FINAL REPORT

CONSUMER REACTIONS TO CALL BOXES ON THE DULLES TOLL ROAD IN VIRGINIA

Report To Virginia Department Of Transportation

Prepared by

Dr. Kenneth Button
Lee Higgins
Kimberly Vachal

Center for Transportation and Logistics
School of Public Policy
George Mason University

June 2001

SUMMARY

This study represents the first part of an assessment of consumer reactions to the introduction of call boxes on the Dulles Toll Road (Northern Virginia). It initially looks at the existing experiences with call boxes in the US. Despite their adoption in many states they are largely concentrated in just five and they offer a variety of services but the greatest distinction is between voice and non-voice call boxes. They have a long pedigree and their use in recent years has tended to be constant despite the widening availability and use of cellular telephones. Costs vary between systems dependent on a wide range of factors but efforts to increase the usefulness of call boxes by adopting more sophisticated systems of 'Smart' call boxes (e.g., to provide input into traffic management systems) have met with practical problems.

A pre-installation survey of users of the Dulles Toll Road reveals a very high level of cellular telephone availability (over 75%) but despite that a very significant proportion of respondents (over 60%) felt that if needing assistance there was at least a possibility that sometimes they would use call boxes. This is despite the fact that the reported use of call boxes in previous situations where assistance was sought on other routes was small compared to that of the cellular telephone or waiting for police or other assistance to arrive. More broadly, there was general support for the program when respondents were asked for additional comments on the scheme.

TABLE OF CONTENTS

SUMMARY 2

STUDY OBJECTIVES AND METHODOLOGY 1

EXPERIENCES WITH CALL BOXES IN THE US 3

- URBAN VERSUS RURAL USE 6
- IMPLEMENTATION STRATEGY AND USAGE 5
- DESIGN 6
- EXTRA-MOTORIST ASSISTANCE 7
- CALL BOX FEATURES 8
- FINANCE 8
- BENEFIT-COST ANALYSIS 9
- MARKET PENETRATION 11
- THE RELEVANCE OF PREVIOUS ANALLYSIS TO THE DULLES TOLL ROAD 11

THE DULLES TOLL ROAD INITIATIVE 14

ASSESSMENT PROCEDURE 16

CONCLUSION 25

APPENDIX 27

STUDY OBJECTIVES AND METHODOLOGY

The purpose of the overall study carried out at George Mason University for the Virginia Department of Transportation (VDOT) dealing with 'Consumer Reactions to Call Boxes on the Dulles Toll Road in Virginia' is to;

- assess the extent that call box installations on the Dulles Toll Road improves customer service,
- determine the role of call boxes versus other forms of motorist communication,
- examine the degree to which call boxes can assist in improving the speedier clearance of roadside obstacles, and
- identify data and appropriate methods for their collection to determine if call boxes are a cost-effective method of receiving motorist information.

The issue under consideration is not whether the call boxes should be installed, that has been decided, but rather to assess the expectations of Dulles Toll Road users as to the benefits associated with having these facilities available. The work, spread over some 15 months (see Appendix) is phased so that initially the particular features of the Dulles Toll Road call boxes can be set in the wider context of other experiences with call boxes. This contextual analysis is also set within a pre-installation assessment of the way users of the Dulles Toll Road usually handle situations where they require some form of assistance and their previous experiences of dealing with these types of situation on this particular road. Some limited stated preference work, seeking tentative information on whether Dulles Toll Road users, is included in this pre-installation assessment.

The later stages of the analysis are concerned with how users of the Dulles Toll Road are using the call boxes and what their perceptions are of their usefulness. This will entail both objective analysis of how the system is operating, and the costs of its maintenance, and a subjective analysis of how the road users perceive the call boxes as meeting their objectives. The objective assessment, which will combine information from surveys of road users, assistance agencies, and operators of the call boxes, will examine the use made of the boxes by various category of user (e.g., regular/less regular and cellular telephone owner/non-cellular telephone holder). The subjective element will embrace

information from assistance providers and road users on how they feel response performance has changed besides other things.

To set these benefits in context, the analysis will provide assessments of various cost options for maintaining the system over the long term. This will then allow a comparison within a quasi-benefit cost framework (strictly a planning balance sheet assessment) of the consumer benefits from having call box facilities with the costs of their provision.

This Interim Report is designed solely to serve two objectives with regard to the overall assessment of consumer responses to the introduction in October 2000 of call boxes on the Dulles Toll Road in Virginia.

- To set the Dulles Toll Road initiative in context. It looks at the nature and experiences that other regions have of various systems of call boxes that are in place across the US and sets the Dulles Toll Road systems within this wider context of experience.
- To assess pre-installation reactions to the availability of call boxes. It reports on the preliminary findings of a pre-installation survey of Dulles Toll Road users that examines their views on the potential usefulness of call boxes on that corridor.

EXPERIENCES WITH CALL BOXES IN THE US

Motorist aid systems (MAS) are designed as devices and systems that assist in the detection of a stranded motorist, to communicate that motorist's needs to the proper entity, and to respond to that need.[1] They are seen to serve the dual purpose of offering a service to the road user in need of assistance but from a traffic management perspective they can also by assist in the more rapid response to traffic incidents and obstacle clearance.

Such systems have a long pedigree going back to the 1920s but the main application has been since the 1920s. Any MAS system has many elements to it starting from a chain originating with the ability of those affected to communicate their problems along a path to the final resolution of the incident. The attention here is entirely on the reporting end of the spectrum looking both at what is know objectively about the actual role of call boxes in this regard and at the subjective, public perception of this role. [2]

MASs have a number of different components and can vary according to the needs of a particular area or road network. Roadside call boxes have formed an important part of MAS for many parts of the US. As of 1997, 21 states and the District of Columbia have operational call box systems.[3] Details of the systems are set out in Table 1. Since that time Virginia and Georgia have initiated systems.

The geographical distribution of the boxes is, however, far from uniform and over 95% of them are installed in California (70%), Florida (12%), Pennsylvania (5%), Massachusetts (4%) and New York (4%). At least one state, Minnesota in 1996, has in the past had call boxes and has then subsequently removed them. This was largely due to the infrequency of use of a system (1.7 calls per million kilometers traveled in rural areas) that involved widely spaced, data based call boxes.

---

1 J.R. Freeland, *Motorist Aid Systems*, NCHRP Synthesis of Highway Practice 7, Transportation Research Board, Washington, 1971.

2 W.R. McCasland, 'Experience in handling freeway corridor incidents in Huston', T*ransportation Research Board Special Report* 153, 1975, pp. 145-55.

3 G.L. Ullman, *Status of Motorist Aid Box Systems in the US*, Texas A&M University, 1997.

Table 1. Call box systems in the US

State	Number of call boxes	Average spacing (kms)	Year introduced	Data/voice technology	Communications mode
Alaska	4	16.0	1987	voice	radio (450Mhz)
Arizona	12	3.2	1991	voice	cellular
California	15,381	0.4–1.6	1986	voice	cellular
	699	0.1–0.2	------	data	wireless
Colorado	52	0.8	1996	voice	cellular
	54	0.1	1992	voice	wireless
Connecticut	16	--------	------	voice	cellular
	18	--------	------	voice	wireless
Delaware	150	0.4	1984	data	radio (72Mhz)
Florida	2,764	1.6	1972	data	radio (72Mhz)
Hawaii	72	--------	1991	voice	cellular
Illinois	310	0.8	1973	data	radio (72Mhz)
Louisiana	420	0.8	1977	data	radio (72Mhz)
Massachusetts	854	0.8	1989	data	radio (72Mhz)
Michigan	4	--------	1990	voice	cellular
New Jersey	378	0.8	1994	voice	radio (800Mhz)
	94	1.6	1984	data	radio (72Mhz)
New York	941	0.8	1991	voice	cellular
	21	--------	------	voice	wireless
	64	3.2	1989	voice	radio (155Mhz)
North Carolina	50	1.6	------	voice	wireless
Ohio	30	0.8	1994	voice	cellular
Pennsylvania	1,040	1.6	1989	data	radio (72Mhz)
Rhode Island	312	0.8	1979	data	radio (72Mhz)
Texas	118	0.8–1.6	1993	voice	cellular
Washington	42	0.4–11.2	1993	voice	cellular
	165	0.1–0.8		voice	wireless
DC	22	--------	-----	voice	cellular

Urban versus rural use

The amount a call box is used is highly sensitive to factors such as location and spacing. [4] In California it is as low as 1 call a box per month in rural areas but can rise to 11 calls per box as in Arizona. The norm is somewhere around 2 to 3 calls per month for most states but is over 7 across the state of California. The high level of average use in California seems to reflect their closer spacing and high level of service offered by the systems deployed there. [5] Studies at the state level show a fairly steady use of call boxes at least until 1996 despite the widespread adoption of portable cellular telephones.

There are wide seasonal and daily variations in the use made of call boxes that generally correlated with traffic volume and with the location of the road (e.g., urban or rural). [6] Call box use, even allowing for traffic volume tends to be higher in rural areas as seen in evidence from California, Florida and Minnesota. But there can also be variations between urban areas; e.g., the much higher use in urban counties in California (9.6 calls pr million vehicle-kilometers) than in urban areas in other states (e.g., 42 per million vehicle-kilometers in Florida and 1.7 for the defunct system in Minnesota).

Implementation strategies

Motorist-aid call boxes are specially designed units that allow stranded motorists to request assistance. Implementation of call box strategies can vary and may embody their spacing at strategically selected locations along a highway or they may be evenly spaced. They may or may not have features such as easy use by the physically impaired, high quality lighting and pull-over areas.

