# Minnesota Seat Belt Use Survey: June 2012

GREENWAY

# Minnesota Seat Belt Use Survey: June 2012 Final Report

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# 1 Introduction

The study reported here is the first implementation of a new methodology (the Uniform Criteria) required by the National Highway Traffic Safety Administration (NHTSA). The new methodology (reported in Title 23: Highways, Part 1340 – Uniform Criteria for State Observational Surveys of Seat Belt Use of the Code of Federal Regulations) affected the sample selection, survey design, data collection methodology, data analysis, and reporting. Minnesota's survey design was submitted December 30, 2011 and accepted by NHTSA on March 30, 2012. No changes in methodology were made after the NHTSA acceptance notice was received.

The focus of the report is to present data analyses of seat belt use by front seat occupants (drivers and outermost passengers), both overall and within categories defined by:

- Vehicle type
- Age
- Sex
- Seating Position
- Time of Day
- Day of Week

The report also includes data analyses reporting cell phone use by drivers and front-seat passengers, as well as helmet use by motorcyclists. This report also provides an overview of the study design and quality control procedures; details of which are available in a separate report: *Seat Belt Use Survey Design for Minnesota: Sampling, Data Collection, and Estimation Plan (Greenway, March 2012)*.

Survey Methodology Changes

2012 marks the first use of the new methodology. The following lists the differences between the 2012 methodology and that used in 2011 as documented in the report *Minnesota Safety Belt and Motorcycle Helmet Use (Eby et al., August 2011).* Note that all of the studies have been conducted in accordance with the NHTSA requirements in force at the time.

1. *Sample Selection*. Beginning in 2012, NHTSA required states to expand the list of counties included in the sample by making sure that sampled counties were selected from among those accounting for 85% of fatal crashes in the state. In Minnesota for 2012, this resulted in 51 of 87 counties being included in the sampling frame. Prior years' sampling frames were smaller (e.g., in 2011, 37 counties were included in the sampling frame). The sampling frame in prior years was selected to exclude those counties in the lowest 15% of state population (i.e., the sampled counties accounted for 85% of the state's population). This change in methodology ensured that more rural counties were included in the sample in 2012 than had been the case in previous years.
2. *Prior knowledge of belt use*. In previous years, the sample was stratified based on belt use and Vehicle Miles Traveled (VMT). Because the 2012 sampling frame included so many counties for which no prior belt use data was available, the stratification methodology was altered to rely on VMT only.

3. *Site Selection*. In the new methodology, NHTSA allowed states to select sites based on a probability of selection related to either road segment length or average daily traffic. Since the Minnesota Department of Transportation (MnDOT) was able to supply comprehensive traffic data for all public roads, the traffic volume selection method was adopted. In prior years, sites were selected at random using a graphical method, which divided the sampled counties into grids of x and y coordinates, then using a random number generator to pick values for x, and y to determine which part of the grid to select. The street falling nearest to the randomly selected values for x and y was added to the sample.

4. *Observer positioning*. In 2012, observations were to take place at mid-block locations in order to obtain data from free-flow traffic positions. In previous years, observers were stationed at intersections and were trained to conduct observations of stationary vehicles at traffic controlled devices. This new methodology for observer positioning poses new risks for the observers and increases the chances of missing some planned observations when speeds are too high.

5. *Case Weighting*. While there were no NHTSA-required changes in data analysis for 2012, this year marks a change in how data were gathered for the purpose of weighting individual cases. In the past, observers collected traffic counts for five minutes prior to starting their observation period, and for a second 5-minute period after the observations. These traffic counts were used to develop volume weightings during data analysis. In 2012 the traffic volume data supplied by MnDOT was used in place of brief counts collected in the field. The 2012 methodology has the advantage of making use of published annualized traffic volume data rather than relying on a brief observation period on a single day.

6. *Data Analysis*. As with case weightings, there were no NHTSA-required changes in data analysis for 2012. In order to support comparisons to prior years' data, it was decided to retain and update several data tables from the 2011 report. The 2012 report includes several tables, graphs, and analyses in addition to those presented in prior years. In particular, the 2012 report includes both weighted and unweighted data, in recognition of the fact that case weighting (as also noted in the 2011 report) can sometimes result in summary data that appear to show results that are contrary to well established trends. It is often the case that these surprising results are due to a small number of sites with both high weightings and unexpected results. For this reason, the reader is encouraged to look at both the weighted and unweighted data in order to form a more complete picture of what is happening. The total number of cases (unweighted) is provided in all data tables to help with interpretation of the results. Unexpected results, when based on a small number of actual cases, should be interpreted with caution and not necessarily used to make judgments at a statewide level. This cautionary note appeared in the 2011 report as well.

7. *Standard Error*. A standard error of less than 2.5% on the seat belt use estimate is required in the new methodology, which is significantly lower than the prior year target of 5%. However, since the 2011 sample size of approximately 11,000 observations obtained a standard error of 0.6%, well below both values, gathering a similar sample size for 2012 should meet the accuracy requirement.

# 2 Methods

## 2.1 Sample Design

Minnesota is composed of 87 counties; 51 of which account for 85.5 percent of the passenger vehicle crash-related fatalities according to Fatality Analysis Reporting System (FARS) data averages for the period 2007-2009. These 51 counties were included in the sample pool for this study.

Using 2010 Road Segment data provided by MnDOT, a listing of county road segments was developed. Each segment was identified by road functional classification (Interstate/Primary, Arterial/Secondary, and Local), by Average Annual Daily Traffic (AADT) and segment length. This descriptive information allowed for stratification of road segments. A systematic probability proportional to size (PPS) sample was adopted to select the road segments to be used as observation sites.

The research design conformed to the requirements of the Uniform Criteria. The selected approach includes a stratified systematic PPS sample of observation sites as is described below.

1. All 87 counties in Minnesota were listed in descending order of the average number of motor vehicle crash-related fatalities for the period of 2007 to 2009. The 51 counties accounting for approximately 85 percent of Minnesota's total passenger vehicle occupant fatalities were selected to compose the sample frame.
2. *A priori*, it was expected there would be a sample size of approximately 11,000 vehicles overall. This is based on the 2011 Minnesota seat belt use survey which had a standard error of 0.6%, well below the allowed value of 2.5%.
3. In 2011, the 37 counties included in that year's seat belt usage survey were stratified according to high, medium, and low belt use (based on prior data or estimated values), with the addition of a separate stratum for Hennepin County (the largest county by population in the state). Because the new sampling frame included more counties than in the past, prior historical belt-use data for a number of counties upon which to base decisions on stratum assignments was not available. A different method of stratification based on 2010 vehicle-miles-traveled (VMT) data provided by MnDOT for each county was therefore adopted. Counties were stratified in three levels (high, medium, and low VMT) with the exception of Hennepin County which, as in previous years, was treated as its own stratum. The designation of high, medium, or low traffic volume was determined by first calculating the total VMT for the remaining 50 counties. Counties were then sorted from highest VMT to lowest. Cut points were then determined which created three strata with roughly equal VMT based on an analysis looking for cut points in the data for county VMT (after excluding Hennepin County from the analysis). See Table 1.
4. Road segments were selected randomly and with PPS from all segments in the sampling frame. The road segments were stratified by functional classification (Interstate/Primary, Arterial/Secondary, and Local). This process resulted in the selection of 240 road segments (4 strata x 60 sites per stratum).
5. Additional stages of selection were used to determine the individual site observation period, travel direction, lane, and vehicles to be observed, at

random and with known probability, as described in Section 4.1 under the Uniform Criteria.

## 2.2 County Selection

The 51 counties accounted for 85.5 percent of the total fatalities and represented the first stage of sampling. These counties were stratified into four groups according to their VMT. The strata, counties, their daily vehicle-miles-traveled (DVMT), and stratum total DVMT are shown in Table 1.

**Table 1. County and Regional Vehicle Miles Traveled, by Stratum, for County Selection**

| Strata | County | County DVMT | Region DVMT Total |
|---|---|---|---|
| Hennepin County | Hennepin | 30,030,003 | 30,030,003 |
| High VMT | Ramsey | 12,367,507 | 37,193,740 |
| | Dakota | 10,512,179 | |
| | Anoka | 8,188,710 | |
| | Washington | 6,125,344 | |
| Med VMT | St. Louis | 5,970,800 | 35,571,795 |
| | Stearns | 4,962,757 | |
| | Wright | 4,133,188 | |
| | Olmsted | 3,804,351 | |
| | Scott | 3,429,249 | |
| | Sherburne | 2,504,030 | |
| | Crow Wing | 2,269,926 | |
| | Carver | 2,251,316 | |
| | Otter Tail | 2,236,360 | |
| | Chisago | 2,070,261 | |
| | Rice | 1,939,557 | |
| Low VMT | Clay | 1,898,601 | 36,596,759 |
| | Goodhue | 1,798,349 | |
| | Blue Earth | 1,734,871 | |
| | Winona | 1,672,928 | |
| | Freeborn | 1,555,959 | |
| | Douglas | 1,553,009 | |
| | Pine | 1,545,028 | |
| | Steele | 1,407,290 | |
| | Itasca | 1,406,513 | |
| | Morrison | 1,358,758 | |
| | Benton | 1,309,168 | |
| | Kandiyohi | 1,302,302 | |
| | Cass | 1,204,992 | |

| Strata | County | County DVMT | Region DVMT Total |
|---|---|---|---|
| | Beltrami | 1,168,855 | |
| | Mille Lacs | 1,149,914 | |
| | Polk | 1,101,274 | |
| | Becker | 1,095,733 | |
| | Nicollet | 1,064,280 | |
| | Isanti | 1,053,958 | |
| | Martin | 854,203 | |
| | Nobles | 826,623 | |
| | Todd | 820,645 | |
| | Le Sueur | 784,263 | |
| | Lyon | 772,158 | |
| | Hubbard | 719,426 | |
| | Aitkin | 714,619 | |
| | Meeker | 701,873 | |
| | Jackson | 690,695 | |
| | Renville | 661,906 | |
| | Fillmore | 617,252 | |
| | Redwood | 595,570 | |
| | Wabasha | 582,637 | |
| | Pipestone | 310,670 | |
| | Murray | 292,901 | |
| | Stevens | 269,536 | |

## 2.3 Road Segment Selection

Using all 51 counties in the sampling frame, a total of 60 road segments were selected with PPS from within each stratum. The 2010 MnDOT roadway inventory and traffic volume data was used for the selection of road segments. The available exclusion option and removal of non-public roads, unnamed roads, unpaved roads, vehicular trails, access ramps, cul-de-sacs, traffic circles, and service drives from the dataset was exercised.

Road segments within each county were first stratified by functional classification (Interstate/Primary, Arterial/Secondary, and Local). Within each VMT and functional class stratum road segments were selected with PPS with the measure of size (MOS) being DVMT. Let $g = 1,2, \dots G$ be the first stage strata, $v_{gh}$ be DVMT for road segment stratum *h* in stratum $g$, and $v_{gh} = \sum_{all\ i\ in\ gh} v_{ghi}$ be the total DVMT for all road segments in stratum *g* and functional class group *h*. The road segment inclusion probability is $\pi_{i|gh} = n_{gh} v_{i|gh} / v_{gh}$, where $n_{hg}$ is the sample size for the roadway functional class stratum *h* in VMT stratum g that was allocated. If a roadway segment was selected with certainty (i.e., its MOS was equal to or exceeded $v_{gh}/n_{gh}$), it was set aside as a certainty selection and the probabilities of selection were recalculated for the remaining road segments in the stratum. This was repeated and the certainty selections were identified successively until no roadway segment's MOS was equal to or exceeded the recalculated $v_{gh}/n_{gh}$. After all certainty road segments were identified, the R statistical software package sampling function with a selection probability vector as described was used to obtain a road segment sample with PPS. *(Software package used: R Development Core Team. (2010). R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing)*

The resulting composition of the sample of each functional class within each stratum is shown in Table 2.

**Table 2. Roadway Functional Strata by Stratum, Road Segments Population (N), DVMT, and Number of Segments Selected (n)**

| Stratum | | Roadway Functional Strata | | | Total |
|---|---|---|---|---|---|
| | | Interstate/ Primary | Arterial/ Secondary | Local | |
| Hennepin County | N | 245 | 2,458 | 15,606 | 18,309 |
| | DVMT | 17,306,755 | 9,277,288 | 3,445,962 | 30,030,005 |
| | n | 34 | 19 | 7 | 60 |
| High VMT | N | 339 | 3,704 | 24,699 | 28,742 |
| | DVMT | 18,261,044 | 14,340,989 | 4,591,711 | 37,193,744 |
| | n | 29 | 23 | 8 | 60 |
| Medium VMT | N | 658 | 5,183 | 36,256 | 42,097 |
| | DVMT | 17,219,124 | 12,958,057 | 5,394,615 | 35,571,796 |
| | n | 29 | 22 | 9 | 60 |
| Low VMT | N | 1,143 | 8,454 | 57,117 | 66,714 |
| | DVMT | 17,388,783 | 12,871,951 | 6,336,030 | 36,596,764 |
| | n | 29 | 21 | 10 | 60 |

## 2.4 Reserve Sample

The survey design called for a process of replacement for unusable roadway segments. In the event that an original road segment was judged to be permanently unavailable, a reserve road segment was used. The reserve road segment sample consisted of two additional road segments per original road segment selected, resulting in a reserve sample of 480 road segments. These reserve segments were identified and selected based on similarity to the primary selected sample segments they would have to replace. Similarity was verified based on functional classification and DVMT. Thus, reserve road segments were selected with PPS using DVMT as MOS by the same approach as described earlier. For the purposes of data weighting, the reserve road segment inherits all probabilities of selection and weighting components up to and including the road segment stage of selection from the original road segment actually selected. Probabilities and weights for any subsequent stages of selection (e.g., the sampling of vehicles) will be determined by the reserve road segment itself. Appendix A presents the surveyed road segments.

