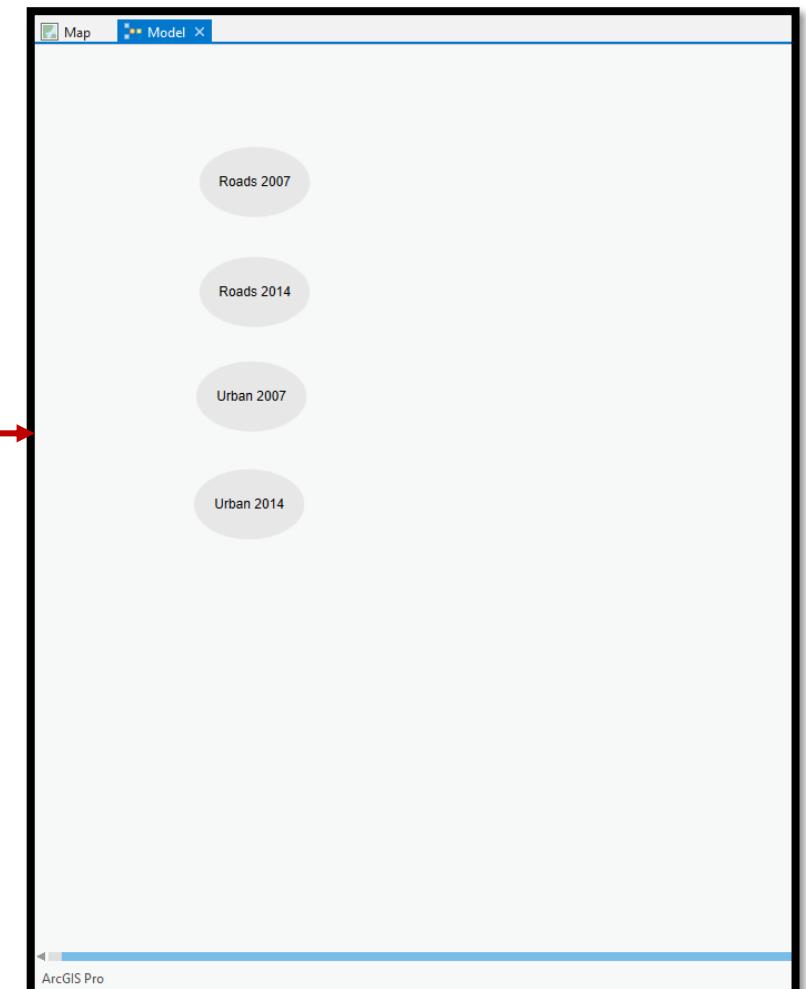
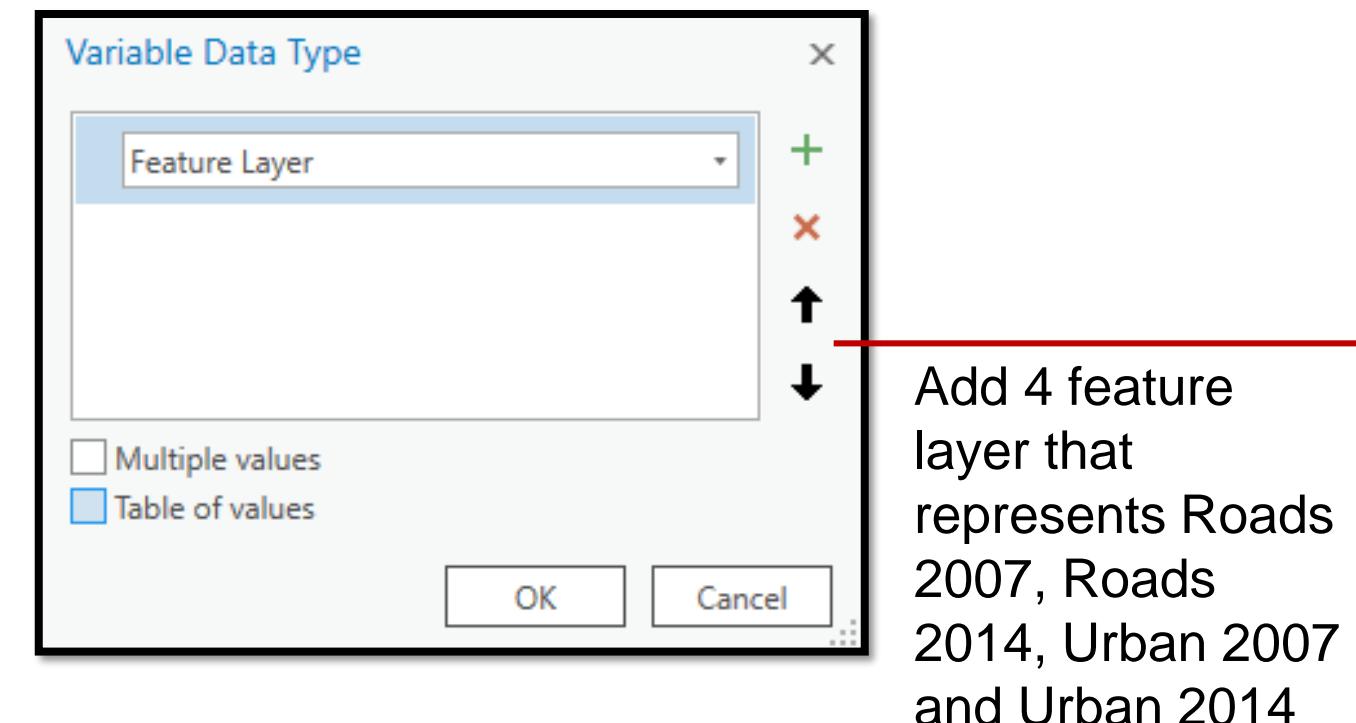
We need to apply same processes for Roads of 2014, Urban Land area of 2007 and 2014. To perform same operations for different data, we'll produce a model that applies the processes for every given input.