The primary use of call boxes across the US is for service calls (e.g., fuel, water, flat tires, and mechanical problems). This amount to about 75% of the total with emergencies seeking police, medical and fire services constituting about 10% of the

---

[4] B.W. Churchill, *Nationwide Motorist Aid Call Box Assessment*, California Department of Transportation/US Department of Transportation, 1994.

[5] Minnesota Department of Transportation, *Motorist Aid Call Box Evaluation Report*, Minnesota Department of Transportation, Minneapolis, 1991.

[6] Tennessee Department of Transportation, *Tennessee Interstate Motorists Aid Study*, Tennessee Department of Transportation, Knoxville, 1989.

remainder. The proportions vary across systems and in part depend on the nature of the call box facilities that are available and the length of time they have been in place. In cases of voice based systems, when initially installed the call boxes seem to have been used a lot for information calls but these diminished as people became familiar with the primary purpose of the facilities.

Since their introduction a significant number of studies have been conducted looking at various aspects of call box policy. Some of these have been of a technical nature examining various installation and maintenance aspects of such MAS systems[7] while others have been concerned with institutional matters such as the involvement of potential users in design and the creation of structures that simplify formal agreements between participating parties.[8]

Design

Concern about call box design involves issues that include access for disabled drivers and concern over personal security when using a box (e.g., the nature of lighting). There are also issues about the safety of call boxes of the positioning of boxes. Proposals, for example, that they could be installed on medians to facilitate quick response to disabled vehicles in left lanes of freeways and hence reduce congestion have been found to a potential safety hazard. They would also result in, because of the infrequency of the type of incident they are intended to deal with, very few traffic benefits.[9]

Access for those who are mobility impaired (as mandated under the American with Disabilities Act) and the need to meet the needs of hearing impaired individuals affects the design of new call boxes. Some retrofitting has also been completed in a number of cases (e.g., on the freeway near Santa Fe Springs) to meet the particular requirements of these groups.

---

[7] For example, regarding emergency call boxes in California, see J.H. Banks and P.A. Powell, 'San Diego field operational test of smart call boxes: technical aspects', *Transportation Research Record* 1603.

[8] J.H. Banks and P.A. Powell, 'San Diego field operational test of smart call boxes: institutional issues', *Transportation Research Record* 1603.

[9] J. H. Banks, 'Should emergency call boxes be placed in freeway medians', *Transportation Research Record* 1485, 1995.

Extra-motorist assistance functions

Solar-powered cellular call boxes are increasingly being seen as offering services beyond that of providing a first indication of an accident or blockage. In particular, they are seen as possible information gathering and control devices in IVHS applications. [10]

Call boxes and their associated infrastructure can be used to serve purposes other than simple MAS functions. Information gathering for traffic management, for instance, is one. The Smart Call Box Traffic Monitoring Program in Clark County Nevada has been assessed in this light and a benefit-cost analysis has indicated significant long- and short-term advantages. [11]

The use of smart call boxes that provide information to road network controller has also been examined in a San Diego study. [12] The region has a significant number of call boxes (some 7,650 units) in place providing a comprehensive motorist aid package and that embody wireless communications, self-contained battery/solar power and microcomputer control. Smart call boxes at 23 sites were selected to provide traffic and weather information to the transportation management center with some also serving as changeable message sign controllers. The outcome of the evaluation study was that the smart call box concept, whilst feasible, was not necessarily optimal.[13] While smart call boxes were relatively cheap to install and would be more economical than hardwired systems (with site savings of between $1,500 and $103,000 because of the high costs of installation in some locations) but suffered from a number of technical problems when used as control field devices such as inability to control changeable message signs and video systems. There were also problems with compatibility of systems that meant that even if information was successfully collected it could not be fully integrated with other

---

[10] S. van Wagoner, 'IVHS applications for solar-powered, cellular call-boxes', *Traffic Technology International*, 1995, pp. 260-1.

[11] R.Y. Chin, 'Needs assessment for ITS applications in Clark County, Nevada', presentation to 69th Meeting of the Institute of transportation Engineers, Las Vegas, 1999.

[12] US Department of Transportation, Federal Highway Administration, *ITS Field Operational Summary, San Diego Smart Call Box*, Washington, 1998.

[13] J.H. Banks and P.A. Powell, *Smart Call Box Field Operational Test Evaluation: Summary Report*, PATH Report D96-33, California PATH Program, Richmond, 1996.

software being used. The studies also commented on the need to test the institutional partnership between the various partners involved as well as technical compatibility.

Variations in call box features

The features of call boxes vary considerable. Some provide a range of instant options (e.g., policy or traffic services) whilst others offer a direct link to a central control authority. In some cases the boxes provide voice options in a number of languages designed to meet the needs of non-English people. In California it has been estimated that about 60% of users make use of non-English facilities while 30% to 40% do in Arizona. Other states, such as Florida, have adopted a data-based system (transmitting an encoded electronic signal to a receiver that identifies the general nature of the type of assistance required) with clearly understood symbols indicating the services available. Of the call boxes in use in 1996 some 73% were voice based.

Finance

Because of the diversity of systems used, the size of the system, the time of installation, the nature of traffic local conditions, whether the system could be linked to other aspects of traffic management, and the methods of administration and financing deployed, the costs of call boxes vary considerably across the US depending on such things as location of boxes and type of service offered.[14]

For example, the annual maintenance costs per box in Illinois is $24 whilst it is $467 in Florida and $160 in Rhode Island. The average cost per box from knockdowns (which average a fairly consistent 7% of boxes across the systems) is as high as $7,000 in Louisiana but falls to just over $1,000 in California. Even within state systems there may be wide variations in the cost per box. In terms of communications costs, in California, for instance, the monthly cellular phone rates charged for the various SAFEs vary from $6.50 per box to $12.00 per box plus a per-minute charge when monthly totals

[14] State of Alaska, Department of Transportation and Public Facilities, *Highway Call Box Report*, State of Alaska, Department of Transportation and Public Facilities, Juneau, 1997.

exceed 35 to 65 minutes.[15] Generalizations are thus extremely difficult and any average figure calculated must be treated with caution. Nevertheless, the average cost per call between the different states providing call boxes ranges between $24 and $950. Against this must be set the benefits not only of reassurance of easy access for road users to assistance when needed but also the value of travel time saved by removing obstacles more expeditiously.

Funding call boxes has come from a number of sources in addition to general revenue pools. The system of 3,000 call boxes in the Service Authority for Freeway Emergencies counties in the San Francisco Bay area was financed from an addition fees of a $1 per annum to the California Department of Motor Vehicles' vehicle registration. [16] Studies of the willingness of motorists to pay for call boxes have been conducted in Texas.[17] The Texas Transportation Institute conducted a small survey of motorists in six Texas cities to assess public interest in a statewide call box system and motorists willingness to pay a small annual fee for it. A positive result emerged.

Benefit-cost analysis

Overall benefit/cost studies of call box systems are rare but one was conducted on Georgia's Emergency Motorist Aid Call Box Pilot Project. [18] Georgia installed 147 call boxes in 1999 on one of the most rural sections of Interstate in the state, 39 miles within Troup, Harris and Muscogee counties on I-185. The elements considered in the benefit/cost analysis were the amortized capital costs, operations costs and maintenance costs which were set against the assumed number of incidents and fatalities eliminated by having call boxes. Each type of incidence was assumed to have a different value of

---

15 California Service Authorities for Freeways and Expressway Committee, *State of Call Box Program*, Sacramento,1996

16 Techplan Corporation, *Motorist Aid System for Metropolitan Transportation Commission Service Authority for Freeway Emergencies*, Techplan Corporation, San Diego, 1989; S.Terry, 'A look at what some states are doing. Bay Area roadside call boxes provide service to citizens', *AASHTO Quarterly Magazine*, 72 (2), 1993, p.8.

17 R. Collins and G.L. Ullman, 'An assessment of potential use and benefits of call boxes in Texas', presentation to the 79th Annual Meeting of the Transportation Research Board, Washington, 2000.

18 S.L. Kolb, E.N. Williams and K.R. Alff, 'Evaluation of Georgia's emergency motorist aid call box pilot project', presentation to 10th ITS American Meeting, Washington, 2000.

benefit. The results indicated that the benefits calculated exceeded the costs estimated by 176%, i.e. a benefit/cost ratio of 2.76.

Market penetration

There is often an alternative to the call box available for those seeking assistance in the form of the cellular phone. The current market penetrations of cellular phone in the US is around 25%. The evidence on the impact of cellular phone availability on other means of seeking assistance is not clear. At the aggregate level there is evidence that cellular telephones provide a complementary service. Their use as a means of reporting incidents or in seeking assistance has risen considerably in many places (e.g., Pennsyvania, California and Minnesota) but where there are also call boxes their use has remained relatively stable. A survey conducted as part of an assessment of motorist aid boxes in Washington State found that only 18% of cellular telephone owners always called in an accident or vehicle breakdown they passed whilst driving and nearly 40% said they never made such calls.[19]

At the more micro level some studies have shown that cellular telephones are often providing what is perceived to be a better means of obtaining assistance [20] although the evidence on this is sparse.

The relevance of previous analysis to the Dulles Toll Road

Lessons can be learned from studying previous work. There has been considerable analysis of existing call box systems across the US. Much of this analysis has been of a technical nature and has looked at the various types of facility that can be provided. There has also been comparative work on the financial costs of providing call box facilities and on the ways in which they have been used. Little, however has been done by way of stated-preference analysis assessing the reaction of road users to the availability of call boxes, either pre or post installation.

---

[19] J. Nee, L. Carson and B. Legg, *An Evaluation of Motorist and Call Boxes in Washington*, Washington State Transportation Center, Seattle, 1996.

[20] R. Abramson, 'Cell phone calls bump freeway call-box users', *Oakland Tribune*, October, 1996.

