travel modelling group

tmg

# ANALYSIS OF TTS 2016 TRIP RATES

Ahmadreza Faghih-Imani, Ph.D.
James Vaughan, h.BSc.
Eric J. Miller, Ph.D.

August, 2018

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING
Transportation Research Institute

UTTRI

# EXECUTIVE SUMMARY

This report presents the findings of an analysis of the TTS 2016 data by the Travel Modelling Group (TMG), which compares the magnitude of trips and the associated per capita daily trip rates from the 2016 survey with those for previous TTS years. Key findings from this analysis include the following.

- TTS 2016 reported fewer total weighted trips compared to TTS 2011 and the lowest overall trip rates among all the TTS years.
- Comparing with TTS data from previous years, especially with 2011 and 2006, it is almost certain that the 2016 TTS underreports trip-making in the region. Since there is no absolute "ground truth" against which the TTS data can be compared, no absolute statement concerning this conclusion can be made.
- Comparing TTS 2016 to TTS 2011, the total number of trips for facilitate passenger, market and other purposes significantly decreased by 14%, 8% and 10%, respectively. The corresponding decreases in trip rates for these three trip purposes are 16.8%, 11.5% and 10%.
- The number of school trips in 2016 also decreased relative to 2011, but this decrease is consistent with an overall decrease in the number of students during this time period.
- Total work trips increased in 2016 relative to 2011. A light decline is observed in work trip rates, which is consistent with the previous years' trend.
- The trip rates for persons aged 25-50 in TTS 2016 is lower than expected based on previous years' data.
- The modal share of passenger trips has significantly decreased while walking and cycling has increased. The increase in walking and cycling is mostly due to better capturing trips in PD1 (the Toronto Downtown) in TTS 2016 relative to previous years.
- The trip rates for both respondents and non-respondents has decreased in 2016 compared to previous years with a larger drop occurring for non-respondents. This is most apparent for non-commute trips of non-respondents in the online portion of the survey.
- Comparing the responses from the online vs telephone sub-samples, it is clear that the differences in reported trips in TTS 2016 relative to previous years largely comes from the online respondents.
- Online and telephone respondents have different household and personal characteristics (household size, number of vehicles, number of fulltime workers and income, age and occupation type).

- The online survey trip definition pop-up was incorrectly coded, with this mistake only being discovered approximately half-way through the survey. This error clearly had a significant impact on the underreporting of facilitate passenger trips.
- Underreporting issues are most readily apparent in following GTHA Planning Districts (PDs), particularly the PDs shown bold: **Oshawa**, Whitby, Ajax, **Pickering**, Toronto eastern PDs (PD#13-16), **Newmarket**, Mississauga, Brampton, and **Hamilton**. I.e., the under-reporting problem is widely distributed spatially.

In summary:

- Reported Work, School and Daycare trips and trip rates appear to be reasonable.
- Market, Facilitate Passenger and Other trips are almost certainly underreported.
- The mode share for passenger trips is almost certainly underreported.
- The online survey and the fact that 68% of the survey respondents used from the online survey has a key role in this underreporting, especially for the non-respondent non-commute trips.
- Toronto PD1 trip-makers and trips by active modes (walk and bicycle) seem to be better represented in 2016 TTS.

# 1 Table of Contents

## LIST OF TABLES

**Page No.**



## LIST OF FIGURES

**Page No.**

# 1 INTRODUCTION

This report presents in in-depth analysis of the overall magnitude of trip-making and associated per capita trip rates observed in the TTS 2016 survey data, compared to similar data from previous TTS years. Documentation of all TTS surveys, in terms of the design and conduct of the surveys, definition of attributes gathered by the surveys, etc. can be found at the Data Management Group (DMG) website (http://dmg.utoronto.ca/#).

In this report, all trip magnitudes are estimated total survey are trips, generated by weighting the observed trip samples to scale them up to population-level totals. Work and school trip rates are computed by dividing the number of weighted trips by the number of workers or students for a given occupation class (for workers) or school type (elementary, secondary or post-secondary, for students). Non-work-school trip rates are computed on a per capita basis, using all persons 11 year or older as the population of interest.[1]

In order to assess the 2016 trips and trip rates these are compared to comparable values from the four previous TTS years, 1996, 2001, 2006 and 2011. It is felt that this 20-year time period can provide an excellent definition of travel trends in the TTS study area. Note that this study area consists of virtually the entire Greater Golden Horseshoe (GGH). Special attention in the analysis is also paid to the "heart" of the GGH, the Greater Toronto-Hamilton Area (GTHA).

The analysis presented in the following sections slices through the TTS data from a variety perspectives. Sections 2 to 4 examine the total number of trips reported by trip purposes and age categories. Section 5 provides a detailed analysis of trip rates in the five TTS datasets. Section 6 presents the trip mode share analysis and Section 7 investigates the differences in trip reporting by respondents and non-respondents. Section 8 focuses on the issues specific to the 2016 TTS data collection. Finally, Section 9 looks at the datasets at the tour level.

# 2 POPULATION & TOTAL NUMBER OF TRIPS

Figure 2-1 plots total GGH population and total daily trips during the 1996-2016 time period. While population has increased over this twenty-year time period as expected, the total number of trips has decreased in 2016 compared to 2011 data, breaking the previously observed trend of a relatively constant rate of increase in total regional daily trip-making. Table 2.1 shows the data plotted in Figure 2-1. It also shows projected estimates for 2016 regional population and total trips based on a simple (and admittedly naïve) linear projection of the 1996-2011 15-year trend. Points to note from Figure 2-1 and Table 2.1 include:

- Between 2001 and 2011, TTS data indicate a marginal decline in average per capita trip-making. This small decline in trip rates has been "masked" by large increases in total population, resulting in a net increase in total trips. In 2016, however, the TTS data indicated both a much slower growth in regional population, along with a much more significant decline in overall daily trip rates. The result is an estimated net decline in total daily trips of approximately 400,000 region-wide.
- If the previous 15-year trend had held between 2011 and 2016, we would have expected approximately a 9% increase in total daily trips, rather than the measured 2% decline.

[1] TTS does not collect trip information for children under the age of eleven.

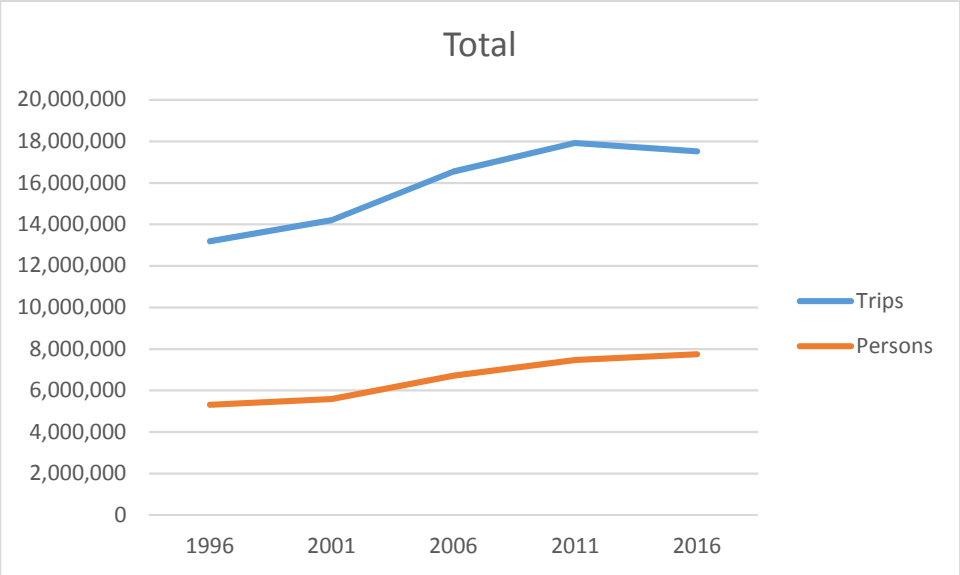



**Figure 2-1 1996-2016 Trends in TTS Total Population & Trips**

**Table 2.1 1996-2016 Trends in TTS Total Population & Trips**

| Year | Population | Change relative to previous year | Trips | Change relative to previous year | Trip Rates | Change relative to previous year |
|---|---|---|---|---|---|---|
| **1996** | 5,315,395 | - | 13,153,001 | | 2.48 | |
| **2001** | 5,588,082 | 4% | 14,193,995 | 8% | 2.54 | 2.4% |
| **2006** | 6,708,647 | 18% | 16,541,740 | 16% | 2.47 | -3.0% |
| **2011** | 7,464,529 | 11% | 17,924,326 | 8% | 2.40 | -2.6% |
| **2016** | 7,745,779 | 4% | 17,522,726 | -2% | 2.26 | -5.8% |
| **2016 Linear Expected based on previous years** | 8,221,326 | 10% | 19,580,090 | 9% | 2.38 | -1% |

These aggregate trends can be spatially disaggregated. Figure 2-2 plots the expected percentage change in total daily trips between 2011 and 2016 (taking the 2011 as the base), based on the linear extrapolation of the 1996-2011 trend. As expected, this figure shows growth in trips throughout the GGH. Figure 2-3 plots the 2016 percentage changes in total trips relative to 2011 and 2006 as measured in TTS.

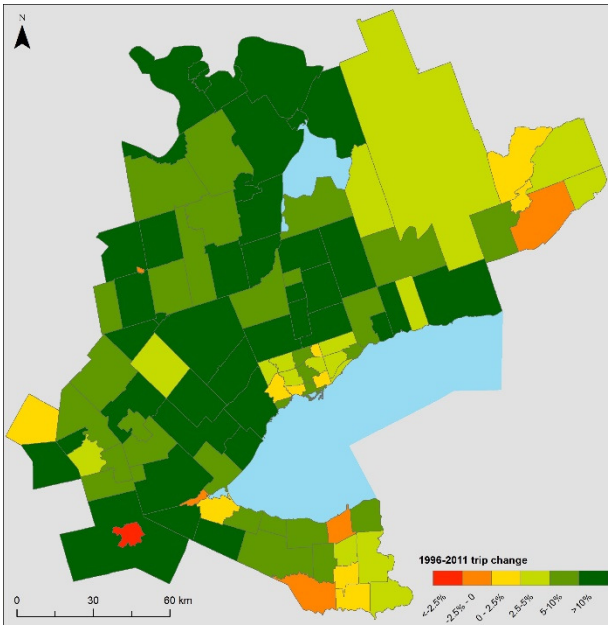



**Figure 2-2 Expected 2016 Percentage Change in Total Daily Trips, Relative to 2011, Based on Projecting the 1996-2011 Linear Trends.**

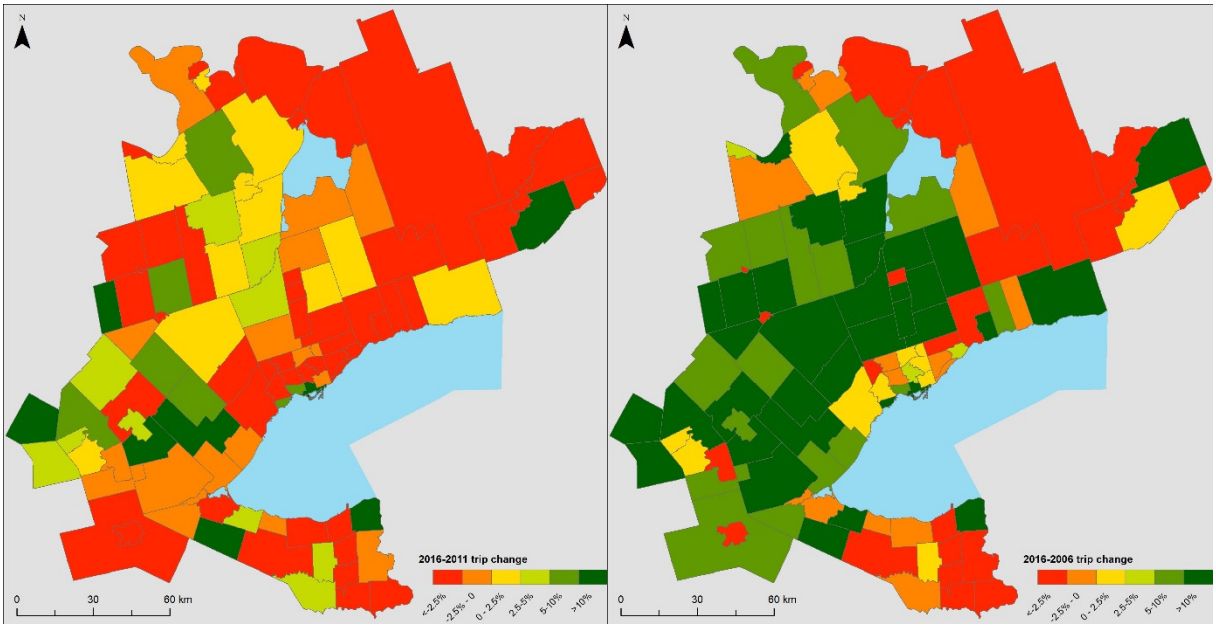



**Figure 2-3 Percentage Changes in TTS Total Daily Trips, 2016 Relative to 2011 (Left) and 2016 Relative to 2006 (Right).**

Figure 2-4 depicts PDs where the 2016 population increased (decreased) but the number of trips has decreased (increased) for 2016 compared to 2011 and 2006. Comparing 2016 to 2011, there are 29 PDs that the population has increased in 2016 compared to 2011 but the number of trips has declined. Of these 29 PDs, only Brantford had a consistent decline in the number of trips in previous TTS data (2011 compared to 2006 while the population has increased). There is also 1 PD (Wainfleet) that has a population decrease but the number of trips has increased. Comparing 2016 to 2006, again there are 30 PDs where population has increased but the number of trips has

reduced. There are 2 PDs (Otonabee and Tiny) where population has decreased but the number of trips has increased. It is important to note that comparing 2011 to 2006, there is no PD that has an inconsistent population and trips change.

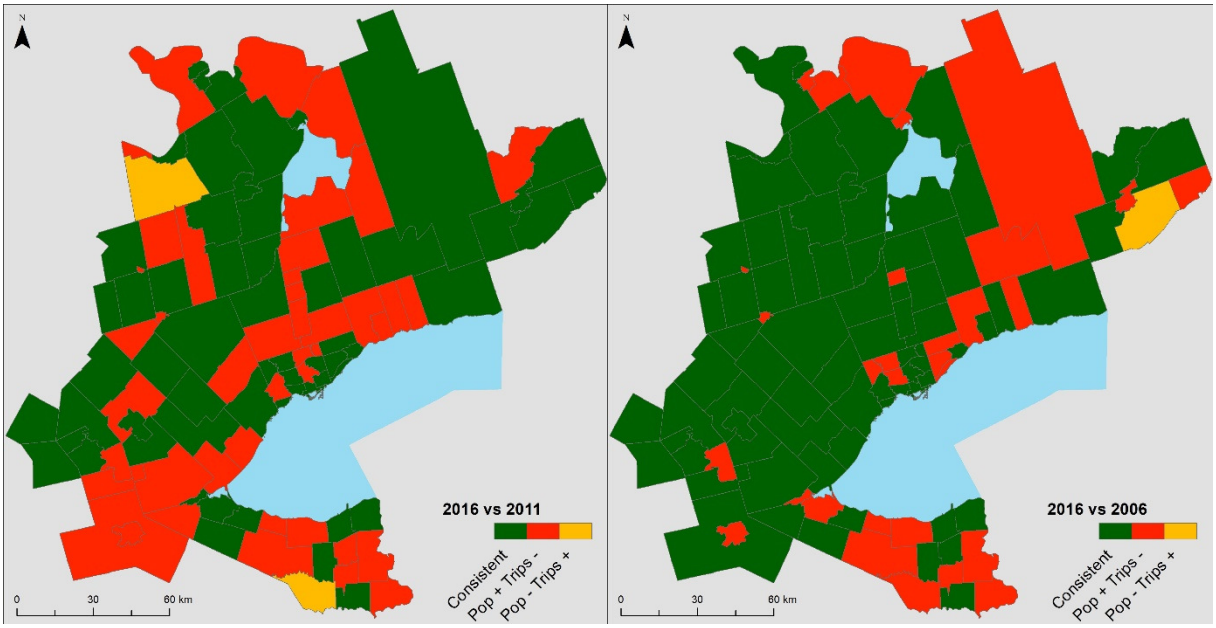



**Figure 2-4 Planning Districts with Inconsistent Changes in Total Daily Trips vs. Population Changes, 2016 vs. 2011 and 2016 vs. 2006.**

# 3 TRIPS BY PURPOSE

This section investigates the changes in the number of daily trips by different trip purposes (Table 3.1). The total number of trips has consistently increased up to 2011. In TTS 2016, only the number of work trips has increased compared to 2011. The highest drop is observed for the other purpose trips. The number of trips with other purpose in 2016 is 7% lower than the number in 2006 even though the population has grown by 15%.

**Table 3.1 Daily Trips by Trip Purpose, 1996 -- 2016**

| YEAR | TOTAL TRIP | WORK | SCHOOL | MARKET | FACILITATE PASSENGER | DAYCARE | OTHER | HOME |
|---|---|---|---|---|---|---|---|---|
| **1996** | 13,185,489 | 2,829,587 | 900,073 | 1,113,198 | 697,755 | 68,634 | 2,014,019 | 5,562,223 |
| **2001** | 14,200,615 | 3,032,822 | 904,557 | 1,188,281 | 894,189 | 65,876 | 2,151,949 | 5,962,941 |
| **2006** | 16,541,740 | 3,385,542 | 1,057,814 | 1,504,689 | 1,126,063 | 82,056 | 2,489,721 | 6,895,855 |
| **2011** | 17,924,326 | 3,583,983 | 1,147,176 | 1,678,522 | 1,322,166 | 147,919 | 2,578,148 | 7,466,412 |
| **2016** | 17,522,726 | 3,797,653 | 1,072,227 | 1,541,479 | 1,141,560 | 215,233 | 2,324,004 | 7,430,570 |
| **2001/1996** | 8% | 7% | 0% | 7% | 28% | -4% | 7% | 7% |
| **2006/2001** | 16% | 12% | 17% | 27% | 26% | 25% | 16% | 16% |
| **2011/2006** | 8% | 6% | 8% | 12% | 17% | 80% | 4% | 8% |
| **2016/2011** | -2% | 6% | -7% | -8% | -14% | 46% | -10% | 0% |
| **2016/2006** | 6% | 12% | 1% | 2% | 1% | 162% | -7% | 8% |

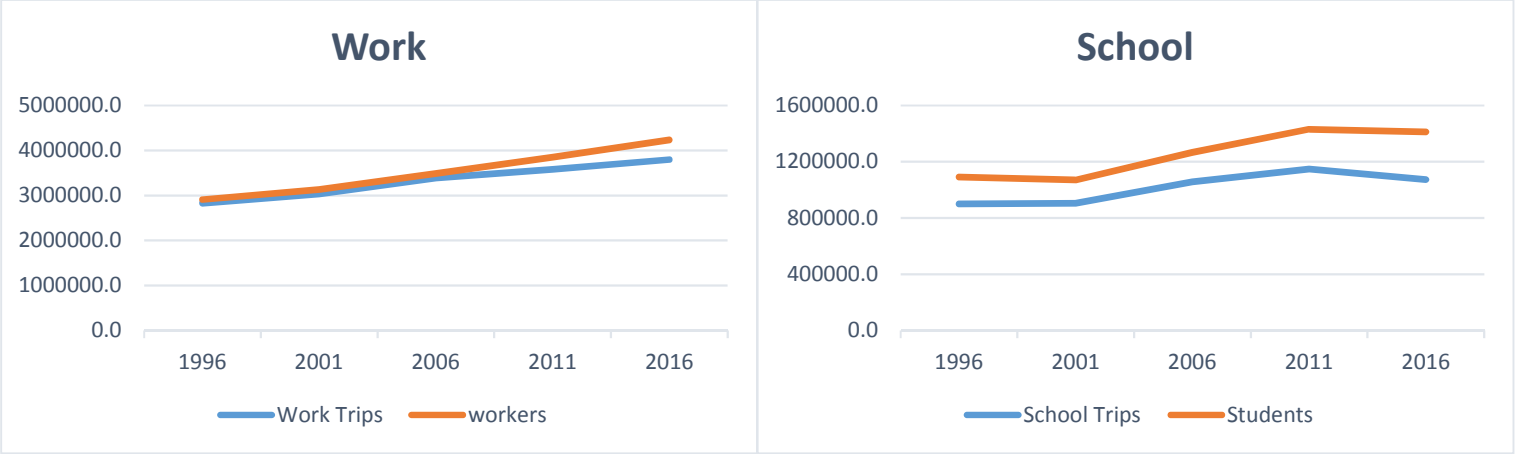



**Figure 3-1 Trends in Number of Workers & Students vs. Total Work & School Trips, 1996 -- 2016**

Figure 3-1 plots total work and school trips and total workers and students by year. Up to 2006, work increases tracked the growth in workers almost exactly. Since 2006, while work trips have continued to increase over time, they have done so at a decreasing rate. This may reflect changes in full-time/part-time splits, other shifts in worker occupation distributions, more workers working at home more often, etc. The school trip trend has tracked the total number of students very closely, although the decline in total school trips between 2011 and 2016 is somewhat more severe than the decline in total students.

Figure 3-2 and Figure 3-3 map the expected 2011-2016 percentage changes (based on extrapolation of the 1996-2011 linear trends) by PD, compared with the observed TTS changes, for work and school trips, respectively. The TTS changes for work trips are generally as expected, except for areas such as Mississauga and regions east of the City of Toronto, which has lower than expected trips. School trips show greater deviations, with lower numbers of trips than expected in many PDs.

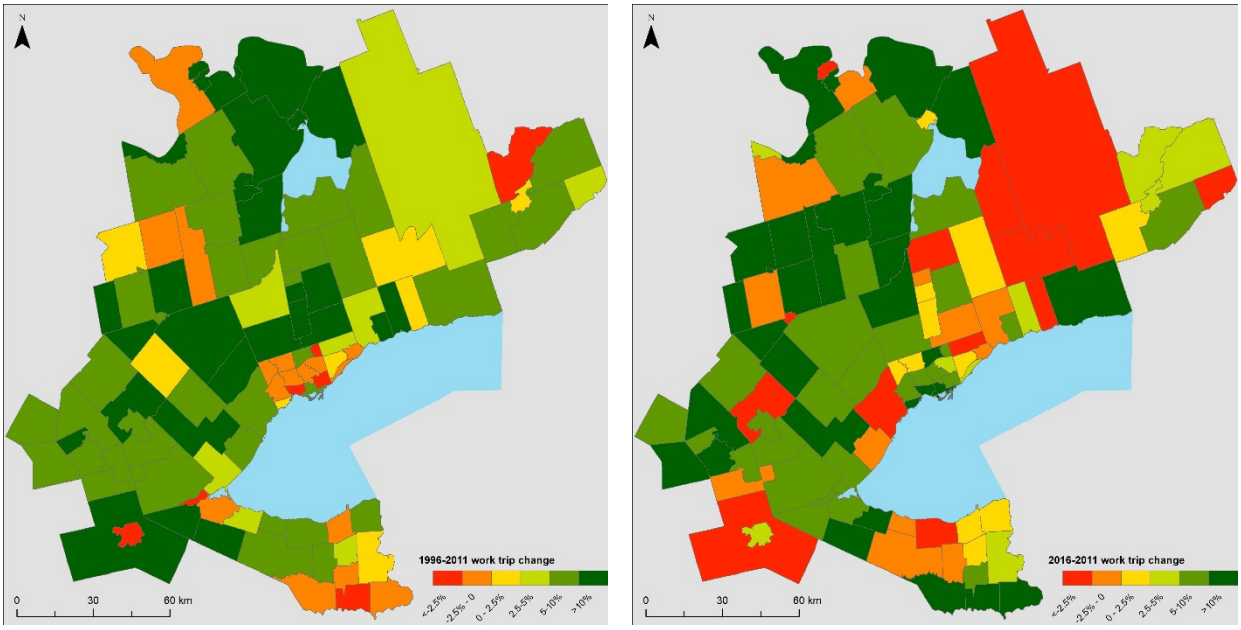



**Figure 3-2 Expected (left) and Actual TTS (right) Changes in Work Trips, 2011-2016**

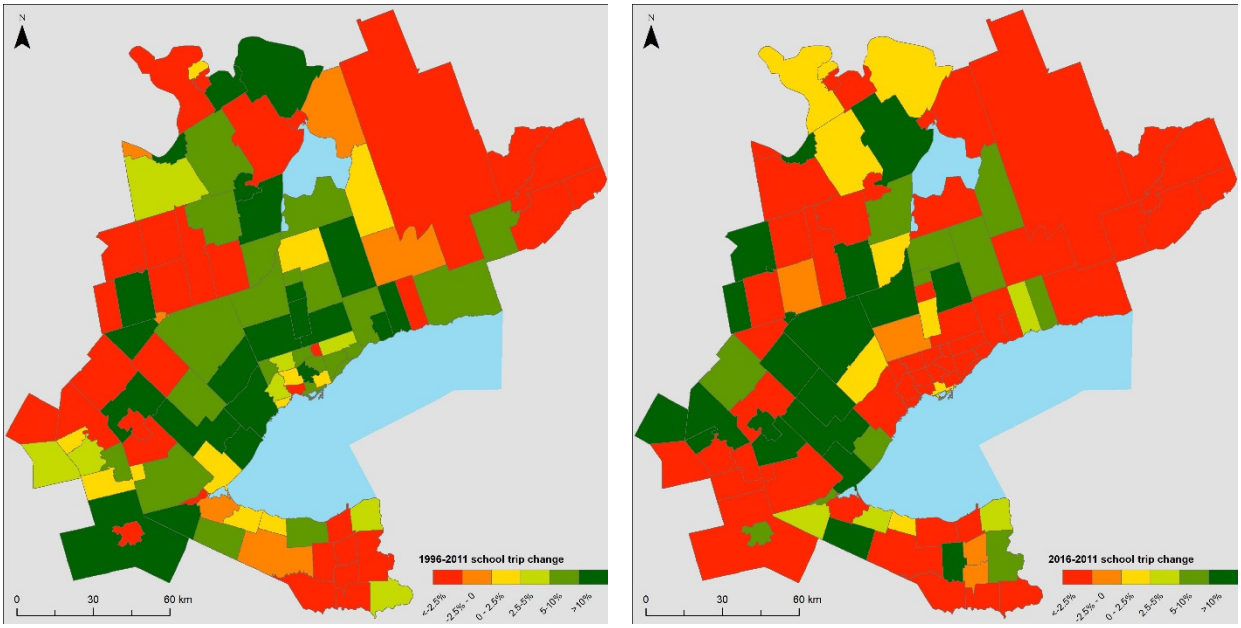



**Figure 3-3 Expected (left) and Actual TTS (right) Changes in School Trips, 2011-2016**

As shown in Figure 3-4, all non-work/school (NWS) trip purposes other than Daycare declined in the 2016 TTS from 2011 values, breaking the 15-year 1996-2011 trends. Figure 3-5 – Figure 3-7 show expected and actual TTS percent changes between 2011 and 2016 for market, facilitate passenger plus daycare and other purpose trips, respectively. As indicated in these figures, TTS 2016 NWS trips appear to be consistently under-counted relative to expectations across much of the TTS study area. Appendix I presents similar maps comparing TTS 2016 trips to 2006 values.

