Developing an Automated Process to Analyze Condo Values in a 3D Environment

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Developing an Automated Process to Analyze Condo Values in a 3D Environment

- Disclaimer and Resources
- Background
- Data Used and Logic
- Automated Process
- SceneViewer Demo
- Lessons Learned

Disclaimer

- I'm very new to Python and by no means claim to be an expert on the subject.

Resources

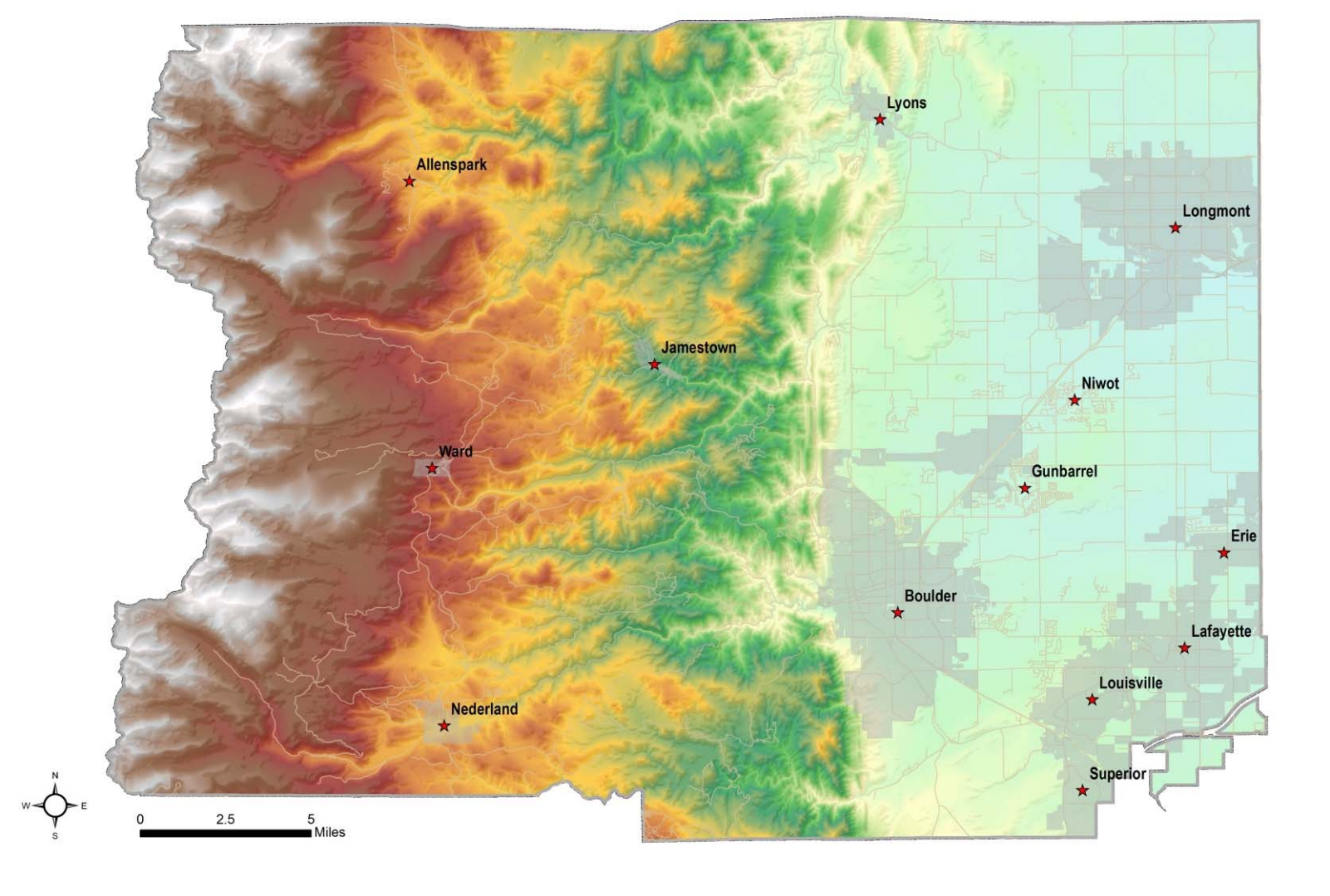
GIS Stack Exchange - https://gis.stackexchange.com/

GeoNet - https://community.esri.com/community/gis

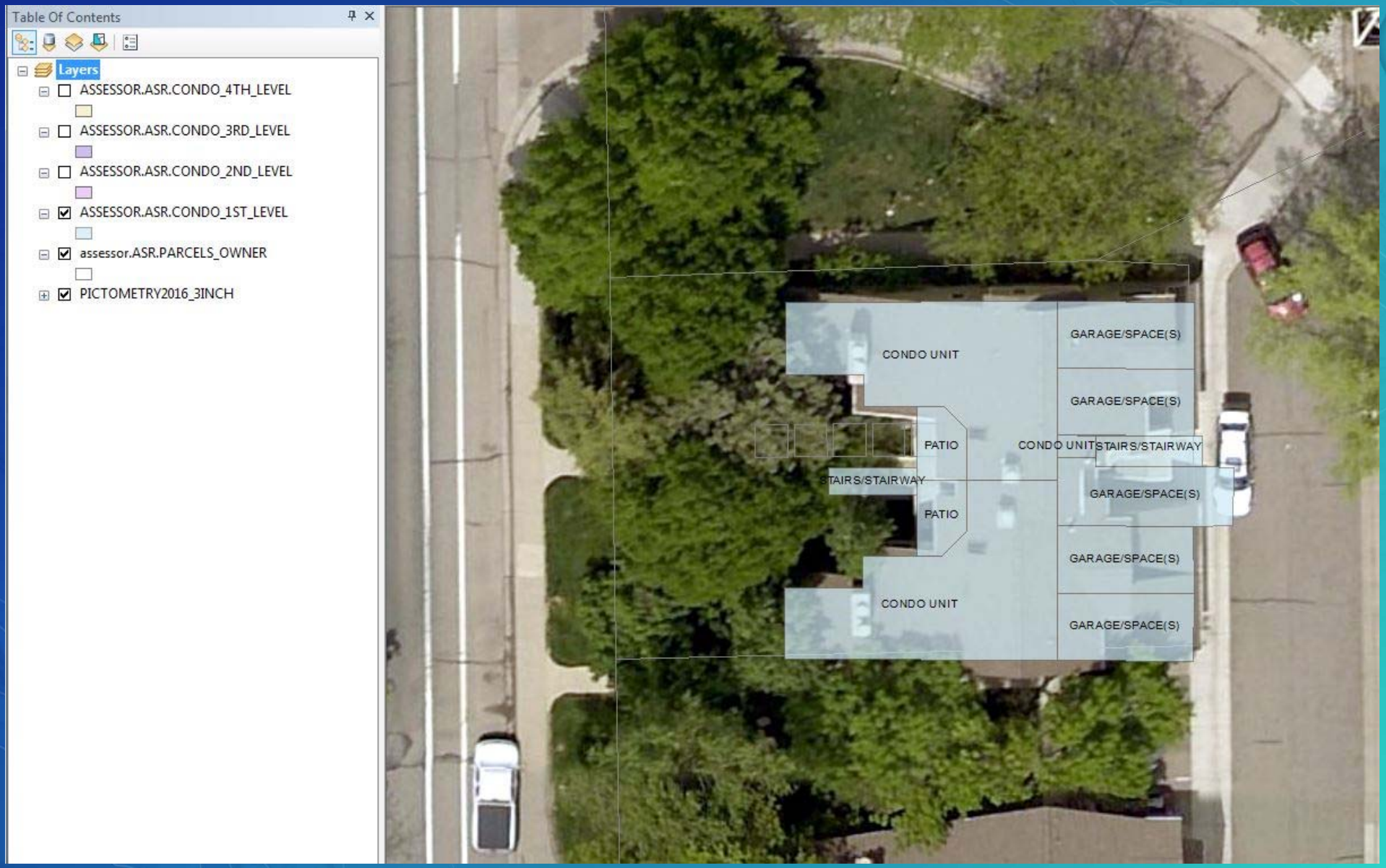
ArcGIS Pro ArcPy Reference - http://pro.arcgis.com/en/pro-app/arcpy/main/arcgis-pro-arcpy-reference.htm