The previous analyses also relate to a somewhat different spatial, social and technical contexts to that strictly relevant to assessing developments on the Dulles Toll Road. The Dulles facility is a tolled road offering high quality service for commuter and other users into Washington DC and the high-technology employment concentrations to the west of the city. It is heavily used. Many call box systems are in older urban areas or in rural areas. The Northern Virginia region is also populated by very high income earning individuals, many involved in the communications sector. They inevitably will be more conversant with the use of such technology as cellar telephones. Additionally, there has been considerable technical and institutional developments since many of the previous call box studies were conducted, On the one hand this affects such things as the costs of providing and maintaining call box services. But it also affects the availability of alternative means of summoning assistance, and most notably the availability of cellar telephones. Since there is a long-term secular trend for incomes to rise, for employment to grow most rapidly in the high-technology sector, and for personal communications systems to proliferate, it seems likely that the Northern Virginia economy is at the leading edge of social change. This means earlier studies of consumer reactions to call may be of only limited relevance

THE DULLES TOLL ROAD INITIATIVE

About 15 years ago, VDOT installed call boxes on interstate type highways in Northern Virginia. The evaluation of this early call box program is now dated. Call box capabilities and requirements have changed considerably in the last 15 years. Even the least sophisticated call box systems allow for conversation between the caller and the responder. High tech models allow the caller to indicate the nature of the problem automatically, improving the response time, and many allow for TTY/TDD communications for the hearing impaired. Most are solar powered and use cellular technology, simplifying their installation and maintenance.

As part of its incident management system in Virginia, the VDOT noted that individuals who have experienced car trouble, have been involved in traffic crashes, have had medical emergencies, or have been involved with (or witnessed) a crime on the interstate system need to be able to request and receive help. With the increase in the number of cellular telephones, many motorists call the authorities without leaving their vehicles. However, not everyone who needs help on the highway has a cellular phone. There are also new technologies being developed offering onboard systems (Mayday technologies[21]) but these are still some way from implementation on a large scale. Since the clearance of road-side obstacles is accelerated by rapid communication of problems to agencies it is important that those without cellular telephones have access to alternative methods of reporting incidents.

In addition, the make up of the commuter population in Northern Virginia has changed. The comfort level associated with high technology solutions of all types has increased as they become more common. Many commuters have cellular service in their vehicles, allowing them to not only call for help or get directions, but also to report accidents and stopped vehicles that may not have cellular capabilities to the authorities. Some higher end vehicles are equipped with traveler information systems, allowing the occupants to get directions, access traffic information in real time, and receive emergency

[21] A. Amanna, E.D. James and S. Panchapakesan, 'Mayday for I-95 Corridor Coalition', presentation to the 3rd World Congress on Intelligent Transport Systems, Orlando, 1996.

assistance automatically. Highway advisory radio and variable message signs allow for the communication of real time information at least in the incoming direction.

These changes in call box/in-vehicle technology, combined with increased comfort among highway users in terms of computer technology, call into question the role of call boxes for motorist assistance and make this an opportune time to pilot test the new generations of call boxes.

Call boxes have been used for years to provide motorist communications, and with the advent of cellular communications and its link with solar energy, the logistics of their installation and use have been simplified. In addition, Virginia has been participating in resource sharing for the past several years. The VDOT allows businesses access to its right of way for communications and other business purposes. In recent years, the most common form of resource sharing has been the use of the VDOT right-of-way for cellular towers.

For this project, twenty-eight of boxes are used on the Dulles Toll Road, one will be used for demonstration purposes. [22]

Call boxes manufactured by Comarco Wireless Technologies of Irvine, California have been chosen by VDOT. VDOT then chose for pilot testing on a 14 mile stretch of the Dulled Toll Road in Northern Virginia. Once installation is completed, motorists require assistance will have only to go to the call box and push a single button and a call will automatically be made to the VDOT Smart Traffic Center (STC). The call box devices allow STC personnel to pinpoint the location of the caller. STC personnel will give call box calls the highest priority of all calls answered in the center. They will determine the nature of the problem and the urgency of the service requested. If the call is of an emergency nature, it will be handled immediately by connecting the caller to the appropriate emergency service provider, such as police, fire, or rescue unit. If the caller requires mechanical assistance, towing companies will be contacted, and if the caller is requesting directions, STC personnel will provide this information as time permits.

---

[22] *NOVA District Call Box Program: Implementation Plan for the Dulles Toll Road*, April 2000

The characteristics of the Dulles Toll Road and the demographics of Northern Virginia create a unique situation, so that these results may not be germane to other roadways. However, there are potential lessons to be learned from the experiences of the Dulles Toll Road that, with appropriate translation, can provide guidance to the usefulness of call boxes, their desirable features and their methods of operation on other VDOT roads.

ASSESSMENT PROCEDURE

As part of this project, customer service and satisfaction is evaluated primarily in terms of awareness of the call box program, ease of call box use, satisfaction with the program, and perception of relative risk/safety associated with the presence of call boxes at one mile intervals. The pre introduction sample survey of users of the Dulles Toll Road is designed to gain insights into what users think of the general strategy as well as to provide a backdrop against which subsequent analysis can be conducted once the system of call boxes is fully operation.

Subsequently, to assist in cost effectiveness assessment, data will be constructed on the number and type of calls received, the location of incidents reported, the additional workload placed on existing staff at the STC, the speed and efficiency with which the call box calls can be handled, and the ability of response agencies in the various localities to interface with the call box responders. There will be a post introduction survey to elicit user views on the system once it has been operational for a period.

A survey of 10,000 users of the Dulles Toll Road was conducted. A prepaid card was distributed to 5,000 SmartTag holders with their regular billing and 5,000 cards were distributed at over three days at three toll plazas situated on the road. The sample of users did not embody the entire population of users. There are also those that makes exact payments through tossing coins into baskets at plazas. These were excluded because of the accident risk associated with passing out cards at these locations.

The sampling was not random but stratified in order to reflect the types insights being sought. The distribution of cards to SmartTag holders was focused on residence of areas that were most likely to be regular users of the road and, thus, have a stronger interest in call box facilities.[23]

In consultation with the operators of the Dulles Toll Road, and in an attempt to both meet sampling needs and to reflect patterns of use, the toll plaza surveys were stratified to broadly reflect use over the day and between weekdays and weekends. Three

[23] These were Zip Codes: 22305, 22301, 22302, 22314, 22311, 22304, 22312, 22213, 22207, 22205, 22203, 22201, 22209, 22204, 22212, 22211, 22214, 22206, 22202.

collection points were targeted in the survey (see Figure 1). A bias towards a relatively larger sample distribution at night was designed to capture insights into concerns about matters such as lighting and security that have emerged in other call box initiatives.

Figure 1. Plazas on the Dulles Toll Road

The survey cards were distributed at the selected toll booths over 14th, 15th, 16th July 2000. During the weekday 4,000 cards were distributed. Of these 3,000 were distributed at the Main Toll Plaza and 500 each at Sulley and Fairfax Parkway Toll Plazas. Of the 3,000 at the Main Toll Plaza, 2,000 were distributed during the day and the

remaining 1,000 at night. For Sulley and Fairfax Parkway plazas, each distributed 300 during the day and 200 at night. On weekends, the 1,000 cards were only distributed at the Main Toll Plaza, 500 on Saturday and 500 on Sunday. For each weekend, 300 were distributed during the day and 200 at night.

For representative temporal coverage, day-time was divided into three periods; morning peak (6 am to 10 am), evening peak (3pm to 7 pm), and off peak (10am to 3 pm). For weekends, daytime was defined as 6 am to 7 pm with evenings from 7 pm to 6 am. Details of the breakdown of the distribution are shown in Table 2.

Table 2. The distribution of cards by location and time.

Day time		
Mail Toll plaza	east bound traffic	morning peak: 300 cards evening peak 500 cards off peak 200 cards
	west bound traffic	morning peak: 500 cards evening peak 300 cards off peak 200 cards
Sulley and Fairfax Parkway plazas	east bound traffic	morning peak: 50 cards evening peak 75 cards off peak 25 cards
	west bound traffic	morning peak: 75 cards evening peak 50 cards off peak 25 cards
Evening hours (7 pm to 6 am)		
Main Toll plaza	east bound traffic	500 cards at about 50 per hour
	west bound traffic	500 cards at about 50 per hour
Sulley and Fairfax Parkway plazas		200 cards at about 20 per hour
Weekends		
Main Toll plaza	east bound	daytime 150 cards per day evenings 100 cards per day
	west bound	daytime 150 cards per day evenings 100 cards per day

The card questionnaire posed questions aimed at gaining information on the views of different users. The number of questions was limited to gain a high response rate and to allow them to fit on a one side of a card. Answers were in terms of either a simple

number within predefined ranges or a yes/no. An open ended question at the end was designed to stimulate more detailed thoughts on the topic and also seen as a device to enhance the response rate. The questions were:

1. How often do you use the Dulles Toll Road?

2. Do you carry a cellular phone while using the Dulles Toll Road?

3. In the past two years, have you needed road side assistance (police, ambulance, tow truck, etc.) while on the DTR?

    3a. How many times?

    3b. How have you received the assistance?

4. In the past two years, how have you received road side assistance elsewhere?

5. How likely are you to use a call box if you need assistance?

6. What is your home zip code?

7. Additional comments in regard to call boxes?

In total there were 931 responses to the survey. The 9.3% rate is high this form of postal survey and may be considered to provide a solid basis for assessing views on the call boxes. Most common respondents (more than 75%) were from the 18 zip codes that received SmartTag mailings.

The majority of those sampled (see Figure 2) were regular users of the Dulles Toll Road with 60% using 4-7 days per week and 22% using it 1-3 days per week. This suggests that the vast majority of respondents are familiar with its features and are in a position to make at least basic comments regarding the call box initiative.

