NCTCOG Multi-year Building Footprints

Documentation

The NCTCOG Research and Information Services (RIS) department has developed a regional planimetric building footprint layer using footprints digitized from aerials flown between 2007 and 2021. Attribution includes land use data, zip code, footprint year and elevation data for those features that have corresponding LiDAR or autocorrelated surface data.

Enhancement Data

The footprint layer can be joined with additional data to suit your analysis purposes. The NCTCOG Regional Data Center has numerous layers (some of which have been listed below) that can used to enhance the footprint layer.

To download data the data for free, visit: https://data-nctcoggis.opendata.arcgis.com/search

- Census
  - Census Blocks (2020)
  - Census Tracts (2020)
  - Environmental Justice Index
  - Urban Areas
- Transportation
  - Mobility 2045 Update Level of Congestion
  - Mobility 2045 Update High-Speed Rail
  - Mobility 2045 Update Recommended Rail Transit
- Boundaries
  - Texas Congressional Districts
  - Independent School Districts
- Demographics
  - 2021 Daytime Population (5-Year ACS)
  - 2022 NCTCOG Population Estimates (City)
  - 2045 NCTCOG Demographic Forecast (Block Group)
- Hydrology
  - NHD Flowline
- Regions (HU2)
- Environment
  - Parks (2020)
  - Soils
- Features
  - Development Monitoring in North Central Texas
  - Features
  - Employers

Additional potential data sources include:

[NCT 9-1-1]

[US Census Bureau]

[Texas National Resources Information System (TNRIS)]

[Federal Emergency Management Association (FEMA)]

[Texas Department of Transportation (TXDOT)]

[Housing and Urban Development (HUD)]

Methodology

The following steps were taken to ensure the most accurate data layer possible:

1. Aggregated all digitized footprint layers into one geodatabase and identified the most current layer for all available areas.

Entity	2007	2009	2011	2013	2015	2017	2018	2019	2020	2021
Addison		Addison		Addison		Addison		Addison		Addison
Allen	Allen	Allen	Allen							
Arlington	Arlington	Arlington		Arlington						
Balch Springs					Balch Springs				Balch Springs	
Bedford						Bedford				
Bridgeport	Bridgeport									
Carrollton			Carrollton	Carrollton						
Cedar Hill	Cedar Hill				Cedar Hill					
Celina								Celina		Celina
Colleyville						Colleyville				
Coppell	Coppell									
Crowley	Crowley									
Dallas	Dallas									
Decatur										Decatur
Denton	Denton		Denton	Denton	Denton	Denton		Denton		Denton
Desoto	Desoto									Desoto
Downtown Dallas, Inc.								DDI		
Duncanville				Duncanville						
DWG-Pantego				DWG-Pantego						
Farmers Branch	Farmers Branch			Farmers Branch	Farmers Branch	Farmers Branch		Farmers Branch	Farmers Branch	Farmers Branch
Farmersville			Farmersville							
Flower Mound	Flower Mound									
Forest Hill						Forest Hill				
Forney	Forney									
Fort Worth	Fort Worth			Fort Worth						
Frisco	Frisco	Frisco	Frisco	Frisco	Frisco	Frisco	Frisco	Frisco	Frisco	Frisco
Garland						Garland				
Grand Prairie	Grand Prairie									
Grapevine								Grapevine		
Haltom City	Haltom City									
Haslet	Haslet					Haslet				
Heath	Heath				Heath					
Highland Village	Highland Village	Highland Village	Highland Village							
Hudson Oaks						Hudson Oaks				
Hurst			Hurst	Hurst	Hurst					
Irving				Irving	Irving		Irving		Irving	
Kaufman	Kaufman									
Keller		Keller		Keller		Keller				
Kennedale				Kennedale						
Lewisville	Lewisville	Lewisville	Lewisville		Lewisville					
Little Elm	Little Elm		Little Elm							
McKinney	McKinney		McKinney	McKinney		McKinney	McKinney	McKinney	McKinney	McKinney
Mesquite	Mesquite			Mesquite						
Mesquite ISD	Mesquite ISD		Mesquite ISD							
Midlothian	Midlothian									
Mineral Wells									Mineral Wells	
North Richland Hills	NRH			NRH						
Parker	Parker									
Plano	Plano	Plano						Plano		Plano
Rhome	Rhome									
Richardson				Richardson						
Rockwall	Rockwall									
Saginaw					Saginaw					
Sanger	Sanger		Sanger		Sanger					
Stephenville	Stephenville									
Tarrant County 911	Tarrant County 911				Tarrant County 911					
Tarrant County UI						Tarrant County UI				
Terrell	Terrell				Terrell					
Texas A&M Commerce		TAMU Commerce								
University Park	University Park	University Park		University Park	University Park					
Waxahachie	Waxahachie									
White Settlement	White Settlement									

2. Merged latest footprints into layers by year and cleaned up overlaps and duplication. This resulted in 9 individual layers, one for each year.
3. Ran adjacent tool on footprints that had been split previously using the NCTCOG index grid and spliced them back together. This was so that each footprint was complete, not partial, representation of the actual footprint.
4. Added a year field for all available years: 2007, 2009, 2011, 2013, 2015, 2017, 2019, 2020 & 2021.
5. Removed structures that were under 500 sq. ft. to cut down on carports and other structures that aren't truly "buildings".
6. Added LiDAR elevation statistics to layers that had matching year LiDAR: 2015, 2017, 2018, 2019, 2020 and 2021using the following ESRI methodology:
    a. Created 2ft buffer of footprint layer
    b. Created <2ft buffer of footprint layer
    c. Mosaiced DEM & DSM layers for each LIDAR year
    d. Created random points (200) from the 2ft buffer and <2ft buffer layers
    e. Add elevation value to random point files from DEM and DSM mosaic layer
    f. Build statistics for all z values (minimum, maximum, median, mean, and standard deviation) for both DEM and DSM random points layer
    g. Joined each Z Statistics table back to DEM and DSM 2ft<2ft building layer
    h. Created points from those 2ft DEM/<2ft DSM polygon layers and spatially joined the points back to original building footprint layer
    i. Calculate building volumes using elevation data
    j. Calculate the building height based upon the difference between DSM and DEM elevation value
    k. QC percentage of building heights based upon known building heights from city websites and city personnel and compare to VRICON data
7. Add elevation statistics to 2007 footprint layer from Auto-correlated Surface data using the above steps.
8. Merge all building footprint layers together into one multi-year layer
9. Populate all footprints with land use information
10. Populate all footprints with zip code information
11. Create final schema for layer with the following data dictionary:

Field	**Alias**	**Description**
YEAR	YEAR	year
DEM_FREQ	DEM_FREQUENCY	count of points within buffered footprint at DEM level (bottom)
DEM_MEAN	DEM_MEAN_Z	average vertical measure (z-value) in DEM points
DEM_MIN	DEM_MIN_Z	minimum vertical measure (z-value) in DEM points
DEM_MAX	DEM_MAX_Z	maximum vertical measure (z-value) in DEM points
DEM_STD	DEM_STD_Z	std dev of vertical measures (z-values) in DEM points
DEM_MED	DEM_MEDIAN_Z	median vertical measure (z-value) in DEM points
DSM_FREQ	DSM_FREQUENCY	count of points within buffered footprint at DSM level (top)
DSM_MEAN	DSM_MEAN_Z	average vertical measure (z-value) in DSM points

DSM_MIN	DSM_MIN_Z	minimum vertical measure (z-value) in DSM points
DSM_MAX	DSM_MAX_Z	maximum vertical measure (z-value) in DSM points
DSM_STD	DSM_STD_Z	std dev of vertical measures (z-values) in DSM points
DSM_MED	DSM_MEDIAN_Z	median vertical measure (z-value) in DSM points
MAX_DIFF	MAX_DSM_DEM	diff between max z-value of DSM and max z-value of DEM
MEAN_DIFF	MEAN_DSM_DEM	diff between mean z-value of DSM and mean z-value of DEM
MAX_VOL	MAX_DSM_DEM_VOL	volume using diff between max DSM and max DEM
MEAN_VOL	MEAN_DSM_DEM_VOL	volume using diff between mean DSM and mean DEM
AREA_SQFT	AREA_SQFT	footprint area (SQFT) calculated using field calculator
COG_LU	COG_LU	COG land use number
CATEGORY	CATEGORY	COG land use description
LU_YEAR	LU_YEAR	Land use year joined to footprint layer: 2010, 2015 or 2020
ZIP	ZIP	Zip code

12. Load final layer into new clean schema
13. Remove structures that are less that 500sft
14. Remove building height statistics that are < 4ft
15. QC final data layer

Important Notes

1. Planimetric footprints were manually drawn using 6” orthophotography so there may be some human error in the data. After the initial creation, entities purchasing planimetric data either opt to have their data updated or drawn new. The year of the data is either the year it was drawn (if brand new) or most recently updated. For updates, the vendor adds new data and removes/changes features that have been notably altered according to the latest orthophotography. Most of the source data remains unaltered or adjusted in preparing these layers. Any limitations or inaccuracies in the original data are likely to be reflected in these layers, either partially or fully.
2. LiDAR is not captured by a sensor and is highly accurate. Due to the man-made nature of the planimetric data and the machine-made nature of the LiDAR, there may be some discrepancy in the building elevation if the footprint was not aligned properly. For this and other reasons, using the footprint layer for macro, not micro level analysis, is recommended.
3. Auto-correlated surface data is similar to LiDAR data and is used to identify elevation and terrain information. However, it is not as accurate as LiDAR, especially in heavily vegetated areas and should be used for macro analysis only. For more information on ACS data vs. LiDAR, visit https://www.asprs.org/a/conference-archive/ottawa07/ottawa_proceedings/16.pdf
4. These data were prepared using indirect methods for purposes of general information or reference and are not a substitute for a detailed analysis of a particular area or structure based on primary data sources such as engineering drawings, surveys, or field studies.
5. These data were prepared using standard methods as applied by the North Central Texas Council of Governments. The resulting data are likely to differ from similar layers produced by other sources using other data or other methods.

6. While care has been taken to evaluate the overall quality of the data through multiple QC procedures, no particular level of accuracy in either the source data or in the final product is guaranteed. Like all data derived through application of various process and indirect methods, these data are subject to a variety of issues and limitations. The user alone is qualified to determine the usefulness and appropriateness of the data, including both the geography and the attributes, for any given application.

Disclaimer of Warranty and Limitation of Liability

There are various ways to generate building footprints and gather associated attributes. The North Central Texas Council of Governments (NCTCOG) has selected a method that facilitates a relatively efficient and consistent process using resources available at the agency. The attributed building footprints layers were developed for general, regional planning activities. They have not been evaluated for other uses and are not for engineering purposes. They can differ from results of detailed analysis for specific areas or from similar products derived through different processes. This document along with the data referenced are presented "as is" without warranty of any kind, express or implied, including warranties of merchantability and fitness for a particular purpose and no such warranties can be assumed. NCTCOG makes no guarantee regarding accuracy, completeness, currency, or reliability. Responsibility for the use of this document and any referenced data lies solely with the user. In no event shall NCTCOG be liable for any claim of loss or other damages, either direct or indirect, arising from use of data or any related materials generated or distributed by NCTCOG