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A Quantitative Analysis of the Impacts from Selected Variables Upon Safety Belt Usage in Massachusetts

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A QUANTITATIVE ANALYSIS OF THE IMPACTS FROM SELECTED VARIABLES UPON SAFETY BELT USAGE IN MASSACHUSETTS

A Thesis Presented

by

SAMUEL WHITE GREGORIO

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DEDICATION

This thesis is dedicated to my friends from the former E-LAB 3 and Pomeroy Lane.

I could not ask for any better friends than you.

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I would like to express thanks to my advisor, Dr. Michael A. Knodler, Jr., for all the assistance, guidance, and support he has provided me over both my undergraduate and graduate career at UMass. In addition, I would also like to express thanks to Dr. John Collura for his many hours of assistance and being a representative on my thesis committee. Finally, I would also like to thank the other 37 professors and teachers that have taught me and guided me to not only be an engineer, but to be a better engineer.

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Most importantly, I would like to thank my family and friends who have supported me, assisted me, and generally put up with me over the past five and a half years while I have strived to earned both my degrees and complete this research thesis.

ABSTRACT

A QUANTITATIVE ANALYSIS OF THE IMPACTS FROM SELECTED VARIABLES UPON SAFETY BELT USAGE IN MASSACHUSETTS

FEBRUARY 2010

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Safety belts are the most effective safety device in vehicles in terms of preventing injuries (1). Every year, safety belt usage data across the nation is collected by the individual states, the District of Columbia, and U.S. territories in a probability-based observational survey. Using this survey, Massachusetts, a secondary seat belt law state, ranked last in safety belt usage in 2008. This percentage was approximately a 2 percent decrease from 2007. This value was not an aberration as within the recent past, Massachusetts, a secondary safety belt law state, has consistently ranked at or near the bottom of the 50 states.

The foremost issue with safety belt usage is the inherent disregard of the safety related benefits for both drivers and passengers, alike. While there is a significant amount of literature documenting the safety related benefits, there is still a need for continued study of the persistent attributes that are associated with those vehicle occupants who make the decision to not buckle up.

The scope of this research encompasses the use of the collected data in the 2009 Massachusetts Safety Belt Usage Observation Study to determine what demographic variables; such as age, gender, race, occupant location, community median income, community population density, community education level, and combined demographics, are at high and low ends of the safety belt usage spectrum. Using this data, along with Massachusetts safety belt usage data from the immediate past observational studies, usage based on these and additional demographic information was quantified and analyzed. An outcome of this research was to identify specific strategies, such as increased education and concentrated enforcement, aimed at increasing safety belt usage amidst those targeted subsections of the population that are not buckling up.

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CHAPTER 1

INTRODUCTION

Traffic safety professionals have been charged with solving many of the issues that present themselves on the vast network of roadways across the United States and abroad. Many roadway and driver issues, although not completely resolved, have been mitigated so that these networks of roadways remain safe for all vehicles and vehicle occupants. Yet, personal choice characteristics for driving are coming to the forefront of improving traffic safety. For example, this can be seen with more emphasis on such issues as in-vehicle tasks like cell phone usage or even occupant safety belt usage.

This chapter will present the motivation for this research in terms of the safety related benefits that safety belts provide and will overview the problem for which this research is meant to assist in improving; the low levels of safety belt usage within the Commonwealth of Massachusetts. In addition, this chapter will provide a brief overview of the scope of research that was constructed to carry out a quantitative analysis into the current safety belt usage in Massachusetts.

1.1 Motivation

Safety belts are the most effective safety device in vehicles in terms of preventing injuries (1). Specifically, it has been well documented, through research and embedded within the associated statistics that safety belts can reduce injuries and fatalities resulting from traffic collisions (2). As reported by the National Highway

Traffic Safety Administration (NHTSA), wearing a safety belt can reduce the chance of death and serious injury by nearly 50 percent for front-seat occupants involved in traffic crashes (1). In 2007, safety belts were estimated at saving 15,147 lives while an additional 5,024 lives could have been saved if safety belts had been worn at the time of the crash (3).

Each year, safety belt usage data across the nation is collected by the individual states, the District of Columbia, and U.S. territories as a probability-based observational survey in accordance with criteria established by NHTSA to ensure reliable results. This collected data has shown over the past decade, that the national average for safety belt usage has increased (see Figure 1) as new regulations and education is inserted into the public domain. For example, the successful implementation and incorporation of directed programs, such as the Click It or Ticket campaign, may be a key aspect to the increase in usage.

Across the United States and the District of Columbia (D.C.) in 2008, the percentage of safety belt usage by state ranged from 66.8 percent usage in Massachusetts to 97.2 percent usage in Michigan (4). The average safety belt usage nationwide was approximately 83 percent as measured by NHTSA's National Occupant Protection Use Survey (NOPUS).

Of the 50 states and D.C., Massachusetts ranked last in the nation for safety belt usage in 2008 at 66.8 percent (4). This percentage was approximately a 2 percent decrease from 2007. Within the recent past, Massachusetts, a secondary safety belt law state in which only motorist can be cited for failure to use a safety belt only when another traffic violation has been committed, has consistently ranked at or near the bottom of the 50 states. Although, Massachusetts has had an increasing safety belt usage rate over for the past ten years, it continues to remain well below the nation average. Figure 1 presents the observed and reported Massachusetts belt use rates as compared to the national average for the past eleven years.

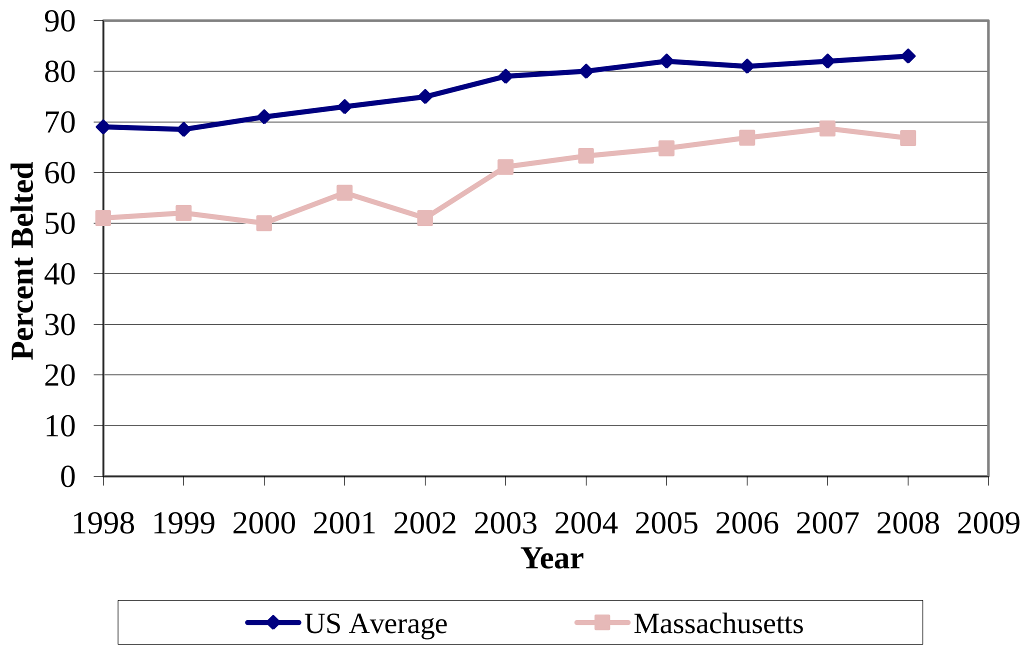

FIGURE 1: Massachusetts and US Safety Belt Use Rates, 1998 to 2008 (4, 5)

1.2 Problem Statement

The foremost issue with safety belt usage is the inherent disregard of the safety related benefits for both drivers and passengers, alike. As noted, safety belts are arguably the single most effective safety device within a vehicle at ensuring occupant safety. While there is a significant amount of literature documenting the safety related benefits, there is still a need for continued study of the persistent attributes that are associated with those vehicle occupants who make the decision to not buckle up. It is only after this quantitative analysis has been completed that the determination of effective programs may be utilized in order to increase compliance; in addition to when and where these can be initiated and carried out.

The intent of this research is to complete a comprehensive and quantitative analysis of safety belt usage statistics in Massachusetts, which has consistently ranked among the nation's lowest, to identify those variables and attributes associated with both high and low levels of safety belt usage (4). Specifically, this research will include both traditional demographics as well as less traditional factors that may further detail the current safety belt usage rates. This research may not lead to the selection of a comprehensive and direct approach to increase usage, but it can and should be used as an attempt to centrally condense safety belt usage for specific demographic groups within various geographic locations of the Commonwealth. An additional outcome of this research will be an attempt to identify specific strategies, such as increased education and concentrated enforcement, aimed at increasing safety belt usage amidst those targeted subsections of the population that are not buckling up.

1.3 Scope of Research

The scope of this research encompasses the use of collected observation data from the 2009 Massachusetts Safety Belt Usage Observation Study to determine what demographic groups are more prone to not using a safety belt while in a vehicle. This observation data was collected throughout the Commonwealth of Massachusetts during

160 site visits by students and staff of the University of Massachusetts Amherst during the month of June 2009. In addition, demographic information gathered from the United States Census Bureau was also utilized in creating community profiles for which many of the analyses are based. Using this data, along with Massachusetts safety belt usage data from the immediate past observational studies (2007 and 2008), usage rates based on particular demographic subsections in the population were analyzed.

1.4 Thesis Organization

This thesis document is organized into five chapters. The next chapter, Chapter 2, presents a general description for some of the current approaches to enforcement and education as related to increasing safety belt usage. The chapter also includes an overview of previous research of safety belt usage based on demographic variables. Chapter 3 describes analytical approach of this research in regards to data collection and quantitative analysis. Chapter 4 presents the results of the quantitative analysis conducted on the results of the 2009 Massachusetts Safety Belt Observation Study and other such safety belt data. Finally, Chapter 5 presents final conclusions and recommendations based on the results presented from the safety belt usage data.

CHAPTER 2

BACKGROUND AND LITERATURE

Two main areas of focus are summarized in the following literature review. The first is a review of the establishment of seat belt laws in the United States and an examination of their effectiveness on safety belt usage. The second is a discussion of the Click It or Ticket and other campaigns that have been developed in the United States in an effort to improve safety belt usage.

In addition, a summary of previous work in regards to safety belt usage based on traditional and non-traditional demographics in Massachusetts has been included. This section will provide an overview of the data presented in recent studies, including similar analyses of demographics that were conducted in 2003 and 2004 for Massachusetts.

2.1 Seat Belt Laws

The following section describes the various types of seat belt laws currently in use within the United States. Included is information regarding the initial incorporation of seat belt law and their effectiveness based upon historical usage increases and average safety belt usage within state of particular seat belt laws.

2.1.1 Description of Current Seat Belt Laws

Currently, in the United States, seat belt usage laws are divided into two categories: primary and secondary seat belt laws. Primary seat belt laws allow for law enforcement officers to stop and cite a driver solely for not wearing a safety belt, without the occurrence of another traffic infraction. Secondary seat belt laws allow law enforcement officers to issue a citation for not wearing a safety belt, but only when there is another citable traffic infraction serving as a rationale for the stop.

From a historical prospective, New York became the first state in the United States to implement a seat belt law in 1984 (6). Since then, all but one U.S. state (including D.C.) have either a primary or secondary seat belt law. New Hampshire is the only state yet to have either; however New Hampshire does have a child restraint law. Currently, 30 states and the District of Columbia have primary seat belt laws and 19 states have secondary seat belt laws (7). The breakdown of state by state law is presented in Figure 2. The details of each primary and secondary law vary from state to state. These variations are based upon an occupant's seating position, passenger or driver age, and the dollar amount of the citation fine. For instance, many of the seat belt requirements are only applicable to front-seat occupants.

While not all states have a general primary or secondary seat belt law, all 50 states and D.C. have child restraint laws which require children to travel in approved child restraint devices. The difference between child restraint laws between states is the age of the occupant. Different states require usage for certain age brackets and up to certain max-out ages.

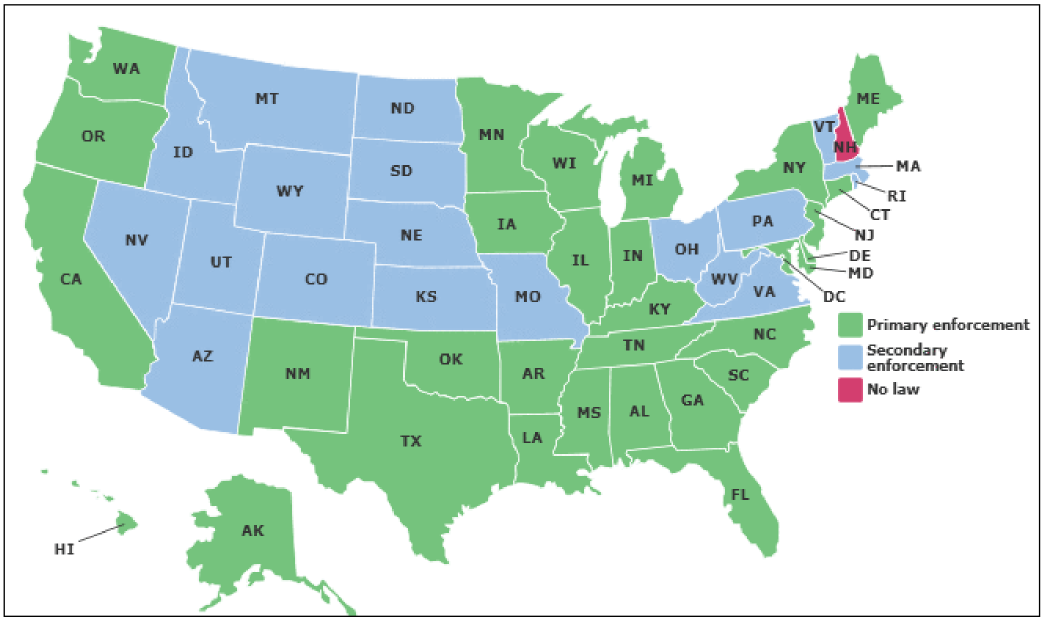

FIGURE 2: Seat Belt Use Law by State as of December 10, 2009 (6)

2.1.2 Effectiveness of Seat Belt Laws

During 2008, the average state safety belt usage by primary seat belt law states (including D.C.) was 88.2 percent, ranging from 97.2 percent to 71.3 percent (4). The average state safety belt usage by secondary seat belt law states was 79.5 percent, ranging from 90.9 percent to 66.8 percent (4). From this data, it can clearly be seen that states with primary seat belt laws are more likely to have vehicle occupants wear safety belts. New Hampshire, the only state without a seat belt law has 69.2 percent usage. Therefore, it can be suggested that seat belt laws are effective and that primary laws are more effective than secondary laws just be looking at the percentage data.

A closer look at the 2008 national data will show that some states with only secondary seat belt laws still have a high level of safety belt usage. For example, West

Virginia (89.5 percent) and Nevada (90.9 percent) both have superior safety belt usage than the primary state average. Both of these states have also decreased from 2007 and were actually at an even higher percentage previously. About half, 11 of 23, of the 2008 secondary law states have usage percentages greater than 80 percent (4).

Only four states with primary laws, including: South Carolina (79.0 percent), Mississippi (71.3 percent), Louisiana (75.5 percent), and Kentucky (73.3 percent), comprise inferior average usage than the secondary law average (4). It should be noted that these states do share a relative geographic proximity in the southeastern U.S. where belt usage has regularly been lower in NOPUS studies (4). Also worth noting is that previous literature has identified states with a lower median household income are found to have low safety belt usage, and these four states rank in the bottom 11 states in median household income (8).

An excellent measure of effectiveness of a secondary law as compared to a primary seat belt laws occurs when a state upgrades the law from secondary to primary. In the past eight years, nine states have upgraded their seat belt laws from secondary to primary (not including upgrades in 2009 that include Arkansas, Florida, Minnesota, and Wisconsin). All nine of these states witnessed an immediate increase in usage in the year following the change. Eight of nine were increases greater than 2.6 percent and two were greater than 10.0 percent. All nine have also increased since implementation (4).

2.2 The Click It or Ticket Campaign

The following section describes the Click It or Ticket mobilization campaign that is currently utilized within the United States and includes information regarding its incorporation, its current implementation strategies, and the overall effectiveness of the education and enforcement campaign.

2.2.1 History of Click It or Ticket Mobilization

Click It or Ticket (CIOT) is a mobilization campaign currently used nationally by NHTSA and directed at increasing the usage of safety belts among vehicle occupants in the United States. It was first developed by North Carolina in 1993 (9). With its implementation in North Carolina, over 58,000 citations were issued in the state for safety belt violations. The safety belt usage rate in the state increased from 65 percent to 81 percent by the following summer (9). North Carolina has yet to drop below 80 percent safety belt usage since. It took seven years for another state, South Carolina, to implement a similar program.

Due to the effectiveness of CIOT in North Carolina, the program spread into other states by the turn of the century. Currently, all 50 states and the District of Columbia run a CIOT mobilization coordinated by NHTSA. The year 2006 was the first year the national CIOT mobilization ran under the jurisdiction of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).

The Commonwealth of Massachusetts Click It or Ticket program started in the fall of 2002. It is based on a successful national model developed by previous states and

NHTSA, and currently involves two to three week "mobilization" periods of high-visibility traffic enforcement, public service announcements utilizing paid and earned media, and community-based education. It is currently under the jurisdiction of the Massachusetts Executive Office of Public Safety and Security (MAEOPSS). The 2009 Massachusetts CIOT spring mobilization ran parallel to the national campaign (10).

2.2.2 The Click It or Ticket Approach

According to the NHTSA website, some of the approaches that are utilized by the CIOT mobilization are saturated patrols, vehicle checkpoints, public service announcements through paid and earned media, community education and redundant signage. Different states and regions utilized different approaches based upon their particular seat belt laws, municipal ordinances, enforcement availability, and funds.

Saturated patrols consist of high-visibility law enforcement activities in a specific geographic area. Vehicle checkpoints consist of organized road block enforcement in compliance with state and local statutes in which usage is checked by vehicle. Public service announcements (PSAs) can be heard on radio and viewed on television reminding listeners and viewers of the increased enforcement and importance of safety belt usage. Visible signage may utilize a Variable Message Signs (VMS) or posted signs to convey the message of CIOT compliance. The most prominent feature of these techniques is to be visible to the general public in order to convey the serious message of enforcement activity and general safety.

2.2.3 Effectiveness of Click It or Ticket

An excellent measure of effectiveness for the Click It or Ticket campaign is to observe the change is safety belt usage before, during, and after the mobilization. In Massachusetts, the observation study includes a subsample of observations taken before the CIOT campaign begins in May. This subsample includes 30 hour-long observational site visits across Massachusetts. Using this data, safety belt usage before the mobilization can be compare to safety belt usage after the mobilization.

In 2009, the subsample observations were made between April 20th and May 8th before the CIOT campaign. Over the 29 observational sites during 30 site visits, the state averaged 69.23 percent safety belt usage. During the post-CIOT mobilization study of 160 site visits, the state averaged for those particular 30 site visit locations was 73.80 percent. This increase of over 4.5 percent can be seen as CIOT being affective, with 19 of the 29 observation locations having an increase (11).

A more effective way of seeing the effects of CIOT in Massachusetts is to view past data. As stated before, Massachusetts program started in the fall of 2002. The average safety belt usage for the state of Massachusetts, as seen in Table 1, increased from 51.0 percent usage in 2002, before implementation, to 61.7 percent usage in 2003, after the original implementation (4). About an 11 percent increase was seen in the one year; which is more than any other usage increase in the state's recorded data history. It should be consider that CIOT had a positive effect on safety belt usage. In addition, consider the previous noted results from North Carolina as well.

In 2001, eight states in the southeastern United States united collectively to launch the first regional Click It or Ticket campaign in May. All eight states simultaneously commenced a five-week media campaign; a $3.6-million two-week paid advertising campaign; and a two-week intensive enforcement crackdown (12). 3,250 law enforcement agencies participated and conducted over 25,000 vehicle checkpoints or patrols. Enforcement resulted in 119,805 safety belt citations (12). Each of the eight states saw an increase in the safety belt usage rates as confirmed in Table 1.

TABLE 1: Change in Safety Belt Usage in Years with Launch of Click It or Ticket Campaign in 2000 and in 2000 (4, 13)

State	2000 (% belted)	2001 (% belted)	00-01 Change
Alabama	70.6	79.4	8.8
Florida	64.8	69.5	4.7
Georgia	73.6	79.0	5.4
Kentucky	60.0	61.9	1.9
Mississippi	50.4	61.6	11.2
North Carolina	80.5	82.7	2.2
South Carolina	53.4	69.9	16.5
Tennessee	59.0	68.3	9.3
State	**2002 (% belted)**	**2003 (% belted)**	**00-01 Change**
Massachusetts	51.0	61.7	10.7

2.3 Previous Work Safety Belt Usage by Demographics

Statewide safety belt observation studies have been carried out in almost all 50 states in the recent past. Each year, as the observational data is collected, certain analyses are performed using this data based on traditional demographics; such as gender, apparent age, and race. Year by year, these analyses are able to track progression of safety belt usage within states based on those and other attributes.

One of the primary functions of this thesis is to determine how safety belt usage is influenced by combined traditional demographics and non-traditional demographics.

Similar research is known to have been conducted within Massachusetts as recent as 2004, using the state safety belt usage data from 2003 to determine the influence of non-traditional demographics on safety belt usage. This data is presented in "Non-traditional Seat Belt Analysis: A Series of Fact Sheets," as prepared by the Massachusetts Traffic Safety Research Program (UMassSafe). This analysis included almost all of the types of analysis that have been presented in the subsequent chapters of this thesis.

What separates this analysis with prior research conducted in the same demographic fields is the change in years. Being 2009, more than five years have passed since that data has been considered up to date. In five years, as presented in Figure 1, the safety belt usage rate in Massachusetts has increased 12.3 percent. Each demographic attribute has consequently has seen changes in safety belt usage. Some more than others.

To signify that this research is unlike the data presented in the past analysis, it is a sensible idea to look at the overall development of events of the last five years. Within the recent past, more and more publicity has been given to the public on increasing safety belt usage. Click It or Ticket has been progressing with more and more citations being written. In addition, the knowledge of Massachusetts' last place ranking for national safety belt usage in 2008 has attributed to the action of more vehicle occupants buckling up; which is increasing and has change significantly since 2003. Therefore, is has been proposed that this research is not as much a duplicate of the research conducted in 2003 and 2004, but a more enhanced and informed look of how safety belt usage is seen today in Massachusetts.

CHAPTER 3

RESEARCH METHODOLOGY

There are two stages to the research methodology. The first stage encompasses the statewide collection of Massachusetts observational data of safety belt usage. The second stage involves the application of the collected observational data to complete a comprehensive quantitative analysis of the data in order to determine the impacts from specific variables on safety belt usage. Although the statewide observation study, completed by the University of Massachusetts Traffic Safety Research Program (UMassSafe) on behalf of the Massachusetts Executive Office of Public Safety and Security - Highway Safety Division and in accordance with NHTSA, is separate from this research, it is important to review how the data was collected as elements of these data are throughout the quantitative analysis.

This section promptly overviews the occupant attributes and the proceeding data analysis of the observational study that was presented to NHTSA in 2009. The section also provides an overview of the general aspects of the quantitative assessment of selected demographic variables and attributes associated with both high and low levels of safety belt usage in Massachusetts.

3.1 Seat Belt Observations

The following section provides an overview of the data collected as part of the Massachusetts Safety Belt Usage Observation Study developed in accordance with NHTSA protocol. Information regarding the statistical precision of carrying out observational site locations and of examining observational variables has been included.

3.1.1 Observational Site Visits

As noted the Massachusetts Safety Belt Usage Observation Study was developed in accordance with NHTSA protocol and as a result of the statistical precision required observations be carried out during 160 hour-long site visits at different locations across the Commonwealth of Massachusetts. At each location, observations were taken by pairs of observational research teams that include the recording of safety belt attributes for both driver and front out-board occupants in vehicles. No observations were made of back seat or front central vehicle occupants.

These observations occurred between the five regions of the Commonwealth of Massachusetts, as shown in Figure 3. Within each region there were an equal number of observational visits based upon time of day and the day of week, as well as the roadway functional classification. The specific state regions, time periods, and roadway functional classification are presented in Table 2. The counterbalancing of these variables resulted in 80 unique divisions for which two observation locations were sampled.

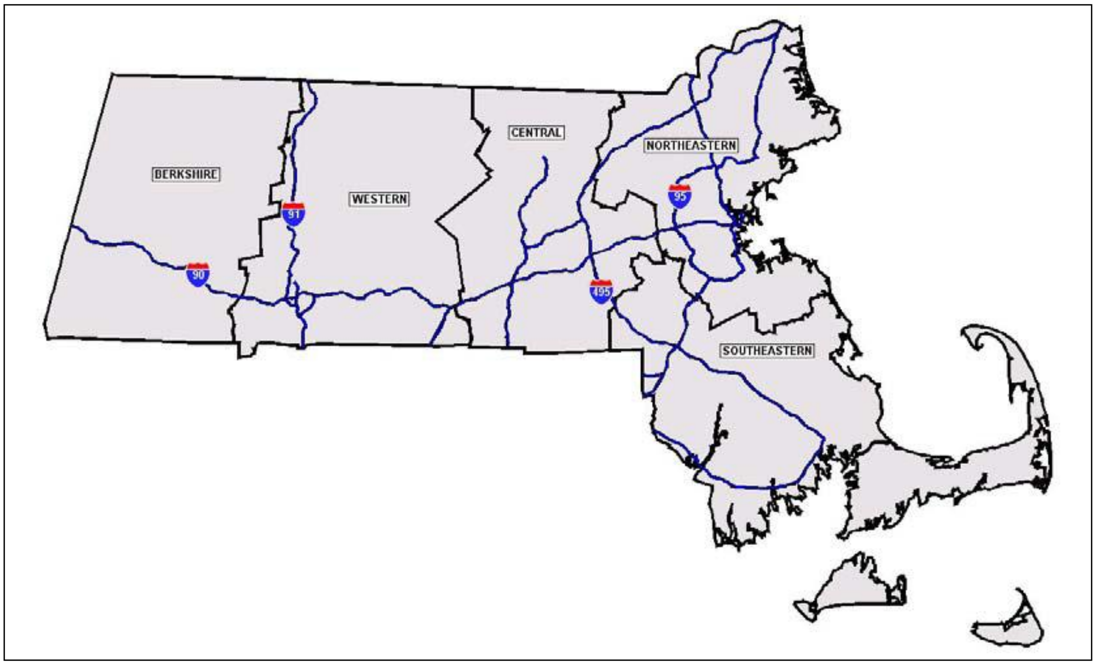

FIGURE 3: Observational Regions Across Massachusetts (11)

TABLE 2: Observational Regions, Time / Day, and Roadway Functional Classifications Splits Within Observational Study

Observational Attribute	Level
State Region	Berkshire Pioneer Valley Central Northeast Southeast
Time / Day	Weekday A.M. Peak Period (6 a.m. to 10 a.m.) Weekday Midday Peak Period (10 a.m. to 3 p.m.) Weekday P.M. Peak Period (3 p.m. to 7 p.m.) Weekend Period (6 a.m. to 7 p.m.)
Roadway Class	Local Collector Arterial Freeway

3.1.2 Observational Data

During observations at these various locations, certain data was obtained by the two person research team. The data obtained included occupant gender, apparent age, apparent race, state of vehicle registration, vehicle type, and seated location of occupant. Each of the various attribute options included space for a status unknown as it is understood that not all data can be obtained by observing moving vehicles in possible large volumes. Table 3 shows the division of observation variables that were attempting to be obtained.

TABLE 3: Data to be Obtained by Observational Variable

Observational Attribute	Level	Observational Attribute	Level
Occupant	Driver Passenger	Gender	Male Female
Apparent Age	Child (passenger <12) Teen Adult Elder Adult (>65)	Apparent Race	Black Hispanic White Other
Vehicle Registration	Massachusetts New Hampshire Out of State (Other)	Occupant Role	Driver Alone Driver w/ Passenger Passenger
Vehicle Type	Passenger Car Pick-up Truck SUV Van Commercial Vehicle		

3.2 Quantitative Analysis

As previously stated, the intent of this research is to complete a comprehensive analysis of safety belt usage in Massachusetts to identify variables and attributes associated with both high and low levels of safety belt usage. The expectation of this thesis was to learn new information about how demographics and other variables affect safety belt usage. Therefore, the steps of the quantitative analysis are presented in the following section.

For all of the following analyses, the roadway classification has been singled out and separated from all of the data as most analyses that deal directly with community based usage will be conducted by two types of roadway class: non-freeway and freeway. Non-freeway will include: local, collector, and arterial classified roadways. Freeways have been separated as it is not indicative of a specific communities usage, but more indicative of a regional usage.

3.2.1 Conversion Rates by Observational Location

Conversion rate, or the percentage of those of a specific variable in prior years who did not buckle up and who have buckled up the next, is a quality variable to determine where safety belt usage is changing (improving or declining). The value is representative of the percentage of non safety belt users in some initial year that were “converted” to users in a later year. Consider a brief example: if a observation location had an 80 percent usage rate in 2008 and a 90 percent usage rate in 2009, the conversion rate would be 50 percent; meaning, 50 percent of the on non safety belt users are now buckling up.

A conversion rate is based off the assumption that it is more difficult to increase usage rates if an observational location already holds a higher usage rate. For example, it is more difficult to increase usage by one percent in a location where belt use is 90 percent than it is to increase usage by one percent in a location where the usage is 50 percent (14). The conversion rate will be able to describe the change in non-user behavior rather than a change in user behavior (14).

Within this study, overall safety belt usage progression through conversion rates, over the years of 2007 to 2009, has been analyzed by the observed locations to determine which locations within communities have progressed and which have digressed. This is made possible by the same observational locations being utilized during the statewide observation study each of the past few years. Conversion rates from 2007 to 2008 and from 2008 to 2009 are presented for each observed location.