PyCharm IDE – www.jetbrains.com

Boulder County, Colorado



Background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CONDO UNIT
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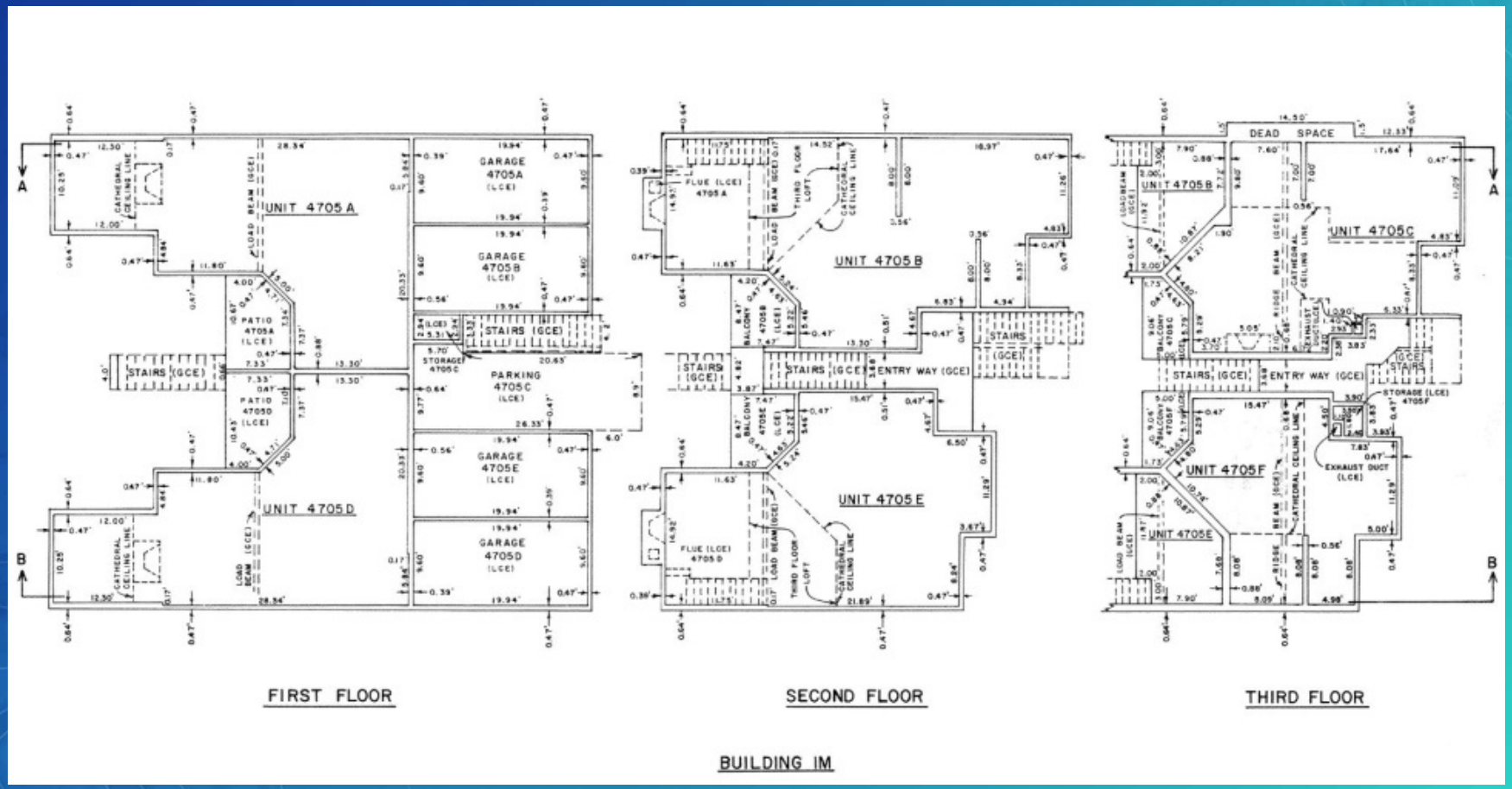
GARAGE/SPACE(S)
PATIO
GARAGE/SPACE(S)
CONDO UNIT
GARAGE/SPACE(S)

Data Used and Logic

- Georeference recorded condo plat to parcel fabric
- Digitize footprint characteristics
- Repeat for each floor/level



