

UMTRI 2004-29

**Developing an Optimal In-Vehicle
Safety Belt Promotion System**

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October 2004

Technical Report Documentation Page

1. Report No. UMTRI-2004-29	2. Government Accession No.	3. Recipient's Catalog No.																										
4. Title and Subtitle Developing an Optimal In-Vehicle Safety Belt Promotion System	5. Report Date October, 2004																											
	6. Performing Organization Code																											
7. Author(s) Eby, D.W., Molnar, L.J., Kostyniuk, L.P., Shope, J.T., & Miller, L.L.	8. Performing Organization Report No.																											
9. Performing Organization Name and Address The University of Michigan Transportation Research Institute 2901 Baxter Road, Ann Arbor, MI 48109	10. Work Unit No. (TRAIS)																											
	11. Contract or Grant No. Research Agreement																											
12. Sponsoring Agency Name and Address Toyota Motor North America, Inc. 1850 M Street, NW, Suite 600 Washington, DC 20036	13. Type of Report and Period Covered Final 8/1/02 – 10/31/04																											
	14. Sponsoring Agency Code																											
15. Supplementary Notes																												
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17. Keywords safety belt, technology, reminder system, interlock			18. Distribution Unlimited																									
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 90	22. Price																									

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INTRODUCTION

Background

The single most effective technology for reducing or preventing injuries from a motor vehicle crash is the safety belt restraint system. This system, however, is only effective if it is used. The most recent nationwide survey of safety belt use in the United States (US), the National Occupant Protection Use Survey, NOPUS), estimated that 80 percent of front-outboard motor vehicle occupants use their safety belt (Glassbrenner, 2004). While this is the highest rate ever in the US, the rate is lower than many other developed countries (e.g., Boase, Jonah, & Dawson, 2004) and shows that a significant portion of US travelers do not use safety belts, even though belt use is mandated in all but one state.

For nearly thirty years, the US federal government and vehicle manufacturers have developed and implemented numerous technologies for promoting safety belt use, with varying degrees of success. In the 1970s, the federal government mandated two vehicle-based safety belt use promotion technologies. The first required vehicles manufactured after 1971 to have a continuous buzzer-light safety belt reminder when safety belts were not used (vehicles equipped with air bags were excluded; Robertson, 1975). Analysis of belt use before and after the buzzer-light systems were installed showed no statistical increase in safety belt use (Robertson & Haddon, 1974). The federal government then mandated that all new vehicles sold after August 15, 1973 be equipped with a safety-belt-ignition-interlock system that prevented the vehicle from starting if the driver and front-right passenger were not using safety belts (Buckley, 1975). Despite the fact that these interlock systems increased safety belt use by as much as 30 percentage points (see e.g., Robertson, 1974, 1975), public opposition to them led Congress to rescind the legislation in 1975. The three main reasons cited for opposition to safety-belt-interlock system: 1) problems with proper functioning of the system when no front-right passenger was present; 2) safety concerns associated with preventing drivers from rapidly starting a vehicle in the event of an emergency; and 3) the relative ease of disabling the ignition interlocks.

After 1975, the US federal government turned its attention to legislating safety belt use. In the 1980s, the federal government began to urge states to pass legislation that required the use of safety belts, with New York passing the first mandatory safety belt use law in 1984. While these laws were initially unpopular in many states, every state except New Hampshire has now passed a safety belt use law. There is clear evidence that these laws have been successful in increasing safety belt use (see e.g., Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, 2002; Reinfurt, Campbell, Stewart, & Stutts, 1990; Ulmer, Preusser, & Preusser, 1994; Williams, Wells, & Lund, 1987).

In the 1980s, the federal government required that vehicles have passive occupant protection systems and manufacturers responded by developing the automatic belt systems in which the shoulder belt automatically positions itself

after the driver starts the vehicle. Research has shown that automatic belt systems do increase safety belt use (Streff & Molnar, 1991). However, these systems were judged as being less effective than the 3-point safety belt and were not well liked by consumers. When the federal government clarified their definition of “passive occupant protection” to encompass air bags, automatic belts were largely eliminated from newly manufactured vehicles.

Recent attention has turned to the development of new in-vehicle technologies for increasing belt use (NHTSA, 2003; Transportation Research Board, TRB, 2003). One promising technology is the safety belt reminder system. Since 1975, all new vehicles in the US have been required to display a 4-8 second signal if the driver does not use the safety belt after starting the vehicle. Once the belt is fastened, the signal stops. This relatively benign reminder system is easily ignored. Therefore, further research is needed to develop more effective and acceptable in-vehicle technologies to promote safety belt use, such as safety belt reminder systems.

The Project

This project was sponsored by Toyota Motor North America to promote safety belt use in the US by gaining a better understanding of the effectiveness of current safety belt reminder systems as well as suggesting appropriate improvements. The project examined several aspects of vehicle-based safety belt use technologies. Two main research tasks were completed: a nationally-representative survey of part-time safety belt users and a series of focus groups with part-time safety belt users. A literature review was also performed. Results from this review appear throughout this document.

The project design was iterative in nature; that is, after each task University of Michigan Transportation Research Institute (UMTRI) personnel met with Toyota representatives and we refined our thinking about the characteristics that would lead to effective and acceptable in-vehicle safety belt promotion technology. Combining information obtained from the literature review, UMTRI’s background in occupant protection research, and Toyota’s expertise in developing in-vehicle safety technology, we developed a set of topics for the telephone survey and focus groups that we believed were relevant to the development of safety belt reminder systems. These topics included:

- The demographic trends of part-time safety belt users;
- Part-time safety belt users’ attitudes toward belt use;
- Reasons for part-time belt use by seating position;
- Which types of system were thought be effective and acceptable to part-time users.

After detailed discussion with all parties on the project, we realized that the number of potential systems we could investigate was vast. The decision was

made, therefore, to investigate *features* of potential systems rather than example systems per se. These features were:

- The type of signal;
- The signal presentation method;
- The signal recipient.

In addition, safety-belt-interlock systems have the potential to be effective in-vehicle technologies for promoting safety belt use. As discussed previously, safety-belt-*ignition* interlocks were mandated in the US until public dissatisfaction lead to the repeal of them. Other vehicle systems could be interlocked with safety belt use, such as the heating/cooling or entertainment systems. Therefore, we investigated features of this potential technology in the project.

NATIONWIDE TELEPHONE SURVEY

The objective of the telephone survey was to gather information from a nationally representative sample of part-time safety belt users about their non use of safety belts, the reasons for this behavior, and what it would take to get them to use their safety belt. For the purpose of this survey a part-time safety belt user was defined as a person who, by self-report, had not used a safety belt on at least one occasion in the last year either as a driver or passenger (front or back seat) in a private car that had safety belts available. This included not using a safety belt for some portion of the trip, other than the few moments at the very beginning or the very end of the trip.

A telephone survey instrument was developed to identify part-time safety belt users and to collect basic demographic information from those who did not qualify as part-time users. Once part-time users were identified, they were asked about their safety belt nonuse by seating position, reasons for safety-belt non-use, the perceived usefulness and acceptability of a set of system features of in-vehicle safety belt promotion technologies. The three system features investigated in the survey were: the signal type; the ways in which the signal could be delivered; and who receives the signal. We also investigated, to some extent, acceptability and effectiveness of these features for the driver when he or she is not belted (driver-driver), for the driver when a passenger is not belted (driver-passenger); and for the passenger when he or she is not belted (passenger-passenger). Other survey topics included:

- How often respondent was driver and/or passenger;
- Questions about the last time respondent did not use safety belt;
- Questions about respondent's general safety belt nonuse as driver and as passenger;
- Questions to driver about belt use of his/her passengers;
- Demographics.

The complete survey instrument can be found in Appendix A.

Sampling and Survey Administration

The telephone survey utilized a nationally representative random-digit-dial (RDD) sample design of households. The telephone interviews were conducted by a professional survey research firm using Computer Assisted Telephone Instruments (CATI) from April 21 to June 25, 2003. In all, there were 1,100 completed interviews from part-time safety belt users. The final sample was weighted to reflect regional and population density distributions of the US. The details of the sample distribution by region and by population density are shown in Appendix B.

To obtain the final sample of 1,100 part-time safety belt users, 21,670 telephone numbers were used. If not answered, a telephone number was tried up to six times. Of the 21,670 telephone numbers called, 8,557 yielded persons eligible for an interview, 6,613 resulted in an ineligible classification (not part-time safety-belt users, not age 18 or older, disconnected number, fax or data line, business number), and 6,500 numbers resulted in an unknown classification (no answer, answering machine, scheduled for call-back). Using standard definitions for the final disposition of samples for RDD telephone surveys (American Association for Public Opinion Research, 1998), the minimum response rate for this survey was 7.3 percent and the maximum response rate 12.9 percent. These response rates were calculated using the following equations:

Minimum Response Rate = complete interviews / (complete interviews + discarded interviews + refused + incomplete interviews + language barrier or deaf + unknown);

Maximum Response Rate = complete interviews / (complete interviews + discarded interviews + refused + incomplete interviews + language barrier or deaf).

As part of the survey, demographic information for people who were not part-time users was also collected. The intent was to use these data to help estimate the proportion of part-time safety-belt users in the population. At the end of the first month of the telephone interviews, there were 683 completed interviews from part-time users and the short demographic information for 955 persons who were not part-time users. Because of cost and time involved in collecting the additional information, it was decided to abandon the collection of demographic information of the non-part-time safety belt users.

Survey Respondents

The demographics of the survey respondents are shown in Table 1. About 60 percent of respondents were female; education level was fairly well-distributed; a wide variety of ages were included; and about 40 percent of respondents had young children in their household.

General car use and safety belt nonuse of the respondents are summarized in Table 2. Approximately 84 percent of the part-time safety belt users drove a car almost every day, and almost all were passengers in a car at some time in the past year. Nearly 80 percent of respondents were passengers in the back seat at least a few times in the last year. Nearly 42 percent did not use a safety belt within the last week. When asked about seating position the last time a belt was not used, about 40 percent reported being a driver, 21 percent were passengers in the front seat, and about 34 percent were passengers in the back seat.

Table 1: Demographics of Telephone Survey Respondents		
	Number	Percent
<u>Sex</u>		
Male	438	39.8
Female	662	60.2
<u>Education</u>		
High school or less	395	35.9
Some college	279	25.4
College grad or higher	422	38.4
Refused	4	0.3
<u>Age</u>		
18-24	153	13.9
25-34	233	21.2
35-44	252	22.9
45-54	188	17.1
55-64	154	14.0
65+	66	10.6
Refused	3	0.3
<u>Children < age 15 in Household</u>		
Yes	419	38.1
No	678	61.6
Refused	3	0.3

Table 2: Self-Reported Vehicle and Safety Belt Use of Telephone Survey Respondents		
	Number	Percent
<u>How often did you drive a car in the last year?</u>		
Almost every day	928	84.4
A few days a week	105	9.6
A few days a month	18	1.6
A few days a year	13	1.2
Never	36	3.3
<u>How often were you a passenger in a car in the last year?</u>		
Almost every day	120	10.9
A few days a week	425	38.6
A few days a month	375	34.1
A few days a year	160	14.6
Never	20	1.8
<u>How often were you a passenger in the back seat?</u>		
Almost every day	7	0.6
A few days a week	65	6.0
A few days a month	280	25.9
A few days a year	503	46.6
Never	224	20.7
Don't know	1	0.1
<u>When was the last time you did not wear a seat belt?</u>		
Today	183	16.6
Within the past week	252	22.9
Within the past month	336	30.6
Within the last year	295	26.8
Can't remember (last year)	22	2.0
Don't know	8	0.7
Refused	4	0.4
<u>Where were you sitting the last time you did not wear a seat belt?</u>		
Driver's seat	457	42.3
Front Seat	228	21.0
Back Seat	369	34.2
Don't know	24	2.2
Refused	2	0.2

Telephone Survey Results

We analyzed the primary reasons people gave for part-time nonuse of safety belts. In the survey, people were asked to think back to the last they did not use a safety belt in the past year and report the main reason for their lack of use. Respondents gave a wide variety of responses to this open-ended question. We discovered, however, that all of the responses fell into six broad nonuse categories: *cognitive/personal* (e.g., forgetting or not in habit); *comfort* (e.g., too big for belt or belt does not fit correctly), *convenience* (e.g., belt hard to reach), *low perceived risk* (e.g., only driving a short distance or not driving on public road), *social* (e.g., others not wearing belt), and *vehicle* (e.g., no belt in vehicle). Figures 1-3 show the percent of respondents in each category as a function of seating position (Figure 1), sex (Figure 2), and age group (Figure 3).

Across all figures, the most commonly cited reason for nonuse involved perceived risk, followed by cognitive/personal reasons. Comfort and convenience were also commonly-cited factors. Comparing reasons by seating position showed that risk was much more commonly cited by drivers than occupants in other seating positions; cognitive/personal reasons were more commonly cited for front-seat occupants than those in the back-seat; both comfort and convenience were more important for back-seat passengers than for the driver; and vehicle-based reasons were much more common for back-seat passengers. Analysis of reasons by sex showed that men were more likely to cite cognitive/personal and low perceived risk reasons for nonuse, while women were more likely to cite comfort, convenience, and vehicle factors. Comparisons by age group showed few differences, except that the older respondents were more likely to cite low risk and less likely to cite comfort as reasons for nonuse.

Because so few respondents indicated that their lack of belt use resulted from social factors, this classification was excluded from further analyses. In addition, the vehicle-based reasons could not be addressed through any type of in-vehicle safety belt promotion technology; that is, if the belt is missing or the buckle is broken, a vehicle occupant cannot use the belt regardless of how effective the system. Therefore, the vehicle-based classification was also excluded from further analyses. The classifications of comfort and convenience are not directly related to the development of effective in-vehicle belt promotion technologies as these factors are best addressed through human factors and ergonomic improvements to the vehicle interior. However, since these classifications were representative of many respondents and were of interest to the project team, we combined them and addressed them separately from the in-vehicle belt promotion technology analyses.

Figure 1: Main Reason for Not Wearing Belt Last Time by Seating Location

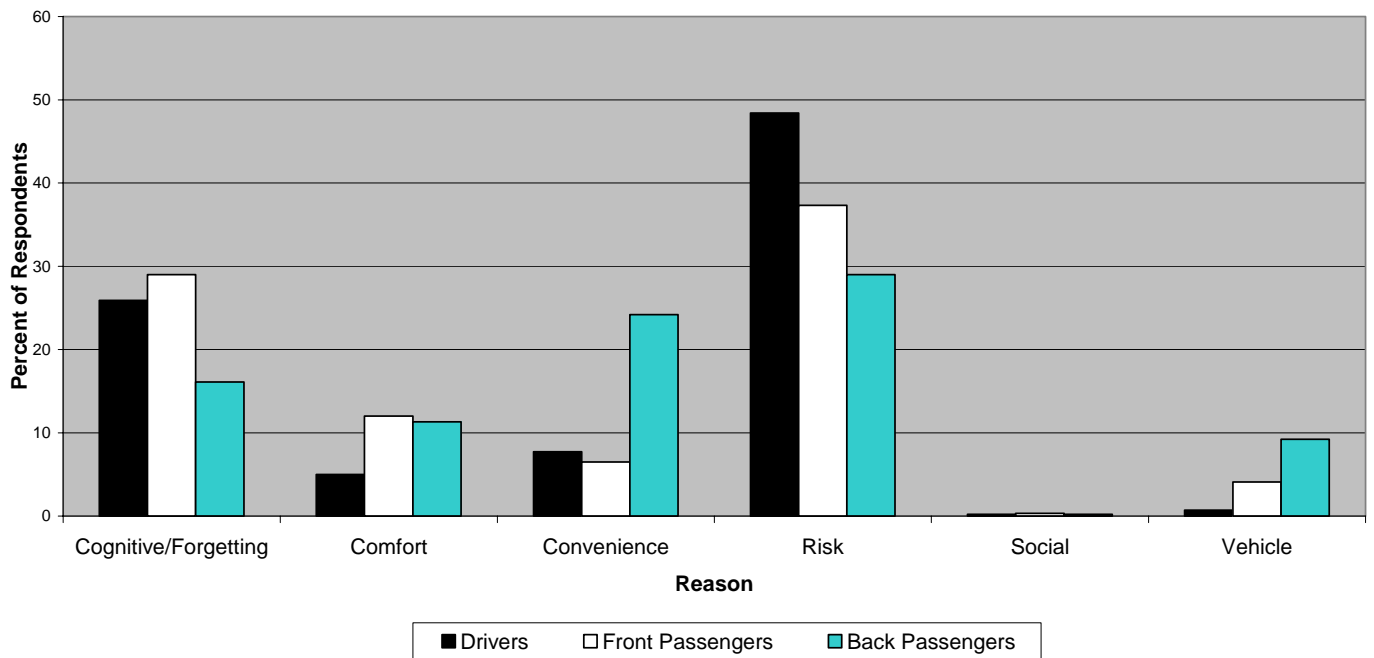


Figure 2: Main Reason for Not Wearing Belt Last Time by Sex

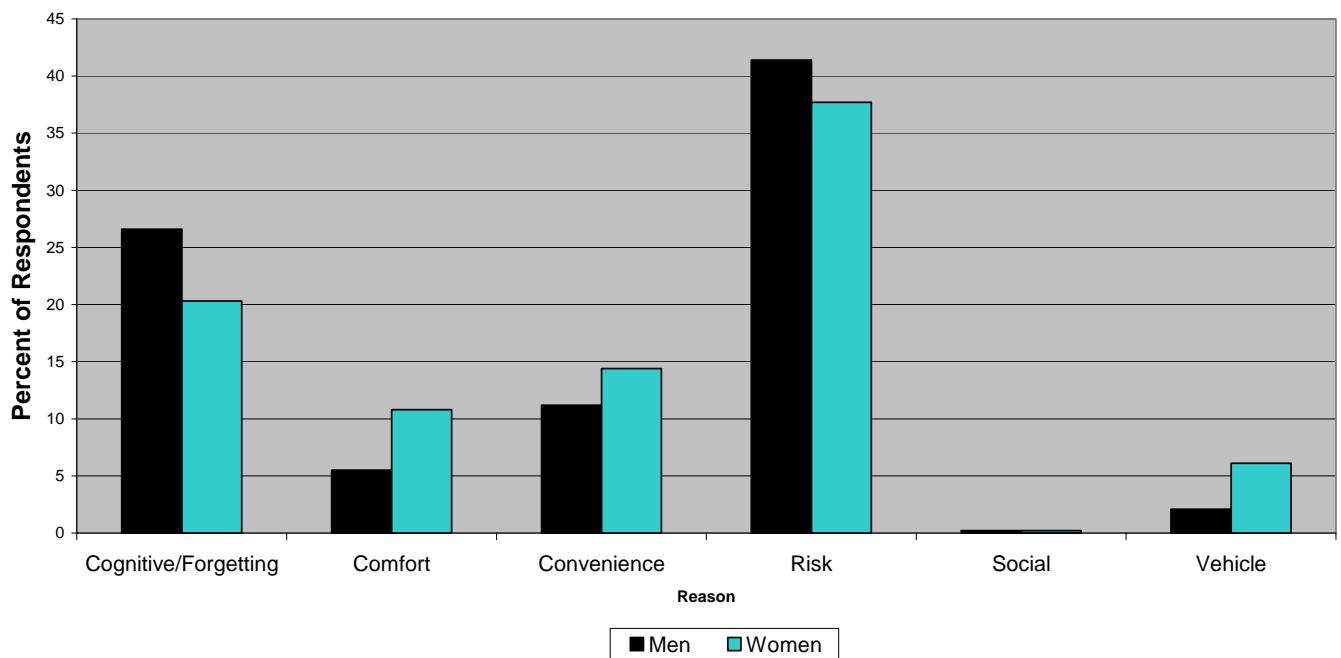
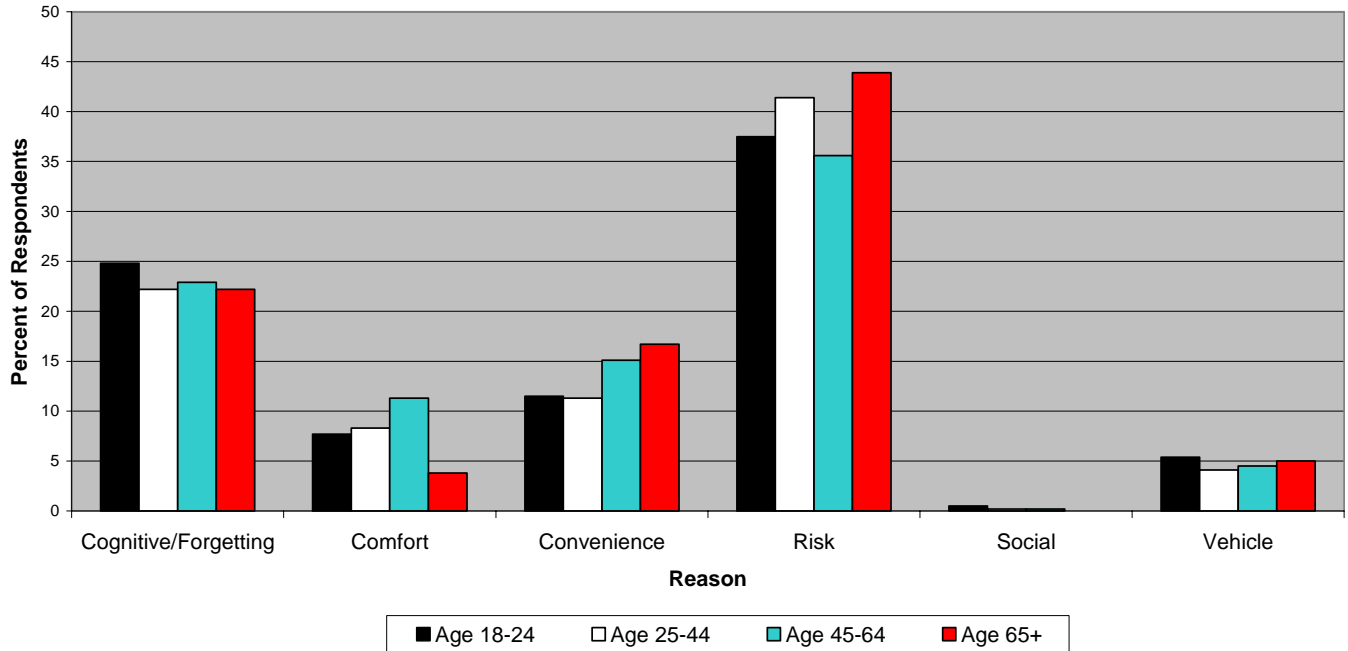


Figure 3: Main Reason for Not Wearing Belt Last Time by Age



Comfort and Convenience

Survey results indicated that about 9 percent of respondents cited comfort and 13 percent cited convenience as the primary reason for nonuse of safety belts. As these classifications do not relate to the development of effective in-vehicle technology to promote belt use, the nationwide survey did not explore the dimensions of comfort and convenience in depth. We did, however, conduct a literature review on the topic to see what other researchers have concluded about these dimensions. The literature was sparse, but the search yielded the following general results:

- Discomfort is a factor especially for shorter subjects (belt cuts into neck or clavicle);
- Subjects who say they are not in the habit of buckling up are more likely to say belts are restricting and uncomfortable;
- Discomfort is more likely to be mentioned during winter and with heavier, bulkier clothing or coats;
- More complaints regarding comfort come from drivers over age 40;
- Women, overweight, and short drivers experience more problems with comfort/convenience;
- The most important convenience-related issues are:

- Location and accessibility of buckle;
- Levels of retraction force;
- Perceptiveness to webbing extraction;
- Susceptibility of webbing to tangling and twisting;
- Belt buckle is too far back;
- Belt trapped in door;
- Awkward negotiating around clothes;
- Belt twisting when getting it, when it retracts, and when adjusting it;
- Belt locking up unexpectedly when leaning forward and when pulling belt;
- Reaching for and gripping the belt buckle.

