TRAFFIC SAFETY STUDY

ROCK CREEK PARK

WASHINGTON D.C.

Traffic Safety Study
Rock Creek Park, Washington, D.C.

United States Department of the Interior
National Park Service
Denver Service Center

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Prepared by:

Robert Peccia & Associates
825 Custer Avenue
P.O. Box 5653
Helena, Montana 59604

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National Park Service, Rock Creek Park

William R. Shields, Superintendent
Cindy Cox, Chief of Maintenance
Steve LeBel, Concessions Analyst
Lieutenant Sidney Wiggins, Commander District 3
Sergeant Charles Orton, Administrative Officer District 3

National Park Service, Denver Service Center

Elmer Hernandez, Highway Engineer, Professional Services, Transportation Branch

NPS Field Operations Technical Support Center - Highway Operations

Bill Cottrill, P.E., Highway Engineer

List of Preparers

This study was prepared by the Transportation Division of the consulting firm of Robert Peccia & Associates, Inc., Helena, Montana. The following members of our firm were major contributors to this study or helped prepare the document:

Robert J. Peccia, P.E., Project Director
Douglas E. Widmayer, P.E., Project Manager
Thomas R. Cavanaugh, Engineer-In-Training
Tracy L. Donaldson, Engineer-In-Training
Jennifer L. Flanders, Engineer-In-Training
Jeffrey A. Key, Engineer-In-Training
Nicholas L. Ladas, Graphics Designer
Mary A. Bell, Production Manager

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Executive Summary

Summary

The purpose of this study was to analyze the road system in Rock Creek Park and identify traffic safety concerns or problems. To accomplish this purpose, the physical condition, operational characteristics, and the accident history of Park roads were reviewed. The study ultimately identified a number of system-wide traffic safety problems and deficiencies on the road system. In addition, eleven individual sites on the Park road system were evaluated in detail as part of this study.

Rock Creek Park is divided geographically into two logical parts. The northern portion of the Park includes everything north of the intersection of Beach Drive and Rock Creek Parkway. The Rock Creek and Potomac Parkway area includes everything south of this intersection, extending to the intersection of Ohio Drive and Parkway Drive just south of the Theodore Roosevelt bridge. For purposes of this traffic safety study, these two regions of the Park are often discussed separately.

The physical and operational characteristics of the Park road system are examined in Chapters 2 and 3, while Chapter 4 contains an evaluation of current road maintenance practices in the Park. These sections of the report describe baseline conditions on the Park road system. An in-depth discussion of traffic accident characteristics and accident rates on Park roads over the past three years is presented in Chapter 5. Chapter 6 summarizes Parkwide traffic safety problems and offers recommendations addressing each problem.

As a result of this work, Rock Creek Park was found to be relatively safe with respect to traffic operations. The accident analysis failed to identify any major traffic safety deficiencies or portions of the road system which are extremely hazardous to motorists. On average, about 392 traffic accidents were reported within the Park each year (173 in the northern portion of the Park, and 219 along the Parkway) with 23% resulting in injuries. Four fatal accidents occurred on Park roads during the three years (1993-1995) examined in this study (two fatal accidents in the northern portion of the Park and two along the Parkway).

Parkwide safety deficiencies which were identified as part of the study process include the following:

1. The greatest safety problem on Park roads is related to speeding. Excessive vehicle speeds are common on all of the roads in the Park. The aggressive driving tendencies of urban commuters who frequently use the Park road system make it almost impossible for a visitor to have a comfortable driving experience in the Park. High vehicle speeds also create a safety problem for pedestrians and bicyclists using the Park. A more aggressive program of speed violation enforcement is needed if the posted speed limit is to be effective.

2. The largest accident concentrations occurred at intersections within the Park and near on-ramps to the Parkway. The best way to improve this situation is to ensure that adequate sight distance is provided at these critical locations.

3. Encroaching vegetation is a problem throughout the Park. Trees and brush often block the driver's view of signs and the road alignment ahead. Areas of special concern are in the vicinity of intersections, crosswalks and curved road sections. These areas should be

carefully maintained through aggressive trimming of roadside vegetation to provide clear visibility.

4. Safe roadway designs include a "clear zone" area along the shoulder of the road. This clear zone is provided as a safe area that motorists can use to stop or regain control of their vehicles after leaving the roadway. The clear zones along the Park roads should be reviewed to identify large fixed objects such as rocks and trees that should be removed.

5. The most common signing problem is a lack of adequate guidance signing within the Park. A Park visitor receives limited guidance at most major intersections, creating driver confusion and indecision. A Park sign coordinator should be a appointed, and the signing plan for the Park should be updated and approved by the regional sign coordinator.

6. Conflicts between vehicles and bicycles or pedestrians are commonplace throughout the Park and Parkway. Visitors attempting to recreate on Park grounds are forced to interact with traffic at numerous locations due to the layout of the Park trail and road system. In some areas of the Park no pedestrian or bicycle facilities are provided, forcing bicyclists to ride in the road and pedestrians to walk along the shoulder of the road. There is a need for a continuous paved pedestrian/bicycle trail system throughout the Park.

Detailed evaluations of eleven specific sites are contained in Chapter 7. The evaluations include a description of safety-related and operational problems, and a list of short-term and long-term improvements designed to address deficiencies or traffic safety concerns at each site. The final chapter contains a prioritization of the recommended improvements at the individual sites.

The total cost of short-term improvements for the sites is estimated at $349,350. A large portion of this total is the cost of modifying the geometrics at several intersections, including Beach Drive/Blagden Avenue, Beach Drive/Piney Branch Parkway, Beach Drive/Klingle Road, and the P Street interchange on the Parkway. Signal modifications are recommended for the intersection of Virginia Avenue and the Parkway. The other short-term improvements generally focus on signing and pavement marking changes with minimal road modifications. Short-term improvement projects have been prioritized based on the accident history of each site, the cost of the improvements, and the ease of implementation. A summary of the improvement costs and priorities is presented below.

The long-term improvements at the eleven sites are estimated to cost $4,230,000. Long-term improvement projects include closing the access and egress to the Parkway at Cathedral Avenue, and signalizing the intersection of Beach Drive with the Parkway. The bulk of the cost of the long-term improvements is earmarked for providing grade separation at the intersection of Park Road, Tilden Street and Beach Drive, which would include a new bridge structure over Beach Drive.

Conclusions

One of the most important conclusions of this study is that the Park administration needs to learn how to manage and control the commuter traffic that uses the Rock Creek Park road system on a daily basis. High vehicle speeds and aggressive driving habits do not contribute to a safe and enjoyable driving experience in the Park. It seems essential that the Park administration examine this issue and develop a long-term and sustainable plan for providing future visitors to the Park with

a safe experience. It is noteworthy that there is a General Management Plan for Rock Creek Park in the development stage at this time. The GMP planning team is looking at alternative strategies for controlling commuter traffic.

Site Improvement Costs and Priorities

Site Description	Estimated Cost of Short-Term Improvements	Priority Ranking of Short-Term Improvements
Site 9 - Parkway/Beach/Cathedral	$ 12,750	1
Site 10 - Parkway/P Street	$ 38,400	2
Site 1 - Beach/West Beach	$ 8,150	3
Site 5 - Beach/Tilden/Park	$ 49,750	4
Site 6 - Bluff Bridge Curve	$ 5,600	5
Site 3 - Beach/Broad Branch	$ 7,300	6
Site 7 - Beach/Piney Branch	$ 54,900	7
Site 2 - Wise/Oregon/Chestnut	$ 10,500	8
Site 11 - Parkway/Virginia	$ 63,000	8
Site 4 - Beach/Blagden	$ 52,500	10
Site 8 - Beach/Klingle	$ 46,500	11
TOTAL	$349,350	

Chapter 1. Introduction

Chapter 1: Introduction

1.1 Project Purpose and Goals

The purpose of this study is to assist the National Park Service (NPS) and Rock Creek Park in bringing the Park road system into conformance with national traffic safety standards and signing practices. This study is intended to be a tool that will be used along with other management tools in determining Park policy. This study is also intended to provide the basis for requesting funds to implement traffic safety improvement projects in the Park.

Specific goals of this project include the following:

- Define and examine the physical and operational characteristics of the Park road system;
- Examine the maintenance practices and policies of the Park to determine their effect on traffic safety;
- Review the accident reporting practices and bookkeeping system;
- Analyze the traffic accident history on Park roads over the past three years;
- Identify and examine twelve locations within the Park that have a high frequency of traffic accidents or significant operational problems;
- Develop a set of recommended improvements that address identified traffic safety problems;
- Prioritize the recommended improvements to facilitate implementation.

Background information and data for this study was collected from various sources including: field observation and measurements, interviews with NPS personnel, and review of NPS STARS database. In addition, the following pertinent past documents were reviewed: an Engineering Study for Rock Creek Park prepared by FHWA in 1988, and an Environmental Assessment Bicycle Trail Study for National Capital Park Rock Creek Park prepared by NPS in 1980.

1.2 Project Study Area

This study includes an examination of traffic conditions within Rock Creek Park. Rock Creek Park, located in the heart of Washington D.C., is divided geographically into two logical parts. The northern portion of the Park includes everything north of the intersection of Beach Drive and Rock Creek Parkway. The Rock Creek and Potomac Parkway area includes everything south of this intersection, extending to the intersection of Ohio Drive and Parkway Drive just south of the Theodore Roosevelt bridge. For purposes of this transportation study, these two regions of the Park are often discussed separately.

The northern portion of the Park consists of approximately 1,750 acres of wooded terrain along the Rock Creek waterway between the Maryland State Line and the National Zoological Park. The southern portion of the Park is a narrow strip of parkland extending 2.6 miles along the Rock Creek

and Potomac Parkway from the National Zoo to the Lincoln Memorial. A map showing the regional location of Rock Creek Park is presented in **FIGURE 1-1**.

Beach Drive, which runs generally north and south, is the main route through the northern portion of the Park. The Rock Creek and Potomac Parkway serves as a major access route into the Park from the south, and numerous side roads provide entry from the east and west along Beach Drive and the Parkway. Two minor access points also exist along Military Road, which traverses the park from east to west. To the north, Chevy Chase and Silver Spring, Maryland serve as gateway communities to the Park. The National Zoo is located just north of the Parkway, and can be accessed from either Beach Drive or the Parkway.

Rock Creek Park

Map Scale: 1"= 0.5 Miles

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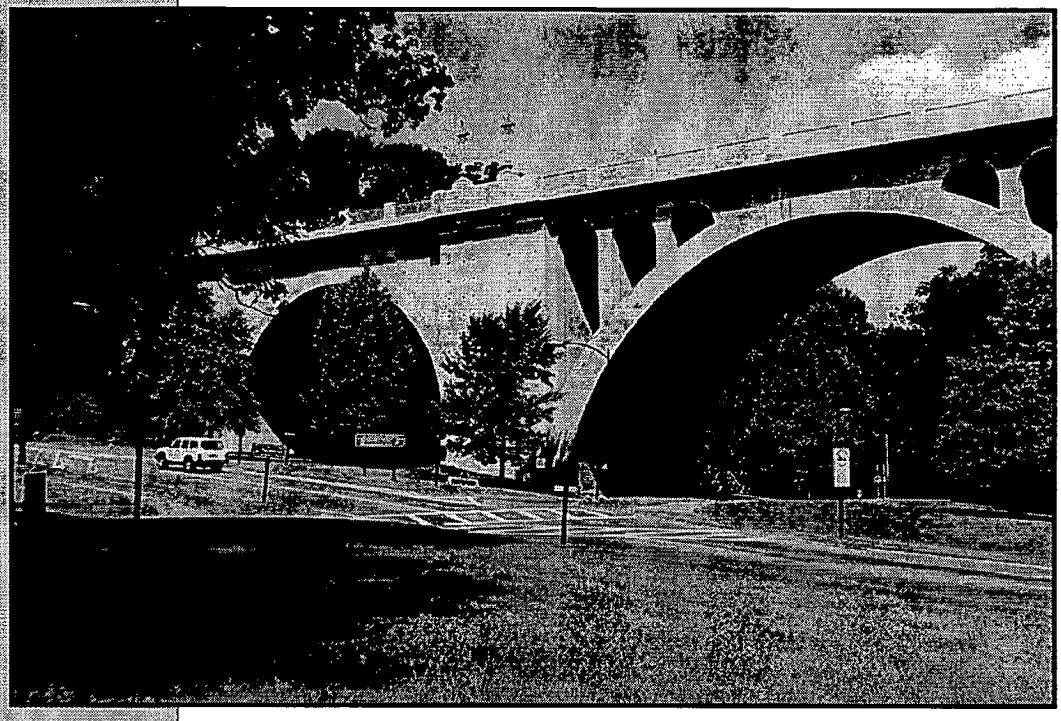
ROCK CREEK PARK

Figure 1-1
Study Area Location

Chapter 2. Physical Characteristics



Chapter 2: Physical Characteristics

2.1 Park Road System

2.1.1 Park Access and Road Network

Visitors entering Rock Creek Park by car have typically traveled on the major arterials within the District of Columbia. These generally run parallel to the east and west Park boundaries and include Connecticut Avenue on the west, and 16th Street NW on the east.

Numerous entry routes are used to access Rock Creek Park. The access point most heavily used by visitors is the Rock Creek and Potomac Parkway. From north to south, other major points of entry include Beach Drive at the Maryland State Line, West Beach Drive, and Wise Road. There are two access points on Military Road, which crosses the Park from east to west, essentially separating the northern portion of the Park into two halves. Major access points south of Military Road include: Joyce Road, Morrow Drive, Broad Branch Road, Blagden Avenue, Park Road, Tilden Street, and the Piney Branch Parkway. Accesses along the Rock Creek and Potomac Parkway are discussed in section 2.1.3. Access to the northern portion of the Park can also be obtained via the 16th Street NW and Kennedy Street Area (location of the Tennis Center and Carter Barron amphitheater), and from the National Zoological Park.

There are approximately 18 miles of road within the northern portion of Rock Creek Park, and the Rock Creek and Potomac Parkway is an additional 2.6 miles long. Several roads, including Glover Road and Ross Drive, are fully contained within the Park. All Park roads other than the Parkway are paved, about 22-feet wide with curbs, and provide two-way operation. These roads are generally open to the driving public day and night, year-round, except during snow and maintenance closures. Some sections of the Park road system, used as recreation routes for pedestrians, bicyclists, and in-line skaters, are closed on weekend days. **FIGURE 1-1** shows the layout of the Park road system.

2.1.2 Beach Drive

Beach Drive is the primary north-south route in the northern portion of the Park, serving as the backbone of the northern Park road network. Beach Drive extends approximately 6.6 miles from the Maryland State Line at the Park's northwestern boundary to its intersection with the Rock Creek and Potomac Parkway south of the National Zoo. The roadway typically has about 22-feet of paved surface with curbs and raised channelization at major intersections. The posted speed limit along the entire length of Beach Drive is 25 mph.

Many of the other roads in the Park approach from the east or west, meeting Beach Drive at at-grade intersections. Military Road, Porter Street, and Harvard Street have grade-separated crossings over Beach Drive, with access to the Park through various ramps and access road connections. Connecticut Avenue and Calvert Street also cross the Park on grade-separated structures, but have no direct access to Beach Drive. The only traffic signal within the northern portion of the Park is located at the intersection of Beach Drive with Park Road and Tilden Street. Beach Drive provides access to and egress from the National Zoological Park, and passes through a tunnel beneath a

section of the Zoo. On weekends, portions of Beach Drive are closed to vehicular traffic to allow the roadway to be used as a recreational facility for pedestrians, bicyclists, and in-line skaters.

2.1.3 Rock Creek and Potomac Parkway

The Rock Creek and Potomac Parkway extends approximately 2.6 miles south from its intersection with Calvert Street to its intersection with Ohio Drive and Parkway Drive just south of the Theodore Roosevelt Bridge. The Parkway is a limited-access facility which currently serves as a primary urban commuter route within the District of Columbia. Except for a short two-lane segment between Calvert Street and Beach Drive, the roadway consists of a four-lane paved surface with curbs and continuous roadway lighting. Between Calvert Street and Beach Drive, as well as south of Virginia Avenue, the speed limit is 25 mph. The posted speed limit along the remaining length of the Parkway is 35 mph.

On the north end, the Parkway can be accessed at one of three at-grade intersections: the signalized intersection with Calvert and 24th Streets, or the two stop-controlled intersections at Cathedral Avenue and Beach Drive. There is also one at-grade intersection near the south end of the Parkway at the signalized intersection with Virginia Avenue. At its southern terminus, the Parkway connects with Ohio Drive and Parkway Drive south of the Theodore Roosevelt Bridge. All other access to the Parkway is provided via grade-separated interchanges at the following streets: Massachusetts Avenue, P Street, Pennsylvania Avenue, and K Street. During weekday morning and evening peak commuting hours, the Parkway operates with all four lanes one-way southbound and northbound, respectively.

A paved pedestrian/bicycle trail located on the west side of the Parkway is heavily used by recreationalists, as well as pedestrian and bicycle commuters. The Thompson Boat House, located near the southern end of the Parkway, is the other main recreational attraction which can be accessed from the Parkway at the Virginia Avenue intersection. The Parkway also provides access to and from the Kennedy Center near its southern end.

2.1.4 Intersections and Interchanges

The majority of intersections within the northern portion of the Park are at-grade "T" or "Y" intersections, where a minor side road joins a major route. Grade-separated intersections in the northern portion of the Park occur at Military Road and Harvard Street. Klingle Road provides a connection between Beach Drive and grade-separated Porter Street. The only four-way intersections within the northern portion of the Park are on Beach Drive at Park Road/Tilden Street, and at Joyce Road.

With the exception of the one signalized intersection at Beach Drive and Park Road/Tilden Street, all other major intersections within the northern portion of the Park are controlled by stop or yield signs. Painted stop bars are typically used in conjunction with stop signs on the stop approaches to an intersection. Pavement widening for turn lanes is present at several of the major intersections. In these locations, lane lines and painted arrows have been installed on the pavement to help identify the channelization at the intersection. Most of the intersections also make use of raised curbed

medians to channel traffic.

There are also both at-grade and grade-separated intersections along the Rock Creek and Potomac Parkway. Both the northern and southern ends of the Parkway have at-grade intersections, while the majority of its length in between is served by grade-separated interchanges. There are five at-grade intersections on the Parkway. Two of these are four-way, signalized intersections: Calvert Street/24th Street and Virginia Avenue. The other three are three-way, stop-controlled intersections: Cathedral Avenue, Beach Drive, and Ohio Drive/Parkway Drive.

Use of grade-separated interchanges with on- and off-ramps along the Parkway allows for smoother traffic flows and higher travel speeds on this heavily-traveled arterial. Of the four interchanges along the Parkway, K Street has the only complete interchange. The P Street interchange has no northbound off-ramp, and there is no southbound off-ramp at Massachusetts Avenue. Pennsylvania Avenue has only a southbound on-ramp. All on-ramps are controlled by stop or yield signs, but none of them have acceleration lanes.

There are numerous intersections along the boundaries surrounding the Park. These intersections generally consist of a north/south city street and an east/west street which is split between city and Park jurisdictions at the Park boundary. The naming pattern is such that the Park leg of the east/west road will have a different name than the city leg. Although these intersections are not actually within the Park boundaries, the fact that they involve Park roads makes them relevant to this discussion. Examples of this type of intersection include: Oregon Avenue and Wise Road/Chestnut Street, Military Road and Glover Road/Oregon Avenue, 16th Street and Sherrill Drive/Aspen Street, and 16th Street and Morrow Drive/Kennedy Street. Some of these intersections are signalized. **FIGURE 1-1** shows the intersections located along the east and west boundaries of the Park.

2.1.5 Roadside Environment (See **FIGURES 2-1 and 2-2**)

For purposes of this discussion, the roadside environment, or clear zone, generally consists of the area immediately behind the curb line on a paved road surface.

The Rock Creek and Potomac Parkway is characterized by a well-defined roadway clear zone containing few fixed objects. The Parkway was constructed close to grade with the surrounding terrain, and the roadway shoulders are generally well-maintained. There is guiderail located in the median adjacent to the Parkway and guardrail along some shoulder locations. Typically the only other fixed objects located within the clear zone of the Parkway are light standards, post-mounted traffic signs, and bridge supports.

Beach Drive and most of the roads within the northern portion of the Park have a less forgiving roadside environment. Most areas adjacent to Park roads other than the Parkway are heavily overgrown, with vegetation and large trees encroaching up to, and sometimes beyond the curb line. It is common to find large trees located near these roadways. Other fixed objects often found within the clear zones in the northern portion of the Park include: large rocks and rock formations; wooden guiderails and steel guardrails; obsolete light standards; the entire post-mounted traffic signing system; and hinged gates. In some areas, Rock Creek or one of its tributaries is located within or

near the edge of the clear zone.

2.1.6 Signing (See **FIGURE 2-3**)

The existing signing along the Park road system consists mainly of regulatory and warning signs, with some guidance signs. It was apparent from field observations that a significant number of signs were missing from the system. At a number of locations, sign posts or post bases were evident without the corresponding sign actually being present. It seems as though signs did exist at these locations in the past, but were not replaced as they became damaged or removed over the years.

Regulatory sign applications generally consist of speed limit and intersection traffic control signs. All of the major Park roads have posted speed limits. Traffic control at all major intersections is provided by stop and/or yield signs. The approaches from large off-road parking areas are typically not controlled by stop or yield signs. Most pullouts do not have any form of traffic control.

Warning signs are used throughout the Park to alert the motorist to potential hazards or changes in driving conditions. Object markers are sometimes used to identify bridge ends or other fixed objects located adjacent to the roadway. It was observed that advance warning signs were absent for most locations where trails cross roadways within the northern portion of the Park.

There are too few street signs and guidance signs throughout the Park road system. This lack of adequate guidance makes the Park very confusing to the newcomer. Signs unique to Rock Creek Park include the large, wooden entrance signs, and other guidance and informational signs.

Park road signing, with the exception of guidance signs, is generally in conformance with the *Manual on Uniform Traffic Control Devices* (MUTCD) and the *NPS Sign Manual.* Sign usage, with respect to regulatory and warning signs, was generally correct throughout the Park. Areas where the sign system is most often not in conformance with MUTCD or NPS Sign Manual include:

- Sign visibility - overgrown vegetation along the roadside sometimes obscures signs for approaching motorists.

- Sign maintenance - signs within the Park are generally dirty, decreasing their effectiveness, especially at night.

- Signs associated with the one-way operation of the Parkway - in an effort to accommodate the unique operating conditions on the Parkway, some of the hinged signs used during peak commuting times exhibit creative design. In some cases, these signs can actually be confusing to the motorist.

The large rocks on the shoulder of this curve on Glover Road are effective deterants to parking but are also significant roadside objects. They will compound the severity of any run-off-the-road incidents at this location. The rocks should be removed and replaced with conventional no parking signs.

Notice that the elevation of the shoulder area behind the curb on this section of Beach Drive is 4-6-inches lower than the adjacent curb. This condition can compound the severity of a run-off-the-road accident due to the grade change.

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ROCK CREEK PARK

Figure 2-1

These two trees on the west side of Beach Drive south of Tilden are located immediately behind the curb line. Both trees show evidence of vehicle impacts.

The large tree on the right is located within a foot of the curb line on the south approach to the Klingle Road intersection.

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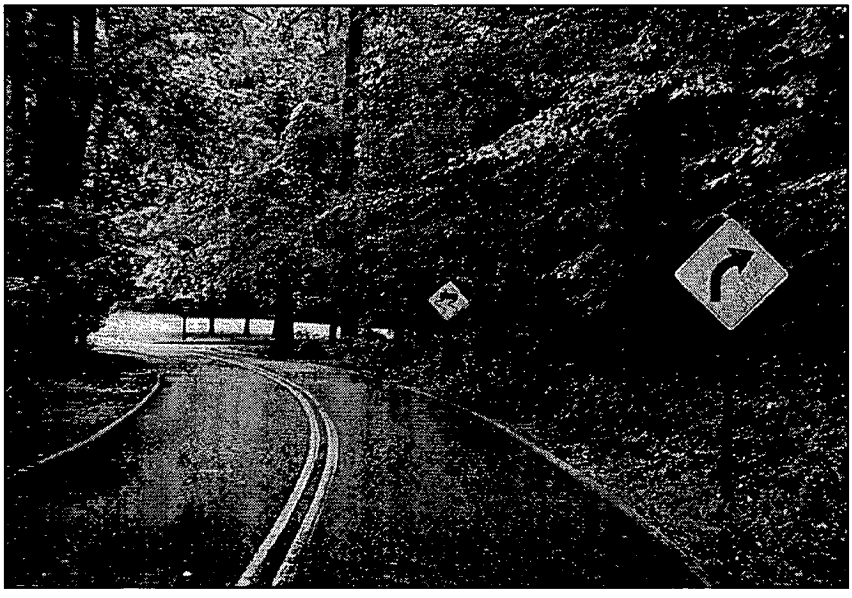
ROCK CREEK PARK

Figure 2-2

This keep right sign on the RCP is displayed twice. This is non-standard. In this case the lower sign is folded up to cover the upper sign during one-way operations in afternoons. It would be more appropriate if the lower sign was blocked out or left blank.



The curve warning sign on Glover Road indicates a curve to the right when the roadway is clearly turning to the left. It would be more appropriate if the location of this sign was switched with the slippery when wet warning sign farther along the road.

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ROCK CREEK PARK

Figure 2-3

2.1.7 Striping

For the most part, pavement markings in the Park consist of extruded thermoplastic stripes. Double solid centerline striping has been applied on all Park roads. There are also broken lane lines on the four-lane portions of the Parkway. Passing is not permitted anywhere on the two-lane roadways in the Park road system. Shoulder striping is not typically used along Park roads other than the Parkway. Other pavement markings include stop bars, lane-use markings (words and symbols), pedestrian crosswalks, and delineation within parking and/or developed areas.

The use of pavement markings is generally appropriate throughout the Park, with respect to color and application. Most pavement markings are in good to fair condition. There are isolated areas, such as stop bars, lane use markings, and centerlines on the inside of curves where pavement markings have been worn down so that they are no longer visible due to repetitive wheel traffic.

A relatively unique application of pavement marking can be found near the intersection of Beach Drive and the Parkway, where white thermoplastic markings have been used to create rumble strips across the travel lanes on the Parkway.

Plowable raised pavement markings (RPMs) are used in various locations throughout the Park (See **FIGURE 2-4**). RPMs are effective in the low visibility and low-light conditions that frequently occur on Park roads during rainstorms or at night, dawn, or dusk. The RPMs are typically used for delineating the centerline of the roadway, or to highlight special channelization at intersections or interchanges.

2.1.8 Drainage

The Parkway, Beach Drive, and all other roads within the Park are constructed with curbs that are used for surface water drainage. Drainage is accommodated in the gutter sections along these curbs, which carry storm runoff into drop inlets spaced along the length of the roadways. The storm drain system on the Parkway functions reasonably well. Most culverts and bridge structures seem to be adequately sized and protected.

Beach Drive experiences flooding and ponding conditions during heavy rains when Rock Creek runs high. The curbing funnels storm water, creating a flume down the sides of the road when rains are heavy. As is indicated by ponding on the road surface, the drainage inlets within the Park seem to be inadequate or poorly maintained in some locations. Drains may be clogged, undersized, or too few in number. Numerous pavement overlays on Beach Drive over the years have decreased the water-carrying capacity of the roadway from the original design by reducing the distance between the road elevation and the elevation of the top of the curb. This has also caused many of the drainage inlet grates to be significantly lower than the adjacent road surface, creating a hazard for bicyclists and an irritant to drivers. Drivers tend to shy away from these depressed grates and hug the centerline of the road, creating the potential for conflicts with opposing traffic (See **FIGURE 2-4**).

2.1.9 Guiderails, Guidewalls, and Guardrails (See **FIGURE 2-5**)

The Park uses several types of guiderails, guidewalls, and guardrails to protect vehicles from greater roadside dangers such as steep embankments. Wooden guiderails and stone guidewalls are used in many areas of the Park. A newer application of tube steel guardrails is used on several bridges. An examination of the wooden guiderails reveals many of these structures are old and have rotten members. The rock walls and newer tube steel guardrails used on bridges are structurally sound. The end sections of most of the wooden guiderails and stone guidewalls are not rolled down or flared to the outside of the shoulder area. The tube steel guardrails on the bridges have appropriate end treatments but are located immediately adjacent to the driving lane and most show evidence of vehicle scrapes. None of the guiderails, guardrails, or guidewalls have reflectors or other delineators to help identify them at night. Appropriate object markers are used to identify the end sections of the stone guidewalls.

2.1.10 Temporary Road Closure Devices (See **FIGURE 2-6**)

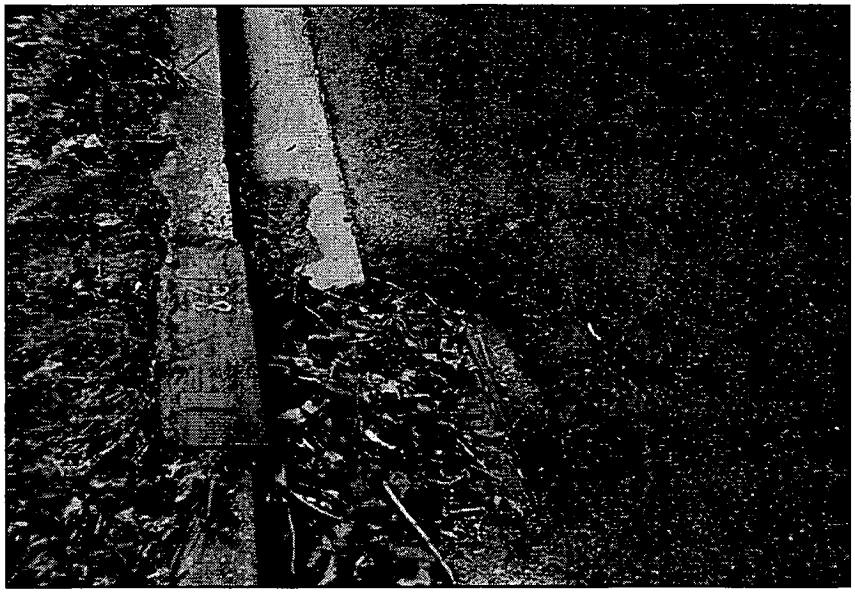
There are two types of road closure devices in use in the Park: permanently mounted steel tube gates, and temporary wooden sawhorses used in conjunction with orange traffic cones. Permanent gates are used within the northern portion of the Park for regularly-scheduled weekend road closures, winter snow closures, closures caused by high water on the roadway, or routine maintenance-related road closures. Temporary barricades (wooden sawhorses) are used for emergency road closures within the Park, and for regular weekday peak hour directional restrictions on the Parkway.

The mounting posts for the permanent gates are appropriately offset from the road, and the steel gates seem structurally sound. The signing on the gates and advance warning signing, however, is not standard. Many of the flashing lights mounted on the steel gates are not functional and need maintenance. The gates do have reflective signs and tape to help identify them during low-light conditions. Several of these permanent gates show evidence of low speed vehicle impacts. Advance warning should be provided for these gates through the use of hinged signs. **FIGURE 2-7** shows an appropriate signing treatment for this type of gate.

With temporary barricades, consistent placement and visibility are of utmost concern. Slight variations in the locations of sawhorses and orange cones occur from day to day due to hand-placement; these inconsistencies can confuse motorists. The wooden sawhorses typically do not have any effective reflective surfaces. Reflective paint or reflective tape should be applied to the sawhorses to improve their visibility.

Both types of temporary road closure devices are occasionally in use at night. During winter months, sawhorse barricades are used during the morning and evening peak hour travel times which occur partially during dusk and dawn. Visibility of gates and sawhorses is a concern during low-light hours; any road closure device in use at low-light times should be equipped with a functioning flashing light system.

This photo shows how the concrete bridge deck on Tilden Street has been grooved to increase skid resistance. The reflectors on the center-line are plowable. Both applications are appropriate and effective. This bridge is under the jurisdiction of the DC DPW.



Leaves that block drainage grates are a common maintenance problem throughout the park. This condition can cause localized flooding during heavy rain showers.

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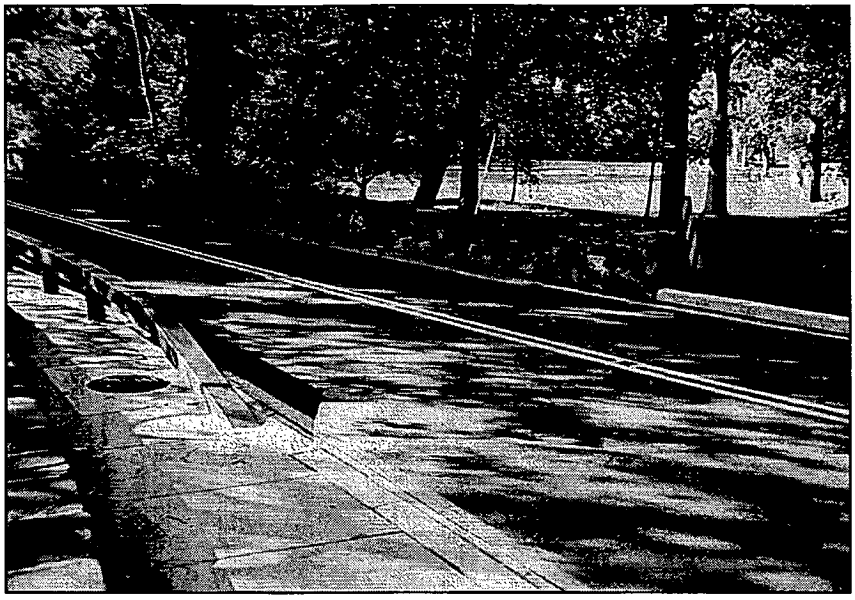
ROCK CREEK PARK

Figure 2-4



This photo of the west end of the bridge on Tilden Street shows two bridge end treatments used in the Park. The stone guidewall on the far side of the street is vertical and appropriately accompanied by a black and yellow object marker. The steel guardrail on the near side of this street is rolled down. Tilden Street and this bridge are under the jurisdiction of the DC DPW.

The steel guardrail on the Klingle Road bridge is located directly over the inside edge of the curb. The rail shows evidence of vehicle scrapes. Silver reflectors mounted on the face of this rail would help identify it for drivers at night. This bridge is under the jurisdiction of the DC DPW.

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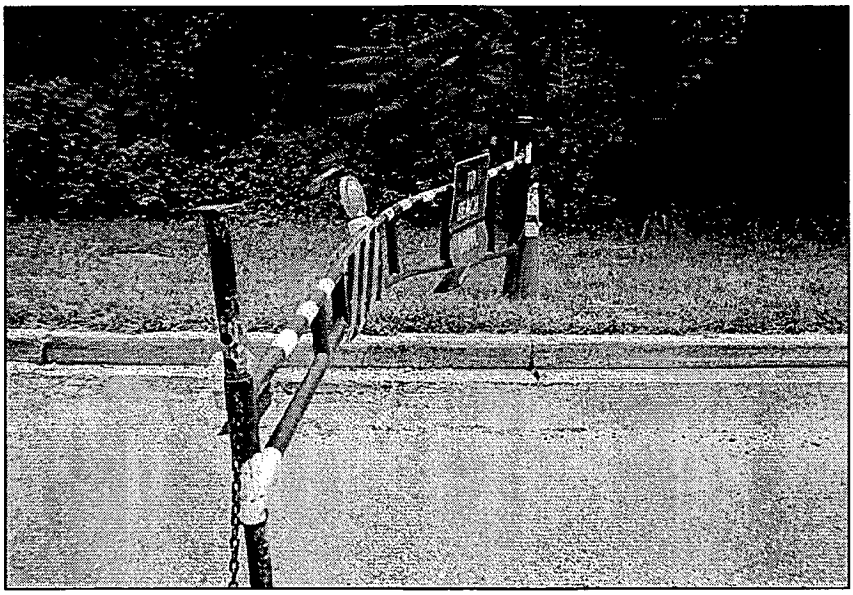
ROCK CREEK PARK

Figure 2-5

The Park uses gates like this one for temporary road closures. The supports and gate structure are well designed and appropriate for the conditions. The object marker signs on the gates should be red and white striped instead of yellow and black. Two of these object marker signs should be presented.

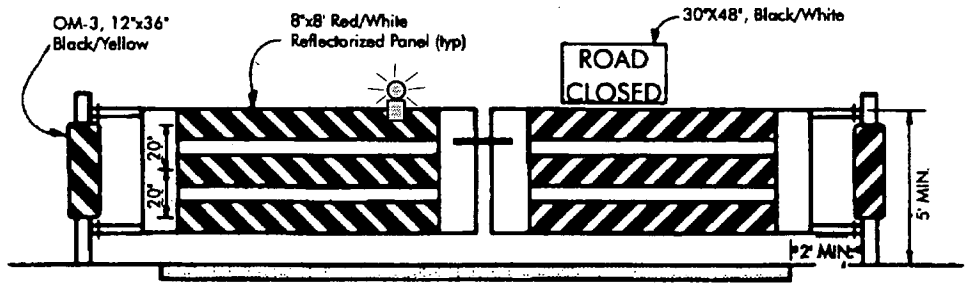


This gate shows evidence of repeated vehicle impacts. The signing on the gate is non-standard and there is inadequate advance warning signing identifying the road closure.

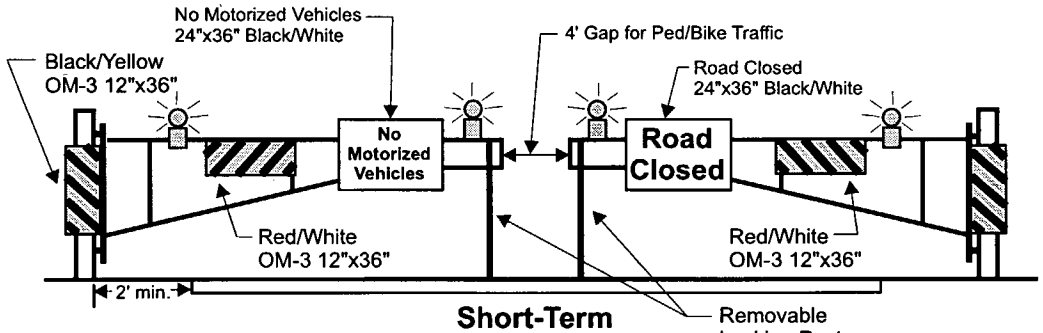
maint6.cdr

ROCK CREEK PARK

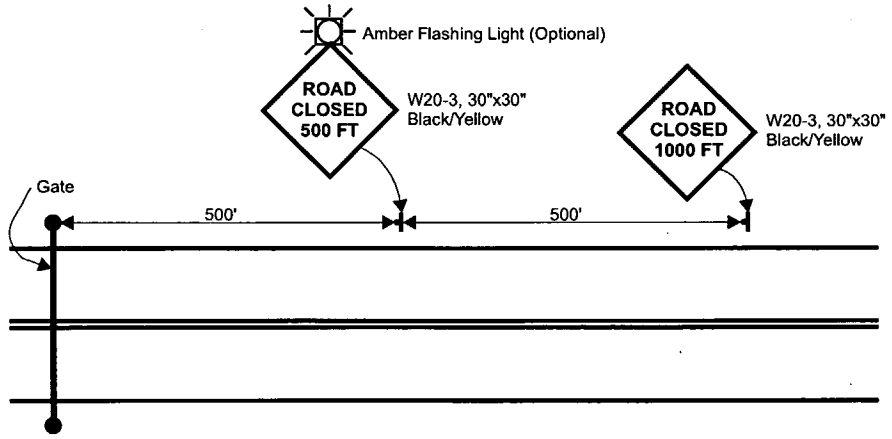
Figure 2-6



Long-Term Closure Gate



Short-Term Closure Gate



Note: In cases where there is not 1000' available advance warning distance, one and preferably both of these signs should still be presented in advance of the gate in the location of greatest visibility to motorists.

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ROCK CREEK PARK

Figure 2-7
Recommended
Gate Treatment

2.1.11 Roadway Lighting

The Rock Creek and Potomac Parkway is well illuminated with corridor lighting, as well as intersection and interchange lighting throughout. This extensive lighting system provides effective nighttime visibility for motorists.

At one time the roads within the northern portion of the Park were illuminated, however, the roadway lighting system was disconnected during the energy crisis of the 1970's and is no longer functional. The ambient light level at many locations within the northern portion of the Park is low due to the presence of a full tree canopy. Although Rock Creek Park is closed to visitor use at night, the roads within the Park remain open. The majority of Park roads other than the Parkway are dark at night. Of particular concern are intersections which have raised channelization; an unfamiliar driver may not be able to see potential obstructions in the roadway.

2.2 Other Related Park Facilities

2.2.1 Developed Areas

The northern portion of the Park contains several major developed areas including: the Tennis Stadium and athletic fields near the intersection of 16th and Kennedy Streets, the Carter Barron Amphitheater, the Rock Creek Golf Course, the Rock Creek Park Horse Center, the Rock Creek Nature Center and Planetarium, and Pierce Mill. These developed areas offer a wide variety of recreational opportunities such as tennis, soccer, softball, picnicking, golf, horseback riding, hiking, nature walks, performing arts and exhibits. Information about the history of the Park area and the natural environment is also provided at several of the developed areas.

The area of the Park located near the intersection of 16th and Kennedy Streets is home to the Tennis Center, softball fields, and a large recreation field which is suitable for soccer, softball, football, volleyball and field hockey. The Tennis Stadium hosts one major professional tennis tournament on an annual basis. The Carter Barron Amphitheater, also located near 16th and Kennedy Streets, hosts a variety of performing arts events during the summer months.

The Rock Creek Golf Course is an 18-hole public course located off Joyce Road west of 16th Street. The Horse Center and Nature Center are located off the east fork of Glover Road. Horse rentals, and information and activities related to the Park's natural and cultural history are the focus of these facilities. The Pierce Mill complex, including the Mill, a Carriage House and a Springhouse, is located just west of the intersection of Beach Drive and Tilden Street. The Mill is open to the public and is staffed by park rangers. The Carriage House is occupied by the Rock Creek Gallery and has local art exhibits and activities.