3.2.2 Change in Usage by Traditional Demographic

The Massachusetts Safety Belt Usage Observation Study used tradition attributes of safety belt usage in the Commonwealth of Massachusetts. The report to NHTSA broke down usage by age, race, and gender. The report showed the difference in safety belt usage by vehicle type and vehicle registration as well. Therefore, a general analysis of each attribute has not been conducted in this thesis. What has been conducted is a review of the change in belt usage over these demographic attributes.

Within this study, overall safety belt usage progression through conversion rates, over the years of 2007 to 2009, has been analyzed by the observed traditional demographic attributes to determine which attributes have progressed and which have digressed. This is once again made possible by the same observed attributes being utilized during the statewide observation study each of the past few years. Conversion rates from 2007 to 2008 and from 2008 to 2009 are presented for each observed traditional occupant attributes. The occupant attributes include: gender, apparent age, and apparent race; and for each regional and vehicle characteristic, including: occupant position, vehicle type, state of vehicle registration, and state region.

Beyond conversion rates from demographic to demographic, the overall change in belt usage from 2008 to 2009 was examined. The purpose was to determine which the annual change in usage and whether it was significant. A conversion rate can present information about a demographics' progress, but we can determine if the change is significant using a simple statistical analysis.

The 2009 observational data was compared to the published data from 2008 for each observed traditional demographic attribute. A two-sample t-test for proportions was used to test the significance of differences in belt usage percentages between the two years, 2008 to 2009. For all tests, the degrees of freedom and the test statistic were computed and the p-value was determined. A difference in means was considered as significant if the calculated p-value was less than 5 percent.

3.2.3 Combining Traditional Demographic Attributes

The report to NHTSA broke down usage by age, race, gender, and other traditional demographics. This research will not deeply analyze any one particular demographic attribute. Instead, this research will use combinations of these specific attributes directly from the observation study.

Similar to what was conducted with conversion rates split by gender, age, and race beyond communities, this portion of the analysis includes attribute combinations such as by apparent race by apparent age mutually or apparent gender by vehicle type. This type of analysis permits a more in depth proposal for which demographic attribute groups should be targeted for specific strategies to increase safety belt usage.

Of traditional demographic attribute combinations, the specific demographics and roadway characteristics that this research will hope to evaluate based on safety belt usage are:

- age by gender,
- age by race,
- gender by race,
- race and occupant location,
- age by occupant location, and
- gender by occupant location

3.2.4 Non-traditional Demographic Attributes

The use of non-traditional demographics allow for the separation of usage rates by types of communities. Each community is different in different ways. Within Massachusetts, the range of community type cannot be seen anywhere else. Boston, Massachusetts is in the Top 10 largest metropolitan areas in the nation, yet there are large agricultural farms and plantations within 10 miles of the city limits. Less than 100 miles from Boston is a major mountain range with modest settlement comparative to the city.

With such a vast difference between region and communities, non-traditional demographic attributes were examined. Each demographics category was divided into groups. Each group contained a differing number of Massachusetts' 351 communities. Of non-traditional demographic attributes, the specific demographics and roadway characteristics that were evaluated based on safety belt usage are:

- community median household income,
- community population density, and
- community education level

This analysis consisted of in-depth research of profiles for the communities of the Commonwealth. If a community fell into a particular group for one demographic category, it did not affect its grouping for one of the other categories. The specific grouping arrangements are presented with the data in Chapter 4.

Specific demographics were determined from the most recent demographic information which in some cases was the Census 2000. It is understood that being nine year old data, some community characteristics may have changed. Being that this causes limitations to the data, it can be assumed that with time all communities experience changes, and that being that the demographics are split into ranged groups, a modest increase or decrease in a demographic category would not affect a communities placement into a different group within this short period of time.

An example of this can be seen when analyzing median household income by community. An income group's smallest range is $15,000; which is a lot to change in just a nine year span. Also, because the value of a U.S. dollar is equal between communities, inflation can be ignored and the year 2000 census data can be considered sufficient.

3.2.5 Combining Traditional and Non-traditional Demographics

With the analysis of both traditional occupant attribute and non-traditional demographics, a combination analysis was conducted. The analysis covers the different attributes of an occupant such as apparent age and gender based on the specific community demographics like median income and population density. The combination of specific demographic attributes groups by community profile allows for a more precise identification of the population groups of low usage which warrant strategies and efforts to increase usage.

3.2.6 Change in Usage by Non-traditional Demographic Attributes

Within this study, overall safety belt usage progression through conversion rates over the years was analyzed for each of the non-traditional demographic. Conversion rates from 2008 to 2009 are presented for each assigned group for community population density, median household income, and education level. The overall change in usage rates between 2008 and 2009 was also examined; similar to the traditional demographic attributes. Once again, a two sample t-test for proportions was used to determine whether the change in belt usage from 2008 to 2009 was a significant change.

3.2.7 Citation Data

Beyond the scope of demographic circumstances or graphic location is safety belt citation data. In Massachusetts, a secondary seat belt law state, a citation for non-usage can only be given in the event of a citation for another traffic violation. Therefore, citation data from previous years was analyzed to determine the connection of seat belt citations by original traffic violation citation. The citation data has also been separated into gender and age related sub-divisions in order to better understand who is receiving citations and how does it compare to the overall distribution of people within the state of Massachusetts. Safety belt citation data from 2007 was researched from Massachusetts Traffic Safety Research Program (UMassSafe) and the Commonwealth of Massachusetts.

3.3 Recommendations and Future Goals

The final portion of this research focused on the translation of the quantified analyses into an application of the data, including, but not necessarily limited to, recommendations for the given groups in which safety belt usage is low. Although, direct recommendations will not be made; however, a general review of the approaches that could be carried out in order to increase usage will be presented. Particular information concerning recommendations has been presented based on strategies summarized in the National Cooperative Highway Research Program (NCHRP) Report 500 Volume 11: A Guide for Safety Belt Usage.

In addition to recommendations, a brief overview of possible strategies for improving the way to collect safety belt usage during the observation studies has also been considered. These strategies are being reported as a final assessment of how additional data can be use in order to develop a better sense of safety belt usage throughout particular states, in this case Massachusetts.

CHAPTER 4

RESULTS OF QUANTITATIVE ANALYSIS

The intention of this chapter is to present and examine the results of the 2009 Massachusetts Safety Belt Observation Study completed by the University of Massachusetts Traffic Safety Research Program (UMassSafe) on behalf of the Massachusetts Executive Office of Public Safety and Security - Highway Safety Division and in accordance with NHTSA protocol. The 2009 data is presented by community, observed demographic attributes, and non-traditional demographics, in order to construct an image of those demographic fields that encompass both low and high safety belt usage. Therefore, it can be determined where direct targeting of education and enforcement, in order to improve safety belt usage, needs to be incorporated.

Beyond the scope of the 2009 safety belt usage data, published data from the previous two years has also been presented by community, observed demographic attributes, and non-traditional demographics. This has been conducted in order to construct an image of those demographic fields that have seen progress and regress over two prior years.

4.1 Safety Belt Usage

During the observational study in June 2009, a total of 49,407 drivers and front out-board passengers in a total of 40,294 vehicles were observed at the 160 pre-determined site locations; during 160 hours of direct observation (11). The statistically weighted percentage (occupants with unknown safety belt status not included) of front seat occupants properly using their safety belt during the periods of observational study was found to be 73.61 percent (11). This number represents a 6.77 percent increase in safety belt usage in Massachusetts from 2008. In an unweighted format the percentage of belt usage was 73.99 percent (11). Table 4 presents a breakdown of observed occupant characteristics and Table 5 presents a breakdown in observed vehicle and location information.

TABLE 4: Summary of Study Data by Occupant Observational Variable – Weighted (11)

	2009 Data		**2008 Data**	**2007 Data**
Observational Variable	**Total Observed Occupants**	**Weighted Pct. Belted**	**Weighted Pct. Belted**	**Weighted Pct. Belted**
All Vehicle Occupants	**49,407**	**73.61**	66.84	68.72
Gender				
Male	**23,064**	**68.44**	61	62
Female	**26,212**	**79.43**	74	76
Status Unknown	**131**	**84.30**	83	68
Apparent Age				
Child (passenger <12)	**651**	**87.87**	83	83
Teen	**2,205**	**66.91**	59	69
Adult	**41,886**	**72.81**	66	68
Elder Adult (>65)	**4,612**	**82.12**	76	78
Status Unknown	**53**	**75.08**	90	78
Apparent Race				
Black	**2,076**	**71.98**	63	68
Hispanic	**2,477**	**63.82**	48	61
White	**43,094**	**73.92**	68	69
Other	**1,458**	**82.63**	70	75
Status Unknown	**302**	**77.41**	62	51
Occupant Role				
Driver Alone	**30,578**	**72.05**	66	67
Driver with Passenger	**9,716**	**77.30**	68	72
Passenger	**9,113**	**74.94**	70	73

TABLE 5: Summary of Study Data by Vehicle and Location Information – Weighted (11)

Observational Variable	2009 Data		2008 Data	2007 Data
	Total Observed Occupants	Weighted Pct. Belted	Weighted Pct. Belted	Weighted Pct. Belted
All Vehicle Occupants	**49,407**	**73.61**	66.84	68.72
State of Vehicle Registration				
Massachusetts	**44,913**	**72.63**	66	64
New Hampshire	**540**	**71.85**	69	75
Out of State (Other)	**3,929**	**84.93**	78	82
Unknown	**25**	**91.53**	80	NR
Vehicle Type				
Passenger Car	**26,819**	**75.77**	69	71
Pick-Up Truck	**4,761**	**60.87**	49	56
SUV	**11,469**	**77.04**	72	71
Van	**3,787**	**80.07**	70	74
Commercial Vehicle	**2,571**	**49.96**	43	45
Time of Day / Day of Week				
A.M. Peak - Weekday	**10,998**	**72.46**	67	65
Midday Peak - Weekday	**12,508**	**70.85**	66	69
P.M. Peak - Weekday	**13,255**	**75.33**	67	71
Weekend	**12,646**	**75.55**	66	70
Observational Region				
Berkshire	**9,054**	**77.61**	71	72
Pioneer	**9,456**	**73.27**	69	71
Worcester	**10,429**	**72.48**	65	68
Northeast	**9,998**	**72.92**	68	67
Southeast	**10,470**	**72.26**	61	65
Roadway Functional Classification				
Local	**1,615**	**72.54**	72	65
Collector	**14,369**	**68.59**	60	64
Arterial	**19,691**	**73.11**	66	66
Freeway	**10,567**	**80.05**	74	77

These tables present both 2007 and 2008 published weighted safety belt usage data, along with the 2009 weighted data, for comparison and have been acquired directly from the published 2008 and 2009 Massachusetts Safety Belt Observation Study.

4.1.1 Massachusetts Statewide Data

Massachusetts safety belt usage rate, as previously stated, has been historically lower comparative to the usage rate of the rest of the nation. 2009 was again no different from this fact. As reported from the 2009 Massachusetts Safety Belt Observation Study Report, yet not currently approved by NHTSA and therefore still preliminary, the weighted usage rate in Massachusetts, although increasing from 2008, was determined to be 73.61 percent. Although the national rate will not be released until 2010, Massachusetts still figures to be below the national average.

On a positive note, this is the second largest single year increase in usage in the past decade, only being behind the single year increase from 2002 to 2003; the year of which Click It or Ticket went into effect in Massachusetts. Furthermore, many observational locations and observation demographics within the state have increased their usage from previous years.

4.1.2 Data Considerations and Possible Data Limitations

While usage rates and conversion rates provide useful information into behavior and changes in behavior, it is important to be aware of the limitations of the data that has been presented and that will be presented within these results. The data is based on observational data and may not reflect the exact usage of the state or the particular communities. Furthermore, past observational data is being compared to current data and does not encompass directly the same users year to year.

The observational study does not take into account that motorists or passenger may only be using a safety belt some of the time and not always. A motorist or passenger may only be using a safety belt in response to a recent traffic collision or citation or as a result of the Click It or Ticket campaign that was completed immediately before the start of observational data collection. Also, data collected from particular observational locations include below 10 vehicles, and therefore, may not be a representative sample of the actual usage of a roadway, let alone that community.

These presented data and usage rates are of an instantaneous point in time and do not imply that it represents the exact usage rate or conversion rates over time.

4.2 Massachusetts Safety Belt Usage by Specific Observational Location

The Massachusetts Safety Belt Usage Observation Study is set up to have observations carried out at selected observational locations within communities across the state in order to insure a random sample of vehicle occupants. With UMassSafe conducting the study in previous years, similar observational locations have been used year to year. Therefore, the change in safety belt usage by observational location can be analyzed to determine which particular locations are progressing in usage or digressing; however, it is important to stress that the usage rate presented is reflective of the observational location and not necessarily of the community itself.

Knowing the rate of usage change at specific observational locations, it can be determined which types of roadways in specific types of communities, are seeing change. Noting that there is a possibility of very low volumes on some of these roadways, roadways with moderate to high volumes may show increases or decreases in usage for which it can be determined that particular communities are improving safety belt usage; pending there is more than one roadway represented by a community.

4.2.1 Comparing Usage by Year

Through the past few year of the observational study, not all the same observational locations have been used; and in 2009, additional communities were added to the list of visited communities during the study. Particular observational locations within communities that do not have data for at least two years of data for 2007, 2008, and 2009, have not been included in this section for comparing year to year belt usage rates. Locations with less than 50 occupants recorded for any two of the three years has also not been included as it has been judged that the sample size is too small to get an accurate difference. Freeway (may be referred to as highway) data has also not been included as highway data does not accurately represent a community, but a regional belt usage.

4.2.2 Why Conversion Rates?

The usage conversion rate is defined as the change in safety belt usage comparative to the previous known usage. NHTSA uses conversion rates to show the fact that it is more difficult to increase belt usage for particular populations that already have higher usage rates. For instance, it is more difficult to increase usage by one percent in a location where belt use is 90 percent than it is to increase usage by one percent in a location where the usage is 50 percent (13). A conversion rate will be able to describe the change in non-user behavior rather than a change in user behavior (13).

Inversely, conversion rates can also tell the story of users converting to non-users. A negative conversion rate is defined as the percentage of previous users who are currently non-users. Moving from 2007 to 2008, the statewide safety belt use rate decreased and therefore, there are many selected variables that had a negative conversion rate.

4.2.3 Conversion Rates by Observational Location

As previously mentioned with the analysis of the change in observational locations community usage year by year, conversion rates were attached to each observational location as seen in Table 6. Once again, observational locations with less than 50 occupants observed in two of the three year (2007, 2008, and 2009) have not been included as it has been judged that the sample size is too small to get an accurate difference. Even as communities with multiple observational locations have been grouped together, it is once again important to stress that the usage rate presented is reflective of the observational location and not necessarily of the community itself.

TABLE 6: Summary of Conversion Rates by Observational Location

City / Town	Roadways	2007 Data Weighted Belt Use Rate	2008 Data Weighted Belt Use Rate	2009 Data Weighted Belt Use Rate	Conversion Rate from 2008 to 2009	2-yr Conversion Rate from 2007 to 2009
Agawam	Bodurtha Hwy	80.1%	63.0%	63.5%	**1.3%**	**-20.7%**
Amherst	College Street	73.9%	81.6%	79.2%	**-2.9%**	**20.4%**
Arlington	Dudley Street	51.9%	63.6%	65.0%	**3.7%**	**27.2%**
Attleboro	Pleasant Street Park Street	70.4%	64.3%	73.5%	**25.7%**	**10.4%**
Auburn	Oxford Street	69.6%	76.5%	75.6%	**-1.2%**	**20.0%**
Ayer	Fitchburg Road	65.2%	60.5%	71.1%	**26.9%**	**16.9%**
Barnstable	Main Street Iyanough Road	74.9%	71.1%	75.2%	**14.3%**	**1.1%**
Belchertown	Howard Street	77.0%	73.6%	64.1%	**-12.9%**	**-16.8%**
Belmont	Lake Street	69.6%	77.4%	68.8%	**-11.2%**	**-1.2%**
Beverly	Eastern Avenue	55.9%	73.8%	67.7%	**-8.3%**	**26.8%**
Boston	Medallion Avenue Columbus Avenue	55.8%	62.7%	71.2%	**22.7%**	**34.8%**
Boxford	Georgetown Road	73.3%	82.0%	95.6%	**75.5%**	**83.5%**
Braintree	Granite Street	63.2%	54.5%	69.0%	**31.8%**	**15.8%**
Brockton	Main Street Warren Avenue	53.2%	40.5%	60.7%	**33.9%**	**16.1%**
Cheshire	North Street	68.1%	66.1%	73.8%	**22.7%**	**18.1%**
Chicopee	Montgomery Street Fuller Road Mellen Street Center Street	71.6%	64.8%	74.4%	**27.3%**	**9.7%**
Clinton	Chestnut Street	61.8%	51.4%	70.3%	**39.0%**	**22.4%**
Concord	Elm Street	77.9%	86.9%	87.9%	**7.1%**	**45.1%**
Dalton	North Street	80.0%	81.3%	67.3%	**-17.2%**	**-15.9%**
Danvers	Elliott Street	74.1%	75.0%	70.0%	**-6.7%**	**-5.5%**
Dartmouth	Old Westport Road	45.0%	67.0%	70.3%	**9.8%**	**46.0%**
Dracut	Methuen Road	64.3%	72.8%	62.8%	**-13.7%**	**-2.3%**
Eastham	Republic Highway	0.0%	71.4%	95.9%	**85.7%**	**N/A**
Easthampton	Main Street	0.0%	80.2%	77.1%	**-3.8%**	**N/A**
Fairhaven	Huttlecon Avenue	60.9%	54.4%	64.0%	**21.0%**	**7.7%**
Fall River	Broadway	39.9%	26.8%	53.1%	**36.0%**	**22.0%**
Falmouth	Carey Lane	73.2%	72.9%	84.6%	**43.2%**	**42.7%**
Fitchburg	Hurd Street	53.1%	47.5%	75.9%	**54.0%**	**48.5%**

NOTE: Table continues on next page.

TABLE 6 cont: Summary of Conversion Rates by Observational Location

City / Town	Roadways	2007 Data Weighted Belt Use Rate	2008 Data Weighted Belt Use Rate	2009 Data Weighted Belt Use Rate	Conversion Rate from 2008 to 2009	2-yr Conversion Rate from 2007 to 2009
Holyoke	Hampden Street Locust Street Beech Street Linden Street	77.7%	63.1%	71.8%	**23.5%**	**-7.6%**
Lakeville	Bettys Neck Road	70.8%	67.9%	72.7%	**15.2%**	**6.5%**
Lanesborough	Summer Street South Main Street	63.1%	62.9%	74.3%	**30.8%**	**30.4%**
Lawrence	Broadway	36.8%	55.2%	57.6%	**5.3%**	**32.9%**
Lee	West Park Street High Street Pleasant Street	67.3%	60.9%	74.3%	**34.2%**	**21.3%**
Lenox	Housatonic Street	74.5%	77.5%	71.9%	**-7.3%**	**-3.6%**
Leominster	West Street Bainbridge Street	61.7%	73.0%	58.3%	**-20.1%**	**-5.4%**
Lowell	Middlesex Street	42.05%	58.57%	62.97%	**10.6%**	**36.1%**
Ludlow	Center Street	64.64%	57.88%	65.67%	**18.5%**	**2.9%**
Lynn	Lynn Shore Drive	69.46%	74.84%	78.03%	**12.7%**	**28.1%**
Malden	Salem Street	54.34%	56.92%	63.33%	**14.9%**	**19.7%**
Mansfield	Ware Street School Street	70.79%	73.17%	75.25%	**7.8%**	**15.3%**
Mashpee	Falmouth Road	70.28%	72.19%	93.00%	**74.8%**	**76.4%**
Monson	Main Street	70.27%	76.64%	75.92%	**-0.9%**	**19.0%**
New Bedford	Coggeshall Road	58.12%	41.03%	61.68%	**35.0%**	**8.5%**
Newton	Watertown Street Stuart Street	70.62%	71.56%	83.42%	**41.7%**	**43.6%**
North Adams	Main Street Curran Highway	66.57%	72.38%	73.17%	**2.8%**	**19.7%**
Northborough	Main Street B-W Turnpike	71.16%	71.84%	82.40%	**37.5%**	**39.0%**
Northbridge	Quaker Street	60.61%	49.02%	56.00%	**13.7%**	**-7.6%**
Norwood	Central Street	58.52%	54.14%	67.50%	**29.1%**	**21.7%**
Plymouth	Circuit Avenue Sandwich Street	58.40%	50.85%	69.29%	**37.5%**	**26.2%**
Raynham	North Main Street	62.86%	63.68%	68.81%	**14.1%**	**16.0%**
Revere	Broadway	0.00%	54.31%	59.92%	**12.3%**	**N/A**

NOTE: Table continues on next page.

TABLE 6 cont: Summary of Conversion Rates by Observational Location

City / Town	Roadways	2007 Data Weighted Belt Use Rate	2008 Data Weighted Belt Use Rate	2009 Data Weighted Belt Use Rate	Conversion Rate from 2008 to 2009	2-yr Conversion Rate from 2007 to 2009
Pittsfield	North Street West Street Newell Street Dalton Avenue First Street West Street Bishop Parkway Cheshire Road	59.59%	67.56%	70.24%	**8.3%**	**26.4%**
Rochester	Neck Road	63.64%	61.76%	68.52%	**17.7%**	**13.4%**
Saugus	Essex Street	71.52%	74.74%	66.89%	**-10.5%**	**-6.5%**
Somerset	Davol Street	63.42%	45.76%	63.38%	**32.5%**	**-0.1%**
Southborough	Southville Road	77.94%	66.33%	73.71%	**21.9%**	**-5.4%**
Spencer	Main Street Main Street	73.13%	55.93%	69.25%	**30.2%**	**-5.3%**
Springfield	Cambria Street Alden Street Plumtree Road	67.58%	68.33%	69.28%	**3.0%**	**5.2%**
Sturbridge	Southbridge Road New Boston Road	62.78%	78.57%	74.39%	**-5.3%**	**31.2%**
Walpole	West Street	72.80%	71.52%	71.67%	**0.5%**	**-1.6%**
W.Springfield	Park Street Rotary	66.92%	56.90%	66.98%	**23.4%**	**0.2%**
W. Stockbridge	G. Barrington Road	69.68%	80.09%	86.27%	**31.1%**	**54.7%**
Westfield	North Elm Street Elm Street	66.70%	69.35%	75.32%	**19.5%**	**25.9%**
Williamstown	Petersburg Road	82.72%	81.48%	100.00%	**100.0%**	**100.0%**
Worcester	Stafford Street Annisquam Street School Street Massasoit Road Clark Street Doyle Road Grafton Street Millbury Street Belmont Street	68.86%	58.31%	67.26%	**21.5%**	**-2.3%**
Wrentham	Beech Street	76.39%	71.20%	81.00%	**34.0%**	**19.5%**

As seen in the previous tables, only three communities saw conversion rates of 50 percent of more over the two-year period from 2007 to 2009; including: Georgetown Road in Boxford, Massachusetts had a conversion rate of 83.5 percent (75 occupants in 2007, 89 occupants in 2008, and 68 occupants in 2009), Falmouth Road in Mashpee, Massachusetts had a conversion rate of 76.4 percent (535 occupants in 2007, 303 occupants in 2008, and 657 occupants in 2009), and Great Barrington Road in West Stockbridge, Massachusetts had a conversion rate of 54.7 percent (188 occupants in 2007, 221 occupants in 2008, and 153 occupants in 2009). All three locations fall within communities that are of different regions within the state. From 2008 to 2009, again only three locations within communities had conversion rates of 50 percent or more; including: Georgetown Road in Boxford at 75.5 percent conversion, the Eastham Rotary in Eastham at 85.7 conversion (406 occupants in 2008 and 513 occupants in 2009), and Falmouth Road in Mashpee at 74.8 percent conversion.

Only one quarter (15 of 60) of the communities that a conversion rate was calculated had a negative conversion rate from 2007 to 2009. When the two years are separated, only about half of communities (26 of 60) had a negative conversion rate from 2007 to 2008 in which 25 of the 26 had positive conversions rates from 2008 to 2009. Only 15 of 60 communities had a negative conversion rate from 2008 to 2009.

This data can be seen as not valid due to the lack of observations for each observation locations within particular communities. With only one roadway per community in multiple cases, many of these communities are underrepresented. This structure of determining differences in safety belt usage is not as effective a structure as looking at groups of communities together so that the number of occupants observed is of a larger sample as one roadway in a random community. This type of analysis will be carried out with the non-traditional community demographic analysis.

4.3 Traditional Demographic Attributes

The following section incorporates the traditional demographic data directly from the 2009 Massachusetts Safety Belt Observation Study. The data has been compared year to year using conversion rates and t-test for significant differences. In addition, safety belt usage within these demographic variables have been combined to establish a foundation for trends within the data based on such attributes as age, gender, race, and occupant seating position.

4.3.1 Conversion Rates by Observed Occupant Attribute

Using the observational data from Tables 4 and 5, the conversion rates for selected occupant variables were calculated and presented in Table 7. These conversion rates were calculated for 2007 to 2008, 2008 to 2009, and a two year conversion from 2007 to 2009 directly. The two-year conversion rate was included due to Massachusetts drop in usage during 2008. Therefore, it would be credible to present how the state has progress over the two year span with the deficit year of 2008 excluded.

The overall conversion rate for all vehicle occupants from 2007 to 2008 was a negative conversion of 2.7 percent. The overall conversion rate from 2008 to 2009 was 20.4 percent. Over the two-year period, the conversion rate from 2007 to 2009 was 15.6

percent. As a result, in the past two years, a bit less than one of every 5 non-users of safety belts is now a user.

TABLE 7: Two-year Conversion Rates for Selected Observational Variables

Observational Variable	2007 Data	2008 Data	Conversion Rate from 2007 to 2008	2009 Data	Conversion Rate from 2007 to 2009 (2 yr)	Conversion Rate from 2008 to 2009
	Weighted Belt Use Rate (%)	Weighted Belt Use Rate (%)		Weighted Belt Use Rate (%)		
All Occupants	68.72	66.84	-2.7%	73.61	15.6%	20.4%
Gender						
Male	62	61	-1.6%	68	15.8%	17.9%
Female	76	74	-2.6%	79	12.5%	19.2%
Apparent Age						
Child	83	83	0.0%	88	29.4%	29.4%
Teen	69	59	-14.5%	67	-2.9%	19.5%
Adult	68	66	-2.9%	73	15.6%	20.6%
Elder Adult	78	76	-2.6%	82	18.2%	25.0%
Apparent Race						
Black	68	63	-7.4%	72	12.5%	24.3%
Hispanic	61	48	-21.3%	64	7.7%	30.8%
White	69	68	-1.4%	74	16.1%	18.8%
Other	75	70	-6.7%	83	32.0%	43.3%
Occupant Role						
Driver Alone	67	66	-1.5%	72	15.2%	17.6%
Driver w Pass	72	68	-5.6%	77	17.9%	28.1%
Passenger	73	70	-4.1%	75	7.4%	16.7%
Vehicle Type						
Passenger Car	71	69	-2.8%	76	17.2%	22.6%
Pick-Up Truck	56	49	-12.5%	61	11.4%	23.5%
SUV	71	72	3.4%	77	20.7%	17.9%
Van	74	70	-5.4%	80	23.1%	33.3%
Commercial	45	43	-4.4%	50	9.1%	12.3%

As seen in the previous table, the most prominent conversion rates for the past year from 2008 to 2009 was in occupants of non-specified race (Asian, Arab, Indian, etc) with a 43.3 percent conversion of non-users to users. It is also the largest conversion over the two-year period, at 32.0 percent. The least converted non-user from 2008 to 2009 was of occupants in commercial vehicles, at 12.3 percent. Yet, at least in saw an increase in usage opposed to most of 2007 to 2008 belt usage.

Most of the selected variables saw a negative conversion rate from 2007 to 2008. This is indicative of the state's decrease belt usage between those two years. However, not all variable groups saw a decrease. SUV as a vehicle is the only variable group that saw a positive conversion of belt usage from 2007 to 2008, at 3.4 percent. SUVs also saw a positive conversion from 2008 to 2009, at 17.9 percent.

A notable conversion seen in the table is teen drivers and passengers. From 2007 to 2008, teen occupants had 14.5 percent of users become non-users; a major jump backwards for safety belt usage. Yet, from 2008 to 2009, that conversion has almost completely recovered with a conversion of 19.5 percent of the non-users becoming users. Although the belt usage decreases over the two-years, the rebound after a rather low 2008 is notable. Teens were the only age group the experienced a negative conversion over the two-year period.

An encouraging conversion rate is that of drivers with passengers in the front out-board seat. As one of the largest conversion rates, at 17.9 percent from 2007 to 2009, more and more occupants of this combination are buckling up. Occupants involved in the situation for which there is a passenger, the distraction level increases for the driver of the vehicle. Hence, with increased belt usage with this variable, there is likely the mindset that the occupants may be aware of the distraction that can be caused.

4.3.2 Comparing Usage for Observed Occupant Attribute by Year

It is seen through the actual published 2008 data and the 2009 data, along with the calculated conversion rates, that safety belt usage had increased from 2008 to 2009 in all of the occupant, vehicle, and observed location categories. Yet, this assessment of increased usage is incomplete. An increase of one percent does not necessarily signify an actual increase, based on the overall population of state and the total number of safety belt observations conducted.

To determine if there was a significant change in safety belt usage, the 2009 observational data was compared to the published data from 2008 for each observed traditional demographic attribute using a two-sample t-test for proportions. For these t-tests, the degrees of freedom and the test statistic were computed and the p-value was determined. The yearly safety belt usage percentage was considered as significantly different if the calculated p-value was less than 5 percent.

The results of the t-tests, in which the null hypothesis is defined as the percentage of safety belt usage being equal (H_o: $p_{2008} = p_{2009}$), are presented in Tables 8 and 9.

