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NOVA SCOTIA TRAVEL ACTIVITY (NOVATRAC) SURVEY
AND
ENERGY USE AND EMISSION STUDY

Working Paper
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CHAPTER 1: NOVA SCOTIA TRAVEL ACTIVITY SURVEY

1 INTRODUCTION

This report presents a detailed review of the design and conduct of the 2016 version of the Nova Scotia Travel Activity (NovaTRAC) survey. This is the second year for the household travel activity survey to be conducted in the Province of Nova Scotia. The survey was initiated by Dalhousie Transportation Collaboratory (DalTRAC) in partnership with the Province of Nova Scotia and Halifax Regional Municipality (HRM). The survey collected information regarding when, where and how people traveled to assist in measuring and monitoring sustainable transportation and emission indicators for the Province. It also included the addition of health and personal attitudinal questions, to investigate the effects of transportation choice on health and wellbeing.

Travel surveys "aim to collect data which represents, as accurately as possible, the travel behaviour of the population of an area and understand travel patterns to inform transport and land-use planning decisions" (Inbakaran and Kroen, 2011). Travel behaviour analyses offer insight into choices that households and individuals make daily, for example, frequency of trips, mode choice, route choice, and places to visit. This type of information is critical in benchmarking current behaviour and monitoring progress in achieving sustainability goals of communities (Krizek, 2003). Transportation and Planning departments, and municipal policies across the Province of Nova Scotia emphasize the importance of sustainable transportation activities (Halifax Regional Municipality, 2014; Province of Nova Scotia, 2013). However, limited information is available to develop sustainable transportation indicators. The Nova Scotia Travel Activity (NovaTRAC) survey will generate key parameters (e.g. modal split, travel time, and distance travelled) to estimate indicators for the Province.

The survey asked respondents to provide information regarding their socio-demographics and detailed travel activities for a 24-hour period of a typical weekday for each household member. For the 2016 survey, it also asked health and attitudinal questions to allow investigation into the correlation between transportation and health. Surveys were submitted online, through a website created by DalTRAC, which provided flexibility for responses as the website was desktop and mobile friendly.

Although Nova Scotia is relatively new to household travel surveys, the NovaTRAC survey is consistent with other travel surveys conducted across North America. These include Toronto's Transportation Tomorrow Survey (TTS) which is conducted every five years since 1986, Oregon Household Activity Survey which is conducted every ten years since 1994, and Chicago's Travel Tracker Survey 2008 (TTS Transportation Information Steering Committee, 2008; Oregon Modelling Steering Committee, 2011; Bricka, 2007). It is expected that the successful completion of the Nova Scotia Travel Activity survey for a second year will further enforce the argument for the biannual continuation of travel activity surveys in Nova Scotia.

This report is organized as follows: chapter one will begin by discussing the NovaTRAC survey design, web tool development, promotion, and distribution. Then data processing and analysis of results are presented and the report concludes with recommendations and lessons learned for future surveys. Chapter two describes the direct application of the NovaTRAC results to determine energy use and emission estimates for the province of Nova Scotia. It also describes the methods and results from that analysis.

2 SURVEY DESIGN

The survey design followed that of the NovaTRAC 2015 survey, although the 2016 survey introduced new health and attitudinal questions. The survey was designed to collect information in five sections: household characteristics, household members' information, health information, attitudinal questions and a 24-hour travel log of each member. The survey asked respondents to provide the following information:

I. Household Characteristics
   - Number and type (make and model) of vehicles available for personal use
   - Number of bicycles
   - Public transit use
   - Active transportation use
   - Location of residence, ownership status and type of dwelling
   - Household size and income

II. Household Members Information
   - Demographics (age, education, employment, etc.)
   - Possession of a valid driver's license and transit pass
   - Primary mode for commuting
   - Distance and travel time of one-way commute

III. Health Information
   - General health description
   - Mental health description
   - Physical activity level

IV. Attitudinal Questions
   - Transportation and vehicle preferences
   - Feelings towards commuting
   - Feelings towards their neighbourhood
   - Concern towards the natural environment

V. 24-hour Travel Activity Log
   - Location of each place the household member traveled
   - Arrival and departure time for each location
   - Mode of transportation used
   - Reason for making the trip

As a continuation of the NovaTRAC 2015 survey, the NovaTRAC 2016 questions had to receive ethics re-approval. The survey was originally approved for deployment in October 2015, and re-approved in September, 2016. The survey was promoted through social media channels, partnerships with local organizations with large list serves, and universities across Nova Scotia to send out to faculty, students and staff.

The NovaTRAC survey website, www.daltraclab.com, was re-launched and advertised to be used by the public to submit their travel information. After signing in with the passcode "nova2016", the participants were asked to read and agree to the consent form and then continue to the survey. After the participating household agreed to the consent form, the session was saved in a private database within the DalTRAC lab. The website results were automatically processed and locations on the maps were geocoded. For the participant, once the survey was complete and submitted, they had the option to enter for a chance to win one $200 VISA gift card or one of ten $25 VISA gift cards by providing their email address.

3 WEB TOOL DEVELOPMENT

The NovaTRAC survey system consists of two separate connected interfaces: the front-end and back-end. The user front-end interface is the main web survey platform that enables the user to view and complete the travel activity questions online using any available browser on systems such as smartphone and personal computers. The back-end is the DalTRAC administrative server that includes the data processing script and a database designed to collect and store survey responses. Figure 1 shows how the NovaTRAC survey system is set up.

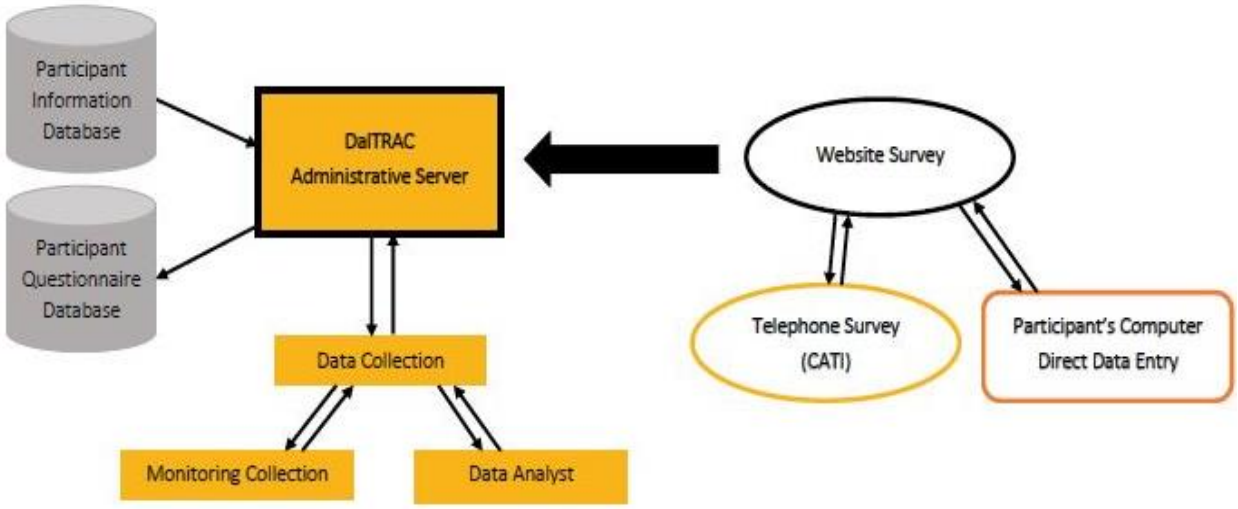


FIGURE 1: NOVATRAC NETWORK SETUP

I. FRONT-END INTERFACE

The front-end interface, which is available for most systems with internet connectivity, provides a platform that collects survey data from a variety of residents living in Nova Scotia with the right access code provided in correspondence. It was developed using various web programming language such as HTML, CSS (Bootstrap), Java Script and PHP. This web interface enables the user to send data to back-end seamlessly from anywhere in the province, as long as they have access to the internet or mobile device. The major purpose for the front-end interface design is not only to collect travel information but to automatically geocode this information using built-in script provided by Google Map API.

II. BACK-END INTERFACE

All response data collected from the front-end interface were processed and uploaded to the database via the back-end interface. The administrative server was configured using Internet Information Services, an extensible web server provided by Microsoft. The server was given a unique IPv4 address which allowed DalTRAC to transmit information from lab computers as well as relate with the third party using a local port.

To make this port accessible publicly without ambiguity, a domain called daltraclab.com was registered and the IP address of the domain was linked to the lab server IP address. The data processing script was developed in-house using Structure Query Language (SQL) and PHP. The in-house database design enabled collection, monitoring and analysis of the survey correspondence without the use of external party

software. This enabled DalTRAC to monitor performance and efficiency, and allowed relevant changes to be made based on observations.

All information transmitted on the website is 100% secured as there is no third party access to the administrative server or survey results, even after the completion of the exercise. The only port to access the survey result files is in the DalTRAC lab which is under strict key card access.

3.1 Web Survey

The original survey website was to be created using Survey Systems Computer-Assisted Web Interviewing (CAWI) software, however a prototype was created for this project which provided more flexibility for the user. This survey website could be accessed by desktop computer or by smartphone or tablet. The web based survey was tested multiple times throughout the development process by a variety of parties, including planners, engineers, Dalhousie professors, students, etc.

The web survey saved the household responses in sessions. Once a household respondent entered their survey access code and agreed to the consent form the session began and responses were saved in the database. The session ended when the respondent selected “save and exit” at the bottom of the survey page. The respondent was then taken to a separate page which asked for their name and email address, if they would like to be entered for the chance to win a VISA gift card. The household respondents name and email address were saved in a separate table which was not connected to the household responses.

4 Survey Promotion

The NovaTRAC 2016 survey was open to the public and depended on promotion through multiple channels. These channels include DalTRAC's website, social media outlets (Twitter and Facebook), community newsletters and partnerships. To entice participants to complete the survey, incentives were used such as a draw for VISA gift cards.

4.1 DalTRAC Website

DalTRAC created a NovaTRAC Survey link on its website to ensure participants could find information regarding the survey. The website link, www.dal.ca/sites/daltrac/novatrac-info.html, includes links to the web survey, a promotional video, printable travel logs and our list of partners. Our team also promoted the survey weekly on our local Twitter and Facebook pages, and purchased paid promotions monthly.

4.2 Promotional Video

In the early stages of NovaTRAC development, PLANifax, a local production team, created an informative video to highlight the survey. This promotional video is available to view on DalTRAC's website, and on social media sites.

4.3 Community Promotions

The DalTRAC team reached out to all Halifax Councillors to promote the survey within their contacts and constituents. The councillors from District 2 (Preston-Chezzetcook-Eastern Shore), District 4 (Cole Harbour-Westphal), District 6 (Harborview-Burnside-Dartmouth East), District 13 (Hammonds Plains-St. Margret's), and District 16 (Bedford-Wentworth) shared the survey on their Twitter and Facebook pages. The survey was even featured in the December edition of District 2 community newsletter which was mailed out to all residents in that area. DalTRAC also partnered with the Downtown Halifax Business Commission and the Sackville Business Commission for this project. Both organizations promoted the survey in their August issues of their newsletters. DalTRAC would like to thank the following organizations for providing their support:

4.4 Survey Incentives

For the completion of the NovaTRAC survey, DalTRAC offered participants the chance to be entered to win a $200 VISA gift card or one of ten $25 VISA gift cards. The participant entered by entering their name and email address on the website. This information was saved separately from household responses. The draw for these gift cards was conducted in March, 2017.

5 Data Preparation

The data preparation of the NovaTRAC survey involves extensive cleaning and processing. A detail of the data preparation process is described below.

5.1 Data Cleaning and Processing

The NovaTRAC survey collected a total of 591 household responses through an online survey between July 16th, 2016, and December 16th, 2016. Following the completion of the survey period, data cleaning was conducted which involved extensive checks for range, consistency, and typographical errors in the full database.

First, range checking was conducted by manually reviewing the categorical values such as "1 = Yes" and "2 = No", and the chronological values such as "2 = 2 people living in my home" to ensure that all values occurred within the range specified (Appendix A shows the survey code book). The second step in data cleaning and processing was checking consistency between relevant previous questions and checking for missing values. For instance, if the respondent answered no to having a valid driver's licence, the respondent should not report travelling as auto driver throughout the 24-hour period. Similarly, checks were conducted on a respondent's mode of transportation for a trip and corresponding travel time (i.e. if the reported travel distance is 5 km in 1 hour the respondent most likely walked). Lastly, typographic errors were checked which includes reviewing misspelled or inconsistent information.

In addition, some activity locations were missing longitude and latitude values. The longitude and latitude of such addresses were derived by geocoding the civic address information using the software BatchGeo. Finally, for each trip, the distance between the origin and destination was measured on the HRM road network using the Network Analyst tool in ArcGIS.

6 Data Analysis

After cleaning and processing the data set, an exploratory analysis was conducted to characterize the travel behaviour and travel choices of the sample and compare to Statistics Canada General Social Survey 2005 and 2010, Statistics Canada Census 2006 and 2011, National Household Survey 2011, Household Mobility and Travel Survey (HMTS) 2013, and the NovaTRAC 2015 survey, with a focus on understanding the travel trends among the Nova Scotia population.

6.1 Sample Characteristics

The following sample characteristics describe the individual and household demographic information for the sample.

6.1.1 Employment Level

Over half of the respondents were employed full-time. Students comprised 13% of the survey population, followed by part-time employees with 7% and retired respondents with 7% (Figure 2).

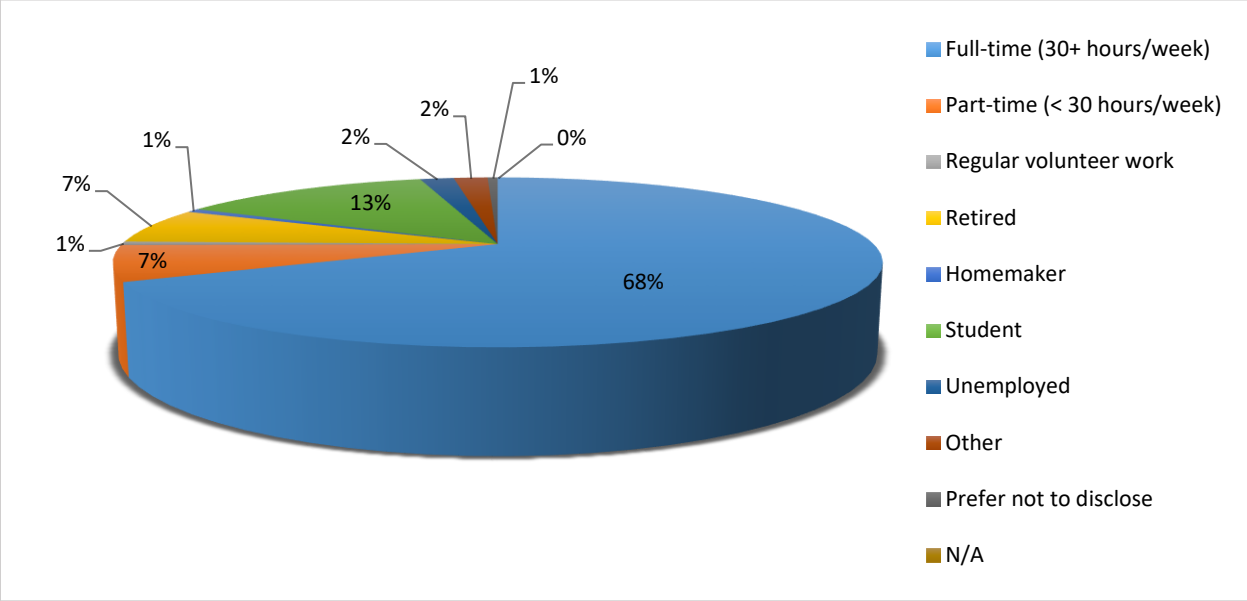


FIGURE 2: EMPLOYMENT LEVEL

6.1.2 Occupation

Just under one quarter of the respondents have an occupation in education, law, social, community and government services, followed by 15% of respondents working in business, finance and administration occupations, and 11% in management occupations (Figure 3).