The Park Police Substation is centrally located just south of the intersection of Beach Drive and Joyce Road. Maps are available to the public, and visitor assistance is provided from this facility. The Substation is open daily from 7:00 a.m. to 4:00 p.m.

The Park Maintenance Yard is located off Glover Road near the Horse Center and Nature Center.

The Maintenance Yard houses the office of the maintenance foreman, space for vehicle storage and maintenance activities, and storage areas for maintenance equipment. Maintenance facilities are open from 7:00 a.m. to 3:30 p.m., Monday through Friday. Maintenance staff members are available prior to 7:00 a.m. during much of the year.

The Park Administrative Headquarters is in the Klingle Mansion located north of Porter Street near the west Park boundary.

The Thompson Boat House is located on the east bank of the Potomac River, and can be accessed from the Rock Creek and Potomac Parkway at its intersection with Virginia Avenue. Although the parking lot and entrance bridge are under the administration of Rock Creek Park, the Boat House itself is a concession operation of the C&O Canal National Historic Park. This popular recreation site offers bicycle, canoe and rowboat rentals. The Boat House is open to the public daily February through November, weather permitting.

2.2.2 Picnic Areas

There are 30 designated picnic areas scattered throughout Rock Creek Park. Picnic areas are classified as either group or individual sites. The ten group picnic areas can be reserved through the D.C. Department of Recreation for use by groups of up to 100. The group picnic areas have larger, off-road parking lots, and four are equipped with restrooms. Individual picnic areas are available for smaller gatherings on a first-come, first-served basis. The individual picnic sites typically have short, on-road pullout areas for parking. A notable exception is individual Picnic Area #2 which has a large, off-road parking lot. All picnic sites in the Park are equipped with picnic tables and trash cans, most have stone fireplaces, and four have rain shelters.

Some of the picnic parking areas were found to be undersized for the summer demand. This situation results in parking shortages and other typical parking problems at these locations.

There are three potential safety concerns associated with the picnic areas in the Park:

- Restrooms for the group picnic areas along Beach Drive are typically located across the road from the picnic facilities. This situation forces picnickers to cross a busy roadway to reach restroom facilities, creating potential conflicts between pedestrians and vehicles traveling on Beach Drive.

- Although they are not signed for one-way operation, the access roads for off-road parking lots are too narrow for two-way traffic. This is a problem because it is not clear as to whether one access should be used as an entrance and the other as an exit, and if so, which is which.

- Some of the individual picnic parking areas are not clearly separated from the adjacent travel lane. In some cases, depressed concrete curb parallels Beach Drive between the travel lane and the adjacent parking area. In most cases, however, no pavement markings or other delineation system exist to clearly delineate the parking pullouts from the roadway.

2.2.3 Pedestrian and Bicycle Facilities

The Park contains an extensive network of paved and unpaved trails. These trails are designated for either pedestrian use only, or pedestrian and bicycle use. Pedestrians are also welcome on the horse trails. Bicycles are limited to designated paved trails or roadway use.

The asphalt path running parallel to portions of Beach Drive and Rock Creek, extending south adjacent to the Parkway is the most heavily used pedestrian and bicycle facility in the Park. A 1.5 mile segment of this trail south of Calvert Street is set up as an exercise course. In addition, a series of hiking trails within the Park is maintained by the Potomac Appalachian Trail Club.

In many areas, "volunteer trails" have been worn into the grass along Park roadways, particularly on Beach Drive between Bluff Bridge and Klingle Road. Volunteer trails also appear along Morrow Drive, Piney Branch Parkway and Blagden Avenue. The existence of these types of paths indicates a need for additional pedestrian and bicycle facilities, particularly adjacent to roadways. When pedestrians or bicyclists are forced to use the roadway due to lack of available trails, conflicts with motor vehicles are a resulting problem.

Within the Park, painted pedestrian crosswalks are provided at most locations where pedestrian trails cross a roadway. Unfortunately, advance warning signs are not provided for most of these crossings, and pedestrian crossing signs are missing at some of these locations. Appropriate signs at all crossings would alert drivers to pedestrian presence and encourage vehicles to yield.

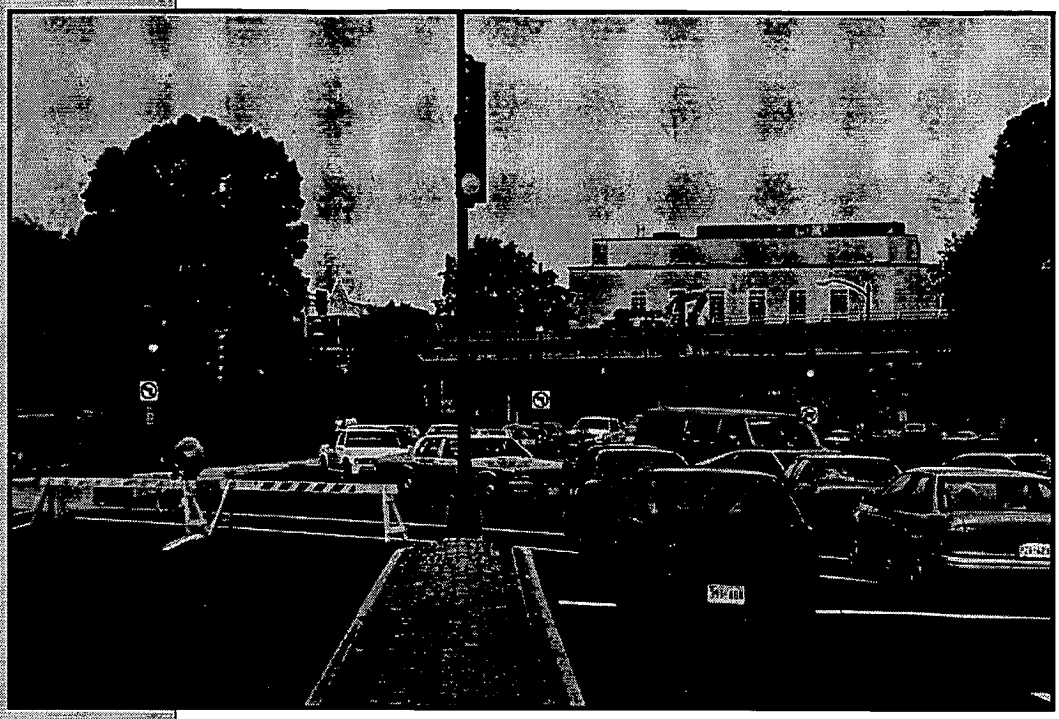
The portions of Beach Drive between Wise Road and Picnic Area #10, and between the Park Police Substation and Broad Branch Road, as well as Bingham and Sherrill Drives, are closed to motorized traffic from 7:00 a.m. Saturday to 7:00 p.m. Sunday, and on holidays. During closure times, these portions of Beach Drive serve as important recreational corridors for use by pedestrians, bicyclists, and others.

2.2.4 Equestrian Trails

A network of wide dirt and gravel bridle trails traverses the back country of the Park, mainly in the northern portion. The equestrian trail system connects such facilities as the Horse Center, the Park Police Stables, and the Equitation Field on Glover Road.

There are several places where horse trails cross Park roadways. These locations are identified with horse crossing signs for vehicles traveling on the road, but advance warning signs are not provided. Of some concern are the horse crossings that occur in locations without good sight distance for motorists and riders.

Chapter 3. Operational Characteristics



Chapter 3: Operational Characteristics

3.1 General

The operational characteristics of the transportation system in Rock Creek Park can be best defined by reviewing available historical traffic count data, and by performing traffic studies that measure the use of the existing system. A proper assessment of visitor usage and the operation of the road system is fundamental to identifying traffic safety problems or deficiencies.

3.2 Weekday A.M. and P.M. Road-Use Changes

In order to accommodate peak hour commuter traffic, the Rock Creek and Potomac Parkway is designated as a one-way facility on weekday mornings and evenings. In the mornings between 6:45 a.m. and 9:30 a.m., the Parkway serves southbound traffic only. The road is one-way northbound between 3:45 a.m. and 6:30 p.m. It is important to note that the practice of manually converting the Parkway to one-way operation for weekday commuter traffic began in 1937.

The process of changing the Parkway to a one-way facility is labor intensive, involving sawhorses, traffic cones, hinged signs, and United States Park Police officers. Signing and traffic operations at most of the intersections and interchanges along the Parkway must be modified during each peak period to achieve the desired result. Beach Drive, near the intersection with the Parkway, is the only other road in Rock Creek Park that requires traffic control modification to accomplish the one-way operation. However, the traffic impacts of this practice affect most of the roads in the Park, as well as numerous city streets and other park roads in the Washington D.C. area.

3.3 Weekend Road Closures

Several Park roads are closed to vehicular traffic on weekends from 7:00 a.m. on Saturday until 7:00 p.m. on Sunday. The roads affected are as follows: Beach Drive from Broad Branch Road to Joyce Road, Beach Drive from Picnic Area 10 to Wise Road, Beach Drive north of West Beach Drive, Bingham Drive, and Sherrill Drive. Between Joyce Road and Picnic Area 10, Beach Drive is open to vehicles only for the purpose of providing access to group picnic areas and parking lots. All of the closures serve to make Beach Drive available as a recreational facility for pedestrians, bicyclists, and in-line skaters. The road closures are achieved using gates and are also in effect on holidays.

3.4 Traffic Volumes

Traffic volumes are the best indicator of the use of a highway system. Traffic volume data is collected by the District of Columbia for the roads in the vicinity of the Park. The average annual weekday traffic volumes for the region are presented in **FIGURE 3-1.**

Traffic volume data is also the primary indicator of vehicle utilization of the Park roads. Historical traffic volumes were obtained for two permanent NPS traffic counters: one at the intersection of Beach Drive and Joyce Road, the second on the Parkway north of Waterside Drive. 1995 AADT volumes are nearly the same as 1991 volumes. The NPS count volumes were supplemented with temporary machine counts collected by the consultant at various locations throughout the Park in

August and December, 1996. All count locations are shown in **FIGURE 3-2.**

3.4.1 Seasonal Variations

FIGURES 3-3 and **3-4** present a breakdown of monthly traffic in 1995 at the two permanent NPS counter locations. As shown in the figures, seasonal variations in traffic volumes at Rock Creek Park are not as extreme as those that might be seen at a traditional rural park. This consistency in traffic volumes is due to the high number of commuters using Park roads, and the Park's location within a large metropolitan community. The Parkway data shows even more consistent use throughout the year than does the Beach Drive data.

FIGURE 3-3

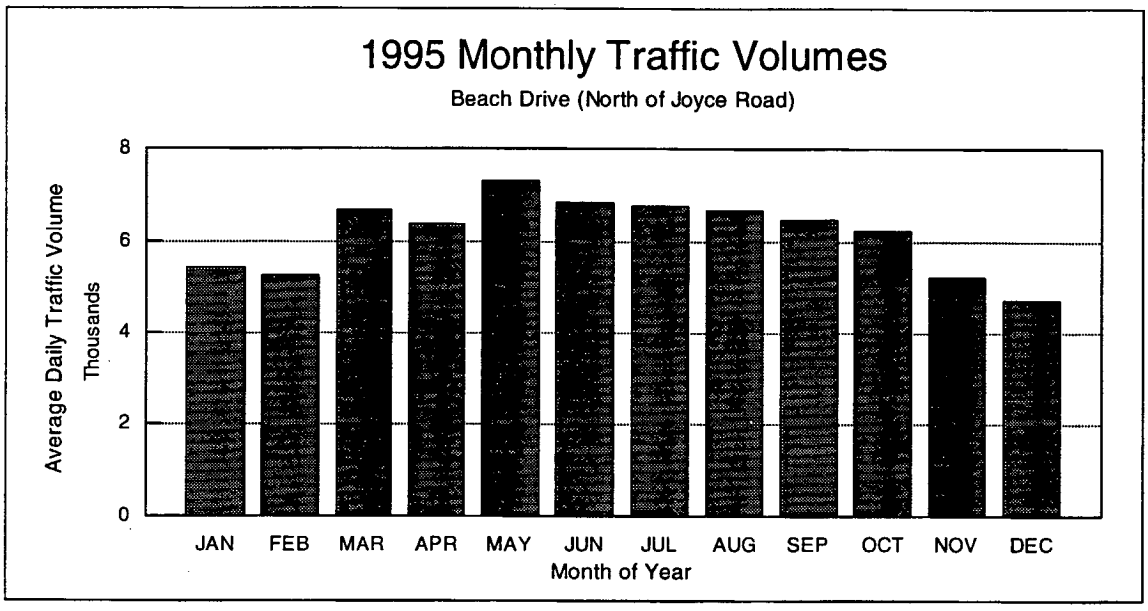
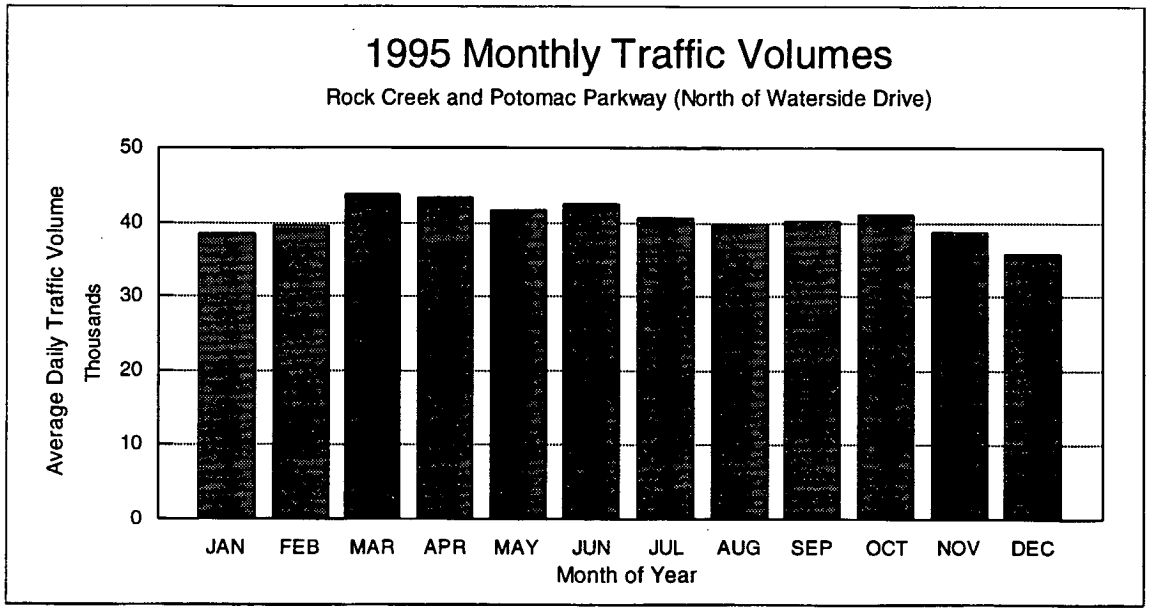


FIGURE 3-4



1993 Traffic Volumes, Average Annual Weekday Volumes - Volumes in 1000's

Source: D.C. Dept. of Public Works

Rock Creek Park

Map Scale: 1"= 0.5 Miles

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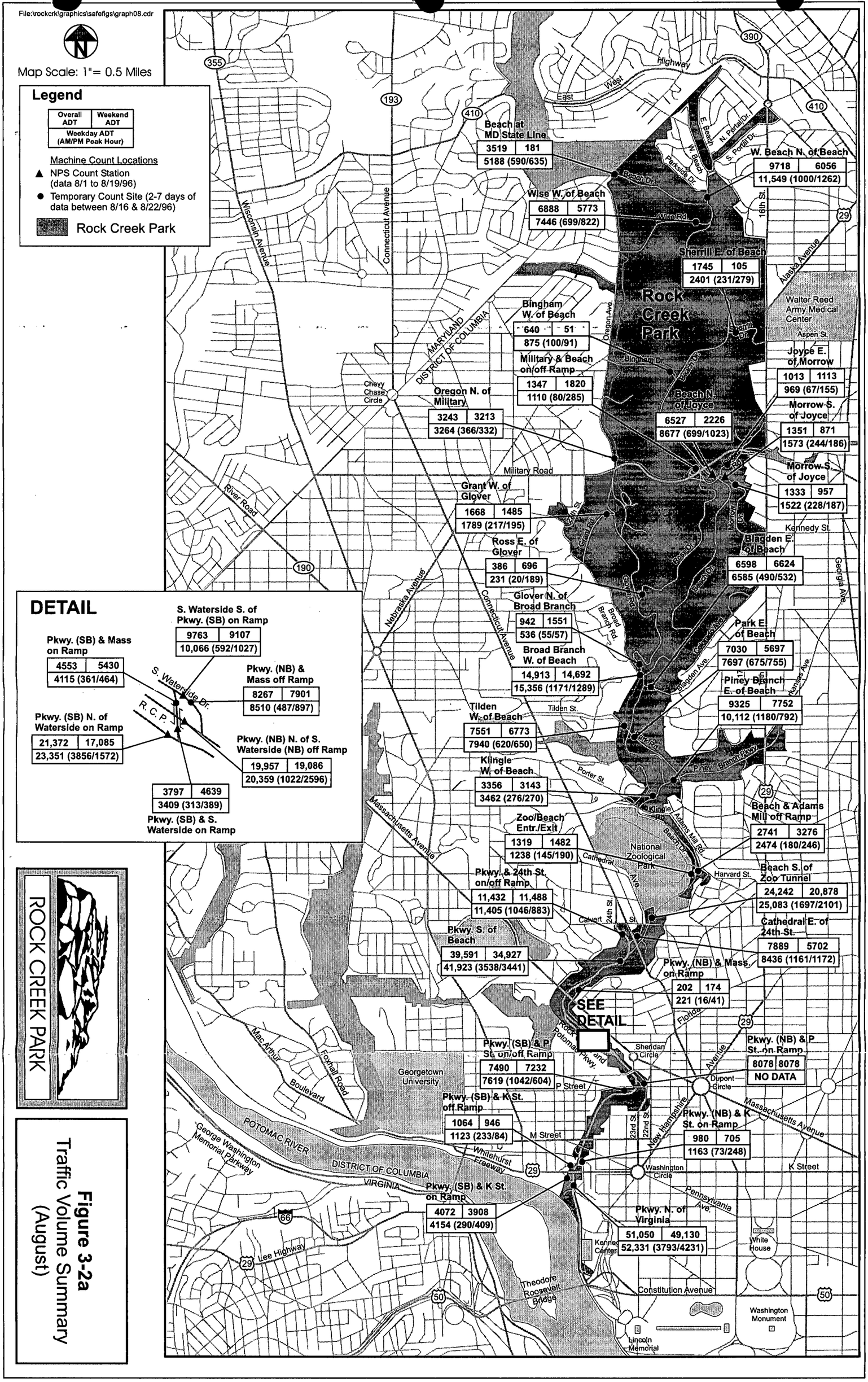
ROCK CREEK PARK

Figure 3-1
Regional Traffic Volumes


File:\rockcrk\graphics\safefigs\graph08.cdr
Map Scale: 1"= 0.5 Miles
Legend
Overall ADT | Weekend ADT
Weekday ADT (AM/PM Peak Hour)
Machine Count Locations
▲ NPS Count Station (data 8/1 to 8/19/96)
● Temporary Count Site (2-7 days of data between 8/16 & 8/22/96)
Rock Creek Park
DETAIL
S. Waterside S. of Pkwy. (SB) on Ramp
9763 | 9107
10,066 (592/1027)
Pkwy. (SB) & Mass on Ramp
4553 | 5430
4115 (361/464)
Pkwy. (NB) & Mass off Ramp
8267 | 7901
8510 (487/897)
S. Waterside Dr.
R.C.P.P.
Pkwy. (SB) N. of Waterside on Ramp
21,372 | 17,085
23,351 (3856/1572)
Pkwy. (NB) N. of S. Waterside (NB) off Ramp
19,957 | 19,086
20,359 (1022/2596)
3797 | 4639
3409 (313/389)
Pkwy. (SB) & S. Waterside on Ramp
ROCK CREEK PARK
Figure 3-2a
Traffic Volume Summary
(August)
Beach at MD State Line
3519 | 181
5188 (590/635)
Wise W. of Beach
6888 | 5773
7446 (699/822)
W. Beach N. of Beach
9718 | 6056
11,549 (1000/1262)
Sherrill E. of Beach
1745 | 105
2401 (231/279)
Bingham W. of Beach
640 | 51
875 (100/91)
Military & Beach on/off Ramp
1347 | 1820
1110 (80/285)
Oregon N. of Military
3243 | 3213
3264 (366/332)
Joyce E. of Morrow
1013 | 1113
969 (67/155)
Morrow S. of Joyce
1351 | 871
1573 (244/186)
Beach N. of Joyce
6527 | 2226
8677 (699/1023)
Morrow S. of Joyce
1333 | 957
1522 (228/187)
Grant W. of Glover
1668 | 1485
1789 (217/195)
Ross E. of Glover
386 | 696
231 (20/189)
Blagden E. of Beach
6598 | 6624
6585 (490/532)
Glover N. of Broad Branch
942 | 1551
536 (55/57)
Park E. of Beach
7030 | 5697
7697 (675/755)
Broad Branch W. of Beach
14,913 | 14,692
15,356 (1171/1289)
Piney Branch E. of Beach
9325 | 7752
10,112 (1180/792)
Tilden W. of Beach
7551 | 6773
7940 (620/650)
Klingle W. of Beach
3356 | 3143
3462 (276/270)
Beach & Adams Mill off Ramp
2741 | 3276
2474 (180/246)
Zoo/Beach Entr./Exit
1319 | 1482
1238 (145/190)
Beach S. of Zoo Tunnel
24,242 | 20,878
25,083 (1697/2101)
Pkwy. & 24th St. on/off Ramp
11,432 | 11,488
11,405 (1046/883)
Cathedral E. of 24th St.
7889 | 5702
8436 (1161/1172)
Pkwy. S. of Beach
39,591 | 34,927
41,923 (3538/3441)
Pkwy. (NB) & Mass. on Ramp
202 | 174
221 (16/41)
SEE DETAIL
Pkwy. (SB) & P St. on/off Ramp
7490 | 7232
7619 (1042/604)
Pkwy. (NB) & P St. on Ramp
8078 | 8078
NO DATA
Pkwy. (SB) & K St. off Ramp
1064 | 946
1123 (233/84)
Pkwy. (NB) & K St. on Ramp
980 | 705
1163 (73/248)
Pkwy. (SB) & K St. on Ramp
4072 | 3908
4154 (290/409)
Pkwy. N. of Virginia
51,050 | 49,130
52,331 (3793/4231)
Rock Creek Park
Walter Reed Army Medical Center
Georgetown University
National Zoological Park
Kennedy Center
White House
Washington Monument
Lincoln Memorial
Theodore Roosevelt Bridge
Constitution Avenue
Pennsylvania Ave.
K Street
M Street
P Street
Harvard St.
Florida Avenue
Sheridan Circle
Dupont Circle
Washington Circle
Chevy Chase Circle
Connecticut Avenue
Wisconsin Avenue
Nebraska Avenue
Massachusetts Avenue
Military Road
River Road
Beach Dr.
Wise Rd.
Bingham Dr.
Aspen St.
Kennedy St.
Tilden St.
Porter St.
Klingle Rd.
Adams Mill Rd.
Cathedral Ave.
Calvert St.
Piney Branch Pkwy.
Broad Branch Rd.
Glover Rd.
Ross Dr.
Colorado Ave.
Blagden Ave.
Georgia Ave.
Alaska Avenue
Oregon Ave
Sherrill Dr.
Joyce Rd.
Morrow Dr.
16th St.
17th St.
24th St.
23rd St.
22nd St.
MARYLAND
DISTRICT OF COLUMBIA
VIRGINIA
POTOMAC RIVER
Rock Creek and Potomac Pkwy.
MacArthur Boulevard
Foxhall Road
George Washington Memorial Parkway
Whitehurst Freeway
Lee Highway
New Hampshire Avenue
Highway
East
West
E. Beach
W. Beach
N. Portal Dr.
S. Portal Dr.
Parkside Dr.
355
193
410
390
29
66
50

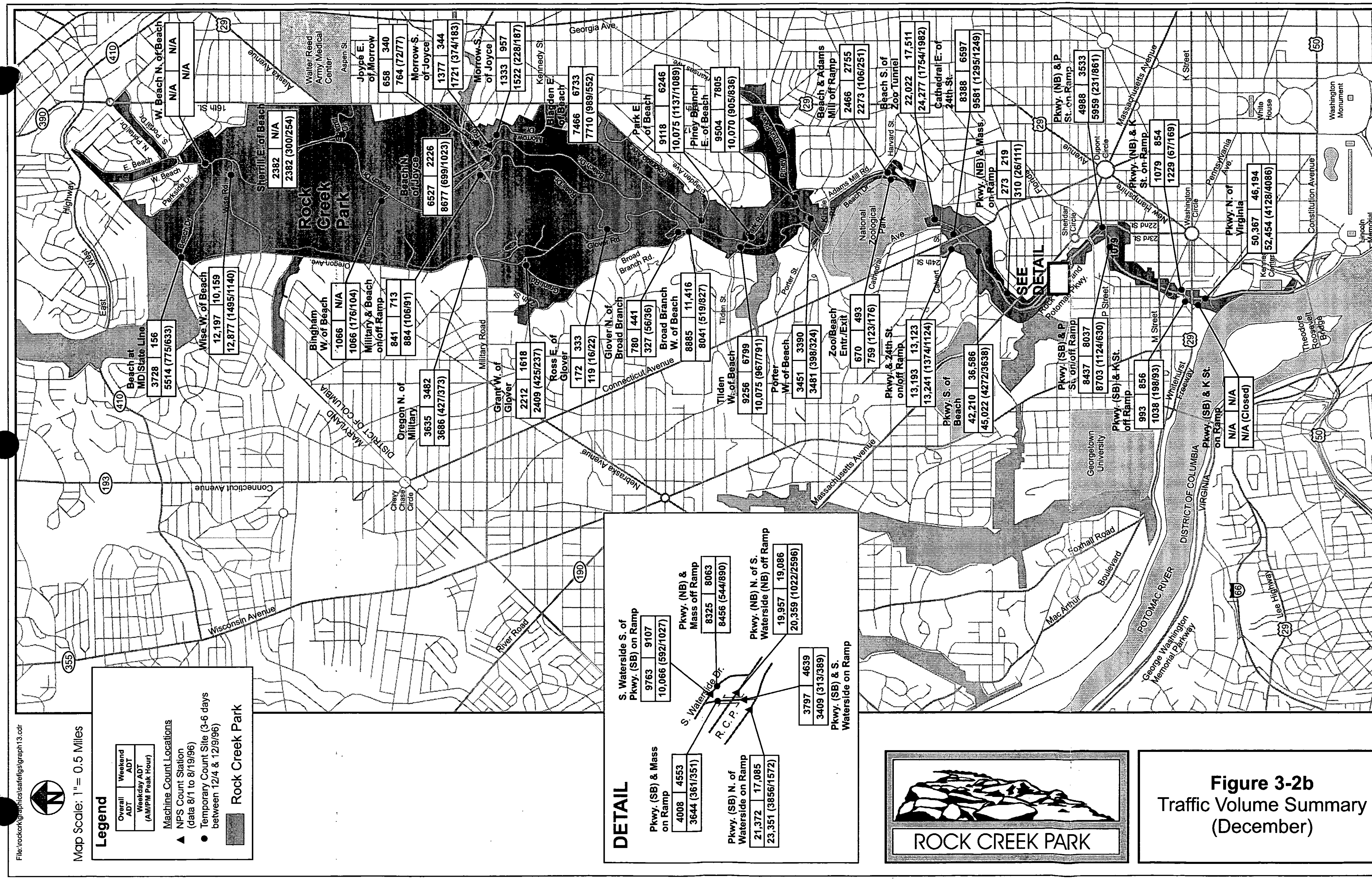


Figure 3-2b
Traffic Volume Summary
(December)

3.4.2 Daily Variations

The permanent traffic counter data was used to further identify traffic volume characteristics on the Park road system. The typical daily traffic volume distributions shown in **FIGURES 3-5** and **3-6** are based on traffic volumes recorded on Beach Drive and the Parkway in August of 1996. The data indicates that there is little variation in traffic volumes during weekdays, when peak commuting conditions occur. Because the Beach Drive counter is located on a segment of road that is closed to through traffic, Saturdays and Sundays have significantly less traffic than an average weekday. The Parkway shows a slight drop in use on the weekends. At both locations, Thursdays had the highest traffic volume of all the days in the week.

FIGURE 3-5

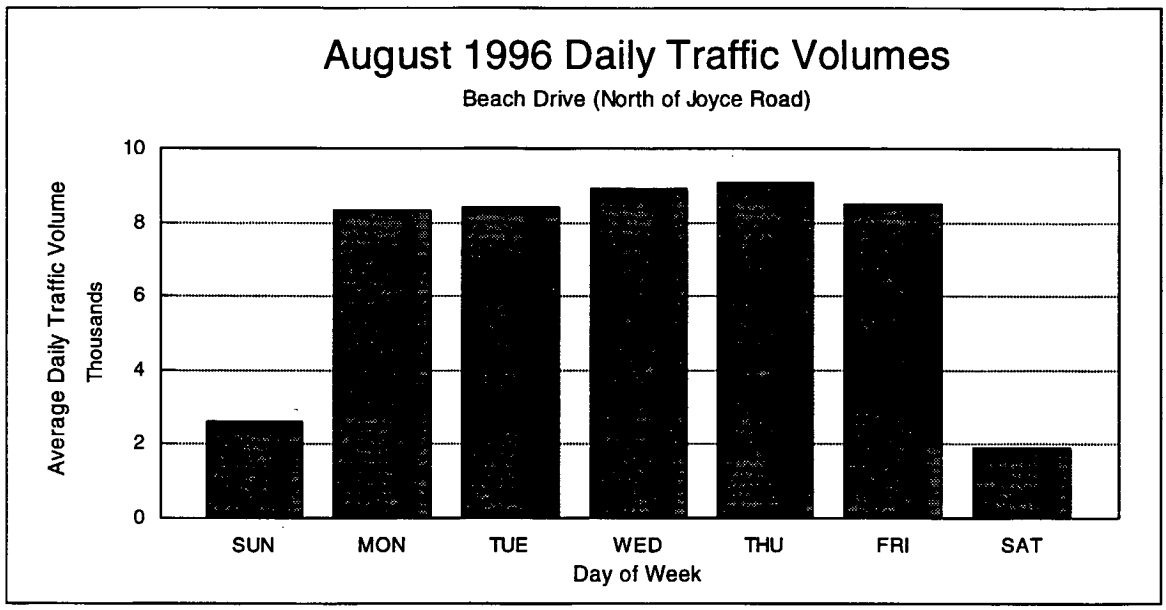
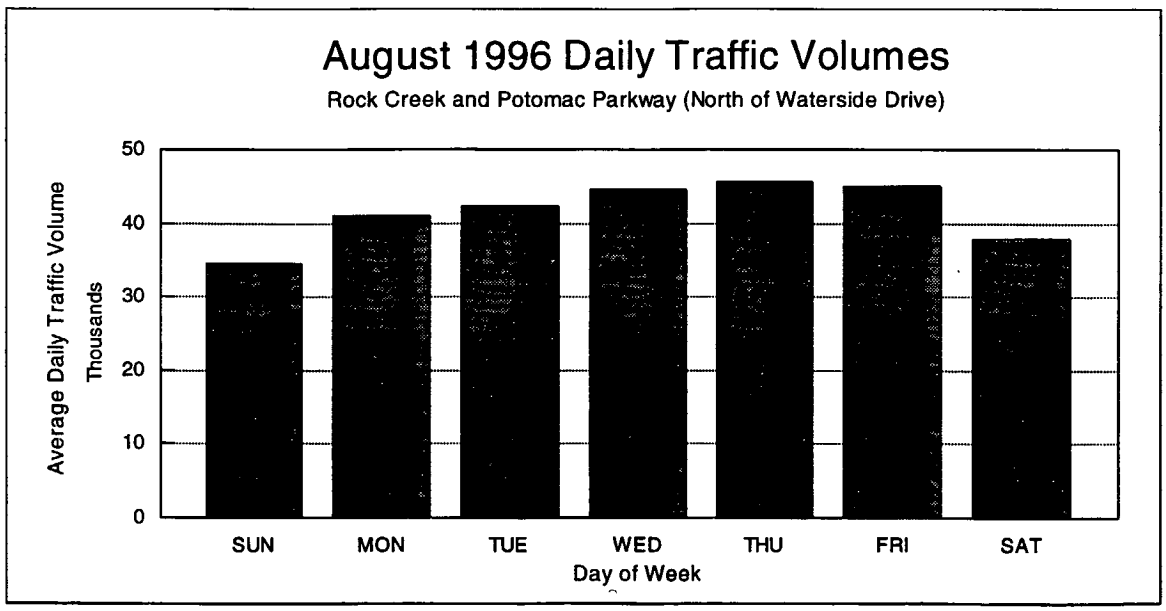


FIGURE 3-6



3.4.3 Hourly Variations

The typical daily traffic distributions by hour were developed from the NPS counts taken in August of 1996. **FIGURES 3-7** and **3-8** show the hourly variations in average daily traffic volumes (all seven days of the week were included) on Beach Drive and the Parkway. Both locations exhibit well defined A.M. and P.M. peaks that are characteristic of typical urban area travel patterns. The peak travel hours generally occur between 7:00 a.m. and 10:00 a.m. and 3:00 p.m. and 7:00 p.m. due to commuter traffic. Traffic volumes are extremely light between midnight and 6:00 a.m.

FIGURE 3-7

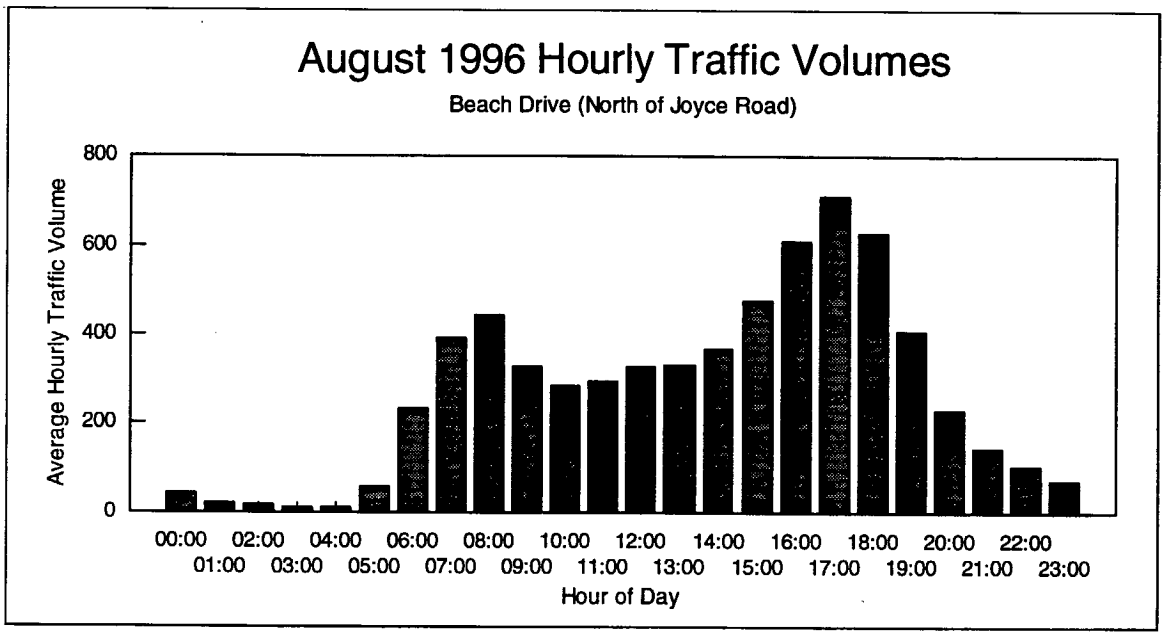
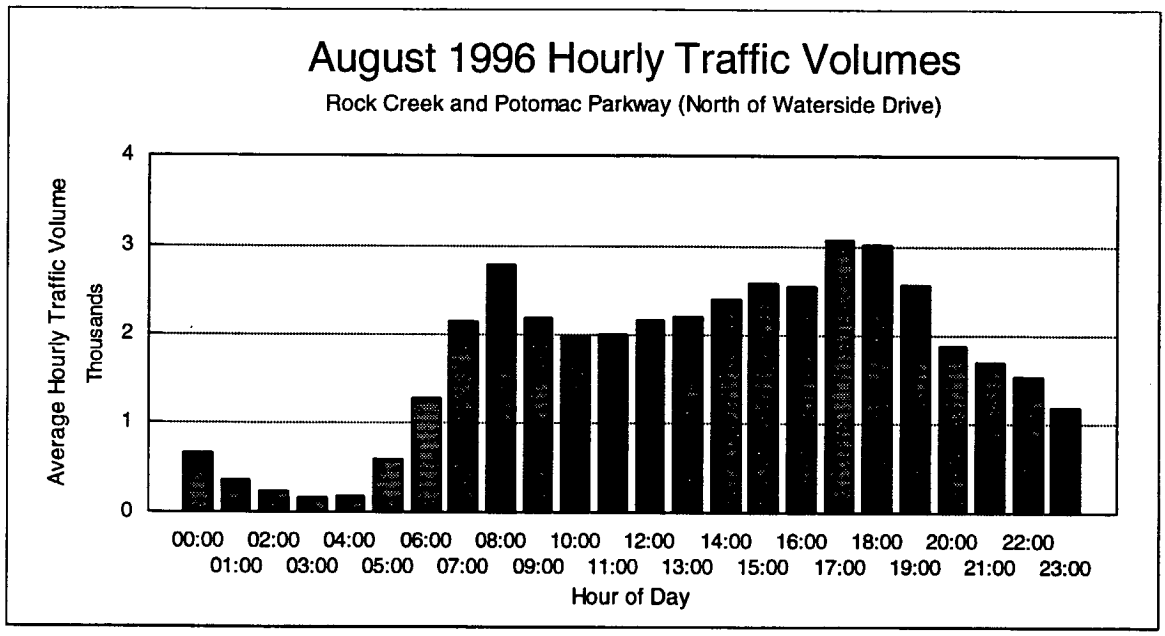


FIGURE 3-8



3.5 Turning Movement Counts

Turning movement counts were collected at 19 locations: seven intersections within the northern portion of the Park, four intersections along the Parkway, two intersections south of the Parkway, and six intersections adjacent to the Park. The counts were performed during morning, noon, and evening peak hours on Tuesday, August 20, Wednesday August 21, and Friday, August 23, 1996. The locations at which turning movement counts were performed are shown in **FIGURE 3-9**. Turning movement count summaries for each of the locations can be found in Appendix A. Turning movement count data was used to develop the level of service analysis and to assist in estimating commuter travel patterns.

3.6 Level of Service

Most of the major intersections within the Park were evaluated to determine the current Level of Service (LOS). The Level of Service analysis is used to determine how well the intersections are functioning, given the existing lane-use configuration, traffic control and traffic volumes. The current procedures outlined in the Transportation Research Board's ***Highway Capacity Manual - Special Report 209*** were used in the evaluation of each intersection.

Different calculations are used for signalized intersections and unsignalized intersections, but the rating scheme is the same. This rating method assigns LOS values ranging from A for intersections with excellent operation to F for intersections operating at or beyond capacity. An analysis was conducted for each subject intersection using the existing conditions. An additional analysis was conducted using a possible all-way stop configuration for the unsignalized intersections and possible signalization of the intersection of Beach Drive and the Parkway. A summary of the LOS for the major unsignalized intersections in the Park is shown in **TABLE 3-1**. **TABLE 3-2** presents a summary of the LOS for signalized intersections in or near the Park.

TABLE 3-1
Unsignalized Intersection Level of Service Summary

	Existing Control			All-Way Stop		
	A.M.	Noon	P.M.	A.M.	Noon	P.M.
Beach/West Beach	C	---	F	F	---	F
Beach/Joyce	B	---	F	---	---	---
Beach/Broad Branch	A	---	A	B	---	F
Beach/Blagden	F	---	A	F	---	F
Beach/Piney Branch	F	---	A	F	---	F
Beach/Klingle	B	---	F	F	---	F
Beach/Parkway	---	F	---	---	F	---

TABLE 3-2
Signalized Intersection Level of Service Summary

	Existing Signal			Possible Signal		
	A.M.	Noon	P.M.	A.M.	Noon	P.M.
Military/Glover/Oregon	B	---	C	---	---	---
Beach/Park/Tilden	D	---	F	---	---	---
Beach/Parkway	---	---	---	---	B	---
RCP/Virginia	---	B	---	---	---	---
Connecticut/Tilden	B	---	B	---	---	---
Connecticut/Cathedral	C	---	C	---	---	---
16th/Kennedy/Morrow	F	---	C	---	---	---
16th/Colorado	B	---	A	---	---	---

3.7 Vehicle Speeds

The quality of travel is most often associated with speed or travel time. Travel speed is an important consideration because the rate of speed has bearing on the safety and service aspects of a roadway. Travel speeds may be expressed in terms of spot speeds, which represent the instantaneous speed of a given traffic sample at a specific location. The following narrative discusses the speed studies conducted for this project and summarizes major findings.

3.7.1 Average Travel Speeds

A travel time and delay study was conducted on Beach Drive and the Parkway. This study consists of driving the corridors using the average car method, in which the test car matches the speed of the other vehicles traveling along the corridor. The results of this study provide a reasonable idea as to the average vehicle speeds occurring on various segments of the corridors. The average vehicle speeds determined in the travel time and delay study are presented graphically in **FIGURE 3-10.**

3.7.2 Spot Speed Studies

Spot speed studies are designed to measure the speed characteristics of a specified traffic sample at a particular location on the road network. A total of 38 spot speed studies were performed at 12 different locations within the northern portion of the Park and two locations on the Parkway during August of 1996. The locations of the spot speed tests are depicted in **FIGURE 3-11**.

