

Inventory & Monitoring Division

National Park Service



Standard Operating Procedure 2.11.13

Processing Source Data to Derive Landscape Dynamics Metrics: Road Source Data

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Summary

Internal SOP for processing TIGER road data for later use in calculating Landscape Dynamics summary statistics for road density and area without roads.

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Overview

This SOP describes the process of downloading and processing TIGER data for later use in Landscape Dynamics metric statistics calculations for road density, and area without roads.

TIGER Line Road data comes from the United States Census Bureau. The data are regularly updated, and since 2007 updates have been posted annually. Beginning in 2015, TIGER road data will be obtained annually from the US Census Bureau and incorporated into Landscape Dynamics. Previous versions of TIGER road data also used in Landscape Dynamics include 2010. There are currently no plans to incorporate other historic TIGER road data into Landscape Dynamics.

Tiger road data are extracted and re-projected based on geographic extent (Alaska, Continental US (CONUS), Puerto Rico and the US Virgin Islands, Hawaii, Guam, Commonwealth of the Northern Mariana Islands, and American Samoa). No other changes to the source data are made.

It is assumed users of this SOP have prior knowledge of data paths, file locations, and repositories referenced in this SOP.

Requirements

- Internet connection, sufficient disc space for data download
- Zip file extract tool, sufficient storage for data extraction and processing
- ArcGIS Pro
- Write access to X: drive
- Data Store permissions and access

Pre-Processing

Step 1: Download TIGER Data

Download the current year TIGER Road data from US Census. There are two locations to check for current year data (data is identical at either source):

- National TIGER Roads (tlgdb_YYYY_a_us_roads.gdb.zip) from <ftp://ftp2.census.gov/geo/tiger/> (identical to <https://www2.census.gov/geo/tiger/>) (see *TIGERGDBYY directory for the current year's roads*)
- 'Roads National Geodatabase' from <http://www.census.gov/geo/maps-data/data/tiger-geodatabases.html>

Additionally, download any Documentation posted on the TIGER website. See Table 1 for download history, and add additional download information as needed.

Table 1. TIGER Road Data download tracking.

Year	Date of Publication	Date of Download	Download Link
2010	20101213	Dec 2015	https://www2.census.gov/geo/tiger/TIGER2010/ROADS/
2015	20150820	Dec 2015	https://www2.census.gov/geo/tiger/TGRGDB15/
2016	20160920	Oct 2016	https://www2.census.gov/geo/tiger/TGRGDB16/
2017	20170929	20171006	https://www2.census.gov/geo/tiger/TGRGDB17/
2018	20180917	20180924	https://www2.census.gov/geo/tiger/TGRGDB18/
2019	tbd	tbd	

Note: NHDH data should be updated/downloaded concurrently with TIGER Roads, see ‘Download and Process NHD Data’ in Post-Processing for more.

Step 2: Extract TIGER Data

Save a copy of all downloaded files to a year-stamped folder in X:\ProjectData\LandscapeDynamics\Roads\SourceData.

On the local drive, extract the data from the download of National TIGER Roads (tlgdb_YYYY_a_us_roads.gdb.zip).

Note: If the geodatabase is not visible in ArcCatalog after extraction, run Recover File Geodatabase tool from ArcToolbox.

Processing

With a local copy of the data, run the TIGER Roads tool. The tool may take several hours to run.

Beginning with 2016 TIGER data, the following methods are used to process TIGER Roads. See Appendix 2 for information and processing details for pre-2016 TIGER Roads.

Step 1: Run TIGER Roads Tool

Processing Summary: The tool will extract roads by defined geographic extents, then re-project the extracted roads into respective feature classes using standard spatial references.

1. In Pro, run **Tiger Roads Processing** from the Roads.pyt Toolbox. See Table 2 for tool parameter definitions.
 - a. If ‘Tiger Roads Processing’ fails due to memory, see Appendix 1 for possible solution.