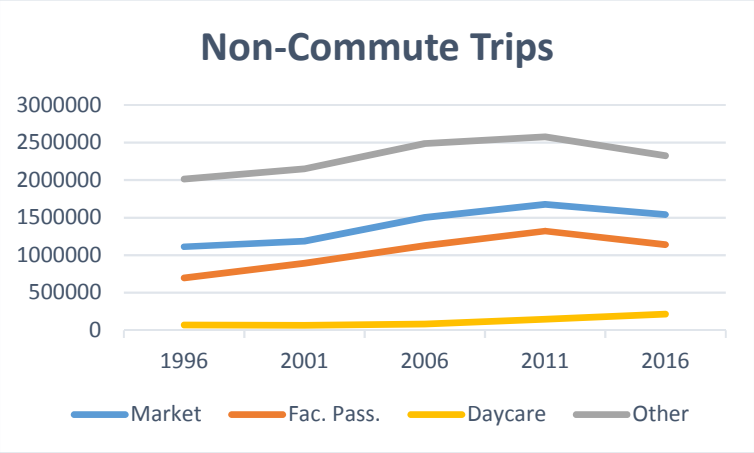



**Figure 3-4 Trends in Total Daily Trips for Non-Work/School Purposes, 1996 -- 2016**

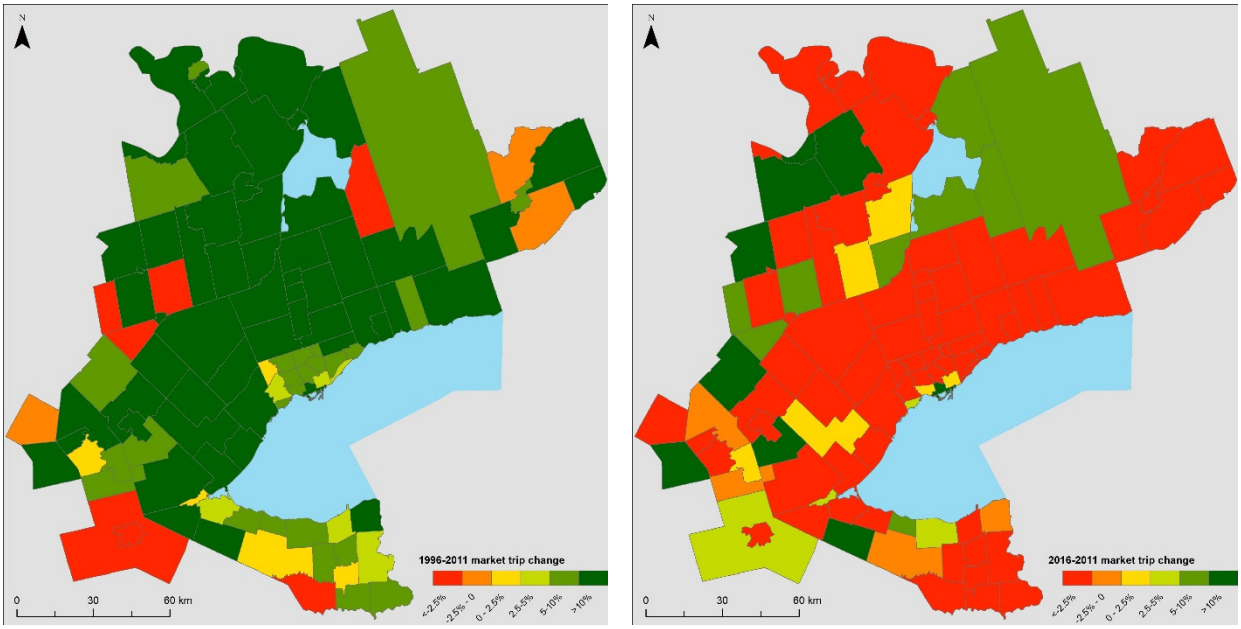



**Figure 3-5 Expected (left) and Actual TTS (right) Changes in Market (Shopping) Trips, 2011-2016**

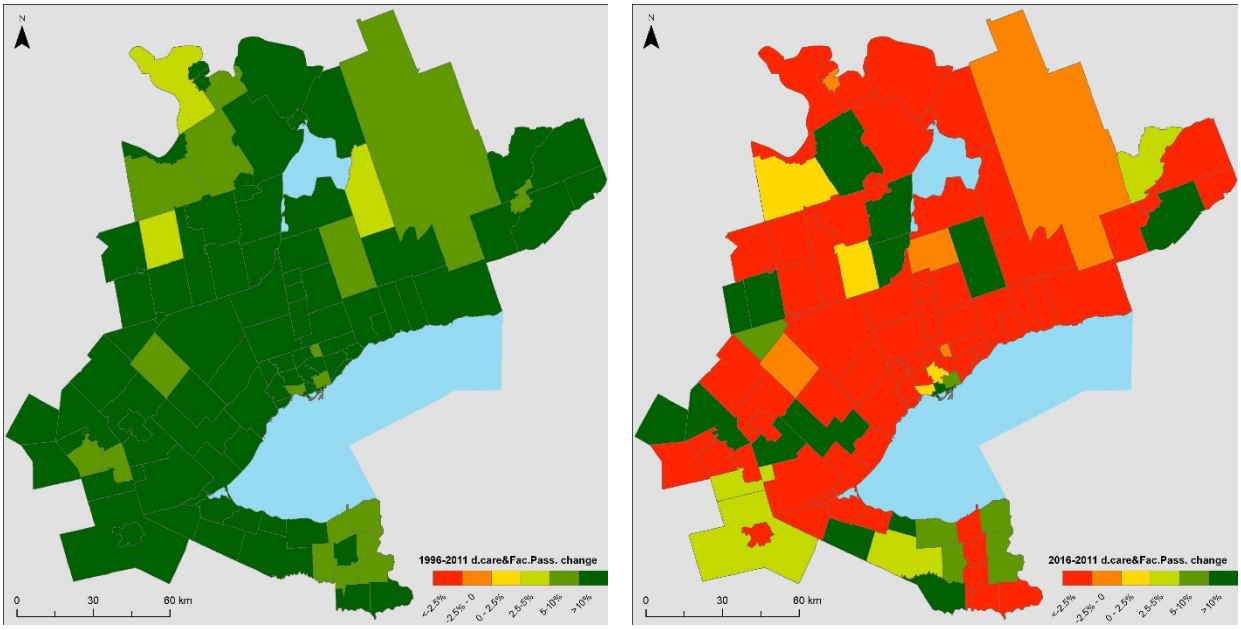



**Figure 3-6 Expected (left) and Actual TTS (right) Changes in Facilitate Passenger & Daycare Trips, 2011-2016**

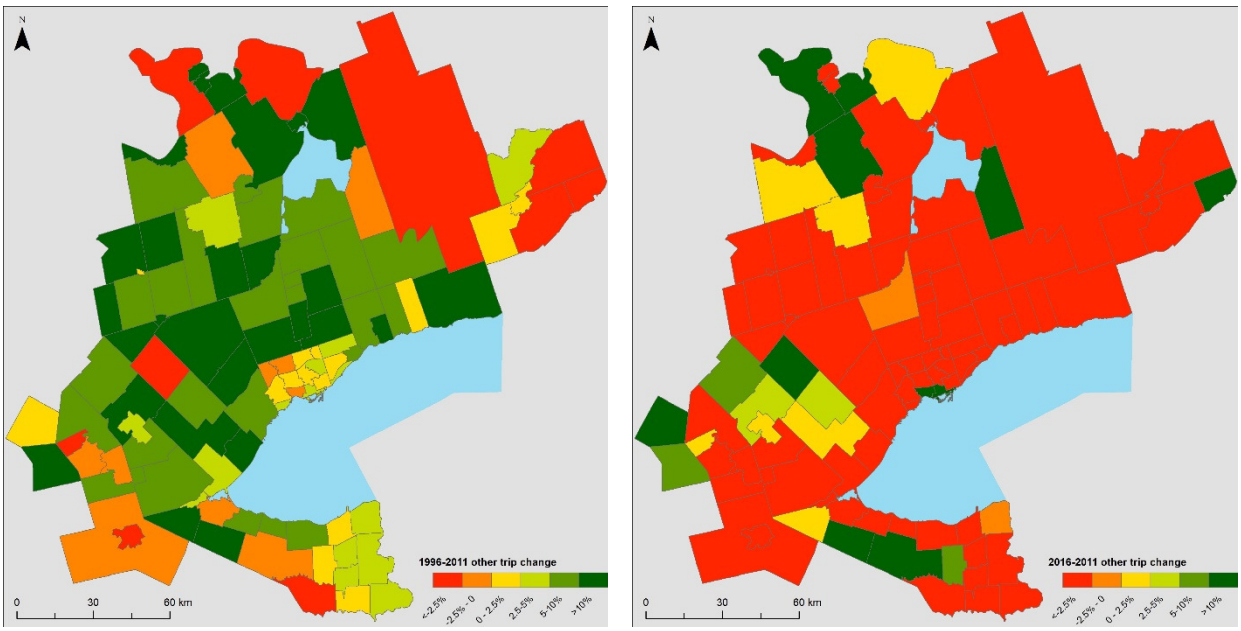



**Figure 3-7 Expected (left) and Actual TTS (right) Changes in Other Purpose Trips, 2011-2016**

# 4 TRIPS BY AGE CATEGORIES

In this section, we look at the number of trips made by trip-maker age. Figure 4-1 plots total daily trips by age category, along with total persons by age. While the 2016 distribution of persons by age appears consistent with 2011 data, it is clear that the 2016 distribution of trips by age categories is different compared to previous years. In 2016 data, we do not see the peak in the middle age group and the average age weighted by trips are slightly higher than previous years.

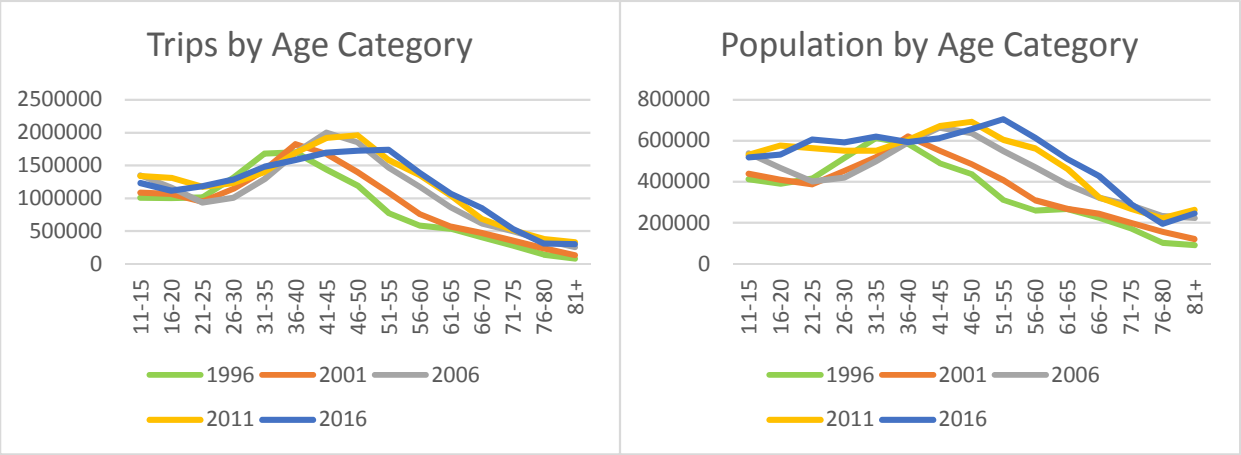



**Figure 4-1 TTS Total Daily Trips & Population by Age & Year**

Further, we explore the number of trips by purpose and age group. It is observed that work trips (Figure 4-2) in 2016 TTS have a wider distribution over age categories than previous years. The distribution of work trips by age is consistent with the observed age distribution and historical trends. Figure 4-3 shows that the decrease in total students is largely in the 11-14 age group (elementary school students), as well as very marginally in the 18-25 (post-secondary primary age group). The decline from 2011 to 2016 in school trips by 11-14 year-olds is generally consistent with the population decline, but the decline in trips by 18-25 year-olds seems to be larger than one might expect given the population change.

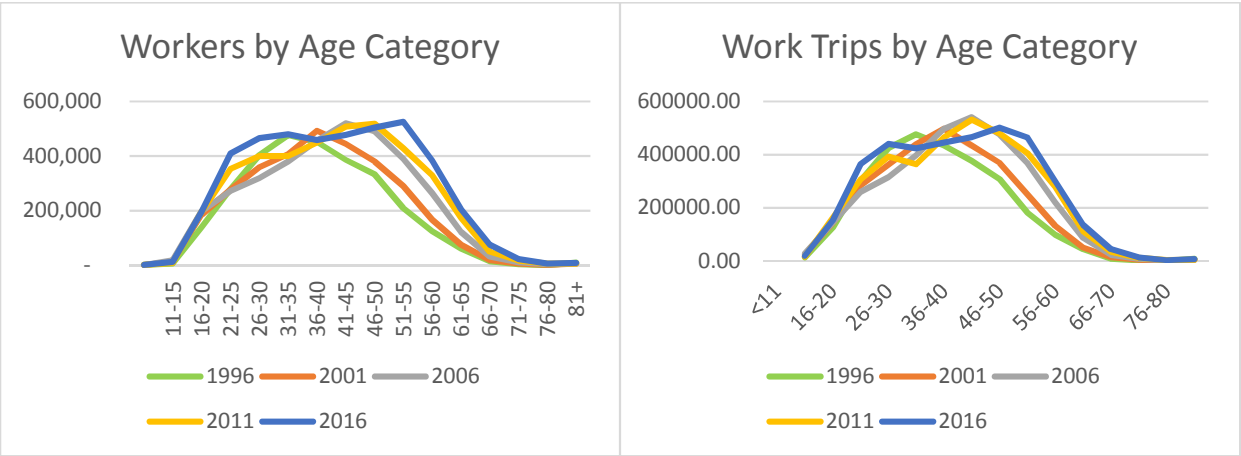



**Figure 4-2 TTS Workers & Work Trips by Age & Year**

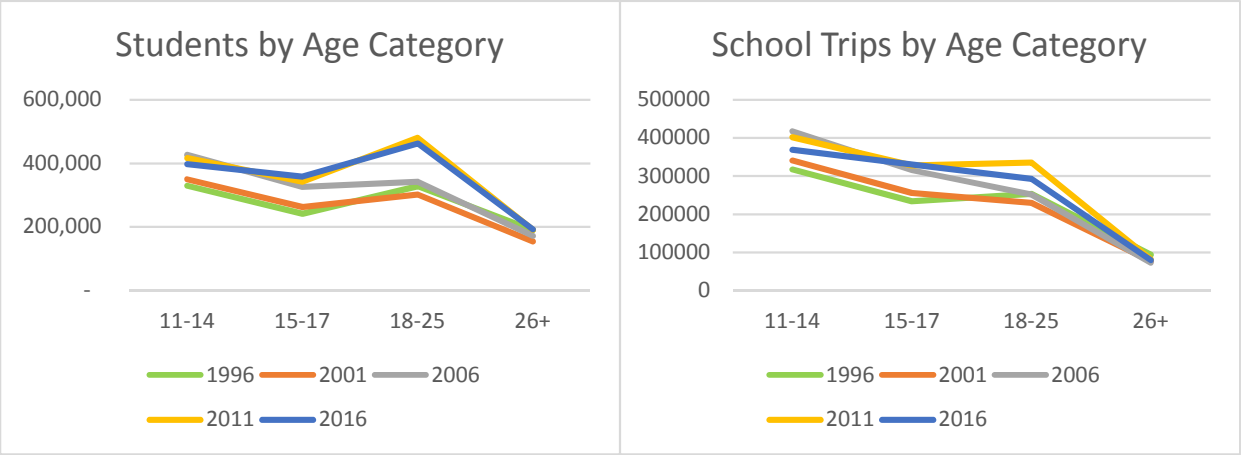



**Figure 4-3 TTS Students & School Trips by Age & Year**

Figure 4-4 displays NWS trips by age and trip purpose. Facilitate passenger and daycare trips show the same general pattern as in previous years, but with a decline relative to 2011 values due to the under-reporting of facilitate passenger trips, discussed further in Section 8.2. Market and other trips, however, show a markedly different age distribution relative to previous years, with significant under-representation of 25-55 year old trip-makers.

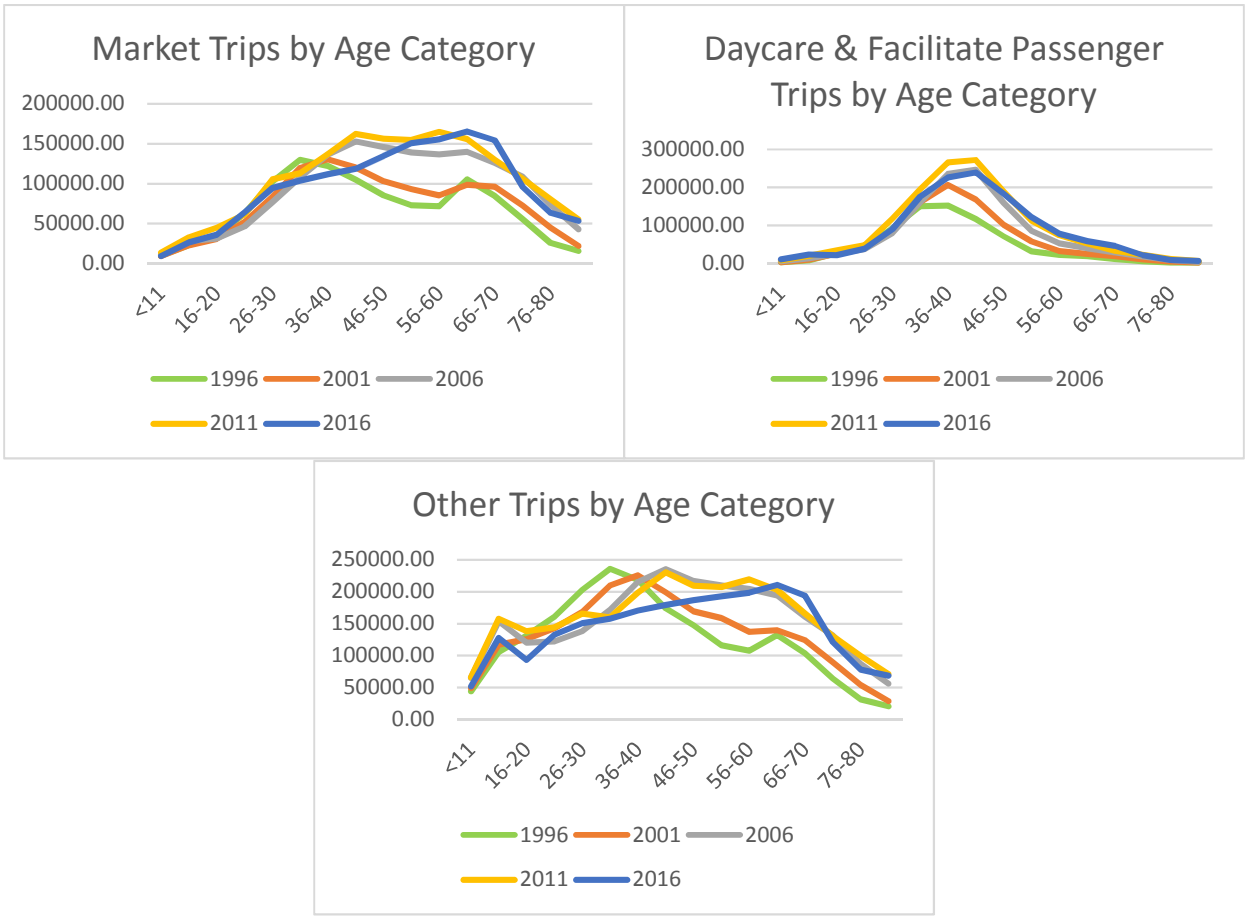



**Figure 4-4 NWS TTS Trips by Age & Year**

# 5 Trip Rates

The overall daily trip rate, and trip rates by purposes, has decreased in 2016 compared to previous TTS years (Table 5.1 & Figure 5-1). The trip rates in 2016 surveys done by phone are consistent with the trends in previous years but the online surveys have lower rates, except for daycare trips.

**Table 5.1 Per Person Trip Rates by Trip Purpose and Year**

| *Year* | *Total* | *Work* | *School* | *Market* | *Fac. Pass.* | *Daycare* | *Other* | *Home* |
|---|---|---|---|---|---|---|---|---|
| *1996* | 2.47 | 0.97 | 0.83 | 0.21 | 0.13 | 0.01 | 0.38 | 1.05 |
| *2001* | 2.54 | 0.97 | 0.85 | 0.21 | 0.16 | 0.01 | 0.39 | 1.07 |
| *2006* | 2.47 | 0.97 | 0.84 | 0.22 | 0.17 | 0.01 | 0.37 | 1.03 |
| *2011* | 2.40 | 0.93 | 0.80 | 0.22 | 0.18 | 0.02 | 0.35 | 1.00 |
| *2016* | 2.26 | 0.89 | 0.76 | 0.20 | 0.15 | 0.03 | 0.30 | 0.96 |
| *2016 Phone* | 2.28 | 0.89 | 0.81 | 0.23 | 0.16 | 0.009 | 0.36 | 0.96 |
| *2016 Online* | 2.25 | 0.90 | 0.74 | 0.19 | 0.14 | 0.037 | 0.27 | 0.96 |
| *2001/1996* | 2.6% | 0.0% | 2.4% | 1.5% | 21.9% | -8.7% | 1.6% | 2.0% |
| *2006/2001* | -2.9% | 0.0% | -1.2% | 5.5% | 4.9% | 3.8% | -3.6% | -3.7% |
| *2011/2006* | -2.6% | -4.1% | -4.0% | 0.3% | 5.5% | 62.0% | -6.9% | -2.7% |
| *2016/2011* | -5.8% | -4.3% | -5.3% | -11.5% | -16.8% | 40.2% | -13.1% | -4.1% |

*Note: Work (school) trip rates are per worker (student). All other rates are per person 11 years of age or older.*

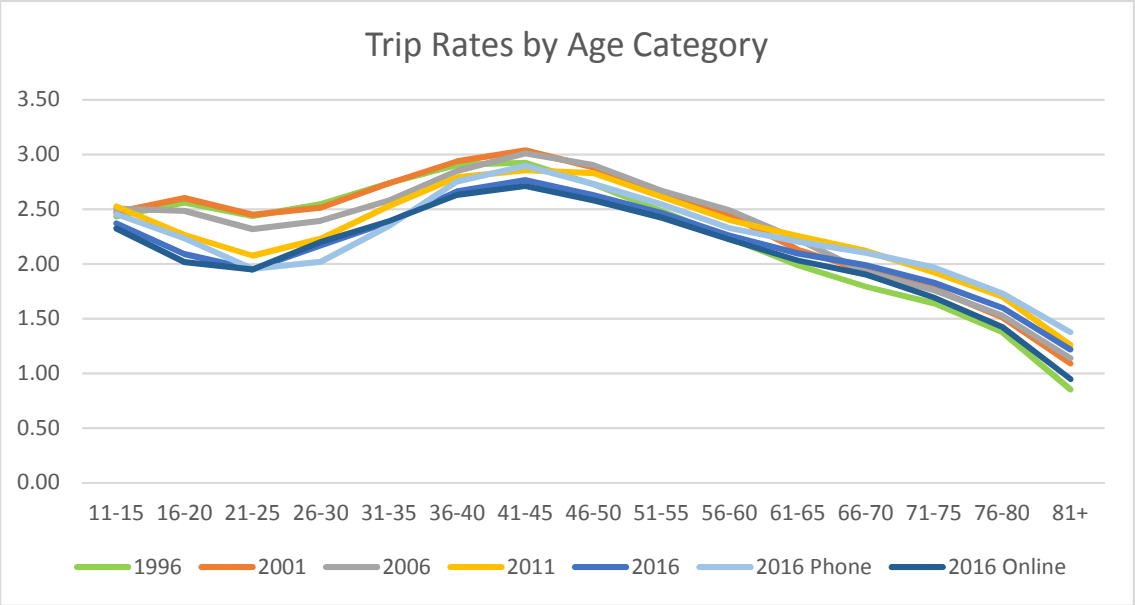



**Figure 5-1 Total Daily TTS Trip Rates by Age & Year**

Figure 5-2 plots work trip rates by age and year. Online and phone respondents' rates are very similar, but both are consistently lower than 2011 rates for workers aged 40 and above.

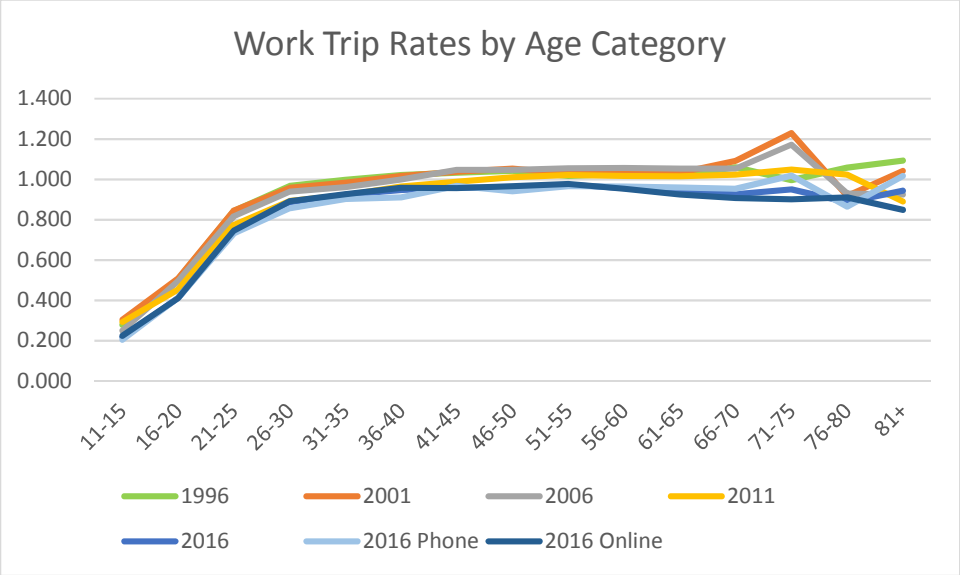



**Figure 5-2 TTS Work Trip Rates by Age & Year**

Figure 5-3 similarly plots school trip rates by age and year, while Table 5.2 provides the data displayed in Figure 5-3. Trip rates for elementary and secondary students (17 years old or younger) are generally consistent with previous years, but the trip rates for post-secondary students (age 18 and above) are discernably lower, especially for online respondents (who dominate this sub-population).