# 3 Data Collection

## 3.1 Site Selection

Road segments were mapped according to their latitude and longitude. The selected road segments were examined using both Google Maps® and ESRI® mapping tools to identify an intersection or interchange that occurs within the segment. If no intersection or interchange occurred within the segment, then any suitable point within that segment was used for observation. Observation sites were selected to identify a safe and convenient location for the observer to be stationed during the survey period. Observation site selection also included cross-checking survey dates against scheduled construction activities via MnDOT's 511 Traveler Information Service and inspection of state highway GIS base maps for posted speed limits and supporting traffic control installations. Sites including an intersection or interchange were assigned to locations in the segment at or as near as possible to any controlled intersections. For interstate highways and other primary roads with interchanges, observation sites were selected to be on a ramp carrying traffic that is exiting the highway. The observed direction of travel was randomly assigned for each road segment.

For high-volume roadways (those in which an observer could not reasonably be assured of surveying all lanes of travel in the desired direction), observations were taken from the curbside or next-to-curbside lanes. This was because it was found to be impractical (especially in free-flowing traffic at speeds in excess of 40 mph) to observe vehicles more than two lanes distant from the observer's position. The locations of the observation sites were described on Site Assignment Screens provided to aid the observers and Quality Control (QC) Monitor in travelling to the assigned locations.

## 3.2 Staff Selection and Training

Four experienced observers from prior years' Minnesota belt use surveys were hired and assigned observation sites throughout the state. One staff member was designated as the quality control (QC) Monitor responsible for monitoring observations conducted at 5% of all sites.

Observer and QC Monitor training was conducted at the Office of Traffic Safety and in the field for two days during the week prior to the data collection period; on May 31, 2012 and June 1. 2012 The training syllabus is shown as Figure 1.

### Figure 1. Training Syllabus

**Day 1:**
Welcome

Review and sign contracts

Distribute training materials

Survey overview

Data collection techniques
- Definitions of belt/booster seat use, passenger vehicles, cell phone use, and motorcycle helmet use
- Observation protocol
- Weekday/weekend/rush hour/non-rush hour
- Weather conditions
- Duration at each site

Scheduling and rescheduling
- Site Assignment Sheet
- Daylight
- Temporary impediments such as weather
- Permanent impediments at observation sites

Site locations
- Locating assigned sites
- Interstate ramps and surface streets
- Direction of travel/number of observed lanes
- Non-intersection requirement
- Alternate site selection

Data collection instrument
- Explanation of features
- Basic descriptions
- Recording observations
- Process for recording alternate site information
- Supporting software/applications

Data uploads

**Day 2:**
Day 1 review

Quiz

Safety and security

Timesheet and expense reports

Field practice

Field Reliability Testing

At the conclusion of the classroom portion of the training the observers took a 12 question quiz to ensure that they understood the survey terminology, the data collection protocols, and reporting requirements. The observers scored over 90% correct on the quiz. Incorrect responses were discussed in a final classroom briefing at the end of the second day of training.

One observation site was designated for training and device familiarization. Two more sites were selected for reliability testing where about 70 vehicles were observed in order to assess agreement among the observers and the QC monitor. Criterion performance was set at no greater than 5% disagreement on the count of vehicles and overall belt use percentage. The results of the reliability testing are contained in a separate document provided to the Office of Traffic Safety.

A pre-deployment meeting was conducted on June 7, 2012 to distribute final observation site assignments and survey equipment. The seat belt observation survey was scheduled for June 8 – June 21, 2012.

## 3.3 Observation Periods and Quality Control

All observations were conducted during weekdays and weekends between 7:00 a.m. and 6:00 p.m. The schedule included rush hour (before 9:30 a.m. and after 3:30 p.m.) and non-rush hour observations. Observation of belt usage was conducted for 45 minutes per site, at up to five sites per day for each observer. Sites within close proximity were grouped as observation clusters and were randomly assigned a day of the week observation period. Start times were staggered to ensure that a representative number of weekday/weekend/ rush hour/non-rush hour sites were included. The first site in each group and its observation time was randomly selected. The order for the observations of the remaining sites for the day was designed to reduce travel time and costs.

Maps showing the location of all observation sites and site assignment sheets were provided to the observers and QC Monitor. These indicated the observed road name, the crossroad included within the road segment (or nearest crossroad), assigned date, assigned time, direction of travel, and (if necessary) lane/s assigned.

**Data Collection**

All passenger vehicles, including commercial vehicles weighing less than 10,000 pounds, were eligible for observation. The data collection input screens are shown in Appendix B. The start-up screen was designed to allow for documentation of descriptive site information, including: date, site location, site number, alternate site data, assigned traffic flow, number of lanes available and observed, start and end times for observations, and weather conditions. This form was completed by the observer at each site.

A five-minute pre-observation period was used to collect eligible vehicle counts for the lane/s to be observed at each site. This method, similar to prior years' seat belt observation studies in Minnesota, was designed to provide the expected traffic volume during the 45-minute belt use observation period. This period of counting was used to determine the sampling rate of vehicles at the site. In keeping with the guidance in the Preamble of the Uniform Criteria, observers were instructed to sample every Nth vehicle at locations, using the following guideline:

1. For 31 or more vehicles per five minute count – observe every 5th vehicle*.

2. For 16-30 vehicles per five minute count – observe every 3rd vehicle*.
3. For 0-15 vehicles per five minute count – observe every vehicle.

   *Observers were instructed to collect helmet-use information for every motorcycle and keep a count of those missed in the event of a large rally passing during the observation period.

This technique (as briefly described in the Uniform Criteria) allowed for detailed information to be gathered beyond the collection of belt-use alone. This is in keeping with the survey designs in past years for Minnesota and gives the state additional useful information tied directly to the vehicle occupants for which seat belt use information was obtained. All relevant information was collected for all qualifying front seat occupants. The data collection screens were designed to record seat belt use, cell phone use by drivers and passengers, as well as motorcycle helmet use by motorcycle riders. The apparent age and gender of all drivers, front seat passengers, and motorcycle riders were collected as well.

For low-to-moderate volume locations, the observer surveyed as many lanes of traffic as s/he could while obtaining data on at least 90% of the vehicles included in the sample. For high-volume sites, the observer was instructed to survey the pre-selected lane of traffic. Only one direction of traffic was observed at any given site.

Observations were made of all drivers and right front seat occupants in eligible vehicles. This included children riding in booster seats. *The only right front seat occupants excluded from this study were child passengers who were traveling in child seats with harness straps*. All entries were made on data entry screens.

**Alternate Sites and Rescheduling**

When a site could not be observed due to safety concerns, construction or inclement weather and an alternate site was not immediately available, data collection was rescheduled for later in the data collection period, selecting a similar time of day and day of week. In the event that the site was going to be unavailable for the duration of the study, then a preselected alternate site was taken from the reserve sample and used as a permanent replacement.

During the survey, 4 alternate sites were used due to construction and 5 sites were rescheduled due to bad weather. The alternate sites and survey rescheduling were disclosed to the observers by the QC Monitor. All observations, including rescheduled observations, were completed by June 29, 2012.

**Quality Control Procedures**

The QC Monitor made unannounced visits to 19 of the observation sites. This represented 7.9% of the sites and was greater than the required 5% monitoring rate. During these visits, the QC Monitor evaluated the observer's performance from a distance (if possible) to ensure that the observer was following all survey protocol including: being on time at assigned sites, completing the data collection forms, and making accurate observations of seat belt use. The QC Monitor then worked alongside the observer to obtain comparison data of at least 20 vehicles when possible. The monitoring results are contained in a separate document provided to the Office of Traffic Safety.

# 4 Imputation, Estimation and Variance Estimation

## 4.1 Imputation

No imputation was done on missing data.

## 4.2 Sampling Weights

The following is a summary of the notation used in this section.

*g* – Subscript for PSU strata

*h* – Subscript for road segment strata

*i* – Subscript for road segment

*j* – Subscript for time segment

*k* – Subscript for road direction

*l* – Subscript for lane

*m* – Subscript for vehicle

*n* – Subscript for front-seat occupant

Under this stratified multistage sample design, the inclusion probability for each observed vehicle is the product of selection probabilities at all stages: $\pi_{gh}$ for road segment strata, $\pi_{i|gh}$ for road segment, $\pi_{j|ghi}$ for time segment, $\pi_{k|ghij}$ for direction, $\pi_{l|ghij}$ for lane, and $\pi_{m|ghijl}$for vehicle. So the overall vehicle inclusion probability is:

$$\pi_{ghijklm} = \pi_{gh}\pi_{i|gh}\pi_{j|ghi}\pi_{k|ghij}\pi_{l|ghij}\pi_{m|ghijl}.$$

The sampling weight (design weight) for vehicle *m* is:

$$w_{ghijklm} = \frac{1}{\pi_{ghijklm}}$$

## 4.3 Nonresponse Adjustment

Given the data collection protocol described in this plan, including the provision for the use of alternate observation sites, road segments with non-zero eligible volume and yet zero observations conducted should be a rare event. Nevertheless, if eligible vehicles passed an eligible site or an alternate eligible site during the observation time but no usable data were collected for some reason, then this site will be considered as a "non-responding site." The weight for a non-responding site will be distributed over other sites in the same road type in the same PSU. Let:

$$\pi_{ghi} = \pi_{gh}\pi_{i|gh}$$

be the road segment selection probability, and

$$w_{ghi} = \frac{1}{\pi_{ghi}}$$

be the road segment weight. The nonresponding site nonresponse adjustment factor:

$$f_{gh} = \frac{\sum_{all\ i} w_{ghi}}{\sum_{responding\ i} w_{ghi}}$$

will be multiplied to all weights of non-missing road segments in the same road type of the same stratum and the missing road segments will be dropped from the analysis file. However, if there were no vehicles passing the site during the selected observation time (45 minutes) then this is simply an empty block at this site and this site will not be considered as a non-responding site, and will not require non-response adjustment.

There was one site with zero observation and no non-responding sites encountered during the survey

## 4.4 Seat Belt Use Estimator

Since AADT and DVMT are available at the roadway and segment level, belt use was estimated as follows:

Noting that all front-seat occupants were observed, let the driver/passenger seat belt use status be:

$$y_{ghijklmn} = \begin{cases} 1, & if\ belt\ used \\ 0, & otherwise \end{cases}.$$

The seat belt use rate estimator is a ratio estimator:

$$p_{VMT} = \frac{\sum_g \sum_h \sum_i w_{ghi} VMT_{ghi} p_{ghi}}{\sum_{all\ jklmn\ in\ ghi} w_{jklm|ghi}}.$$

Here $w_{ghi}$ is the road segment weight, $VMT_{ghi}$, is the road segment VMT. The road segment level seat belt use rate $p_{ghi}$ is estimated by:

$$p_{ghi} = \frac{\sum_{all\ jklmn\ in\ ghi} w_{jklm|ghi} y_{ghijklmn}}{\sum_{all\ jklmn\ in\ ghi} w_{jklm|ghi}}.$$

Here weight $w_{jklm|ghi} = (\pi_{j|ghi}\pi_{k|ghij}\pi_{l|ghijk}\pi_{m|ghijkl})^{-1}$ is the subsequent vehicle selection probability after the site is selected.

Further assuming that all vehicles observed at the same road segment *i* have the equal selection probabilities for the subsequent sampling after road segment selection, then all weights $w_{jklm|ghi}$ for the same road segment are equal and can be cancelled in the calculation of $p_{ghi}$. One example of this situation is treating the observed vehicles at the same site as a simple random sample of all vehicles passing that site. So $p_{ghi}$ can be estimated by the sample mean.

The seat belt use rate estimator is a ratio estimator:

$$Pghi = \frac{1}{n_{ghi}} \sum_{all\ jklmn\ in\ ghi} y_{ghijklmn}$$

Together the road segment level DVMT and the assumption of equal vehicle selection probabilities at the same site not only simplify the road segment level seat belt use rate estimation, but dramatically reduce the amount of information to be collected at the field.

## 4.5 Variance Estimation

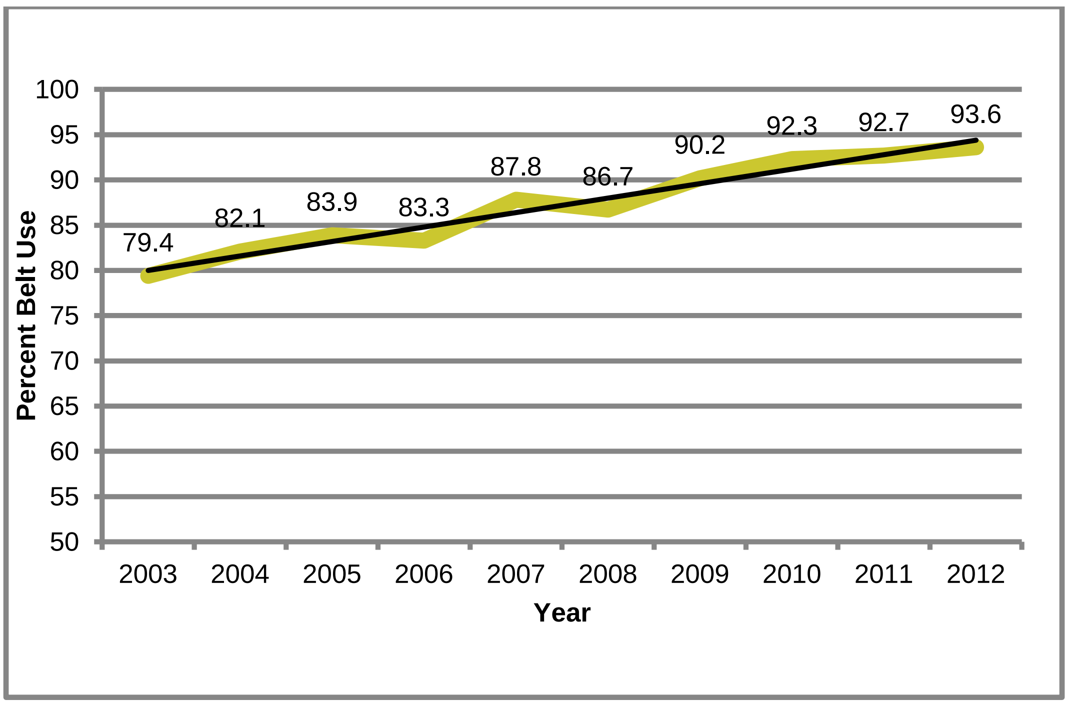
PROC SURVEYFREQ and PROC SURVEYMEANS in SAS were used for the ratio estimator $\rho_{VMT}$ along with the joint PSU selection probabilities to calculate the seat belt use rate and its variance.

