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National Neighborhood Data Archive (NaNDA): Traffic Volume by Census Tract and ZIP Code Tabulation Area, United States, 1963-2019

P.I. Documentation for Traffic Volume by ZIP Code Tabulation Area Data

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Overview and Data Dictionary

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Dataset Overview

Description

This dataset contains measures of traffic volume per ZIP code tabulation area (ZCTA) in the United States from 1963 to 2019 (primarily 1997 to 2019). High traffic volume may be used as a proxy for heavy traffic, high traffic speeds, and impediments to walking or biking. The dataset contains measures of the average, maximum, and minimum traffic volume per ZCTA per year. These figures are available for all streets, highways, and non-highways. Because data is collected intermittently across locations over time, traffic volume has been interpolated for years in which no measures are available.

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Data Sources

Traffic volume measurements are derived from Kalibrate's TrafficMetrix database accessed via Esri Demographics (Kalibrate, 2019). Kalibrate collects traffic counts from multiple sources, such as city governments, engineering firms, and highway and transportation departments (Kalibrate, n.d.). Traffic counts include a latitude and longitude and up to five estimates of traffic volume at that location over multiple years. Traffic estimates are based on short-term measurements but are adjusted to approximate average traffic volume over time.

ZCTA boundaries come from the 2019 TIGER/Line shapefiles (U.S. Census Bureau, 2019).

Coverage

The dataset contains one observation per year per ZIP code tabulation area in the United States, excluding U.S. island territories. Note that data is not available for every ZCTA and year because traffic measurements are not available in every year. Most observations are from 1993 and later. Measures for missing years are interpolated where possible. For more information, see the Methodology section and Appendices A and B.

Methodology

This dataset is one of several created to investigate the impact of disamenities (Weiss et al., 2011) on neighborhood walkability. Walkability blends geography, urban planning, and public health to measure how friendly an area is to walking through built and social environmental features such as pedestrian street design, transit nodes, land use mix, parks, greenspace, and welcoming public spaces (Sallis et al., 2009, Chudyk et al. 2017). However, neighborhood disamenities such as crime, pedestrian safety (e.g. due to high volumes of traffic), and noxious land uses might inhibit walkability by dissuading people from using neighborhood resources such as parks and recreational facilities (Weiss et al., 2011). Studies have found an inverse relationship between perceptions of traffic/busy roads and walking for transit and recreation (Owen et al., 2004). High traffic volume especially limits walkability for older adults and people with disabilities (Rosenberg et al., 2013, Early et al., 2021). In addition, residence in

neighborhoods with a high density of traffic and industrial facilities has been shown to contribute to chronic respiratory morbidity in children, which may have broad implications for other urban populations that commonly have high asthma prevalence and exposure to a high density of traffic and stationary air pollution sources (Patel, 2011).

This dataset aims to characterize the average volume of traffic passing through a ZCTA in a given year. To create this data, we used three different types of traffic counts within TrafficMetrix:

Count Type	Definition	Portion of Data
Average annual daily traffic (AADT)	Traffic counts that are both seasonally adjusted to represent an average day of the year, and day-of-week adjusted to represent both weekday and weekend traffic.	91%
Average annual weekday traffic (AAWDT)	Traffic counts that are seasonally adjusted to represent an average day of the year, but are taken Monday-Friday only.	2%
Average daily traffic (ADT)	Traffic counts that are day-of-week adjusted to represent both weekday and weekend traffic, but are not seasonally adjusted.	7%

For each location corresponding to one of these counts, we obtained its latitude and longitude and whether the location is on a highway. We assigned the latitudes and longitudes to ZIP code tabulation areas, then determined the average, maximum, minimum, and number of traffic volume measurements across all locations in the ZCTA in a given year. We also created these measures for highway traffic only and for non-highway traffic only.

No traffic counts are available for many ZCTAs in a given year because no measurements were taken during that year. Years-long gaps between measures are common. To address these gaps, we interpolated values for years between observations. Missing values were created using a linear interpolation of the two nearest non-missing years. For example, if a ZCTA has an average traffic volume value for 2015 and 2019, the interpolated value for 2016 is 75% of the value from 2015 and 25% of the value from 2019. An interpolation flag variable identifies observations created in this manner. Appendix A shows the distribution of measurements and interpolated values in the data over time. Appending B shows the distribution of measurements and interpolated values by state over the entire 57-year measurement period. Users who want to use only traffic counts from the source data can use the interpolation flag to identify interpolated values and exclude them from analysis.