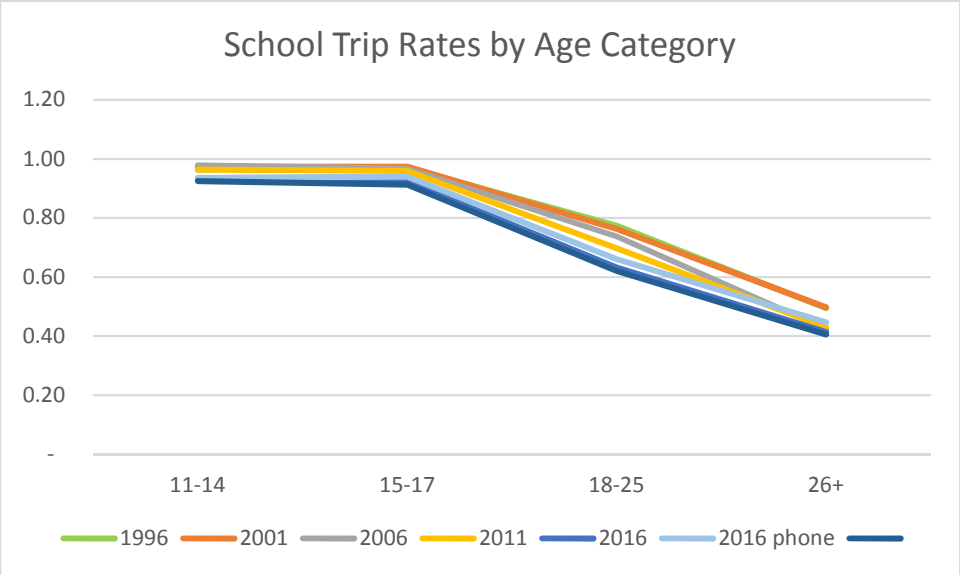



**Figure 5-3 TTS School Trip Rates by Age & Year**

**Table 5.2 TTS School Trip Rates by Age & Year**

| *School Trip Rates by Age Category* | *1996* | *2001* | *2006* | *2011* | *2016* | *2016 phone* | *2016 online* |
|---|---|---|---|---|---|---|---|
| *11-14* | 0.96 | 0.97 | 0.98 | 0.96 | 0.93 | 0.94 | 0.93 |
| *15-17* | 0.97 | 0.97 | 0.97 | 0.96 | 0.92 | 0.94 | 0.91 |
| *18-25* | 0.77 | 0.76 | 0.74 | 0.70 | 0.63 | 0.66 | 0.62 |
| *26+* | 0.49 | 0.50 | 0.42 | 0.43 | 0.41 | 0.45 | 0.41 |
| *Total* | 0.83 | 0.85 | 0.84 | 0.80 | 0.76 | 0.81 | 0.74 |

Looking at the trip rates by age category, we can see that market and other purpose trips in 2016 are lower than 2011 for every age category. The school trip rates in 2016 are lower for each age group compared to previous years. However, the distribution of the school trips over age groups in 2016 is very similar to previous years.

Daycare rip rates (Figure 5-4) is the one trip purpose showing a significant increase between 2011 and 2016. The large difference between the online and phone respondents' trip rates reflects the demographics of the two sub-populations, with the phone respondents generally being much older and so relatively unlikely to be making daycare trips.

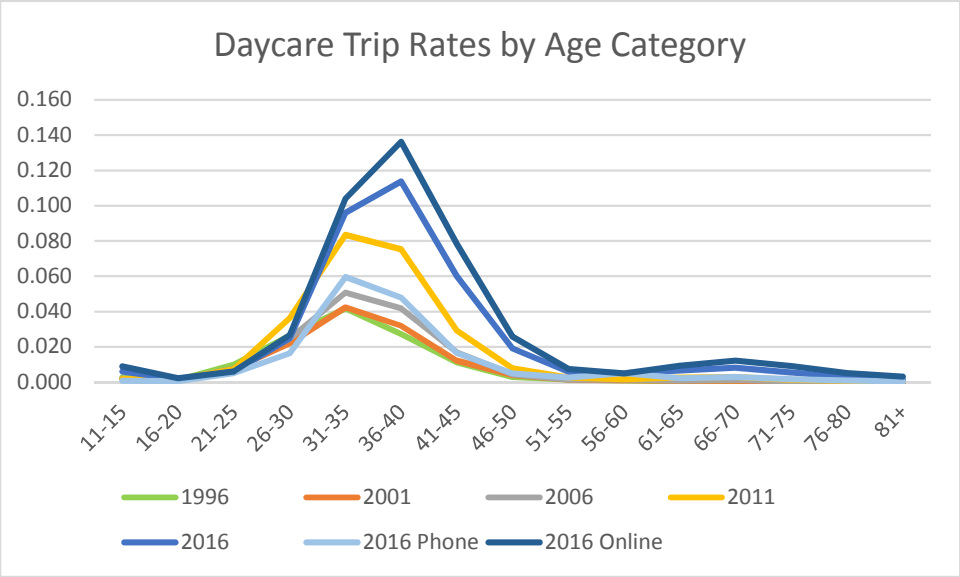



**Figure 5-4 TTS Daycare Trip Rates by Age & Year**

Trip rates by age and year for the other NWS trip purposes (market, facilitate passenger and other), as well as return home trips are shown in Figure 5-5 through Figure 5-8. All three NWS trip rates are significantly lower in 2016 relative to previous years, particularly, facilitate passenger and other purpose trips, largely due to very low rates for the online respondents. Return home trip rates necessarily are lower, given the lower NWS trip rates, although this issue is revisited in Section 8.1.1.

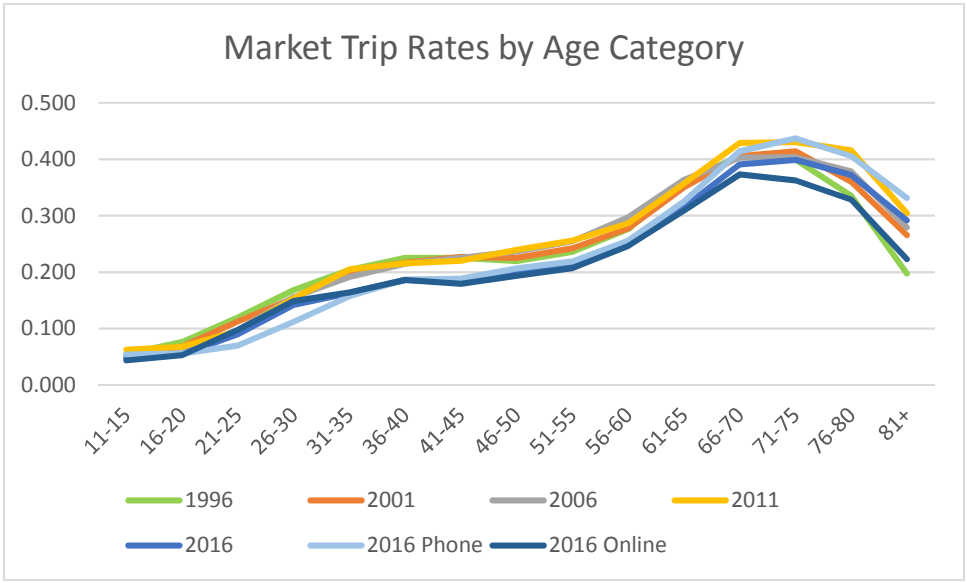



**Figure 5-5 TTS Market (Shopping) Trip Rates by Age & Year**

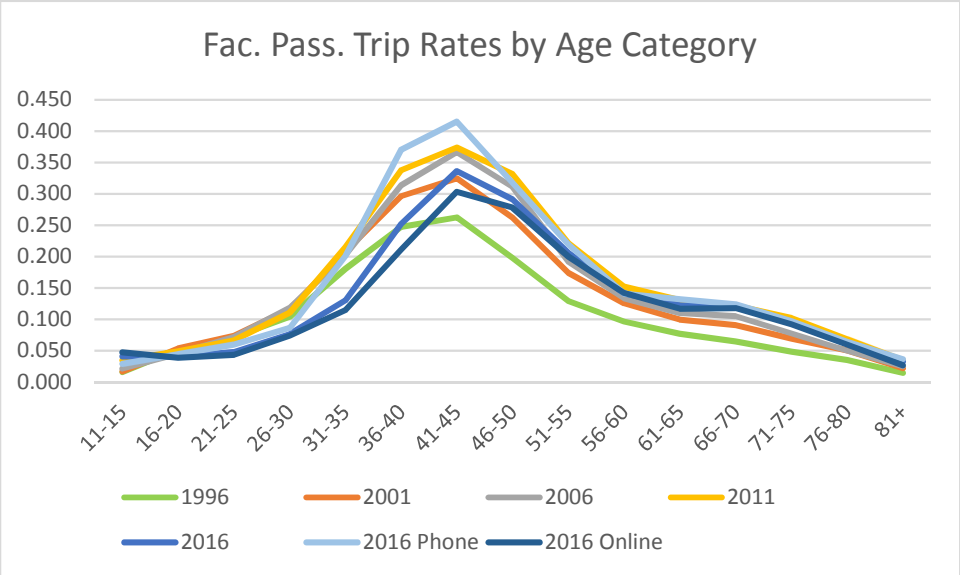



**Figure 5-6 TTS Facilitate Passenger Trip Rates by Age & Year**

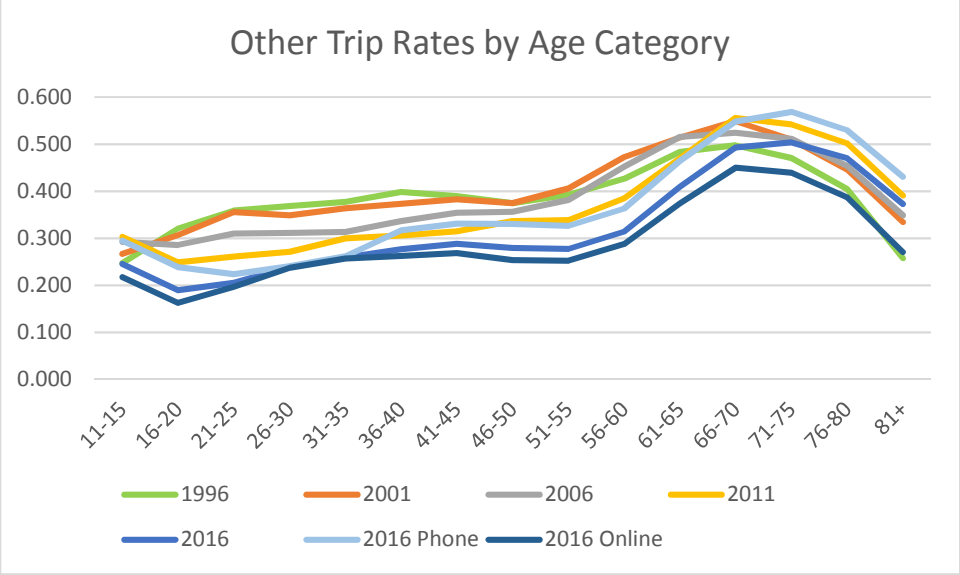



**Figure 5-7 TTS Other Purpose Trip Rates by Age & Year**

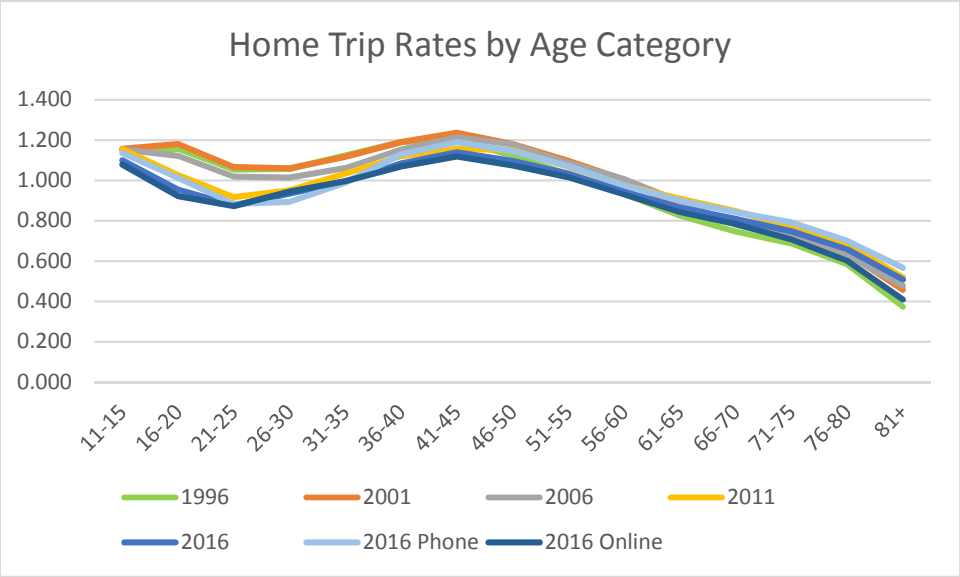



**Figure 5-8 TTS Return Trip Rates by Age & Year**

Figure 5-9 plots the expected percentage change in trip rates between 2011 and 2016 based on the extrapolated 1996 – 2011 trend, while Figure 5-10 shows the actual percentage changes in TTS trip rates relative to 2011 and 2006 rates. Comparing Figure 5-10 and Figure 5-9, it is seen that the trip rates have declined virtually throughout the TTS study area, even relative to 2006 values, and that these decreases are greater than expected given past trends.

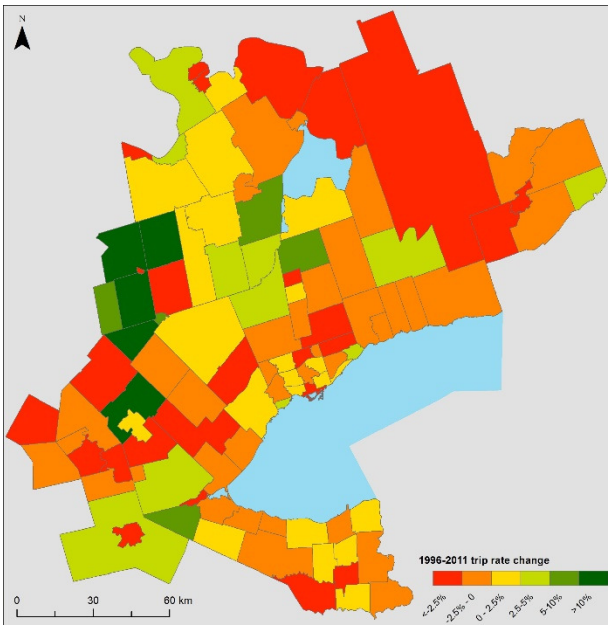



**Figure 5-9 Expected Percentage Change in Average PD Trip Rates, 2011-2016, Based on 1996-2011 Trends**

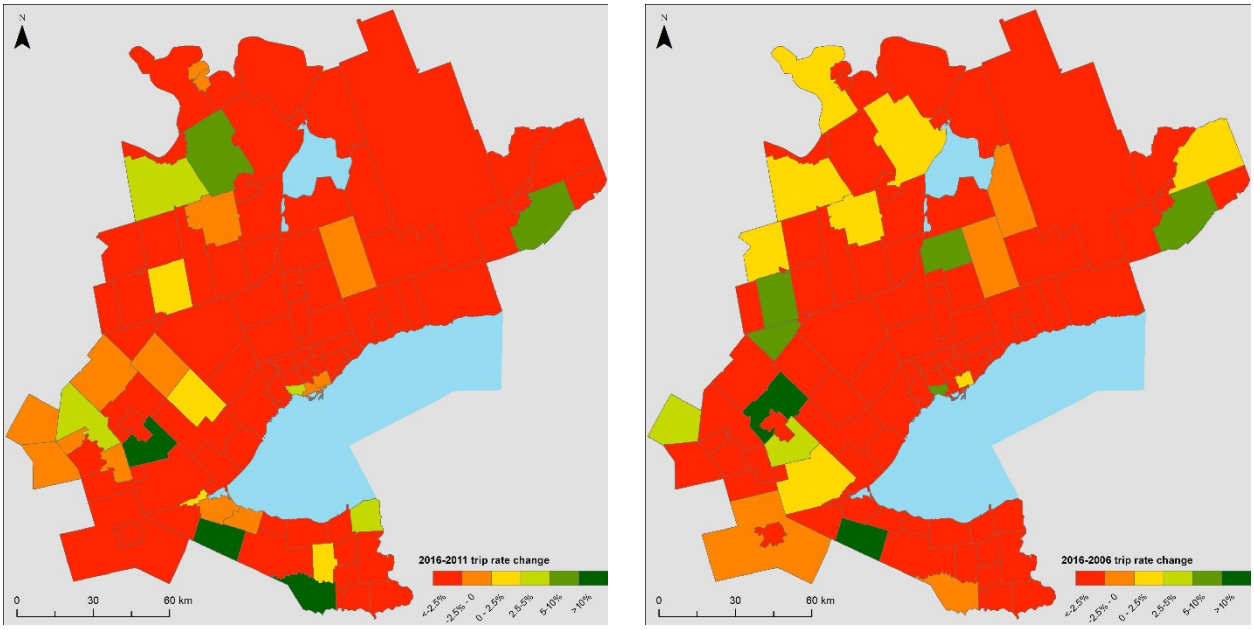



**Figure 5-10 Percentage Changes in Trip Rates, 2016 Relative to 2011 and 2006**

Aggregating the spatial analysis to compare the trends within the GTHA and the rest of the TTS study area (essentially the rest of the GGH) in Table 5.3, we see that the overall trend is similar in these two major portions of the region.

**Table 5.3 Population, Trips & Trip Rates, GTHA vs. Rest of GGH**

| | POPULATION | | TRIPS | | TRIP RATE | |
|---|---|---|---|---|---|---|
| | GTHA | Outside GTHA | GTHA | Outside GTHA | GTHA | Outside GTHA |
| **1996** | 4,176,247 | 1,139,148 | 10,168,958 | 2,921,409 | 2.43 | 2.56 |
| **2001** | 4,613,061 | 975,021 | 11,573,338 | 2,548,202 | 2.51 | 2.61 |
| **2006** | 5,107,911 | 1,600,736 | 12,350,905 | 4,125,619 | 2.42 | 2.58 |
| **2011** | 5,759,635 | 1,704,894 | 13,705,530 | 4,133,286 | 2.38 | 2.42 |
| **2016** | 5,978,530 | 1,767,249 | 13,366,984 | 4,070,118 | 2.24 | 2.3 |
| **2001/1996** | 10.5% | -14.4% | 13.8% | -12.8% | 3.3% | 2.0% |
| **2006/2001** | 10.7% | 64.2% | 6.7% | 61.9% | -3.6% | -1.1% |
| **2011/2006** | 12.8% | 6.5% | 11.0% | 0.2% | -1.7% | -6.2% |
| **2016/2011** | 3.8% | 3.7% | -2.5% | -1.5% | -5.9% | -5.0% |

# 6 TRIP MODE

Table 6.1 and Figure 6-1 summarize trips by mode and mode shares for TTS years. The mode share trends are generally as expected in 2016 except for the significant drop in the passenger mode. The share for walk and bike has also increased significantly. This can be due to more investments in active transportation and a better sample frame for collecting a more representative data for Toronto's PD1. The drop in the passenger mode share can be related to the lower facilitate passenger trip purpose in the dataset.

**Table 6.1 Trips & Mode Shares by Mode & Year**

| | *Drive* | *Passenger* | *Transit* | *School Bus* | *Bicycle* | *Walk* | *Other* |
|---|---|---|---|---|---|---|---|
| *1996* | 8,424,917 | 2,145,668 | 1,420,851 | 247,347 | 93,295 | 737,870 | 80,327 |
| *2001* | 9,265,236 | 2,246,841 | 1,469,137 | 288,273 | 95,378 | 743,830 | 82,430 |
| *2006* | 10,732,992 | 2,695,973 | 1,693,448 | 344,452 | 97,323 | 881,668 | 95,766 |
| *2011* | 11,534,161 | 2,908,490 | 2,036,098 | 346,190 | 152,545 | 850,836 | 95,534 |
| *2016* | 11,160,392 | 2,318,190 | 2,155,998 | 356,076 | 238,927 | 1,150,262 | 142,881 |
| *1996* | 64.07% | 16.32% | 10.80% | 1.9% | 0.71% | 5.61% | 0.61% |
| *2001* | 65.29% | 15.83% | 10.35% | 2.0% | 0.67% | 5.24% | 0.58% |
| *2006* | 64.88% | 16.30% | 10.24% | 2.1% | 0.59% | 5.33% | 0.58% |
| *2011* | 64.35% | 16.23% | 11.36% | 1.9% | 0.85% | 4.75% | 0.53% |
| *2016* | 63.69% | 13.23% | 12.30% | 2.0% | 1.36% | 6.56% | 0.82% |
| *2016 phone* | 64.82% | 16.05% | 10.40% | 2.3% | 0.77% | 4.89% | 0.75% |
| *2016 online* | 63.13% | 11.83% | 13.25% | 1.9% | 1.66% | 7.39% | 0.85% |

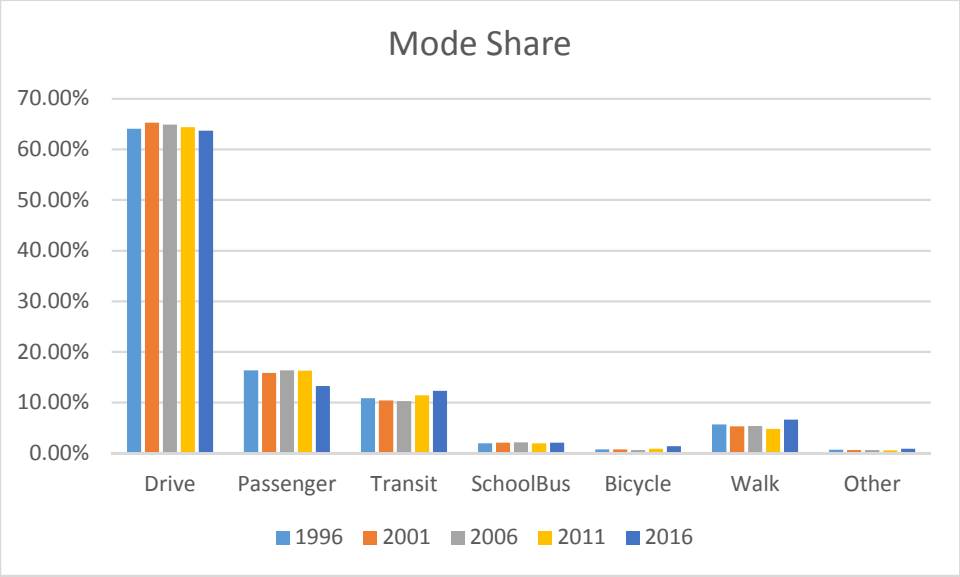



**Figure 6-1 TTS Mode Shares by Mode & Year**

Looking at the trends for passenger trips by purpose (Figure 6-2), there is a large decrease in market and other purpose passenger trips. Trips by mode and purpose, and maps for the spatial mode share trends for the GGH area are shown in Appendix II These also confirm that the overall trends make sense except for the passenger mode. A more detailed investigation shows that the passenger mode share in 2016 surveys by telephone is similar to the previous years, however, the share is significantly lower in the online survey (discussed further in Section 7).

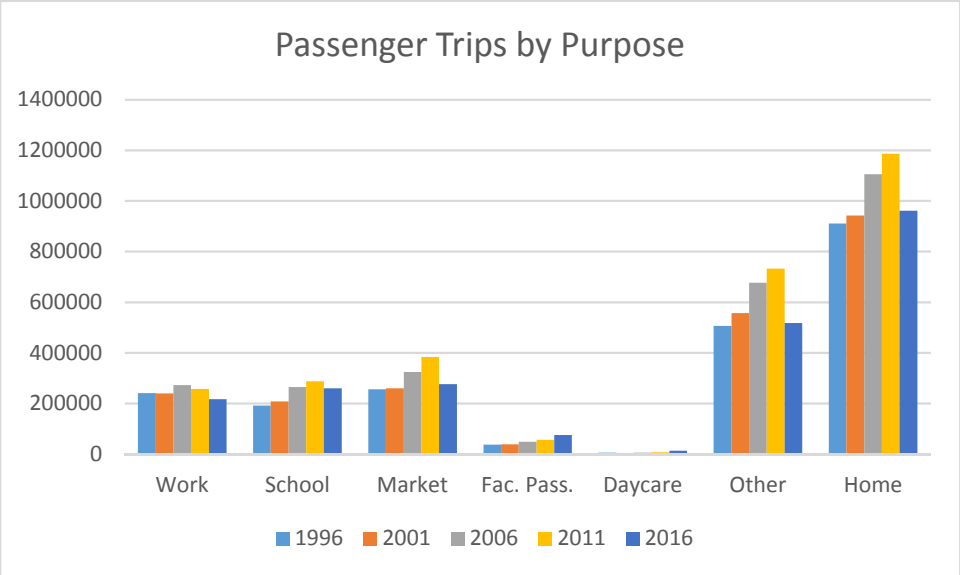



**Figure 6-2 TTS Passenger Trips by Purpose & Year**

# 7 Proxy Bias

Another important dimension to check is the proxy bias. It is known that people typically underreport trips for other household members when they are responding on their behalf. Looking at overall trends in trip reporting in Figure 7-1 and Table 7.1, we can see a significant drop in the total number of trips for non-respondents in 2016. The trip rates for both respondents and non-respondents has decreased in 2016 compared to previous years with a larger drop for non-respondents. One important thing to note is that the average household size has decreased in 2016 and the number of single households has increased. Interestingly, respondents reported higher trip rates in online survey than by phone while the opposite is true for non-respondents. We further investigate the trips by respondents, by purpose and by mode.

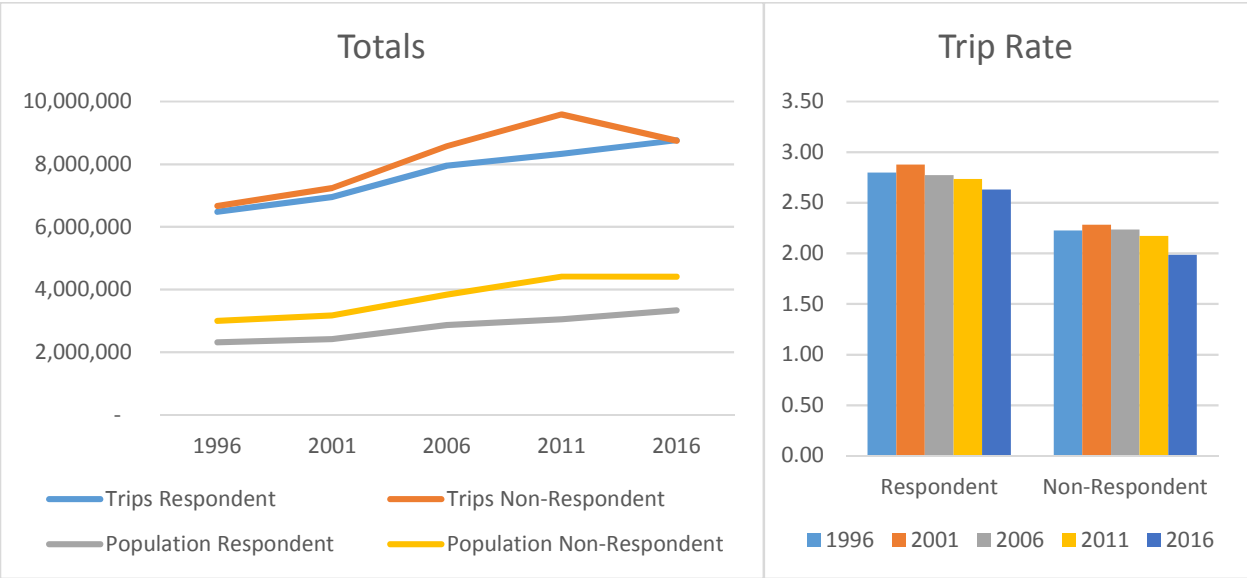



**Figure 7-1 TTS Trips & Trip Rates, Respondents vs. Non-Respondents by Year**

**Table 7.1 TTS Trips & Trip Rates, Respondents vs. Non-Respondents by Year**

| | TRIPS | | POPULATION | | TRIP RATE | | HH SIZE | |
|---|---|---|---|---|---|---|---|---|
| | Resp. | non-Resp. | Resp. | non-Resp. | Resp. | non-Resp. | Mean | Single |
| **1996** | 6,483,199 | 6,669,801 | 2,316,497 | 2,998,902 | 2.80 | 2.22 | 2.71 | 495,411 |
| **2001** | 6,953,355 | 7,240,640 | 2,417,183 | 3,170,904 | 2.88 | 2.28 | 2.70 | 514,023 |
| **2006** | 7,960,340 | 8,581,400 | 2,871,120 | 3,837,528 | 2.77 | 2.24 | 2.68 | 592,888 |
| **2011** | 8,333,346 | 9,590,980 | 3,048,874 | 4,415,656 | 2.73 | 2.17 | 2.73 | 582,689 |
| **2016** | 8,768,618 | 8,754,108 | 3,335,566 | 4,410,217 | 2.63 | 1.98 | 2.64 | 822,254 |
| **2016 phone** | 2,813,545 | 2,984,447 | 1,097,648 | 1,446,849 | 2.56 | 2.06 | 2.60 | 38% |
| **2016 online** | 5,955,073 | 5,769,661 | 2,237,921 | 2,963,365 | 2.66 | 1.95 | 2.67 | 62% |
| **2001/1996** | 7% | 9% | 4% | 6% | 3% | 3% | 0% | 4% |
| **2006/2001** | 14% | 19% | 19% | 21% | -4% | -2% | -1% | 15% |
| **2011/2006** | 5% | 12% | 6% | 15% | -1% | -3% | 2% | -2% |
| **2016/2011** | 5% | **-9%** | 9% | 0% | -4% | -9% | -3% | 41% |

Figure 7-2 and Figure 7-3 compare respondent and non-respondent trips and trip rates by trip purpose by year. With the exception of facilitate passenger trips, 2016 respondent trends in both total trips and trip rates are generally consistent with past trends. Non-respondent trips, on the other hand, all declined discernably between 2011 and 2016. Non-respondent trip rates also generally declined, most noticeably for other purpose trips.