Vehicle travel speed distributions were plotted for each of the spot speed study locations. From these distributions, a number of important travel speed characteristics were obtained. These characteristics include: the 85th percentile speed, the pace, and the average travel speeds. The 85th percentile speed is the speed at or below which 85 percent of the traffic is moving. This speed is the one characteristic of traffic speeds that is most indicative of a safe and reasonable speed limit.

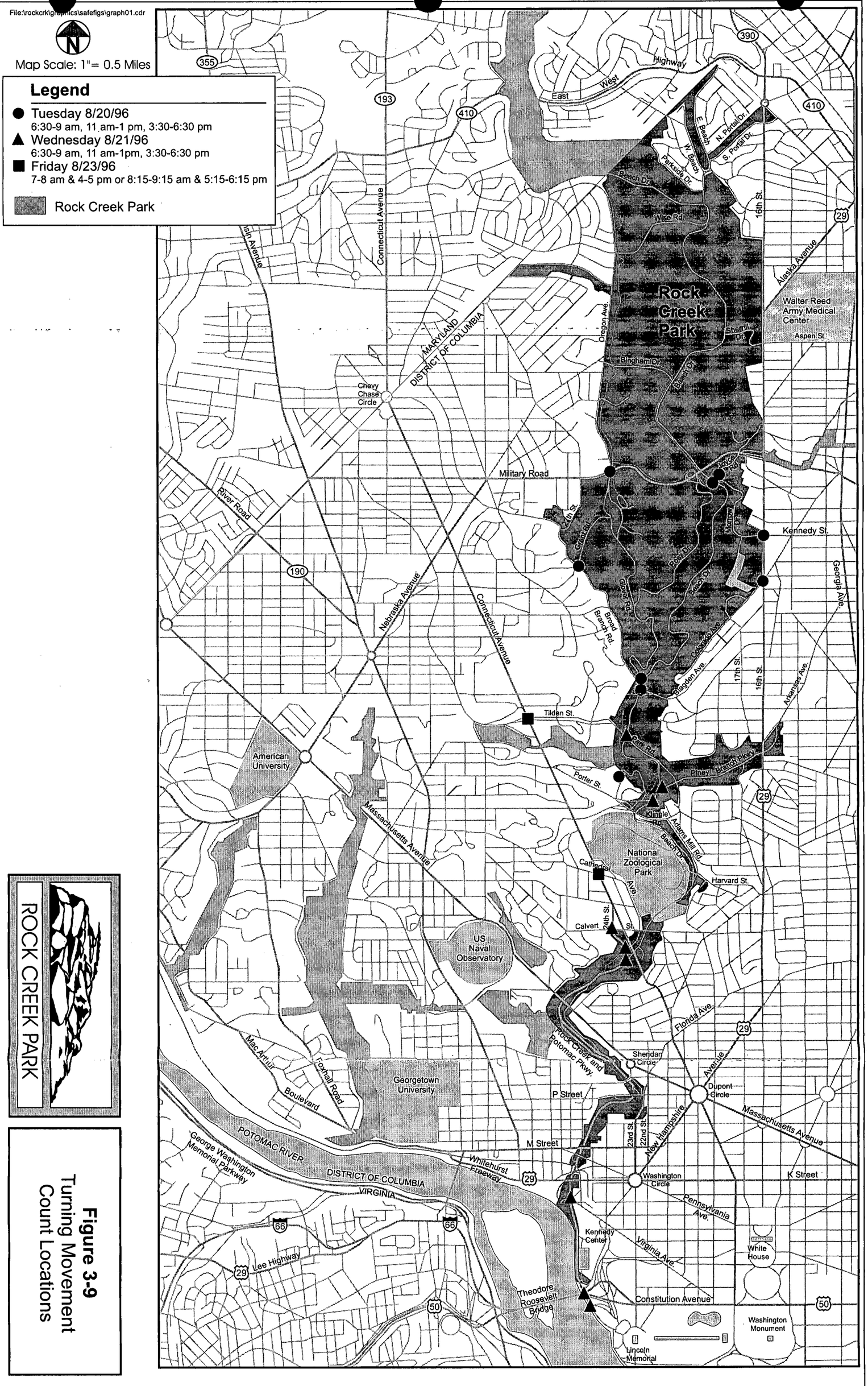
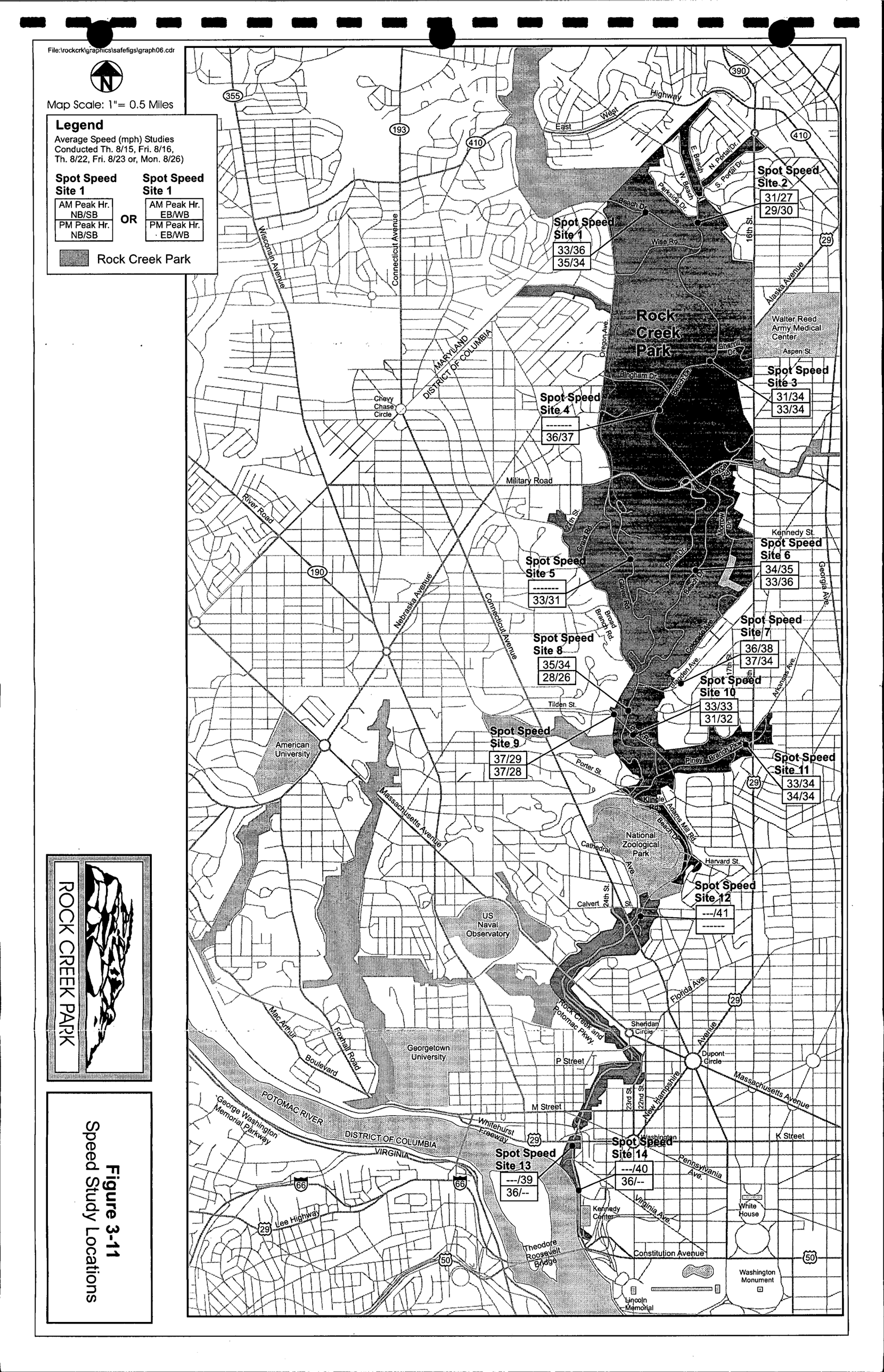


Figure 3-9
Turning Movement
Count Locations

Figure 3-10
Average Travel Speeds
(RCP/Beach Dr.)



ROCK CREEK PARK

Figure 3-11
Speed Study Locations

The pace of a sample group represents a ten mile per hour range of speeds containing the largest number of observations. A normal speed distribution will have approximately 70 percent of the sample within the pace and 15 percent above and below it. The average speed of the total sample is always within the pace, while the 85th percentile speed is typically within two miles per hour of the upper limit of the pace.

The average speeds recorded at each location during the morning peak and evening peak are displayed in **FIGURE 3-11**. Average speed distributions for all speed studies performed in the northern portion of the Park and on the Parkway are shown graphically in **FIGURES 3-12** and **3-13**. The characteristics of the vehicle speeds observed during each of the studies are presented in **TABLES 3-3** and **3-4**.

It should be noted in the interpretation of the spot-speed data that the distribution of vehicle speeds is a general indication of traffic patterns and driving habits. In cases where the majority of the traffic is traveling within the pace, the frequency of passing is less, thereby minimizing potential conflicts that are created when slower vehicles are overtaken. Alternately, a distribution containing a wide range of vehicle speeds with a larger percentage of the sample speeds outside the pace indicates a less desirable situation with greater potential between fast and slow-moving vehicles.

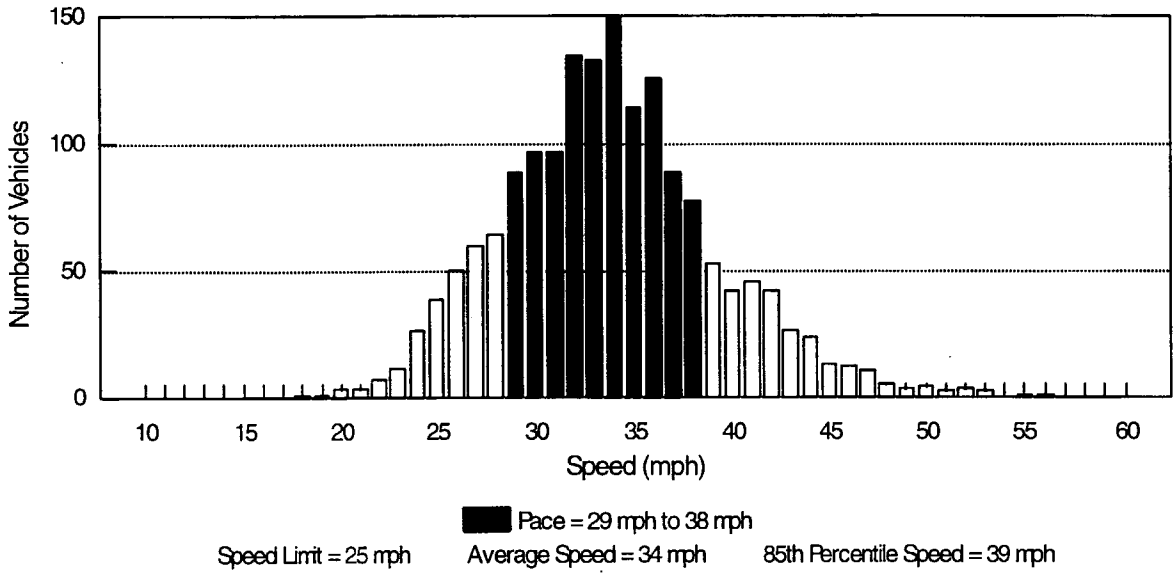
There is no significant difference in free flow travel speeds during peak hours as compared to non-peak hours. There are, however, greater delays at certain intersections during peak hours because of higher traffic volumes. Most visitors drive at or above the posted speed limits on Park roads. The speed data indicates that the average 85th percentile speed on the northern Park roads is 39 to 40 mph, which is 15 mph over the posted speed limit. The average 85th percentile speed on the Parkway was 42 to 43 mph, which is eight mph over the posted speed limit.

Drivers in Rock Creek Park tend to be more aggressive than the average visitor at a rural Park. Visitors who are unfamiliar with the Park are often distinguishable from daily commuters by their lower speed. Drivers who maintain a travel speed within 10 mph of the speed limit are likely to develop a queue of cars behind them. During a moving observation, the test car was passed on Beach Drive (which has a full-length no passing zone) while traveling at 35 mph and a trailing vehicle queue was present for the entire drive of the Beach Drive corridor.

FIGURE 3-12

NORTHERN PARK SPEED DISTRIBUTION

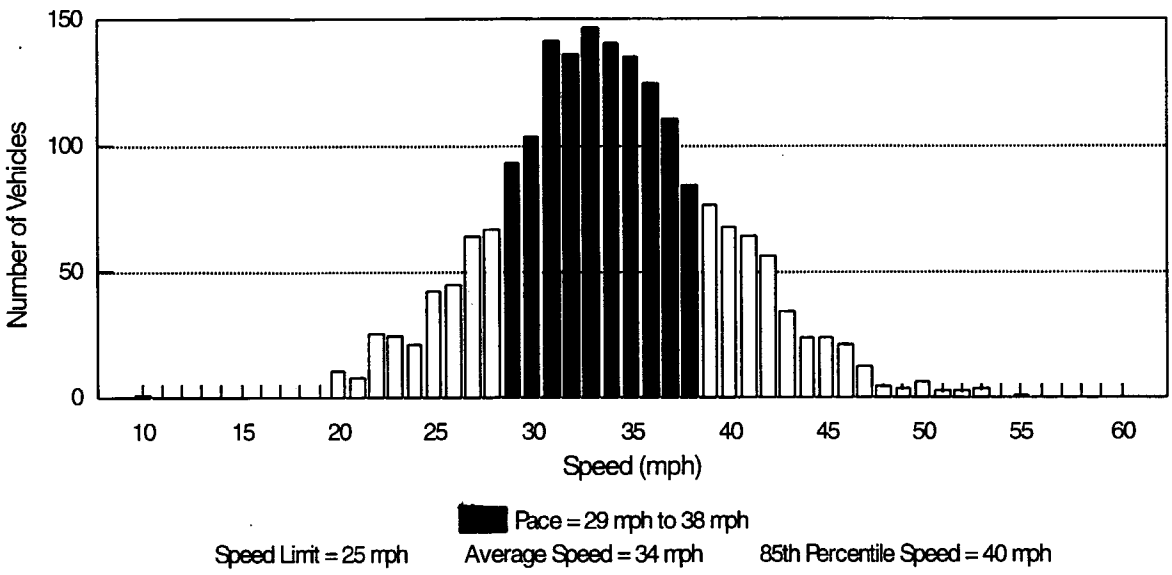
Northbound/Eastbound



Speed Limit = 25 mph Average Speed = 34 mph 85th Percentile Speed = 39 mph

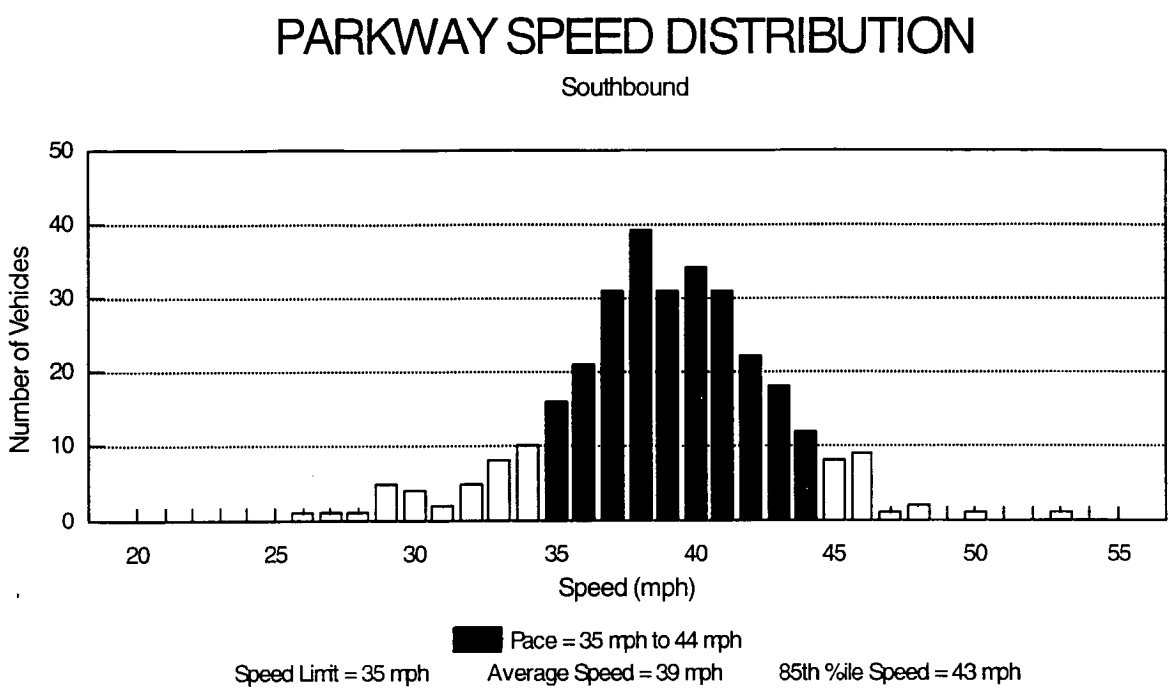
NORTHERN PARK SPEED DISTRIBUTION

Southbound/Westbound



Speed Limit = 25 mph Average Speed = 34 mph 85th Percentile Speed = 40 mph

FIGURE 3-13


PARKWAY SPEED DISTRIBUTION
Southbound
Number of Vehicles
0
10
20
30
40
50
20
25
30
35
40
45
50
55
Speed (mph)
Pace = 35 mph to 44 mph
Speed Limit = 35 mph
Average Speed = 39 mph
85th %ile Speed = 43 mph

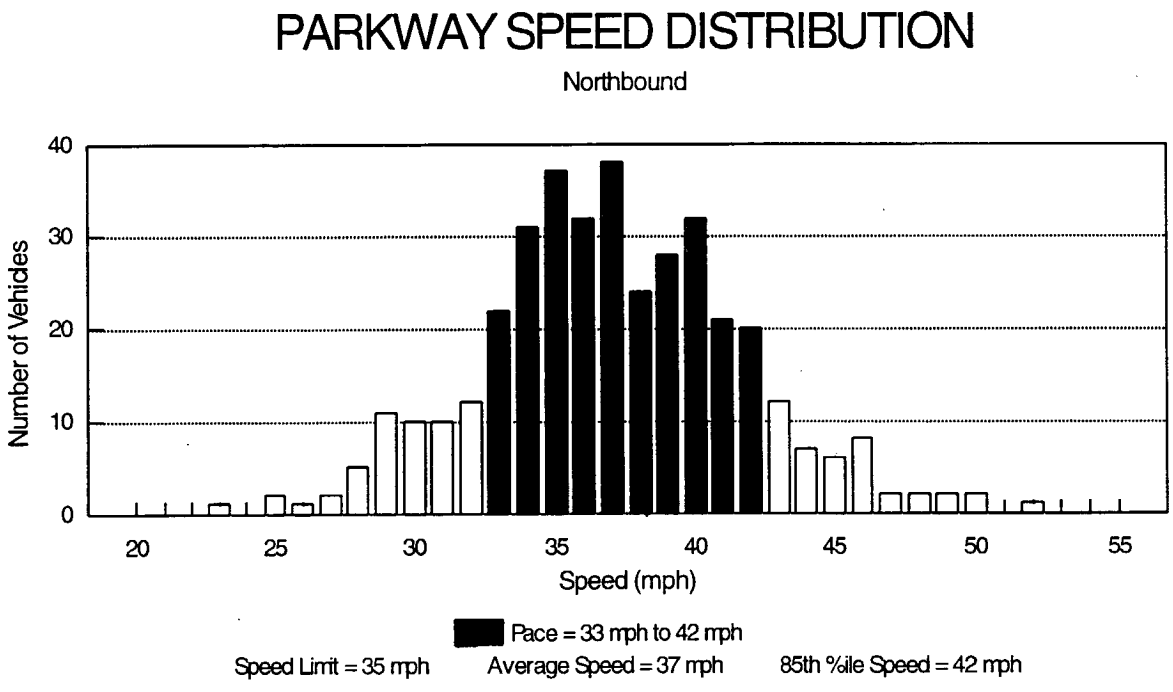

PARKWAY SPEED DISTRIBUTION
Northbound
Number of Vehicles
0
10
20
30
40
20
25
30
35
40
45
50
55
Speed (mph)
Pace = 33 mph to 42 mph
Speed Limit = 35 mph
Average Speed = 37 mph
85th %ile Speed = 42 mph

TABLE 3-3
Northern Park Speed Analysis*

Location	Description	Date	Time	Northbound/Eastbound							Southbound/Westbound						
				85th	%+	Pace	%-	Avg.	% Over Limit	% Over 35 mph	85th	%+	Pace	%-	Avg.	% Over Limit	% Over 35 mph
1	**Beach Drive**	8/23/96	7:40 A	37	0	29 - 38	8	33	96	20	41	11	32 - 41	21	36	100	63
	West of	8/23/96	1:30 P	38	9	29 - 38	10	33	99	23	38	10	29 - 38	8	34	99	33
	West Beach	8/15/96	5:15 P	39	18	29 - 38	5	35	99	39	37	7	29 - 38	3	34	100	33
2	**West Beach Drive**	8/23/96	8:00 A	35	13	26 - 35	4	31	96	13	32	34	20 - 29	0	27	57	0
	South of	8/15/96	10:15 A	35	3	27 - 36	10	31	91	7	32	3	24 - 33	13	28	74	2
	Parkside	8/23/96	4:55 P	34	12	25 - 34	15	29	80	5	34	13	25 - 34	7	30	84	11
3	**Beach Drive**	8/23/96	7:10 A	37	20	25 - 34	0	31	80	20	36	2	30 - 39	11	34	98	25
	South of	8/15/96	2:50 P	37	11	28 - 37	11	33	98	29	39	17	29 - 38	8	34	100	43
	Sherrill	8/15/96	3:40 P	37	2	29 - 38	14	33	95	26	37	8	29 - 38	9	34	99	29
4	**Beach Drive** South of Bingham	8/23/96	5:15 P	39	3	32 - 41	7	36	100	47	41	0	35 - 44	14	37	100	57
5	**Glover Road**	8/23/96	12:05 P	38	8	29 - 38	23	32	85	31	39	24	27 - 36	12	32	92	32
	North of Ross Drive	8/22/96	6:05 P	38	15	27 - 36	12	33	88	19	37	0	28 - 37	18	31	11	31
6	**Beach Drive**	8/23/96	6:40 A	36	13	27 - 36	0	34	100	25	38	6	30 - 39	2	35	100	45
	South of	8/16/96	2:00 P	38	7	30 - 39	7	35	100	41	41	6	32 - 41	20	36	100	51
	Police Substation	8/23/96	5:30 P	36	11	27 - 36	0	33	100	23	41	16	31 - 40	5	36	100	63
7	**Blagden Avenue**	8/23/96	8:40 A	38	0	29 - 38	0	36	100	50	42	8	34 - 43	9	38	100	74
	East of	8/23/96	11:20 A	42	25	30 - 39	3	37	100	57	40	8	31 - 40	8	36	95	49
	Beach Drive	8/23/96	4:20 P	42	12	33 - 42	20	37	100	57	37	6	28 - 37	0	34	100	23
8	**Beach Drive**	8/23/96	6:15 A	38	0	30 - 39	0	35	100	50	38	9	29 - 38	3	34	100	34
	North of	8/16/96	1:20 P	36	11	27 - 36	6	32	95	19	36	12	27 - 36	2	32	100	19
	Park Road	8/16/96	5:30 P	30	4	23 - 32	2	28	78	2	30	6	22 - 31	6	26	56	0
9	**Tilden Street**	8/23/96	9:05 A	42	12	33 - 42	10	37	96	69	34	7	26 - 35	17	29	83	7
	West of	8/23/96	1:30 P	42	9	33 - 42	15	37	100	57	32	18	22 - 31	3	28	83	1
	Beach Drive	8/23/96	3:50 P	41	7	33 - 42	7	37	100	61	31	13	22 - 31	3	28	77	3
10	**Park Road**	8/26/96	7:10 A	36	9	29 - 38	5	33	98	16	37	8	29 - 38	9	33	96	30
	East of	8/23/96	2:10 P	40	8	32 - 41	21	39	97	49	36	15	27 - 36	9	33	98	23
	Beach Drive	8/16/96	3:00 P	36	8	27 - 36	10	31	94	16	36	6	28 - 37	12	32	94	18

TABLE 3-3
Northern Park Speed Analysis*

Location	Description	Date	Time	Northbound/Eastbound							Southbound/Westbound						
				85th	%+	Pace	%-	Avg.	% Over Limit	% Over 35 mph	85th	%+	Pace	%-	Avg.	% Over Limit	% Over 35 mph
11	**Piney Branch**	8/26/96	8:00 A	42	48	24 - 33	0	33	78	35	38	12	29 - 38	6	34	98	28
	East of	8/23/96	10:40 A	42	6	34 - 43	23	37	98	60	41	27	29 - 38	6	36	98	46
	Beach Drive	8/23/96	3:20 P	38	5	31 - 40	22	34	93	32	41	23	27 - 36	4	34	96	32
12	**Beach Drive**	8/16/96	7:50 A	---	---	---	---	---	---	---	45	5	37 - 46	5	41	100	98
	South of Nat'l Zoo	8/16/96	12:30 P	47	14	38 - 47	8	43	100	98	42	7	34 - 43	6	39	100	85
AVERAGE				39	17	29 - 38	16	34	94	35	40	21	29 - 38	16	34	93	37
				Based on 1648 Observations							Based on 1914 Observations						

* All roads in the Park have a posted speed limit of 25 mph

TABLE 3-4
Parkway Speed Analysis**

Location	Description	Date	Time	Northbound/Eastbound							Southbound/Westbound						
				85th	%+	Pace	%-	Avg.	% Over Limit	% Over 45 mph	85th	%+	Pace	%-	Avg.	% Over Limit	% Over 45 mph
13	**Parkway**	8/26/96	8:40 A	---	---	---	---	---	---	---	43	10	34 - 43	11	39	79	4
	North of	8/16/96	10:15 A	41	10	33 - 42	5	38	70	3	42	8	34 - 43	6	38	84	2
	Virginia	8/16/96	4:40 P	41	8	33 - 42	17	36	53	2	---	---	---	---	---	---	---
14	**Parkway**	8/16/96	9:15 A	---	---	---	---	---	---	---	43	4	36 - 45	0	40	100	4
	North of	8/16/96	9:35 A	45	22	33 - 42	6	40	79	12	44	4	37 - 46	11	40	90	7
	Kennedy Center	8/16/96	4:00 P	41	10	32 - 41	15	36	57	3	---	---	---	---	---	---	---
AVERAGE				42	11	33 - 42	14	37	62	4	43	7	35 - 44	12	39	83	4
				Based on 381 Observations							Based on 314 Observations						

**The Parkway has a posted speed limit of 35 mph

3.8 Commuter Traffic Patterns

The roads through Rock Creek Park present commuters with an attractive alternative to driving on the busy streets of the District of Columbia. Park roads provide a more relaxing, scenic route with fewer potential stopping points than adjacent city streets. During the summer months, the Park also serves as an oasis from the heat of the City.

Rock Creek and Potomac Parkway

The Rock Creek and Potomac Parkway flows with the pulse of the City, south in the mornings and north in the evenings. Directional volumes are reasonably balanced during the middle of the day. Most vehicles on the Parkway are essentially passing through the Park facilities on their way to another final destination. Traffic volumes and parking studies confirm that the Parkway is utilized almost entirely by commuter traffic. The only exceptions are people using the Parkway to access the Thompson Boat House facility, the Kennedy Center, or Rock Creek Park when the Park is their final destination.

Northern Rock Creek Park

It is much more difficult to document the amount and patterns of commuter traffic through the northern portion of the Park. During August of 1996, a special cut-through study was performed to determine the extent at which commuters use the northern Park roads. A license plate survey was conducted to identify travel patterns and a parking lot study was used to ascertain the number of vehicles that stop and use the Park facilities during the commute hours of the average weekday. The results of this study indicate that only 4.5 percent of all vehicles entering this part of the Park during the morning commute hours stop and use the facilities in the Park. During the evening commute the percentage is slightly lower at 3.5 percent. It is likely that this rate drops even lower during the shoulder and winter seasons when the weather is less conducive to outdoor activities. The data clearly indicates that over 95 percent of all traffic that enters the northern portion of the Park during the weekday commute hours passes through the property without stopping.

Commuter travel patterns were estimated by analyzing the license plate survey data in combination with the parking study and the turning movement counts. A summary of this analysis is presented in **TABLE 3-5**. This table shows where vehicles traveling on Beach Drive come from and go to during the A.M. and P.M. commuter periods of the average weekday. Much of the traffic on the side roads in the Park is also related to this north-south progression on Beach Drive, although a significant number of commuters traverse the Park from east to west. Even on weekends, the objective of most drivers in the Park is to get to the other side rather than to stop within. Several major east-west commuter routes were identified as a result of this study. These routes include: Wise/West Beach, Tilden/Park, and Piney Branch/Klingle/Porter.

TABLE 3-5
Commuter Patterns

Location	% of Vehicles that Entered the Park at the Location Shown During the AM and Exited onto the Parkway	% of Vehicles that Entered from the Parkway During the PM and Exited the Park at the Location Shown
Beach at Maryland State Line	3%	1%
West Beach Drive	3%	3%
Wise Road	1%	3%
Bingham Drive	*	*
Joyce East of Beach	1%	3%
Joyce West of Beach	1%	*
Glover Road at Military	1%	5%
Grant Road	*	2%
Broad Branch	17%	18%
Blagden Avenue	20%	19%
Park Road	1%	2%
Tilden Street	4%	4%
Piney Branch Parkway	34%	33%
Klingle Road	6%	2%
Zoo/Harvard Street	8%	5%

* Less than 1%

Chapter 4. Maintenance Evaluation

Chapter 4: Maintenance Evaluation

4.1 General

The road maintenance practices within the Park have an affect on the overall safety of the Park road system. A review of maintenance practices was done in an effort to identify any safety problems that are created by the way the Park road system is currently being maintained.

4.1.1 Pavement Condition

In 1991, Sherrill Drive, Morrow Drive, and much of Beach Drive were resurfaced. Several other side roads in the Park were resurfaced in 1995. A windshield survey of the pavement condition of the Park roads and parking areas was conducted during the summer of 1996 in an effort to establish the general condition of the Park roads.

The overall condition of the pavement surface in the Park and on the Parkway could be described as fair. There is not a proliferation of potholes, rutting or alligator cracking. General deterioration is evident in some of the larger parking areas, especially the parking lots that serve the Tennis Stadium and Carter Barron Amphitheater.

With time, overlaying of the road base has lowered the reveal of the road channelization and decreased the water carrying capacity of the original design. Such areas will require milling before future overlays can occur.

There are a number of "slippery when wet" signs located throughout the Park, and approximately one third of all accidents Parkwide occur on wet pavement surfaces. Skid testing of Park roads may be beneficial to determine whether the existing signs are justified. If so, some type of skid resistant overlay may be in order.

Pavement and curb conditions on Park roads and parking areas should be evaluated on a periodic basis. Based on this evaluation, prioritization of pavement improvement projects can occur.

4.1.2 Roadway Shoulder and Clear Zone

In most areas, the road shoulders were found to be stable and close to the grade of the back of curb. However, in some locations there are significant drops directly behind the curb, most likely caused by water erosion rather than wheel trafficking. Such drops become a safety consideration when vehicles leave the road, and should therefore be filled in and maintained at a grade that is slightly higher than the back of the curb.

The shoulder area along many sections of road in the Park is very unforgiving to motorists that leave the roadway. Objects such as trees, rocks, and obsolete light standards are common throughout the northern portion of the Park.

It is desirable to provide a forgiving roadside environment for Park roads through proper road design and maintenance practices. A forgiving roadside area has the tendency to reduce the number and

severity of run-off-the-road accidents. The roadside environment should include a "clear zone" that is free of obstructions when ever practical. This clear zone provides a safe recovery area for vehicles that stray from the paved road surface.

The width of the clear zone varies throughout the Park. Large trees and rock outcrops are of particular concern when they exist near the shoulder of the road. From a traffic safety viewpoint, the clear zone should be as wide as practical for each road section. A 30 foot clear zone is desirable on the Parkway, and an absolute minimum of 10 feet should be maintained on all other Park roads. Significant obstructions within these clear zones should be reviewed for removal or placement of object markers.

Vegetation should be pruned back in locations where sight distance is particularly important. Such locations include pedestrian, bicycle and horse crossings as well as intersections and the inside of curves. Vegetation should also be trimmed around signs to improve visibility.

4.1.3 Signing

Park road signs are generally in good condition, but many of them need to be washed. A layer of dirt lowers the reflectivity of the signs at night and causes them to blend in with the scenery during the day. Some signs are hidden or partially obscured by vegetation, which should be trimmed as mentioned above.

It was apparent from field observations that a significant number of signs were missing from the system. At a number of locations, sign posts or post bases were evident without the corresponding sign actually being present. It seems as though signs did exist at these locations in the past, but were not replaced as they became damaged or removed over the years. This type of oversight might be avoided by the effective use of a Park sign coordinator. A Park signing plan should be developed and approved by the regional sign coordinator in order to ensure that all signs in the Park comply with the National Park Service Sign Manual and/or the MUTCD.

4.1.4 Pavement Markings

The centerline striping on Park roads was visible and in good condition on most sections of road. Some pavement markings that are exposed to high wheel traffic, such as stop bars and lane use markings, need to be re-applied.

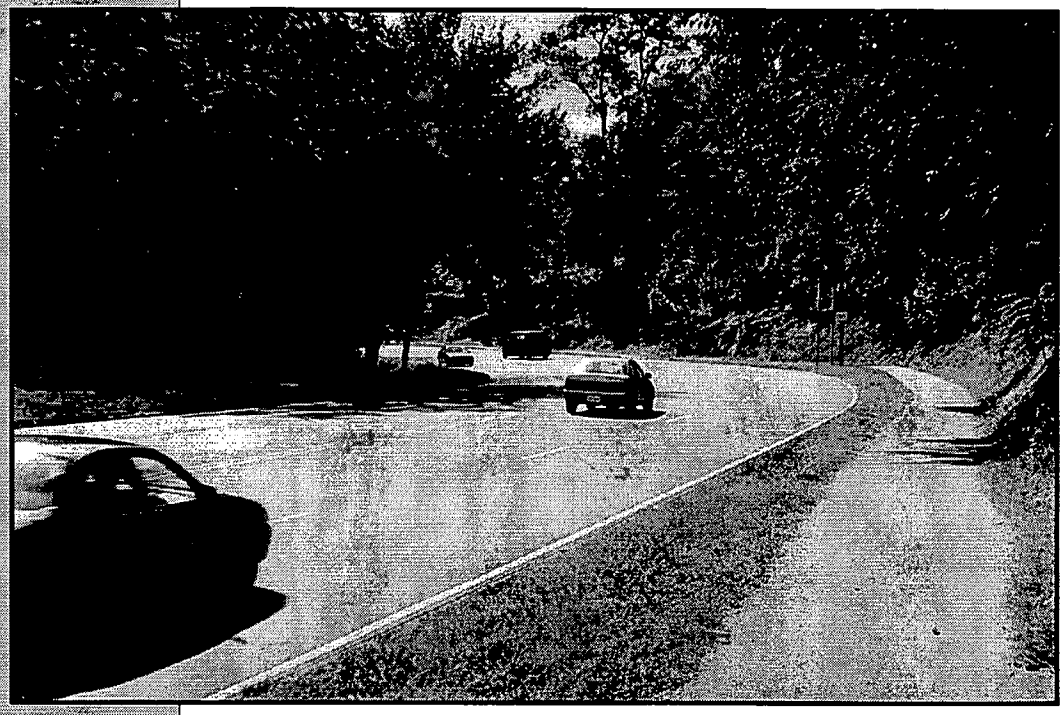
4.1.5 Winter Maintenance Practices

Although the field observations for this project were conducted during the summer, some comments can be made about winter maintenance. The existence of the steel gates allow for the closing of various segments of the Park road system during periods of snow or ice. The Park roads are plowed and sanded throughout the winter months. As is appropriate, the maintenance staff has a priority system in addressing the plowing and sanding effort. The roads are closed to traffic during most of the plowing and sanding operations and opened to traffic only after the road is cleared and deemed ready for traffic.

4.1.6 Routine Maintenance Practices

Routine maintenance such as mowing and clearing the picnic areas is done in what appears to be a very effective manner. The maintenance staff will close sections of the Park road system when maintenance or repair work is required on a road. Although this practice forces traffic to detour around the work site using other Park roads, it appears to be the safest and most effective method for performing these types of maintenance tasks.

Chapter 5. Accident Analysis



Chapter 5: Accident Analysis

5.1 General

An analysis of recent motor vehicle accidents on the Rock Creek Park road system was performed to identify trends and patterns that may be indicative of traffic safety problems. The accident analysis required a detailed review of all reported motor vehicle accidents that occurred on Park roads during a three-year period beginning January 1, 1993, and ending on December 31, 1995.

5.2 Accident Reporting and Record Keeping

A computerized accident reporting and record keeping system was implemented by the NPS in 1989. This system, known as the Service-wide Traffic Accident Reporting System (STARS), utilizes a standard form (NPS Form 10-413) for reporting accidents in all park units. STARS uses a standard coding manual to identify accident characteristics. A link-node map has been developed for each Park to help investigators locate each accident on the road system. Accident reporting using STARS enables the NPS to develop service-wide accident statistics and statistics for road segments, routes, or systems within specific Parks.

In addition to accident location data like FHWA Route and STARS Node numbers, other accident information coded on Form 10-413 includes:

- light, weather, and road surface conditions
- accident class, location on the roadway, and road character
- type of collision or type of fixed-object struck
- information about the types of vehicles in the accident
- information about drivers and passengers
- information about the number of injuries or fatalities that resulted from the accident
- violations charged in the accident
- information about pedestrian/bicyclist involvement

The United States Park Police (USPP) have the primary responsibility for law enforcement and accident investigation on the Park road system. All accidents on the Park road system and in developed areas are investigated and reported by the Park Police. In addition, through a special experimental program of cooperation with D.C. Police, the U.S. Park Police periodically assist in the investigation of accidents on city streets. Traffic accident investigations are conducted at the scene where information is gathered and transferred to an accident report form. The accident reports are reviewed at Rock Creek Park before being sent to the NPS Denver Service Center where the information is entered into the STARS database.

A complete accident analysis for Rock Creek Park is difficult to do since records for the Park are found within three separate databases. This situation makes it difficult to get a clear picture of what is going on in the Park, and may make it hard for the Park to track its progress with respect to accident history.

5.3 Accident Analysis Methodology

Accident records were obtained from STARS for the period January 1, 1993 through December 31, 1995. STARS information was obtained from three separate National Park databases: Rock Creek Park (Park #3450, Park Code "ROCR"), National Capitol Parks - Central Area (Park #3400, Park Code "NACC"), and John F. Kennedy Center (Park #3600, Park Code "JOFK"). Portions of all three databases were required to include all reported accidents occurring within the Rock Creek Park study area. A total of 1,175 accidents were reported within Rock Creek Park during the three-year study period.

In reviewing the STARS database, a number of records were identified which applied to accidents which did not occur within the confines of Rock Creek Park. A listing of 11 such records from the Parkway database and 30 records from the northern Park database was provided to the NPS. According to information received from Rock Creek Park administration, these records resulted from an experimental program whereby U.S. Park Police worked in cooperation with D.C. Police to assist in accident investigations on city streets. These accident records were not considered in this analysis, since they did not occur within the study area.

The accident records were initially sorted by location into two distinct categories for analysis: Rock Creek and Potomac Parkway, and all other Park roads (the northern portion of the Park). Accidents occurring on Beach Drive were subsequently sorted from the northern Park database for separate analysis. The information provided in STARS was used to map accident locations, as well as to analyze various accident characteristics. The analysis of accidents in each area allows the identification of patterns and trends which may indicate traffic safety problems within the Park. The Parkway, northern Park, and Beach Drive accident summaries compose the remainder of this chapter.

Precise location of accidents is not always possible using STARS accident data. Due to errors in completing the accident report form or errors in entering data into the STARS database, certain inconsistencies exist in the accident location information. In some records, the node number referenced will not match the road name, or the road name will not match the route number. If any confusion exists between conflicting data fields, it can be impossible to determine for certain what the actual location of the accident may have been. In these instances, the analyst's best guess as to where to locate the given accident was used, based on reasonable assumptions.

Through examination of the accident data as well as discussions with Park personnel, 11 specific sites within the study area were identified for more detailed analysis. These sites are listed below:

- Intersection of Beach Drive and West Beach Drive
- Wise Road Curve and intersection of Wise Road and Oregon Avenue/Chestnut Street
- Intersection of Beach Drive and Broad Branch Road
- Intersection of Beach Drive and Blagden Avenue
- Intersection of Beach Drive and Park Road/Tilden Street
- Bluff Bridge Curve (segment of Beach Drive)
- Intersection of Beach Drive and Piney Branch Parkway

- Intersection of Beach Drive and Klingle Road
- Intersections of Beach Drive and Cathedral Avenue with Rock Creek and Potomac Parkway
- Intersection of Rock Creek and Potomac Parkway with P Street
- Intersection of Rock Creek and Potomac Parkway with Virginia Avenue

Discussions of each of these sites, including detailed analyses of their accident characteristics are contained in Chapter 7 of this report.