Since there has been a rapid upsurge in the availability and use of cellular telephones it is important to understand whether these offer a satisfactory alternative as a MAS. Previous studies indicate that at least to date they do not. In the Dulles Toll Road situation it was found that 76% of the respondents did carry a cellular phone in their car (Figure 3). This is high by national standards (about 30% of calls in the US are made by cellular phone) and probably reflects the high income in the region, its spread geography, and the considerable number of residents who work in the ‘New Economy’ where there is a proclivity to adopt new communications technologies more rapidly.

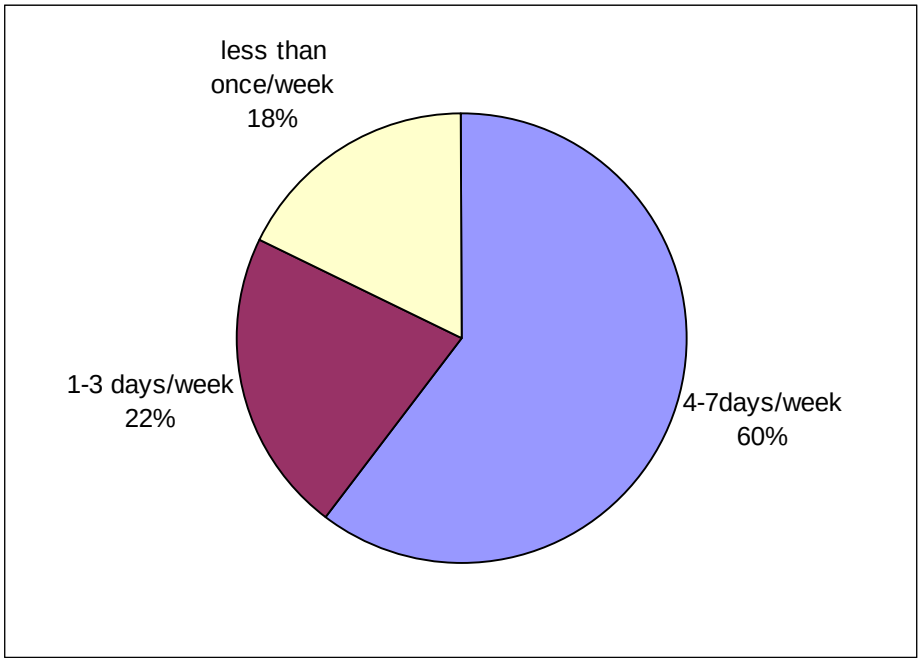


Figure 2. Use of the Dulles Toll Road

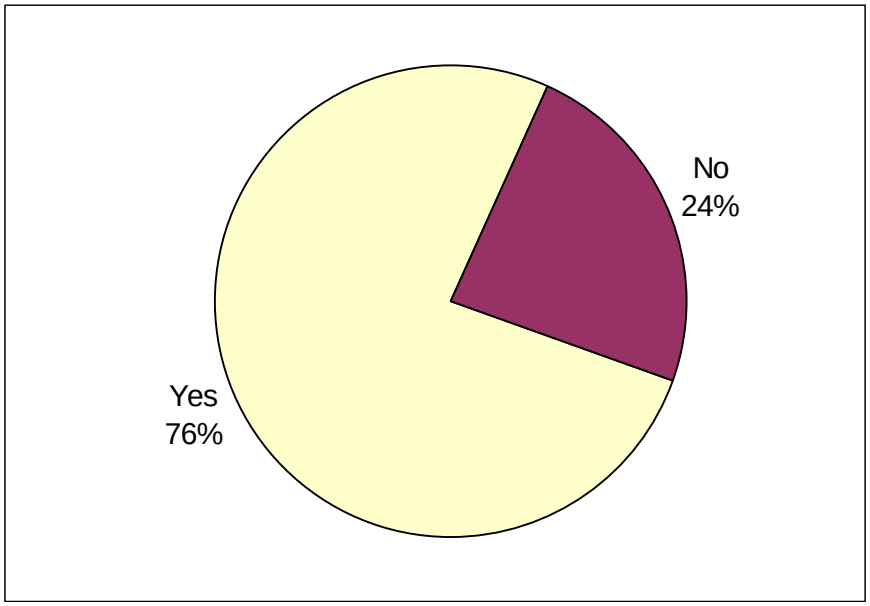


Figure 3. Availability of Cellular Telephones

In terms of the their past needs to summon assistance (police, ambulance, tow truck, etc.) whilst traveling along the Dulles Toll Road, some 9% of respondents said that this had been necessary over the previous two years (Figure 4). The vast majority of those needing aid did so only once (70%) but nevertheless this meant that a significant proportion were involved in multiple incidences requiring assistance.

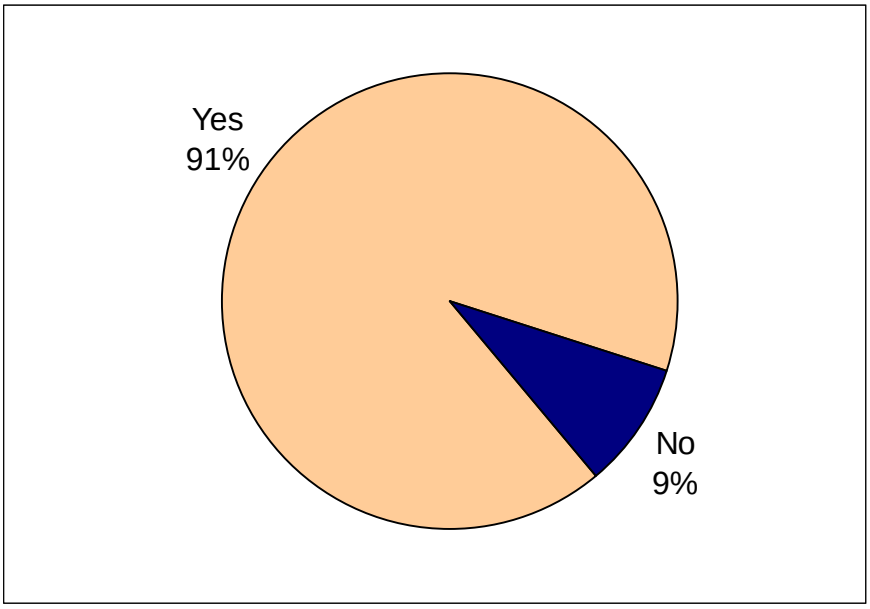


Figure 4. History of Need for Assistance on Dulles Toll Road

The cellular phone proved to be the singularly most important means of obtaining assistance (nearly 50% – see Figure 5) with about 20% of those needing help electing to wait for assistance to arrive from on route patrols.

The wider experiences of Dulles Toll Road users is that they have suffered over 325 incidents requiring road side assistance elsewhere. In these cases the use of the cellular phone was more common (nearly 60% – see Figure 6) possibly because many of these incidents were in areas more remote than the Dulles Toll Road and options such as waiting (11% compared to 17% for the Dulles Toll Road were less attractive). The use of call boxes in these incidents elsewhere was comparatively small – about 4% of those needing assistance.

