TIP ATLAS – ARCGIS PRO TOOL DOCUMENTATION

The TIP Atlas is a python tool that summarizes and displays transportation improvement projects (TIP) by legislative districts. The tool produces a series of CSVs and Image files (PDF or PNG) containing:

1. Map displaying individual TIP projects within a selected legislative district. The map includes labels related TIP projects records displayed in the summary table.
2. Insert map highlighting the district location within the CMAP region.
3. Dynamic text displaying the name of the legislative district and the total number of projects within the district.
4. Horizontal bar chart displaying the count of TIP projects within the selected district by project type.
5. Summary table displaying the details of TIP projects within the district.
    a. **Note**: Summary table only includes 20 TIP records, for a full list see the CSV output listing all TIP projects within the selected district.

Figure 2 - Chicago Ward Example Output

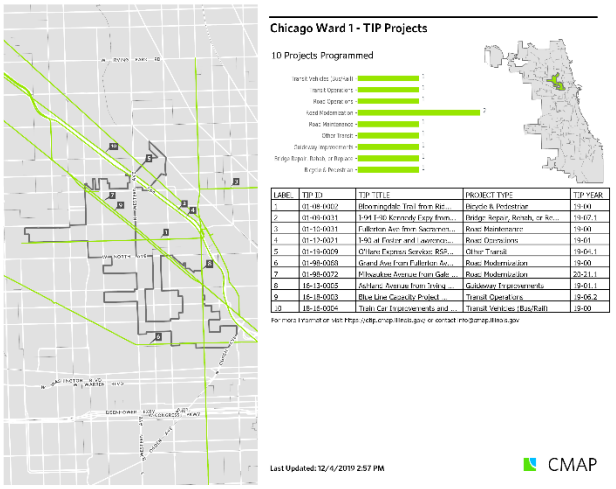
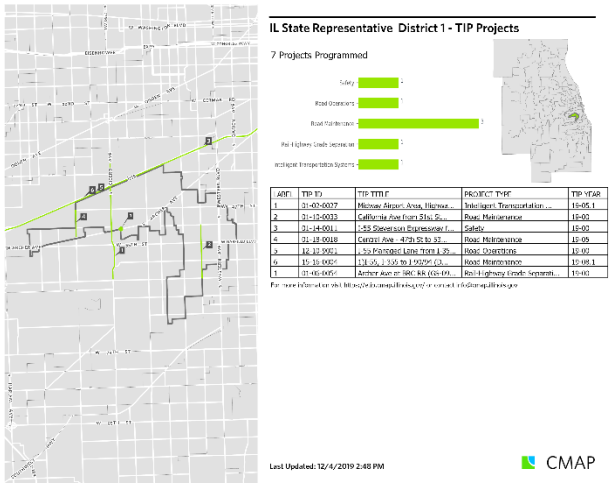


Figure 1 - Example State Representative Output



REQUIREMENTS

The TIP Atlas requires ArcGIS Pro and a connection to the CMAP network to access input datasets the Data Depot (V: Drive) and the Dynamic Maps FY 20 Projects Folder (S: Drive).

Datasets & Maps

Legislative District shapefiles are referenced from the CMAP Data Depot. These shapefiles include:

- **Illinois State Representative Districts**:
    - V:\Administrative_and_Political_Boundaries\Legislative\StateRepDistIL_IlStBoardOfElections_201111.shp
- **Illinois State Senate Districts**:
    - V:\Administrative_and_Political_Boundaries\Legislative\StateSenDistIL_IlStBoardOfElections_201111.shp
- **Chicago Wards**:
    - V:\Administrative_and_Political_Boundaries\Legislative\Wards_Chicago_201505.shp
- **US Representative Districts**:
    - V:\Administrative_and_Political_Boundaries\Legislative\USRepDistIL_IlStBoardOfElections_201111.shp

Scratch Geodatabase located in Dynamic Maps FY 20 Projects Folder is used to store temporary datasets produced by the tool. This geodatabase also contains base layers referenced by the tool.

- **TIPDynamicMaps.gdb**: S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\TIPDynamicMaps.gdb

Symbolized Layer Files are referenced by the tool to import label style properties for the TIP line and point feature classes.

- **tipLines.lyrx**: S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\baseLayers\tipLines.lyrx
- **tipPoints.lyrx**: S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\baseLayers\tipPoints.lyrx

ArcGIS Project File is referenced to access **maps** and **layouts** used to create district maps.