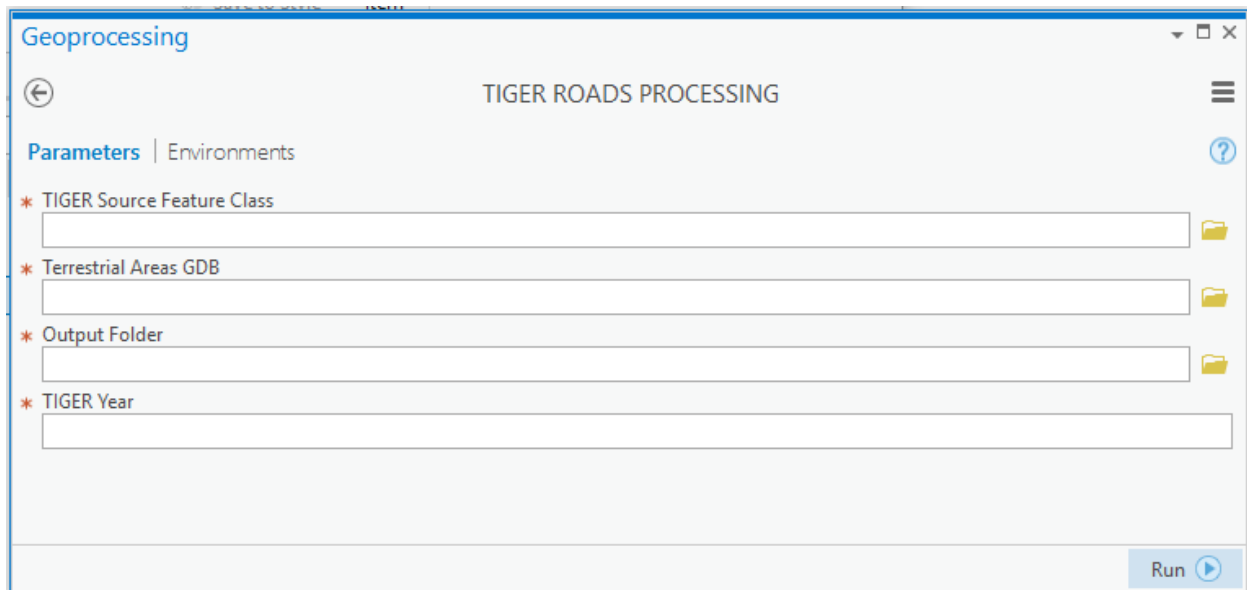
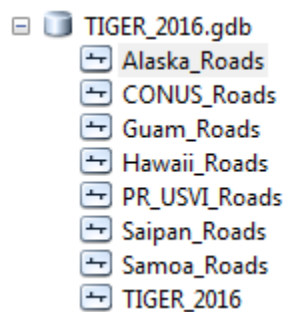


Table 2: Options to use for parameters in the Tiger Roads Processing Tool.

Parameter	Notes
TIGER Source Feature Class	Road feature class from downloaded TIGER .zip
Terrestrial Areas GDB	LandscapeDynamics_Geographical_Boundaries.gdb
Output Folder	The local output folder
TIGER Year	Four-digit year of data, YYYY

Example Output:



- When the tool is finished, check the outputs for appropriate spatial reference (Table 3), for full extent of features, and for matching attribute fields to previous TIGER roads data.