TABLE 8: Test for Significant Difference Between 2008 and 2009 Occupant Data

Observational Variable	2008 Weighted Pct. Belted	2009 Weighted Pct. Belted	DF	t-stat	p-value	Result
All Vehicle Occupants	**66.84**	**73.61**	90,124	22.191	p < .0001	**Sign. Diff.**
Gender						
Male	**61**	**68**	45,159	15.548	p < .0001	**Sign. Diff.**
Female	**74**	**79**	44,763	12.37	p < .0001	**Sign. Diff.**
Apparent Age						
Child (passenger <12)	**83**	**88**	1,116	2.37	p = .0180	**Sign. Diff.**
Teen	**59**	**67**	3,913	5.157	p < .0001	**Sign. Diff.**
Adult	**66**	**73**	76,020	20.92	p < .0001	**Sign. Diff.**
Elder Adult (>65)	**76**	**82**	9,004	6.997	p < .0001	**Sign. Diff.**
Apparent Race						
Black	**63**	**72**	4,058	6.125	p < .0001	**Sign. Diff.**
Hispanic	**48**	**64**	4,267	10.43	p < .0001	**Sign. Diff.**
White	**68**	**74**	78,689	18.516	p < .0001	**Sign. Diff.**
Other	**70**	**83**	2,627	7.898	p < .0001	**Sign. Diff.**
Occupant Role						
Driver Alone	**66**	**72**	56,713	15.433	p < .0001	**Sign. Diff.**
Driver with Passenger	**68**	**77**	17,132	13.164	p < .0001	**Sign. Diff.**
Passenger	**70**	**75**	16,275	7.116	p < .0001	**Sign. Diff.**

The results of the t-test, for data pertaining to just the occupants of the vehicles, showed significant differences between the years of 2008 and 2009. In these cases, the significant differences were a significant increase in safety belt usage from 2008 to 2009.

TABLE 9: Test for Significant Difference Between 2008 and 2009 Vehicle and Location Data

Observational Variable	2008 Weighted Pct. Belted	2009 Weighted Pct. Belted	DF	t-stat	p-value	Result
All Vehicle Occupants	**66.84**	**73.61**	90,124	22.191	p < .0001	**Sign. Diff.**
State of Vehicle Registration						
Massachusetts	**66**	**73**	82,839	21.862	p < .0001	**Sign. Diff.**
New Hampshire	**69**	**72**	812	0.891	p = .3730	Stat Equal
Out of State (Other)	**78**	**85**	6,401	7.145	p < .0001	**Sign. Diff.**
Vehicle Type						
Passenger Car	**69**	**76**	49,606	17.457	p < .0001	**Sign. Diff.**
Pick-Up Truck	**49**	**61**	9,196	11.565	p < .0001	**Sign. Diff.**
SUV	**72**	**77**	20,322	8.143	p < .0001	**Sign. Diff.**
Van	**70**	**80**	7,095	9.75	p < .0001	**Sign. Diff.**
Commercial Vehicle	**43**	**50**	3,897	4.448	p < .0001	**Sign. Diff.**
Time of Day / Day of Week						
A.M. Peak - Weekday	**67**	**72**	20,645	7.797	p < .0001	**Sign. Diff.**
Midday Peak - Weekday	**66**	**71**	22,233	7.984	p < .0001	**Sign. Diff.**
P.M. Peak - Weekday	**67**	**75**	24,550	13.814	p < .0001	**Sign. Diff.**
Weekend	**66**	**76**	22,690	16.588	p < .0001	**Sign. Diff.**
Observational Region						
Berkshire	**71**	**78**	16,637	10.359	p < .0001	**Sign. Diff.**
Pioneer	**69**	**74**	17,508	5.823	p < .0001	**Sign. Diff.**
Worcester	**65**	**72**	18,246	10.118	p < .0001	**Sign. Diff.**
Northeast	**68**	**73**	18,808	7.515	p < .0001	**Sign. Diff.**
Southeast	**61**	**72**	18,917	16.007	p < .0001	**Sign. Diff.**
Roadway Functional Classification						
Local	**72**	**73**	4,042	0.697	p = .4860	Stat Equal
Collector	**60**	**69**	25,730	15.033	p < .0001	**Sign. Diff.**
Arterial	**66**	**73**	35,335	14.25	p < .0001	**Sign. Diff.**
Freeway	**74**	**80**	21,846	10.516	p < .0001	**Sign. Diff.**

In almost every case in the test for significant differences between years for vehicle and general location data, the null hypothesis of the t-test was rejected and the percentages from 2008 and 2009 were classified as significantly different. However, that was not the case for two of the observational variables. These two statistically equal variables from 2008 to 2009 were:

- New Hampshire vehicles within Massachusetts (69 percent usage in 2008 to 72 percent usage in 2009)
- Occupants in vehicles traversing local roads (72 percent usage in 2008 to 73 percent usage in 2009)

4.3.3 Combining Traditional Demographics

In order to narrow the specific demographic situation in which high and low safety belt usage is achieved, traditional demographics that were observed in the observational study have been combined. Such examples of this include:

- age by gender,
- age by race,
- age by occupant seating arrangement,
- gender by race,
- gender by occupant seating arrangement
- race and occupant seating arrangement, and
- age by gender by race

An objective of this section would be to point out personal demographics that can be targeted for education and enforcement. The emphasis for this section, while dealing with particular personal attributes, would be on education. Targeted enforcement for particular age, gender, or race groups can be considered as profiling.

Although particular age, gender, and race groups may be seen to have lower safety belt usage rates comparative to others, it is wrong to have enforcement singling out age, gender or race groups in any type of enforcement; whether it is for safety belt violations or other traffic infractions.

4.3.3.1 Safety Belt Usage by Age and Gender

The previous chapter presented that separately, teen belt usage was the lowest and child belt usage was the highest for all of the age groups and males had a lower usage rate than females. In order to obtain a better sense of overall safety belt usage within these groups, age and gender were combined. Each apparent age group was separated by both genders. The results are presented in Figure 4.

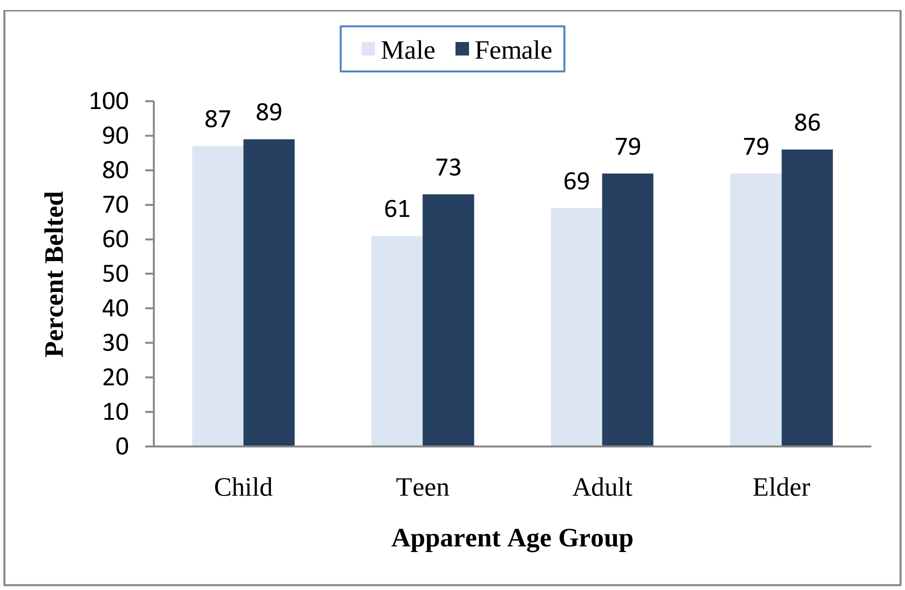

FIGURE 4: Safety Belt Usage by Age Group and Gender Group

As expected, females had a higher belt usage rate for all age groups. Also, as expected, belt usage increased in both genders as age (non-child) increased. Of course, child belt usage is the highest in both gender, but should be thought of separately from the other age groups as they qualify only as passengers. The lowest belt usage rate is by male teens, at 61 percent. The highest belt usage rate (outside of children) is of female elder adults, at 86 percent belt usage.

4.3.3.2 Safety Belt Usage by Age and Race

The previous chapter presented that separately, teen belt usage was the lowest and child belt usage was the highest for all of the age groups and Hispanic occupants had the lower usage rate while those of unspecified races (Asian, Arabic, Indian, etc.) had the highest belt usage rate. In order to obtain a better sense of overall safety belt usage within these groups, age and race were combined. Each apparent age group was separated into each race. The results are presented in Figure 5.

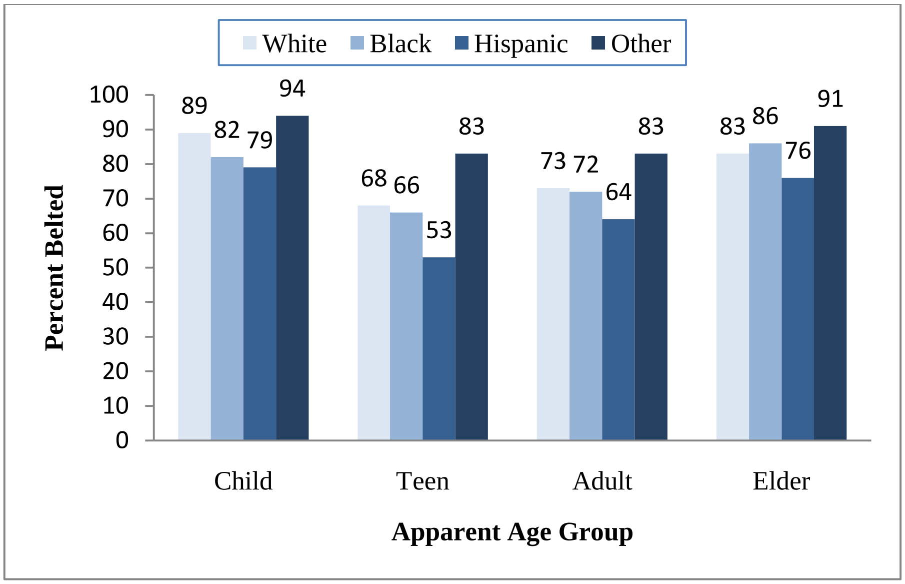

FIGURE 5: Safety Belt Usage by Age Group and Race Group

As expected, within each age group, the un-specified "Other" race category of occupants showed the highest belt usage rate while Hispanic occupants showed the lowest. Once again, as by gender, children showed the highest belt usage by any age group for all races, with the exception of elder adult black occupants who were higher than child black occupants, at 86 and 82 percent respectively. Hispanic teens showed the lowest belt usage rate for all combined race and age groups, at 53 percent usage. Outside of child occupants, as before, belt usage increased or remained equivalent within each race by increasing age group.

4.3.3.3 Safety Belt Usage by Race and Gender

The previous chapter presented that separately, Hispanic occupants had the lower usage rate while persons of unspecified races (Asian, Arabic, Indian, etc.) had the highest belt usage rate and males had a lower usage rate than females. In order to obtain a better sense of overall safety belt usage within these groups, race and gender were combined. Each apparent race group was separated into both genders. The results are presented in Figure 6.

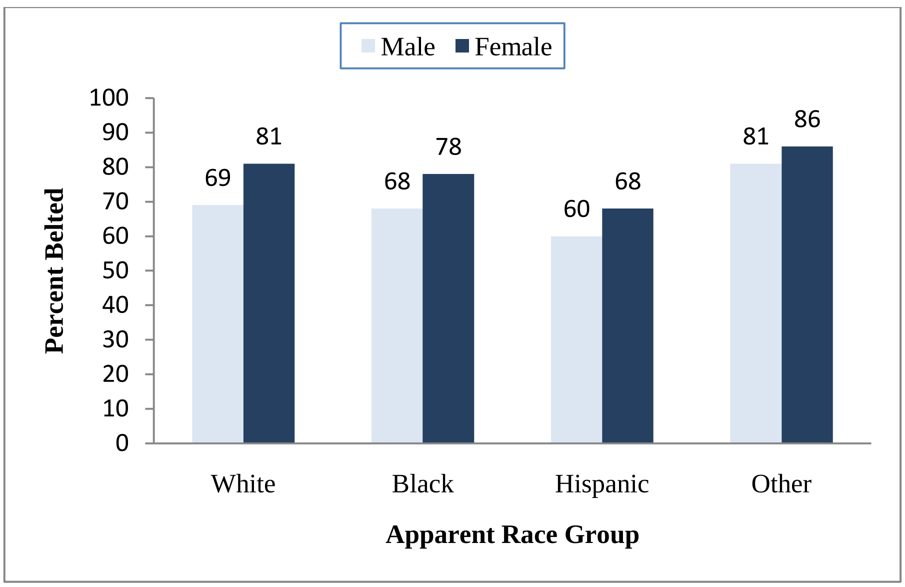

FIGURE 6: Safety Belt Usage by Race Group and Gender Group

Once again, within each race group, female belt usage was superior to male belt usage. Also, as seen previously, the unspecified "Other" race category of occupants showed the highest belt usage rate for each gender, at 81 percent for males and 86 percent for females; while Hispanic occupants showed the lowest for each gender, at 60 percent for males and 68 percent for females. As seen with race by age, black and white occupants were found to be very similar in belt usage for each particular gender, as compared to the other race groups presented.

4.3.3.4 Safety Belt Usage by Race and Occupant Seating Arrangement

An analysis of safety belt usage by the occupant's race and the seating arrangement of those occupants in the vehicle were conducted. As presented in Figure 7, with the exception of white occupants, the highest belt usage rates were seen by drivers who had a passenger in the front out-board passenger seat. This suggests that it is possible that a driver may be realizing the possible in-vehicle distraction that a passenger happens to be and decides to buckle up. This is similar to what was seen with conversion rates (see Table 7) in which drivers with a passenger showed such a high conversion rate.

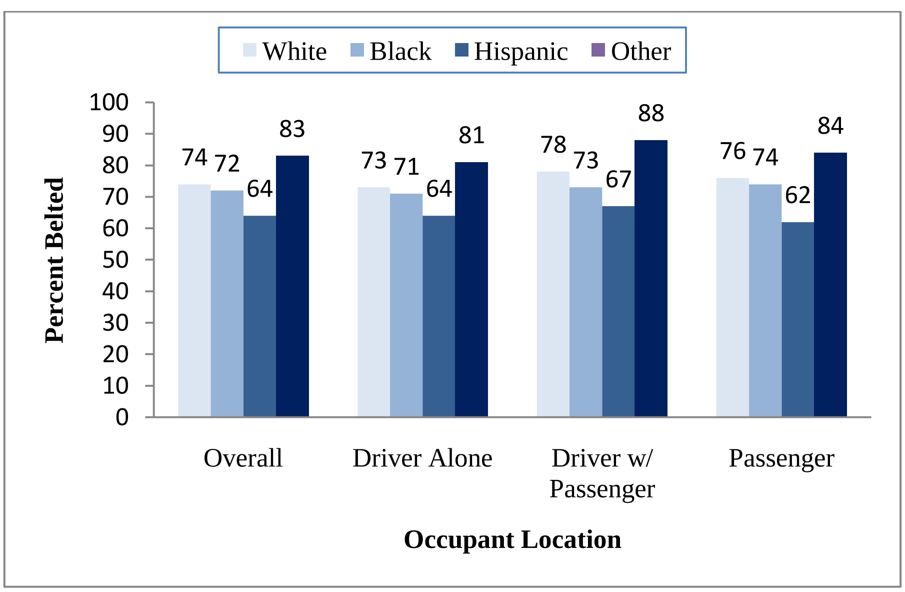

FIGURE 7: Safety Belt Usage by Occupant's Race and Vehicle Seating Arrangement

With the exception of Hispanic occupants, the lowest belt usage rates for the race groups are for a driver alone in a vehicle. These percentages are in all races a drop off from when a driver is with a passenger. This suggests that a driver is more apt to buckle up when he or she has a passenger in the vehicle. Hispanics showed the lowest belt usage in all seating arraignments and the unspecified "Other" race category showed the highest belt usage in all seating arraignments.

4.3.3.5 Safety Belt Usage by Age and Occupant Seating Arrangement

An analysis of safety belt usage by the occupant's age and the seating arrangement of those occupants in the vehicle were conducted. As presented in Figure 8, the belt usage rate increased for drivers when they had a passenger in the vehicle in all age groups. In each case of seating position, it was also clearly seen once again that seat belt usage increased with increasing age.

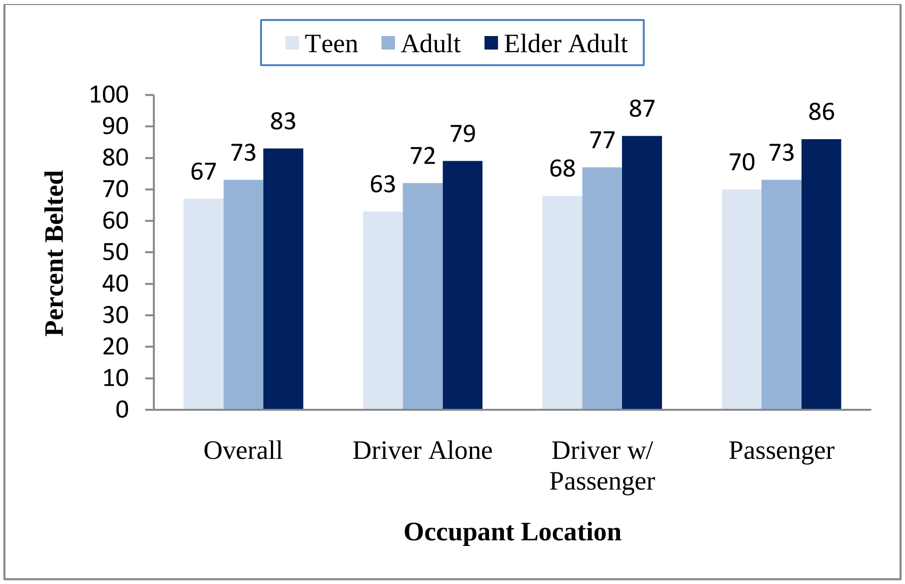

FIGURE 8: Safety Belt Usage by Occupant's Age and Vehicle Seating Arrangement

A direct analysis of occupant configuration with a vehicle by age group allowed for an enhanced look at how a particular class of passenger or a particular class of driver, affect each other in terms of belt usage. The following figures represent the safety belt usage by age of the driver by each possible combination of a similar or different age passenger.

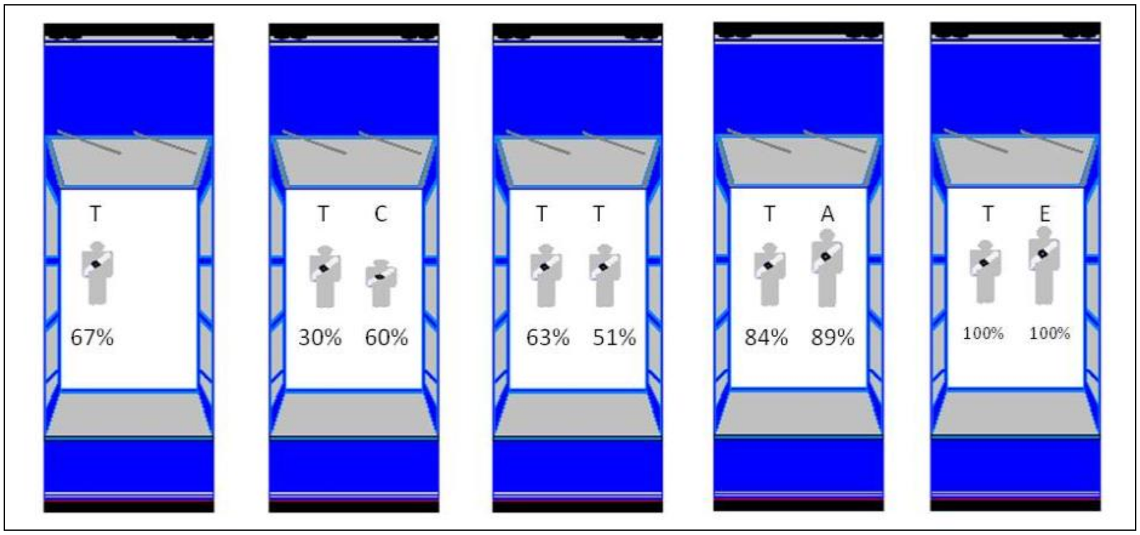

FIGURE 9: Safety Belt Usage by Occupant Age with Teen Driver

Belt usage for a teen driver increased with the age of his / her passenger, as shown in Figure 9. Passenger belt usage increased with age, outside of children passengers. The only passenger age group that showed a lesser belt usage rate than the teen driver was that of a teenage passenger. When a teenager accompanied teenage driver were riding in the front seat of the vehicle together, their belt usage rates were low at 63 and 51 percent for driver and passenger, respectively. It is also presented that teenage drivers have a lower belt usage rate when accompanied by a passenger of equal or lesser age than when they were a driver alone.

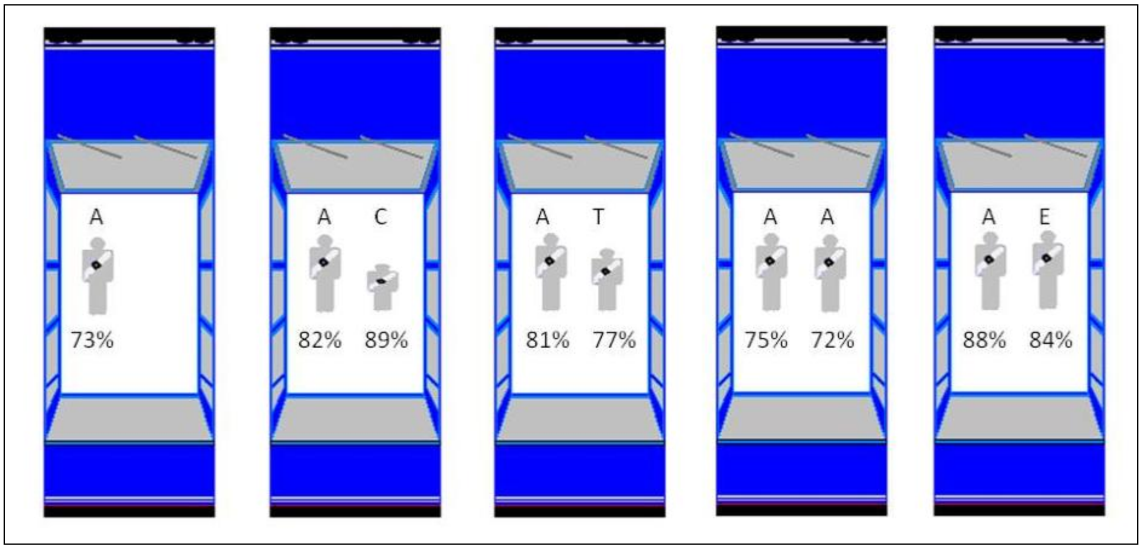

FIGURE 10: Safety Belt Usage by Occupant Age with Adult Driver

Belt usage for an adult driver did not see a similar trend than that of teen drivers. Belt usage fluctuated with the age of the passenger. The lowest belt usage rate for an adult driver or an adult passenger was when they were seated together in the front seat, as shown in Figure 10. Passenger belt usage also saw no significant trend with age and an adult driver. The highest belt usage rate for an adult driver occurred when they were accompanied by an elder adult, at 88 percent. The highest passenger belt usage rate with an adult driver was of children, at 89 percent. In all passenger age cases, an adult driver buckled up more with the passenger then when the adult drove alone.

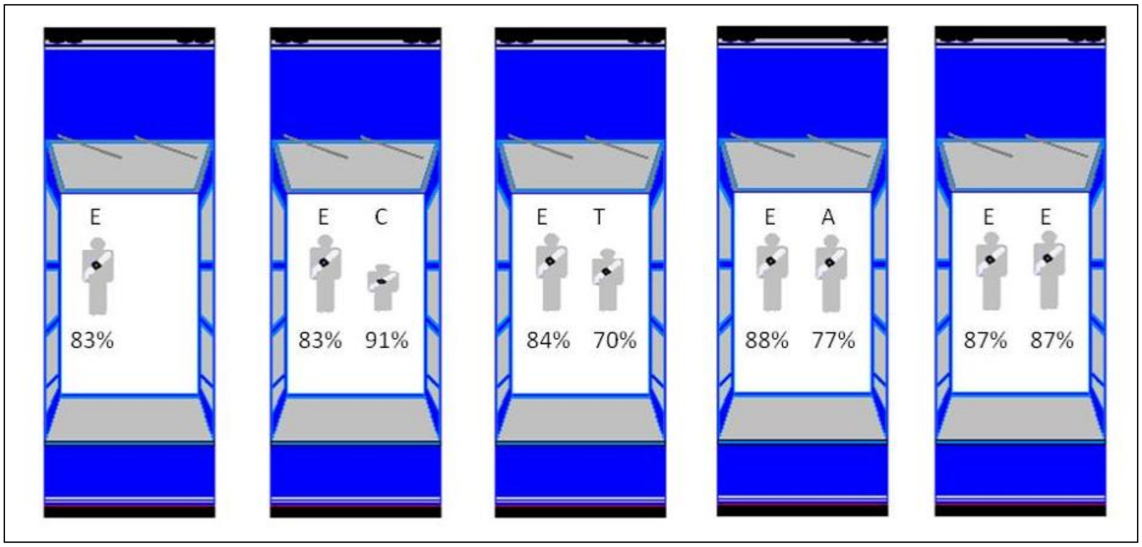

FIGURE 11: Safety Belt Usage by Occupant Age with Elder Adult Driver

Belt usage for an elder adult driver saw a trend of increased belt usage with an increase in passenger age, as shown in Figure 11. The passenger usage rate did not follow that trend. The highest belt usage rate for an elder adult driver was when accompanied by an adult passenger, at 88 percent. The highest belt usage rate for a passenger accompanying an elder adult driver is a child passenger, at 91 percent. As with adults, elder adult drivers had a higher belt usage rate in all passenger age groups than when the elder driver drove alone. Safety belt usage by elder driver with an elder passenger was equal to the usage rate of that elder passenger. This suggests that elder adults driving together tend to buckle up together or not buckled up at all.

4.3.3.6 Safety Belt Usage by Gender and Occupant Seating Arrangement

An analysis of safety belt usage by the occupant's gender and the seating arrangement of those occupants in the vehicle were conducted. As presented in Figure 12, the belt usage rate was higher for females whether they were the driver alone, driving with a passenger, or the passenger.

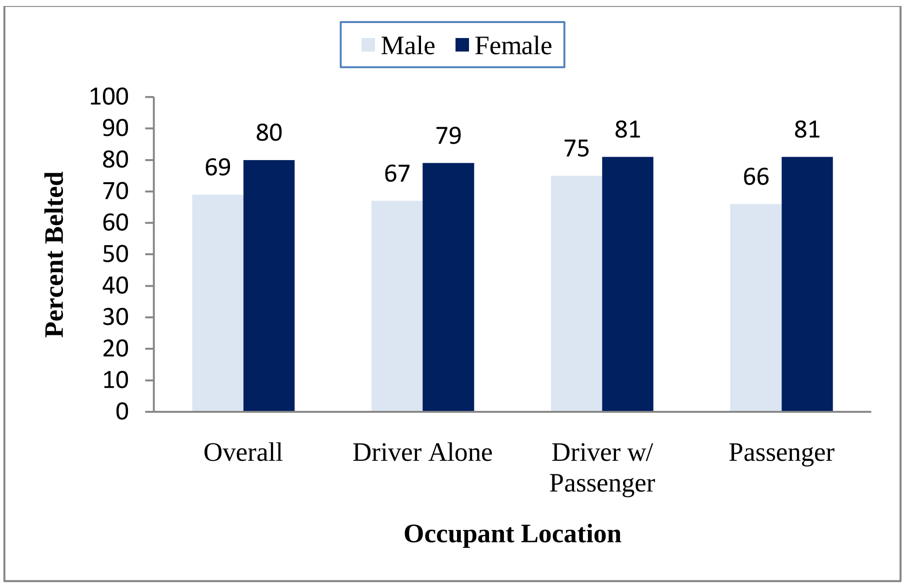

FIGURE 12: Safety Belt Usage by Occupant's Gender and Vehicle Seating Arrangement

A direct analysis of occupant configuration within a vehicle by gender allowed for a further enhanced look at how a particular class of passenger or a particular class of driver, affect each other in terms of belt usage. The following figures represent the safety belt usage by gender of the driver by each possible combination of a male or female passenger.

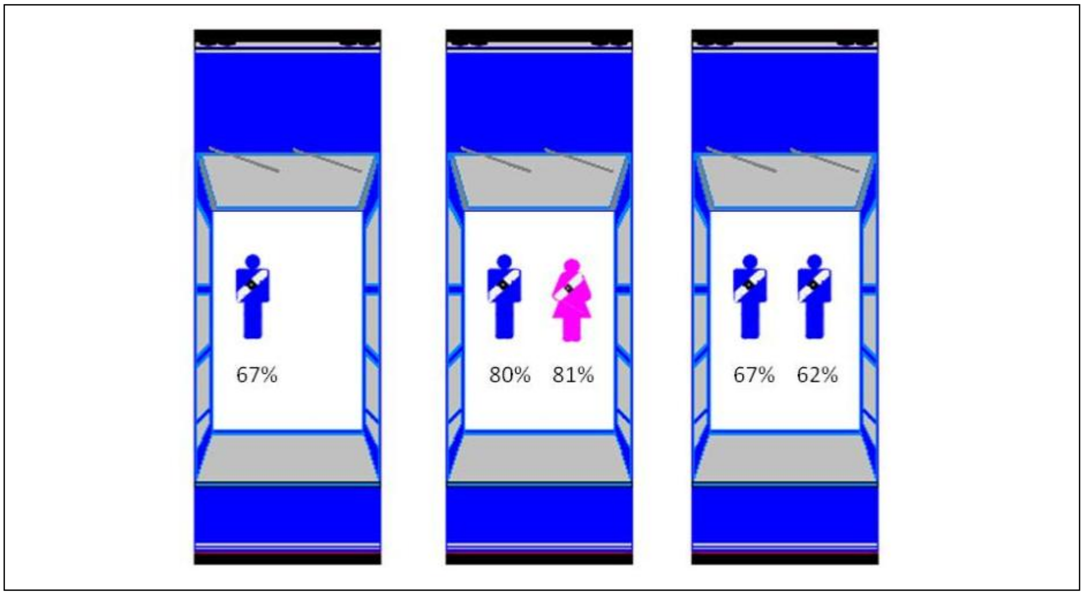

FIGURE 13: Safety Belt Usage by Occupant Gender with Male Driver

An important gender aspect to safety belt usage can be found when a female accompanies a male as the passenger in a vehicle. The highest safety belt usage rate for a male, as a driver or a passenger, is for male occupants when they accompanied by a female. A male driver with a female passenger has a belt usage rate of 80 percent as seen in Figure 13. When a male passenger accompanies a female driver, the belt usage is 72 percent, as seen in Figure 14. Males showed their lowest belt use rate when they were together in the front seats of a vehicle at 67 and 62 percent for driver and passenger, respectively.

