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Montgomery County Parking Project c/o
Interdisciplinary and Global Studies Division
Worcester Polytechnic Institute
100 Institute Road
Worcester, MA 01609

December 12, 2002

Mr. Stan Gray
1104 Spring Street
Silver Spring, MD 20910

Dear Mr. Gray,

Enclosed is our report entitled *Assessing Patrons' Perceptions of Safety and Security in Parking Facilities*. It was written at the Division of Traffic and Parking Services during the period of October 21, 2002, through December 10, 2002. Preliminary work was completed in Worcester, Massachusetts, prior to our arrival in Silver Spring, MD. Copies of this report are simultaneously being submitted to Prof. Susan Vernon-Gerstenfeld and Prof. Ronald Biederman for evaluation. Upon faculty review, the original will be catalogued in the Gordon Library of Worcester Polytechnic Institute. We thank you for the time that you and everyone in the office has devoted to us.

Sincerely,

A handwritten signature in cursive script that reads "John Chrzanowski".

John Chrzanowski

A handwritten signature in cursive script that reads "Cory Melemed".

Cory Melemed

A handwritten signature in cursive script that reads "Allan Sword".

Allan Sword

ASSESSING PARKING PATRONS'
PERCEPTIONS OF SAFETY AND SECURITY

Report Submitted to:

Susan Vernon-Gerstenfeld
Ronald Biederman

Washington, Project Center

John Chrzanowski

Cory Melemed

Allan Sword

In Cooperation With:

Stan Gray, Security Program Manager

Montgomery County Department of Public Works and Transportation

December 12, 2002

Advisor Signature

Co-Advisor Signature

ABSTRACT

Our report involved our work with the Montgomery County, Maryland Department of Public Works and Transportation. We created a way to annually survey parking patrons and assess their perceptions of security in parking facilities. To do this, we first created a questionnaire based on the topics of demographics, parking behavior, and safety and security issues. We then determined our sample, pre-tested the questionnaire, and distributed it. We then analyzed the responses to draw conclusions about the patrons' perception.

AUTHORSHIP

Each section of this report has been typed, edited, and developed by John Chrzanowski, Cory Melemed, and Allan Sword. Because of this, we do not feel that we can delineate the contributions for each section between the group members.

We want to acknowledge the help and service of the following people:

Professor Susan Vernon-Gerstenfeld – Advisor

Professor Ronald Biederman – Advisor

Stan Gray, Security Program Manager – Liaison

John Greiner, Office of Management and Budget – Project Coordinator

Rick Siebert, Chief of Parking Operations

Veeda Wilkenson, Parking Program Specialist

Division of Traffic and Parking Services Personnel

MVA Sting Security

Corey Lusher

Michae

Please leave
hard copy with
Barbara. before
sending to Registrar

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EXECUTIVE SUMMARY

When security breaches are brought to public attention, people's perceptions can become biased. The Montgomery County Government asked us to determine how the people's perceptions are affected by the maintenance and security of the parking facilities. They proposed this quantitative study to assess these perceptions of patrons that use their facilities.

There has been more research done by groups involving parking security issues related to the security standpoint than from the patrons' perception. Little research has been done, however, from the public point of view involving the social repercussions of crimes in parking facilities.

The results were used to determine the perceptions of facility patrons. The goal of Montgomery County is to provide the people who use county facilities with the highest level of service possible. Even though liability is not the primary concern of the County, it is nevertheless a beneficial aspect related to improving their parking facilities.

Regardless of the motivation driving the research, the data collected could be useful for other groups such as the people who use parking facilities, managers of other parking facilities, and social scientists. Those people could use this information to form more accurate perceptions of existing parking services. In order to fulfill the tasks requested for the study involving the parking facilities run by Montgomery County Government, our group researched aspects of parking garage security to determine the most prevalent factors involving crime, patrons, and the administrators of the facilities.

The perceptions of Montgomery County parking facility patrons are affected by the crime that transpire in the vicinity of the facilities, causing us to do research on social perceptions. As a result, part of the work undertaken for this study involved identifying

sources of social perception that related to how safe people feel in parking facilities. One source of negative perception was related to the statistics of crime in the area.

Completely preventing criminal behavior in parking facilities is not always possible, but understanding the problem is the first step in solving it. Twenty percent of crimes that incite security related lawsuits take place in parking lots. As much as thirty percent of all of assault and battery cases, twenty percent of robberies, fourteen percent of wrongful deaths, and fourteen percent of rape cases occur in parking lot facilities (Parking: Lots of Crime, 1996). With this information in mind, we assumed that the percentage of crime occurring in parking facilities is frightening to both consumers and facility owners.

An aspect of growing significance in the eyes of parking facility owners is the increase in liability lawsuits stemming from criminal activity carried out on their property. During a ten-year study, 40 percent of security lawsuits in malls were filed due to incidents in parking facilities (Parking: Lots of Crime, 1996), and one third have resulted in an average judgment of \$1.2 million. Due to this development, parking lot owners have been forced to become more proactive in the security of their patrons.

Unfortunately, the owners have found that picking the most effective form of security for a parking facility can prove to be a very difficult task. The easiest and cheapest way to improve security in parking facilities is adequate lighting.

Crimes in parking facilities have caused the patrons to have negative perceptions pertaining to the level of security, especially at night, which could possibly explain a thirty-five percent drop in retail sales after six o'clock PM (Parking: Lots of Crime, 1996).

The goal of this project was to create a method for the Division of Traffic and Parking to routinely assess and analyze the perceptions of safety and security among the patrons that use parking garages and parking lots in Montgomery County.

There are approximately fifty facilities maintained by Montgomery County Government. Security for the parking facilities is provided by several different agencies, including a private contractor, Montgomery County Police Department, Maryland National Capital Park Police, and Silver Spring Service Corporation. The physical structures of the parking facilities provided us with an idea of what kinds of conditions are affecting the perceptions of the facility patrons. As a result, we gained an understanding of how patrons utilize the facilities and whether any facility has had recurrent issues that have endangered the safety of their patrons.

Once we created all of our questions for our questionnaire, we determined our sample population, size and sampling method. More specifically, it was those people who use the county-run parking facilities, even if they live outside the county. We distributed 1500 questionnaires to allow for an approximate seventy-four percent non-response among patrons in order to get an accurate sample. The parking facility patrons pay by three different methods: cash, Parking Convenience Stickers (PCS) which act as monthly passes, and cash keys in which patrons add money and have it deducted from their account at parking meters. We felt that due to factors of turnover rates, patrons utilizing PCS and from touring the facilities that there were more people who used parking meters than PCS. The other 600 questionnaires would be mailed to randomly selected PCS owners, whose information was obtained from renewal slips provided by the Parking Division.

Our next step was to create a questionnaire that all of the patrons could answer easily. Stratifying the patrons allowed us to search for patterns among the responses to see if perceptions differ among the various groups of patrons. Other questions involved using the criteria and variables defined earlier to see how patrons felt about conditions in the parking facilities. After the DPWT supervisors approved our questionnaire, we pre-tested the questionnaire.

The facilities we administered our pre-test on was City Place in Silver Spring, Shady Grove Metro in Shady Grove, Lot 13 in Wheaton, and Lot 24 in Bethesda. By using a pre-coded questionnaire, results were more efficiently tabulated to speed up the analysis. We used this procedure for the pre-test, but during the final administration of the survey, the patrons read, answered and returned the questionnaires themselves. With the data involving several variables affecting patrons' perceptions of the parking facilities, the DPWT now has a greater understanding of the parking facilities image to the public.

INTRODUCTION

Security is an issue of utmost importance to people everyday. Everyone is concerned about their safety and the security of their possessions when situations are out of their control. When security breaches are brought to public attention, people's perceptions can become biased. Perceptions in general, however, do not always accurately display the true level of security. When perceptions are negatively biased, people become more fearful than they need to be.

According to Stan Gray (personal communication, September 3, 2002), the Security Program Manager of the Montgomery County's Department Public Works and Transportation, the criminal activity in the county is vastly lower than that of surrounding cities and counties. The FBI releases crime statistics for the country each year. In 2000, Washington DC reported 6,600 motor vehicle thefts, whereas Montgomery County had 2,731. Also, recent statistics show that Washington DC has a population of 572,059 and Montgomery County has a population of 873,341 (FBI, October 22, 2001). Although vehicular theft rates are lower in Montgomery County, considering that the majority of the citizens are upper-middle class, the patrons of the county-run parking lots and garages still have concerns pertaining to the magnitude of the automobile crime situation. The Montgomery County Government asked us to determine how the people's perceptions are affected by the maintenance and security of their parking facilities. They proposed this quantitative study to assess these perceptions of patrons who use their facilities in order to obtain baseline data and to monitor the changes in perception as their security program evolves.

There has been more research done by groups involving parking security issues related to the security standpoint than from the patrons' perception. A study was conducted at John Hopkins Medical Institution to evaluate the parking facilities' security from the viewpoint of the security personnel (Coppola J., Cohen L., Economas G., October, 2001). Little research has been done, however, from the public point of view involving the social repercussions of crimes in parking facilities.

This project's purpose was to create a questionnaire that the county government could routinely administer to evaluate the perceptions of their clientele. Part of our process was to define criteria that would be used to evaluate these perceptions. With the criteria in mind and the approval of our supervisors, we created a questionnaire that was distributed to the sample population. The results were used to determine the perceptions of facility patrons. This research was then submitted to the Montgomery County Public Works and Transportation Department.

The purpose of pilot testing is to evaluate the effectiveness that the enhancements have provided. In the case of Montgomery County, the Federal aid money was used for security improvements. In order to effectively utilize the award, the Montgomery County is implementing the measures to give a baseline from which to gauge how beneficial each development is compared to the cost.