Table 3 shows the types of discomfort/inconvenience associated with safety belts as a function of several characteristics. As can be seen in this table, women cite several types of discomfort related to safety belt use. Needing two hands to fasten the safety belt is the most frequently mentioned type of discomfort. These results should prove helpful in guiding human factors research to increase the use of safety belts by improving comfort and convenience.

Table 3: Types of Discomfort/Inconvenience Associated with Safety Belts by Selected Occupant Characteristics						
	Women	Age		Stature		
		41-55	56-70	Short	Light	Heavy
Reaching/gripping too high	X					
Locks up too early	X					
Too loose	X					
Need two hands to fasten/unfasten	X		X	X	X	
Cuts into neck	X					
Tightens over time	X					
Touches when turning head	X					
Shoulder adj. range not low enough/too far back	X	X				
Locks up when pulled over chest	X	X				
Locks up when reaching/leaning	X				X	
Retracts too fast	X					
Twists when retracts/adjusting	X			X		X
Cannot move freely when steering	X					
Pulling is not smooth process		X		X		
Difficult to locate buckle		X				
Excessive latching needed			X			
Slips off shoulder			X			
Too tight		X				
Lap belt too close to hips			X			
Tongue difficult to grasp				X		
Locked tongue					X	
Trapped in door						X

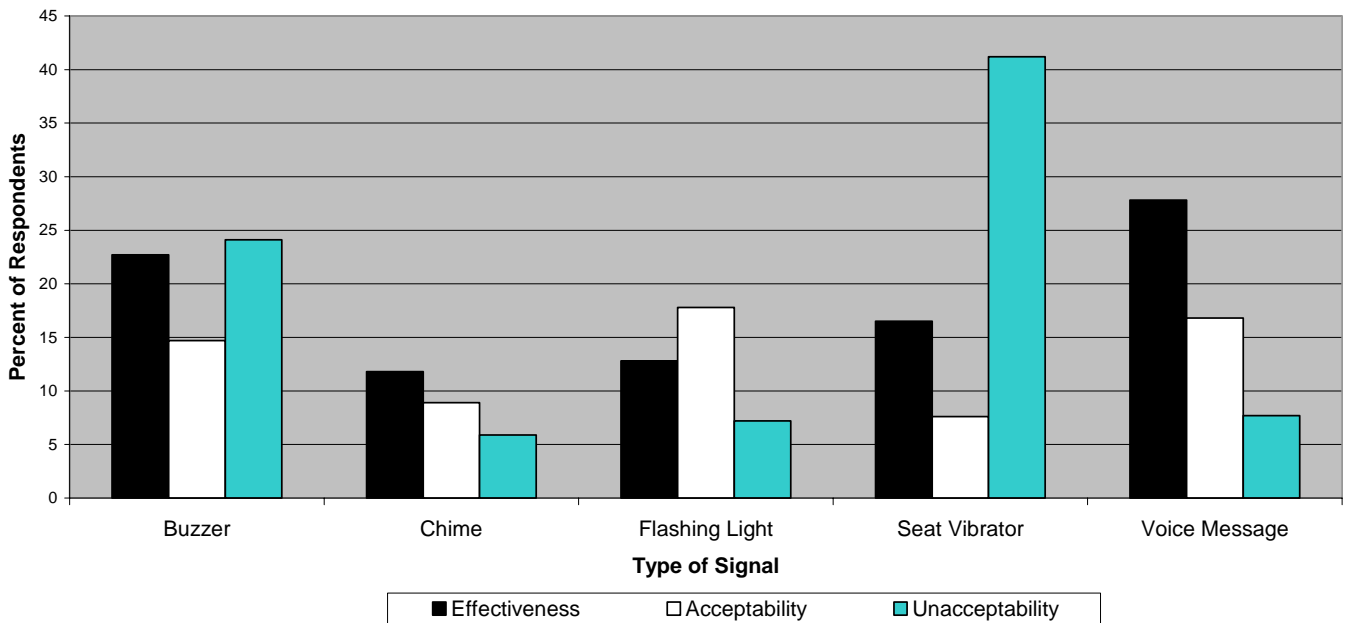
Cognitive/Personal

As mentioned previously, opinions about the type of signal, signal delivery method, and signal recipient (driver-driver; driver-passenger; and passenger-passenger) were examined separately for each of the nonuse classification groups of respondents. According to our survey, people who cite cognitive/personal reasons (usually forgetting) account for approximately 23 percent of part-time safety belt users nationwide.

Type of Signal: Driver-Driver

Figure 4 shows the percent of cognitive/personal respondents who rated each type of signal on effectiveness, acceptability, and unacceptability as a driver. Unacceptability includes responses to the question: What signals would you definitely not want in your car? As can be seen in Figure 4, the voice message and buzzer scored the highest on perceived effectiveness. The voice message, flashing light, and buzzer also scored high on acceptability. The voice message, flashing light, and chime all scored low on unacceptability.

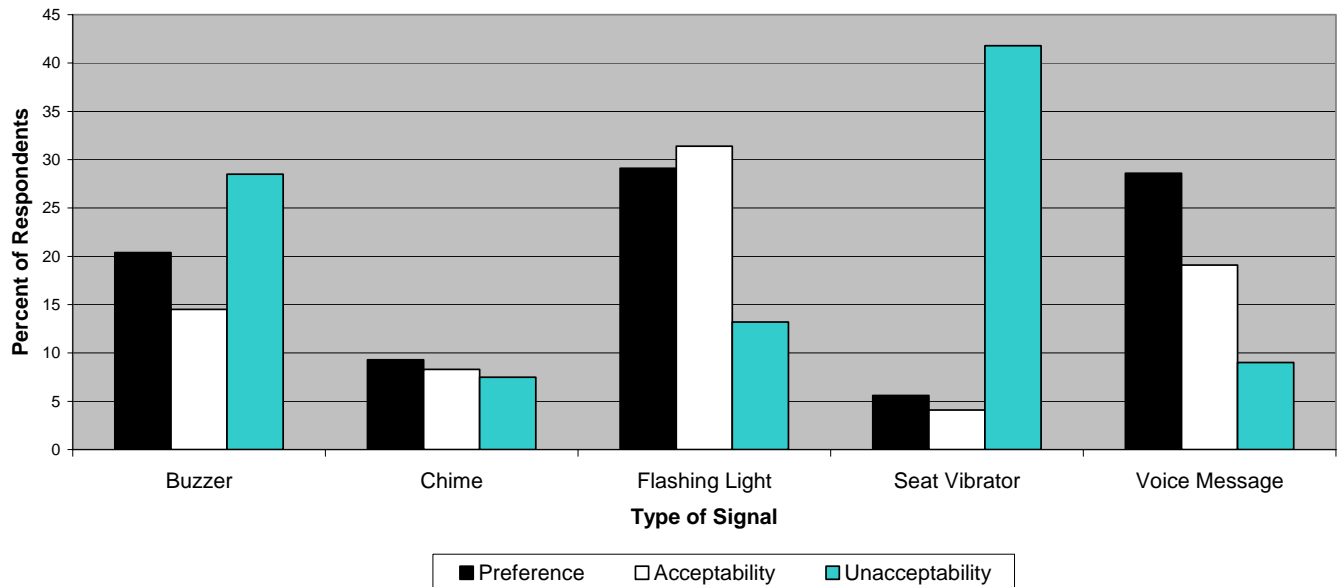
**Figure 4: Reminder System Signal Preferences as a Driver
Cognitive/Personal Group**



Type of Signal: Driver-Passenger

Figure 5 shows the percent of cognitive/personal respondents who rated each type of signal on their preference, acceptability, and unacceptability for a driver to be reminded that a *passenger* is not using a safety belt. Effectiveness in getting the passenger to buckle-up was not asked about for this situation because a respondent could not be expected to accurately predict the behavior of another vehicle occupant. As can be seen in Figure 5, the voice message, flashing light, and buzzer were selected most often as the preferred signal. The flashing light, voice message, and buzzer were also frequently cited as acceptable signals. The seat vibrator and buzzer were selected most frequently as unacceptable to drivers.

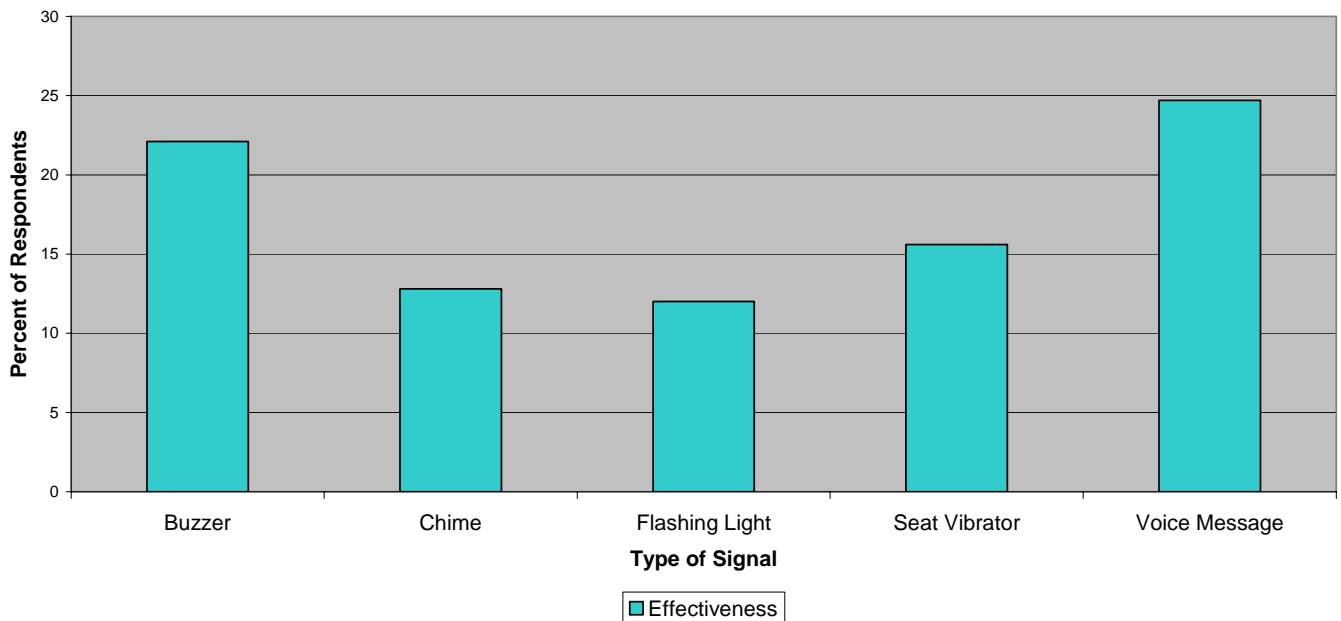
**Figure 5: Reminder System Signal Preferences as a Driver for an Unbuckled Passenger
Cognitive/Personal Group**



Type of Signal: Passenger-Passenger

Figure 6 shows the percent of cognitive/personal respondents who selected each type of signal as the most effective for getting them to use a safety belt while they were traveling in a vehicle as a *passenger*. We only asked about effectiveness, because passengers do not necessarily purchase the vehicle in which they are traveling so acceptability/unacceptability are not relevant. As can be seen in Figure 6, the voice message and buzzer were the two most frequently selected signal types to remind passengers to use their safety belt.

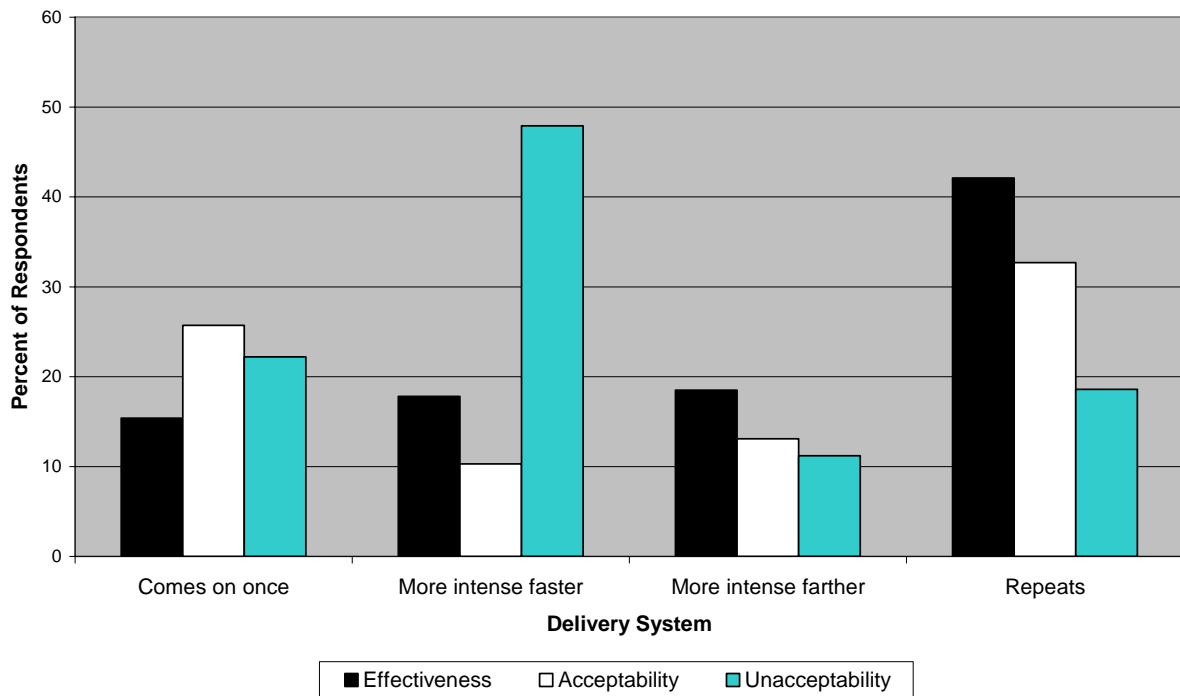
**Figure 6: Reminder System Signal Preferences as a Passenger
Cognitive/Personal Group**



Type of Signal Delivery: All Types of Systems

Figure 8 shows the percent of cognitive/personal respondents who rated each signal delivery method on effectiveness, acceptability, and unacceptability. The survey did not explore these questions as a function of seating position. As seen in Figure 8, repeating at a constant interval was the most frequently selected delivery system. Repeating, and a system that comes on once, were judged as the most acceptable overall. The most unacceptable system was one that became more intense the faster the vehicle traveled.

**Figure 7: Reminder System Signal Delivery Preferences
Cognitive/Personal Group**



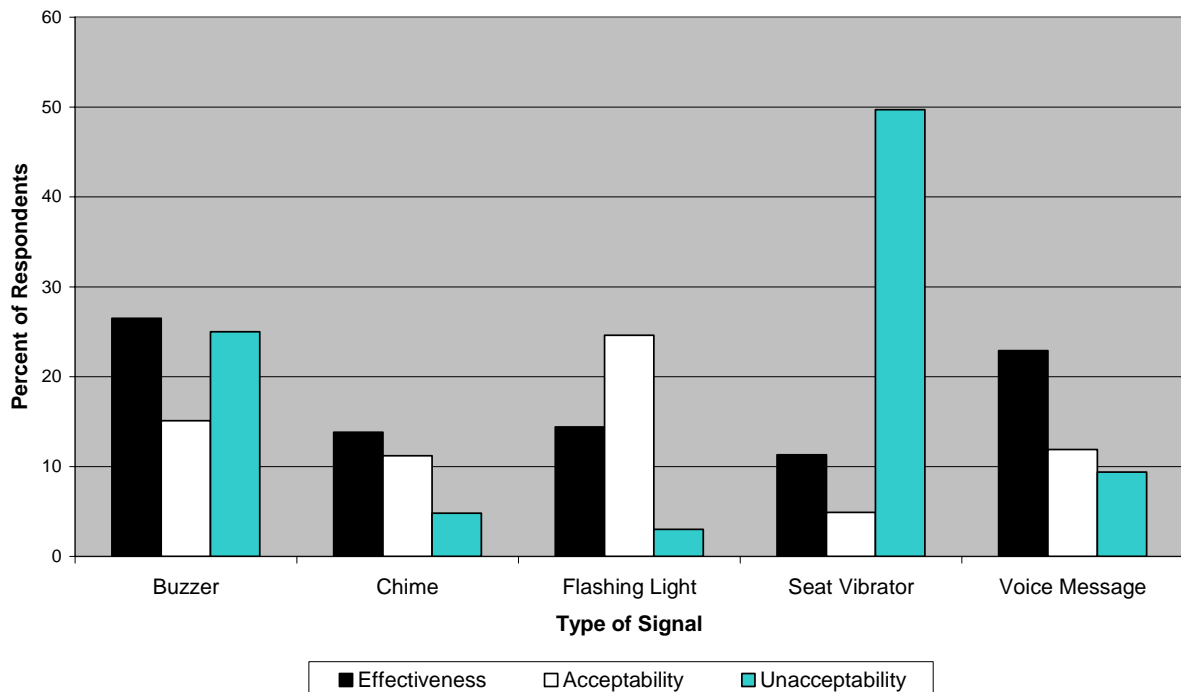
Low-Risk

According to our survey, these people account for approximately 39 percent of part-time safety belt users nationwide. As with the cognitive/personal group, three system features were investigated in the survey: the signal type; the way in which the signal was delivered; and who received the signal. We also investigated, to some extent, acceptability and effectiveness of these features for the driver when he or she is not belted (driver-driver), for the driver when a passenger is not belted (driver-passenger); and for the passenger when he or she is not belted (passenger-passenger).

Type of Signal: Driver-Driver

Figure 8 shows the percent of low-risk-based respondents who rated each type of signal on effectiveness, acceptability, and unacceptability as a driver. As can be seen in Figure 8, the voice message and buzzer were selected most often as effective signals. The seat vibrator, chime, and voice message were found to be the least acceptable signals. The seat vibrator was selected by nearly half of this group as unacceptable, while nearly 25 percent thought the buzzer was unacceptable.

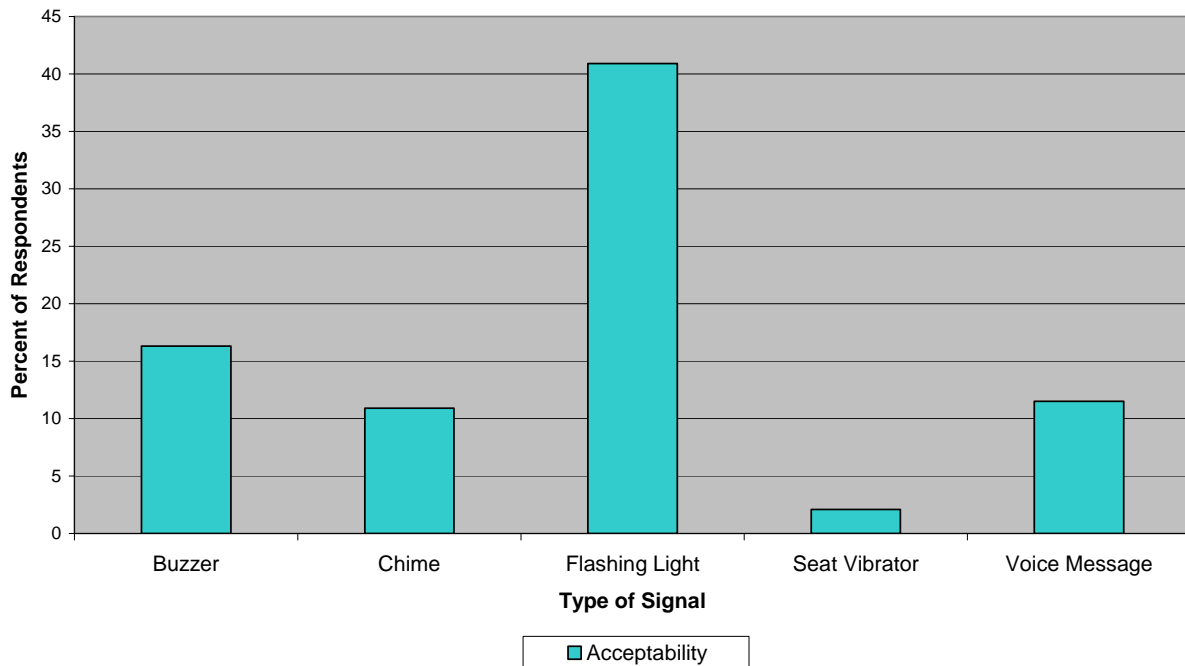
**Figure 8: Annoyance System Signal Preferences as a Driver
Low Risk Group**



Type of Signal: Driver-Passenger

Figure 9 shows the percent of low-risk-based respondents who rated each type of signal on acceptability as a driver to be told that a passenger is unbelted. As can be seen in Figure 9, the flashing light was selected most often as an acceptable signal. The seat vibrator was judged to be the least acceptable signal.

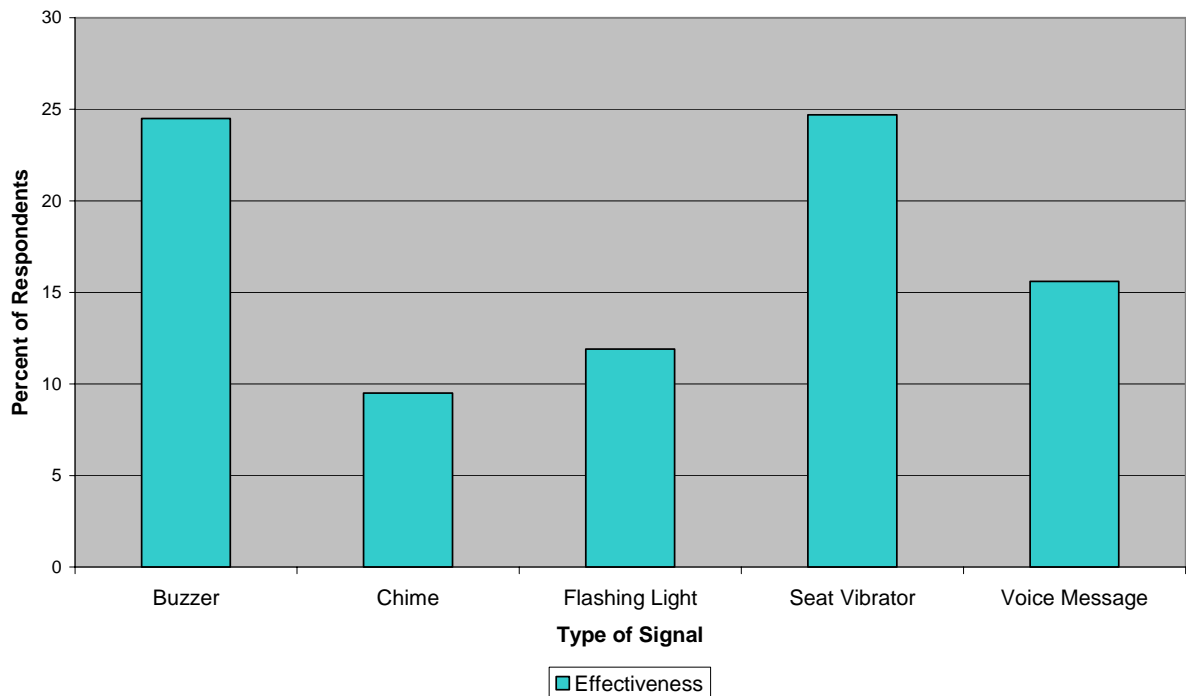
Figure 9: Annoyance System Signal Preferences as a Driver for an Unbuckled Passenger, Low Risk Group



Type of Signal: Passenger-Passenger

Figure 10 shows the percent of low-risk-based respondents who selected each type of signal as the most effective for getting them to use a safety belt while they were traveling in a vehicle as a passenger. We only asked about effectiveness, because passengers may not necessarily purchase the vehicle in which they are traveling, therefore acceptability is not an issue. As can be seen in Figure 10, the seat vibrator and buzzer were the two most frequently selected signal types to get a passenger to use their safety belt, with nearly identical proportions citing them.