- **TIPDynamicMaps.aprx** - S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\TIPDynamicMaps.aprx

ArcGIS Pro Layout Files are used as standardized layouts for each legislative district type.

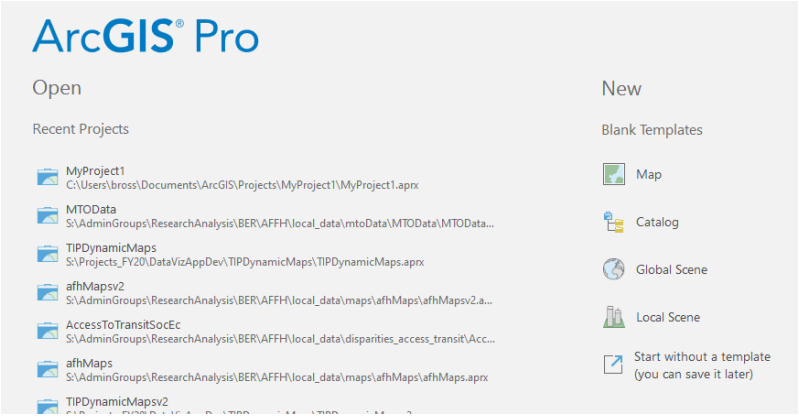
- **IL State Representative Districts (2011)**
  - S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\layouts\IL State Representative Districts (2011) Letter.pagx
- **IL State Senate Districts (2011)**
  - S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\layouts\IL State Senate Districts (2011) Letter.pagx
- **US Representative Districts (2011)**
  - S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\layouts\US Representative Districts (2011) Letter.pagx
- **Chicago Wards (2015)**
  - S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\layouts\Chicago Wards (2015) Letter.pagx

ArcGIS Pro Map Files are referenced by the standardized layout files for each legislative district type.

- **IL State Representative Districts (2011)**
  - S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\maps\StateRepMap.mapx
- **IL State Senate Districts (2011)**
  - S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\maps\StateSenateMap.mapx
- **US Representative Districts (2011)**
  - S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\maps\USRepMap.mapx
- **Chicago Wards (2015)**
  - S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\maps\ChicagoWardsMap.mapx

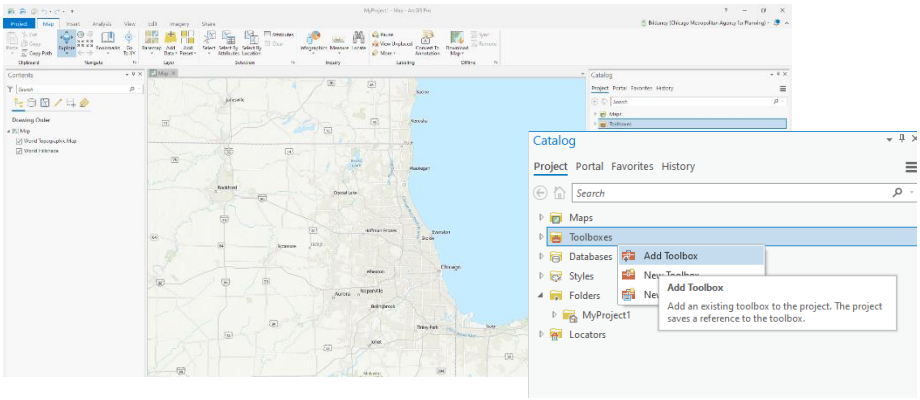
USER GUIDE

1. Open **ArcGIS Pro**. Create new project or open existing.



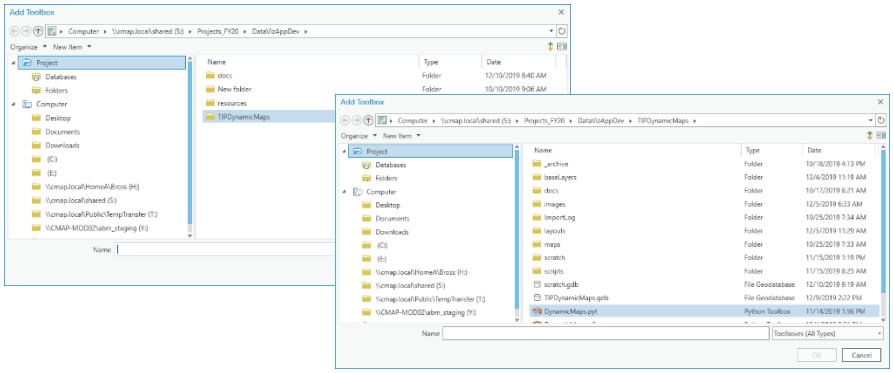
The tool requires **ArcGIS Pro** version 2.4 or later and an **ArcGIS Online** account. Contact IT to have ArcGIS Pro installed and Matt Rogus for ArcGIS Online credentials.