Data Used and Logic

- **Ends here…**

Table

ASSESSOR.ASR.CONDO_1ST_LEVEL

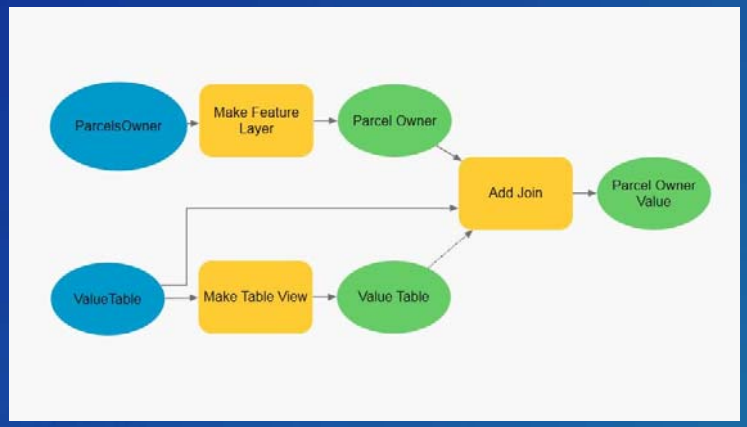
SHAPE.area	SHAPE.len	OBJECTID *	SUBCOD	CATEGOR	PARCEL_NO	UNIT_NO	TYPE_AREA	FLOOR	FLOOR_ELE	XY_POLY	REMARKS	EDITOR	SHAPE *	GlobalID *
680.248623	110.390116	1	9211	CONDO	146307097001	1477	CONDO UNIT	1ST	5536	YES	<Null>	Lori Krager	Polygon	{2A7BC35A-57E2-4017-9A1B-A3C947144112}
680.248623	110.390116	2	9211	CONDO	146307097002	1489	CONDO UNIT	1ST	5536	YES	<Null>	Lori Krager	Polygon	{AD0DDE8A-23B5-4C78-B98C-B90C581FD2DF}
17.958942	17.082199	3	9211	LCE	146307097001	1477	PORCH	1ST	5536	NO	<Null>	Lori Krager	Polygon	{DF848C06-0C46-48A4-8989-FE4520F6DA7D}
65.191666	35.01058	4	9211	LCE	146307097001	1477	PORCH	1ST	5536	NO	<Null>	Lori Krager	Polygon	{F442C322-A263-46FD-B7FE-6F8A12CC3BD8}
19.068471	17.563097	5	9211	LCE	146307097002	1489	PORCH	1ST	5536	NO	<Null>	Lori Krager	Polygon	{1A7E543E-CDFF-48A9-8D6C-71BDE09E7F82}
64.177559	35.315279	6	9211	LCE	146307097002	1489	PORCH	1ST	5536	NO	<Null>	Lori Krager	Polygon	{F79FCFAB-ED0E-44AE-A0A0-8E0B7F8287B0}
445.35522	93.841017	7	6633	CONDO	146113434008	745	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{645E278B-10D2-4F70-B930-B07FF24E6B7A}
19.735014	17.796469	8	6633	LCE	146113434008	745	UNSPECIFIED	1ST	5578	NO	<Null>	Lori Krager	Polygon	{98658852-CDF9-4FC9-AEB8-DC3B3A094838}
202.145137	56.983298	9	6633	CONDO	146113434010	765	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{E7297E4E-7A6A-456D-A467-F5911FFC0B28}
538.327808	109.339206	10	6633	GCE	<Null>	<Null>	OTHER	1ST	5578	NO	ATRIUM	Lori Krager	Polygon	{6555F627-C245-42A6-BB28-1405229155AB}
536.737257	112.689626	11	6633	CONDO	146113434009	755	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{D81E405C-F9CF-4BB5-8224-94D739CEF1AF}
29.171347	22.917584	12	6633	GCE	<Null>	<Null>	RESTROOM	1ST	5578	NO	<Null>	Lori Krager	Polygon	{C56442E5-6FCC-4E4C-A5C3-B0FDDB760B3E}
608.134638	114.615548	13	6633	CONDO	146113434007	735	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{FD1BEE93-C650-46E6-9D8C-5959CEB3F563}
582.273963	108.279279	14	6633	CONDO	146113434011	775	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{C8CC35CD-82CA-461D-A9AC-C6D28D91C0BA}
39.094727	29.32526	15	6633	GCE	<Null>	<Null>	STAIRS/STAIRWA	1ST	5578	NO	<Null>	Lori Krager	Polygon	{36CE5355-7594-4F66-A0D9-1B8CFC6C3297}

1 (0 out of *2000 Selected)

Data Used and Logic

Automated Process
Where to begin?