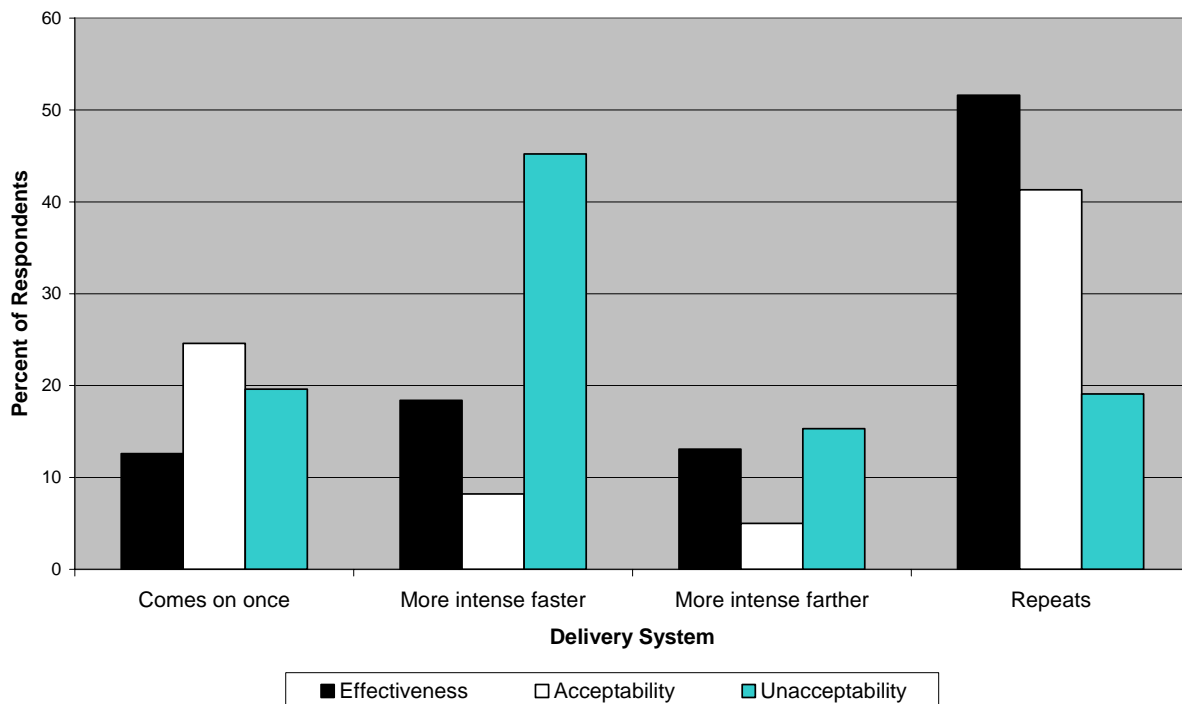
**Figure 10: Annoyance System Signal Preferences as a Passenger
Low Risk Group**



Type of Signal Delivery: All Types of Systems

Figure 11 shows the percent of low-risk based respondents who selected each method for signal delivery on effectiveness, acceptability, and unacceptability. The survey did not explore this question as a function of seating position. As seen in Figure 11, repeating a signal at a constant interval was the most frequently selected delivery system for effectiveness, followed distantly by a signal that becomes more intense the faster the vehicle moves. The two least acceptable signal delivery methods were one in which the signal gets more intense the farther the vehicle travels and one in which the signal gets more intense the faster the vehicle travels. By far, the most unacceptable delivery method was one that gets more intense the faster the vehicle travels.

**Figure 11: Annoyance System Signal Delivery Preferences
Low Risk Group**



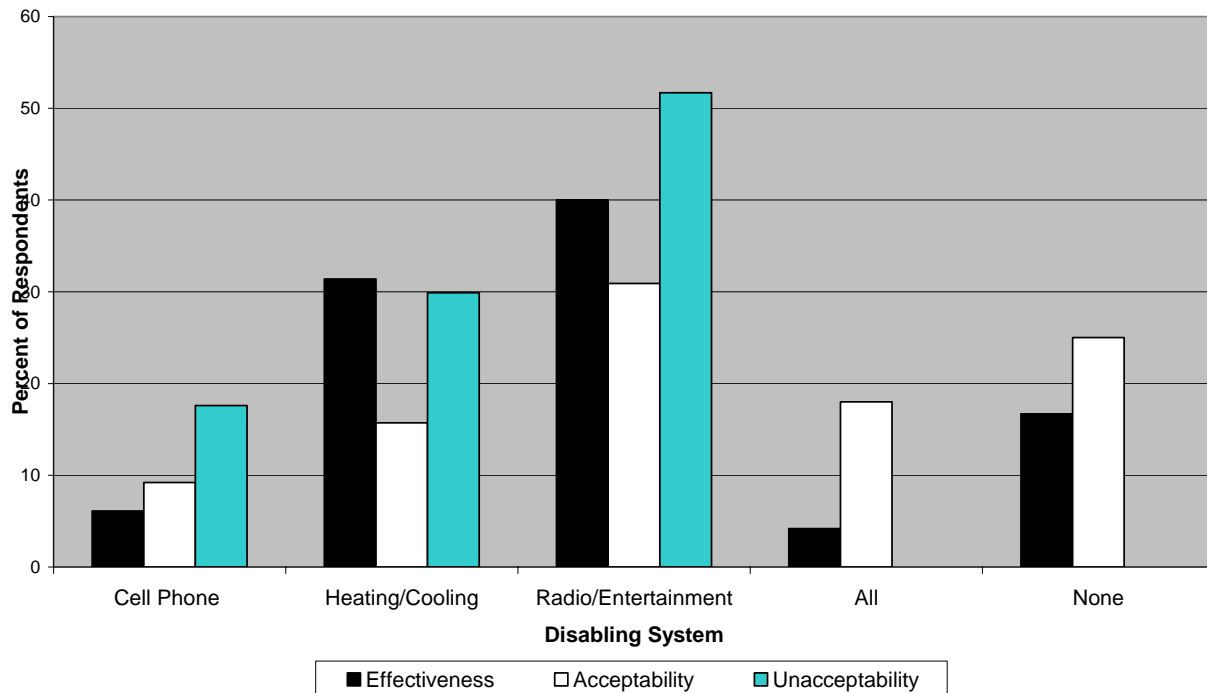
Interlock Systems

We investigated only interlocks that link to some vehicle feature other than the ignition. If a vehicle has an ignition interlock system, then no other system is necessary. The survey only considered interlock systems that would disable some system operating in the vehicle if anyone in the vehicle was not using a safety belt.

Vehicle System to Disable: Interlock System

Figure 12 shows the percent of respondents who selected each system to be interlocked with safety belt nonuse on effectiveness, acceptability, and unacceptability for all respondents in the survey. The survey clearly showed that disabling the radio/entertainment system was most often judged to be effective for promoting belt use and the most unacceptable system to have in the vehicle. Disabling the heating/cooling system was also judged to be fairly effective and unacceptable.

Figure 12: Disabling System Preferences
All Respondents



Summary of telephone survey results

- Most commonly reported reasons for nonuse of belts
 - Cognitive/personal (23%)
 - Low perceived risk (39%)
 - Comfort/convenience (22%)

- Characteristics and preferences of cognitive/personal group
 - More likely to be front-seat passengers and men
 - Ideal reminder system should maximize both effectiveness and acceptability
 - Most effective signal for driver reminder - voice message
 - Most acceptable/least unacceptable signals for driver reminder – voice message, flashing light
 - Preferred signals for telling driver about passenger - flashing light, voice message
 - Most acceptable/least unacceptable signal for telling driver about passenger - flashing light
 - Preferred signals for passenger reminder – voice message, buzzer
 - Most effective delivery system – repeating at constant interval
 - Most acceptable/least unacceptable delivery system – repeating at constant interval

- Characteristics and preferences of low perceived risk group
 - More likely to be drivers and men
 - Ideal annoyance system should maximize effectiveness and minimize acceptability
 - Most effective signals for driver reminder – buzzer
 - Least acceptable/most unacceptable signals for driver reminder – seat vibrator, buzzer
 - Preferred signal for telling driver about passenger – flashing light
 - Preferred signals for passenger reminder – seat vibrator and buzzer
 - Most effective delivery system – repeating at constant interval
 - Least acceptable/most unacceptable delivery systems – more intense faster car is driven

- Views of total sample on interlock systems
 - Ideal interlock system should minimize acceptability
 - Most effective interlock system – radio/entertainment system
 - Least acceptable/most unacceptable interlock system – radio/entertainment system

Focus Groups

Equipped with the knowledge gained from the nationwide telephone survey, we designed a focus group moderator's guide that had two main objectives: to help us understand responses from the survey; and to gather additional data on areas that the survey showed were important.

Methods

Twelve focus groups were conducted in Michigan to collect qualitative data from part-time safety belt users on the potential effectiveness and public acceptance of various features of systems that could be placed in cars to remind or encourage people to buckle up. Discussions also focused on safety belt use in general, including reasons for wearing and not wearing belts. Six of the groups were conducted in Ann Arbor, an urban/suburban area, and six in Clare, a rural area of the state. Within each location, two groups each of 18-29 year olds, 30-64 year olds, and people 65 and older were conducted.

Part-time safety belt users (defined as those who reported nonuse at least some of the time) were recruited through advertisements in local newspapers, as well as postings at local businesses, academic institutions, and community organizations (e.g., senior centers). Potential participants were screened via telephone to ensure that they met eligibility criteria (age 18 and older, valid driver license, part-time safety belt user). Background information on participants was collected during the telephone screening process. Each selected participant was scheduled for a focus group session and sent written confirmation through regular mail or e-mail according to their preference. Reminder telephone calls were made the day before each session. A total of 97 participants were recruited, and 87 actually appeared at their session and participated in the focus group. Participants received an honorarium of \$50 cash as an incentive to participate. Each session lasted about 2 hours.

Discussion during the groups was guided by a moderator using a uniform set of questions. Participants were also provided with workbooks on which to record some of their answers to facilitate discussion. During each session, focus group participants were shown a short computer demonstration of a sample safety belt reminder system and asked about their reactions. Participants were told that the system was made up of three levels, with each level being activated only when the driver or front seat passenger remains unbuckled. If someone unbuckles during the trip, the system starts over from the beginning.

- Level 1 corresponded to the current US government requirement that cars display a 4 to 8 second signal if drivers do not put on their seat belt after starting the car. This is typically a flashing light on the dashboard with some type of sound signal. In the sample reminder system, it included a blinking light and a beeping signal that came on when the engine started and continued for 8 seconds.

- Level 2 included a sound signal (delivered by a female voice, a male voice, a buzzer, or a beeping signal) that repeats three times with 8 seconds in between.
- Level 3 included either a buzzer or beeping signal that stays on continuously for 45 seconds.

Each group was audio-taped and a project staff member was present at each session, in addition to the moderator, to take notes. After each group, a debriefing session was held to identify important themes that emerged from the discussion. Analysis of the focus group discussions was based on the debriefings of project staff conducted immediately after each focus group, a review of notes taken during the focus groups, and the audio tape recordings of the focus group sessions.

Description of Focus Group Participants

Descriptive information for the 87 participants is provided in the Table 4.

Table 4: Demographics of Focus Group Participants		
Category	Number	Percent
<u>Sex</u>		
Male	39	44.8
Female	48	55.2
<u>Education</u>		
High School or less	20	23.0
Some college	37	42.5
College grad or higher	30	34.5
<u>Race</u>		
White/Caucasian	72	82.8
Black/African American	13	14.9
Other	2	2.3
<u>Household income</u>		
Less than \$20,000	29	33.3
\$20,000-\$49,999	36	41.4
\$50,000-\$79,999	17	19.5
More than \$80,000	4	4.6
<u>Marital status</u>		
Single	36	41.4
Married	29	33.3
Separated/divorced	14	16.1
Widowed	8	9.2
<u>Age</u>		
18-29	30	34.5
30-64	35	40.2
65+	22	25.3
<u>Location</u>		
Urban/suburban	40	46.0
Rural	47	54.0

Focus Group Results

Main Reasons For Wearing A Safety Belt

Participants were asked “Let’s think about the reasons people have for wearing a seat belt. What do you think are the main reasons?”

- The most frequently given reasons had to do with either safety or Michigan’s mandatory safety belt law.
- Discussion of safety generally focused on how belts protect people in the event of a crash by keeping them from being thrown out of the car. For some participants, safety related to how belts keep drivers in place so they are better able to control the car and avoid a crash.
- Safety was often mentioned within the context of situations that participants perceived as more dangerous. However, opinions varied about what made driving more dangerous or risky (e.g., riding with another driver rather than driving oneself was seen as more risky by some and less risky by others).
- Discussion of the safety belt law generally focused on the tickets and fines associated with breaking the law. For a few however, the issue was more fundamental – they felt that people should obey the law because it’s the right thing to do.
- “Setting an example for children” was mentioned by some participants, although it was generally not portrayed as a safety issue, but rather one of getting children to “do the right thing.”
- Habit was also mentioned by some participants as a reason for wearing a safety belt. A few younger participants spoke about their parents’ role in helping them to develop a habit by requiring belt use in the car. At the same time, a few participants admitted that their habit had not persisted once they became an adult.
- A few of the younger participants mentioned that when they are drinking they wear their belt so they do not give police an added reason for pulling them over.
- Illustrative quotes:
 - *“Safety – so you don’t get thrown out of the car if you’re in an accident.”*
 - *“I want to stay in the car, not go through the windshield.”*
 - *“Better control while you drive.”*
 - *“Because of the way other people on the road drive.”*
 - *“If you’re with a certain person who’s a bad driver.”*

- *“It’s the law. I’d rather put on the seat belt than get a ticket.”*
- *“Training by parents to wear seat belt – habit.”*
- *“If I’m driving drunk, I remember because there’s no need to get a DUI for it.”*

Main Reasons For Not Wearing A Safety Belt

Participants were asked “What are the main reasons for not wearing a seat belt?”

- The most frequently given reason was that belts are uncomfortable or inconvenient.
- Lack of habit or forgetting to put on the belt were reasons mentioned by several participants. While some participants also identified “being in a hurry” as a reason, it appeared that the non-use resulted from a conscience decision not to put on the belt because of the time constraints rather than simply forgetting.
- Another reason mentioned by several participants was “just driving a short distance.” Interestingly, when asked to clarify “short distance,” participants gave varying responses ranging from a few blocks to several miles.
- For several participants, not wearing belts was related to having a low perceived risk of a crash or the belief that belt use may actually increase injury risk.
- For a few, not wearing a belt was seen as a defiant response to being “told what to do.” Although this view was not a frequent one, when it was mentioned, it was expressed quite strongly.
- Illustrative quotes:
 - *“Cuts right across my neck because I’m short.”*
 - *“If you’re not thin and you have short legs, it hits you on the neck.”*
 - *“I’m an overweight American. You’d think they’d design them for us.”*
 - *“It limits my mobility. I have two small kids. If I reach, I have to take it off and I don’t put it back on.”*
 - *“I’m older and not used to wearing seat belts so I forget.”*
 - *“If your parents didn’t force you to wear your seat belt, you’re not accustomed to it.”*
 - *“When I’m in a hurry, I just jump in and go.”*
 - *“I’ve been in an accident and didn’t have my seat belt on, and I didn’t get injured.”*
 - *“I don’t think that I’m going to get in an accident.”*
 - *“I’m not convinced about the safety issues.”*

- *“I think a lot of people get mad at the government for telling them what to do.”*

Safety Belt Discomfort and Inconvenience

Participants were asked “What makes seat belts uncomfortable or inconvenient?”

- The most common response was that seat belts cut into people’s necks. This response came from participants representing a variety of shapes and sizes, although people of short stature or relatively heavy stature were somewhat more likely to give this response.
- Several participants mentioned that belts lock up or fit too tightly across the chest or body.
- Other less frequent responses to what makes seat belts uncomfortable or inconvenient included the roughness of the belt material, a tendency to wrinkle nice clothes, difficulty in reaching buckle, and twisting of the belt.
- Some participants, especially younger ones, mentioned that safety belts restrict their movements too much in the car, making it hard to do such things as deal with children in the back seat, pick up dropped items, or use the entertainment center.
- A few of the younger participants also mentioned that if they have their cell phone in their pocket, the belt inconveniently cuts across their pocket, making it hard to extract the phone.
- Illustrative quotes:
 - *“It cuts into my neck.”*
 - *“I’m short so it rubs on my neck.”*
 - *“The fabric it’s made of is hard.”*
 - *“It locks up and I can’t move.”*
 - *“Having it right against your chest – I want to be able to pull it away.”*
 - *“Sometimes it’s hard with a winter coat to get into the locking mechanism.”*
 - *“It adds stress to a stressful day, wrestling with the seat belt. You go get ready to go and you’re fighting with it.”*
 - *“When I’m dressed nice, it wrinkles my clothes.”*
 - *“Reaching behind you – I’m not trying to do yoga.”*
 - *“I have a chronic strained thumb from getting the seat belt.”*
 - *“Changing radio or CD – it’s constraining.”*

Participants were also asked “What do you think could be done to make seat belts more comfortable or more convenient?”

The most popular response was to make the belt out of a softer material or to soften its edges, followed closely by the suggestion that some type of padding be added to the belt to cushion the neck and shoulder. A handful of participants suggested replacing the belt with a five-point harness, similar to what race car drivers use, and a couple wondered, in all seriousness, if some type of occupant protection was possible that did not rely on belts at all (e.g., a light beam or energy shield that would envelope the occupant in the event of a crash). Improving the retraction and adjustment capability of belts was also mentioned by a few participants.

Differences Between Times Participants Did and Did Not Wear Safety Belts

Participants were asked “Now think back to some of the times you did not wear your seat belt. What was different about those times from times when you did wear your seat belt?”

- Participants tended to cite specific circumstances of nonuse – it was not that they forgot to buckle up, but rather that they deliberately chose to remain unbuckled in those circumstances.
- Many participants reported that they were less likely to wear their seat belt on short trips. However, there was little agreement on what constituted a short trip, with definitions ranging from two blocks to several miles. There were also differences of opinion about what exactly it was about short trips that led to nonuse. For some, short trips meant lower speeds and therefore, less crash risk. For others, short trips meant being close to home (and knowing about police patrols), and therefore less risk of being pulled over. For other respondents, short trips meant frequent stops, making buckling and unbuckling inconvenient.
- Presence of police patrols, whether close to home or not, influenced belt use for several participants, with nonuse much more likely in areas without a police presence.
- A few participants mentioned low speeds as a circumstance of nonuse, separate from short trips. However, the definition of low speed ranged from under 35 MPH to under 70 MPH.
- Being in a hurry was associated with nonuse for several participants. For them, the issue appeared to be less about forgetting than about not wanting to take the time to put on the belt.
- Several participants reported they were less likely to wear their belt when traveling in someone else’s car or as a passenger in general. However, the

reasons for this varied considerably, and included not liking the belt system in the back seat, feeling more comfortable and safe in the back seat, not being subject to the mandatory belt law in the back seat, and peer pressure when traveling with friends. For others, being a passenger had the opposite effect – it led them to buckle up because they did not trust another’s driving.

- Several participants mentioned other situations in which they were more likely to buckle up, including driving on the freeway, having someone in the car to remind them, having children in the car, and in bad weather. Some younger participants reported wearing their belt when they were drunk so they would be less likely to be stopped by the police. A few participants from the rural groups mentioned being more likely to buckle up during times that deer were likely to be on the roads.
- Illustrative quotes:
 - *“Maybe you feel safer because you’re not going far.”*
 - *“In town you go so slow that you just don’t bother.”*
 - *“I only put it on if I think there’s a policeman around or if I’m trying to set an example for the kids.”*
 - *“When you’re in a big hurry, you don’t have time for it.”*
 - *“Sometimes when I’m in another’s vehicle so it’s peer pressure. If they aren’t wearing one, I don’t.”*

Participants’ Usual Sequence of Actions Before Putting on Safety Belt

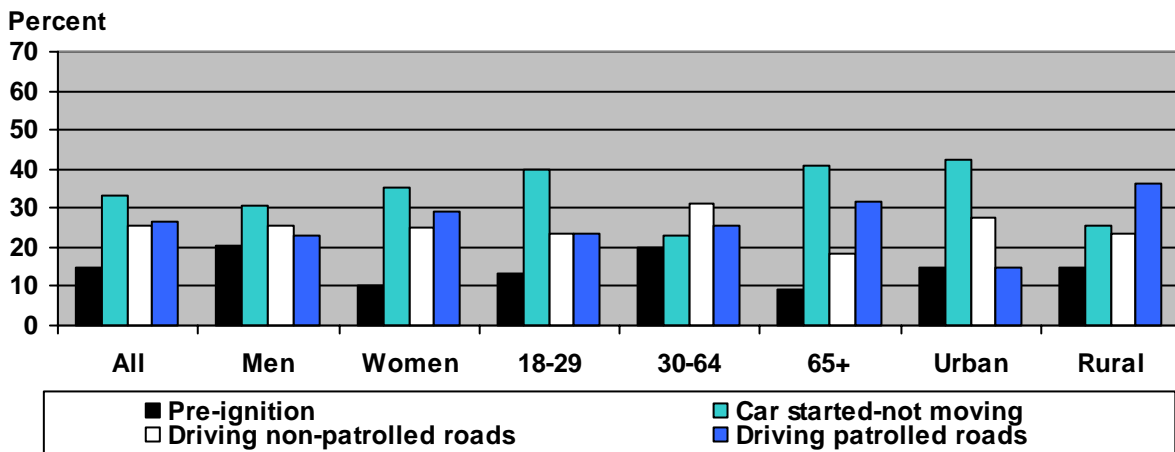
Participants were asked “When you wear your seat belt as the driver of the car, what are the things you usually do before putting on your seat belt?” and “Are there times when you vary from this sequence?” To facilitate discussion, a list of potential actions that people could engage in before putting on their belt was included in the workbook. Each action on the list was typed on a separate label that could be peeled off the page and repositioned. Two labels were provided for participants to write in “other” actions that they might engage in that were not included in the list. Participants were asked to reorder the list to reflect their usual sequence of actions, omitting any actions they did not usually do before putting on their belt. The list of possible actions included:

- ✓ Open door
- ✓ Sit in seat
- ✓ Shut door
- ✓ Adjust seat
- ✓ Adjust mirrors
- ✓ Start engine
- ✓ Put car in gear
- ✓ Release hand brake

- ✓ Check left/right views
- ✓ Accelerate
- ✓ Start driving
- ✓ Enter public roadway
- ✓ Other _____
- ✓ Other _____

Based on analysis of each participant’s usual sequence of actions, participants were classified into one of four categories, depending on the point at which they put on their safety belt. The four categories included: pre-ignition; car started–not moving; driving non-patrolled roads; driving patrolled roads. The latter two categories focused on non-patrolled versus patrolled roads rather than non-public versus public roads because it became apparent during group discussions that participants were actually thinking of roadways patrolled by police when they chose “enter public roadway” as one of their usual actions.