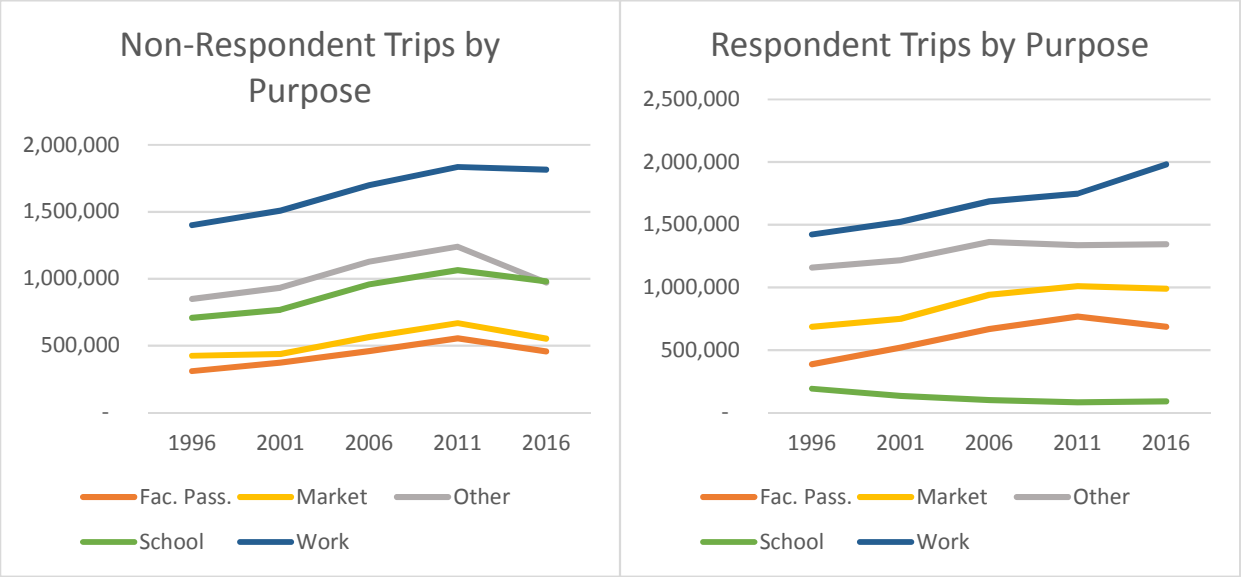



**Figure 7-2 Respondent vs. Non-Respondent Total Daily Trips by Trip Purpose & Year**

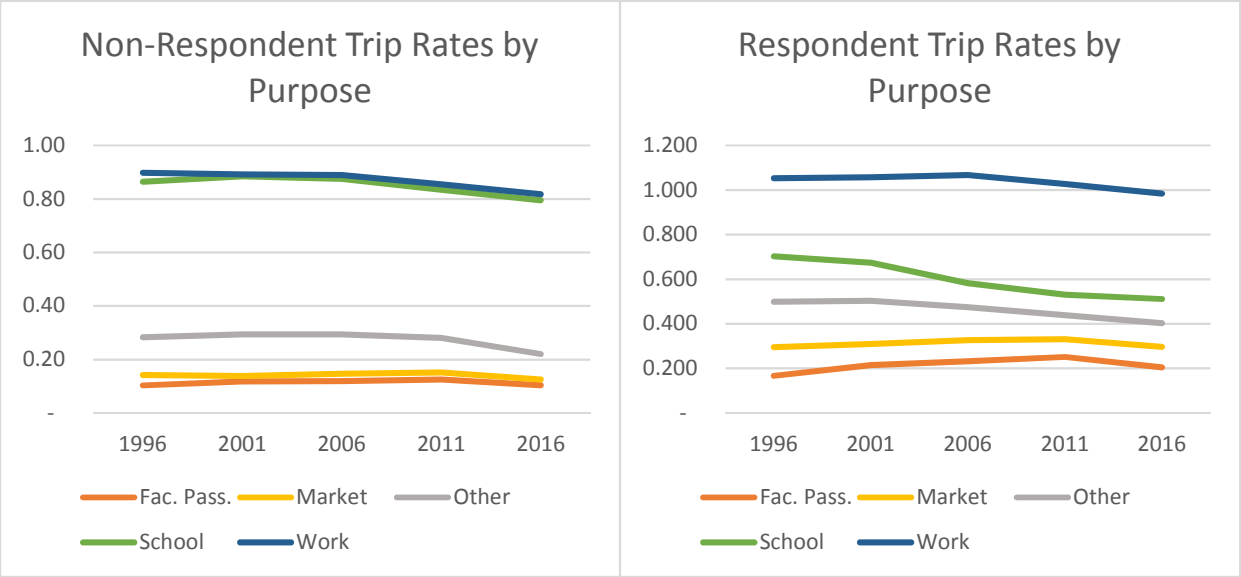



**Figure 7-3 Respondent vs. Non-Respondent Daily Trip Rates by Trip Purpose & Year**

Appendix III presents graphs comparing respondent and non-respondent trips and mode shares by mode and year. Points to note from these graphs include:

- Drive mode share for both respondents and non-respondents have a consistent trend over the past 20 years.
- For non-respondents, passenger mode share has been increasing but declined significantly in 2016.
- For respondents, transit and walk mode share have been decreasing until 2016 where we can see a significant increase for both of these modes.

# 8 TTS 2016 Specific Analysis

There were several major changes in 2016 TTS procedures, relative to previous surveys. These include:

- The 2016 sample frame was different than previous years. From 1986 to 2011, the sample frame was based on telephone subscriber lists. However, in 2016, the survey sample was based on addresses.
- Usually TTS surveys have been conducted in the fall of two consecutive years. For example, TTS 2011 has actually been conducted in the fall of 2011 and 2012. However, 2016 TTS is done in one year, from September to December 2011.
- While the ability to respond to the survey online was introduced in 2011, in 2016 the majority of the survey was done via the online platform.

## 8.1 Survey Method

With a majority of respondents using the online, web-based option for the first time, the impact of this new survey mode on responses needs to be investigated. In this sub-section differences in person, household and trip characteristics for the two survey methods are explored.

### 8.1.1 Trips by Survey Method

Table 8.1 presents aggregate statistics for TTS 2016 comparing the online and telephone samples and their travel characteristics. In almost all cases, the trip attributes reported via telephone are similar to previous TTS data. Thus, differences in TTS 2016 from previous trends appear to come from the portion of the data recorded online.

**Table 8.1 Summary TTS 2016 Statistics, Telephone vs. Online Responses**

| | PERSONS | TRIPS | TRIP RATE | WORK RATE | SCHOOL RATE | MARKET RATE | FAC. PASS. RATE | DAYCARE | OTHER | HOME |
|---|---|---|---|---|---|---|---|---|---|---|
| **TELEPHONE** | 2544488 | 5,797,992 | 2.28 | 0.89 | 0.81 | 0.23 | 0.16 | 0.009 | 0.36 | 0.96 |
| **ONLINE** | 5201292 | 11,724,733 | 2.25 | 0.90 | 0.74 | 0.19 | 0.14 | 0.037 | 0.27 | 0.96 |
| **TELEPHONE** | 32.8% | 33.1% | - | - | - | - | - | - | - | |
| **ONLINE** | 67.2% | 66.9% | - | - | - | - | - | - | - | |

| PURPOSE | TELEPHONE | ONLINE |
|---|---|---|
| **WORK** | 27.6% | 72.4% |
| **SCHOOL** | 34.0% | 66.0% |
| **MARKET** | 37.2% | 62.8% |
| **FAC. PASS.** | 36.0% | 64.0% |
| **DAYCARE** | 11.0% | 89.0% |
| **OTHER** | 39.8% | 60.2% |

| MODE | TELEPHONE | ONLINE | MODE SHARE | TELEPHONE | ONLINE |
|---|---|---|---|---|---|
| **Drive** | 33.7% | 66.3% | **Drive** | 64.8% | 63.1% |
| **Passenger** | 40.1% | 59.9% | **Passenger** | 16.1% | 11.8% |
| **Transit** | 28.0% | 72.0% | **Transit** | 10.4% | 13.2% |
| **School bus** | 37.8% | 62.2% | **School Bus** | 2.3% | 1.9% |
| **Bicycle** | 18.7% | 81.3% | **Bicycle** | 0.8% | 1.7% |
| **Walk** | 24.7% | 75.3% | **Walk** | 4.9% | 7.4% |
| **Other** | 30.3% | 69.7% | **Other** | 0.7% | 0.8% |

| | PERSONS | | TRIPS | | TRIP RATES | |
|---|---|---|---|---|---|---|
| | Resp. | non-Resp. | Resp. | non-Resp. | Resp. | non-Resp. |
| **TELEPHONE** | 1,097,648 | 1,446,849 | 2,813,545 | 2,984,447 | 2.56 | 2.06 |
| **ONLINE** | 2,237,921 | 2,963,365 | 5,955,073 | 5,769,661 | 2.66 | 1.95 |
| **TOTAL** | 3,335,569 | 4,410,214 | 8,768,618 | 8,754,108 | 2.63 | 1.98 |
| **TELEPHONE** | 32.9% | 32.8% | 32.1% | 34.1% | - | - |
| **ONLINE** | 67.1% | 67.2% | 67.9% | 65.9% | - | - |

### 8.1.2 Person Characteristics by Survey Method

Differences in age, employment status and occupation type of the population responding online vs telephone were examined. As expected, the online population is younger than the telephone population (Figure 8-1). Further, the telephone worker population characteristics (employment status and occupation type) is more similar to the previous years than the online worker population (Table 8.2).

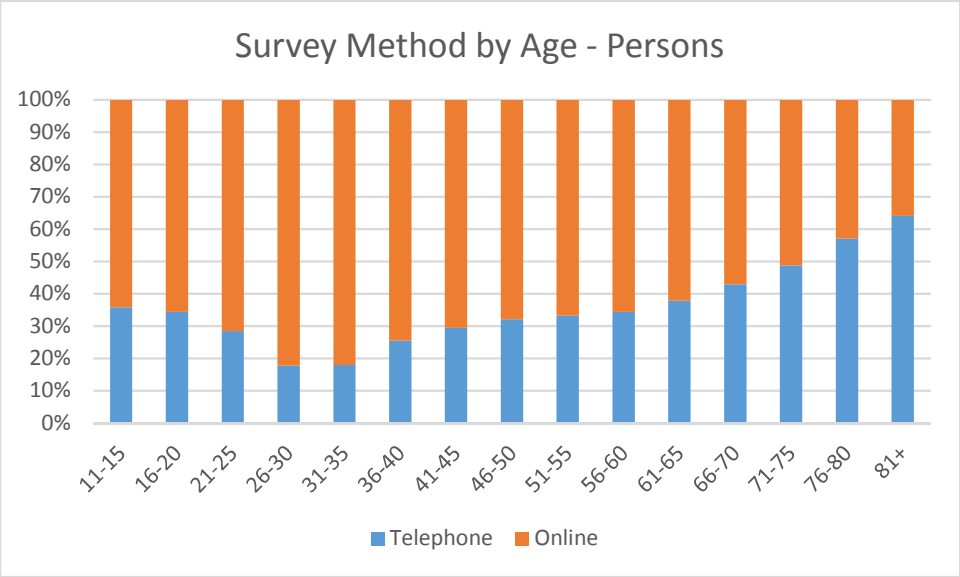



**Figure 8-1 Age Distribution of Respondents by Survey Method**

**Table 8.2 Worker Characteristics by Year and 2016 Survey Method**

| *Worker Population* | *1996* | *2001* | *2006* | *2011* | *2016 (Phone/Online)* |
|---|---|---|---|---|---|
| *General Office / Clerical* | 407,768 | 404,750 | 519,817 | 651,803 | 604,246 (191,742/412,504) |
| *Manufacturing / Construction / Trades* | 703,846 | 755,843 | 650,729 | 608,022 | 667,034 (175,438/491,597) |
| *Professional / Management / Technical* | 1,197,047 | 1,440,602 | 1,320,867 | 1,342,845 | 2,042,143 (432,188/1,609,955) |
| *Retail Sales and Service* | 725,833 | 697,831 | 1,300,456 | 1,597,815 | 1,227,431 (488,030/739,401) |
| *Fulltime* | 2,377,411 | 2,577,003 | 2,847,558 | 3,076,724 | 3,446,185 (912,940/2,533,245) |
| *Part time* | 532,237 | 554,462 | 643,300 | 772,112 | 789,022 (268,027/520,995) |
| *Work at home full time* | 105,347 | 136,319 | 235,483 | 271,210 | 242,986 (82,459/160,527) |
| *Work at home part time* | 29,567 | 39,661 | 70,019 | 91,765 | 95,058 (28,102/66,956) |
| *General Office / Clerical* | 13% | 12% | 14% | 16% | 13% (15%/13%) |
| *Manufacturing / Construction / Trades* | 23% | 23% | 17% | 14% | 15% (14%/15%) |
| *Professional / Management / Technical* | 39% | 44% | 35% | 32% | 45% (34%/49%) |

| | | | | | |
|---|---|---|---|---|---|
| *Retail Sales and Service* | 24% | 21% | 34% | 38% | 27% (38%/23%) |
| *Fulltime* | 78% | 78% | 75% | 73% | 75% (71%/77%) |
| *Part time* | 17% | 17% | 17% | 18% | 17% (21%/16%) |
| *Work at home full time* | 3% | 4% | 6% | 6% | 5% (6%/5%) |
| *Work at home part time* | 1% | 1% | 2% | 2% | 2% (2%/2%) |

### 8.1.3 Household Characteristics by Survey Method

Approximately 68% of households in TTS 2016 completed the survey using the online web tool. Figure 8-2 shows the proportion of online surveys by planning district, indicating that the online responses are relatively uniformly distributed across the study area. This section examines differences in household attributes between the online and telephone sub-samples.

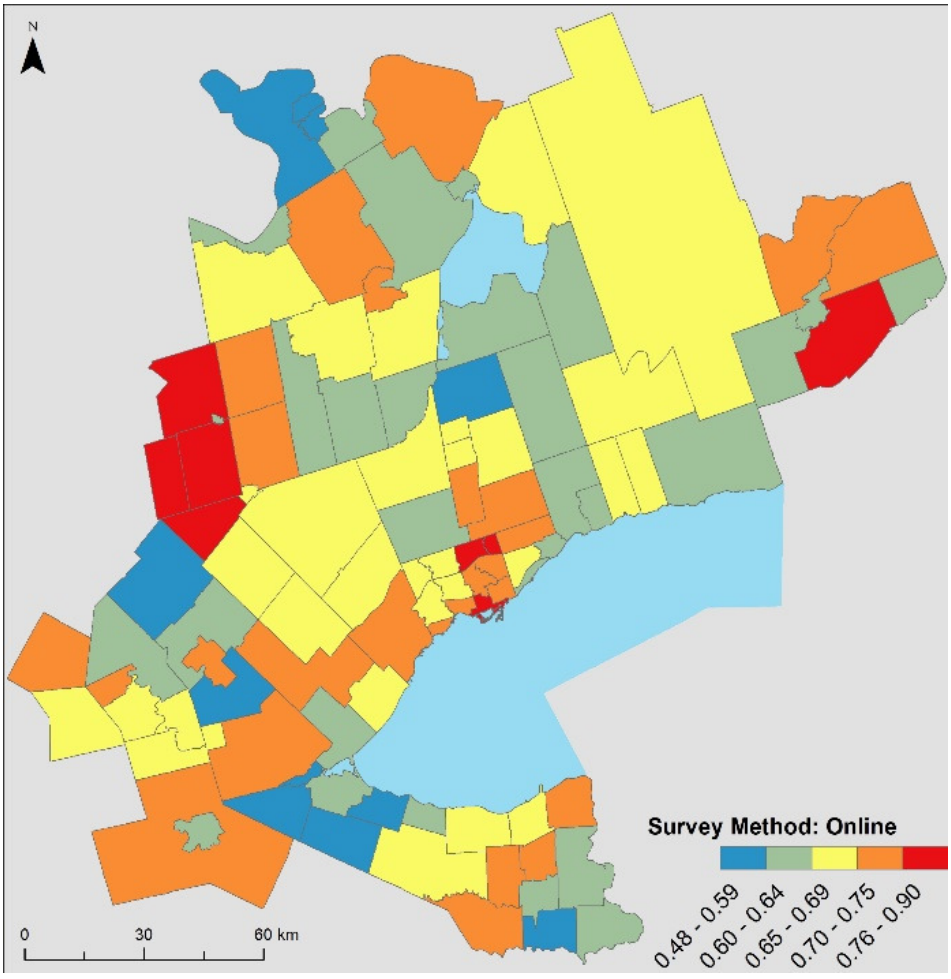



**Figure 8-2 Fraction of TTS 2016 Households Responding Online**

2016 household attributes from the two sub-samples are compared with each other and with previous years' values in the following figures. Figure 8-3 and Figure 8-4 display household size

distributions, Figure 8-5 and Figure 8-6 display household vehicle ownership levels and Figure 8-7and Figure 8-8 present number of fulltime workers per household. Overall, this analysis shows that the 2016 online and telephone respondent groups have significantly different household characteristics. In addition, the online group household characteristics are generally more similar to the previous years than the telephone group household characteristics. The online group is a larger population (about 68% of the survey) and that may result in household attributes more similar to the previous surveys. This also implies that the possible issue with the online survey was in the trip reporting of the survey and not in the household questions.

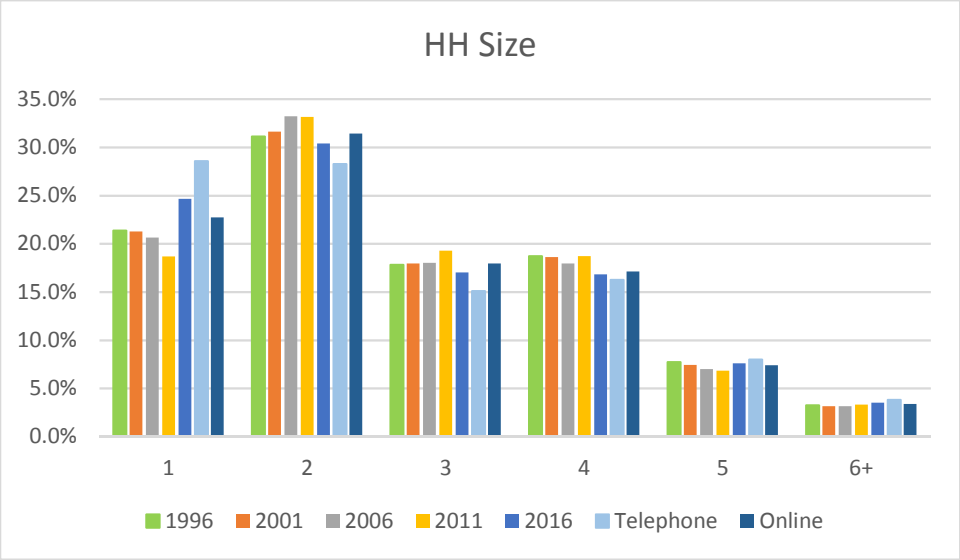



**Figure 8-3 Household Size Distribution, 1996 – 2016; Online vs. Telephone Respondents in 2016**

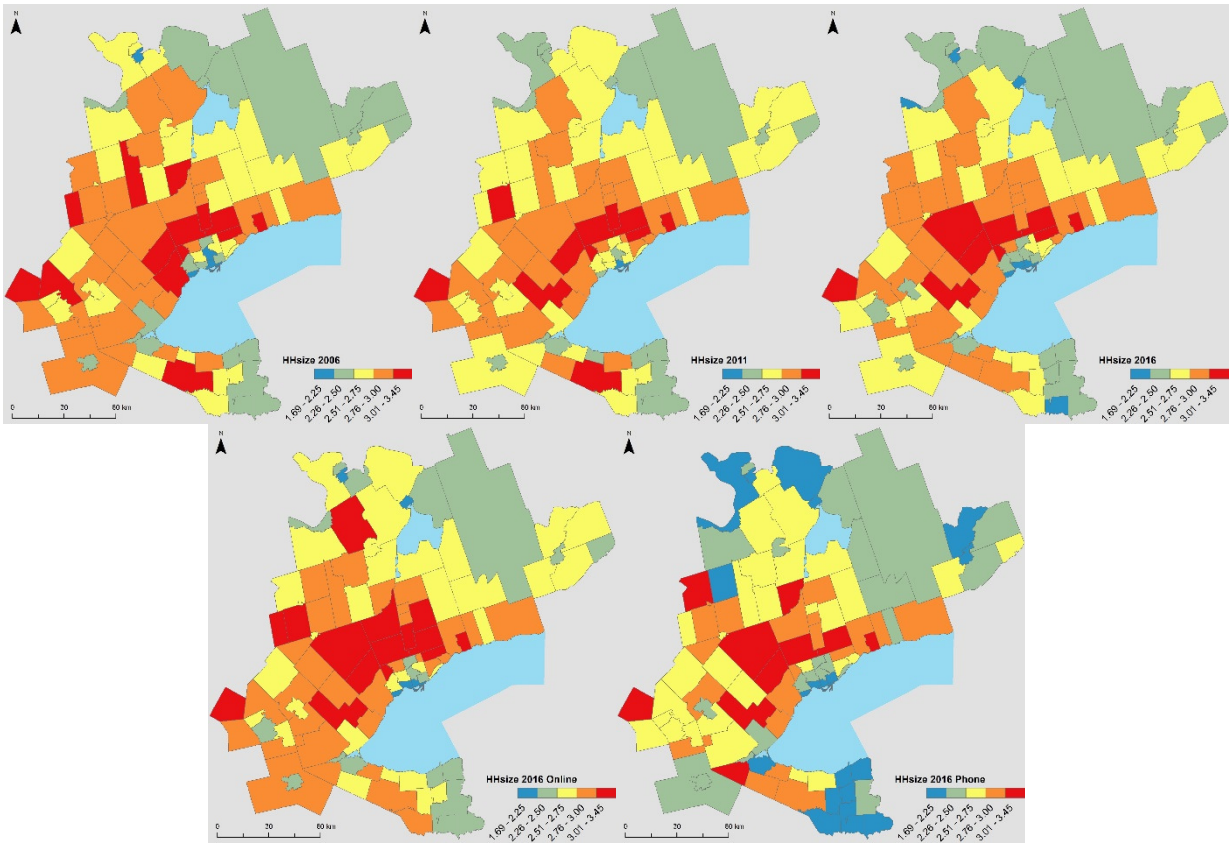



**Figure 8-4 Average Household Size by Planning District, 2006 – 2016, Online vs. Telephone Respondents in 2016**

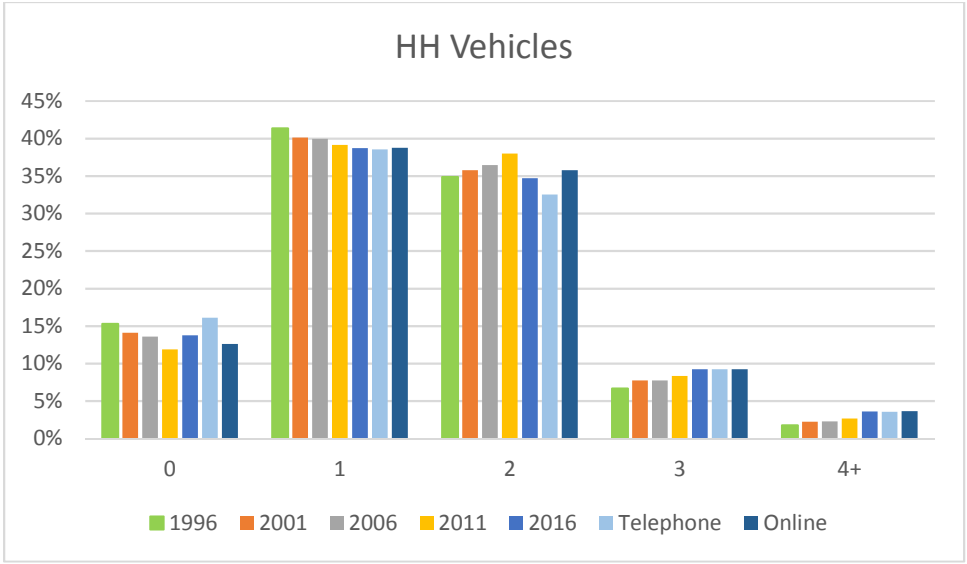



**Figure 8-5 No. of Household Vehicles, 1996 – 2016; Online vs. Telephone Respondents in 2016**

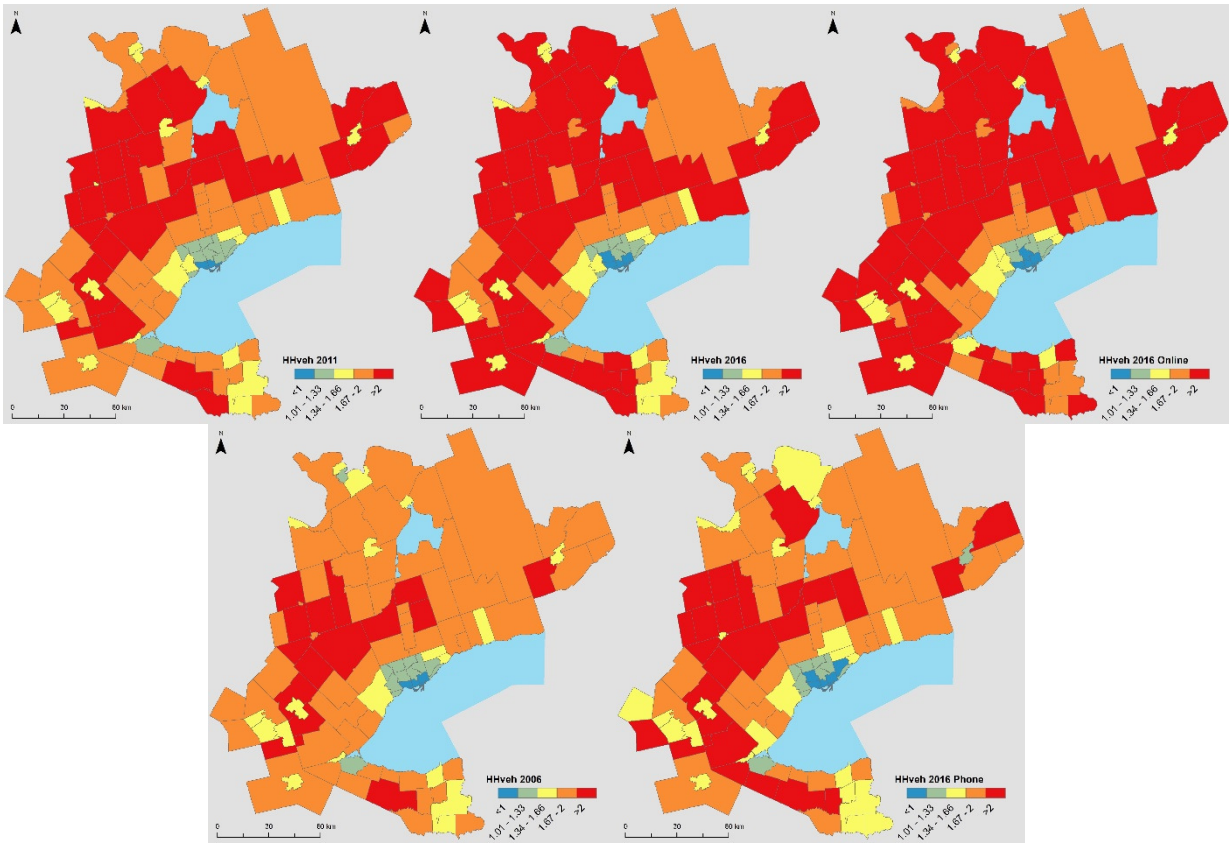



**Figure 8-6 Average No. of Household Vehicles by Planning District, 2006 – 2016, Online vs. Telephone Respondents in 2016**