This project is important to the Montgomery County Government since it will provide the Department of Public Works and Transportation with the information that will help provide for the parking patrons' needs. The goal of Montgomery County is to provide the people who use county facilities with the highest level of service possible. A byproduct of the increased service is a reduction in liability for Montgomery County.

This is beneficial for the county because parking facility crimes are the leading cause of lawsuits related to crimes committed on a property (Mesenbrink J., September, 2001). Even though liability is not the primary concern of the County, it is nevertheless a beneficial aspect related to the improvement of their parking facilities.

Regardless of the motivation driving the research, the data collected could be useful for other groups such as the people who use parking facilities, managers of other parking facilities, and social scientists. Those people could use this information to form more accurate perceptions of existing parking services. Managers of other parking facilities could gain a better understanding of their own patrons, and social scientists may be able to further recognize patterns in human behavior.

LITERATURE REVIEW AND BACKGROUND

In order to fulfill the tasks requested for the study involving the parking facilities run by Montgomery County Government, our group researched aspects of parking garage security to determine the most prevalent factors involving crime, patrons, and the administrators of the facilities.

The sections in this literature review include the following topics: the concept of perception and crime in parking facilities. We will also discuss the background of the Montgomery County's Division of Traffic and Parking. For parking facility crime, we will discuss security, statistics of crime, and Crime Prevention Through Environmental Design (CPTED). The Montgomery County section discusses the mission of the Parking District Services, current security, and parking conditions in each district. We will describe perception, what influences it, and how it relates to our study.

Crime in Parking Facilities

Crime can be an unpleasant facet of our society to discuss, but it exists and must be considered. Completely preventing criminal behavior in parking facilities is not always possible, but understanding the problem is the first step in solving it. The second step is to evaluate what steps are needed to protect the owners of the facility in case an incident does occur on their property. There is an increasing need for parking facility owners to secure their surface lots and garages due to the rise in liability lawsuits as is discussed in the liability section on page 15.

After the initial problem of lacking security is assessed by the parking administrators, the next step is to decide what security precautions are most needed for

the particular type of facility as well as which measures would be the most cost-effective for accomplishing the task. The final phase is to then implement and utilize the most useful methods for preventing crime in the facility.

Crime Statistics in Parking Lots

Twenty percent of crimes that incite security-related lawsuits take place in parking lots. As much as thirty percent of all of assault and battery cases, twenty percent of robberies, fourteen percent of wrongful deaths, and fourteen percent of rape cases occur in parking lot facilities (Parking: Lots of Crime, 1996). With this information in mind, our team assumes that the percentage of crime occurring in parking facilities is frightening to both consumers and facility owners. During a ten year study, forty percent of security lawsuits in malls were filed due to incidents in parking facilities (Parking: Lots of Crime, 1996), and one third have resulted in an average judgment of \$1.2 million. Due to this development, parking lot owners have been forced to become more proactive in the security of their patrons. In the United States, assault and battery account for nearly forty-two percent of all crimes resulting in security negligence claims (J. Mesenbrink, 2001). The crimes have caused parking facility users to have negative perceptions pertaining to the level of security, especially at night, which could possibly explain a thirty-five percent drop in retail sales after six o'clock PM (Parking: Lots of Crime, 1996).

Liability

An aspect of growing significance in the eyes of parking facility owners is the increase in liability lawsuits stemming from criminal activity carried out on their property. Although the owners cannot be expected to stop all occurrences of crime in their facilities, they can do some things to protect themselves from liability. Abbot and Fried (1999) stated that if the facility operator has sufficiently protected the patron from any reasonably foreseeable crime, there is less of a chance of a lawsuit and a much smaller chance of a large settlement. "Sufficient Protection" is loosely defined, but generally means that the facility operator has the responsibility to warn customers and employees of danger they may incur on the property. Perlik (December 2000) wrote that precautionary measures such as electronic surveillance do not guarantee the safety of persons on their property, but taking reasonable action for the benefits of guests and employees is necessary to avoid liability for the facility owners in the event of a criminal incident.

Available Security Measures for Parking Facilities

Picking the most effective form of security for a parking facility can prove to be a very difficult task. Not only are there many solutions to solve any security problem, the cost/benefit aspect must be weighed and justified. Copolla, Cohen and Economas (October 2001) showed that Johns Hopkins Medical Institutions created a survey team to decide what kind of changes needed to be made to their 2.65 million square feet of parking, driving lanes, stairwells, and elevator lobbies. The most advanced solution to upgrading the security in their facility would be to install closed circuit television

(CCTV) equipment in all of their surface and multilevel parking areas. The cost for a procedure of this magnitude, however, would cost too much money. As an alternative, they placed hard-wired, analog call boxes in strategic locations throughout their surface lots and multi-level garages.

An important factor in choosing which security measures need to be taken in a given facility is the purpose of the facility and what type of people are using it. Bowers (December 1999) suggests that in a private, corporate parking lot, a viable option might be to use card readers or Automatic Vehicle Identification (AVID) to allow cars and pedestrians to enter the lot securely. However, in a public parking lot like a civic center or a mall, a much larger population of people must enter and leave the facility. In order to facilitate a larger, more diverse population, it would not be practical to have each potential patron use an access card, so other steps to keep the facility secure must be taken.

Another consideration when determining security precautions for a facility is the area in which the parking lot or garage is located. In an area where crime is minimal to non-existent, it may not be necessary to have extensive (CCTV) equipment throughout all of the facility. Following the same logic, in an area where criminal activity is more rampant, much more extensive security precautions might need to be taken to protect the patrons of the facility.

Preventing Parking Facility Crimes Through Security Measures

Although experts and analyst have differing opinions on the best and most effective ways to securing parking facilities, most agree on the most basic ways to begin

prevention of criminal activity in these areas. The easiest and cheapest way to improve security in parking facilities is adequate lighting. The necessities consist of lighting that is bright enough to read a newspaper with and produces as little glare as possible (Weant R., 1978).

Another aspect most experienced parking facility planners and analyst agree on is making sure the parking area's physical structure is as helpful to preventing security as possible. Visibility is very important for both the ability of security personnel to identify a problem, and for patrons to see potential danger from a distance. One way to improve visibility in the facility is to minimize the use of slopes and ramps, which create excellent hiding places (Chrest, Smith, and Bhuyan, 1996). Another major structural change that can have a large impact on criminal activity is controlling the access to the facility. This includes concrete barriers, chain-link fence, and walls. Also having as few active entrances and exits, the rest should be equipped with alarms and be for emergency use only, will help control the entrance of deviants onto the property. While these structures will not prohibit the entrance of people determined to commit crimes, it will deter the passive, identify loiterers, and slow the escape of suspects (Fennely & Lombardi, 1997). The use of these measures, along with trained security guards and educated non-security employees are the most common changes suggested by analyst in the field.

Montgomery County Division of Traffic and Parking Services

This section describes the parking facilities and the programs that are in place in Montgomery County's parking lots and garages. First, there is the mission statement of the agency for which we will be working. The second section details the parking in

Montgomery County and the availability of parking spaces. Lastly, the third section deals with plans for security in parking garages of Montgomery County.

Mission of the Division of Traffic and Parking Services

In Montgomery County, we worked for the Department of Public Works and Transportation in the Division of Parking Services. The mission of the Parking District Services portion of the Division of Traffic and Parking Services is to:

(Office of Management and Budget [OMB], March 2002)

- Support the role of public parking in commercial areas throughout the County. Parking management is growing in importance as a tool for achieving public objectives of economic development and transportation management.
- Support the comprehensive development of the Silver Spring, Bethesda, Wheaton, and Montgomery Hills central business districts and promote their economic growth and stability by supplying a sufficient number of parking spaces to accommodate that segment of the public demand which is neither provided for by developers nor served by alternative travel modes;
- Promote and complement a total transportation system through the careful balance of rates and parking supply to encourage the use of the most efficient and economical transportation modes available; and

- Develop and implement parking management strategies designed to maximize the usage of the available parking supply in order to enhance the economic development of specific central business districts.

The Parking District Services division is also working to maintain low costs of its facilities while still producing enough revenue to cover costs of maintenance and security. Also, they have efforts to supply enough parking for specific purposes such as short-term parking for those that could be shopping and there are car-pool spaces to accommodate those which are utilizing ridesharing measures. Finally, and most importantly for our project, they are in charge of instituting policies to maintain the safety and security of the patrons which use the facilities (<http://www.dpwt.com/parking>).

Parking in Montgomery County

Based on information provided by Stan Gray, there are approximately forty-eight parking facilities that Montgomery County owns. These facilities are located primarily in Bethesda, Silver Spring and Wheaton. There are also two parking lots in Montgomery Hills and one garage in Shady Grove. Each facility is assigned a reference number to distinguish one from another.

The county collects approximately nineteen million dollars per year from taxes, parking fees, fines and penalties, and investments (<http://www.dpwt.com/parking>). A portion of these collections go towards maintaining the 16,605 parking spots in garages and lots that the county runs. Of these, 14,370 are in parking garages and the remaining

2,235 are in parking lots. The individual breakdown of the parking spaces is summarized in the table below (<http://www.dpwt.com/parking>).

Table 1: Quantity of County-Owned Parking Spaces of Garages and Lots

	Garages	Lots	Total
Bethesda	4747	881	5628
Silver Spring	8985	818	9803
Montgomery Hills	0	104	104
Wheaton	638	432	1070

Although no information is provided about the commercial or economic development of each town, the differences in parking situations for each town are not based on populations. The population, as reported by the United States Census Bureau, of Bethesda is 55,277, Silver Spring is 76,540 and Wheaton is 57,694. Montgomery Hills does not have a population recorded because it is considered a part of Wheaton. (Please refer to Appendix C for maps of each parking facility location in Montgomery County.)