Usage Notes

Zip Codes and ZIP Code Tabulation Areas

Users should be aware that ZCTAs are not equivalent to ZIP codes. ZIP codes are linear mail delivery routes created by the US Postal Service. ZIP code tabulation areas are spatial features

consisting of census blocks grouped by the predominant ZIP code found on the block (United States Census Bureau, 2020).

In some cases, a location's address is not the same as its ZCTA. For example, some ZIP codes represent single-point addresses such as large post offices or office buildings. Also, the ZIP code for an address may not match its ZCTA if the ZIP code is not the most common ZIP code on the block. See the Census Bureau's ZCTA overview at https://www.census.gov/programs-surveys/geography/guidance/geo-areas/zctas.html (United States Census Bureau, 2020) for more information on how ZCTA boundaries are calculated.

Users wanting to combine this dataset with ZIP code geocoded data must use a ZIP code to ZCTA crosswalk. Such a crosswalk is available on the UDS Mapper website at https://www.udsmapper.org/zcta-crosswalk.cfm (John Snow Inc., 2018). Sample code for merging the UDS Mapper crosswalk with NaNDA datasets is available on the NaNDA repository at https://www.openicpsr.org/openicpsr/project/120088/ (Chenoweth & Khan, 2021).

Related Datasets

Data users interested in walkability and neighborhood disamenities (such as pollution and traffic) might find useful data in these other NaNDA datasets:

- Polluting sites by ZIP code tabulation area, United States, 2000-2018
- Primary and secondary roads by ZIP code tabulation area, United States, 2010
- Street connectivity by ZIP code tabulation area, United States, 2010

Data users interested in other resources that contribute to walkability, such as parks, public transit, and retail and other destinations, may find the following additional NaNDA datasets to be of use:

- Arts, entertainment, and recreation services by ZIP code tabulation area, United States, 2003-2017
- Eating and drinking places by ZIP code tabulation area, United States, 2003-2017
- Retail establishments by ZIP code tabulation area, United States, 2003-2017
- Parks by ZIP code tabulation area, United States, 2018
- Public transit stops by ZIP code tabulation area, United States, 2016-2018

Variables

Variable	Type	Obs	Unique	Mean	Min	Max	Label
zcta19	string	675326	31332	.	.	.	ZIP code tabulation area, 2019 TIGER/Line shapefiles
year	float	675326	57	2005.966	1963	2019	Interpolated: Traffic count year
intp_flag	float	675326	2	0.5647361	0	1	Flag for interpolated value. 0=Original data, 1=Interpolated data
i_mean_traffic	float	675326	451701	8769.471	1	359666.7	Interpolated: Mean of average daily traffic counts in ZCTA
i_min_traffic	float	675326	125301	4052.759	1	356000	Interpolated: Lowest average daily traffic count in ZCTA
i_max_traffic	float	675326	213131	20441.69	1	1785989	Interpolated: Highest average daily traffic count in ZCTA
i_count_traffic	float	675326	11814	14.61501	1	966	Interpolated: # traffic measurements in ZCTA
i_total_traffic	float	675326	360779	108149.5	1	7662600	Interpolated: Sum of average daily traffic counts in ZCTA
i_mean_hw_traffic	float	140955	91825	29418.18	4	406200	Interpolated: Mean of average daily highway traffic counts in ZCTA
i_min_hw_traffic	float	140955	62799	23194.01	1	406200	Interpolated: Lowest average daily highway traffic count in ZCTA
i_max_hw_traffic	float	140955	68147	36914.34	6	674123	Interpolated: Highest average daily highway traffic count in ZCTA
i_count_hw_traffic	float	675326	2099	0.913447	0	88	Interpolated: # highway traffic measurements in ZCTA
i_total_hw_traffic	float	675326	118712	26404.06	0	7544600	Interpolated: Sum of average daily highway traffic counts in ZCTA
i_mean_nonhw_traffic	float	637780	414777	6591.173	1	375250	Interpolated: Mean of average daily non-highway traffic counts in ZCTA
i_min_nonhw_traffic	float	637780	113903	3131.143	1	352600	Interpolated: Lowest average daily non-highway traffic count in ZCTA
i_max_nonhw_traffic	float	637780	189450	14049.6	1	1785989	Interpolated: Highest average daily non-highway traffic count in ZCTA
i_count_nonhw_traffic	float	675326	11660	13.70156	0	966	Interpolated: # non-highway traffic measurements in ZCTA
i_total_nonhw_traffic	float	675326	335985	81745.44	0	5990708	Interpolated: Sum of average daily non-highway traffic counts in ZCTA
count_intersections	float	675326	2761	659.0388	0	13988	# intersections in ZCTA
i_mean_traf_per_intersection	float	674710	636856	37.95221	0.0006897	58032.5	Intp: Avg daily traffic per intersection (i_mean_traffic/count_intersections)