2. Navigate to **Toolboxes** in the **Catalog** pane (right-pane). Right-click on **Toolboxes** and select **Add Toolbox**.



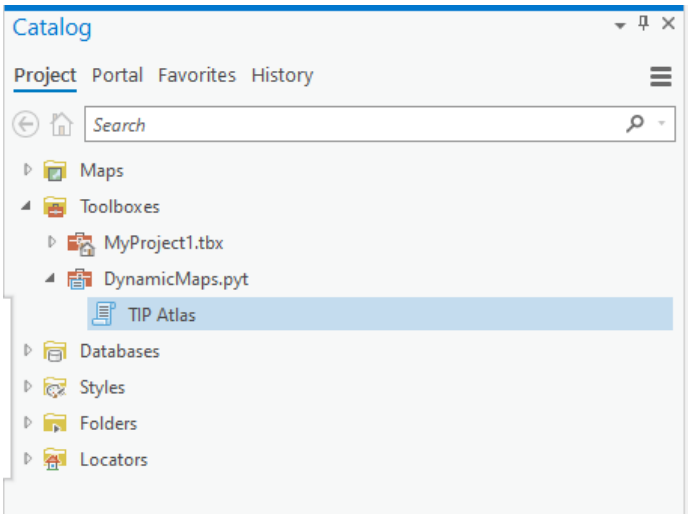
The **Catalog** pane and the catalog view allow you to access all items associated with a specific project in one place, whether they are available from a local or network computer, ArcGIS Online, or an ArcGIS Enterprise portal. For more info click here.

3. Navigate to the **DynamicMaps** project folder and select the **Dynamic Maps Python Toolbox.**

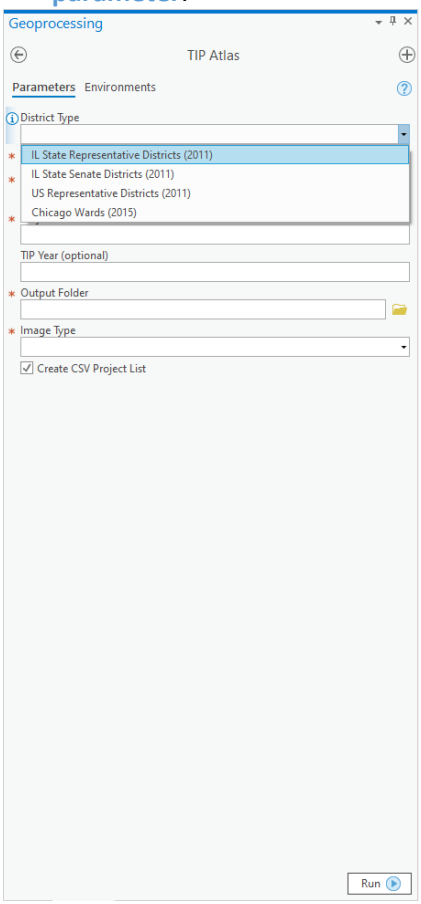


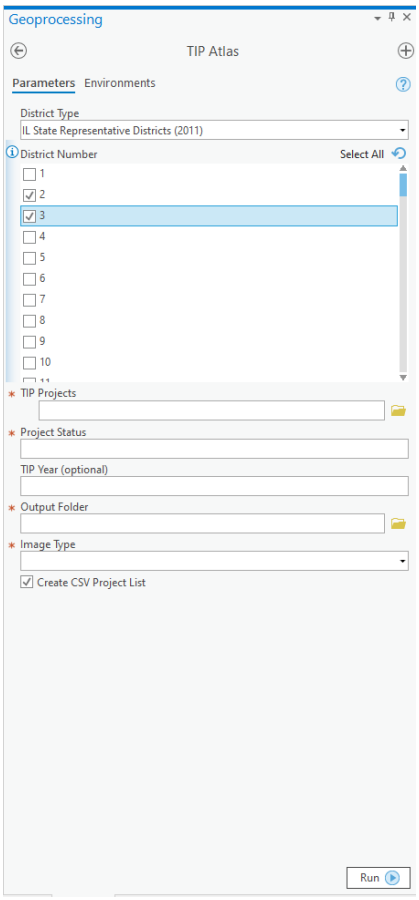
Click here to copy path to project folder. Select **DynamicMaps.pyt**.