# 5 Data Analysis

## 5.1 Overall Measures of Seat Belt Use

The 2012 Minnesota seat belt survey included 16,924 front seat occupant observations from 13,339 vehicles. The overall percent belt use by front seat occupants was 93.6% (std error = 1.42%; 95% confidence interval is 90.8% - 96.4%). This weighted value represents a slight increase from the value for 2011 and is the highest value obtained since the first seat belt observation studies were performed in Minnesota in 1986. Figure 2 shows the annual weighted average belt use and a linear trend line over the years 2003-2012.

**Figure 2. Belt Use Percentage for 2003-2012**




The equation for the trend line is y= (1.5976 * YEAR) + 78.413. The upward trend is significantly different from zero (flat) ($R^2$ = 0.9581). This indicates a baseline value (pre-2003 of 78.413% belt use, and a steady increase of about an additional 1.6% belt usage each year.

Note that an alternative weighting scheme that takes into account the probability of selecting any particular front-seat occupant returned a statistically equivalent value of 92.9% belt use (std. error = 1.49%; 95% confidence limit is 90.0% to 95.9%). This alternative weighting is used in those analyses reported as a function of seating position. From a statistical data analysis perspective, the two weighting methods give nearly identical results. The measure with the smaller standard error is used because it ignores seating position as a factor.

The remainder of this section provides high-level summary data in graphic format. Detailed data tables showing both weighted and unweighted data are contained in a separate document provided to the Office of Traffic Safety. In the figures that are presented here, all percentages are based on weighted data.

Figure 3 shows the belt use rate as a function of time of day for the years 2003 – 2012.

**Figure 3. Belt Use Across Hours of the Day: 2003-2012**

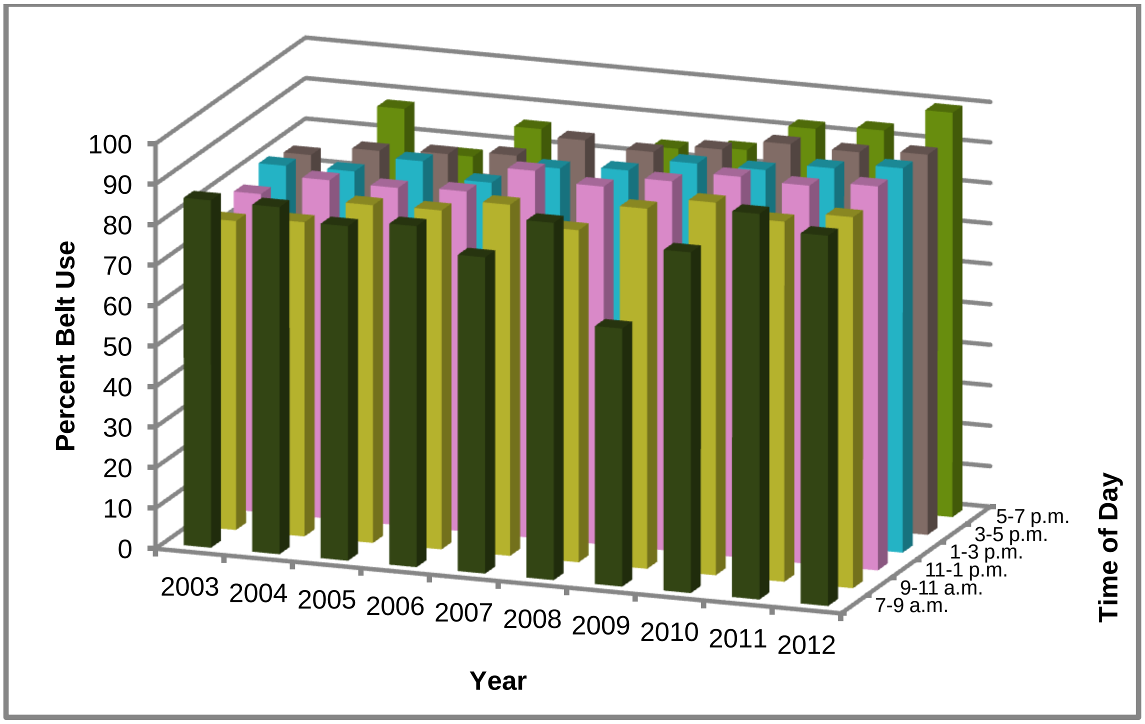


Figure 4 shows the belt use patterns over the days of the week for the years 2003-2012.

**Figure 4. Belt Use Across Days of the Week: 2003-2012**

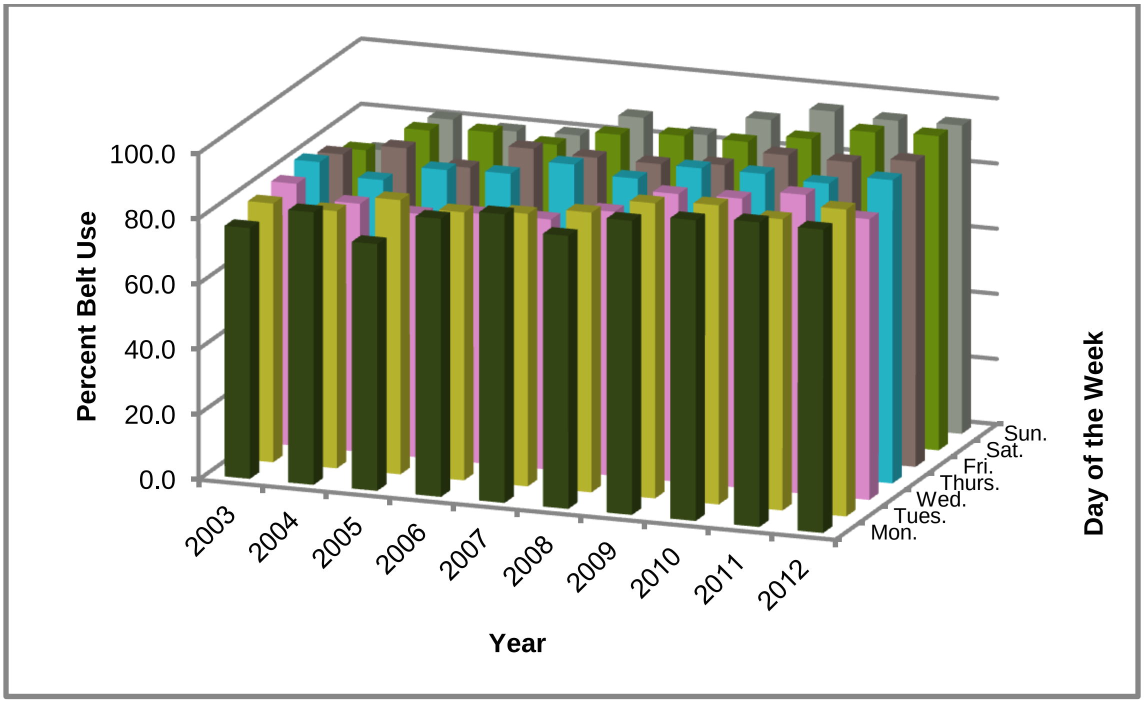



Figure 5 shows the belt use patterns as a function of occupant age for the years 2003 – 2012.

**Figure 5. Belt Use Among Age Groups: 2003-2012**

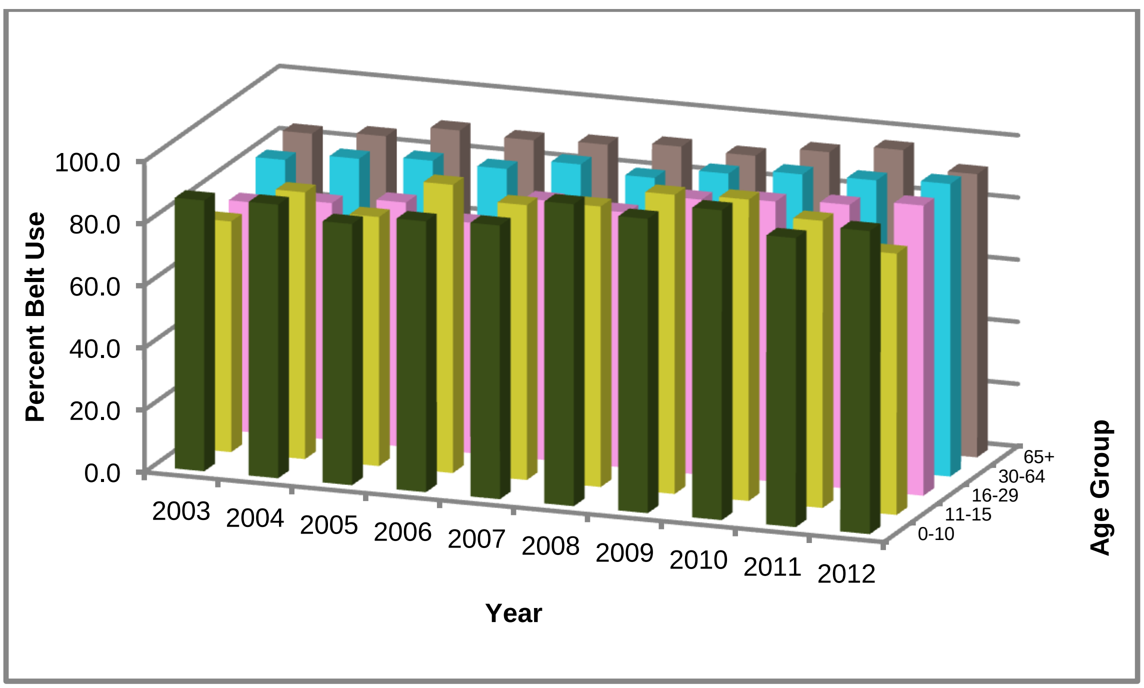


Figure 6 shows belt use for male and female front seat occupants for the years 2003-2012.

**Figure 6. Belt Use as a Function of Sex of the Occupant: 2003-2012**

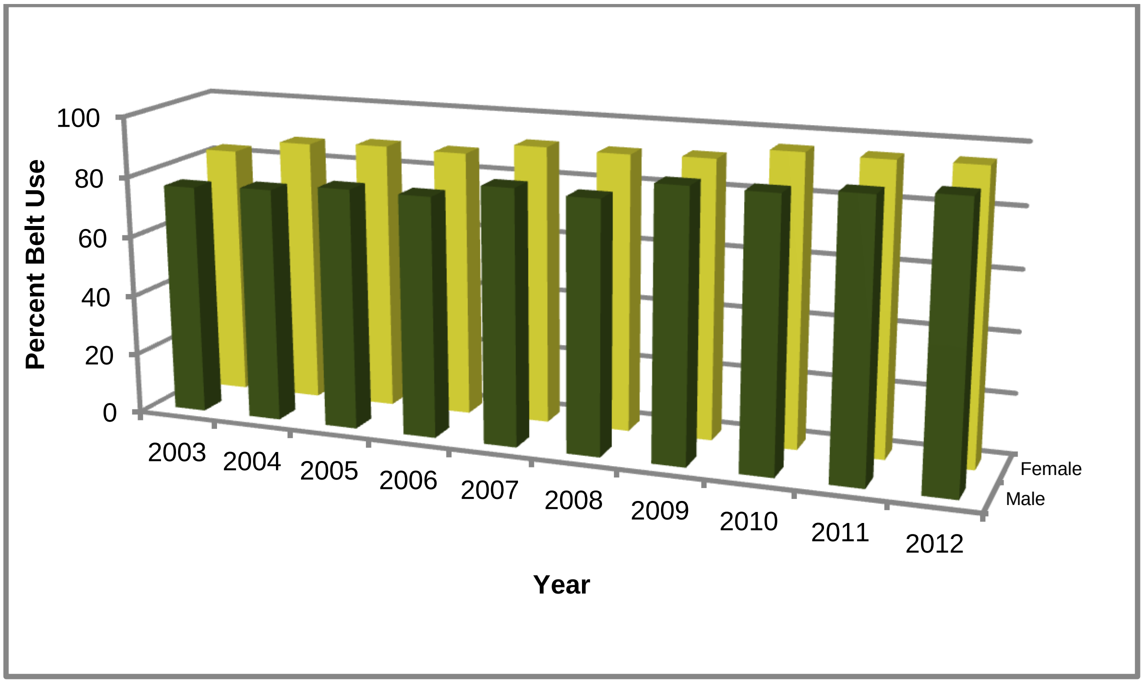
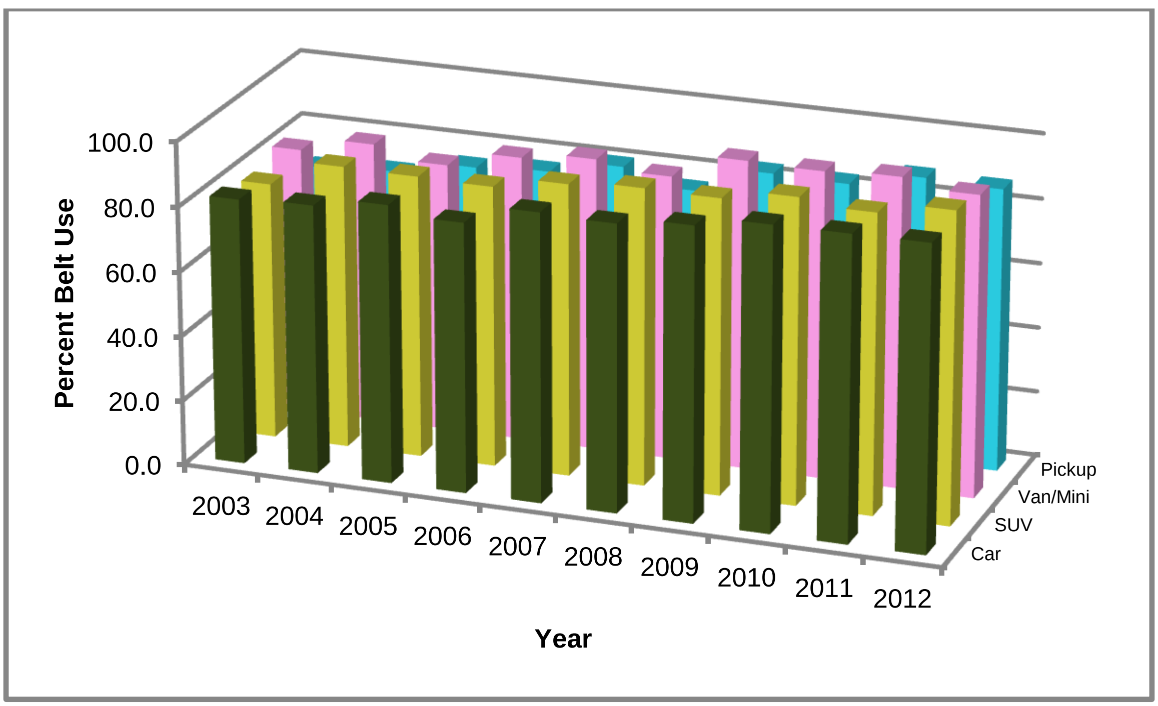