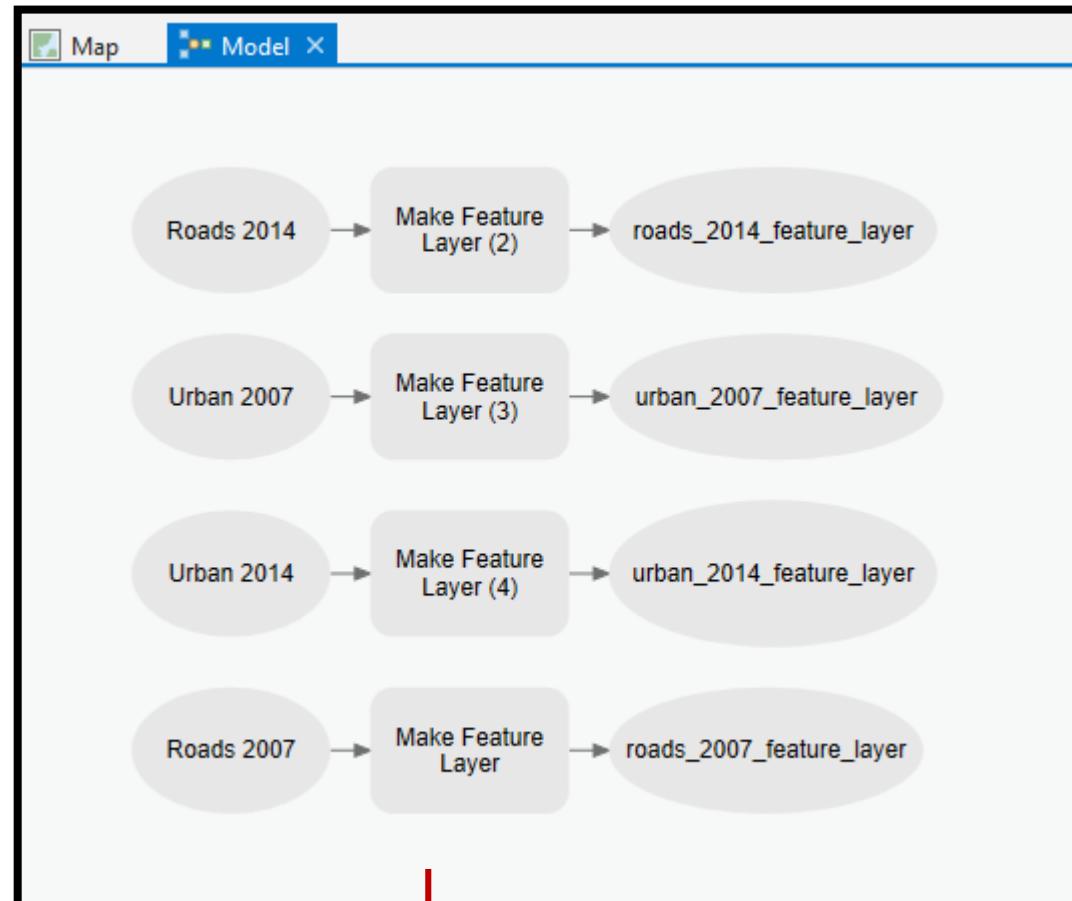
ModelBuilder Toolbar



First we need to add input layers by using “Variable” insert.