Model Builder



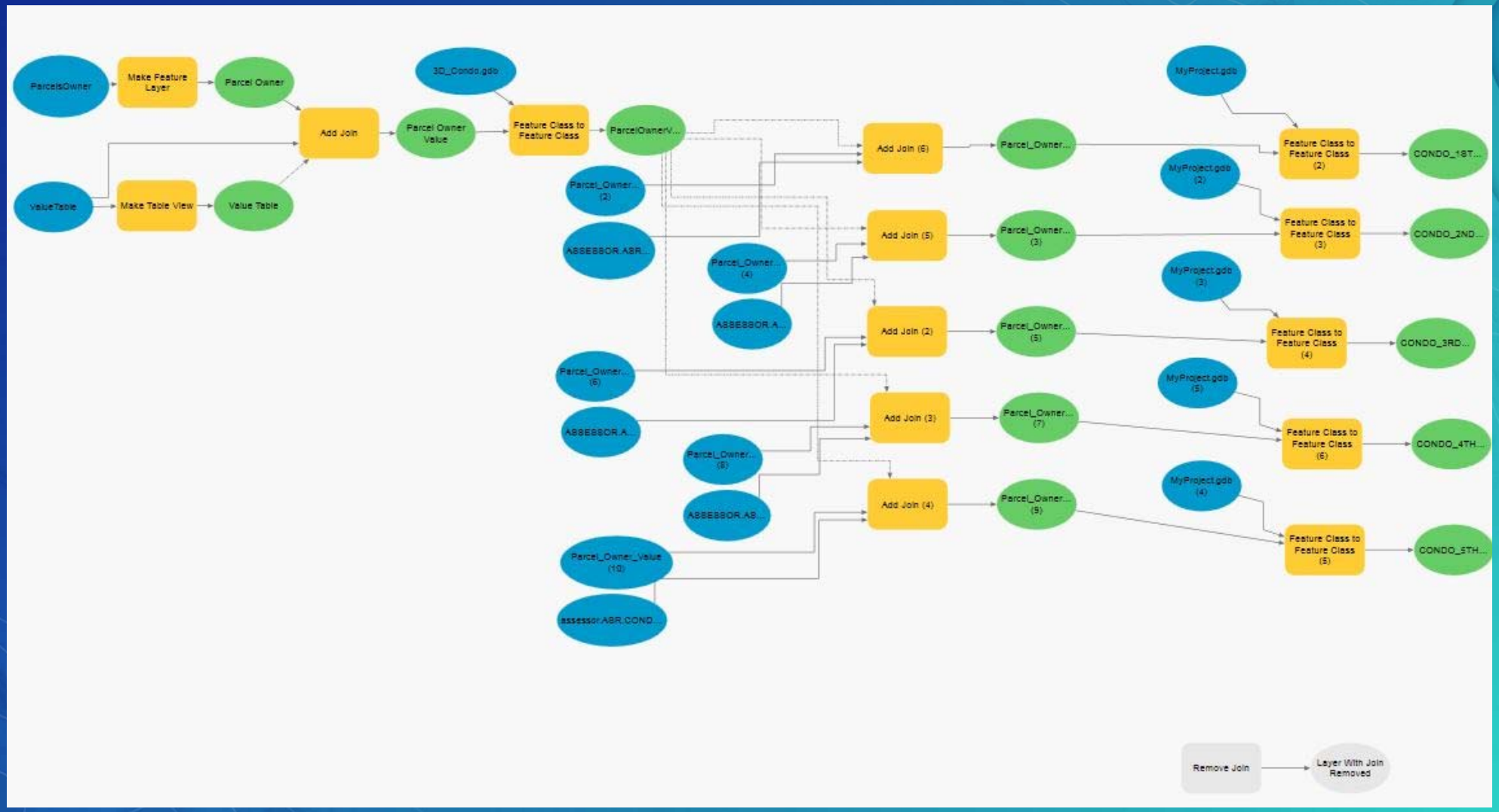
ArcPy

Source: www.thenewgeo.com

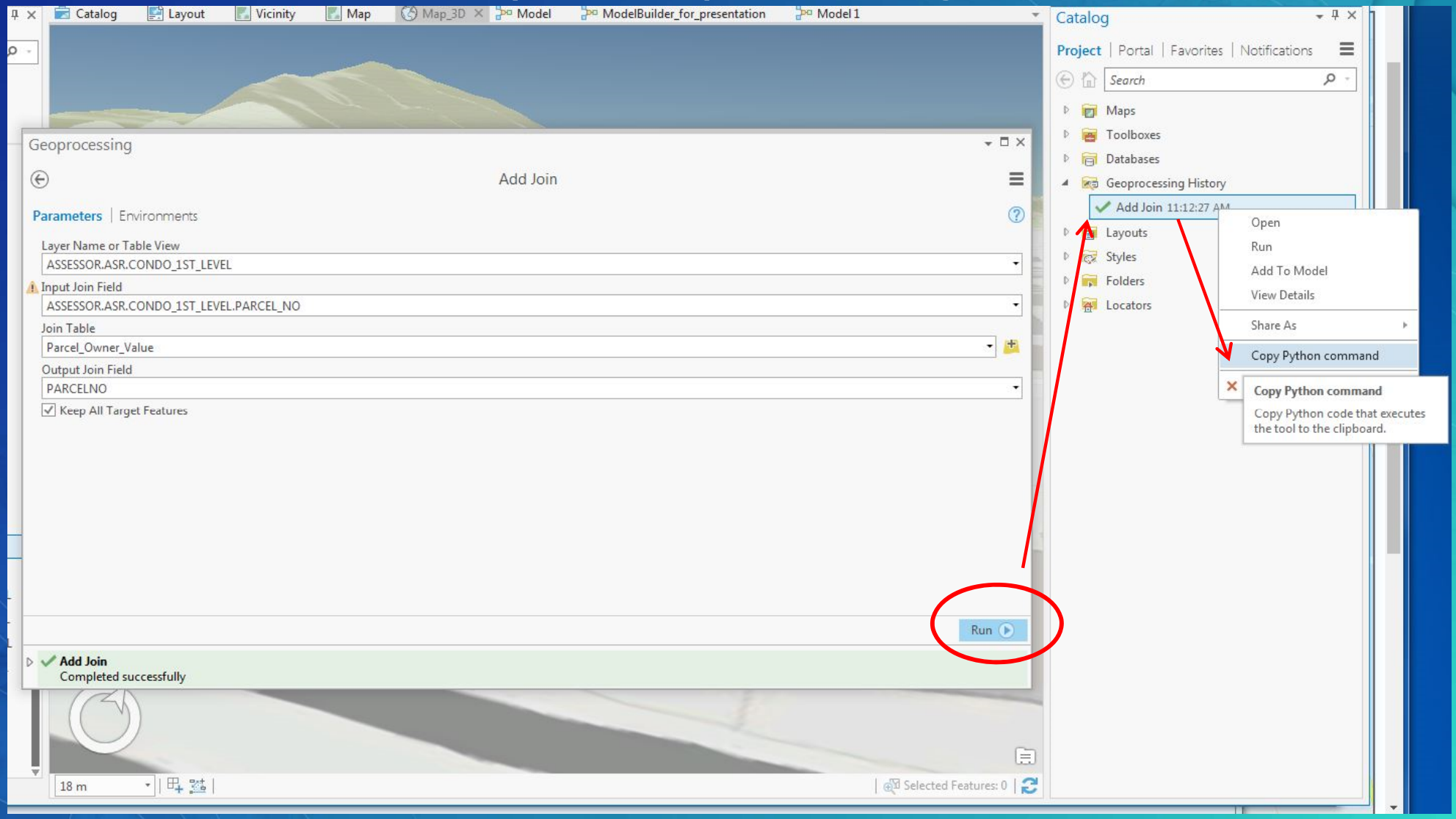
Automate process using the following data:

- CONDO 1st LEVEL…thru 5th LEVEL
- PARCELS_OWNER (Parcel Layer with Ownership)
- VALUES Table (Assessor Values)

Data Prep – Model Builder



Data Prep – Geoprocessing Tools



Data Prep – Geoprocessing Script

```
arcpy.management.AddJoin("ASSESSOR.ASR.CONDO_1ST_LEVEL", "ASSESSOR.ASR.CONDO_1ST_LEVEL.PARCEL_NO", "Parcel_Owner_Value", "assessor_ASR_PARCELS_OWNER_PARCELNO", "KEEP_ALL")
```