Figure 13. Point in Driving Sequence When Safety Belt is Put On



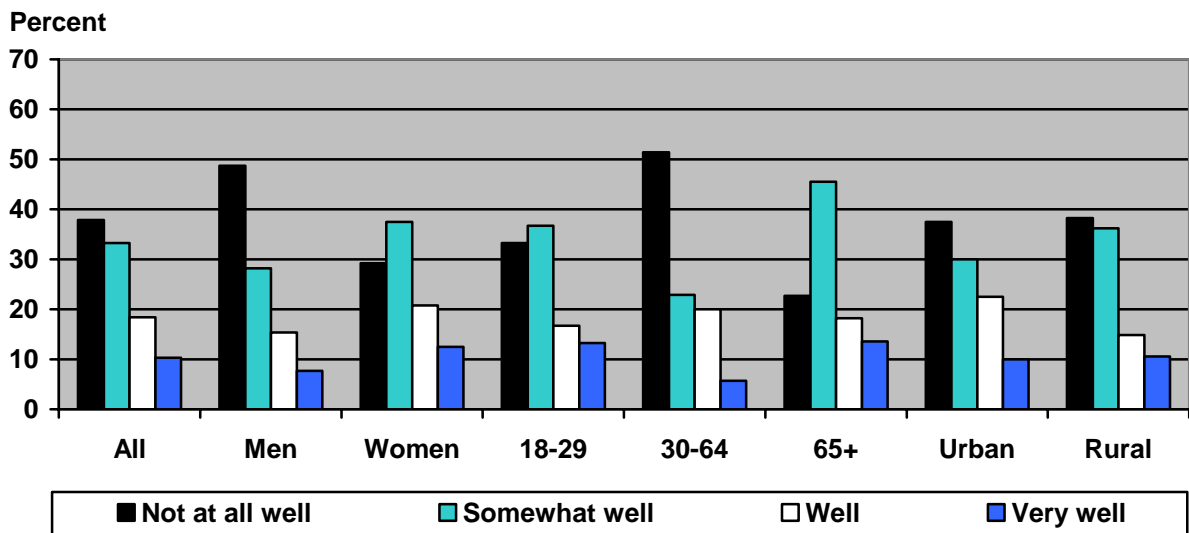
- About half of all participants reported that they usually do not buckle up until they are actually driving (either on a non-patrolled or patrolled road). Relatively few participants reported putting on their belt before they start the car. Buckling up after starting the car but before moving was the most frequently mentioned point in the driving sequence.
- Individual responses varied considerably. Responses also varied across subsets of participants. Participants in rural areas, those age 65 and older, and women were the most likely to wait until they were on patrolled roads to put on their belt. Waiting to buckle up until driving on non-patrolled roads was mentioned most frequently by those age 30-64 and least frequently by those age 65 and older. Buckling up after starting the car but before moving was mentioned most frequently by participants in the rural groups, and those age 18-29 and 65 and older. Buckling up before starting the car was mentioned

the most by men and those 30-64, but was the least popular response in every subgroup except rural participants.

- Participants reported buckling up earlier in their usual sequence when others were in the car (either to remind them or to set the tone), in areas where police patrols were present, on long trips or in unfamiliar areas, when children were in the car, in public places with other cars around, when alcohol-impaired, in inclement weather, and at night in order to see the belt mechanism before turning off the interior light.
- Participants reported buckling up later in their usual sequence when they were in a hurry.

Effectiveness and Acceptability of Current US Requirement (Level 1 of Sample Reminder System)

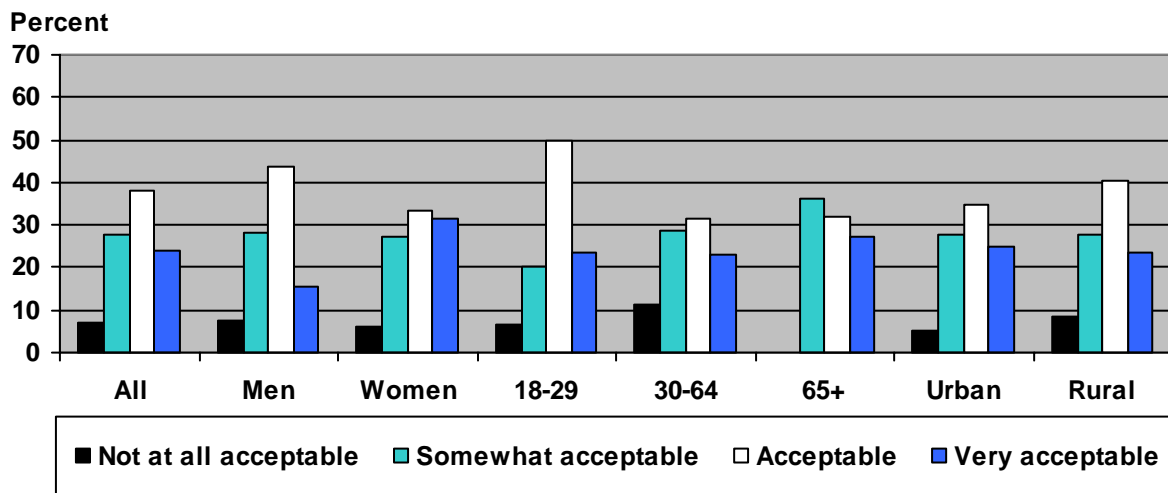
**Figure 14. Level 1 Effectiveness:
How Well Does This System Work to Get You to Buckle Up?**



- The majority of participants felt that the current US required system worked only somewhat well or not at all well to get them to buckle up. The response of “not at all well” was given most frequently by men and those age 30-64.
- The lack of effectiveness of the current US required system was most often seen as resulting from the short duration of the signal, the ease with which the signal, particularly the flashing light, could be ignored, or the low level of annoyance created by the signal.
- While some participants found the signal annoying enough to make them buckle up, feeling annoyed did not always translate into buckling up. A few participants reported that they simply waited for it to end.

- One participant, who found belts unuseable because of her large size, reported that no system would be effective, regardless of its features.
- Illustrative quotes:
 - *“It’s not annoying to the point that I’d rather put on my seat belt.”*
 - *“Once you see the light flashing you say ‘it will stop’.”*
 - *“It’s just a small tiny light. I hardly notice it.”*
 - *“Doesn’t get me to buckle up at all – I have an anti-lock brake light that comes on at the same time and the radio comes on so it’s insignificant.”*
 - *“I have senior hearing – it doesn’t work too well.”*
 - *“It works for me – it reminds me.”*

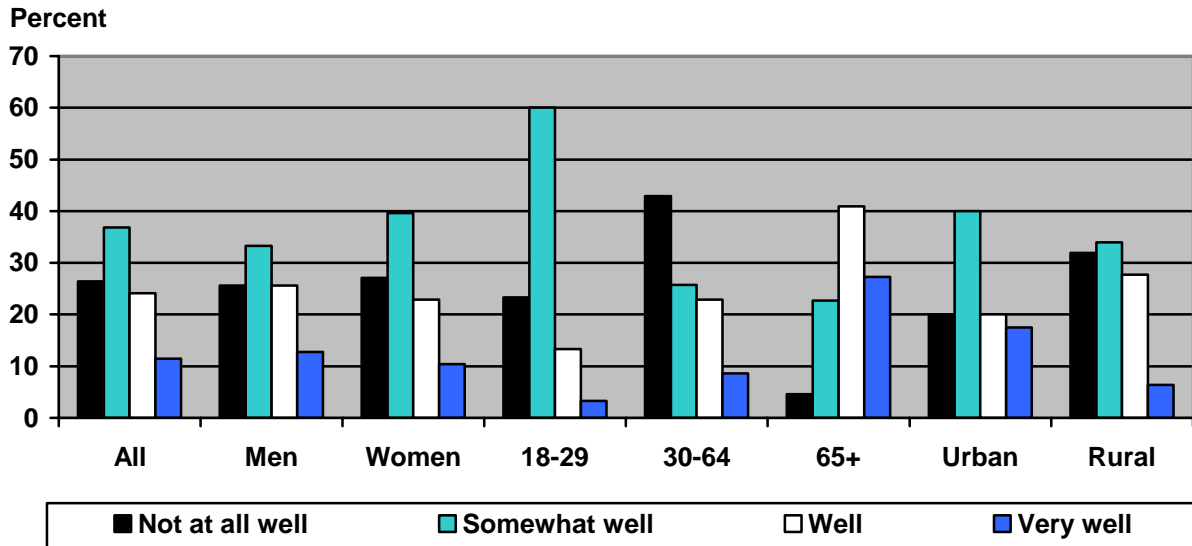
**Figure 15. Level 1 Acceptability:
How Acceptable is This System to Have in Your Car?**



- Acceptability of the current US required system was high, with the majority of respondents finding it acceptable or very acceptable.
- Relatively few participants found it not at all acceptable, regardless of what subgroup they fit into.
- Participants, for the most part, did not elaborate much on their choices, and the question did not elicit strong reactions or emotions one way or the other.

Effectiveness and Acceptability of Level 2 Sound Signals

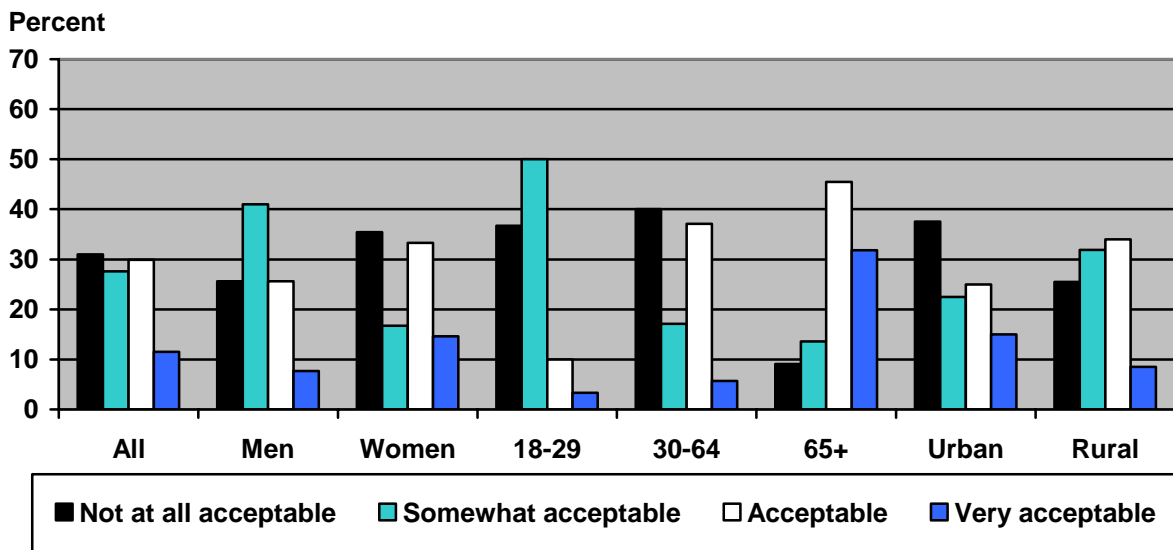
Figure 16. Level 2 Male Voice Effectiveness:
How Well Would This System Work to Get You to Buckle Up?



- The majority of participants felt that the male voice would work only somewhat well or not at all well to get them to buckle up. Only among participants age 65 and older was this not the case, with a clear majority reporting that it would work well or very well. Participants age 30-64 were especially likely to believe that it would not work at all well.
- Individuals and subgroups expressed mixed reactions to the male voice.
- The reasons given by participants for thinking of the male voice as effective were often the very same reasons given by those who thought it ineffective. For example, many (especially age 65+) thought it would work very well because it was stern and authoritative. Others (especially age 18-29) thought it would not be effective because it was authoritative.
- A few expressed concern about being able to hear the voice over other sounds in the car. Others thought the voice would stand out from the typical sounds and signals in the car.
- Some participants objected to having any voice in the car, regardless of its qualities, because it was someone telling them what to do or nagging them. Others wanted to choose their own voice but admitted that having that capability might not necessarily lead to buckling up.

- Illustrative quotes:
 - *“Won’t work – you won’t hear it because of the car stereo.”*
 - *“Voice works the best because [the system is] saying something – there’s so many noises in the car.”*
 - *“Would work very well...someone using authoritative voice telling you what to do.”*
 - *“Would work very well...because horrible to listen to.”*
 - *“I felt they were nagging at me. I wouldn’t respond.”*
 - *“Not annoying ...enough that I’d put on my seat belt to shut it off.”*

**Figure 17. Level 2 Male Voice Acceptability:
How Acceptable Would This System Be to Have in Your Car?**

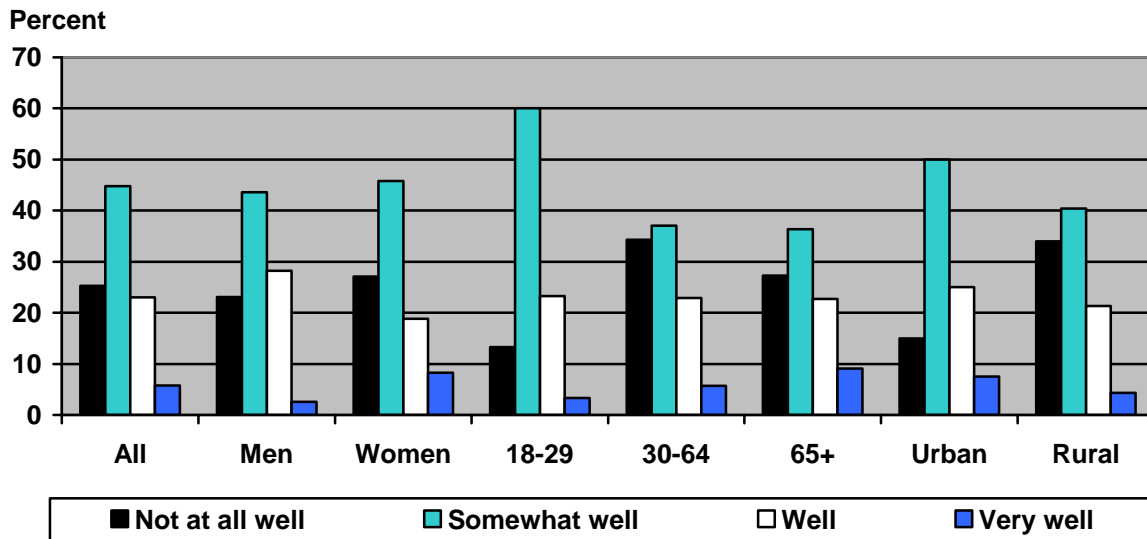


- Participants were somewhat more likely to find the male voice not at all acceptable/somewhat acceptable than acceptable/very acceptable. In each subgroup, participants were more than twice as likely to find the male voice not at all acceptable as very acceptable, except those age 65 and older, who reported relatively high levels of acceptance.
- Acceptability was often tied to feelings of annoyance – the more annoying people found the voice, the less acceptable they thought it would be. However, annoyance meant different things to different people. For some, it was the idea of someone telling them what to do, but for others it was the tone of the voice itself or some other quality. At the same time, qualities that made the voice annoying for some had the opposite effect on others (e.g., authoritarian tone).
- For many, there was a clear tradeoff between acceptability and effectiveness – the more acceptable they found it, the less effective they thought it would

be. For others, the two went hand in hand – they either found it effective and acceptable or ineffective and unacceptable. These latter participants seemed to have difficulty distinguishing between the two concepts.

- Illustrative quotes:
 - *“Male voice more acceptable because more accepting of command from a man.”*
 - *“I liked the male voice – his was strong and fun, maybe like a Dad.”*
 - *“Male voice is acceptable – he sounded happy.”*
 - *“Voice acceptable – pleasant, not gnawing, overbearing, aggressive.”*
 - *“I felt they were nagging at me. The voices are not acceptable.”*
 - *“Horrible to listen to – not acceptable at all.”*
 - *“Voices would work, but they’re annoying.”*
 - *“I don’t like the voice telling me what to do – it’s not at all acceptable.”*

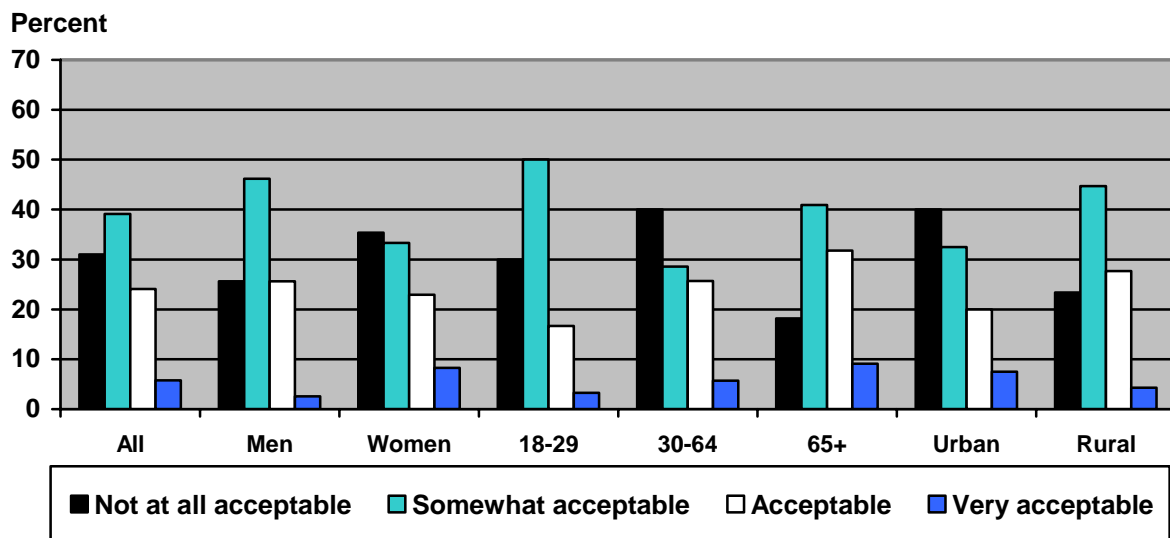
**Figure 18. Level 2 Female Voice Effectiveness:
How Well Would This System Work to Get You to Buckle Up?**



- The majority of participants felt that the female voice would work only somewhat well or not at all well to get them to buckle up, with the most frequent response overall being ‘somewhat well.’ Very few thought it would work very well, although women and older participants were a little more likely than others to voice this opinion.
- Reactions to the female voice were mixed, especially when comparing it to the male voice. Some thought it would be more effective, some less effective, and some saw no difference between the two voices in terms of getting them to buckle up.

- Several considered the female voice to lack the authority of the male voice, and therefore to be less effective. Others (generally women) thought the female voice would be effective because it was calmer and represented a 'mother figure' - someone they were used to listening to. However, some questioned whether they might get used to it and forget about it.
- While some participants liked the idea of a female voice, they objected to the particular voice in the sample reminder system because of its pitch and/or tone (e.g., too high pitched).
- Similar to reactions to the male voice, a few participants felt that any voice in the car telling them what to do was so objectionable that they would intentionally remain unbuckled.
- Illustrative quotes:
 - *"Female voice would work somewhat well because I'm used to a female voice."*
 - *"If it were a beautiful model, I'd do it."*
 - *"Most people will obey a man's voice but I respond to a female voice."*
 - *"Female voice (is) more calm (and) asking – wouldn't work."*
 - *"Female voice wouldn't work very well – not forceful enough."*
 - *"No matter what sound, it won't stand up – you need a variety of sounds at random."*

**Figure 19. Level 2 Female Voice Acceptability:
How Acceptable Would This System Be to Have in Your Car?**

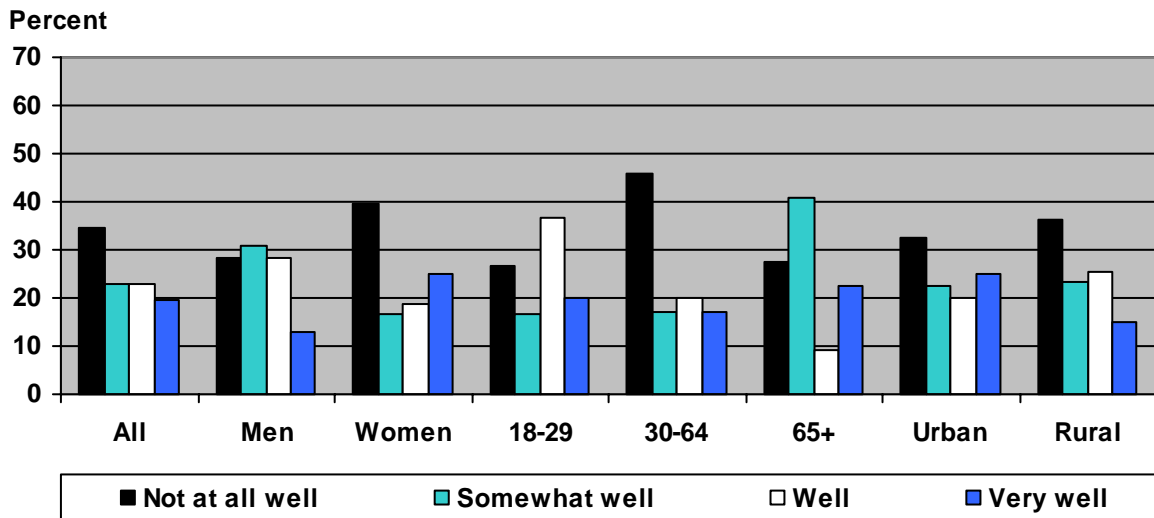


- The majority of participants found the female voice to be only somewhat acceptable or not at all acceptable to have in their car. Acceptance was

slightly higher among the oldest participants, although very few people in any group found the female voice to be very acceptable.