Parking Security

Montgomery County was awarded \$9.5 million in Federal aid for security improvements in order to enhance the safety of their facilities. A portion of this aid was used to pay for improvements in some of the garages of Bethesda and Silver Spring

(OMB, 2002). Some of these enhancements were new security officers, a security planning manager, and other measures to secure a safe environment for patrons and pedestrians. In Bonifant-Dixon Garage of Silver Spring, the County will be installing cameras. If the cameras prove to be effective in the County's pilot test, they will be added to other garages as well (Keeping Our Community Safe, 2002).

Understanding Perception

Since this report centers on the measurement of perception, it is important to understand what perception is. This section provides a definition of perception and describes how it is applied in everyday situations. After that, the sources of influence that alter perception are listed and how those influences impact human thought.

Defining Perception

Perception is generally defined as what can be physically detected by one's senses (Heil, 1983). Many things perceived are real, but others can be illusionary. For example, Rock (1975) mentions that although it appears that the moon is moving, astronomy has proven that our moon is in orbit around the Earth and does not actually move. This means that the apparent movement of the Moon is only an illusion of what observers perceive. Rock continues to explain that we live in two worlds: the world we see and the world we perceive. In some cases, the two worlds overlap, such as viewing the color of a chemical reaction. Although both examples relate to vision, other senses can perceive as well, as noted in the definition of perception. When one hears the word "bear," it is possible that one might perceive the word heard to be "bare," or vice versa. The only

thing that can distinguish the two words is the context in which the word is used. As the first two examples have shown, perception is not limited to psychology, or even to social science. In contrast, it can be applied in any field of study that includes observation. However, this study will only deal with social perception, which focuses on “all forms of social awareness of the personality of other people and of interhuman relations” (Ichheiser, September, 1949). The perceptions of Montgomery County parking facility patrons are affected by the crime that transpire in the vicinity of the facilities, causing us to do research on social perceptions. As a result, part of the work undertaken for this study will involve identifying sources of social perception that relate to how safe people feel in parking facilities.

Influences of Social Perception on Crime in Parking Facilities

There are several sources of influence that can affect perception. According to Adams, Heimer, Scheppele, Smith, Stinchcombe, and Taylor (1980), in areas perceived to be criminally active, Americans tend to not walk in those areas at night. The reason for this is that people have perceived those areas to be dangerous based upon those stories that they have heard, and thus feel insecure when being in those areas during that time. However, one can be a victim of these crimes or, in contrast, someone who has not been victimized to have these perceptions. Victims may base their perceptions on their own past experience with a crime committed against them, but those who have not been victimized usually get their perceptions from other sources.

One source of negative perception may be the statistics of crime in an area. Although the Bureau of Justice web page

(<http://www.ojp.usdoj.gov/bjs/pub/pdf/cv01.pdf>) shows that personal crime has decreased 50.4 percent from 1993 to 2001 throughout the United States and property crime has decreased 47.7 percent in the same time period, Peterson (1973) explains that many crimes are unreported by the public, while other crimes are reported, but are not recorded by the police. He also points out that crime is heavier in some areas of the country than in others, causing some locations to have high amounts of crime and some to have little or no crime. Because of these differences in crime levels throughout the United States, the areas with high amounts of crime may cause patrons of the local parking facilities to feel unsafe while using them. More specific information on crime rates is described in the Crime section of this report.

According to Maxfield and Skogan (1981), another source of influence that significantly affects negative perception is indirect victimization. The researchers define indirect victimization as “the knowledge of crime or victimization experiences of family, friends, and neighbors via interpersonal communication.” The media also has a great impact on perception, according to Baccaglioni and Liska (1990), because those who read about a recent crime in a location may gain negative perceptions about that area and are likely to make efforts to stay away from it. It is clear from all this information that perceptions are influenced by social interaction.

One source, the manager of a local parking facility, who wishes to remain anonymous (personal communication, September 17, 2002), explained that customers have positive perceptions of the facility regarding their feelings of safety while using it. One source of these perceptions is the simple layout of each floor, which allows patrons to see the entire level. The manager believes that the patrons feel safe knowing that there

is nowhere in the facility for criminals to hide due to the layout and good lighting that is maintained throughout the facility. Another characteristic of the garage that people have commented on is the experienced staff that watches over the facility. According to the manager, each member of the staff has worked at the facility for at least five years. To complement this, the majority of the patrons have used the facility for years while they were at work. It is believed that this also enhances positive perception to the facility, since the patrons know that they are leaving their vehicles in good hands. With this information, a possible generalization of perception might be that positive perceptions of parking facilities comes from experienced workers, good lighting throughout the facility, and a simple layout that eliminates hiding spots for criminals.

In contrast, the assistant manager of another parking facility, who also wishes to remain anonymous (personal communication, September 27, 2002), believes the patrons of her facility have a negative perception of security because of the environment in which it is situated. She has noticed that her patrons are afraid of the alcoholics and homeless that loiter in the area. To add to this, she also believes that the events of September 11, 2001 have caused people to be more suspicious of others than before these events took place. These two influences might have caused people to feel very nervous in using the garage, but there have not been any reported complaints of bad security to the facility.

METHODOLOGY

The goal of this project was to create a method for the Division of Traffic and Parking to routinely assess and analyze the perceptions of safety and security among the patrons that use parking garages and parking lots in Montgomery County. In order to complete this goal, we completed the following objectives:

- Inquired about the nature and issues relating to security in the parking facilities.
- Developed criteria to evaluate parking security from the patrons' perspective.
- Determined the best method in terms of cost, time and simplicity to collect the data.
- Designed, pre-tested and printed the questionnaire.
- Administered the questionnaire among parking lots and garages.
- Pre-coded, recorded and analyzed the data.
- Made recommendations based on the data collected.
- Taught the appropriate personnel how to use the system for data collection and analysis.

By accomplishing these objectives, we created a method for Montgomery County to assess their parking facility security from the perspective of their patrons. Having this information allows the county to optimize the use of their parking facilities and make their patrons feel more comfortable using them. This benefits Montgomery County's economic growth by allowing people to have a place to park in commercial areas, and increases traffic flow will create revenue for the government through parking fees.

Analyze Facility Conditions

There are approximately fifty facilities maintained by Montgomery County Government. This number fluctuates due to changing parking conditions and patrons' needs. Security for the parking facilities is provided by several different agencies, including a private contractor, Montgomery County Police Department, Maryland National Capital Park Police, and Silver Spring Service Corporation.

We traveled to each of the Central Business Districts to examine the layouts of each facility. The physical structures of the parking facilities provided us with an idea of what kinds of condition are affecting the perceptions of the facility patrons. Furthermore, time was spent speaking with any available parking personnel on the issues of safety and security. As a result, we gained an understanding of how patrons utilize the facilities and whether any facility has had recurrent issues that have endangered the safety of their patrons.

Create and Obtain Approval for Criteria

We created a framework of criteria that served as a basis for our questionnaire by completing our previous objective. The criteria gave insight to what questions should be asked and factors to be inquired about. We learned what affects perceptions of safety and security from interviews that took place before and after our arrival in Washington, DC. Further sources of information on perceptions came from previous studies that were performed by other organizations and from our assessments of the facilities that we visited.

Once our group developed the criteria and identified the variables, we then presented them to Stan Gray and Rick Siebert for review. Together we arrived at a

consensus on what and how well we performed the analysis. We used our finalized criteria to assess the parking facilities and gauge the public's perceptions of crimes in the garages.

Establish an Accurate Sample

Once all questions were defined, we determined our sample population, size and sampling method. In general, the population of our sample was the citizens of Montgomery County. More specifically, it was those people who use the county run parking facilities, even if they live outside the county. Gillman and Salant (1994) demonstrated that with a population of ten thousand people, we needed 378 replies to gain an accurate response. We distributed 1500 questionnaires to allow for an approximate seventy-four percent non-response among patrons in order to get an accurate sample. We used purposive sampling in order to assess the perceptions of those who use the facilities for different purposes and during different time periods.

Even though using a verbal questionnaire can remove many sources of bias, time and resources did not permit such an involved study procedure. One such example of bias involved the education levels of some patrons. Those who were illiterate would not be able to read the questionnaire. Another source of bias was that we only distributed an English version of the questionnaire. This resulted in a loss of responses from those who do not utilize the English language.

The parking facility patrons pay by three different methods: cash, Parking Convenience Stickers (PCS) which act as monthly passes, and cash keys in which patrons add money and have it deducted from their account at parking meters. Our biggest obstacle was the impossibility of knowing the percentage of people who paid with cash,

either to cashiers or meters. We felt that due to factors of turnover rates, patrons utilizing PCS and from touring the facilities that there were more people who used parking meters than PCS.

The only available lists were for those people who use PCS. Using these customers, we chose a monthly sampling procedure. Every month, current PCS users return renewal slips to the department for processing. We used renewal slips addresses to build forty percent of our sample base. This proved to be a random sample in itself since the slips were both mailed in by customers and returned the slips in person.

Compose and Obtain Approval for the Questionnaire

Our next step was to create a questionnaire that all of the patrons could answer easily. Stratifying the patrons allowed us to search for patterns among the responses to see if perceptions differ among the various groups of patrons. However, in order to have equal representation between PCS and cash payers, one of the questions asked for their method of payment. Other questions involved using the criteria and variables defined earlier to see how patrons felt about conditions in the parking facilities.