Table 3. Standard spatial references by processing extent

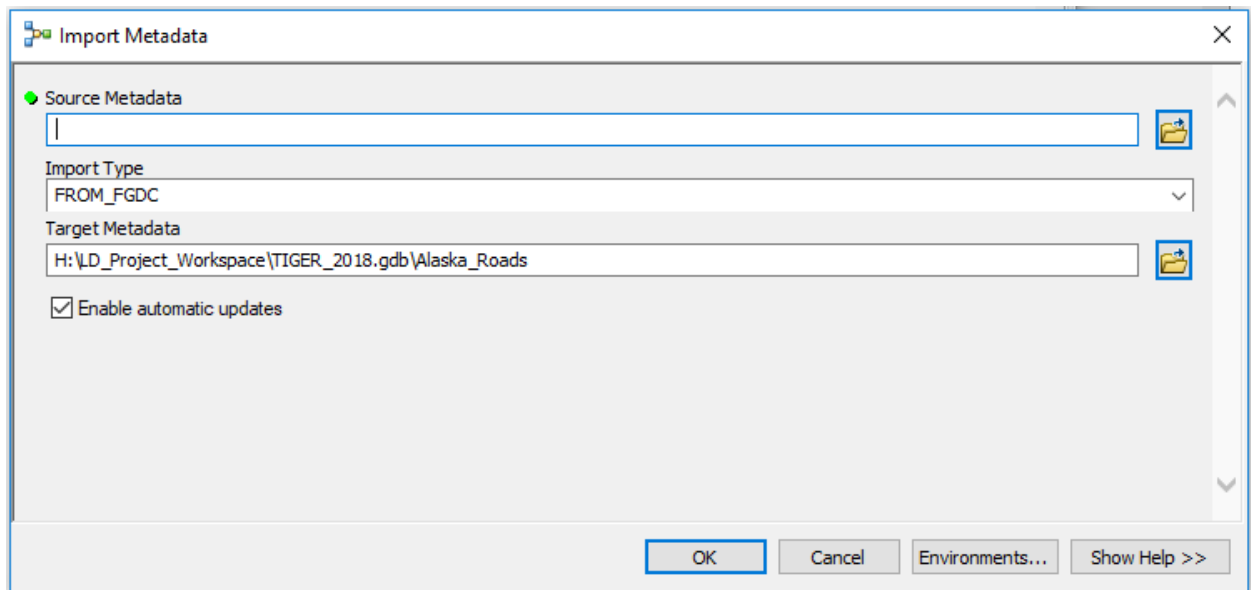
Processing Extent	Spatial Reference Name (datum)	Well-known ID (WKID)
North America (US, Canada, Mexico)	USA Contiguous Albers Equal Area Conic USGS (NAD83)	WKID: 102039
CONUS	USA Contiguous Albers Equal Area Conic USGS (NAD83)	WKID: 102039
Puerto Rico and USVI	USA Contiguous Albers Equal Area Conic USGS (NAD83)	WKID: 102039
Alaska	Alaska Albers Equal Area Conic (NAD83)	WKID: 3338
Hawaii	UTM Zone 5N (NAD83)	WKID: 26905
American Samoa	NAD_1983_HARN_UTM_Zone_2S (NAD83 HARN)	WKID: 2195
<i>Transform (if needed):</i>	WGS_1984_(ITRF00)_To_NAD_1983 + NAD_1983_HARN_To_WGS_1984_2	
Guam	WGS_1984_UTM_Zone_55N (WGS84)	WKID: 32655
<i>Transform (if needed):</i>	WGS_1984_(ITRF00)_To_NAD_1983	
CN Mariana Islands	WGS_1984_UTM_Zone_55N (WGS84)	WKID: 32655
<i>Transform (if needed):</i>	WGS_1984_(ITRF00)_To_NAD_1983	

Step 2: Import Metadata

When the tool has finished, import metadata to each feature class.

In ArcCatalog:

1. From Description, Import.



Dissemination

Step 1: Move Processed Data

1. Move final output geodatabase to final location
(X:\ProjectData\LandscapeDynamics\Roads\SourceData\TIGER_YYYY).
2. Make sure initial TIGER download is also located at
X:\ProjectData\LandscapeDynamics\Roads\SourceData\TIGER_YYYY
3. If not completed, run processes in Processing Source Data, NHD SOP (see SOP 2.11.10; Kinseth and Nelson 2018a).

Step 2: Publish to Data Store

Go to Publishing to Data Store SOP (SOP 4.1.1; Kinseth and Nelson 2018b) and use the following information (Table 4) as a guide when uploading TIGER Road data to Data Store.

1. From Environmental Settings Program,
<https://irma.nps.gov/DataStore/Reference/Profile/2244060>, go to Roads Project.
2. Compress the processed TIGER data into a .zip folder, by year.

TIGER_<YYYY>.zip

Table 4. Required upload parameters for holdings: Landscape Dynamics Source Data - Roads.

Parameter	Application
Date of Issue/Publication	Reference Level; Date of upload, update annually when new data is added
Description, Notes, Purpose	Reference Level; Make necessary edits to text in the reference for these two fields. Update years of data, reasons for new reference, etc, as needed.
Permissions	Reference/Holding Level; Public, all
Description	Holding Level; "National Hydrological Dataset High Resolution YYYY (File Geodatabase)"

3. Add external links to the source data (update url as needed).
 - a. US Census – TIGER (<https://www2.census.gov/geo/tiger/>)

Literature Cited

Kineth, M. and L. Nelson. 2018a. Processing source data to derive landscape dynamics metrics: NHD high-resolution source data. Inventory & Monitoring Program Standard Operating Procedure NPS/NRSS/IMD/SOP—2.11.10. National Park Service, Fort Collins, Colorado.

Kineth, M. and L. Nelson. 2018b. Publishing to Data Store. Inventory & Monitoring Division Standard Operating Procedure NPS/IMD/SOP—4.1.1. National Park Service, Fort Collins, Colorado.