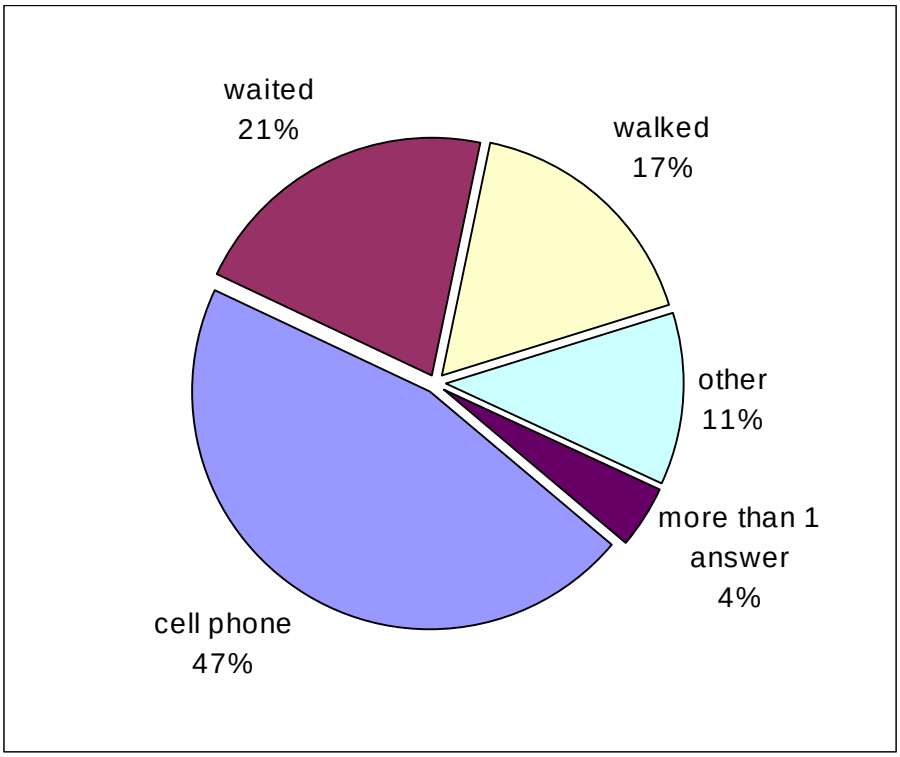


Figure 5. Method of Obtaining Road-side Assistance on Dulles Toll Road

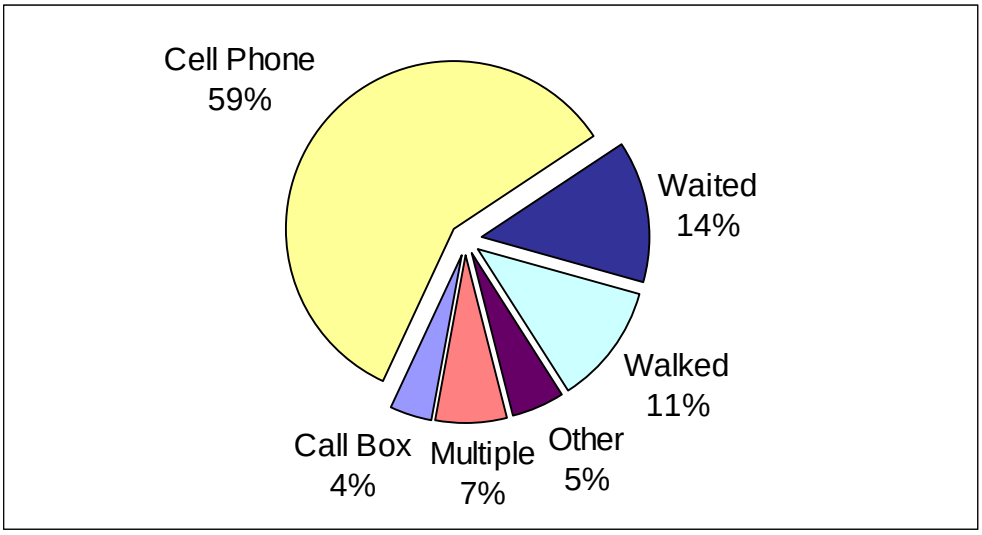


Figure 6. Method of Obtaining Road-side Assistance on Other Road

In terms of the more subjective questions aimed at seeking views on the usefulness of call boxes in the eyes of Dulles Toll Road users. Figure 7 indicates that

62% of the respondents feel that they are ‘very likely’ or ‘somewhat likely’ to use a call box in the case of an incident on the road. This is a high figure given the widespread availability of cellular telephones amongst users of the road and implies that many with a cellular telephone available would utilize call boxes. This may be explained in terms of the direct link that call boxes provided to a relevant source of assistance.

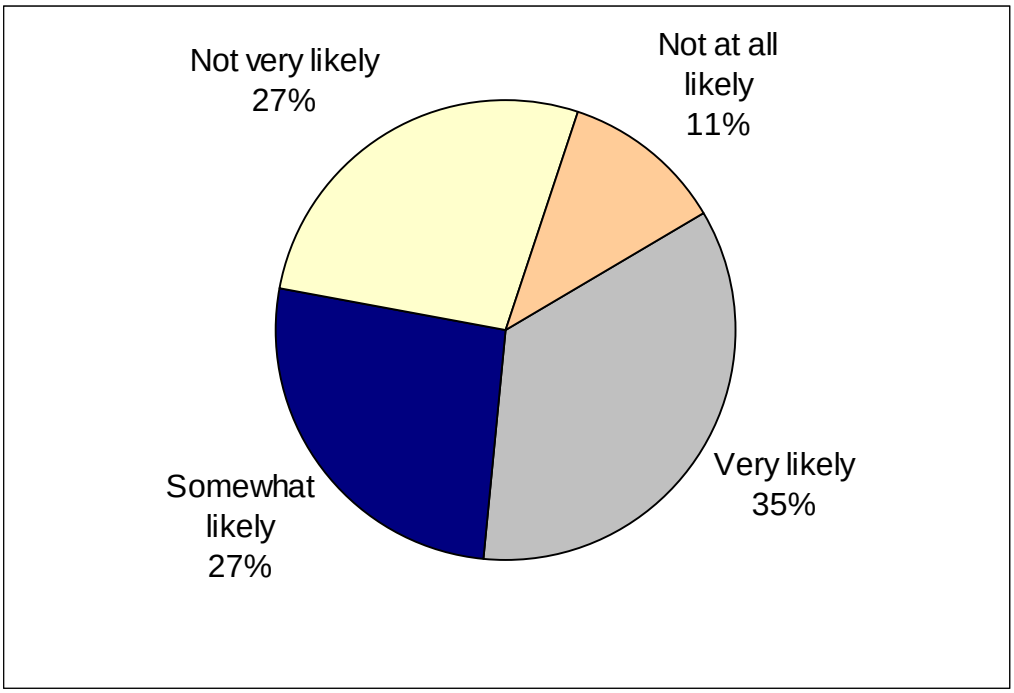


Figure 7. Likely use of Call Box to Summon Assistance

The more general call for additional comments provides insights into the wider issues of interest to Dulles Toll Road users. Just over 300 respondents offered one type of comment or another. About 15% of these had negative comments most either believed that they were not necessary because of prevalence of cellular telephones or concerned that walking to call box was not safe, particularly for females. A limited number suggested alternatives were preferable most notably more police patrols. A very small number indicated the funds for the call boxes could more usefully be devoted to other, non-transportation alternatives such as tax reductions and improving education.

Most comments were broadly positive (e.g., ‘great idea’, ‘excellent safety device’) with some having caveats attached to them. Greatest concerns were expressed regarding the safety of use, particularly whether they would be off highway and well lit. Whether the system will meet these concerns can only be discovered in the post-initiation survey.

CONCLUSIONS

Call boxes have been widely adopted across the US as a mechanism to allow motorists in need of assistance to communicate with emergency and other services. The systems that have been adopted vary considerably in terms of such characteristics as, the types of service offered, the spacing of call boxes, and the costs of provision. It is difficult to draw many broad conclusions from this body of analysis because of the diversity of both the systems examined and the methods of analysis deployed.

Much of the previous analysis has been concerned more with the technical characteristics of call boxes and with the ways in which they have been used rather than with consumer reactions to them. The relevance of the limited previous work on consumer reaction to the Northern Virginian area is also limited because it often concerns populations that are distinctly different. Northern Virginia is a high-income area with a large proportion of its population involved in new economy employment. The travel behavior of residents and their demands on social infrastructure such as call boxes is, therefore, likely to be leading national patterns rather than following them.

A pre-installation survey of current Dulles Toll Road users indicates a very high level of cell telephone availability and that where they have experienced a prior need to summons assistance, either on the Dulles Toll Road or elsewhere, this means of communication has been widely used. Despite this, the survey showed a high level of support for the introduction of call boxes on the Toll Road. Often cellar-telephone owners seeing call boxes as a service to non-owners. It also revealed that the majority of Dulles Toll Road users, despite the exceptions level of cell telephone availability, would at least be ‘somewhat likely’ to make use of call boxes when in need of assistance. In the case of cellar-telephone owners his may be because they are uncertain whom to contact by other means or because they feel their telephone may fail.

The pre-installation findings will be combined with subsequent subjective and objective information gathered after the system has had time to be come fully operational and Dulles Road users aware of its availability. A post-installation road user survey (for sequencing see Annex) will offer a statistical assessment of whether motorists using the

Dulles Toll Road have changed their overall views on the introduction of call boxes after they have been in operation for a time.

This analysis will be combined with objective information gathered from agencies responsible for operating the system and those that provide roadside assistance on impact of the system to overall incidents response. It will also be set beside the use made of individual call boxes to permit assessment of such things as call-box spacing. This will provide a vector of benefits than can then be set against the costs of providing and maintaining the system within the framework of a broad benefit/cost methodology. Because of the diversity of effects to be assessed and the impossibility of quantification and evaluation of many of them, a planning balance sheet methodology will be used.

The outcome is intended to provide a basis for assessing the system of call boxes on the Dulles Toll Road as an entity but also allow more detailed consideration of the role of individual boxes in the system.

POST-INSTALLATION SURVEY

The results presented in this section of the report summarize data collected in a post-installation survey of Dulles Toll Road drivers. The objective of the post-installation survey is to ascertain customer perceptions regarding the value benefits of the call boxes installed along the Dulles Tool Road. This data is combined with information pertaining to the maintenance costs and call box use to establish a framework for a planning balance sheet assessment of the Dulles Toll Road call box system. In addition, the results obtained in the survey may provide insight into the value of conducting driver surveys regarding service and investment issues.

The process for the post-installation survey mirrored the process followed in the pre-installation survey. A survey of 10,000 users of the Dulles Toll Road was conducted during March 2001. Average weekly traffic on the Dulles Toll Road is 980,000 vehicles. As noted previously, the sample and application of the survey were designed to distribute surveys to a representative sample of the driver population. Surveys were distributed to approximately 10 percent of the Toll Road driver population.

A temporal stratification of the weekly driver population, as defined for the pre-installation survey, was defined by weekdays and weekends, and three periods, morning peak, evening peak and off-peak. An equal number of surveys were distributed by tollbooth operators and through the mail with the monthly billing. Distribution, conducted on the 14th, 15th, and 16th of March, included 4,000 weekday surveys and 1,000 weekend surveys. Of the weekday surveys, 3,000 were handed out from the Main Toll Plaza, with the remainder split evenly between Sulley and Fairfax Parkway Toll Plazas. For the Main Toll Plaza, Sulley, and Fairfax Parkway plazas, two-thirds of the surveys were distributed during the day and the balance during evening hours. Delivery of the weekend surveys was handled by the Main Toll Plaza, with 500 cards distributed on each day of the weekend. As with the weekday survey, two-thirds of the surveys were allocated to daytime travelers and one-third to evening travelers. Details of the distribution process followed for the surveys are presented in Table 2.

