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A Focus Group Study of Automated Highway Systems and Related Technologies

Youngbin Yim

**California PATH Working Paper
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June 1997

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ABSTRACT

The paper presents the findings of a focus group study of the automated highway system and its related technologies, specifically adaptive cruise control and collision avoidance systems, in the **San** Francisco Bay Area. A majority of the participants had a favorable reaction to AHS despite the fact that almost all were concerned about its safety and funding capability. Responses to the adaptive cruise control were generally positive. The focus group participants recognized the safety benefits, the convenience, and especially the stress reduction of using the automated highway system, when comparing it to the collision avoidance system.

Keywords: automation adaptive cruise control system vehicle

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EXECUTIVE SUMMARY

During the week of May 13, 1996, six focus group meetings were held in the San Francisco Bay Area to investigate consumer response to the automated highway system (AHS) and its related technologies, the adaptive cruise control (ACC) and collision avoidance system (CAS). The focus group study was aimed at an understanding of Bay Area consumer attitudes toward various stages of AHS technology deployment. Since the AHS is relatively unknown to most consumers, the study was designed to guide participants through the process of the technology deployment by introducing the familiar system, ACC, first, following through with CAS and, finally, with AHS. Participants were asked to share their freeway driving experiences and then to react to ACC, CAS and AHS technologies. The issues covered in the focus group study were: 1) willingness to use and pay for these technologies; 2) perceived benefits of each system, and 3) concerns about the system from the user perspective.

Two group meetings per night were held on three consecutive nights: May 14 in South San Francisco, May 15 in Walnut Creek, and May 16 in Sunnyvale. Groups were segregated by age and income, and were recruited from lists compiled by the focus group facilitators. Two groups were comprised of ages under 35, two groups were ages between 36-55, and two groups were ages over 56. Participants were paid incentive fees of \$40 for participation in the study.

The focus group meetings were moderated by GLS Research, a market research consulting firm, and the summary findings were prepared in collaboration with the moderator. The PATH project leader and Caltrans project administrators attended all six focus group meetings.

Key Findings

In general, a majority of the participants had a favorable reaction to AHS despite the fact that almost all expressed concerns about its safety and feasibility, including the availability of funding and potential institutional barriers. No doubt, in their minds AHS is technically

doable. The benefits of the system to the users are, clearly, improved safety, enhanced convenience, and especially reduction in stress. Their concerns about AHS were mostly associated with emergency situations as when the system breaks down or in the event of an earthquake.

ACC and AHS were more favorably perceived by the participants than was CAS. They saw CAS as less safe and felt uncomfortable using it on a freeway where there are reckless drivers. Their worry about CAS focused on its possible inability to respond quickly to other vehicles in emergency situations. AHS is more appealing because they felt that they were safer when all vehicles are operating in a totally controlled environment.

Attitudes toward the AHS seemed to vary by age and driving experience. Surprisingly, the older people (over 55) were more enthusiastic about the technology than were the younger people, under 35. We expected that the younger age group would be more receptive to the system as they are more familiar with emerging technologies. The study however found that younger people expressed less enthusiasm, less trust in the technology, and were less willing to give up their customary driving experience. For the youngest people, ages under 25, these technologies restrict their freedom: driving gives them a sense of being in control, not only of the car, but also of their personal destinies. Automated transportation systems were seen as threatening to this sense of control.

Older people, on the contrary, saw the system as a way of compensating for their own deteriorating driving skills, especially on long journeys. They seemed to trust the technology and looked at freeway automation in a positive light. Commuters generally responded positively, while those who do not frequently drive on freeways saw little need for such a capital intensive automated system.

1. Freeway Driving Experience

Most people felt that driving conditions in the Bay Area have worsened noticeably in the last few years, especially as a result of the post-earthquake highway construction but also because of an increase in traffic congestion and a decrease in driving standards. All participants were annoyed by other drivers' lack of courtesy and irritated by the disorder on the freeways.

Participants in all focus groups mentioned instances of drivers talking on the phone, putting on makeup, or combing their hair rather than paying attention to the road. As a result, they felt a loss of control in their driving and a sense that their safety was compromised by the growing number of poor drivers on the road.

2. Adaptive Cruise Control

Responses to the ACC were generally positive but those who routinely use cruise control and particularly those who are high mileage drivers expressed greater enthusiasm than the participants who do not currently have cruise control. Some of the low mileage drivers found little value in it.

Close to half the participants said that they would use the ACC. Most younger age groups, 20-35, were divided about 2 to 1 against it but the groups of seniors were strongly in favor of the ACC. The middle age group was divided almost evenly.

Older people who routinely use cruise control generally liked the idea because they saw it as an opportunity to make driving safer and more convenient, especially when they encountered poor visibility in fog or at night. Another important benefit of the ACC is making cruise control easier to operate. Many drivers complained about having to constantly set and reset cruise control on long drives and when they encounter cars going at different speeds.

In general, participants saw ACC as most appropriate for long journeys on relatively uncongested stretches of freeway. Participants who liked this technology were willing to pay between \$250 and \$500 for it, with a few who were willing to pay up to \$1,000.

Most of the younger participants, particularly ages under 30, expressed concern about giving up control of their car to a computer. Some participants were worried not only about breakdowns but also about the capability of the computer to properly control speed with respect to other vehicles. In several groups, participants expressed concerns about the possibility of a car ahead stopping suddenly while a car behind continued to accelerate. Another problem several people foresaw, was potential failure of computer-controlled braking in icy conditions.

3. Collision Avoidance System

Responses were in general far more negative regarding the CAS, due mostly to the fact that the computer is taking over the steering of the car from the driver. Most people, however, liked the warning system by itself. Older people, in particular, saw the system as a way to compensate for poor visibility or brake lights being out or in other situation their own judgment might be faulty. They also liked it better as a back-up system, one that kicks in only if the driver **does** not react in time to a crisis situation.

The estimated cost for this system was higher than for the ACC, with most people guessing in the \$1,000 to \$2,000 range.

4. Automated Highway System

Most of the respondents reacted favorably to the AHS; even those who said they would not use it felt more comfortable with the AHS than with the CAS. AHS lanes dedicated solely to automated vehicles made it easier for them to accept freeway automation. What participants liked about the AHS compared to the other technologies is that by its being kept in a separate lane, there was a reduction in potential risks associated with complex situations that a

computer can not handle. It is crucial that in any demonstration, a physical barrier be in place separating the AHS lane from conventional traffic.

As compared to the **CAS**, people clearly recognized the safety benefits, the convenience, and especially the reduction in stress. Many said that it would allow them to get other things done while traveling, such as reading and grooming.