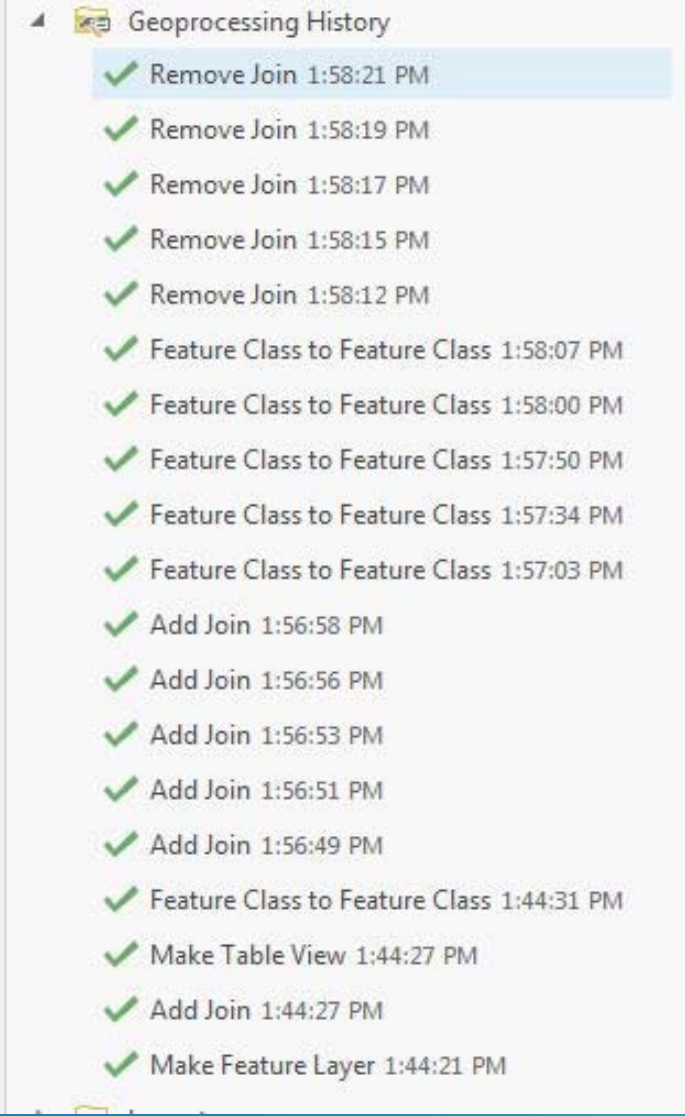
Python Geoprocessing script

- Make Feature Layer
- Make Table View
- Add Join
- FC to FC
- Add Join
- FC to FC
- Remove Join

```
import arcpy

# Make Feature Layer from ASR Parcel Owner
arcpy.management.MakeFeatureLayer("assessor.ASR.PARCELS_OWNER", "Parcel Owner", None, None, "OBJECTID OBJECTID HIDDEN NONE;DateUpdated DateUpdated HIDDEN NONE;ACCOUNTNO ACCOUNTNO VISIBLE NONE;PARCELNO PARCELNO

# Make Table View from ASR Values table
arcpy.management.MakeTableView("assessor.ASR.ASR_VALUES", "Values", None, None, "OBJECTID OBJECTID HIDDEN NONE;strap strap VISIBLE NONE;tax_yr tax_yr HIDDEN NONE;bldAcutalVal bldAcutalVal VISIBLE NONE;LandAcut

# Join Parcel Owner with ASR Values table based on strap
arcpy.management.AddJoin("Parcel Owner", "ACCOUNTNO", "Values", "strap", "KEEP_ALL")

# Create new Feature Class from joined Parcel Owner and Value table
arcpy.conversion.FeatureClassToFeatureClass("Parcel Owner", r"G:\OM\ArcThemes\3D_Condo\3D_Condo.gdb", "Parcel_Owner_Value", None, 'assessor_ASR_PARCELS_OWNER_ACCOUNTNO "ACCOUNTNO" true true false 25 Text 0 0,F

# Join each Condo Footprint Layer with Parcel Owner
arcpy.management.AddJoin("ASSESSOR.ASR.CONDO_1ST_LEVEL", "PARCEL_NO", "Parcel_Owner_Value", "assessor_ASR_PARCELS_OWNER_PARCELNO", "KEEP_ALL")
arcpy.management.AddJoin("ASSESSOR.ASR.CONDO_2ND_LEVEL", "PARCEL_NO", "Parcel_Owner_Value", "assessor_ASR_PARCELS_OWNER_PARCELNO", "KEEP_ALL")
arcpy.management.AddJoin("ASSESSOR.ASR.CONDO_3RD_LEVEL", "PARCEL_NO", "Parcel_Owner_Value", "assessor_ASR_PARCELS_OWNER_PARCELNO", "KEEP_ALL")
arcpy.management.AddJoin("ASSESSOR.ASR.CONDO_4TH_LEVEL", "PARCEL_NO", "Parcel_Owner_Value", "assessor_ASR_PARCELS_OWNER_PARCELNO", "KEEP_ALL")
arcpy.management.AddJoin("ASSESSOR.ASR.CONDO_5TH_LEVEL", "PARCEL_NO", "Parcel_Owner_Value", "assessor_ASR_PARCELS_OWNER_PARCELNO", "KEEP_ALL")

# Feature Class to Feature Class
arcpy.conversion.FeatureClassToFeatureClass("ASSESSOR.ASR.CONDO_1ST_LEVEL", r"G:\OM\ArcThemes\3D_Condo\3D_Condo.gdb", "CONDO_1ST_LEVEL", None, 'SUBCODE "SUBCODE" true true false 2 Short 0 5,First,#,ASSESSOR.AS
arcpy.conversion.FeatureClassToFeatureClass("ASSESSOR.ASR.CONDO_2ND_LEVEL", r"G:\OM\ArcThemes\3D_Condo\3D_Condo.gdb", "CONDO_2ND_LEVEL", None, 'SUBCODE "SUBCODE" true true false 2 Short 0 5,First,#,ASSESSOR.AS
arcpy.conversion.FeatureClassToFeatureClass("ASSESSOR.ASR.CONDO_3RD_LEVEL", r"G:\OM\ArcThemes\3D_Condo\3D_Condo.gdb", "CONDO_3RD_LEVEL", None, 'SUBCODE "SUBCODE" true true false 2 Short 0 5,First,#,ASSESSOR.AS
arcpy.conversion.FeatureClassToFeatureClass("ASSESSOR.ASR.CONDO_4TH_LEVEL", r"G:\OM\ArcThemes\3D_Condo\3D_Condo.gdb", "CONDO_4TH_LEVEL", None, 'SUBCODE "SUBCODE" true true false 2 Short 0 5,First,#,ASSESSOR.AS
arcpy.conversion.FeatureClassToFeatureClass("ASSESSOR.ASR.CONDO_5TH_LEVEL", r"G:\OM\ArcThemes\3D_Condo\3D_Condo.gdb", "CONDO_5TH_LEVEL", None, 'SUBCODE "SUBCODE" true true false 2 Short 0 5,First,#,ASSESSOR.AS


# Remove any existing joins on Assessor.ASR.CONDO_levels
arcpy.management.RemoveJoin("ASSESSOR.ASR.CONDO_1ST_LEVEL", "Parcel_Owner_Value")
arcpy.management.RemoveJoin("ASSESSOR.ASR.CONDO_2ND_LEVEL", "Parcel_Owner_Value")
arcpy.management.RemoveJoin("ASSESSOR.ASR.CONDO_3RD_LEVEL", "Parcel_Owner_Value")
arcpy.management.RemoveJoin("ASSESSOR.ASR.CONDO_4TH_LEVEL", "Parcel_Owner_Value")
arcpy.management.RemoveJoin("ASSESSOR.ASR.CONDO_5TH_LEVEL", "Parcel_Owner_Value")
```