4. Open the DynamicMaps.pyt toolbox and select the TIP Atlas.



5. Select a legislative district type from the **District Type** dropdown. Select one or more districts to map from the **District Number multi-select parameter**.



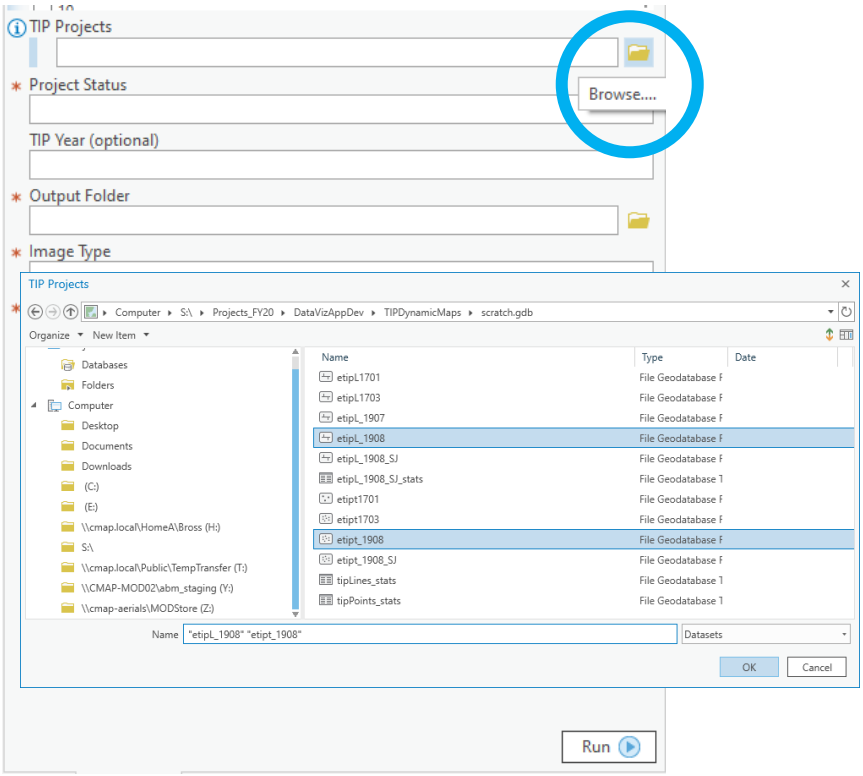


The District Type dropdown includes 4 options:

- IL State Senate Districts
- IL State Representative Districts
- US Representative Districts
- Chicago Wards

The **District Number** parameter will auto populate after a district type is selected.

6. Click on the folder icon to the right of the **TIP Projects** parameter to navigate to TIP feature classes.

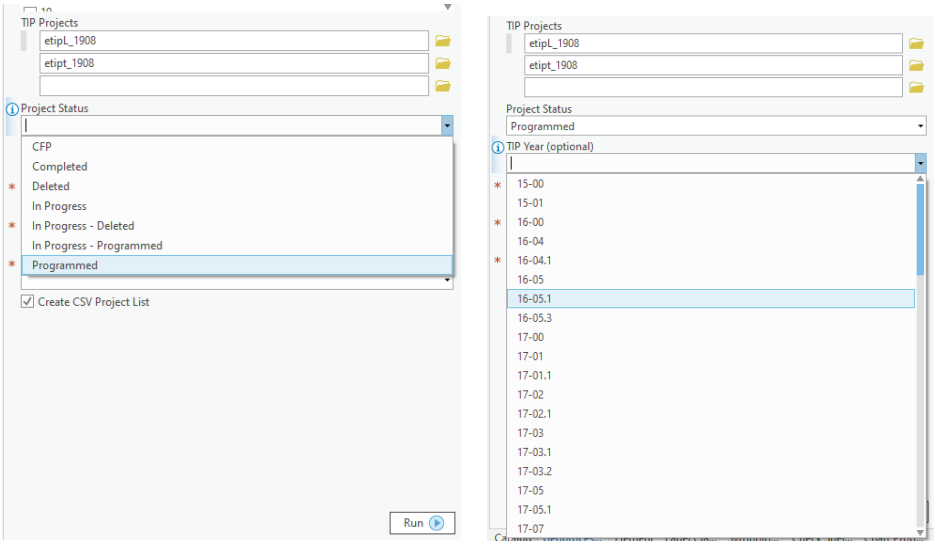


TIP Projects can include any TIP line and/or point feature classes.