From a historical perspective, it is interesting to note that many of these same locations were identified as high accident areas in the 1988 Engineering Study for Rock Creek Park prepared by FHWA. That study examined accident data for years 1980 through 1984 and identified the following nine sections of roadway as high accident areas:

- Rock Creek and Potomac Parkway at K Street and Virginia Avenue
- Rock Creek and Potomac Parkway at P Street
- Rock Creek and Potomac Parkway at South Waterside Drive
- Rock Creek and Potomac Parkway at Beach Drive
- Beach Drive from Klingle Road to Park Road
- Beach Drive at Park Road
- Beach Drive south of Boulder Bridge
- Beach Drive near Alvin's Rock
- Beach Drive at West Beach Drive

5.4 Rock Creek and Potomac Parkway

5.4.1 Accident Summary

Accident Severity

A total of 657 accidents were reported on the Rock Creek and Potomac Parkway between Calvert Street and Ohio Drive during the three-year study period, 1993-1995. Two of the accidents resulted in fatalities, and 155 caused injuries. Fatality and injury accidents accounted for nearly 24% of all reported accidents on the Parkway. Accident severity statistics are summarized by year in **TABLE 5-1**.

A review of the two fatal accidents occurring on the Parkway showed the following characteristics:

- the first occurred in the southbound lanes near K Street, the second occurred near the intersection with Virginia
- both occurred mid-week, late in the evening
- the first occurred in September and the second in October, both in rainy weather on wet roads
- both were collisions with pedestrians, and in both instances the fatality was a pedestrian
- both accidents occurred at night, in lighted areas
- contributing factors for both: pedestrian illegally on the roadway, and clothing not visible

TABLE 5-1
Parkway Severity Summary

	1993	1994	1995	Totals
Fatal Accidents	2	0	0	**2**
(# of fatalities)	2	0	0	**2**
(# of people injured)	0	0	0	**0**
Injury Accidents	49	60	46	**155**
(# of people injured)	88	91	81	**260**
P.D.O. Accidents	155	159	186	**500**
Totals	**206**	**219**	**232**	**657**

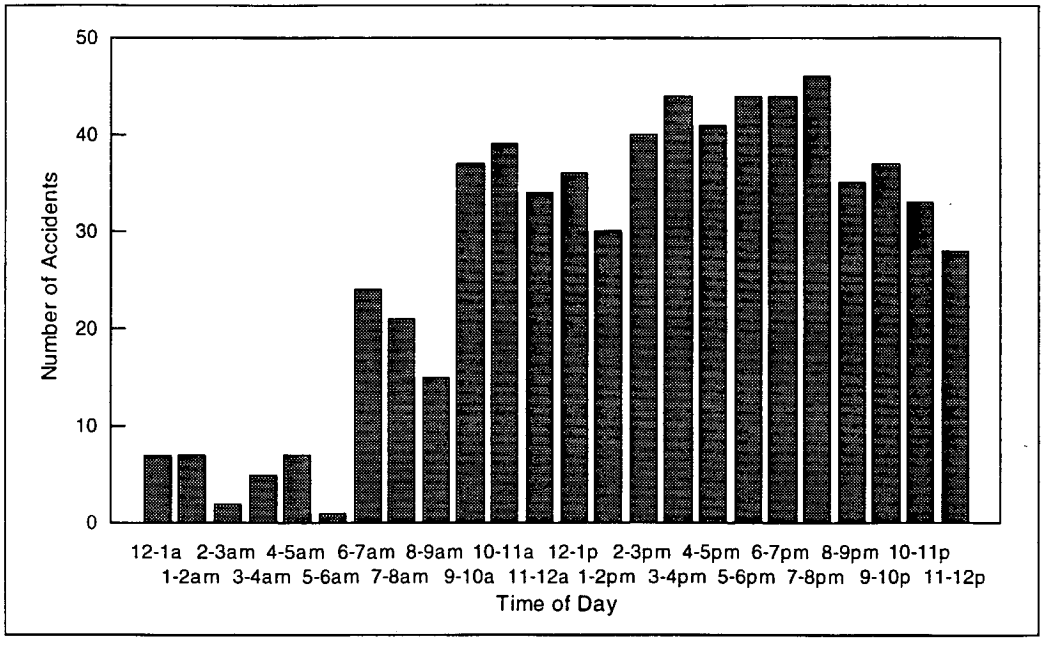
Accident Locations

FIGURE 5-1 shows the locations of all accidents included in the STARS database which occurred on the Parkway during the study period. The severity of each accident is also identified on the map.

Variations by Time of Occurrence

A review was made of the time of day that Parkway accidents occurred. The hourly distribution of accident data is shown in **FIGURE 5-2.**

FIGURE 5-2
Hourly Distribution of Parkway Accidents



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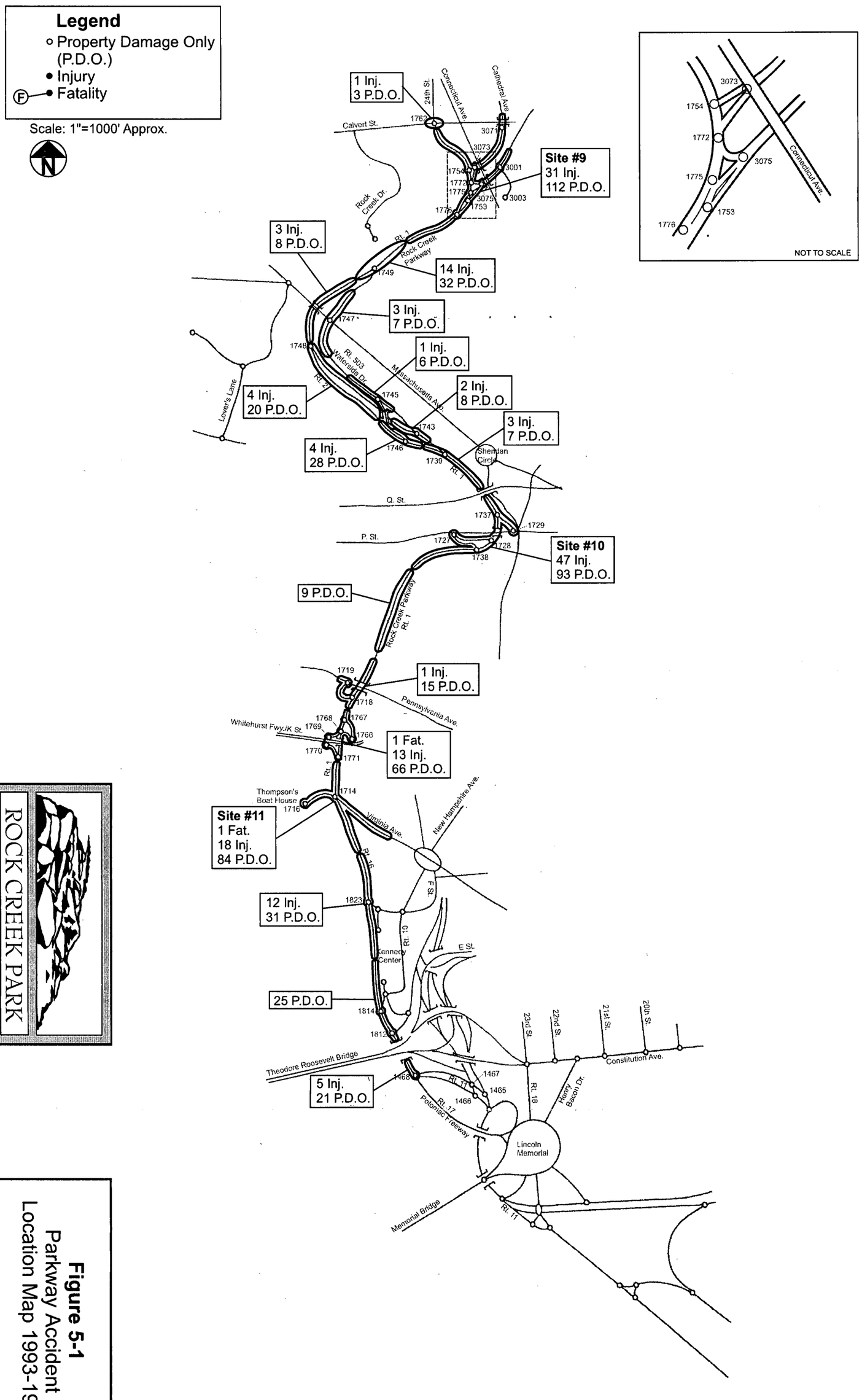
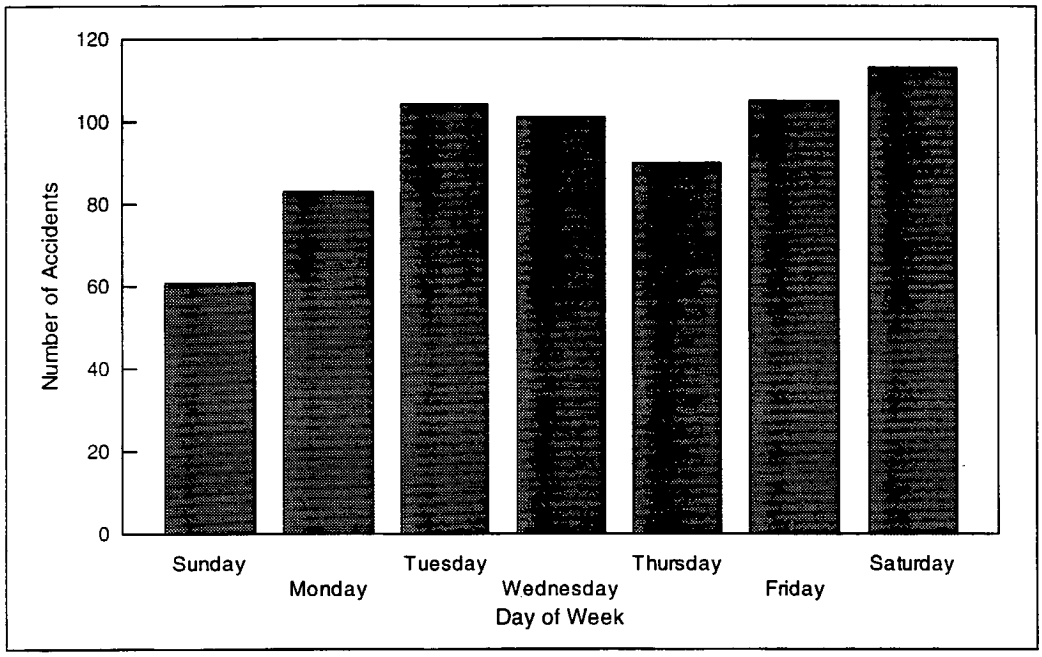


Figure 5-1
Parkway Accident
Location Map 1993-1995

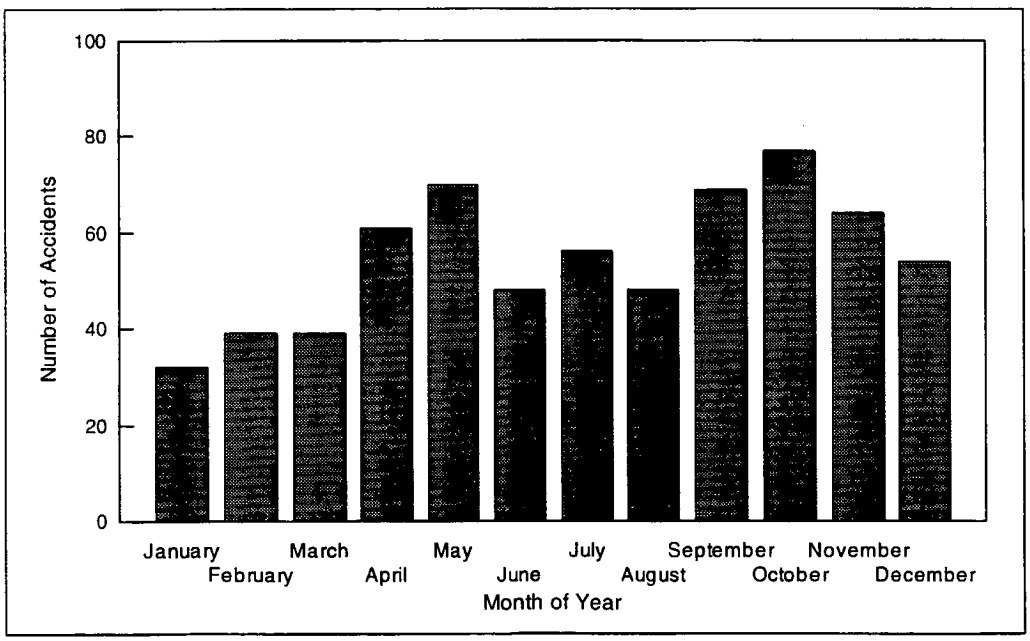
Parkway accidents were also reviewed for day of occurrence during the week. **FIGURE 5-3** shows the daily distribution of accidents.

FIGURE 5-3
Daily Distribution of Parkway Accidents



Seasonal variations were analyzed by reviewing the month in which each reported accident occurred. The monthly distribution of accidents on the Parkway is shown in **FIGURE 5-4**.

FIGURE 5-4
Monthly Distribution of Parkway Accidents



5.4.2 Primary Accident Characteristics

Accident information from the STARS databases was compiled to determine the primary characteristics of accidents occurring on the Parkway during the three year study period. In addition to severity, location, and time of occurrence, important characteristics include: collision type, accident class, fixed object struck, location in relation to the road, road character, roadway surface condition, light and weather conditions, and contributing factors.

Accident Class

The database showed the following breakdown in type of accident:

• Non-collision	25 accidents	(3.8%)
• Collision with other motor vehicle	518 accidents	(78.8%)
• Collision with fixed object	93 accidents	(14.2%)
• Collision with pedestrian	6 accidents	(0.9%)
• Collision with bicycle	4 accidents	(0.6%)
• Collision with animal	1 accident	(0.2%)
• Collision with other object	8 accidents	(1.2%)
• Collision - unknown	2 accidents	(0.3%)

Of the accidents involving collisions with another motor vehicle, rear-end collisions (43%) were most commonly reported. Angle accidents between vehicles accounted for 15% of collisions, followed by head-on collisions (7%), sideswipe collisions between overtaking vehicles (6%), and sideswipe collisions between opposing vehicles (5%).

Of the 93 accidents involving collisions with fixed objects, the objects most frequently struck were the following:

• Pole, Sign	32 accidents	(34.4%)
• Tree/Shrub	28 accidents	(31.2%)
• Guardrail/Barrier	7 accidents	(7.5%)
• Rock/Stone Wall, Boulder	7 accidents	(7.5%)
• Bridge Structure	5 accidents	(5.4%)
• Ditch, Backslope	4 accidents	(4.3%)
• Barricade	1 accident	(1.1%)

Accident Location

A total of 188 (29%) Parkway accidents occurred on roadway at an intersection, a parking/driveway access, or an on- or off-ramp. Only 6% of all accidents occurred at an off-roadway location.

Road Character and Surface Condition

201 (31%) of the 657 reported Parkway accidents occurred on straight and level roadway sections,

187 (28%) occurred on curved and level roads, and 172 (26%) occurred on curved sections of road on grade. Only 11% of all accidents occurred on straight sections on grade.

The majority of accidents (63%) occurred on dry roads, while 30% happened when roadway surfaces were wet. Only 5% of all accidents occurred on icy, slushy or snowy road surfaces.

Weather and Light Conditions

The majority of all accidents (58%) occurred on clear days with another 11% occurring when it was cloudy. 25% of the accidents occurred during rainy weather, and only 3% of accidents occurred during periods of snow, sleet, hail or freezing rain.

A total of 252 (38%) accidents occurred at night, dawn or dusk. Both fatality accidents, and 63 (41%) of the injury accidents occurring on the Parkway during the study period happened during low-light conditions.

Animal-Vehicle Accidents

A total of three accidents involving animals occurred on the Parkway during the study period. Only one of those was classified as an animal-vehicle collision, while the remainder listed an animal as a contributing factor in the accident. One of these accidents resulted in an injury. Two of the three animal-vehicle accidents occurred during low-light conditions.

Pedestrian and Bicyclist Accidents

There were 11 accidents involving pedestrians or bicyclists reported on the Parkway. Six of these were classified as collisions with pedestrians, four were classified as collisions with bicycles, and one listed a pedestrian/cyclist contributing factor. Two of the 11 accidents were fatalities, both of which killed a pedestrian; and six resulted in injuries, three of which injured a pedestrian or bicyclist. Seven of the pedestrian/bicyclist accidents occurred mid-week (Tuesday through Thursday). Five accidents involving pedestrian or bicyclist occurred during low-light conditions. Contributing factors included: "pedestrian/cyclist illegally in roadway" (six accidents), "pedestrian/cyclist disregarded traffic control" (three accidents), and "pedestrian/cyclist clothing not visible" (two accidents).

Contributing Factors

The NPS Motor Vehicle Accident reporting form allows for up to six contributing factors to be listed for each reported accident. A review was made of all contributing factors reported for accidents occurring on the Parkway. A total of 125 (19%) accidents on the Parkway involved excessive speed. Of these, 93 listed "too fast for conditions" as a contributing factor, while 32 were at least partially caused by "driver exceeding the speed limit". "Driver under the influence of alcohol or drugs" contributed to 17 (3%) accidents reported during the study period.

5.4.3 Accident Rates

The accident rate compares the number of accidents that occur on a road during a period of time with the number of vehicle-miles that are traveled on the road over the same time period. The accident rate for a road segment is described in terms of accidents per million vehicle-miles traveled (ACC/MVMT). Corresponding accident rates can also be determined for fatality and injury accidents on a road segment. These are generally presented in terms of accidents per hundred-million vehicle-miles traveled (ACC/100MVMT) since they are of significantly smaller magnitude.

Accident rates were calculated for the Parkway between Calvert Street and Ohio Drive. A comparison of accident rates for the Rock Creek and Potomac Parkway and several other NPS parkways in the Washington D.C. area is provided later in this chapter. The three-year accident rate is based on the number of accidents and estimated traffic volumes for the period 1993-1995. The 1993-1995 accident rates for Rock Creek and Potomac Parkway are listed below:

Fatality Accident Rate	1.6 ACC/100MVMT
Injury Accident Rate	127.4 ACC/100MVMT
Total Accident Rate	5.40 ACC/MVMT

5.5 All Other Park Roads

5.5.1 Accident Summary

Accident Severity

A total of 518 accidents were reported on the road system within the northern portion of Rock Creek Park during the three-year study period, 1993-1995. Two of the accidents resulted in fatalities, and 120 involved injuries. Together, fatality and injury accidents accounted for nearly 24% of all reported accidents in the northern portion of the Park. The accident severity statistics are summarized by year in **TABLE 5-2**. The data in the table has been separated into three levels of severity: fatal accidents, accidents resulting in injury, and those resulting in property damage only (P.D.O.).

A review of the two fatal accidents that occurred in the northern portion of the Park indicated the following characteristics:

- the first occurred on Morrow Drive south of Joyce, the second on Beach Drive near Blagden
- both occurred mid-week, late in the evening
- the first occurred in March with clear weather and a dry road, the second in November on a wet road in sleet, hail, or freezing rain
- both were fixed object collisions, occurring in the dark and involving a single vehicle
- driving too fast for conditions was a contributing factor in the second accident

TABLE 5-2
Northern Park Severity Summary

	1993	1994	1995	Totals
Fatal Accidents	0	1	1	**2**
(# of fatalities)	0	1	1	**2**
(# of people injured)	0	0	4	**4**
Injury Accidents	41	43	36	**120**
(# of people injured)	57	64	62	**183**
P.D.O. Accidents	150	119	127	**396**
Totals	**191**	**163**	**164**	**518**

Accident Locations

FIGURE 5-5 shows the locations of all accidents included in the STARS database which occurred within the northern portion of the Park during the study period. The severity of each accident is also identified on the map.

Accident records are coded by route number, allowing a sort to determine the routes within the northern portion of the Park where the majority of accidents occurred. Beach Drive, the major north-south road through the northern portion of the Park was the site of the majority of the northern Park accidents. Additional characteristics of accidents occurring on Beach Drive are summarized later in this chapter. The number of accidents by route is summarized below:

- Beach Drive (Route 10) - 294 accidents (nearly 57% of total)
- Piney Branch Parkway (Route 24) - 43 accidents (8%)
- Glover Road (Route 19) - 31 accidents (6%)
- Wise Road (Route 12) - 24 accidents (5%)
- Stage Road (Route 18) - 22 accidents (4%)
- Park Road/Tilden Street (Route 23) - 20 accidents (4%)
- Blagden Avenue (Route 22) - 17 accidents (3%)
- Morrow Drive (Route 17) - 15 accidents (3%)
- Sherrill Drive (Route 13) - 11 accidents (2%)

Variations by Time of Occurrence

A review was made of the time of day that accidents occurred in the northern portion of the Park. The hourly distribution of accident data is shown in **FIGURE 5-6**.

The hour of the day during which the most accidents occurred was 4:00 to 5:00 p.m. Forty of the 518 northern Park accidents (7.7%) took place during this hour. The percentages of accidents that occurred during various time frames throughout the day are as follows: midnight to 6:00 a.m. (6.6%), 6:00 to 10:00 a.m. (18.5%), 10:00 a.m. to 3:00 p.m. (30.1%), 3:00 to 7:00 p.m. (24.3%), and 7:00 p.m. to midnight (20.5%).

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Legend

- ○ Property Damage Only (P.D.O.)
- ● Injury
- Ⓕ ● Fatality

Scale: 1"=1000' Approx.

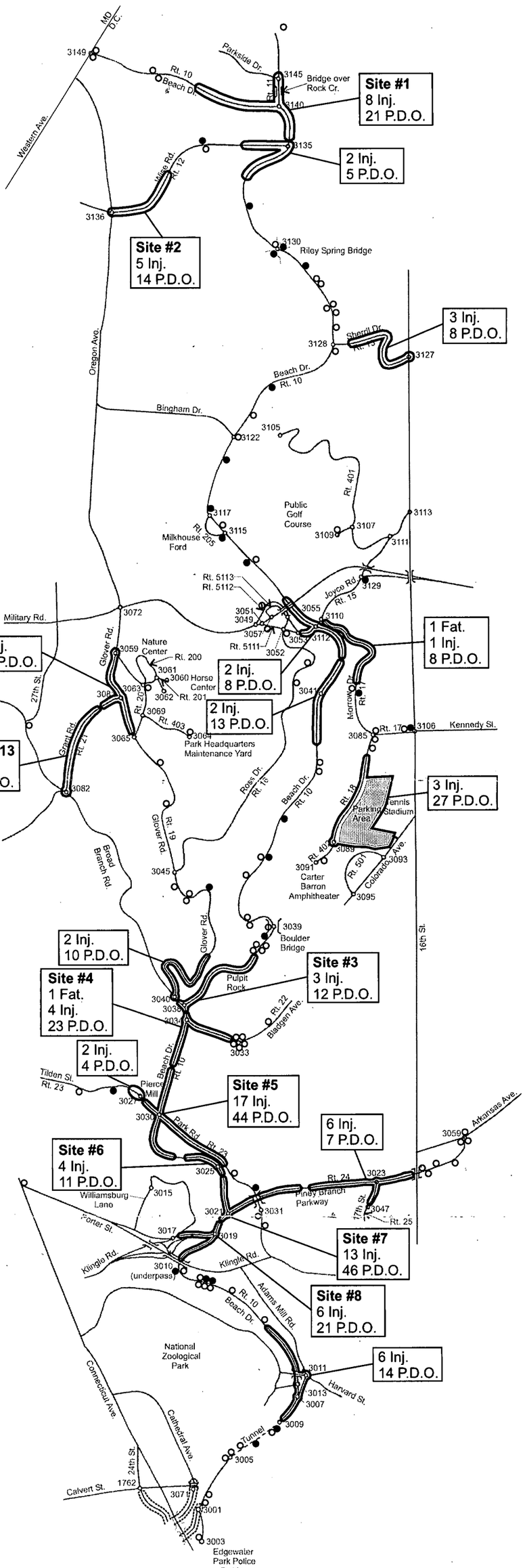
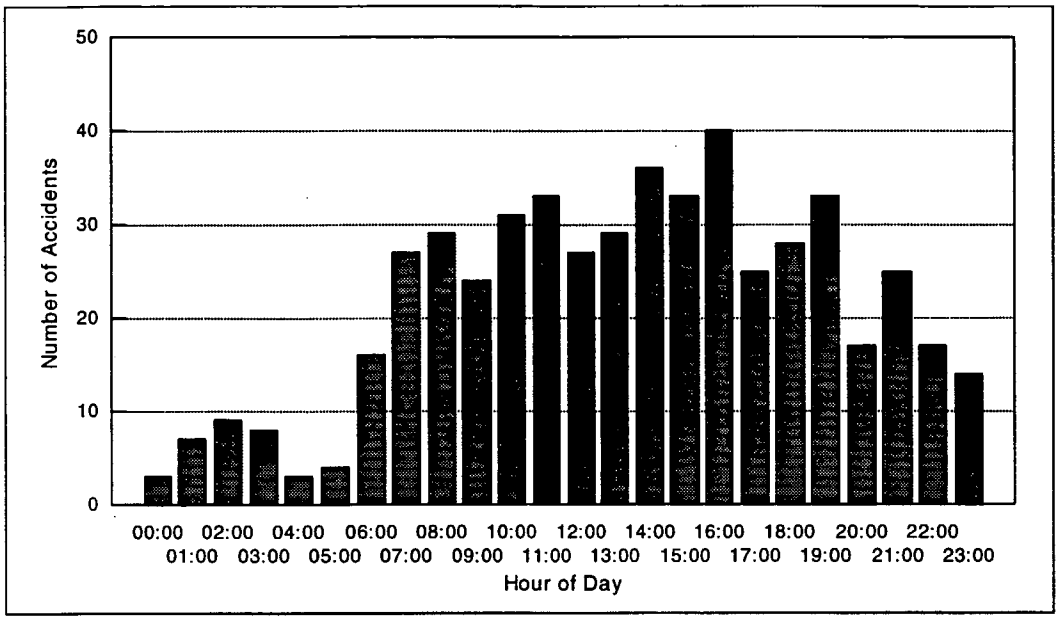


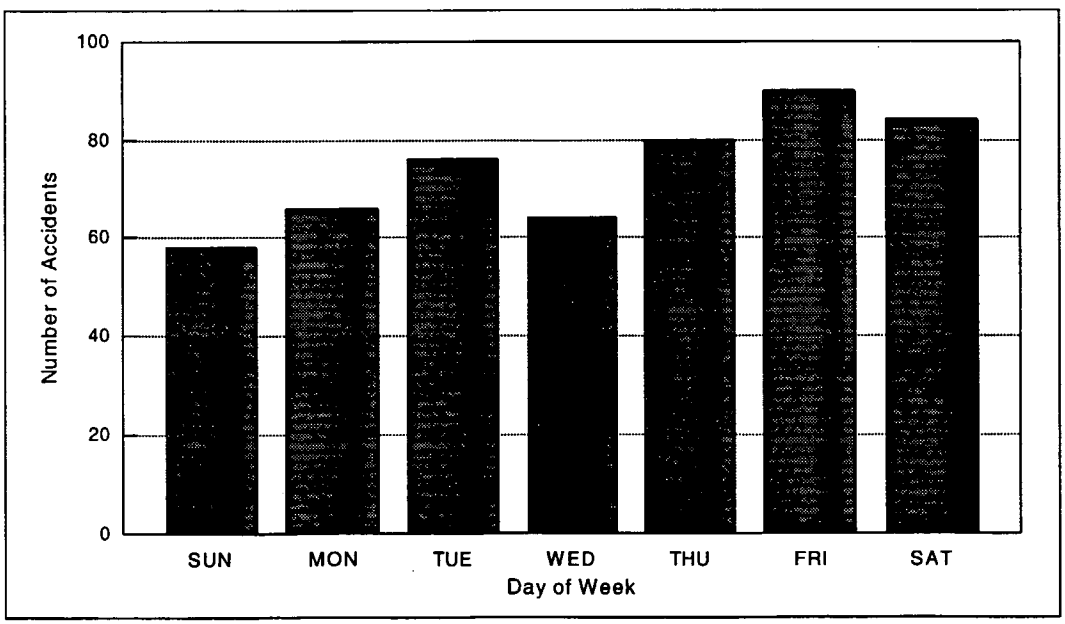
Figure 5-5
Northern Park Accident
Location Map 1993-1995

FIGURE 5-6
Hourly Distribution of Northern Park Accidents



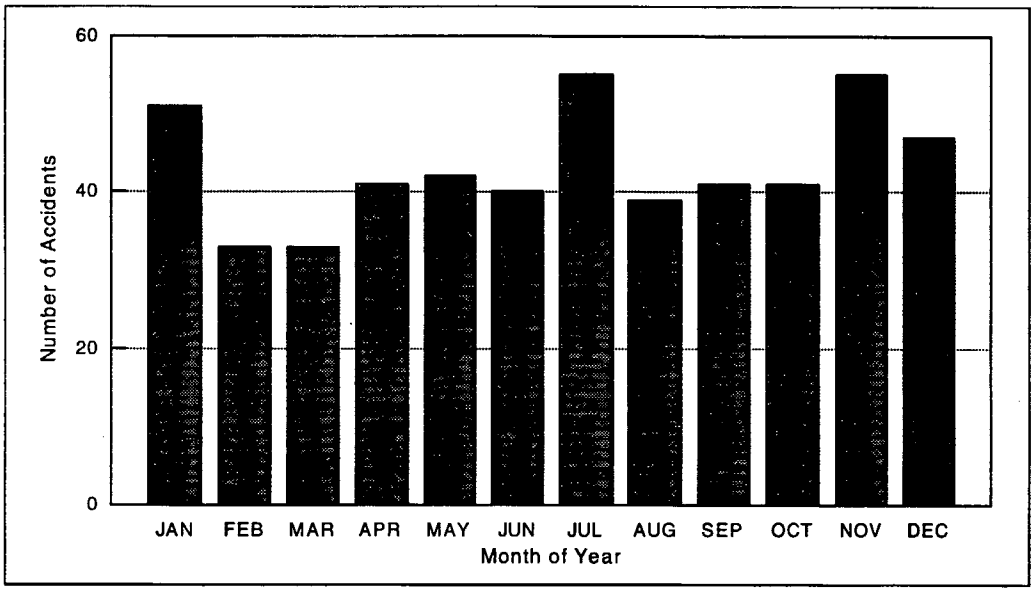
The day of the week that accidents occurred was also reviewed. **FIGURE 5-7** shows the daily distribution of northern Park accidents. The highest percentage of accidents (17.4%) occurred on Fridays. 72.6% of the accidents in the northern portion of the Park took place on weekdays, and 27.4% took place on weekends.

FIGURE 5-7
Daily Distribution of Northern Park Accidents



Northern Park seasonal variations were analyzed by reviewing the month in which each reported accident occurred. The monthly distribution of accidents is shown in **FIGURE 5-8.**

FIGURE 5-8
Monthly Distribution of Northern Park Accidents



January (51 accidents), July (55 accidents), and November (55 accidents) have noticeably higher accident frequencies than the other months of the year. Approximately 40 accidents took place during each of the other months. January is traditionally a bad weather month in the Washington area, and July sees high visitor use. There is no clear explanation for the high frequency of accidents in November.

5.5.2 Primary Accident Characteristics

Accident information was compiled from the STARS database in order to identify the primary characteristics of accidents occurring within the northern portion of the Park during the three year study period. In addition to severity, location and time of occurrence; important characteristics include: number of vehicles involved, collision type, accident class, fixed object struck, location in relation to the road, road character, roadway surface condition, light and weather conditions, and contributing factors.

Vehicle Involvement

Two-vehicle accidents were most prevalent in the northern portion of the Park during the study period, accounting for 310 (60%) of the reported accidents. Single-vehicle accidents accounted for 183 (35%) of the total, while more than two vehicles were involved in only 25 (5%) accidents during the study period.

Of the accidents involving more than one vehicle, angle collisions (36%) were the most common

collision reported. Rear-end collisions (24%) were closely followed by sideswipe collisions between opposing vehicles (21%); and head-on accidents accounted for 16% of vehicle collisions.

Accident Class

The database showed the following breakdown by type of accident:

•	Non-collision	18 accidents (3.5%)
•	Collision with other motor vehicle	320 accidents (61.8%)
•	Collision with fixed object	134 accidents (25.9%)
•	Collision with pedestrian	5 accidents (1.0%)
•	Collision with bicycle	12 accidents (2.3%)
•	Collision with parked vehicle	7 accidents (1.4%)
•	Collision with animal	5 accidents (1.0%)
•	Collision with other object	11 accidents (2.1%)
•	Collision - unknown	6 accidents (1.2%)

Of the 134 accidents involving collisions with fixed objects, the objects most frequently struck are:

•	Tree/Shrub	55 accidents (41.0%)
•	Guardrail/Barrier	22 accidents (16.4%)
•	Pole, Sign	20 accidents (14.9%)
•	Rock/Stone Wall, Boulder	17 accidents (12.7%)
•	Ditch, Backslope	13 accidents (9.7%)
•	Drainage Structure	5 accidents (3.7%)
•	Bridge Structure	2 accidents (1.5%)

Accident Location

A total of 161 (31%) of the northern Park accidents occurred on the roadway at an intersection, a parking/driveway access, or an interchange. 19% of all accidents occurred off of the roadway, on a roadside or median, or in a parking area.

Road Character and Surface Condition

167 (32%) of the 518 reported accidents in the northern portion of the Park occurred on curved and level road segments, 153 (30%) occurred on curved sections of road on grade, and 140 (27%) occurred on straight and level roadway sections. Only 8% of all accidents occurred on straight sections on grade.

The majority of accidents (51%) occurred on dry roads, but a significant number (38%) happened when roadway surfaces were wet. Only 7% of all accidents occurred on icy, slushy or snowy road surfaces.

Weather and Light Conditions

The majority of all accidents (51%) occurred on clear days with another 18% occurring when it was cloudy. It was raining when 25% of the accidents occurred, while a mere 3% of accidents occurred during periods of snow, sleet, hail or freezing rain.

A total of 169 (33%) accidents occurred at night, dawn or dusk. More than half (54%) of these low-light condition accidents involved only a single vehicle. Both fatality accidents, and 39 (33%) injury accidents occurring in the northern portion of the Park during the study period happened during low-light conditions.

Animal-Vehicle Accidents

A total of nine accidents involving animals occurred during the study period in the northern portion of the Park. Five of those were classified as animal-vehicle collisions, while the remainder listed an animal as a contributing factor in the accident. Only one of these accidents resulted in an injury. Eight of the nine animal-vehicle accidents involved a single vehicle, and seven occurred at night, dawn or dusk.

Pedestrian and Bicyclist Accidents

There were 17 accidents involving pedestrians or bicyclists reported within the northern portion of the Park. Five of these were classified as collisions with pedestrians, while 12 were classified as collisions with bicycles. Of the 17, 11 resulted in injuries, four of which injured a pedestrian or bicyclist. All but one of the 17 accidents involved two or more vehicles. Ten of the pedestrian/bicyclist accidents occurred on a Saturday or Sunday. Only two accidents involving a pedestrian or bicyclist occurred during low-light conditions. Common factors contributing to these accidents included: "driver failed to yield right of way" (five accidents), and "driver disregarded traffic signs, signals, or road markings" (three accidents).

Contributing Factors

The NPS Motor Vehicle Accident reporting form allows for up to six contributing factors to be listed for each reported accident. A review was made of all contributing factors reported for accidents occurring in the northern portion of the Park. A total of 101 (19%) northern Park accidents involved excessive speed. Of these, 84 listed "too fast for conditions" as a contributing factor, while 17 were at least partially caused by "driver exceeding the speed limit". Alcohol or drugs were a contributing factor in 12 (2%) accidents reported during the study period.

5.6 Beach Drive

5.6.1 Accident Summary

Accident Severity

Of the 518 accidents occurring in the northern portion of the Park, a total of 294 accidents were reported on Beach Drive between the Maryland State Line and Rock Creek and Potomac Parkway during the study period. One of these accidents caused a fatality, and 75 resulted in injuries. Fatality and injury accidents accounted for almost 26% of all reported accidents on Beach Drive. Severity statistics for these accidents are summarized by year in **TABLE 5-3**.

A review of the one fatality accident which occurred on Beach Drive showed the following characteristics:

- the accident occurred on Beach Drive near Blagden Avenue
- it occurred around 8:30 p.m. on a Tuesday
- it occurred in November, in sleet/hail/freezing rain, on a wet road surface
- it was classified as a collision with a fixed object, and the object struck was a tree or shrub
- the accident occurred in the dark, in an unlighted area
- the main contributing factor listed for the accident was driving "too fast for conditions"

TABLE 5-3
Beach Drive Severity Summary

	1993	1994	1995	Totals
Fatal Accidents	0	0	1	1
(# of fatalities)	0	0	1	1
(# of people injured)	0	0	4	4
Injury Accidents	22	27	26	75
(# of people injured)	32	41	42	115
P.D.O. Accidents	77	67	74	218
Totals	**99**	**94**	**101**	**294**

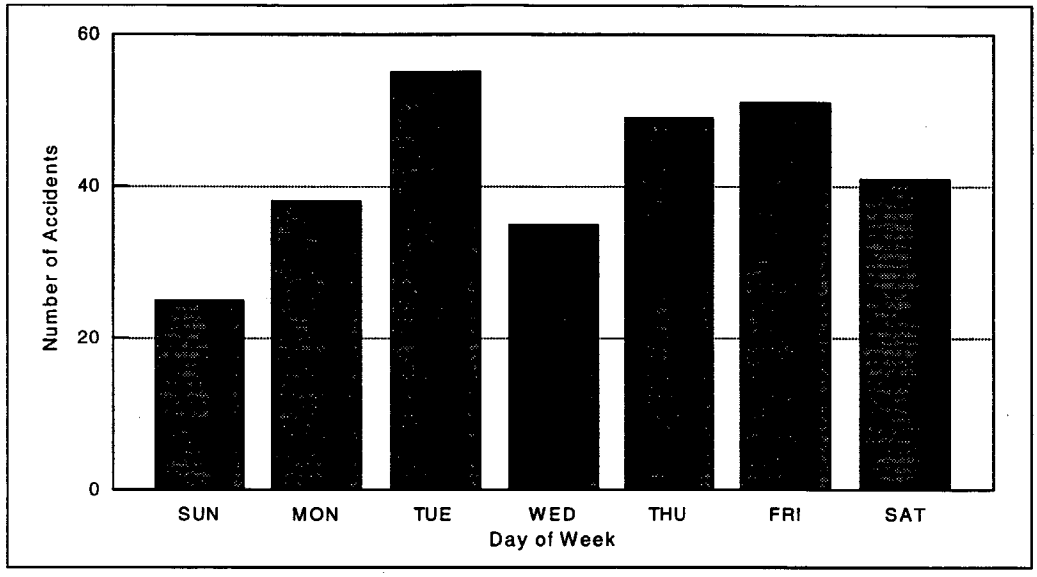
Accident Locations

The locations and severity of accidents in the STARS database which occurred on Beach Drive during the study period are included in **FIGURE 5-5**.

Variations by Time of Occurrence

Beach Drive accidents were reviewed to determine what time of day they occurred. The hourly distribution of accident data is shown in **FIGURE 5-9**.

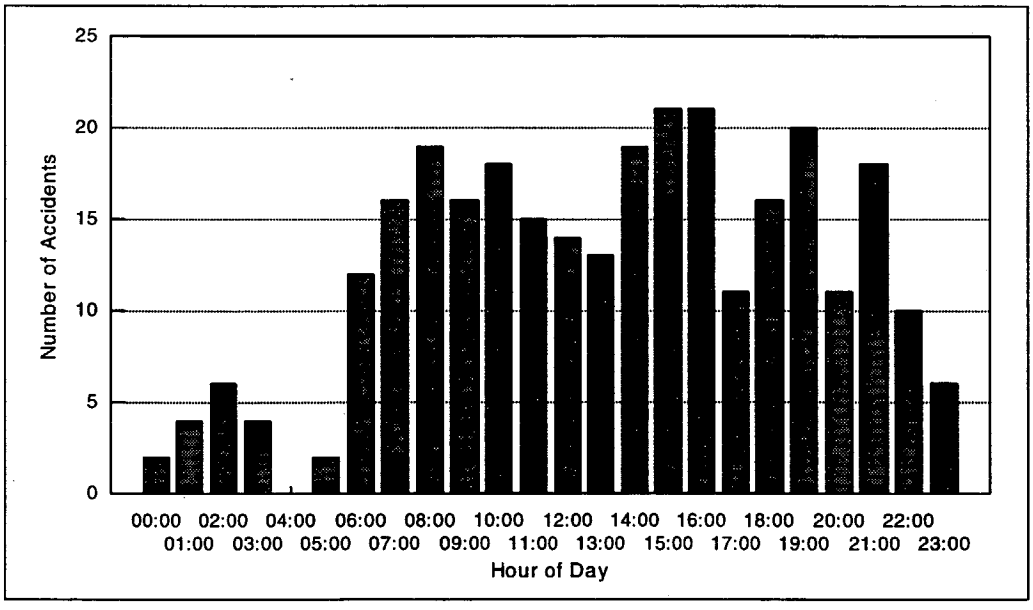
FIGURE 5-9
Hourly Distribution of Beach Drive Accidents



Forty-two accidents occurred between 3:00 and 5:00 p.m., accounting for 14.3% of all accidents on Beach Drive.