Figure 7 shows belt use for front seat occupants of pickup trucks, vans/min-vans, SUVs, and cars for the years 2003-2012.

**Figure 7. Belt Use as a Function of Vehicle Type: 2003-2012**



## 5.2 Updated Versions of Data Tables from the 2011 Report

In order to facilitate comparison of seat belt usage results between this 2012 survey and the data reported for 2011, this section presents data tables that are equivalent to those produced last year.

Table 3 presents the belt use results for each stratum. The belt use values and Ns are the unweighted (actual) number of front seat occupants observed. The presentation in the body of this report of both weighted and unweighted values was determined by a close examination of the results to identify areas of analysis where the unweighted values appear to offer a more usable view of the information for policy makers. All of the analyses (both weighted and unweighted) appear in a separate report provided to the Office of Traffic Safety.

**Table 3. Unweighted Safety Belt Use Rates and Ns as a function of Stratum, Roadway Type**

| Stratum | Location/Road Type | Percent Use | N |
|---|---|---|---|
| Hennepin | Primary | 95.5 | 2660 |
| | Secondary | 94.9 | 1808 |
| | Local | 93.7 | 143 |
| Low VMT | Primary | 90.6 | 2089 |
| | Secondary | 87.0 | 1160 |
| | Local | 86.0 | 93 |
| Med VMT | Primary | 94.2 | 2686 |
| | Secondary | 91.6 | 1802 |
| | Local | 89.4 | 180 |
| High VMT | Primary | 94.7 | 2459 |
| | Secondary | 93.6 | 1730 |
| | Local | 90.4 | 114 |
| OVERALL Statewide | | 93.5 | 16924 |

Table 4 presents weighted belt use percentages and unweighted Ns as a function of Site Type, Time of Day, Day of Week, Weather, Sex, Age, and Position in the Vehicle.

**Table 4. Weighted Safety Belt Use Rates and Unweighted Ns as a function of Subgroup, Vehicle Type**

| | | All Vehicles | | Car | | SUV | | Van/ Minivan | | Pickup Truck | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % Use | N | % Use | N | % Use | N | % Use | N | % Use | N |
| **Overall** | | 93.6 | 16924 | 93.9 | 7904 | 95.9 | 4321 | 93.0 | 2034 | 87.2 | 2498 |
| **Site Type** | Intersection | 93.1 | 9449 | 93.7 | 4262 | 95.7 | 2323 | 92.0 | 1179 | 85.7 | 1624 |
| | Mid-Block | 94.9 | 1937 | 93.6 | 914 | 96.9 | 513 | 95.0 | 241 | 95.6 | 259 |
| | Ramp | 96.4 | 5211 | 97.2 | 2728 | 96.8 | 1485 | 97.3 | 614 | 90.2 | 615 |
| **Time of Day** | 7-9 am | 91.4 | 2334 | 91.3 | 1132 | 93.5 | 602 | 94.7 | 246 | 83.3 | 346 |
| | 9-11 am | 91.6 | 4517 | 91.1 | 2080 | 95.0 | 1170 | 88.7 | 575 | 85.8 | 658 |
| | 11-1 pm | 94.8 | 4133 | 94.1 | 1941 | 97.3 | 1063 | 94.6 | 537 | 90.4 | 576 |
| | 1-3 pm | 94.9 | 4143 | 96.6 | 1842 | 95.6 | 1084 | 94.0 | 503 | 87.2 | 687 |
| | 3-5 pm | 93.9 | 1612 | 94.9 | 843 | 96.6 | 374 | 93.4 | 163 | 87.9 | 220 |
| | 5-7 pm | 99.9 | 115 | 99.9 | 66 | 100 | 28 | 100 | 10 | 82.7 | 11 |
| **Day of Week** | Monday | 93.0 | 2456 | 96.2 | 1074 | 93.2 | 626 | 86.6 | 341 | 88.0 | 396 |
| | Tuesday | 94.1 | 2707 | 95.9 | 1285 | 95.3 | 645 | 92.5 | 358 | 83.3 | 410 |
| | Weds | 86.1 | 2187 | 86.6 | 1001 | 88.8 | 573 | 91.9 | 280 | 74.4 | 326 |
| | Thursday | 93.0 | 1681 | 91.7 | 826 | 95.9 | 354 | 92.1 | 206 | 93.9 | 269 |
| | Friday | 93.6 | 3276 | 96.9 | 1517 | 92.8 | 865 | 95.5 | 404 | 85.9 | 475 |
| | Saturday | 96.4 | 1976 | 93.0 | 825 | 99.1 | 533 | 95.1 | 175 | 89.1 | 413 |
| | Sunday | 94.6 | 2571 | 92.5 | 1376 | 95.7 | 703 | 99.3 | 250 | 94.4 | 209 |
| **Weather** | Sunny | 93.4 | 9614 | 92.6 | 4538 | 96.5 | 2492 | 91.8 | 1156 | 86.6 | 1376 |
| | Cloudy | 93.9 | 5847 | 95.7 | 2705 | 88.4 | 1451 | 94.9 | 711 | 88.4 | 940 |
| | Rainy | 93.7 | 1393 | 94.8 | 661 | 83.6 | 378 | 93.2 | 167 | 83.6 | 182 |
| **Sex** | Male | 91.9 | 9161 | 92.1 | 3996 | 95.6 | 2059 | 91.1 | 1043 | 85.1 | 2018 |
| | Female | 95.6 | 7653 | 95.5 | 3890 | 94.4 | 2254 | 95.0 | 989 | 94.4 | 468 |
| **Age** | 0-10 | 97.4 | 24 | 99.7 | 8 | 86.5 | 5 | 100 | 5 | 100 | 6 |
| | 11-15 | 84.0 | 227 | 84.2 | 87 | 89.9 | 64 | 77.3 | 41 | 80.7 | 34 |
| | 16-29 | 93.3 | 3706 | 93.6 | 2299 | 97.3 | 703 | 90.6 | 275 | 87.0 | 407 |
| | 30-64 | 94.1 | 11557 | 94.2 | 404 | 95.6 | 2363 | 93.8 | 1516 | 89.9 | 1905 |
| | 65+ | 91.9 | 1312 | 93.8 | 694 | 99.7 | 275 | 97.7 | 195 | 55.9 | 143 |
| **Position** | Driver | 93.2 | 13339 | 93.9 | 6376 | 95.1 | 3374 | 92.9 | 1541 | 86.8 | 1983 |
| | Passenger | 94.6 | 3515 | 93.7 | 1528 | 97.3 | 947 | 93.3 | 493 | 88.5 | 515 |

## 5.3 Cell Phone Use

Table 5 shows unweighted cell phone use by occupants of passenger vehicles in 2012.

**Table 5. Unweighted Cell Phone Use Rate by Vehicle Type**

| Cell Phone Usage Type | | Vehicle Type | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | missing | Car | Pickup | SUV | Van/MiniVan | |
| Hand Held | Count | 6 | 398 | 130 | 261 | 121 | 916 |
| | % within Vehicle Type | 6.2% | 5.0% | 5.2% | 6.0% | 5.9% | 5.4% |
| Hands Free | Count | 0 | 18 | 4 | 3 | 1 | 26 |
| | % within Vehicle Type | .0% | .2% | .2% | .1% | .0% | .2% |
| None | Count | 91 | 7524 | 2378 | 4070 | 1919 | 15982 |
| | %within Vehicle Type | 93.8% | 94.8% | 94.7% | 93.9% | 94.0% | 94.4% |
| TOTAL | Count | 97 | 7940 | 2512 | 4334 | 2041 | 16924 |
| | % within Vehicle Type | 100% | 100% | 100% | 100% | 100% | 100% |

The majority of occupants were not using a cell phone. Roughly one-in-twenty (5.4%) front seat occupants were observed to be using a hand-held cell phone. Fewer than one-in-one-hundred were judged to be using a hands-free cell phone. This is, naturally, a difficult judgment for the observers to make and is particularly difficult when there are passengers in the vehicle (i.e. one cannot tell if the conversation is between vehicle occupants only or if an occupant is using a hands-free cell phone).

Table 6 shows unweighted counts of and percentages of belt and phone use by occupants of passenger vehicles by vehicle occupant position.

**Table 6. Unweighted Cell Phone and Belt Use by Vehicle Occupant Position**

| Position | Belt Use | | Phone Use Type | | | Total |
|---|---|---|---|---|---|---|
| | | | Hand Held | Hands Free | None | |
| Driver | No | Count | 55 | 0 | 791 | 846 |
| | | % within phone use type | 6.6% | .0% | 6.3% | 6.3% |
| | Yes | Count | 779 | 26 | 11688 | 12493 |
| | | % within phone use type | 93.2% | 100% | 93.3% | 93.3% |
| | Missing | Count | 2 | 0 | 42 | 44 |
| | | % within phone use type | .2% | .0% | .3% | .3% |
| | TOTAL | Count | 836 | 26 | 12521 | 13383 |
| | | % within phone use type | 100% | 100% | 100% | 100% |
| Passenger | No | Count | 2 | | 242 | 244 |
| | | %within phone use type | 2.5% | | 7.0% | 6.9% |
| | Yes | Count | 78 | | 3193 | 3271 |
| | | % within phone use type | 97.5% | | 92.3% | 92.4% |
| | Missing | Count | 0 | | 26 | 26 |
| | | % within phone use type | .0% | | .8% | .7% |
| | Total | Count | 80 | | 3461 | 3541 |
| | | % within phone use type | 100% | | 100% | 100% |

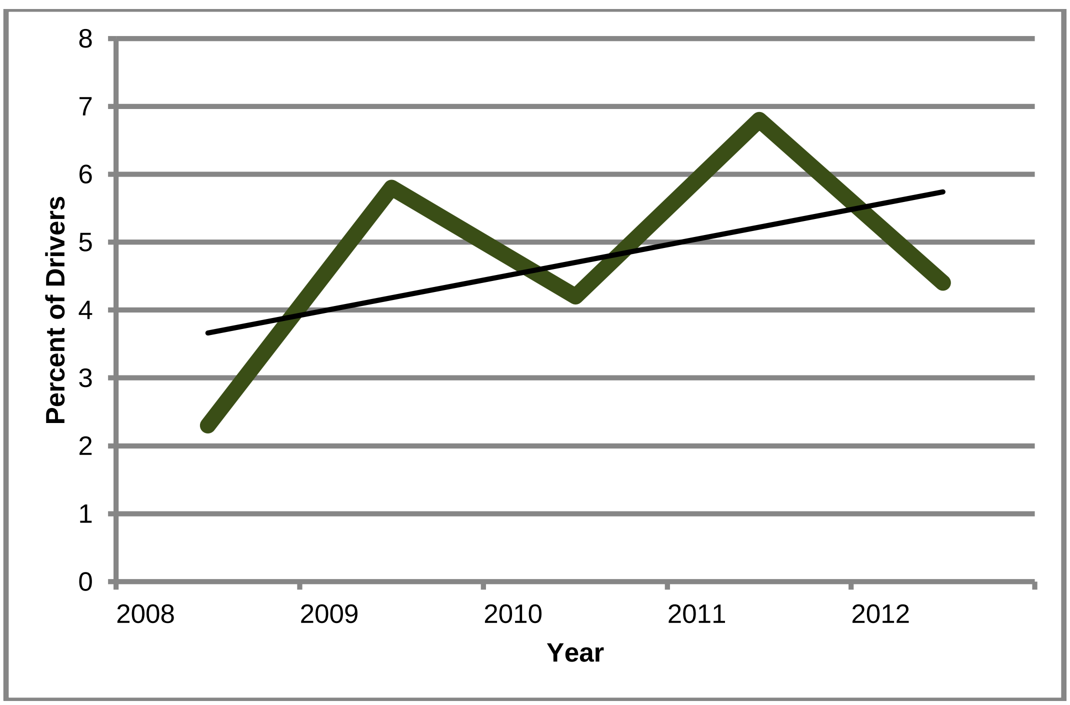
Table 6 appears to indicate that drivers are the only individuals to use hands-free cell phones. This is an artifact of the data collection protocol—it was impossible to determine if a conversation taking place in a vehicle with both a driver and a front seat passenger might have also included use of a hands-free cell phone, so those cells in the table are blank by design. Looking at the column for use of hand-held cell phones, there does not seem to be a strong relationship between belt use and cell phone use. At least among drivers (for whom there is a sufficiently large sample), the percentage of belt use by those using a hand-held cell phone is virtually the same as the overall percentage of belt use (just over 93%).