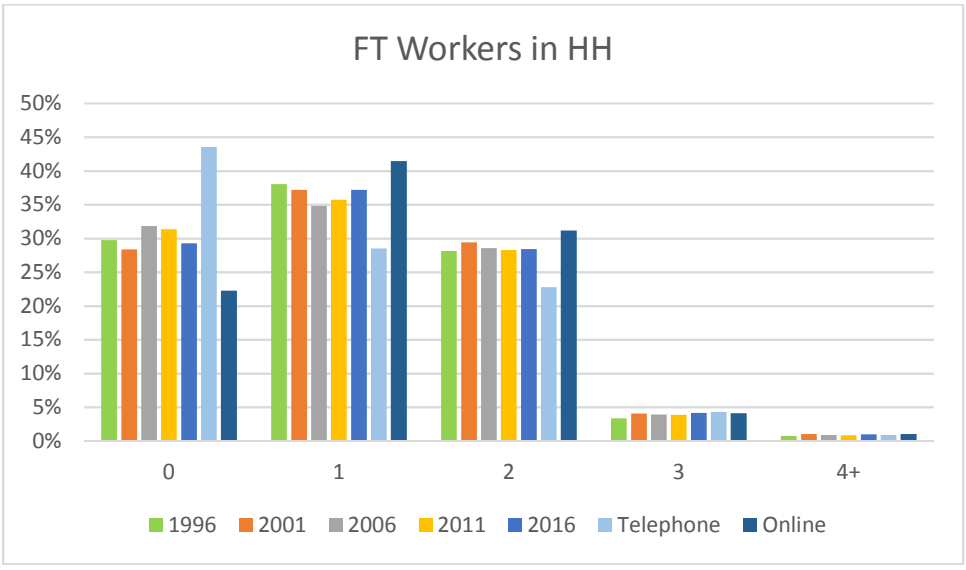



**Figure 8-7 No. of Fulltime Workers per Household, 1996 – 2016; Online vs. Telephone Respondents in 2016**

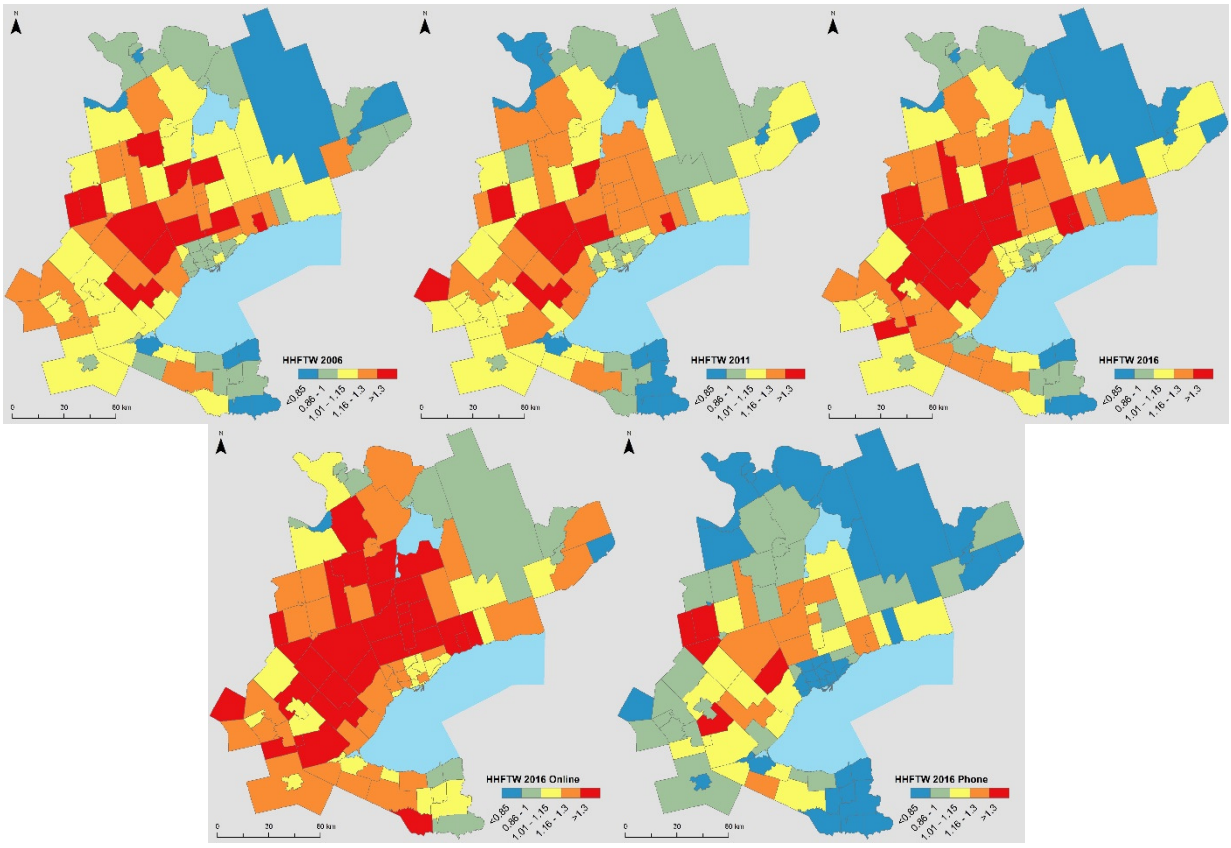



**Figure 8-8 Average No. of Household Fulltime Workers by Planning District, 2006 – 2016, Online vs. Telephone Respondents in 2016**

The distribution of household dwelling types, on the other hand, does not vary dramatically between the two sub-samples (Figure 8-9). However, the sample frame (address based vs telephone recruitment) has significant impact on dwelling type. The address based sample frame clearly helped to collect more data from the apartment dwellers than previous years.

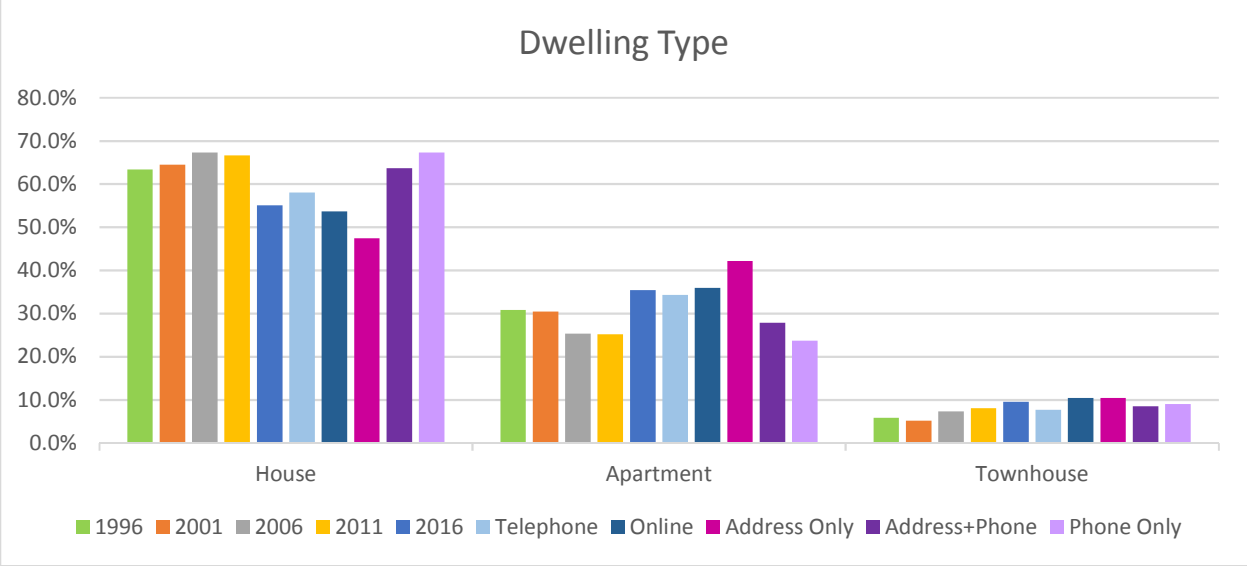



**Figure 8-9 Dwelling Type Distributions, 1996 – 2016; 2016 Survey Mode & Sample Frame Impacts**

A household income question was first asked in the 2016 survey, so comparison to previous surveys is not possible. As shown on Figure 8-10, higher income households responded more to the survey via online method.

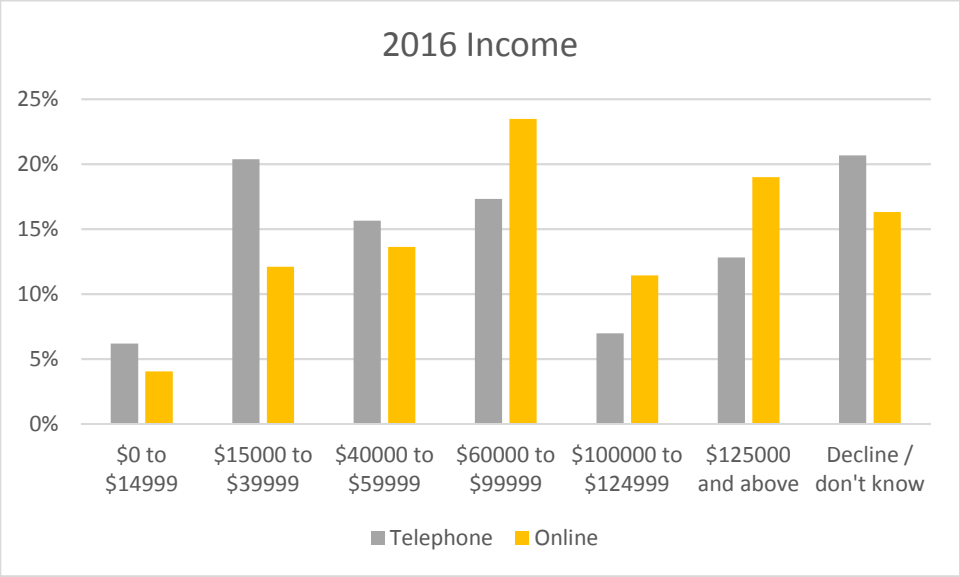



**Figure 8-10 TTS 2016 Household Income Distribution, Online vs. Telephone Respondents**

## 8.2 Change in Trip Definition in the Middle of the 2016 Survey

The pop-up for trip definition in the web survey was changed part-way through the survey. Before Nov 7th (week 1-10 of the data collection), the trip definition clearly says "Do not report quick stop-offs on your way to somewhere else …". This might have resulted in people not reporting their pick up/drop off trips. Figure 8-11 shows the before and after wordings of the trip definition.

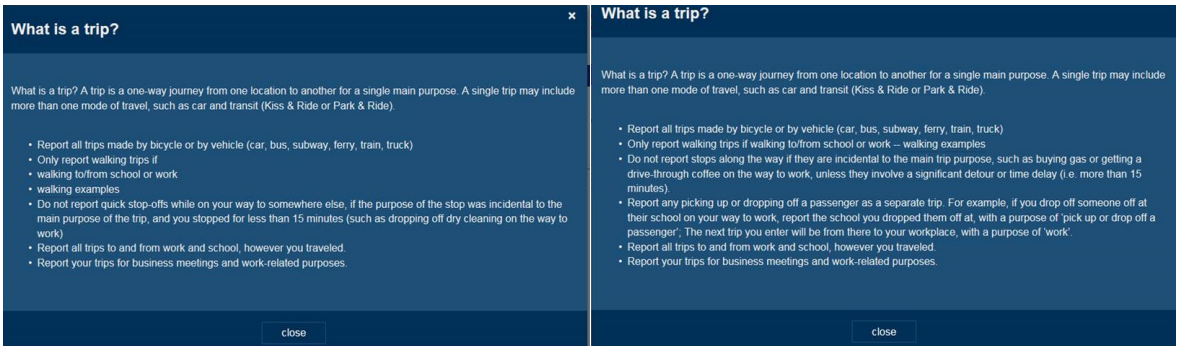



**Figure 8-11 Before & After Wordings of Trip Definition in the 2016 Online Survey**

To check if this has change in trip definition had any impact, the trip rates before and after Nov 7th by survey method and mode were investigated. As shown in Table 8.3, the Weeks 1-10 average facilitate passenger trip rates were very low relative to the 2011 numbers. After the change was made online, the trip rate for facilitating trips improved but still never reached the level of either the 2011 phone or web completes. The daycare trip rate remained about the same after the definition was changed. Daycare trip rate on the telephone in 2016 seem much lower compared to all of 2011 and 2016 online which might be because of older population responding via telephone.

Facilitating trips by the telephone in 2016 have a higher rate than the 2016 online but are lower than the 2011 rate.

**Table 8.3 Impact of Online Trip Definition on Trip Rates**

| TTS 2011 | TOTALS | | TRIP RATES | | |
|---|---|---|---|---|---|
| | Persons | Trips | all | Fac. Pass. | Daycare |
| ONLINE | 1,261,349 | 3,015,210 | 2.390 | 0.166 | 0.021 |
| TELEPHONE | 6,192,890 | 14,890,572 | 2.404 | 0.180 | 0.019 |
| TOTAL | 7,454,239 | 17,905,782 | 2.402 | 0.177 | 0.020 |

| TTS 2016 | TOTALS | | TRIP RATES | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| WEEKS 1-10 | Persons | Trips | all | Fac. Pass. | Daycare | Work | School | Market | Other | Home |
| ONLINE | 2,944,190 | 6,634,550 | 2.25 | **0.132** | 0.037 | 0.90 | 0.74 | 0.18 | 0.27 | 0.96 |
| TELEPHONE | 1,716,504 | 3,977,712 | 2.32 | 0.161 | 0.009 | 0.89 | 0.81 | 0.22 | 0.38 | 0.99 |
| TOTAL | 4,660,694 | 10,612,262 | 2.28 | 0.143 | 0.027 | 0.90 | 0.77 | 0.19 | 0.31 | 0.97 |
| WEEKS 11-15 | Persons | Trips | all | Fac. Pass. | Daycare | Work | School | Market | Other | Home |
| ONLINE | 2,253,758 | 5,084,737 | 2.26 | **0.152** | 0.037 | 0.90 | 0.73 | 0.20 | 0.26 | 0.95 |
| TELEPHONE | 815,896 | 1,800,107 | 2.21 | 0.163 | 0.01 | 0.87 | 0.80 | 0.24 | 0.34 | 0.93 |
| TOTAL | 3,069,654 | 6,884,844 | 2.24 | 0.155 | 0.03 | 0.89 | 0.75 | 0.21 | 0.28 | 0.95 |

## 8.3 Temporal Variations

Comparing the month of data collection between 2011 and 2016 (Figure 8-12) shows that there is not any significant difference in the number of people surveyed each month in the two survey years, with the majority of the data collected during October and November.

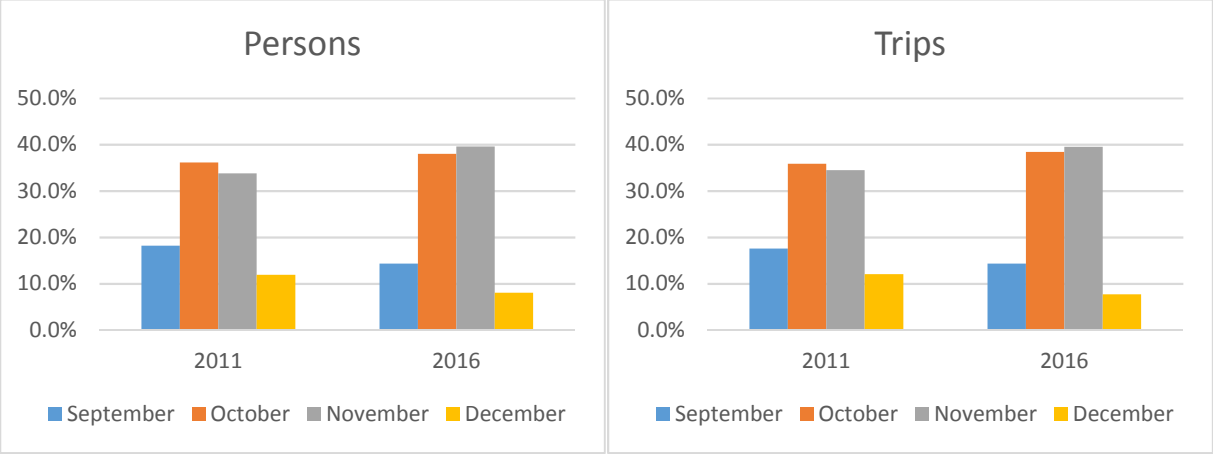



**Figure 8-12 Survey Responses by Month, 2011 & 2016**

As shown in Figure 8-13, there has been a general trend for more responses to be received for Thursdays and Fridays than for earlier days in the week. This trend continued in 2016

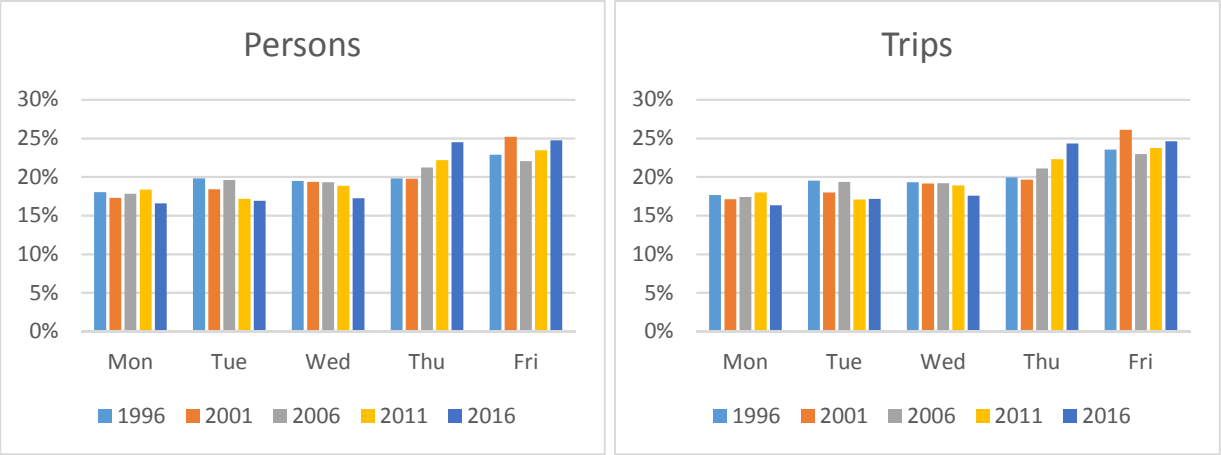



**Figure 8-13 Percentage of Persons & Trips Recorded by Survey Day, 1996 -- 2016**

When we look at the survey method used in each day of the week (Figure 8-14), it is clear that a good portion of the online respondents answered the survey for Thursdays and Fridays. This can because of having more free time on Fridays or weekends to check the mailbox or fill out the survey online.

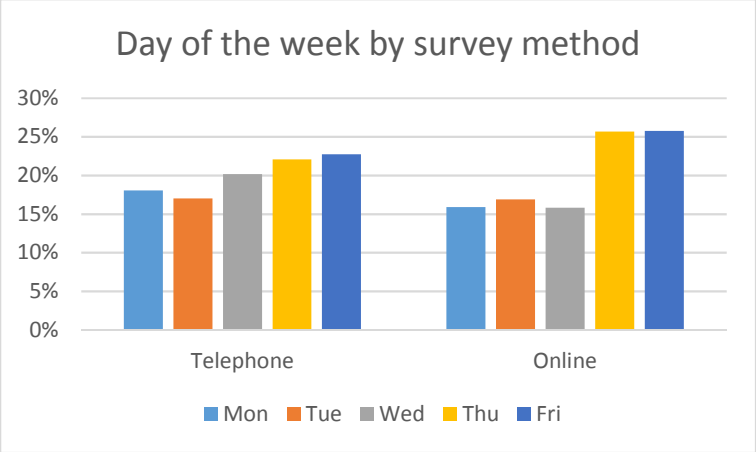



**Figure 8-14 2016 Responses by Survey Method and Day of the Week**

Historically, Thursday and (especially) Friday average daily trip rates have been higher than the average trip rates for earlier days in the week (Figure 8-15). This is reversed in TTS 2016, with Thursdays and Fridays have significantly lower daily trip rates than Tuesdays and Wednesdays. This is presumably a result of the large number of online surveys completed at the end of the week, and the observed under-reporting of NWS trips by these respondents.

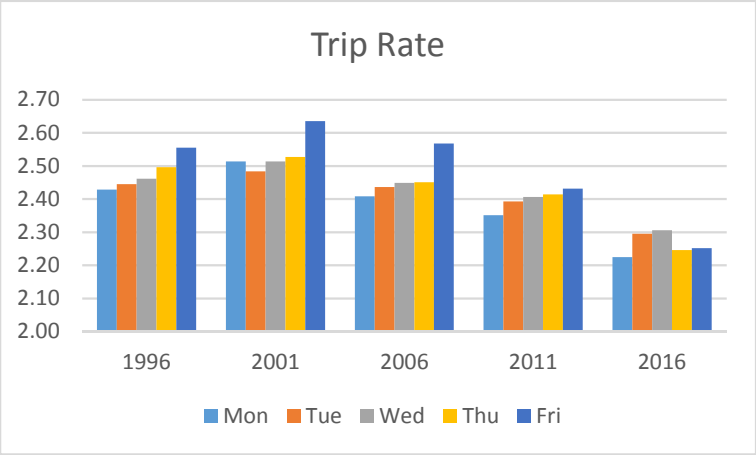



**Figure 8-15 Average Daily Trip Rates by Day of the Week, 1996 -- 2016**

Figure 8-16 plots total trips by time of day by year. As indicated by this graph, it appears that the decline in reported trips discussed in previous sections occur largely in the off-peak (midday and evening/night) time periods, not during the morning and afternoon peak periods. Appendix IV presents trip time of day distributions for individual trip purposes.

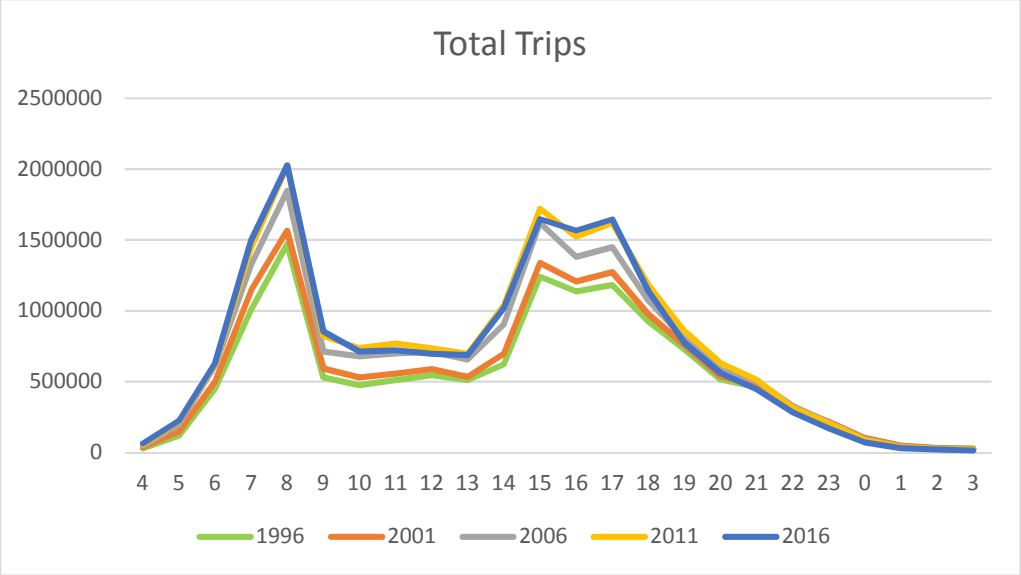



**Figure 8-16 Total Trip Start Times by Survey Year**

# 9 Tour-Based Analysis

This section investigates tour structures present in the TTS surveys. To begin, Figure 9-1 and 9.2 plot the distribution of tour lengths by survey year. Tour rates are normalized using individuals over the age of 11. For work and school activities, only workers / students are used for normalization. As shown in the figure, the number of simple (2-trip) tours has increased roughly in step with previous surveys. The number of more complex / longer tours have declined in 2016, breaking the trend seen in previous years.