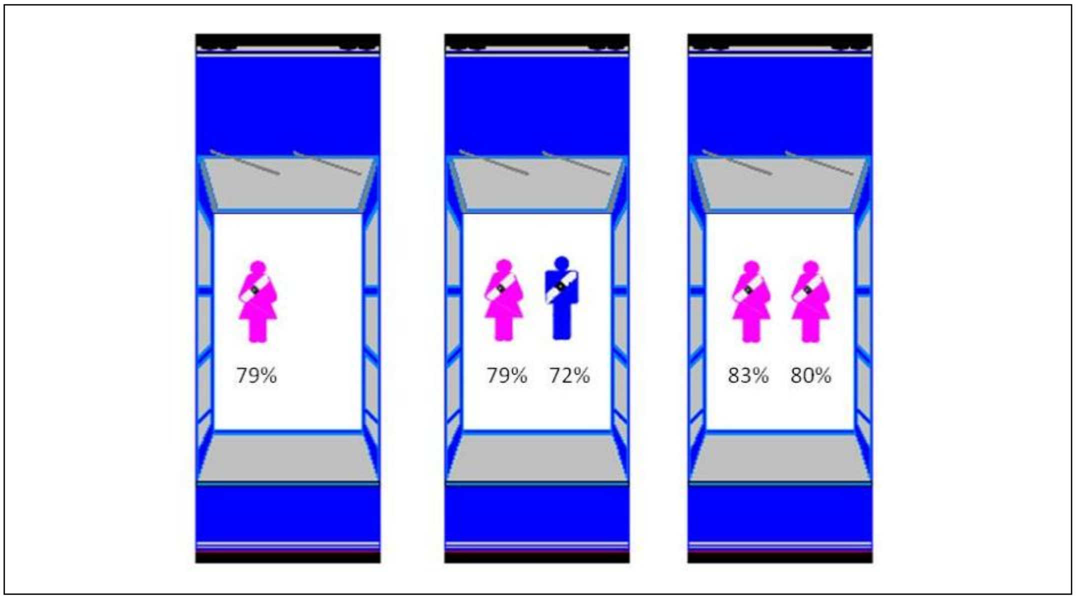

FIGURE 14: Safety Belt Usage by Occupant Gender with Female Driver

A female driver is more likely to buckle up when accompanied by another female in the front seat, as shown in Figure 14. When two females were riding together in the front seat of a vehicle together, their belt usage rate was higher, at 83 and 80 percent for driver and passenger, respectively. What is interesting is that females are more likely to buckle up when together, yet males, as seen previously in Figure 13, are less or only equally likely to buckle up when they are together in the front seat of a vehicle.

4.4 Non-Traditional Demographic Attributes

The following section incorporates the non-traditional demographic data directly from the observational data of the 2009 Massachusetts Safety Belt Observation Study and from community profile information gathered from the U.S. Census Bureau. The data is divided into community population density, median household income, and education level. In addition, these non-traditional demographics have been compared year to year using conversion rates and t-test for significant differences.

4.4.1 Data Restrictions

Before the presentation of results of safety belt usage by non-traditional demographic categories, there must be a mention of the restrictions to this obtained data. Most importantly, it must be presented that the data obtained from the 2009 Massachusetts Safety Belt Observation Study does not include data from each of the 351 communities in Massachusetts. As the demographic categories, such as population density, median household incomes, and education level, are analyzed, it could be noted that with data from all communities, the significance of a usage rate by group may and could be altered. The results are however subject to the constraints of the statewide observational data.

It should also be noted that each group within these demographics, such as *low* population density versus *high* population density, do not have an equal number of communities within; or for that matter, an equal number of belt usage observations. Therefore, the data may be and could have been altered if more observations for particular communities existed. The groupings are based off census-based demographic data and not from observational counts from the study.

Finally, the data is subject to the grouping of the demographic data. There will not be consciences on what defines a community's demographic situation grouping; for instance, whether a community is of low, mid-level, or high education level. A community being moved from one grouping to another may change the percentages of which grouping shows high or low belt usage. Each of the following sections presents, at least in broad terms, the reasoning and selection of the groupings for each of the following demographic analysis.

4.4.2 Usage by Community Population Density

Safety belt usage by a community's population density was analyzed using the safety belt data collected by the 2009 Massachusetts Statewide Safety Belt Usage Observation Study. Population density is defined as the number of persons per square land mile within a specific community. To complete an analysis of population density, 2007 community population estimates from the U.S. Census Bureau were used. These 2007 estimates were the most current and statewide completed population estimates on record and reflect a community's profile more accurately than Census 2000 data. Square land area data was provided by the Commonwealth of Massachusetts website.

In Massachusetts, population density ranges from six people per square mile (Mount Washington and Gosnold) to 18,148 people per square mile (Somerville) based on the 2007 population estimates. Considering that each community has a different population density and that the ranges of these densities are extensive, communities were organized into three population density groups. Group I are communities with the lowest population densities from 0 to 499.9 people per square mile; Group II are communities with medium population densities from 500 to 1,199.9 people per square mile; and Group III are communities with the densest population from 1,200+ people per square mile. A map of all Massachusetts communities classified by population density is shown in Figure 15.

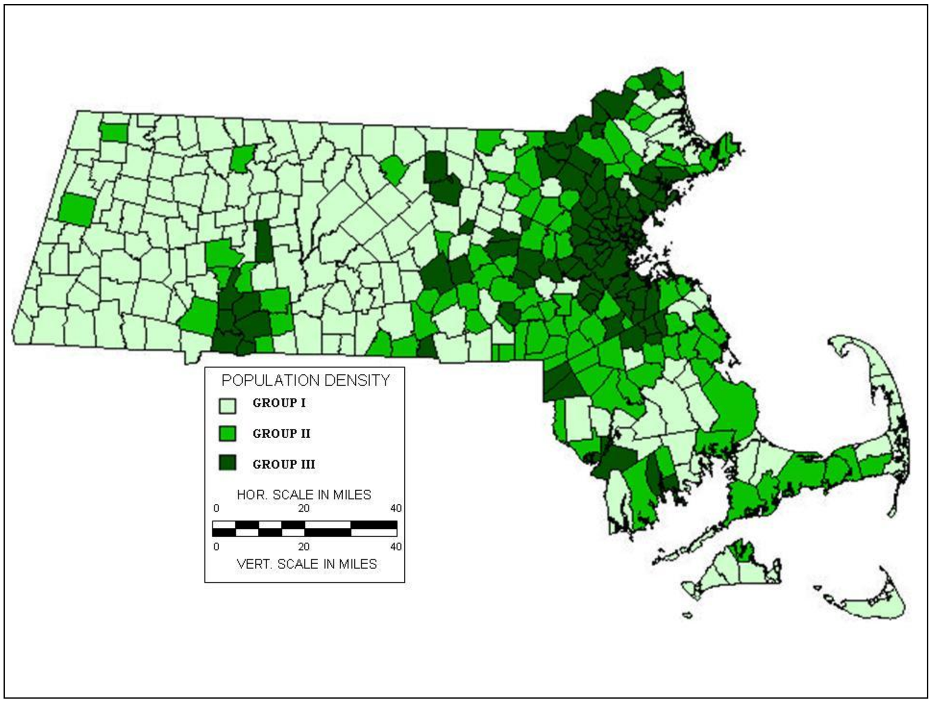

FIGURE 15: Classification of Massachusetts Communities by Population Density Group

The population density groups were not assigned by the state or Census Bureau. These groups were assigned based on logical groupings and rational density divisions. It was determined that 500 persons per square mile was a fair cut point in determining what should be considered a low population density community. To justify the 1,200 persons per square mile cut-off, the determination that particular communities are urban in comparison to others. Therefore, a break point was determined based on the rounded hundred for which communities sat upon the point of urban.

Most of the densest population areas in the state center around Boston, Worcester, Springfield and the major freeway corridors of Interstate 95, 93, the center-east Interstate 90, U.S. 3, and State Route 24; which is to be expected. With the exception of metro-Springfield, most of central and western Massachusetts is of low or hardly mid-level population density.

A constraint to the data that is directly tied to population density is the community's population density versus the location of observation population density. Although some communities have low population densities, particular sections of communities are within the next level. Take for instance Barnstable on Cape Cod. Although Barnstable is a mid-level density community, the observations within Barnstable were conducted in the village of Hyannis which itself, in comparison to the entire community of Barnstable, had an extremely high population density. Once again, the data is constrained to the demographic profile of the entire community.

4.4.2.1 Statewide Usage by Population Density

Communities with low-level population densities (Group I) showed the highest belt use rate, at 80 percent. In contrast, communities with the highest population densities (Group III) showed the lowest belt use rate, at 70 percent. As shown in Figure 16, there is a trend of decreased usage as population density of a community increases.

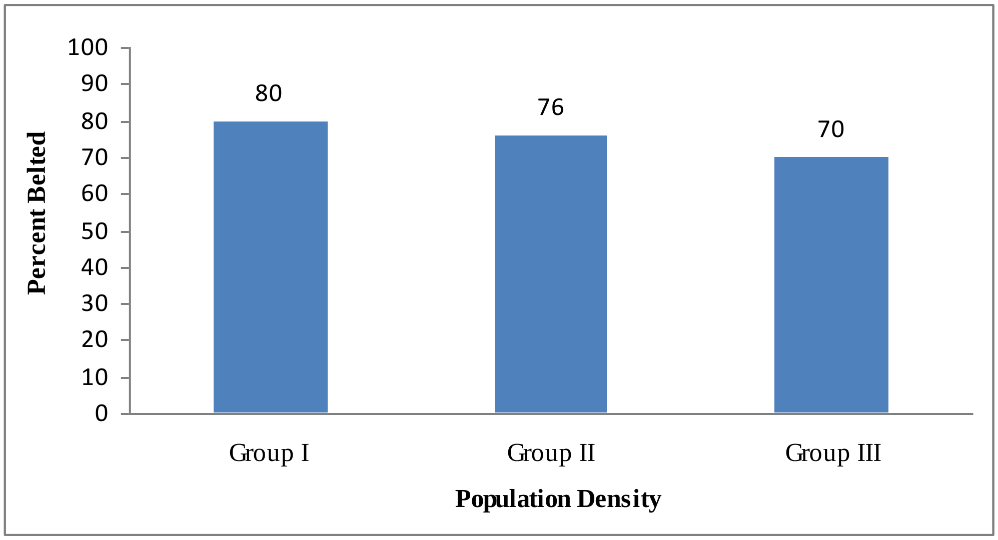

FIGURE 16: Safety Belt Usage by Population Density Group

As stated before, highway travel does not concretely represent a specific community's driving habit, but more of a regional habit. Therefore, when safety belt usage was separated for each population density group by highway usage and non-highway usage as shown in Figure 17, a different trend becomes evident. Just examining the non-highway data, communities with mid-level population densities (Group II) now showed the highest safety belt use rate, at 76 percent. This would suggest that it is more accurate to say that communities with mid-level population densities show the highest safety belt use rates.

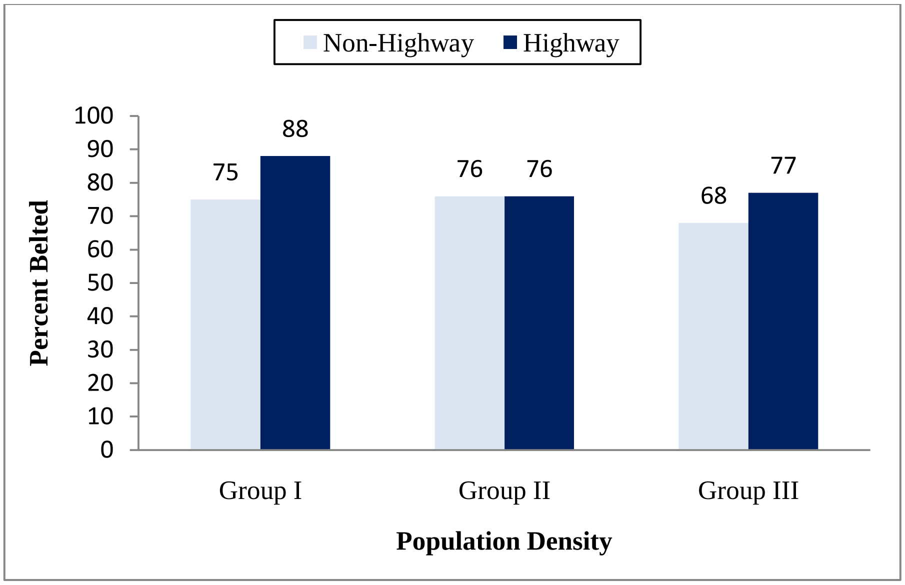

FIGURE 17: Safety Belt Usage by Population Density with Roadway Classification

It is understandable that safety belt usage for communities with mid-level population densities is and would be the highest. With the expectation that persons in communities of the lowest population density (rural) and the highest population densities (urban) are less likely to buckle up based on the characteristics of their travel. Consider the mindset of the urban / rural driver and passenger. Consider that on urban roadways, a person may be under the belief that with congestion, increased traffic controls, and lower roadway speeds, that safety belt usage is not needed. Similarly, a driver or passenger in the most rural sections of the state may find that with less intersection (high angle collisions), and with less congestion, and in some cases for tangent roadways, the use of safety belts is also not-needed.

Looking back on the data, in all three groups, safety belt usage was equal or superior for usage on highways compared to the grouping of arterials, collectors, and local roadways. This reiterates that in or on a roadway that feels to be more dangerous to a driver or passenger, the likelihood of buckling up increases. Group II shows where highway driving and non-highway driving may be similar danger-wise where there is more reason to an occupant to use a safety belt.

4.4.2.2 Statewide Usage by Population Density and Occupant Gender

Knowing how overall safety belt usage by a community's population density was illustrated, the usage by population density was divided by occupant gender as shown in Figure 18. Female safety belt usage was higher than male usage in all three density groupings. The difference between male and female usage was similar in all density groups ranging from +10 to +12 percent greater usage by female occupants.

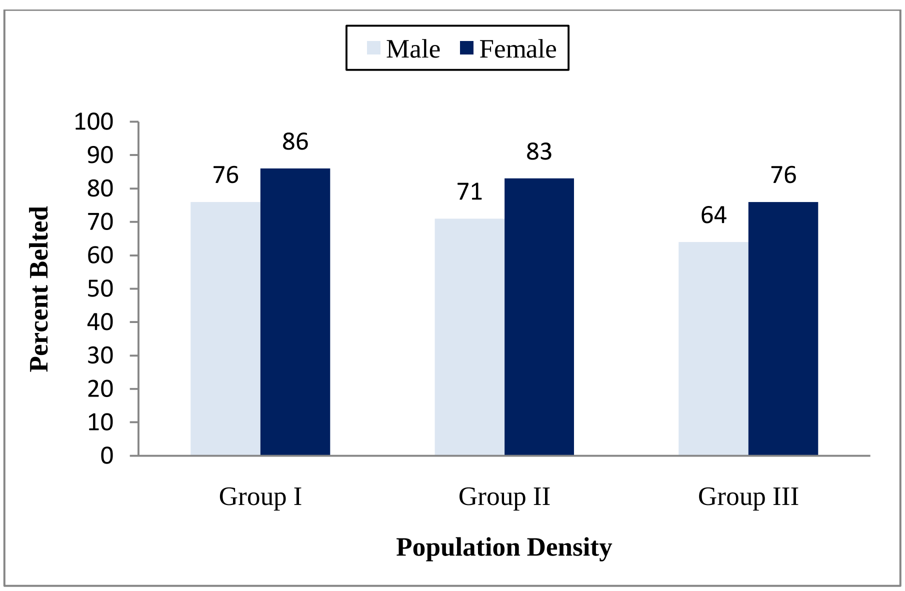

FIGURE 18: Safety Belt Usage by Population Density and Gender

The trend of decreasing usage with increasing population density is once again evident for both male and female occupants. But, once again, how would this data appear with the removal of highway data to better reflect usage within a specific community and its population density group. Figure 19, shows that for only non-highway data, females once again have consistently higher usage than males in all density groups. It is also shown that Group II communities have the highest belt use rates. Closely followed by Group I communities. This would suggest and reinforce that communities with mid-level population densities have the highest safety belt usage rate while the communities with high population densities are correlated to have low safety belt usage.

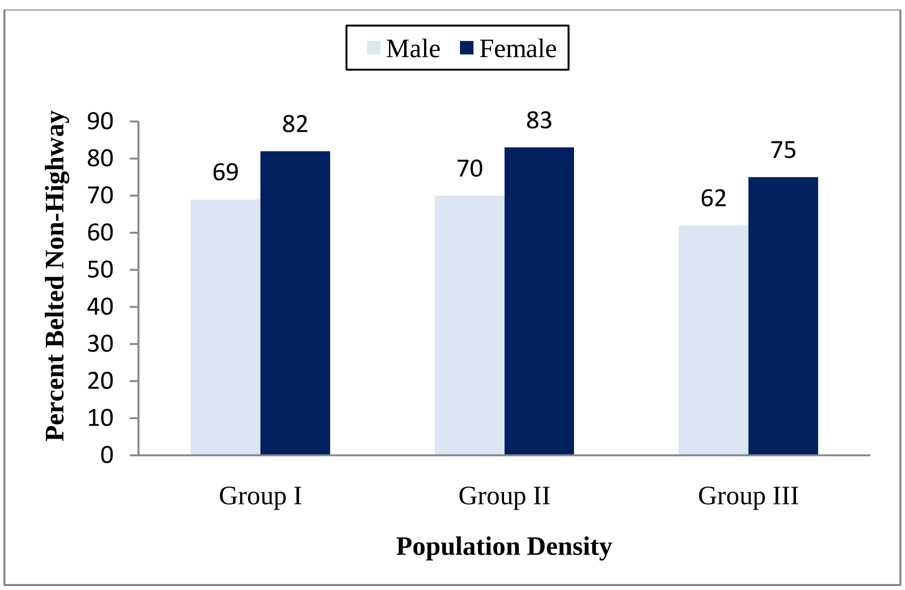

FIGURE 19: Non-Highway Safety Belt Usage by Population Density and Gender

4.4.2.3 Statewide Usage by Population Density and Occupant Age

Once again, knowing how overall safety belt usage by a community's population density was illustrated, the usage by population density was also divided by apparent occupant age, as shown in Figure 20. In all three population density groups, belt usage increases with age. This is as expected as seen from the overall statewide data presented by the 2009 Massachusetts Safety Belt Observation Study. Once again, as seen with overall usage (highway and non-highway) and gender, the all age groups showed decreased usage with increased population density.

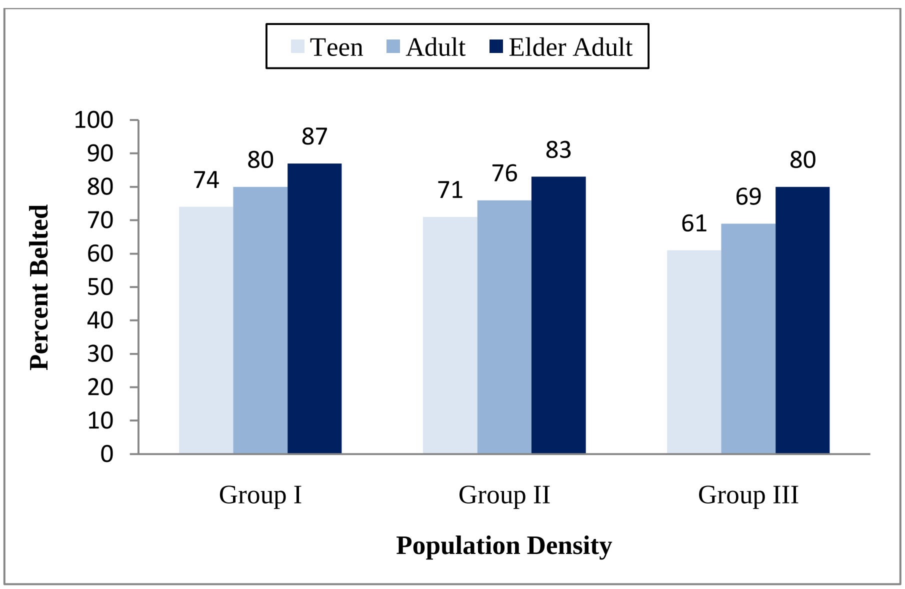

FIGURE 20: Safety Belt Usage by Population Density and Apparent Age

Once again, how would this data stack up with the removal of highway data to better reflect usage within a specific community and its population density group instead of the larger region? Figure 21, shows that for only non-highway data, Group II, or the mid-level population density showed the highest belt usage rate in all apparent age groups. This again supports the idea that a mid-level population density community encompasses the highest belt use rates. Notice that even when highway travel is removed, the usage still increases with age in all three population density groups.

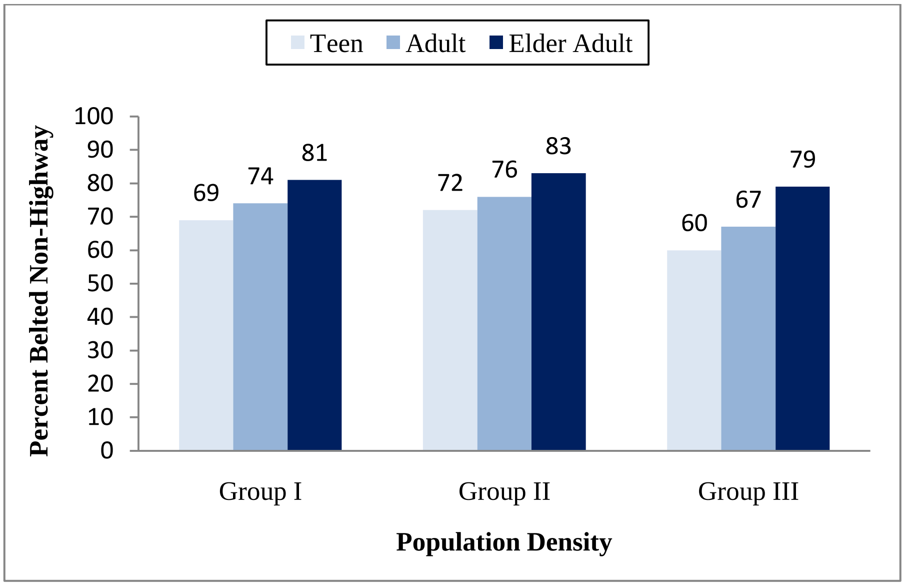

FIGURE 21: Non-Highway Safety Belt Usage by Population Density and Apparent Age

4.4.2.4 Statewide Usage by Population Density and Vehicle Type

Finally, knowing how overall safety belt usage by a community's population density was illustrated, the usage by population density was then divided by vehicle type, as shown in Figure 22. Once more, as seen with overall usage (highway and non-highway) with both gender and apparent age, the vehicle type groups showed decreased usage with an increased population density.

In all groups, commercial vehicles showed the lowest belt usage rate, closely following by pick-up trucks. What can be classified by the family vehicles; including passenger cars, SUVs, and vans, showed different, but relatively similar belt usage comparatively to trucks and commercial vehicles? This is as expected as seen from the overall statewide data presented by the 2009 Massachusetts Safety Belt Observation Study.

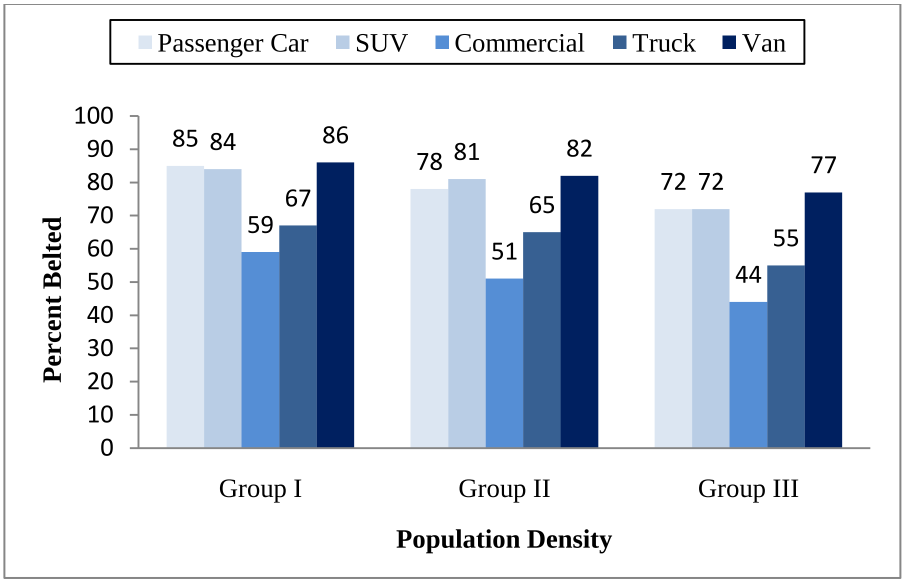

FIGURE 22: Safety Belt Usage by Population Density and Vehicle Type

Once more, how would this data stack up with the removal of highway data to better reflect usage within a specific community and its population density group instead of the larger region? Figure 23, shows that for only non-highway data, Group II, or the mid-level population density showed higher or equal belt usage rate in all vehicle type groups with the exception of commercial vehicles. There is minor support, within vehicle type, that a mid-level population density community may encompass the highest belt use rates. Group III, again still has the lowest belt usage rate. Notice that even when highway travel is removed, the usage within each density group is still roughly similar for passenger cars, SUVs, and vans comparative to pick-up trucks and commercial vehicles.

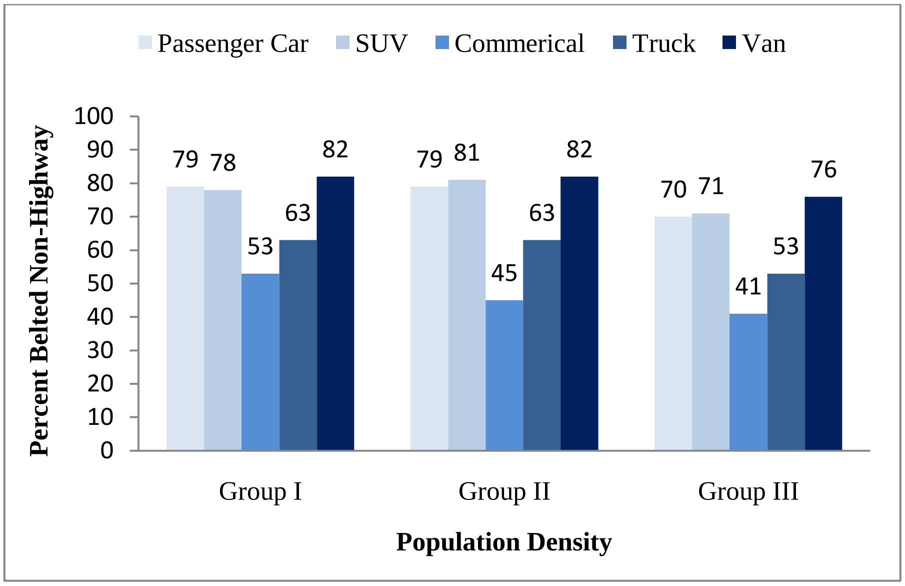

FIGURE 23: Non-Highway Safety Belt Usage by Population Density and Vehicle Type

4.4.3 Usage by Community Median Income Level

Safety belt usage by a community's median income was analyzed using the safety belt data collected by the 2009 Massachusetts Statewide Safety Belt Usage Observation Study. To complete an analysis of median income, Census 2000 income data from the U.S. Census Bureau were used. This data were the most complete and current median income on record. Some communities have more current data, but because not all communities share a similar updated year for this data, the Census 2000 data is the most complete.

Considering it is now nine years after the collection of the Census 2000 data, data assumptions must be made. An accurate assumption can be made that each community's median income level has changed. However, it will be assumed that the monetary amount for median income has increased with inflation consistently throughout each community and that no community has increased or decreased their 1999 USD income in any significant amount as to alter their placement in specific median income groupings.

Considering that each community has a different median income level and that the ranges of these income levels are extensive, communities were organized into four median income level groups. Group I are communities with the lowest median income levels from 0 to $44,999 (1999 USD); Group II are communities with low median income levels from $45,000 to $59,999 (1999 USD); Group III are communities with high median income levels from $60,000 to $89,999 (1999 USD); and Group IV are communities with the highest median income levels from $90,000+ (1999 USD). A map of Massachusetts communities classified by population density is shown in Figure 24.