Variable	Type	Obs	Unique	Mean	Min	Max	Label
i_mean_hw_traf_ per_intersection	float	140945	135705	65.97037	0.0039177	48641.75	Intp: i_mean_hw_traffic / count_intersections
i_mean_nh_traf_ per_intersection	float	637174	599351	30.19564	0.0006897	48805	Intp: i_mean_nonhw_traffic / count_intersections

References

Chenoweth, M. M. & Khan, A. M. (2021). National Neighborhood Data Archive (NaNDA): Code for merging ZCTA level datasets with the UDS Mapper ZIP code to ZCTA crosswalk (Version 2) [source code]. Inter-university Consortium for Political and Social Research. https://doi.org/10.3886/E120088V2

Chudyk, A. M., McKay, H. A., Winters, M., Sims-Gould, J., & Ashe, M. C. (2017). Neighborhood walkability, physical activity, and walking for transportation: A cross-sectional study of older adults living on low income. *BMC Geriatr. 17*(1), 82.

Early, A., Suarez-Balcazar, Y., & Arias, D. (2021). Latinx parents' perceptions of neighborhood walking safety for their youth with intellectual disabilities: A mixed-methods investigation. *Family & Community Health 44*(1), 10-20. https://doi.org/10.1097/FCH.0000000000000274

John Snow, Inc. (2018). ZIP code to ZCTA crosswalk (2018 UDS report version) [Data set]. UDS Mapper. https://www.udsmapper.org/docs/zip_to_zcta_2019.xlsx

Kalibrate (2019). TrafficMetrix (2019 version) [Data set]. Esri Demographics.

Kalibrate (n.d.). Published counts: TrafficMetrix. https://downloads.esri.com/esri_content_doc/dbl/us/Kalibrate-TrafficMetrix_Published_Manual.pdf

Owen, N., Humpel, N., Leslie, E., Bauman, A., & Sallis, J. F. (2004). Understanding environmental influences on walking: Review and research agenda. *American Journal of Preventive Medicine 27*(1), 67-76. https://doi.org/10.1016/j.amepre.2004.03.006

Patel, M. M., Quinn, J. W., Jung, K. H., Hoepner, L., Diaz, D., Perzanowski, M., Rundle, A., Kinney, P. L., Perera, F. P., & Miller, R. L. (2011). Traffic density and stationary sources of air pollution associated with wheeze, asthma, and immunoglobulin E from birth to age 5 years among New York City children. *Environmental research, 111*(8), 1222-1229. https://doi.org/10.1016/j.envres.2011.08.004

Rosenberg, D. E., Huang, D. L., Simonovich, S. D., & Belza, B. (2013). Outdoor built environment barriers and facilitators to activity among midlife and older adults with mobility disabilities. *The Gerontologist 53*(2), 268-279. https://doi.org/10.1093/geront/gns119

Sallis, J. F. (2009). Measuring physical activity environments: A brief history. *American journal of preventive medicine 36*(4 Suppl), S86-92.

United States Census Bureau (2019). TIGER/Line shapefiles, 2010 ZIP Code Tabulation Areas (2019 version) [Data set]. https://www2.census.gov/geo/tiger/TIGER2019/ZCTA5/tl_2019_us_zcta510.zip

United States Census Bureau (2020, April 1). ZIP code tabulation areas (ZCTAs). https://www.census.gov/programs-surveys/geography/guidance/geo-areas/zctas.html

Appendices

Appendix A. Observations per ZCTA by Year and Interpolation Status

n=32,983 ZIP code tabulation areas in 2019 (John Snow Inc., 2018).