- In general, participants were somewhat less accepting of the female voice than either the male voice or the beeping signal. However, individual reactions to the female voice were quite mixed. Some liked it because of its pleasant and calming qualities, other found it too high pitched and irritating, and others saw it as no different from the male voice.
- While some participants were quite annoyed by the female voice and reported not wanting it in their car, reactions were, for the most part, relatively mild (i.e., not characterized by strong emotions).
- Some participants objected to having any type of voice in their car because they did not like the idea of being told what to do.
- Illustrative quotes:
 - *“I liked the (female) voice a bit better because people usually give cars female names.”*
 - *“Female voice was the best.”*
 - *“Female voice was too high pitched and really irritating.”*
 - *“Female voice unacceptable because reminded me of being a child.”*
 - *“Voices are pleasant – not gnawing, overbearing, or aggressive.”*
 - *“Voices unacceptable because so intrusive – don’t want someone telling you what to do in your car – I’d have to remove them.”*

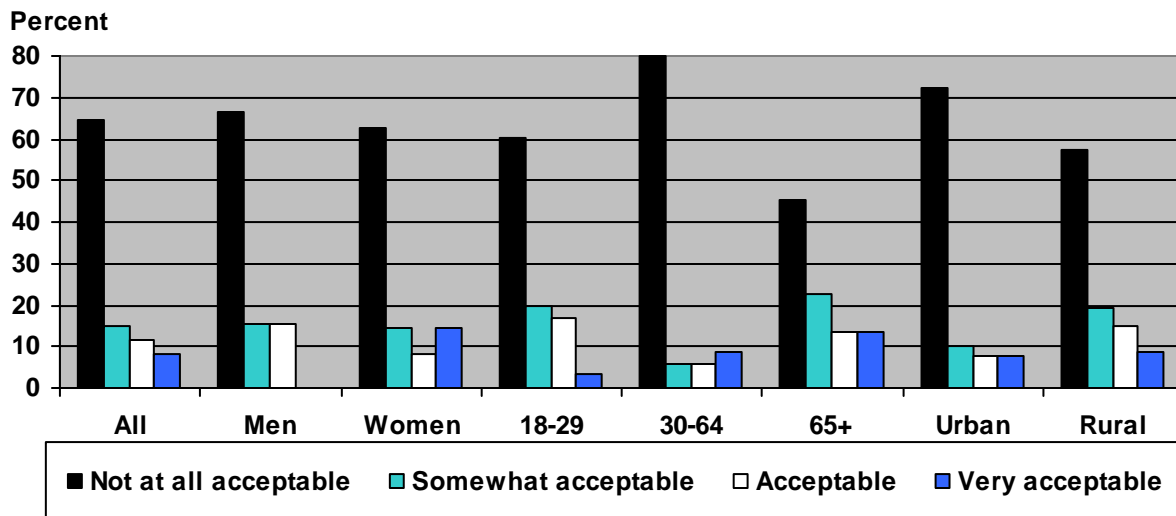
**Figure 20. Level 2 Buzzer Effectiveness:
How Well Would This System Work to Get You to Buckle Up?**



- A majority of participants thought that the buzzer would work only somewhat or not at all well to get them to buckle up, with the most frequent response overall being 'not at all well.' Participants age 30-64 were especially likely to discount the effectiveness of the buzzer, and to a lesser extent, women and rural groups. Older participants, women, and urban groups were slightly more likely than others to think that the buzzer would work very well.
- There was widespread agreement that the buzzer was quite annoying. However, there were different views about what this meant for getting people to buckle up. Some thought that the annoyance factor would lead them to put on their belt. Others indicated that they would purposely remain unbelted in defiance of the system or try to disable it because they found it so offensive. For many of these participants, it appeared that their dislike of someone or something telling them what to do was so strong that they were willing to put up with the annoyance as a way of protesting such intervention.
- Even among many of the participants who thought that the buzzer would be effective, there was a feeling that they would not want it in their car.
- Because participants had such strong views about the buzzer, it seemed difficult for them to separate the issues of effectiveness and acceptability, focusing instead on their dislike of it.
- Illustrative quotes:
 - *"The buzzer is louder and gets your attention. The others you can ignore and get used to."*
 - *"Buzzer would work best because it's so annoying that you'd want to buckle."*
 - *"Buzzer would work because it's so obnoxious."*

- *“The buzzer would drive me crazy. I think I would talk back to it or ignore it.”*
- *“I’d do something to get it to stop. It would aggravate me.”*
- *“Totally unacceptable to have buzzer but it would get me to buckle up to shut the thing off.”*

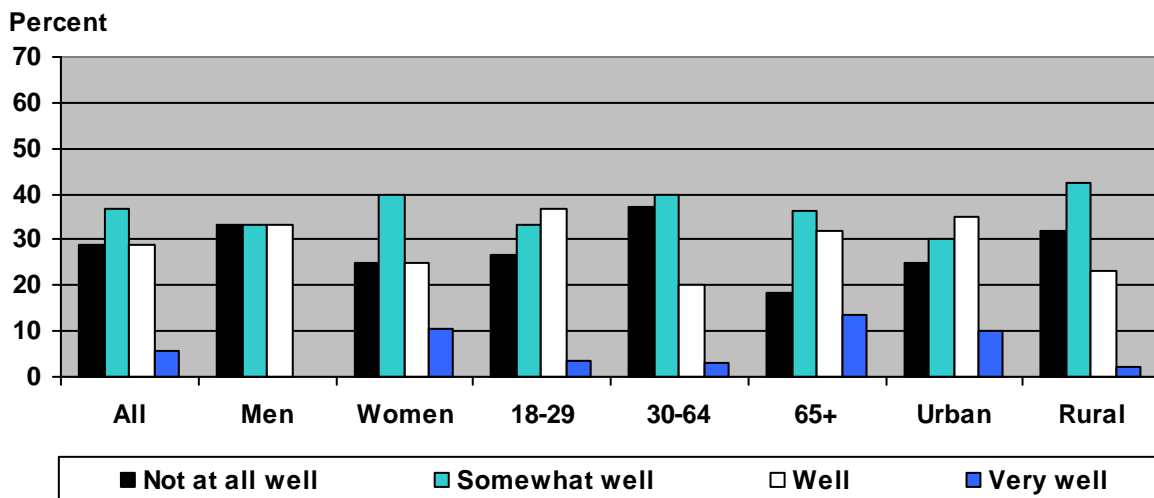
**Figure 21. Level 2 Buzzer Acceptability:
How Acceptable Would This System Be to Have in Your Car?**



- Participants tended to have strong negative reactions to the buzzer in terms of its acceptability, with the majority stating that it would not be at all acceptable to have in their car. Participants age 30-64 and those in the urban groups were the least accepting of the buzzer.
- For most participants, the lack of acceptability of the buzzer was tied to its annoying or intrusive sound. However, for a few, it was the duration rather than the actual sound.
- Several participants indicated, in sometimes strong language, that they would not buy a car if it had the buzzer in it or that they would find a way to disable it if it were in their car.
- A minority view held that the buzzer would be more acceptable because it gave the message that ‘this is important.’
- Illustrative quotes:
 - *“I would not buy a car with a male voice or female voice or a buzzer – it would irritate me so much.”*
 - *“I might not buy the car if it had the buzzer.”*
 - *“Buzzer and beeper – I’d rip them out. I can’t stand aggravating noises.”*

- *“Not acceptable because if I want to, I want to. You can turn radio up over all of them.”*
- *“Buzzer unacceptable because so intrusive – don’t want someone telling you what to do in your car –I’d have to remove them.”*
- *“The more intrusive, the more likely I’d find a way to stop it.”*
- *“Buzzer would work somewhat well but unacceptable. My car is my castle - don’t invade my castle. ”*

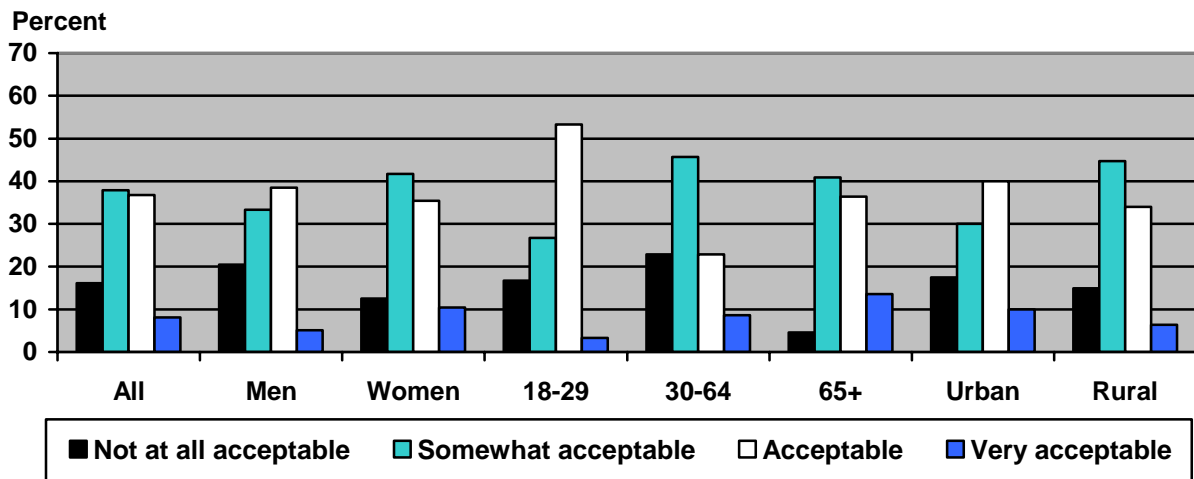
**Figure 22. Level 2 Beeping Signal Effectiveness:
How Well Would This System Work to Get You to Buckle Up?**



- The majority of participants thought that the beeping signal would work only somewhat well or not at all well, with the most frequent response overall being ‘somewhat well.’ Relatively few thought it would work very well to get them to buckle up. Participants age 30-64 were the most likely, and those age 65 and older, the least likely to think that it would not work at all well. Participants age 65 and older, women, and those in urban areas were somewhat more likely than others to think it would work very well.
- One of main reasons cited for the beeping signal’s perceived lack of effectiveness was that it could be easily ignored.
- Several participants pointed out that it sounded too much like other sounds already built into the car or sounds that surrounded them in general (e.g., cell phone).
- A few participants described the beeping signal as not irritating enough to get them to buckle up.

- There was some disagreement about the loudness of the signal, with a few participants saying that it was loud enough and others saying that it was too soft and would be drowned out by the radio or other noises in the car.
- One participant said that the beeping signal would work well but was not at all acceptable.
- Illustrative quotes:
 - *“Beeping would be easiest to ignore.”*
 - *“Too many beeps in the car – just another beep.”*
 - *“Beeping signal sounds like a cell phone so wouldn’t work at all.”*
 - *“Way too soft. I have my music so loud.”*
 - *“I have a car that beeps now and it doesn’t work well.”*

**Figure 23. Level 2 Beeping Signal Acceptability:
How Acceptable Would This System Be to Have in Your Car?**

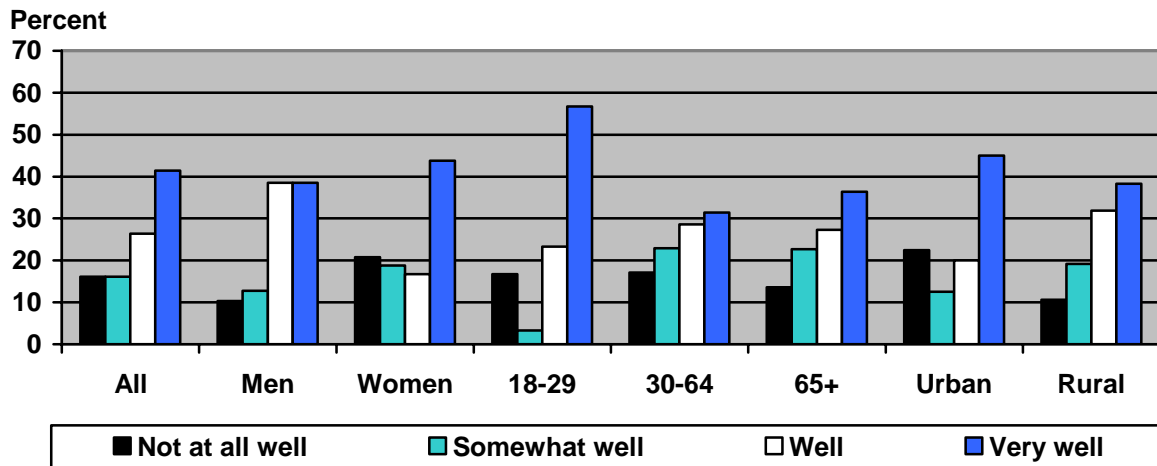


- Participants’ reactions relative to the acceptability of the beeping signal were more moderate than for the buzzer, with the most frequent responses being in the middle categories (acceptable or somewhat acceptable). Only among the youngest participants, did a clear majority think it would be somewhat or very acceptable.
- Unlike the buzzer, which participants tended to respond to without regard to the other options, the beeping signal tended to elicit comparisons. For example, several people said that the beeping signal was the least annoying of the four, or that it was more tolerable than the buzzer, or that it was the best of the group.
- While some participants did not seem to mind the beeping signal at all, others found it so objectionable that they reported they would try to disable it.

- A few participants mentioned that while the beeping signal was acceptable they did not know how well it would work to get them to buckle up.
- A few participants reported that they would not want any signal in their car, regardless of which one it was.
- Illustrative quotes:
 - *“Beeping was the least annoying.”*
 - *“Beeping was the least intrusive.”*
 - *“Beeping more tolerable.”*
 - *“I could live with the beeping.”*
 - *“I would be so annoyed with (it) that I would do something like rip out the fuse.”*
 - *I don’t want any of them in my car. It should be an option.”*

Effectiveness and Acceptability of Level 3 Sound Signals

Figure 24. Level 3 Buzzer Effectiveness:
How Well Would This System Work to Get You to Buckle Up?

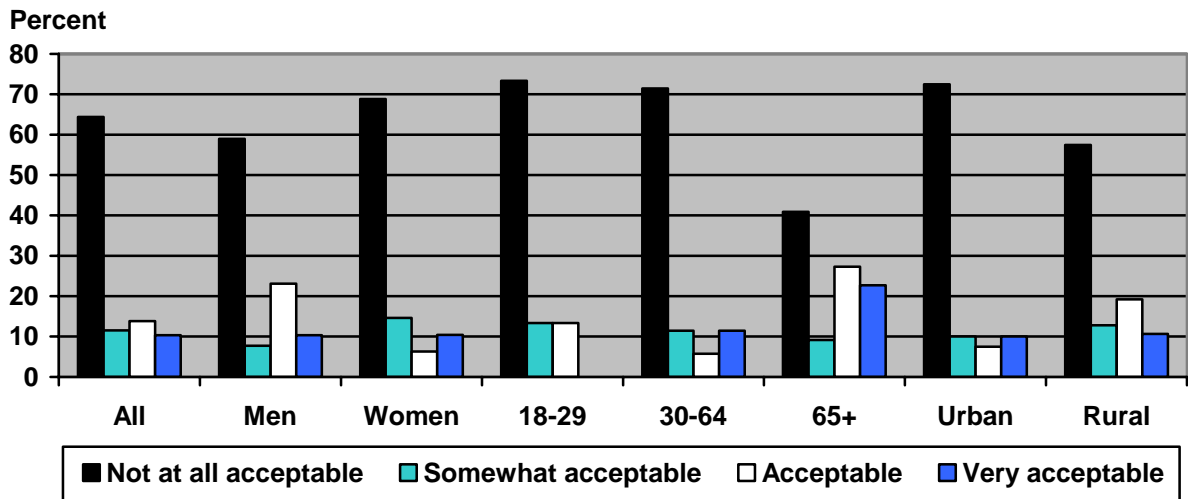


- The majority of participants thought that the buzzer would work well or very well to get them to buckle up. In fact, the most frequent response among almost every group was that it would work very well. The youngest participants were the most likely and those age 30-64 were the least likely to voice this opinion.
- The main reason given for the high effectiveness of the buzzer was that participants found the sound quite annoying. Because of this, opinions of high effectiveness generally went hand-in-hand with opinions of high

unacceptability. Some participants said they found the sound so offensive that they would rebel against wearing their belt, and others said they would not buy a car with the buzzer in it or would find a way to disable the buzzer.

- A few of the oldest participants, however, considered the buzzer to be a clear or authoritative sound, and one that they would welcome as a reminder.
- A few reported that no system would be effective if people did not want to buckle up.
- Illustrative quotes:
 - *“Buzzer would work well because it’s so annoying.”*
 - *“Buzzer sounds like an alarm so it would work.”*
 - *“I’d half kill myself just to get it to stop.”*
 - *“Buzzer would work very well because I’d be afraid of it coming on.”*
 - *“Buzzer wouldn’t work. I’d rebel. It’s offensive.”*
 - *“It was clear to me.”*
 - *“That’s exactly what I need because when I start, I forget.”*
 - *“This system is not going to get people to wear seat belts if the law doesn’t or crashing through the windshield doesn’t”*

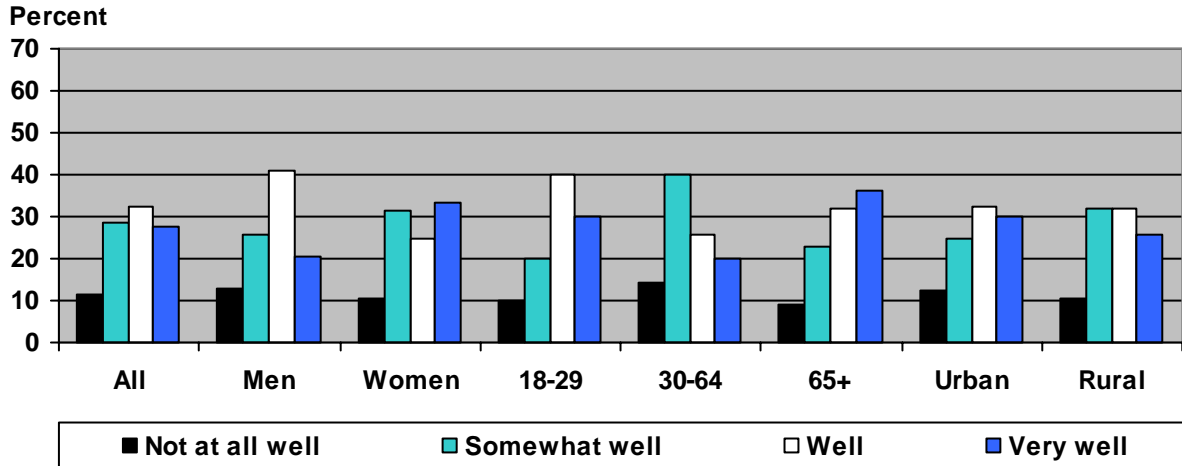
**Figure 25. Level 3 Buzzer Acceptability:
How Acceptable Would This System Be to Have in Your Car?**



- Similar to participants’ opinions about the Level 2 buzzer, a clear majority thought the Level 3 buzzer would not be at all acceptable to have in their car. Well over half of every subgroup expressed this view with the exception of the oldest participants, who were more likely than others to find the buzzer acceptable or very acceptable.

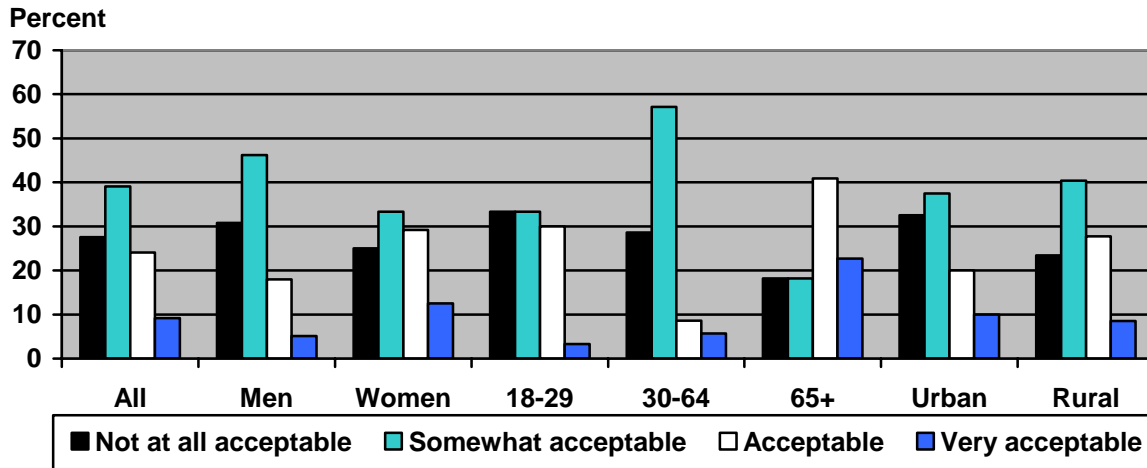
- The main qualities that made the buzzer unacceptable were that it was annoying and intrusive. It reminded many of an alarm system in a school or hospital – a sound that would evoke feelings of panic or anger in the car.
- Negative reactions to the buzzer often included strong language and emotions. That is, people who disliked the buzzer, really disliked it.
- Several participants mentioned that they would not buy a car with the buzzer in it or would find a way to defeat the system.
- For some participants, however, especially among the oldest, the buzzer was considered more acceptable than the beeping signal.
- Illustrative quotes:
 - *“Buzzer is really annoying and not acceptable.”*
 - *“Buzzer would cause major repair because I would tear things apart.”*
 - *“I’d be busy trying to figure out how to defeat it – not acceptable.”*
 - *“Reminds me of an alarm at school or the hospital. I would hate my car.”*
 - *“It would be like, where’s my hammer?”*
 - *“I wouldn’t buy the car.”*

**Figure 26. Level 3 Beeping Signal Effectiveness:
How Well Would This System Work to Get You to Buckle Up?**



- The Level 3 beeping signal was considered to be less effective than the buzzer for getting participants to buckle up, although more than half thought it would work well or very well. In every subgroup, participants were least likely to think it would not work at all well. Other patterns were not as clear. In general, perceived effectiveness was lowest among participants age 30-64 and highest among those age 65 and older.
- The main reason given by those who did not find the beeping signal effective was that it could be easily ignored.
- The main reason given by those who found it effective was that it was annoying to them and would make them want to buckle up to stop the noise.
- A few of the oldest participants mentioned that it would work well because it was clear and authoritative.
- Illustrative quotes:
 - *“Beeping I could ignore pretty easily.”*
 - *“Beeping not as effective because it’s just another noise.”*
 - *“Beeping is like any other beep in the car like the turn signal. I wouldn’t pay much attention.”*
 - *“Would work very well because (it’s) so annoying.”*
 - *“It would make me buckle up quick because I couldn’t stand it until I could find a way to snip the wire.”*
 - *“Beeping would work well because it’s clear and authoritative and acceptable.”*

**Figure 27. Level 3 Beeping Signal Acceptability:
How Acceptable Would This System Be to Have in Your Car?**

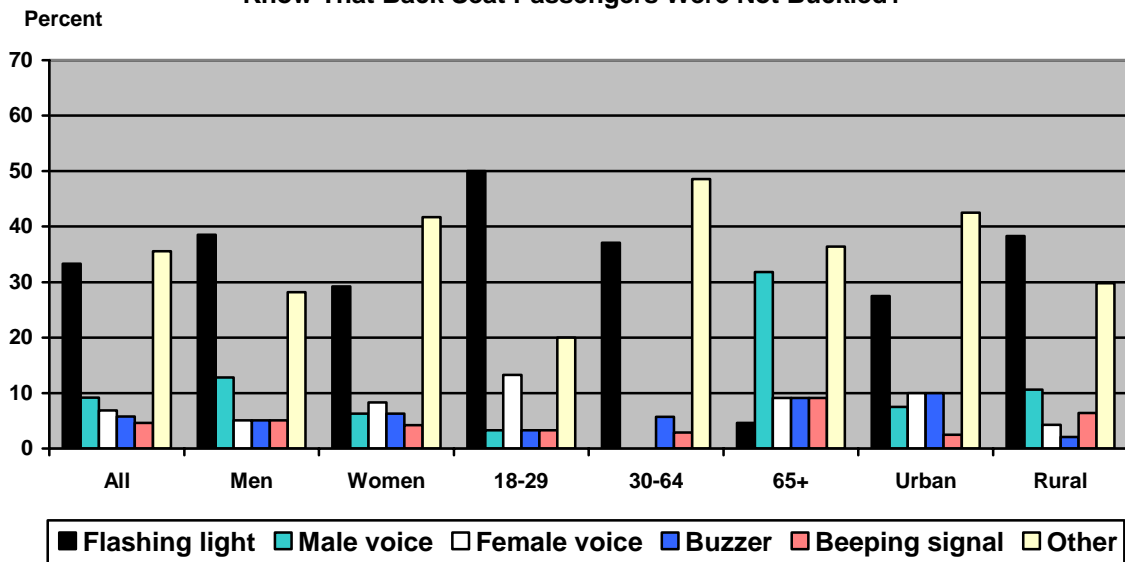


- Reactions to the acceptability of the Level 3 beeping signal were much more moderate than those to the Level 3 buzzer. Still, the majority of participants thought that the beeping signal would only be somewhat acceptable or not at all acceptable. Only among the oldest participants did substantial numbers voice the opinion that it would be very acceptable.
- Many who found the beeping to be more acceptable than the buzzer mentioned that it was less irritating or annoying. Others found the beeping signal to be acceptable because it was a familiar sound. However, not everyone agreed. Some found the beeping signal to be too loud or too long.
- A few participants objected to the idea of having any system in their car or at least having a Level 3 system.
- Illustrative quotes:
 - *“Beeping not as irritating.”*
 - *“Beeping sounded better to my ears.”*
 - *“Beeping more acceptable because I hear beeps all over.”*
 - *“The beeping is too long.”*
 - *“Loudness of the beeping is not very acceptable.”*
 - *“Buzzer and beeper not acceptable because if I didn’t do it on the first two times, why are you pushing me?”*
 - *“I don’t want anything beeping at me for 45 seconds. I’d find a way to dismantle it.”*

System to Alert Driver About Back Seat Passengers

Participants were asked “As a driver, what would you think about a system that let you know if back seat passengers were not buckled?” and “What kind of signal would you prefer?”