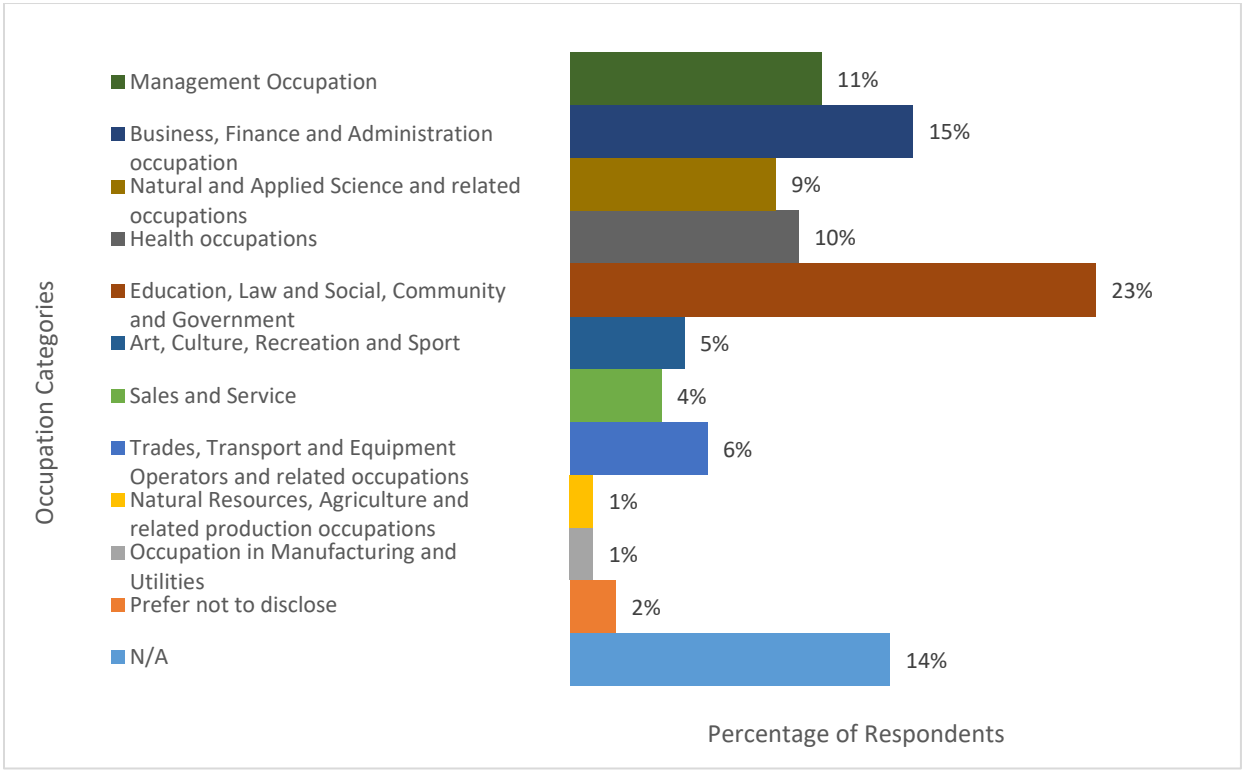


FIGURE 3: OCCUPATION

6.1.3 Household Income

Of the NovaTRAC respondents, 33% have a household income of over $100,000 per year (Figure 4). Approximately 25% of respondents have a household income of less than $50,000 per year.

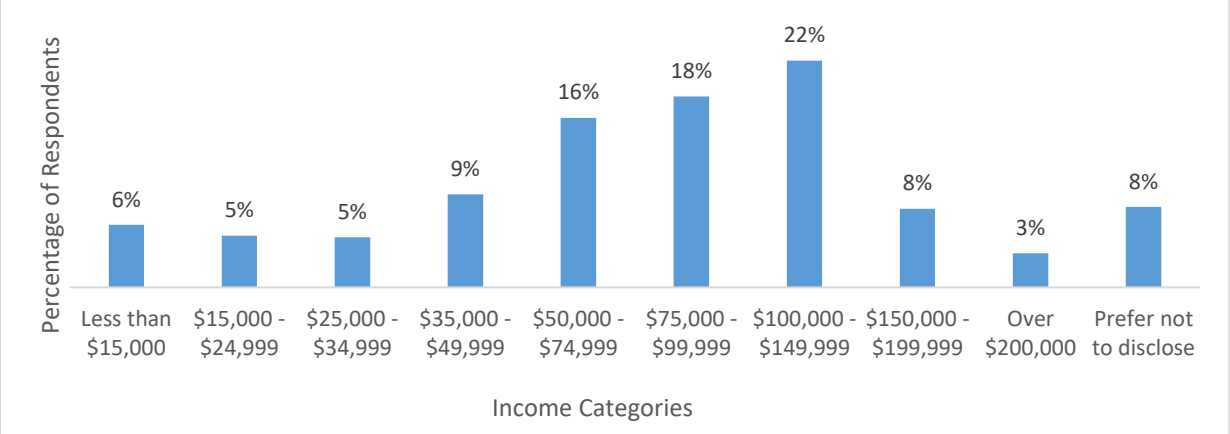


FIGURE 4: HOUSEHOLD INCOME

6.1.4 Education Level

Approximately 98% of respondents have a high school diploma or higher, with 61% reporting to have a university degree (Figure 5).

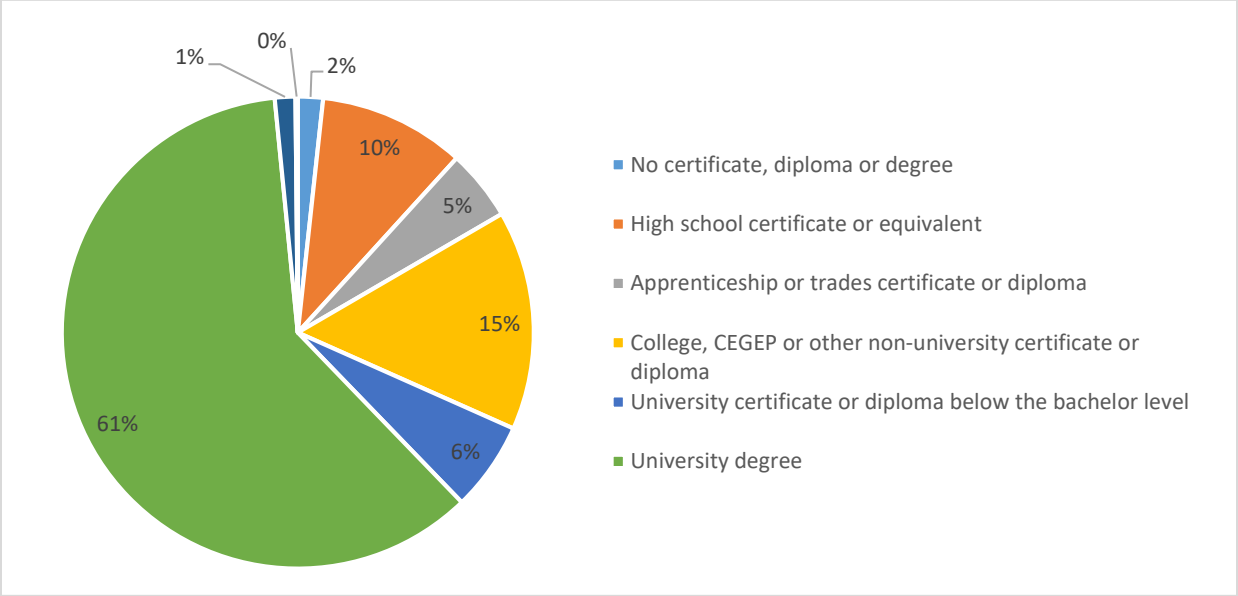


FIGURE 5: LEVEL OF EDUCATION

6.1.5 Household Structure

Most of the NovaTRAC respondents (61%) live in a single detached dwelling (Figure 6), followed by apartments with less than 5 storeys (13%) and apartments with more than 5 storeys (9%).

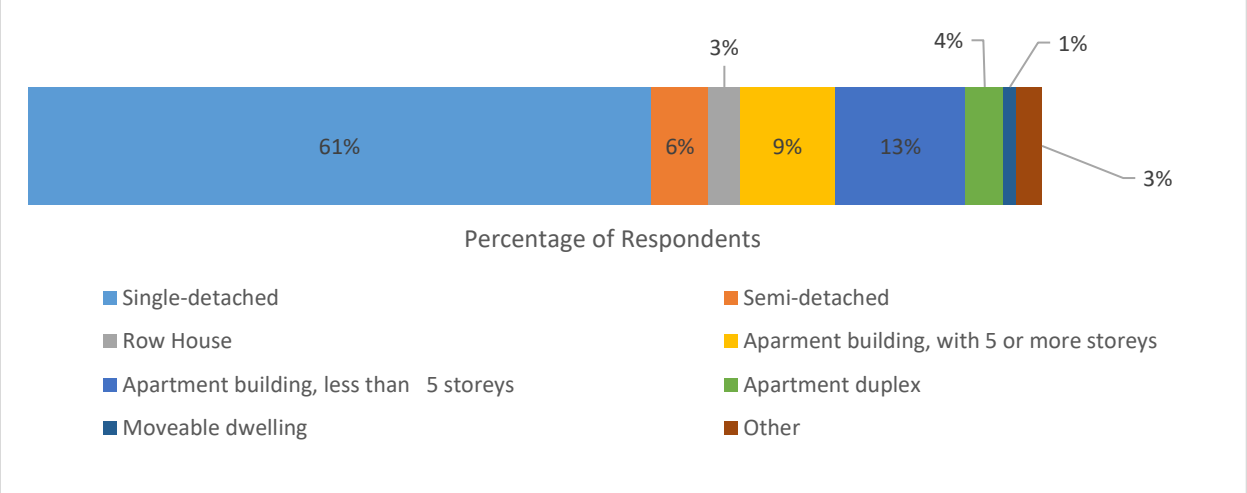


FIGURE 6: DWELLING TYPE

Approximately, 40% of respondents live in a 2-person household, and 18% live alone (Figure 7).

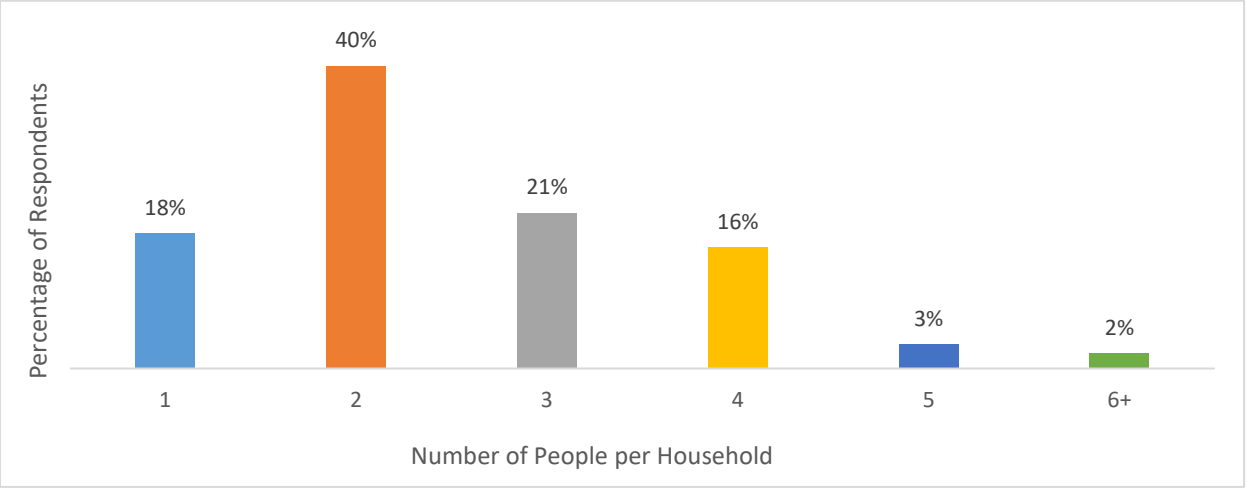


FIGURE 7: NUMBER OF PEOPLE PER HOUSEHOLD

Over half (58%) of NovaTRAC respondents are female, 41% are male, and 1% prefer not to disclose (Figure 8).

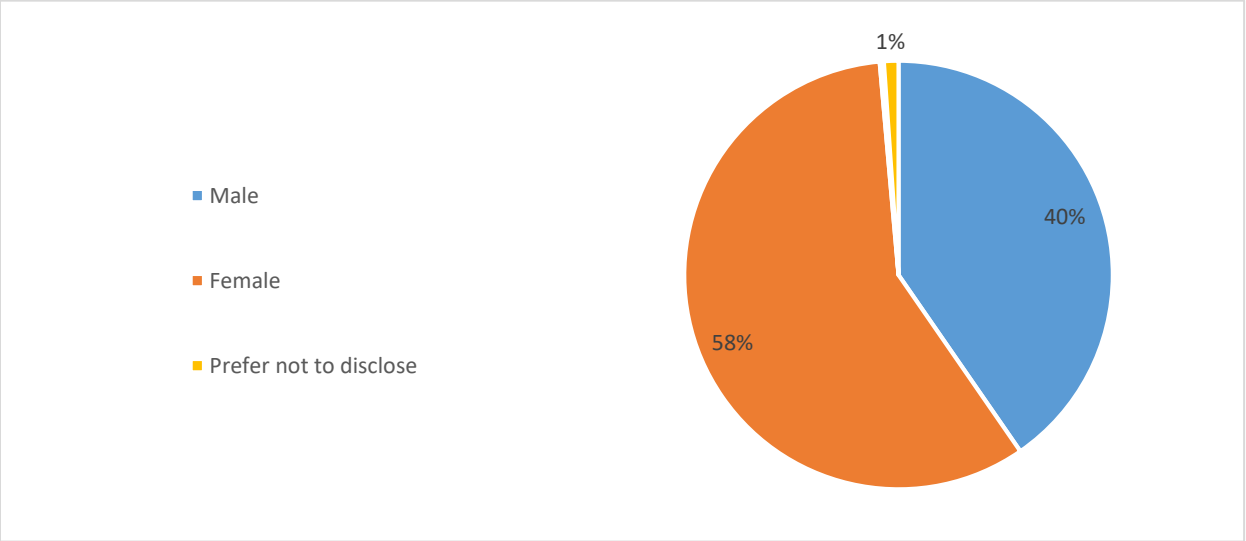


FIGURE 8: GENDER

6.1.6 Vehicles per Household

Almost 42% of households own at least one vehicle, and 32% own two vehicles (Figure 9).

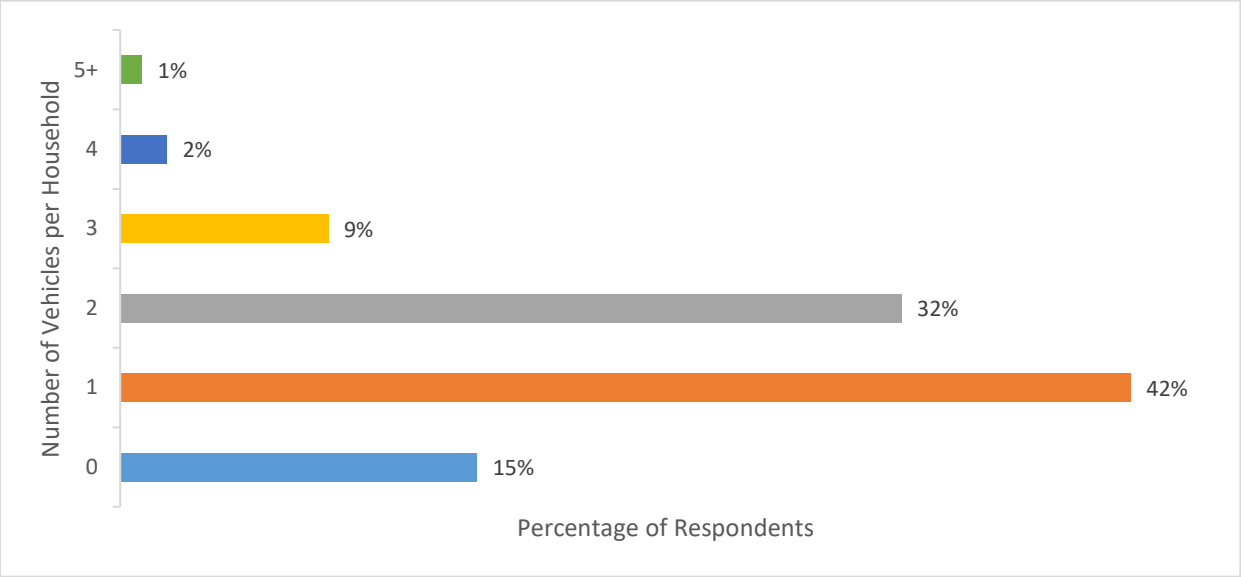


FIGURE 9: NUMBER OF VEHICLES PER HOUSEHOLD

6.1.7 Bicycles per Household

Over half (51%) of households own at least one bicycle and 33% own two or more bicycles (Figure 10).