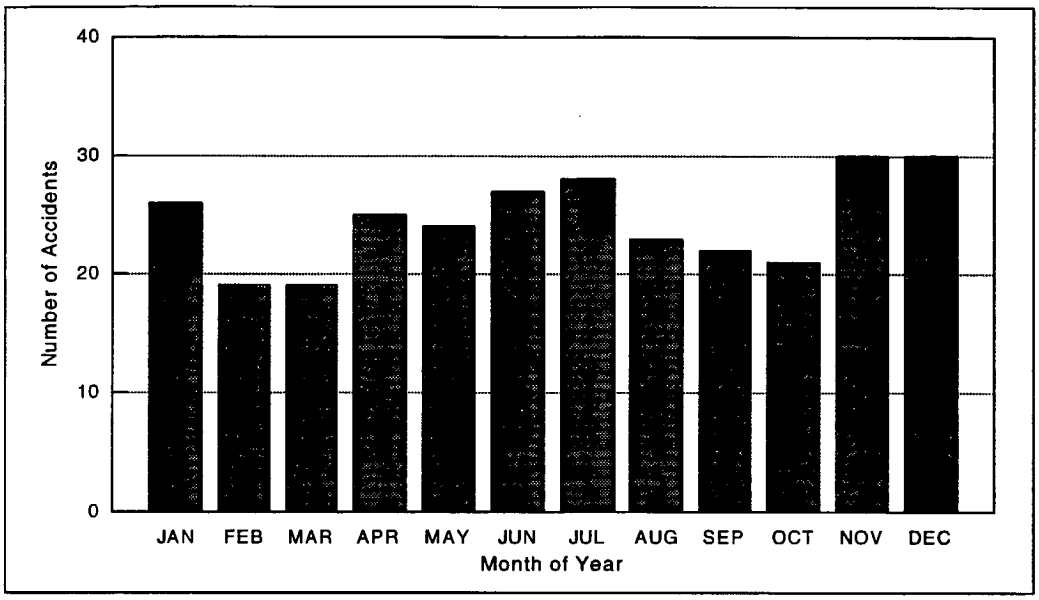
The day of the week when accidents occurred on Beach Drive was also reviewed. **FIGURE 5-10** shows the daily distribution of accidents.

FIGURE 5-10
Daily Distribution of Beach Drive Accidents



Seasonal variations were analyzed by reviewing the month in which each reported accident occurred. The monthly distribution of accidents on Beach Drive is shown in **FIGURE 5-11.**

FIGURE 5-11
Monthly Distribution of Beach Drive Accidents



More accidents occurred during the winter months of November, December and January than during the other months of the year. June and July also had relatively high accident rates.

5.6.2 Primary Accident Characteristics

Accident information from the STARS database was compiled to determine the primary characteristics of accidents occurring on Beach Drive within the northern portion of the Park during the 1993-95 study period. In addition to severity, location and time of occurrence; important characteristics include: number of vehicles involved, collision type, accident class, fixed object struck, location in relation to the road, road character, roadway surface condition, light and weather conditions, and contributing factors.

Vehicle Involvement

Two-vehicle accidents occurred most often on Beach Drive during the study period, accounting for 199 (68%) of the 294 reported accidents. Single-vehicle accidents accounted for 85 (29%) of the total, while only 10 (3%) of the accidents during the study period involved more than two vehicles.

Of the accidents involving more than one vehicle, angle collisions (36%) were the most common collision reported. Sideswipe collisions between opposing vehicles (24%) were followed by rear-end collisions (19%) and head-on collisions (18%); while sideswipe accidents between vehicles accounted for only 2% of vehicle collisions.

Accident Class

The database showed the following breakdown by type of accident:

•	Non-collision	8 accidents (2.7%)
•	Collision with other motor vehicle	200 accidents (68.0%)
•	Collision with fixed object	58 accidents (19.7%)
•	Collision with pedestrian	4 accidents (1.4%)
•	Collision with bicycle	9 accidents (3.1%)
•	Collision with parked motor vehicle	1 accident (0.3%)
•	Collision with animal	2 accidents (0.7%)
•	Collision with other object	8 accidents (2.7%)
•	Collision - unknown	4 accidents (1.4%)

Of the 58 accidents involving collisions with fixed objects, the objects most frequently struck were the following:

•	Tree/Shrub	22 accidents (37.9%)
•	Rock/Stone Wall, Boulder	12 accidents (20.7%)
•	Pole, Sign	7 accidents (12.1%)
•	Guardrail/Barrier	7 accidents (12.1%)
•	Ditch, Backslope	5 accidents (8.6%)
•	Drainage Structure	3 accidents (5.2%)
•	Bridge Structure	1 accident (1.7%)

Accident Location

A total of 110 (37%) Beach Drive accidents occurred on the roadway at an intersection, or a parking/driveway access. 40 accidents (14%) occurred at an off-roadway location.

Road Character and Surface Condition

131 (45%) of the 294 reported accidents on Beach Drive occurred on curved and level roads, 64 (22%) occurred on curved sections of road on grade, and 74 (25%) occurred on straight and level roadway sections. Only 7% of all accidents occurred on straight sections on grade.

The majority of accidents (57%) occurred on dry roads, while 32% happened on wet road surfaces. Only 6% of all accidents occurred on icy, slushy or snowy road surfaces.

Weather and Light Conditions

The majority of all accidents (56%) occurred on clear days with another 15% occurring when it was cloudy. 22% of accidents occurred during rainy weather, and only 4% of accidents occurred during periods of snow, sleet, hail or freezing rain.

A total of 97 (33%) accidents occurred at night, dawn or dusk. The one fatality accident, and 23

(31%) of the injury accidents occurring on Beach Drive happened during low-light conditions.

Animal-Vehicle Accidents

A total of six accidents involving animals occurred on Beach Drive during the study period. Two of these were classified as animal-vehicle collisions, and the remaining four listed an animal as a contributing factor in the accident. One of these accidents resulted in an injury. Five animal-vehicle accidents occurred during low-light conditions.

Pedestrian and Bicyclist Accidents

There were 13 accidents involving pedestrians or bicyclists reported on Beach Drive. Four of these were classified as collisions with pedestrians, and nine were classified as collisions with bicycles. Eight of the 13 accidents resulted in injuries, three of which injured a pedestrian or bicyclist. Eleven of these pedestrian/bicyclist accidents occurred on a Monday. Only one accident involving a pedestrian or bicyclist occurred during low-light conditions. The most common contributing factor was "driver failed to yield right of way" (five accidents); and one of the pedestrian collisions listed "animal contributing" as a factor.

Contributing Factors

A total of 45 (15%) accidents on Beach Drive involved excessive speed. Of these, 32 listed "too fast for conditions" as a contributing factor, while 13 were at least partially caused by "driver exceeding the speed limit". "Driver under the influence of alcohol" contributed to seven (2%) accidents reported during the study period.

5.6.3 Accident Rates

The accident rate compares the number of accidents that occur on a road during a period of time with the number of vehicle-miles that are traveled on the road over the same time period. The accident rate for a road segment is described in terms of accidents per million vehicle-miles traveled (ACC/MVMT). Corresponding accident rates can also be determined for fatality and injury accidents on a road segment. These are generally presented in terms of accidents per hundred-million vehicle-miles traveled (ACC/100MVMT) since they are of significantly smaller magnitude.

Accident rates were calculated for Beach Drive between the Maryland State Line and its intersection with Rock Creek and Potomac Parkway south of the National Zoo. A comparison of accident rates for Beach Drive and several other NPS parkways in the Washington D.C. area is provided in the next section. The three-year accident rate is based on the number of accidents and estimated traffic volumes for the period 1993-1995. The 1993-1995 accident rates for Beach Drive are listed below:

Fatality Accident Rate	1.3 ACC/100MVMT
Injury Accident Rate	98.7 ACC/100MVMT
Total Accident Rate	3.87 ACC/MVMT

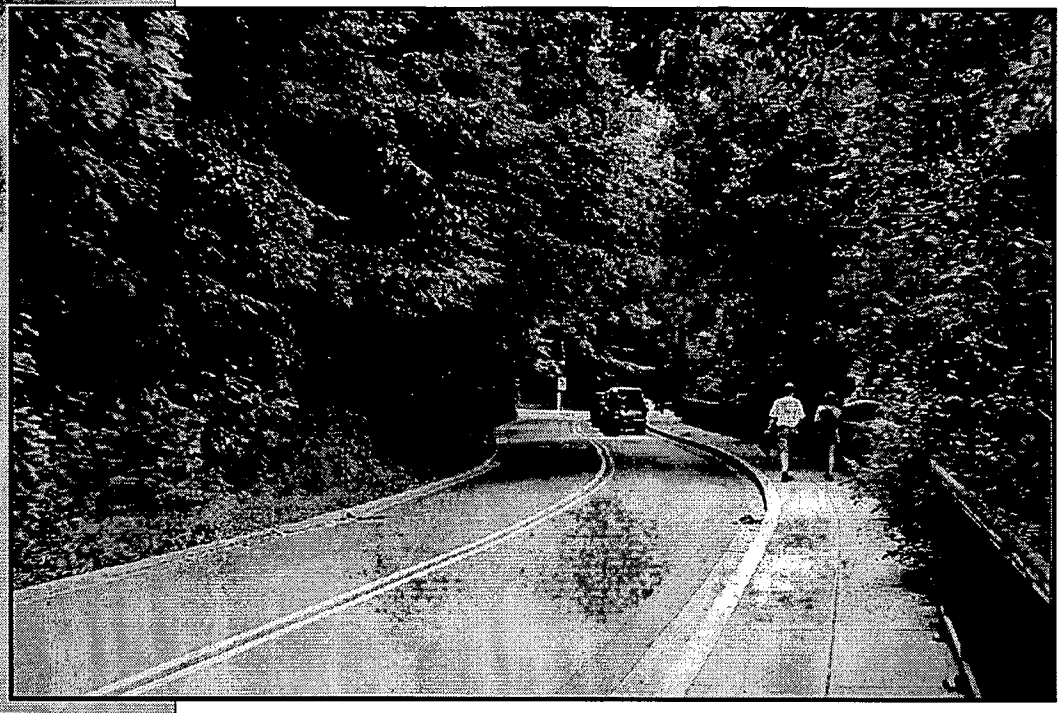
5.7 Accident Rate Comparisons

Permanent traffic counter volume data was provided by the NPS for the following parkways in the Washington D.C. area: the Baltimore - Washington Parkway, the George Washington Memorial Parkway, and the Suitland Parkway. The total number of accidents occurring on each of these parkways was also provided for the years 1991, 1993, 1994 and 1995. Permanent counter volumes were used to estimate total vehicle miles traveled on each parkway for the same years. An estimated accident rate was calculated for each parkway for these four years based on this accident and volume data. Annual accident rates were calculated for the Rock Creek and Potomac Parkway and Beach Drive for each of the four years for comparative purposes. A comparison of estimated accident rates for these Washington D.C. area roadways is presented in **TABLE 5-4**.

TABLE 5-4
Accident Rate Comparisons

	1991	1993	1994	1995
Beach Drive	1.69	3.50	3.22	3.47
Rock Creek Pkwy.	2.82	4.31	4.68	4.94
Baltimore-Washington Pkwy.	1.17	1.53	1.37	1.05
George Washington Memorial Pkwy.	1.44	1.36	1.20	1.22
Suitland Pkwy.	1.37	1.97	3.17	2.32

Chapter 6. System-Wide Traffic Safety Deficiencies and Recommendations



Chapter 6: System-Wide Traffic Safety Deficiencies and Recommendations

6.1 General

Physical and operational problems that occur system-wide within the Park are described in this chapter. The problems and deficiencies identified herein are based on the results of traffic studies and field observations that were conducted during the summer and fall of 1996.

6.2 Problems Identified through Accident Analysis

6.2.1 Intersections

At-grade intersections were the site of the majority of accidents reported in the northern portion of the Park during the study period. These intersections are typically three-way junctions between Beach Drive and a side road. The safety problems at these intersections are generally related to drivers failing to yield the right-of-way as they attempt to enter the Beach Drive corridor, resulting in an angle accident. Vehicles were observed at all intersections rolling through or running the stop signs. For the most part, the source of the problem is not in the intersection design but rather in the aggressive nature of the drivers.

Another problem identified at Park intersections relates to the design and operation of right-turn ramps. Most intersections have been designed with a right-turn ramp that is controlled by a yield sign. This design encourages motorists to drive these ramps at high speeds, often failing to yield to other traffic. Sight distance is often limited on the inside of these ramps due to encroaching vegetation. Of special concern is the ability of pedestrian and bicycle traffic to negotiate intersections with these high-speed, free-flowing ramps.

The general recommendation is to change the traffic control at most of these intersections to three-way stop designs. Redesign of the intersections to eliminate the free-flowing right-turn ramps is also recommended. The intersections would be safer and more predictable if all vehicles were required to stop. Three-way stops would allow a safe gap in the traffic for vehicles to access from the side street. A safer environment would also be provided for pedestrian and bicycle traffic. In cases where the warrants for all-way stops are not yet met, the intersection should be monitored and a three-way stop installed when appropriate.

6.2.2 Parkway Interchanges

The interchanges along the Parkway were designed for efficient traffic movement. Instead of at-grade intersections, the Parkway is equipped with on- and off-ramps and grade separated road crossings. This type of roadway design accommodates and encourages high vehicle speeds.

A high proportion of the accidents that occurred on the Parkway took place where on-ramp traffic merges with Parkway traffic. The on-ramps are currently controlled by either stop or yield signs, and this treatment should be standardized. Regardless of the type of traffic control on a ramp, it is

common for the entering vehicles to run the sign in an effort to accelerate to Parkway speeds and attempt a smooth merge during heavy traffic conditions. This tendency can be attributed to the aggressive driving characteristics of the D.C. commuter, combined with a lack of adequate gaps in the high speed Parkway traffic flow. A safety problem occurs when the entering driver misjudges the Parkway traffic and has to force their vehicle onto the roadway, causing potential sideswipe, angle or rear-end collisions. It is recommended that acceleration lanes be provided on the Parkway where space is available to allow entering vehicles to get up to speed before merging. If an acceleration lane is provided, the ramp should be controlled with a yield sign. If there is no way to provide an acceleration lane, the ramp should be controlled with a stop sign, with rumble strips on the ramp to enforce the stop condition. It is essential to keep vegetation cleared at these interchanges to ensure maximum sight distance on the ramps.

The off-ramps appear to function fairly well, but they are not designed to be driven at the high speeds that occur on the Parkway. For example, the P Street off-ramp has a maximum safe speed of 15 miles per hour, while traffic approaching the off-ramp is traveling at an average speed of 45 miles per hour or more. In this location, the driver receives no advance warning of this condition. Exit speeds need to be posted in advance of these off-ramps to alert drivers to the slower speed requirements on the ramps.

Another problem at some of the on- and off-ramps is related to the presence of pedestrian and bicycle traffic. The free-flowing nature of the ramps creates safety problems for these Park users. The area where the paved pedestrian/bicycle trail crosses the ramp is often not easily visible to the driver because of the curved alignment, bridge structures, or encroaching vegetation. In some cases, a combination of all of these factors contribute to poor sight distance. Special care needs to be taken in locating the trail crossing at these ramps. Good sight distance is essential to the safe passage of pedestrians and bicyclists, as it allows the driver time to react and avoid a collision.

6.2.3 Wet Roads

Approximately one third of the accidents reported in the Park during the study period occurred on wet roads. It is recommended that all Park roads be skid tested to determine whether some type of skid resistant pavement overlay is in order.

6.3 Problems Identified through Field Observations

6.3.1 Speeding

The greatest safety problem in the Park is the excessive vehicle speeds that occur on the Park road system. When considering the roadway designs, ball bank testing results, and available sight distance, the posted speed limits seem appropriate. However, in most areas of the Park the 85th percentile speed is at least ten miles per hour above the posted speed limit. Many of the accidents occurring on Park roads were attributed, at least in part, to high speeds. High speeds, combined with limited visibility due to roadside vegetation, create potential safety problems for motorists as well as people who walk or ride their bikes along the roads in the Park.

The United States Park Police do not stop vehicles for speeding in Rock Creek Park unless they are exceeding the limit by more than ten miles per hour. Although the U.S. Park Police actively patrol Park roads, their presence has a limited effect on vehicle driving speeds. Speed studies conducted in the Park and on the Parkway show that the drivers using these facilities totally disregard the posted speed limit. Many fail to reduce their speed even when in the presence of law enforcement vehicles. It is clear that the current methods used by the U.S. Park Police are not effective in controlling the undesirable and unsafe driving habits of aggressive urban commuters who frequent Park roads. A more aggressive program of speed violation enforcement is needed if the posted speed limit is to be effective. This would most likely require that additional time and personnel be dedicated to speed control.

6.3.2 Pedestrian and Bicycle Conflicts with Vehicles

The paved paths along the Parkway and Beach Drive are popular recreational facilities which are heavily used by pedestrians and bicyclists. The paths cross side roads and access ramps that connect to the Parkway and Beach Drive in many locations. The combination of aggressive, high speed commuter traffic and large volumes of pedestrian and bicycle traffic causes potential conflicts.

Bicyclists often use Park roads and travel in the driving lane with vehicular traffic. Bicycles on the road cause traffic congestion and force drivers to swing into the oncoming traffic lane to pass. This situation creates serious operational and safety problems.

It is recommended that a more complete system of paved paths be provided along Beach Drive and the major side roads in the northern portion of the Park. One such alternative was presented in the 1980 Environmental Assessment Bicycle Trail Study. A continuous paved trail system would enable bicyclists to travel safely on paths without interfering with the flow of vehicular traffic. Most of the vehicle/bicycle conflicts occur in areas where there is no paved trail available. It is acknowledged that the physical limitations of the Rock Creek ravine may make construction difficult in some areas of the Park.

6.3.3 Directional Operation of the Parkway

The changing of the directional operation of the Parkway 20 times each week is a very expensive, labor intensive process. This practice has been going on since 1937. The safety concern relating to these operational changes involves consistency. All of the road signs must be appropriate for three different types of operation. In order to meet this need, various locations are equipped with hinged signs that must be manually flipped up or down to present the applicable sign message for the current conditions. It is critical that the driver be given the correct message at all times in order to prevent driver confusion or lack of regard for traffic control signs. The sawhorse barricades and orange traffic cones must also be consistently placed in the correct locations to be effective on a day-to-day basis. The United States Park Police follow standard operating procedures to ensure that these rush hour operations are performed correctly, but there is still room for human error.

One major concern relating to the one-way operation of the Parkway involves the incorrect operation of the traffic signal at Virginia Avenue, which is maintained by the D.C. Department of Public Works. This signal is equipped for fully actuated operation, but at the time of the field review it was

operating under two-way fixed timing during peak hours. As a result, drivers deliberately run the red cycle of the signal on a routine basis. Motorists unfamiliar with the situation tend to respect the stop condition when the red phase of the signal is presented. Since the local commuter has learned to disregard the signal, a potential rear-end collision is created. The signal phasing should be modified so that it presents the correct traffic control message for the varying conditions. A pedestrian phase should also be provided during peak hours.

The directional operation of the Parkway costs approximately $450,000 each year. It is recommended that this practice be thoroughly evaluated for discontinuation.

6.3.4 Conflicts at Picnic Areas

The two restrooms for the group picnic areas along Beach Drive are located across the road from the picnic facilities. This situation forces picnickers to cross a busy roadway to reach restroom facilities, creating potential conflicts between pedestrians and vehicles traveling on Beach Drive. If at all possible, the restrooms should be relocated to the same side of the road as the picnic facilities and parking lots. Otherwise, the crossings should be identified with the appropriate pavement markings and signing.

Although they are not signed for one-way operation, the access roads for the parking lots at the group picnic areas are too narrow for two-way traffic. This is a problem because it is not clear as to whether one access should be used as an entrance and the other as an exit, and if so, which is which. These driveways should either be widened or signed for one-way flow. If the latter option is chosen, directional arrows should also be painted down the aisle in the parking lot.

Some of the individual picnic parking areas are not clearly separated from the adjacent travel lane. In some cases, depressed concrete curb parallels Beach Drive between the travel lane and the adjacent parking area. In most cases, however, no delineation system exists to clearly separate the parking pullouts from the roadway. A shoulder line should be applied in such areas.

6.4 Problems Identified through Maintenance Evaluation

6.4.1 Drainage

A lack of adequate drainage creates hydroplaning problems when water stands on the road. The storm drains in the Park must be maintained clear of debris and in functioning order at all times. Additional drains should be placed in areas where persistant ponding problems occur.

Drainage grates are a safety problem in themselves because they have not been raised during past pavement overlay projects. The grates are now several inches below the adjacent roadway pavement. This causes bicyclists to swing out into the traffic lane and motorists to cross the centerline to avoid the low grates.

6.4.2 Vegetation

In many locations throughout the Park, vegetation encroaches too close to or over the roadway, restricting the drivers' sight distance and view of road signs. It is essential that Park roads are maintained clear of vegetation around intersections, curve sections, crosswalks, and signs. This practice will ensure that necessary sight distances are provided at these critical locations.

The clear zone along the road should be examined for fixed objects that constitute safety hazards. A 30-foot clear zone is desirable on the Parkway, and an absolute minimum of 10 feet should be maintained on all other Park roads. Significant obstructions within these clear zones should be reviewed for removal or placement of object markers. Small trees should be removed from the clear zone before they become formidable objects. No new vegetation, other than grass and low ground cover, should be planted within ten feet of a Park road.

6.4.3 Signing

Most signs in the Park are in need of washing in order to improve their nighttime effectiveness and to help them stand out against the background of trees. For the most part, the regulatory signing in the Park is correct and appropriate. Warning signs are lacking in several areas, including advance warning of road closures, crosswalks, and significantly low ramp speeds on Parkway interchanges.

The northern portion of Rock Creek Park is characterized by winding routes and heavy vegetation. This combination can be disorienting for a driver unfamiliar with the area. The lack of adequate guidance signing in the Park creates problems for drivers who are unfamiliar with the Park road system. The confused or disoriented driver tends to conflict with traffic that is exhibiting the aggressive driving tendencies commonly displayed by urban commuter drivers. An effective guidance signing system is needed throughout the Park. Advance guidance signs should be provided for all intersections, and all road name signs should be standardized.

In order to ensure that all appropriate signs are in place, the Park signing plan should be updated by a Park sign coordinator. The plan should then be reviewed and approved by the regional sign coordinator.

6.4.4 Roadway Lighting

The roadway lighting system in the northern portion of the Park was turned off during the 1970s and is no longer functional. The light standards now serve only as numerous fixed objects along the shoulder of the road. Since these standards serve no useful function, they should be removed.

Roadway corridor lighting is not recommended for the northern Park roads. However, intersection lighting should be considered at any intersection that has raised medians.

The roadway lighting on the Parkway appears to be functional and effective.

6.4.5 Wooden Guiderails

In general, the wooden guiderails throughout the park are in poor shape. All of these guiderail sections should be replaced with new steel-backed timber guardrail.

Chapter 7. Identification and Evaluation of Specific High-Accident Locations

Chapter 7: Identification and Evaluation of Specific High-Accident Locations

7.1 Site Identification Process

The accident data obtained from the NPS for the period of January 1, 1993 through December 31, 1995 provided the basis for the high-accident site identification process. The first phase of the process included an analysis of the accident records to identify locations on the Park road system where multiple accidents occurred during the study period. The locations where multiple accidents occurred were then mapped and considered as potential sites for detailed analysis. The preliminary accident cluster locations were reviewed with Park staff and Park Police in an effort to identify eleven locations on the road system where detailed evaluations would be performed.

7.2 Sites Selected for Further Examination

As a result of comments from NPS staff and a review of accident locations during the three-year study period, eight sites in the northern portion of the Park and three sites on the Rock Creek and Potomac Parkway were selected for further investigation. These eleven sites are listed in **TABLE 7-0** and their locations are shown on **FIGURE 7-0**.

TABLE 7-0
Sites Selected for Detailed Analysis

Site Number	Site Description
1	Intersection of Beach Drive and West Beach Drive
2	Wise Road Curve and Intersection of Wise Road/Chestnut Street and Oregon Avenue
3	Intersection of Beach Drive and Broad Branch Road
4	Intersection of Beach Drive and Blagden Avenue
5	Intersection of Beach Drive and Tilden Street/Park Road
6	Bluff Bridge Curve
7	Intersection of Beach Drive and Piney Branch Parkway
8	Intersection of Beach Drive and Klingle Road
9	Intersections of Beach Drive and Cathedral Avenue with the Rock Creek and Potomac Parkway
10	Intersection of the Rock Creek and Potomac Parkway with P Street
11	Intersection of the Rock Creek and Potomac Parkway with Virginia Avenue

7.3 Site Evaluation Process

A systematic approach employing historical accident research, physical measurements of site conditions, observations of driver characteristics and quality of travel, and assessments of the driver's perception of the site was used in the evaluation of each high-accident location. The data collected through these procedures identified the circumstances or conditions that make these specific locations on the Park road system more hazardous than others. The following narrative describes each activity performed during the data collection phase of this project.

7.3.1 Accident Research

All accidents recorded at each site during the study period were thoroughly examined and used to help identify accident trends, potential operational problems, and possible site deficiencies. Accident rates and accident severity rates were calculated for each site. The accident rate is expressed in accidents per million vehicles entering (MVE) for intersections, and accidents per million vehicle miles traveled (MVMT) for road segments. The accident severity rate is established by assigning a value of one for each accident resulting in property damage, a value of two for each accident resulting in injury, and a value of five for each fatal accident, then averaging the values.

7.3.2 Initial Site Visit

The consultant visited each location to conduct field observations of the traffic at the site and to locate all accidents that occurred within it during the period of study. A subjective assessment of the driver's perception of the site and the presentation of traffic control devices was also performed to assess the driveability of each site.

7.3.3 Site Survey

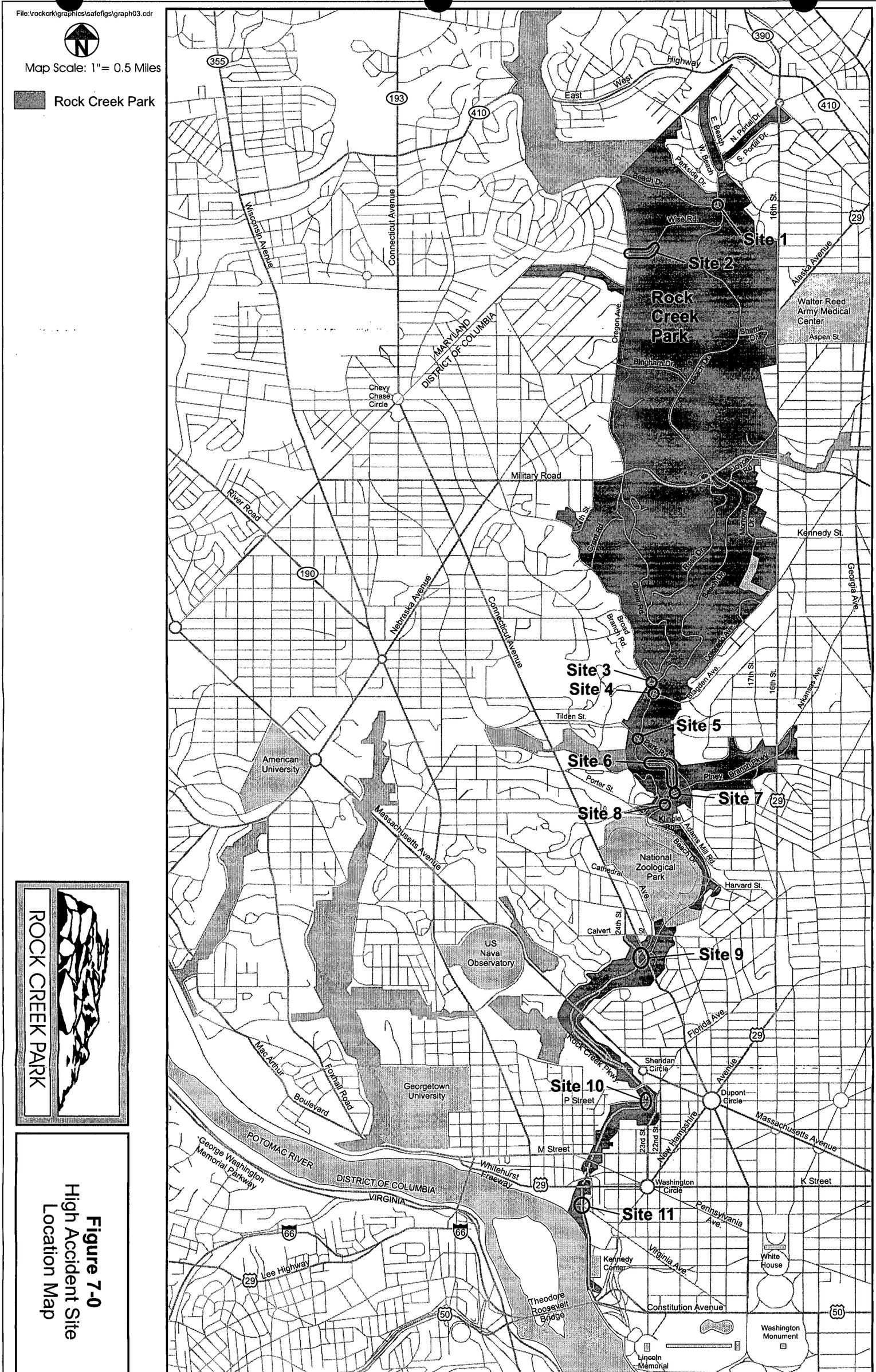
Field technicians utilized survey equipment to measure the physical layout of the site. Data gathered during the survey included average road grades, road widths, and road alignment. Stopping-sight distance and, where applicable, passing-sight distances were determined in the field for all high-accident locations. Ball-bank testing (using a safe-curve-speed indicator) was performed as needed to verify posted advisory speeds for sites with curves.

7.3.4 Site Photography

Photographs were taken to illustrate specific characteristics or to identify site deficiencies. These photographs were used extensively during the preparation of this report.

7.3.5 Identification of Site Features

This phase of the data collection involved field measurements of site features including sign locations, pavement markings, location of medians, and other roadside objects. Coordination between field measurements and site photography resulted in the production of accurate graphics for each location. Measurements of sign sizes were also conducted to assess their conformance to *Manual on Uniform Traffic Control Devices* (MUTCD) and NPS signing standards.



ROCK CREEK PARK

Figure 7-0
High Accident Site
Location Map

7.3.6 Traffic and Turning-Movement Counts

All available traffic count data from applicable permanent and periodic traffic count locations were obtained from the NPS. The consultant conducted extensive spot machine traffic counts to supplement the NPS data. A manual count of vehicle-turning maneuvers was generally conducted to supplement traffic count data at sites that included a major intersection. The traffic count data was used to estimate average daily traffic and to calculate accident rates for the study period.

7.3.7 Site Deficiencies and Proposed Solutions

The results of the accident analyses, and field observations were used to identify operational problems, site deficiencies, signing needs, and other traffic safety problems at each site. Proposed solutions were developed to address identified problems and deficiencies at each high-accident location.

7.4 Individual Site Analyses and Recommendations

The ultimate objective of the site evaluations was to identify improvements that will reduce accident numbers and severity or alleviate operational and/or traffic safety problems at each site. Because each of the eleven sites selected for detailed evaluation requires some type of action, a means of ranking improvement projects was necessary to determine priorities for implementation. The following factors were considered in developing recommendations for implementing the improvement projects at these sites:

- accident rate
- accident frequency (numbers of accidents per year)
- accident severity
- operational deficiencies (excessive speeds, signing problems, etc.)
- physical deficiencies (geometrics, sight distance, road surface)

These plus other factors such as costs of improvement projects and ease of implementation will be discussed further in Chapter 8.

The following pages contain a discussion of the physical layouts, the operational characteristics, and the accident histories for the eight high accident locations on the northern road system in Rock Creek Park and the three high accident sites on the Rock Creek and Potomac Parkway. This information combined with the results of various on-site traffic studies, helped to identify the cause(s) of the accidents at each site. Recommendations addressing the causes or contributing factors to accidents at each site were formulated in an effort to reduce the frequency and/or severity of accidents.

Most of the proposed solutions involve limited construction and are designed to provide direct benefits to the motorists using the road system. Many of the improvements are relatively low-cost items which could be easily implemented by NPS maintenance personnel.

The existing signing for each site is correct in its size, shape, and placement unless otherwise noted. Existing signs are shown on the existing conditions and recommended improvements figures which are presented in this chapter. The recommendations for new signs include *MUTCD* sign identification numbers, suggested sizes for regulatory and warning signs, and placement suggestions. The cost estimates provided for each improvement are approximate and intended for planning purposes only.

7.4.1 Site 1 - Intersection of Beach Drive and West Beach Drive

Site Description:
This site consists of the "Y" intersection formed by the junction of Beach Drive and West Beach Drive. The intersection is located on a curved section of Beach Drive at the north end of Rock Creek Park. **FIGURE 7-0** shows the location of the site within the Park. Although Beach Drive runs roughly east-west at this site, it is regarded as a north-south route through the park. Therefore, West Beach Drive, which approaches from the north, is considered for discussion purposes to be the east approach to this intersection. West Beach Drive crosses a bridge immediately north of the intersection. There are sidewalks along both sides of the bridge, but no other pedestrian or bicycle facilities exist at this site. **FIGURE 7-1.1** shows the site layout, and **FIGURE 7-1.2** contains photos of the location.

There are five raised medians channelizing traffic through this intersection. A short distance before the intersection, the south approach of Beach Drive is divided into a through lane and a right turn lane with a ramp. The north approach consists of a shared left/through lane, while the West Beach approach has a single left turn lane and a right turn ramp. Traffic turning right onto Beach from West Beach is controlled by a yield sign, while left turns are controlled by a stop sign. Unless there is conflicting traffic on Beach Drive, left-turning drivers tend to creep or roll through the intersection rather than coming to a complete stop. During a brief period of observation, nearly sixty percent of the drivers observed failed to stop. The north leg of this intersection is closed to vehicle traffic every weekend from 7:00 a.m. on Saturday until 7:00 p.m. on Sunday. During these periods, the northern portion of Beach Drive is used exclusively by bicyclists, in-line skaters, walkers, and joggers.

Accident History:
A total of 29 accidents were reported at this site between January 1, 1993 and December 31, 1995. No fatal accidents occurred at this location. Eight (28%) of the 29 accidents at the site resulted in injuries. The time of accident occurrence is fairly uniform between the hours of 6:00 a.m. and 8:00 p.m. More accidents occurred on Monday, Tuesday, and Friday than any other days of the week. There was a slightly higher occurrence of accidents during the winter months (November through February). A complete summary of accident statistics at Site 1 is shown in **TABLE 7-1**. Some notable characteristics of the accidents occurring at this intersection are listed below:

- The average accident frequency was 10 accidents per year, with an accident rate of 2.91 accidents per million vehicles entering (MVE), and an accident severity rate of 1.28.
- 24 (83%) of the 29 accidents involved two vehicles, the remaining five (17%) were single-vehicle accidents.
- 19 (66%) of the 29 accidents were collisions with another motor vehicle; 79% of these were angle collisions.
- The majority of accidents (17) occurred on dry roads, and eight occurred while the roadway surface was wet.
- A total of six (21%) accidents at the intersection occurred at night, dawn or dusk.
- Two accidents involved animals.
- Four accidents involved collisions with bicycles, and all four resulted in injuries (one injury to a bicyclist).
- The most common contributing factor listed was "driver failed to yield right of way" - 15 accidents (52%).

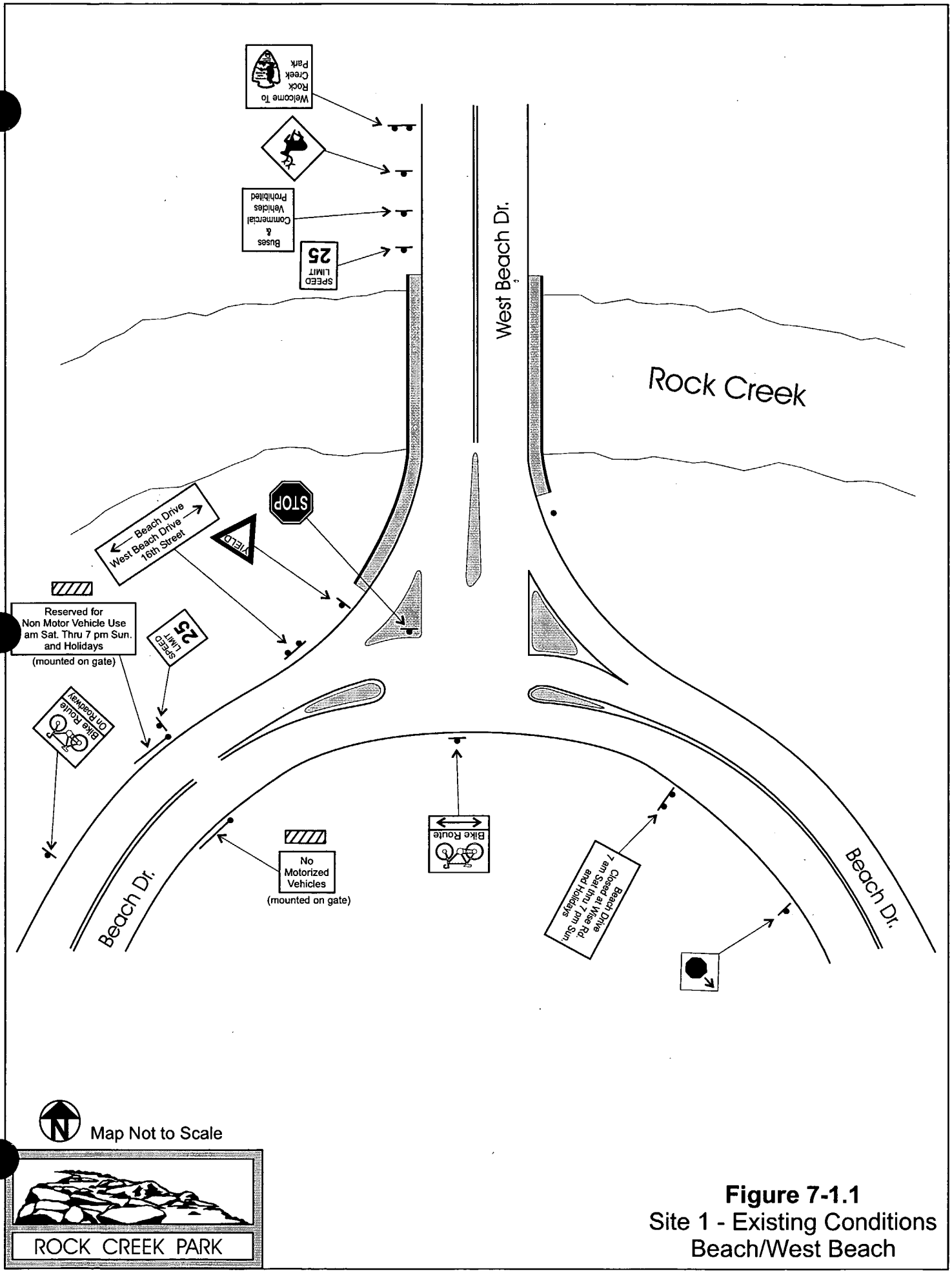
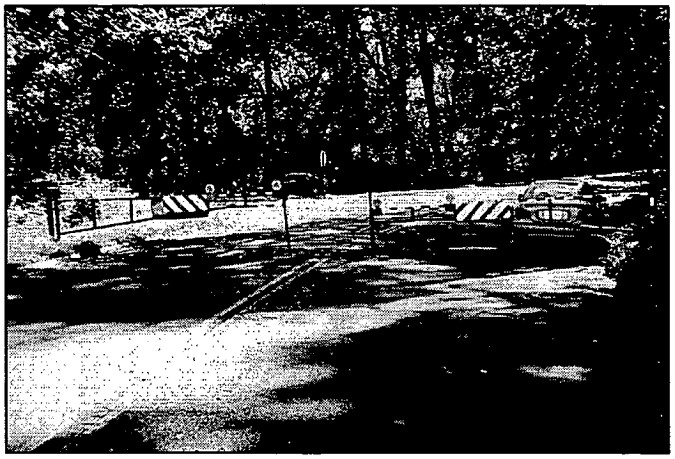


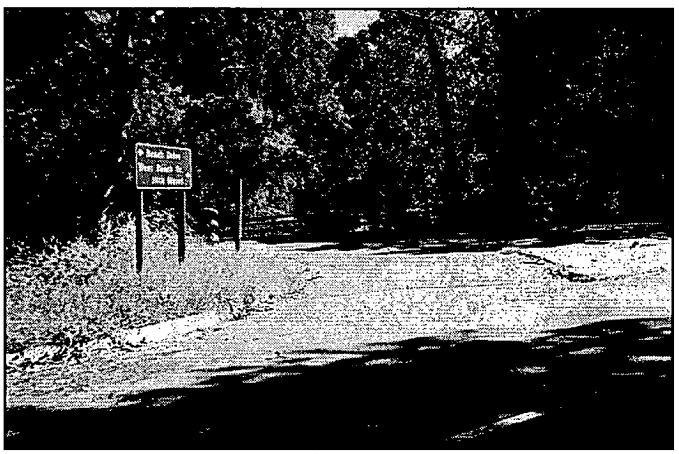
Figure 7-1.1
Site 1 - Existing Conditions
Beach/West Beach



A barricade gate is located to the northwest of the intersection. Beach Drive is closed to vehicle traffic north of the intersection during the days on weekends. The intersection remains open to traffic at all times.

A bridge over Rock Creek is located on the east approach to the intersection. The intersection and the stop sign are visible to drivers as they cross the bridge.

This photo shows the south approach to the intersection. The raised channelization delineates the right turn lane. Orange cones are used to divert traffic to the right during times when Beach Drive is closed north of the intersection.



A guidance sign is located on the north side of the intersection for vehicles traveling north on Beach Drive. This photo also shows the right ramp for vehicles turning north onto Beach Drive from West Beach Drive. This turning movement is controlled by a standard yield sign.

