
NC NHTS Data Analysis

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2009 National Household Travel Survey (NHTS)



Provides information to assist planners, modelers and decision makers who need comprehensive data on travel patterns in the United States

- Trip purpose
 - Trip characteristics
 - Occupancy
 - Person characteristics
 - Vehicle attributes
 - Vehicle occupancy
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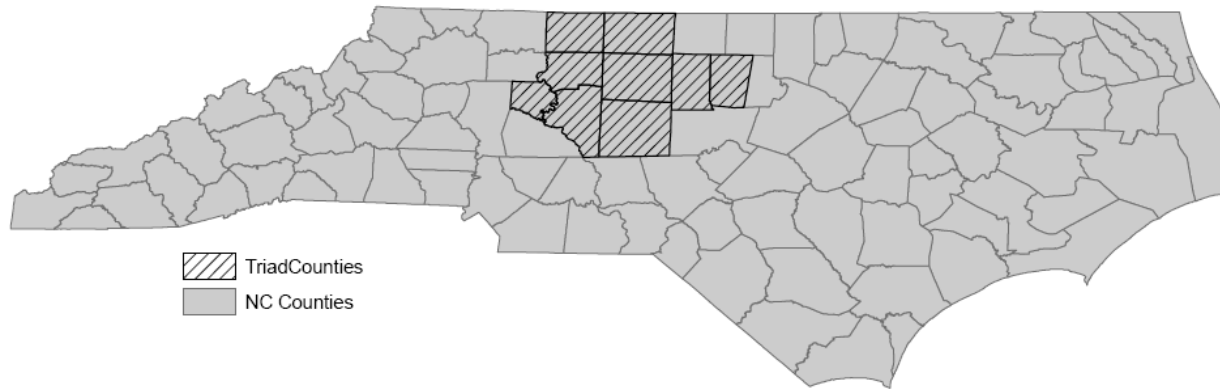
NHTS Advantages



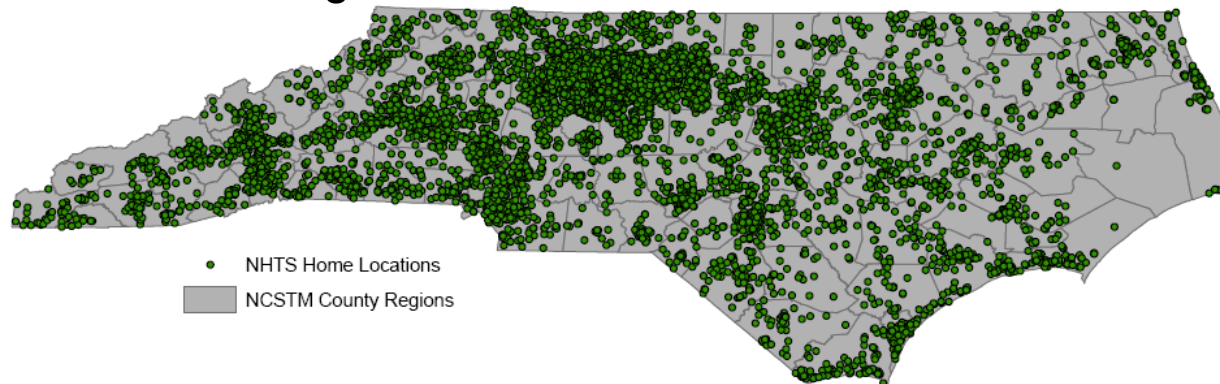
- NHTS covers entire state of NC
- Available in states adjacent to NC (public dataset)
- 2009 data close to model base year
- Statewide and Triad Region add-ons provided
large dataset
- NCDOT received some additional samples at no
cost through the FHWA
- Large user community (MPO, DOT, academic)

NHTS Geography

NHTS add-on surveys processed for the State and for the Triad Region



Statewide coverage of households



Sample size and expansion



Number of records

	Statewide	Triad
Households	5,929	5,161
Persons	11,829	10,274
Trips	44,187	39,968

Expanded numbers compared to other data sources

	ACS 2008	NC LINC 2008	W&P 2008	NHTS Statewide	NHTS Triad	NHTS Combined
Households	3,595,175		3,704,407	3,158,780	481,579	3,575,062
Persons	8,575,899	8,621,032	9,247,134	7,546,078	1,141,359	8,546,378

Expanded numbers compare very well at statewide level, not so well at county level.

NHTS and modeling



NHTS data was processed for use in:

- Trip Generation – rates calculated by average trips per household
- Trip Attractions (NHB purposes only) – rates calculated by regressing number of attractions by employment in industries
- Destination Choice – Estimation file for alogit model input, trip length frequency distribution targets
- Mode Choice – Mode share

NHTS Data Processing

- All data processing done using R scripts
 - possible for later users to duplicate results
 - R is open source
- Dropped records result in about 12% under-reported trip rate

Trip File Field	Problem	Count
WHYTO	Missing	1290
WHYFROM	Missing	378
TRPTRANS	Missing	166
FRSTHM	Missing	25
TRPEDGEO	Poor Geocoding	7,835
TDWKND	Weekend Travel	24,533
HHFAMINC	Missing	5,004
Joined to skims	Trips over 50 miles	934

Data provides home location and trip end, trip origin must be imputed:

- If first trip of day starts at home, origin is home end
 - If first trip of day does not start at home, trip origin cannot be determined and record cannot be coded to a location
 - Subsequent trips use end of previous trip as origin
 - If coordinates are unknown, origin cannot be determined
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Geocoding issue discovered while processing destination choice.