Limitations:

- TIP Projects input can include a maximum of one TIP line and one TIP point feature class.
- ArcGIS Pro cannot read feature classes from a personal geodatabase (.mdb)

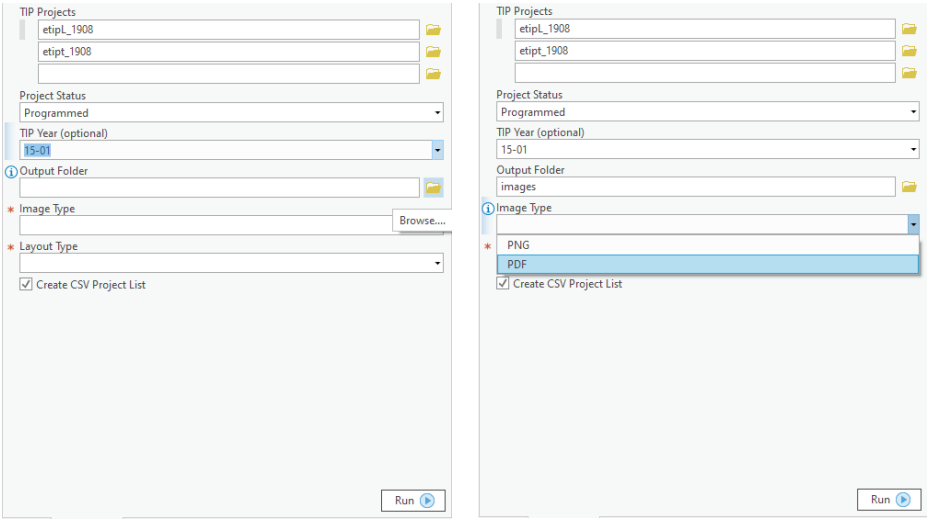
7. Select status type from the **Project Status** dropdown.



The **Project Status & TIP Year** parameters will auto populate after TIP projects are selected.

Note: TIP Year is an optional parameter and will populate after the **Project Status** is selected. If a selection is not made TIP projects for all years will be included in the outputs.

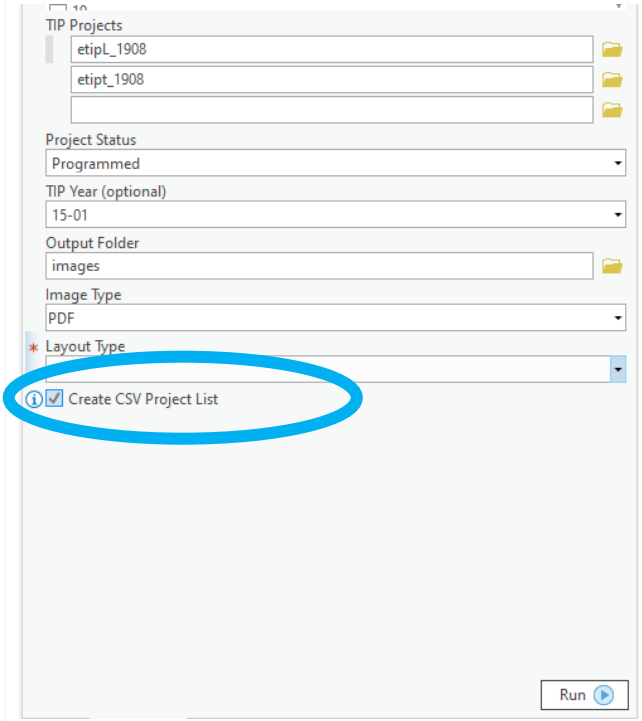
8. Browse to a location for the tool outputs from the **Output Folder** parameter and **Image Type** using the dropdown.



The **Image Type** dropdown selections include:

- PNG
- PDF

9. A full list of TIP projects will be exported to a CSV (based on tool selections) will be created by default. Uncheck the **Create CSV Project List** to disable this feature. Finally, click **Run** to execute the tool.



An individual map (PNG or PDF) will be created for each district selected and saved to the location specified in the **Output Folder.**

If **Create CSV Project List** is checked an individual CSV will also be created for each districted and saved to the same location as the map.

FAQS

How to update required datasets?

How is the TIP data processed?

How are TIP features added to the map?

How are the TIP features styled?

How are labels styled?

What and where are the map layout files?