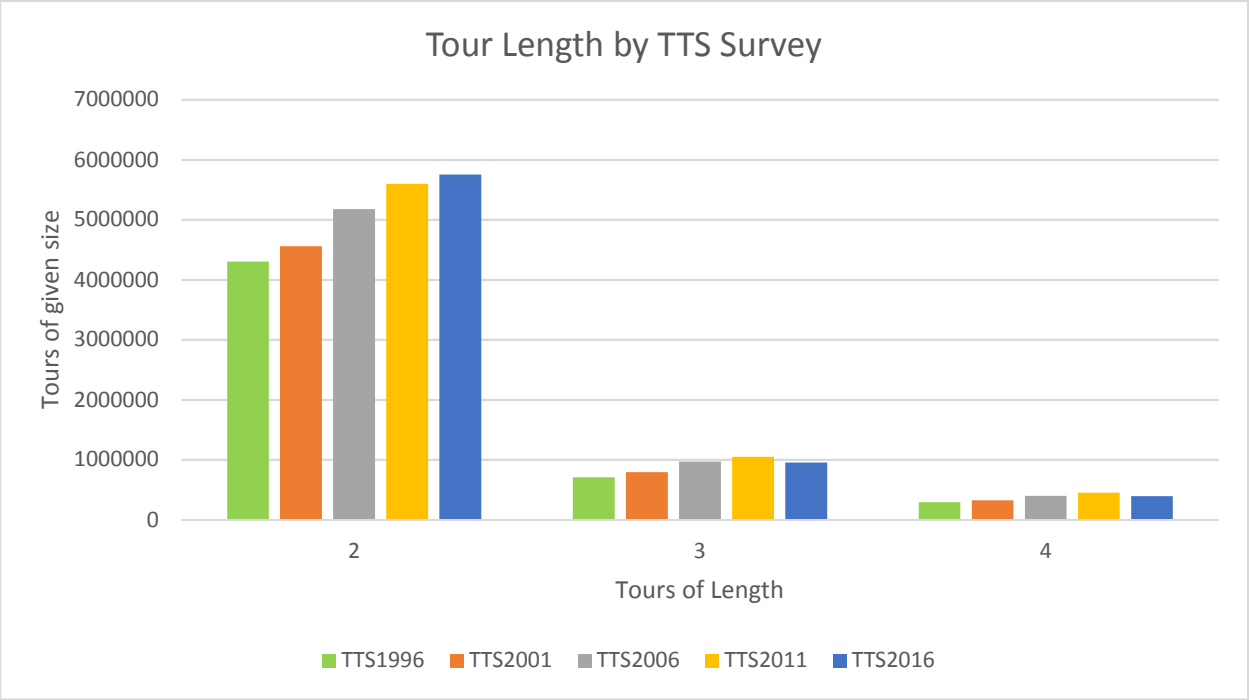



**Figure 9-1 Tour Length Distribution by Survey Year**

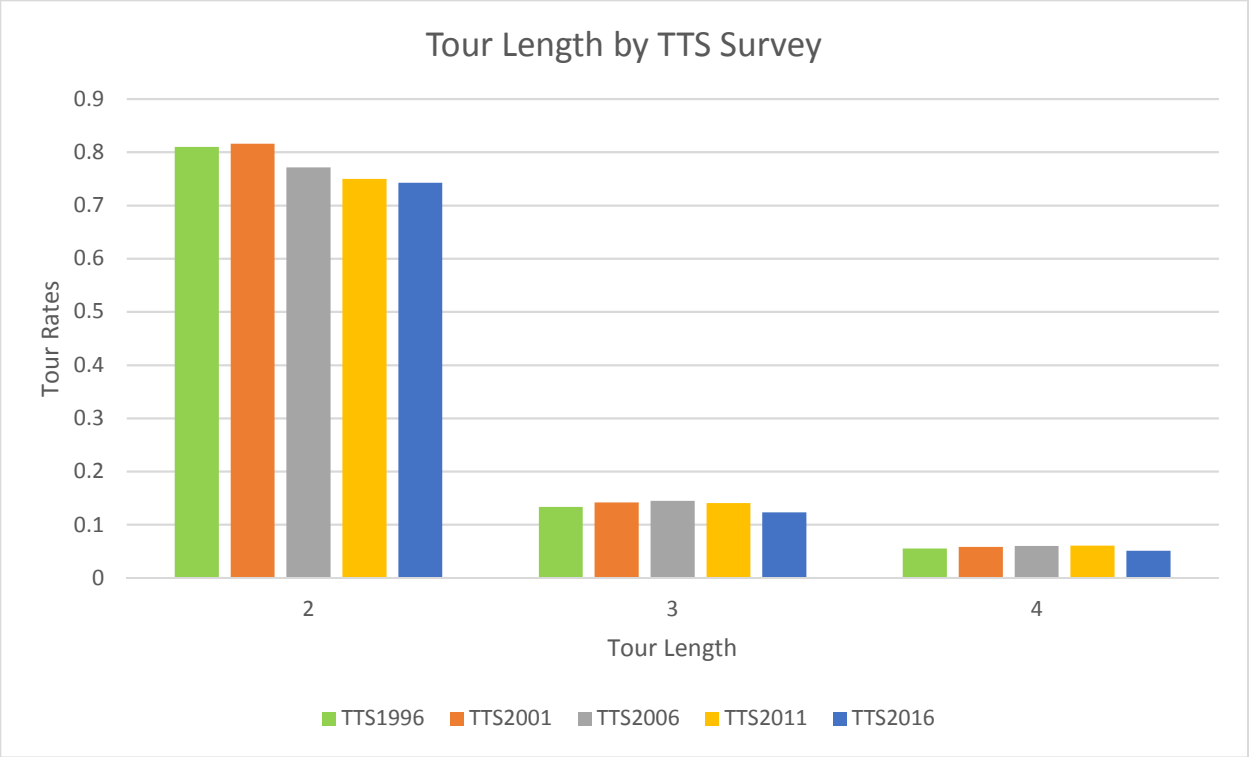



**Figure 9-2 Tour Length Distribution Rates**

Figure 9-3-3 splits the tour distributions by respondents and non-respondents. It is seen that 2016 2-trip tours increase relative to 2011 (and increase by a greater amount than what would be implied by the previous years' trend), and 2016 3- and 4-trip tours decrease marginally. Non-respondent

report tours decline in 2016 for all tour lengths. Looking at the rates however, it shows that there has been a steady decrease in the rates of two-trip tour generation since 2006. The rate for TTS2016 does not look to be out of line with the expected trend.

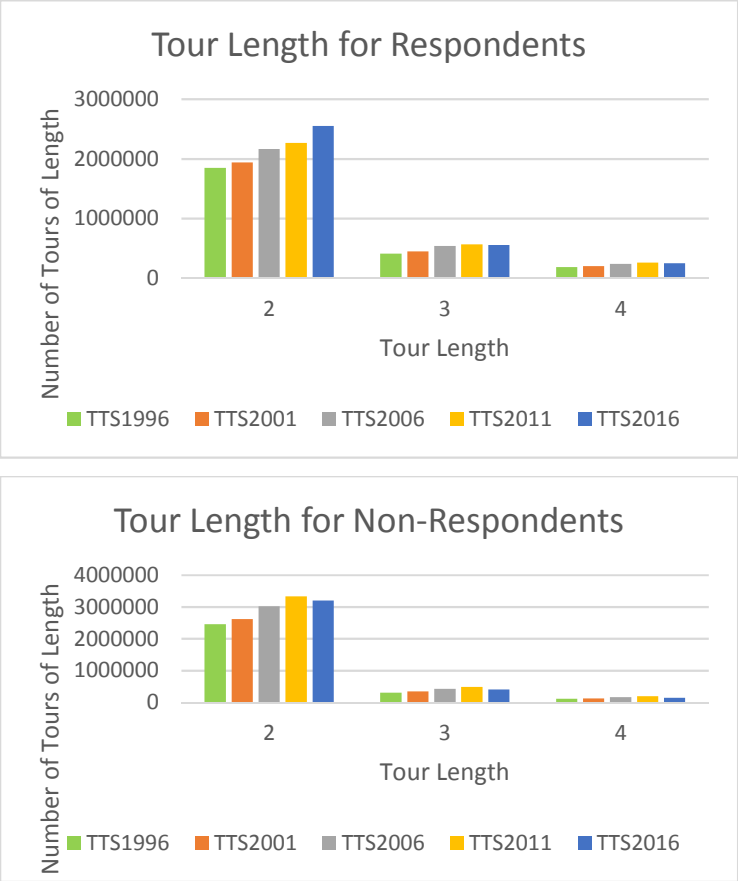
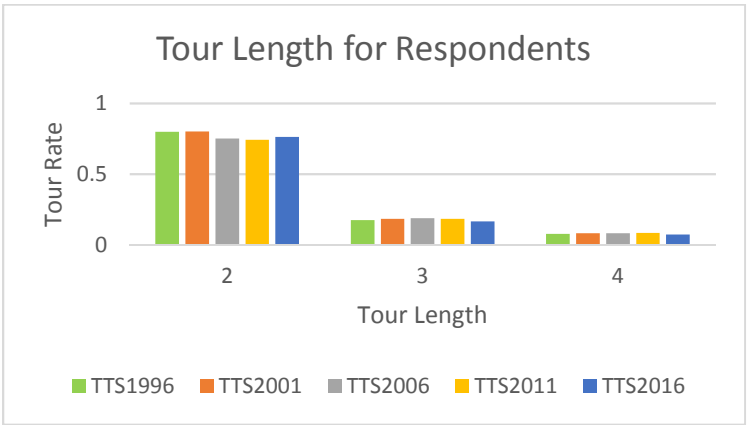



**Figure 9-3 Tour Length Distribution by Survey Year, Respondents vs. Non-Respondents**



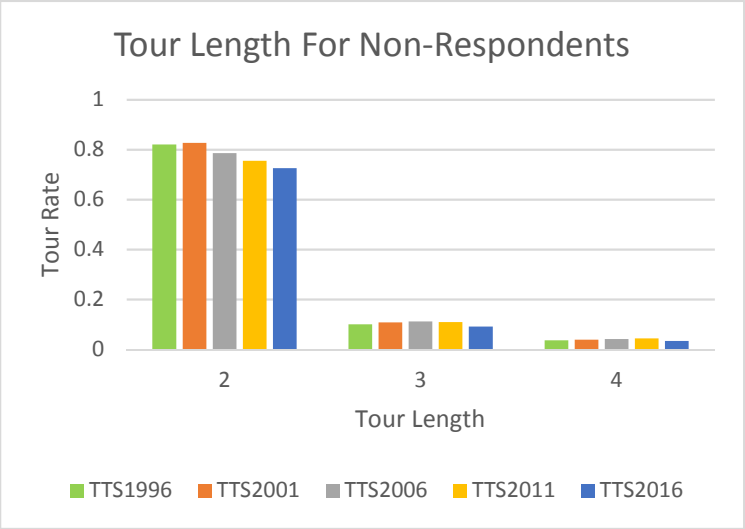



**Figure 9-4 Tour Length Distribution Rates by Survey Year, Respondents vs. Non-Respondents**

As shown in Figure 9-55, web-based respondents reported fewer 3-trip tours and more 2-trip tours than telephone-based respondents did. Of note, the TTS2016 2 trip tour rates for respondents is actually higher than in TTS2011 but less for Non-Respondents.

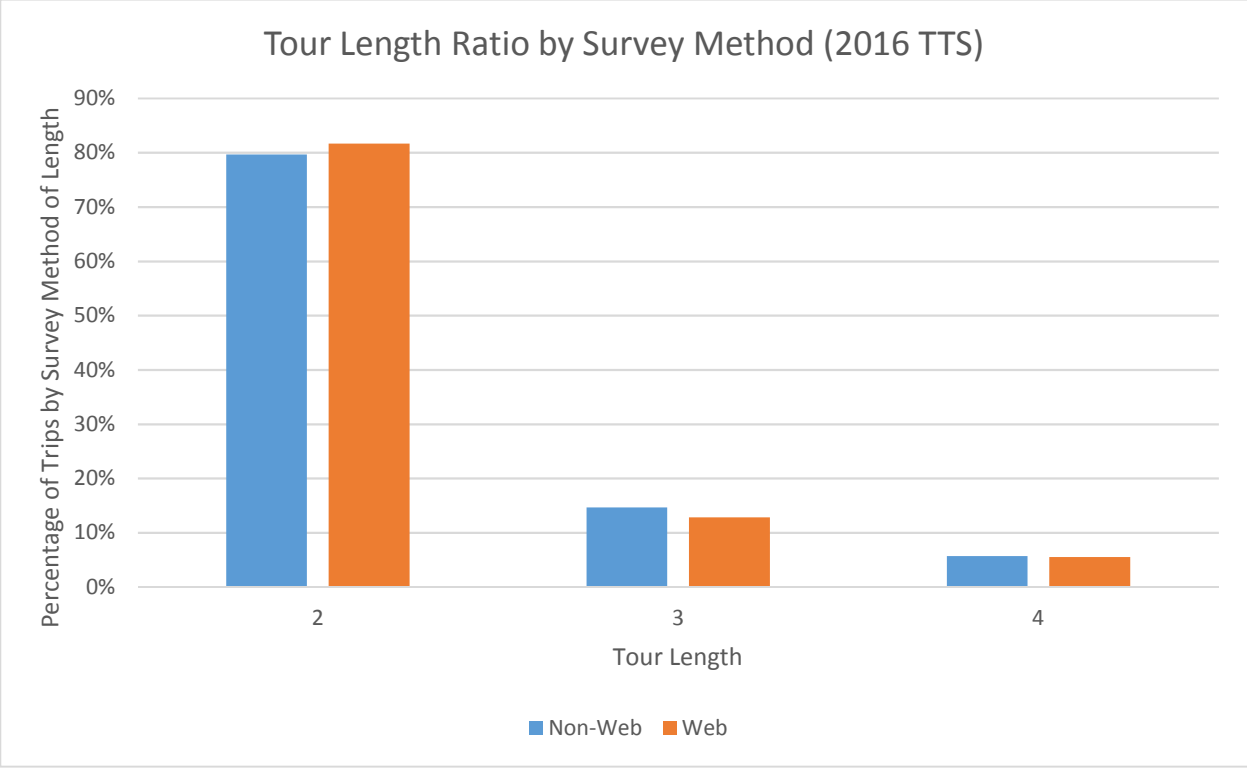



**Figure 9-5 TTS 2016 Tour Lengths by Survey Method (Phone vs. Web)**

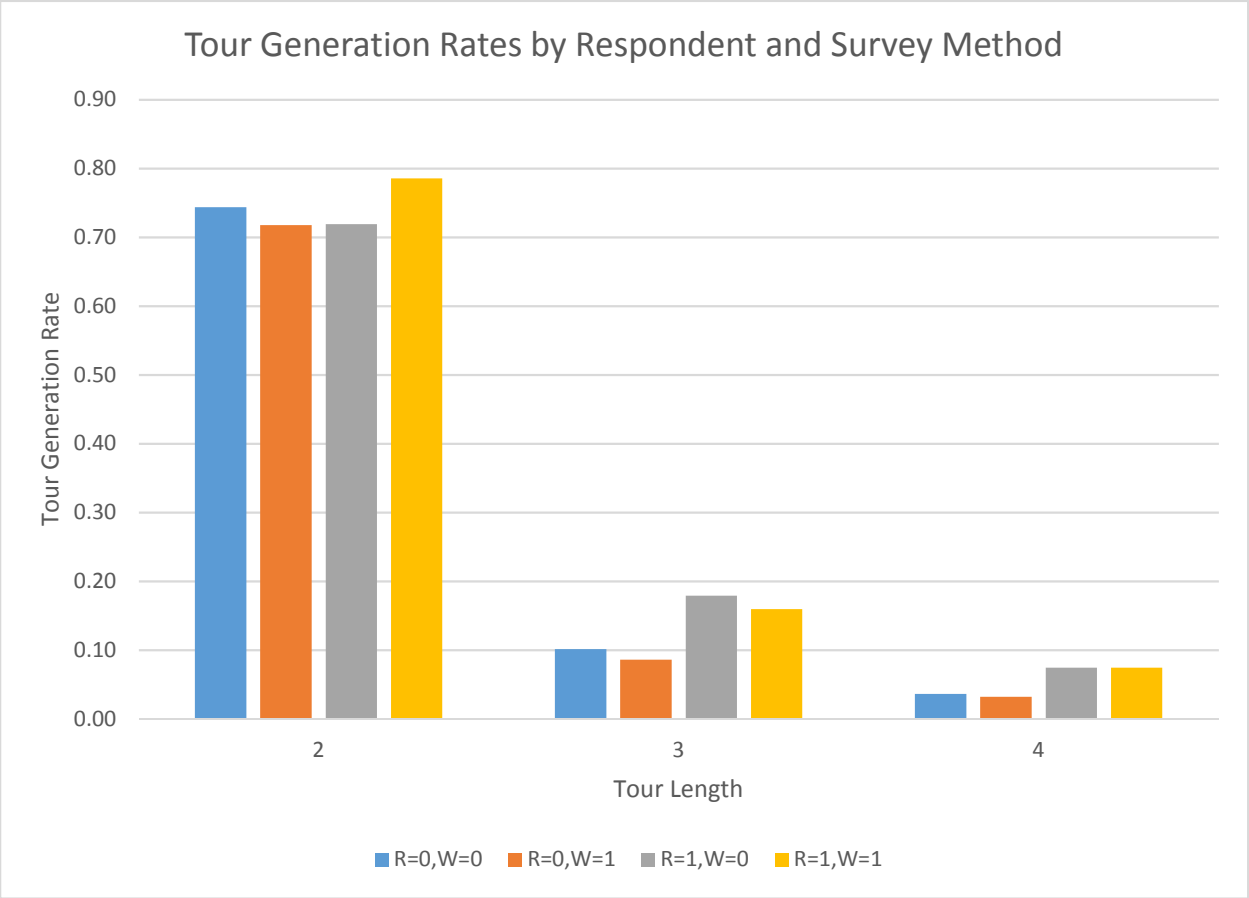



**Figure 9-6 Trip generation rates by Survey Method and Respondent**

Figure 9-6 breaks down the survey method and if they were the respondent with R representing if they were the respondent and W representing if it used the web survey. For non-respondents, web-surveyed individuals are less likely to generate tours. Web-surveyed respondents generate more simple two trip tours, but are less likely to generate three trip tours.

Appendix V presents a more detailed analysis of the changes in the composition (activity purposes) of 2-, 3- and 4-trip tours. Key findings are:

- Two-trip tours declined in 2016 for all non-work tours, with the exception of daycare.
- For 3-legged tours involving a work trip there is a decline in 2016 in reported tours involving facilitate passenger and market trips. There is an increase, however, in the number of other, and school activities following a work activity.
- Unlike its work counterpart, there is a steep decline in other activities before and after a School activity in 3-trip tours. Market activities have a smaller decline. Surprisingly, facilitate passenger trips are higher than in previous TTS surveys.
- For 4-legged tours with the middle activity being work or school, as anticipated the number of facilitate passenger and other activities in the 2016 survey has declined significantly for tours of length four for both work and school based tours with activities before and after. Market activities for this tour structure seem to be insignificant across all years.