Figure 8 shows the trend across years 2008-2012 in driver's use of hand-held cell phones from the annual June observations using weighted data. At 4.4% the 2012 drivers' percentage of hand-held cell phone use is slightly below the weighted average of 4.7% for the years in which data are available.  Across years, there is a noticeable upward trend, as shown in the linear trend line displayed in the figure. The equation for this trend line is:

Cell phone use percentage = 0.52(YEAR) + 3.14 ($R^2$=0.2307)

This indicates that cell phone use is increasing on average about 0.52 percentage points per year. However, the strength of the correlation between years and cell phone use is not high as shown by the low value of $R^2$.

**Figure 8. Driver's Hand Held Cell Phone Use (Weighted Data): 2008-2012**



## 5.4 Motorcyclist Analyses

The following data are presented for motorcyclists in 2012. All of the data are unweighted. Motorcycle helmet use of 46.3% in 2012 is down significantly from the 2011 value of 57.1%. Overall usage rates for 2012 are 46.9% for riders and 40.9% for passengers. In 2011 the riders were at 55.6% helmet usage rates and passengers were at 65.2%. Inclusive of riders and passengers considered together, males were only slightly less likely than females to wear a helmet (46.4% for males, 46.9% for females overall), however (as shown in Table 7) the number of female riders and passengers is low and thus the helmet use rate might be less reliable for females as opposed to males.

Table 7 presents the overall unweighted helmet use by all riders and separated by age, gender and position on the motorcycle.

**Table 7. Unweighted Motorcyclist Helmet Use by Age, Sex, Riding Position**

| | | Rider | | Passenger | |
|---|---|---|---|---|---|
| | | % Helmet Use | N | % Helmet Use | N |
| Age: | 16-29 | 65.2 | 46 | 67.7 | 6 |
| | 30-64 | 40.1 | 137 | 26.7 | 16 |
| | 65+ | 54.6 | 11 | 100 | 1 |
| Sex: | Male | 46.4 | 181 | 50 | 2 |
| | Female | 58.3 | 12 | 40 | 20 |
| Overall | | 46.9 | 194 | 40.9 | 22 |
| All Occupants | | | | | **46.3 %** |

# 6 Discussion

The 2012 Minnesota Seat Belt Use Survey was successful in implementing the new NHTSA methodology and meeting the accuracy requirements put forward by NHTSA. As with any methodological change, there is the danger that results gathered with the new procedures will not be strictly comparable to those from prior years. This appears not to be a concern with the 2012 data for Minnesota. The belt use rate estimates and overall measures of variability are in line with the data reported in recent years. In fact, it is safe to say that belt use rates in Minnesota have achieved the 90%-plus level, with some indication that the rate continues to climb slightly each year.

The 2012 study also shows results that are in keeping with the trend in usage rates among specific segments of the population. For the second year in a row, belt use among male front seat occupants was above 90% (90.4% in 2011 and a record high 91.9% in 2012). Female front seat occupants achieved a similar level (92%) in 2007 and have shown a less clear pattern of annual increases over the years since then. The 2012 belt use rate among females is 95.6%--very close to the rates reported in 2010 and 2011. The gap between male and female front seat occupants' belt use levels appears to be narrowing. The average gender gap in belt use for 2003-2005 was just under eight percentage points. The gap has narrowed to 3.7 percentage points in 2012, down from 5 percentage points in 2011. One possible explanation for the narrowing gap is that 95% belt use might represent a practical maximum for the population under observation. Females, having already reached this level, are thus unlikely to increase year-to-year while males are still able to improve slightly to achieve a similar level.

Vehicle choice continues to be related to seat belt usage rates for front seat occupants. As in past years, the 2012 data show that occupants of pickup trucks are less likely to wear a seatbelt than are occupants of any of the other vehicle types in the study (cars, SUVs, and vans/minivans). Belt use among pickup truck occupants dropped slightly from the high of 88.0% in 2011 to 87.2% in 2012. Belt use by occupants of vans also dropped slightly from the 2011 record of 95.7% to a five-year low of 93.0%. SUV and passenger car occupants achieved record levels of belt use in 2012 (95.9% and 93.9% respectively). Small differences from year to year, and the direction of those changes, should be interpreted with caution. All of the changes noted are well within the 95% confidence limits for the data and could simply be an artifact of weighting versus an indication of an important shift in behavior.

Belt use varies across age groups, but the pattern is not stable from year to year—that is, there is no reliably best or worst age group for belt use among front seat occupants. In 2012, passengers aged 0-10 years old were much more likely to be belted (97.4% belt use) than any other age group of front seat occupants). 11-15 year olds had the lowest belt use rates in 2012 (84.0%); this group was at 92.3% in 2011 and 95.9 percent in 2010. There are many non-behavioral reasons why the rates vary so much from year to year, including the fact that weighted summary data tend to vary dramatically when separated into multiple categories (i.e., the N becomes smaller in each cell of the summary table).

Belt use also varies among hours of the day and days of the week. The pattern across years is not stable—there is no reliably high or low day of the week or hour of the day. In 2012, the 5-7 PM time interval achieved a near-perfect 99.9% belt use—the highest ever recorded for any time period from 2003 to the present. In prior years this time period has been at or near the middle of the pack. Similarly, in 2012 Saturday was the day of the week with the highest belt use (96.4%). Saturday belt use was also highest in 2011. Prior to that Saturday would have been ranked 4th in 2010 and 5th in 2009. The most likely explanation for this pattern of differences among time periods across the years is that the sampling and weighting can magnify small changes. This issue was noted in the 2011 report as well.

In summary, Minnesota's seat belt use rate has climbed steadily over the years. There are some stable patterns within the data (such as pickup truck occupants consistently showing lower belt use rates than occupants of other vehicle types and females' belt use being consistently higher than that for males). The reader is cautioned to be aware that there may be a practical upper limit to the belt use levels achievable within a given population. Looking at the data for 2012 in comparison to prior years, it is possible that female front seat occupants are at or near that hypothetical maximum achievable value (about 95% in present-day Minnesota). If so, future gains in overall belt use will come from males gradually achieving the same potential maximum rate. Against this backdrop of gradual increases, therefore, there may be a point at which Minnesota's rate stabilizes. At that point, it could be expected that the annual rate will fluctuate up and down around that upper-limit value. It is likely that Minnesota will reach that point in the not-too-distant future. At that point, annual belt use rates can be expected to be near 95% (an estimate based on the relatively flat trend among female occupants). Some years the value will be higher, some years lower. It is also worth considering that the achievable maximum belt use rate for males may be lower than that achieved by females. If so, the pattern for male usage rates will stabilize at some value less than 95% and the statewide value (a combination of usage rates for males and females) will also stabilize at a value lower than 95%. Since the seatbelt usage rate for males has been rising steadily in Minnesota, there is no reason to suspect today that their rate is nearing its maximum.

Hand-held cell phone use by drivers has shown an increase across the years from 2008 to the present. The weighted 2012 value is about average overall for the years 2008-2012 (the years for which June observation study data is available for cell phone use). Based on the trend analysis, Minnesota is experiencing a percentage-point increase in cell phone use every two years (slope of the line is 0.52). This correlation between years and cell phone use is not particularly strong (the $R^2$ is 0.23 indicating a weak correlation). The increase over years may just reflect increased use of cell phones in general.

The drop in helmet use between 2011 and 2012 by motorcycle occupants (riders and passengers) from 57.1% to 46.3% is concerning. As in 2011, however, these data must be interpreted with caution because the number of observations is low. The drop could be a result of the sampling frame (including more rural counties than in prior years); however, it is important to recognize that the change in the sampling frame did not apparently affect the belt usage rate. It would be surprising to see such a large difference (roughly 10 percentage points) as that seen for helmet use due merely to the broadening of the sample to include a few more rural areas. The more likely explanation is that the change indicates a downward trend in helmet use. It should be possible to analyze the change in helmet use as it correlates to changes in the frequency and severity of injuries arising from motorcycle crashes. By this hypothesis, it would be expected that 2012 data on crash severity would show evidence of an increase in motorcycle-related injuries and fatalities as well as the costs associated with those crashes.

# APPENDIX A

## List of Road Segment by Stratum

## List of Road Segment Samples by Stratum

| ID | Roadtype | County | Observation Site | Route Number | Beg. Ref Point | End Ref. Point |
|---|---|---|---|---|---|---|
| **Hennepin Stratum** | | | | | | |
| 1 | Primary | Hennepin | EB US 55 & CH 101 (Sioux Dr) | 94 | 208.313 | 214.045 |
| 2 | Primary | Hennepin | EB MN 62 & Lyndale Ave S off ramp | 494 | 10.956 | 11.999 |
| 3 | Primary | Hennepin | EB MN 62 & 28th Ave S off ramp | 94 | 206.008 | 207.617 |
| 4 | Primary | Hennepin | SEB I-94 & MN 101 (Main St) off ramp | 100 | 9.785 | 11.435 |
| 5 | Primary | Hennepin | SEB I-94 & Maple Grove Pkwy off ramp | 394 | 5.855 | 7.604 |
| 6 | Primary | Hennepin | NWB I-94 & Maple Grove Pkwy off ramp | 62 | 113.682 | 114.512 |
| 7 | Primary | Hennepin | WB I-94 & CH 61 (Hemlock La) off ramp | 62 | 111.043 | 112.106 |
| 8 | Primary | Hennepin | EB I-94 & CH 152 (Brooklyn Blvd) off ramp | 694 | 34.191 | 35.762 |
| 9 | Primary | Hennepin | SB I-94 & 53rd Ave off ramp | 94 | 216.99 | 218.393 |
| 10 | Primary | Hennepin | WB I-94 & Riverside Ave S off ramp | 394 | 4.606 | 5.855 |
| 11 | Primary | Hennepin | SB MN 100 & CH 40 (Glenwood Ave) off ramp | 394 | 0.727 | 1.511 |
| 12 | Primary | Hennepin | NB MN 100 & 36th Ave N off ramp | 100 | 7.726 | 8.902 |
| 13 | Primary | Hennepin | NB US 169 & CH 1 (Pioneer Tr) off ramp | 35W | 16.399 | 16.944 |
| 14 | Primary | Hennepin | NB US 169 & 7th St S off ramp | 494 | 17.622 | 19.765 |
| 15 | Primary | Hennepin | NB US 169 & CH 81 (Lakeland Ave) | 494 | 16.016 | 17.622 |
| 16 | Primary | Hennepin | SB US 169 & 117th Ave N | 94 | 234.828 | 235.565 |
| 17 | Primary | Hennepin | SWB US 212 & CH 4 (Eden Prairie Rd) off ramp | 494 | 13.657 | 16.016 |
| 18 | Primary | Hennepin | EB I-394 & CH 61 (Plymouth Rd) off ramp | 94 | 221.277 | 223.223 |
| 19 | Primary | Hennepin | WB I-394 & CH 61 (Plymouth Rd) off ramp | 394 | 0 | 0.727 |
| 20 | Primary | Hennepin | WB I-394 & Xenia Ave S off ramp | 55 | 175.534 | 176.393 |
| 21 | Primary | Hennepin | EB I-394 & CH 2 (Penn Ave S) off ramp | 94 | 226.35 | 227.386 |
| 22 | Primary | Hennepin | EB I-494 & CH 1 (24th Ave ) off ramp | 169 | 139.278 | 142.631 |
| 23 | Primary | Hennepin | EB I-494 & CH 17 (France Ave S) off ramp | 169 | 122.65 | 124.797 |
| 24 | Primary | Hennepin | WB I-494 & Prairie Center Dr off ramp | 94 | 214.045 | 216.329 |
| 25 | Primary | Hennepin | SB I-494 & CH 62 (Townline Rd) off ramp | 494 | 20.175 | 21.473 |
| 26 | Primary | Hennepin | NB I-494 & CH 5 (Minnetonka Blvd) off ramp | 35W | 15.339 | 16.399 |
| 27 | Primary | Hennepin | SB I-494 & CH 16& CH 5 (Minnetonka Blvd) off ramp | 494 | 19.765 | 20.175 |
| 28 | Primary | Hennepin | NB I-494 & Carlson Pkwy on ramp | 494 | 7.045 | 7.976 |
| 29 | Primary | Hennepin | SB I-494 & Carlson Pkwy off ramp | 169 | 136.46 | 137.412 |
| 30 | Primary | Hennepin | SB I-494 & CH 9 (Rockford Rd) off ramp | 169 | 116.579 | 118.192 |
| 31 | Primary | Hennepin | WB I-94 & Shingle Creek Pkwy off ramp | 494 | 23.335 | 26.027 |
| 32 | Primary | Hennepin | SB I-35 & W 35 St off ramp Driver's side | 35W | 18.217 | 18.748 |
| 33 | Primary | Hennepin | NB I-35 & E 37 St off ramp | 212 | 155.209 | 157.166 |
| 34 | Primary | Hennepin | SB I-35 & Washington Ave S off ramp | 494 | 2.064 | 2.789 |
| 35 | Secondary | Hennepin | NB CH 101 & Covington Rd | 27000101 | 0.146 | 0.9 |
| 36 | Secondary | Hennepin | SB 3rd Ave S & 10th St S | 25850305 | 1.03 | 1.43 |
| 37 | Secondary | Hennepin | NB Mcginity Rd W (CH 16) & I -494 | 27000016 | 0.84 | 2.71 |
| 38 | Secondary | Hennepin | WB W77th St & Lyndale Ave | 32100108 | 0.4 | 0.53 |
| 39 | Secondary | Hennepin | SB W Broadway Ave & 37th Ave N | 32300297 | 0 | 0.68 |
| 40 | Secondary | Hennepin | WN MN 5 & CH 4 (Eden Prairie Rd) | 5 | 48.193 | 49.096 |
| 41 | Secondary | Hennepin | NB Ch 116 & CH 3 (97th Ave N) | 27000116 | 4.88 | 5.86 |

