

Automated Map Book Production Workflow: Using ArcGIS and Python Programming

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Southern California Association of Governments (SCAG)



Nation's largest Metropolitan Planning Organization (MPO)

6 counties and 191 cities

19.0 million people within 38,000+ square miles

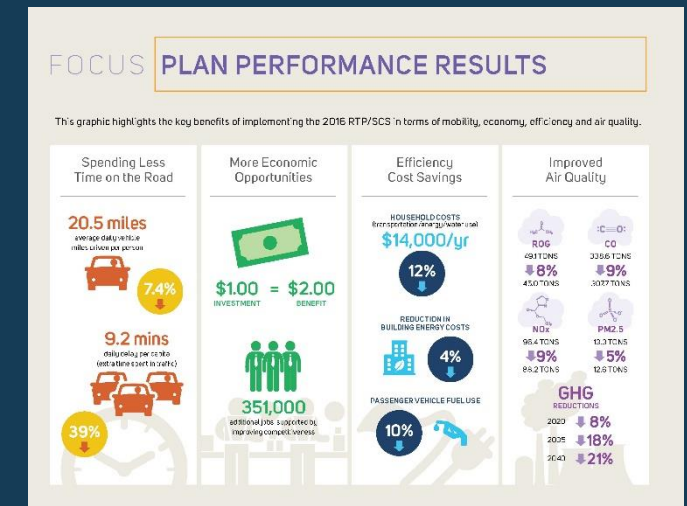
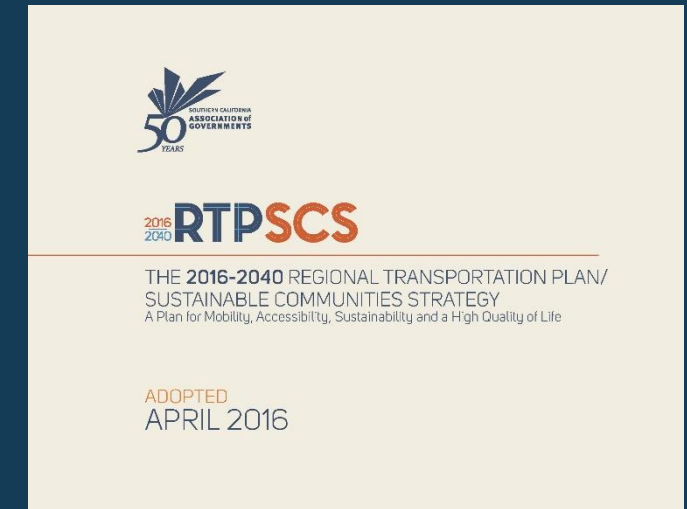
**GRP in 2017: \$1,205 Billion
(15th largest economy in the world)**



BACKGROUND



- **Regional Transportation Plan (RTP)**
 - A long-range transportation plan developed every 4 years
 - Providing a vision for investing in transportation system in the region.
 - Identifying regional transportation strategies to address mobility needs
- **Sustainable Communities Strategy (SCS) and Senate Bill 375**
 - Identifying the general location of uses and residential densities in the region
 - Gathering and considering the best practically available scientific information regarding resource areas and farmland in the region
 - Engaging the region in the SCS development process