Figure 28. As a Driver, What Kind of Signal Would You Prefer to Let You Know That Back Seat Passengers Were Not Buckled?



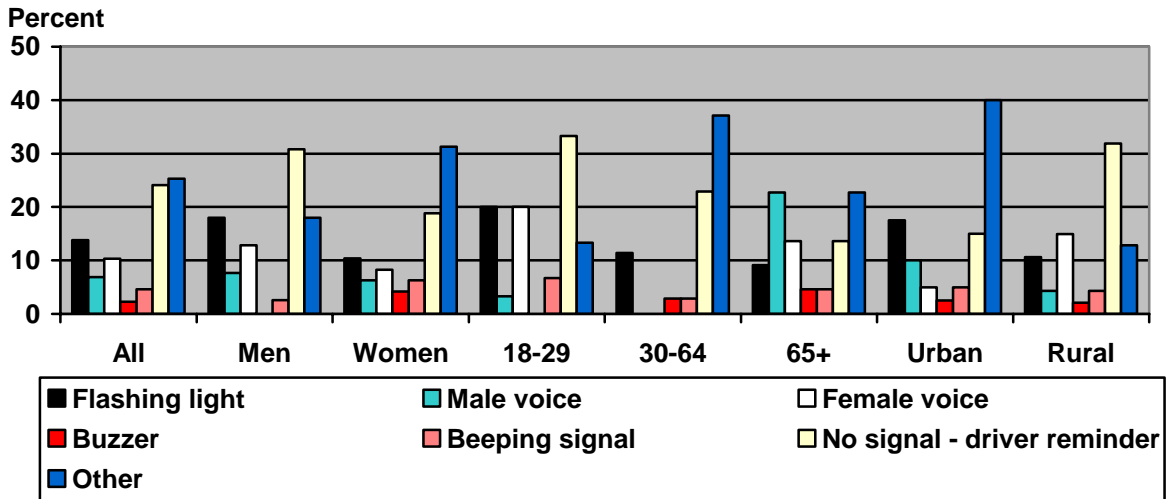
- Reactions to this system were mixed. Some participants opposed it, indicating they already had enough to worry about as the driver, or already knew who was belted and did not need a special system to tell them. Others (especially the oldest) gave it complete support, indicating that they were responsible for the passengers in their car and should know what was going on in the back seat. The most frequent reaction, however, was qualified support, with participants saying that they would like the system for children but not for adults who should be able to make their own choice. Some of the younger participants noted that they did not really care if their friends in the back seat were belted or not.
- The preferred signal of participants for letting them, as drivers, know about unbuckled back seat passengers was the flashing light, although about as many participants identified an option not on the list presented to them. These ‘other’ responses included: lighted diagram on dashboard to identify seating positions of unbuckled passengers (9); none (4); different system than front seat (3); non-flashing light (4); chime (3); voice (2); louder sound (1); or something that could be turned off for adult passengers (1).

- Illustrative quotes:
 - “More of a hazard if anything. There’s enough things a driver has to worry about.”
 - “I can hear the click of the belts so I don’t need a system to tell me.”
 - “I would welcome that. As a driver, I’m responsible for everyone being buckled up.”
 - “I guess if I had children, it would be a great system. For adults back there, that should be their choice.”
 - “I don’t care if my friends wear a seat belt, but if it’s a kid – depends who’s back there.”

System to Alert Back Seat Passengers Directly

Participants were asked “As a driver, what would you think about a system that reminded the back seat passengers directly to buckle up?” and “If you were the back seat passenger, what kind of signal would you prefer to remind you to buckle up?”

Figure 29. As a Back-Seat Passenger, What Kind of Signal Would You Prefer to Remind You to Buckle Up?



- Reactions to this system were also mixed. The strongest support came from the oldest participants, who liked the idea of having a neutral source remind their passengers to buckle up, although several noted that they rarely had back seat passengers. There was no clear pattern among the middle and youngest age groups. Several participants gave qualified support – indicating they would like the system if children were in the back seat or if there was an on/off switch. Others expressed moderate support, indicating it would be acceptable because of its intent to save lives. Those who opposed it offered various reasons including that it would not be helpful, it would be distracting, it

should be the responsibility of the driver, or conversely, people should take personal responsibility on their own.

- Participants' preference, as back seat passengers, for reminding them directly to buckle up was to have no signal, but instead to have the driver remind them, although large numbers of participants identified an option not on the list presented to them. These 'other' responses included: no signal (5); diagram showing the seating position of the unbuckled passenger (5); combination of sound and visual (2); choice of voices (2); non-flashing light (1); something that could be turned on and off (1).
- Illustrative quotes:
 - *"Better than informing the driver. You're not the bad guy making them (buckle up)."*
 - *"With my kids, maybe they'd take it better not coming from me."*
 - *"If I'm a driver, I don't want to worry about my friends. If I had kids I probably would."*
 - *"It's acceptable – just trying to save lives."*
 - *"If you had (it), it still falls to you if you get pulled over, you still have the responsibility."*
 - *"Where is personal responsibility here? Not enough people taking responsibility."*

Radio or Entertainment Center Interlock System

Participants were asked "What would you think about a system that would not let the car radio or entertainment center turn on if anyone in the car were unbuckled?"

- In general, there was not a lot of support for a radio or entertainment center interlock system. Many participants expressed strong opposition, with several reporting that they would find a way to circumvent the system or not buy a car with the system in it.
- A large number of participants pointed out a major limitation of the system – that is, it can only work for drivers who listen to the car radio while driving. Several participants, mostly in the older groups, reported that they rarely listen to the radio in the car, especially when passengers are present. These same older participants, however, thought that the system might work well to get young people to buckle up.
- A group of participants reported that the system might be effective in getting people, in general, to wear their safety belts, but that it would not be an acceptable system to have in their car.

- Others, mostly in the young age group, expressed concern about being able to sit comfortably in the car and listen to the radio when not actually driving on the road. For them, being comfortable meant being unbelted, something the system would not allow. Concern was also expressed by a few participants that they might become distracted if someone unbuckled during a trip and the radio suddenly stopped working.
- A few participants expressed strong support for a radio or entertainment center interlock system, saying that it was a good idea that they would accept. This opinion was not generally expressed by the youngest participants.
- Illustrative quotes:
 - *“I’d find a way around it –if you take away rights, people will find ways to get around it.”*
 - *“That’s like trying to control society. You can’t do that.”*
 - *“Wouldn’t work on me at all because if there’s anyone in my car, the radio is off because it makes it seem like I don’t care.”*
 - *“Maybe for young people it would work. It would be a good reminder.”*
 - *“Would work well to get people buckled, but not acceptable.”*
 - *“What about when you park to listen to the radio?”*
 - *“Spending all this money trying to get people to buckle up, why can’t they make cars that don’t break down?”*
 - *“I think that would work.”*
 - *“Excellent, we’re talking safety.”*

Ignition Interlock System

Participants were asked “Given that seat belt use is required by law, what would you think about a system that would not let the car start until everyone was buckled up?”

- For the most part, participants reacted negatively to the idea of an ignition interlock, with many reporting that it ‘went too far’ and others simply expressed dislike for the idea. Several said they would not buy a car with such a system or would find a way to disable it.
- A number of concerns were raised about an ignition interlock system including how the system would work in an emergency situation, when starting the car in winter to warm it up before driving, when using a remote starter, in circumstances when a seat belt was broken or could not be worn by someone in the car for some other reason, and in situations in which someone had to unbuckle during the trip.
- While several participants did respond positively to the system, many of the responses were qualified. For example, one thought the system should only

be used for drivers, another for front seat occupants, and two others for young people or old people. A few expressed the view that the system should be an option for car buyers.

- The most favorable reactions tended to come from participants in older age groups (65+), but not all older participants supported the ignition interlock, especially in the rural groups.
- Some participants viewed the ignition interlock system much more negatively than the radio interlock system because it meant a greater loss of freedom of choice. For others however, the ignition interlock system represented a fairer system because it seemed more democratic (i.e., everyone would be subject to it).
- Illustrative quotes:
 - *“That’s going too far. I’m really opinionated that wearing a seat belt should be a choice.”*
 - *“I wouldn’t buy it.”*
 - *“I’d use a bus.”*
 - *“It would make me wear my seat belt but I find it highly objectionable. I’d find a way to counteract it.”*
 - *“Good for teenagers or old people who forget, but I don’t need it.”*
 - *“You start a car in the winter to warm it up. How would that work?”*
 - *“Dangerous in an emergency.”*
 - *“I’m not crazy about it but I know it’s the right thing to do.”*
 - *“I think it’s an excellent idea, and it would be acceptable because everyone would be doing it. You have no choice.”*

Summary of focus group discussion results

- Main reasons for wearing a safety belt – safety, Michigan’s belt law, setting example for children in car, habit
- Main reasons for not wearing a safety belt - discomfort and inconvenience, lack of habit/forgetting, just driving short distance, low perceived crash risk
- Most commonly reported reasons for discomfort - safety belt cutting into neck, belt locking up or too tight across chest or body, roughness of belt material, tendency to wrinkle clothing, difficulty reaching buckle, twisting of belt
- Ideas for making belts more comfortable - make belt out of softer material or soften belt edges, add padding to belt to cushion neck and shoulder

- Nonuse of belts tends to be deliberate decision rather than simply forgetting; times when less likely to wear belt – short trips, lack of police presence, lower speeds, being in a hurry, traveling in someone else’s car or as a passenger
- Point in driving sequence when participants buckle up
 - About half buckle up before starting to drive
 - About half wait until they are actually driving to put on belt (half of this group waits until on patrolled roads)
 - Responses vary considerably across individuals and subgroups
 - Participants buckle up earlier with passengers present, where there is police presence, on long trips or in unfamiliar areas, in public places with other cars, in inclement weather, at night
- Reactions to current US requirement (Level 1 of sample reminder system)
 - For most, it works only somewhat well or not at all well to get them to buckle up because of signal’s short duration, ease with which it can be ignored, and low level of annoyance
 - For majority, it is acceptable or very acceptable to have in their car
- Reactions to Level 2 sound signals
 - For each signal - male voice, female voice, buzzer, and beeping signal – a majority think it would work only somewhat well or not at all well
 - Wide range of individual reactions to signals; similar reasons often given for both liking and not liking signals
 - Buzzer reported to be least acceptable signal, with people voicing strong negative views
 - Beeping signal somewhat more acceptable than male or female voice
 - Acceptability often linked to annoyance – the more annoying, the less acceptable
 - For many, acceptability and effectiveness inversely linked – the more acceptable, the less effective, and vice versa
- Reactions to Level 3 sound signals
 - For most, buzzer would work well or very well because of high level of annoyance associated with it
 - Beeping signal thought to be less effective because easier to ignore
 - Majority reported buzzer would not be at all acceptable; buzzer associated with strong negative reactions
 - Beeping signal more acceptable than buzzer but still thought to be only somewhat or not at all acceptable by majority

- Reactions to system to alert driver about back seat passengers
 - Mixed opinions, with support generally limited when children are in back seat
 - Preferred signals – flashing light and lighted diagram on dashboard to identify seating positions of unbuckled passengers

- Reactions to system to alert back seat passengers directly
 - Mixed opinions, with strongest support from oldest age group
 - Preferences for driver to remind passengers rather than signal or to have diagram visible to passengers that shows the seating position of unbuckled passenger

- Reactions to radio or entertainment center interlock system
 - General opposition to system, sometimes strong, with many finding the system unacceptable
 - Concern that system only works if people listen to radio
 - Oldest age group somewhat more supportive of system

- Reactions to ignition interlock system
 - For most part, negative reactions to system; many feel it goes too far
 - Concerns about how system would work in emergency situations when driver might need to move quickly or in circumstances when belt could not be worn by someone in car
 - Somewhat more favorable views from oldest age group, especially in urban setting

DISCUSSION AND CONCLUSIONS

This section contains our synthesis of the results from the entire study including the literature review, telephone survey, and focus groups. We attempt to bring together this accumulated knowledge to provide guidelines for the development of an optimal in-vehicle safety belt promotion system.

Principles for Optimal System Design

As discussed previously, the purpose of this project was to promote safety belt use in the US by gaining a better understanding of the effectiveness of current in-vehicle safety belt promotion systems, as well as to suggest appropriate system improvements. Toward this end, we conducted a nationwide telephone survey, a series of focus groups in Michigan, and a review of the literature. Based upon the literature review () and our own expertise, we derived seven principles for the development of an optimal safety belt reminder system:

1. The fulltime seat belt user should not notice the system.
2. It should be more difficult and cumbersome to cheat on the system than to use the safety belt.
3. Permanent disconnection of the system should be difficult.
4. The system should be reliable and have a long life.
5. Crash and injury risk should not be increased as a result of the system.
6. System design should be based on what is known about the effectiveness and acceptability of system types and elements.
7. System design should be compatible with the manufacturer's intended purpose/goals for the system.

Different Systems For Different Belt Users

Our results showed that the part-time belt users in the US fall into three broad, distinct categories when the reasons for part-time nonuse are considered: comfort/convenience, cognitive/personal, and low perceived risk. Full-time users, by virtue of their belt use pattern, form a fourth distinct group. Full-time nonusers, who are willing to face citations and higher injury levels in the event of a crash, form a distinct fifth belt use group. Thus, safety belt use behavior among people in different categories is motivated by different factors. We conclude, therefore, that optimal in-vehicle belt promotion technologies should target people in the different categories using different systems features and/or systems.

Level of Intrusiveness

In a recent publication by the Transportation Research Board (TRB, 2003), safety belt promotion technologies were described as varying along an intrusiveness dimension, with reminder systems at the low end of the intrusiveness scale and interlock systems at the high end of the scale. This concept, combined with the conclusions that different users should be targeted with different features and/or systems, led us to the conclusion that the optimal in-vehicle technology should

be adaptive in response to the type of belt user. A similar conclusion has been drawn by other researchers (TRB, 2003; Fildes, Fitzharris, Koppel, & Vulcan, 2002).

The conclusion that different belt use groups should be targeted with different features and/or systems and that the level of intrusiveness should be different depending upon the group, led to the development of Figure 30. The figure shows a continuum of intrusiveness, with low intrusiveness on the left and high on the right. We have placed each belt use group along the continuum, based on how we thought the intrusiveness of the system and/or features designed for each group would fall relative to each other. Note that the comfort/convenience part-time user group is not placed along the continuum. The most effective countermeasure for promoting belt use among this group is proper human factors and ergonomics research to enhance the comfort and convenience of belt use. Low on the continuum are the full-time users, while high on the continuum are the full-time nonusers. In the middle part of the continuum, we have first placed the cognitive/personal part-time user group, followed by the low-perceived-risk group. Thus, we propose that cognitive/personal part-time users need a less intrusive system for the effective promotion of belt use than those in the low perceived risk group.

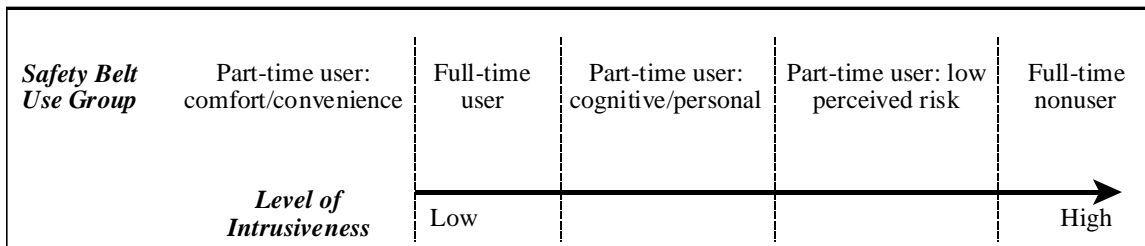


Figure 30: Safety belt use groups aligned in order of the relative level of system intrusiveness necessary to change behavior.

Effectiveness versus Acceptability

As previously discussed, the main thrust of the current research was to qualitatively determine which signals, signal presentation methods, and systems would be most likely to get a user to buckle up and would be acceptable to have in a vehicle. Effectiveness and acceptability, however, can be at odds with one another in belt promotion systems; that is, a highly intrusive system would be so unacceptable that even though the driver would be more likely use his or her belt to stop the annoyance, he or she would not want the system in the vehicle.

In order to maximize both effectiveness and acceptability, we developed effectiveness and acceptance criteria for each system feature and/or system to be targeted at each belt use group. These criteria are shown in Figure 31. Based upon Principle 1 for optimal system design, full time users, or those who

use their belt at the start of trip, should not notice the system; that is, the system goal is that it is invisible to the full-time user. For the part-time belt users for cognitive/personal reasons, a more intrusive system is needed. The goals of this system are to maximize both user acceptance and effectiveness. Such a system corresponds to what is currently called a *safety belt reminder system*. The part-time users who cite low perceived risk as the reason for nonuse, do not need reminding, but rather need a system that provides a great enough annoyance to get people to use their belt. For lack of a better term, we have called this type of system an *annoyance system*. Because the system would be designed to be unpleasant, the system goal here is to maximize effectiveness and minimize acceptance. If this system were acceptable, then it is not going to be annoying enough to change behavior. Finally, we have the hard-core full-time nonusers. Despite the fact that safety belt nonuse can result in a citation and greater injury in the event of a crash, these people have made the conscious decision to not buckle up. Therefore, we believe that only the most intrusive system, an *interlock system*, would be effective in getting these people to use a safety belt. As such, the system goal is simply to minimize acceptability.

<i>Intrusiveness</i>	➔			
<i>Safety Belt Use Group</i>	Full-time user	Part-time user: cognitive/personal	Part-time user: low perceived risk	Full-time nonuser
<i>System Goals</i>	System invisible to driver	Effectiveness and user acceptability are maximized	Effectiveness is maximized; acceptability is minimized	Acceptability is minimized
<i>Type of System Engaged</i>	No system engaged	Reminder system	Annoyance system	Interlock system

Figure 31: Types of systems and system goals necessary for effective and acceptable in-vehicle safety belt promotion technology.

Signal Type and Presentation Method

Following the framework depicted in Figure 31, the next step in developing an optimal in-vehicle belt promotion system is to determine which signals and signal presentation methods best meet the system goals for each belt use group. According to the first system design principle discussed previously, if a driver uses his or her belt, the in-vehicle belt promotion technology should be invisible. Therefore, there should be no signal presented to this group. This recommendation suggests that the current 4-8 second signal that is required in US vehicles be removed.

For the cognitive/personal part-time belt use group, our survey suggested that the signals that maximized effectiveness and acceptability were a flashing light and a voice message. During the focus group discussions, however, where actual voice messages were presented, it was clear that there were strong preferences for certain voices and strong dislikes for others. Having a single voice message, therefore, would be unacceptable for many users and would violate an important goal of the system for this belt use group. Many focus group participants suggested that they be allowed to input or select the voice used in this system. Since acceptance is an important criteria for this group, we extend this idea, and propose that the signal, whether it is a specific voice, light, buzzer, or chime, be selectable by the driver. The presentation method for the signal, on the other hand, must still maintain a moderate level of intrusiveness to be effective. An optimal delivery method would be selected most often by the cognitive/personal respondents as effective and acceptable, and least often as unacceptable. As seen in Figure 8, repeating at a constant interval scored high on both acceptability and effectiveness. Thus, based upon these results, we recommend that the signal delivery method for reminder systems should be one that repeats at a constant interval.

Moving along the intrusiveness continuum, the next system is the annoyance system targeted at those drivers who are part-time belt users due to low perceived risk. An optimal signal and delivery method for this group should optimize effectiveness and minimize acceptability. As shown in Figure 9, the buzzer scored fairly high on both effectiveness and unacceptability. The seat vibrator scored quite high on unacceptability but quite low on effectiveness. Based upon these survey results, the buzzer seems to be the best annoyance signal for getting a driver to buckle-up. Based on the finding in Figure 8, a signal that gets more intense the faster the vehicle travels scored high on both effectiveness and unacceptability. We conclude, therefore, that this would be the best signal delivery method for getting the low-risk-based part-time belt user to buckle up. Note that we did not describe the characteristics of how the intensity of the signal changes. There are three options that are open for further research: increasing frequency (decreasing the inter-signal-interval); increasing volume, and increasing pitch.

The final group to target are the full-time nonusers. This group is targeted with the most intrusive system, the interlock. The system goals for the interlock, are simply to maximize unacceptability—drivers should not like having the system engage. Here we do not consider effectiveness, because these drivers will either buckle up or go to the extreme measure of disconnecting the system. Figure 12 shows that the most unacceptable vehicle system to interlock with belt use is the radio/entertainment system. This is also the system that our respondents thought would be most effective. One must be careful, however, to design this system so that the driver is not surprised and potentially distracted trying to figure out why the entertainment system is not operating. Such a situation could increase the driver's chance of crashing, violating system design principle

number five. Therefore, we propose that the optimal delivery system provide a warning signal (not determined in this study) prior to engaging the interlock, so that the driver is aware that the interlock has turned off the entertainment system.

The recommendations for all safety belt user groups are summarized in Figure 32.