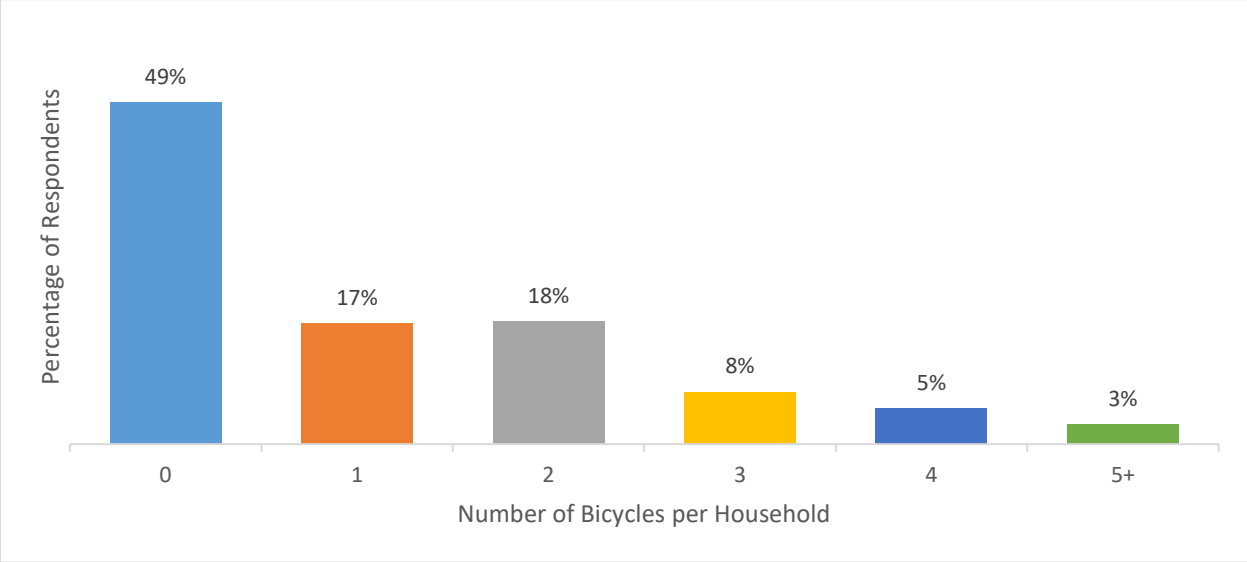


FIGURE 10: NUMBER OF BICYCLES PER HOUSEHOLD

6.2 Health and Attitude

6.2.1 Health Status

Only 1% of respondents reported having poor health. Approximately, 42% reported having very good health, with 20% claiming to have excellent health (Figure 11).

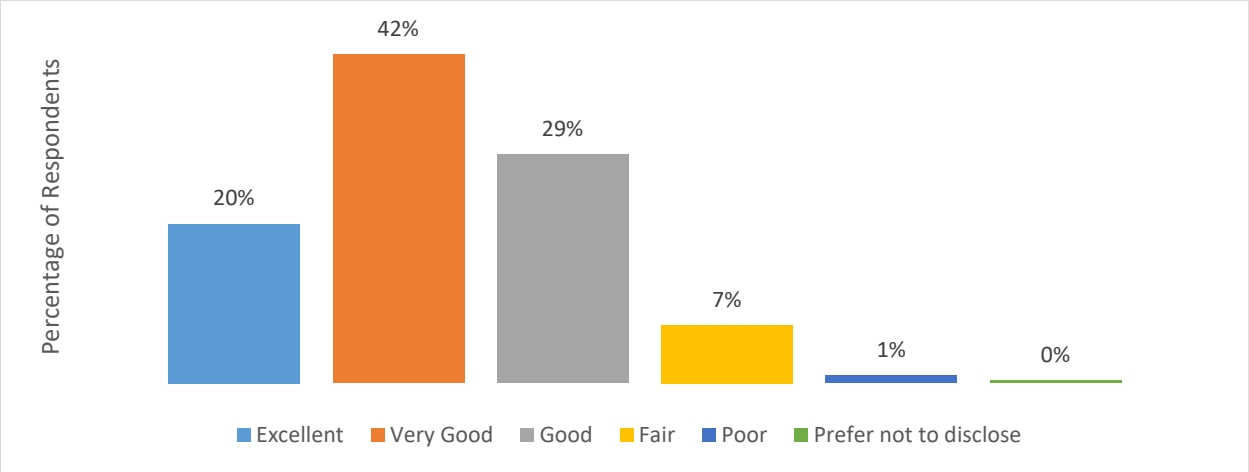


FIGURE 11: PERSONAL HEALTH STATUS

Respondents who regularly choose auto and active transportation perceive themselves in better health than those who take transit (Figure 12).

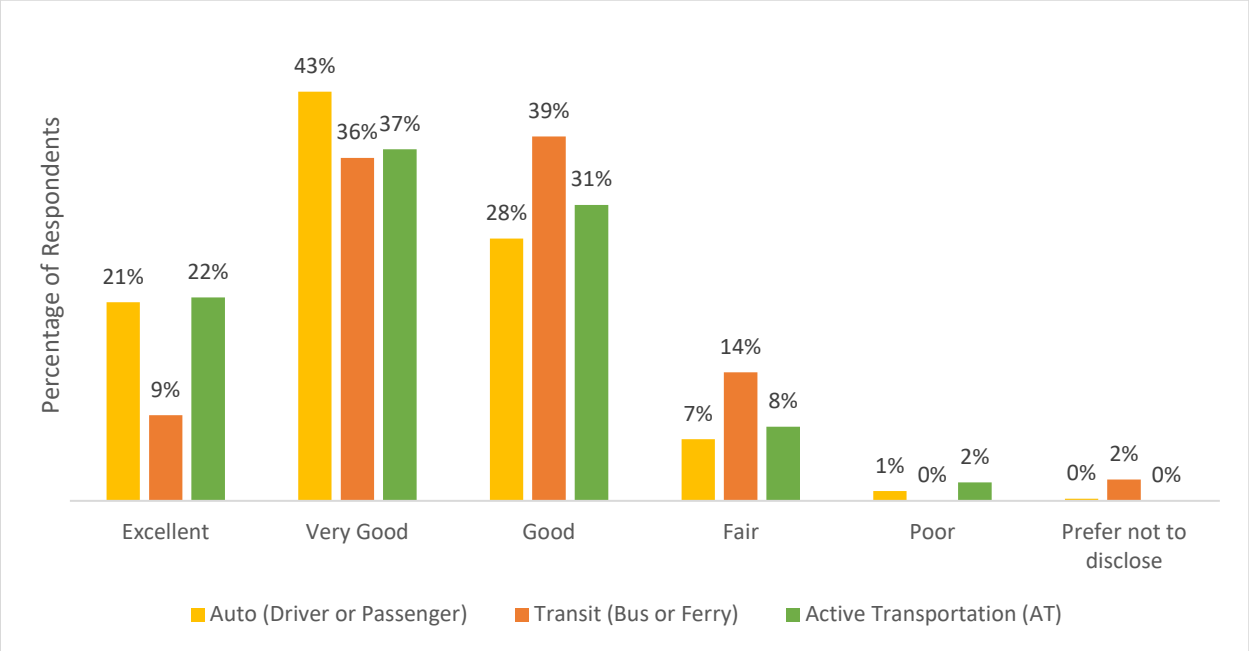


FIGURE 12: PERCEIVED HEALTH BY MODE CHOICE

6.2.2 Happiness and Interest

The majority (65%) of respondents described themselves as happy and interested in life. Approximately, one quarter (25%) described themselves as somewhat happy and 1% described themselves as unhappy with little interest in life (Figure 13).

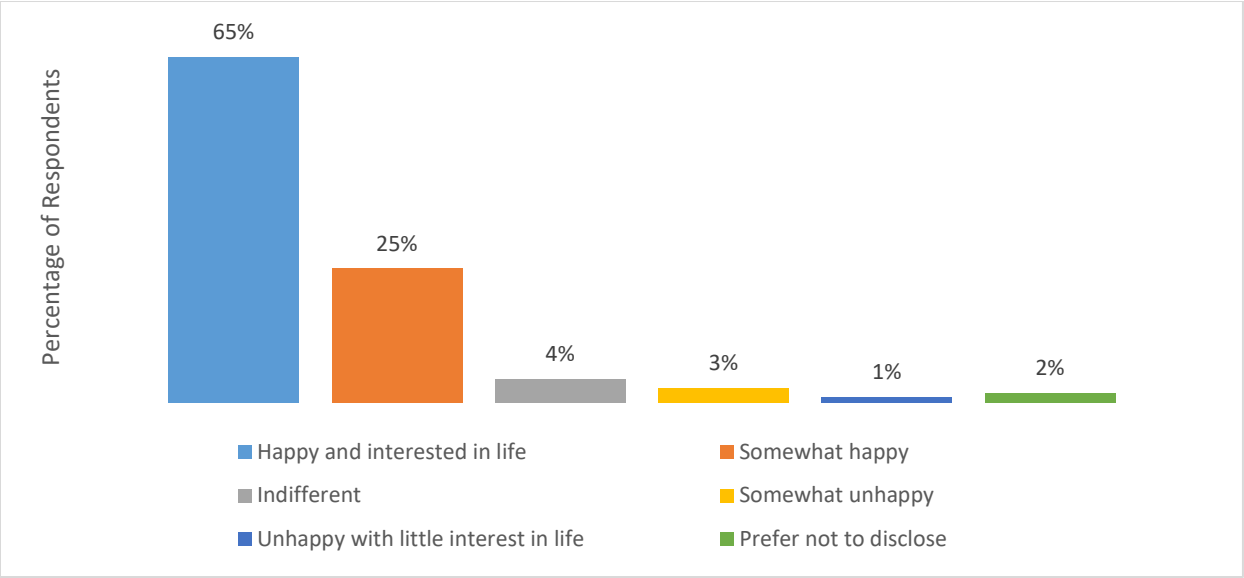


FIGURE 13: PERSONAL HAPPINESS

Most respondents were happy and interested in life, or somewhat happy, for all mode choices. However, 8% of active Ttansportation users responded as somewhat unhappy and 2% stated they are unhappy with little interest in life (Figure 14).

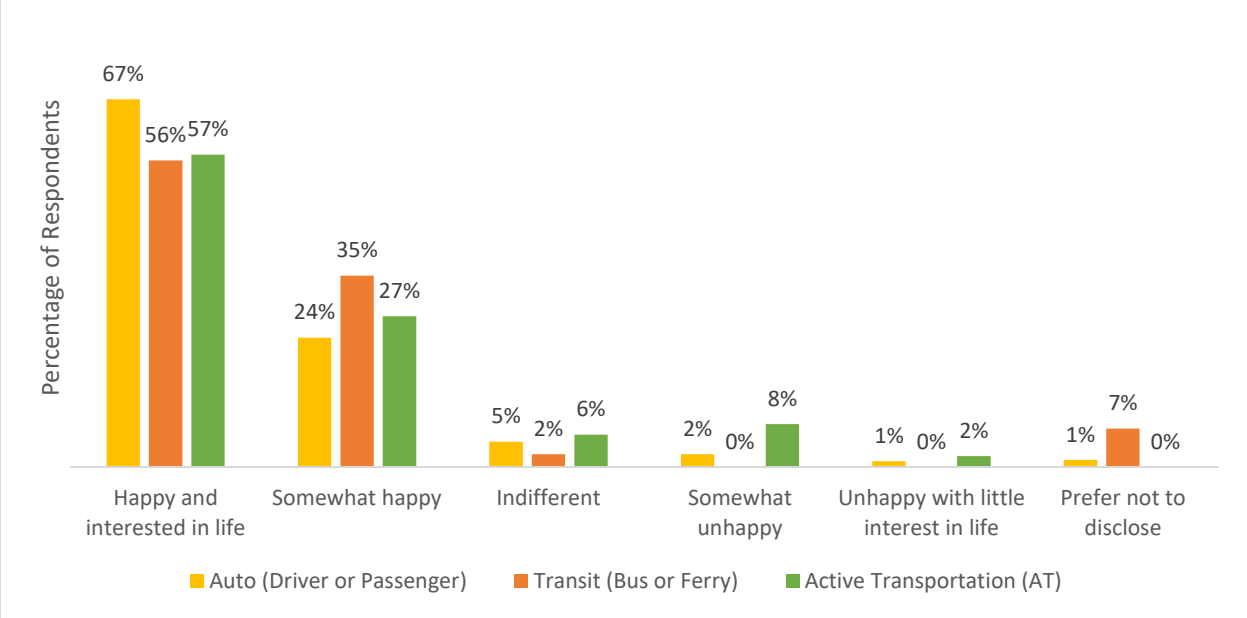


FIGURE 14: HAPPINESS BY MODE CHOICE

6.2.3 Stress Levels

Approximately one third of respondents (35%) described their typical weekday as a bit stressful. The next most popular categories were somewhat stressful with 30%, and not very stressful with 23% (Figure 15).

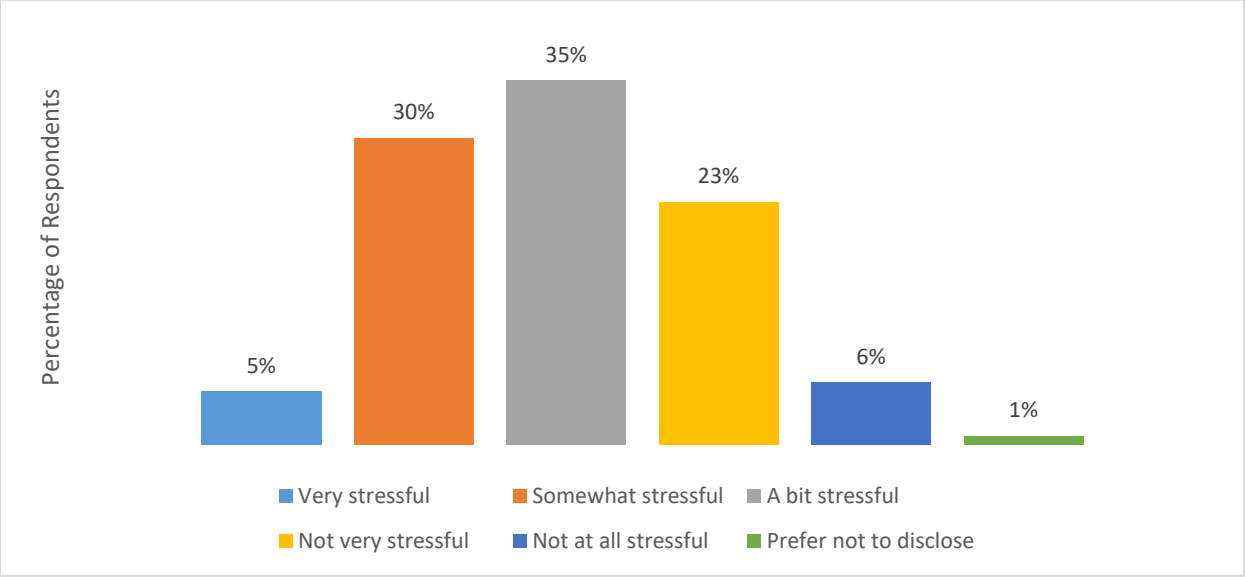


FIGURE 15: STRESS IN A TYPICAL WEEKDAY

When comparing stress in a typical weekday to mode choice, auto and active transportation users report very stressful or somewhat stressful days more so than transit users (Figure 16).

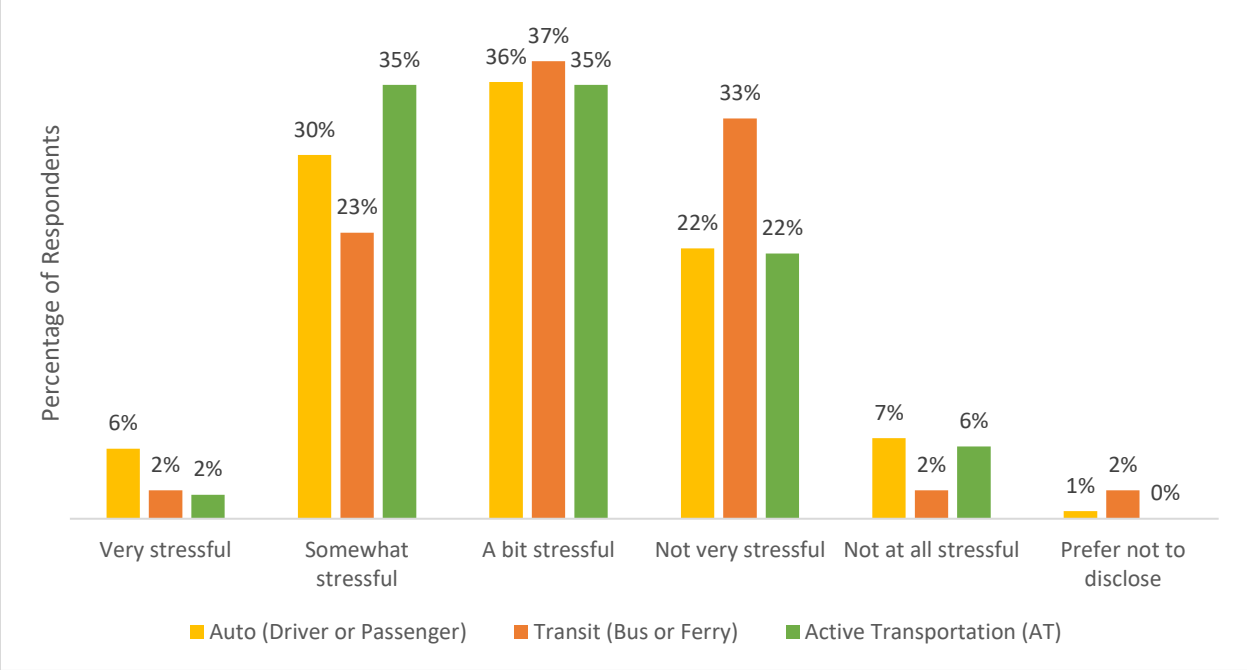


FIGURE 16: STRESS IN A TYPICAL WEEKDAY BY MODE CHOICE

6.2.4 Physical Activity Levels

Approximately, 43% of respondents described themselves as moderately physically active. Approximately one quarter (26%) described themselves as a bit physically active, and 13% described themselves as very physically active (Figure 17).