The postcard survey was designed to elicit information from a representative sample of the Dulles Toll Road driver population. An initial post-installation survey was drafted by the School of Public Policy (SPP). The survey format and questions regarding

driver characteristics were based on those of the pre-installation survey so that samples could be tested for statistical similarity. The remaining questions, included in the survey, were designed to gain insight into the perceptions of drivers, regarding the newly installed call boxes A draft of the post-installation survey was submitted to the Virginia Department of Transportation (VDOT) for comments. Revisions were made to the survey based on comments returned to the SPP, and final approval of the survey was given by VDOT. Questions included in the post-installation survey were:

1. How often do you use the Dulles Toll Road?
2. Do you carry a cell phone while using the Dulles Toll Road?
3. Have you observed the call boxes along the Dulles Toll Road?
4. Does the presence of call boxes enhance your sense of security along the Dulles Toll Road?
5. In the past 5 months, have you needed roadside assistance on the Dulles Toll Road?
    - If Yes, Did you use a call box for assistance? If not, why.
6. How likely are you to use a call box if you need assistance?
7. Did you receive the previous Dulles Toll Road call box survey?
8. What is your home and work zip codes
9. Please rate these characteristics of call boxes along the Dulles Toll Road:
    a. Visibility
    b. Accessibility
    c. Value

The 500 surveys returned by drivers represent a response rate of 5 percent. The sample is statistically valid at the 95th percentile. The response to the post-installation survey is about half the response to the pre-installation survey. One explanation for the higher response rate in the pre-installation survey might be attributed to driver perceptions about their ability to influence the investment decisions of the VDOT. This is indicated by the comments drivers provided in their pre-installation survey returns. Approximately three percent of the post-installation survey response group also received

the pre-installation call box survey. Characteristics of the drivers, considering average weekly use of the Dulles Toll Road,[24] need for assistance in the past two years,[25] likely use,[26] and cell phone use,[27] were not statistically similar for the pre-installation and post-installation surveys. Therefore, comparisons between the surveys will not be included in the summary.

[24] T=6.44, ∝=.01
[25] T=39.27, ∝=.00
[26] T=54.26, ∝=.00
[27] T=10.27, ∝=.00

Driver Profile

Over three-quarters of the survey respondents are regular users of the Dulles Toll Road, traveling the road at least once day per week. Average weekly use of the Toll Road is concentrated in the group reporting that they travel the road 4 to 7 days per week. Other respondents indicated a fairly even split between users traveling the road 1 to 3 days per week and less than once a week, at 24 and 22 percent, respectively.

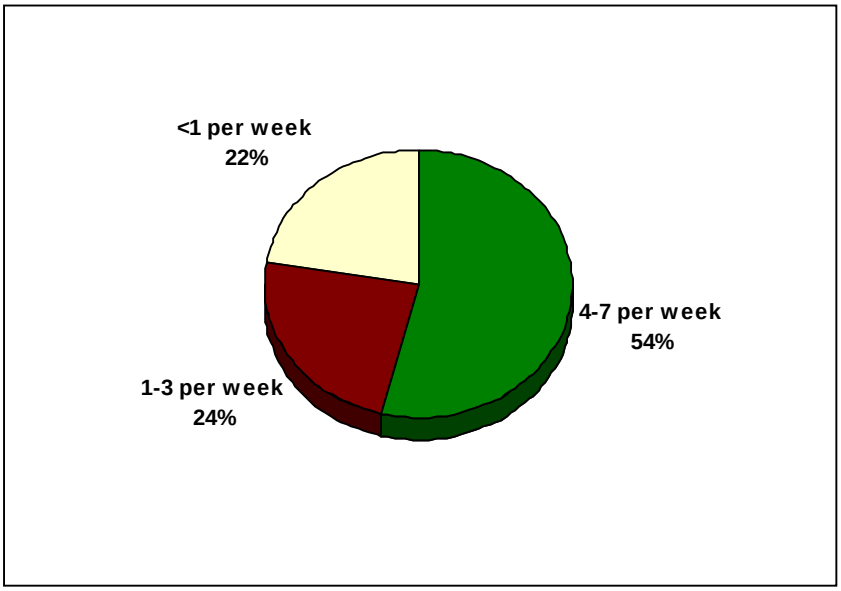


Figure 1. Average Use of Dulles Toll Road, in Days per Week

In addition to use of the Toll Road, drivers were asked if they carry a cell phone while traveling the road. The cell phones provide an alternative for drivers in need of assistance to contact help. Based on survey

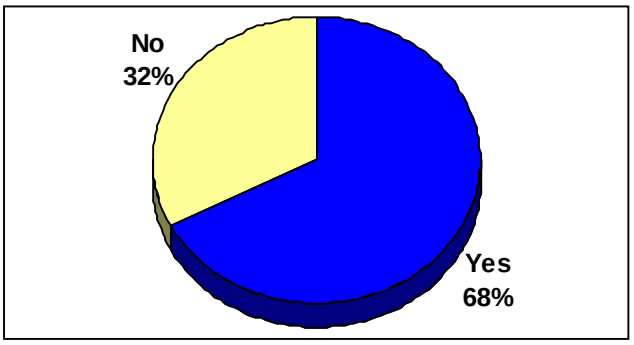


Figure 2. Respondents that Carry Cell Phone when Traveling the Dulles Toll Road

responses, 68 percent of the drivers on the Dulles Toll Road carry a cell phone when they

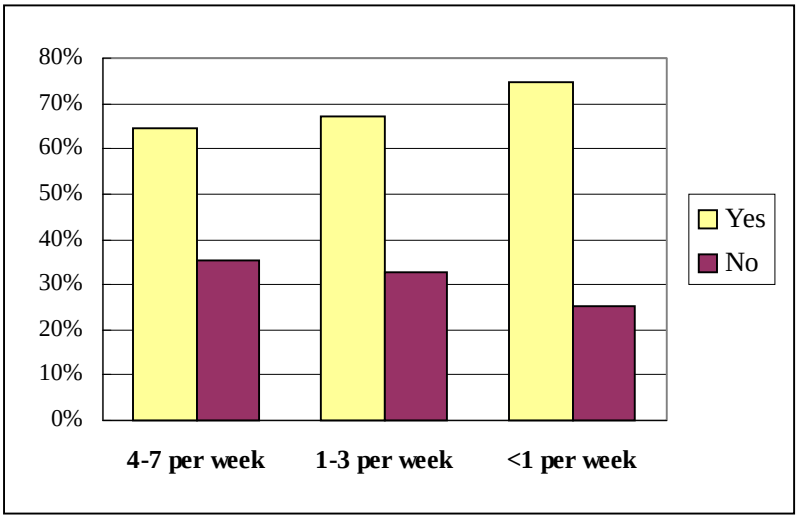


Figure 3. Drivers Carrying Cell Phones, by Days per Week Traveling the Dulles Toll Road

travel the road. At the 90th percentile, there is a statistically significant difference in the likelihood that drivers will carry a cell phone when drivers are grouped into regular users of the toll road (those traveling the road at least once per week) and infrequent users (those traveling the road less than once per week). Approximately 75 percent of the drivers traveling the Toll Road less than once per week are carrying a cell phone. This compares to about 65 percent of the regular toll road users. This response suggests that the call boxes may be more important for regular customers of the Dulles Toll Road than to those individuals who use the road sporadically.

The likelihood of drivers to use the call boxes is an important indication of the value the boxes offer drivers. Only 7 percent of the drivers reported that they were not at all likely to use the call boxes along the Dulles Toll Road. Over a third, 36 percent, of the drivers indicated that they were very likely to use a call box if they were in need of

assistance. As previously noted, the prevalence of cell phones among drivers on the Toll Road may influence perceptions and likely use of the call boxes for obtaining driver assistance.

Drivers were asked about their need for assistance on the Dulles Toll Road in the past two years. Only 5 in per 100 respondents had required assistance during the specified time period. For the 22 respondents reporting they had required assistance, 3, or 14 percent, had used a call box to request help. The primary source of assistance for those needing help was the cell phone. Other reported that the tollbooth operators and nearby patrolmen as sources of their assistance.

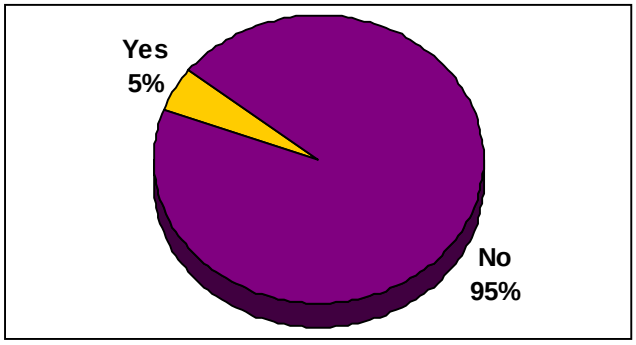


Figure 4. Percent of Drivers Needing Assistance on the Dulles Toll Road in the Past

Determining a relationship between certain driver characteristics and likely call box use may provide an opportunity to use secondary data source to discuss how drivers value call boxes along roadways. A least-squares regression model was used to evaluate the relationship between driver characteristics and likelihood of call box use for Dulles Toll Road drivers. When the effects of carrying a cell phone, frequency of Toll Road

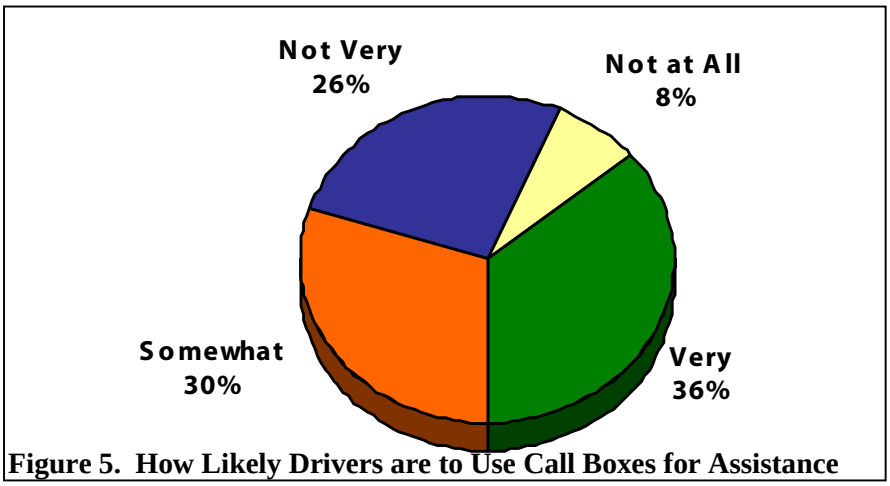


Figure 5. How Likely Drivers are to Use Call Boxes for Assistance

travel, and need for assistance during the past two years are controlled, 25 percent of the variance is explained (R^2=.253). The likelihood of a driver using the call box has a significant inverse relation to carrying a cell phone at the 99th percentile (t=-11.77, ∝=.00).