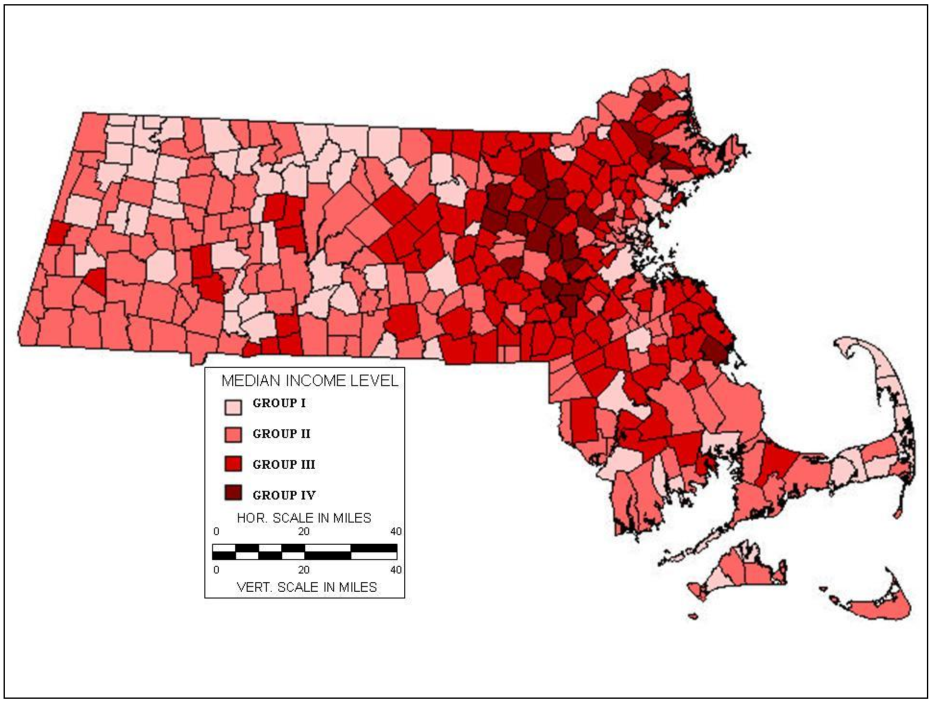

FIGURE 24: Classification of Massachusetts Communities by Median Household Income Group

The median income level groups were not assigned by the state or Census Bureau. These groups were assigned based on logical groupings. The particular income groups are based approximately on the grouping that the Census Bureau usage within their median household income analysis. The Census Bureau, when specifying income by five-digit zip code (similar to how this thesis uses median income by community), divides its income classes or groups into five groups based on 1999 dollars: $0 to $20,354, $22,292 to $46,364, $46,475 to $64,818, $65,050 to $90,524, and $91492 and above. In order to simplify, there two low income groups were combined as no community would have fallen into their first group based on the collected census data. In addition, the groupings were rounded off to the similar groupings previously presented.

Most of the lowest median income areas in the state included the major cities of Boston, Worcester, Springfield, or are scattered within western and central Massachusetts; which is to be expected. The highest median household income communities are centered in the region just northwest of Boston and the Interstate 95 beltway. This may stem from the business structure of commercial staple of Interstate 95, and old high income workforce hubs like the Raytheon Corporation and Hanscom Air Force Base.

4.4.3.1 Statewide Usage by Median Income Level

As shown in Figure 25, there is a trend of increased belt usage based on an increase in a community's median household income. Communities with low-level median household incomes (Group I) showed the lowest belt use rate, at 73 percent. From there, belt usage increased to 74, 76, and 84 percent respectively by increasing median household income group.

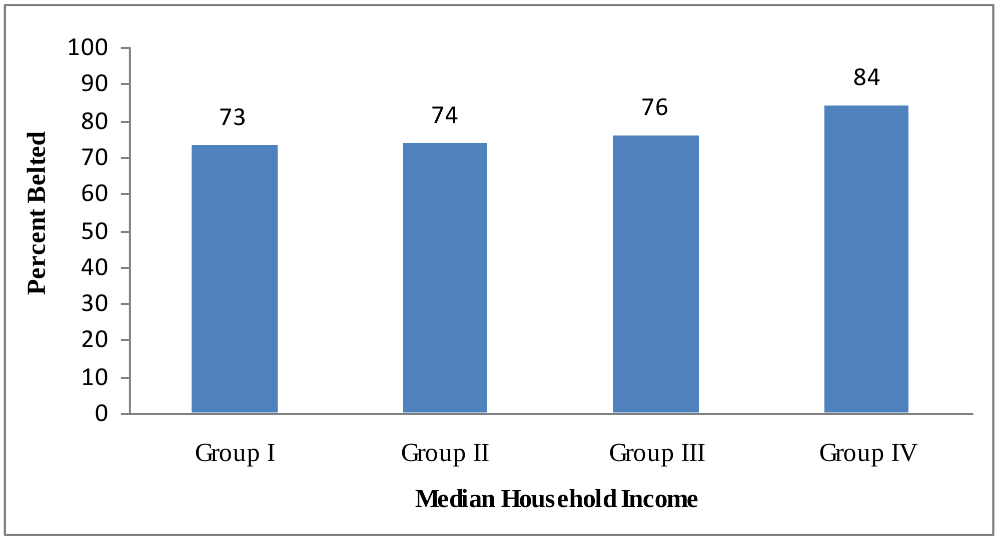

FIGURE 25: Safety Belt Usage by Median Household Income Group

As previously stated, highway travel does not concretely represent a specific communities driving habit, but more of a regional habit. When safety belt usage was separated for each group by highway usage and non-highway usage as shown in Figure 26, there is a similar trend of increasing usage with increased median household income. Just examining the non-highway data, communities with the highest median household income level (Group IV) showed the highest safety belt use rate, at 85 percent. This would suggests that it is accurate to say that communities with high median household incomes show the highest safety belt use rates and that belt usage increases with that income level.

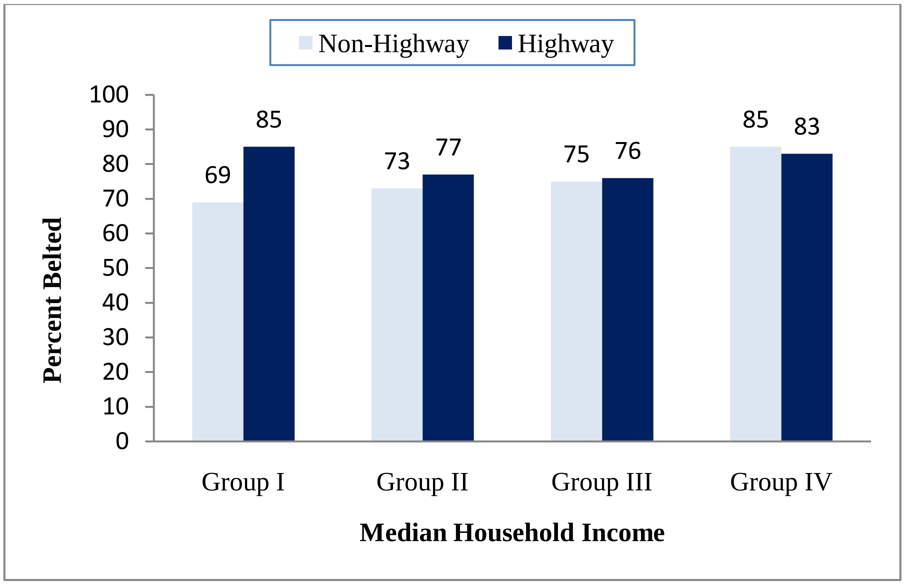

FIGURE 26: Safety Belt Usage by Median Household Income with Roadway Classification

The belt usage rate in communities with high median household income levels is considerably higher in non-highway, as well as the combined roadway classifications. As will be seen in the following breakdown, Group II and Group III belt usage rates are quite similar throughout. These groups, when separated into demographic categories never see a different of more than three percent in the belt usage rates. For instance, as seen previously in Figure 26, non-highway Group II data and non-highway Group III data differ by only two percent.

4.4.3.2 Statewide Usage by Median Household Income and Occupant Gender

Knowing how overall safety belt usage by a community's median income level was illustrated, the usage by median income level was divided by occupant gender as shown in Figure 27. Female safety belt usage was, like within the population density groups, higher than male usage in all four income groupings. Once again, the difference between male and female usage was similar in all income groups ranging from +9 to +14 percent greater usages by female occupants.

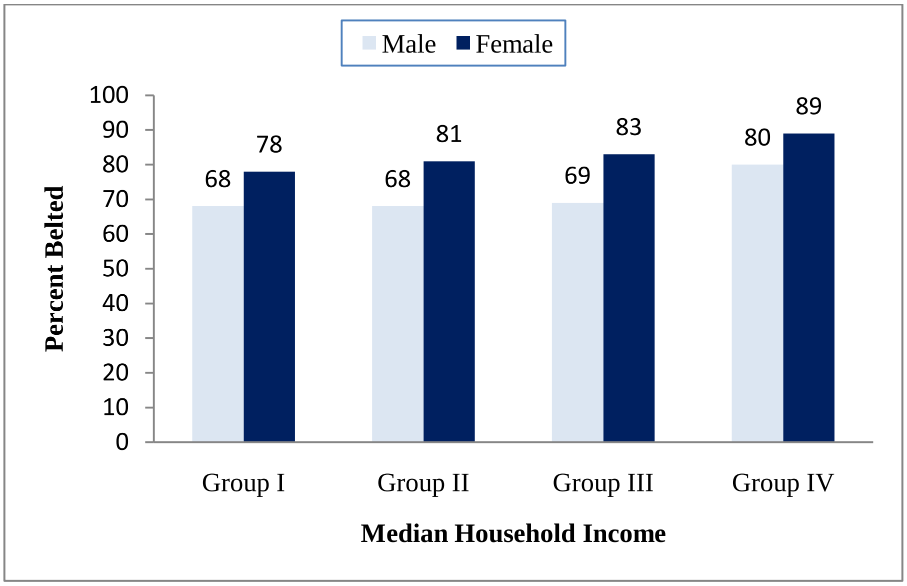

FIGURE 27: Safety Belt Usage by Median Income Level and Gender

The trend of decreasing usage with increasing population density is once again evident for both male and female occupants. With the removal of highway data to better reflect usage within a specific community and its median household income group, Figure 28 shows that for only non-highway data, females once again have consistently higher usage than males in all income groups. This data closely resembles the data for all types of roadways presented.

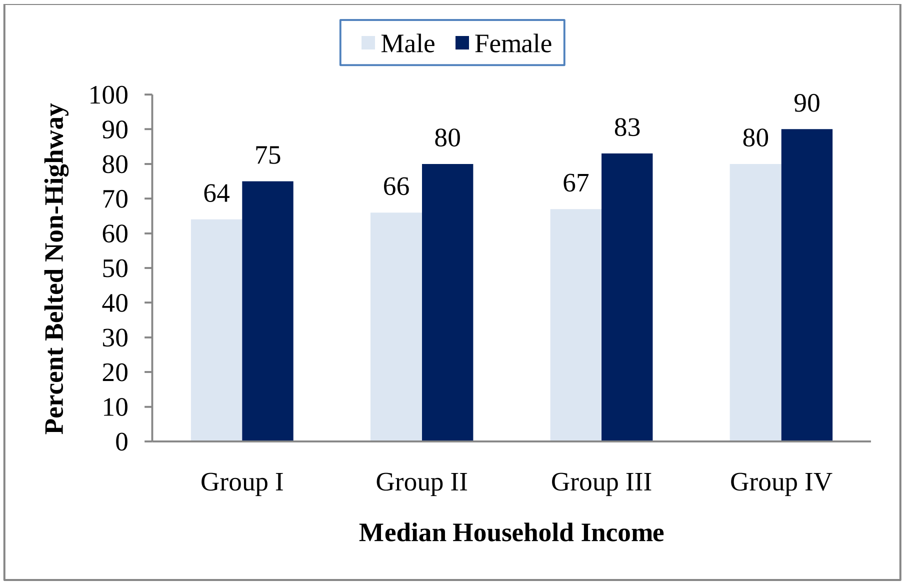

FIGURE 28: Non-Highway Safety Belt Usage by Median Household Income and Gender

4.4.3.3 Statewide Usage by Median Household Income and Occupant Age

The usage by median household income group was also divided by apparent occupant age, as shown in Figure 29. In all four income groups, belt usage increases with age. This is as expected as seen from the overall statewide data presented by the 2009 Massachusetts Safety Belt Observation Study. In this case, adult usage increased as income level increased. Both teen and elder occupants saw a similar trend, but both saw a slight decrease in belt usage within Group III. Each decreased one percent from the previous income level group before increasing again on the progression to Group IV.

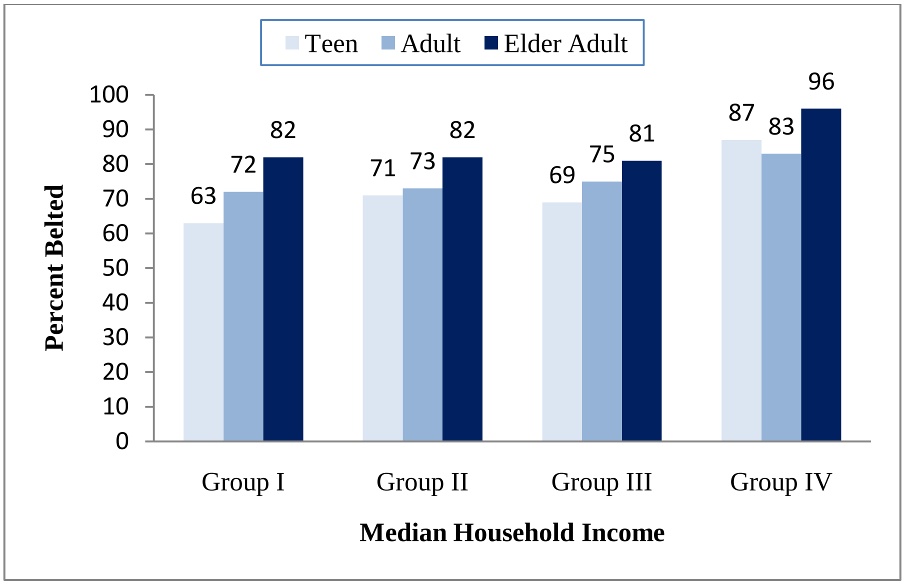

FIGURE 29: Safety Belt Usage by Median Household Income and Apparent Age

Figure 30, shows that for only non-highway data, Group III, or the higher mid-level median household Income group again saw a slight decrease from the increasing trend. This occurrence was shown once again with teens and their occupants. Adult occupants saw a recurring increase with the increased median household income level groups. Also, as seen in both all roadway classifications and when there is separation, the Group IV, or highest median household income communities, showed belt usage well above the other income groups for each of the different apparent age classes.

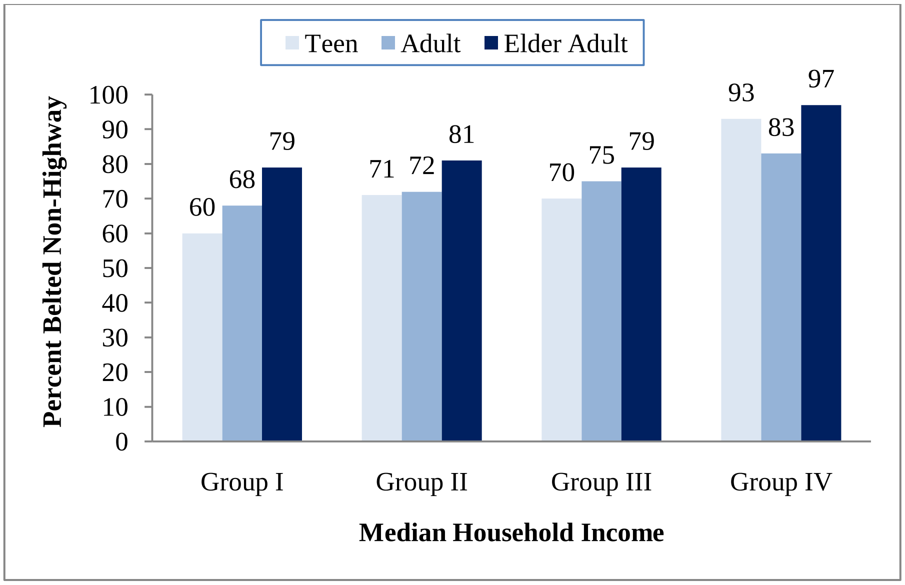

FIGURE 30: Non-Highway Safety Belt Usage by Median Household Income and Apparent Age

This data supports the idea that there is an increasing trend in belt usage with the increase in median household income. Group III showed only slight decreases against this trend. In general, this data also confirms that usage does increase with age as seen with the analysis of the community's population density.

4.4.3.4 Statewide Usage by Median Household Income and Vehicle Type

When each median household income group was separated by vehicle type, it was discovered that the three family vehicles, being passenger cars, SUVs, and vans, saw an increase in belt usage with the increase in median household income. This is presented in Figure 31. Trucks also saw an increase in usage with increased income, even as their belt usage rates were considerably lower. Commercial vehicles once again showed the lowest belt usage in each income group.

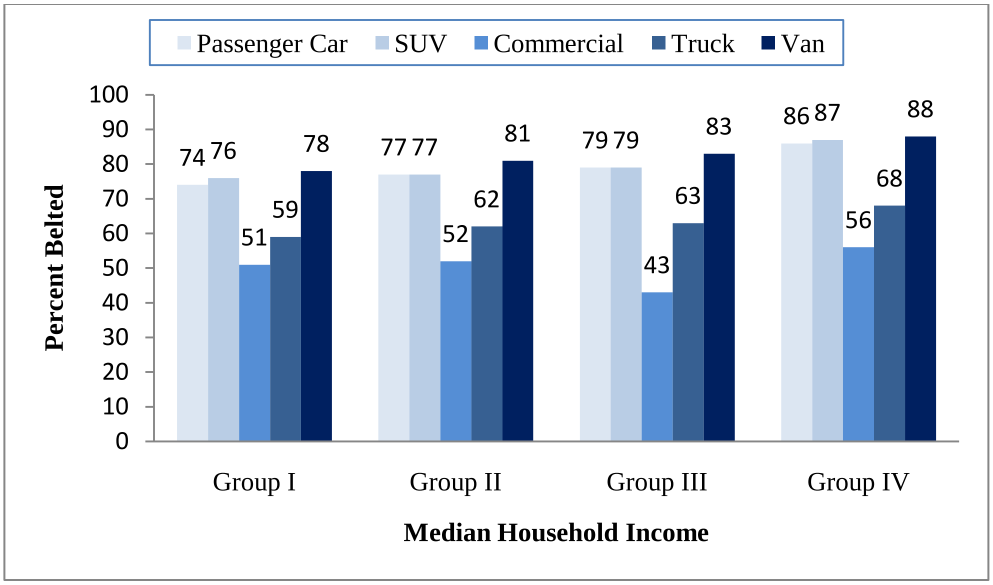

FIGURE 31: Safety Belt Usage by Median Household Income and Vehicle Type

As will see in Figure 32, showing for only non-highway data, that belt usage again increases with income based on the three family type vehicles. Trucks trended towards an increase with a slight decrease from Group II to Group III. The overall trend, as seen in other demographics, is that the belt usage rate is increasing as median household income increases.

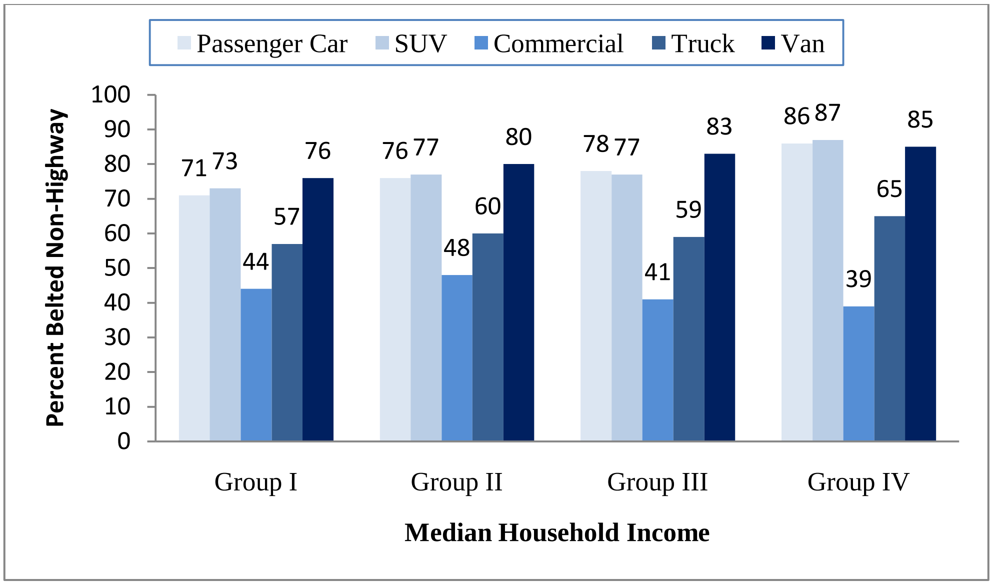

FIGURE 32: Non-Highway Safety Belt Usage by Median Household Income and Vehicle Type

4.4.4 Usage by Community Education Level

Safety belt usage by a community's education level was analyzed using the safety belt data collected by the 2009 Massachusetts Statewide Safety Belt Usage Observation Study. Education level, in this case, is defined as the percentage of the number of persons over the age of 25 who have less than some college education. To complete an analysis of education level, Census 2000 education data from the U.S. Census Bureau were used. This data were the most complete and current education data on record. Some communities have more current data, but because not all communities share a similar updated year for this data, the Census 2000 data is the most complete.

Considering it is now nine years after the collection of the Census 2000 data, an accurate assumption can be made that each community's education level has changed. However, it is being assumed that with any change in education level for specific communities, considering more and more youths are attending college, that any change in a community's education level is equal to other communities percentagewise. Therefore, their groupings would remain constant as the groupings would and could be adjusted.

Considering that each community has a different education level and that the ranges of these education levels are extensive, communities were organized into four education level groups. Group I are communities with the lowest education levels with more than 50 percent of persons with less than some college; Group II are communities with low education levels from 40 percent to 49.9 percent of persons with less than some college; Group III are communities with higher education levels from 30 percent to 39.9 percent of persons with less than some college; and Group IV are communities with the highest education levels with less than 29.9 percent of persons with less than some college. A map of Massachusetts communities classified by population density is shown in Figure 33.

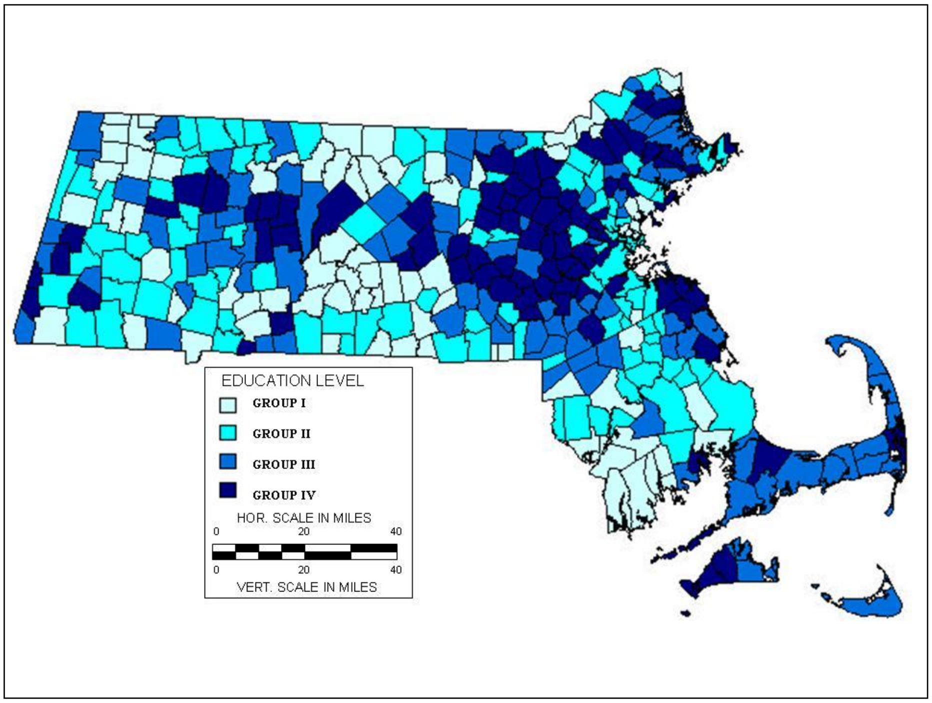

FIGURE 33: Classification of Massachusetts Communities by Education Level Group

The population density groups were not assigned by the state or Census Bureau. These groups were assigned based on logical groupings. These groups are based upon how most communities fell between 30 percent and 50 percent of persons with less than some college. Therefore, this grouping was separated into ten equally percentage groups with the other two groups being made up of the extremes.

Most of the lower education level communities once again center on Boston, Worcester, and Springfield as the low median household income communities did. High education level communities once again became congested around the region northwest of Boston in the high commercial locations of Interstate 95. High education levels also centered on the town of Amherst in the western portion of the state. This of course is highly due to the mass of colleges and universities in the area and a high level of college students who would be registered to live in those communities.

4.4.4.1 Statewide Usage by Education Level

Communities with low-level education levels (Group I) showed the lowest belt use rate, at 69 percent. In contrast, communities with the highest education level (Group IV) showed the highest belt use rate, at 80 percent. As shown in Figure 34, there is a trend of increased belt usage as education level of a community increases.

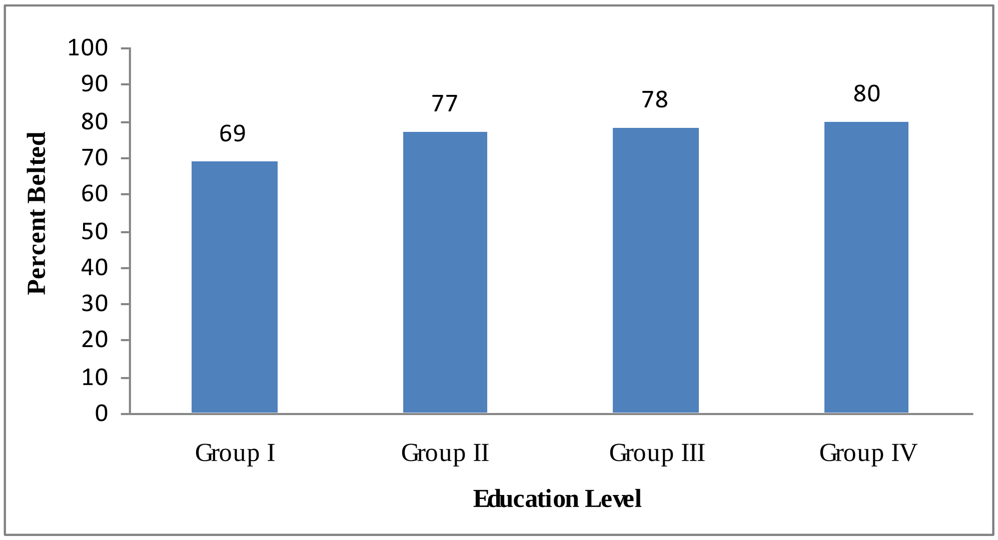

FIGURE 34: Safety Belt Usage by Education Level Group

As stated before, highway travel does not concretely represent a specific community's driving habit, but more of a regional habit. Therefore, when safety belt usage was separated for each group by highway usage and non-highway usage as shown in Figure 35, a similar trend again occurs. Just examining the non-highway data, communities with the lowest education level have the lowest belt usage rate, at 68 percent; while communities with the highest education level have the highest belt usage rate, at 80 percent. There again is an increasing trend. This would suggest that it is accurate to say that communities with lower education levels will have the lowest levels belt usage and that belt usage will increase with an increase in education level.

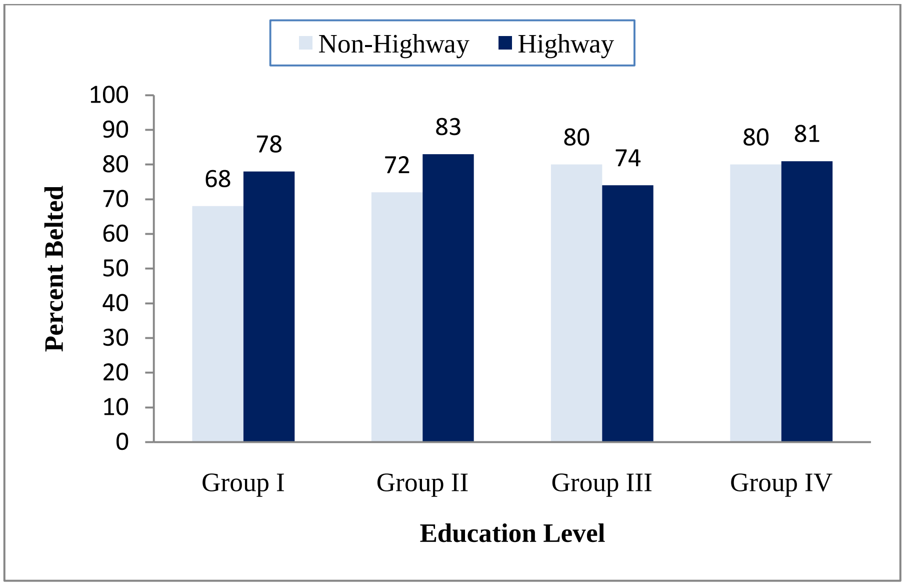

FIGURE 35: Safety Belt Usage by Education Level with Roadway Classification

It is understandable that safety belt usage for communities with high level education levels is and would be the highest. Without the intention of being stereotypical, persons with a higher education and a greater value for education would more likely be one to buckle up. Education is a large part of safety belt usage. With a larger portion of persons, in this case college; there is a larger chance of persons not attending even high school or even lower levels of education. Therefore, it would be expected that less knowledge of possible risks and hazards has been accessed by the person.

Looking back on the data, in three of four groups, safety belt usage was equal or superior for usage on highways compared to the grouping of arterials, collectors, and local roadways. Only Group III saw a drop in usage. This reiterates that in or on a roadway that feels to be more dangerous to a driver or passenger, the likelihood of buckling up increases.

4.4.4.2 Statewide Usage by Education Level and Occupant Gender

Knowing how overall safety belt usage by a community's education level was illustrated, the usage by education level was divided by occupant gender as shown in Figure 36. Female safety belt usage was higher than male usage in all four density groupings, as has been the case throughout demographics. The difference between male and female usage was similar in all education groups at either +11 to +12 percent greater usage by female occupants.