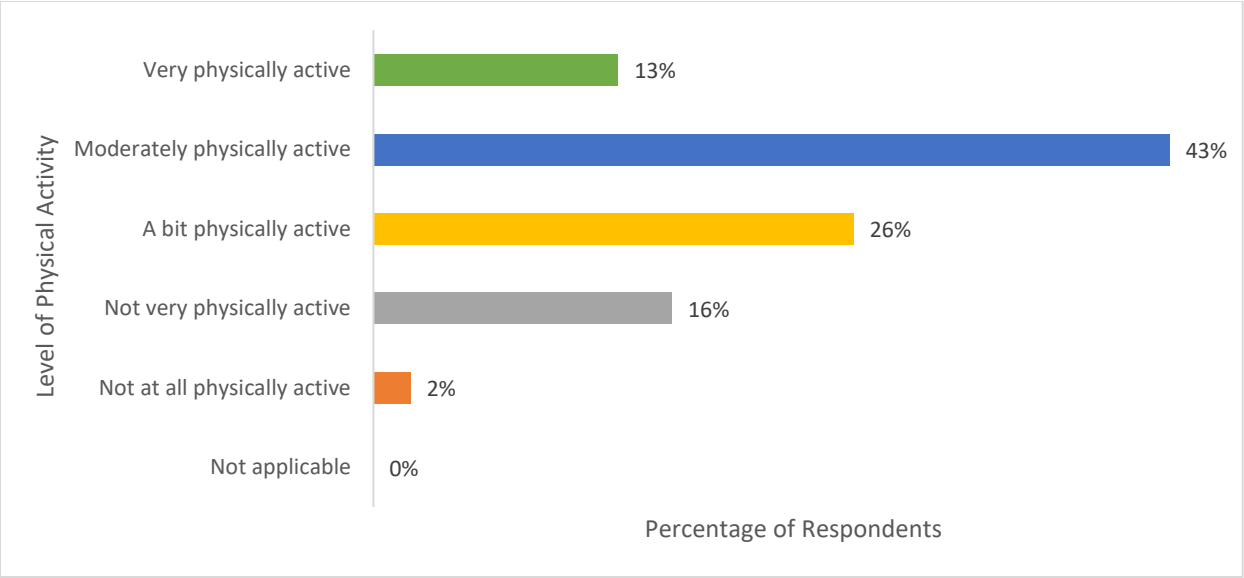


FIGURE 17: LEVEL OF PHYSICAL ACTIVITY

Over half of auto and active transportation users report themselves as very physically active or moderately physically active. Surprisingly, 6% of active transportation users reported being not very physically active and 4% reported being not at all physically active (Figure 18).

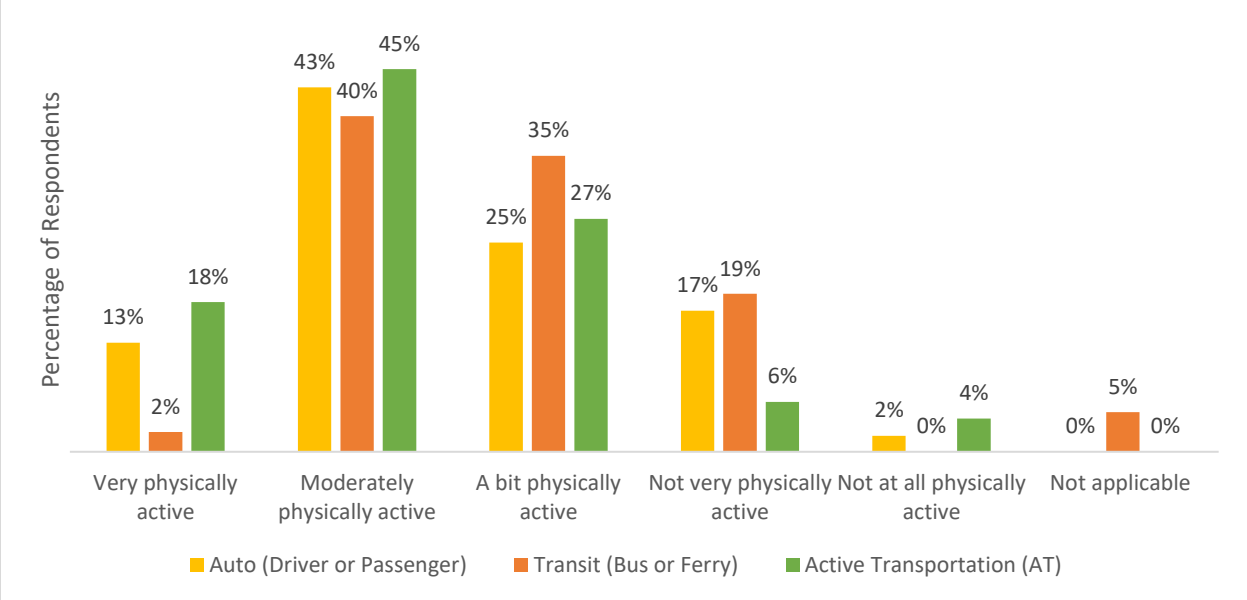


FIGURE 18: PHYSICAL ACTIVITY BY MODE CHOICE

6.2.5 Attitude Towards Transportation and Lifestyle

Figure 19 shows the answers to various attitudinal questions related to transportation and the environment.

	Percentage of Respondents				
Statement	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I enjoy riding a bicycle	32%	30%	20%	9%	9%
I prefer walking to driving whenever possible	31%	33%	19%	13%	4%
I feel happier when riding a bike	10%	15%	28%	24%	23%
I take pride in owning a car	15%	32%	32%	11%	10%
Driving provides me with freedom	41%	42%	11%	5%	1%
I am fully satisfied with my commute	24%	34%	21%	16%	5%
My commute makes me feel stressed	6%	14%	23%	34%	23%
I am happy with where I live	47%	38%	8%	5%	2%
I invest a lot of time into the community I live in	15%	29%	32%	19%	5%
A suburban environment offers the best quality of life	7%	23%	30%	23%	17%
I limit my driving because it is bad for air quality	9%	21%	30%	32%	8%
I consider global warming a major concern	44%	38%	14%	3%	1%

FIGURE 19: ATTITUDINAL QUESTIONS RESPONSE TABLE

6.2.5.1 I ENJOY RIDING A BICYCLE

Although most of all mode users do enjoy riding a bicycle, active transportation users responded with a higher percentage of strongly agree (Figure 20).

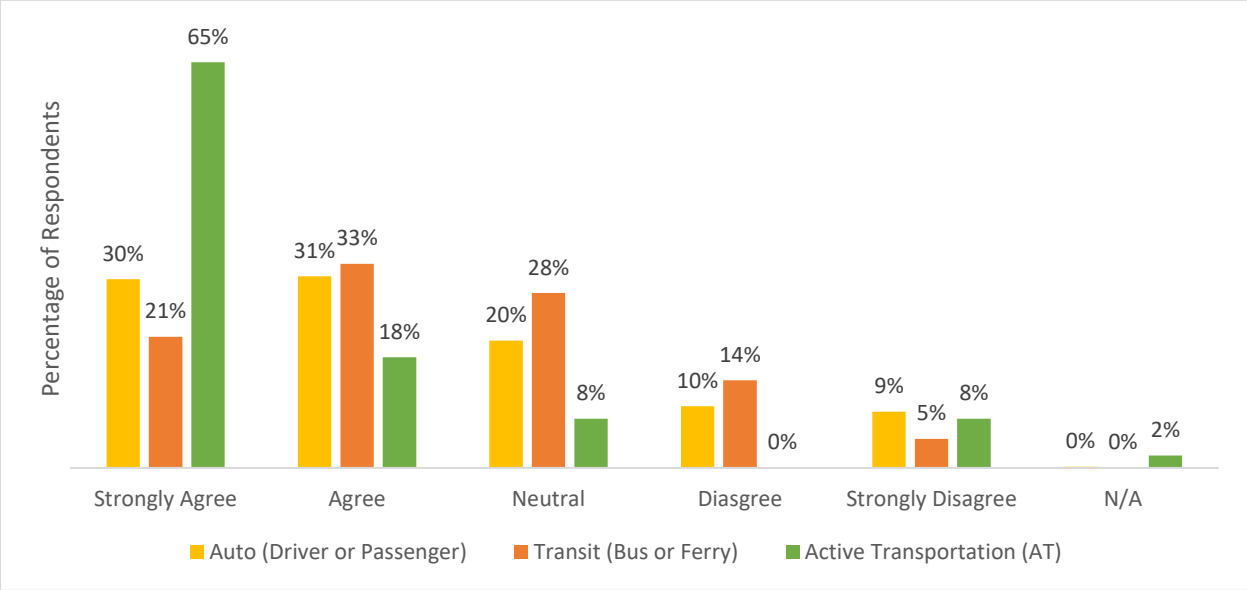


FIGURE 20: "I ENJOY RIDING A BICYCLE" BY MODE CHOICE

6.2.5.2 I PREFER WALKING TO DRIVING WHENEVER POSSIBLE

Similarly to the previous response, active transportation users responded in higher agreement that they prefer to walk over driving whenever possible. Interestingly, 4% of auto users and 4% of active transportation users do not prefer walking to driving whenever possible (Figure 21).

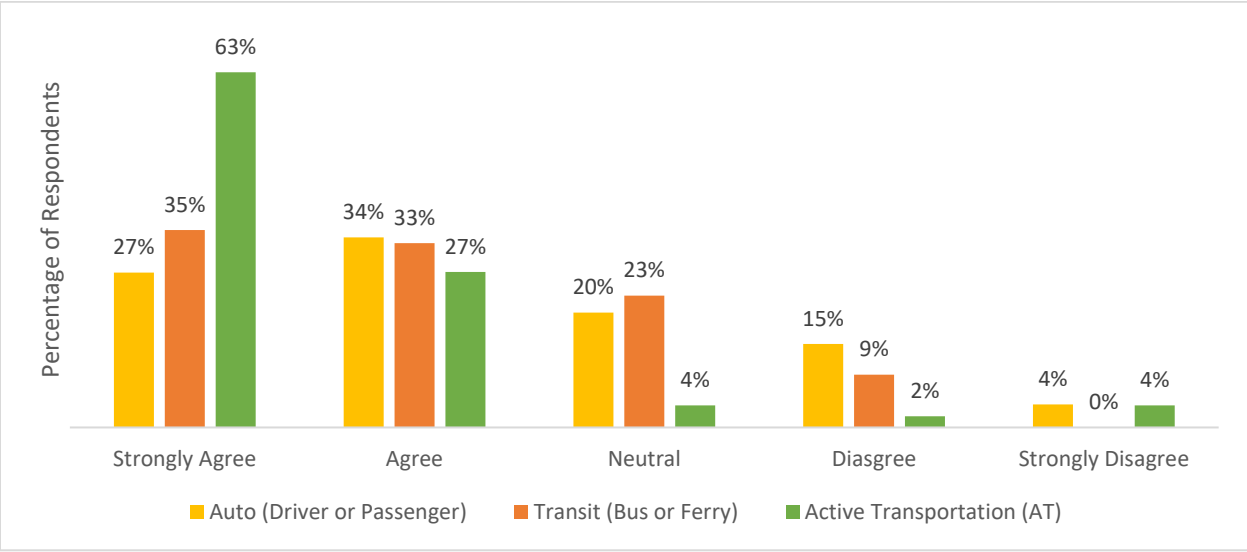


FIGURE 21: "I PREFER WALKING TO DRIVING WHENEVER POSSIBLE" BY MODE CHOICE

6.2.5.3 I FEEL HAPPIER WHEN RIDING THE BUS THAN DRIVING

Only 42% of transit users responded with strongly agree or agree to feeling happier when riding the bus to driving. Over half (51%) of auto users disagree or strongly disagree to feeling happier when riding the bus than driving (Figure 22).

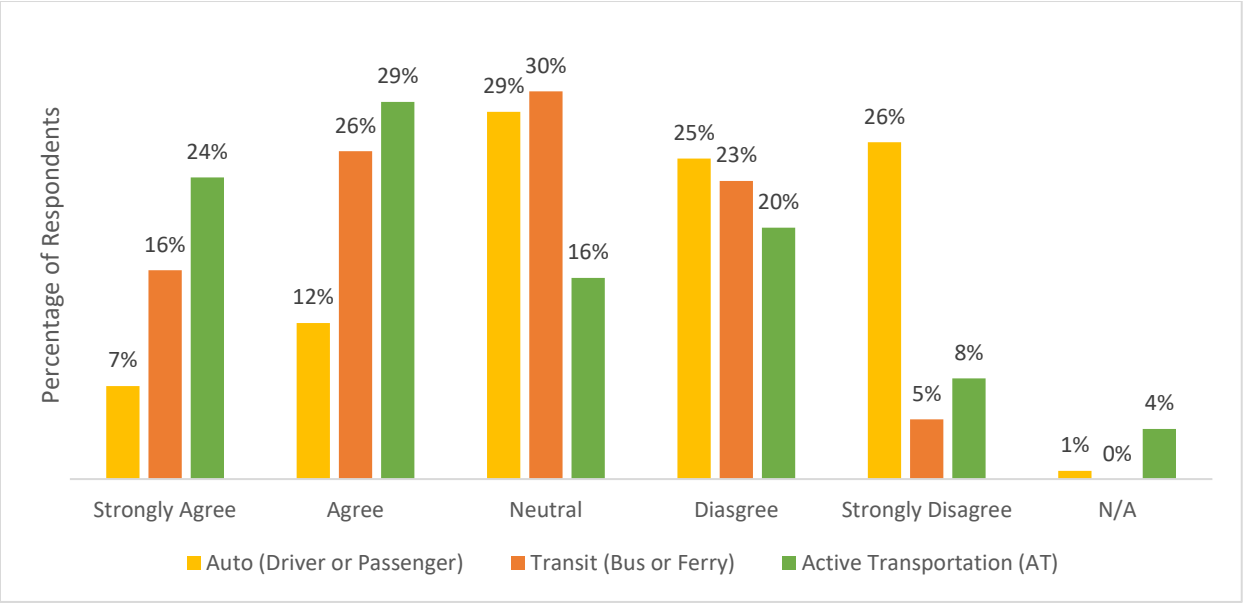


FIGURE 22: "I FEEL HAPPIER WHEN RIDING THE BUS THAN DRIVING" BY MODE CHOICE

6.2.5.4 I TAKE PRIDE IN OWNING A CAR

Most auto users (54%) take pride in owning a car, and the highest percentage of transit users (47%) remain neutral on the subject. Over half (55%) of active transportation users reported that they do not take pride in owning a car (Figure 23).

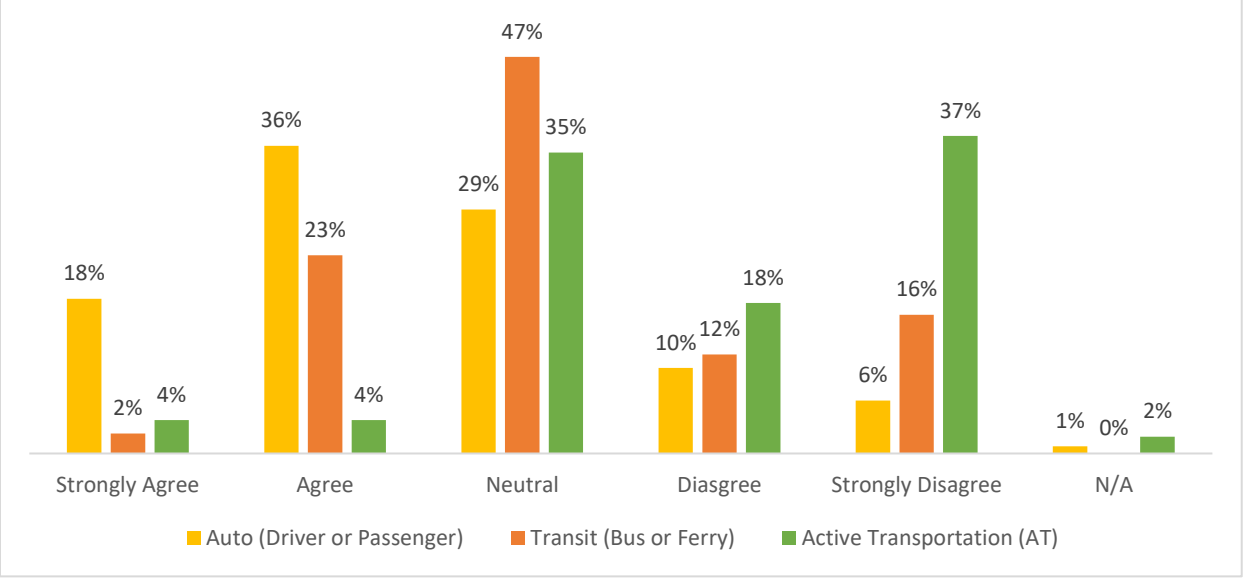


FIGURE 23: "I TAKE PRIDE IN OWNING A CAR" BY MODE CHOICE

6.2.5.5 *Driving provides me freedom*

Over half of all modes agree or strongly agree that driving provides them freedom (Figure 24).