ROCK CREEK PARK

Figure 7-1.2
Site 1 - Photo Page
Beach/West Beach

TABLE 7-1
Rock Creek Park Accident Information
Site #1 - Intersection Beach Dr. & W. Beach Dr.

site1sum.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	0	0	0	0
(Number of Fatalities)	0	0	0	0
Injury Accidents	3	2	3	8
(Number of Injuries)	3	4	3	10
P.D.O. Accidents	7	8	6	21
Totals	10	10	9	**29**

Summary by Hour (TIMEACC)

000-059	0
100-159	0
200-259	0
300-359	0
400-459	0
500-559	0
600-659	3
700-759	1
800-859	2
900-959	2
1000-1059	4
1100-1159	2
1200-1259	2
1300-1359	2
1400-1459	1
1500-1559	2
1600-1659	2
1700-1759	2
1800-1859	2
1900-1959	2
2000-2059	0
2100-2159	0
2200-2259	0
2300-2359	0
Total	29

Summary by Month (ACCDATE)

January	4
February	3
March	2
April	2
May	1
June	3
July	2
August	2
September	3
October	1
November	3
December	3
Total	29

Summary by Day of Week (DAY)

Sunday (01)	4
Monday (02)	6
Tuesday (03)	6
Wednesday (04)	1
Thursday (05)	4
Friday (06)	6
Saturday (07)	2
Total	29

Surface Condition (SURFCOND)

Dry (01)	17
Wet (02)	8
Icy/slushy (03)	3
Snowy (04)	0
Muddy (05)	0
Debris(06)	1
Other (88)	0
Unknown (99)	0
Total	29

Pedestrian (PED)

(Y)	1

Accident Class (ACCLASS)

	Totals
Non-collision (00)	0
Collision with other motor vehicle (01)	19
Collision with fixed object (02)	5
Collision with pedestrian (03)	0
Collision with pedacycle -bicycle (04)	4
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	1
Collision with other object (88)	0
Collision -unknown (99)	0
Total	29

animal coll.-PDO,clear,dry,dark,single-vehicle,Dec.

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Single-Veh.	Fatalities	Injuries	Animals	Total	
Daylight (01)	3	0	8	0		23 (10 inj.)
Dawn (02)	0	0	0	0		1
Dusk (03)	0	0	0	0		2
Dark-lighted (04)	0	0	0	0		0
Dark-not lighted (05)	2	0	0	2		3
Unknown (99)	0	0	0	0		0
Totals	5	0	8	2		29 (10 inj.)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	22
On roadway -parking/driveway access (12)	0
On roadway -interchange (13)	0
On roadway -bridge (14)	1
On roadway -workzone (15)	0
On roadway -other (16)	5
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	0
Off roadway -median (24)	0
Off roadway -other (25)	1
Unknown (99)	0
Total	29

Weather (WEATHER)

Clear (01)	17
Cloudy (02)	7
Rain (03)	4
Snow (04)	0
Fog, smog, smoke (05)	1
Sleet, hail, freezing rain (06)	0
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	0
Unknown (99)	0
Total	29

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	6
Head on (01)	3
Rear end (02)	2
Angle (03)	15
Sideswipe -opposing (04)	1
Sideswipe -overtaking (05)	1
Other (88)	1
Unknown (99)	0
Total	29

Road Character (ROADCHAR)

Straight & level (01)	4
Straight on grade (02)	0
Curved & level (03)	10
Curved on grade (04)	15
Unknown (99)	0
Total	29

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	24
Guardrail/Barrier (01)	1
Rock/Stone Wall (02)	0
Pole (03)	2
Tree/Shrub (04)	1
Culvert End Wall (05)	0
Drainage Structure (06)	0
Bridge Structure (07)	0
Sign (08)	0
Barricade (09)	0
Boulder (10)	0
Ditch (11)	1
Backslope (12)	0
Other fixed object (88)	0
Total	29

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	0
Exceeding Speed Limit (A05)	1
Too Fast for Conditions (A06)	1
Ped/Bike Contributing (D**)	0
Animal Contributing (B06)	1
*Driver Failed to Yield R/W (A03)	15

Number of Vehicles Involved (UNITU)

Single Vehicle (1)	5
Two-Vehicle (2)	24
more than 2 Vehicles (>2)	0
Total	29

Problems:

- Because the intersection is located on a curve, sight distance is limited for drivers approaching from the north and south on Beach Drive.
- Many vehicles straddle the lane line on the south approach, making it difficult for drivers stopped on West Beach to determine whether the northbound traffic is turning right or continuing through on Beach Drive.
- The yield sign is undersized.
- There is no functional street lighting to illuminate the raised channelization or to aid in identification of the intersection during low light conditions.
- The guidance signing at this intersection is not adequate.
- There is not advance warning of the intersection on the north and south approaches.
- Pedestrian traffic has created trails in the dirt along this section of Beach Drive, indicating a need for developed pedestrian facilities.
- Sight distance is limited by vegetation on the northeast corner as well as on the inside of the curve.

Recommendations:

The recommended improvements for this site are shown in **FIGURE 7-1.3**.

- This intersection currently meets the MUTCD warrants for muliway stop signs and should be converted into a three-way stop by adding stop signs and stop bars on the north and south approaches. Adjust the mounting height of the existing 30" x 30" stop sign on the West Beach approach for better visibility. In this case it is desirable for base of the sign to be six feet above the road surface. Control the northbound right ramp with a standard-sized yield sign. Replace the undersized yield sign on the right ramp of the east approach with a standard-sized sign.

  Estimated Cost: $ 1,100

- Trim the vegetation along the shoulder of the road on all approaches. Remove all trees located within 10 feet of the road on all approaches. Keep the grass mowed close to the ground near the intersection.

  Estimated Cost: $ 3,000

- Install stop ahead warning signs on all approaches.

  Estimated Cost: $ 450

- Install advance guidance signing on all approaches.

  Estimated Cost: $ 900

- Modify the gate as indicated in the Parkwide Recommendations (see **FIGURE 2-7**.)

  Estimated Cost: $ 400

- Install a lane use sign on the south approach.

  Estimated Cost: $ 200

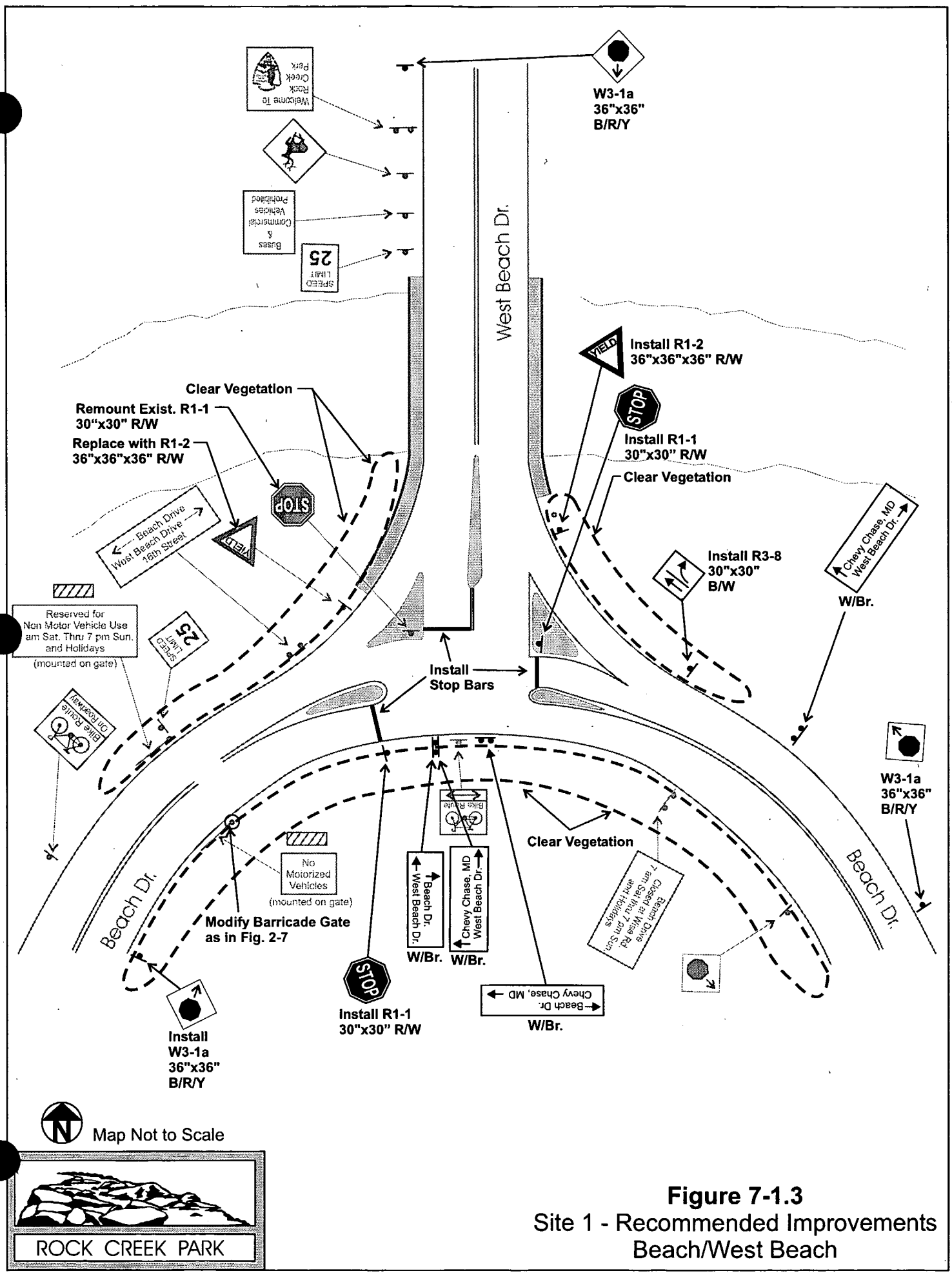


Figure 7-1.3
Site 1 - Recommended Improvements
Beach/West Beach

- Consider installing a paved pedestrian/bicycle trail along this section of Beach Drive. The best location for the path with respect to environmental impacts appears to be on the east side of Beach Drive.

  Estimated Cost: Unknown

Total Estimated Cost: $8,150

7.4.2 Site 2 - Wise Road Curve and Intersection of Wise Road/Chestnut Street and Oregon Avenue

Site Description:

This site includes a curve at the west end of Wise Road as well as the adjacent intersection of Wise Road with Chestnut Street and Oregon Avenue. The intersection is located along the northwestern edge of the park, as shown in **FIGURE 7-0**. Oregon Avenue runs north and south, while Chestnut Street approaches the intersection from the west. Wise Road extends to the east, with the curve beginning approximately 100 yards from the intersection. There are no pedestrian facilities at this site, but an asphalt bicycle path leads into the woods from the southeast corner of the intersection. There is a bus stop on the north leg of Oregon Avenue, and a horse path crosses Wise Road just east of the curve. **FIGURE 7-2.1** is a sketch of the site and **FIGURE 7-2.2** is a collection of site photos.

In addition to three bi-directional chevron signs on the outside of the curve, there is a "slippery when wet" sign on the west approach to the curve. A speed limit of 25 mph is in effect throughout the site, and 25 mph was determined to be the safe travel speed for the curve. There are numerous trees alongside the road which have been scarred by vehicle impacts.

All legs of the intersection are controlled by stop signs. One lane of traffic enters the intersection from each direction, with the south and east legs seeing the heaviest use. Field observations indicate that most drivers tend to roll through the intersection rather than coming to a complete stop. Those who do stop tend to do so in front of the marked stop bar.

Accident History:

A total of 19 accidents were reported at this site during the three year period, 1993 through 1995. There were no fatal accidents at this location. Five (26%) of the 19 accidents occurring at the site resulted in injuries. Time of accident occurrence is sporadic around the clock, with peaks around 10:00-11:00 a.m. and 2:00-5:00 p.m. Accidents were more prevalent Friday through Sunday; and the highest number of accidents occurred during the months of November and December. A complete summary of accident statistics at Site 2 is shown in **TABLE 7-2**. Notable characteristics of accidents occurring at this site are as follows:

- An average of six accidents occurred at this location each year. The accident rate was 1.87 accidents/MVE and the severity rate was 1.26.
- Accident occurrence has decreased for the past three years, with only one accident reported in 1995. No injuries were reported at the site in 1994 or 1995.
- Vehicle involvement was split between single-vehicle accidents (58%), and two-vehicle accidents (42%).
- 11 (58%) of the 19 accidents were collisions with fixed objects, and the remainder were collisions with another motor vehicle.
- Of the 11 fixed object collisions: a tree or shrub was the most common object struck (eight accidents), followed by one collision each with a guardrail/barrier and pole.
- Of the eight motor vehicle collisions: three were head-on collisions, two each were rear-end and sideswipe collisions between opposing vehicles, and one was a sideswipe by an overtaking vehicle.
- 15 (79%) of the accidents reported at this site occurred when roads were wet, and 12 of these happened while it was raining.

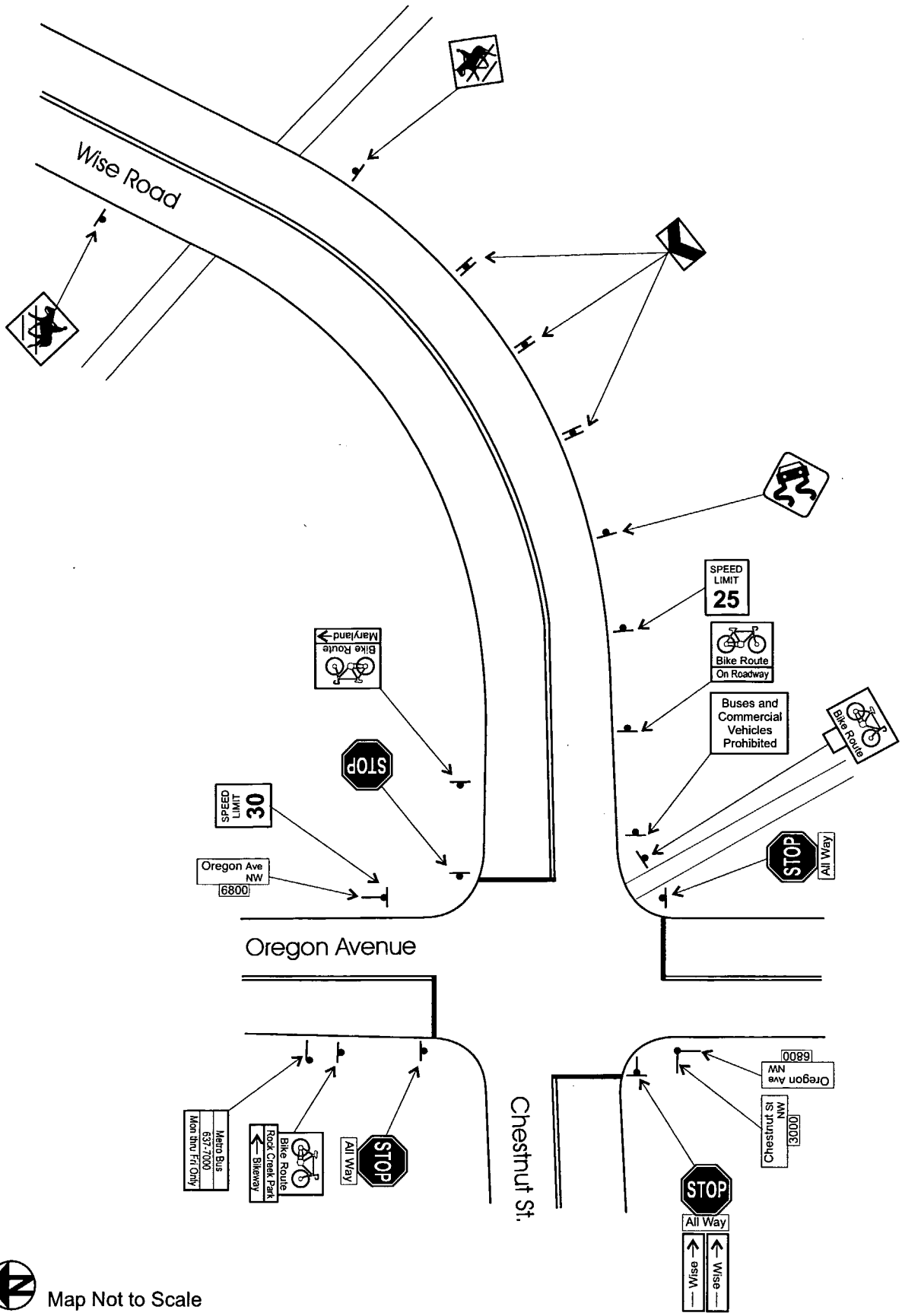
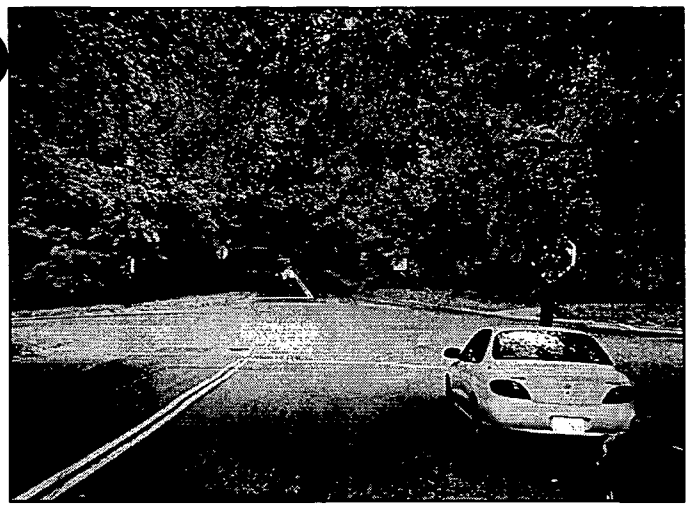


Figure 7-2.1
Site 2 - Existing Conditions
Wise Road/Oregon



Low tree branches block the driver's view of the stop sign on the west approach to the intersection of Wise and Oregon. Vegetation blocks the view of other signs on the east approach.

The three chevron signs tend to blend into the vegetation behind the signs. It is recommended that additional chevrons be added at this site so that 3 signs can be seen on both approaches to the curve. All of the chevrons should be oversized for better visibility.

A horse trail crossing is located on the east side of the curve on Wise Road. The lack of adequate sight distance created by the curve makes the location of this crossing undesirable. The crossing should be relocated farther to the east along the tangent section of Wise Road.

The drivers approaching this curve from the east can only see one chevron sign prior to the curve. The trees on the inside of the curve block the driver's view of the other chevron sign.

ROCK CREEK PARK

Figure 7-2.2
Site 2 - Photo Page
Wise Road/Oregon

TABLE 7-2
Rock Creek Park Accident Information
Site #2 - Intersection Wise Rd. & Oregon Ave./Chestnut St. + segment of Wise Rd.

site2sum.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	0	0	0	0
(Number of Fatalities)	0	0	0	0
Injury Accidents	5	0	0	5
(Number of Injuries)	7	0	0	7
P.D.O. Accidents	9	4	1	14
Totals	14	4	1	**19**

Summary by Hour (TIMEACC)

000-059	1
100-159	0
200-259	1
300-359	0
400-459	0
500-559	0
600-659	0
700-759	0
800-859	2
900-959	0
1000-1059	3
1100-1159	1
1200-1259	1
1300-1359	1
1400-1459	2
1500-1559	2
1600-1659	2
1700-1759	1
1800-1859	0
1900-1959	0
2000-2059	1
2100-2159	0
2200-2259	0
2300-2359	1
Total	19

Summary by Month (ACCDATE)

January	0
February	1
March	1
April	2
May	0
June	0
July	0
August	0
September	1
October	2
November	7
December	5
Total	19

Summary by Day of Week (DAY)

Sunday (01)	3
Monday (02)	2
Tuesday (03)	2
Wednesday (04)	2
Thursday (05)	1
Friday (06)	5
Saturday (07)	4
Total	19

Surface Condition (SURFCOND)

Dry (01)	2
Wet (02)	15
Icy/slushy (03)	0
Snowy (04)	1
Muddy (05)	0
Debris(06)	0
Other (88)	0
Unknown (99)	1
Total	19

Pedestrian (PED)

(Y)	0

Accident Class (ACCLASS)

	Totals
Non-collision (00)	0
Collision with other motor vehicle (01)	8
Collision with fixed object (02)	11
Collision with pedestrian (03)	0
Collision with pedacycle -bicycle (04)	0
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	0
Collision with other object (88)	0
Collision -unknown (99)	0
Total	19

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Single-Veh	Fatalities	Injuries	Animals	Total	
Daylight (01)	8	0	3	0	13	(4 inj.)
Dawn (02)	0	0	0	0	0	
Dusk (03)	0	0	0	0	1	
Dark-lighted (04)	1	0	0	0	1	
Dark-not lighted (05)	2	0	1	0	3	(2 inj.)
Unknown (99)	0	0	1	0	1	(1 inj.)
Totals	11	0	5	0	19	(7 inj.)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	1
On roadway -parking/driveway access (12)	0
On roadway -interchange (13)	0
On roadway -bridge (14)	0
On roadway -workzone (15)	0
On roadway -other (16)	14
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	1
Off roadway -median (24)	0
Off roadway -other (25)	2
Unknown (99)	1
Total	19

Weather (WEATHER)

Clear (01)	0
Cloudy (02)	4
Rain (03)	12
Snow (04)	1
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	0
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	1
Unknown (99)	1
Total	19

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	11
Head on (01)	3
Rear end (02)	2
Angle (03)	0
Sideswipe -opposing (04)	2
Sideswipe -overtaking (05)	1
Other (88)	0
Unknown (99)	0
Total	19

Road Character (ROADCHAR)

Straight & level (01)	2
Straight on grade (02)	4
Curved & level (03)	7
Curved on grade (04)	6
Unknown (99)	0
Total	19

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	8
Guardrail/Barrier (01)	1
Rock/Stone Wall (02)	0
Pole (03)	1
Tree/Shrub (04)	8
Culvert End Wall (05)	0
Drainage Structure (06)	0
Bridge Structure (07)	0
Sign (08)	0
Barricade (09)	0
Boulder (10)	0
Ditch (11)	0
Backslope (12)	0
Other fixed object (88)	1
Total	19

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	0
Exceeding Speed Limit (A05)	0
Too Fast for Conditions (A06)	7
Ped/Bike Contributing (D**)	0
Animal Contributing (B06)	0
*Driver disregarded traffic signs, signals, c	2

Number of Vehicles Involved (UNITU)

Single Vehicle (1)	11
Two-Vehicle (2)	8
more than 2-vehicles (>2)	0
Total	19

- ♦ Five (26%) accidents occurred at night, dawn or dusk.
- ♦ No accidents were reported as involving animals, pedestrians, or bicyclists at this location.
- ♦ The most common driver-related contributing factor was "too fast for conditions" - seven accidents (37%).

Problems:

- There are no advance curve warning signs.
- The chevrons in the curve blend in with the foliage. Only one chevron sign can be seen from the east approach.
- This curved segment of road is very dark due to the full canopy of trees.
- There are old street light standards along Wise Road, but they do not function and therefore serve only as fixed objects.
- The stopping sight distance is less than 150 feet on the east approach to the curve and 200 feet on the west approach.
- At the intersection, three of the four stop signs are obstructed by foliage. The stop sign on Wise Road does not have a supplementary "all way" panel.

Recommendations:

The recommended improvements for Site 2 are shown in **FIGURE 7-2.3**.

- ■ Trim vegetation and remove trees located within 10 feet of roadway on the outside of the curve. Remove all vegetation on the inside of the curve.

  Estimated Cost: $ 2,000

- ■ Remove the "slippery when wet" warning sign and install turn warning signs on both approaches.

  Estimated Cost: $ 500

- ■ Remove the existing chevrons and replace with larger bi-directional chevron signs to increase the sign visibility. Use five bi-directional chevrons rather than three to better delineate the curve.

  Estimated Cost: $ 2,400

- ■ Relocate the horse crossing signs and trail to the tangent section of road east of the curve.

  Estimated Cost: $ 2,000

- ■ Remove the street light standards at this site.

  Estimated Cost: $ 2,000

- ■ Cut the vegetation on the east, west, and south approaches to the intersection to improve visibility of the stop signs.

  Estimated Cost: $ 1,500

- ■ Install an "all way" panel on the stop sign for the east approach to the intersection.

  Estimated Cost: $ 100

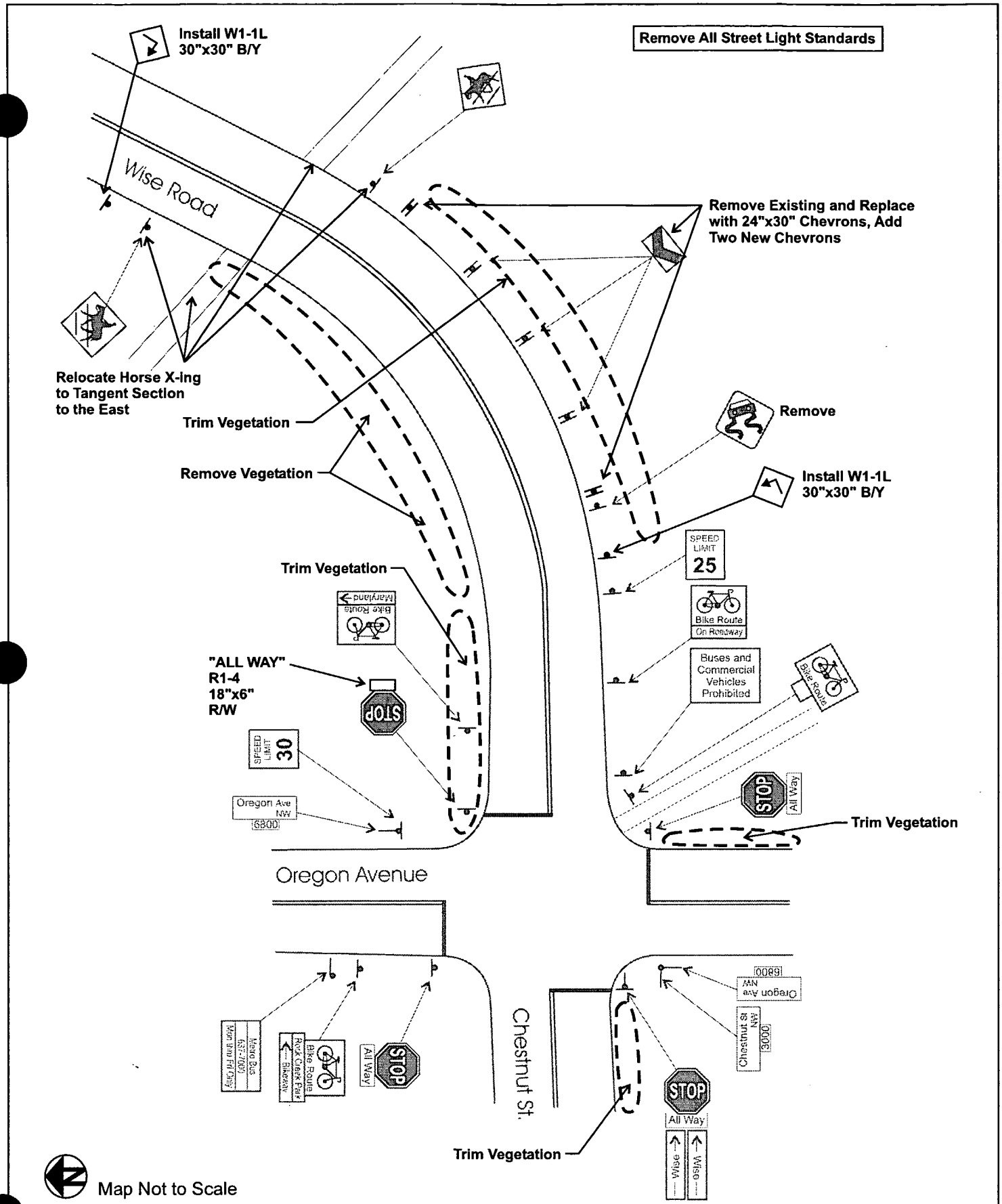


Figure 7-2.3
Site 2 - Recommended Improvements
Wise Road/Oregon

- Conduct a pavement skid resistance test on this site. It the skid resistance is determined to be unacceptable, then Wise Road should receive a chip seal type overlay to increase the skid resistance.

  Estimated Cost: Unknown

Total Estimated Cost: $10,500

7.4.3 Site 3 - Intersection of Beach Drive and Broad Branch Road

Site Description:
This site encompasses the "Y"-shaped intersection of Beach Drive and Broad Branch Road. As shown in **FIGURE 7-0**, the intersection is located near the western edge of the Park. This segment of Beach Drive, although curved, runs essentially north and south, with Broad Branch Road approaching from the west. The south and west legs of the intersection consist of bridges spanning Rock Creek and Broad Branch, respectively. Picnic Grove 2 lies immediately west of the intersection, and Glover Road intersects Broad Branch Road slightly further to the west.

Picnic Grove 2 serves as a trail head for an asphalt pedestrian and bicycle path that runs south along Rock Creek. There is also a pedestrian/bicycle crossing on the west leg of the intersection which leads from Picnic Grove 2 to a system of trails on the northwest corner of the intersection. All of the bridges at this location have adjacent sidewalks. A site drawing and site photos are presented in **FIGURES 7-3.1** and **7-3.2**.

There are six raised medians at this site, including two near the entrance of the picnic grove. The north and west approaches each consist of one lane for through traffic and a right turn ramp, while the south approach is divided into a through lane and a left turn lane. Nearly half of the drivers observed turning left on to Broad Branch from Beach Drive encroached on the through lane. Traffic turning left from Broad Branch is controlled by a stop sign and right-turning traffic is controlled by a yield sign. The north leg of this intersection is closed to motor vehicles on weekends by means of a permanent barricade gate. Peak hour turning movement counts for this site can be found in Appendix A.

Accident History:
A total of 15 accidents were reported at Site 3 during the three-year study period. No fatalities were reported at this intersection. Only three (20%) of the 15 accidents at the site caused injuries. The time of accident occurrence is sporadic throughout the day, with a small peak between 2:00 and 4:00 p.m. Tuesday was the busiest day of the week for accidents at this site. There was a slight peak in accident occurrence in May and December. A complete summary of accident statistics at Site 3 is shown in **TABLE 7-3**. Notable characteristics of the accidents occurring at this intersection are listed below:

- The average accident frequency was five accidents per year, with an accident rate of 0.98 accidents/MVE and a severity rate of 1.20.
- 12 (80%) of the 15 accidents involved two or more vehicles, 11 of these were two-vehicle accidents.
- Three (20%) of the accidents were collisions with fixed objects..
- Angle collisions accounted for 55% of the collisions between vehicles, followed by rear-end collisions (36%).
- The majority of accidents (10) occurred on dry roads, while two occurred when the roadway surface was icy or slushy.
- Four (27%) accidents occurred during low light conditions (night, dawn or dusk).
- No accidents were reported involving animals or pedestrians.
- One reported accident involved a collision with a bicycle; one injury resulted from this accident.

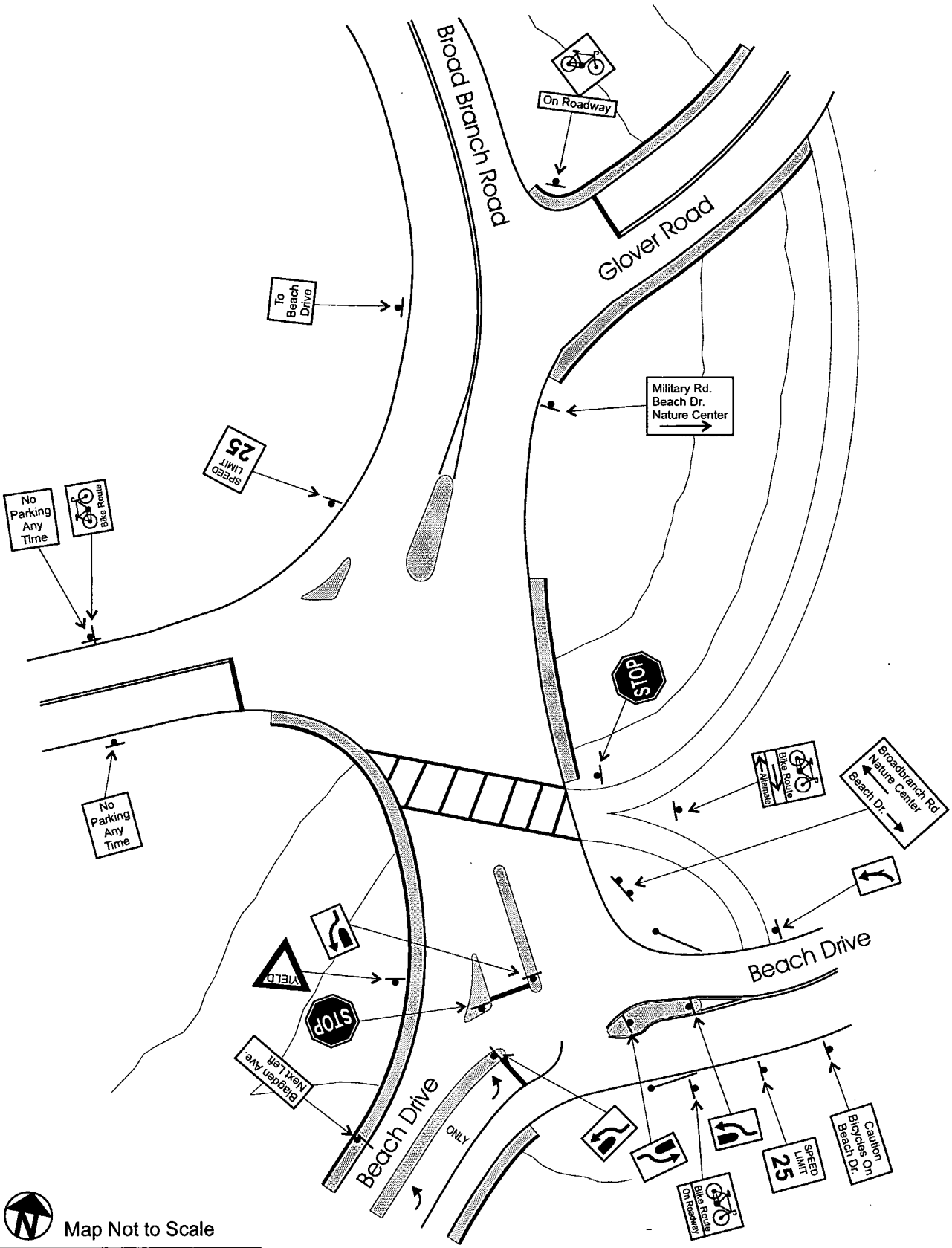
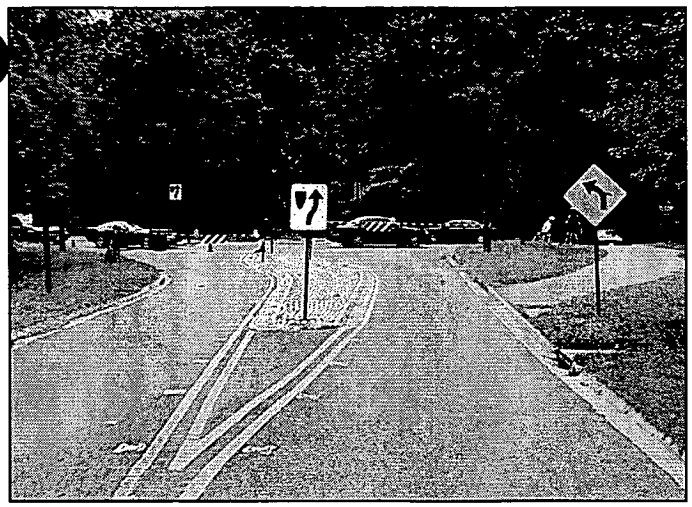
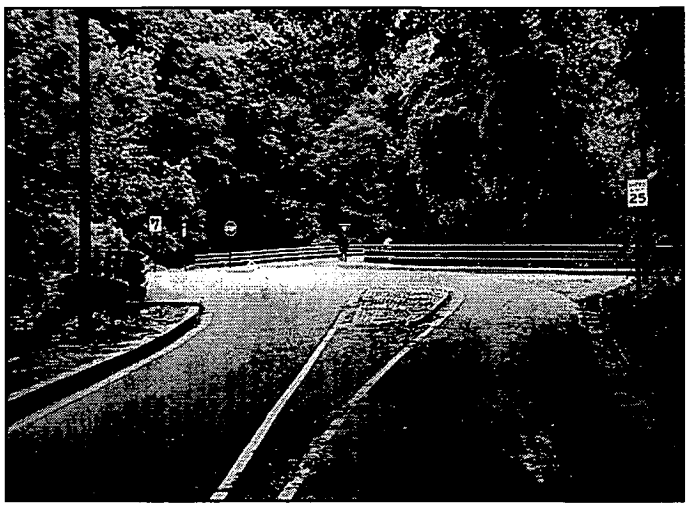


Figure 7-3.1
Site 3 - Existing Conditions
Beach/Broad Branch



This is a view of the intersection from the north approach. Beach Drive north of the intersection was closed to traffic when this photo was taken as evidenced by the barricade gates. The intersection has raised channelization and plowable raised pavement markers that help guide the driver.



This photo shows the west approach to the intersection. Notice the entrance to the picnic parking area on the right. The driver has a clear view of the Beach Drive intersection when approaching on Broad Branch.

The south approach to the intersection has a designated left turn lane and a through lane. Drivers tend to straddle the center lane line when making left turns which pushes through vehicles into the far right curb.

There is a high use pedestrian crossing located adjacent to the intersection on the west approach. Vehicles stopping for pedestrians or bicyclists back traffic up into the intersection.

ROCK CREEK PARK

Figure 7-3.2
Site 3 - Photo Page
Beach Dr./Broad Branch

TABLE 7-3
Rock Creek Park Accident Information
Site #3 - Int. Beach Dr. & Broad Branch Rd.

site3sum.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	0	0	0	0
(Number of Fatalities)	0	0	0	0
Injury Accidents	0	2	1	3
(Number of Injuries)	0	2	1	3
P.D.O. Accidents	7	1	4	12
Totals	7	3	5	**15**

Summary by Hour (TIMEACC)

000-059	0
100-159	0
200-259	0
300-359	1
400-459	0
500-559	0
600-659	0
700-759	3
800-859	0
900-959	1
1000-1059	1
1100-1159	0
1200-1259	0
1300-1359	0
1400-1459	3
1500-1559	2
1600-1659	0
1700-1759	0
1800-1859	0
1900-1959	1
2000-2059	1
2100-2159	1
2200-2259	0
2300-2359	1
Total	15

Summary by Month (ACCDATE)

January	2
February	1
March	0
April	0
May	3
June	1
July	1
August	1
September	1
October	1
November	1
December	3
Total	15

Summary by Day of Week (DAY)

Sunday (01)	0
Monday (02)	3
Tuesday (03)	5
Wednesday (04)	2
Thursday (05)	1
Friday (06)	3
Saturday (07)	1
Total	15

Surface Condition (SURFCOND)

Dry (01)	10
Wet (02)	1
Icy/slushy (03)	2
Snowy (04)	0
Muddy (05)	0
Debris(06)	1
Other (88)	0
Unknown (99)	1
Total	15

Pedestrian (PED)

(Y)	0

Accident Class (ACCLASS) Totals

Non-collision (00)	1
Collision with other motor vehicle (01)	10
Collision with fixed object (02)	3
Collision with pedestrian (03)	0
Collision with pedacycle -bicycle (04)	1
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	0
Collision with other object (88)	0
Collision -unknown (99)	0
Total	15

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Single-Veh.Fatalities		Injuries	Animals	Total
Daylight (01)	0	0	2	0	10 (2 inj.)
Dawn (02)	0	0	0	0	0
Dusk (03)	1	0	1	0	1 (1 inj.)
Dark-lighted (04)	0	0	0	0	0
Dark-not lighted (05)	1	0	0	0	3
Unknown (99)	1	0	0	0	1
Totals	3	0	3	0	15 (3 inj.)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	7
On roadway -parking/driveway access (12)	0
On roadway -interchange (13)	1
On roadway -bridge (14)	0
On roadway -workzone (15)	0
On roadway -other (16)	4
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	3
Off roadway -median (24)	0
Off roadway -other (25)	0
Unknown (99)	0
Total	15

Weather (WEATHER)

Clear (01)	11
Cloudy (02)	1
Rain (03)	1
Snow (04)	0
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	1
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	0
Unknown (99)	1
Total	15

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	2
Head on (01)	0
Rear end (02)	4
Angle (03)	6
Sideswipe -opposing (04)	1
Sideswipe -overtaking (05)	0
Other (88)	1
Unknown (99)	1
Total	15

Road Character (ROADCHAR)

Straight & level (01)	2
Straight on grade (02)	0
Curved & level (03)	12
Curved on grade (04)	1
Unknown (99)	0
Total	15

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	11
Guardrail/Barrier (01)	2
Rock/Stone Wall (02)	0
Pole (03)	0
Tree/Shrub (04)	1
Culvert End Wall (05)	0
Drainage Structure (06)	1
Bridge Structure (07)	0
Sign (08)	0
Barricade (09)	0
Boulder (10)	0
Ditch (11)	0
Backslope (12)	0
Other fixed object (88)	0
Total	15

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	1
Exceeding Speed Limit (A05)	0
Too Fast for Conditions (A06)	2
Ped/Bike Contributing (D**)	0
Animal Contributing (B06)	0
*Failed to yield R/W (A03)	3
*Failed to give full time & attention (A16)	1
*Followed too closely (A09)	1

Number of Vehicles Involved (UNITU)

Single Vehicle (1)	3
Two-Vehicle (2)	11
more than 2-vehicles (>2)	1
Total	15

- ♦ The most common contributing factor listed was "driver failed to yield right of way" (three accidents), followed by "too fast for conditions" (two accidents).
- ♦ One accident listed "driver under the influence of alcohol" as a contributing factor.

Problems:

- Because of the curved nature of Beach Drive at this location, drivers on the north and south approaches have difficulty determining who has the right-of-way. Through traffic on the north approach tends to yield to left turning traffic on the south approach.
- Traffic on the south approach has difficulty staying in the designated lanes. The left turning traffic tends to drift into the thru lane forcing thru traffic into and over the right curb.
- Vehicle speeds are excessive on the north and south approaches.
- There are several "Keep Right" signs missing from the ends of the raised medians.
- The pedestrian crossing on the west leg is close to the intersection and creates problems for pedestrians/bikes as well as for vehicles that back up into the intersection when yielding. Rear-end and angle accident potential is great at this intersection.

Recommendations:

The recommended improvements for this site are shown in **FIGURE 7-3.3**.

- ■ Install advance guidance signing for all approaches.