The focus groups suggested that men and older people were more open to the AHS than were women and younger people. Women appeared to be more concerned about giving up control to the computer, while the young, under 30, seemed to see less need for the system and were less trusting of the technology.

The reasons quoted were that the older generation have seen many improvements in technology; they have experienced positive changes as a result of technology while the younger generation has only their limited experience with technology. Young people work routinely with computers and have seen the bugs and crashes, older people have less experience with computers and are more willing to trust scientists and the government on such matters. Moreover, older people are more willing to make communal investments to benefit future generations. Some of the elderly participants indicated that they would support the AHS by their taxes even though they will not have the experience of using it in their lifetime. Most of the elderly participants said they would use the AHS if it were available now.

People who liked the AHS were willing to pay substantial amounts for the technology, with figures offered in the \$2,000 to \$5,000 range, and one frequent commuter was willing to pay up **to \$20,000** for it.

Several groups compared the AHS to BART and noted that AHS permitted privacy, which they valued highly. Participants also debated the wisdom of letting people take control back from the computer in an emergency and while most recognized the danger of a manual

override under normal circumstances, they also said that they would feel more comfortable if they knew they could take over in the event of a system failure.

Other specific concerns included: 1) the question about AHS entry and about existing facilities, especially how cars would get off the system and the fear of falling asleep and ending **up** miles away from the intended destination, 2) earthquakes or other system-wide disasters, **3)** individual cars breaking down and wreaking havoc with the system, and **4)** individual cars performing differently and the system not being able to compensate for the differences.

Among buying, leasing, or renting automated vehicles, those most hesitant about the system said they might rent it to try it out, while proponents almost universally said they would buy it. The rejection of leasing was clearly the result of lack of familiarity with leasing and had nothing to do with the AHS.

People wanted to see proof that the system works as described; they were not willing to take the word of either the government or the private sector on this matter. Consumer Reports was mentioned in every group as a credible, independent source of information, and the AAA was also mentioned frequently. Participants said that university research reports and government documents usually take too long to reach consumers and by the time they get hold of the reports, the information is often outdated.

People want to see this system in place somewhere else before trying it themselves. Several mentioned that they would not buy a new model car or an automated vehicle until the bugs are worked out.

1. INTRODUCTION

Recent Automated Highway Systems (AHS) research has demonstrated that the integration of AHS concepts into the California freeway infrastructure is technically feasible (Yim, et al, 1995). These concepts, however, have not been tested with consumer groups. A knowledge of consumer needs and concerns is essential to AHS product development and technology deployment. To investigate consumer response to AHS and its related technologies, six focus group meetings were held in the San Francisco Bay *Area* during the third week of May 1996. The paper presents the key findings of these focus group meetings. The present study is aimed at an understanding of consumer attitudes toward AHS in various stages of its development and deployment. The goal of the study is to gain insight into consumer acceptance of these technologies by examining attitudes of a wide cross section of the Bay Area population.

Consumer research to date on the subject of *AHS* and related Advanced Vehicle Control System technologies has included focus group discussions on Adaptive Cruise Control (ACC) and Collision Avoidance Systems (CAS). Recent focus group studies of AHS technologies have dealt with environmental and technical issues among stakeholders but have not addressed consumer aspects of AHS deployment (Horan, et al, 1995). The broad issue of AHS deployment is whether there will be enough demand for the technology to make it economically viable. But the important methodological issues are whether it is possible to realistically estimate a market potential for a largely conceptual technology that is yet to be fully developed and tested, and how to define the targeted users of future generations whose attitudes, life styles, and demographic characteristics are virtually unknown.

Recently, computer aided market research tools, such as virtual reality (the ability to create a future environment in *AHS*) or Information Acceleration (interactive user survey) have been developed to deal more effectively with the future market conditions of emerging technologies. However, the effectiveness of these techniques is yet to be validated. In this study, the focus group method was used because qualitative assessments of consumer attitudes are most practical

considering the present state of the technology, and the concerns of different generations *can be assessed* from focus group discussions, whether they are actual users of **AHS**.

The objectives of the present study are to identify perceptions of and concerns about automated highway systems from the user perspective and to assess consumer attitudes toward *AHS* and its related **AVCS** technologies, specifically toward **ACC** and **CAS**. Since the **AHS** is relatively unknown to most consumers, the focus group study was designed to guide participants through successive stages of technology deployment by introducing the familiar system, **ACC**, first, following through with **CAS** and finally with **AHS**. Participants were asked to share their freeway driving experiences first and then to react to **ACC**, **CAS** and **AHS** technologies. The issues covered in the focus group study were: 1) willingness to use and pay for these technologies; 2) perceived benefits of each system, and 3) concerns about the system from the user perspective.

The paper begins with previous research on this topic followed by the method used in the focus group meetings and the findings of the study.

2. PREVIOUS STUDIES

While there has been a great deal of research on **AHS** and **AVCS** design concepts, little has been done to explore the consumer acceptance of these technologies. Previous studies of experts' opinions and vanpool riders are close but they do not deal explicitly with consumer perceptions of automated highway systems. According to the University of Michigan study, experts believe that consumers will eventually become receptive to **AHS** when traffic congestion becomes intolerable (Underwood et al, 1990). The greatest benefit of **AHS** is expected to be travel time savings although other benefits could include driver safety and stress reduction if **AHS** is completely reliable. The probable adverse impacts of **AHS** would include inefficient operations during the transition from conventional highways to **AHS** and major changes in the trucking industry, including less need for **truck** drivers. Land-use patterns could also be affected by **AHS** if the technology fosters a significant increase in throughput and if interurban trips are made via **AHS** instead of by short air travel. The major barriers to **AHS** deployment would be the technical

reliability of the system, trusted system design, liability and cost. Technical obstacles could include the necessary advancements in sensing, information integration, and vehicle control systems.

The study of experts' opinion on AHS conducted by the University of California at Berkeley found that the key areas of concern with AHS are increased automobile travel, further urban sprawl, and the environmental impacts on aesthetics, safety under seismic hazards, and freeway noise (Miller, 1995).

On ACC and CAS, a driver experiment was conducted using 20 subjects in Germany (Haugen, 1993). The experiment found that the ACC system positively affected motorists' driving behavior; their driving was calmer, smoother and less aggressive and they were willing to drive within a more limited speed range, instead of at typical high Autobahn speeds. Regarding safety, drivers felt at ease and safe.