Once our questionnaire was constructed, we met with Stan Gray, Program Security Manager, for any comments he had about our questions and noted his responses. The questionnaire was also distributed among the office workers to get opinions on grammar and clarity of questions. More revisions and conversations occurred between our group, Stan Gray, and Rick Siebert, the Division's Chief of Parking Operations. Finally, we met with John Greiner, the Office of Management and Budget Specialist, who gave his own commentary on the questions and gave us his changes to the questionnaire. These were evaluated and appropriate changes we made.

Pre-Coding

Pre-coding is the method of using questions with pre-set multiple-choice answers to create statistical subpopulations of a sample for a questionnaire. We sorted the patrons into different categories based on their responses to the questions. By pre-coding the possible responses, we made the process of analyzing more efficient. We then categorized the pre-coded data and organized it. The languages that people spoke, whether a patron was male or female, and their age bracket were only some of the variables that were stratified. By stratification, the data helped the WPI team and the Montgomery County Government in analyzing the results of the questionnaire.

Pre-Test

After the DPWT supervisors approved our questionnaire, we pre-tested the questionnaire. The purpose of pre-testing was to assess our questionnaire with a trial group to see if there were any sections that were misunderstood, if there were sources of bias, and if there were other mistakes in the format or phrasing of the questionnaire. In order to achieve the best results with our pre-test, we went to facilities that had patrons that were not parking in a location that would make them a unique population.

One facility we did not include in our pre-test and administration is garage fifty-eight, located beneath the National Oceanic and Atmospheric Administration (NOAA) building in Silver Spring. The reasoning for this was that the security is heightened due to NOAA being a government organization. The perceptions of these patrons are most likely drastically different from the rest of the parking population because of the increased security precautions including guard posts, car searches and identity checks.

The facilities we administered our pre-test on was City Place – Silver Spring, Shady Grove Metro – Shady Grove, Marketplace – Wheaton, and Farm Woman’s Market – Bethesda. The Silver Spring garage was closed shortly after our pre-test; however, the patrons were not separate from the average population. The Shady Grove garage was chosen because the DPWT will be selling this facility to Metro. In Bethesda, we chose this lot because it was large allowing for more patrons to pass through and survey. Finally, the reason for the Wheaton lot was the high turnover rate that it had because it was in a large consumer district of the city.

The pre-test was very important in determining the strengths and weaknesses of our questionnaire. Also, it gave us a chance to see what data could be obtained from the results. Using it on a test group gave us a chance to fix mistakes and flaws in the questions before starting the full administration.

Administration of the Questionnaire

A major hurdle of the study was how to implement the questionnaire while reducing bias. One of the largest contributors of bias in a questionnaire is the number of people who do not respond to mail surveys. This source of bias is due to the possibility that the portion of the sample that chooses not to respond usually had some factor in common which would be valuable to the study. According to Fowler (1988), that portion of the bias can often be eliminated through the use of a personal interview survey. Even though the most accurate method of administration is through this procedure, it was not feasible due to time constraints and lack of personnel. Therefore, our group did a

combination of mailings and handbills. Handbills refer to the fliers placed on the windshield of vehicles.

The next step in acquiring data for analysis was collecting the data without adding undue bias. The Survey Research Center (1976) claims that asking pre-set questions and checking off the closest pre-coded answer will lead to the most accurate results when doing questionnaires of this type. The SRC believes that for answers that do not fit the pre-coded options, the interviewer should write down the responses verbatim in order to maintain accuracy. By using a pre-coded questionnaire, results were more efficiently tabulated to speed up the analysis. Using this system of data entry allowed each interview to check for multiple variables that may contribute to the same area of interest. We used this procedure for the pre-test, but during the final administration of the survey, the patrons read, answered and returned the questionnaires themselves. Multivariable studies have a great advantage for getting quantitative results on a particular area of interest in an efficient manner (Kish L., 1967). With the data involving several variables affecting patrons' perceptions of the parking facilities, the DPWT now has a greater understanding of the parking facilities' image to the public.

Analyze Data and Draw Conclusions

In order to make the data more readable, presentable and understandable, we utilized visual representation to display the data collected from the questionnaires. This will be done through data-entry into an Access database that will be cross-referenced to Excel in order to create graphs of the data.

We then analyzed these graphs and drew conclusions of peoples' perceptions based on the trends that were shown to have the greatest effect on the patrons of the Montgomery County parking facilities. Some of these factors included the locations of the facilities and the time of day the facility was predominately utilized. From our analysis we drew conclusions and recommendations that are included within this document.

Create Training Materials

In order for the DPWT to measure patrons' perceptions in parking facilities to be repeated in future years, our final step involved training Stan Gray and Rick Siebert to administer the questionnaire and to analyze the responses that are collected. We decided to create an interactive CD containing Microsoft PowerPoint presentations. This CD represented a digital instruction manual with each presentation being a chapter within that manual. These presentations discussed the methods that we followed to administer the questionnaire and how the data was graphed and analyzed.

One presentation explained how to appropriately divide the questionnaires between mailings and handouts that would be sent to the parking garages and parking lots of Bethesda, Montgomery Hills, Silver Springs, and Wheaton. Another presentation demonstrated how to use Microsoft Access and Microsoft Excel to enter the responses into a database.

Furthermore, the CD included help files to change the appearance of the graphs and charts. For example, we instructed on the process to change the color combinations and how the information can be placed into a document or PowerPoint presentation.

After the database was constructed, the presentation ended with instructions on creating charts to display how different elements of the database related to each other.

RESULTS

Of the fifteen hundred surveys that were distributed among Montgomery County's parking facility patrons, approximately four hundred surveys were returned. However, of the results, only 325 (5.4% error) could be used in the results. Reasons to exclude questionnaires included incomplete data and biased information.

Entire surveys could not be included when patrons did not complete the questions which were most important to the survey. If the person did not give their overall perception of safety in the facilities, their rating of security, their rating of maintenance, or the frequency with which they saw patrols, the questionnaire could not be used. Furthermore, some surveys were returned that did not have all the demographic information filled out, such as their gender or age. Without this information, we could not categorize the responses.

Another reason for the exclusion of data was patrons that have been considered a separate sub-population with perceptions that will be altered because of their parking location. More specifically, we have excluded any patrons that responded from Garage fifty-eight, located beneath the National Oceanic and Atmospheric Association building in Silver Spring. Since this garage is beneath a government building, security guards and video cameras are constantly monitoring the facility. We have found that because of the difference in impressions and attitudes provided by the security, the patrons' perceptions are considerably dissimilar from the rest of the public parking population.

With the data of the remaining valid surveys entered into the specially designed database, charts and graphs were created so that we could analyze the perceptions of safety and security. More females were willing to complete the questionnaire than males

(Figure 1). It is not known whether this is an accurate portrayal of the parking population, or rather it has anything to do with a willingness to complete the survey and return it.

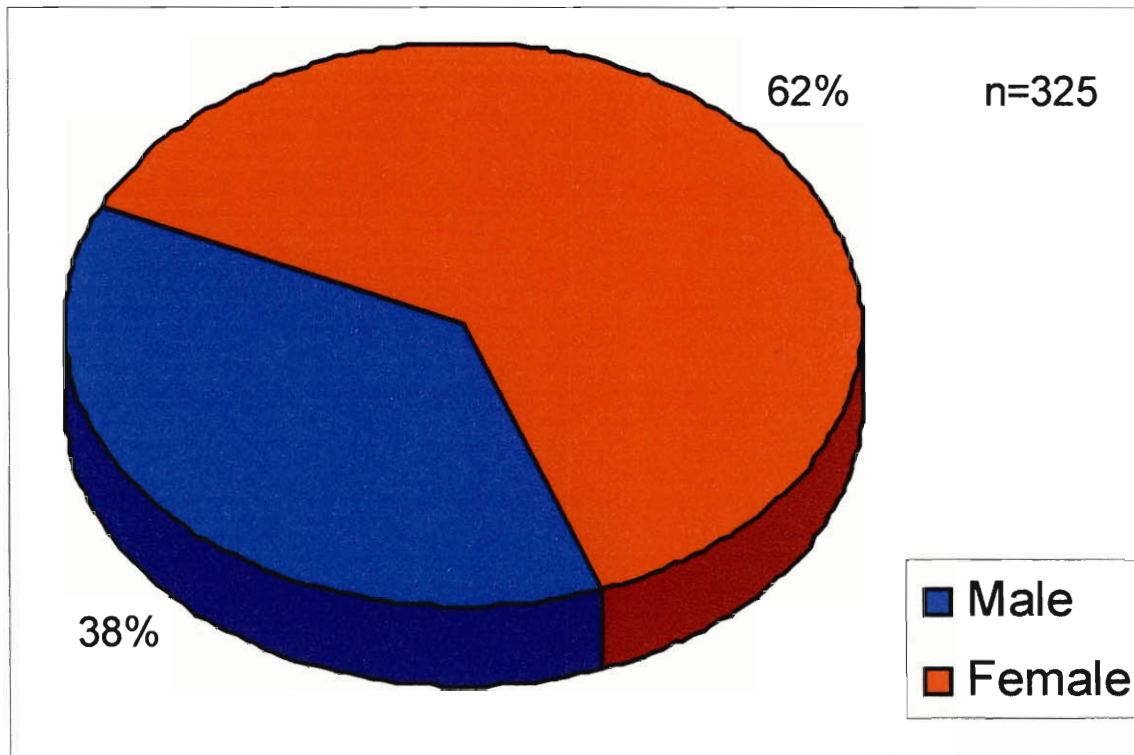


Figure 1: Gender Population Percentage

When we compared the returns of the survey with the method of payment, more returns came from those that use the Parking Convenience Sticker than those that pay through a cashier or a meter combined.