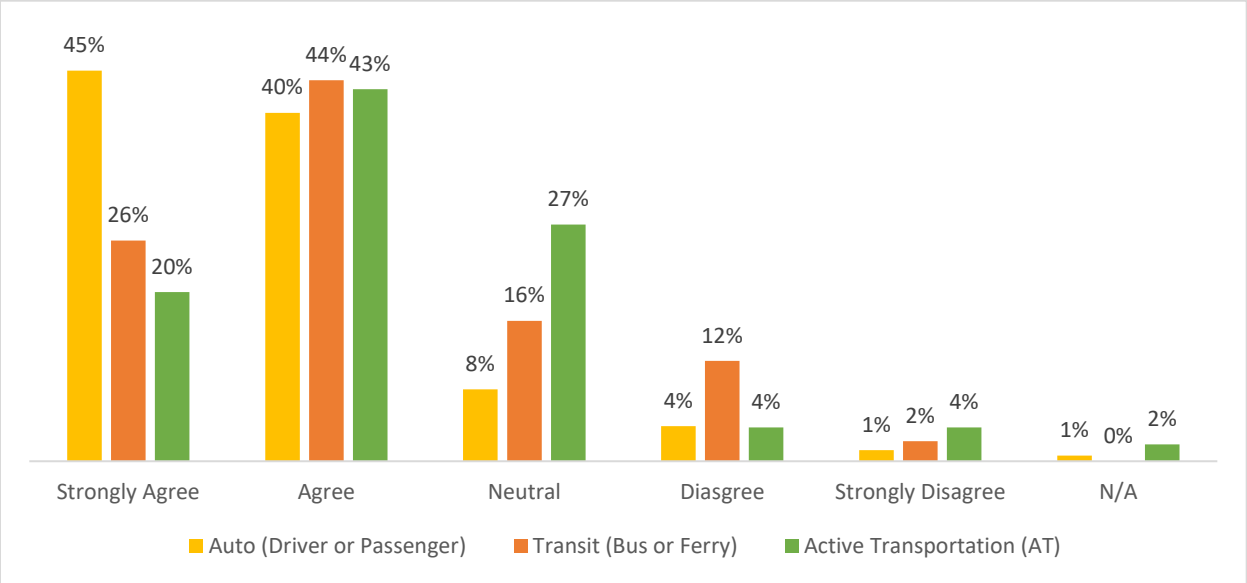


FIGURE 24: "DRIVING PROVIDES ME FREEDOM" BY MODE CHOICE

6.2.5.6 *I am fully satisfied with my commute*

Active transportation users were most satisfied with their commute. Alternatively, transit users were the most unsatisfied with their commute (Figure 25).

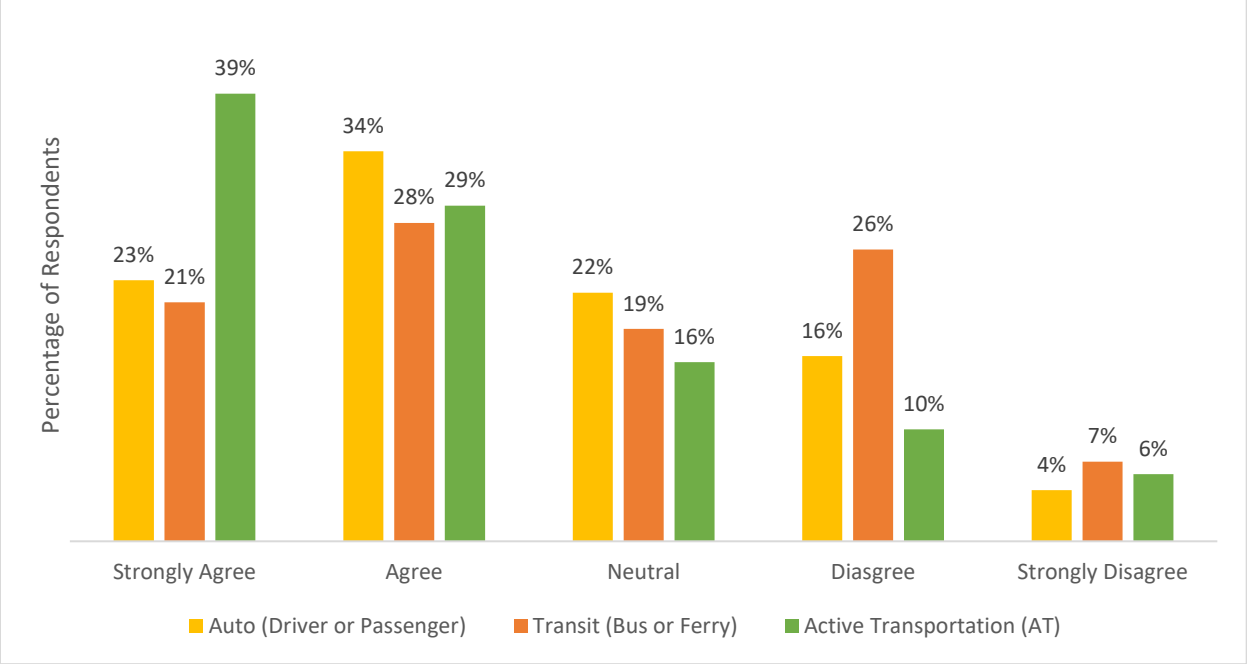


FIGURE 25: "I AM FULLY SATISFIED WITH MY COMMUTE" BY MODE CHOICE

6.2.5.7 My commute makes me feel stressed

Generally, respondents from all modes do not feel that their commute makes them feel stressed (Figure 26).

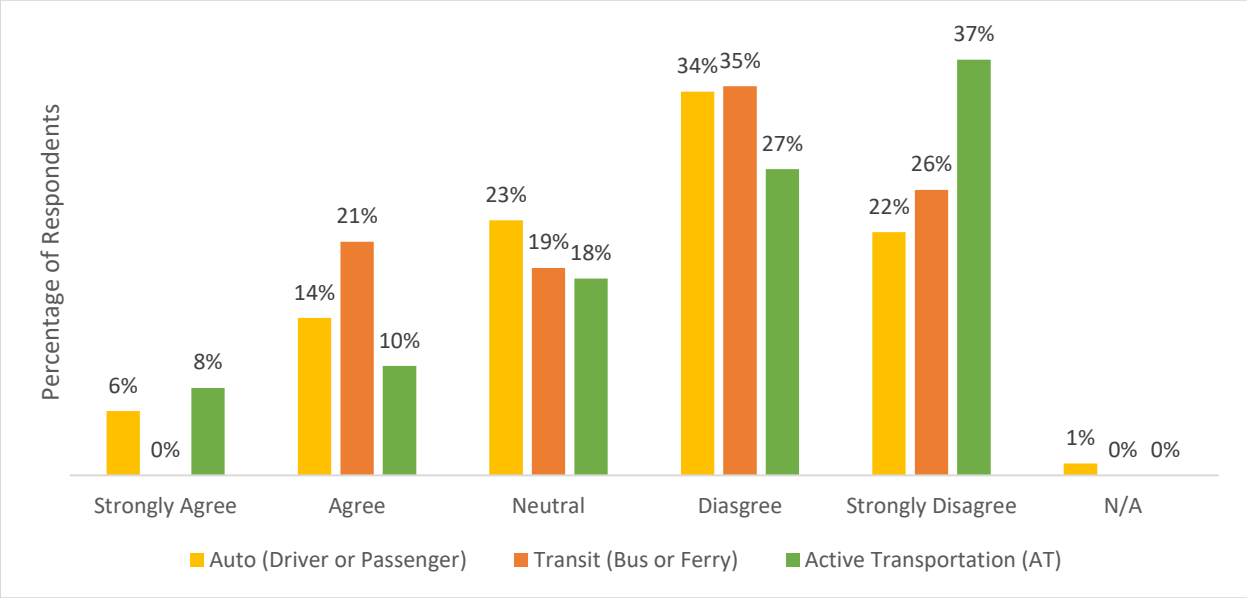


FIGURE 26: "MY COMMUTE MODE MAKES ME FEEL STRESSED" BY MODE CHOICE

6.2.5.8 I am happy with where I live

Although most respondents were happy with where they live, the highest agreement can be seen by active transportation users, with 63% strongly agreeing. Interestingly, approximately 5% of all respondents from each mode did not agree (Figure 27).

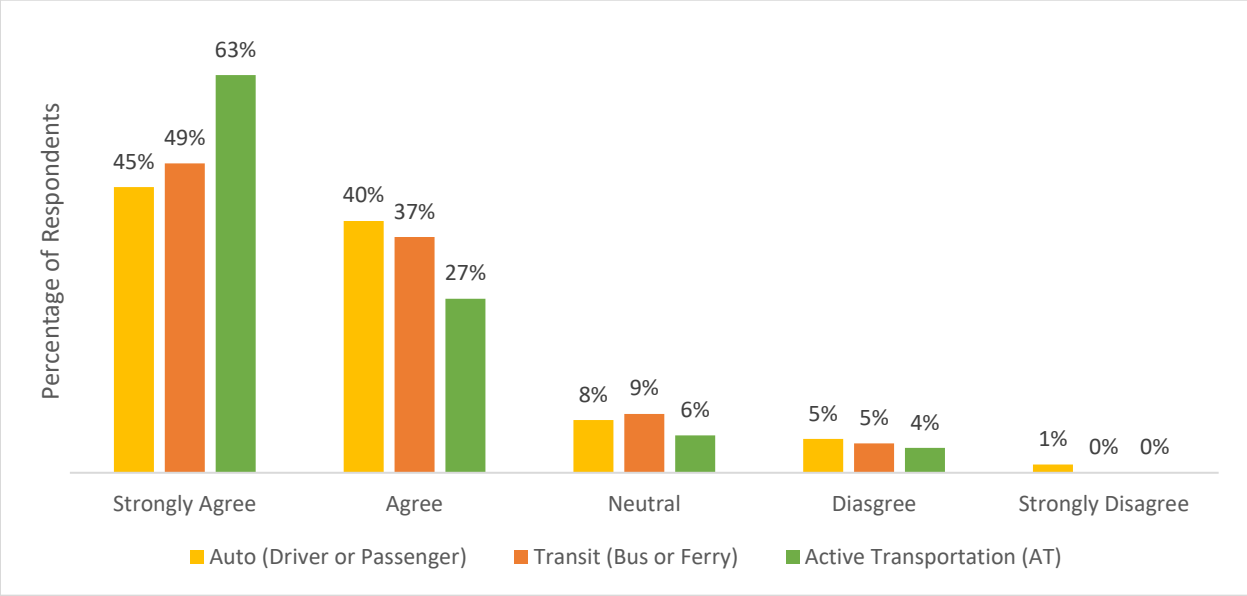


FIGURE 27: "I AM HAPPY WITH WHERE I LIVE" BY MODE CHOICE

6.2.5.9 I INVEST A LOT OF TIME INTO THE COMMUNITY I LIVE IN

Active transportation users reported investing more time in their communities (49%), followed by auto users (44%) and transit users (35%). More transit users reported not investing a lot of time in their communities (37%) than all other modes (Figure 28).

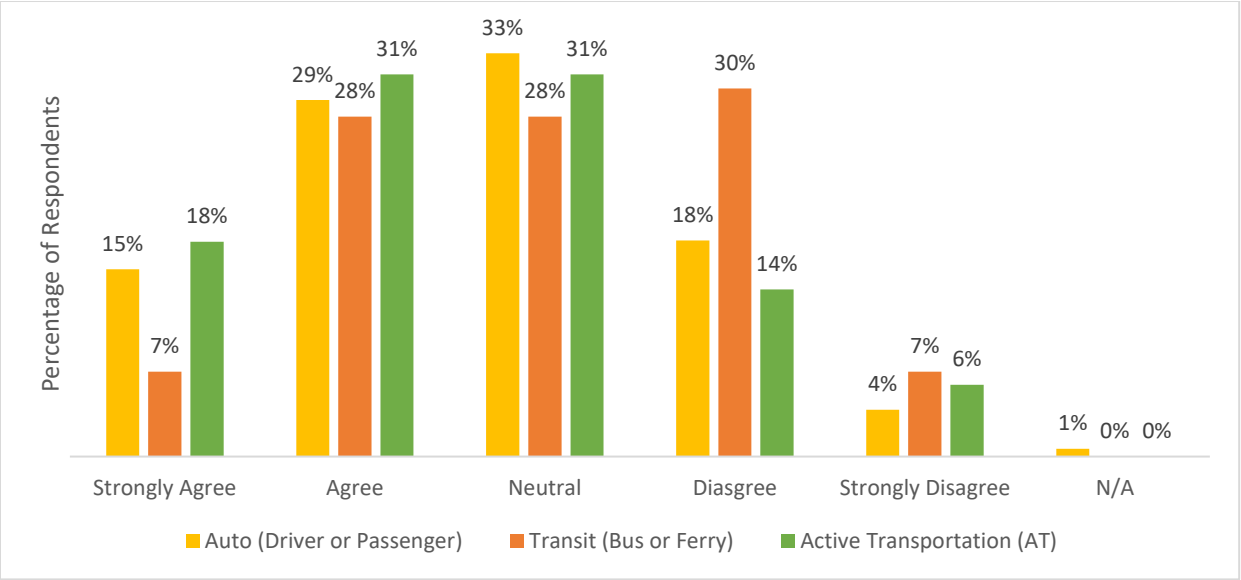


FIGURE 28: "I INVEST A LOT OF TIME INTO THE COMMUNITY I LIVE IN" BY MODE CHOICE

6.2.5.10 A SUBURBAN ENVIRONMENT OFFERS THE BEST QUALITY OF LIFE

The majority (70%) of active transportation users disagree and strongly disagree that a suburban environment offers the best quality of life, whereas 30% of auto users agree (Figure 29).

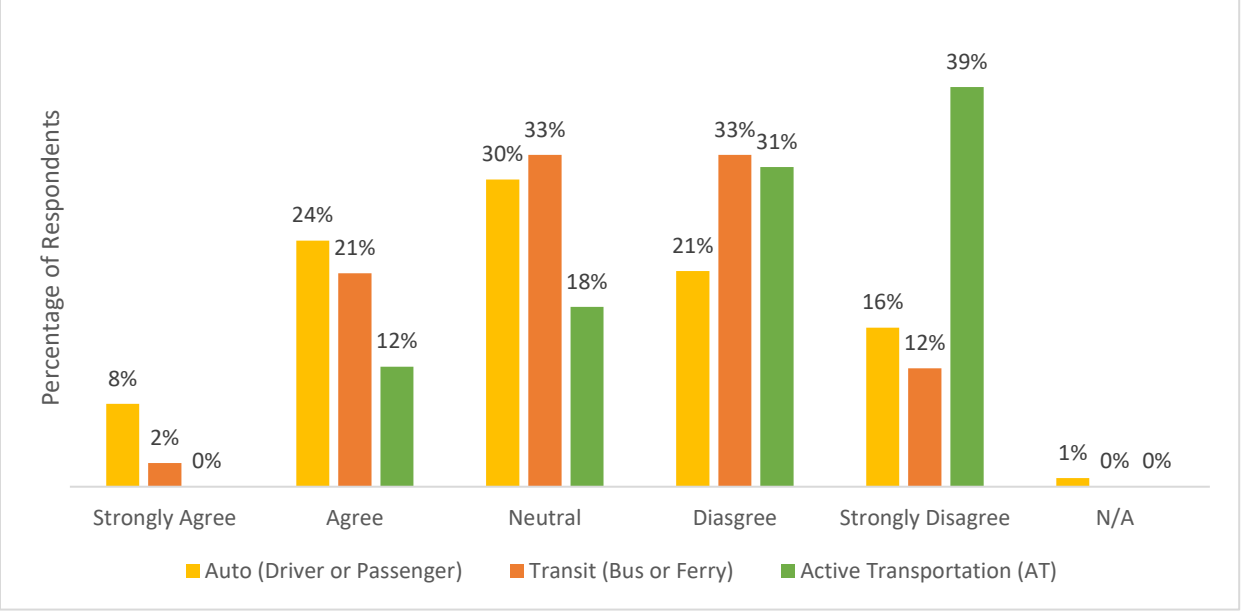


FIGURE 29: "A SUBURBAN ENVIRONMENT OFFERS THE BEST QUALITY OF LIFE" BY MODE CHOICE

6.2.5.11 I LIMIT MY DRIVING BECAUSE ITS BAD FOR AIR QUALITY

Approximately, 42% of drivers reported not limiting their driving because it's bad for air quality (Figure 30).