The distribution responses from drivers carrying a cell phone while traveling the Dulles Toll Road is compared to that of responses from drivers not carrying a cell phone in Figure 4. The difference in responses is evident as 72 percent of the drivers who do not carry a cell phone very likely to use a call box, compared to only 19 percent of the drivers who carry a cell phone. Thus, as expected, those drivers not carrying cell phones attribute a higher value to the availability of call box for emergency communications.

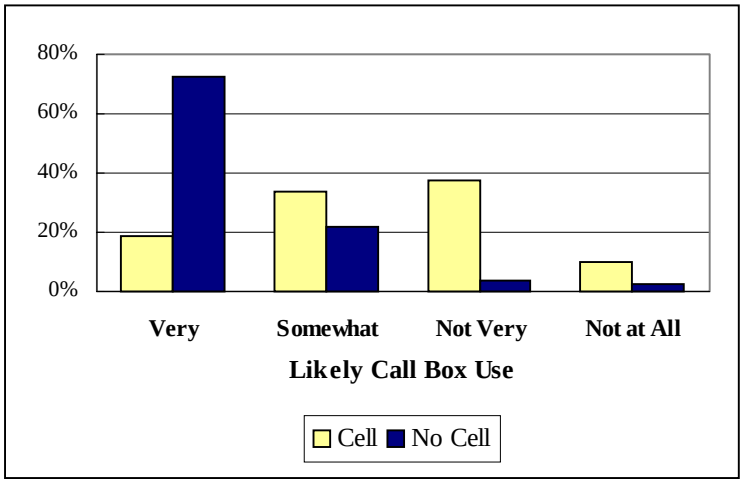


Figure 6. Likelihood of Driver to Use Call Box, Drivers Carrying Cell Phone Compared to Drivers not Carrying Cell Phone

Regarding driver awareness of call box installation, the VDOT did provide an educational notice describing call box locations and features in the monthly customer

billing shortly after the call boxes were installed. As the call boxes are a new feature of traveling the

Dulles Toll Road, drivers were asked if they had observed the call boxes when traveling the road.

Slightly more than half, 51 percent, of the respondents indicated they had identified the call boxes when driving the Toll Road. Visibility of the call boxes is less than optimal because the

Dulles Toll Road was not designed to house call boxes. The VDOT worked within restricted parameters, defined by road design and safety concerns, in positioning the call boxes along the Dulles Toll Road.

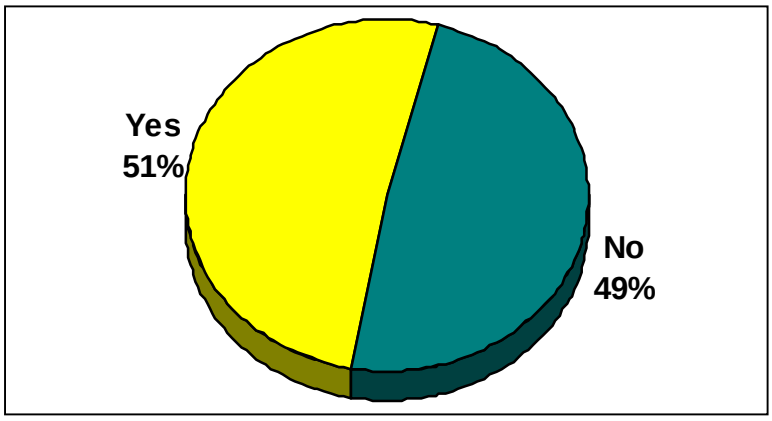


Figure 7. Observation of Call Boxes Along the Dulles Toll

Driver Perceptions

The balance of the survey questions were subjective. The questions were directed

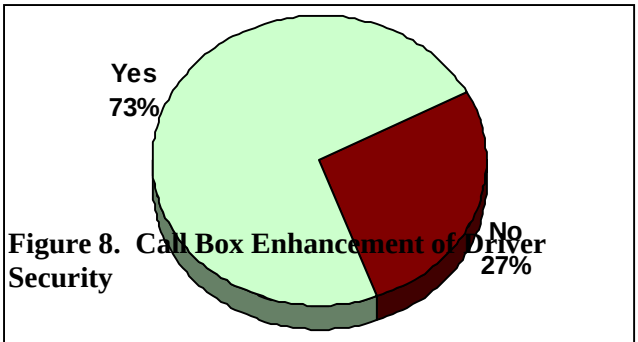
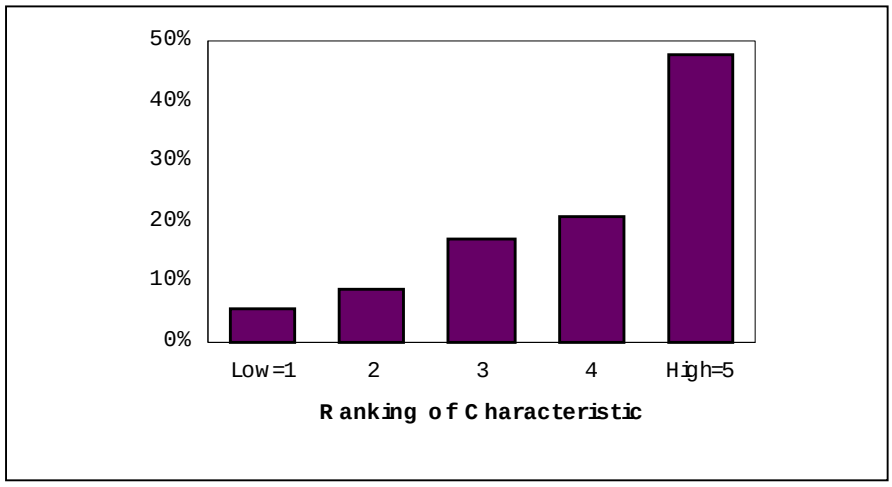


Figure 8. Call Box Enhancement of Driver Security

at ascertaining driver perceptions of the newly installed call boxes. One goal of the VDOT Dulles Toll Road call box project was to enhance the service provided to drivers. The call boxes lend to driver's ability to secure timely assistance if a mishap should occur while traveling the Toll Road. With regard to security, a vast majority of drivers reported that the call boxes did contribute to their sense of security. Nearly three-quarters of the survey respondents indicated that they felt the call boxes enhanced driver security.

In the final section of the survey drivers were asked to convey their opinions of three characteristics through an ordinal ranking. Drivers rated visibility, accessibility, and value of call boxes on a scale of 1 to 5, with 1 indicating a low opinion and 5 indicating a high opinion. The value of call boxes to drivers received a rating of 4.0. Approximately 48 percent of the respondents selected the high end of the scale, five, to indicate their perception of the value of call boxes to drivers. Only 6 percent of the respondents thought the call boxes had low value to drivers. This high rating is consistent with the driver reaction to the role of call boxes in enhancing security.



The visibility and accessibility of call boxes are both in the neutral range of the scale. Visibility was given a rating of 2.8, just below mid-range. Accessibility was rated 3.2, slightly higher than the mid-point in the scale. Over one-quarter of the respondents ranked the visibility characteristic with the lowest rating allowed. As aforementioned, the VDOT was limited by safety and engineering parameters in positioning the call boxes

Figure 9. Respondent Rating of Call Box Value to Drivers

along a road that had not been designed to house such enhancements, so less than optimal ratings were expected.