- Approximately 85 trip ends were miscoded
- Geocoding levels of accuracy are flagged in survey by NHTS.

- 1 – Matched to street address
- 2 – Matched to nearest intersection
- 3 – Matched to nearest landmark's street address
- 4 – Matched to Zip Code centroid
- 5 – Matched to City centroid (Census Designated Place)
- 6 – Matched to State
- 7 – Unmatched

NHTS Expansion Factors



Advantages:

- Already attached to data set
- Used by other NHTS clients
- Re-expansion may introduce bias

Disadvantages:

- Expansion conducted by the NHTS was not specifically for travel demand model use
- Expansion process not well documented
- Use of both add-on surveys included duplicate records, which should not be sampled twice
- Some very large expansion factors – up to 12,516 on one household

Conclusions:

- NHTS expansion rates would be used, but would have to be adjusted up to make up for dropped records

NHTS Analysis

Household Size in Persons	ACS HH's	NHTS SW HH's
1	28%	27%
2	35%	36%
3	17%	16%
4	13%	13%
5	5%	5%
6	2%	1%
7+	1%	1%
Total	100%	100%

NHTS Analysis



Income Category	ACS	NHTS Statewide
<10K	8%	11%
10,000-14,999	6%	8%
15,000-19,999	6%	6%
20,000-24,999	6%	6%
25,000-29,999	6%	8%
30,000-34,999	6%	5%
35,000-39,999	5%	8%
40,000-44,999	5%	3%
45,000-49,999	5%	6%
50,000-59,999	9%	8%
60,000-74,999	10%	8%
75,000-99999	11%	11%
>100,000	16%	13%
Total	100%	100%

NHTS Analysis

Using fully cleaned data set, weekday motorized trips < 50 miles

Average Trip Rate:
9.12/Household

Household Size	Trip Rate
1 Person	3.55
2 Persons	6.33
3 Persons	11.72
4+ Persons	17.29

Income Group	Trip Rate
< \$20,000	6.62
\$20,000-\$35,000	7.06
\$35,000-\$55,000	9.01
\$55,000-\$80,000	11.37
>\$80,000	12.45

NHTS Analysis

Trip Rates for neighboring states

Trip rate per HH	GA	SC	TN	VA	NC
Total	9.92	10.18	9.23	9.51	9.12
Home Based Other	4.92	5.15	4.53	4.87	4.90
Home Based Work	1.61	1.56	1.44	1.61	1.27
Non Home Based	3.20	3.25	3.04	2.83	2.93

NHTS Analysis

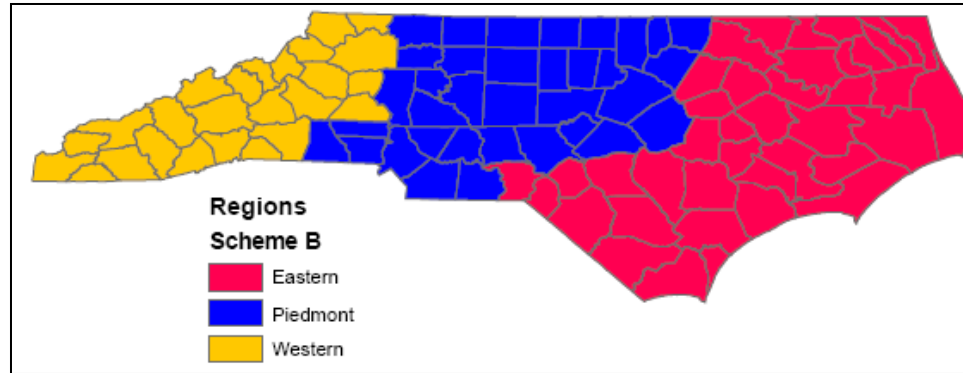
Trip Rates by Purpose

- **HBO – Home Based Other**, one end at home, one end at non-work, non-shop activity
- **HBS – Home Based Shop**, one end at home, one end at shop activity
- **HBW – Home Based Work**, one end at home, one end at work
- **NHB – Non Home Based**, neither end at home, neither end at work activity
- **NHBW – Non Home Based Work**, neither end at home, at least one end at a work activity