A focus group study on ACC and CAS conducted among two user groups, avid and less frequent users of cruise control in Santa Clara county south of San Francisco, revealed that avid users are not likely candidates for early technology adopters since their interest is driving efficiency rather than safety or convenience. Infrequent users are more likely the target for early adoption of CAS since they value the importance of the emergency assistance offered by CAS to compensate for their driving inefficiency (Turrentine et al, 1991). The participants also indicated that the advantages of cruise control were fuel savings and its ability to control speed on long journeys. Its disadvantages were the difficulty of use in city driving, the danger of driver over-relaxation and possible system malfunction. CAS was perceived as a favorable safety supplement but the ACC was not. The participants especially valued the safety benefits, although they doubted the reliability of these technologies and their ability to respond to different types of dangers and obstacles.

The results of the above studies suggest that consumers are more concerned with safety benefits than with convenience benefits and to a large extent they are reluctant to give over vehicle control to computers. Other studies, however, contended that deployment of vehicle automation technologies will depend on a number of factors; among them are the cost, safety, operating speed,

convenience, comfort, and accomplishment of other tasks while traveling (Bonanno et al, 1993). Through surveys of vanpoolers in the San Francisco Bay Area and Los Angeles, the authors investigated the reasons for an individual's decision to ride rather than drive in an attempt to better understand the market potential for automated vehicles. The study found that people placed a high value on the **use** of travel time to accomplish other tasks.

In light of the previous consumer research on AHS and AVCS, the present study is intended to establish a baseline for the assessment of the benefits of these technologies, their value to consumers and the identification of consumer profiles who are likely to use these technologies in the future.

3. METHODOLOGY

The focus groups study was designed to assess consumer opinions on five study elements:

1) *Bay Area* freeway driving experience, 2) collision avoidance system, 3) adaptive cruise control, 4) automated highway system, and finally 5) the usage and advocacy issues concerning these technologies. The working hypothesis was that the younger generation between 18 - 35 would favorably react to **AHS** and **AVCS** technologies because of their exposure to and familiarity with electronic and computer technologies.

During the week of May 13, 1996, six focus group meetings were held in the **San** Francisco Bay area. Two groups in each of three locations; the Peninsula, East Bay and South Bay. These groups were comprised of drivers representing a broad spectrum of demographic attributes including gender, age, education, household income, ethnicity, and marital status. All participants were recruited via telephone from households in the vicinity of the focus group facilities. Recruiting specifications were devised to ensure that the groups contained a mix of different types of individuals representing divergent viewpoints. The groups were recruited to be comprised of a roughly 50/50 female to male ratio, both employed and retired individuals, and individuals representing various age, education, and income levels. These specifications were compiled into a recruitment screener script that the recruiters used to guide their efforts.

Two group meetings per night were held on three consecutive nights: May 14 in South San Francisco (Peninsula), May 15 in Walnut Creek (East Bay), and May 16 in Sunnyvale (South Bay). Eight to ten people participated in each group. The participants were paid a \$40 incentive fee for their two hour participation. The profile of the participated groups is shown in Table 1. The meetings were moderated by a professional moderator and were held in professional focus group facilities at locations representing three subregions of the Bay Area, East Bay, South Bay and Peninsula. Two focus group meetings were held in each subregion.

Table 1. Profile of the Focus Group Participants

	Location	Gender	Age	Ethnicity	Income in 1000	Occupation	Driving Experience
May 14,1996 6 PM	Peninsula	5 male 5 female	(2) 36-40 (1) 41-45 (5) 46-50 (3) 51-55	8 White 2 Asian 1 Black	3 \$30 5 \$40150 3 \$60	4 Professional 2 Managerial 5 Service, labor	7 Everyday 3 Frequently 1 Occasionally
May 14,1996 8 PM	Peninsula	5 male 5 female	(5) 56-60 (2) 61-65 (1) 66-70 (2) 71-75	8 White 2 Black	3 \$30 5 \$40/50 2 \$60	6 Retired 2 Housewife 1 Professional 1 Service, labor	6 Everyday 4 Frequently
May 15,1996 6 PM	East Bay	5 male 4 female	(2) 36-40 (3) 41-45 (3) 46-50 (1) 51-55	8 White 2 Black	2 \$30 2 \$40150 5 \$60	6 Professional 1 Managerial 2 Service, labor	4 Everyday 4 Frequently 1 Occasionally
May 15,1996 8 PM	East Bay	3 male 4 female	(3) 26-30 (4) 31-35	8 White 1 Asian	2 \$30 2 \$40150 3 \$60	4 Professional 1 Managerial 2 Service, labor	1 Everyday 3 Frequently 3 Occasionally
May 16,1996 6 PM	South Bay	5 male 5 female	Younger age group 18-34	7 White 2 Asian 1 Hispanic	4 \$30 4 \$40150 2 \$60	4 Professional 2 Managerial 4 Service, labor	4 Everyday 3 Frequently 3 Occasionally
May 16,1996 8 PM	south Bay	5 male 5 female	Older age group 55-71	8 White 1 Asian 1 Hispanic	2 \$30 5 \$40150 3 \$60	7 Retired 2 Housewife 1 Service, labor	4 Everyday 3 Frequently 3 Occasionally

The focus group study addressed five issues pertaining to the AHS: 1) freeway driving experience, 2) adaptive cruise control, 3) collision avoidance system, 4) automated highway system, and finally 5) information source and system usage. Considering the conceptual nature of the AHS technology, the participants were introduced to the familiar system, adaptive cruise control, first and then the discussion was directed to the collision avoidance

system and finally to the **AHS**. The paper reports on the group responses to the presentation of the **AHS** concepts.

A moderator's guide was developed to follow the same general outline for all groups. The group discussions were focused on:

1. The participants' general background, including names, occupations, locations of their residence, the kinds of automobiles that they drive, how often and how much they drive on the freeway and whether they currently have cruise control in their vehicles and how much they use it. The participants were also told that the information they furnished would be kept confidential.
2. The participants' freeway driving experience at the present time, the changes that the participants have noticed in Bay Area freeways over the past several years and the improvements desired for their future freeway driving.
3. The presentation and a discussion of three conceptual technologies, the adaptive cruise control system, the collision avoidance system and the **AHS**. The discussions on these technologies were **focused** primarily on the participants' perceived benefits and concerns about the technology, and their willingness to use and pay for the system.
4. A discussion on the usage of automated vehicles and the sources of information to learn more about the system.