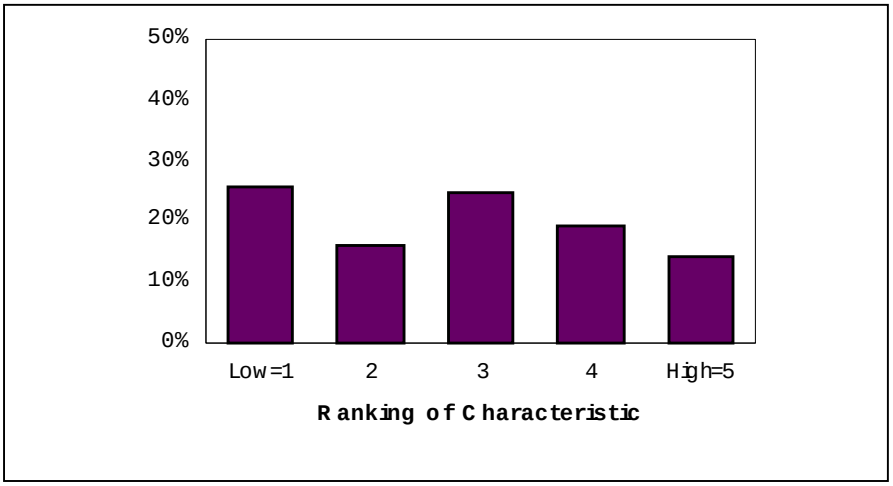


Figure 10. Driver Rating of Call Box Visibility

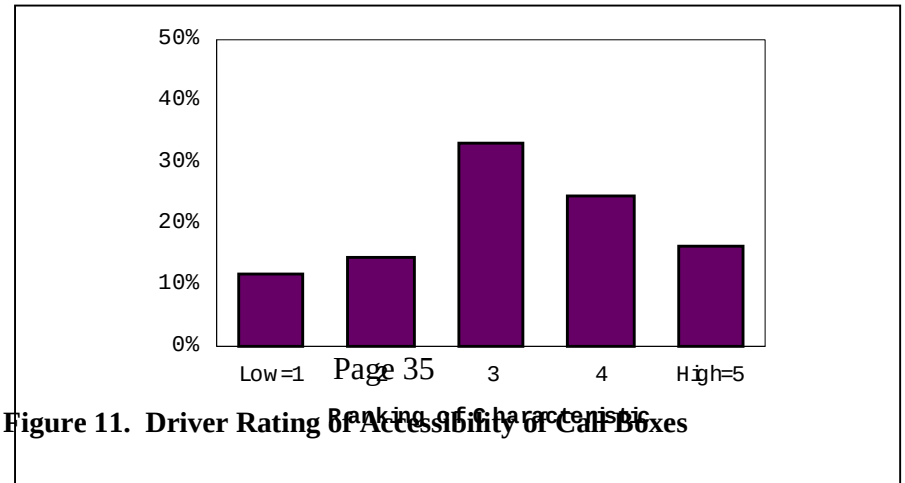


Figure 11. Driver Rating of Accessibility of Call Boxes

PLANNING BALANCE SHEET ASSESSMENT

Costs

The primary costs considered in this evaluation of the Dulles Toll Road call box system are administration and maintenance. Administration costs are based on the VDOT estimate of the contract administration support and operation costs. The discussion of administration costs are based on the log of calls handled through the call box operations center in the VDOT Smart Traffic Center (STC) control room. Maintenance of the call box system includes conducting regularly scheduled system tests, cleanings, and repairs. Maintenance is currently handled by a contractor to the VDOT, Comarco Wireless Technologies. The cost for this contractor as well as options for in-house and alternative contractors are discussed.

The estimated cost of contract administration support is $10,400 (Bertsch, et al., 2000). The salaries of personnel assigned to the STC included as a cost in the VDOT estimate of the call box program. The VDOT deemed this an additional responsibility for current duties (Bertsch, et al., 2000).

Administration of the call box system required response to an average of 64 calls per month, or approximately 2 per day, during the first six months the system was in full operation, from October 2000 to March 2001. Of these calls, approximately 21 calls per month (less than 1 per day) were identified to be calls related to driver emegencies such as road hazards and car trouble. The balance of the calls were for other purposes such as information. In visits to the Smart Traffic Center, operators relayed postivie comments

about the system. The operators did not view the system as overly burdensom, and provided anecdotal support of the value of the call boxes in enhancing driver experiences on the Toll Road.

Dulles Toll Road Call Box Activity, October 2000 to March 2001

	Oct	Nov	Dec	Jan	Feb	Mar
Demo/Training	80	10	14	3	47	3
Information	51	25	58	31	29	44
Emergency	25	24	24	27	19	17

Maintenance and service costs for the call box system were estimated to be $12,499 annually for the 2-year pilot project, with an estimated $7,975 required for maintenance and $4,524 required for cellular phone service. Comarco Wireless Technologies, the current contracted maintenance provider, provided details of the maintenance program components and any repair costs for the Dulles Toll Road call box system. To gain a broader perspective on the potential for future repair needs and alternatives handling maintenance of the system three other facilities in the area that house similar call box systems were contacted: the Dulles Greenway, the Congressional Country Club, and the Dulles Airport.

A summary of the tasks and timetable for the regular maintence contract and a log of additional maintenance calls was supplied by Comarco. The maintenance log for the VDOT call box system for October 1, 2000 through March 31, 2001 included 21 service calls. The total for cost for repair calls to the VDOT Dulles Toll Road call box system

during the six month period was $914. Comarco did note that "all failures labeled TTY-Key/Cable were the result of improper assembly during the manufacturing process. These problems did not show up until cold weather arrived in your area. The cable problems have been resolved and therefore this was a one time manufacturing deficiency. These cable problems should not be included in standard ongoing maintenance."

Comarco provided this summary regarding tasks and timetable for regular maintenance contract terms. "Each individual callbox contains a controller board that reports to a maintenance computer any failures such as handset failure, keyboard failure, low battery voltage, etc. Since the system is self-diagnostic, there is no reason to perform any kind of periodic inspection for any reason. The only routine maintenance done is to periodically send someone to the call box to clean the housing. This removes the road grime and makes the call box look clean and new. This is done typically once or twice a year. Comarco does charge a fee (per box) to monitor the system and make any necessary repairs as needed. We can also sell, to the system owner, the maintenance computer so that monitoring and maintenance can be done in-house."

Table . CamarcoVDOT Maintenance Summary, Period 10/01/2000 to 3/31/2001

ANI	Service date	**Reason for service**	Cost	Hours
205	10/20/00	Missed report	74.00	1
226	11/06/00	Missed report	60.00	1
202	12/05/00	TTY	60.00	1
207	12/05/00	TTY		
209	12/05/00	TTY-key/cable	60.00	1

210	12/05/00	TTY-key/cable		
212	12/05/00	TTY-key/cable	60.00	1
215	12/06/00	TTY-key/cable	60.00	1
216	12/06/00	TTY		
220	12/06/00	TTY		
205	12/21/00	TTY		
219	12/21/00	TTY	60.00	1
219	1/02/01	TTY	60.00	1
226	1/02/01	TTY		
229	1/10/01	TTY	74.00	1
213	2/21/01	TTY-tray		
226	2/21/01	TTY-tray	60.00	1
206	2/22/01	TTY-tray	60.00	1
206	3/16/01	Missed report	74.00	1
221	3/16/01	*Missed report*	150.00	2
225	3/16/01	TTY		
Total			**914.00**	

A summary of information collected for similar systems in the area is provided. The Dulles Greenway reported that they have 10 of the Comarco Wireless Technologies call boxes in operation along their road. During the 5 years the call boxes have been in place, repair costs have been minimal - 1 solar panel and 1 static sign. Maintenance for the Dulles Greenway call boxes is handled by Transcore. The maintenance plan includes a weekly check of the system and a monthly check and cleaning. Theses services are a part of the contract the Dulles Greenway maintains with Transcore to handle both toll booth and call box preventive maintenance and repairs.

The Dulles Airport has call boxes in each of its remote parking lots. The maintenance and repairs are handled by Bell Atlantic, the service provider. The Congressional Country Club, as with the Dulles Toll Road, contracts with Comarco

Wireless Technologies for call box maintenance and service. Neither the Airport or Country Club could provide additional maintenance information.

The information regarding in-house and alternative contractor options maintenance are also considered. This information provides a framework for assessing the current arrangements and costs and may also be of value to the VDOT in future evaulating its maintenance plans and contracts.

The VDOT has not, to date, conducted an assessment of internalizing call box maintenace and repair responsibilities. Three potential contractors were contacted regarding maintenace: Verizon, Cellular One, and Transcore. Verizon provides maintenance only for system which it also provide communications services. Cellular One does not provide this type of service. Transcore, the company which currently maintains the boxes along the Dulles Greenway, agreed to submit a task schedule and cost estimate for maintaining the 28 call boxes along the Dulles Toll Road.

RECOMMENTATION AND COMMENTS

Recommendations are noted for informational purposes and for potential customer enhancement of the call box service.

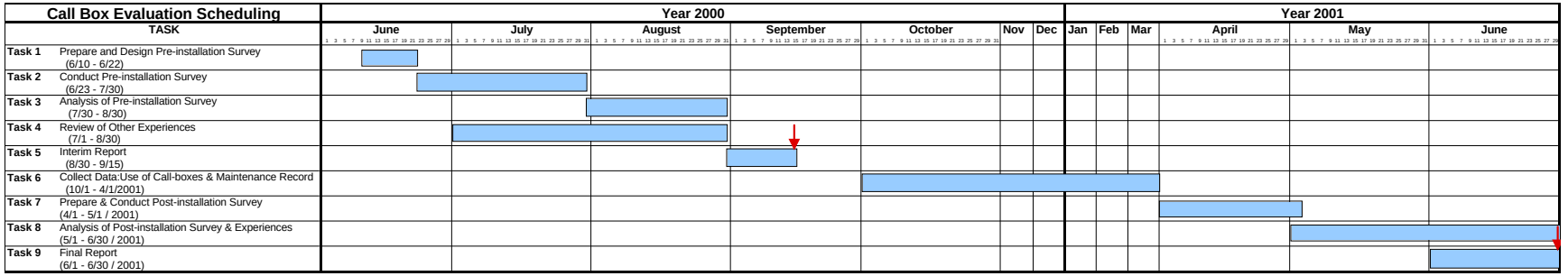
- review of log entries for consistency,
- continued training program
    - "random" scheduled calls to the STC from call boxes by VDOT personnel
    - feedbad and critique session for call box operators
- some recognition program for performance of call box operators,
- assessment internalization of call box maintenance and repairs, and
- with regard to drivers, a sign in the box that would alert drivers that the call box connection may take up to three minutes (or some increment there of).

- **REFERENCES**

Bertsch, Randall J. and Alan W. McCormick. "NOVA District Call Box Program: Implementation Plan for the Dulles Toll Road," April 2000.

ANNEX.

Schedule of Work*



* Due to the delayed operation of the call boxes, the middle phases of the work will be pushed back 2 months