| ID | Roadtype | County | Observation Site | Route Number | Beg. Ref Point | End Ref. Point |
|---|---|---|---|---|---|---|
| 42 | Secondary | Hennepin | SB CH 116 (Pinto Dr) & Clydesdale Tr (near MN 55) | 27000116 | 0 | 1.35 |
| 43 | Secondary | Hennepin | SB CH 156 (Winnetka Ave N) & Plymouth Ave | 27000156 | 1.45 | 2.45 |
| 44 | Secondary | Hennepin | WB CH 1 (Old Shakopee Rd) & Hampshire Ave S | 27000001 | 8.39 | 9.28 |
| 45 | Secondary | Hennepin | NWB CH 152 & CH 130 (68th Ave) | 27000152 | 2.751 | 3.165 |
| 46 | Secondary | Hennepin | EB CH 19 (Smith Town Rd)& Wood duck Cir | 27000019 | 0.47 | 2.61 |
| 47 | Secondary | Hennepin | NB Dogwood St (CH 92) / MN 55, Rockford | 15650014 | 0.03 | 3.57 |
| 48 | Secondary | Hennepin | NB CH 48 (26th Ave S) & CH 5 (Franklin Ave) | 27000048 | 2.45 | 3.2 |
| 49 | Secondary | Hennepin | SB CH 101 (Central Ave) & US 12 | 27000101 | 6.865 | 8.269 |
| 50 | Secondary | Hennepin | NB Medicine Ridge Road & 28th Ave | 31050158 | 0.39 | 0.882 |
| 51 | Secondary | Hennepin | WB CH 3 (Excelsior Blvd) & Scenic Heights Dr | 27000003 | 0.61 | 2.11 |
| 52 | Secondary | Hennepin | SB CH 156 (Winnetka Ave N) & Orkla Dr | 27000156 | 0.95 | 1.45 |
| 53 | Secondary | Hennepin | CH 9 (Rockford Rd) & Plymouth Blvdd) | 27000009 | 0.821 | 1.047 |
| 54 | Local | Hennepin | SB Menimac La & CH 6 | 31050248 | 0 | 0.46 |
| 55 | Local | Hennepin | NB  Bunker Ct & Howard La | 10940950 | 0 | 0.075 |
| 56 | Local | Hennepin | SB Browndale Ave &W 50th St | 11050488 | 0 | 0.6 |
| 57 | Local | Hennepin | NB Niagara Lane & 61st Ave N | 31051568 | 0 | 0.337 |
| 58 | Local | Hennepin | NB Woodale Ave & W 50th St | 11050150 | 2.235 | 2.735 |
| 59 | Local | Hennepin | NB Texas Ave& Utah Ave N | 6300082 | 0 | 0.32 |
| 60 | Local | Hennepin | NB W Island Ave & Grove St | 25850866 | 0 | 0.48 |
| **High VMT** | | | | | | |
| 61 | Primary | Dakota | SB US 52 & CH 73 (Thompson Ave) off ramp | 52 | 127.834 | 128.567 |
| 62 | Primary | Ramsey | WB I-35E & W Victoria Ave off ramp | 35E | 104.26 | 105.716 |
| 63 | Primary | Dakota | EB CH 42 & CH 23 (Cedar Ave) | 19000042 | 3.704 | 5.837 |
| 64 | Primary | Ramsey | NB I-35W & CH 96 off ramp | 35W | 26.815 | 27.402 |
| 65 | Primary | Ramsey | WBD I-94 & US 61 (Mounds Blvd) off ramp | 94 | 244.088 | 245.235 |
| 66 | Primary | Washington | EB I-94 & Mn 95 (CH 18) off ramp | 94 | 256.357 | 258.992 |
| 67 | Primary | Ramsey | WBD I-94 & CH 56 (N Marion St) off ramp | 94 | 242.04 | 242.554 |
| 68 | Primary | Ramsey | WB US 10 & Airport Rd Off ramp | 10 | 237.551 | 238.948 |
| 69 | Primary | Washington | WB I-94 & MN 95 (Manning Ave S) off ramp | 94 | 254.275 | 256.357 |
| 70 | Primary | Dakota | NB I-35E & CH 32 (Cliff Rd) off ramp | 35E | 93.536 | 94.633 |
| 71 | Primary | Anoka | SB US 10 & Foley Blvd NW, off-ramp | 10 | 230.787 | 234.159 |
| 72 | Primary | Dakota | SB I-35 & CH 70 (210th St W) off ramp | 35 | 82.083 | 84.5 |
| 73 | Primary | Washington | WB I-94 & Mn 95 (CH 18) off ramp | 94 | 258.992 | 259.341 |
| 74 | Primary | Washington | EB I-94 & CH 13 (Radio Dr) off ramp | 94 | 249.751 | 251.074 |
| 75 | Primary | Dakota | SB MN 316 & US 61 | 316 | 1.999 | 3.844 |
| 76 | Primary | Dakota | NB US 52 & Ch 46 (160th St W) off ramp | 52 | 107.158 | 113.982 |
| 77 | Primary | Washington | SWB I-494 & Lake Rd off ramp | 494 | 59.636 | 60.951 |
| 78 | Primary | Ramsey | SB I-35E & MN 13 off ramp | 35E | 102.75 | 103.214 |
| 79 | Primary | Dakota | NB I-35E & MN 110 off ramp | 35E | 99.928 | 101.454 |
| 80 | Primary | Ramsey | NB MN 280 & Energy Park DriveOff ramp | 280 | 0 | 0.714 |
| 81 | Primary | Dakota | NB MN 316 (Red Wing Blvd) & Tuttle Dr | 316 | 7.09 | 8.562 |
| 82 | Primary | Ramsey | WB I-94 & Vandalla Ave off ramp | 94 | 237.265 | 238.849 |
| 83 | Primary | Washington | EB MN 36 & MN 5 (Stillwater Blvd) off ramp | 36 | 16.775 | 17.743 |
| 84 | Primary | Ramsey | EB I-694 & US 61 off ramp | 694 | 47.067 | 48.309 |

| ID | Roadtype | County | Observation Site | Route Number | Beg. Ref Point | End Ref. Point |
|---|---|---|---|---|---|---|
| 85 | Primary | Dakota | EB CH 42 & CH 31 (Pilot Knob Rd) | 19000042 | 6.343 | 7.849 |
| 86 | Primary | Washington | NWB I-494 & Lake Rd off ramp | 494 | 60.951 | 62.651 |
| 87 | Primary | Washington | SB I-35 & MN 97 Lake Dr off ramp | 35 | 130.034 | 132.176 |
| 88 | Primary | Anoka | EB MN 610 & CH 51 (Univ Ave NW) off ramp | 610 | 11.066 | 12.314 |
| 89 | Primary | Dakota | EB MN 13& CH 5 | 13 | 94.384 | 95.669 |
| 90 | Secondary | Ramsey | SEB CH 10 & CH 3 (MSAS 237) | 62000010 | 0.089 | 2.288 |
| 91 | Secondary | Ramsey | EB CH 3 (MSAS 237) & Jackson St | 62000003 | 0.22 | 0.98 |
| 92 | Secondary | Ramsey | WB Phalen Blvd & N Frank St | 34250288 | 1.131 | 2.215 |
| 93 | Secondary | Dakota | WB MN 110 & MN 3 (Robert Tr S) off ramp | 110 | 4.475 | 5.245 |
| 94 | Secondary | Dakota | SB Cliff Lake Rd & Target Access | 10630124 | 0 | 0.328 |
| 95 | Secondary | Ramsey | NEB S Dodd Rd & W Baker St | 34250119 | 0.015 | 0.31 |
| 96 | Secondary | Ramsey | SB MN51 (Snelling Ave) & Roselawn Ave W | 51 | 6.348 | 7.674 |
| 97 | Secondary | Washington | NB MN 95 & Parker St | 95 | 92.199 | 96.089 |
| 98 | Secondary | Washington | NB Hadley Ave N & 41st St N | 28880121 | 4.081 | 4.868 |
| 99 | Secondary | Anoka | SB CH 9 (Lake George Blvd NW) & CH 22 (Viking Blvd NW) | 2000009 | 8.624 | 9.62 |
| 100 | Secondary | Anoka | EB CH 22 (Viking Blvd NW) & CH 66 (Cleary Rd NW) | 2000022 | 4.02 | 6.569 |
| 101 | Secondary | Washington | EB MN 5 (34th St N) & Imation Pl | 5 | 79.227 | 79.906 |
| 102 | Secondary | Ramsey | SB MN51 (Snelling Ave) & Lydia Ave | 51 | 9.082 | 9.586 |
| 103 | Secondary | Dakota | NB Holyoke Ave & 190th St W | 21500105 | 2.68 | 2.815 |
| 104 | Secondary | Dakota | NB Blackhawk Rd & Davenport Ave | 10630103 | 2.807 | 3.125 |
| 105 | Secondary | Anoka | SB CH 7 (7th Ave) & Jackson St | 2000007 | 0.75 | 1.11 |
| 106 | Secondary | Anoka | SB CH 17 (Lexington Ave NE) & CH 52 (Lovel Rd) | 2000017 | 1.22 | 2.04 |
| 107 | Secondary | Ramsey | WB CH 31 (W University Ave) & Hamline Ave | 62000034 | 2.714 | 3.216 |
| 108 | Secondary | Ramsey | SB CH 51 (Lexington Ave) & Edmund Ave | 62000051 | 3.03 | 3.28 |
| 109 | Secondary | Anoka | NB CH 7 (7th Ave) & Grant St | 2000007 | 1.31 | 1.54 |
| 110 | Secondary | Anoka | SB CH 1 (E River Rd) & CH 132 (85th Ave NE) | 2000001 | 6.716 | 7.66 |
| 111 | Secondary | Anoka | EB 181st Ave NW & CH 58 (Palm St NW) | 2000058 | 5.808 | 6.804 |
| 112 | Secondary | Anoka | WB CH 11 (Northdale Blvd NW) & CH 78 (Hanson Blvd NW) | 2000011 | 4.41 | 4.89 |
| 113 | Local | Ramsey | WB E Ross Ave & N Waukon Ave | 34251285 | 0 | 0.16 |
| 114 | Local | Anoka | WB 143rd Ave NW & CH 56 (Ramsey Blvd NW) | 31480319 | 0 | 0.696 |
| 115 | Local | Washington | SB Lincolntown Ave & Old Wildwood Rd | 24050100 | 1.931 | 2.251 |
| 116 | Local | Ramsey | SB Marion St & W Cottage Ave | 34250378 | 0 | 0.174 |
| 117 | Local | Anoka | NB W Shadow Lake Dr & Sandpiper Dr | 22650332 | 0 | 1.287 |
| 118 | Local | Washington | NB Fox Run Cove & Fox Run Rd | 41730747 | 0 | 0.08 |
| 119 | Local | Washington | NB Market Dr& W Orleans St | 36750124 | 0.06 | 0.26 |
| 120 | Local | Anoka | WB 150th Ave NW &Raven St NW | 880713 | 0 | 0.46 |
| **Medium VMT** | | | | | | |
| 121 | Primary | Rice | NB I-35 &MN 60 off ramp , Fairbault | 35 | 55.287 | 55.725 |
| 122 | Primary | Stearns | SEB I-94 & MN 23 off ramp, St Cloud | 94 | 160.679 | 164.514 |
| 123 | Primary | Wright | WB US 12 (6th St) & CH 6 (10th Ave), Howard Lake | 12 | 123.521 | 124.806 |
| 124 | Primary | Olmsted | SB US 14 & 2th St SW, Rochester | 14 | 215.66 | 216.279 |
| 125 | Primary | St. Louis | SB US 169 & MN 37 , Hibbing | 169 | 335.836 | 337.784 |