In the interest of obtaining individual opinions on the **AHS**, the groups were introduced to the **AHS** concept twice, first in the form of a written description of the technology and then in the form of a video. After the presentation of the concept in each medium, the participants were asked to react **to** similar questions. They were asked first to respond to the written description that they had **just** read and then the moderator played a 3 minute clip from a video **tape** which showed the

automated vehicle platooning and the driver sitting in a passenger seat while the vehicle was in motion. The participants were again asked to react, this time to the video clip. The discussion topics included: 1) the first thing that comes to mind after learning about an automated highway system, 2) the main benefits of this kind of technology for driving on a highway, 3) any concerns about driving in an automated highway system lane, 4) when all things are considered, whether or not they would use an automated highway system and 5) for what kind of driving or in what situations would the AHS be most appropriate.

Following the discussion on the AHS, the participants were asked to comment on the options of *buying, leasing, or renting* an automated vehicle, where or how they could get good information about any proposed automated highway system and who or what organization they would look to for credible information about any proposed automated highway system.

The results of the group discussions were grouped into the consumer characteristics by age, sex, income, driving experience, interest in the product (product class interest), knowledge or understanding of the product (product knowledge), their ability to use the product successfully (self-efficacy). According to the consumer characteristics definition, *product class interest* was defined as “inherent interest in the product category,” *product knowledge* was defined as “the knowledge about the product or similar products” and *self-efficacy* was defined as “the perceived ability to oneself to use a product successfully” (10). The results of the focus group meetings are summarized in the following section.

A topical outline was prepared to guide the group discussions (Appendix A). The questions included in the outline were:

1. Assessment of Bay Area freeway driving experience

- What is the first thing that comes to mind when you think about driving on the freeway?
- How has freeway driving in the Bay Area changed over the past several years?

If you could change anything about your freeway driving experience what would you change first?

2. Evaluation of the adaptive cruise control system

- If the adaptive cruise control technology were available to you in your automobile do you think you would use it?
- For what kind of driving or in what situations would you use it?
- What do you **see** as the main benefit or advantage to you of using this adaptive cruise control technology?
- What would concern you the most about using this adaptive cruise control technology?
- When and if you get another ~~car~~ would you look for a car that had adaptive cruise control technology as a *standard* feature?

3. Evaluation of the collision avoidance system

- If the collision avoidance system technology were available in your automobile would you **use** it?
- For what kind of driving or in what situation would you use it?
- What do you **see as** the main benefit or advantage to you of using the collision avoidance system technology?
- What would concern you the most about using this collision avoidance system technology?
- When and if you get another ~~car~~ would you look for a car that had collision avoidance system technology **as** a *standard* feature?

4. Assessment of the automated highway system

- What is the first thing that comes to mind after learning about an automated highway system?
- What do you **see** as the main benefits of this kind of technology for driving on a highway?
- What concerns you the most personally about driving in an automated highway system lane?
- All **things** considered, if an automated highway system lane were available to you do you think you would **use** it?
- For what kinds of driving or in what situations would you use it?

5. Usage and advocacy issues

- Which of the three options, *buying, leasing, or renting* an automated vehicle, would you prefer in using the AHS?
- Do you **think** your preference would change if you made greater usage of the AHS?
- Where or how do you **think** you would get good information about any proposed automated highway system?
- Who or what organization would you look to for credible information about any proposed automated highway system?

The focus group meetings were moderated by GLS Research, a market research consulting firm and the summary findings were prepared in collaboration with the moderator. Audio tapes were transcribed and the participants' opinions were systematically recorded on a spread sheet to examine the similarities and differences in their responses by age and gender.

4. KEY FINDINGS

This section presents the findings of the focus group study. The section is organized into five parts; 1) freeway driving experience, 2) adaptive cruise control, 3) collision avoidance systems, 4) automated highway systems, and 5) usage and advocacy issues. Typical responses to questions in each topic are summarized below.

4.1, Freeway Driving Experience

Most people felt that driving conditions in the Bay Area have worsened noticeably in the last few years, especially as a result of the post-earthquake highway construction but also because of an increase in traffic congestion and a decrease in driving standards. All participants were annoyed by other drivers' lack of courtesy and irritated by the disorder on the freeways. Participants in all **focus** groups mentioned instances of drivers talking on the phone, putting on makeup or combing

their hair rather than paying attention to the road. **As** a result, they felt a loss of control in their driving and a sense that their safety was compromised by the growing number of poor drivers on the road. Typical responses are listed after each question.

What are the first words that come to mind when you think about driving on the freeway? Common reactions mostly had to do with their negative driving experience such as *congestion, boring, anxiety, stress, accidents, people reading, putting on make up, or on the carphone talking and taking notes*. Positive words included: *faster, convenient, I enjoy driving on certain freeways, i.e., Interstate 280*.

How has freeway driving in the Bay Area changed over the past several years? Most participants felt that the freeway has become *more congested, more crowded, more dangerous, with more stressful, more construction and diamond lanes, and more reckless driving*.

Has the freeway more dangerous or more safe over the last couple of years? Some of the elderly participants said that they are *safer because everybody is moving pretty much at the same speed now and there's more dividing and more room*. They indicated that it is *safer to drive on the freeway than around town because people can't run stop signs and hit you*.

If you could change anything about your freeway driving experience what would you change first? Many did not seem to have any ideas on how to solve the current traffic problems. However a few participants indicated that their vision was something like a totally controlled freeway where no one can cut in while they are driving.

4.2. Adaptive Cruise Control

A description of the adaptive cruise control system was handed out and the participants were asked to read and react to the **ACC** concept as they perceived it. The description was as follows:

“Adaptive cruise control is an enhancement of the capabilities of current cruise control technology. Current cruise control technology allows you to set the speed of your automobile at a certain level so that you can maintain that speed without having to keep your foot on the gas pedal.

Adaptive cruise control will automatically slow down your speed when necessary to maintain the proper spacing behind other vehicles. The technology will either ease up on the gas, apply the brakes, and/or give you a warning light or sound if the vehicle in front of you slows down or if a slower vehicle cuts in front of you.”

After reading the ACC description, the participants generally responded favorably to the ACC but those who routinely use cruise control and particularly those who are high mileage drivers expressed greater enthusiasm than did the participants who do not currently have cruise control. Some of the low mileage drivers found it of little value.

Older people who routinely use cruise control generally liked the idea because they saw it as an opportunity to make driving safer and more convenient, especially when they encounter poor visibility in fog or at night. Another important benefit of the ACC is that it makes cruise control easier to operate. Many drivers complained about having to constantly set and reset cruise control on long drives and when they encounter cars going at different speeds.