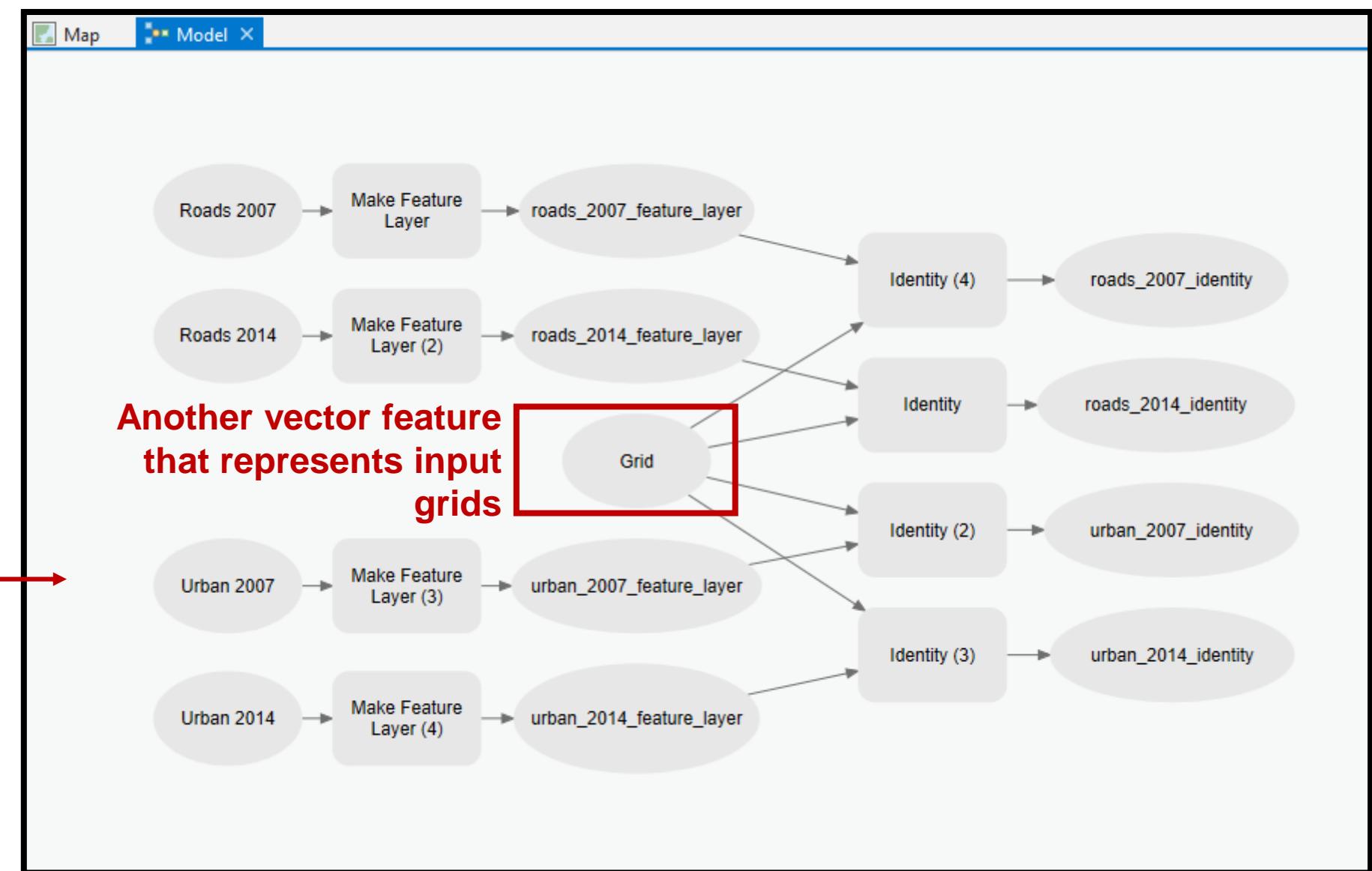


# Developing the Model

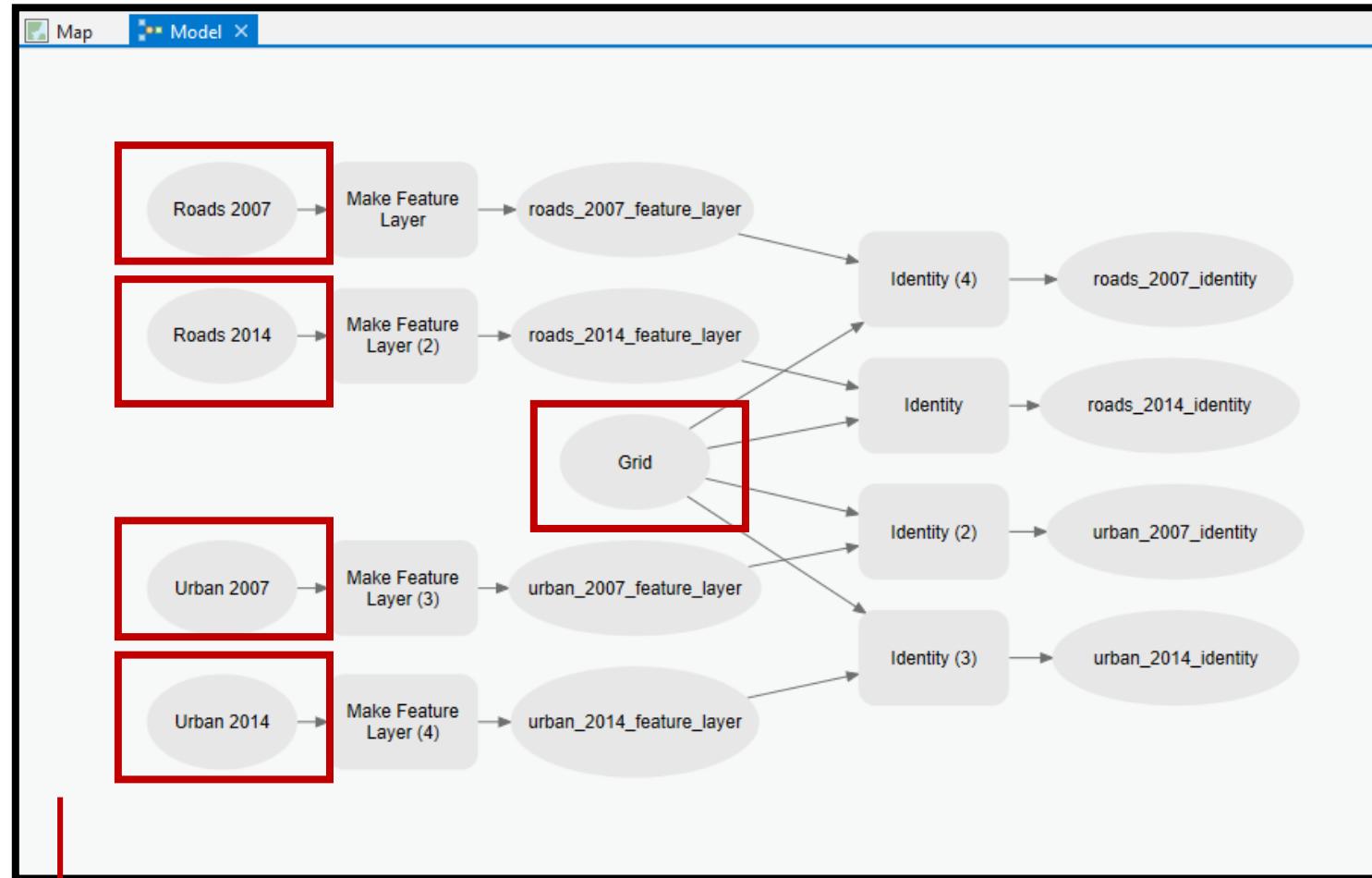


The first tool that we used is “Make Feature Layer”. Add this tool by using “Tools” insert

Then we implement “Identity” analysis to split the data into each grid.



# Setting Parameters for Tools



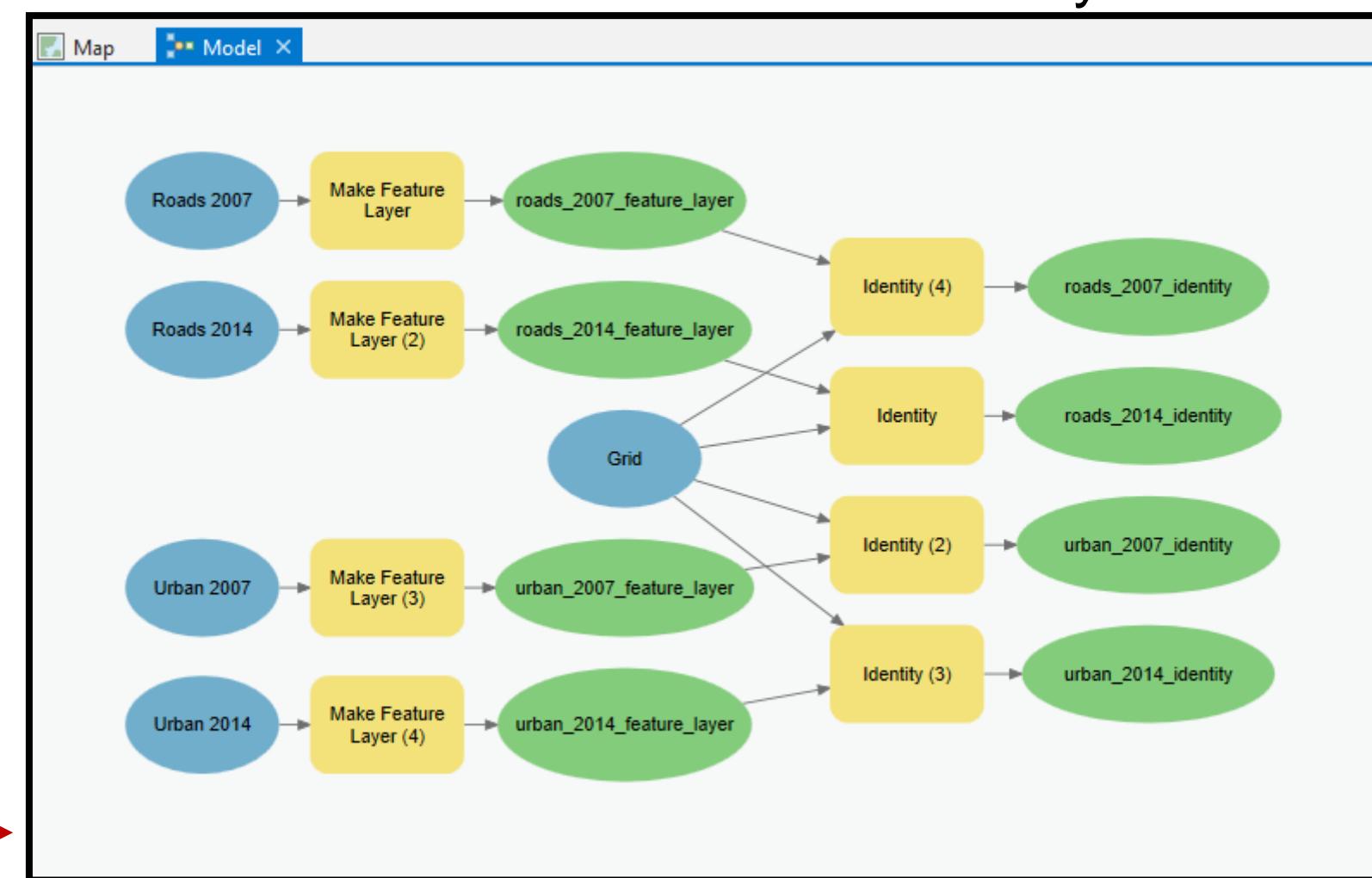
## Make Feature Layer Parameters



Use Ratio Policy on  
“Shape\_Length” for roads  
and “Shape\_Area” for  
urban lands