Purpose	Trip Rate
Total	9.12
HBO	3.56
HBS	1.61
HBW	1.31
NHB	1.76
NHBW	0.83

NHTS Analysis

Regional Differences in Rates

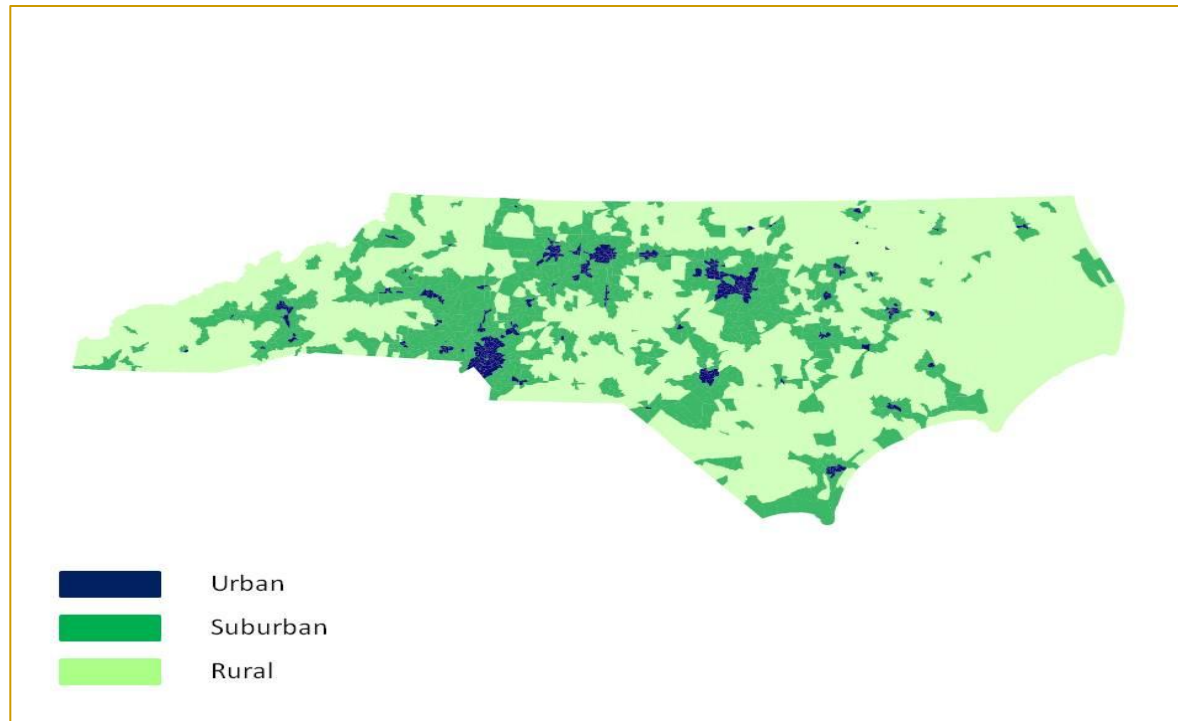


Region	Trip Rate
Eastern	8.73
Piedmont	9.51
Western	7.99

NHTS Analysis

Area Type Differences in Rates

Density = (Zone Households + Zone Total Employment) / Zone Area



NHTS Analysis

Area Type Differences in Rates

Density	Total	HBO	HBS	HBW	NHO	NHBW
Urban	9.61	3.89	1.76	1.39	1.74	0.81
Suburban	9.40	3.50	1.62	1.44	1.86	0.92
Rural	8.40	3.36	1.48	1.11	1.66	0.75

Trip Generation Rates

Trip generation rates prepared from the cleaned NHTS data set

HBW and NHBW:

- Number of Workers, Income, Density

HBO, HBS, and NHB:

- Household Size, Income, Density

Due to low numbers of observations in some bins, data was smoothed by combining bins with low observations, by averaging neighboring bins, and by hand when necessary to show a reasonable pattern

NHTS Data Raking



- Many records were dropped in data cleaning
 - Total expanded survey numbers (not rates) were needed for model targets
 - NHTS expansion rates were adjusted to match ACS totals (marginals)
 - Adjusted rates retain NHTS processing, but match population totals
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NHTS Data Raking



Income	ACS 2006-2010	NHTS	NHTS Clean	NHTS Raked
0 to 25K	1,010,303	1,019,035	658,808	921,366
25 to 50K	1,016,702	990,340	648,926	927,412
50 to 100K	1,121,277	878,849	595,651	1,022,669
100K +	596,873	424,709	275,390	544,506
	3,745,155	3,312,934	2,178,775	3,415,954

NHTS Data Raking



Income	ACS 2006-2010	NHTS	NHTS Clean	NHTS Raked
0 to 25K	27.0%	30.8%	30.2%	27.0%
25 to 50K	27.1%	29.9%	29.8%	27.1%
50 to 100K	29.9%	26.5%	27.3%	29.9%
100K +	15.9%	12.8%	12.6%	15.9%
	100%	100%	100%	100%

NHTS Data Raking

	NHTS, cleaned	NHTS, raked
Total Trip Rate	9.12	9.15
HBO	3.56	3.50
HBS	1.61	1.32
HBW	1.31	1.37
NHB	1.76	1.88
NHBW	0.83	0.95
Unknown	0.17	0.13

Conclusions



- Robust dataset
 - Thoroughly compared to other data sources and lines up well
 - Clear differences in travel patterns by income, household size, and geography
 - NHTS expansion rates can be used, with adjustment for dropped records
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