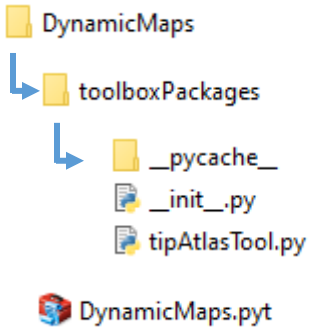
How is the bar chart created?

How is summary table created?

How is the CSV created?

TECHINCAL DOCUMENTATION

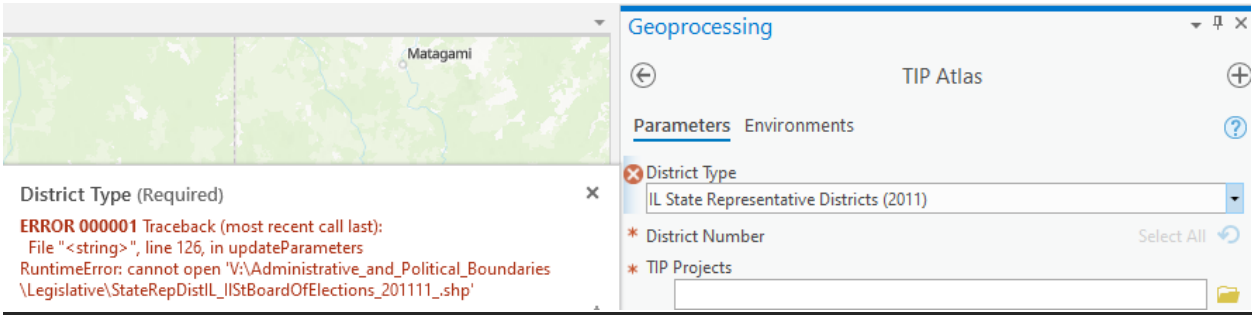
This section describes the inputs and functions of the python module - **tipAtlasTool.py**, which is imported into the DynamicMaps python toolbox. The DynamicMaps python toolbox exists in a directory structure that allows custom python modules such as the tipAtlasTool.py to be imported and executed within the DynamicMaps.pyt toolbox (see directory structure below). For more information on custom toolboxes containing modules or script tools click here.



Updating Required Datasets

As mentioned earlier in the **REQUIREMENTS** section, the TIP Atlas references a number of legislative district shapefiles, a scratch geodatabase, base layers, ArcGIS Pro layout files, and an ArcGIS Pro project file. In the event that any of these inputs or input paths are modified, changes to the script must be made in order to run the tool successfully.

Has the path changed?



If you experience the error above – "**RuntimeError: cannot open.**." the path to a required file cannot be located by the tool. To resolve this error open the tipAtlasTool.py in a text editor (sublime, IDLE, notepad+) and copy and paste the correct path to variable being referenced by the tool. In the example above the tool cannot locate the IL State Representative Districts (2011) file, so the correct path must be copied to the ilRep variable on line 17 of the script (see below).

```
File  Edit  Selection  Find  View  Goto  Tools  Project  Preferences  Help
DynamicMaps.pyt   tipAtlasTool.py
1  #title: tipAtlasTool.py
2  #description: The TIP Atlas is a python tool that summarizes and displays transportation improvement projects (TIP) by legislative districts.
3  #             The tool produces a series of CSVs and Image files (PDF or PNG).
4  #author: Aaron Brown and Brittaney Harkness
5  #documentation: S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\docs\tipAtlasDocumentation
6
7  import arcpy
8  import os
9  import sys
10 import matplotlib.pyplot as plt
11 import numpy as np
12 import pandas as pd
13
14
15 #INPUT PATHS FOR DISTRICT TYPE (PARAMETER 1)
16 #read district files from data dept (vdrive)
17 ilRep = r'V:\Administrative_and_Political_Boundaries\Legislative\StateRepDistIL_IlStBoardOfElections_201111.shp'
18 ilSenate = r'V:\Administrative_and_Political_Boundaries\Legislative\StateSenDistIL_IlStBoardOfElections_201111.shp'
19 chiWard = r'V:\Administrative_and_Political_Boundaries\Legislative\Wards_Chicago_201505.shp'
20 usRep = r'V:\Administrative_and_Political_Boundaries\Legislative\USRepDistIL_IlStBoardOfElections_201111.shp'
21
22 #global variable: STATUS field in TIP projects
23 status = 'LAST_STATUS'
24 tipYr = 'LAST_MTIP_VERSI'
25
26 #temp (?) workspce - all GIS data created in the executable code goes here during development
27 scratch_gdb = r'S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\TIPDynamicMaps.gdb'
28 scratchFolder = r'S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\scratch'
29 tipLinesLyrx = r'S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\baseLayers\tipLines.lyrx'
30 tipPointsLyrx = r'S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\baseLayers\tipPoints.lyrx'
31
32 #create dict of district paths & district number fields
33 district_dict = {'IL State Representative Districts (2011)': [ilRep, 'HousDist_N', 'StateRepMap', 'cmapStateRepDistILClip', 1440282],
34                  'IL State Senate Districts (2011)': [ilSenate, 'SenDist_N', 'StateSenateMap', 'StateSenDistIL_201111_cmapclip', 1440282],
35                  'US Representative Districts (2011)': [usRep, 'Dist_N' , 'USRepMap', 'USRepDistIL_201111_cmapclip', 1440282],
36                  'Chicago Wards (2015)': [chiWard, 'ward', 'ChicagoWardsMap', 'Wards_Chicago_201505', 164981]}
37
38
39 #Path to ArcGIS Pro project
40 #Base layers and new tip features are virtually added here when the tool runs
41 #This ArcGIS Project references map layouts for each district type
42 legMapName = r'S:\Projects_FY20\DataVizAppDev\TIPDynamicMaps\TIPDynamicMaps.aprx'
```