First, double click every feature to add real features into them

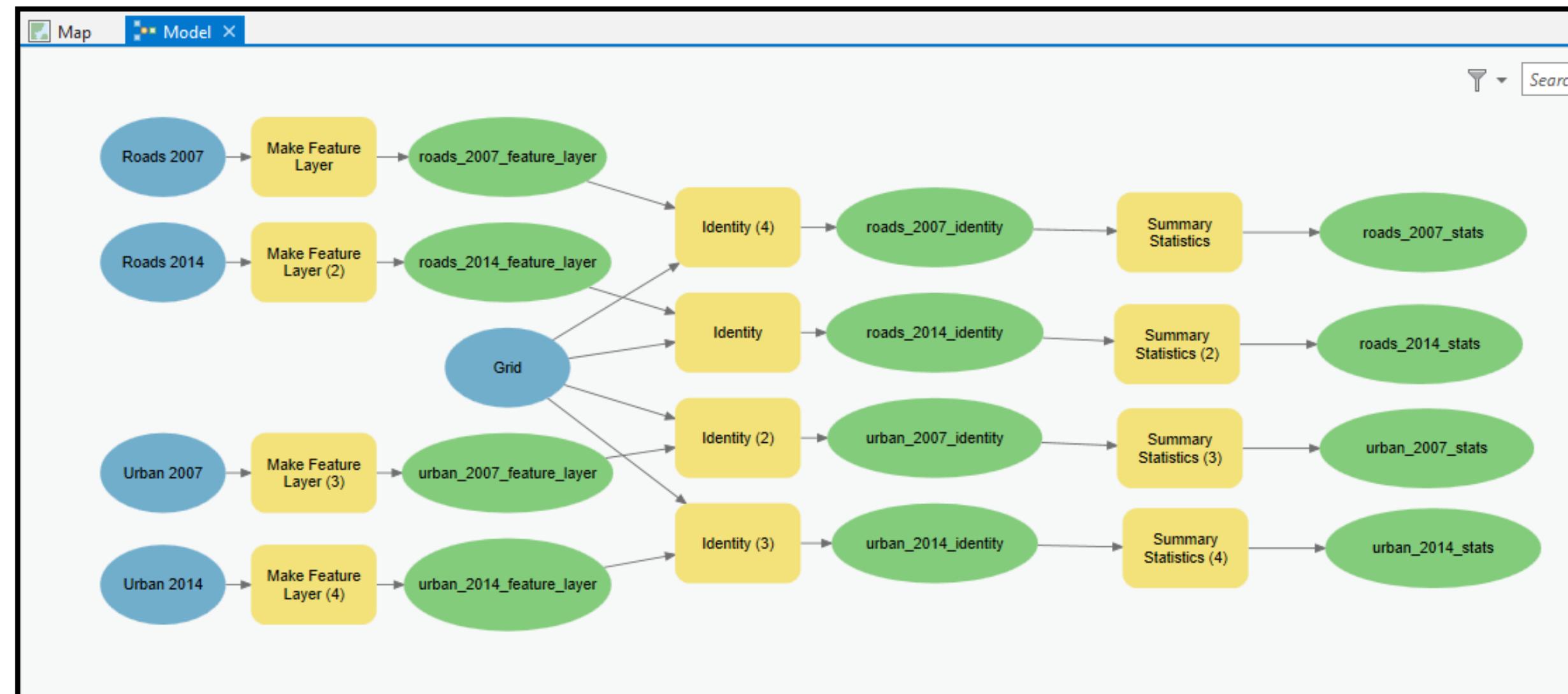
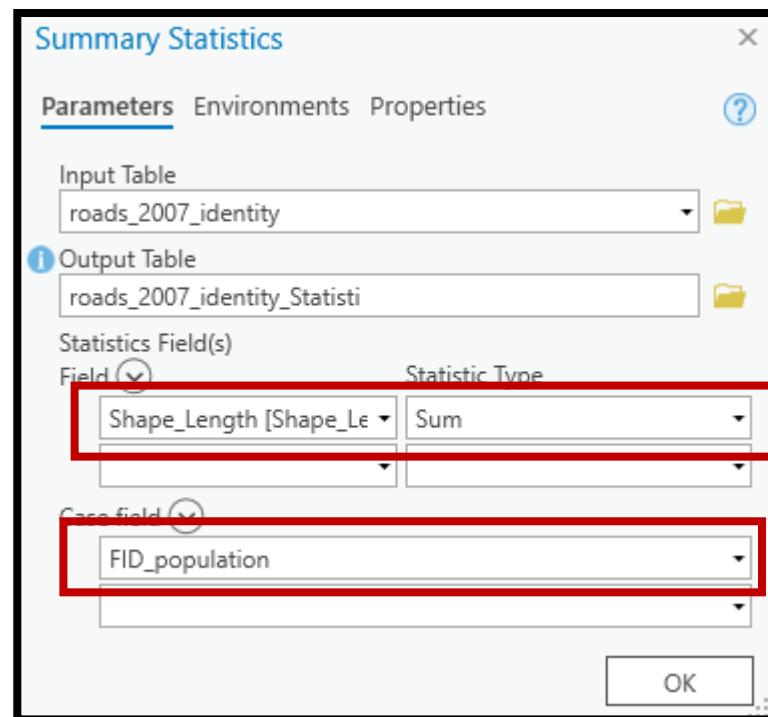
After adding necessary parameters, click Validate to validate your model



# Developing the Model

Add Summary Statistics Tool to ModelBuilder to find the total length/area that falls into each grid