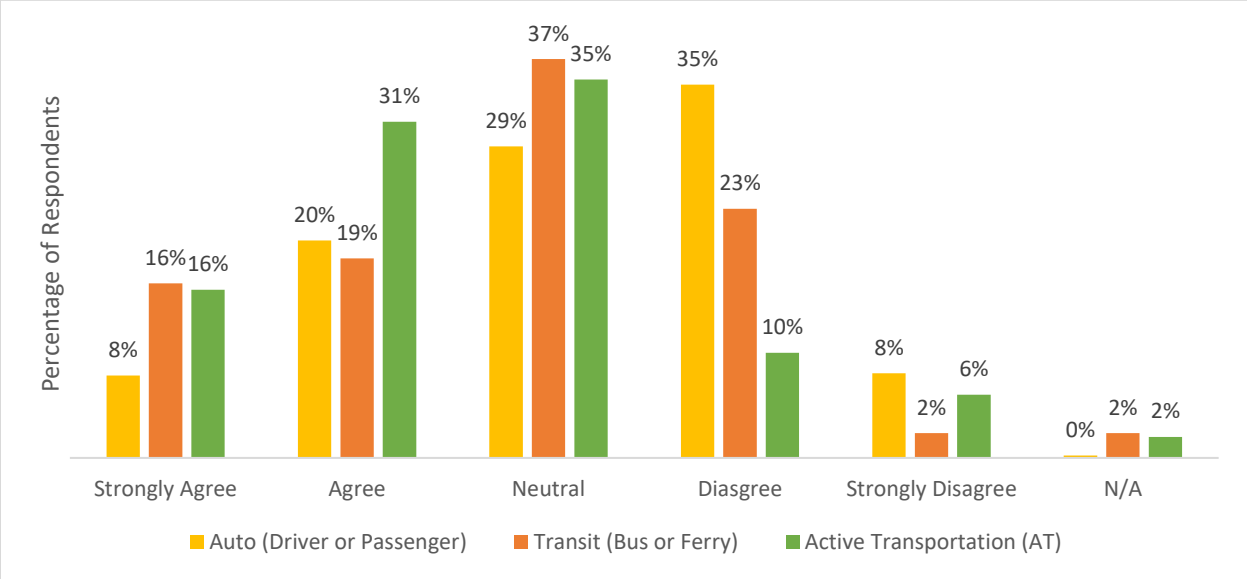


FIGURE 30: "I LIMIT MY DRIVING BECAUSE IT'S BAD FOR AIR QUALITY" BY MODE CHOICE

6.2.5.12 I CONSIDER GLOBAL WARMING A MAJOR CONCERN

Over three-quarters of active transportation users (89%), transit users (81%), and auto users (80%) strongly agree or agree that global warming is a major concern. However, 7% of transit users strongly disagree that global warming is a major concern (Figure 31).

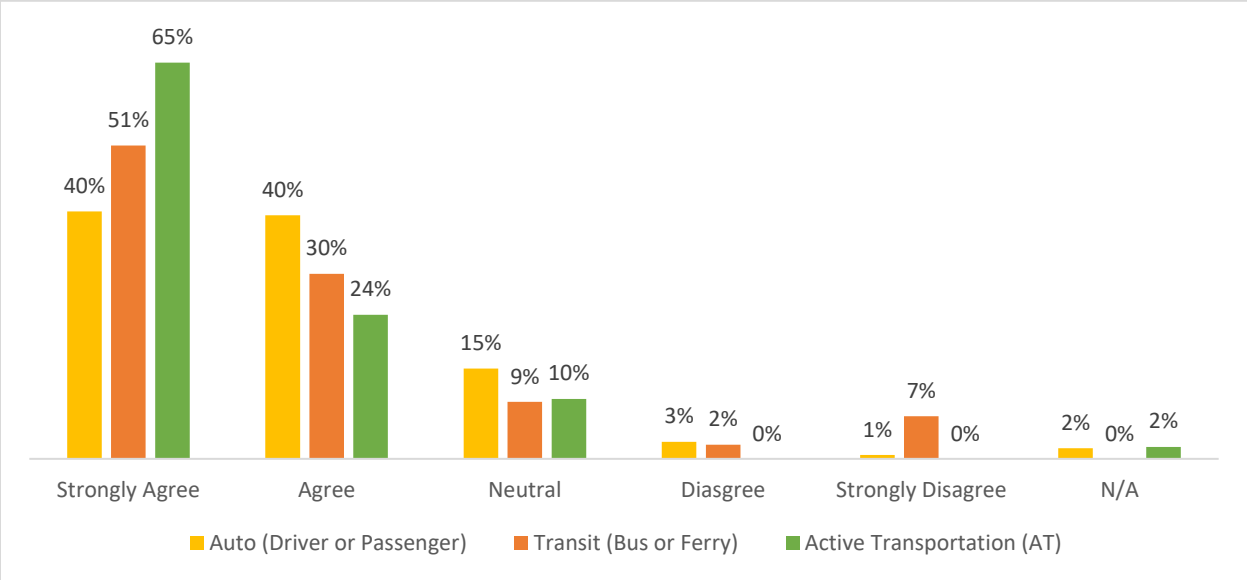


FIGURE 31: "I CONSIDER GLOBAL WARMING A MAJOR CONCERN" BY MODE CHOICE

6.3 Travel Choice and Behaviour in Nova Scotia

6.3.1 Modal Share for Work Trips

Figure 32 illustrates the modal share for work trips in Nova Scotia between 2006 and 2016. The percentage of work trips by auto drivers in Nova Scotia has been steadily increasing since 2006. In contrast, the percentage of auto passenger work trips has been steadily decreasing since 2006. Similarly, the percentage of work trips by public transit has also been decreasing in Nova Scotia. The percentage of work trips by walking has remained relatively stable. Bicycle use has increased from 1% in 2006 to 4% in 2016. Appendix B shows the data tables for each infographic in the section below.

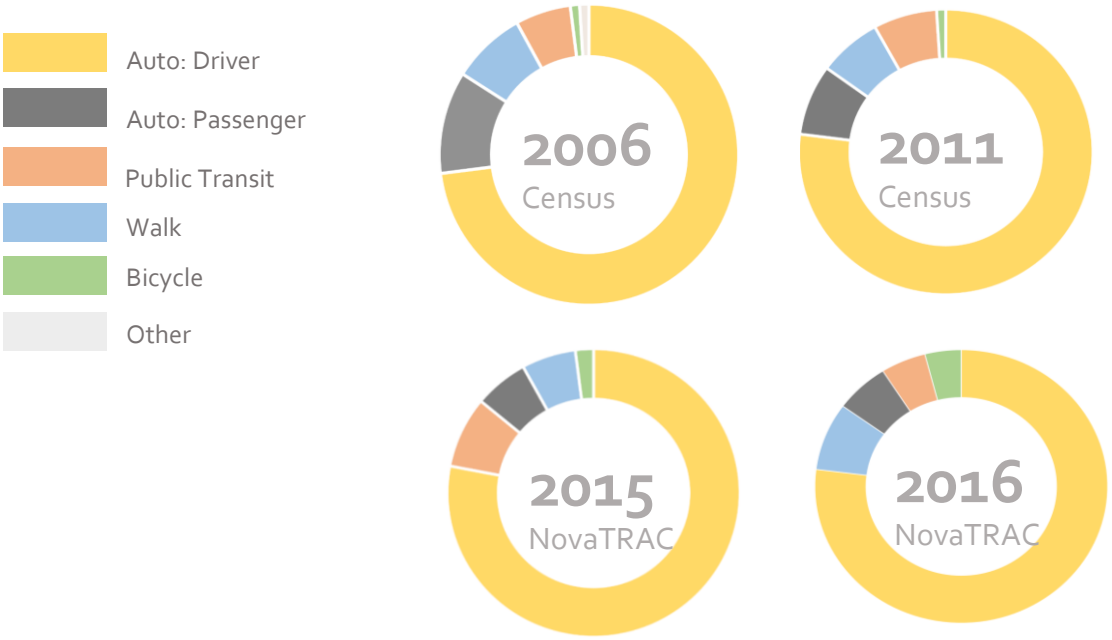


FIGURE 32: NOVA SCOTIA MODAL SHARE FOR WORK TRIPS

6.3.2 Modal Share for Non-Work Trips

The 2015 and 2016 NovaTRAC survey determined the modal share for non-work trips in Nova Scotia (Figure 33). The percentage of non-work trips as auto drivers has slightly decreased from 2015. The percentage of change in Nova Scotia is 2%. A similar trend was also noticed for auto passengers. In contrast, walking and biking have slightly increased since 2015. In Nova Scotia, there is a 1% increase in walking and 2% increase in biking. The percentage of non-work trips by public transit has been steady since 2015 in Nova Scotia.

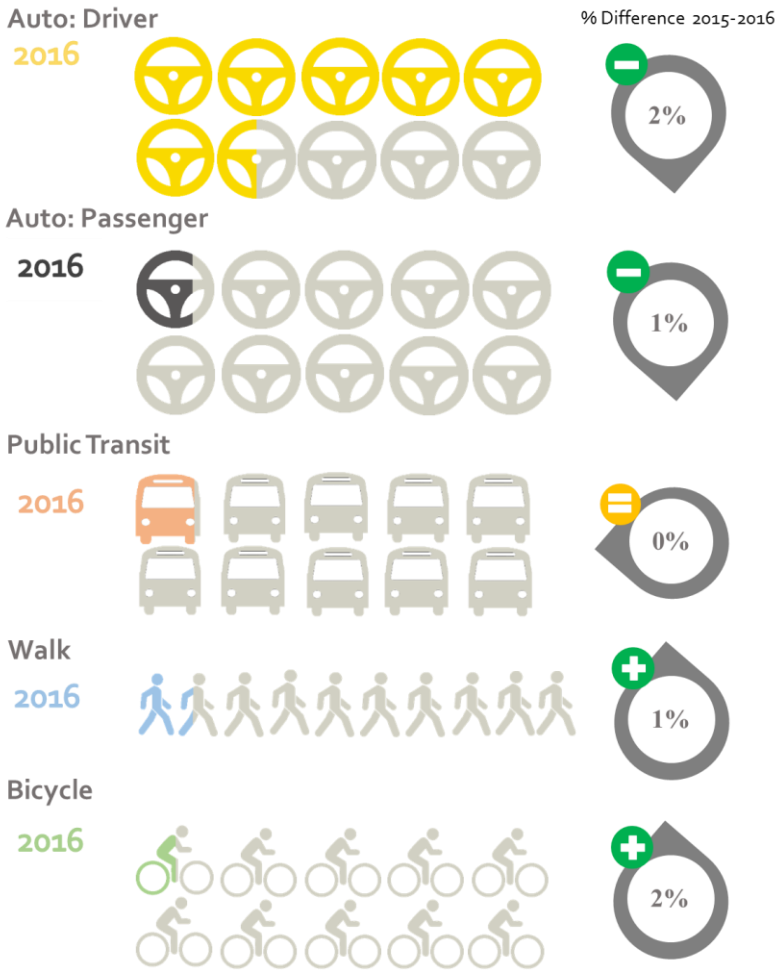


Figure 33: Nova Scotia Modal Share for Non-Work Trips

6.3.3 Distance Travelled Per Person

The NovaTRAC survey data demonstrates that there is a 7 km increase in vehicle kilometers traveled (VKT) for non-work trips (Figure 34). It was also concluded that there is a 1.6 km increase in transit and active transportation for non-work trips, which is a positive change. Both increases could be attributed to the survey being conducted in the summer, as people may be traveling further for vacation by car but also enjoying the warmer weather by other modes.

FIGURE 34: DISTANCE TRAVELLED PER PERSON FOR NON-WORK TRIPS

6.3.4 Average Daily Travel Time

In Nova Scotia, the average travel time per person for auto drivers increased 29 minutes between 1992 and 2015. In 2016, the average travel time decreased by 5 minutes (Figure 35). For all modes of transportation, the NovaTRAC survey found that the daily average travel time per person was 68.5 minutes in 2016 and 63 minutes in 2015.

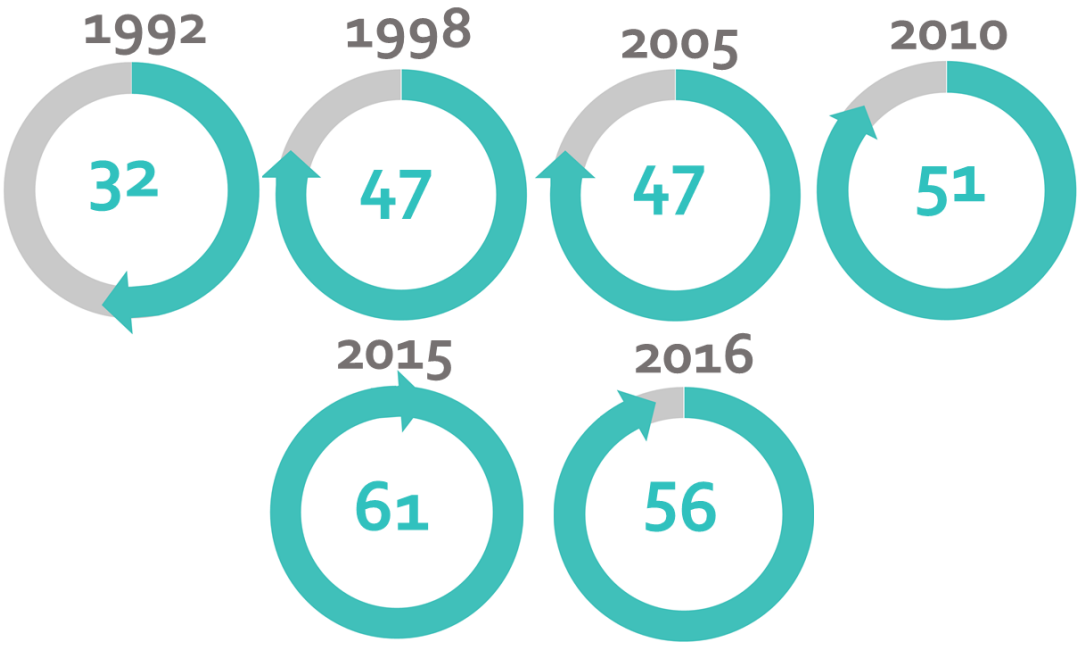


FIGURE 35: AVERAGE DAILY TRAVEL TIME FOR AUTO DRIVERS

6.4 Travel Choices and Behaviour in Halifax Regional Municipality (HRM)

6.4.1 Modal Share for Work Trips

Figure 36 illustrates the modal share for work trips in HRM. The percentage of work trips by auto drivers in HRM has been steadily increasing since 2006. In contrast, the percentage of work trips as auto passengers has been steadily decreasing since 2006. Similarly, the percentage of work trips by public transit has also been decreasing from 12% in 2006 to 6% in 2016. The percentage of work trips by walking has remained relatively stable. Bicycle use has increased from 1% in 2006 to 5% in 2016.

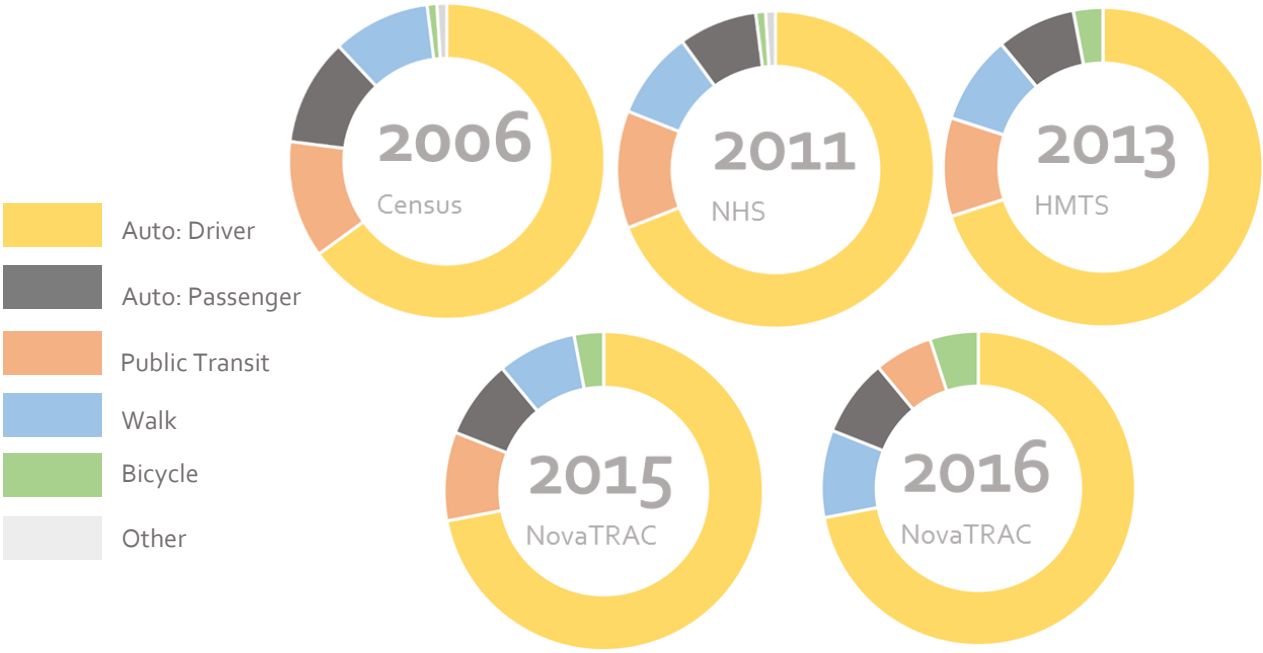
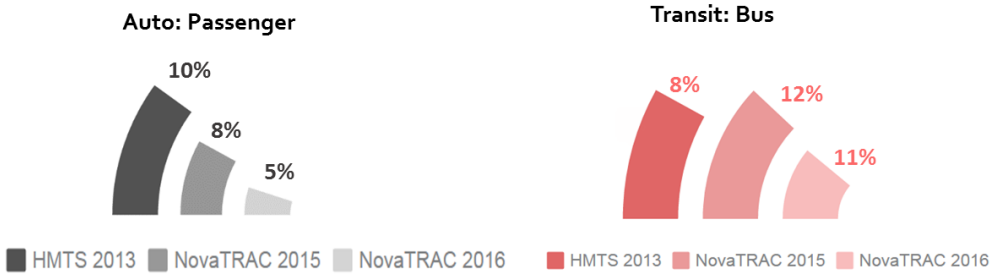


FIGURE 36: MODAL SHARE FOR WORK TRIPS FOR HRM

6.4.2 Modal Share for Non-Work Trips

The percentage of non-work trips as auto drivers has decreased slightly from 2015 (Figure 37). The percentage of change in HRM is 1%. In contrast, walking and biking have slightly increased since 2015. There is a 3% increase in walking, and 2% increase in biking. The percentage of non-work trips by public transit has decreased from 12% to 11% since 2015.