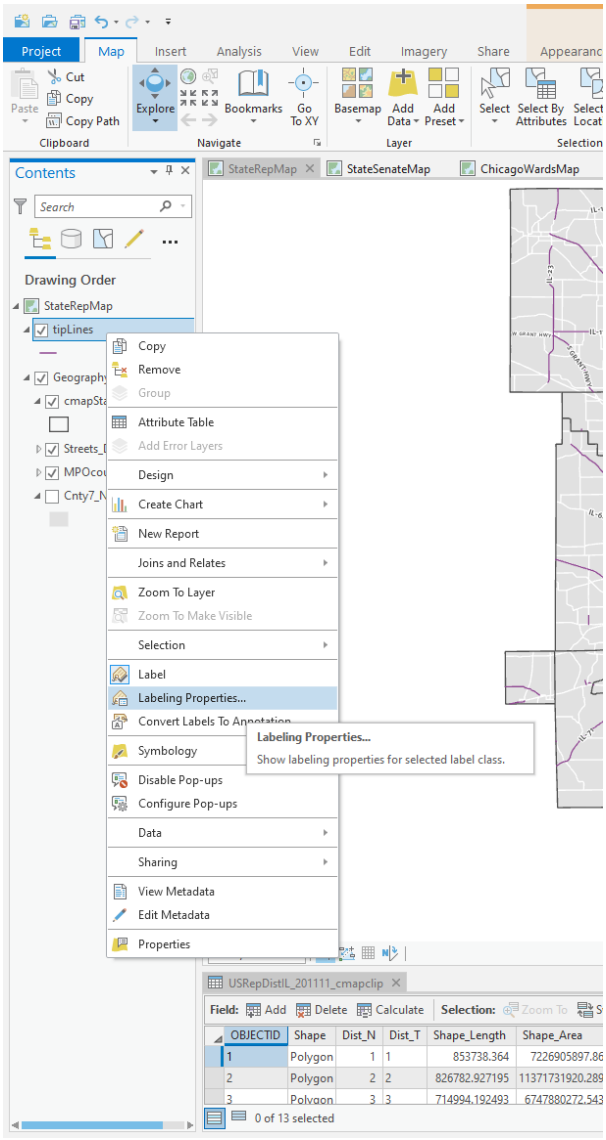
TIP Data Processing

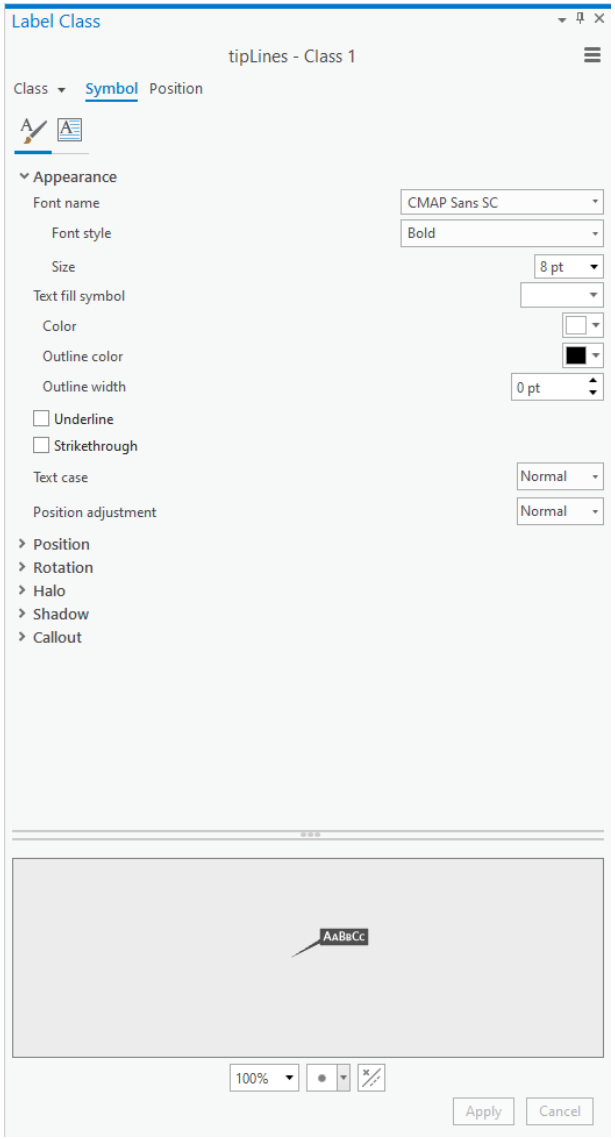
Explanation of importing TIP project files, joins to district geometry, significance of global variables

Adding TIP Features to a Map

After TIP point and line feature classes have been created and stored in the scratch geodatabase, the properties of the TIP **feature layers** stored in the **TIPDynamicMaps base layers folder** are automatically modified. Two feature layers exist in the base layers folder: tipLines.lyrx and tipPoints.lyrs. These layers reference the feature classes of processed TIP project files and are displayed in the map with preset label properties. The layers are added to a **district map** using the **addDataFromPath** arcpy map method.

Logic in plain English, the tool adds the tipLines and tipPoints layers to a district map instead of the actual processed TIP files because currently there are no capabilities to set the label properties for map layers using arcpy. So, instead the label properties are set manually in ArcGIS Pro and saved to a feature layer that references the TIP files stored in the scratch geodatabase. All other labels for base layers in the each legislative district map are set manually as well.





TIP Feature Symbology

The TIP feature symbology is set dynamically after the TIP point and line feature layers are added to a district map with the **symbolizeLayers(districtNumber)** method.

- The method sets a definition query to the TIP point and line layers to only draw features where the district number is equal to the methods districtNumber parameter.
- Sets TIP line and point color (hard coded to light green color **RGB : [152,230,0]**)
- Emphasize outline size of the district geography feature based on the districtNumber parameter and demphasizes all other features.

Method Overview

Method	Explanation
symbolizeLayers(districtNumber)	Symbolizes TIP line, TIP point, and legislative district map layers based on the selected district number.