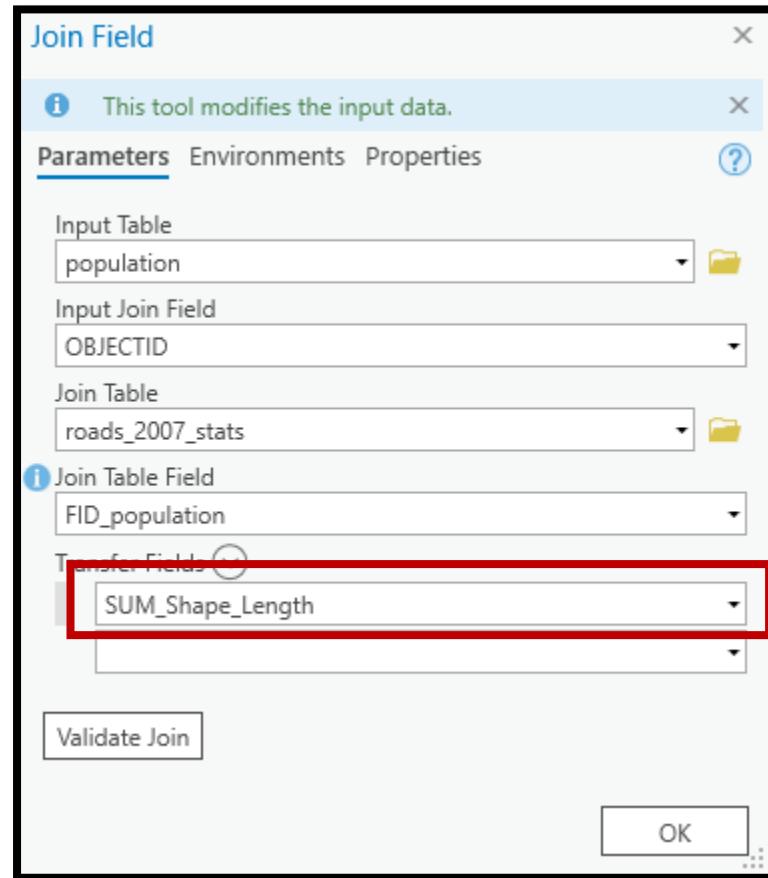
## Summary Statistics Parameters



# Developing the Model

## Join Field

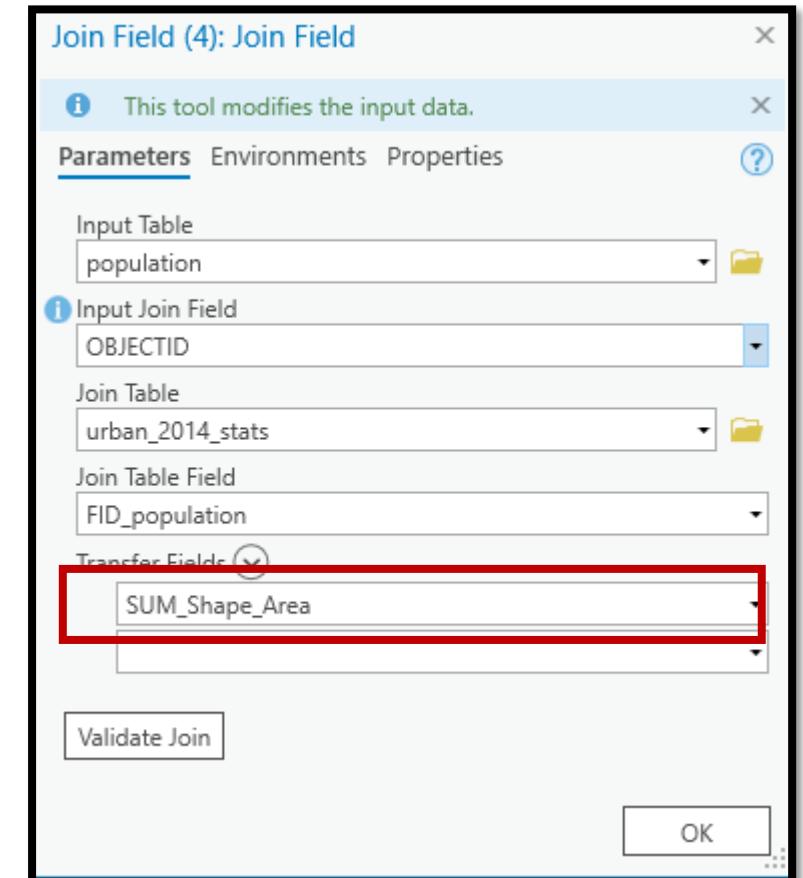
### Parameters for Roads



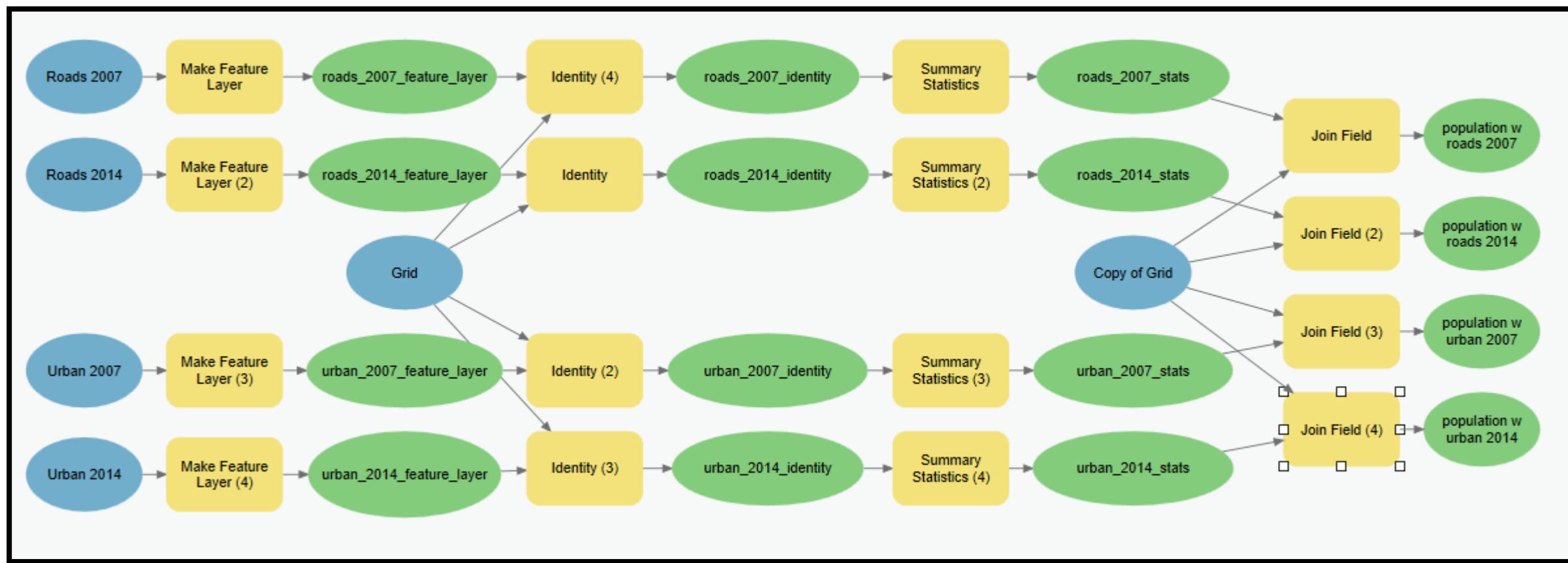
Join the resulted information to population grids

## Join Field

### Parameters for Urban Areas

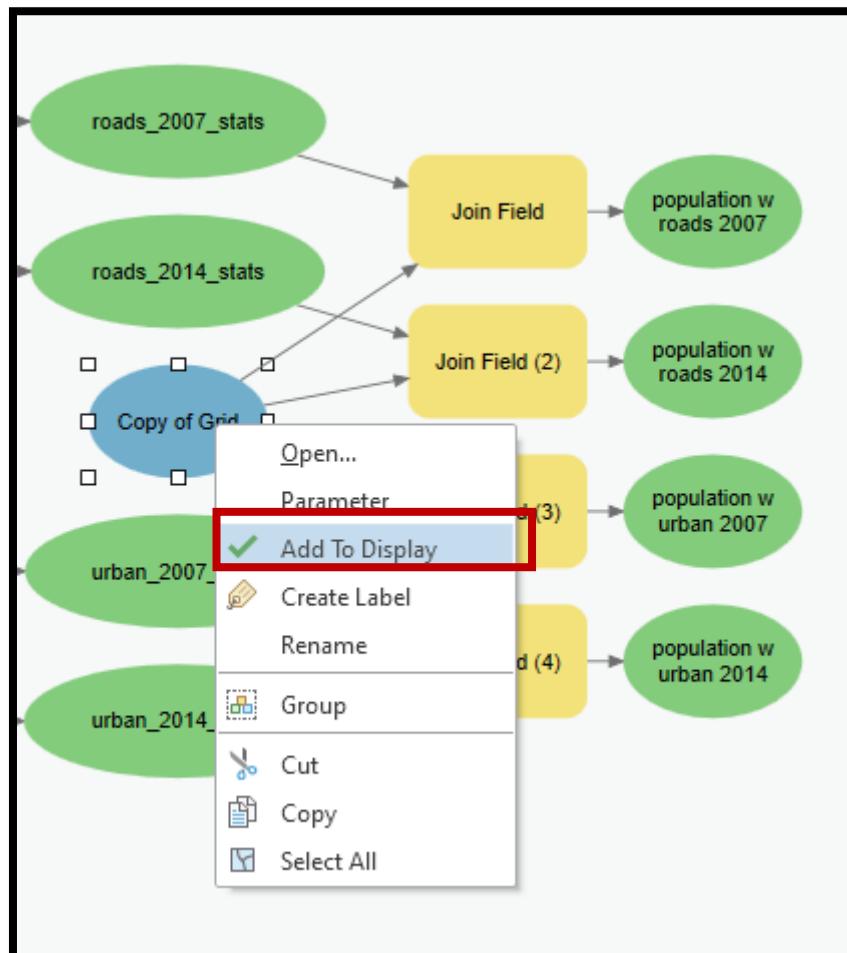
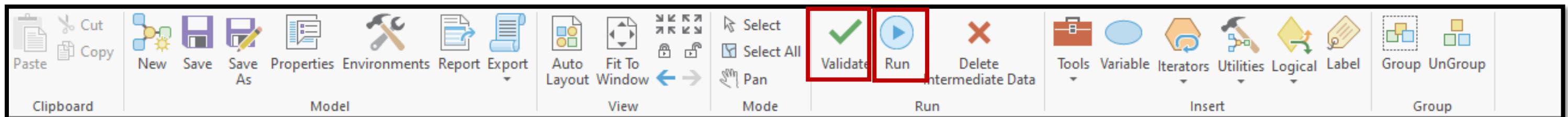