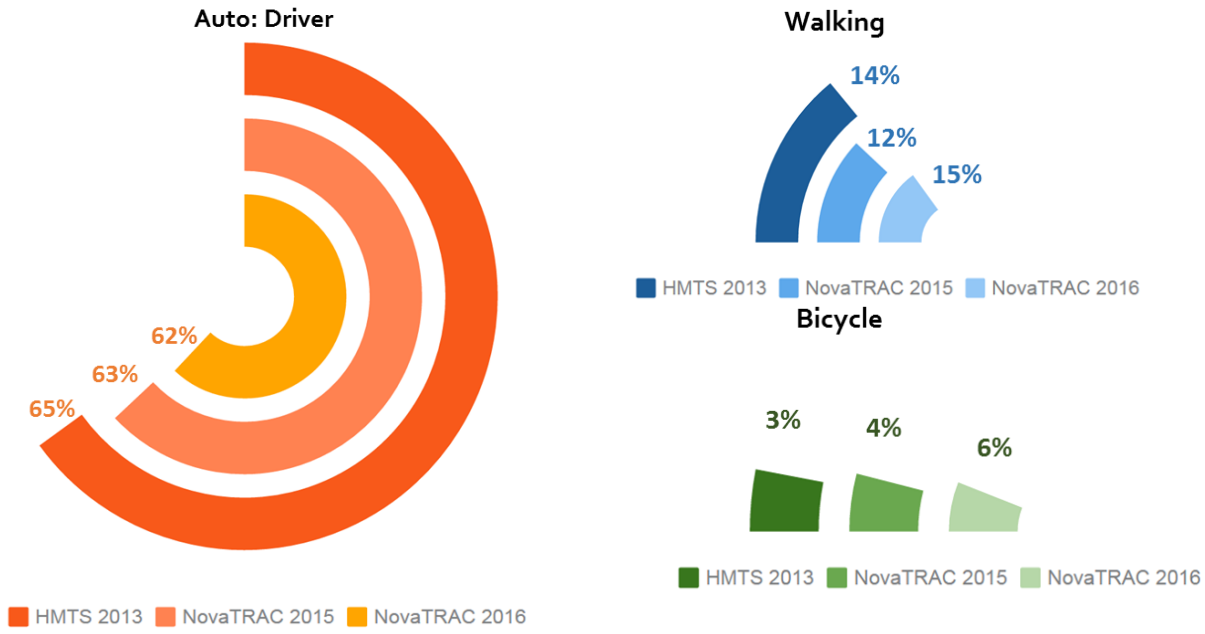


FIGURE 37: MODAL SHARE FOR NON-WORK TRIPS FOR HRM

6.4.3 Distance Travelled Per Person

The NovaTRAC survey illustrates that the VKT per person per day for all activities is 23.5 km in 2016 (Figure 38). It also identifies that the average traveled distance per person per day for all activities by transit or active transportation is 8.2 km in 2016.

FIGURE 38: DISTANCE TRAVELLED PER PERSON FOR ALL ACTIVITIES

6.4.4 Average Daily Travel Time

The NovaTRAC survey estimates that the average daily travel time per person for all trips has increased from 62 minutes in 2015 to 71.6 minutes in 2016 (Figure 39). The average travel time per person per day for auto drivers has slightly decreased from 2015.

Per person for all trips
This has increased from
62 minutes in 2015.

As auto driver per day
This has decreased slightly
from 54 minutes in 2015.

FIGURE 39: AVERAGE DAILY TRAVEL TIME

7 Conclusion and Lessons Learned

Overall, Nova Scotians predominantly use their vehicle more than any other mode for work and non-work trips. However, there is a positive trend and an increase in people using active transportation modes (i.e. walk and bike) for trips. Respondents displayed an increase in distance traveled by all modes of transportation compared to previous surveys, which could be due to this survey being conducted in the spring, summer and fall (unlike the 2015 survey, which was conducted in the winter). Further growth in the use of active transportation (AT) could be achieved by investing in AT and transit infrastructure, for communities across Nova Scotia to offer more diversified travel choices.

7.1 Survey Design

The 2016 survey deployment followed the advice from the previous survey and deployed in the summer and continued into the fall of 2016. All surveys should be deployed between spring and fall to gain a more holistic household travel routine. The addition of health questions was well received and gave significant insights for analysis.

7.2 Survey Promotion

Promoting the NovaTRAC survey through DalTRAC Twitter and Facebook channels seemed to work well; however, the survey could reach a greater audience by being promoted on the Halifax Regional Municipality's and the Province of Nova Scotia's website. This would not only encourage more people to complete the survey, it would also strengthen the legitimacy and importance of the study. Further aggressive promotion may be required in the future

7.3 Recommendations

The indicators estimated through the Nova Scotia Travel Activity (NovaTRAC) survey can provide valuable information for transportation planning and policy making in the Province. It is recommended that the NovaTRAC survey be conducted biannually to track changes in Nova Scotia's travel behavior on a regular basis.

CHAPTER 2: ENERGY USE AND EMISSION STUDY

1 INTRODUCTION

This chapter discusses energy use and emission estimates for Nova Scotia utilizing NovaTRAC survey data. The focus of this chapter is on the estimation of transportation fuel consumption; transportation greenhouse gas (GHG) emissions; and criteria air contaminants (CAC) from transportation. By generating estimates of the above indicators, this study facilitates the tracking progress of reducing fuel consumption and vehicle emissions from the road passenger transportation sector in Nova Scotia.

Climate change persists as a concern for communities locally and globally. The reduction of GHG emissions and CAC has become a key policy issue, due to their adverse effects on climate change, air quality and health (Matheson and Habib, 2016). The transportation sector continues to be a major contributor of GHG and CAC emissions, accounting for approximately 23% of the GHG emissions in Canada in 2014 (Environment and Climate Change Canada, 2014). The transportation sector is one of the most challenging sectors to cut emissions, requiring all levels of government to work together to be successful (Kelly et al., 2009; Marsden and Rye, 2010). The Nova Scotia government have taken steps towards reducing GHG emissions and CAC in the province, with a specific goal to reduce GHG emissions to 10% below 1990 levels by 2020 (Province of Nova Scotia, 2007). To meet this goal, it is important to identify a baseline level of emissions and track Nova Scotia's progress using emission indicators. To better understand the state of fuel consumption, GHG emissions and CAC, and how policy changes could affect vehicular emissions and fuel consumption, Dalhousie Transportation Collaboratory (DalTRAC) has identified a means of generating estimates at finer spatial level.

This study builds on the knowledge base generated through DalTRAC's Nova Scotia Sustainable Transportation Indicators Summary Report 2015 (Habib, 2015), and utilizes a transportation model developed by Rahman and Habib, 2016. The modeling process (Figure 41) generates estimates for Nova Scotia's fuel consumption and vehicle emissions, and compares those to previous years, to provide insight to develop fuel consumption and emission reduction strategies.

2 METHODS

The energy use and emission model for Nova Scotia involves two steps: (1) developing a travel demand forecasting model, and (2) generating emission and fuel consumption estimates. Mode specific Vehicle Kilometers Traveled (VKT) estimates are generated in the first step, which is fed into the second step as input for the emission and fuel consumption estimates. A conceptual framework of the energy use and emission model is presented in Figure 41. The travel demand forecasting model is developed as a four-stage process of: trip generation, trip distribution, modal split, and traffic assignment. Trip generation involves the development of a regression model to generate the number of trip production and attraction in each traffic analysis zone (TAZ). The regression model can be expressed in the following form:

$$Y_{i/j} = \theta_0 + \theta_1 X_{1i/j} + \cdots \ldots \ldots \ldots \ldots \ldots \ldots + \theta_k X_{ki/j}$$

Here, *i* represents the trip production at a TAZ and *j* represents the trip attraction at a TAZ, *X* represents the socio-demographic characteristics of the households and neighbourhood characteristics, and θ_0 is the constant parameter. Trip distribution is performed by developing a doubly-constrained gravity model. Mathematically, the gravity model takes the following form:

$$T_{ij} = \frac{A_j F_{ij} K_{ij}}{\sum_{n=1}^{m} A_j F_{ij} K_{ij}} X\ P_i$$

Here, *Tij* represents the trip produced from TAZ *i*, and attracted to TAZ *j; P_i* refers to the total trip production in TAZ *i*; *A_j* refers to the total trip attraction in TAZ *j*; *K_{ij}* is a socio-economic adjustment factor; and *F_{ij}* is the impedance factor. Distance between the TAZ is used as the impedance. A time of day model is developed to distribute the total daily trips on an hourly basis over the 24-hour period in a day. This model is developed utilizing the 2009 General Social Survey (GSS). For the modal split, a multinomial logit model (MNL) is developed to estimate the mode choice in the following five categories: auto driver, auto passenger, transit, bike and walk. The MNL model can be expressed in the following equation:

$$P_{ijc} = \frac{\exp(\beta X_{ijc})}{\sum_{c=1}^{C} \exp(\beta X_{ijc})}$$

Here, *c* is the mode, *P_{ijc}* is the probability of choosing model *c* for a trip from TAZ *i* to TAZ *j*, and *X* is vector parameter for TAZ *i,j,* and model *c*. This MNL model is utilized to generate the TAZ-specific mode choice for the population on the basis of travel time, distance, and land use characteristics. In the traffic assignment stage, the trips are assigned to the road network for auto and transit modes on an hourly-basis for 24-hours using the user equilibrium (EU) assignment procedure in the EMME/4 platform. The traffic assignment algorithm uses volume-delay function to minimize the total travel time for all travellers in the network. The volume-delay function can be written as:

$$t = t_0[1 + \alpha(V/Q)^{\beta}]$$

Here, *t* is the average travel time for a vehicle in the street, *t_0* is the free-flow travel time on the link per unit of time, *V* is the volume of traffic on the link per unit of time, *Q* is the capacity of the link per unit of time, α and β are considered to be 0.15 and 4 respectively as assigned by the Bureau of Public Roads (BPR). This assignment stage generates the Vehicle Kilometers Traveled (VKT) for auto and transit in each link of the network. This travel demand forecasting model is developed for the Halifax Regional Municipality (HRM). Detail of this model can be found in Rahman and Habib, 2016. For the rest of the Nova Scotia, the VKT is generated using the Nova Scotia Travel Activity (NovaTRAC) survey. The average daily VKT for work and non-work trips is estimated from the NovaTRAC survey for the following three modes: auto driver, auto passenger, and transit. A travel adjustment factor is used to generate the weekly VKT. For example, full-time workers go to work an average of 5.11 days/week and part-time workers work an average of 3.67 days/week. Therefore, the average of the full-time and part-time workers work is 4.39 days/week, which is used as the adjustment factor for the work trips to convert from daily to weekly. Finally, the yearly VKT is estimated for 52 weeks. The yearly VKT for the HRM and the rest of the Nova Scotia are combined to generate the yearly total VKT for Nova Scotia for the following three modes: auto driver, auto passenger, and transit.

In the second step, the emission and energy use estimates are generated for fuel consumption, greenhouse gas (GHG), and six Criteria Air Contaminants (CAC) including carbon monoxide (CO), total hydrocarbons (THC), volatile organic compounds (VOC), nitrogen oxides (NOx), and particulate matter under 10 microns (PM_{10}) and particulate matter under 2.5 microns ($PM_{2.5}$). The emission and energy use for the above mentioned eight factors are estimated using the following equation:

$$EEU_n = \sum VKT_{c,w} * EF_n$$

Here, *EEU* is the emission and energy use estimates, *EF* is the emission estimation factors, *w* is the type of trip which includes work and non-work trips, *c* is the type mode which includes auto driver, auto passenger, and transit, and *n* is the type of emission factor. The mode specific *EF* are collected from the Transport Canada's Urban Transportation Emission Calculator (UTEC), and United States Environmental Protection Agency (USEPA). These factors are presented in Figure 40.

	Fuel (L/km)	GHG (g/km)	CO (g/km)	THC (g/km)	VOC (g/km)	NOx (g/km)	PM10 (g/km)	PM2.5 (g/km)
Auto Driver	0.098	242.942	6.266	0.716	0.676	0.475	0.00282	0.00262
Auto Passenger	0.0362	89.663	2.3126	0.261	0.249	0.176	0.00104	0.000966
Transit	0.0338	93.049	0.131	0.0137	0.0136	0.574	0.00106	0.0115

FIGURE 40: FUEL CONSUMPTION AND EMISSION ESTIMATION FACTORS FROM THE UTEC AND USEPA

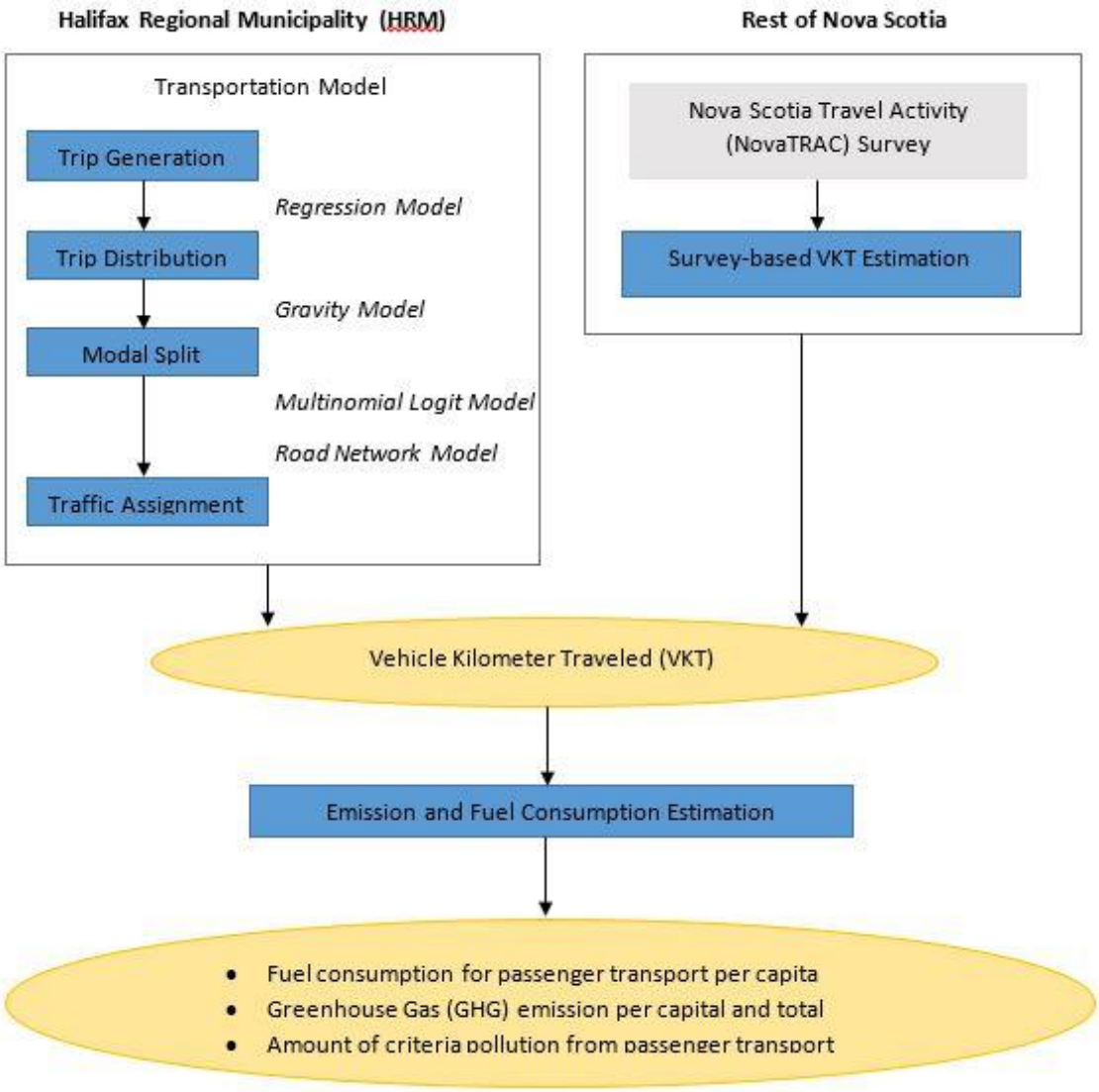


FIGURE 41: ENERGY USE AND EMISSION MODELING PROCESS

3 RESULTS

3.1 NOVA SCOTIA

Nova Scotians consumed a total of 1198.34 million liters of fuel in 2016, with 1204L being consumed per capita. Both calculated values have increased since the 2015 emission study (Figure 42).