| ID | Roadtype | County | Observation Site | Route Number | Beg. Ref Point | End Ref. Point |
|---|---|---|---|---|---|---|
| 126 | Primary | Olmsted | NB CH 22 (Salem Rd SW) & CH 25 (16th St SW) , Rochester | 55000022 | 0.499 | 0.987 |
| 127 | Primary | Sherburne | SEB MN 25 & Norwood Dr (West of juntion), Big Lake | 25 | 68.915 | 70.157 |
| 128 | Primary | Crow Wing | NB MN 371 & CR 77 ( Wise Rd), start of lane | 371 | 28.809 | 32.437 |
| 129 | Primary | Chisago | SB I-35 &Ch 22 (Viking Blvd) off ramp, Wyoming | 35 | 135.552 | 138.413 |
| 130 | Primary | Wright | SB I-94 & MN 25 (Pine St) off ramp , Monticello | 94 | 184.131 | 192.646 |
| 131 | Primary | Sherburne | NB US 169 & CH 12 (Main St) ,Elk River | 169 | 155.776 | 156.642 |
| 132 | Primary | Chisago | SB I-35 &MN 95 (St Crix Tr) off ramp , North Branch | 35 | 147.928 | 151.171 |
| 133 | Primary | Scott | NB US 169 & MN 282 (2nd St NW) , Jordan | 169 | 96.209 | 97.914 |
| 134 | Primary | Scott | SB US 169 & MN 19 (280th St W) off ramp, Belle Plaine | 169 | 83.821 | 88.921 |
| 135 | Primary | Olmsted | NB US 14 & 6th St SW, Rochester | 14 | 216.279 | 216.889 |
| 136 | Primary | Stearns | EB CH 75 (Division St) & CH 81 (15th Ave N), Waite Park | 73000075 | 14.688 | 15.543 |
| 137 | Primary | Sherburne | NB US 10 & US 169 off ramp , Elk River | 10 | 216.029 | 219.812 |
| 138 | Primary | Scott | SB US 169 & MN 21 off ramp, Jordan | 169 | 99.038 | 101.197 |
| 139 | Primary | Chisago | SB I-35 &CH 19 (Stacy Tr N) off ramp, Stacy | 35 | 139.983 | 145.163 |
| 140 | Primary | Otter Tail | NB US 10 & MN 87 off ramp, Frazee | 10 | 55.163 | 60.02 |
| 141 | Primary | Sherburne | NB US 169 & CH 4 (Fremont Ave NW) , Zimmerman | 169 | 166.228 | 166.753 |
| 142 | Primary | Wright | NEB MN 55 (Cherry St) & Ash St, Rockford | 55 | 159.22 | 165.315 |
| 143 | Primary | St. Louis | NB US 53 & MN 37, Eveleth Top of off ramp | 53 | 24.259 | 55.991 |
| 144 | Primary | Crow Wing | NB MN 371 & CH 18 , Nisswa | 371 | 32.437 | 39.133 |
| 145 | Primary | Sherburne | EB US 10 (Jefferson Blvd) & MN 25 (Lake St S) Big Lake | 10 | 192.425 | 196.139 |
| 146 | Primary | Carver | EB MN 7 & MN 25, Mayer | 7 | 161.941 | 165.964 |
| 147 | Primary | St. Louis | EB US 2 & US 53 | 2 | 221.018 | 244.825 |
| 148 | Primary | Sherburne | NB US 169 & CH 9 (293rd Ave NW) off ramp, Princeton | 169 | 167.499 | 174.761 |
| 149 | Primary | Olmsted | NB US 52 & CH 25 (16th St SW) off ramp , Rochester | 52 | 51.936 | 54.111 |
| 150 | Secondary | St. Louis | SB Lester River Rd & E Superior St, Duluth | 69000012 | 0.31 | 1.14 |
| 151 | Secondary | Scott | WB CH 2 (Main St) & Todd St, Elko New Market | 72 | 12.17 | 14.16 |
| 152 | Secondary | Chisago | EB CH 10 & CH 8 (Cedar Crest Tr), Harris | 13000010 | 0 | 4.15 |
| 153 | Secondary | St. Louis | EB CR 115 & Vermilion Dr | 69000115 | 0 | 1.62 |
| 154 | Secondary | Otter Tail | WB CH 1 & MN 78, Ottertail | 56000001 | 42.949 | 45.189 |
| 155 | Secondary | Stearns | WB CH 30 & MN 237 (Main St) , New Munich | 73000030 | 0 | 6.9 |
| 156 | Secondary | Chisago | NB CH 20 (Furuby Rd) & CH 9 (Oasis Rd N) Lyndstrom | 13000020 | 0.4 | 3.5 |
| 157 | Secondary | St. Louis | EB MN 37 & US 53, Eveleth | 37 | 16.285 | 20.241 |
| 158 | Secondary | Otter Tail | SB MN 78 & MN 210, Battle Lake | 78 | 18.403 | 20.977 |
| 159 | Secondary | Stearns | SB CH 3 & Norway Rd | 73000003 | 1.71 | 7.66 |
| 160 | Secondary | St. Louis | WB MN 169 & MN 1, Ely | 169 | 415.07 | 416.033 |
| 161 | Secondary | Crow Wing | EB CR 37 & CR 37, Crosslake | 18000036 | 1.64 | 5.33 |
| 162 | Secondary | Crow Wing | NB CR 3 & SW Horseshoe Lake Rd , Merrifield | 18000003 | 14.747 | 18.887 |
| 163 | Secondary | Wright | EB CH 39 (Club View Rd) & Elm St, Monticello | 86000039 | 17.686 | 18.169 |
| 164 | Secondary | Stearns | SB Cooper Ave & 33rd St S, St Cloud | 33800141 | 1.018 | 2.67 |
| 165 | Secondary | St. Louis | NEB N 40th W & Grand Ave, Duluth S | 10400110 | 0.07 | 0.34 |
| 166 | Secondary | St. Louis | NB CH 4 (Mesaba Ave) & E Skyline Pkway, Duluth | 69000004 | 0.09 | 0.73 |
| 167 | Secondary | Stearns | NB Pine Cone Rd & CH 133 (Heritage Rd), Sartell | 34700103 | 0 | 1.67 |
| 168 | Secondary | Wright | WB CH 34 (10th St) & CH 120 (Ibarra Ave NE), St | 86000034 | 4.66 | 7.92 |

| ID | Roadtype | County | Observation Site | Route Number | Beg. Ref Point | End Ref. Point |
|---|---|---|---|---|---|---|
| | | | Michael | | | |
| 169 | Secondary | St. Louis | EB MN 23 (Grand Ave) & S 75th Ave W, Duluth | 23 | 338.401 | 339.797 |
| 170 | Secondary | Scott | SEB CH 21 (Eagle Creek Ave SE) & Duluth Ave SE, Prior Lake | 70000021 | 6.228 | 7.171 |
| 171 | Secondary | Crow Wing | WB W College Dr & East River Rd, Brainerd | 4350126 | 0.412 | 0.99 |
| 172 | Local | Olmsted | NB Kenosha Dr & 35th St, Rochester | 32351803 | 0 | 0.344 |
| 173 | Local | Olmsted | EB Sunset La NE & Century Hill Dr NE, Rochester | 32351310 | 0 | 0.05 |
| 174 | Local | Sherburne | SB Sanford Ave& Traverse La, Big Lake | 3350211 | 0 | 0.452 |
| 175 | Local | St. Louis | SEB Pineview Ave & W 24th St, Duluth | 10400491 | 0 | 0.11 |
| 176 | Local | Crow Wing | SB Cross Ave NW & MN 210 (Main St), Crosby | 8600036 | 0 | 0.55 |
| 177 | Local | Wright | SB Desoto Ave NW & CH 37, Maple Lake | 86000561 | 0 | 0.348 |
| 178 | Local | Scott | NB Fleetwood Blvd & 2nd St W, Jordan | 19600108 | 0 | 0.34 |
| 179 | Local | Stearns | SB CH 168 & Ch 17, Melrose, S of junction | 73000168 | 4.35 | 6.79 |
| 180 | Local | Wright | WB Town Center Dr NE & Edgewood Dr NE, St Michael | 34200440 | 0 | 0.517 |
| **Low VMT** | | | | | | |
| 181 | Primary | Nobles | EB I-90 & MN 264 off ramp, Round Lake | 60 | 10.606 | 11.323 |
| 182 | Primary | Winona | EB I90 & MN 43, Rushford off ramp | 90 | 242.24 | 249.103 |
| 183 | Primary | Kandiyohi | WB US 12 (Pacifica Ave) & CH 8 (N 4th St), Kandiyohi | 12 | 79.467 | 87.2 |
| 184 | Primary | Mille Lacs | NB US 169 & MN 27 , Onamia | 169 | 213.818 | 218.639 |
| 185 | Primary | Douglas | NB I-94 & CH 7, Brandon off ramp | 94 | 89.938 | 97.415 |
| 186 | Primary | Itasca | WB US 2 & CR 137, Deer River | 2 | 160.999 | 163.791 |
| 187 | Primary | Martin | WB I-90 & MN 15 (State St) off ramp, Fairmont | 90 | 102.231 | 103.227 |
| 188 | Primary | Murray | NB US 59 & Frontage Rd exit Slayton | 59 | 42.135 | 46.748 |
| 189 | Primary | Kandiyohi | NB MN 23 & W South St, Spicer | 23 | 147.087 | 150.999 |
| 190 | Primary | Clay | WB US 10 & MN 32 N, Hawley top of off ramp | 10 | 24.624 | 28.629 |
| 191 | Primary | Jackson | SB US 71 (3rd St) & 4th St, Jackson | 71 | 8.835 | 9.806 |
| 192 | Primary | Benton | NB US 10 & CH 2 (Rice St), Rice | 10 | 165.685 | 167.869 |
| 193 | Primary | Itasca | EB US 2 & La Prairie Ave Grand Rapids | 2 | 185.127 | 190.54 |
| 194 | Primary | Cass | NB MN 371 & CH 42 (Main St), Pine River | 371 | 56.527 | 65.213 |
| 195 | Primary | Benton | SB US 10 & CH 79 (75th St NE), Sauk Rapids | 10 | 167.869 | 171.743 |
| 196 | Primary | Goodhue | NB US 52 & MN 19 (W Main St) off ramp, Cannon Falls | 52 | 91.642 | 98.445 |
| 197 | Primary | Martin | WB I-90 & MN 4 (Main St) off ramp, Sherbum | 90 | 87.309 | 93.675 |
| 198 | Primary | Lyon | NB US 59 & 260th Ave, Marshall | 59 | 58.66 | 70.721 |
| 199 | Primary | Isanti | NB MN 65 (Candy St SE) & CH 5 , Isanti | 65 | 34.274 | 37.019 |
| 200 | Primary | Morrison | NB US 10 & N 3rd St, Royalton | 10 | 158.026 | 158.985 |
| 201 | Primary | Todd | SB US 71 & 8th Ave S (Long Prairie) | 71 | 172.069 | 180.939 |
| 202 | Primary | Mille Lacs | NB US 169 & MN 23, Milaca off ramp | 169 | 182.371 | 189.108 |
| 203 | Primary | Kandiyohi | EB MN 23 & 2nd St, Paynesville | 23 | 161.676 | 165.886 |
| 204 | Primary | Todd | NEB I-94 & MN 127, Osakis off ramp | 94 | 115.209 | 119.363 |
| 205 | Primary | Wabasha | WB US 61 & Terrace Rd, Lake City | 61 | 64.135 | 70.594 |
| 206 | Primary | Pine | NB I-35 & MN 324 (Hillside Ave), off ramp | 35 | 165.707 | 169.567 |
| 207 | Primary | Polk | SB US 2 & W 2nd St, Crookston | 2 | 26.392 | 26.534 |
| 208 | Primary | Nobles | SB MN 60 & I-90, Worthington | 60 | 11.86 | 12.232 |
| 209 | Primary | Itasca | EB US 169 & Morgan St, Calumet | 169 | 321.233 | 323.887 |