APPENDIX I TRIP PURPOSES 2016 VS. 2006


**Figure A1: Trip by Purpose 2016 Relative to 2006.**

APPENDIX II MODE SHARES BY PURPOSE

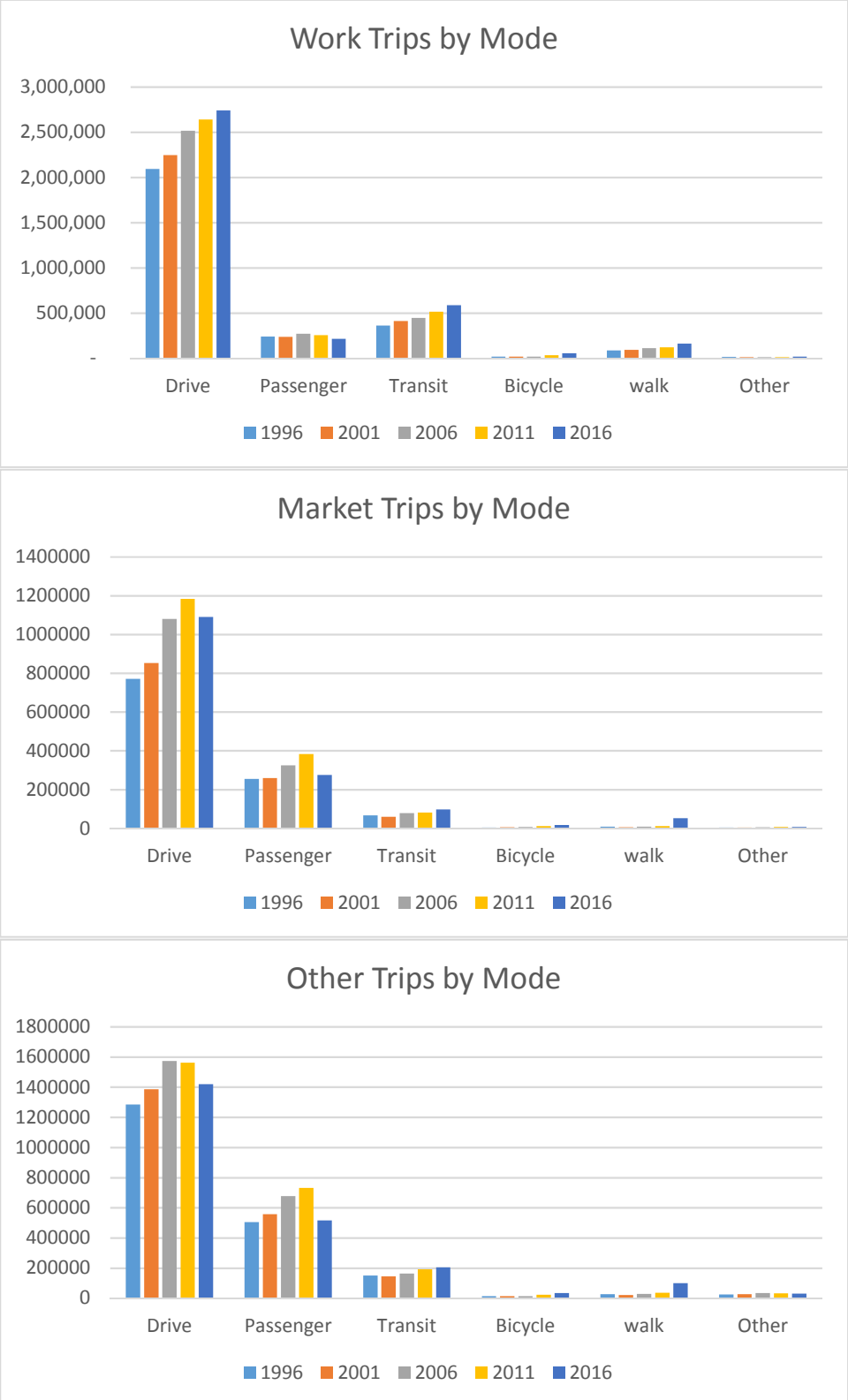



**Figure A2: Trips by Mode & Purpose & Year.**

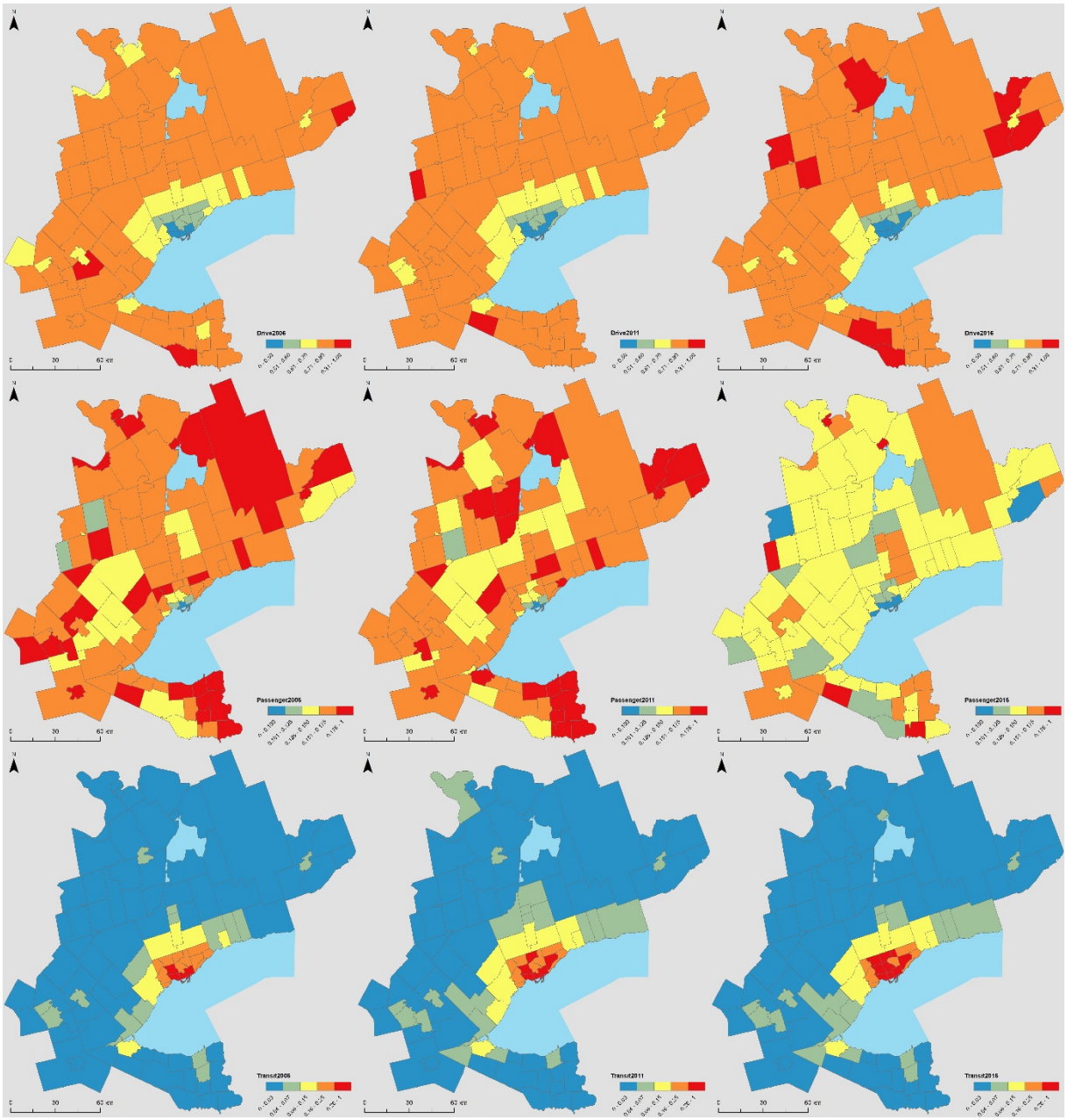



**Figure A3: Drive, Passenger and Transit Mode Share for 2006, 2011, 2016.**

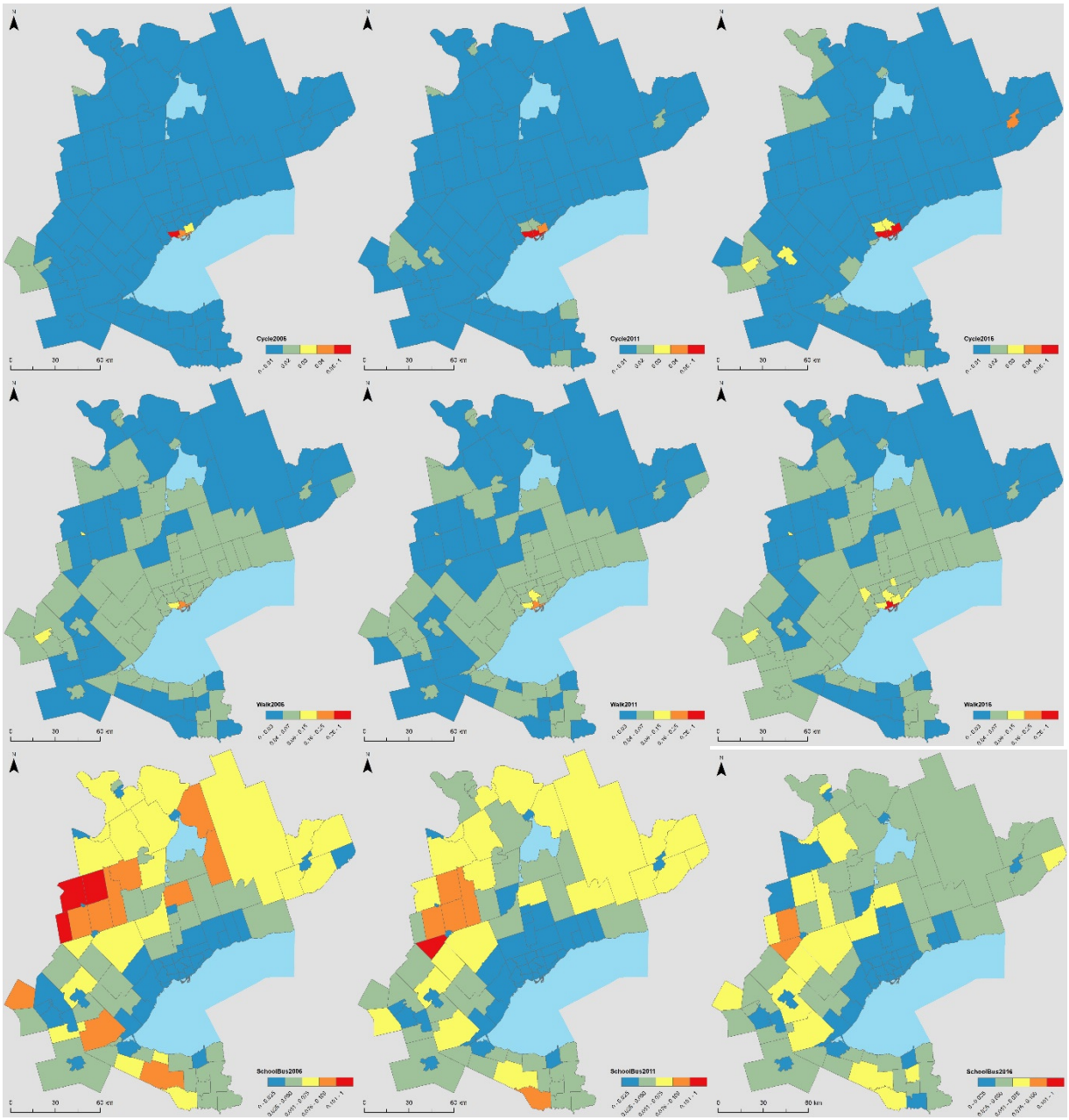
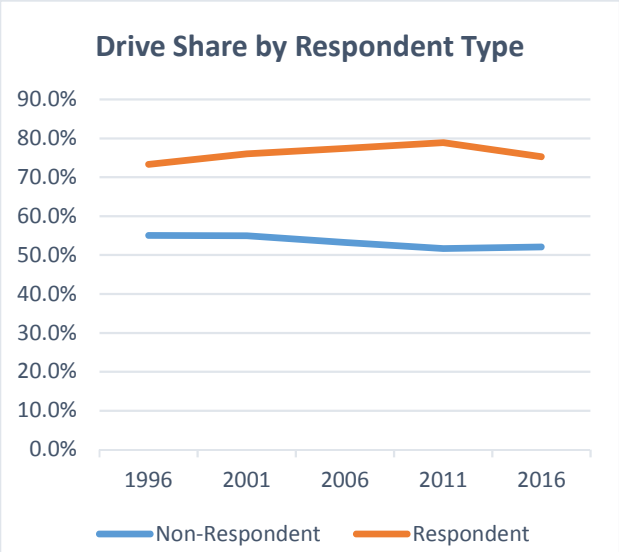
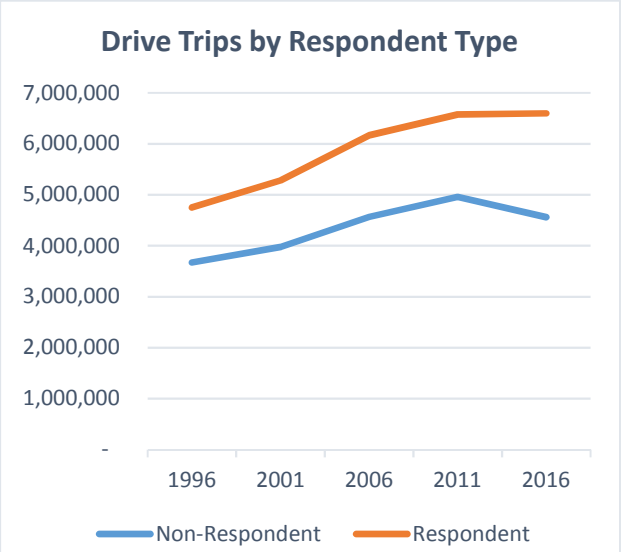
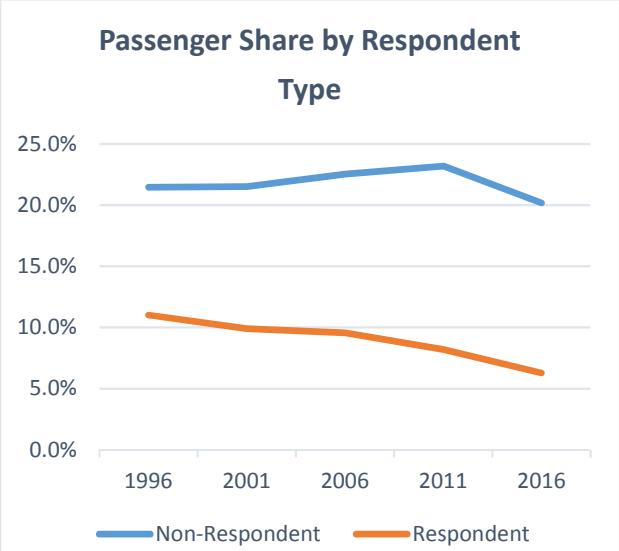


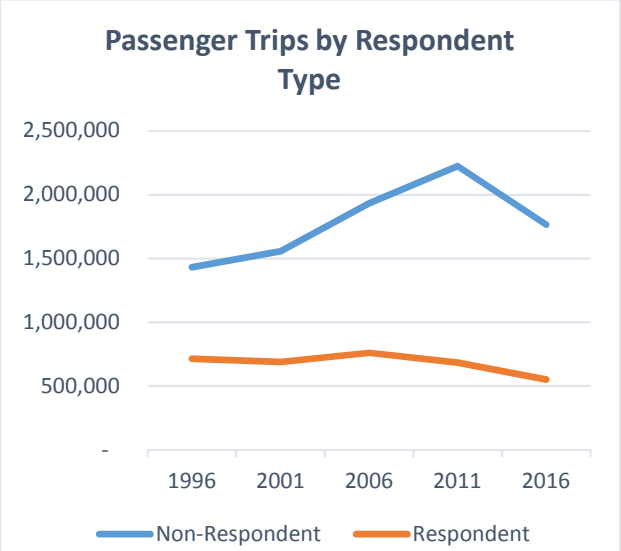

**Figure A4: Cycle, Walk and School Bus Mode Share for 2006, 2011, 2016.**

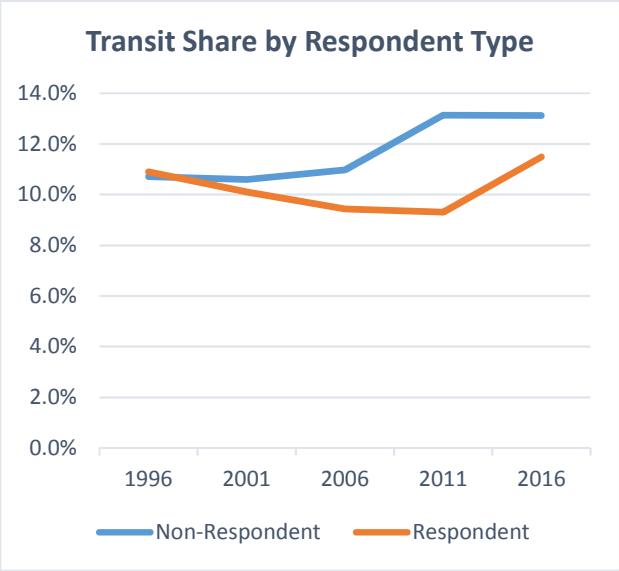
# APPENDIX III RESPONDENT & NON-RESPONDENT TRIPS & MODE SHARES BY MODE

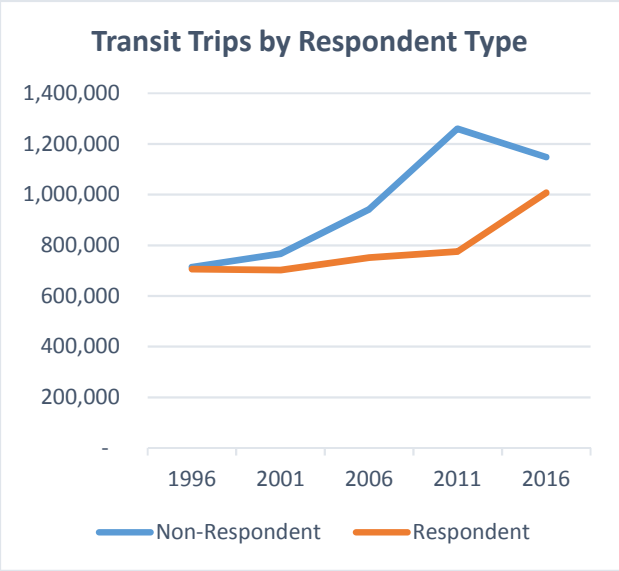


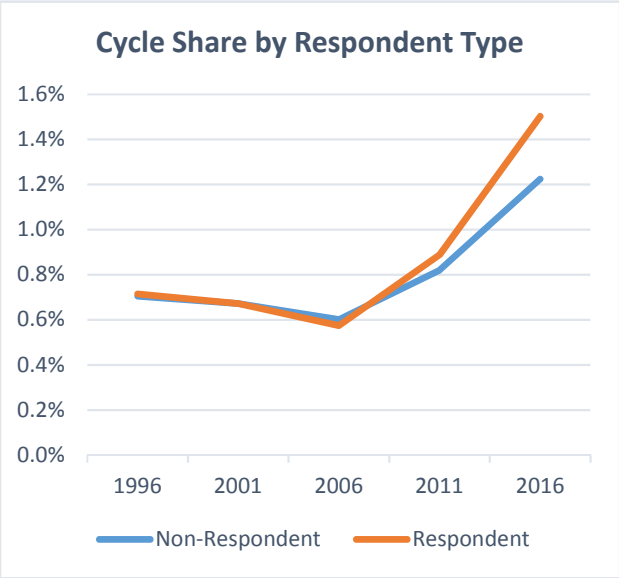



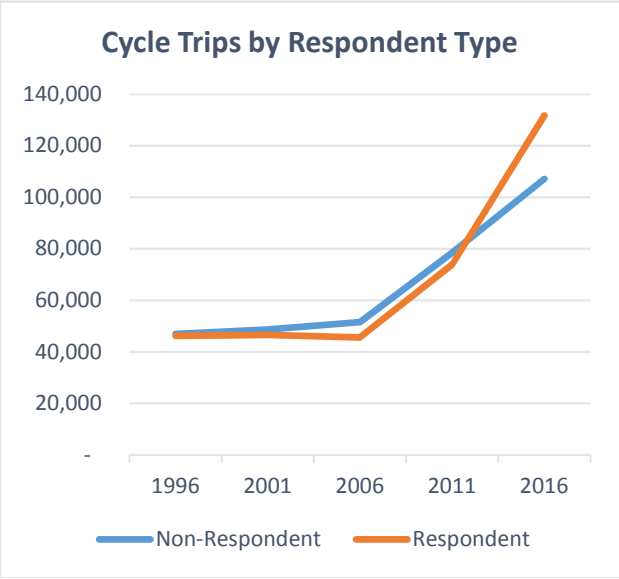



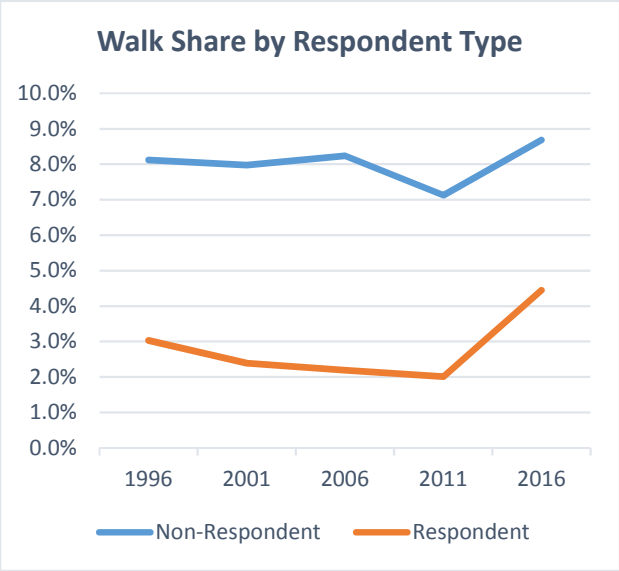



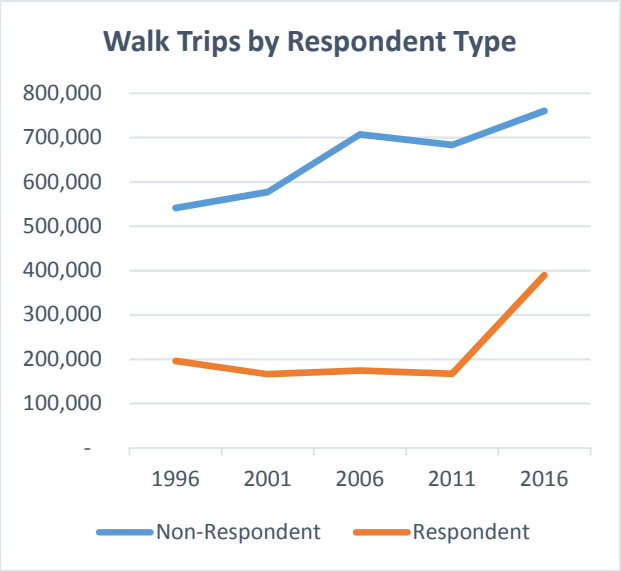

Transit Share by Respondent Type
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
1996
2001
2006
2011
2016
Non-Respondent
Respondent

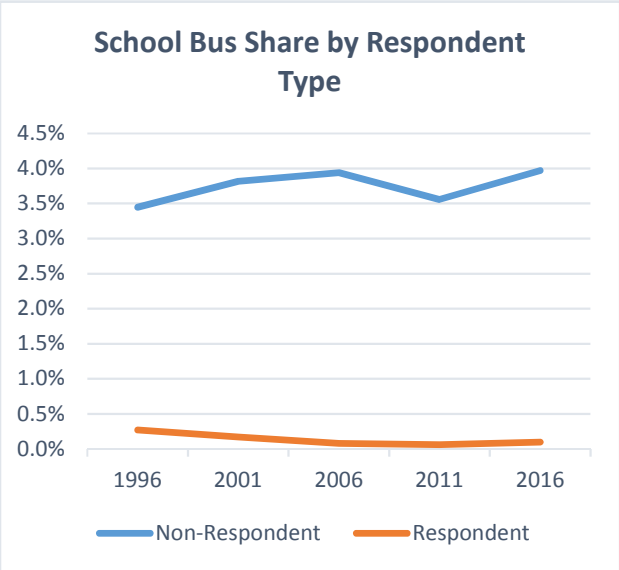

Transit Trips by Respondent Type
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
-
1996
2001
2006
2011
2016
Non-Respondent
Respondent

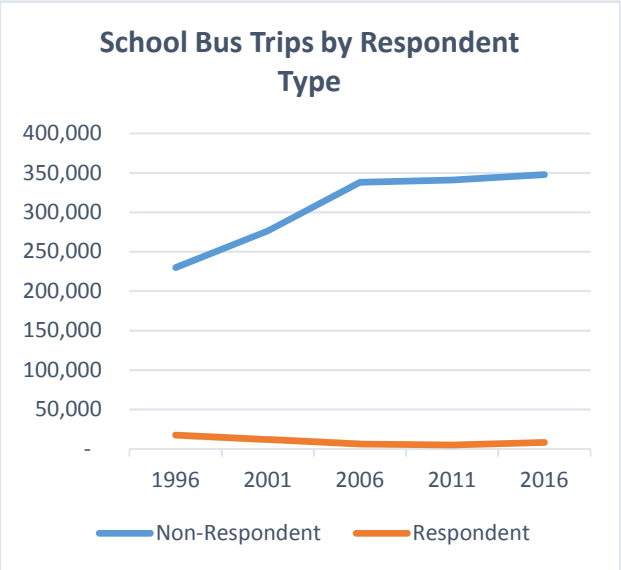

Cycle Share by Respondent Type
1.6%
1.4%
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
1996
2001
2006
2011
2016
Non-Respondent
Respondent


Cycle Trips by Respondent Type
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
1996
2001
2006
2011
2016
Non-Respondent
Respondent


Walk Share by Respondent Type
10.0%
9.0%
8.0%
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
1996
2001
2006
2011
2016
Non-Respondent
Respondent


Walk Trips by Respondent Type
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
1996
2001
2006
2011
2016
Non-Respondent
Respondent


School Bus Share by Respondent Type
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
1996
2001
2006
2011
2016
Non-Respondent
Respondent


School Bus Trips by Respondent Type
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
-
1996
2001
2006
2011
2016
Non-Respondent
Respondent

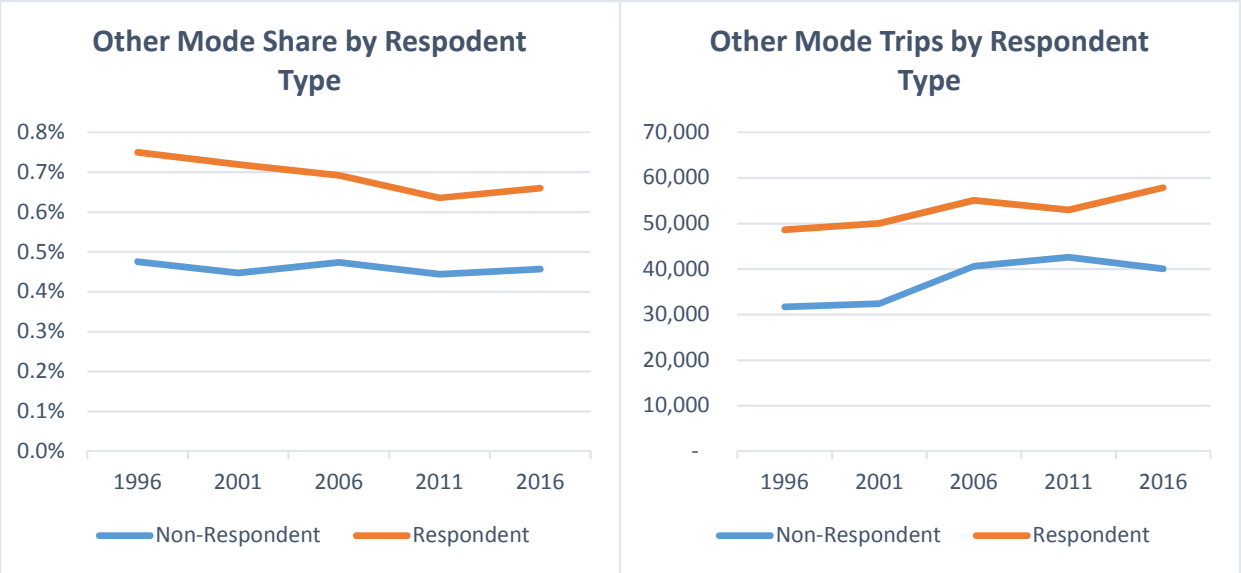
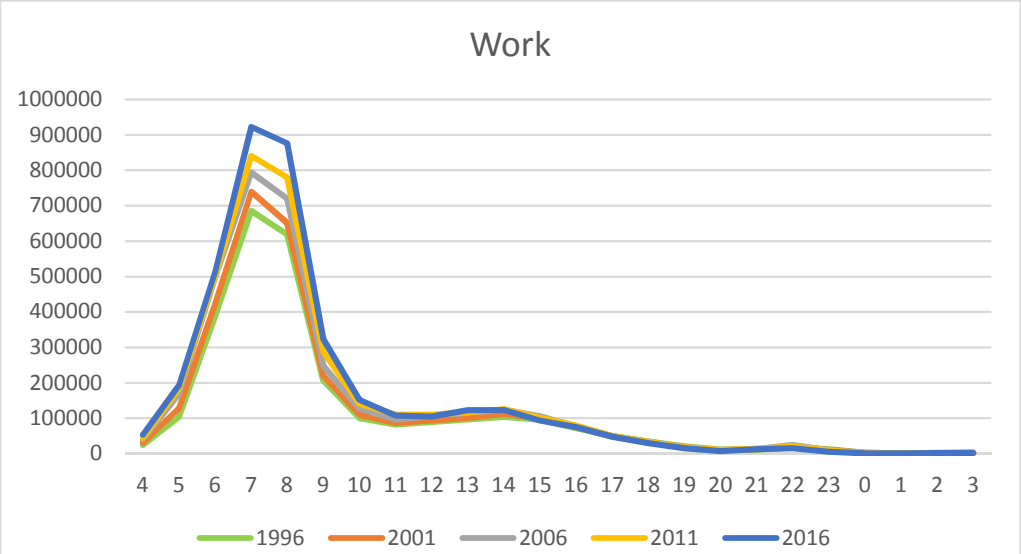
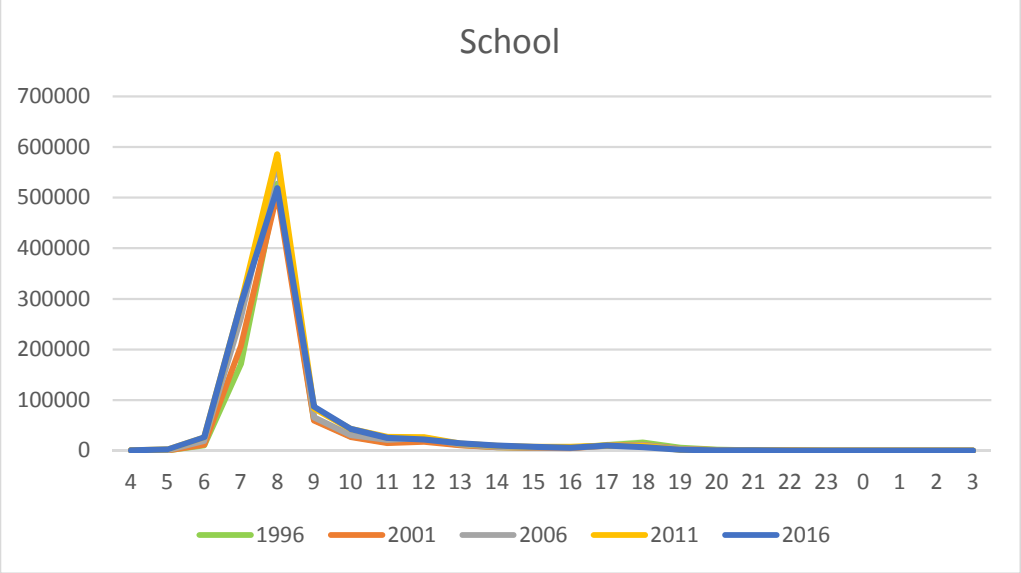
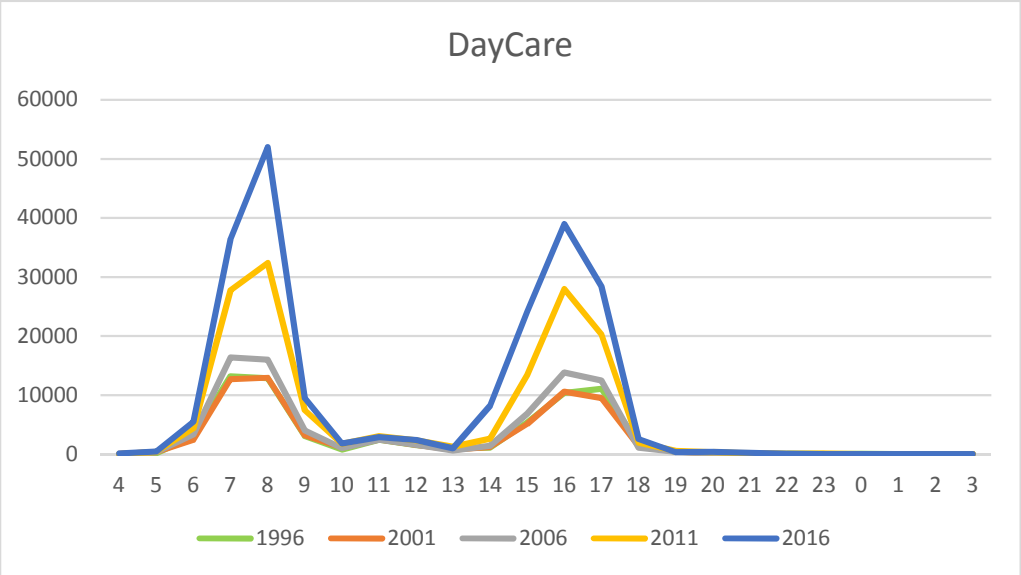


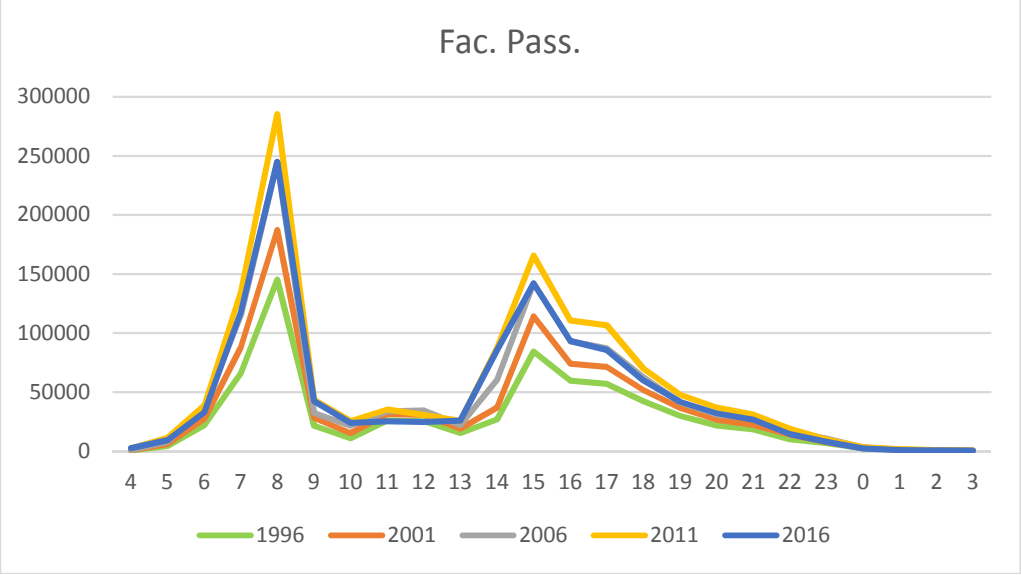

**Figure A5: Trips by Mode & Purpose & Respondent Type & Year.**

# APPENDIX IV TRIP START TIMES BY TIME OF DAY BY YEAR BY TRIP PURPOSE




DayCare
60000
50000
40000
30000
20000
10000
0
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3
1996
2001
2006
2011
2016


Fac. Pass.
300000
250000
200000
150000
100000
50000
0
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3
1996
2001
2006
2011
2016