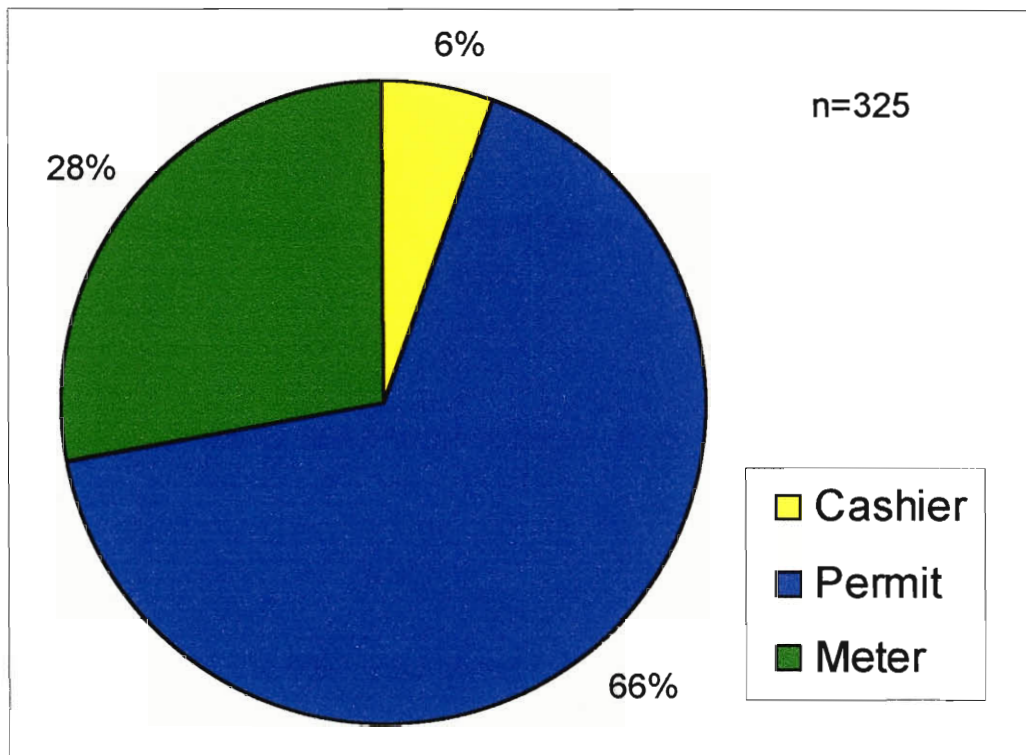


Figure 2: Payment Methods

The first analysis we wanted to perform was just how safe patrons felt overall. By looking at Figure 3, it is apparent that over eighty percent of the population feels fairly safe in the parking lots and garages. Furthermore, there is consistency among gender showing that males feel the same about security as females.

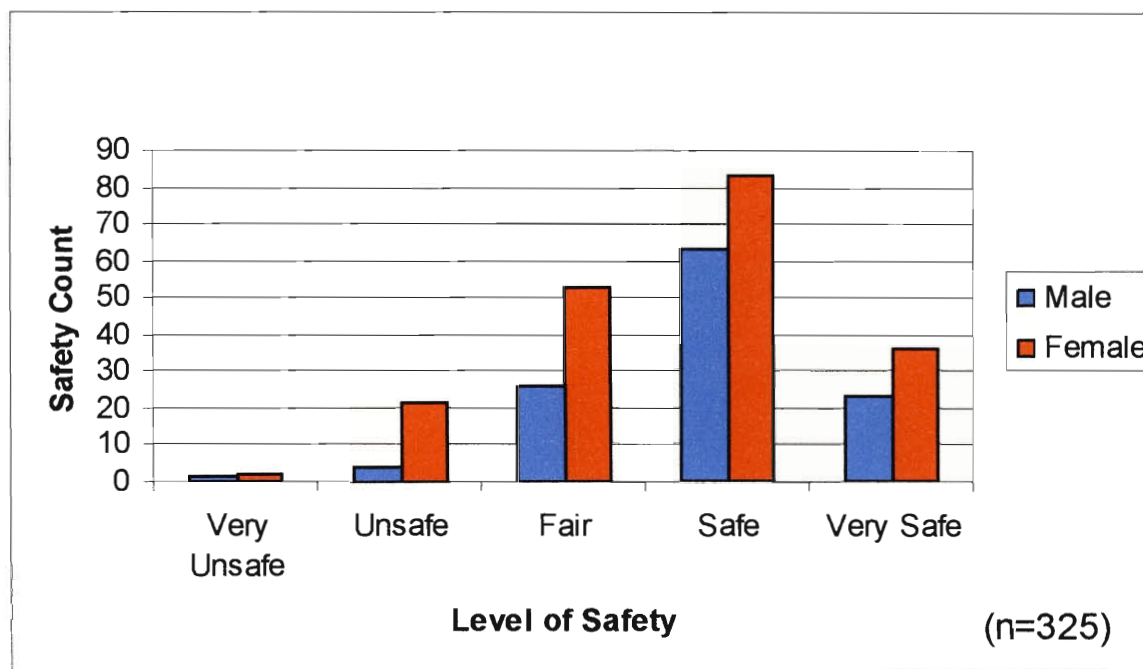


Figure 3: Perception of Safety by Gender

Now, when we look at how the patrons rate the security in the facilities, we can see that the overall rating of security seems to be pretty low (Figure 4). When these low ratings are compared to how often patrons see security patrolling the facilities per week, they often see them more than three times per week (Figure 5). Further studies could investigate why the rating of security is so low when the visibility is fairly good.



Figure 4: Gender vs. Perception of Security

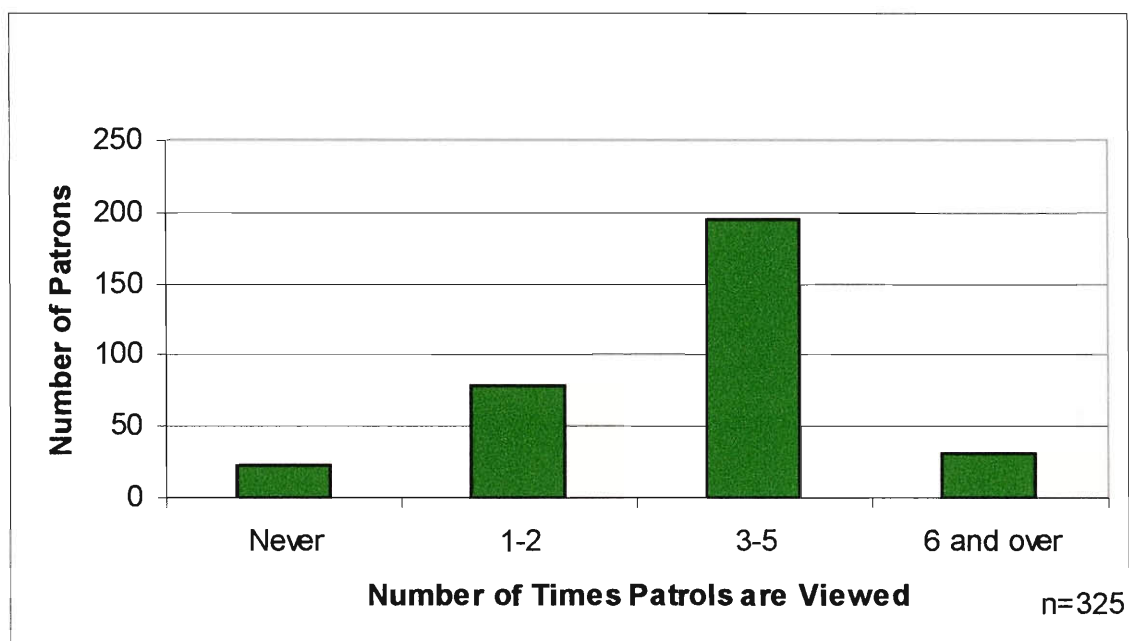


Figure 5: Overall Visibility of Security

Parking facility patrons' perception of safety tended to match their perception of the level of maintenance in the facility. In Figure 6, the safety perceptions are the major groups along the x-axis and are divided by the ratings of maintenance. The level of satisfaction with maintenance is consistent with the level of satisfaction in safety. In other words, as the perception of safety increases, so do patrons' perceptions of maintenance.