Method Parameters

Parameter	Explanation	Data Type
districtNumber	Number of legislative district that will be emphasized in map.	Int

TIP Summary Table

The TIP summary table is created using a pandas dataframe and text elements from the ArcGIS Pro layout object. The method for creating the table is based on the second code sample seen here.

Method Overview

Method	Explanation
createTableElement(lyrLine,LyrPoint, geography, outCSV)	Creates matplotlib horizontal bar chart from tipProjTypes pandas dataframe.

Method Parameters

Parameter	Explanation	Data Type
lyrLine	Name of the TIP line layer	String
LyrPoint	Name of TIP point layer	String
districtNumber	Legislative district number	Int
outCSV	File name of CSV output	String

TIP Summary Chart

The TIP summary chart is created using the pandas and matplotlib python libraries. The createChart(tipProjTypes) method was created to read a pandas dataframe containing the TIP records from the line and point layers and convert them to a horizontal barchart using the matplotlib plot method.

- The method calculates the total number of projects based on length of pandas dataframe
- Injects total number of projects into a layout text element to display # of projects in the output
- The records in the dataframe are counted by each project type and saved to new dataframe
- Dataframe containing a count by project type is referenced in the chart to visualize # of projects by type

- Chart is saved to scratch directory as a png and set as the sourceImage path for the picture element in the map layout.
- If no records are available "No Projects to Display" will appear

Method Overview

Method	Explanation
createChart(tipProjTypes)	Creates matplotlib horizontal bar chart from tipProjTypes pandas dataframe.

Method Parameters

Parameter	Explanation	Data Type
tipProjTypes	Pandas dataframe containing combined TIP records from line and point layers.	Pandas Dataframe