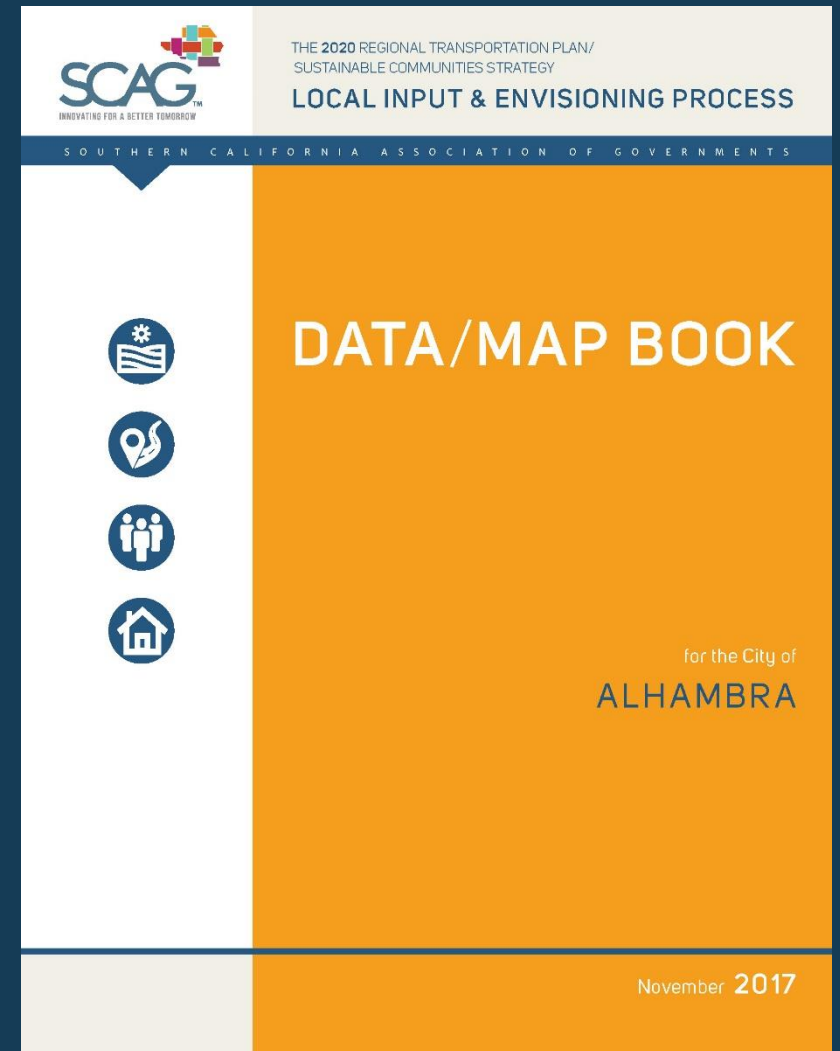
- **Bottom-Up Local Input and Envisioning Process**
 - Engaging with 197 local governments in the region to establish a regional profile of land use, resource areas datasets and socioeconomic growth forecast in preparation for the RTP/SCS development
- **To facilitate and assist in the local review of SCAG's base datasets**
 - Conducting one-on-one outreach meetings
 - Producing the Data/Map Book for 197 local governments
 - Collecting data changes and providing technical guidance

Data/Map Book Production



- Producing 197 Data/Map Books for the Local Input & Envisioning Process, including data descriptions and maps for:

Land Use	General Plan, Zoning, Existing Land Use, Specific Plan
Resource Areas & Farmland	Open Space and Parks, Endangered Species and Plants, Flood areas, Natural Community & Habitat Conservation, Farmland, Sea Level Rise
Transportation	Major Transit Stops, High Quality Transit Corridors, High Quality Transit Areas, Transit Priority Areas, Bikeways, Truck Routes
Admin Boundary	City Boundary & Sphere of Influence, Census Tract, Transportation Analysis Zone (TAZ)
Growth	Socioeconomic Growth Forecast Entitlements, Potential Infill Sites



OBJECTIVES



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- **Produce the Data/Map Books for 197 local jurisdictions in a timely and labor-efficient manner**
 - Development of an automated workflow to streamline repetitive tasks to develop and updated regional land use database (parcel-based)
 - Development of an automated map book production workflow to streamline repetitive mapping tasks to generate a series of maps for 197 jurisdictions

METHODOLOGY



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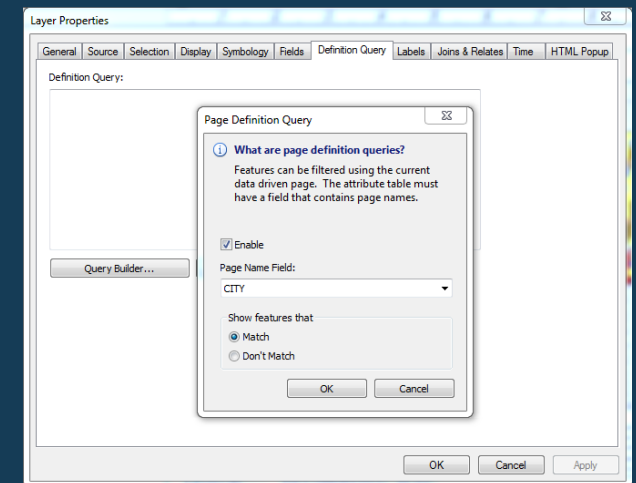
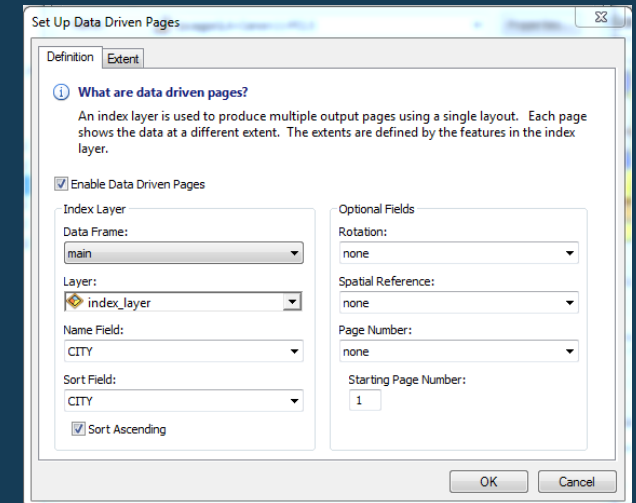
- **ArcGIS Data Driven Pages**
 - To create a series of maps from a single map document
 - Easy and quick – no need to write code
- **ArcPy site package**
 - Allows users to perform geographic data analysis, data conversion, data management, and map automation with Python
- **Arcpy.mapping**
 - Python mapping module
 - Allows users to manipulate map contents such as map documents (.mxd) and layer files (.lyr) and to automate map production like exporting
 - Ex) arcpy.mapping.MapDocument, arcpy.mapping.ListLayers, arcpy.mapping.AddLayer, etc.