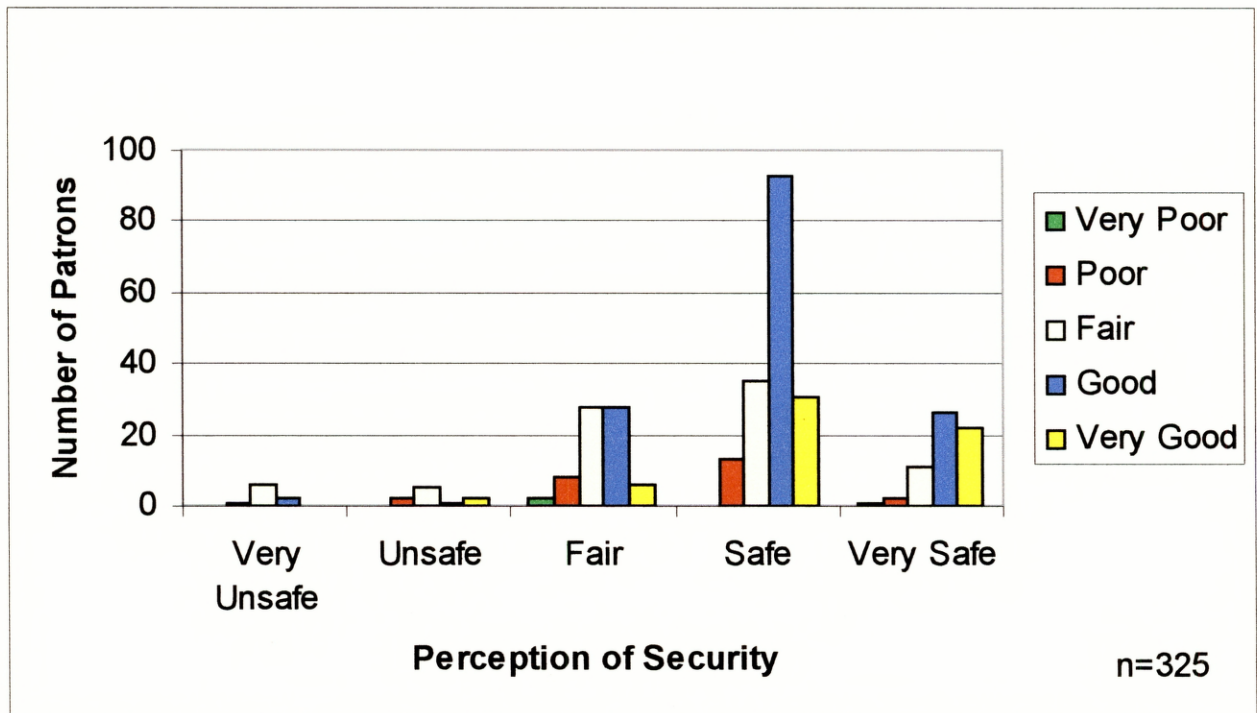


Figure 6: Perception of Safety by Maintenance

There is not a correlation between the use of anti-theft devices and the perception of safety in parking facilities, as seen in Figure 7. People who use anti-theft devices do not feel safer than those who do not use anti-theft devices.



Figure 7: Perception of Safety by Theft-Deterrent Device

When looking at how perception measures for each district (Figure 8), it must be noted that less responses came from Wheaton and Montgomery Hills because the parking population is smaller there. Fewer surveys were distributed to those districts, which would correlate to fewer returns.

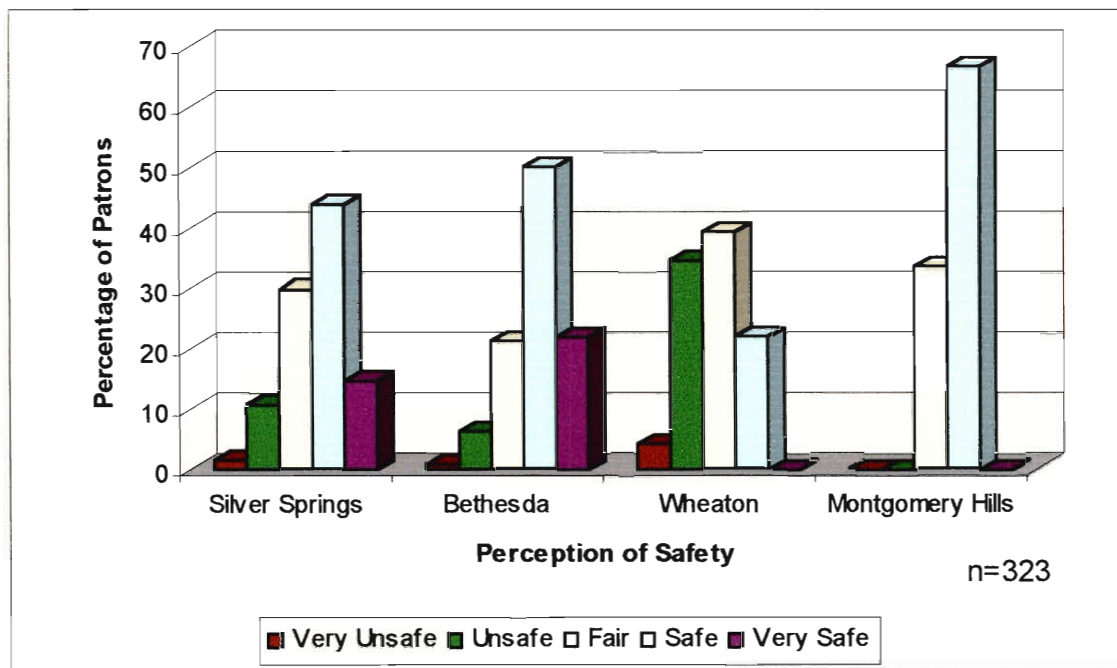


Figure 8: Perception of Safety by District

Since Wheaton and Montgomery Hills have populations that are so much lower than Silver Spring and Bethesda, an analysis of these two parking districts would not be accurate. In Silver Spring, we see a decrease in perceived safety than in Bethesda. The average rating in Bethesda is 3.86 points and in Silver Spring, the average rating is 3.61 points.

CONCLUSIONS

The charts developed from the questionnaire data were in most cases straightforward. We were able to predict many of the patterns that we observed in the data. It is difficult in some cases to analyze the data efficiently due to the lack of responses in the less trafficked regions that were included in our sample population.

Some sampling difficulties may have caused some errors in our data. There was not a way to send questionnaires to the houses of patrons who pay in cash. This caused under-representation to some degree of cash paying customers; however, the responses were not significantly different from those of permit users. There were only three responses from the Montgomery Hills parking patrons, and twenty-three responses from the Wheaton area. This made it difficult to analyze the data for these parking regions, but the number of responses accurately reflected the amount of traffic in the Montgomery Hills and Wheaton central business districts as opposed to the higher population using the Silver Spring and Bethesda facilities. We also had to discard over one hundred questionnaires due to some being returned from Garage 58, which is an anomaly in the Montgomery County parking facilities and since many patrons did not respond to vital questions on the questionnaire and returned them anyway.

From our data, we drew the following conclusions:

1. The majority of patrons feel safe to very safe in the facilities. This means that people overall do not fear for their safety in the Montgomery County parking facilities.

2. We found that a majority of the patrons felt that maintenance and security was above average. Once again, this shows that people in general are content with the performance of the services provided by the Montgomery County Department of Public Works and Transportation.
3. On the average, men feel safer than women in the parking facilities. When the data is analyzed to show the relationship between women who carpool and those who do not, there is no pattern between their perceptions of security and traveling with others or traveling alone. Therefore, even though women feel slightly less safe than men do, they do not seem to feel safer when traveling in groups rather than alone.
4. People in general feel slightly safer in parking lots than in parking garages, so it can be concluded that they feel safer in the open than in the partially enclosed garages. This could be due to a decrease in the line of sight, increased lighting difficulties, and more places for a delinquent to hide. However, there are many more garages than lots in Montgomery County, and therefore more responses were received. There is also a wider range of reply from garages than from parking lots.

RECOMMENDATIONS

From these conclusions, some changes can be made on the part of the Montgomery County to improve security. The Department of Public Works and Transportation has already developed a plan for improving security over the next several years, but our group has made the following recommendations for ways to improve the perception of security in the parking facilities:

1. Even though the majority of the population in every respect feels that Montgomery County is doing its part to ensure the safety of the parking patrons, a large percentage rarely or never sees security in the facilities. From our observations, this was due to the randomness of the patrolling and due to the inability of some patrons to recognize security personnel. We recommended increasing the frequency of patrols as well as increasing the visibility of the personnel through changing the standard uniform. It is necessary for security to be seen because our results have shown that patrons still believe security to be inadequate even with seeing patrols frequently.
2. To increase the number of women who feel safe in the parking facilities in Montgomery County, an increase in the number of female security officers or some other program specifically targeting women might help in this category.

We also feel that there are other projects that can occur from the results of this survey. It would be very helpful to learn why patrons feel security is not doing well, even though they may see patrols routinely throughout the week. Another study would

be to analyze how the perceptions of safety range throughout the day as patrons enter or leave the facilities. Finally, we were considering a possibility of studying how economic status may affect perceptions, but this was an area that required too much attention and detail be taken away from the main purpose of the project description.

SOCIAL IMPLICATIONS

This project offers many data points that will have an affect on the services provided to patrons. Depending on how Montgomery County uses the results, the information this study provides may have dramatic effects on the security changes that are implemented in the future.

One important social implication is how perceptions of safety appear to have evolved into becoming more gender neutral. In the past, women have been portrayed as being more fearful for their safety. Our study has shown that women feel only marginally less safe than men, which shows change in the societal characterization of women over the past several decades.

Another stereotype involves how people feel that smaller communities make people feel more comfortable than when they are in urban areas. Contrary to this norm, our data shows that the patrons parking in Wheaton feel less safe than those who park in Silver Spring and Bethesda. It is possible that the greater population in cities cause people to feel safer because they see others in the facility with them during their arrival and departure.

Finally, as this survey is completed annually, patrons will begin to recognize that Montgomery County is working on a continual basis to make changes in security and stay current on patrons' feelings of safety. Patrons will take more notice of security and the changes that are occurring. As the government makes changes and the patrons' needs are met, due to the Hawthorne Effect, people will feel more safe as they government makes a genuine effort to fulfill their needs.

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APPENDIX A: MISSION AND ORGANIZATION REFERENCE

All information in the appendix was obtained from the Montgomery County Government web site, available at www.co.mo.md.us

Mission Statement

“The mission of the Montgomery County Government is to provide for the peace, good government, health, safety, and welfare of the County in accordance with, and under authority of, the Constitution and laws of Maryland, and the Montgomery County Charter. To accomplish this mission, the Montgomery County Government provides: public laws and oversight through the County Council and the offices and boards of the Legislative Branch; the administration of judicial offices; and public programs, services, and infrastructure through the County Executive and departments, offices, boards, and commissions within the Executive Branch.”