  Estimated Cost: $ 900

- ■ On the median on the west approach, rotate the existing "Keep Right" sign to face the opposite direction and install another "Keep Right" sign on the other end of the median.

  Estimated Cost: $ 300

- ■ Install candlestick delineators between the through and left turn lanes on the south approach to help maintain the necessary vehicle separation on this approach to the intersection.

  Estimated Cost: $ 600

- ■ Modify the gate as shown in **FIGURE 2-7**.

  Estimated Cost: $ 2,500

- ■ Remove the two raised medians at the entrance to Picnic Grove 2. These medians are not essential for channelization and do not have any apparent impact on vehicle speeds. These median islands are fixed objects that do not need to be in the roadway.

  Estimated Cost: $ 3,000

Total Estimated Cost: $ 7,300

Long-Term Recommendation:

- ■ This intersection currently meets the MUTCD volume warrants but not the side street delay requirements for a multiway stop configuration. This intersection should be monitored in the future and when the warrants are met convert the intersection to a three-way stop. Install stop ahead warning signs on all approaches when the three-way stop is implemented.

  Estimated Cost: $ 3,200

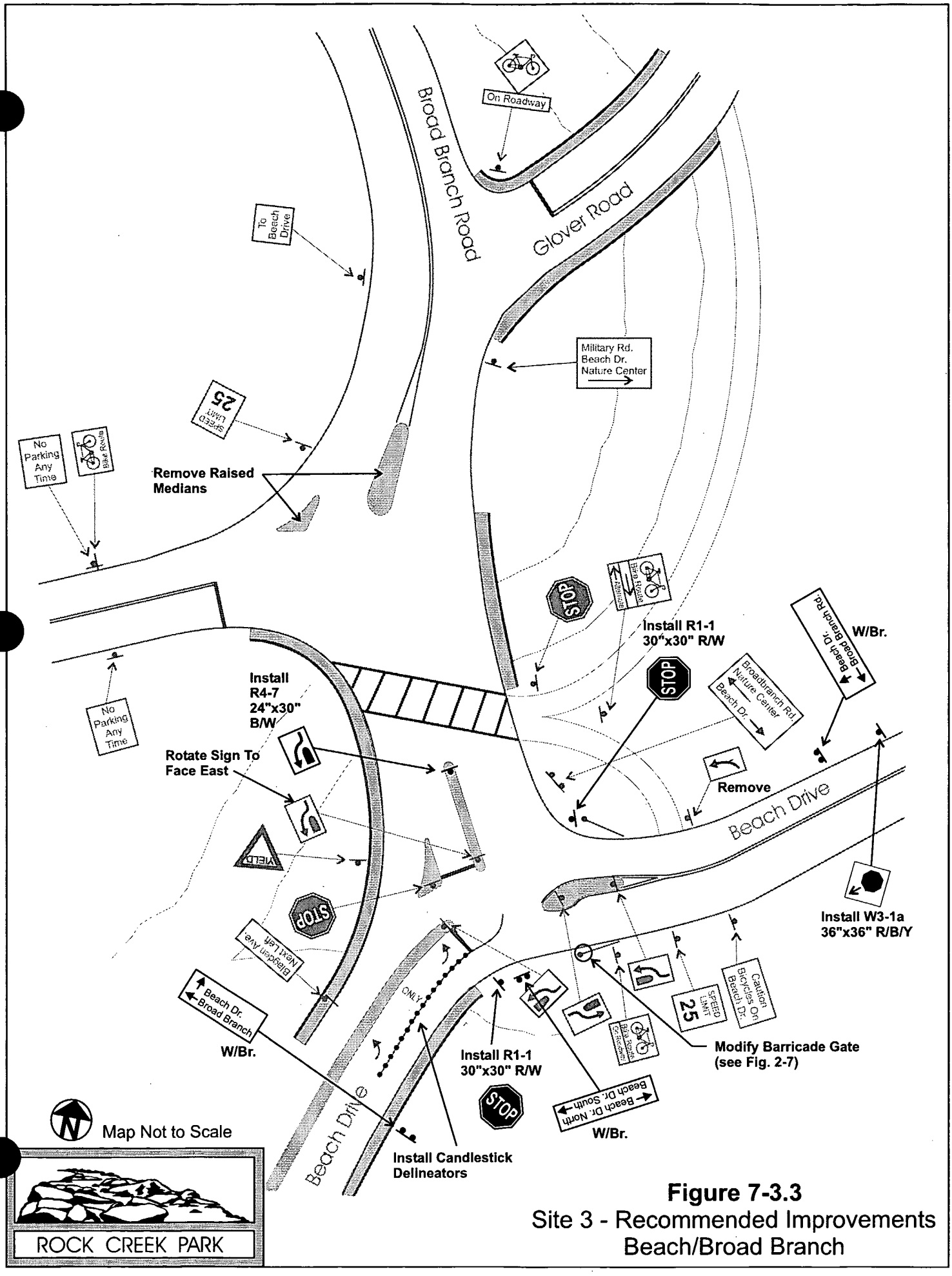


Figure 7-3.3
Site 3 - Recommended Improvements
Beach/Broad Branch

7.4.4 Site 4 - Intersection of Beach Drive and Blagden Avenue

Site Description:
This site is comprised of the "Y" intersection formed at the junction of Blagden Avenue with Beach Drive. The intersection is located immediately south of Site 3, as indicated in **FIGURE 7-0**. The intersection is located on a curved section of Beach Drive, which constitutes the north and south legs. Blagden Avenue approaches from the east. The north approach crosses Rock Creek over a bridge with adjoining sidewalks. A trail leads into the woods on the northeast corner of intersection. There are no other pedestrian or bicycle facilities at this location. **FIGURE 7-4.1** is a drawing of the site, and **FIGURE 7-4.2** shows photos of the intersection.

Four raised medians channelize traffic through the intersection of Beach Drive and Blagden Avenue. The south approach has one lane for through traffic and a right turn ramp. The north approach consists of a through lane and a left turn lane. The left turn lane and right turn ramp on the east approach are controlled by a stop sign and a yield sign, respectively. During the field observation, nearly 50 percent of drivers rolled through the stop sign rather than coming to a full stop. Appendix A contains peak hour turning movement counts for this intersection.

Accident History:
A total of 28 accidents were reported at this site during the study period. One fatal accident occurred at the intersection in 1995, resulting in one fatality and four injuries. Eight (28%) of the 29 accidents at the site resulted in injuries. The time of accident occurrence is fairly uniform between the hours of 6:00 a.m. and 8:00 p.m. More accidents occurred on Monday, Tuesday or Friday than any other days of the week. There was a slightly higher occurrence of accidents during the winter months (November through February) than during other months of the year. A complete summary of accident statistics at Site 4 is shown in **TABLE 7-4**. Some notable characteristics of the accidents occurring at this intersection are listed below:

- On average, nine accidents occurred at this site each year. The accident rate was 1.51 accidents/MVE and the severity rate was 1.29.
- Two-vehicle accidents (57%) were slightly more prevalent than single-vehicle (43%).
- Of the multi-vehicle accidents, 44% were angle collisions, followed by 25% rear-end collisions, and 19% sideswipes between opposing vehicles.
- Nine (32%) accidents involved collisions with fixed objects; the most common object struck was a tree or shrub (five accidents).
- 13 accidents occurred on dry roads, 12 occurred on wet roads, and two occurred while roadway surfaces were icy, slushy or snowy.
- Half of all accidents at the intersection occurred at night, dawn or dusk; three of the four injury accidents occurred during low-light conditions.
- One accident was an animal-vehicle collision.
- There were no accidents involving pedestrians or bicyclists.
- The most common contributing factor was excessive speed: driving "too fast for conditions" (six accidents) and "exceeding speed limit" (two accidents); followed by "driver failed to give full time and attention" and "driver disregarded traffic signs, signals or road markings" (three accidents each).
- One reported accident listed "driver under the influence of alcohol" as a contributing factor.

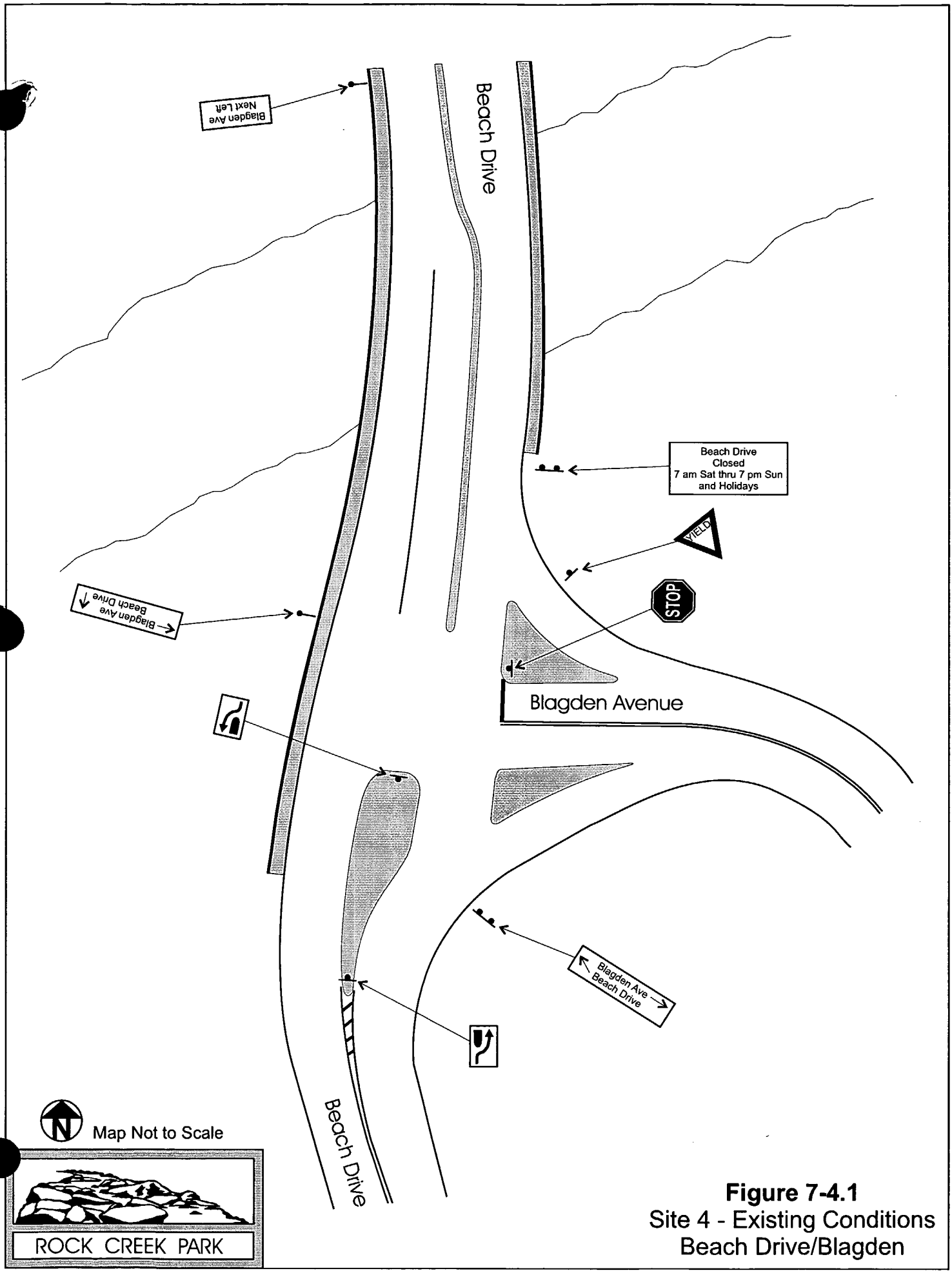
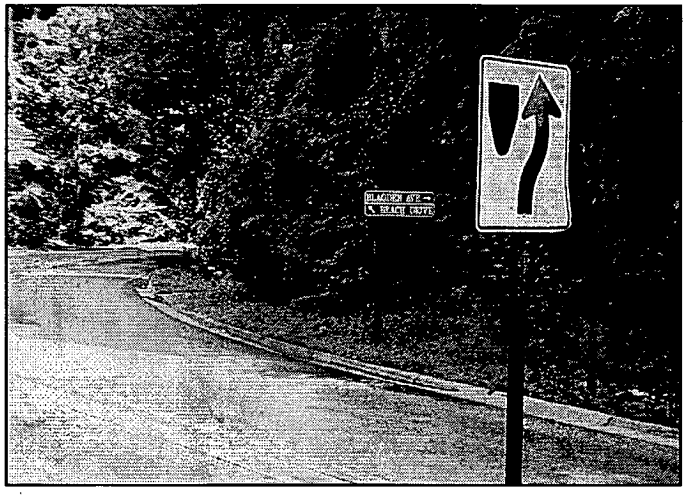


Figure 7-4.1
Site 4 - Existing Conditions
Beach Drive/Blagden

It is difficult to predict whether traffic approaching the intersection from the south is turning right or proceeding straight through the intersection until the last minute. Drivers waiting at the stop sign often misread the situation and pull out in front of through traffic causing angle accidents.

This photo shows the intersection from the east approach. The intersection has raised channelization. The east approach is controlled by a stop sign for left turning traffic and a yield sign for traffic turning right.

The driver's view of the stop ahead sign on the east approach is blocked by vegetation.



The guidance sign on the south approach is too small and located too close to the intersection to be effective.

ROCK CREEK PARK

Figure 7-4.2
Site 4 - Photo Page
Beach Drive/Blagden

TABLE 7-4
Rock Creek Park Accident Information
Site #4 - Int. Beach Dr. & Blagden Ave.

site4sum.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals	
Fatal Accidents	0	0	1	1	
(Number of Fatalities)	0	0	1	1	(+4 inj.)
Injury Accidents	2	1	1	4	
(Number of Injuries)	3	1	1	5	
P.D.O. Accidents	9	7	7	23	
Totals	11	8	9	**28**	

Summary by Hour (TIMEACC)

000-059	0
100-159	0
200-259	1
300-359	0
400-459	1
500-559	0
600-659	1
700-759	2
800-859	2
900-959	0
1000-1059	1
1100-1159	3
1200-1259	1
1300-1359	2
1400-1459	1
1500-1559	2
1600-1659	0
1700-1759	0
1800-1859	1
1900-1959	6
2000-2059	1
2100-2159	2
2200-2259	0
2300-2359	1
Total	28

Summary by Month (ACCDATE)

January	3
February	1
March	1
April	1
May	2
June	2
July	1
August	0
September	3
October	4
November	6
December	4
Total	28

Summary by Day of Week (DAY)

Sunday (01)	1
Monday (02)	1
Tuesday (03)	6
Wednesday (04)	5
Thursday (05)	7
Friday (06)	4
Saturday (07)	4
Total	28

Surface Condition (SURFCOND)

Dry (01)	13
Wet (02)	12
Icy/slushy (03)	1
Snowy (04)	1
Muddy (05)	0
Debris(06)	0
Other (88)	0
Unknown (99)	1
Total	28

Pedestrian (PED)

(Y)	0

Accident Class (ACCLASS)

	Totals
Non-collision (00)	1
Collision with other motor vehicle (01)	15
Collision with fixed object (02)	9
Collision with pedestrian (03)	0
Collision with pedacycle -bicycle (04)	0
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	1
Collision with other object (88)	1
Collision -unknown (99)	1
Total	28

animal coll.-PDO,clear,dry,dusk,single-vehicle,Sept.

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Single-Veh	Fatalities	Injuries	Animals	Total	
Daylight (01)	4	0	1	0		13 (1 inj.)
Dawn (02)	0	0	0	0		0
Dusk (03)	1	0	0	1		1
Dark-lighted (04)	1	0	0	0		2
Dark-not lighted (05)	6	1	3	0		11 (1fat,4+4 inj
Unknown (99)	0	0	0	0		1
Totals	12	1	4	1		28 (1fat,4+5 inj

Accident Location (ACCLOCTN)

On roadway -intersection (11)	11
On roadway -parking/driveway access (12)	0
On roadway -interchange (13)	1
On roadway -bridge (14)	0
On roadway -workzone (15)	0
On roadway -other (16)	11
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	1
Off roadway -median (24)	0
Off roadway -other (25)	1
Unknown (99)	3
Total	28

Weather (WEATHER)

Clear (01)	12
Cloudy (02)	4
Rain (03)	8
Snow (04)	1
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	2
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	0
Unknown (99)	1
Total	28

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	10
Head on (01)	2
Rear end (02)	4
Angle (03)	7
Sideswipe -opposing (04)	3
Sideswipe -overtaking (05)	0
Other (88)	1
Unknown (99)	1
Total	28

Road Character (ROADCHAR)

Straight & level (01)	2
Straight on grade (02)	0
Curved & level (03)	15
Curved on grade (04)	9
Unknown (99)	2
Total	28

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	18
Guardrail/Barrier (01)	0
Rock/Stone Wall (02)	0
Pole (03)	0
Tree/Shrub (04)	5
Culvert End Wall (05)	0
Drainage Structure (06)	0
Bridge Structure (07)	0
Sign (08)	1
Barricade (09)	0
Boulder (10)	0
Ditch (11)	1
Backslope (12)	0
Other fixed object (88)	3
Total	28

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	1
Exceeding Speed Limit (A05)	2
Too Fast for Conditions (A06)	6
Ped/Bike Contributing (D**)	0
Animal Contributing (B06)	0
*Failed to give full time & attention (A16)	3
*Disregarded traffic signs, signals or road	3
*Failed to yield R/W (A03)	2
*Improper turn (A07)	2

Number of Vehicles Involved (UNITU)

Single Vehicle (1)	12
Two-Vehicle (2)	16
more than 2-vehicles (>2)	0
Total	28

Problems:

- There is a lack of appropriate guidance signing on all three approaches.
- The alignment of the intersection makes it difficult to identify whether the north or west approach is the continuation of Beach Drive when approaching from the south.
- Significant traffic queues occur on Blagden Avenue during the morning peak.
- The vegetation on the east side of the south approach limits the view of approaching traffic for drivers attempting to enter Beach Drive from Blagden.
- The pedestrian facilities at this intersection are inadequate. There are sidewalks on the bridges but no connecting trails along the roadway.
- Traffic speeds are excessive on this section of Beach Drive.
- The stop ahead sign on the east approach is completely hidden by vegetation.
- There is no "Keep Right" sign on the ends of the raised median on the north approach.

Recommendations:

The recommended improvements for Site 4 are shown in **FIGURE 7-4.3**.

- This intersection meets the MUTCD warrants for multiway stop signs and should be converted to a three-way stop intersection. Eliminate the right ramps and reduce the curb radii on the northeast and southeast corners. These geometric modifications will tend to slow the traffic through this site. Widen the south approach to provide a full right turn lane that is at least 200 feet long.

  Estimated Cost: $50,000

- Install appropriate guidance signing on all approaches.

  Estimated Cost: $ 900

- Install stop ahead warning signs on the north and south approaches.

  Estimated Cost: $ 400

- Install a "Keep Right" sign on the median on the north approach.

  Estimated Cost: $ 200

- Clear the vegetation around the stop ahead sign on the east approach.

  Estimated Cost: $ 500

- Remove the vegetation that limits sight distance on the southeast corner of the intersection.

  Estimated Cost: $ 500

- Add a paved path along the west side of Beach leading south to Picnic Area #2.

  Estimated Cost: Unknown

Total Estimated Cost: $52,500

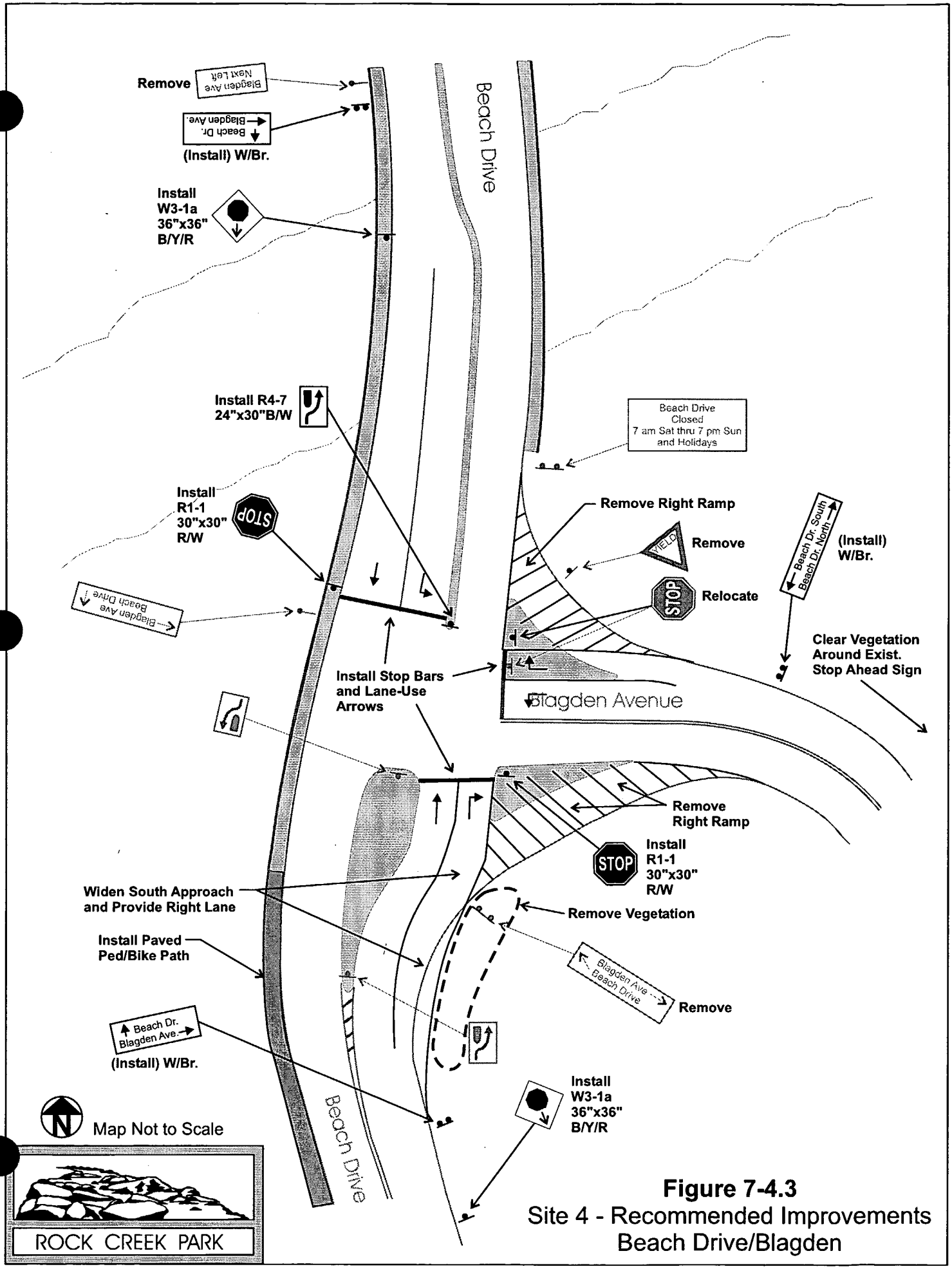


Figure 7-4.3
Site 4 - Recommended Improvements
Beach Drive/Blagden

7.4.5 Site 5 - Intersection of Beach Drive and Tilden Street/Park Road

Site Description:
This site includes the intersection of Beach Drive with Tilden Street and Park Road, as well as the curve on Beach Drive directly south of this intersection. As shown in **FIGURE 7-0**, the site is located just east of Pierce Mill. Beach Drive forms the north and south legs of the intersection, and Park Road is the east approach. Tilden Street approaches the intersection over a bridge from the west. Pierce Mill and Picnic Area #1 are located west of the bridge. Picnic Area #2 lies immediately north of the intersection.

There is sidewalk leading along the west side of Beach from Picnic Area #2, around the northwest corner of the intersection, and over the bridge to Pierce Mill. A paved bicycle/pedestrian path runs along the west bank of Rock Creek, crossing beneath the Tilden Street bridge. The site layout is presented in **FIGURE 7-5.1**, while **FIGURES 7-5.2A** and **7-5.2B** contains photos of the site.

One lane of traffic approaches the intersection on each of the four legs. The intersection is signalized and operates under fixed timing. There are signal warning signs on the north and south legs. Right turns on red are prohibited from the south and the west. Left turns are prohibited from the north and the west between 4:00 and 6:30 p.m. on weekdays. However, during a brief observation of the intersection during the afternoon peak, approximately one driver per cycle (100 seconds) disregarded a left turn restriction. Traffic at the signal tends to back up in the direction of highest demand during peak commuting hours. Peak hour turning movement counts for this intersection can be found in Appendix A.

There is a curve immediately south of the intersection. Through ball-bank testing, the safe travel speed for this curve was determined to be approximately 25 miles per hour. A sign south of the curve warns of stopped vehicles, and five bi-directional chevron warning signs are located on the outside of the curve.

Accident History:
A total of 61 accidents were reported at this site during the 1993-1995 study period. There were no fatalities reported at the intersection. 26 injuries resulted from 17 (28%) of the 61 accidents at the site. Accidents occurred during nearly every hour of the day, with the largest volume appearing between 4:00 and 5:00 p.m., and smaller peaks occurring during the 8:00 a.m., 11:00 a.m. and 6:00 p.m. hours. Monday and Friday were the days which had the most accidents reported during the week. Summer was the busiest time of year for accidents (May through July). A complete summary of accident statistics at Site 5 is shown in **TABLE 7-6**. Noteworthy characteristics of accidents occurring at this intersection are listed below:

- The average accident frequency was 20 per year, with an accident rate of 2.71 accidents/MVE and a severity rate of 1.28.
- 1995 (24 accidents) saw the highest accident occurrence in the three year history studied.
- The majority of accidents involved two vehicles (66%), 23% were single-vehicle accidents, and 11% had more than two vehicles involved.
- 48 of the 61 accidents were collisions with another motor vehicle; of these 17 were rear-end collisions, 11 were head-on collisions, nine were angle collisions, and nine were sideswipes between opposing vehicles.

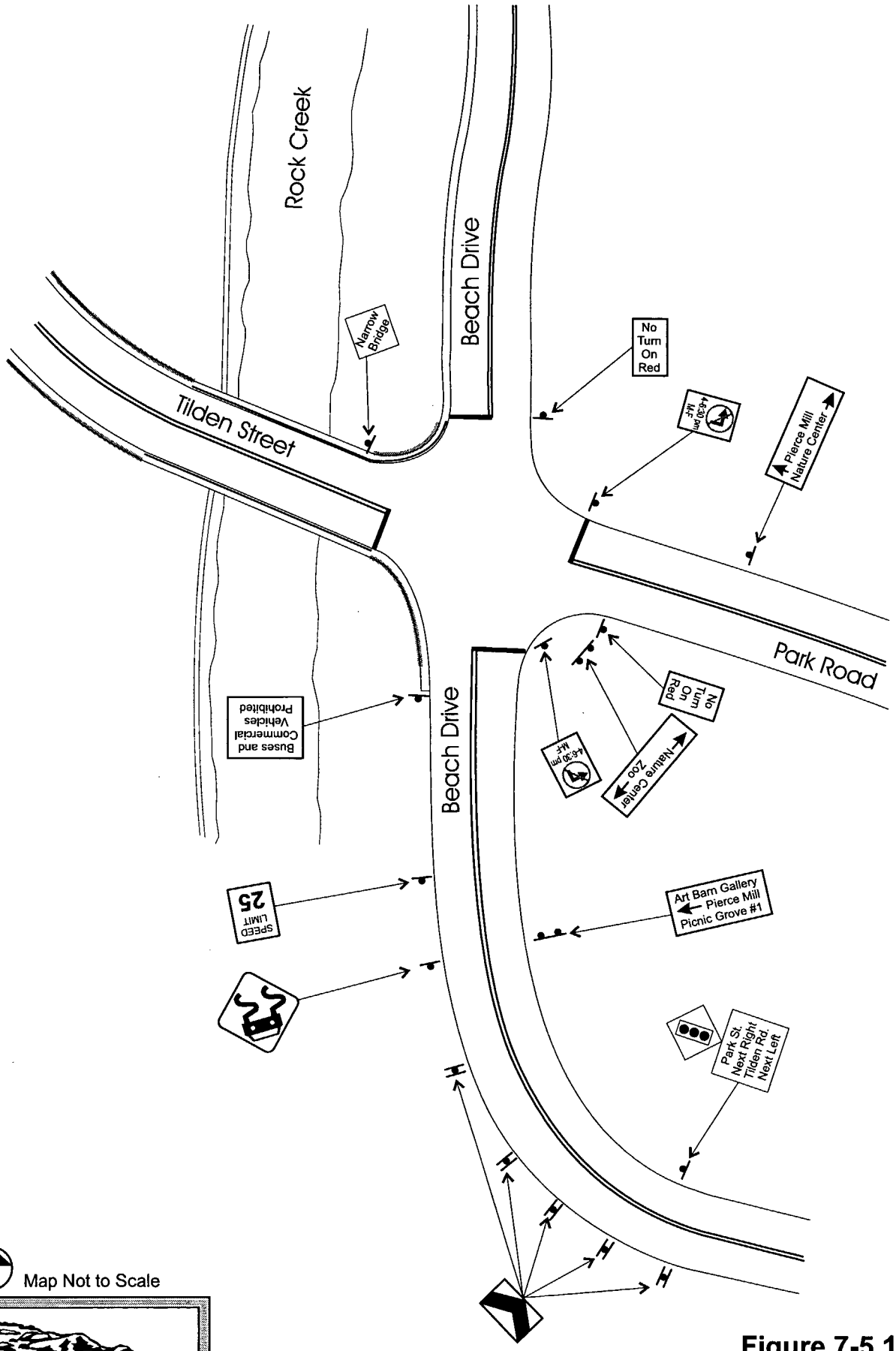
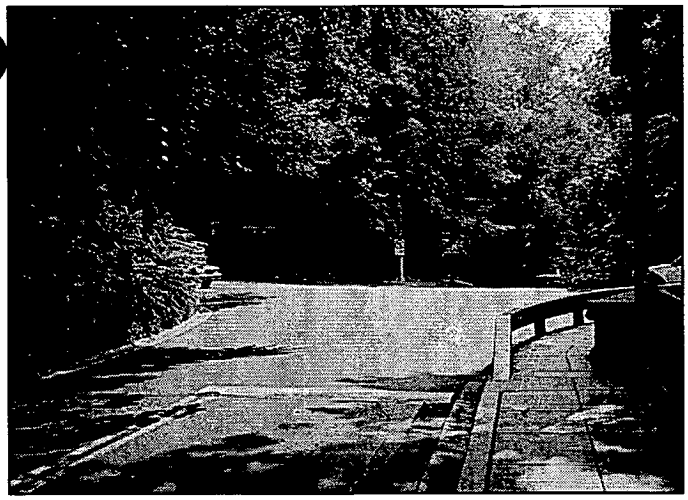
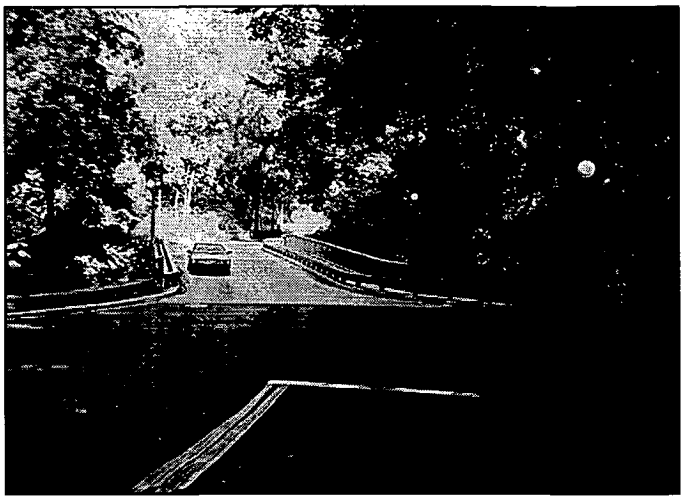


Figure 7-5.1
Site 5 - Existing Conditions
Beach Drive/Park Drive

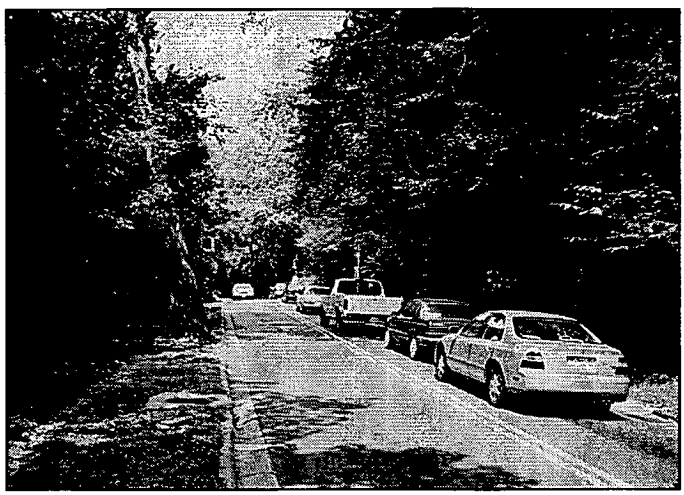


The guardrail on the northwest corner of the intersection is located directly above the curbline and shows evidence of repeated vehicle sideswipes. There is a concern that the turned down end of the guardrail could vault a vehicle if struck from the north.



This photo shows the east approach on the west side of Beach Drive and the Tilden Street bridge on the west approach. The vegetation on the northeast corner encroaches into the driving lane and should be pruned back.

Signal ahead warning signs are located on both the north and south approaches to the intersection. The access into the picnic area shown in this photo is recommended to be closed because it is located so close to the intersection.

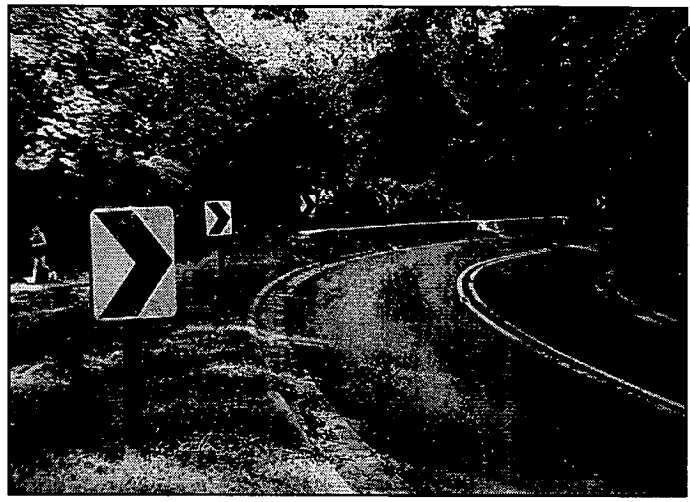


The traffic signal creates long traffic queues that extend south around the curve located south of the intersection. Notice the tree located just outside the curbline on the left in the photo. The tree shows evidence of repeated vehicle impacts.

ROCK CREEK PARK

Figure 7-5.2A
Site 5 - Photo Page 1
Beach Drive/Park/Tilden

This "Slippery When Wet" warning sign is the only warning provided prior to the curve when approaching from the north. Notice how the vegetation on the inside of the curve limits the sight distance.



Five chevron warning signs are used to delineate the curve. Notice the large gap between the 4th and 5th sign in the series. This gap should be filled with an additional chevron sign. Additional chevrons are recommended at both ends of the existing series of signs.

Although there is a paved path adjacent to this site bicyclists still use the roadway causing vehicles to hug the centerline through this curve.

This signal ahead warning sign alerts drivers of the condition around the curve. Traffic often backs up down to and around this curve. Rear end accidents or near accidents occur at the location partially due to the limited sight distance in this curve.

ROCK CREEK PARK

Figure 7-5.2B
Site 5 - Photo Page 2
Beach Drive/Park/Tilden

TABLE 7-5
Rock Creek Park Accident Information
Site #5 - Int. Beach Dr. & Park Rd./Tilden St.

site5sum.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	0	0	0	0
(Number of Fatalities)	0	0	0	0
Injury Accidents	5	4	8	17
(Number of Injuries)	9	8	9	26
P.D.O. Accidents	15	13	16	44
Totals	20	17	24	**61**

Summary by Hour (TIMEACC)

000-059	0
100-159	1
200-259	1
300-359	1
400-459	1
500-559	0
600-659	3
700-759	0
800-859	5
900-959	1
1000-1059	3
1100-1159	6
1200-1259	4
1300-1359	3
1400-1459	4
1500-1559	1
1600-1659	9
1700-1759	1
1800-1859	5
1900-1959	3
2000-2059	2
2100-2159	2
2200-2259	4
2300-2359	1
Total	61

Summary by Month (ACCDATE)

January	3
February	6
March	5
April	4
May	8
June	7
July	8
August	6
September	3
October	5
November	4
December	2
Total	61

Summary by Day of Week (DAY)

Sunday (01)	6
Monday (02)	13
Tuesday (03)	8
Wednesday (04)	5
Thursday (05)	8
Friday (06)	12
Saturday (07)	9
Total	61

Surface Condition (SURFCOND)

Dry (01)	38
Wet (02)	17
Icy/slushy (03)	3
Snowy (04)	0
Muddy (05)	0
Debris(06)	0
Other (88)	0
Unknown (99)	3
Total	61

Pedestrian (PED)

(Y)	0

Accident Class (ACCLASS)

	Totals
Non-collision (00)	1
Collision with other motor vehicle (01)	48
Collision with fixed object (02)	8
Collision with pedestrian (03)	1
Collision with pedacycle -bicycle (04)	0
Collision with parked motor vehicle (05)	1
Collision with railway train (06)	0
Collision with animal (07)	0
Collision with other object (88)	1
Collision -unknown (99)	1
Total	61

ACCCLASS=07
CONFACT=B06

Light (LIGHT)	**Single-Veh**	**Fatalities**	**Injuries**	**Animals**	**Total**
Daylight (01)	3	0	13	0	37 (22 inj.)
Dawn (02)	1	0	0	0	2
Dusk (03)	0	0	0	0	4
Dark-lighted (04)	2	0	2	0	6 (2 inj.)
Dark-not lighted (05)	8	0	2	0	11 (2 inj.)
Unknown (99)	0	0	0	0	1
Totals	14	0	17	0	61 (26 inj.)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	22
On roadway -parking/driveway access (12)	0
On roadway -interchange (13)	0
On roadway -bridge (14)	0
On roadway -workzone (15)	0
On roadway -other (16)	34
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	2
Off roadway -median (24)	0
Off roadway -other (25)	1
Unknown (99)	2
Total	61

Weather (WEATHER)

Clear (01)	40
Cloudy (02)	7
Rain (03)	11
Snow (04)	0
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	1
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	0
Unknown (99)	2
Total	61

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	11
Head on (01)	11
Rear end (02)	17
Angle (03)	9
Sideswipe -opposing (04)	9
Sideswipe -overtaking (05)	1
Other (88)	2
Unknown (99)	1
Total	61

Road Character (ROADCHAR)

Straight & level (01)	14
Straight on grade (02)	18
Curved & level (03)	10
Curved on grade (04)	17
Unknown (99)	2
Total	61

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	52
Guardrail/Barrier (01)	2
Rock/Stone Wall (02)	1
Pole (03)	0
Tree/Shrub (04)	2
Culvert End Wall (05)	0
Drainage Structure (06)	0
Bridge Structure (07)	0
Sign (08)	0
Barricade (09)	0
Boulder (10)	0
Ditch (11)	1
Backslope (12)	0
Other fixed object (88)	3
Total	61

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	4
Exceeding Speed Limit (A05)	2
Too Fast for Conditions (A06)	4
Ped/Bike Contributing (D**)	0
Animal Contributing (B06)	0
*Failed to give full time & attention (A16)	9
*Failed to yield R/W (A03)	8
*Followed too closely (A09)	8
*Wrong side or wrong way (A08)	4

Number of Vehicles Involved (UNITU)

Single Vehicle (1)	14
Two-Vehicle (2)	40
more than 2-vehicles (>2)	7
Total	61

- Collisions with fixed objects accounted for eight (13%) of the 61 accidents, resulting in the following objects being struck: guardrail/barrier, tree/shrub, rock/stone wall, and ditch.
- The majority of accidents (62%) occurred on dry roads, 28% occurred when the roadway surface was wet, and 5% occurred in ice, slush or snow.
- 23 (38%) accidents occurred while it was night, dawn or dusk.
- There were no reported accidents involving animals or bicyclists.
- One accident involved a collision with a pedestrian; no injuries were reported as a result of this accident.
- Common contributing factors were "driver failed to give full time and attention" (nine accidents), and "driver failed to yield right of way" and "followed too closely" (eight accidents each). In addition, six accidents were attributed to excessive speed.
- "Driver under the influence of alcohol" was a contributing factor in four accidents at the site.

Problems:

- The traffic signal at this intersection backs traffic up on the south approach around a blind curve, creating the distinct possibility of major rear-end collisions. The signal traffic also backs up through the Blagden and Broad Branch intersections to the north, interfering with their operation during the morning peak.
- Vegetation blocks the drivers view of the signal heads and the signing at the intersection.
- At the time of the field investigation, the yellow light was burned out on the signal head that faces east from northeast corner of the intersection.
- The guard rail on the northwest corner of the bridge is located directly over the curb line and shows evidence of repeated vehicle impacts.
- The guidance sign on the southeast corner is directed at eastbound traffic but is placed at an angle which will confuse southbound traffic.
- The spacing of the second chevron from the north is out of sequence with the other signs in the curve. Southbound drivers can only see one chevron on the approach to the curve.
- There are no curve warning signs in advance of this curve in either direction.
- The stone wall on the outside of the curve has an abrupt, squared-off end which will most likely compound the severity of an accident if it is struck.
- Vegetation on the inside of the curve severely limits the sight distance. Sight distance is less than 75 feet for northbound traffic and 150 feet for southbound traffic.

Recommendations:

The recommended improvements for Site 5 can be found in **FIGURE 7-5.3**.

- Upgrade the signal to fully actuated operation.

  Estimated Cost: $25,000

- Replace the burned out bulb behind the yellow lens in the traffic signal on the northeast corner of the intersection.