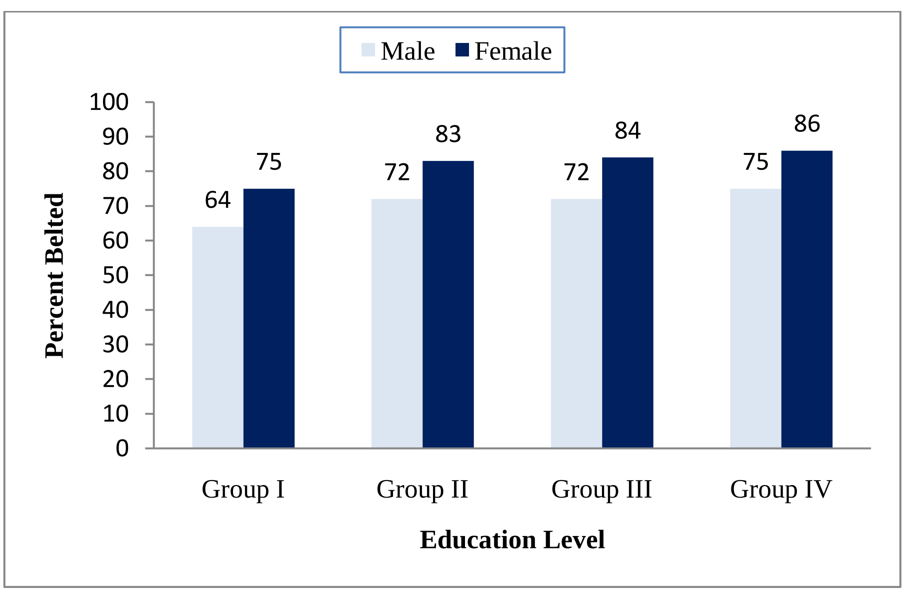

FIGURE 36: Safety Belt Usage by Education Level and Gender

The trend of increasing usage with increasing levels of education is once again evident for both male and female occupants. This is also clearly evident when the highway data is separated and only looking at non-highway data as shown in Figure 37. Once again, for only non-highway data, females once again have consistently higher usage than males in all education level groups. This data closely resembles the data for all types of roadways presented previously.

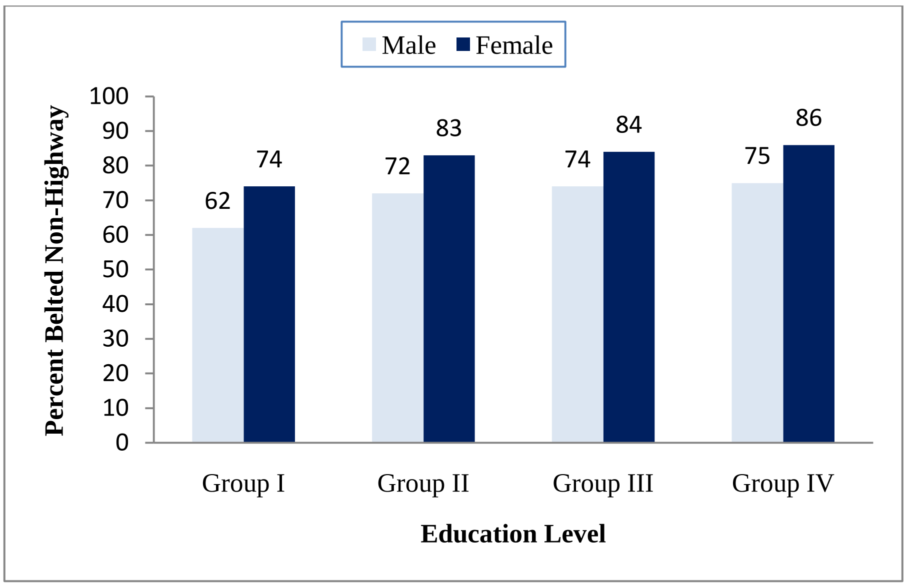

FIGURE 37: Non-Highway Safety Belt Usage by Education Level and Gender

4.4.4.3 Statewide Usage by Education Level and Occupant Age

Once again, knowing how overall safety belt usage by a community's education level was illustrated, the usage by education level was also divided by apparent occupant age, as shown in Figure 38. Belt usage did not increase with age in all four groups as there is a drop off in adult usage from teen usage in Groups III and IV. There is still an overall trend of increased usage within each age group as education level increases however. The only exception being teen usage dropping by one percent from Group III to Group IV.

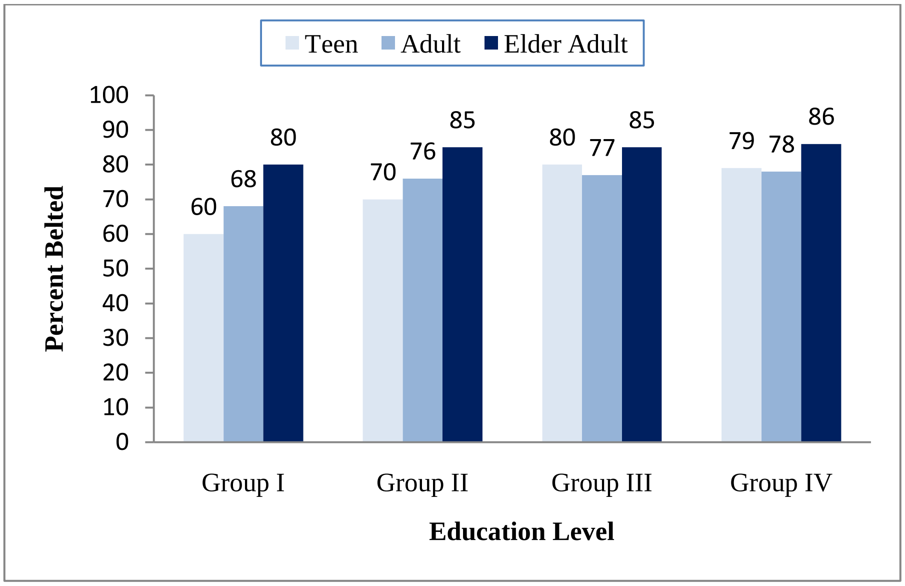

FIGURE 38: Safety Belt Usage by Education Level and Apparent Age

When the non-highway data is separated and analyzed alone, as shown in Figure 39, once again belt usage did not increase with age in all four groups as there is a drop off in adult usage from teen usage in Groups III and IV. Also, once again, there is an increasing trend of usage within age group with the only exception being teen usage dropping by one percent from Group III to Group IV.

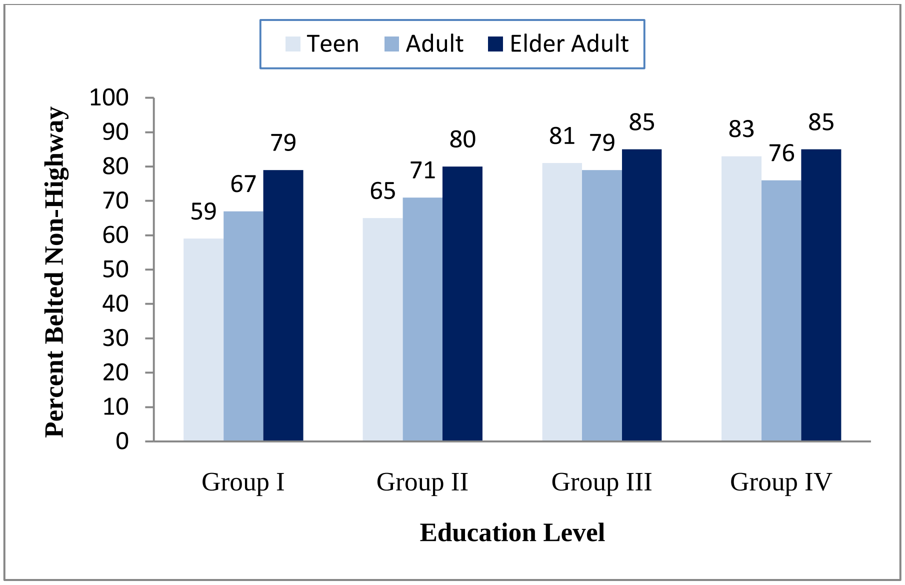

FIGURE 39: Non-Highway Safety Belt Usage by Education Level and Apparent Age

There is a level of consistency that supports that notion of belt usage increasing by age with increasing education level with exception to teens in the higher education groups. This may be a result of minor difference in education level from Group III and Group IV or the fact that teens have no reflection upon an education level model that includes whether or not a person of 25 years of age has or has not attended college. For the former idea, belt usages for non-highway belt usage in Group III and Group IV for combined age groups were equal, at 80 percent (see Figure 35).

4.4.4.4 Statewide Usage by Education Level and Vehicle Type

Finally, knowing how overall safety belt usage by a community's education level was illustrated, the usage by education level was then divided by vehicle type, as shown in Figure 40. Passenger cars and vans occupants saw increased usage as education level increased. SUVs occupants had increased usage with education level until reaching the highest education level (Group IV) in which there was a two percent drop from Group III. Trucks saw a trend of increased usage with a slight decrease in Group III before increasing to Group IV. Commercial vehicles showed a decreasing trend with the increasing education level from Group II to Group IV.

In all groups, commercial vehicles showed the lowest belt usage rate, closely following by pick-up trucks. What can be classified by the family vehicles; including passenger cars, SUVs, and vans, showed different, but relatively similar belt usage comparatively to trucks and commercial vehicles. This with exception to the lowest education level group where there was more scattered usage rate.

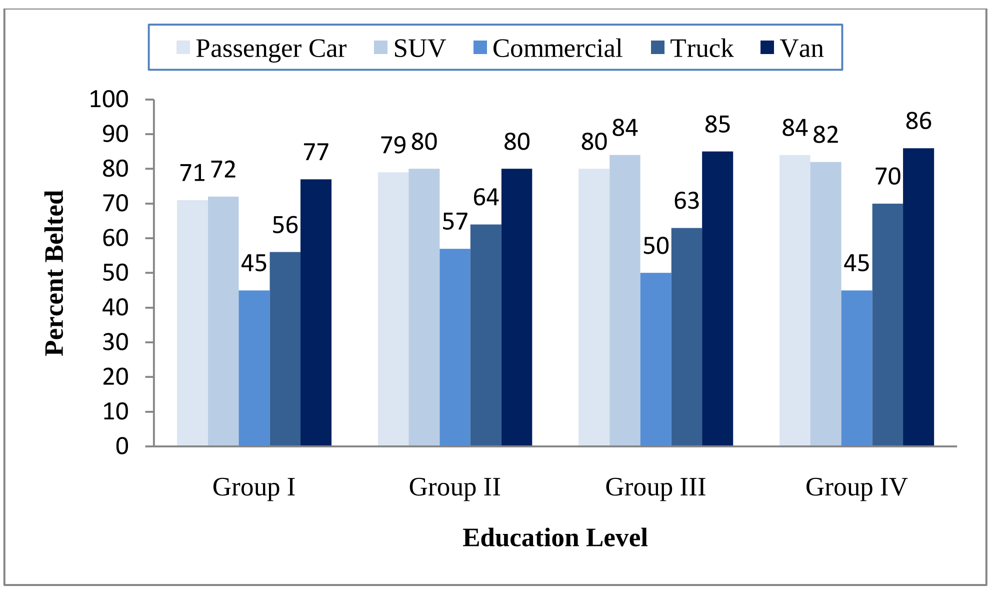

FIGURE 40: Safety Belt Usage by Education Level and Vehicle Type

As highway data is removed, as seen in Figure 41, belt usage in passenger cars and trucks increased with increased education level. Vans, SUVs, and commercial vehicles increased usage with increased education level until Group IV had a decrease of either two or three percent. Though not exactly the same as a combined freeway and non-highway data set, the data is similar. There is still a rough similarity to the data of combined highway and non-highway data.

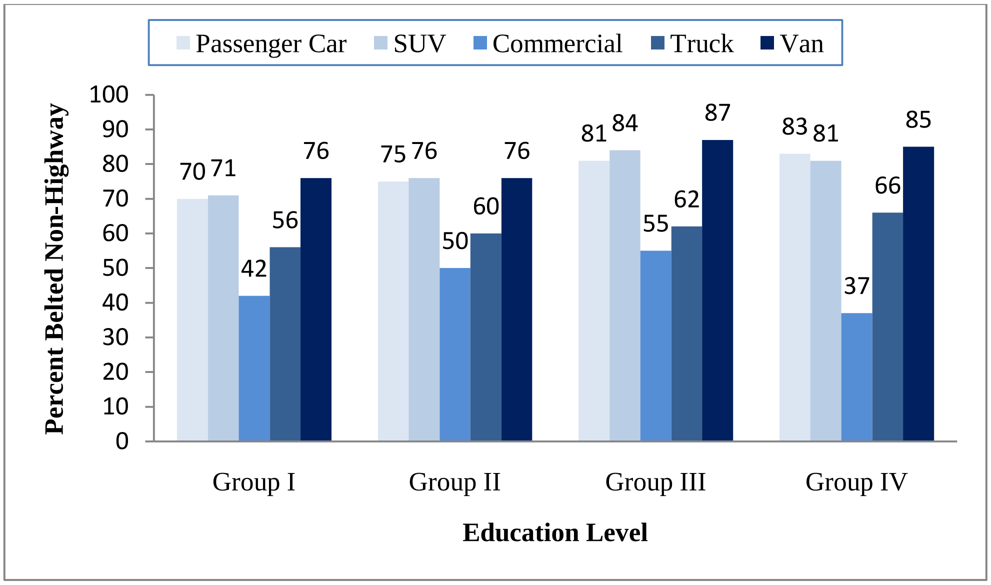

FIGURE 41: Non-Highway Safety Belt Usage by Education Level and Vehicle Type

4.4.5 Conversion Rates for Non-traditional Demographics

Conversion rates were once again used to determine the change in belt usage from 2008 to 2009. In this analysis, the conversion rates were used for the groupings of the non-traditional demographics. The conversion rates were only calculated for non-highway roadways (local, collector, arterials) as these roadways better represent the driving habit of occupants within those communities. The conversion rates are presented in Table 10 by grouping.

TABLE 10: Conversion Rates for Non-Highway Safety Belt Usage within each Non-traditional Demographic Group

Non-Highway Demographic Groups	2008 Data	2009 Data	Conversion Rate from 2007 to 2008
	Weighted Belt Use Rate (%)	Weighted Belt Use Rate (%)	
All Occupants	66.84	73.61	20.4%
Community Population Density (persons per square mile)			
Group I (0-499)	70	75	16.7%
Group II (500 - 1,199)	71	76	17.2%
Group III (1,200 +)	61	68	17.9%
Community Median Household Income (1999 USD)			
Group I ($0 - $44,999)	61	69	20.5%
Group II ($45,000 - $59,999)	68	73	15.6%
Group III ($60,000 - $89,999)	72	75	10.7%
Group IV ($90,000 +)	84	85	6.3%
Community Education Level (% of persons with less than some college)			
Group I ($\geq$ 50%)	60	68	20.0%
Group II (40% - 49.9%)	66	72	17.6%
Group III (30% - 39.9%)	73	80	25.9%
Group IV (< 30%)	78	80	9.1%

Within the analysis of community's population density, communities in Group III, or the most densely population communities, saw the largest conversion rate of each of the groups. Although, the conversion rates for each of the population density groups were relatively equal. Both the conversion rates for community median household income and community education level were more wide spread.

Within the analysis of community's median household income level, Group I communities, or those with the lowest median household income, saw the greatest conversion at 20.5 percent conversion of non-users to users. This is noteworthy as it was previously presented that Group I communities had the lowest belt usage rate comparative to the other income groups. The conversion rates for income groupings decreased as the median household income groupings increased. Group IV communities, those communities with the highest income level, saw the lowest conversion at 6.3 percent.

Within the analysis of community's education level, Group III communities, the high end mid-level education level communities, saw the greatest conversion at 25.9 percent conversion of non-users to users. Group I communities, or those communities with the lowest education level, also had a significantly large conversion rate which is noteworthy as Group I communities had the lowest safety belt usage rate based on a community's education level. Group IV communities, those communities with the highest education level, saw the lowest conversion at 9.1 percent.

4.4.6 Comparing Usage for Non-traditional Demographic by Year

In order to assist in verifying that the 2009 safety belt data, based on the non-traditional demographics, was concretely identifiable to a demographic group, the published 2008 safety belt usage data was also split up by these non-traditional demographics. The identical groups and group boundaries were used within each demographic and each community remained in the same group as the data used was pre-2007 and would therefore not affect the 2008 data.

4.4.6.1 Safety Belt Usage by Population Density Group by Year

When published 2008 data is lined up adjacent to the 2009 safety belt usage data, direct similarities are present. Although the 2009 shows a much highest safety belt usage rate overall, indicative of the increase of seven percent in overall belt usage, the trend of decreasing belt usage with increasing community population density, as seen in Figure 42. This further promotes that the 2009 data is an accurate depiction of usage by community.

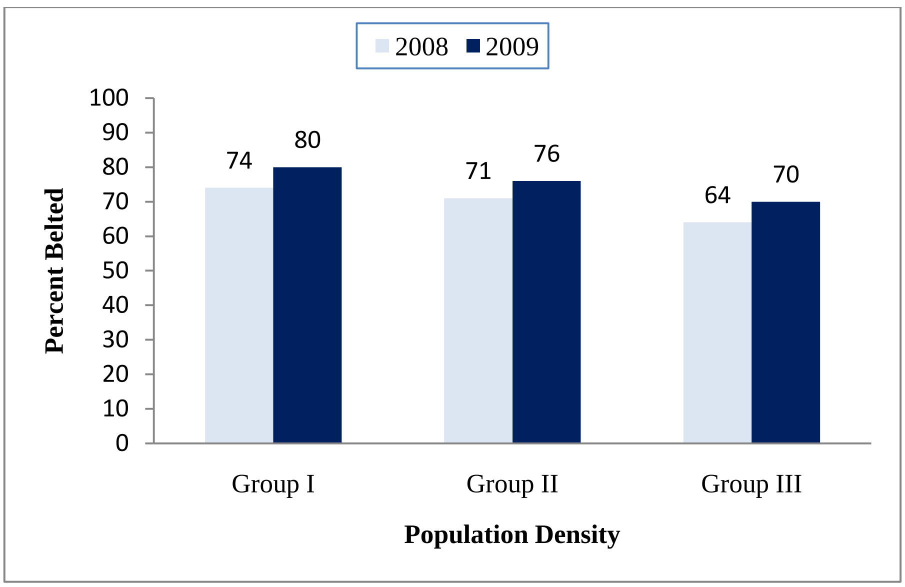

FIGURE 42: Safety Belt Usage with Population Density Group by Year

As previouly conducted, highway and non-highway data was seperated, as presented in Figure 43, to obtain a sense of directly how a community's population density affects safety belt usage. It is evident once again that mid-level population density communities have the highest safety belt usage rate while the most densely populated communities have the lowest safety belt use rate. Notice that there is almost equal increases in usage from 2008 to 2009 across each density group.

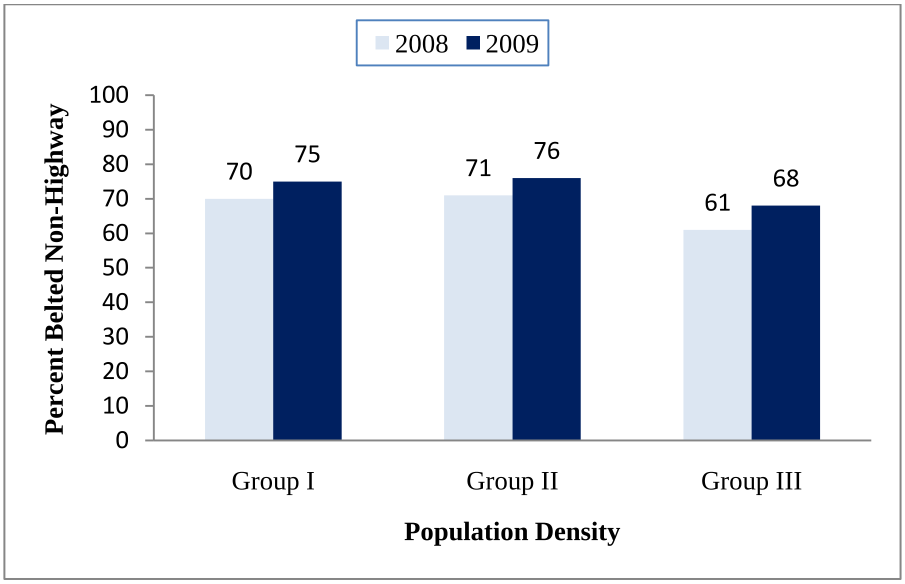

FIGURE 43: Non-Highway Safety Belt Usage with Population Density Group by Year

As the trends for belt usage across population density groups remains similar in 2008 and 2009, it can also be determined if data from 2008 and 2009 are significantly different. Table 11 overviews the test for significant differences between the publiched data of 2008 and the data of 2009. Non-highway, highway, and total combined data for each group was analyzed. All aspects of the analysis of community population density from 2008 to 2009 were found to be significantly different; in this case a significant increase in safety belt usage.

TABLE 11: Test for Significant Difference Between 2008 and 2009 Community Population Density Data

	Road Class	Group	2008 Weighted Pct. Belted	2009 Weighted Pct. Belted	DF	T-stat	p-value	Result
Community Population Density	Non-Highway	Group I	70	75	11,799	5.891	p < .0001	**Sign. Diff.**
		Group II	71	76	17,948	8.358	p < .0001	**Sign. Diff.**
		Group III	61	68	35,960	13.284	p < .0001	**Sign. Diff.**
	Highway Only	Group I	80	88	7,448	8.826	p < .0001	**Sign. Diff.**
		Group II	73	76	8,118	3.501	p = .0005	**Sign. Diff.**
		Group III	73	77	8,841	4.947	p < .0001	**Sign. Diff.**
	Combined Total	Group I	74	80	19,249	11.007	p < .0001	**Sign. Diff.**
		Group II	71	76	26,068	8.821	p < .0001	**Sign. Diff.**
		Group III	64	70	44,803	13.252	p < .0001	**Sign. Diff.**

4.4.6.2 Safety Belt Usage by Median Household Income Group by Year

When published 2008 data is lined up adjacent to the 2009 safety belt usage data, direct similarities are present for communities with similar median household incomes. Although the 2009 shows a much highest safety belt usage rate overall, indicative of the increase of seven percent in overall belt usage, the trend of increasing belt usage with increasing community median household income, as seen in Figure 44. This further promotes that the 2009 data is an accurate depiction of usage by community.

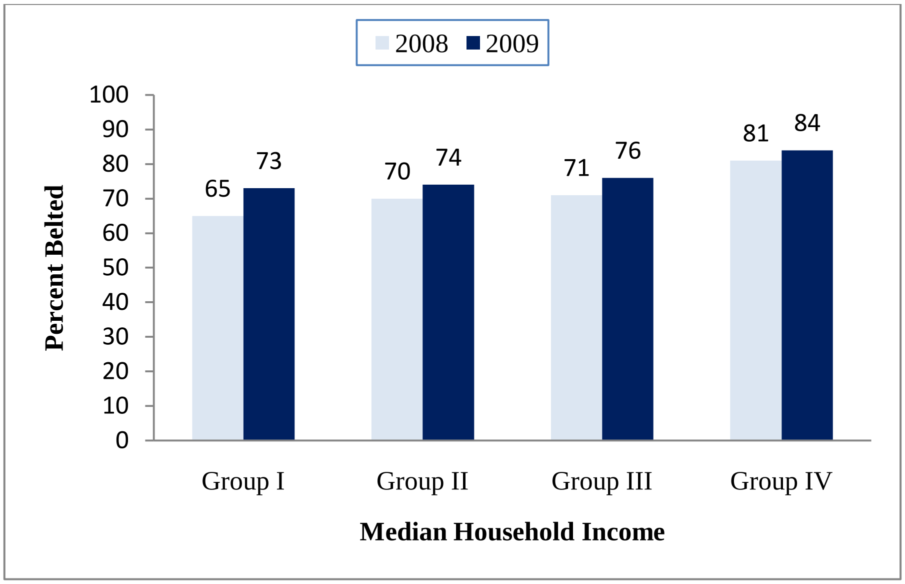

FIGURE 44: Safety Belt Usage with Median Household Income Group by Year

As previouly conducted, highway and non-highway data was seperated, as presented in Figure 45, to obtain a sense of directly how a community's median household income affects safety belt usage. It is evident once again that there is a definite increasing trend of belt usage with increasing communtiy median household income. High-level income communities have the highest safety belt usage rate in both years while the least income communities have the lowest safety belt use rate. An interesting fact from Figure 45 shows that the difference in usage from 2008 to 2009 within each group decreases as a community's median household income increases. The percentage increases were +8, +5, +3, and +1 percent increases for Groups I through IV, respectively.

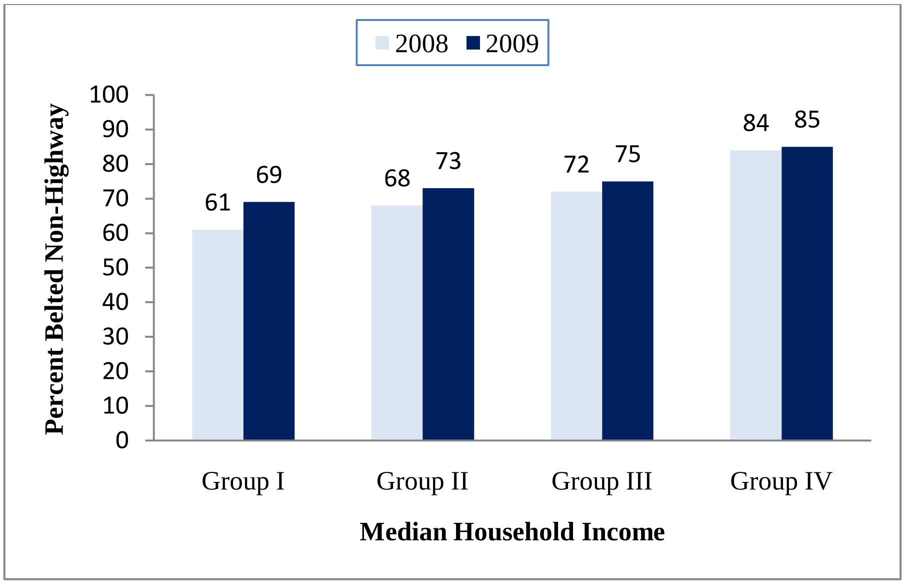

FIGURE 45: Non-Highway Safety Belt Usage with Median Household Income Group by Year

As the trends for belt usage across median household income groups remains similar in 2008 and 2009, it can also be determined if data from 2008 and 2009 are significantly different. Table 12 overviews the test for significant differences between the published data of 2008 and the data of 2009. Non-highway, highway, and total combined data for each group was analyzed. In two cases, the difference between 2008 and 2009 safety belt usage was considered statistically equal. These cases were:

- For only non-highway data, Group IV, or the communities with the highest median hiousehold income ($90,000 + in 1999 USD), and
- For only highway data, Group II, or the communnties with the low end mid-level median household income ($45,000 - $59,999 in 1999 USD)

All other aspects of the analysis of community median household income from 2008 to 2009 were found to be significantly different; in this case a significant increase in safety belt usage.

TABLE 12: Test for Significant Difference Between 2008 and 2009 Community Median Household Income Data

	Road Class	Group	2008 Weighted Pct. Belted	2009 Weighted Pct. Belted	DF	T-stat	p-value	Result
Community Median Household Income	Non-Highway	Group I	61	69	32,343	15.272	p < .0001	**Sign. Diff.**
		Group II	68	73	22,786	7.809	p < .0001	**Sign. Diff.**
		Group III	72	75	8,716	3.839	p = .0001	**Sign. Diff.**
		Group IV	84	85	1,860	0.613	p = .5402	Stat Equal
	Highway Only	Group I	76	85	9,924	11.705	p < .0001	**Sign. Diff.**
		Group II	76	77	8,000	0.861	p = .3891	Stat Equal
		Group III	71	77	5,300	4.688	p < .0001	**Sign. Diff.**
		Group IV	73	83	1,181	3.883	p = .0001	**Sign. Diff.**
	Combined Total	Group I	65	73	42,269	17.742	p < .0001	**Sign. Diff.**
		Group II	70	74	30,788	7.305	p < .0001	**Sign. Diff.**
		Group III	71	76	14,018	5.882	p < .0001	**Sign. Diff.**
		Group IV	81	84	3043	2.388	p = .0170	**Sign. Diff.**

4.4.6.3 Safety Belt Usage by Education Level Group by Year

When published 2008 data is lined up adjacent to the 2009 safety belt usage data, some similarities are present for communities with similar education levels; yet, there are some differences. Although the 2009 shows a much highest safety belt usage rate overall, indicative of the increase of seven percent in overall belt usage, there was a complete increasing trend in the 2008 data based on a community's education level. There was a slight decrease in usage from Group II to Group III in the 2008 data, as seen in Figure 46.

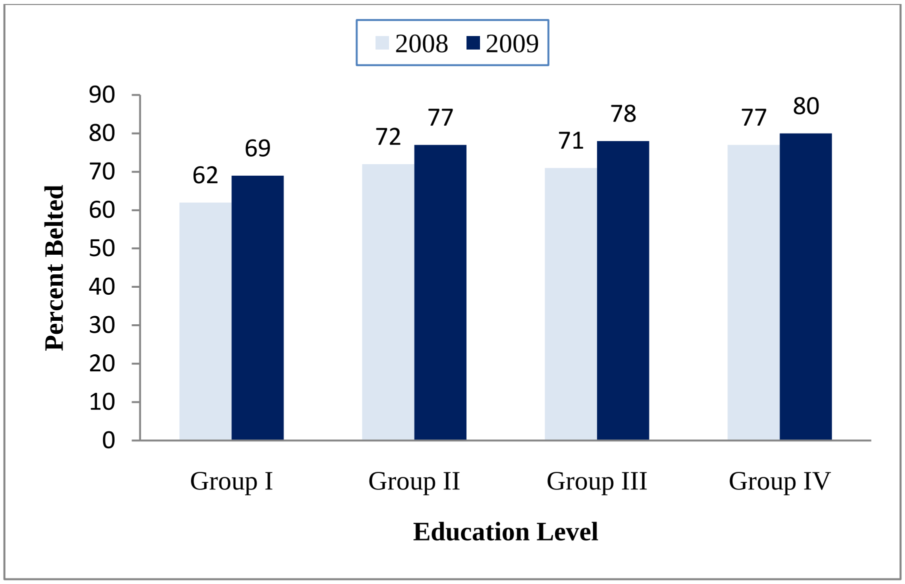

FIGURE 46: Safety Belt Usage with Education Level Group by Year

However, when highway data is removed to better represent belt usage on a community basis, the trend of increasing usage with increasing education level as seen in 2009 was eident in 2008. Figure 47 clearly shows an even more increasing trend in 2008 than in 2009. This further suggests and reiterates that safety belt usage generally increases with a community's education level. A positive sign for the prospect of universal belt usage is the increases seen in the lower level educaiton level groups from 2008 to 2009.