	Fuel Consumption per capita (L)	Fuel consumption (millions of L)	Source of Estimate
Emission Study 2015	1203	1109.25	Multi-source, Estimation
2016	1204	1198.34	

FIGURE 42: NOVA SCOTIA FUEL CONSUMPTION FOR PASSENGER TRANSPORT PER CAPITA

Expectedly, with the increase fuel consumption by Nova Scotians, there is also an increase in GHG emissions emitted. In 2016, 3.012 tonnes of road passenger transportation related GHG (CO2 equivalent) emissions were emitted per capita (Figure 43).

	GHG per capita (tonnes)	GHG emitted (tonne)	Source of Estimate
Emission Study 2015	2.987	2,753,157.40	Multi-source, Estimation
2016	3.012	2,998,425.19	

FIGURE 43: NOVA SCOTIA GHG EMISSIONS PER CAPITA AND TOTAL AMOUNT

Total CAC emissions have also seen an increase for Nova Scotia (Figure 44). However, per capita criteria pollutants of CO (kg), THC (kg) and VOC (kg) have decreased (Figure 45 and 46).

Total Emissions	NOx (tonne)	CO (tonne)	PM_{10} (tonne)	$PM_{2.5}$ (tonne)	THC (tonne)	VOC (tonne)
Emission Study 2015	5,526	70,183	32	34	8,017	7,571
2016	7,039	73,358	35	64	8,378	7,608

FIGURE 44: NOVA SCOTIA TOTAL AMOUNT OF CRITERIA POLLUTION FROM PASSENGER TRANSPORT

Per capita	NOx (kg)	CO (kg)	PM_{10} (kg)	$PM_{2.5}$ (kg)	THC (kg)	VOC (kg)
Emission Study 2015	6.00	76.14	0.03	0.04	8.70	8.21
2016	7.07	73.69	0.03	0.06	8.42	7.64

FIGURE 45: NOVA SCOTIA AMOUNT OF CRITERIA POLLUTION FROM TRANSPORTATION PER CAPITA

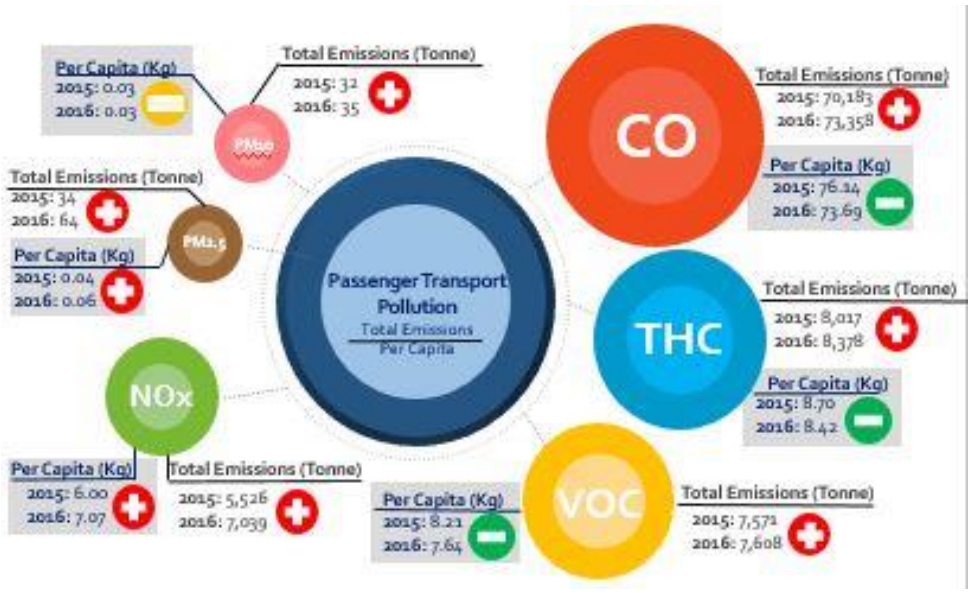


FIGURE 46: NOVA SCOTIA GHG AND CAC EMISSION

3.2 Halifax Regional Municipality

The values for energy use and emissions for HRM were first calculated in 2016 using the transportation model developed by Rahman and Habib, 2016. HRM residents consumed a total of 1572.55L of fuel per capita (Figure 47).

	Fuel Consumption per capita (L)	Fuel consumption (millions of L)
2016	1572.55	533.58

FIGURE 47: HRM FUEL CONSUMPTION FOR PASSENGER TRANSPORT PER CAPITA

A total of 3.96 tonnes of GHG emissions were emitted per capita in HRM (Figure 48).

	GHG per capita (tonnes)	GHG emitted (tonne)
2016	3.96	1,675,520.62

FIGURE 48: HRM GHG EMISSIONS PER CAPITA AND TOTAL AMOUNT

Table 49 and 50 show the total CAC estimates and CAC estimates per capita for HRM.

Year	NOx (tonne)	CO (tonne)	PM_{10} (tonne)	$PM_{2.5}$ (tonne)	THC (tonne)	VOC (tonne)
2016	4,443.48	39,283.30	19.39	49.33	4,484.73	3,931.74

FIGURE 49: HRM TOTAL AMOUNT OF CRITERIA POLLUTION FOR PASSENGER TRANSPORT

Year	NOx (kg)	CO (kg)	PM_{10} (kg)	$PM_{2.5}$ (kg)	THC (kg)	VOC (kg)
2016	10.5114	92.93	0.0459	0.1167	10.61	9.3008

FIGURE 50: HRM AMOUNT OF CRITERIA POLLUTION FROM TRANSPORTATION PER CAPITA

4 Conclusion

In Nova Scotia, fuel consumption and greenhouse gas (GHG) emissions increased slightly, as well as most CAC. However, there is a positive trend and an increase in people using active transportation modes (i.e. walk and bike) for trips. Further growth in the use of transit and active transportation (AT) would be achieved by strategically investing in infrastructural development to promote the use of these modes. Such steps will allow the communities across Nova Scotia to have access to diversified travel choices, which will in turn reduce fuel consumption and emissions.

5 Recommendations

The estimates generated through this study provide a solid baseline for energy use and emissions in Nova Scotia. It is recommended that the NovaTRAC survey be conducted biannually as the finer grain data provides increased confidence in the estimation results, presenting valuable insights for decision makers to consider when planning how to move forward towards a more sustainable transportation system for the province. Additionally, future resources should be allocated to develop a regional transportation and emission model to estimate emissions at a finer detail, utilizing the Motor Vehicle Emission Simulator (MOVES) software from USEPA, which is expected to assist to track progress towards achieving the emission targets.

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APPENDICES

Appendix A: Survey Code Book

Appendix B: Data Tables for Infographics

APPENDIX A: SURVEY CODE BOOK

Field	Description
ID (Stage)	NovaTRAC survey Stage 1 (random) or Stage 2 (public)
response no	Respondent ID number
ID	Computer ID number
access code	Survey access code
age	Age of respondent
age code	Age distribution category
no veh	Number of vehicles available to household members
no cyc	Number of bicycles available to household members
trans/ferry_com	Commute (at least once a week) by transit bus or ferry
	1. Yes 2. No 3. Not applicable
walk/bike_com	Commute (at least once a week) by active transportation
	1. Yes 2. No
county	County of residence
	1. Annapolis 2. Antigonish 3. Cape Breton 4. Colchester 5. Cumberland 6. Digby 7. Guysborough 8. Hants 9. Halifax 10. Inverness 11. Kings 12. Lunenburg 13. Other 14. Pictou 15. Queens 16. Richmond 17. Shelburne 18. Victoria 19. Yarmouth
own_stat	Current home ownership status
	1. Owner 2. Renter 3. Other
home_des	Description of home
	1. Single-detached 2. Semi-detached 3. Row house

	4. Apartment building, with 5 or more storeys 5. Apartment building, less than 5 storeys 6. Apartment duplex 7. Moveable dwelling 8. Other
loc_yr	Number of years lived at current location
no ppl_hh	Number of people currently living in the home
income_hh	Annual gross household income (before tax)
	1. Less than $15,000 2. $15,000 - $24,999 3. $25,000 - $34,999 4. $35,000 - $49,999 5. $50,000 - $74,999 6. $75,000 - $99,000 7. $100,000 - $149,999 8. $150,000 - $199,999 9. Over $200,000 10. Prefer not to disclose
gender	Gender of respondent
	1. Male 2. Female 3. Other 4. Prefer not to disclose
edu_lvl	Highest level of education achieved by respondent
	1. No certificate, diploma or degree 2. High school diploma or equivalent 3. Apprenticeship or trades certificate or diploma 4. College, CEGEP or other non-university certificate or diploma 5. University certificate or diploma below the bachelor level 6. University degree 7. Prefer not to disclose 8. Not applicable
emp_lvl	Current employment status of respondent
	1. Full-time (30 + hours/week) 2. Part-time (< 30 hours/week) 3. Regular Volunteer Work 4. Retired 5. Homemaker 6. Student 7. Unemployed 8. Other 9. Prefer not to disclose 10. Not applicable
occu	Occupation of respondent
	1. Management Occupation

	2. Business, Finance and Administration Occupation 3. Natural and Applied Sciences and related Occupation 4. Health Occupation 5. Occupation in Education, Law and Social, Community and Government Services 6. Occupation in Art, Culture, Recreation and Sport 7. Sales and Service Occupation 8. Trades, Transport and Equipment Operators and related Occupation 9. Natural Resources, Agriculture and related Production Occupation 10. Occupation in Manufacturing and Utilities 11. Prefer not to disclose 12. Not applicable
drv_lic	Valid driver's licence
	1. Yes 2. No 3. Under the age of 16
trans_pass	Ownership of a transit pass for the month
	1. Yes 2. No 3. Not applicable
com_dist (km)	Commute distance in kilometres (one-way)
com_dist (min)	Commute time in minutes (one-way)
com_mode	Primary commute mode (e.g. to work or school)
	1. Auto Driver 2. Auto Passenger 3. Transit: Bus 4. Transit: Ferry 5. Walking 6. Bicycle 7. Dial-A-Ride Transit 8. Other Community Transit 9. School Bus 10. Taxi 11. Other 12. Not applicable
Travel Log (# = travel location)	
address#	Address of respondent's location (0 = home address)
lat#	Latitude of location
lng#	Longitude of location
time#2	Time respondent left location
time#1	Time respondent arrived at location
mode_comm#	Commute mode for trip to location

	1. Auto Driver 2. Auto Passenger 3. Transit: Bus 4. Transit: Ferry 5. Walking 6. Bicycle 7. Dial-A-Ride Transit 8. Other Community Transit 9. School Bus 10. Taxi 11. Other 12. Not applicable
loc#	Location type
	1. My Home 2. My School 3. My Work 4. Other Place 5. Bus stop or ferry terminal
acti#	Activity of respondent at location
	1. Working at home (for pay) 2. All other activities at home (e.g. sleeping, meals, etc.) 3. Work/Job (for pay or volunteer) 4. All other activities at workplace 5. Attending class 6. All other activities at school 7. Change type of transportation/transfer (from car to bus/ferry, walk to bus/ferry, etc.) 8. Dropped-off passenger in car 9. Picked-up passenger in car 10. Other 11. Routine Shopping (groceries, clothing, convenience store, household maintenance) 12. Shopping for major purchases of specialty items (appliances, electronics, new vehicle, major household repairs, etc.) 13. Household errands (bank, dry cleaning, etc.) 14. Work-related errands (pickups, drop-offs, meetings, etc.) 15. Personal business (visit government office, attorney, accountant, etc.) 16. Health care (doctor, dentist) 17. Eat meal outside of home 18. Civic/Religious activities 19. Recreation/Entertainment 20. Visit friends/relatives 21. Other

travel#	Persons travelling with respondent for commute to location
	1. Alone 2. Spouse/partner 3. Child(ren) of the household 4. Relative/family member (s) 5. Co-worker (s) 6. Friend (s) 7. Other person (s)
veh_make_model_plc#	Vehicle make and model used for commute to location
route_._plc#	Transit route number(s) or ferry used for commute
#a-#b_Total_Leng	Total distance travelled between two locations
veh_make_#	Vehicle make
veh_model_#	Vehicle model
veh_year#	Vehicle year
Health_status	1. Excellent 2. Very good 3. Good 4. Fair 5. Poor 6. Prefer not to disclose
State_of_Happiness	1. Happy and interested in life 2. Somewhat happy 3. Indifferent 4. Somewhat unhappy 5. Unhappy with little interest in life 6. Prefer not to disclose
Typical_Weekday	1. Very stressful 2. Somewhat stressful 3. A bit stressful 4. Not very stressful 5. Not at all stressful 6. Prefer not to disclose
physical_activity	1. Very physically active 2. Moderately physically active 3. A bit physically active 4. Not very physically active 5. Not at all physically active 6. Not applicable
enjoy_riding	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
prefer_walking	1. Strongly agree 2. Agree 3. Neutral

	4. Disagree 5. Strongly disagree
happy_riding	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
pride_car	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
driving_freedom	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
satisfied_commute	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
commute_stress	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
happy_live	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
invest_community	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
suburban_environment	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
air_quality	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

global_warming	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

APPENDIX B: DATA TABLES FOR INFOGRAPHICS

Figure 16 Data Table

Modal Share for Work Trips in Nova Scotia					
Travel Mode	2006 Census	2011 Census	2015 NovaTRAC	2016 NovaTRAC	% Change 2015 to 2016
Auto: Driver	73%	77%	78%	77.2%	-0.8%
Auto: Passenger	11%	8%	6%	6.3%	+0.3%
Public Transit	6%	7%	8%	5.3%	+2.7%
Walk	8%	7%	6%	7.4%	-1.4%
Bicycle	1%	1%	2%	3.6%	1.6%
Other	1%	0%	0%	0.2%	+0.2%

Figure 17 Data Table

Modal Share for Non-work Trips in Nova Scotia			
Travel Mode	2015 NovaTRAC	2016 NovaTRAC	% Change 2015 to 2016
Auto: Driver	67%	65.0%	-2.0%
Auto: Passenger	7%	6.3%	-0.7%
Public Transit	9%	8.9%	-0.1%
Walk	13%	14.1%	+1.1%
Bicycle	3%	4.9%	+1.9%
Other	1%	0.8%	-0.2%

Figure 18 and 19 Data Table

Average Distance and Time Travelled per Person					
NovaTRAC Responses	Purpose	Average Distance 2015 (km)	Average Distance 2016 (km)	% Change 2015 to 2016	Average Travel Time 2015 (minutes)
Vehicle Kilometers Travelled (VKT)	Work	26	25.9	-0.4%	50
	Non-work	21	28.0	33.3%	40
Transit of Active Transportation	Work	4	5.6	40.0%	18
	Non-work	8.5	8.1	-4.7%	41

Figure 19 Data Table

Average Daily Travel Time as Auto Driver		
Year and Survey	Daily Travel Time	Change
1992 GSS	32 minutes	NA
1998 GSS	47 minutes	+ 15 minutes
2005 GSS	47 minutes	0 minutes
2010 GSS	51 minutes	+ 4 minutes
2015 NovaTRAC	61 minutes	+ 10 minutes
2016 NovaTRAC	56.1 minutes	-4.9 minutes

Figure 20 Data Table

HRM Modal Share for Work Trips						
Survey	Auto: Driver	Auto: Passenger	Transit: Bus	Walking	Bicycle	Other
Census (HRM) 2006	65%	11%	12%	10%	1%	1%
NHS (HRM) 2011	69%	8%	12%	9%	1%	1%
HMTS 2013	70%	8%	10%	9%	3%	0%
NovaTRAC (HRM) 2015	72%	8%	9%	8%	3%	0%
NovaTRAC (HRM) 2016	72.3%	8.0%	6.3%	8.8%	4.6%	0.0%

Figure 21 Data Table

HRM Modal Share for Non-Work Activities						
Survey	Auto: Driver	Auto: Passenger	Transit: Bus	Walking	Bicycle	Other
HMTS 2013	65%	10	8%	14%	3%	0%
NovaTRAC (HRM) 2015	63%	8%	12%	12%	4%	1%
NovaTRAC (HRM) 2016	62.3%	5.0%	11.3%	14.6%	6.0%	0.8%