Data Prep – Final Results

Approximately 14 minutes to run…



Scene Layer Package – Same Logic

For each Condo Level FC:

- Definition query
- Apply base height
- Apply elevation
- Extrude each Condo Level FC
- Layer 3D to FC
- Create Scene Layer Package (final product)
- Delete temporary FC

```python
import arcpy
# BEFORE RUNNING THIS PYTHON SCRIPT
# DELETE ALL 5 CONDO_1ST...CONDO_5TH
# SERVICE LAYER PACKAGES FROM
# HERE - G:\OM\ArcThemes\3D_Condo\AGOL_SLP

# Variables to form defintion query

field = 'SUBCODE'

value = "(1152,1153,1154,1155)"
# concatenate query syntax

queryStr = str(field) + '"IN"' + str(value)

# Specify the aprx project (CURRENT), dataframe (Layers)

p = arcpy.mp.ArcGISProject("CURRENT")

m = p.listMaps("Map_3D")[0]

# Apply defintion query to specified layer group

for lyr in m.listLayers("CONDO*"):
    if lyr.supports("DEFINITIONQUERY"):
        lyr.definitionQuery = queryStr
arcpy.MakeFeatureLayer_management("CONDO_1ST_LEVEL","CONDO_1ST_LEVEL_SELECTED")
arcpy.MakeFeatureLayer_management("CONDO_2ND_LEVEL","CONDO_2ND_LEVEL_SELECTED")
arcpy.MakeFeatureLayer_management("CONDO_3RD_LEVEL","CONDO_3RD_LEVEL_SELECTED")
arcpy.MakeFeatureLayer_management("CONDO_4TH_LEVEL","CONDO_4TH_LEVEL_SELECTED")
arcpy.MakeFeatureLayer_management("CONDO_5TH_LEVEL","CONDO_5TH_LEVEL_SELECTED")
arcpy.Layer3DToFeatureClass_3d("CONDO_1ST_LEVEL_SELECTED','CONDO_1ST_LEVEL_3D')
arcpy.Layer3DToFeatureClass_3d("CONDO_2ND_LEVEL_SELECTED','CONDO_2ND_LEVEL_3D')
arcpy.Layer3DToFeatureClass_3d("CONDO_3RD_LEVEL_SELECTED','CONDO_3RD_LEVEL_3D')
arcpy.Layer3DToFeatureClass_3d("CONDO_4TH_LEVEL_SELECTED','CONDO_4TH_LEVEL_3D')
arcpy.Layer3DToFeatureClass_3d("CONDO_5TH_LEVEL_SELECTED','CONDO_5TH_LEVEL_3D')
# Apply extrusion
for lyr in m.listLayers("3D*"):
 if lyr.supports("EXTRUSION"):
    lyr.extrusion('BASE_HEIGHT',10)
#Creates a Scene Layer Package so that AGOL can consume the data
arcpy.management.CreateSceneLayerPackage("CONDO_1ST_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_1ST.slpk")
arcpy.management.CreateSceneLayerPackage("CONDO_2ND_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_2ND.slpk")
arcpy.management.CreateSceneLayerPackage("CONDO_3RD_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_3RD.slpk")
arcpy.management.CreateSceneLayerPackage("CONDO_4TH_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_4TH.slpk")
arcpy.management.CreateSceneLayerPackage("CONDO_5TH_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_5TH.slpk")

#Deleting the 'selected' feature classes since these are temporary
arcpy.management.Delete("CONDO_1ST_LEVEL_SELECTED", None)
arcpy.management.Delete("CONDO_2ND_LEVEL_SELECTED", None)
arcpy.management.Delete("CONDO_3RD_LEVEL_SELECTED", None)
arcpy.management.Delete("CONDO_4TH_LEVEL_SELECTED", None)
arcpy.management.Delete("CONDO_5TH_LEVEL_SELECTED", None)
```

Geoprocessing

Caveat with AGOL

- AGOL Scene Viewer has a 2,000 record import limit
- AGOL Map (2D viewer) doesn't have this limitation

Result

- I had to limit my import records and alter logic
- Embed a Definition Query within the Script and utilize SubCode Field