<i>Safety Belt Use Group</i>	<i>Intrusiveness</i> 			
	Full-time user	Part-time user: cognitive/personal	Part-time user: low perceived risk	Full-time nonuser
<i>System Goals</i>	System invisible to driver	Effectiveness and user acceptability are maximized	Effectiveness is maximized; acceptability is minimized	Acceptability is minimized
<i>Type of System Engaged</i>	No system engaged	Reminder system	Annoyance system	Interlock system
<i>System Signal Type</i>	No signal	User selected	Buzzer	Shut off entertainment system
<i>Signal Presentation Method</i>	No signal	Repeats at a constant interval	Intensity increases the faster the vehicle moves	A warning signal prior to interlock

Figure 32. Types of systems, system goals, signal, and signal presentation methods necessary for effective and acceptable in-vehicle safety belt promotion technology.

An Integrated and Adaptive Reminder System

The final issue in the development of an optimal in-vehicle safety belt promotion system, is how to integrate the various systems we have discussed. We propose the adaptive system depicted in Figure 33. The figure depicts an adaptive system that changes its characteristics as the trip proceeds either in time, distance, vehicle operation, or some other metric. The figure also shows for each period of the trip, the safety belt nonuse group that is targeted by the system, that group's primary reasons for nonuse of safety belts, the system that is activated, and the important characteristics of the countermeasure. Once a trip begins, the system would assume that the driver is a full-time user and does nothing. Thus, if the driver uses his or her safety belt, then the system is invisible to them. If, however, belts are not used within some period of time or distance traveled (or other metric), then the system assumes that the unbelted occupant has forgotten to use his or her safety belt. At this point, the reminder system is activated. As more time passes, or as a greater distance is traveled, if the driver

still does not use his or her safety belt, then the system assumes that the driver has chosen not to use a belt because of a low perceived risk of a crash or citation. At this point, the annoyance system is activated. Again, as more time or distance passes without the driver using his or her belt, at some point the system assumes that the driver is a full-time nonuser and an interlock system is activated, shutting off the entertainment system following the warning signal. If at any time during the trip, the buckled driver removes his or her belt, the sequence of events begins again.

The Choice of a Metric: The project did not gather definitive information about which metric is optimal or at which point along the metric the various systems should engage. We have provided three examples, based on our best judgment, the literature review, and comments from the focus group participants. In particular, during the focus groups, we discussed when during an average trip people buckle up (see Figure 13). We developed the first metric based on how people answered this question. When choosing a metric, it is important to keep in mind the principles of optimal system development, in particular the principle that states that safety should not be compromised. The most appropriate metric or combination of metrics should be the topic of further research.

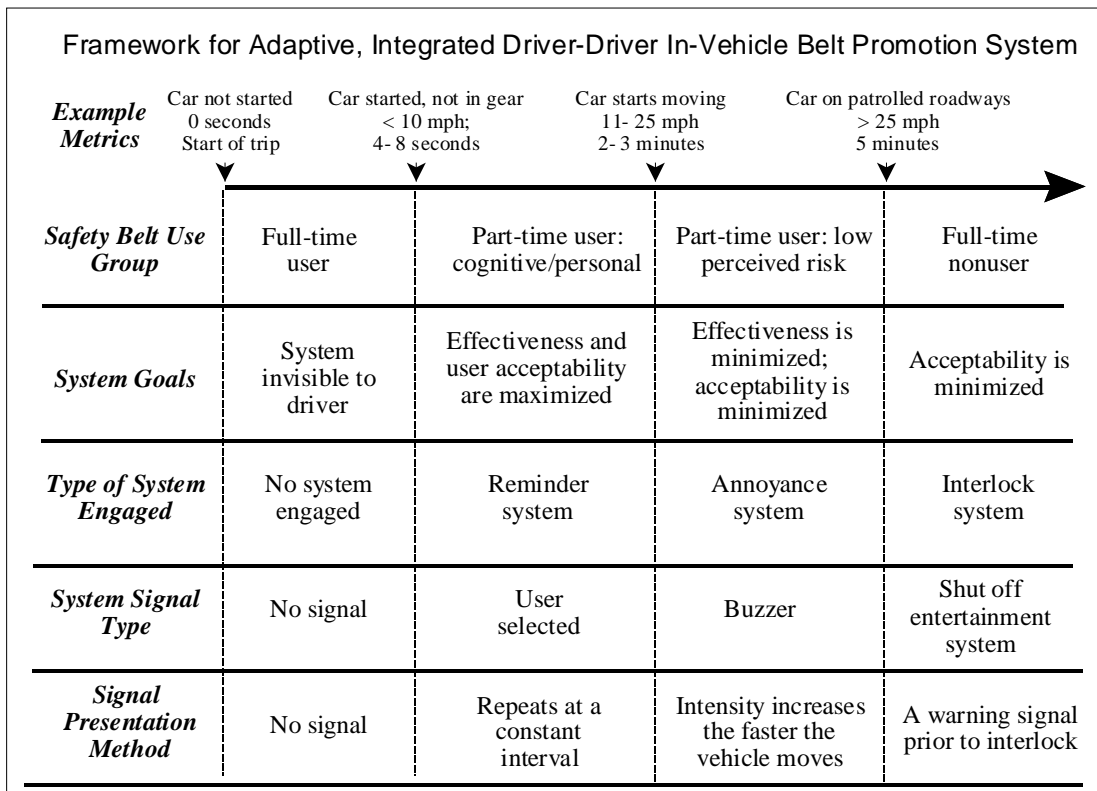


Figure 33: Framework for developing an integrated, adaptive driver-driver safety belt promotion system.

Other Reminder System Recommendations

The previous system design recommendations refer to a system designed to promote driver safety belt use (called driver-driver systems). This project, however, also investigated (in less detail) features of systems to inform the driver that a passenger is not using a safety belt (called driver-passenger systems) and to inform a passenger that he or she is not buckled (called passenger-passenger systems).

Driver-Passenger Systems: The intent of this system is let the driver know that a passenger is not using a safety belt. In most US jurisdictions, adult passengers in a vehicle are responsible for their own belt use and will receive the citation for nonuse. Non-adult passengers, on the other hand, are the responsibility of the driver who can be cited for violating the child passenger safety law, if a non-adult does not use a proper restraint. As such, the goal of a driver-passenger system is to inform the driver of passenger nonuse of belts, so that he or she can require and monitor passenger belt use. Because the driver may not have perceived authority over an adult passenger, we conclude that a driver-passenger system should include the reminder and interlock components, but not the annoyance component of the system described in Figure 33. The signal type indicated for driver-passenger systems in the survey that maximized effectiveness and acceptability was a flashing light on the dashboard (see Figures 5 and 8). In the focus groups, however, many participants suggested that the driver should be presented with a pictograph that shows the seating positions where passengers are not buckled. Combining these two ideas, we propose that the best signal and signal presentation method for a driver-passenger system is a seating-position pictograph that flashes at a constant interval.

Passenger-Passenger Systems: This type of system is designed to let passengers know that they are unbelted and encourages them to use their belt. As with driver-passenger systems, the passenger may be a child or adult. The large majority of focus group participants did not favor such a system, citing that the driver should tell the passenger. Therefore, as with the previous system, the annoyance system component should be omitted from a passenger-passenger system. Survey results showed that respondents thought the most effective signal for the reminder component of a passenger-passenger system would be either a buzzer or a voice message (see Figures 6 and 10). In the focus groups, however, these signals were strongly opposed (see Figure 29) in favor of either a flashing light or no signal at all. The survey did not investigate acceptability of various passenger-passenger system components, but the focus group suggest that the buzzer or voice would not be well received by vehicle owners. We propose, therefore, that the best signal and signal presentation method for a passenger-passenger system is a light or “unbelted” pictograph that flashes at a constant interval.

A Fully Integrated System

We have discussed three potential systems to promote safety belt use. These systems, however, would be most effective if they were integrated. Figure 34, shows the framework for a fully integrated system. This figure shows the sequence of signals, how they should be presented, and to whom, as the trip progresses. If the driver uses his or her belt, then the sequence for the driver stops. If the passenger uses his or her belt, then the sequence for the passenger stops. If either the driver or passenger unbuckles after having used the belt, the sequence will begin again for the person who unbuckles.

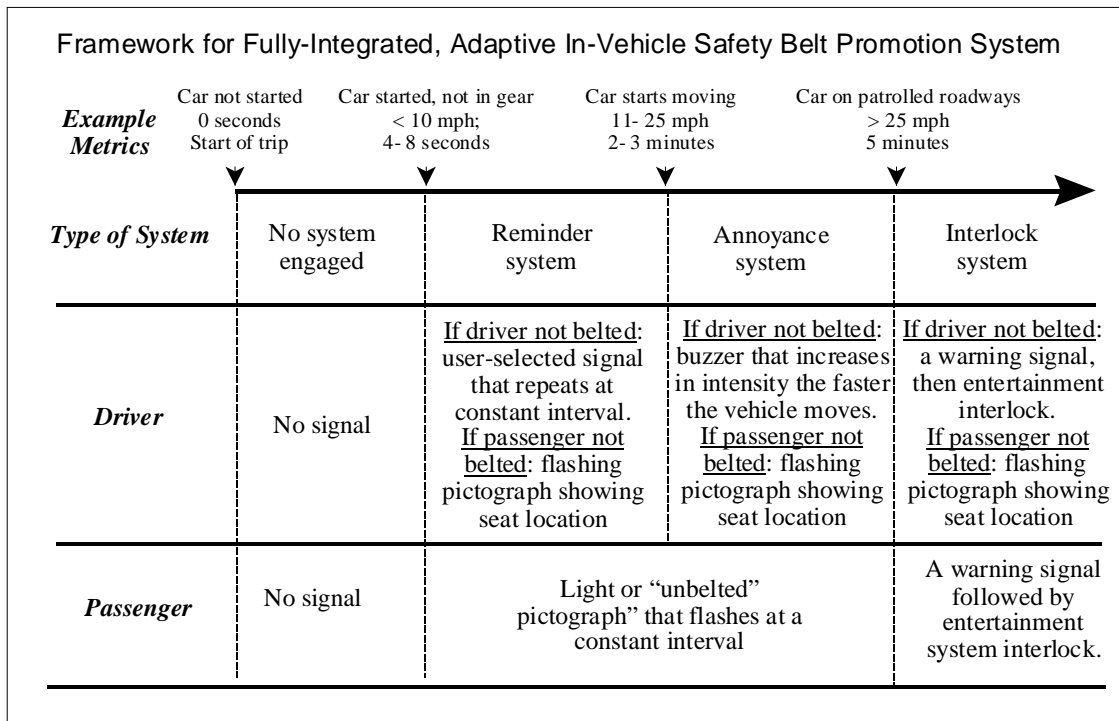


Figure 34: Framework for developing a fully-integrated, adaptive safety belt promotion system.

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APPENDIX A: The Telephone Survey Text

**The University of Michigan Transportation Research Institute
Social and Behavioral Analysis Division
National Survey of Part-Time Safety Belt Users
Job M030184**

The objective of this survey is to support development of effective vehicle-based countermeasures for promoting safety belt use. Specifically, this survey is to gather information on the amount of safety belt non use by seating position, reasons for safety belt non use, and perceived usefulness and acceptability of a set of countermeasure systems.

Survey topics and sections

- A. How often respondent is driver, passenger
- B. Questions about the last time respondent did not use safety belt
- C. Questions about respondent's general safety belt non-use as driver, passenger
- D. Questions to driver about belt use of his/her passengers
- E. Countermeasure attributes - Usefulness and acceptability
- F. Demographics

INTROA. Hello, my name is <INSERT INTERVIEWER'S NAME> from MORPACE International, calling on behalf of the University of Michigan. Your household has been selected randomly for a research study about seat belt use. We would appreciate your help in this study by participating in a voluntary 10-minute survey.

Are you 18 years of age or older?

(INTERVIEWER: IF NOT 18 YEARS OF AGE, ASK:
"May I talk to someone in your household who is 18 or older?"
When adult comes to phone, repeat introduction.)

- | | | |
|---|-----------------------------|----------------------------|
| 1 | Yes | (GO TO INTACONT) |
| 2 | Not ready/Adult unavailable | (SCHEDULE CALLBACK) |
| 3 | No, unwilling - terminate | (GO TO VTERM) |
| 8 | Don't Know | (GO TO ADULT_C) |
| 9 | Refused | (GO TO ADULT_C) |

(ASK IF INTROA>3)

ADULT_C. I am only allowed to interview individuals that are at least 18 years of age. Are you at least 18?

(INTERVIEWER: IF UNWILLING TO CONFIRM ELIGIBILITY, READ:
"Thank you for your time."
Then enter "2", which will terminate the interview.)

- | | | |
|---|----------------------------------|-------------------------|
| 1 | Yes | (GO TO INTACONT) |
| 2 | Unwilling to confirm eligibility | (TERMINATE) |

(ASK IF INTROA=1 OR ADULT_C=1)

INTACONT. We would like to ask you some questions about your attitudes toward and use of safety belts. We are also interested in your opinions about signs and devices in cars and trucks for promoting safety belt use.

All information received from you will be held confidentially to the extent provided by law and no identifying information will be released. Your participation in this 10-minute survey is entirely voluntary. You may terminate this interview at any time. Your help in this study will help save lives in traffic accidents.

Do you have any questions?

- | | | |
|---|------------------------------|----------------------------|
| 1 | Continue | (GO TO INTROB) |
| 2 | Not ready - need to callback | (SCHEDULE CALLBACK) |
| 3 | Unwilling - terminate | (GO TO VTERM) |

(ASK IF INTROA=3 OR INTACONT=3)

VTERM. Thank you for considering our request.
(TERMINATE)

(ASK IF TAKE2=1)

HHMEM2. (INTERVIEWER: ENTER "1" TO CONTINUE)

(ASK IF INTACONT=1 OR TAKE2=1)

INTROB. I'm going to be asking you some questions about how often you use your seat belt. I would like you to answer the questions thinking ONLY about times over the past year that you were traveling in a vehicle that had seat belts available.

SBUSEF. Which of the following best describes how often you use your seat belt when you are DRIVING?
(READ ANSWERS 1 TO 4 ONLY!)

(IF NEEDED: Time frame is the past year, last 12 months.)
(INTERVIEWER: If respondent always wears seat belt, except for a few moments at the very beginning or very end of a trip, select "1" (Always).)

- | | | |
|---|---------------------------|-------------------------|
| 1 | Always | (GO TO SBUSECK1) |
| 2 | Most of the time | (GO TO DEMG1) |
| 3 | Some of the time | (GO TO DEMG1) |
| 4 | Never | (GO TO SBUSEB) |
| 5 | (DO NOT READ) Don't drive | (GO TO SBUSEB) |
| 8 | Don't Know | (GO TO SBUSEB) |
| 9 | Refused | (GO TO SBUSEB) |

(ASK IF SBUSEF=1)

SBUSECK1. Has there been ANY time in the past year that you did not wear your seat belt when you were driving?

- 1 Yes
- 2 No

- 8 Don't Know
- 9 Refused

(ASK IF SBUSEF=1 OR SBUSEF>3)

SBUSEB. Which of the following best describes how often you use your seat belt when you're a PASSENGER?
(READ ANSWERS 1 TO 4 ONLY!)

(IF NEEDED: Can be as a passenger in the front or back seat.)

(IF NEEDED: Time frame is the past year, last 12 months.)

(INTERVIEWER: If respondent always wears seat belt, except for a few moments at the very beginning or very end of a trip, select "1" (Always).)

- 1 Always **(GO TO SBUSECK2)**
- 2 Most of the time **(GO TO DEMG1)**
- 3 Some of the time **(GO TO DEMG1)**
- 4 Never
- 5 (DO NOT READ) Never a passenger

- 8 Don't Know
- 9 Refused

(ASK IF SBUSEB=1)

SBUSECK2. Has there been ANY time in the past year that you did not wear your seat belt as a passenger, either in the front or the back seat?

- 1 Yes
- 2 No

- 8 Don't Know
- 9 Refused

(ASK IF HHMEM2 NE 1 AND SBUSEF NE 2 AND SBUSEF NE 3 AND SBUSEB NE 2 AND SBUSEB NE 3 AND SBUSECK1 NE 1 AND SBUSECK2 NE 1)

TAKE2. We have reached our quota of respondents meeting your profile. We are currently looking to interview individuals that wear their seat belt part of the time. Is there anyone living in your household, at least 18 years of age, who is a PART-TIME seat belt user?

(INTERVIEWER: If YES, have part-time seat belt user on the phone before proceeding. Schedule callback if necessary.)

- 1 Yes **(GO TO HHMEM2)**
- 2 No **(TERMINATE)**

- 8 Don't Know **(TERMINATE)**
- 9 Refused **(TERMINATE)**

(ASK IF TAKE2=1 AND SBUSEF NE 2 AND SBUSEF NE 3 AND SBUSEB NE 2 AND SBUSEB NE 3 AND SBUSECK1 NE 1 AND SBUSECK2 NE 1)

TERMSCR. We have reached our quota of respondents meeting your profile. Thank you for your time. **(TERMINATE)**

(ASK IF SBUSEF=2 OR SBUSEF=3 OR SBUSEB=2 OR SBUSEB=3 OR SBUSECK1=1 OR SBUSECK2=1)

DEMG1. (INTERVIEWER: RECORD GENDER, BY OBSERVATION.)

- 1 Male
- 2 Female

DEMG2. What is your age?
(RECORD AGE IN YEARS)

___ ___ ___ (PROGRAMMER: Allow 18 to 115.)

999 Refused

(ASK IF DEMG2=999)

DEMG2_A. Are you...?
(READ LIST, AS NEEDED)

- 01 18 to 24
- 02 25 to 34
- 03 35 to 44
- 04 45 to 54
- 05 55 to 64
- 06 65 to 74
- 07 75 or older
- 99 Refused

QA1. In the last year, HOW OFTEN did you DRIVE a car?
(READ LIST)

(IF NEEDED:
"By car, we mean a passenger car, van, SUV, or pick-up truck."
"This includes driving as part of your job.")

- 1 Almost every day
- 2 A few days a week
- 3 A few days a month
- 4 A few days a year
- 5 Never
- 8 Don't Know

9 Refused

QA2. In the last year, HOW OFTEN were you a PASSENGER in a car driven by someone else?

(READ LIST, IF NEEDED)

(IF NEEDED: "This includes driving in cars as part of your job, but does not include riding in taxis, shuttles, and other commercial transportation.")

- 1 Almost every day
- 2 A few days a week
- 3 A few days a month
- 4 A few days a year
- 5 Never **(GO TO QB1)**

- 8 Don't Know
- 9 Refused

(ASK IF QA2 NE 5)

QA3. In the last year, HOW OFTEN were you a PASSENGER in the BACK SEAT?
(READ LIST, IF NEEDED)

- 1 Almost every day
- 2 A few days a week
- 3 A few days a month
- 4 A few days a year
- 5 Never

- 8 Don't Know
- 9 Refused

QB1. Think of the LAST TIME you did NOT wear a seat belt, when one was available. When did this happen?
(READ ANSWERS 1 TO 5 ONLY!)

(IF NEEDED: "We are NOT interested in times when you did not have your belt on a few seconds at the very beginning or very end of the trip.")

- 01 Today
- 02 Within the past week
- 03 Within the past month
- 04 Within the last year
- 05 More than a year ago **(GO TO TERMSQR)**
- 06 (DO NOT READ) I can't remember exactly, but it was sometime last year
- 07 (DO NOT READ) I always wear my seat belt **(GO TO TERMSQR)**

- 98 Don't Know
- 99 Refused

(ASK IF QB1=5 OR QB1=7)

TERMSQR. We have reached our quota of respondents meeting your profile. Thank you for your time.
(TERMINATE)

(ASK IF QA2<5, ELSE GO TO QB3)

QB2. Where were you sitting?
(IF NEEDED:
"Where were you sitting the last time you did not wear your seat belt?"
"A third row of seats is considered a back row of seats.")
(DO NOT READ LIST. PROMPT, IF NEEDED.)

- 01 Driver's seat
- 02 Right front seat
- 03 Middle front seat
- 04 Left back seat
- 05 Middle back seat
- 06 Right back seat

- 98 Don't Know
- 99 Refused

QB3. What was the MAIN reason that you did NOT wear your seat belt on the trip?
(DO NOT READ LIST. SINGLE MENTION.)

- 001 I forgot.
- 002 I was distracted and forgot.
- 003 I was only going a short distance.
- 004 The traffic was light.
- 005 I was in a hurry (rush).
- 006 I did not want to get my clothes wrinkled.
- 007 The seat belt was uncomfortable.
- 008 No one in the car was wearing his/her seat belt.
- 009 My chance of being in a crash was very low.
- 010 The seat belt was interfering with what I was doing.
- 011 My mind was on other things.
- 012 I reached for something and had to unbuckle the belt.
- 013 My <BODY PART> hurts when reaching buckle.
- 014 I don't like it.
- 015 It's broken.
- 016 I'm in and out of the car a lot.
- 017 It's awkward to use/hard to reach.
- 018 I'm too big.
- 019 I'm too small.
- 020 It does not fit right.
- 021 The driver was a safe driver, so I did not need a seat belt.
- 022 I was in the back seat. It's safe, so I did not need a seat belt.
- 996 Other (Specify _____)

- 998 Don't Know
- 999 Refused

QB4A. Was there another reason?
(IF NEEDED: "Was there another reason you did NOT wear your seat belt on the trip?")

- 1 Yes
- 2 No (GO TO SECT_C)
- 8 Don't Know (GO TO SECT_C)
- 9 Refused (GO TO SECT_C)

(ASK IF QB4A=1)

QB4B. What was it?
 (IF NEEDED: "Why else did you NOT wear your seat belt on the trip?")
 (DO NOT READ LIST. SINGLE MENTION.)
 (PROGRAMMER NOTE: This is the same answer list as QB3.)

- 001 I forgot.
- 002 I was distracted and forgot.
- 003 I was only going a short distance.
- 004 The traffic was light.
- 005 I was in a hurry (rush).
- 006 I did not want to get my clothes wrinkled.
- 007 The seat belt was uncomfortable.
- 008 No one in the car was wearing his/her seat belt.
- 009 My chance of being in a crash was very low.
- 010 The seat belt was interfering with what I was doing.
- 011 My mind was on other things.
- 012 I reached for something and had to unbuckle the belt.
- 013 My <BODY PART> hurts when reaching buckle.
- 014 I don't like it.
- 015 It's broken.
- 016 I'm in and out of the car a lot.
- 017 It's awkward to use/hard to reach.
- 018 I'm too big.
- 019 I'm too small.
- 020 It does not fit right.
- 021 The driver was a safe driver, so I did not need a seat belt.
- 022 I was in the back seat. It's safe, so I did not need a seat belt.
- 996 Other (Specify _____)

- 998 Don't Know
- 999 Refused

SECT_C. We've been talking about the LAST time that you did not wear your seat belt.

(ASK IF QA1<5, ELSE GO TO QC5)

QC1. *If QB2=1 OR QA2=5:*
 Were there OTHER occasions in the last year when you did NOT wear your seat belt as the DRIVER of the car?
If QB2>1:
 Were there occasions in the last year when you did NOT wear your seat belt as the DRIVER of the car?