Year	ZCTAs with Non-interpolated Values		ZCTAs with Interpolated Values		Total ZCTAs	
	n	*%*	*n*	*%*	*n*	*%*
1963	1	0.00%	0	0.00%	1	0.00%
1964	3	0.01%	1	0.00%	4	0.01%
1965	4	0.01%	4	0.01%	8	0.02%
1966	20	0.06%	6	0.02%	26	0.08%
1967	7	0.02%	19	0.06%	26	0.08%
1968	2	0.01%	25	0.08%	27	0.08%
1969	11	0.03%	24	0.07%	35	0.11%
1970	5	0.02%	30	0.09%	35	0.11%
1971	5	0.02%	32	0.10%	37	0.11%
1972	32	0.10%	29	0.09%	61	0.18%
1973	54	0.16%	44	0.13%	98	0.30%
1974	10	0.03%	92	0.28%	102	0.31%
1975	39	0.12%	95	0.29%	134	0.41%
1976	40	0.12%	118	0.36%	158	0.48%
1977	79	0.24%	143	0.43%	222	0.67%
1978	117	0.35%	163	0.49%	280	0.85%
1979	69	0.21%	259	0.79%	328	0.99%
1980	118	0.36%	291	0.88%	409	1.24%
1981	155	0.47%	339	1.03%	494	1.50%
1982	234	0.71%	358	1.09%	592	1.79%
1983	220	0.67%	439	1.33%	659	2.00%
1984	322	0.98%	482	1.46%	804	2.44%
1985	484	1.47%	541	1.64%	1,025	3.11%
1986	719	2.18%	629	1.91%	1,348	4.09%
1987	862	2.61%	794	2.41%	1,656	5.02%
1988	1,051	3.19%	937	2.84%	1,988	6.03%
1989	1,468	4.45%	1,138	3.45%	2,606	7.90%
1990	1,809	5.48%	1,462	4.43%	3,271	9.92%
1991	2,300	6.97%	1,821	5.52%	4,121	12.49%
1992	3,143	9.53%	2,217	6.72%	5,360	16.25%
1993	3,908	11.85%	2,966	8.99%	6,874	20.84%
1994	5,903	17.90%	3,421	10.37%	9,324	28.27%
1995	7,344	22.27%	4,239	12.85%	11,583	35.12%
1996	10,230	31.02%	5,324	16.14%	15,554	47.16%

Year	ZCTAs with Non-interpolated Values		ZCTAs with Interpolated Values		Total ZCTAs	
1997	17,995	54.56%	6,470	19.62%	24,465	74.17%
1998	12,855	38.97%	14,320	43.42%	27,175	82.39%
1999	9,259	28.07%	18,114	54.92%	27,373	82.99%
2000	7,424	22.51%	20,135	61.05%	27,559	83.56%
2001	9,258	28.07%	18,628	56.48%	27,886	84.55%
2002	14,263	43.24%	14,152	42.91%	28,415	86.15%
2003	12,416	37.64%	16,364	49.61%	28,780	87.26%
2004	11,027	33.43%	17,818	54.02%	28,845	87.45%
2005	11,425	34.64%	17,483	53.01%	28,908	87.65%
2006	9,779	29.65%	18,650	56.54%	28,429	86.19%
2007	7,760	23.53%	19,753	59.89%	27,513	83.42%
2008	9,331	28.29%	18,213	55.22%	27,544	83.51%
2009	8,998	27.28%	18,323	55.55%	27,321	82.83%
2010	10,325	31.30%	17,050	51.69%	27,375	83.00%
2011	9,918	30.07%	17,296	52.44%	27,214	82.51%
2012	10,421	31.60%	16,630	50.42%	27,051	82.01%
2013	10,446	31.67%	16,550	50.18%	26,996	81.85%
2014	10,243	31.06%	16,663	50.52%	26,906	81.58%
2015	11,476	34.79%	15,323	46.46%	26,799	81.25%
2016	8,417	25.52%	17,803	53.98%	26,220	79.50%
2017	9,086	27.55%	16,601	50.33%	25,687	77.88%
2018	23,041	69.86%	530	1.61%	23,571	71.46%
2019	7,983	24.20%	0	0.00%	7,983	24.20%

Appendix B. Observations by State and Interpolation Status

Source for number of ZCTAs per state: John Snow Inc. (2018). “Max Possible Values” is the number of ZCTAs in the state multiplied by the total number of observation years (57).