The responses to the study questions were as follows. If the adaptive cruise control technology were available to you in your automobile do you think you would use it? Close to half the participants said that they would use the ACC. Most younger age groups, **20-35**, were divided about **2** to 1 against it but the groups of seniors were strongly in favor of the ACC. The middle aged group was divided almost evenly. Some of the responses were: [They] *wouldn't use it in congested traffic* and *it depends on how adaptive it is as far as a safe distance*.

For what kinds of driving or in what situations would you use it? While most said that ACC would be appropriate for long drives, others said it could be good in congested situations and could be used in intra-urban travel as well.

What do you see as the main benefit or advantage to you of using this adaptive cruise control technology? The majority saw it as a safety device or a device that can warn drivers. Other benefits mentioned were: *it could reduce gas consumption, good for using in fog and for elderly people who lose their [driving] judgment*.

What would concern you the most about using this adaptive cruise control technology? Concerns were *computer malfunctioning and availability of a backup in case of failure, slowing mechanism in different weather conditions, when continuously cut in, one has to listen to the warning signal all the time, what if a slower car cuts in front, the response time, the size of the other vehicle in order to be able to be recognized by ACC.*

When and if you get another car would you look for a car that had adaptive cruise control technology as a *standard* feature? In general, the participants saw ACC as most appropriate for long journeys on relatively uncongested stretches of freeway. Participants who liked this technology were willing to pay between \$250 and \$500 for it, with a few willing to pay up to \$1,000. When asked how much more they thought it would cost them for the extra adaptive cruise control, the answers ranged from \$200 to \$500.

Most of the younger participants, particularly those aged under 30, expressed concern about giving up control of their car to a computer. Some participants were worried not only about breakdowns but also about the capability of the computer to properly control speed with respect to other vehicles. In several groups, participants expressed concern about the possibility of the car ahead stopping suddenly while the car behind continued to accelerate. Another problem several people foresaw was a potential failure of computer-controlled braking in icy conditions.

4.3. Collision Avoidance System

The participants were asked to read the following description of the collision avoidance system and then respond to the questions.

“Collision avoidance systems warn drivers of an impending collision, and may in some cases take corrective **actions** if the driver does not respond quickly and appropriately. They are especially designed to reduce frontal, side, and lane change or run-off-the-road collisions. Drivers are warned of an impending collision by an audible (beeping or voice) and/or visible (flashing lights) warning. Automatic corrective actions are determined by an onboard computer that takes control of the gas pedal, brakes, and possibly the steering system to direct the car away from an impending collision.”

Responses to the CAS were in general far more negative than to the ACC. This was due mostly to the fact that the participants did not like the computer taking over the steering of the car from the driver. However, most people liked the warning system by itself. Older people, in particular, saw the system as a way to compensate for poor visibility or for brake lights being out or for times when their own judgment might be faulty. They also liked it better as a back-up system, one that kicks in only if the driver does not react in time to a crisis situation. Responses to each question were as follows:

When asked *What is your first reaction to CAS*, the older groups responded, *wonderful, as a matter of fact, before I had a chance to speak up earlier, I was thinking of a beeping, any kind of signal, a beeping, you're too close to the car, and this is exactly what I had in mind,* "in case it malfunctions, then how do you get out of a collision?"

After the participants had read the statements, "The collision avoidance system may, in some cases, take corrective actions if the driver does not respond quickly and appropriately," they were then asked if that made a difference to them.

When it was emphasized that the computer wouldn't take over if the driver started react, several people agreed it did make a difference. *When you don't see other car approaching to yours, it would be good to have the warning signals, the whistles and bells.* However, younger participants between the ages of 18-35 did not see the need for such additional features.

If the collision avoidance system technology were available in your automobile would you use it? **Only** one quarter of the respondents indicated that they would be interested in using the CAS, 40% did not know and 35% said they definitely would not use the system. More people in the groups with the older participants thought that they would use it while the majority of the younger participants said that they would not. Most of the middle aged group participants were not sure. For those who liked the idea of having a CAS in their vehicle, the early warning signal was thought to be the most useful.

For what kind of driving or in what situations would you use it? The responses were: emergency situations to avoid a collision, driving in bad weather, and for night driving. It was also thought to be good for older drivers and student drivers.

When and if you get another car would you look for a car that had collision avoidance system technology as a *standard* feature? The participants gave an estimated cost for this system that was higher than for the ACC. When asked how much more they would be willing to pay for the device and then told the participants to pick a number, the participants chose numbers ranging from \$200 to \$750. When asked how much more did they think it would actually cost, the majority said above \$1,000 with some estimating as high as 2,000.

4.4. Automated Highway System

A discussion on the AHS were divided into two parts, reactions to AHS after reading a written description and after watching a video tape. The written description stated:

“An automated highway system (AHS) is an extension of both adaptive cruise control and collision avoidance systems technologies that permits the driver to give full control of the vehicle to the system. Here’s how it works

A separate roadway would be maintained along existing freeway and/or highway routes. This roadway would be for the exclusive use of cars equipped with AHS technology and would have its own entry/exit ramp locations. Cars which were not equipped with AHS technology would not be permitted on this roadway at any time.

Drivers would enter the AHS at a designated entry ramp. The driver would give control of the vehicle to the AHS, which would merge the vehicle onto the roadway and maintain full control of the speed and navigation of the vehicle as long as it was on the AHS roadway. If a driver did not give control of their vehicle to the AHS, it would not be allowed to enter the AHS roadway.

The driver in essence becomes a passenger in the vehicle. His or her only responsibility is to “tell” the system at what marked exit point he or she wants to get off the system.

When the vehicle arrives at the desired exit point the AHS moves the vehicle onto the exit ramp and allows the driver to take control of the vehicle. The system will signal the driver that

he or she will be given control of the vehicle, and the driver must respond with a signal that he or she is ready to take control of the vehicle. The system will not allow a vehicle to leave the exit ramp if the driver has not signaled their readiness to assume control of the vehicle.”

When **asked** what was the first thing that came to mind after learning about an automated highway system, the common reaction was “people movers,” “an automated transit system,” “train,” “the Bay Area Rapid Transit.” Most participants were able to comprehend the AHS on a conceptual level fairly well. They understood what the AHS concept is. A few said they had heard of or had read about it.

Benefits of AHS

When asked what were the benefits of this kind of technology for driving on a highway, the participants clearly recognized the safety benefits, the convenience, and especially the reduction in stress made possible by the AHS. Many said it would allow them to get other things done while traveling, such as reading and grooming. Several groups compared the AHS to BART and noted that the AHS permitted privacy, which they valued highly. The stated benefits of the AHS to users included safety, convenience, less stressful driving, travel time savings, use of travel time for other tasks, savings in gasoline, and less pollution. A woman in her 30s said, “we don’t have to worry about being shot.” A man stated, “reduction in accidents, everyone is following the right rules,” and another man said, “environmentally kind (less pollution)” and “savings in gasoline.”