- 1 Yes
- 2 No (GO TO QC5)
- 8 Don't Know
- 9 Refused

(ASK IF QC1 NE 2)

QC2. About how often does this happen?
(IF NEEDED: "How often do you NOT wear your seat belt when you are the DRIVER?")
(INTERVIEWER: If respondent says "never", please back-up one question to change and confirm that answer as a "no", there were NOT occasions in the last year when you did NOT wear your seat belt as the driver.)
(READ LIST)

- 1 Always
- 2 Most of the time
- 3 Some of the time

- 8 Don't Know
- 9 Refused

QC3. What is the MAIN reason why that happens?
(IF NEEDED: "What is the main reason you do not always wear your seat belt while driving?")
(DO NOT READ LIST. SINGLE MENTION.)

- 001 I forget.
- 002 I am distracted and forget.
- 003 I am only going a short distance.
- 004 The traffic is light.
- 005 I am in a hurry (rush).
- 006 I do not want to get my clothes wrinkled.
- 007 The seat belt is uncomfortable.
- 008 No one in the car is wearing his/her seat belt.
- 009 My chance of being in a crash is very low.
- 010 The seat belt interferes with what I am doing.
- 011 My mind is on other things.
- 012 I reach for something and have to unbuckle the belt.
- 013 My <BODY PART> hurts when reaching buckle.
- 014 I don't like it.
- 015 It's broken.
- 016 I'm in and out of the car a lot.
- 017 It's awkward to use/hard to reach.
- 018 I'm too big.
- 019 I'm too small.
- 020 It does not fit right.
- 021 I'm a safe driver, so I do not need a seat belt.
- 996 Other (Specify _____)

- 998 Don't Know
- 999 Refused

QC4A. Is there another reason?
(IF NEEDED: "Is there another reason you do NOT always wear your seat belt when driving?")

- 1 Yes
- 2 No (GO TO QC5)

- 8 Don't Know (GO TO QC5)
- 9 Refused (GO TO QC5)

(ASK IF QC4A=1)

QC4B. What is it?
(IF NEEDED: "Why else do you NOT always wear your seat belt when driving?")
(DO NOT READ LIST. SINGLE MENTION.)
(PROGRAMMER NOTE: This is the same answer list as QC3.)

- 001 I forget.
- 002 I am distracted and forget.
- 003 I am only going a short distance.
- 004 The traffic is light.
- 005 I am in a hurry (rush).
- 006 I do not want to get my clothes wrinkled.
- 007 The seat belt is uncomfortable.
- 008 No one in the car is wearing his/her seat belt.
- 009 My chance of being in a crash is very low.
- 010 The seat belt interferes with what I am doing.
- 011 My mind is on other things.
- 012 I reach for something and have to unbuckle the belt.
- 013 My <BODY PART> hurts when reaching buckle.
- 014 I don't like it.
- 015 It's broken.
- 016 I'm in and out of the car a lot.
- 017 It's awkward to use/hard to reach.
- 018 I'm too big.
- 019 I'm too small.
- 020 It does not fit right.
- 021 I'm a safe driver, so I do not need a seat belt.
- 996 Other (Specify _____)

- 998 Don't Know
- 999 Refused

(ASK IF QA2<5, ELSE GO TO QC9)

QC5. *If QB2=2 OR QB2=3:*

Were there OTHER occasions in the last year when you did NOT wear your seat belt as a PASSENGER in the FRONT seat?

If QB2<2 OR QB2>3:

Were there occasions in the last year when you did NOT wear your seat belt as a PASSENGER in the FRONT seat?

- 1 Yes
- 2 No **(GO TO QC9)**
- 8 Don't Know
- 9 Refused

(ASK IF QC5 NE 2)

QC6. About how often does this happen?

(IF NEEDED: "How often do you NOT wear your seat belt when you are a PASSENGER in the FRONT SEAT?")

(INTERVIEWER: If respondent says "never", please back-up one question to change and confirm that answer as a "no", there were NOT occasions in the last year when you did NOT wear your seat belt as a front seat passenger.)

(READ LIST)

- 1 Always
- 2 Most of the time
- 3 Some of the time
- 8 Don't Know
- 9 Refused

QC7. What is the MAIN reason you do not buckle up?

(IF NEEDED: "What is the main reason why you do not always wear your seat belt while riding as a passenger in the front seat?")

(DO NOT READ LIST. SINGLE MENTION.)

- 001 I forget.
- 002 I am distracted and forget.
- 003 I am only going a short distance.
- 004 The traffic is light.
- 005 I am in a hurry (rush).
- 006 I do not want to get my clothes wrinkled.
- 007 The seat belt is uncomfortable.
- 008 No one in the car is wearing his/her seat belt.
- 009 My chance of being in a crash is very low.
- 010 The seat belt interferes with what I am doing.
- 011 My mind is on other things.
- 012 I reach for something and have to unbuckle the belt.
- 013 My <BODY PART> hurts when reaching buckle.
- 014 I don't like it.
- 015 It's broken.
- 016 I'm in and out of the car a lot.
- 017 It's awkward to use/hard to reach.
- 018 I'm too big.
- 019 I'm too small.

- 020 It does not fit right.
- 021 If the driver is a safe driver, I do not need a seat belt.
- 996 Other (Specify _____)

- 998 Don't Know
- 999 Refused

QC8A. Is there another reason?
 (IF NEEDED: "Is there another reason you do NOT always wear your seat belt when riding in the front seat?")

- 1 Yes **(GO TO QC8B)**
- 2 No

- 8 Don't Know
- 9 Refused

(ASK IF QC8A=1)

QC8B. What is it?
 (IF NEEDED: "Why else do you NOT always wear your seat belt when riding in the front seat?")
 (DO NOT READ LIST. SINGLE MENTION.)
 (PROGRAMMER NOTE: This is the same answer list as QC7.)

- 001 I forget.
- 002 I am distracted and forget.
- 003 I am only going a short distance.
- 004 The traffic is light.
- 005 I am in a hurry (rush).
- 006 I do not want to get my clothes wrinkled.
- 007 The seat belt is uncomfortable.
- 008 No one in the car is wearing his/her seat belt.
- 009 My chance of being in a crash is very low.
- 010 The seat belt interferes with what I am doing.
- 011 My mind is on other things.
- 012 I reach for something and have to unbuckle the belt.
- 013 My <BODY PART> hurts when reaching buckle.
- 014 I don't like it.
- 015 It's broken.
- 016 I'm in and out of the car a lot.
- 017 It's awkward to use/hard to reach.
- 018 I'm too big.
- 019 I'm too small.
- 020 It does not fit right.
- 021 If the driver is a safe driver, I do not need a seat belt.
- 996 Other (Specify _____)

- 998 Don't Know
- 999 Refused

(ASK IF QA2<5 AND QA3 NE 5, ELSE GO TO SECT_D)

QC9. *If QB2>3 AND QB2<7:*

Were there OTHER occasions in the last year when you did NOT use your seat belt as a PASSENGER in the BACK seat?

If QB2<4 OR QB2>6:

Were there occasions in the last year when you did NOT use your seat belt as a PASSENGER in the BACK seat?

- 1 Yes
- 2 No **(GO TO SECT_D)**
- 8 Don't Know
- 9 Refused

(ASK IF QC9 NE 2)

QC10. About how often does this happen?
(IF NEEDED: "How often do you NOT wear your seat belt when you are a PASSENGER in the BACK SEAT?")
(INTERVIEWER: If respondent says "never", please back-up one question to change and confirm that answer as a "no", there were NOT occasions in the last year when you did NOT wear your seat belt as a back seat passenger.)
(READ LIST)

- 1 Always
- 2 Most of the time
- 3 Some of the time
- 8 Don't Know
- 9 Refused

QC11. What is the MAIN reason that happens?
(IF NEEDED: "What is the main reason why you do not always wear your seat belt while riding as a passenger in the back seat?")
(DO NOT READ LIST. SINGLE MENTION.)

- 001 I forget.
- 002 I am distracted and forget.
- 003 I am only going a short distance.
- 004 The traffic is light.
- 005 I am in a hurry (rush).
- 006 I do not want to get my clothes wrinkled.
- 007 The seat belt is uncomfortable.
- 008 No one in the car is wearing his/her seat belt.
- 009 My chance of being in a crash is very low.
- 010 The seat belt interferes with what I am doing.
- 011 My mind is on other things.
- 012 I reach for something and have to unbuckle the belt.
- 013 My <BODY PART> hurts when reaching buckle.
- 014 I don't like it.
- 015 It's broken.
- 016 I'm in and out of the car a lot.
- 017 It's awkward to use/hard to reach.
- 018 I'm too big.
- 019 I'm too small.
- 020 It does not fit right.
- 021 If the driver is a safe driver, I do not need a seat belt.

- 022 The back seat is safe. I do not need a seat belt.
- 996 Other (Specify _____)

- 998 Don't Know
- 999 Refused

QC12A. Is there another reason?

(IF NEEDED: "Is there another reason you do NOT always wear your seat belt when riding in the back seat?")

- 1 Yes **(GO TO QC12B)**
- 2 No

- 8 Don't Know
- 9 Refused

(ASK IF QC12A=1)

QC12B.

What is it?

(IF NEEDED: "Why else do you NOT always wear your seat belt when riding in the back seat?")

(DO NOT READ LIST. SINGLE MENTION.)

(PROGRAMMER NOTE: This is the same answer list as QC11.)

- 001 I forget.
- 002 I am distracted and forget.
- 003 I am only going a short distance.
- 004 The traffic is light.
- 005 I am in a hurry (rush).
- 006 I do not want to get my clothes wrinkled.
- 007 The seat belt is uncomfortable.
- 008 No one in the car is wearing his/her seat belt.
- 009 My chance of being in a crash is very low.
- 010 The seat belt interferes with what I am doing.
- 011 My mind is on other things.
- 012 I reach for something and have to unbuckle the belt.
- 013 My <BODY PART> hurts when reaching buckle.
- 014 I don't like it.
- 015 It's broken.
- 016 I'm in and out of the car a lot.
- 017 It's awkward to use/hard to reach.
- 018 I'm too big.
- 019 I'm too small.
- 020 It does not fit right.
- 021 If the driver is a safe driver, I do not need a seat belt.
- 022 The back seat is safe. I do not need a seat belt.
- 996 Other (Specify _____)

- 998 Don't Know
- 999 Refused

(ASK IF QA1 NE 5. IF QA1=5, GO TO SECT_E.)

SECT_D. Now, I'll ask you some questions about when YOU are the DRIVER.

QD1. In the last year, have you driven a car in which ADULT PASSENGERS were NOT wearing seat belts?
(IF NEEDED: "ADULTS" are defined as those 16 years of age and older.)

- 1 Yes
- 2 No

- 8 Don't Know
- 9 Refused

QD2. How IMPORTANT is it to you, when you are driving, that ALL your adult passengers ARE WEARING their seat belts?
(IF NEEDED: "ADULTS" are defined as those 16 years of age and older.)
(READ LIST)

- 1 Very
- 2 Somewhat
- 3 A little
- 4 Not at all important

- 8 Don't Know
- 9 Refused

QD3. In the last year, have you driven a car in which CHILD PASSENGERS were NOT wearing seat belts or in child safety seats?
(IF NEEDED: "CHILDREN" are defined as those 15 years of age and younger.)

- 1 Yes
- 2 No

- 8 Don't Know
- 9 Refused

QD4. How IMPORTANT is it to you that ALL children are SAFELY RESTRAINED?
(IF NEEDED: "CHILDREN" are defined as those 15 years of age and younger.)
(READ LIST)

- 1 Very
 - 2 Somewhat
 - 3 A little
 - 4 Not at all important

 - 8 Don't Know
 - 9 Refused
-

(ASK IF QA1<5, ELSE GO TO E36)

SECT_E. Now I'm going to describe some systems that could be put into cars to encourage people to wear seat belts. I am interested in which are likely to get YOU to buckle up and which would be acceptable to you in your car. Assume that the systems will know when a person is in a seat.

QE1. Let's start with different signals that can be used to remind a person to buckle up. As a DRIVER, which would be the MOST likely to get YOU to buckle up? (READ ANSWERS 1 TO 6 ONLY!)

- 01 A warning label
- 02 A flashing light
- 03 A buzzer
- 04 A chime
- 05 A voice message
- 06 A seat vibrator that shakes the car seat
- 07 (DO NOT READ) All are equally likely
- 08 (DO NOT READ) None are likely to get me to buckle up

- 98 Don't Know
- 99 Refused

QE2. Which of the signals would be ACCEPTABLE in your car? Any others? (READ ANSWERS 1 TO 6 ONLY!) (MULTIPLE MENTION, UP TO 5)

- 01 A warning label
- 02 A flashing light
- 03 A buzzer
- 04 A chime
- 05 A voice message
- 06 A seat vibrator that shakes the car seat
- 07 (DO NOT READ) All are okay
- 08 (DO NOT READ) None of them

- 98 Don't Know
- 99 Refused

(ASK IF QE2 NE 7. IF QE2=7, GO TO QE33)

QE3A. Are there any that you would definitely NOT WANT in your car?

- 1 Yes
- 2 No **(GO TO QE33)**

- 8 Don't Know **(GO TO QE33)**
- 9 Refused **(GO TO QE33)**

(ASK IF QE3A=1)

QE3B. Which?
Any others?
(IF NEEDED: "Which of the signals would you definitely NOT WANT in your car?")
(READ LIST, IF NEEDED)
(MULTIPLE MENTION, UP TO 6)

- 01 A warning label
- 02 A flashing light
- 03 A buzzer
- 04 A chime
- 05 A voice message
- 06 A seat vibrator that shakes the car seat

- 98 Don't Know
- 99 Refused

QE33. As a DRIVER, which signal would you prefer to LET YOU KNOW that a PASSENGER is not buckled up?
(READ ANSWERS 1 TO 5 ONLY!)

- 01 A flashing light
- 02 A buzzer
- 03 A chime
- 04 A voice message
- 05 A seat vibrator that shakes your car seat
- 06 (DO NOT READ) All are okay
- 07 (DO NOT READ) None of them

- 98 Don't Know
- 99 Refused

QE34. Which of the signals would be ACCEPTABLE in your car to let you know that a passenger is not buckled up?
Any others?
(READ ANSWERS 1 TO 5 ONLY!)
(MULTIPLE MENTION, UP TO 4)

- 01 A flashing light
- 02 A buzzer
- 03 A chime
- 04 A voice message
- 05 A seat vibrator that shakes your car seat
- 06 (DO NOT READ) All are okay
- 07 (DO NOT READ) None of them

- 98 Don't Know
- 99 Refused

(ASK IF QE34 NE 6. IF QE34=6, GO TO QE36)

QE35A. Are there any that you would definitely NOT WANT in your car?

- 1 Yes **(GO TO QE35B)**
- 2 No

- 8 Don't Know
- 9 Refused

(ASK IF QE35A=1)

QE35B. Which?
Any others?
(IF NEEDED: "Which of the signals would you definitely NOT WANT in your car?")
(READ LIST, IF NEEDED)
(MULTIPLE MENTION, UP TO 5)

- 01 A flashing light
- 02 A buzzer
- 03 A chime
- 04 A voice message
- 05 A seat vibrator that shakes your car seat

- 98 Don't Know
- 99 Refused

(ASK IF QA1=5, ELSE GO TO QE36)

E36. Next I'll describe some systems that could be put into cars to encourage people to wear their seat belts. I am interested in which are likely to get YOU to buckle up. Assume that the systems will know when a person is in a seat. Let's start with the different signals that can be used to indicate a person is not buckled up.

QE36. As a PASSENGER, which would be MOST likely to get YOU to buckle up?
(READ ANSWERS 1 TO 6 ONLY!)

- 01 A warning label
- 02 A flashing light
- 03 A buzzer
- 04 A chime
- 05 A voice message
- 06 A seat vibrator that shakes your car seat
- 07 (DO NOT READ) All are equally likely
- 08 (DO NOT READ) None are likely to get me to buckle up

- 98 Don't Know
- 99 Refused

QE4. Imagine a seat-belt-unbuckled system with one of those signals. Which of the following would be MOST LIKELY to get YOU to buckle up?
(READ ANSWERS 1 TO 4 ONLY!)

- 01 The signal comes on for a few seconds when you're not buckled and does NOT come on again.
- 02 The signal comes on for a few seconds when you're not buckled and KEEPS REPEATING at random intervals until you buckle up.
- 03 The signal becomes more intense as the car goes FASTER, until you buckle up.
- 04 The signal becomes more intense as the car goes FARTHER, until you buckle up.
- 05 (DO NOT READ) All are equally likely
- 06 (DO NOT READ) None are likely to get me to buckle up

- 98 Don't Know
- 99 Refused

QE5. Which of these would be ACCEPTABLE in your car?
Any others?
(READ ANSWERS 1 TO 4 ONLY!)
(MULTIPLE MENTION, UP TO 3)

- 01 The signal comes on just ONCE
- 02 The signal REPEATS
- 03 The signal becomes more intense as the car goes FASTER
- 04 The signal becomes more intense as the car goes FARTHER
- 05 (DO NOT READ) All are okay
- 06 (DO NOT READ) None of them

- 98 Don't Know
- 99 Refused

(ASK IF QE5 NE 5. IF QE5=5, GO TO E7)

QE6A. Are there any that you would definitely NOT WANT in your car?

- 1 Yes **(GO TO QE6B)**
- 2 No

- 8 Don't Know
- 9 Refused

(ASK IF QE6A=1)

QE6B. Which?
Any others?
(IF NEEDED: "Which of the signals would you definitely NOT WANT in your car?")
(READ LIST, IF NEEDED)
(MULTIPLE MENTION, UP TO 4)

- 01 The signal comes on just ONCE
- 02 The signal REPEATS
- 03 The signal becomes more intense as the car goes FASTER

04 The signal becomes more intense as the car goes FARTHER

98 Don't Know

99 Refused

E7. Some systems can signal the DRIVER which person is not buckled up; others can signal only the UNBUCKLED PERSON directly; other systems can signal BOTH the DRIVER and the UNBUCKLED PERSON; and others can signal EVERYONE in the car that someone is unbuckled.

QE7. Assume that YOU are a PASSENGER. Which of the following would be MOST LIKELY to get YOU to buckle up? A system that signals...?
(READ ANSWERS 1 TO 4 ONLY!)

01 The driver

02 Only the unbuckled person

03 Both the driver and the unbuckled person

04 Everyone in the car

05 (DO NOT READ) All are equally likely

06 (DO NOT READ) None are likely to get me to buckle up

98 Don't Know

99 Refused

QE8. Now assume YOU are the DRIVER. Which system is MOST LIKELY to get YOU to buckle up? A system that signals...?
(READ ANSWERS 1 AND 2 ONLY!)

01 The driver

04 Everyone in the car

05 (DO NOT READ) Both are equally likely

06 (DO NOT READ) Neither is likely to get me to buckle up

98 Don't Know

99 Refused

QE9. Which of these would be ACCEPTABLE in your car? A system that signals...?
Any others from this list?
(READ ANSWERS 1 TO 4 ONLY!)
(MULTIPLE MENTION, UP TO 3)

01 The driver

02 Only the unbuckled person

03 Both the driver and the unbuckled person

04 Everyone in the car

05 (DO NOT READ) All are okay

06 (DO NOT READ) None of them

98 Don't Know

99 Refused

(ASK IF QE9 NE 5. IF QE9=5, GO TO QE11)

QE10A. Are there any that you would definitely NOT WANT in your car?

- 1 Yes **(GO TO QE10B)**
- 2 No

- 8 Don't Know
- 9 Refused

(ASK IF QE10A=1)

QE10B. Which? A system that signals...?

Any others from this list?

(IF NEEDED: "Which of the systems would you definitely NOT WANT in your car? A system that signals...?")

(READ LIST, IF NEEDED)

(MULTIPLE MENTION, UP TO 4)

- 01 The driver
- 02 Only the unbuckled person
- 03 Both the driver and the unbuckled person
- 04 Everyone in the car

- 98 Don't Know
- 99 Refused

QE11. Suppose that certain other systems in your car would not work unless everyone is buckled up. Which of the following would be MOST LIKELY to get YOU to buckle up? A system that disables...?
(READ ANSWERS 1 TO 3 ONLY!)

- 01 The radio and entertainment
- 02 The heating and cooling
- 03 The cell phone
- 04 (DO NOT READ) All are equally likely
- 05 (DO NOT READ) None are likely to get me to buckle up

- 98 Don't Know
- 99 Refused

QE12. Which of the three would be ACCEPTABLE in your car? A system that disables ...?
Would any other of these three be acceptable?
(READ ANSWERS 1 TO 3 ONLY!)
(MULTIPLE MENTION, UP TO 2)

- 01 The radio and entertainment
- 02 The heating and cooling
- 03 The cell phone
- 04 (DO NOT READ) All are okay
- 05 (DO NOT READ) None of them

- 98 Don't Know
- 99 Refused

(ASK IF QE12 NE 4. IF QE12=4, GO TO QE14)

QE13A. Are there any of these three that you would definitely NOT WANT in your car?

- 1 Yes **(GO TO QE13B)**
- 2 No

- 8 Don't Know
- 9 Refused

(ASK IF QE13A=1)

QE13B. Which? A system that disables ...?
(IF NEEDED: "Which of the systems would you definitely NOT WANT in your car?")
(READ LIST, IF NEEDED)
(MULTIPLE MENTION, UP TO 3)

- 01 The radio and entertainment
- 02 The heating and cooling
- 03 The cell phone

- 98 Don't Know
- 99 Refused

QE14. If such systems were developed, do you think they should work only if the DRIVER is not buckled up OR if ANYONE in the car is not buckled up?
(DO NOT READ LIST)

- 1 Just the driver
- 2 Anyone

- 8 Don't Know
- 9 Refused

SECT_F. Now I need to ask you for some basic information about yourself for statistical purposes.

QF1. What is the HIGHEST grade or year of school you completed?
(READ LIST, IF NEEDED)

- 01 8th grade or less
- 02 Some high school
- 03 High school or GED
- 04 Technical or trade school
- 05 Some college
- 06 College graduate or higher

- 98 Don't Know
- 99 Refused

QF2. Do you have any CHILDREN UNDER AGE 15 living in YOUR household?

- 1 Yes
- 2 No

- 8 Don't Know
- 9 Refused

END. These are all the questions I have. For more information about this study, you may contact Dr. Eby at the University of Michigan at 734-764-2466. If you have any questions or concerns about your rights as a research subject, you may also contact the Medical Institutional Review Board at the University of Michigan Hospitals and Health Systems, at 734-763-4768. Thank you for your time.

APPENDIX B

Tables B-1 and B-2 show the proportions of households by region and population density category in the original national RRD sample, as well as the number of completed interviews, and the weights needed to have the survey be nationally representative.

Table B-1
Region

Region*	Nationally Representative percentage	Number of Completed Interviews	Weight
Northeast	20.34	222	1.0090
Midwest	22.16	328	0.7439
South	36.00	353	1.1217
West	20.85	187	1.2246
Alaska/Hawaii	0.65	10	0.700
Total	100.00	1,100	

Table B-2
Population Density

Population Density	Nationally Representative percentage	Number of Completed Interviews	Weight
In City Center of MSA	34.71	353	1.0822
Outside City Center of MSA	19.44	200	1.0700
Suburban County of MSA	22.11	230	1.0565
In MSA without City Center	4.94	47	1.1489
Not in an MSA	18.81	270	0.7667
Total	100.00	1,100	

**US Census population density categories

*States in Regions

Region	States
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
Midwest	Illinois, Iowa, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin
South	Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia
West	Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming
Alaska/Hawaii	Alaska, Hawaii