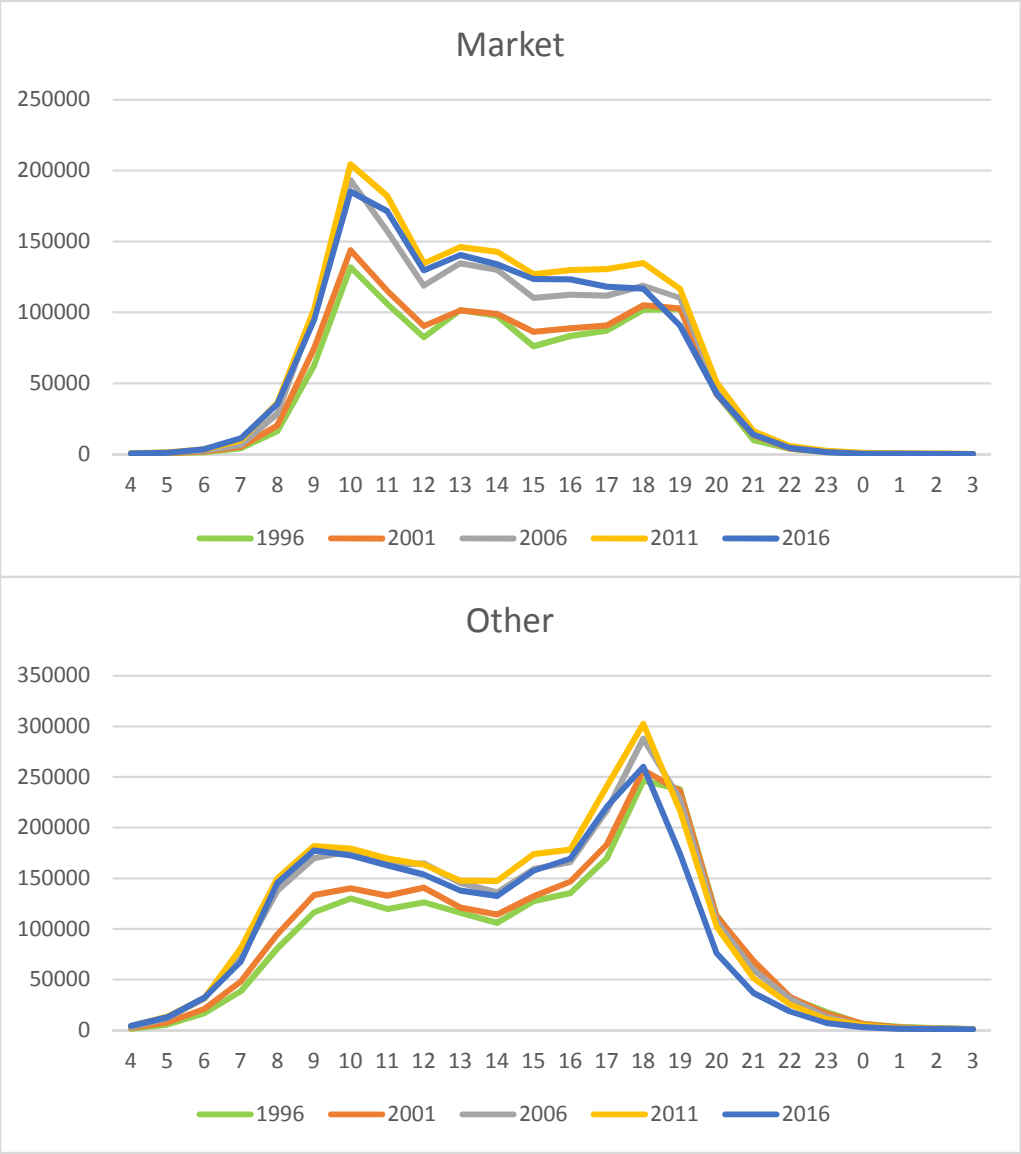
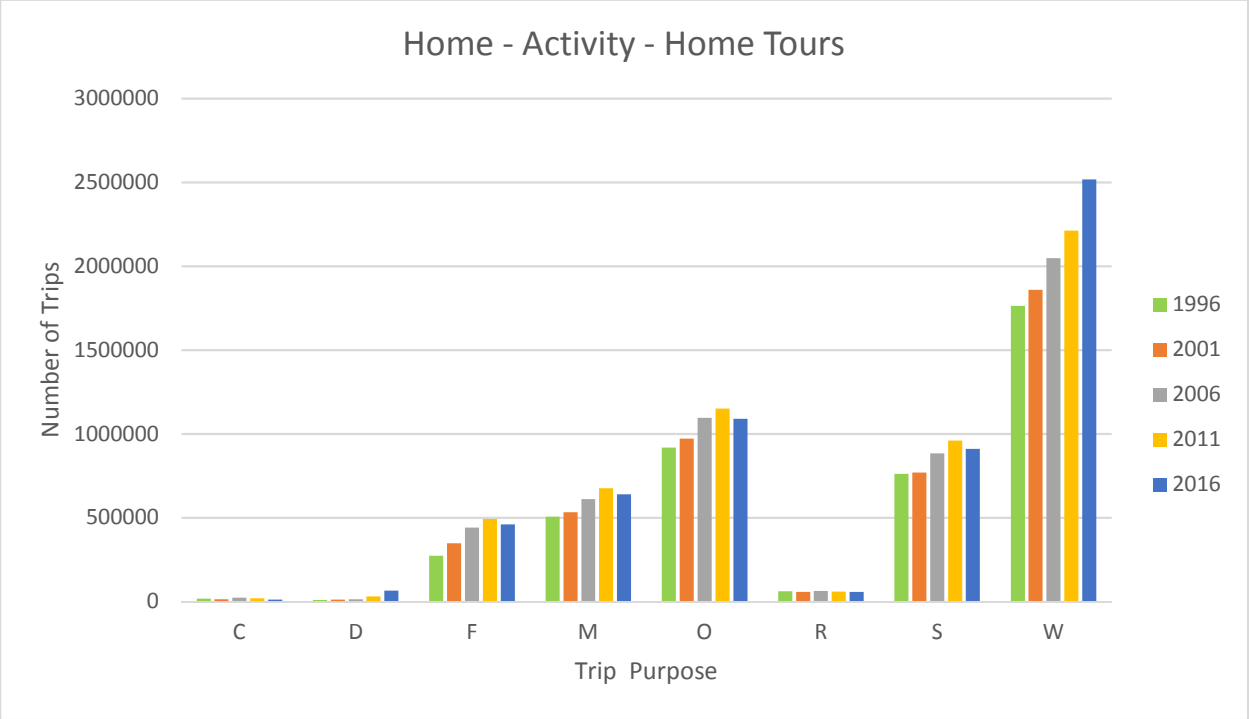
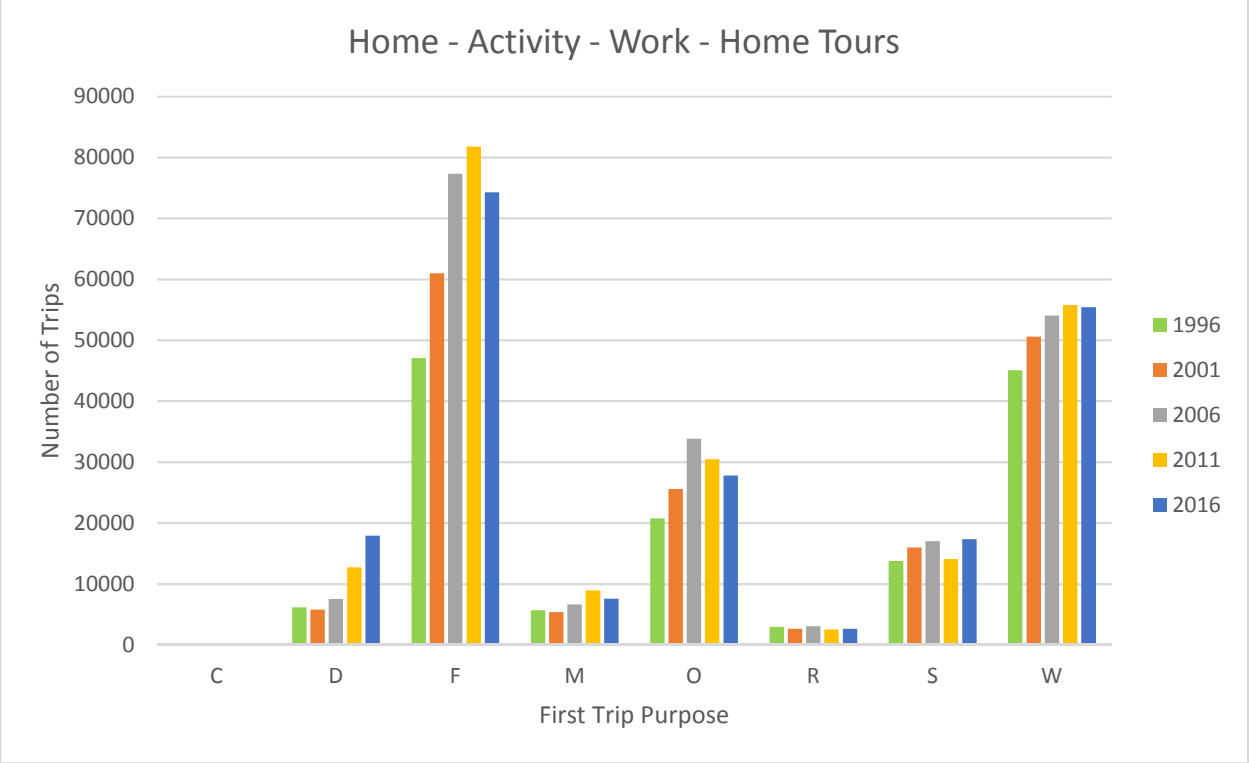
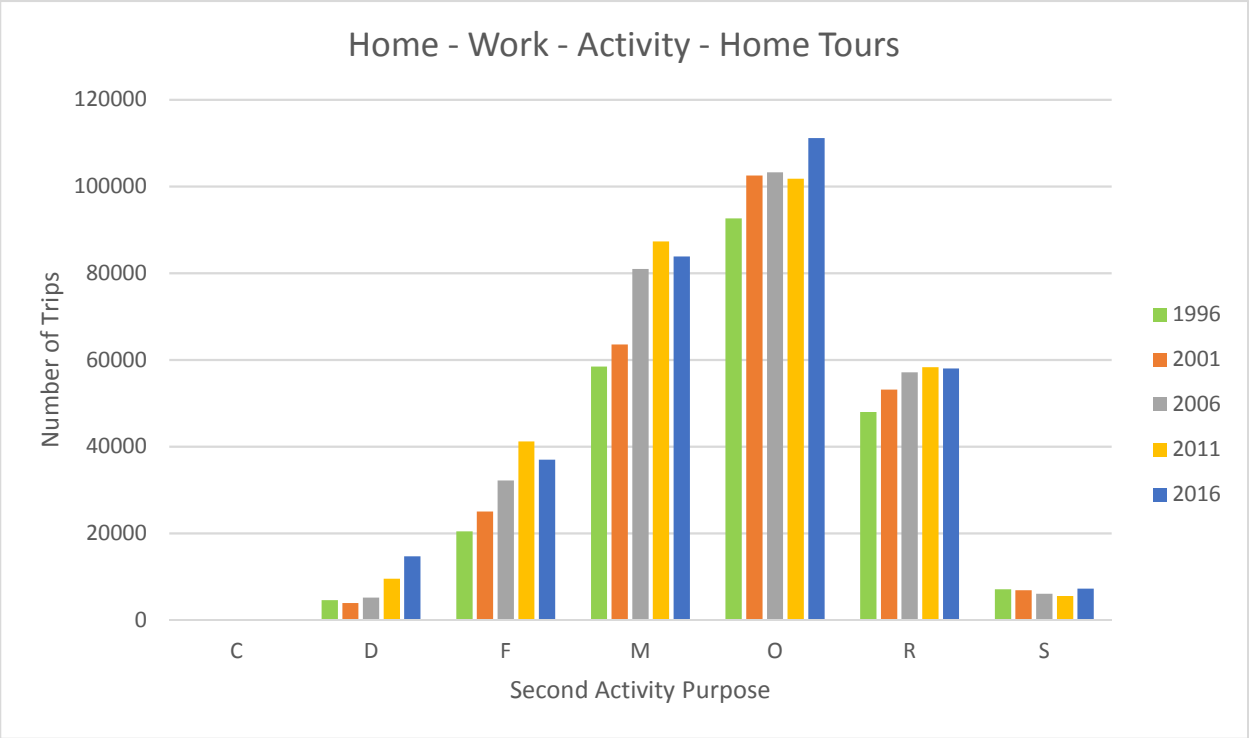


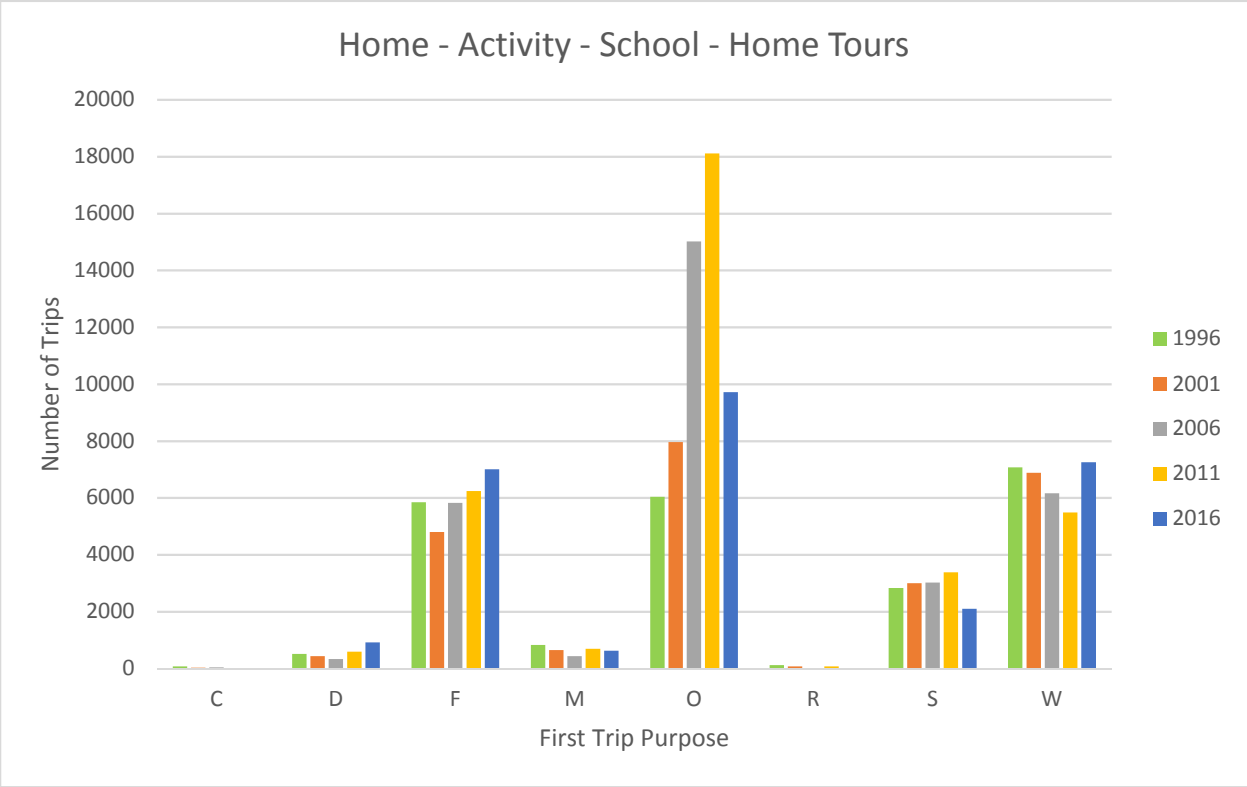

**Figure A5: Trip Start Times by Time of Day by Year by Trip Purpose.**

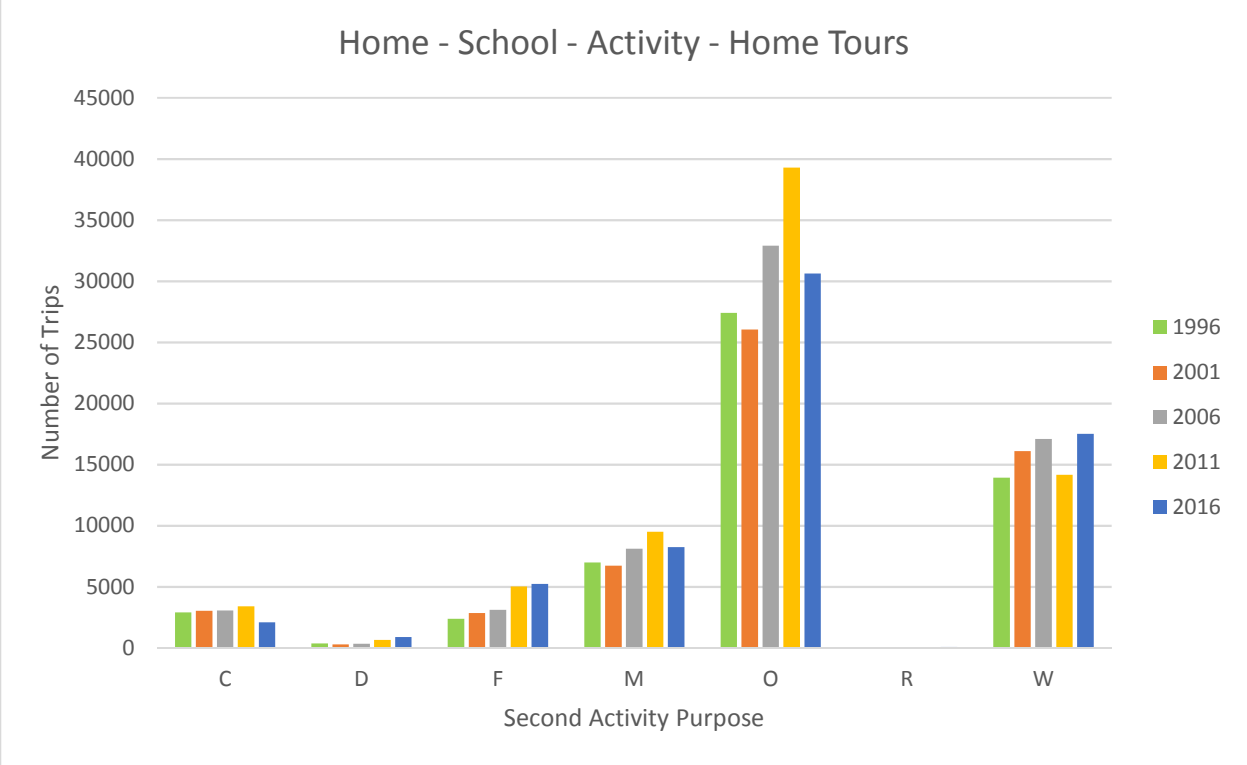
APPENDIX V TOUR ACTIVITY COMPOSITION

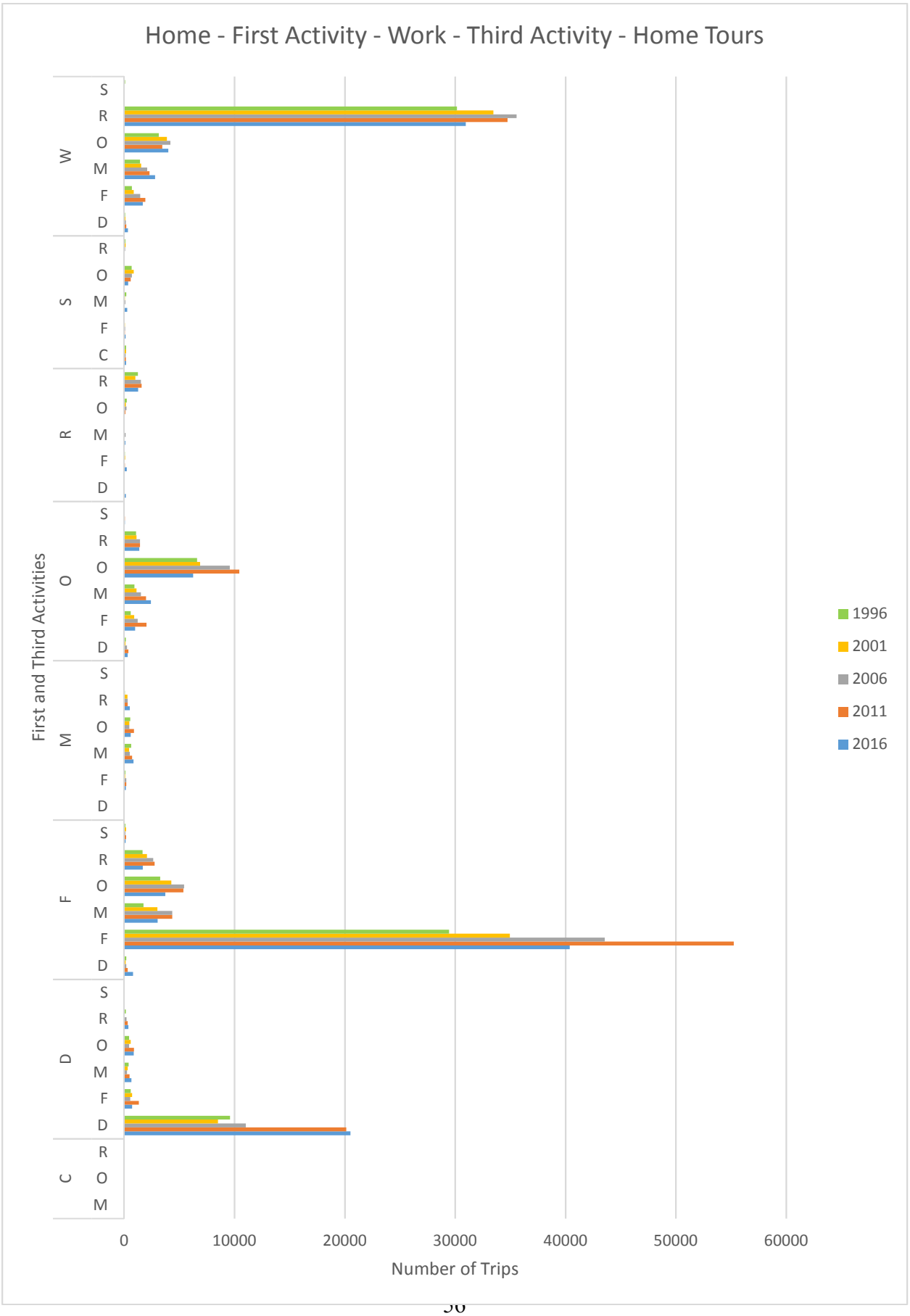


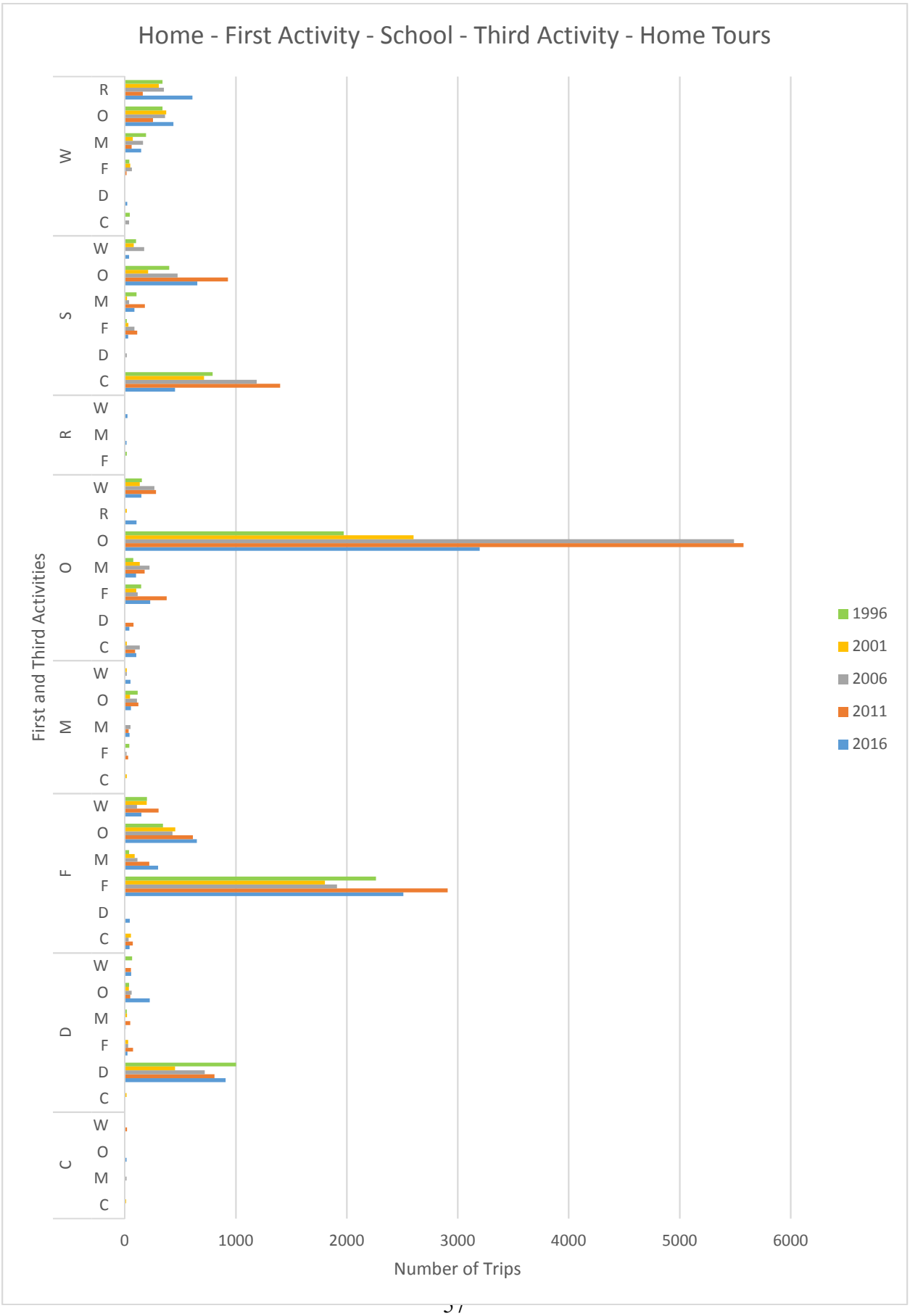




Home - Work - Activity - Home Tours
120000
100000
80000
60000
40000
20000
0
Number of Trips
C
D
F
M
O
R
S
Second Activity Purpose
1996
2001
2006
2011
2016


Home - Activity - School - Home Tours
Number of Trips
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
C
D
F
M
O
R
S
W
First Trip Purpose
1996
2001
2006
2011
2016


Home - School - Activity - Home Tours
Number of Trips
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
C
D
F
M
O
R
W
Second Activity Purpose
1996
2001
2006
2011
2016


Home - First Activity - Work - Third Activity - Home Tours
First and Third Activities
W
S
R
O
M
F
D
C
0
10000
20000
30000
40000
50000
60000
Number of Trips
1996
2001
2006
2011
2016


Home - First Activity - School - Third Activity - Home Tours
First and Third Activities
W
R
O
M
F
D
C
S
W
O
M
F
D
C
R
W
M
F
O
W
R
O
M
F
D
C
M
W
O
M
F
C
F
W
O
M
F
D
C
D
W
O
M
F
D
C
C
W
O
M
C
0
1000
2000
3000
4000
5000
6000
Number of Trips
1996
2001
2006
2011
2016