U.S. Census Bureau. 2016. MAF/TIGER Feature Class Codes and Definitions website.
<https://www.census.gov/geo/reference/mtfcc.html> (accessed 12/09/2016).

Appendix 1: Data Availability and Known Issues

Data Availability

Prior to 2013, TIGER road data was not available at a national level for download, and county level data had to be downloaded and manually mosaicked to create desired national, seamless layers. National level road products from 2015 and 2016 have been compared to county-level road data for those same years in multiple locations across the data extent and are found to be identical. This has removed the need for additional post-processing that existed with obtaining TIGER road data by County (2010, 2015) for all the United States and associated territories, as TIGER road data can now be obtained in a single file geodatabase download as a National product (2016 - current).

When calculating Area without Roads summary statistics for Landscape Dynamics, areas of water of a certain size are erased. The source of this water data is the National Hydrography Dataset. This data is continually updated and updates are posted through the year. Because of this, it is important to obtain NHD data at the same time new TIGER road data is obtained. It is very important to note the date of download, and the date of publication (last modified) in table 1 for reference.

Additional Issues

TIGER 2015 roads were downloaded in March 2016. NHD Data for use with the 2015 (and 2010) TIGER Roads were downloaded in April 2016. For 2016 and onward, TIGER and NHD data were downloaded/obtained at the same time.

Memory Issues

If the TIGER roads tool fails due to an issue with memory, see <http://support.esri.com/en/technical-article/000001418>.

The following is extracted and modified slightly from the above-linked article. User must have Admin privileges.

Use the following procedure to set an ARCTMPDIR system environment variable:

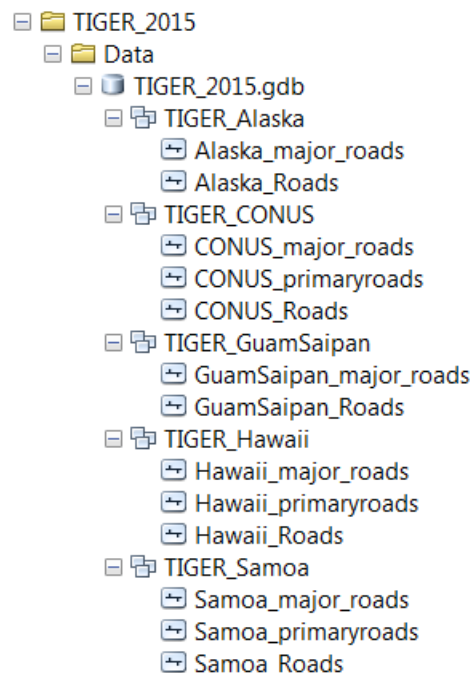
1. Navigate to Start > Control Panel > System and Security > System.
2. Select Advanced system settings, and click the Environment Variables button.
3. Under System variables, click the New button and enter the following:
variable name: ARCTMPDIR
variable value: *new drive location here* (for example, D:\temp)
4. Click OK on the New System Variable dialog box and click OK on the System Properties dialog box.
5. Restart ArcInfo or ArcGIS Desktop for this change to take effect.

Appendix 2: 2010, 2015 TIGER Roads

National level road products from 2015 and 2016 were compared to county-level road data for those same years in multiple locations across the data extent and were found to be identical. This removed the need for additional processing steps that existed with obtaining TIGER road data by county (2010, 2015) for the whole United States and associated territories. TIGER road data can now be obtained in a single file geodatabase download as a National product (2016 - current), and processed as described in this SOP.

Source Processing

1. County-level TIGER road source geodatabases downloaded from
<ftp://ftp2.census.gov/geo/tiger/TIGER2010/ROADS/>
<ftp://ftp2.census.gov/geo/tiger/TIGER2015/ROADS/>
 2. Road features were selected by location based on processing area. Exported selected features and re-projected to the appropriate spatial reference. Created feature classes by road type using attribute queries. See figure below for 2015 output example.
- All Roads: MFTCC Like 'S%' (Query for primary roads)
 - Major Roads: MFTCC = 'S1100' AND MFTCC = 'S1200' (Query for major roads or precise roads)



Feature class attributes

Refer *MAF_TIGER_CODES_mtfccs.pdf* for attribute definitions (U.S. Census Bureau 2016).