The majority of the participants perceived that the AHS can definitely make freeway driving safer. AHS lanes dedicated solely to automated vehicles made it easier for them to accept freeway automation. They felt more comfortable psychologically with the AHS when compared to other technologies by its being in a separate dedicated lane and by the reduction in potential risks associated with complex situations that a computer can not handle. Quotations from the group discussion were, “Everything is controlled with this,” “with the other [technologies], only you are controlled,” “everyone is using it, and that is what gives me

confidence” However, most participants said that they would feel safer if a physical barrier were in place separating the AHS lane from conventional traffic lanes.

A majority believed that technology is advanced enough to build the AHS. The perception is also that traffic can move faster and drivers can relax and be less attentive to the road when traveling in automated lanes.

Concerns about AHS

After watching a 3 minute video containing automated vehicle platooning and showing the driver seated in the passenger seat, some of the participants reacted to the AHS somewhat differently. When asked what was the first thing that came to mind after seeing what driving in an automated lane might look like, the most common reaction to the video was “cars are too close,” “just a visceral reaction toward the proximity of the cars in front of me and behind me ... I don’t know that I could ever get used to that.”

When asked how far apart the cars would have to be for them to feel comfortable, several said, “at least one car length” while others said, “one to two car lengths.” The negative reaction to the vehicle headway stems from the lack of self-efficacy, the perceived inability to use the product successfully.

When asked what concerns them the most personally about driving in an automated lane, the most common response was the operational reliability of the system. Frequently mentioned concerns were “how would the car get out of the AHS lane if the car breaks down,” “what would happen to the cars behind and who would come and get the disabled car out of the system” and “how would the driver get out of the system if he missed the exit, the next exit may be ten miles from where he wants to get off.” Participants also debated the wisdom of letting people take control back from the computer in an emergency and, while most recognized the danger of a manual override under normal circumstances, they also said that they would feel more comfortable if they knew they could take over in the event of a system failure.

Fears about the reliability of computers were evident especially among the younger participants. The younger groups often expressed their skepticism that the AHS may not ever

be completely reliable. They commented, “what if the system failed,” “it is guaranteed it will fail,” “computers are not always reliable” and “I can do a better job of driving than any computer you can build.”

The common concerns expressed by all groups were: 1) the operational ability to let cars exit the facility where the driver wanted; 2) the system reliability in the event of earthquakes or other system-wide disasters; 3) individual cars breaking down and disabling the system; 4) the system’s capability of compensating for the differences among individual vehicle performances. Curiosity was also expressed by several participants concerning the location of the AHS. As one woman put it, “my concern is where is this extra, this separate roadway going to be?”

Would you use the AHS?

All things considered, if an automated highway system lane were available to you, do you think you would use it (or not use it)? A large proportion (about 75%) of the participants in the older age groups supported the idea of using the system to make the freeway an easier and safer place to drive. The middle age participants were divided almost evenly. Of those younger participants, less than 25% said that they would use the system and then, it was mainly for long drives.

To the younger generation, the first thing that came to mind about the AHS was “cost,” the cost of building the system and the cost of buying an automated vehicle. The most common reactions to the AHS among the young groups were “the automated vehicle is very expensive,” “I can’t afford to buy one,” “only the privileged ones and elitists would be able to use it,” “it’s not fair,” and “who is going to pay for the system?” The younger generation seemed to have social concerns but for varying reasons. Some believed that the solution to the traffic problem is mass transit, that additional freeway facilities should not be built.

Among young people, a minority saw the AHS as a necessity, as a form of progress that was essential to improving their quality of life. For the majority, it was viewed as more of a novelty or even as a luxury. As such, some felt that poor people or non-commuters should not have to pay for it. Some argued that “that money could go to better use.”

Willingness to Pay for AHS

People who liked the AHS were willing to pay substantial amounts for the technology, with figures mentioned in the \$2,000 to \$5,000 range, and one frequent commuter was even willing to pay up to \$20,000 for it. The conjecture was that the older generation would be willing to pay a higher price for it than the younger generation because they were financially more stable than the younger people and because they saw the intrinsic value of the system. However, the price range (hence the value of the system) quoted was similar in all focus groups. The results of the focus group discussions are summarized in Table 2 in the context of consumer characteristics.

Table 2. Focus Group Discussions on the AHS Technology

	Location	Age	Product Interest	Product Knowledge	Self-efficacy	Willingness to use
May 14, 1996 6 PM	South SF 11 people	Middle age group 35-55	65% Yes 35% No	45% Yes 55% No	45% Yes 55% No	45% Yes* 55% No
May 14, 1996 8 PM	South SF 10 people	Older age group 55-75	80% Yes 20% No	60% Yes 40% No	70% Yes 30% No	70% Yes 30% No
May 15, 1996 6 PM	East Bay 9 people	Middle age group 35-55	55% Yes 45% No	65% Yes 35% No	55% Yes 45% No	55% Yes 45% No
May 15, 1996 8 PM	East Bay 7 people	Younger age group 25-35	40% Yes 60% No	85% Yes 15% No	30% Yes 70% No	30% Yes 70% No
May 16, 1996 6 PM	South Bay 10 people	Younger age group 18-34	20% Yes 80% No	80% Yes 20% No	20% Yes 80% No	20% Yes 80% No
May 16, 1996 8 PM	South Bay 10 people	Older age group 55-71	90% Yes 10% No	50% Yes 50% No	90% Yes 10% No	90% Yes 10% No

Product interest = intrinsic interest in the AHS technology
 Product knowledge = knowledge of electronic and computer technologies
 Self-efficacy = confidence in using the system successfully
 Yes* included "may be."

AHS Application

In concept, the participants were willing to accept the **AHS**, both for long distance and commuter driving. Acceptance of the system, however, appeared to depend largely on one's driving experience. People who do not commute or who do not often drive saw it as of little value. Commuters, frequent drivers, and older drivers, who may be concerned about their own driving capabilities, were more supportive of the system and saw it as providing a personal benefit.

Who Should Pay for the AHS?

Many people said that they felt the technology was possible but doubted that there was the political will to build it. When it was mentioned that the possible cost of the system could be in the hundreds of millions of dollars, many felt that money would be a problem. When one person suggested, "let the federal government pay for it," others immediately responded that "we are the federal government," and then others suggested that private firms, such as oil companies, should pay for it. The institutional barrier, while not the subject of these focus groups, was mentioned by many participants. Nearly all the groups mentioned it on their own and many felt that the biggest liability of the AHS is its sponsorship by the public sector and that the private sector should take the responsibility for it.