- **Extends the capabilities of Data Driven Pages**
 - Data Driven Pages does not provide enough functions for complicated map book production.
 - Python scripts enables users to create complicated map books in more efficient manner.
- **Save Python code by using Data Driven Pages-enabled map document.**
 - Data Driven Pages set-up for page extents, map scales, dynamic text, etc.

DDP-Enabled Map Document Set-Up



- **Index layer** – To produce multiple output pages using a single layout
- **Map extent** – Defined by the features in the index layer
- **Page Definition Query (Layer Properties)** – Features can be filtered using current data driven pages.
- **Dynamic text** – To change page titles, labels, etc. dynamically
 - Map title: `<dyn type="page" property="CITYNAME"/>`
 - File path: `<dyn type="document" property="path"/>`
 - Date saved: `<dyn type="document" property="date saved" format="short"/>`



Python Scripts Sample #1



Set the current map document

```
mxd1 = arcpy.mapping.MapDocument ("P:/mxds/GP_City.mxd")
```

Overwrite pre-existing files

```
arcpy.env.overwriteOutput = True
```

Loop for the map production

```
for pageNum1 in range (1, mxd1.dataDrivenPages.pageCount + 1):  
    mxd1.dataDrivenPages.currentPageID = pageNum1
```

Set the main data frame

```
df_main1 = arcpy.mapping.ListDataFrames (mxd1, "main")[0]
```

Python Scripts Sample #2



Set Symbology Layer file path

```
symLyr1 = "P:/shapes/=lyr_2016/" + cityName1 + "_GP.lyr"  
addLyr1 = arcpy.mapping.Layer (symLyr1)  
arcpy.mapping.AddLayer (df_main1, addLyr1, "BOTTOM")
```

Turn on the selected land use layer only and update layer symbology

```
if county1 == 'Imperial':  
    for lyr in arcpy.mapping.ListLayers (mxd1, "GP_IM", df_main1):  
        lyr.visible = True  
        arcpy.mapping.UpdateLayer (df_main1, lyr, addLyr1)
```

...

Remove the layer

```
for lyr in arcpy.mapping.ListLayers(mxd1, addLyr1, df_main1):  
    arcpy.mapping.RemoveLayer(df_main1, lyr)
```

Python Scripts Sample #3



Export PDF files

```
arcpy.mapping.ExportToPDF (mxd1, "P:/images/" + city1 + "/" + city1 + "_GP.pdf",  
resolution = 400)
```

Print the status of export process

```
print "Exporting page {0} of {1} (Portrait): ".format (str(mxd1.dataDrivenPages.curre  
ntPageID), str(mxd1.dataDrivenPages.pageCount)) + city1
```

```
TotalPage = mxd1.dataDrivenPages.pageCount
```

```
print "Total {0} pages are exported".format (str>TotalPage))
```

Save map document

```
mxd1.save()
```

Python Scripts Sample #4



```
# Loop to merge maps
main_folder_path = "P:/DataMap_Guide/images/" + cnty
for dirtop, folder_paths, filenames in os.walk (main_folder_path):
    for folder_path in folder_paths:
        fileList = os.listdir (main_folder_path + "/" + folder_path)
        city_name = folder_path.split("\\")[-1]
        city = str (city_name)
        pdf_name = city + "_Maps.pdf"
        finalPDF_fname = main_folder_path + "/" + str (pdf_name)
```


Python Scripts Sample #5



```
# Create pdf document
finalPDF=arcpy.mapping.PDFDocumentCreate(finalPDF_fname)

# Append maps
for file in fileList:
    if file.split('_', 1)[1]=="GP_City.pdf":
        finalPDF.appendPages(main_folder_path + "/" + folder_path +
            "/" + file)
    ...

# Save map pdf document
finalPDF.saveAndClose()
```

CONCLUSIONS



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Benefits of Automated Mapping Workflow Using Python



- **It makes work easier.**
 - By setting up the proper sequence of tasks
- **It makes map book production task faster.**
 - By speeding up repetitive map production and compilation tasks
- **It makes map book production task more accurate and consistent.**
 - By using same sequence of tasks and consistent map document format

Thank you

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