Appendix 3: U.S. Census Bureau Geographic Codes and Terms

FIPS – Federal Information Processing Standards, a set of standards related to federal, state, and local government agencies and Information Technology. Related to TIGER data, the data are classified according to county and state FIPS codes.

LSAD – Legal/Statistical Area Description codes related to the U.S. Census bureau, the data they release, and collect related to census demographics.

MTFCC – MAF/TIGER Feature Class Codes used to classify items physical, man-made or other, across years, and decades by the U.S. Census Bureau. Codes are standardized, and were adopted in 2002. The U.S. Census Bureau continues to use this code system. (Item1)

MAF – Master Address File

TIGER – Topologically Integrated Geographic Encoding and Referencing

Functional Status Code	Functional Status Code Description	Associated Geographic Entity
A	Active government providing primary general-purpose functions	Consolidated City, County or Equivalent Feature, County Subdivision, Economic Census Place, Incorporated Place, Nation, State or Equivalent Feature, Tribal Subdivision
A	Active entity (federally recognized entities only)	American Indian/Alaska Native/Native Hawaiian Area
B	Active government that is partially consolidated with another government but with separate officials providing primary general-	County or Equivalent Feature, County Subdivision, Economic Census Place, Incorporated Place
C	Active government consolidated with another government with a single set of officials	County or Equivalent Feature, County Subdivision, Economic Census Place
E	Active government providing special- purpose functions	Elementary School District, Secondary School District, Special School Administrative Area, Special-Purpose District, Unified School District
F	Fictitious Entity created to fill the Census Bureau's geographic hierarchy	American Indian/Alaska Native/Native Hawaiian Area, County or Equivalent Feature, County Subdivision, Economic Census Place, Elementary School District, Incorporated Place, Secondary School District, State Legislative District (Lower Chamber), State Legislative District (Upper Chamber), Unified School District, Voting District

Functional Status Code	Functional Status Code Description	Associated Geographic Entity
G	Active government that is subordinate to another unit of govt.	County Subdivision
I	Inactive governmental unit that has the power to provide primary special-purpose functions	County Subdivision, Elementary School District, Incorporated Place, Secondary School District, Special School Administrative Area, Unified School District
L	Inactive, nonfunctioning legal real property entity with potential quasi-legal administrative functions	Military Installation, Park
M	Active legal real property entity with quasi-legal functions	Military Installation
N	Nonfunctioning legal entity	Alaska Native Regional Corporation, American Indian/Alaska Native/Native Hawaiian Area, Congressional District, County or Equivalent Feature, County Subdivision, Economic Census Place, Elementary School District, Incorporated Place, Local/Tribal Legislative District, Secondary School District, Special School Administrative Area, Special- Purpose District, State Legislative District (Lower Chamber), State

MTFCC	Feature Class	Superclass	Point	Linear	Areal	Feature Class Description
C3022	Mountain Peak or Summit	Miscellaneous Topographic Features	Y	N	N	A prominent elevation rising above the surrounding level of the Earth's surface.
C3023	Island	Miscellaneous Topographic Features	Y	Y	Y	An area of dry or relatively dry land surrounded by water or low wetland. [including archipelago, atoll, cay, hammock, hummock, isla, isle, key, moku and rock]
C3024	Levee	Miscellaneous Topographic Features	N	Y	Y	An embankment flanking a stream or other flowing water feature to prevent overflow.
C3026	Quarry (not water-filled), Open Pit Mine or Mine	Miscellaneous Topographic Features	Y	N	Y	An area from which commercial minerals are or were removed from the Earth; not including an oilfield or gas field.

C3027	Dam	Miscellaneous Topographic Features	Y	Y	Y	A barrier built across the course of a stream to impound water and/or control water flow.
C3061	Cul-de-sac	Miscellaneous Topographic Features	Y	N	N	An expanded paved area at the end of a street used by vehicles for turning around. For mapping purposes, the U.S. Census Bureau maps it only as a point feature.
C3062	Traffic Circle	Miscellaneous Topographic Features	Y	N	N	A circular intersection allowing for continuous movement of traffic at the meeting of roadways.
C3066	Gate	Miscellaneous Topographic Features	Y	N	N	A movable barrier across a road.
C3067	Toll Booth	Miscellaneous Topographic Features	Y	N	N	A structure or barrier where a fee is collected for using a road.

Route Type Code	Route Type Code Description
C	County
I	Interstate
M	Common Name
O	Other
S	State recognized
U	U.S.