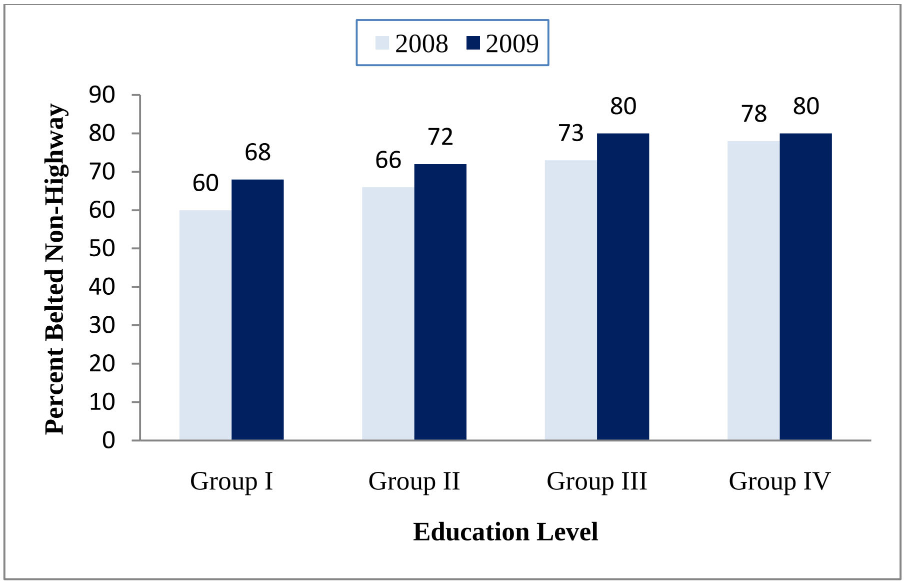

FIGURE 47: Non-Highway Safety Belt Usage with Education Level Group by Year

Trends for belt usage across education level groups remained similar in 2008 and 2009 with the exception of the slight decrease in Group III during 2008. It was also determined that the data from 2008 and 2009 was, for the most part, significantly different. Table 13 overviews the test for significant differences between the published data of 2008 and the data of 2009. Non-highway, highway, and total combined data for each group was analyzed. In only one case, the difference between 2008 and 2009 safety belt usage was considered statistically equal. These case was:

- For only non-highway data, Group IV, or the communities with the highest education level (<30 percent of persons with less than some college)

All other aspects of the analysis of community median household income from 2008 to 2009 were found to be significantly different; in this case a significant increase in safety belt usage.

TABLE 13: Test for Significant Difference Between 2008 and 2009 Community Education Level Data

	Road Class	Group	2008 Weighted Pct. Belted	2009 Weighted Pct. Belted	DF	T-stat	p-value	Result
Community Education Level	Non-Highway	Group I	60	68	33,198	14.527	p < .0001	**Sign. Diff.**
		Group II	66	72	16,789	8.647	p < .0001	**Sign. Diff.**
		Group III	73	80	8,162	7.556	p < .0001	**Sign. Diff.**
		Group IV	78	80	7,556	1.569	p = .1168	Stat Equal
	Highway Only	Group I	69	78	5,546	7.38	p < .0001	**Sign. Diff.**
		Group II	79	83	12,700	4.785	p < .0001	**Sign. Diff.**
		Group III	69	74	3,170	3.101	p = .0019	**Sign. Diff.**
		Group IV	76	81	2,989	3.745	p = .0002	**Sign. Diff.**
	Combined Total	Group I	62	69	38,746	15.555	p < .0001	**Sign. Diff.**
		Group II	72	77	29,491	9.297	p < .0001	**Sign. Diff.**
		Group III	71	78	11,334	8.167	p < .0001	**Sign. Diff.**
		Group IV	77	80	10547	3.31	p = .0009	**Sign. Diff.**

4.5 Using Citation Data

Since February of 2004, Massachusetts has had a secondary safety belt law as an incitement to drivers and passengers to buckle up on the roadways (6). Knowing that Massachusetts is still at a low belt usage rate of 73.61 percent, it may be secure to pronounce that this law is not as demanding of a state law as seen in primary seat belt law states. It was presented in Chapter 2 that during 2008, that the average state safety belt usage by primary seat belt law states (including D.C.) was 88.2 percent, while the average state safety belt usage by secondary seat belt law states was 79.5 percent (4).

4.5.1 Safety Belt Violations within Citation Data

Considering that citations can be written for violations to the secondary seat belt law in Massachusetts, a brief analysis was conducted on the 2007 statewide citation data. Using this data, with the assistance of UMassSafe, all 2007 citations that included a safety belt violation was extracted. A total of 66,464 safety belt violations were present in 63,880 separate citations. Of course, some citations included more than one safety belt violation.

The information obtained from UMassSafe included information on the recipient of the citation, the driver of the vehicle. Therefore, any data that represents any violations would be based off the driver and not passengers. The data included was the cited person's age and gender. Figure 48, breaks down the number of seat belt violations based on age group. Figure 49, breaks down the percentage of all the violations cited by gender and age group.

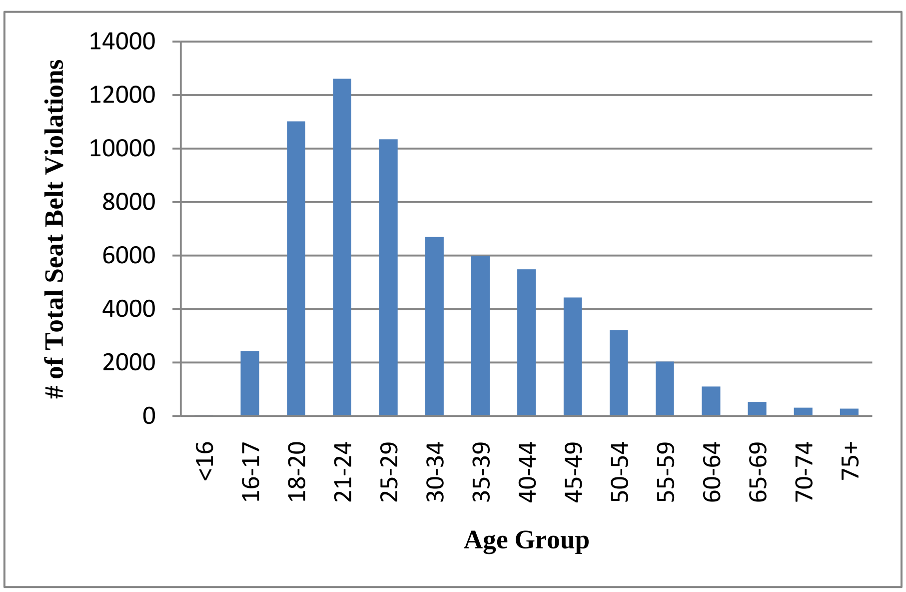

FIGURE 48: Total Number of Safety Belt Violations Cited in 2007 by Age Group

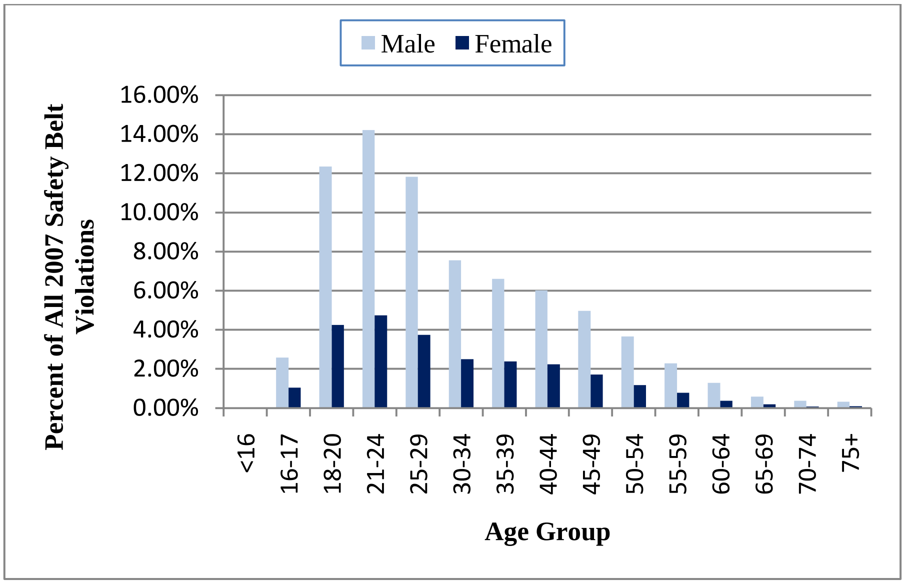

FIGURE 49: Percent of Safety Belt Violations Cited by Age Group and Gender

As seen in the previous figures, the number of safety belt violations is considerably higher in persons less than age 30. The age group that saw the largest number of violations was from 21 to 24 years of age. It is also clearly visible that males get a considerable amount of violations on citations than females do, in all age groups.

Data pertaining to safety belt violations and overall citations may however be bias. Particular age groups and genders receive disproportionate attention on the roadway. For instance, older drivers are more likely not to receive a citation based on empathy and teen drivers may see more citations based on enforcing to educate. That being said, the data presented in these figures lines up with safety belt usage by age and gender as presented throughout Chapter 4; where teens were seen to less likely buckle up, as were males comparative to females.

4.5.2 Other Violations Accompanying Safety Belt Violations

An interesting set of data that was extracted from the 2007 citation data from Massachusetts was the primary or other secondary violations that were included on each citation. In Massachusetts, a secondary seat belt law state, a driver can only be cited for lack of safety belt usage when another roadway safety violation has occurred. As previously stated, there were 63,880 citations given out in 2007. On these citations there were 129 separate other categories of violations that accompanied the safety belt violations.

Some of the most prevalent occurrences of primary or other secondary violations that may have caused or been issued separately are presented in Figure 50. Some citations included multiple violations, such as speeding and a failure to stop. The data in the figure represents the total percentage of citations that a particular violation was included in; knowing that that citation might include several violations.

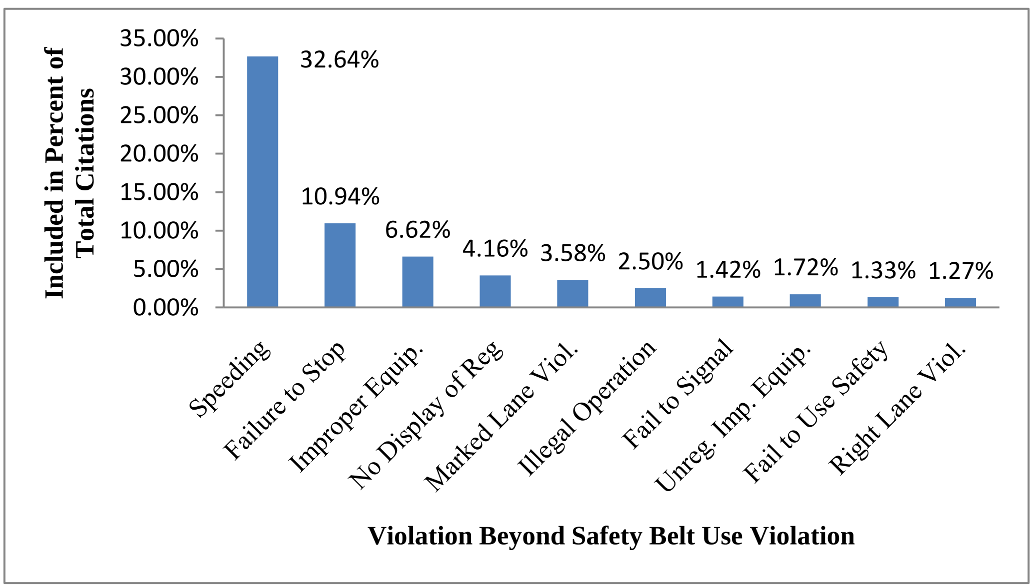

FIGURE 50: Violations Accompanying Safety Belt Violations in 2007 Citations

The most prevalent violation that was attributed in conjunction with a safety belt violation was a speeding violation. This makes sense as the most common violation that occurs on a citation and the most common reason for a traffic enforcement officer to pull a vehicle over is for speeding. Although there were 129 separate violations accompanying safety belt violations, the most common as seen in the figure, are for commonplace traffic violations. The second highest percentage, yet only a third of speeding, was for a failure to stop. This may include, running a stop sign and such other similar traffic violations.

Although not present, only 567 of the violations pertained to drugs or alcohol. This includes driving under the influence, open containers, and possession of drugs. The majority were for driving under the influence. What was surprising was the low amount of safety violations that occur with driving under the influence of drugs and alcohol.

CHAPTER 5

SUMMARY AND RECOMMENDATIONS

The most significant finding in the observational study is the overall increase in safety belt usage by Massachusetts from 66.84 percent in 2008 to 73.61 percent in 2009. Although Massachusetts will likely still remain below the national average, the increase of approximately seven percent is the second largest single year increase since the start of Click It or Ticket in Massachusetts in the fall of 2002. The jump denotes a 21.6 percent conversion of non-users to safety belt usage within the past year. Considering the decrease in usage from 2007 to 2008, this year's improvement should be seen as progress in the right direction.

Again, acknowledging that a 73.61 percent belt usage rate is still below the national average, there is a belief amongst stakeholders that improving seat belt usage further in Massachusetts is and must remain a priority objective for the state's transportation agencies and other primary roadway stakeholders, such as law enforcement, emergency personnel, and every single vehicle occupant.

The purpose of this chapter is to present a summary of the significant results and key facts of the quantitative analysis presented in Chapter 4. Utilizing those results, this chapter will also identify those demographic groups, both traditional and non-traditional, that are in need of specific strategies to improve overall safety belt usage within those groups. Finally, this chapter will present recommendations for possible approaches and countermeasures to attempting to increase safety belt usage within those targeted areas.

5.1 Summary of Key Results

Based on the results presented previously, particular observations can be noted with regards to general safety belt usage. For example, safety belt usage was higher for each age, gender, race, occupant seating position, vehicle type, and state region attribute in 2009 than in 2008. In addition, safety belt usage was higher within each group of non-traditional community demographics in 2009 than in 2008. These data results can be summarized as follows:

- Within every aspect of this analysis, through combinations of demographics and non-traditional demographics, female occupants, both driver and passenger, had a higher safety belt usage rate than males.
- Throughout the analysis, it was found that safety belt usage increased with age from teens to adults to elder adults. Child passenger usage, separated from this increasing trend, seemed to be always near the peak of safety belt usage by age.
- Teen passengers were the least likely to buckle up. They also buckle up only about 50 percent of the time when the corresponding driver is also a teen.
- Occupants in commercial vehicles had the lowest safety belt usage rate throughout the analysis. This was closely followed by occupants of pick-up trucks.
- Generally, occupants in passenger cars, SUVs, and vans had similar usage rates within each portion of the study. For the most part, vans had

the highest belt usage of these three in each analysis, while passenger cars and SUVs were very similar in their usage rates.

- Utilizing only non-freeway data, communities with mid-level population densities had the highest safety belt usage rate. Communities with the densest populations had the lowest safety belt usage rate. This was consistent in both 2008 and 2009.
- Utilizing only non-freeway data, safety belt usage increased as a community's median household income increased. This was consistent in both 2008 and 2009.
- Utilizing only non-freeway data, safety belt usage increased as a community's education level increased. This was consistent in both 2008 and 2009 data.
- Safety belt usage was typically higher on highways than on non-highways in all aspects of the analysis. It would be clear to say that any targeting of education and enforcement would be well utilized on non-highway roadways.
- Teens and younger adult drivers have a much larger number of seat belt citations compared to any other age group. This may be expected as teen drivers and passengers had the lowest safety belt usage rates by age according to the direct observation studies. Nevertheless, it should be noted that given the small percentage of the overall proportion of the population these groups account for, teens and young adults are over-represented in the number of citations issued.

5.2 Recommendations to Increase Safety Belt Usage

The two most effective ways to increase safety belt usage is through increased enforcement and increased education. Over the past decade, these two strategies have proven effective right here in Massachusetts. The largest single year increase in belt usage was concurrent with the implementation of Click It or Ticket, a combined enforcement and education tactic. The second largest increase, 2008 to 2009, as Massachusetts was heavily publicized as the lowest ranking state in safety belt usage and with repeated inquiries on the seat belt law being upgraded to a primary law. This increased media spotlight, no doubt served as an educational initiative.

5.2.1 The Areas of Low Safety Belt Usage

It was determined that the areas of low safety belt usage were in low-level median household income, low education level communities, and the most densely population density communities. This may suggest a need to strengthen education and enforcement campaigns targeted in those areas described above. Using the maps provided in Figures 15, 24, and 33, the areas in which there is need for targeting centers around downtown areas and many of the extreme rural areas of western Massachusetts

Targeted programming may be more beneficial if aimed at male occupants and younger aged occupants including teens and young adults. Knowing that freeway travel shows higher safety belt usage rates, it may be suggested that targeted programs for enforcement would be more useful in locations of surface streets (non-highway) in most communities or to those occupants who are more likely not to travel on a surface street when traversing to a destination.

Considering that even as safety belt usage has an increasing trends in particular demographic groups, it should not be a mask to the overall low safety belt usage of all occupants throughout the state of Massachusetts. All aspects of occupants should be targeted for increased education and enforcement. The amount of this targeted programming should be based on whether that particular demographic group has a lower belt usage rate comparatively.

5.2.2 What Can Be Done?

There are many tactics of targeted education and enforcement that can be utilized to increase safety belt usage in Massachusetts, and in other states that have lower levels of safety belt usage. A series of particular strategies for increasing safety belt usage is summarized in the National Cooperative Highway Research Program (NCHRP) Report 500 Volume 11: A Guide for Safety Belt Usage. Other strategies are easily conjured when considering the past data as seen in Chapter 2.

Massachusetts is currently a secondary seat belt law state. The difference that a secondary seat belt law has compared to overall safety belt usage is its appearance at a phantom law. If a driver is not violating any other traffic law, no citation can be written for lack of safety belt use. Where is the incentive to buckle up? An enforcement strategy that may increase safety belt usage in Massachusetts, based on the average usage rates in states with a secondary or primary seat belt law, is to change the current law to a primary enforcement seat belt law.

Click It or Ticket is seen as a success in most, if not all, states across the U.S. Since its origins in the early 1990s, safety belt usage has increased significantly in each state after its first year of incorporation. Therefore, another strategy for increased enforcement and education is to lengthen Click It or Ticket, maybe indefinitely. The procedures for enforcement within this program could be utilized throughout the year. This would include checkpoints, increased media, and increased citations for all demographic groups.

A strategy listed in the NCHRP 500 Volume 11 is the training of law enforcement personnel to check for proper child restraint usage in all motorist encounters (15). Of all vehicle occupants, it would have been expected to see almost 100 percent usage by children under 12. The 2009 data for Massachusetts presented an 88 percent usage rate for child passengers. Although it was an increase from the 83 percent of 2007 and 2008, this data shows that there needs to be greater direct enforcement of the child restraint laws.

The NCHRP Report also suggests enhanced public education to those population groups that have low safety belt usage rates (15). It was found in this analysis that males, teens, Hispanics, and commercial vehicle occupants had the lowest usage rates of each of the traditional demographic groups. These enhanced education initiatives should be targeted at these groups, along with highly populated areas, and low level income and education communities. Enhanced education strategies may include making all of the safety belt stats, or the overall statewide data, available to the general public.

Additional education strategies could consist of paid and earned media; enacting commercials that relay the statistics over television and radio. A possibility is increased coverage of statistics within news programming and newspapers that increased populations listen and read. Click It or Ticket billboards appear in and around May; therefore, it could be possible to publish statistics and information year round based on the data collected in this and similar statewide studies. Placing billboards or signage on highways and other roadways with stats may be enough to grab driver attention.

With teen occupant shown as of low rates for safety belt usage, and young drivers being overrepresented in the citation data, it may be sensible to look at pre-driver education as a method to increase safety belt usage. Presenting safety belt statistics and information with driver education courses and pushing those student drivers to convey belt important within testing could be effective. In connection, increasing the fines that are associated with safety belt usage violations for those occupants who are under a particular age.

5.3 Enhancing the Observational Data for the Future

The statewide safety belt observation studies are an efficient mechanism to determine safety belt usage across states and within communities. Just taking advantage of the current study system in Massachusetts, observations were able to be carried out to determine much information regarding where persons are not buckling up. Yet, there are a few ways that this data can be enhanced and improved. Enhancing the data can allow for an even more concentrated examination of where there are low and high rates of safety belt usage.

The purpose of this section is to overview possible ways of enhancing the data, if practical.

5.3.1 Communities Selected for Observations

One of the positive aspects of the statewide safety belt observation study is the use of identical observational locations within communities year to year. This has allowed for a constant image, a control, of how the state and specific demographic groups are progressing or digressing. However, if new communities are used in the future, different and possibly more useful analysis may come to the forefront.

An analysis that was unable to be carried out in the process was a direct usage of the surrounding states to Massachusetts. The five states that border Massachusetts; including: New Hampshire, Vermont, New York, Connecticut, and the state of Rhode Island and Providence Plantations, have a diverse set of seat belt laws. Two states have primary laws, two states have secondary laws, and New Hampshire lacks any seat belt law. Observations could be set up on roadways that are near state borders. In response, data can be collected on belt usage in communities based on their proximity to the state with a particular seat belt law. This has the possibility for answering the question: Does observations from a border community affect driving habits? Concurrently, enforcement and education could be directed at border communities if such analysis proved it needed.

The downside of this type of observation is recognized, as the observation study is guided towards the safety belt usage representative of the state of observation and not bordering states. However, these communities still would represent usage in a community in Massachusetts, and additional data can be extracted from data gathered from these border communities.

5.3.2 Utilizing Non-interstate Freeways

It is extremely helpful that the state of Massachusetts has multiple freeways throughout the state, with exception of the Berkshire region. Most of the data that was produced for freeway travel in Massachusetts was collected from the off-ramps of interstate highways (35 of 40 observational locations). Massachusetts does a large amount of interstate highways; however, using interstate highways only for observation study may be polarizing the safety belt usage data in the freeway grouping of the roadway classification category.

Beyond interstate highways, Massachusetts has a large amount of non-interstate freeways. For example, State Route 2 through western Massachusetts and through parts of Lexington and Arlington in the east. There is a large volume of vehicles that enter and exit from this freeway and possibly should be used. This is similar on U.S. Route 3 in the northeast, State Route 3 in the southeast State Route 24 to the south. All are long enough to not fluxgate back and forth from an arterial roadway.

What separate these freeways from the interstate system are the driving speed, speed limits, and the non-interstate freeway mindset. Using freeways with speeds that are always constantly lower than interstates (interstates within urban areas decrease in speed, but possibly only for a few miles), can supply a new set of data to the analysis. This analysis may be able to determine the affect of the speed limit for freeway on safety belt usage. How different would the freeway data in the southeast region be if State Route 3 or 24 were used instead of Interstate 495 and 195? In addition, looking at citation data as it relates to each designation of freeway as they related to safety belt usage.

Knowing what class of freeway is supporting high and low levels of safety belt usage can allow for targeted enforcement and education. A freeway class that shows low belt usage comparative another class, can be subject to increased messages on variable message signs (VMS), increased enforcement, or just increased visible patrols.

5.3.3 Using Additional Non-traditional Demographics in Analyses

Data presented in this thesis document covered safety belt usage rates for non-traditional demographics attributes, including: community population density, community median household income, and community education level. However, there are many other demographic subdivisions that can be utilized in conducting a similar analysis. For example, a communities employment rate or high employment centers, which would affect commuter traffic.

It is quite possible that examining other levels of education levels, such as less than some secondary schooling or percentage public to private schooling within a community, can establish a better understanding on education level's effect of safety belt usage. The idea of adding to the possible analyses within non-traditional demographics is to focus more on possible low and high levels of safety belt usage. This information from the U.S. Census Bureau is vast and relatively untouched.

5.4 Establishing Traction into Increasing Safety Belt Usage

Given the amount of data that is in the public domain, determining precise instances of where traffic safety professionals can target enforcement and target education is in the present. Establishing traction into improving safety belt usage is pinnacle to saving lives. The more the general public knows, the more the general public tends to follow suit. Even if a primary seat belt law cannot be established within a state, notifying the public on usage rates and fatality rates can allow for the driving public to make their own decisions. The public tends to choose for themselves the most safe and efficient way to travel.

APPENDICES

APPENDIX A

CITY AND TOWN DATA

TABLE A.1a: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
Abington	1653.0	3	57,100	2	46.1	2
Acton	1037.7	2	91,624	4	13.6	4
Acushnet	564.5	2	51,500	2	65	1
Adams	358.7	1	32,161	1	64.6	1
Agawam	1221.3	3	49,390	2	49.1	2
Alford	34.0	1	49,632	2	22.4	4
Amesbury	1324.9	3	51,906	2	44.3	2
Amherst	1237.4	3	40,017	1	14.3	4
Andover	1073.7	2	87,683	3	18.5	4
Aquinnah	65.6	1	45,208	2	27	4
Arlington	7912.3	3	64,344	3	27.5	4
Ashburnham	154.0	1	55,568	2	43.1	2
Ashby	123.7	1	61,000	3	44.6	2
Ashfield	45.0	1	52,875	2	26.7	4
Ashland	1273.9	3	68,392	3	28.8	4
Athol	355.9	1	33,475	1	60.4	1
Attleborough	1567.7	3	50,807	2	50	1
Auburn	1055.8	2	51,753	2	45.4	2
Avon	978.0	2	50,305	2	44.6	2
Ayer	818.8	2	46,619	2	43.9	2
Barnstable	779.0	2	46,811	2	35.8	3
Barre	122.3	1	50,553	2	47	2
Becket	38.8	1	46,806	2	46	2
Bedford	959.6	2	87,962	3	22.6	4
Belchertown	265.1	1	52,467	2	38.4	3
Bellingham	859.9	2	64,496	3	45.5	2
Belmont	4969.4	3	80,295	3	20.9	4
Berkley	389.9	1	66,295	3	48.4	2
Berlin	209.2	1	65,667	3	40.2	2
Bernardston	95.1	1	45,259	2	48.1	2
Beverly	2361.3	3	53,984	2	37.1	3

TABLE A.1b: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
Billerica	1623.1	3	67,799	3	47.4	2
Blackstone	829.5	2	55,163	2	56.3	1
Blandford	24.7	1	52,935	2	42.1	2
Bolton	225.2	1	102,798	4	13.9	4
Boston	12383.3	3	39,629	1	45.1	2
Bourne	465.1	1	45,113	2	39.3	3
Boxborough	490.1	1	87,618	3	10.1	4
Boxford	336.4	1	113,212	4	13.9	4
Boylston	266.6	1	67,703	3	29.5	4
Braintree	2476.4	3	61,790	3	41.2	2
Brewster	435.8	1	49,276	2	30.7	3
Bridgewater	927.8	2	65,318	3	42.2	2
Brimfield	106.5	1	50,181	2	47.3	2
Brockton	4329.9	3	39,507	1	59.8	1
Brookfield	195.5	1	45,655	2	59.1	1
Brookline	8060.1	3	66,711	3	11.7	4
Buckland	101.5	1	45,833	2	45.1	2
Burlington	2121.5	3	75,240	3	32.4	3
Cambridge	15841.9	3	47,979	2	22.6	4
Canton	1159.6	2	69,260	3	31.1	3
Carlisle	317.0	1	129,811	4	5.1	4
Carver	307.1	1	53,506	2	52	1
Charlemont	52.4	1	46,548	2	40.3	2
Charlton	295.9	1	63,033	3	45.6	2
Chatham	415.2	1	45,519	2	30.4	3
Chelmsford	1503.4	3	70,207	3	29.3	4
Chelsea	17365.0	3	30,161	1	70.6	1
Cheshire	122.6	1	41,981	1	51.5	1
Chester	35.3	1	43,816	1	54.1	1
Chesterfield	40.9	1	49,063	2	43.6	2
Chicopee	2352.7	3	35,672	1	63.2	1
Chilmark	50.4	1	41,917	1	21.3	4
Clarksburg	127.4	1	43,362	1	62.3	1
Clinton	2461.4	3	44,740	1	50.9	1
Cohasset	725.5	2	84,156	3	17.3	4
Colrain	42.4	1	40,076	1	46.2	2

TABLE A.1c: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
Concord	676.3	2	95,897	4	17.6	4
Conway	50.0	1	56,094	2	26.3	4
Cummington	42.2	1	42,250	1	26.9	4
Dalton	301.9	1	47,891	2	43.3	2
Danvers	2010.2	3	58,779	2	39.1	3
Dartmouth	507.2	2	50,742	2	52.5	1
Dedham	2298.3	3	61,699	3	41.3	2
Deerfield	146.5	1	49,764	2	39.3	3
Dennis	751.1	2	41,598	1	38.5	3
Dighton	301.3	1	58,600	2	44.6	2
Douglas	217.7	1	60,529	3	43.9	2
Dover	367.8	1	141,818	4	9.4	4
Dracut	1411.4	3	57,676	2	50.8	1
Dudley	510.9	2	48,602	2	51.7	1
Dunstable	198.2	1	86,633	3	30.5	3
Duxbury	606.9	2	97,124	4	16.1	4
East Bridgewater	806.9	2	60,311	3	48.5	2
East Brookfield	211.1	1	51,860	2	54.6	1
East Longmeadow	1170.9	2	62,680	3	35.8	3
Eastham	388.9	1	42,618	1	35.6	3
Easthampton	1198.8	2	45,185	2	47.1	2
Easton	808.8	2	69,144	3	31.4	3
Edgartown	145.2	1	50,407	2	35.3	3
Egremont	71.8	1	50,000	2	27.1	4
Erving	110.6	1	40,039	1	63.7	1
Essex	234.0	1	59,554	2	35.1	3
Everett	10961.5	3	40,661	1	64.1	1
Fairhaven	1300.3	3	41,696	1	58.8	1
Fall River	2932.4	3	29,014	1	69.5	1
Falmouth	752.2	2	48,191	2	36.5	3
Fitchburg	1432.9	3	37,004	1	59.8	1
Florida	27.8	1	43,000	1	65.4	1
Foxborough	810.8	2	64,323	3	33.3	3
Framingham	2581.1	3	54,288	2	35.6	3
Franklin	1175.3	2	71,174	3	30.6	3
Freetown	244.1	1	64,576	3	52.5	1