4.5 Usage and Advocacy Issues

One of the research interests was to learn about the consumer response to the AHS usage options. The three usage options that were introduced were:

Option A: Buy a car already equipped with **AHS** technology and pay a toll based on your usage of the **AHS**. The total amount of your toll would increase with your increased usage of the **AHS**.

Option B: Lease a car already equipped with AHS technology for some period of time and pay no toll for your usage of the AHS. The cost of the lease would be somewhat higher than the cost of a comparable car that did not have AHS technology.

Option C: Rent a car equipped with AHS technology for a single trip or day and pay no toll for your usage of the AHS. Rental cars would be made available at lots next to the on/off ramps of the AHS, much like the parking lots adjacent to BART stations.

When asked to choose among *buying, leasing, or renting* automated vehicles, those most hesitant about the system said they might rent it to try it out, while the proponents of the system almost universally said that they would buy it. The rejection of leasing was clearly due to the result of a lack of familiarity with leasing and had nothing to do with the AHS.

Most elderly participants agreed that they would go with Option A. An elderly man said, “I would work with C to start with because I wanna try it out. Then I would go for B.” An elderly woman said, “I would go with A. With this coming out, it has to be tested, I feel that I can trust it enough to enjoy it, so, therefore, why not buy it and pay the little toll. Just like crossing a bridge, you have to pay a toll, so why not.” When asked how come not many of them would lease a vehicle, the typical response was, “I don’t know anything about leases, Not familiar with them.”

Proof of the System

Most participants were unwilling to be early adopters of the technology. They would like to see proof that the system works as it was said to work in the written description. They were reluctant to take the word of either the government or the private sector on this matter. The credible sources that they would rely on were the Consumer Reports, independent sources of information, and the American Automobile Association (AAA). University research reports and government documents were perceived as generally credible but were judged to take too long to reach consumers. The participants also mentioned that they would like to see the system in place elsewhere before trying it themselves so that all the bugs would be worked out before they used the system.

Discussion

In general, men and older people were more open to the AHS than were women and younger people. Women appeared to be more concerned about giving up control to the computer, while the young, under **30**, seemed to see less need for the system and were less trusting of the technology. The inquiry was why were younger people very resistant to the idea of using the **AHS** whereas the groups of somewhat older people were very open to the idea? When asked why this was so, an elderly man said, “I have seen much better conditions for driving before. We need to have more safety factors behind us and faster to get from Point A to Point B.” An elderly woman said, “I get very tired of driving ... having something like this is marvelous. I just get in the car and say, ‘take me over there,’ and I can take my nap.” Another woman said, “I can see a big difference from **30** years ago, ... now every household would have a computer and business going into net to speed the process up, so I trust computers.” The majority of the older participants agreed that “they have seen change, mostly for the better, in terms of technology, and younger people may not have the perspective to see this change.” They indicated that they are more trusting and they see things in the larger sense for the greater good. They said “[a future vision] does come along with age and perspective.”

CONCLUSION

Consumer responses to AHS and its related technologies were investigated to better understand end user concerns and requirements for technology deployment. Although attitudes towards highway and vehicle automation varied by age and driving experience, a majority of the participants, particularly among the elderly population, had a favorable reaction to AHS. The younger groups were less enthusiastic about the AHS and AVCS technologies in general and somewhat skeptical of driver dependence on communications and computer technologies. The older generation, however, viewed riding on an automated highway as safer than driving on a manual freeway. In concept, participants were willing to accept the AHS both for long distance and commuter driving. However, acceptance of the system appeared to depend upon one’s driving experience. People

who do not commute or do not drive much saw it has little value. Commuters, frequent drivers, and older drivers who may be concerned about their own driving capabilities were much more supportive of the system and saw it as providing personal benefit.

The focus group study revealed that three major consumer types will feature in the AHS market; a) early technology adopters who are willing to test and adopt the technology, b) late technology adopters who would rather wait until the technology takes off, and c) technology rejecters who are inherently uninterested in the product category. In all cases, there are certain variations in the technology adoption process. The focus group discussion *can* provide insight into consumer attitudes toward the new technology by age, income, driving experience and user characteristics. Although the findings presented in this paper are qualitative, the present study suggests that income and age are strong indicators by which consumer attitudes toward the AHS *can* be evaluated. To young people, cost was the main factor followed by their confidence in their **driving** ability. The older people are financially more stable and the AHS technology can compensate for their deteriorating driving ability. The study also suggested that the concerns about the **AHS** are intrinsically linked to the product knowledge. With their knowledge of the AHS concept limited in scope and scale, most participants were unable to clearly comprehend how the system works at the realistic level (even though they were able to understand the concept), and what level of system reliability *can* be expected and what amount of risk is involved in using the system.

Inaccurate or partial information about the product may impede the consumer's ability to honestly evaluate the product and consumer research may result in obtaining data that are tainted or biased. Many questions raised in the focus groups were mostly about the operation of the AHS, how the cars would switch from manual to automation, how the cars would get on and off the automated lane, how surveillance of the AHS would work? Consumer attitudes can also be swayed by the presentation material, **as** was experienced with the written description and the video tape of the **AHS**. More advanced market research tools such as virtual reality, the ability to create a future environment in AHS, would help consumers evaluate the AHS technology more realistically. It is expected that as consumers gain knowledge of the AHS and understand fully how the system actually works, the consumer acceptance level would be significantly higher. The

present study was limited to obtaining consumer information at the conceptual level of the **AHS**. Nonetheless, the findings of the study are similar to previous studies that show safety, convenience, cost and reliability are the key factors which will influence the consumer's decision either to accept or to reject the **AHS** technologies. It seems apparent that the ultimate decisions will, however, hinge on consumer 'trust' about the 'product reliability of **AHS**.'

The findings presented in this paper are preliminary, further studies are needed in two basic **areas** of consumer research, end user requirement studies for the improvement of the **AHS** and **AVCS** design and market research for potential users of the system. While the issue at the national level is whether an **AHS** product or service is likely to produce sufficient market demand to justify investment in production and distribution, an equally important research question is *what **AHS** products or services are likely to shift consumer behavior in what particular ways?* The present study is limited in scope; it focused primarily on user perceptions of technologies. It did not address user concerns about design features of **AHS** and **AVCS** technologies. To test **AHS** technology products with respect to consumer behavior, baseline measures and control groups should be identified so that a reference point can be established for evaluation of subsequent changes in consumer behavior over the next several years. For the assessment of baseline **AHS** product attributes, future research should address the benefits of **AHS** technology, its value to consumers and the market segment of potential consumers that will respond favorably to the technology.