People and Society

The population of Montgomery County is 873,341, as determined by the 2000 US. Census Bureau. Of this population, 458,824 are employed with a median family income of \$84,035 (<http://factfinder.census.gov>). There has been an increase of 30% in the population of Montgomery County over the past fifteen years due to immigration. With 125 different languages spoken at the schools, one fourth of all residents were not born in the United States. (McGrath & Montgomery, 2002).

In 2000, Montgomery County was nominated and won the status as being an All-American Community which is only awarded to ten cities and counties a year in the

country to stand as an example of how to build public activism. There have been programs set up to involve youth in politics, work on the academic progress of students with social and/or economical barriers, and setting up a service of free translators to assist citizens that are unable to speak English properly or at all. (McGrath & Montgomery, 2002)

Government

Montgomery County is located in Maryland, right next to Washington D.C. It has three branches: the executive branch, the legislative branch, and the judicial branch. Under the executive branch are over thirty departments and agencies. There are five agencies that consist of the legislative branch, and the circuit and state district courts are part of the judicial branch.

The functions of County Government are grouped by related activities in the following categories:

- General Government
- Public Safety
- Public Works and Transportation
- Health and Human Services
- Culture and Recreation
- Community Development and Housing
- Environment
- Other County Functions

Budget

The current FY03 budget for County Government is \$1,070,450,940 which is increased from \$1,005,056,730. This accounts for a 6.5% increase or \$65,394,210.

The proposed budget for the entire Montgomery County is \$2,898,332,311, and increase of \$147,967,363 or 5.4% from FY02 budget of \$2,750,364,948. This budget funds not only the County Government, but ask the education system, debt services, and park & planning commissions (Office of Management and Budget [OMB], March 2002).

The proposed budget for the parking facilities in FY03 is \$20,491,910 from an approved FY02 budget of \$18,651,920. About 83.8% of this budget is for operating expenses, capital outlay, and debt service. There will be additional monies budgeted to Capital Improvement Programs (CIPs) for the Bethesda, Wheaton and Silver Spring Parking Districts (OMB, 2000). For more information on the individual projects, visit: <http://www.co.mo.md.us/government/omb/fy03app/vol2/11.htm>.

County Government

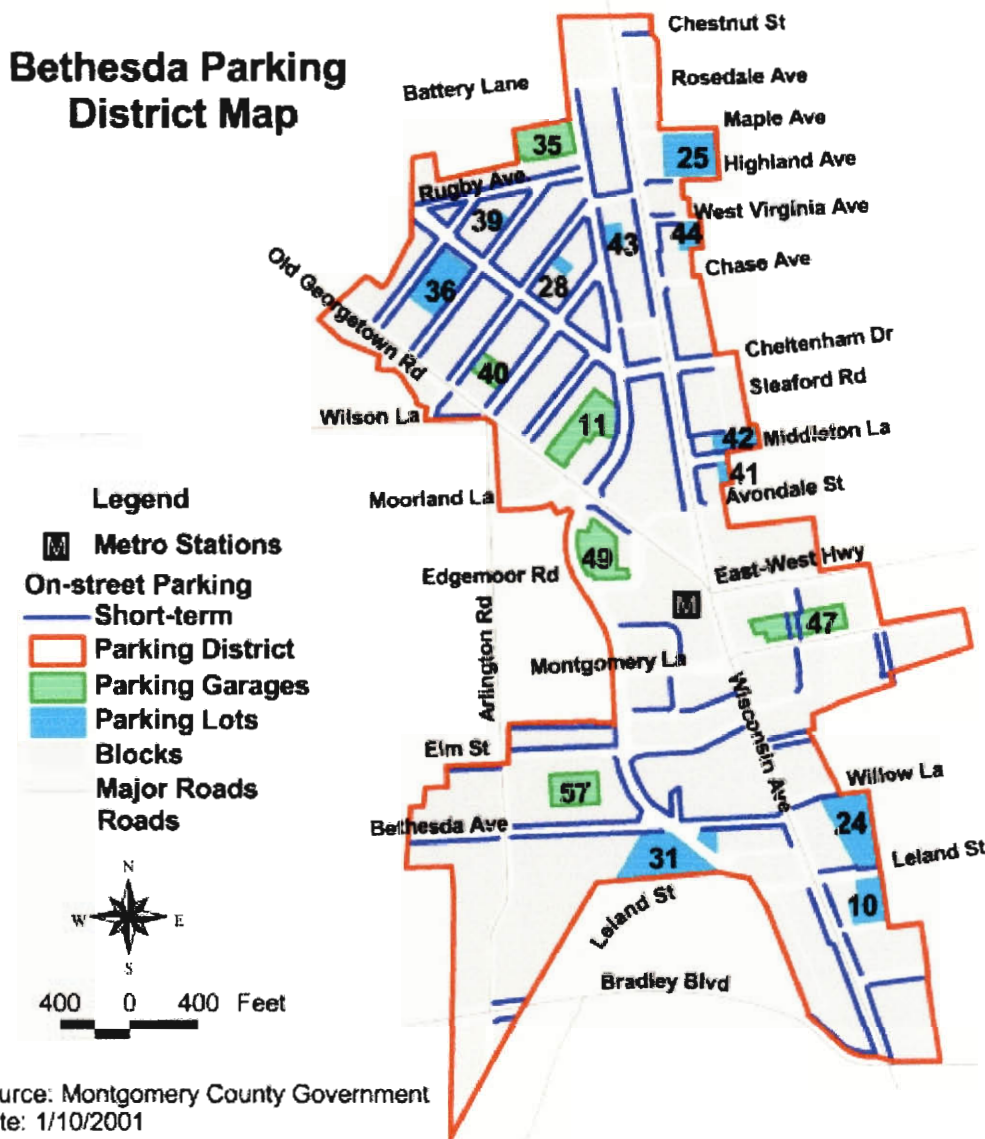
The following is a breakdown of the County Government which is considered to be the Executive branch of the Montgomery County Government.

County Executive	
General Government	Public Works & Transportation
County Executive	Public Works & Transportation
Board of License Commissioners	Community Development & Housing
Commission for Women	Housing & Community Affairs
County Attorney	Economic Development
Ethics Commission	Permitting Services
Finance	Public Safety
Human Relations Commission	Correction & Rehabilitation
Human Resources	Fire & Rescue Services
Information Systems and Telecommunications	Police
Intergovernmental Relations	Conservation of Natural Resources
Management & Budget	Environmental Protection
Procurement	Liquor Control
Public Information	Liquor Control
Regional Services Centers	
Supervisors of Elections	
Urban Districts	
Culture & Recreation	
Community Use of Public Facilities	
Libraries	
Recreation	
Health & Human Services	
Health & Human Services	

Figure 9: Government Structure

APPENDIX B: MONTGOMERY COUNTY PARKING DISTRICT MAPS

These maps describe the parking districts of which Montgomery County is in charge.