## Developed Model



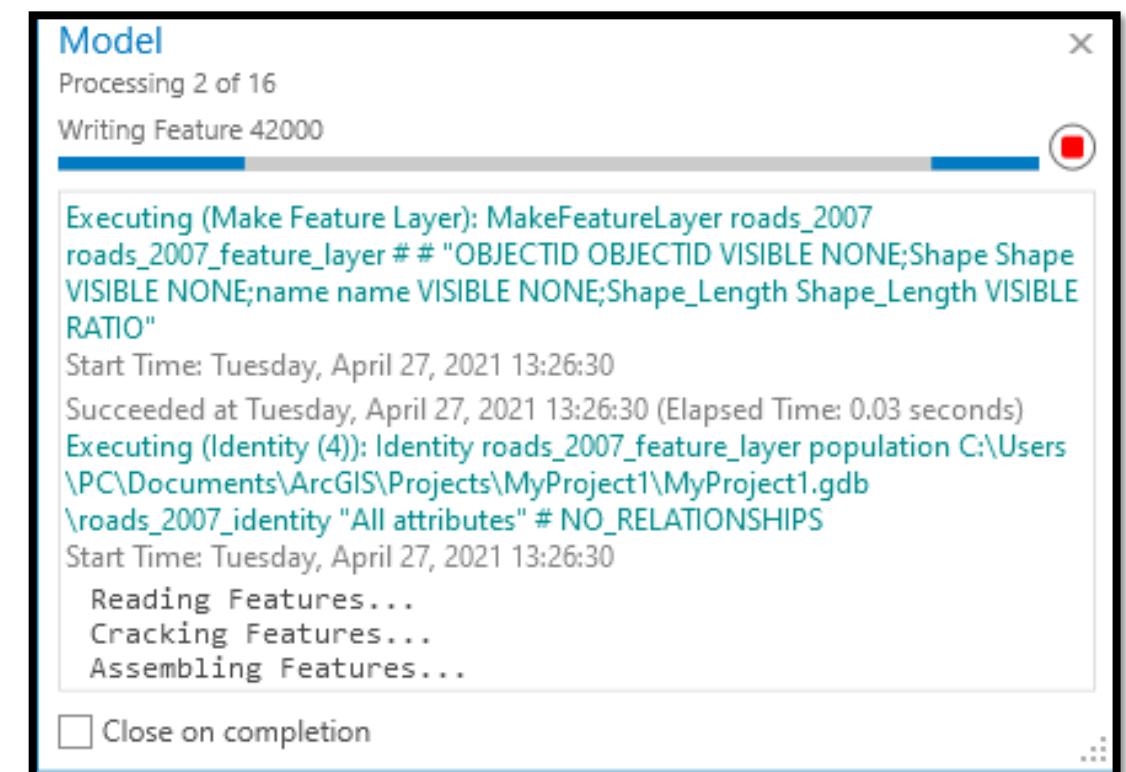
# Running the Model

ModelBuilder Toolbar



Add result to display

Run the Model



# Inspect the Result

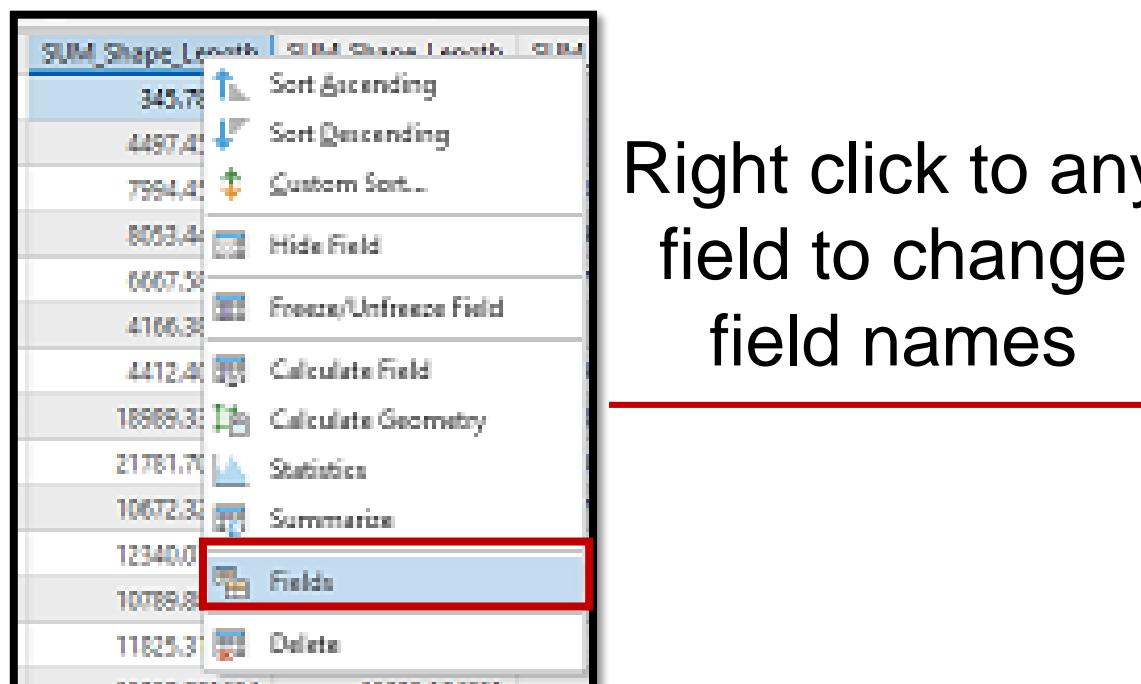
Field:   Selection:

OBJECTID *	Shape *	pop_2007	pop_2014	Shape_Length	Shape_Area	SUM_Shape_Length	SUM_Shape_Length	SUM_Shape_Area	SUM_Shape_Area
1	Polygon	77	116	3999.789012	999894.508552	345.785606	345.785606	<Null>	14721.15019
2	Polygon	53	223	3999.764281	999882.14421	4497.454107	4586.475016	3669.422596	150789.767847
3	Polygon	200	56	3999.739448	999869.728261	7994.451514	8072.94427	36415.362176	293449.485034
4	Polygon	456	163	3999.714229	999857.119385	8053.444622	8053.444622	95448.269831	159014.283454
5	Polygon	889	325	3999.689602	999844.806955	6667.587751	6667.587751	175675.242184	252838.160697
6	Polygon	20	69	3999.664865	999832.439489	4166.384782	4166.384782	<Null>	69313.533087
7	Polygon	1272	1147	3999.366346	999683.19829	4412.402728	4849.26538	198279.396578	224409.580258
8	Polygon	4030	3801	3999.34192	999670.986857	18989.333958	18989.333195	586748.950967	621938.433744
9	Polygon	4669	4337	3999.31699	999658.523973	21781.709276	21781.709276	705711.818998	706384.735631
10	Polygon	3520	3024	3999.29197	999646.016352	10672.324155	10672.324155	477320.657868	494441.185606
11	Polygon	1940	1398	3999.78856	999894.282876	12340.013187	12340.013187	448084.819075	556198.72327
12	Polygon	1102	1130	3999.763933	999881.970218	10789.889416	11946.699577	202754.713886	337220.469065
13	Polygon	475	740	3999.739107	999869.557699	11825.316995	12489.810974	90635.07567	335866.048319
14	Polygon	621	635	3999.714177	999857.093575	15058.031634	15295.184251	94167.20099	311675.883107
15	Polygon	786	609	3999.68935	999844.681212	11627.337805	13412.696057	156254.663405	283548.968409
16	Polygon	543	858	3999.664717	999832.365427	11302.133282	11399.073659	113071.69379	123387.514973
17	Polygon	483	1095	3999.639497	999819.756785	6606.024397	6606.024397	23188.660316	102881.356859
18	Polygon	359	1288	3999.615064	999807.541084	3107.864129	3107.864129	16686.700063	62873.836891
19	Polygon	1179	3326	3999.565011	999782.517191	1480.934112	1480.934112	114910.314426	153912.066459
20	Polygon	2415	5803	3999.540584	999770.305149	9746.26096	12565.744409	337157.42337	429831.208323
21	Polygon	1785	4571	3999.515564	999757.796829	8127.408242	8127.408242	219690.078794	291528.860162
22	Polygon	593	2277	3999.490531	999745.281722	2856.321217	4921.270436	46719.243079	177138.427992