TABLE A.1d: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
Gardner	928.5	2	37,334	1	56	1
Georgetown	631.6	2	76,260	3	34.9	3
Gill	98.5	1	50,750	2	47.4	2
Gloucester	1165.7	2	47,722	2	45.9	2
Goshen	54.9	1	49,583	2	41.9	2
Gosnold	6.3	1	22,344	1	24.1	4
Grafton	772.0	2	56,020	2	37.1	3
Granby	225.3	1	54,293	2	43.3	2
Granville	39.7	1	53,148	2	39.7	3
Great Barrington	163.1	1	45,490	2	43.6	2
Greenfield	815.9	2	33,110	1	44.2	2
Groton	324.4	1	82,869	3	20.5	4
Groveland	777.9	2	69,167	3	31.8	3
Hadley	205.5	1	51,851	2	35.4	3
Halifax	475.3	1	57,015	2	47.7	2
Hamilton	560.8	2	72,000	3	22.5	4
Hampden	270.7	1	65,662	3	37.5	3
Hancock	30.3	1	45,347	2	44.9	2
Hanover	895.3	2	73,838	3	31.5	3
Hanson	663.7	2	62,687	3	38.7	3
Hardwick	68.7	1	45,742	2	54	1
Harvard	227.3	1	107,934	4	19.7	4
Harwich	589.9	2	41,552	1	37.7	3
Hatfield	203.6	1	50,238	2	42.7	2
Haverhill	1798.9	3	49,833	2	47.5	2
Hawley	10.9	1	38,125	1	61.4	1
Heath	32.0	1	50,536	2	45.9	2
Hingham	995.3	2	83,018	3	20	4
Hinsdale	93.1	1	42,500	1	50	1
Holbrook	1440.9	3	54,419	2	51.7	1
Holden	473.7	1	64,297	3	27.2	4
Holland	204.2	1	52,073	2	49.2	2
Holliston	745.5	2	78,092	3	20.4	4
Holyoke	1865.6	3	30,441	1	59.6	1
Hopedale	1185.6	2	60,176	3	39.7	3
Hopkinton	537.9	2	89,281	3	21.7	4

TABLE A.1e: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
Hubbardston	108.8	1	61,462	3	38.2	3
Hudson	1702.6	3	58,549	2	46.1	2
Hull	3689.0	3	52,377	2	37.5	3
Huntington	82.4	1	48,958	2	49.1	2
Ipswich	406.3	1	57,284	2	30.8	3
Kingston	667.0	2	53,780	2	40.3	2
Lakeville	354.1	1	70,495	3	39.8	3
Lancaster	254.4	1	60,752	3	43.9	2
Lanesborough	99.7	1	46,496	2	44.3	2
Lawrence	10009.4	3	27,983	1	71.4	1
Lee	219.8	1	41,556	1	45.5	2
Leicester	469.3	1	55,039	2	50.6	1
Lenox	240.8	1	45,581	2	28.6	4
Leominster	1423.1	3	44,893	1	50.8	1
Leverett	76.2	1	63,203	3	18.4	4
Lexington	1849.5	3	96,825	4	16.7	4
Leyden	44.6	1	50,385	2	43.6	2
Lincoln	555.1	2	79,003	3	7.8	4
Littleton	524.9	2	71,384	3	27.6	4
Longmeadow	1701.7	3	75,461	3	17.7	4
Lowell	7500.9	3	39,192	1	60.8	1
Ludlow	811.1	2	47,002	2	59.9	1
Lunenburg	376.8	1	56,813	2	37.8	3
Lynn	8066.9	3	37,364	1	59.8	1
Lynnfield	1126.9	2	80,626	3	26.8	4
Malden	10923.9	3	45,654	2	49.6	2
Manchester	566.1	2	73,467	3	22.4	4
Mansfield	1121.6	2	66,925	3	31.4	3
Marblehead	4453.1	3	73,968	3	17.6	4
Marion	357.3	1	61,250	3	26.2	4
Marlborough	1804.0	3	56,879	2	37.9	3
Marshfield	862.3	2	66,508	3	30.6	3
Mashpee	606.9	2	50,871	2	34	3
Mattapoisett	390.7	1	58,466	2	31.9	3
Maynard	1957.1	3	60,812	3	38	3
Medfield	845.9	2	97,748	4	18.2	4

TABLE A.1f: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
Medford	6859.9	3	52,476	2	46	2
Medway	1108.6	2	75,135	3	28.9	4
Melrose	5698.3	3	62,811	3	32.8	3
Mendon	318.6	1	71,164	3	33.6	3
Merrimac	755.9	2	58,692	2	39.9	3
Methuen	1963.3	3	49,627	2	51.4	1
Middleborough	305.2	1	52,755	2	49.2	2
Middlefield	22.8	1	50,938	2	46.8	2
Middleton	667.6	2	81,395	3	47	2
Milford	1867.3	3	50,856	2	44.2	2
Millbury	858.0	2	51,415	2	54.8	1
Millis	649.8	2	62,806	3	31.2	3
Milville	578.4	2	57,000	2	51.7	1
Milton	1976.2	3	78,985	3	25.6	4
Monroe	9.0	1	25,500	1	76.2	1
Monson	198.4	1	52,030	2	49.4	2
Montague	274.1	1	33,750	1	53.3	1
Monterey	36.2	1	49,750	2	26.8	4
Montgomery	49.9	1	59,063	2	34.8	3
Mt. Washington	6.2	1	53,125	2	36.9	3
Nahant	2932.5	3	64,052	3	26.9	4
Nantucket	220.3	1	55,522	2	36.2	3
Natick	2117.5	3	69,755	3	25.5	4
Needham	2243.1	3	88,079	3	15.4	4
New Ashford	18.4	1	51,250	2	31.4	3
New Bedford	4569.6	3	27,569	1	70.1	1
New Braintree	53.7	1	54,844	2	53.5	1
New Marlborough	32.2	1	46,875	2	45.7	2
New Salem	22.0	1	48,688	2	32.7	3
Newbury	285.0	1	74,836	3	29.1	4
Newburyport	2041.0	3	58,557	2	30.7	3
Newton	4600.6	3	86,052	3	17.6	4
Norfolk	719.3	2	86,153	3	38.5	3
North Adams	667.5	2	27,601	1	65.9	1
North Andover	1035.1	2	72,728	3	26.8	4
North Attleboro	1500.4	3	59,371	2	37.2	3

TABLE A.1g: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
North Brookfield	228.4	1	44,286	1	54.1	1
North Reading	1054.2	2	76,962	3	33	3
Northampton	823.5	2	41,808	1	32	3
Northborough	789.8	2	79,781	3	26.9	4
Northbridge	835.8	2	50,457	2	49.6	2
Northfield	86.8	1	49,141	2	37.5	3
Norton	669.8	2	64,818	3	39.3	3
Norwell	491.4	1	87,397	3	22.9	4
Norwood	2683.0	3	58,421	2	35.7	3
Oak Bluffs	504.2	2	42,044	1	37.5	3
Oakham	90.3	1	60,729	3	37.3	3
Orange	220.2	1	36,849	1	59.9	1
Orleans	444.7	1	42,594	1	27.1	4
Otis	38.9	1	51,488	2	48	2
Oxford	512.8	2	52,233	2	54.4	1
Palmer	407.9	1	41,443	1	58.8	1
Paxton	308.2	1	72,039	3	24.3	4
Peabody	3136.6	3	54,829	2	49.6	2
Pelham	55.9	1	61,339	3	22	4
Pembroke	853.0	2	65,050	3	38.9	3
Pepperell	504.8	2	65,163	3	38.3	3
Peru	32.4	1	44,531	1	51.5	1
Petersham	23.7	1	47,833	2	28.5	4
Phillipston	73.5	1	46,845	2	51.6	1
Pittsfield	1054.8	2	35,655	1	51.8	1
Plainfield	28.4	1	37,250	1	42.5	2
Plainville	748.7	2	57,155	2	43.3	2
Plymouth	571.9	2	54,677	2	42.6	2
Plympton	187.3	1	70,045	3	44.7	2
Princeton	98.7	1	80,993	3	20.2	4
Provincetown	349.5	1	32,716	1	38	3
Quincy	5453.7	3	47,121	2	43.6	2
Randolph	2986.9	3	55,255	2	44	2
Raynham	665.4	2	60,449	3	47	2
Reading	2336.3	3	77,059	3	27.4	4
Rehoboth	247.0	1	65,373	3	43.4	2

TABLE A.1h: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
Revere	9379.8	3	37,067	1	63.7	1
Richmond	83.7	1	60,917	3	30.8	3
Rochester	153.9	1	63,289	3	44.1	2
Rockland	1778.0	3	50,613	2	49.9	2
Rockport	1075.1	2	50,661	2	26.5	4
Rowe	14.7	1	41,944	1	38.2	3
Rowley	312.2	1	62,130	3	36.4	3
Royalston	32.9	1	44,444	1	53.1	1
Russell	98.3	1	46,600	2	55.5	1
Rutland	222.3	1	62,846	3	36.9	3
Salem	5052.1	3	44,033	1	43.3	2
Salisbury	553.3	2	49,310	2	55.5	1
Sandisfield	16.0	1	45,972	2	49.5	2
Sandwich	471.0	1	61,250	3	27	4
Saugus	2472.0	3	55,301	2	51.6	1
Savoy	20.1	1	41,477	1	60.3	1
Scituate	1039.6	2	70,868	3	24.6	4
Seekonk	742.8	2	56,364	2	48.5	2
Sharon	731.0	2	89,256	3	16.1	4
Sheffield	69.2	1	45,082	2	50.6	1
Shelburne	87.4	1	42,054	1	36.3	3
Sherborn	263.6	1	121,693	4	10	4
Shirley	489.0	1	53,344	2	51.4	1
Shrewsbury	1617.8	3	64,237	3	29.1	4
Shutesbury	68.9	1	60,438	3	17.2	4
Somerset	2255.3	3	51,770	2	55.4	1
Somerville	18147.6	3	46,315	2	43.3	2
South Hadley	957.7	2	46,678	2	38.2	3
Southampton	211.4	1	61,831	3	41.3	2
Southborough	667.9	2	102,986	4	18.1	4
Southbridge	829.7	2	33,913	1	64.8	1
Southwick	304.2	1	52,296	2	53.4	1
Spencer	364.9	1	46,598	2	52	1
Springfield	4671.0	3	30,417	1	59.5	1
Sterling	258.2	1	67,188	3	32.3	3
Stockbridge	97.5	1	48,571	2	28.4	4

TABLE A.1i: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
Stoneham	3469.0	3	56,605	2	41	2
Stoughton	1684.4	3	57,838	2	45.7	2
Stow	359.5	1	96,290	4	22.3	4
Sturbridge	243.4	1	56,519	2	40.2	2
Sudbury	703.2	2	118,579	4	12.6	4
Sunderland	258.4	1	37,147	1	29.5	4
Sutton	278.2	1	75,141	3	34.4	3
Swampscott	4514.2	3	71,089	3	23.9	4
Swansea	702.9	2	52,524	2	58.1	1
Taunton	1197.1	2	42,932	1	60.5	1
Templeton	243.2	1	48,482	2	57.8	1
Tewksbury	1430.3	3	68,800	3	44.2	2
Tisbury	576.5	2	37,041	1	37.3	3
Tolland	14.3	1	53,125	2	50.9	1
Topsfield	477.7	1	96,430	4	22	4
Townsend	284.9	1	61,745	3	36.6	3
Truro	101.1	1	42,981	1	36	3
Tyngsborough	701.8	2	69,818	3	41.2	2
Tyringham	18.3	1	60,250	3	32.1	3
Upton	303.5	1	78,595	3	33.9	3
Uxbridge	428.3	1	61,855	3	45.2	2
Wakefield	3294.1	3	66,117	3	34.3	3
Wales	116.7	1	48,906	2	53.1	1
Walpole	1126.1	2	74,757	3	32.2	3
Waltham	4705.4	3	54,010	2	40	2
Ware	288.8	1	36,875	1	59.1	1
Wareham	590.9	2	40,422	1	54.2	1
Warren	184.4	1	34,583	1	65	1
Warwick	20.1	1	42,083	1	40.7	2
Washington	14.5	1	54,583	2	47.7	2
Watertown	7932.0	3	59,764	2	32.7	3
Wayland	856.4	2	101,036	4	14.9	4
Webster	1336.4	3	38,169	1	59.1	1
Wellesley	2645.6	3	113,686	4	9.7	4
Wellfleet	138.8	1	43,558	1	32.3	3
Wendell	31.3	1	43,846	1	33	3

TABLE A.1j: City and Town Data for Non-Traditional Demographics (U.S. Census Bureau)

CITY / TOWN	Population Density (pp / mi^2 2007)	Density Group	Median Household Income (1999 USD)	Income Group	Education Level (% +25)	Education Group
Wenham	599.4	2	90,524	4	22	4
West Boylston	603.0	2	53,777	2	38.8	3
West Bridgewater	425.4	1	55,958	2	46.7	2
West Brookfield	186.6	1	49,722	2	51.1	1
West Newbury	316.2	1	92,828	4	20.3	4
West Springfield	1643.0	3	40,266	1	49.5	2
West Stockbridge	78.2	1	51,000	2	32.8	3
West Tisbury	105.1	1	54,077	2	20.3	4
Westborough	900.4	2	73,418	3	24.1	4
Westfield	861.8	2	45,240	2	47.4	2
Westford	712.1	2	98,272	4	20.6	4
Westhampton	58.5	1	60,089	3	31.4	3
Westminster	208.1	1	57,755	2	41	2
Weston	688.1	2	153,918	4	10.5	4
Westport	302.1	1	55,436	2	51.4	1
Westwood	1273.6	3	87,394	3	22.4	4
Weymouth	3133.6	3	51,665	2	44.1	2
Whatley	77.0	1	58,929	2	34.8	3
Whitman	2055.0	3	55,303	2	47.2	2
Wilbraham	632.1	2	65,014	3	29	4
Williamsburg	95.3	1	47,250	2	37.3	3
Williamstown	172.9	1	51,875	2	31.7	3
Wilmington	1267.8	3	70,652	3	40	2
Winchendon	233.9	1	43,750	1	59.1	1
Winchester	3522.8	3	94,049	4	17.7	4
Windsor	24.5	1	51,389	2	34.8	3
Winthrop	10077.0	3	53,122	2	41.1	2
Woburn	2916.7	3	54,897	2	44.3	2
Worcester	4626.8	3	35,623	1	52.7	1
Worthington	39.6	1	53,047	2	33.7	3
Wrentham	500.7	2	78,043	3	35.8	3
Yarmouth	988.1	2	39,808	1	39.8	3

APPENDIX B

2009 MASSACHUSETTS OBSERVATIONAL LOCATIONS

TABLE B.1a: Observational Locations (2009 Safety Belt Observation Study)

Town Name	Primary Roadway	Secondary Roadway	Functional Class	Time Period	State Region
Adams	Meadow Street	Meadow Lane	Local	AM Peak	Berkshire
Agawam	Route 57	South Westfield Street	Arterial	Mid-Day	Pioneer
Amherst	College Street	South East Street	Arterial	PM Peak	Pioneer
Arlington	Dudley Street	Brattle Street	Local	PM Peak	Northeastern
Attleboro	Pleasant Street	Starkey Avenue	Arterial	PM Peak	Southeastern
Attleboro	Park Street	Pleasant Street	Arterial	Weekend	Southeastern
Auburn	Ramp from I-395 SB	US Route 20	Freeway	PM Peak	Worcester
Auburn	Oxford Street	Heard Street	Collector	PM Peak	Worcester
Ayer	Fitchburg Road	Groton School Road	Arterial	PM Peak	Worcester
Belchertown	Howard Street	Jackson Street	Local	PM Peak	Pioneer
Belmont	Lake Street	Burch Street	Collector	Mid-Day	Northeastern
Berlin	Ramp from I-495 SB	Route 62	Freeway	AM Peak	Worcester
Beverly	Eastern Avenue	Northern Avenue	Local	Mid-Day	Northeastern
Bolton	Ramp from I-495 NB	State Route 117	Freeway	Mid-Day	Northeastern
Boston	Medallion Avenue	Binford Street	Local	Weekend	Northeastern
Boston	Columbus Avenue	Berkley Street	Arterial	PM Peak	Northeastern
Boxford	Georgetown Road	Ipswich Road	Local	Weekend	Northeastern
Braintree	Granite Street	Wood Road	Collector	Weekend	Northeastern
Brockton	Main Street	Brookside Avenue	Arterial	AM Peak	Southeastern
Brockton	Warren Avenue	Clifton Avenue	Collector	PM Peak	Southeastern
Brookline	Loveland Road	Eliot Street	Local	Mid-Day	Northeastern
Cheshire	North Street	Church Street	Arterial	Mid-Day	Berkshire
Chesterfield	Indian Hollow Road	South Street	Local	Mid-Day	Berkshire
Chicopee	Montgomery Street	Granby Road	Collector	AM Peak	Pioneer
Chicopee	Fuller Road	I-291	Collector	Weekend	Pioneer
Chicopee	Mellen Street	Newbury Street	Local	PM Peak	Pioneer
Chicopee	Center Street	Hampden Street	Collector	Mid-Day	Pioneer
Clinton	Chestnut Street	Cameron St	Arterial	AM Peak	Worcester
Concord	Elm Street	Concord Rotary	Arterial	Weekend	Northeastern
Conway	Conway Station Road	Bardwells Ferry Road	Local	Weekend	Berkshire
Dalton	North Street	Orchard Road	Arterial	Mid-Day	Berkshire

TABLE B.1b: Observational Locations (2009 Safety Belt Observation Study)

Town Name	Primary Roadway	Secondary Roadway	Functional Class	Time Period	State Region
Danvers	Elliott Street	Bridge Street	Arterial	AM Peak	Northeastern
Dartmouth	Old Westport Road	Lucy Little Road	Collector	Weekend	Southeastern
Dighton	Sharps Lot Road	Old Williams Street	Local	Weekend	Southeastern
Dracut	Methuen Road	Broadway	Collector	PM Peak	Northeastern
Eastham	Grand Army Republic Highway	Eastham Rotary	Arterial	PM Peak	Southeastern
Easthampton	Main Street	Union Street	Arterial	PM Peak	Pioneer
Fairhaven	Huttlecon Avenue	Alden Street	Arterial	Mid-Day	Southeastern
Fall River	Broadway	Columbia Street	Collector	Weekend	Southeastern
Fall River	Ramp from Route 79	North Main Street	Freeway	Mid-Day	Southeastern
Falmouth	Carey Lane	Sippewisett Road	Local	PM Peak	Southeastern
Fitchburg	Hurd Street	Franklin Road	Local	Mid-Day	Worcester
Franklin	Ramp from I-495 NB	King Street	Freeway	Weekend	Northeastern
Hadley	Honey Pot Road	Cemetery Road	Local	Weekend	Pioneer
Hardwick	Delargy Road	Thresher Road	Local	Mid-Day	Pioneer
Harwich	Long Pond Road	Orleans Harwich Road	Arterial	AM Peak	Southeastern
Hatfield	West Street	Mountain Drive	Collector	PM Peak	Pioneer
Holden	Causeway Street	Main Street	Local	Weekend	Worcester
Holyoke	Ramp from I-91 SB	Easthampton Road	Freeway	Weekend	Pioneer
Holyoke	Locust Street	West Franklin Street	Local	AM Peak	Pioneer
Holyoke	Beech Street	West Franklin Street	Arterial	AM Peak	Pioneer
Holyoke	Linden Street	Cabot Street	Collector	Weekend	Pioneer
Hyannis	Main Street Highway	Ocean Street Highway	Arterial	Mid-Day	Southeastern
Kingston	Malvern Lane	Dillingham Way	Local	AM Peak	Southeastern
Lakeville	Bettys Neck Road	Bedford Street	Local	PM Peak	Southeastern
Lanesborough	Summer Street	Old Cheshire Road	Collector	PM Peak	Berkshire
Lanesborough	South Main Street	Bull Hill Road	Collector	AM Peak	Berkshire
Lawrence	Broadway	Daisy Street	Arterial	Mid-Day	Northeastern
Lee	Ramp from I-90	US Route 20	Freeway	AM Peak	Berkshire
Lee	Ramp from I-90	US Route 20	Freeway	AM Peak	Berkshire
Lee	Ramp from I-90	US Route 20	Freeway	Mid-Day	Berkshire
Lee	Ramp from I-90	US Route 20	Freeway	Weekend	Berkshire
Lee	Ramp from I-90	US Route 20	Freeway	PM Peak	Berkshire
Lee	Ramp from I-90	US Route 20	Freeway	Weekend	Berkshire

TABLE B.1c: Observational Locations (2009 Safety Belt Observation Study)

Town Name	Primary Roadway	Secondary Roadway	Functional Class	Time Period	State Region
Lee	Ramp from I-90	US Route 20	Freeway	Mid-Day	Berkshire
Lee	Ramp from I-90	US Route 20	Freeway	PM Peak	Berkshire
Lee	West Park Street	Marble Street	Collector	Mid-Day	Berkshire
Lee	High Street	Franklin Street	Local	PM Peak	Berkshire
Lee	Pleasant Street	Meadow Street	Arterial	PM Peak	Berkshire
Lenox	Housatonic Street	Crystal Street	Local	AM Peak	Berkshire
Leominster	West Street	Orchard Street	Collector	Mid-Day	Worcester
Leominster	Bainbridge Street	Willard Street	Local	PM Peak	Worcester
Littleton	Ramp from I-495 NB	Route 119	Freeway	Mid-Day	Northeastern
Lowell	Middlesex Street	Webber Street	Arterial	Mid-Day	Northeastern
Ludlow	Center Street	Chapin Street	Collector	AM Peak	Pioneer
Lynn	Lynn Shore Drive	Ocean Street	Arterial	AM Peak	Northeastern
Malden	Salem Street	Lebanon Street	Collector	PM Peak	Northeastern
Mansfield	Ware Street	East Street	Local	Mid-Day	Southeastern
Mansfield	Ramp from I-495	Route 140	Freeway	AM Peak	Southeastern
Mansfield	School Street	Old Elm Street	Collector	Mid-Day	Southeastern
Mashpee	Falmouth Road	Mashpee Circle	Arterial	Weekend	Southeastern
Methuen	Ramp from I-495 NB	Route 110	Freeway	Weekend	Northeastern
Methuen	Beverly Street	Filbert Street	Local	AM Peak	Northeastern
Middleboro	Ramp from I-495 SB	Route 28	Freeway	Weekend	Southeastern
Millbury	Ramp from I-90	Route 146	Freeway	Mid-Day	Worcester
Monson	Main Street	Wales Road	Arterial	AM Peak	Pioneer
Natick	Nimitz Circle	Macarthur Road	Local	PM Peak	Worcester
Natick	Indian Ridge Road	Sassamon Road	Local	AM Peak	Worcester
New Bedford	Coggeshall Road	North Front Street	Collector	AM Peak	Southeastern
Newton	Watertown Street	Albermarle Road	Arterial	Weekend	Northeastern
Newton	Stuart Street	Waverly Avenue	Local	AM Peak	Northeastern
Newton	Ramp from I-95 NB	Road 16	Freeway	PM Peak	Northeastern
North Adams	Main Street	Ashland Street	Collector	Weekend	Berkshire
North Adams	Curran Highway	Old State Street	Arterial	Weekend	Berkshire
Northborough	Main Street	Hudson Street	Arterial	AM Peak	Worcester
Northborough	Boston-Worcester Turnpike	US Route 20	Arterial	PM Peak	Worcester
Northbridge	Quaker Street	Wolf Hill Road	Local	Weekend	Worcester
Norton	Ramp from I-495 NB	Route 123	Freeway	AM Peak	Southeastern
Norton	Ramp from I-495 SB	Route 123	Freeway	PM Peak	Southeastern
Norwood	Central Street	Cottage Street	Collector	AM Peak	Northeastern

TABLE B.1d: Observational Locations (2009 Safety Belt Observation Study)

Town Name	Primary Roadway	Secondary Roadway	Functional Class	Time Period	State Region
Palmer	Ramp from I-90	Route 32	Freeway	PM Peak	Pioneer
Pepperell	Mount Lebanon Street	Shirley Street	Local	Mid-Day	Worcester
Pittsfield	North Street	Depot Street	Arterial	PM Peak	Berkshire
Pittsfield	West Street	Onota Street	Collector	PM Peak	Berkshire
Pittsfield	Newell Street	Lyman Street	Collector	Mid-Day	Berkshire
Pittsfield	Dalton Avenue	Allendale Road	Arterial	AM Peak	Berkshire
Pittsfield	First Street	Maplewood Avenue	Arterial	AM Peak	Berkshire
Pittsfield	West Street	Jason Street	Collector	AM Peak	Berkshire
Pittsfield	Bishop Parkway	Dawes Avenue	Local	Mid-Day	Berkshire
Pittsfield	Cheshire Road	Asci Drive	Arterial	Weekend	Berkshire
Plymouth	Circuit Avenue	Manomet Avenue	Local	AM Peak	Southeastern
Plymouth	Sandwich Street	Warren Avenue	Collector	AM Peak	Southeastern
Plymouth	Ramp State Road 3 SB	Clark Road	Freeway	Weekend	Southeastern
Raynham	North Main Street	Center Street	Collector	Mid-Day	Southeastern
Revere	Broadway	Park Avenue	Arterial	PM Peak	Northeastern
Rochester	Neck Road	Mendell Road	Local	Weekend	Southeastern
Rockland	Ramp from Route 3 SB	Hingham Street	Freeway	PM Peak	Northeastern
Saugus	Essex Street	Vine Street	Collector	Weekend	Northeastern
Scituate	Wellesley Road	Jericho Road	Local	PM Peak	Northeastern
Seekonk	Ramp from I-195 WB	Route 114A	Freeway	PM Peak	Southeastern
Shrewsbury	Ramp from I-290 WB	Main Street	Freeway	Mid-Day	Worcester
Somerset	Davol Street	Brightman Street	Collector	PM Peak	Southeastern
Southboro	Southville Road	River Street	Collector	Mid-Day	Northeastern
Southboro	Ramp from 495 NB	State Route 9	Freeway	AM Peak	Northeastern
Spencer	Main Street	Greenville Street	Arterial	Mid-Day	Worcester
Spencer	Main Street	Maple Street	Arterial	Mid-Day	Worcester
Springfield	Cambria Street	Pennsylvania Avenue	Local	AM Peak	Pioneer
Springfield	Alden Street	Roosevelt Avenue	Collector	Mid-Day	Pioneer
Springfield	Ramp from I-91 NB	Noble Street	Freeway	PM Peak	Pioneer
Springfield	Ramp from I-291 EB	Dwight Street	Freeway	Weekend	Pioneer
Springfield	Ramp from I-91 SB	West Columbus Avenue	Freeway	AM Peak	Pioneer
Springfield	Plumtree Road	Abbott Street	Collector	PM Peak	Pioneer

TABLE B.1e: Observational Locations (2009 Safety Belt Observation Study)

Town Name	Primary Roadway	Secondary Roadway	Functional Class	Time Period	State Region
Sterling	Ramp from I-190	Route 140	Freeway	AM Peak	Worcester
Stoughton	Ramp from Route 24 NB	Harrison Blvd	Freeway	Mid-Day	Southeastern
Sturbridge	Ramp from Rt 20	I-84	Freeway	Weekend	Worcester
Sturbridge	Southbridge Road	Fiske Hill Road	Arterial	Weekend	Worcester
Sturbridge	New Boston Road Extension	Route 131	Local	Mid-Day	Pioneer
Sutton	Ramp from State Route 146	Central Turnpike	Freeway	PM Peak	Worcester
Walpole	West Street	Norfolk Street	Collector	AM Peak	Northeastern
Waltham	Ramp from I-95 NB	US Route 20	Freeway	AM Peak	Northeastern
Warren	Crouch Road	Reed Street	Local	Weekend	Pioneer
West Springfield	Park Street Rotary	Elmdale Street	Arterial	Weekend	Pioneer
West Springfield	Ramp from I-90	US Route 5	Freeway	Mid-Day	Pioneer
West Stockbridge	Great Barrington Road	Quarry Road	Collector	Weekend	Berkshire
Westfield	Ramp from I-90	US Route 202	Freeway	Mid-Day	Pioneer
Westfield	Ramp from I-90	US Route 202	Freeway	AM Peak	Pioneer
Westfield	North Elm Street	Union Avenue	Arterial	Weekend	Pioneer
Westfield	Elm Street	Main Street	Arterial	Mid-Day	Pioneer
Williamsburg	Grove Street	Pine Street	Local	PM Peak	Berkshire
Williamstown	Petersburg Road	Northwest Hill Road	Local	Weekend	Berkshire
Worcester	Stafford Street	Curtis Parkway	Collector	PM Peak	Worcester
Worcester	Annisquam Street	Willard Avenue	Local	AM Peak	Worcester
Worcester	Ramp from I-190 WB	Route 12	Freeway	Weekend	Worcester
Worcester	School Street	Worcester Center Blvd	Collector	Mid-Day	Worcester
Worcester	Massasoit Road	Sunderland Road	Collector	Weekend	Worcester
Worcester	Clark Street	Burncoat Street	Collector	AM Peak	Worcester
Worcester	Doyle Road	Brattle Street	Collector	Weekend	Worcester
Worcester	Grafton Street	Massasoit Road	Arterial	Weekend	Worcester
Worcester	Millbury Street	Harlem Street	Collector	AM Peak	Worcester
Wrentham	Beech Street	South Street	Local	Mid-Day	Southeastern

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