Table

ASSESSOR.ASR.CONDO_1ST_LEVEL

SHAPE_area	SHAPE_len	OBJECTID *	SUBCOD	CATEGOR	PARCEL_NO	UNIT_NO	TYPE_AREA	FLOOR	FLOOR_ELE	XY_POLY	REMARKS	EDITOR	SHAPE *	GlobalID *
680.248623	110.390116	1	9211	CONDO	146307097001	1477	CONDO UNIT	1ST	5536	YES	<Null>	Lori Krager	Polygon	{2A7BC35A-57E2-4017-9A1B-A3C947144112}
680.248623	110.390116	2	9211	CONDO	146307097002	1489	CONDO UNIT	1ST	5536	YES	<Null>	Lori Krager	Polygon	{AD0DDE8A-23B5-4C78-B98C-B90C581FD2DF}
17.958942	17.082199	3	9211	LCE	146307097001	1477	PORCH	1ST	5536	NO	<Null>	Lori Krager	Polygon	{DF848C06-0C46-48A4-8989-FE4520F6DA7D}
65.191666	35.01058	4	9211	LCE	146307097001	1477	PORCH	1ST	5536	NO	<Null>	Lori Krager	Polygon	{F442C322-A263-46FD-B7FE-6F8A12CC3BD8}
19.068471	17.563097	5	9211	LCE	146307097002	1489	PORCH	1ST	5536	NO	<Null>	Lori Krager	Polygon	{1A7E543E-CDFF-48A9-8D6C-71BDE09E7F82}
64.177559	35.315279	6	9211	LCE	146307097002	1489	PORCH	1ST	5536	NO	<Null>	Lori Krager	Polygon	{F79FCFAB-ED0E-44AE-A0A0-8E0B7F8287B0}
445.35522	93.841017	7	6633	CONDO	146113434008	745	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{645E278B-10D2-4F70-B930-B07FF24E6B7A}
19.735014	17.796469	8	6633	LCE	146113434008	745	UNSPECIFIED	1ST	5578	NO	<Null>	Lori Krager	Polygon	{98658852-CDF9-4FC9-AEB8-DC3B3A094838}
202.145137	56.983298	9	6633	CONDO	146113434010	765	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{E7297E4E-7A6A-456D-A467-F5911FFC0B28}
538.327808	109.339206	10	6633	GCE	<Null>	<Null>	OTHER	1ST	5578	NO	ATRIUM	Lori Krager	Polygon	{6555F627-C245-42A6-BB28-1405229155AB}
536.737257	112.689626	11	6633	CONDO	146113434009	755	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{D81E405C-F9CF-4BB5-8224-94D739CEF1AF}
29.171347	22.917584	12	6633	GCE	<Null>	<Null>	RESTROOM	1ST	5578	NO	<Null>	Lori Krager	Polygon	{C56442E5-6FCC-4E4C-A5C3-B0FDDB760B3E}
608.134638	114.615548	13	6633	CONDO	146113434007	735	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{FD1BEE93-C650-46E6-9D8C-5959CEB3F563}
582.273963	108.279279	14	6633	CONDO	146113434011	775	CONDO UNIT	1ST	5578	YES	<Null>	Lori Krager	Polygon	{C8CC35CD-82CA-461D-A9AC-C6D28D91C0BA}
39.094727	29.32526	15	6633	GCE	<Null>	<Null>	STAIRS/STAIRWA	1ST	5578	NO	<Null>	Lori Krager	Polygon	{36CE5355-7594-4F66-A0D9-1B8CFC6C3297}

1 (0 out of *2000 Selected)