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APPENDIX A: Moderator's Guide



MODERATOR'S GUIDE

I. INTRODUCTION(10 MINUTES)

- A. Introduction to the focus group process.
- B. Introduction of participants.
 - 1. Work/profession, marital status, family?
 - 2. What type of car do you usually drive?
 - 3. How often do you drive on Bay Area Freeways

II. ASSESSMENT OF BAY AREA FREEWAYS (10 MINUTES)

STATEMENT: I'd like you to think about the driving you do on Bay Area freeways. Think about **all** the types of trips that you make that involves driving on the freeway such as going to work, shopping, visiting friends, etc.

- A. What's the first thing that comes to mind when you think about driving on the freeway? Do you like it or dislike it? Why?
- B. In your opinion how has freeway driving in the Bay Area changed over the past several years?

PROBE AS NECESSARY:

- 1. Is it more or less congested?
 - 2. Is it safer or more dangerous?
 - 3. Does it take more or less time to get where you want to go?
- C. If you could change anything about your freeway driving experience what would you change first?

IV. EVALUATION OF COLLISION AVOIDANCE SYSTEM (10 MINUTES)

STATEMENT: Now I'd like you to read a brief description of another new technology that may also become available for automobiles.

[HAND OUT COLLISION AVOIDANCE SYSTEM DESCRIPTION]

- A. If this collision avoidance system technology were available to you in your automobile do you think you would use it? For what kind of driving, or in what situations would you use it (or not use it)?

Probe As Necessary:

1. For freeway or expressway driving in urban areas?
 2. For highway driving in rural areas?
 3. In congested traffic situations?
 4. When there is very little traffic?
 5. When driving at night?
 6. When driving alone?
 7. For short (or long) trips?
- B. What do you see as the main benefit or advantage to you of using this collision avoidance system technology?
- C. What would concern you the most about using this collision avoidance system technology?
- D. When, and if, you get another car would you look for a car that had collision avoidance system technology as a standard feature?
1. If it was an optional feature do you think you would pay a little more to get this technology?
 2. About how much more do you think you would have to pay for a car to get this technology?

III. EVALUATION OF ADAPTIVE CRUISE CONTROL (10 MINUTES)

STATEMENT: Now I'd like you to read a brief description of a new technology that may become available for automobiles.

[HAND OUT ADAPTIVE CRUISE CONTROL DESCRIPTION]

- A. If this adaptive cruise control technology were available to you in your automobile do you think you would use it? For what kind of driving, or in what situations would you use it (or not use it)?

Probe As Necessary:

1. For freeway or expressway driving in urban areas?
 2. For highway driving in rural areas?
 3. **In** congested traffic situations?
 4. When there is very little traffic?
 5. When driving at night?
 6. When driving alone?
 7. For short (or long) trips?
- B. What **do** you see as the main benefit or advantage to you of using this adaptive cruise control technology?
- C. What would concern you the most about using this adaptive cruise control technology?
- D. When, and if, you get another car would you look for a car that had adaptive cruise control technology as a standard feature?
1. If it was an optional feature do you think you would pay a little more to get this technology?
 2. About how much more do you think you would have to pay for a car to get this technology?

V. ASSESSMENT **OF** AUTOMATED HIGHWAY SYSTEM (40 MINUTES)

STATEMENT: Now I'd like you to read a description **of** a proposed kind of technology that **might** become available **to** you on certain highways **or** freeways.

[HAND OUT AUTOMATED HIGHWAY SYSTEM DESCRIPTION]

- A. What is the first thing that **comes** to mind after reading this description of an automated highway system?

Probe As Necessary:

1. **Do** you have a clear sense for what this automated highway system can do? If not, what is unclear?
 2. Do you think that this type of system can be developed or do **you** think it's probably not possible?
- B. What do you see as the main **benefit(s)** of this kind of technology for driving on a highway or freeway? Probe **if** not mentioned:
1. Could this automated highway system make highway/freeway driving safer?
 2. Could traffic move along faster using an automated highway system technology?
 3. Could drivers relax and be less attentive when traveling in automated highway system lanes?

STATEMENT: Now I'd like to show you a couple **of** video clips that shows you how driving in an automated highway system lane might look like.

[PLAY AUTOMATED HIGHWAY SYSTEM VIDEO CLIPS]

- C. What's the first thing that comes to mind after you've seen what driving in an automated highway system lane might look like?

Probe As Necessary:

1. Do you have a clearer sense for what this automated highway system can do? **If** not, what still seems unclear?
 2. Are you more or less convinced that this type **of** system can be developed?
- D. What do you see as the main benefit to you personally if you were to drive in an automated highway system lane?
- E. What concerns you the most personally about driving in an automated highway system lane?
- F. All things considered, if an automated highway system lane were available to you do you think you **would** use it? For what kind of driving, or in what situations would you use it (or not use it?)

Probe As Necessary:

1. For freeway or expressway driving in urban areas?
 2. For highway driving **in** rural areas?
 3. **In** congested traffic situations?
 4. When there is very little traffic?
 5. When driving at night?
 6. When driving alone?
 7. For short (or long) trips?
- G. If automated highway system lanes were developed, it would require that automobiles that used them had special equipment installed on them in an unobtrusive location. Do you think you be willing to pay for this equipment? If yes, about how much do you think you would have to pay?

VI. USAGE AND ADVOCACY ISSUES (15 MINUTES)

STATEMENT: Now I'd like you to read a description of a few possible options that could exist for people to use the automated highway system (**AHS**).

[HAND OUT USAGE OPTIONS DESCRIPTION]

STATEMENT: In thinking about these options please assume that the cost of cars equipped with **AHS** technology was reasonable, and that the toll pricing structure for using the **AHS** was also reasonable.

- A. which of these three options would you prefer in using the AHS? Do you think your preference would change if you made greater (or lesser) usage of the AHS?
- B. Where and/or how do you think you would get good information about any proposed automated highway system?

Probe **As** Necessary:

- 1. Broadcast news media (radio, TV)?
 - 2. Print news media (newspapers, magazines)?
 - 3. Government publications?
 - 4. Scientific or technical journals and/or articles?
- C. Who or what organization would you look to for credible information about any proposed automated highway system?

VII. CLOSING (5 MINUTES)

- A. Any other comments?
- B. Thank and adjourn group.