State	ZCTAs	Max Possible Values	ZCTAs with Non-interpolated Values		ZCTAs with Interpolated Values		Total ZCTAs	
	n	*n*	*n*	*%*	*n*	*%*	*n*	*%*
AK	238	13566	647	4.77%	1,163	8.57%	1,810	13.34%
AL	642	36594	3,497	9.56%	9,467	25.87%	12,964	35.43%
AR	591	33687	5,005	14.86%	4,474	13.28%	9,479	28.14%
AZ	405	23085	5,003	21.67%	5,140	22.27%	10,143	43.94%
CA	1,761	100377	24,935	24.84%	11,700	11.66%	36,635	36.50%
CO	525	29925	5,305	17.73%	3,535	11.81%	8,840	29.54%
CT	282	16074	2,388	14.86%	2,983	18.56%	5,371	33.41%
DC	53	3021	465	15.39%	646	21.38%	1,111	36.78%
DE	67	3819	429	11.23%	1,120	29.33%	1,549	40.56%
FL	983	56031	10,176	18.16%	11,975	21.37%	22,151	39.53%
GA	735	41895	8,724	20.82%	6,445	15.38%	15,169	36.21%
HI	94	5358	709	13.23%	1,237	23.09%	1,946	36.32%
IA	934	53238	5,350	10.05%	15,743	29.57%	21,093	39.62%
ID	278	15846	1,237	7.81%	3,927	24.78%	5,164	32.59%
IL	1,383	78831	11,806	14.98%	17,942	22.76%	29,748	37.74%
IN	775	44175	6,470	14.65%	11,994	27.15%	18,464	41.80%
KS	698	39786	4,591	11.54%	9,504	23.89%	14,095	35.43%
KY	768	43776	6,747	15.41%	7,872	17.98%	14,619	33.40%
LA	515	29355	4,077	13.89%	5,248	17.88%	9,325	31.77%
MA	537	30609	7,953	25.98%	6,910	22.58%	14,863	48.56%
MD	468	26676	4,777	17.91%	5,291	19.83%	10,068	37.74%
ME	432	24624	2,076	8.43%	5,414	21.99%	7,490	30.42%
MI	986	56202	12,083	21.50%	11,709	20.83%	23,792	42.33%
MN	885	50445	6,934	13.75%	11,772	23.34%	18,706	37.08%
MO	1,023	58311	8,309	14.25%	11,229	19.26%	19,538	33.51%
MS	423	24111	2,237	9.28%	6,519	27.04%	8,756	36.32%
MT	361	20577	1,450	7.05%	5,764	28.01%	7,214	35.06%
NC	808	46056	5,445	11.82%	10,538	22.88%	15,983	34.70%
ND	383	21831	2,533	11.60%	3,797	17.39%	6,330	29.00%
NE	581	33117	2,722	8.22%	9,663	29.18%	12,385	37.40%
NH	248	14136	1,958	13.85%	3,813	26.97%	5,771	40.82%
NJ	595	33915	8,270	24.38%	5,505	16.23%	13,775	40.62%
NM	368	20976	1,202	5.73%	4,887	23.30%	6,089	29.03%
NV	175	9975	2,027	20.32%	1,342	13.45%	3,369	33.77%
NY	1,794	102258	15,679	15.33%	10,629	10.39%	26,308	25.73%
OH	1,197	68229	13,731	20.12%	15,268	22.38%	28,999	42.50%

State	ZCTAs	Max Possible Values	ZCTAs with Non-interpolated Values		ZCTAs with Interpolated Values		Total ZCTAs	
OK	648	36936	4,863	13.17%	8,037	21.76%	12,900	34.93%
OR	417	23769	4,001	16.83%	5,367	22.58%	9,368	39.41%
PA	1,797	102429	19,432	18.97%	18,423	17.99%	37,855	36.96%
RI	77	4389	636	14.49%	821	18.71%	1,457	33.20%
SC	424	24168	3,427	14.18%	5,351	22.14%	8,778	36.32%
SD	371	21147	1,287	6.09%	5,211	24.64%	6,498	30.73%
TN	629	35853	4,273	11.92%	8,372	23.35%	12,645	35.27%
TX	1,935	110295	18,011	16.33%	24,721	22.41%	42,732	38.74%
UT	288	16416	2,325	14.16%	3,981	24.25%	6,306	38.41%
VA	896	51072	7,746	15.17%	10,712	20.97%	18,458	36.14%
VT	255	14535	1,358	9.34%	4,121	28.35%	5,479	37.70%
WA	597	34029	7,529	22.13%	4,447	13.07%	11,976	35.19%
WI	774	44118	8,758	19.85%	8,920	20.22%	17,678	40.07%
WV	706	40242	2,847	7.07%	7,911	19.66%	10,758	26.73%
WY	178	10146	474	4.67%	2,791	27.51%	3,265	32.18%