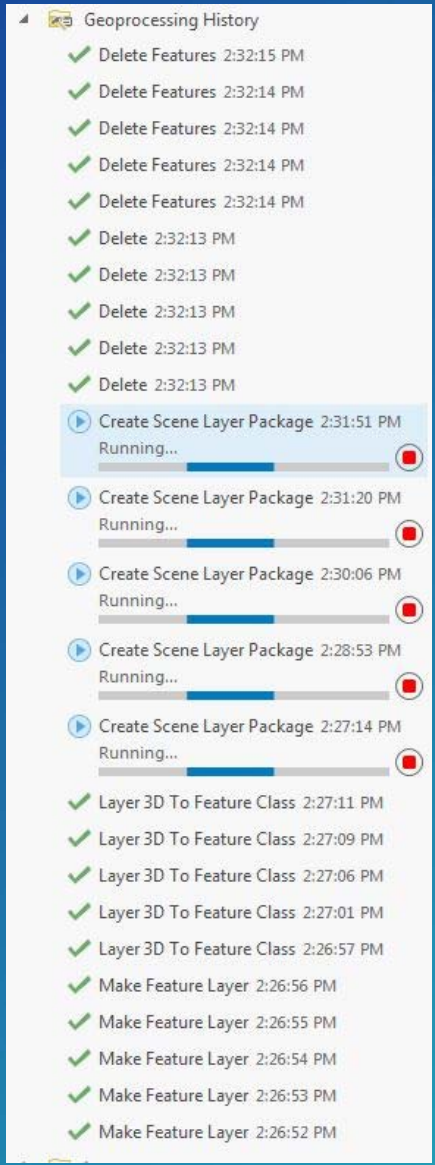
Geoprocessing – Final Results

SubCode

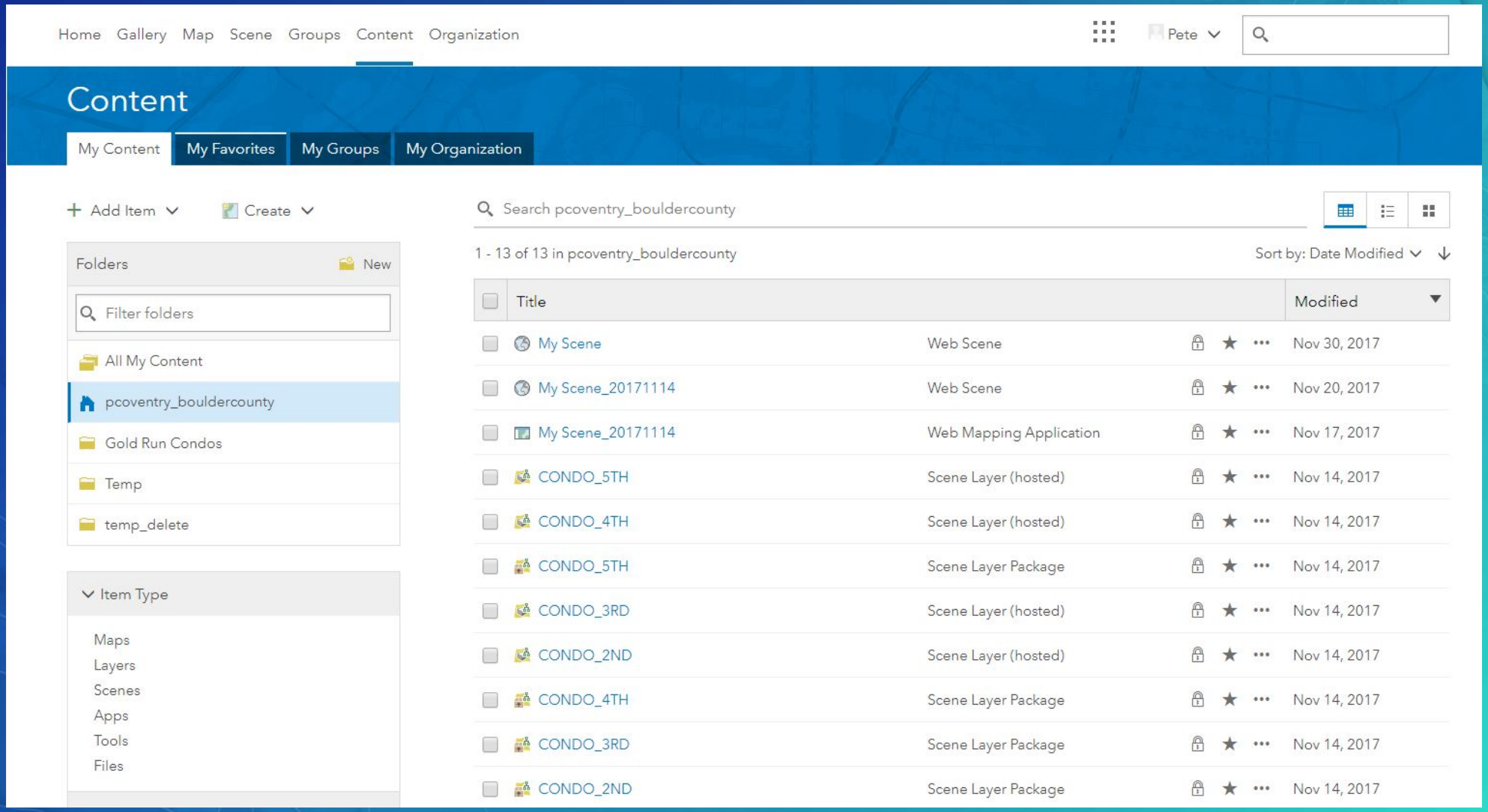
```python
import arcpy
# BEFORE RUNNING THIS PYTHON SCRIPT
# DELETE ALL 5 CONDO_1ST...CONDO_5TH
# SERVICE LAYER PACKAGES FROM
# HERE - G:\OM\ArcThemes\3D_Condo\AGOL_SLP

# Variables to form defintion query

field = 'SUBCODE'

value = "(8400, 8403, 8405, 8413, 8414)"
# concatenate query syntax

queryStr = str(field) + '"IN"' + str(value)

# Specify the aprx project (CURRENT), dataframe (Layers)

p = arcpy.mp.ArcGISProject("CURRENT")

m = p.listMaps("Map_3D")[0]

# Apply defintion query to specified layer group

for lyr in m.listLayers("CONDO*"):
    if lyr.supports("DEFINITIONQUERY"):
        lyr.definitionQuery = queryStr
arcpy.management.MakeFeatureLayer("CONDO_1ST_LEVEL", "CONDO_1ST_LEVEL_Layer", None, None, "OBJECTID OBJECTID HIDDEN NONE;Shape Shape HIDDEN NONE;SUBCODE SUBCODE VISIBLE NONE;CATEGORY CATEGORY VISIBLE NONE;PA
arcpy.management.MakeFeatureLayer("CONDO_2ND_LEVEL", "CONDO_2ND_LEVEL_Layer", None, None, "OBJECTID OBJECTID HIDDEN NONE;Shape Shape HIDDEN NONE;SUBCODE SUBCODE VISIBLE NONE;CATEGORY CATEGORY VISIBLE NONE;PA
arcpy.management.MakeFeatureLayer("CONDO_3RD_LEVEL", "CONDO_3RD_LEVEL_Layer", None, None, "OBJECTID OBJECTID HIDDEN NONE;Shape Shape HIDDEN NONE;SUBCODE SUBCODE VISIBLE NONE;CATEGORY CATEGORY VISIBLE NONE;PA
arcpy.management.MakeFeatureLayer("CONDO_4TH_LEVEL", "CONDO_4TH_LEVEL_Layer", None, None, "OBJECTID OBJECTID HIDDEN NONE;Shape Shape HIDDEN NONE;SUBCODE SUBCODE VISIBLE NONE;CATEGORY CATEGORY VISIBLE NONE;PA
arcpy.management.MakeFeatureLayer("CONDO_5TH_LEVEL", "CONDO_5TH_LEVEL_Layer", None, None, "OBJECTID OBJECTID HIDDEN NONE;Shape Shape HIDDEN NONE;SUBCODE SUBCODE VISIBLE NONE;CATEGORY CATEGORY VISIBLE NONE;PA
arcpy.Layer3DToFeatureClass_3d("CONDO_1ST_LEVEL_LAYER",'CONDO_1ST_LEVEL_3D')
arcpy.Layer3DToFeatureClass_3d("CONDO_2ND_LEVEL_LAYER",'CONDO_2ND_LEVEL_3D')
arcpy.Layer3DToFeatureClass_3d("CONDO_3RD_LEVEL_LAYER",'CONDO_3RD_LEVEL_3D')
arcpy.Layer3DToFeatureClass_3d("CONDO_4TH_LEVEL_LAYER",'CONDO_4TH_LEVEL_3D')
arcpy.Layer3DToFeatureClass_3d("CONDO_5TH_LEVEL_LAYER",'CONDO_5TH_LEVEL_3D')
# Apply extrusion
for lyr in m.listLayers("3D*"):
 if lyr.supports("EXTRUSION"):
    lyr.extrusion('BASE_HEIGHT',10)
#Creates a Scene Layer Package so that AGOL can consume the data
arcpy.management.CreateSceneLayerPackage("CONDO_1ST_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_1ST.slpk")
arcpy.management.CreateSceneLayerPackage("CONDO_2ND_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_2ND.slpk")
arcpy.management.CreateSceneLayerPackage("CONDO_3RD_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_3RD.slpk")
arcpy.management.CreateSceneLayerPackage("CONDO_4TH_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_4TH.slpk")
arcpy.management.CreateSceneLayerPackage("CONDO_5TH_LEVEL_3D", r"G:\OM\ArcThemes\3D_Condo\AGOL_SLP\CONDO_5TH.slpk")
```

Geoprocessing – Final Results

Approximately 4 ½ minutes to run…



ArcGIS Online



ArcGIS Online – SceneViewer demo

http://www.arcgis.com/home/index.html

Summary

- A need to visualize condo value distribution in a 3D environment
- AGOL’s Scene View makes it possible for an appraisal staff
- Python allowed for an automated process

Lessons Learned

Caveat with AGOL

- AGOL Scene Viewer has a 2,000 record import limit
- Unable to Label Features in AGOL Scene Viewer

ArcPy

- ArcMap – ArcPy versus ArcGIS Pro's ArcPy

Benefits of using Python over ModelBuilder:

- Run script outside of ESRI
- Able to schedule an overight script

Any questions??

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