0 of 551 selected

Filters: 100%

Change the field names to easily interpret the result

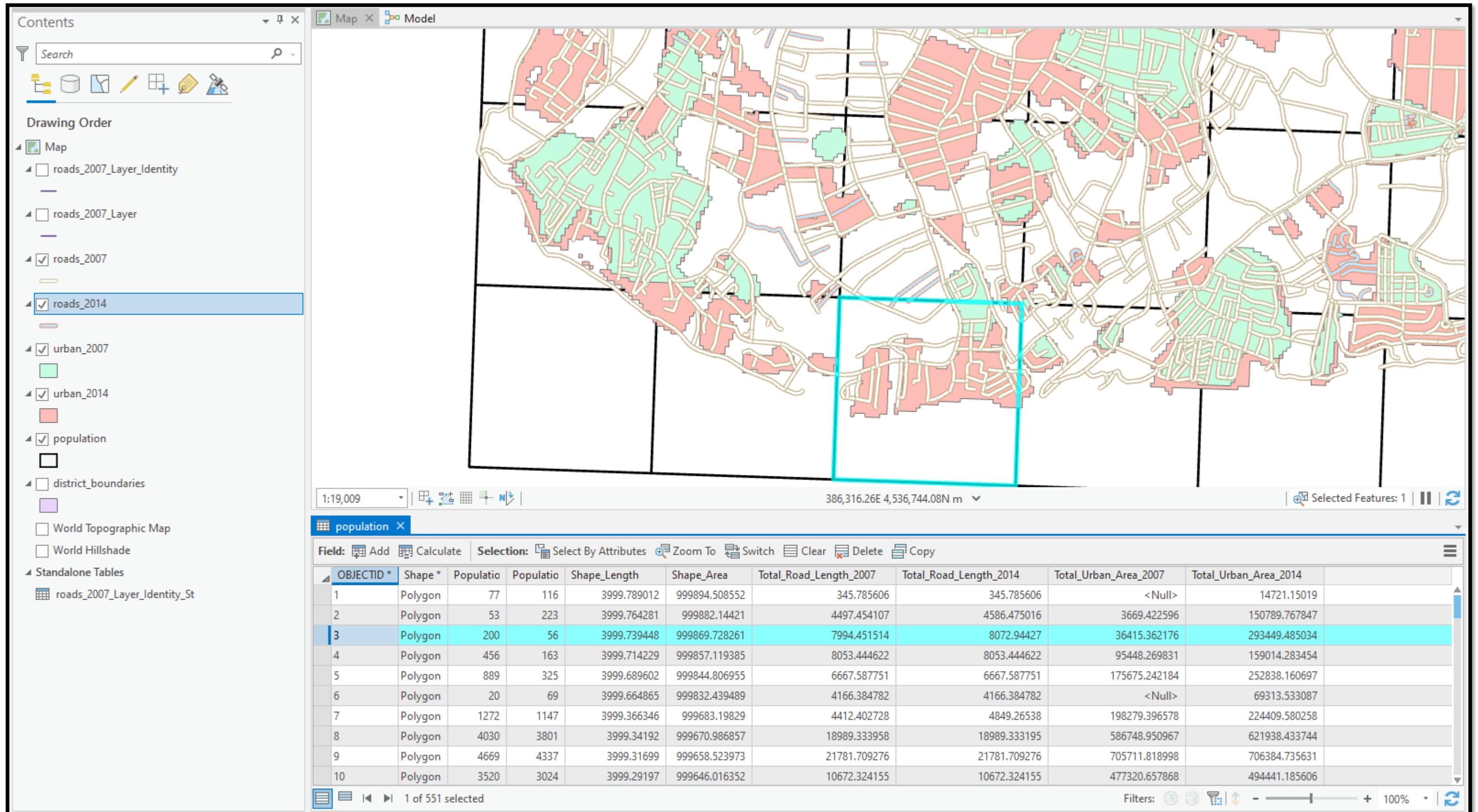


population \*Fields: population

Current Layer: population

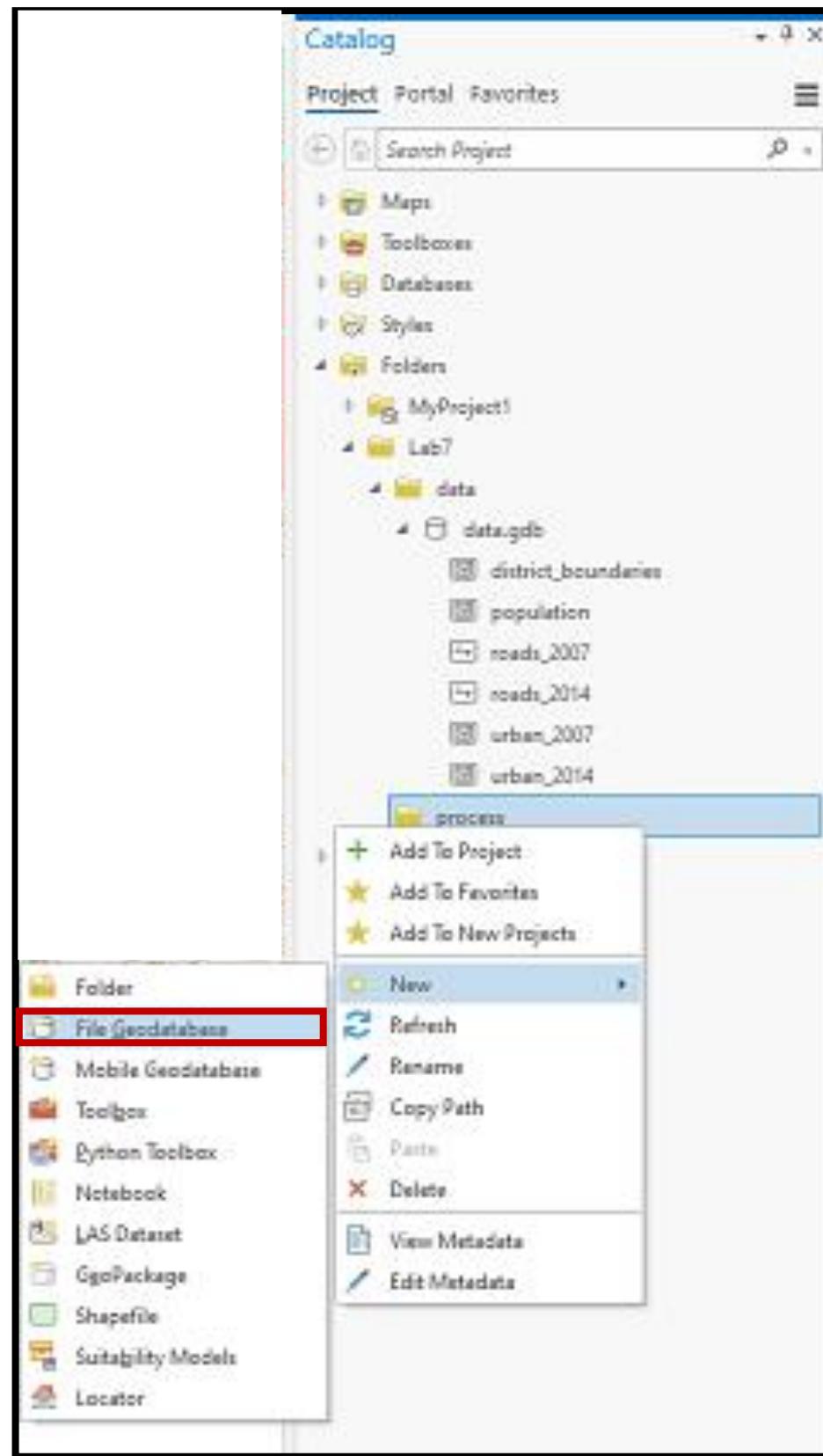
Visible	Read Only	Field Name	Alias	Data Type	Allow NULL	Highlight	Number Format	Domain	Default	Length
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	OBJECTID	OBJECTID	Object ID	<input type="checkbox"/>	<input type="checkbox"/>	Numeric			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Shape	Shape	Geometry	<input checked="" type="checkbox"/>	<input type="checkbox"/>				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	pop_2007	Population_2007	Double	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Numeric			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	pop_2014	Population_2014	Double	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Numeric			
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Shape_Length	Shape_Length	Double	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Numeric			
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Shape_Area	Shape_Area	Double	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Numeric			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	SUM_Shape_Length_12	Total_Road_Length_2007	Double	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Numeric			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	SUM_Shape_Length_12_13	Total_Road_Length_2014	Double	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Numeric			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	SUM_Shape_Area_12	Total_Urban_Area_2007	Double	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Numeric			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	SUM_Shape_Area_12_13	Total_Urban_Area_2014	Double	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Numeric			

# Inspect the Result

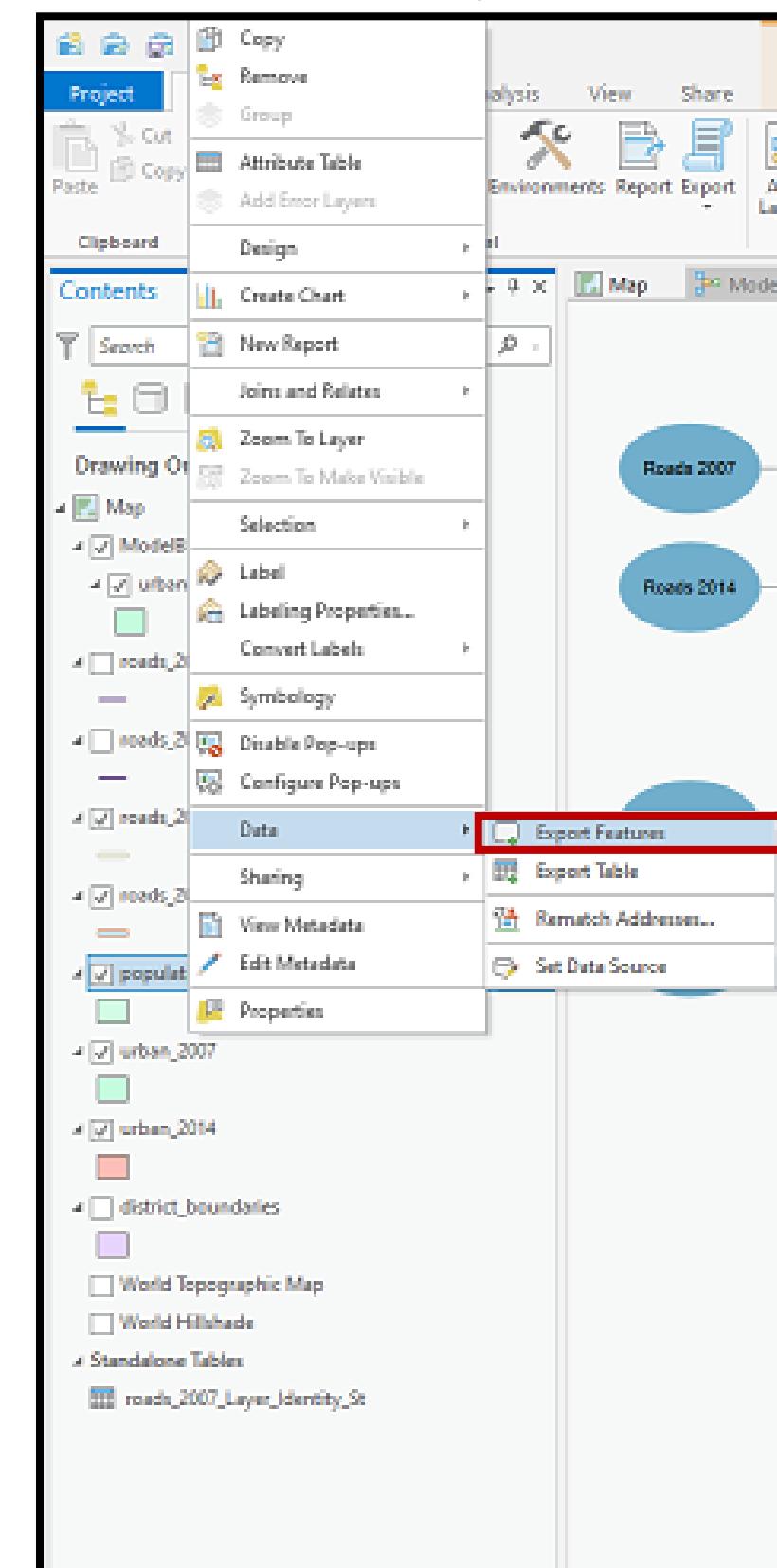


# Export Resulted Grid to a Geodatabase

Create an empty geodatabase named “process.gdb”



Export the result to process.gdb



# Results & Take Home

## *Aim of the Study:*

- *Is there any relationship with population, land use and transportation?*
- *If yes, is this relationship meaningful, linear or can it be described quantitatively?*
- *Could this relationship be shown spatially?*

## *Output Data:*

- *Population Grids that have total road length and total urban areas for 2007 and 2014 (Vector-Polygon)*

## *Take Home:*

- *Try to install ArcGIS Pro Trial Version properly, apply the workflow we have done on your own computer and check that you get the same results.*



*Contact:*

[akinom@itu.edu.tr](mailto:akinom@itu.edu.tr)