Source: Montgomery County Government
Date: 1/10/2001

Figure 10: Bethesda Parking District Map

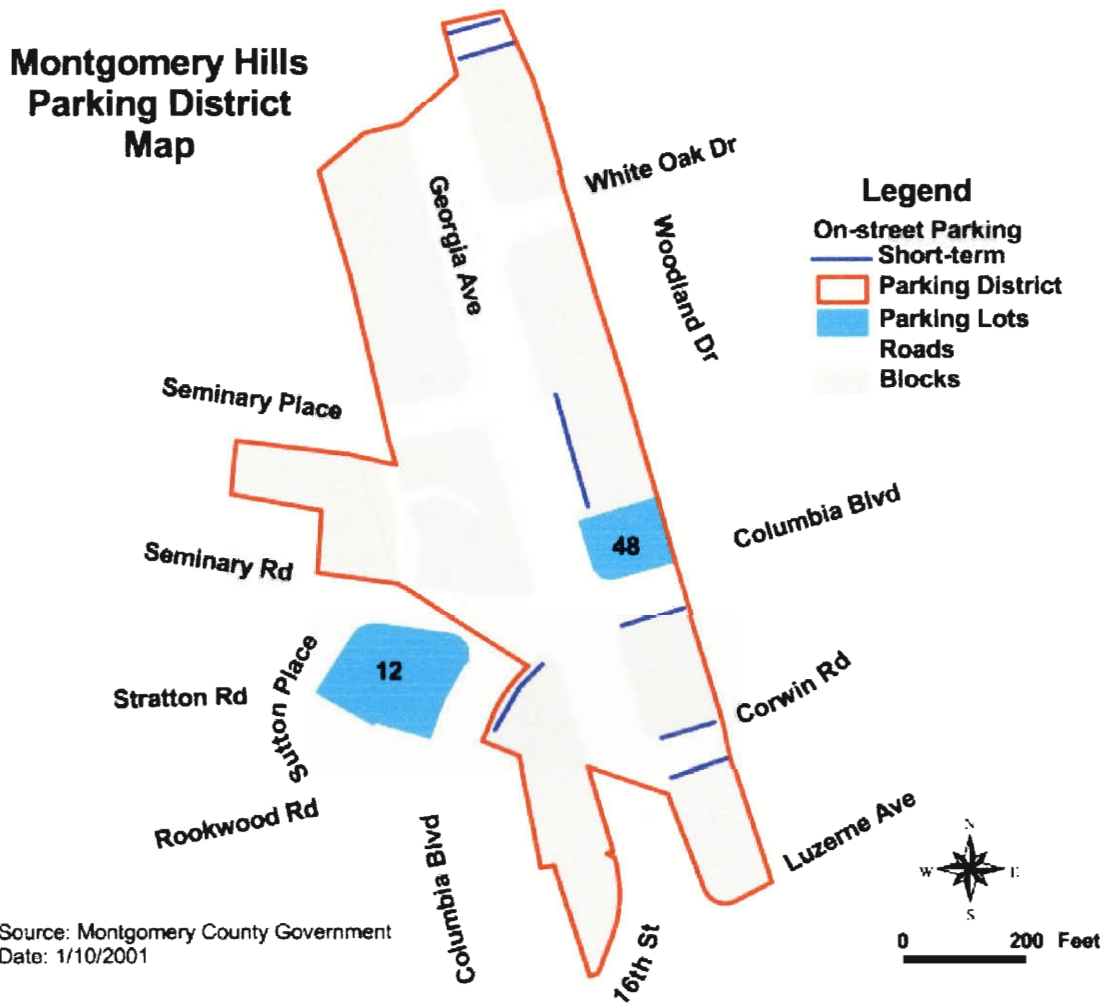


Figure 11: Montgomery Hills Parking District Map



Figure 12: Wheaton Parking District Map

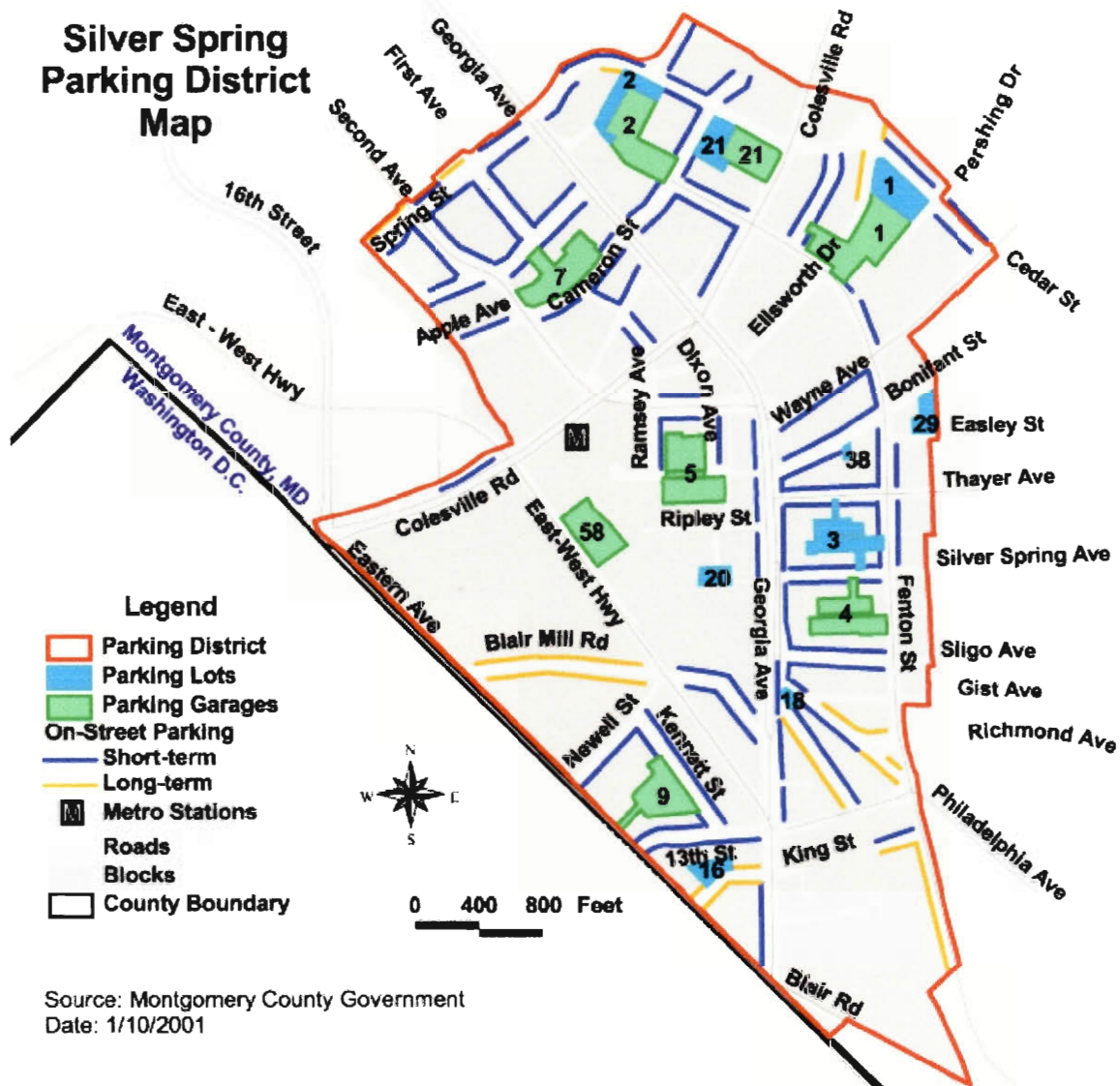


Figure 13: Silver Spring Parking District Map

APPENDIX C: SURVEY MATERIALS

DEPARTMENT OF PUBLIC WORKS
AND TRANSPORTATIONDouglas M. Duncan
*County Executive*Albert J. Genetti, Jr., P.E.
Director

November 15, 2002

On the behalf of the Montgomery County Department of Public Works and Transportation, we ask for a few moments of your time to complete the enclosed survey. The information you provide is very important in our attempt to better serve you. Furthermore, it is our intention to conduct this survey on an annual basis to remain updated on any recurrent issues that may concern you. Your input will be used to analyze the success of the overall security program and its continued development. We want to stress that all information collected will remain completely confidential and be used for statistical purposes only.

In order to show our appreciation for completing this survey, we are offering you the opportunity to enter a raffle where six random customers will receive a month of free parking. If you would like to be entered into the raffle, please complete the contact information at the end of the survey. Each survey has been pre-metered for your convenience, mail your completed survey to the Division of Traffic and Parking by **Friday, November 29, 2002**. Contact information will be used only in the event that you have won a raffle prize. No contact information will be released to any other party or used by this office for any other purpose.

If you have any questions regarding this survey, you may reach Stan Gray, Security Program Manager, at (240) 777-8738 or email him at stan.gray@co.mo.md.us. You are also welcome to provide your feedback at our offices on 1104 Spring Street in Silver Spring. Thank you for your valuable time.

Sincerely,

Parking Operations Section



Division of Traffic and Parking Services • Parking Operations Section

1104 Spring Street, Suite 100 • Silver Spring, Maryland 20910 • 301/565-7696, FAX 301/565-5898

Figure 14: Questionnaire Cover Page



Please check or write in your responses below.
N/A means "Not Applicable" or "Does Not Apply".

PART I: DEMOGRAPHIC INFORMATION

1. What is your gender?
 MALE FEMALE

2. What is your age?
 Under 25 25-34 35-44
 45-54 55-64 Over 65

3. What is your home Zip Code?

4. Do you carpool?
 YES NO SOMETIMES

5. What is your primary language?
 English Spanish French
 Other _____

PART II: PARKING BEHAVIOR

6. Where do you usually park?
 Silver Spring Bethesda
 Wheaton Montgomery Hills

7. Which parking facility do you use the most?
(Print name, address or nearby streets)

8. About how many times per week do you use Montgomery County parking garages and/or parking lots?
 Less than 1 1-2 3-4 5 or more

9. Please indicate what time you typically enter the facility:
 _____ A.M. P.M.

10. Please indicate what time you typically exit the facility:
 _____ A.M. P.M.

11. How do you usually pay?
 Cashier Permit Meter

12. If you use a garage, on which level do you prefer to park?
 1 2 3 4
 5 6 7 N/A

PART III: SAFETY AND SECURITY

13. Do you use a theft deterrent device (*car alarm, manufacture alarm, "The Club"*) on your car?
 YES NO

14. How safe do you usually feel using Montgomery County parking facilities, on a scale of 1 (*Very Unsafe*) to 5 (*Very Safe*)?
 1 2 3 4 5

15. Please explain the reasoning for your above response.

16. How would you rate the security provided in Montgomery County parking facilities over the last six months?
 Poor Fair Good Excellent

17. How many times per week do you usually see security personnel or police patrolling your parking facility?
 Never 1-2 3-5 6 or more

18. During the past six months, have you ever experienced or seen something in a Montgomery County parking facility that made you fear for your safety?
 YES NO Don't Remember

19. If you answered "YES" to Question 18, please describe the incident or incidents.

20. How would you rate the maintenance of Montgomery County parking facilities using a scale of 1 (*Lowest*) to 5 (*Highest*)?
 1 2 3 4 5

21. If you gave a rating of 3 or lower on Question 20, please explain what can be improved:

COMMENTS: Please include any comments or concerns that you may have regarding any topics not covered in this survey.

This information is optional and will remain strictly confidential. It will only be used for informing the winners of the drawing for the "FREE PARKING PASSES". Thank you.

Name: _____
 Daytime Phone: _____
 Address: _____

Figure 15: Questionnaire

THANK YOU FOR HELPING US TO SERVE YOU BETTER!

PLEASE DO NOT STAPLE



DEPARTMENT OF PUBLIC WORKS & TRANSPORTATION
Parking Operations
1104 Spring Street, Suite 100
Silver Spring, Maryland 20910
ATTN: STAN GRAY



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 88 ROCKVILLE MARYLAND

POSTAGE WILL BE PAID BY ADDRESSEE

**MONTGOMERY COUNTY, MARYLAND
101 MONROE ST
ROCKVILLE MD 20897-5044**



PLEASE DO NOT STAPLE

Figure 16: Pre-Metered Postage on the Back of the Questionnaire