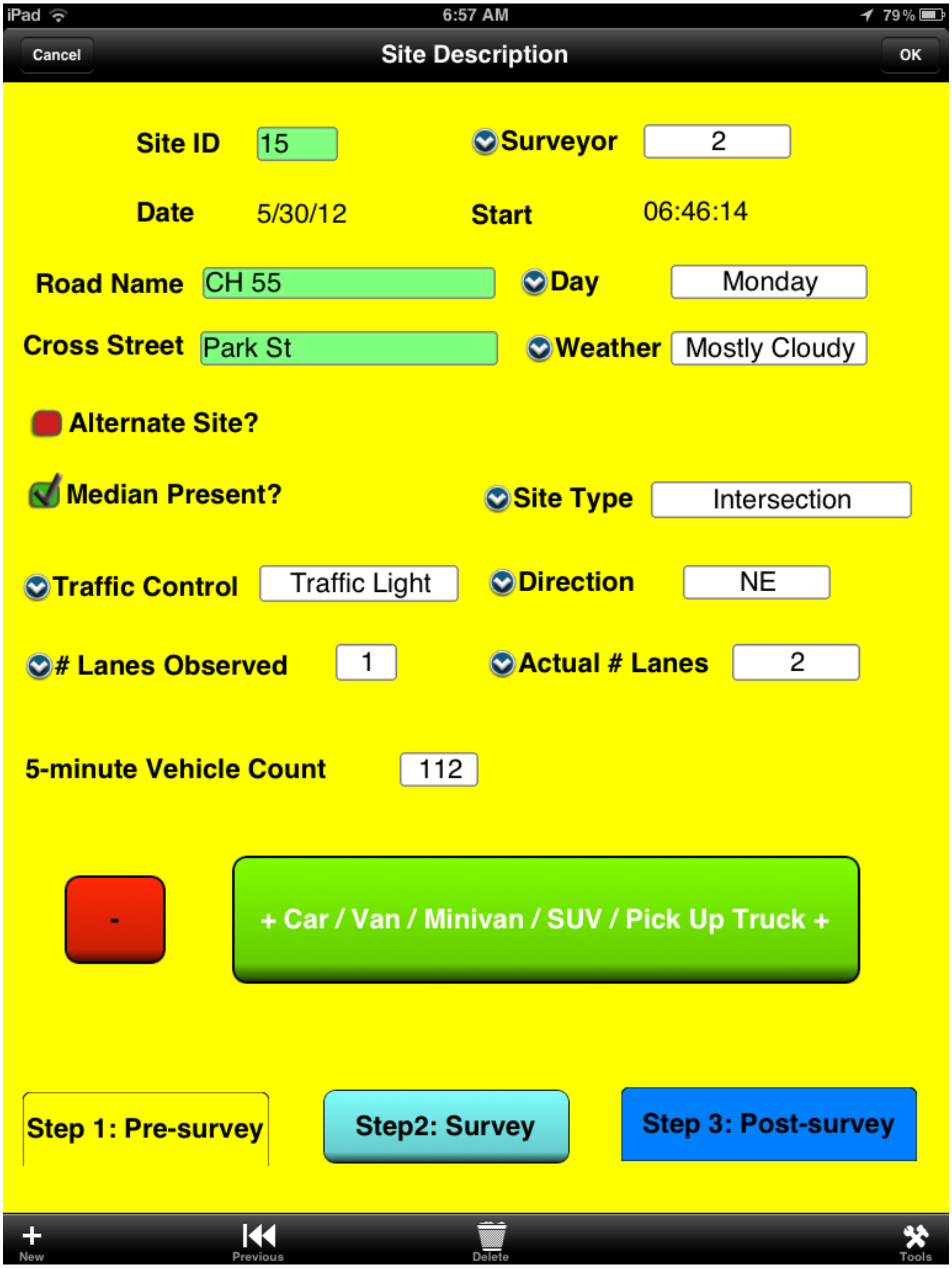
| ID | Roadtype | County | Observation Site | Route Number | Beg. Ref Point | End Ref. Point |
|---|---|---|---|---|---|---|
| 210 | Secondary | Wabasha | NB US 63 & Cross St, Lake City | 63 | 70.95 | 72.748 |
| 211 | Secondary | Douglas | EB MN 27 & CH 45, Alexandria | 27 | 74.742 | 76.805 |
| 212 | Secondary | Blue Earth | EB MN 68 & US 169, Mankato | 68 | 126.172 | 138.983 |
| 213 | Secondary | Freeborn | NB CH 30 (850th Ave) & CH 46, Albert Lea | 24000030 | 4.09 | 10.6 |
| 214 | Secondary | Itasca | SWB Pincherry & CR 323 36695 Pincherry Rd, Cohasset | 31000088 | 1.189 | 5.48 |
| 215 | Secondary | Hubbard | NB MN 64 & CH 12, Akeley | 64 | 38.73 | 48.263 |
| 216 | Secondary | Clay | SB 34th St S & S 4th St, Moorehead | 26450135 | 1.45 | 1.917 |
| 217 | Secondary | Freeborn | SB N Newton Ave & E William St, Albert Lea | 450116 | 0.5 | 0.56 |
| 218 | Secondary | Becker | SB CH34 & CR143 Ogema | 3000034 | 8.839 | 12.86 |
| 219 | Secondary | Isanti | SB Main St & Central Ave, Cambridge | 5700113 | 0.21 | 1.172 |
| 220 | Secondary | Lyon | SEB MN 68 & Channel Parkway, Marshall | 68 | 22.859 | 26.414 |
| 221 | Secondary | Kandiyohi | EB MN 21 (60th Ave NE) & US 71, Wilmar | 34000025 | 1.75 | 3.23 |
| 222 | Secondary | Le Sueur | NB MN 13 & CH 14 (E Main St), Waterville | 13 | 46.217 | 56.475 |
| 223 | Secondary | Morrison | NEB CH 21 (Great River Rd) & 150th Ave, Bowlus | 49000021 | 10.34 | 14.56 |
| 224 | Secondary | Beltrami | WB MN 1 (MN 89) & BIA 50 ,Red Lake | 1 | 110.124 | 117.026 |
| 225 | Secondary | Douglas | EB 22nd Ave & Jefferson St , Alexandria | 650130 | 1.07 | 1.3 |
| 226 | Secondary | Morrison | NB 4th St NE & CR 76 (1st Ave NE), Little Fall | 22850106 | 2.09 | 2.875 |
| 227 | Secondary | Pine | WB CH 110 (570th St) & CH 361 (Forest Blvd), Pine City | 58000110 | 0 | 0.5 |
| 228 | Secondary | Polk | EB MN 11 (260th St SW) & 210th Ave SW Crookston | 60000011 | 2.01 | 7.05 |
| 229 | Secondary | Nobles | NB MN 91 & CH 72 (1st St), Chandler | 91 | 21.925 | 28.192 |
| 230 | Secondary | Wabasha | NB US 63& Main St, Zumbro Falls | 63 | 61.267 | 70.95 |
| 231 | Local | Polk | NB 110th Ave SE & 432nd St SE, Fertile | 60000022 | 0.77 | 1.02 |
| 232 | Local | Hubbard | WB 5th St W & Main St S, Park Rapids | 29950057 | 0 | 0.51 |
| 233 | Local | Goodhue | WB 410th St & 165th Ave, Zumbrota | 25000099 | 3 | 4.54 |
| 234 | Local | Goodhue | NB Wakonade Dr & NSP Rd | 31750287 | 0 | 1.86 |
| 235 | Local | Martin | NB CR 9 (S Seely St) & Lawrence St, Dunnell | 46000009 | 0.33 | 0.52 |
| 236 | Local | Nobles | NB Monroe Ave & 110th St, Fulda | 53000151 | 10.54 | 11.54 |
| 237 | Local | Freeborn | SB Kram Ave & Beth La, Albert Lea | 450465 | 0 | 0.319 |
| 238 | Local | Steele | NB SW 62nd Ave& SW 8th St, Owatonna | 74000038 | 1.01 | 2.01 |
| 239 | Local | Cass | EB Mayo Dr SW & 13th Ave SW, Pequot Lakes | 11005146 | 0 | 0.32 |
| 240 | Local | Mille Lacs | WB 125th St & US 169, Milaca | 48000188 | 0 | 0.54 |

# APPENDIX B

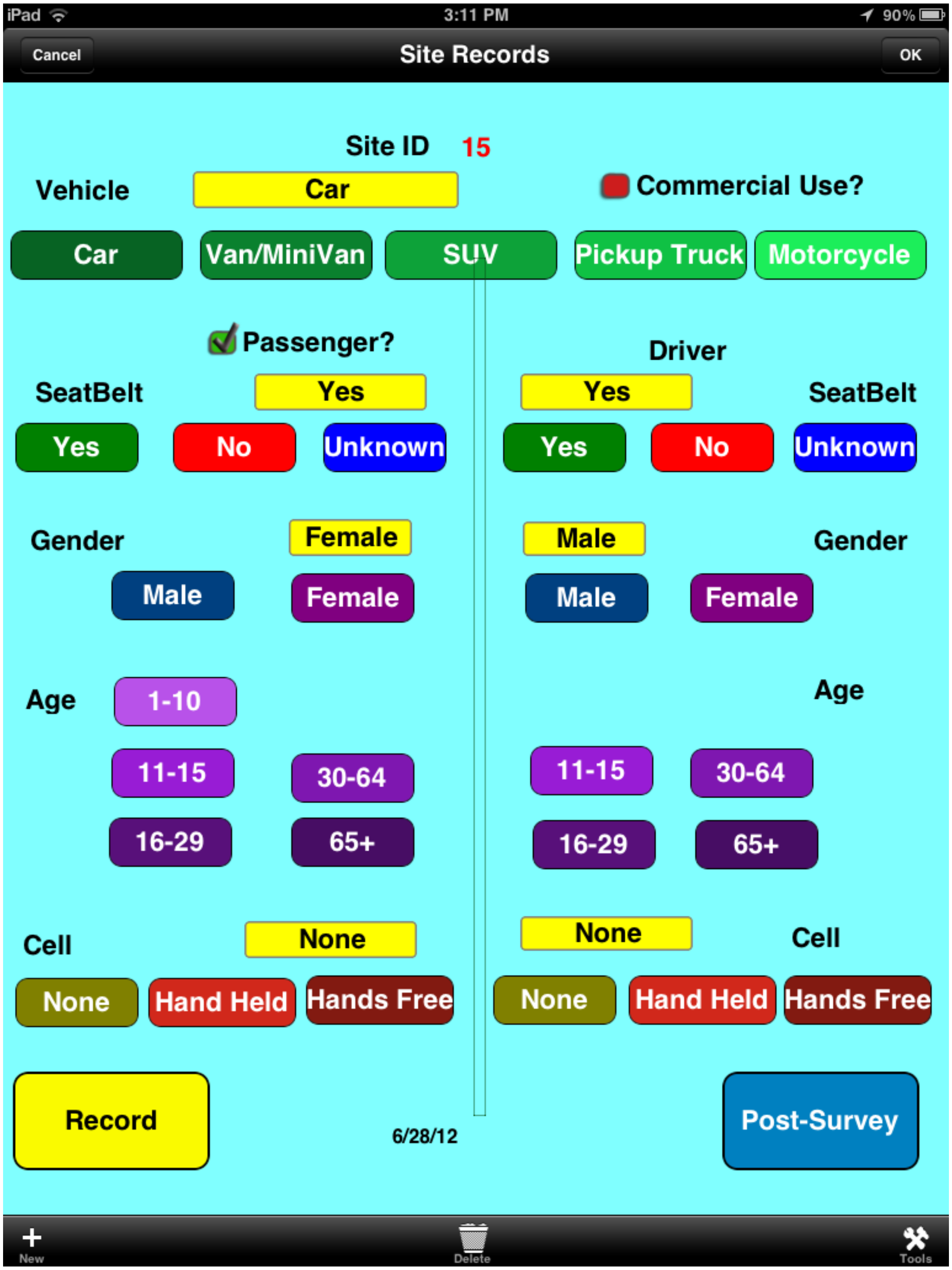
## Data Collection Forms

Minnesota Seat Belt Observation Forms:

Site Description Form



# Survey Form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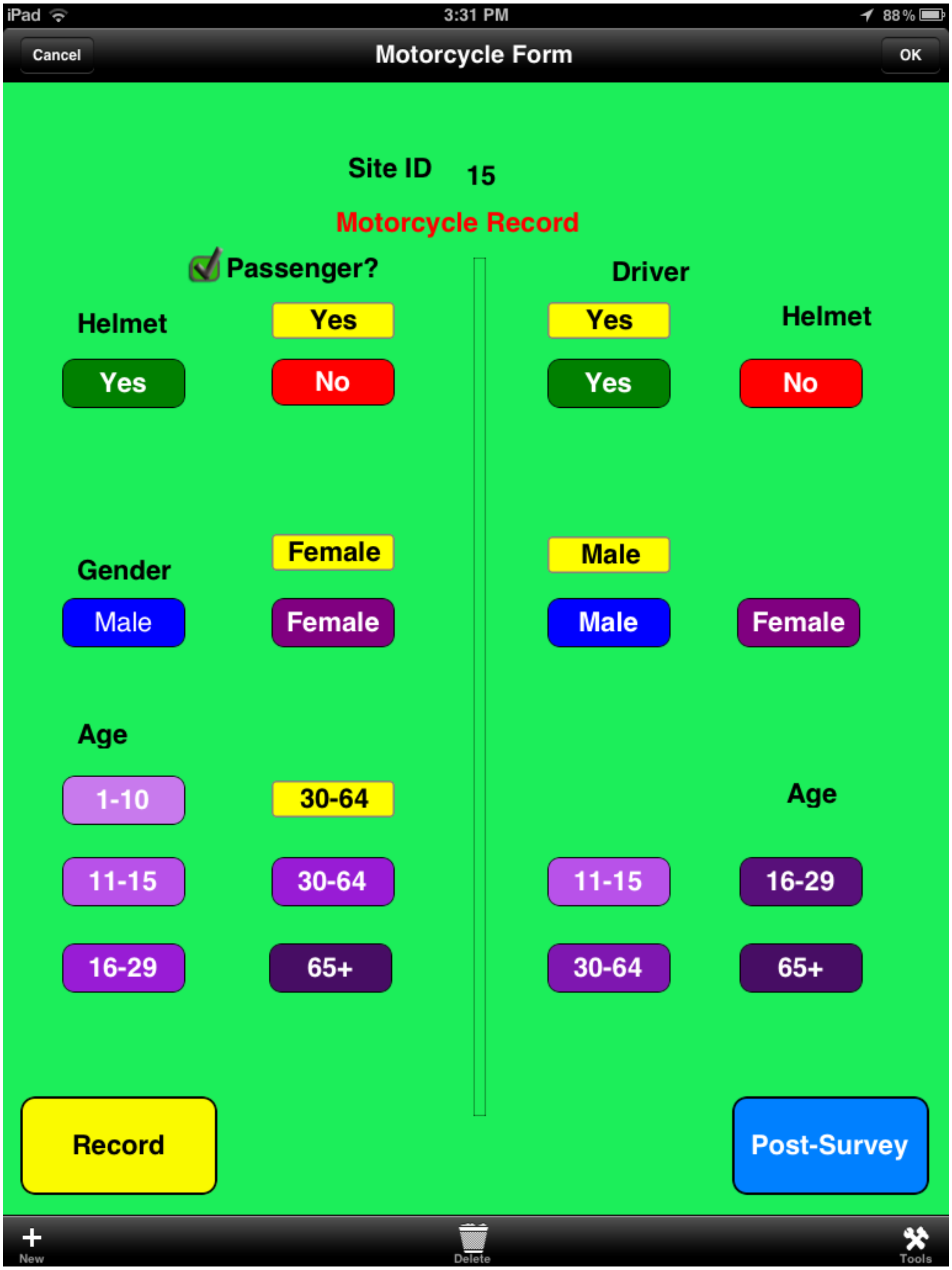
90%
Cancel
Site Records
OK
Site ID 15
Vehicle
Car
Commercial Use?
Car
Van/MiniVan
SUV
Pickup Truck
Motorcycle
Passenger?
Driver
SeatBelt
Yes
Yes
SeatBelt
Yes
No
Unknown
Yes
No
Unknown
Gender
Female
Male
Gender
Male
Female
Male
Female
Age
1-10
Age
11-15
30-64
11-15
30-64
16-29
65+
16-29
65+
Cell
None
None
Cell
None
Hand Held
Hands Free
None
Hand Held
Hands Free
Record
6/28/12
Post-Survey
New
Delete
Tools

Motorcycle Survey Form



Post-Survey Form