  Estimated Cost: $ 100

- Prohibit NB left turns from Beach during both AM and PM peak periods.

  Estimated Cost: $ 200

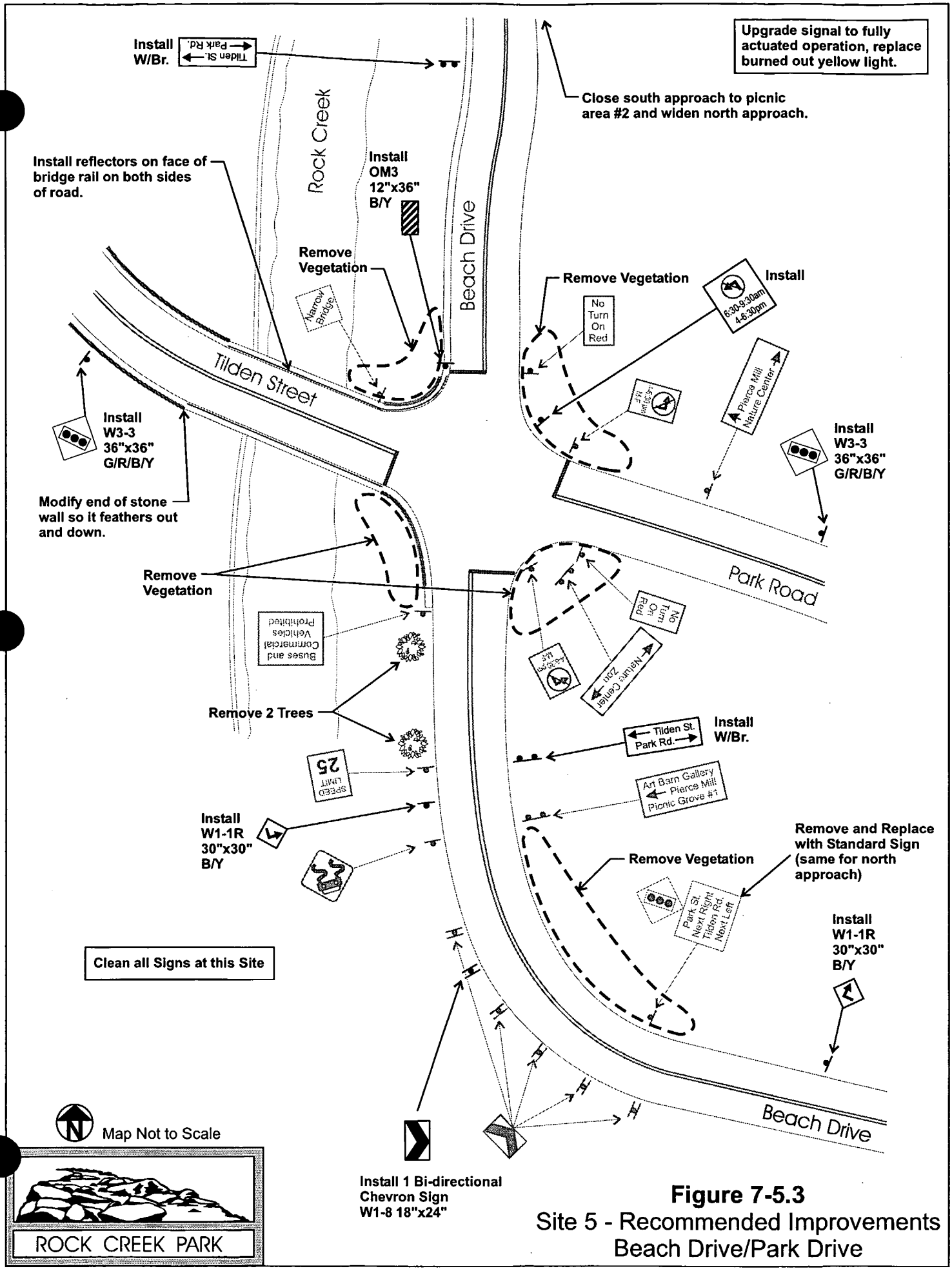


Figure 7-5.3
Site 5 - Recommended Improvements
Beach Drive/Park Drive

- Install signal ahead warning signs on the east and west approaches.
  Estimated Cost: $ 400

- Remove all of the vegetation on all corners of the intersection to improve the visibility of the signal heads and the signing.
  Estimated Cost: $ 1,000

- Install guidance signs on the north and south approaches to the intersection.
  Estimated Cost: $ 600

- Install a yellow reflective object marker sign on the end of the steel guard rail on the NW corner. Install yellow reflectors ("cat eyes") along the face of the guard rail.
  Estimated Cost: $ 650

- Close the south entrance to Picnic Area #2 and use only the north entrance for access and egress. Widen the remaining driveway to handle two-way traffic and control it with a stop sign.
  Estimated Cost: $15,000

- Modify the west end of the stone bridge wall on Tilden so it feathers out and down.
  Estimated Cost: $ 2,500

- Add one additional bi-directional chevron sign to the existing series of chevron sings in the curve south of the intersection. Install the new bi-directional sign the gap next to the northern most sign in the series. Install the new sign at the same spacing as the other signs in the sequence.
  Estimated Cost: $ 600

- Install turn warning signs on both approaches to the curve.
  Estimated Cost: $ 600

- Remove all of the vegetation located on the inside of the curve that limits sight distance. This will include the removal of several large trees.
  Estimated Cost: $ 2,000

- Remove the two trees located within one foot of the southbound driving lane on the west side of Beach Drive south of the intersection. These trees show signs of repeated vehicle impacts.
  Estimated Cost: $ 500

- Replace the non-standard street name signs that are presented with the signal ahead warning signs located on the north and south approaches. The new street name signs should be black letters on a yellow background with the letters in the standard bold block font style.
  Estimated Cost: $ 600

- Clean all signs at this site.
  Estimated Cost: N/A

Total Estimated Cost: $49,750

Long Term Recommendation:

- The access from Park and Tilden should be eliminated by constructing a bridge over Beach Drive. The existing intersection would be converted to a "T" intersection controlled with the west approach, controlled by a three-way stop, providing the only access to Pierce Mill and Picnic Area #1.

  Estimated Cost: $4,000,000

7.4.6 Site 6 - Bluff Bridge Curve

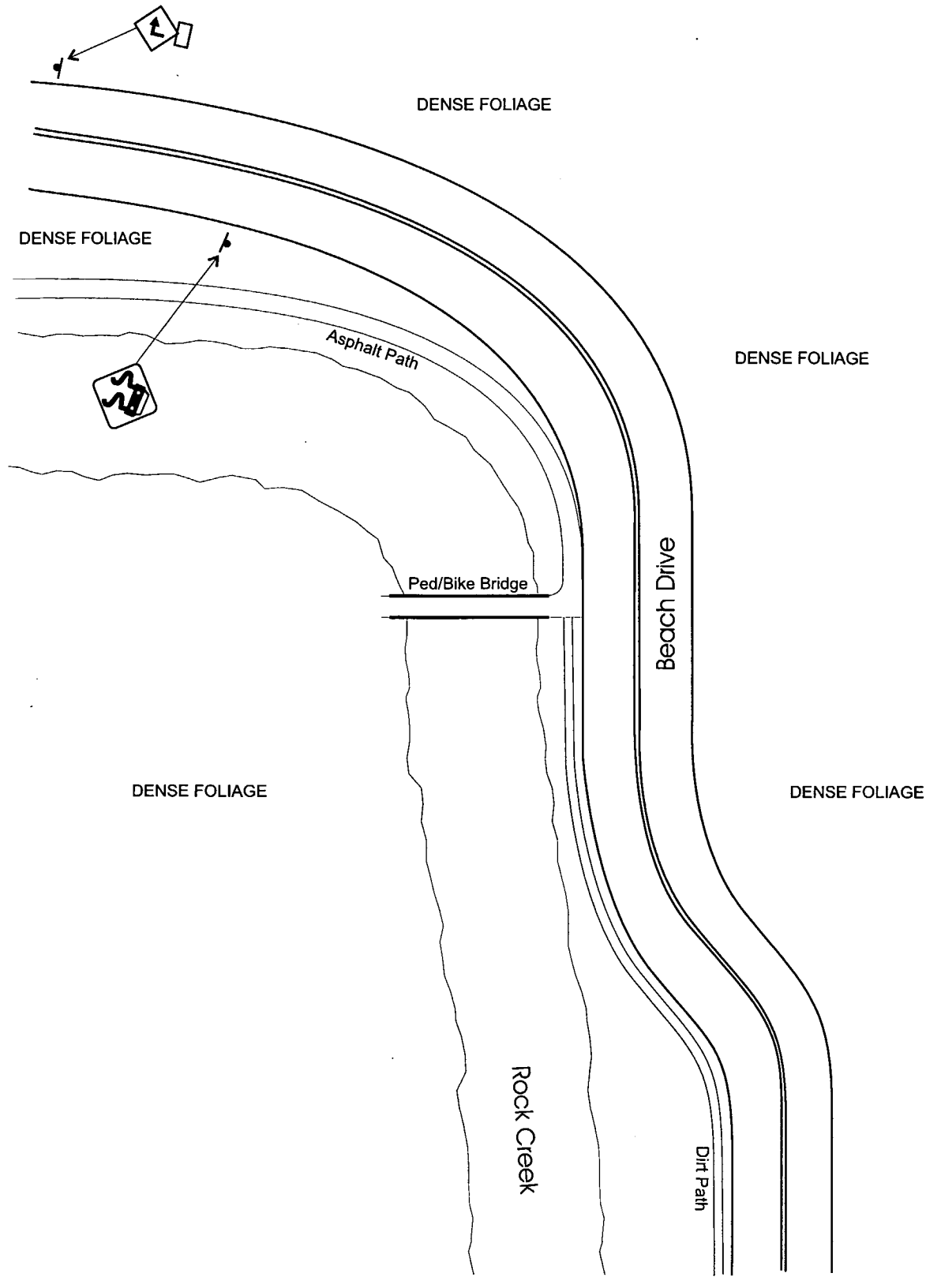
Site Description:
This site consists of the curved section of Beach Drive immediately north of the pedestrian/bicycle bridge over Rock Creek known as Bluff Bridge. The location of this curve within the Park is noted in **FIGURE 7-0**. The safe travel speed for the curve was determined to be 25 mph. An asphalt pedestrian/bicycle path extends for approximately 175 feet north from the bridge along the inside of the curve before turning back toward Rock Creek. A path is worn in the dirt south from the bridge toward Piney Branch Parkway. There is a "slippery when wet" sign on the north approach to the curve. **FIGURE 7-6.1** is a drawing of the Bluff Bridge curve, and photos of the site are displayed in **FIGURE 7-6.2**.

Accident History:
A total of 15 accidents were reported at Site 6 during the three-year study period. No fatal accidents occurred along the curve. Four (27%) of the 15 accidents at the site caused injuries. Accidents occurred intermittently between the hours of 6:00 a.m. and 10:00 p.m. Thursday was the day when the most accidents occurred, followed by Saturday. The month of November saw the highest number of accidents during the year. A complete summary of accident statistics at Site 6 is shown in **TABLE 7-6**. Some notable characteristics of the accidents occurring at this site on Beach Drive are listed below:

- An average of five accidents occurred at this location each year. The accident rate was 2.95 accidents/MVMT and the severity rate was 1.27.
- The history shows inconsistent accident occurrence from year to year, with only two accidents reported in 1993, a high of nine accidents in 1994, and four in 1995.
- Two-vehicle accidents accounted for 73% of accidents at the site, while 27% had single-vehicle involvement.
- 11 of the 15 accidents were collisions with another motor vehicle; seven of these were sideswipe accidents between opposing vehicles and four were angle collisions.
- 53% of all accidents occurred on wet road surfaces.
- 60% of all accidents, and 75% of injury accidents at the site occurred during low-light conditions.
- One accident was reported involving an animal-vehicle collision.
- None of the accidents at the site involved pedestrians or bicyclists.
- Excessive speed was a common contributing factor: driving "too fast for conditions" (three accidents) and "exceeding speed limit" (one accident). "Driver disregarded traffic signs, signals or road markings" also contributed to four accidents.

Problems:

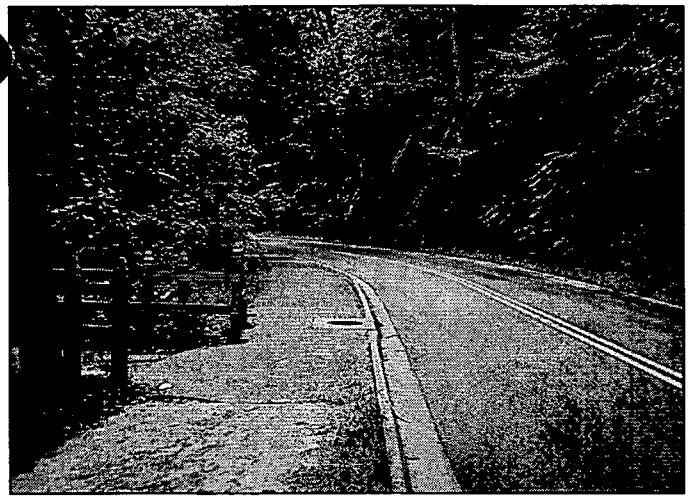
- Vehicles run off of the road under wet pavement conditions.
- The curve is tighter than adjacent curves.
- Vehicle speeds are excessive.
- This section of road is dark due to the full canopy of trees.
- There is no delineation or warning of the curve.
- The asphalt path blends with the roadway.



Map Not to Scale

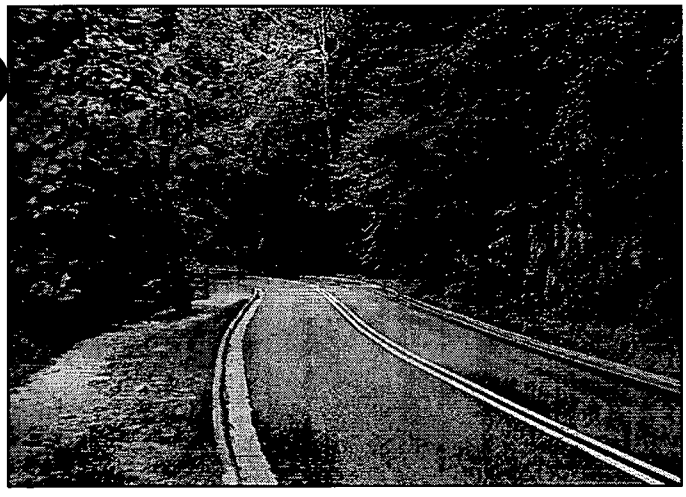
ROCK CREEK PARK

Figure 7-6.1
Site 6 - Existing Conditions
Bluff Bridge Curve



The entrance to Bluff Bridge is located just south of the curve. The paved trail adjacent to the road ends at this point.

The paved pedestrian path is located immediately adjacent to the road through the curve. This places the pedestrian and bicycle traffic very close to passing vehicles. It would be desirable to separate these traffic flows with a white candlestick delineators.



This photo shows a view of the curve from the south approach. There is no advance warning of this curve or any delineation through the curve section. Notice the dirt path that extends south from the Bluff Bridge on the west side of the road.

A large rock outcropping is located on the outside of the curve. These rock formations are often impacted when vehicles leave the roadway at this site.

ROCK CREEK PARK

Figure 7-6.2
Site 6 - Photo Page
Beach Drive/Bluff Bridge Curve

TABLE 7-6
Rock Creek Park Accident Information
Site #6 - Beach Dr. segment - Bluff Bridge Curve

site6sum.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	0	0	0	0
(Number of Fatalities)	0	0	0	0
Injury Accidents	1	2	1	4
(Number of Injuries)	1	4	1	6
P.D.O. Accidents	1	7	3	11
Totals	2	9	4	15

Summary by Hour (TIMEACC)

000-059	0
100-159	0
200-259	0
300-359	0
400-459	0
500-559	0
600-659	1
700-759	0
800-859	0
900-959	2
1000-1059	0
1100-1159	1
1200-1259	0
1300-1359	0
1400-1459	0
1500-1559	2
1600-1659	2
1700-1759	1
1800-1859	1
1900-1959	0
2000-2059	3
2100-2159	2
2200-2259	0
2300-2359	0
Total	15

Summary by Month (ACCDATE)

January	2
February	1
March	1
April	2
May	0
June	2
July	0
August	1
September	0
October	0
November	4
December	2
Total	15

Summary by Day of Week (DAY)

Sunday (01)	2
Monday (02)	1
Tuesday (03)	2
Wednesday (04)	2
Thursday (05)	4
Friday (06)	1
Saturday (07)	3
Total	15

Surface Condition (SURFCOND)

Dry (01)	6
Wet (02)	8
Icy/slushy (03)	1
Snowy (04)	0
Muddy (05)	0
Debris(06)	0
Other (88)	0
Unknown (99)	0
Total	15

Pedestrian (PED)

(Y)	0

Accident Class (ACCLASS)

	Totals
Non-collision (00)	0
Collision with other motor vehicle (01)	11
Collision with fixed object (02)	3
Collision with pedestrian (03)	0
Collision with pedacycle -bicycle (04)	0
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	1
Collision with other object (88)	0
Collision -unknown (99)	0
Total	15

animal coll.-PDO,clear,dry,dark,Jan.

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Single-Veh	Fatalities	Injuries	Animals	Total	
Daylight (01)	3	0	1	0	6	(2 inj.)
Dawn (02)	0	0	0	0	0	
Dusk (03)	0	0	0	0	2	
Dark-lighted (04)	0	0	0	0	0	
Dark-not lighted (05)	1	0	3	1	7	(4 inj.)
Unknown (99)	0	0	0	0	0	
Totals	4	0	4	1	15	(6 inj.)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	0
On roadway -parking/driveway access (12)	0
On roadway -interchange (13)	0
On roadway -bridge (14)	0
On roadway -workzone (15)	0
On roadway -other (16)	12
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	2
Off roadway -median (24)	0
Off roadway -other (25)	1
Unknown (99)	0
Total	15

Weather (WEATHER)

Clear (01)	6
Cloudy (02)	0
Rain (03)	7
Snow (04)	1
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	0
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	1
Other (88)	0
Unknown (99)	0
Total	15

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	3
Head on (01)	1
Rear end (02)	0
Angle (03)	4
Sideswipe -opposing (04)	7
Sideswipe -overtaking (05)	0
Other (88)	0
Unknown (99)	0
Total	15

Road Character (ROADCHAR)

Straight & level (01)	0
Straight on grade (02)	0
Curved & level (03)	10
Curved on grade (04)	4
Unknown (99)	1
Total	15

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	12
Guardrail/Barrier (01)	0
Rock/Stone Wall (02)	2
Pole (03)	0
Tree/Shrub (04)	0
Culvert End Wall (05)	0
Drainage Structure (06)	1
Bridge Structure (07)	0
Sign (08)	0
Barricade (09)	0
Boulder (10)	0
Ditch (11)	0
Backslope (12)	0
Other fixed object (88)	0
Total	15

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	0
Exceeding Speed Limit (A05)	1
Too Fast for Conditions (A06)	3
Ped/Bike Contributing (D**)	0
Animal Contributing (B06)	1
*Disregard traffic signs,signals,road marki	4
*Wrong side or wrong way (A08)	2

Number of Vehicles Involved (UNITU)

Single Vehicle (1)	4
Two-Vehicle (2)	11
more than 2-vehicles (>2)	0
Total	15

Recommendations:
The recommended improvements for this site are presented in **FIGURE 7-6.3**.

- Cut all vegetation on the inside of the curve that limits sight distance.
  Estimated Cost: $ 1,000

- Install five bi-directional chevron signs on the outside of the curve. Space the signs evenly at 75 feet and place them so that at least two signs are visible on each approach to the curve.
  Estimated Cost: $ 2,000

- Install turn warning signs on both approaches and relocate the "slippery when wet" warning sign on the north approach further to the north. Install a "slippery when wet" warning sign on the south approach to this site.
  Estimated Cost: $ 900

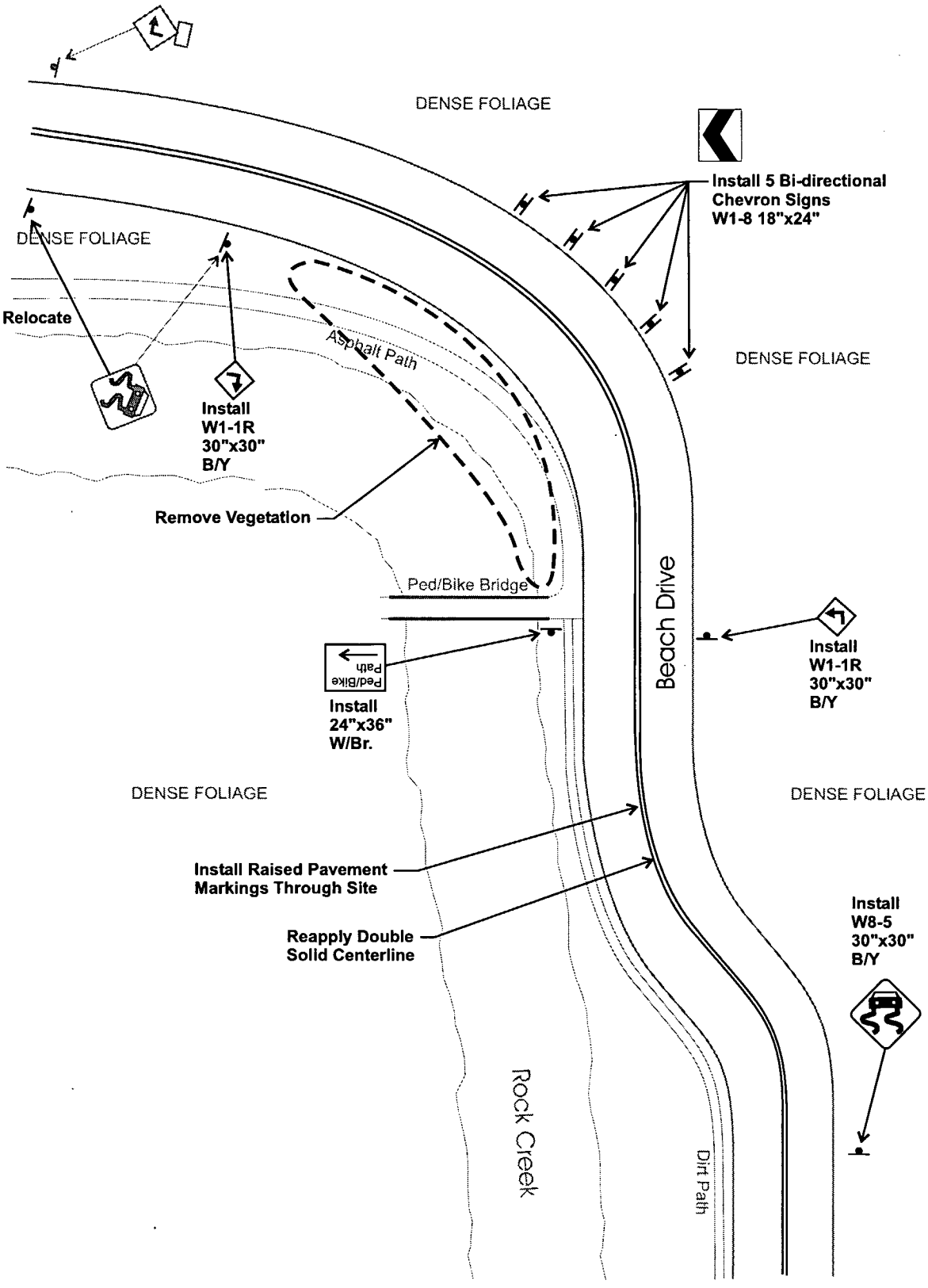
- Conduct a pavement skid resistance test at this site. If the pavement is found to have an unacceptable skid resistance, then the pavement should receive a chip seal type overlay.
  Estimated Cost: $ Unknown

- Install raised pavement markings along the centerline of the road through this curve section.
  Estimated Cost: $ 1,000

- Reapply the double solid centerline through this site.
  Estimated Cost: $ 500

- Place a sign at the end of Bluff Bridge encouraging pedestrian and bicycle traffic to cross over to the west side of Rock Creek rather than continuing along the west side of Beach. This would reduce the need for a paved trail along the west side of Beach through the Piney Branch and Klingle intersections.
  Estimated Cost: $ 200

Total Estimated Cost: $ 5,600



Map Not to Scale

ROCK CREEK PARK

Figure 7-6.3
Site 6 - Recommended Improvements
Bluff Bridge Curve

7.4.7 Site 7 - Intersection of Beach Drive and Piney Branch Parkway

Site Description:
This site encompasses the "Y"-shaped intersection of Piney Branch Parkway and Beach Drive. The intersection is located on the east side of Rock Creek, south of Bluff Bridge, as shown in **FIGURE 7-0**. Piney Branch Parkway approaches Beach Drive from the east. A curved section of Beach Drive constitutes the north and south legs of the intersection. The northern portion of the intersection lies on a bridge over the Piney Branch tributary. There are sidewalks adjacent to the bridge. A path is beaten into the dirt on the west side of Beach Drive, leading north to Bluff Bridge. An asphalt pedestrian and bicycle path runs along the west side of Rock Creek. A site drawing and photographs of the site are presented in **FIGURES 7-7.1** and **7-7.2**.

There are four raised medians at this intersection. The north approach of Beach consists of one shared left/through lane of traffic, while the south approach is divided into a through lane and a right turn lane with a ramp. Piney Branch has left and right turn lanes, both of which are controlled by stop signs. Observations indicate that vehicles on the east leg tend to stop beyond the marked stop bar due to limited visibility to the north. Peak hour turning movement counts for this site are located in Appendix A.

Accident History:
A total of 59 accidents were reported at this site during the 1993-1995 study period. There were no fatalities at the intersection. 13 (22%) of the 59 accidents at the site resulted in 22 injuries. An hourly accident summary showed accidents occurring during every hour between 6:00 a.m. and midnight, with the exception of 4:00-6:00 p.m.; with peaks occurring around 8:00 a.m., during the noon hour, and 9:00-10:00 p.m. Accidents were fairly evenly distributed throughout the days of the week. The fall months of October and November had the highest number of accidents. A complete summary of accident statistics at Site 7 is shown in **TABLE 7-7**. Some noteworthy characteristics of accidents reported at the intersection are listed below:

- The average accident frequency at this site was 20 per year, resulting in an accident rate of 2.86 accidents/MVE and a severity rate of 1.22.
- The largest number of accidents in the three year history were reported in 1995 (24 accidents).
- Two-vehicle accidents (85%) were by far the most common, with single-vehicle accidents accounting for 12% and more than two vehicles involved in only 3% of accidents.
- 49 (83%) of the 59 accidents were collisions with another motor vehicle; of these 17 were angle collisions, 16 were rear-end collisions, eight were head-on collisions and five were sideswipe collisions between opposing vehicles.
- An equal number of accidents occurred on dry and wet roads (28 accidents each), and two occurred when the roadway surface was icy or slushy.
- 13 (22%) accidents occurred during dark light conditions, none while it was dawn or dusk.
- No accidents involving either animals or bicyclists were reported at the intersection.
- One non-injury accident was reported which involved a collision with a pedestrian.
- The most commonly reported contributing factor was "driver failed to yield right of way" (15 accidents), followed by "driving too fast for conditions" (10 accidents), and "driver failed to give full time and attention" and "followed too closely" (seven accidents each).

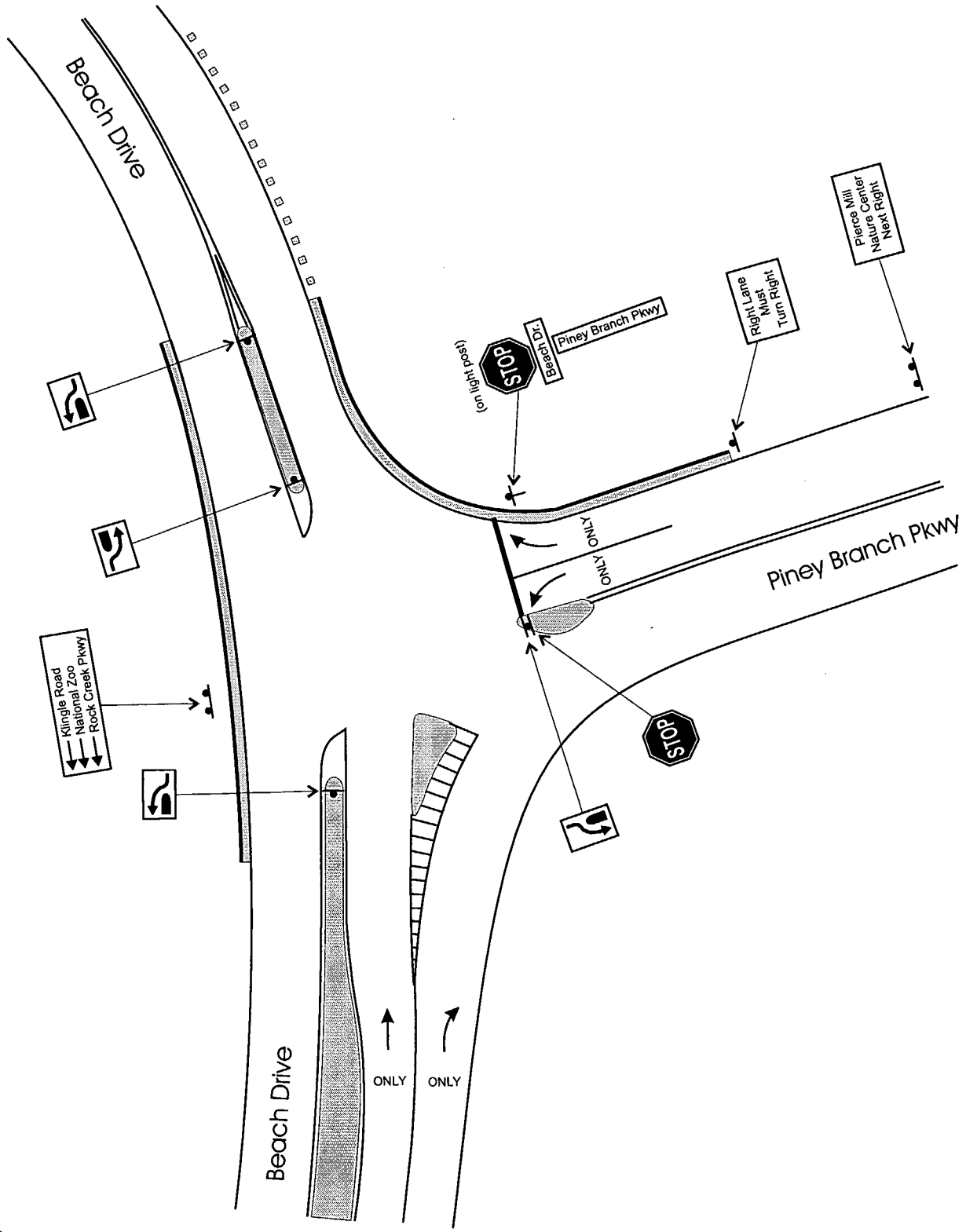
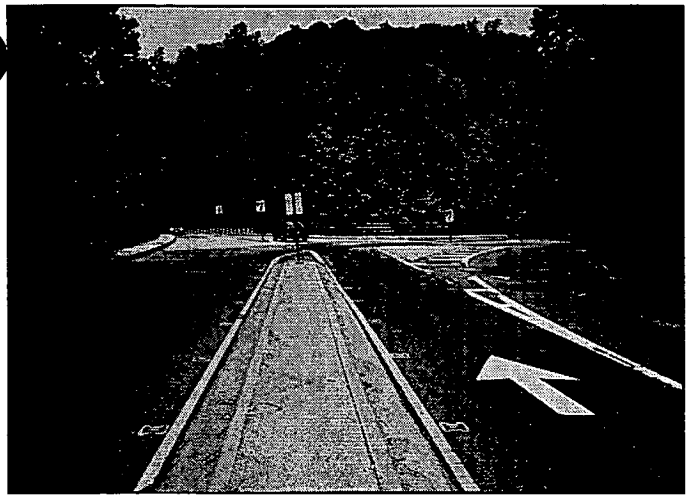
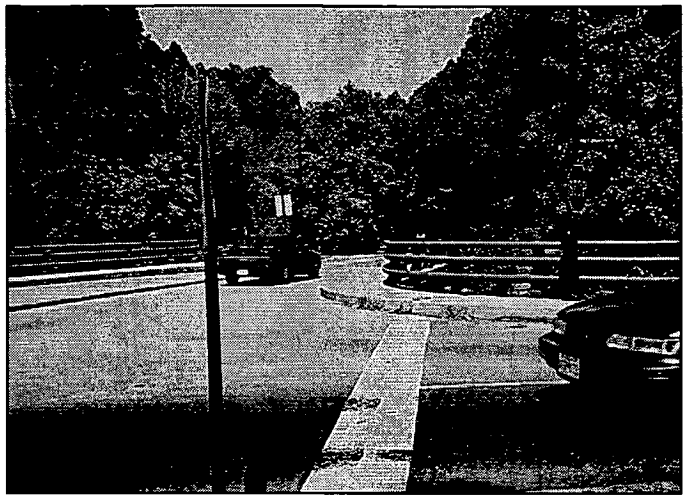


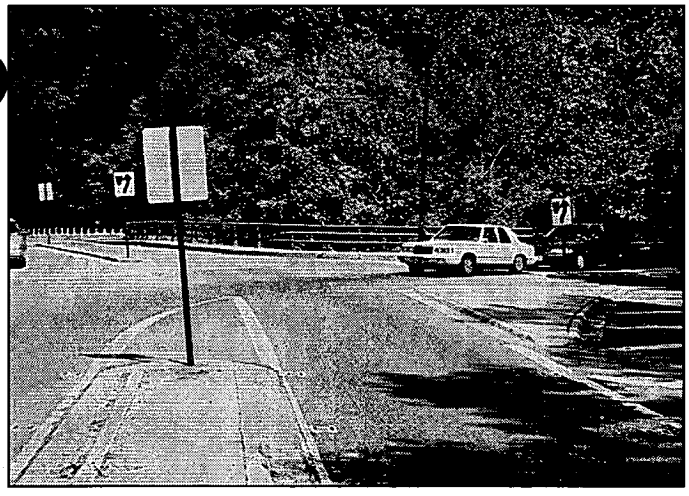
Figure 7-7.1
Site 7 - Existing Conditions
Beach Drive/Piney Branch



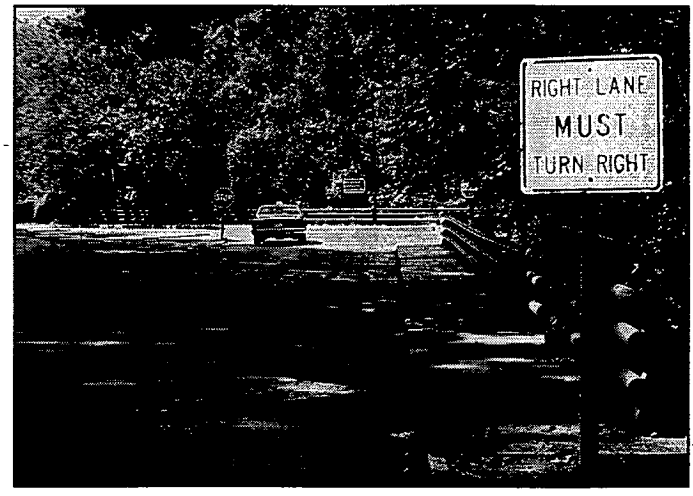
This photo of the south approach to the intersection shows the raised median and raised pavement markers. Portions of the pavement striping have pulled up in the gore area separating the thru and right turn lanes. Notice how the vegetation on the right blocks the view of the right ramp.



The bridge railing on the northeast corner blocks the driver's view of the north approach. Stop signs are used on the right and on the center median to control traffic approaching from the east.



Notice how the drivers must move forward one vehicle length to see to the north, due to the visual obstruction caused by the bridge rail.



The intersection is visible on the east approach. Although it is hard to see in this photo, the pavement marking on this approach have been worn to the point that they are no longer effective.

ROCK CREEK PARK

Figure 7-7.2
Site 7 - Photo Page
Beach Drive/Piney Branch

TABLE 7-7
Rock Creek Park Accident Information
Site #7 - Int. Beach Dr. & Piney Branch Pkwy.

site7sum.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	0	0	0	0
(Number of Fatalities)	0	0	0	0
Injury Accidents	4	5	4	13
(Number of Injuries)	6	7	9	22
P.D.O. Accidents	16	10	20	46
Totals	20	15	24	**59**

Summary by Hour (TIMEACC)

000-059	0
100-159	0
200-259	0
300-359	0
400-459	0
500-559	0
600-659	2
700-759	6
800-859	7
900-959	5
1000-1059	3
1100-1159	4
1200-1259	8
1300-1359	4
1400-1459	4
1500-1559	1
1600-1659	0
1700-1759	0
1800-1859	2
1900-1959	3
2000-2059	1
2100-2159	6
2200-2259	1
2300-2359	2
Total	59

Summary by Month (ACCDATE)

January	2
February	6
March	2
April	5
May	6
June	5
July	5
August	3
September	6
October	7
November	10
December	2
Total	59

Summary by Day of Week (DAY)

Sunday (01)	7
Monday (02)	8
Tuesday (03)	9
Wednesday (04)	8
Thursday (05)	10
Friday (06)	9
Saturday (07)	8
Total	59

Surface Condition (SURFCOND)

Dry (01)	28
Wet (02)	28
Icy/slushy (03)	2
Snowy (04)	0
Muddy (05)	0
Debris(06)	0
Other (88)	0
Unknown (99)	1
Total	59

Pedestrian (PED)

(Y)	0

Accident Class (ACCLASS)

	Totals
Non-collision (00)	4
Collision with other motor vehicle (01)	49
Collision with fixed object (02)	3
Collision with pedestrian (03)	1
Collision with pedacycle -bicycle (04)	0
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	0
Collision with other object (88)	1
Collision -unknown (99)	1
Total	59

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Single-Veh.	Fatalities	Injuries	Animals	Total
Daylight (01)	3	0	10	0	46 (17 inj.)
Dawn (02)	0	0	0	0	0
Dusk (03)	0	0	0	0	0
Dark-lighted (04)	1	0	0	0	2
Dark-not lighted (05)	3	0	3	0	11 (4 inj.)
Unknown (99)	0	0	0	0	0
Totals	7	0	13	0	59 (21 inj.)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	31
On roadway -parking/driveway access (12)	0
On roadway -interchange (13)	0
On roadway -bridge (14)	0
On roadway -workzone (15)	0
On roadway -other (16)	22
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	2
Off roadway -median (24)	0
Off roadway -other (25)	3
Unknown (99)	1
Total	59

Weather (WEATHER)

Clear (01)	26
Cloudy (02)	14
Rain (03)	17
Snow (04)	0
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	2
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	0
Unknown (99)	0
Total	59

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	10
Head on (01)	8
Rear end (02)	16
Angle (03)	17
Sideswipe -opposing (04)	5
Sideswipe -overtaking (05)	0
Other (88)	2
Unknown (99)	1
Total	59

Road Character (ROADCHAR)

Straight & level (01)	27
Straight on grade (02)	2
Curved & level (03)	19
Curved on grade (04)	8
Unknown (99)	3
Total	59

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	53
Guardrail/Barrier (01)	0
Rock/Stone Wall (02)	1
Pole (03)	1
Tree/Shrub (04)	1
Culvert End Wall (05)	0
Drainage Structure (06)	1
Bridge Structure (07)	0
Sign (08)	0
Barricade (09)	0
Boulder (10)	0
Ditch (11)	1
Backslope (12)	1
Other fixed object (88)	0
Total	59

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	0
Exceeding Speed Limit (A05)	0
Too Fast for Conditions (A06)	10
Ped/Bike Contributing (D**)	0
Animal Contributing (B06)	0
*Failed to yield R/W (A03)	15
*Followed too closely (A09)	7
*Failed to give full time & attention (A16)	7
*Disregarded traffic signs, signals or road	3

Number of Vehicles Involved (UNITU)

Single Vehicle (1)	7
Two-Vehicle (2)	50
more than 2-vehicles (>2)	2
Total	59

Problems:

- During the morning peak period the traffic entering the Rock Creek and Potomac Parkway south of the Zoo often backs up through this site.
- Drivers on the east approach can not see the southbound traffic because of the railing on the east side of the bridge.
- Although there are sidewalks on the bridges there are no connecting walkways along Beach Drive through this site.
- There are no pedestrian facilities along Piney Branch Parkway, but there is a path worn into the shoulder area, giving evidence of pedestrian activity.
- The right ramp on the south approach creates right-of-way conflicts with traffic that has just turned left onto Piney Branch from the north approach.

Recommendations:

The recommended improvements for Site 7 are shown in **FIGURE 7-7.3**.

- This intersection meets the MUTCD warrants for a multiway stop configuration and should be converted into a three-way stop intersection. Minimize the radius on the northeast corner and move the stop bar closer to the intersection so the driver can see the north approach. Replace the right ramp on the south approach with a standard right turn lane controlled by a stop sign. The geometric changes to the intersection will tend to reduce the traffic speeds through this site.

  Estimated Cost: $50,000

- Install a stop ahead warning sign on the east approach. When the intersection is converted to a three way stop, add stop ahead warning signs on the north and south approaches.

  Estimated Cost: $ 600

- Install guidance signs on the north and south approaches.

  Estimated Cost: $ 600

- Remount the stop signs on the east approach at 5 foot mounting heights.

  Estimated Cost: $ 200

- Reapply lane use markings on the east approach.

  Estimated Cost: $ 500

- Relocate the lane use sign for the south approach 100 feet to the north.

  Estimated Cost: $ 200

- Remove the tree on the west side of the north approach. This tree is located within a foot of the driving lane and shows signs of being struck by vehicles.

  Estimated Cost: $ 300

- Remove all of the non-functional street lights at this site.

  Estimated Cost: $ 2,000

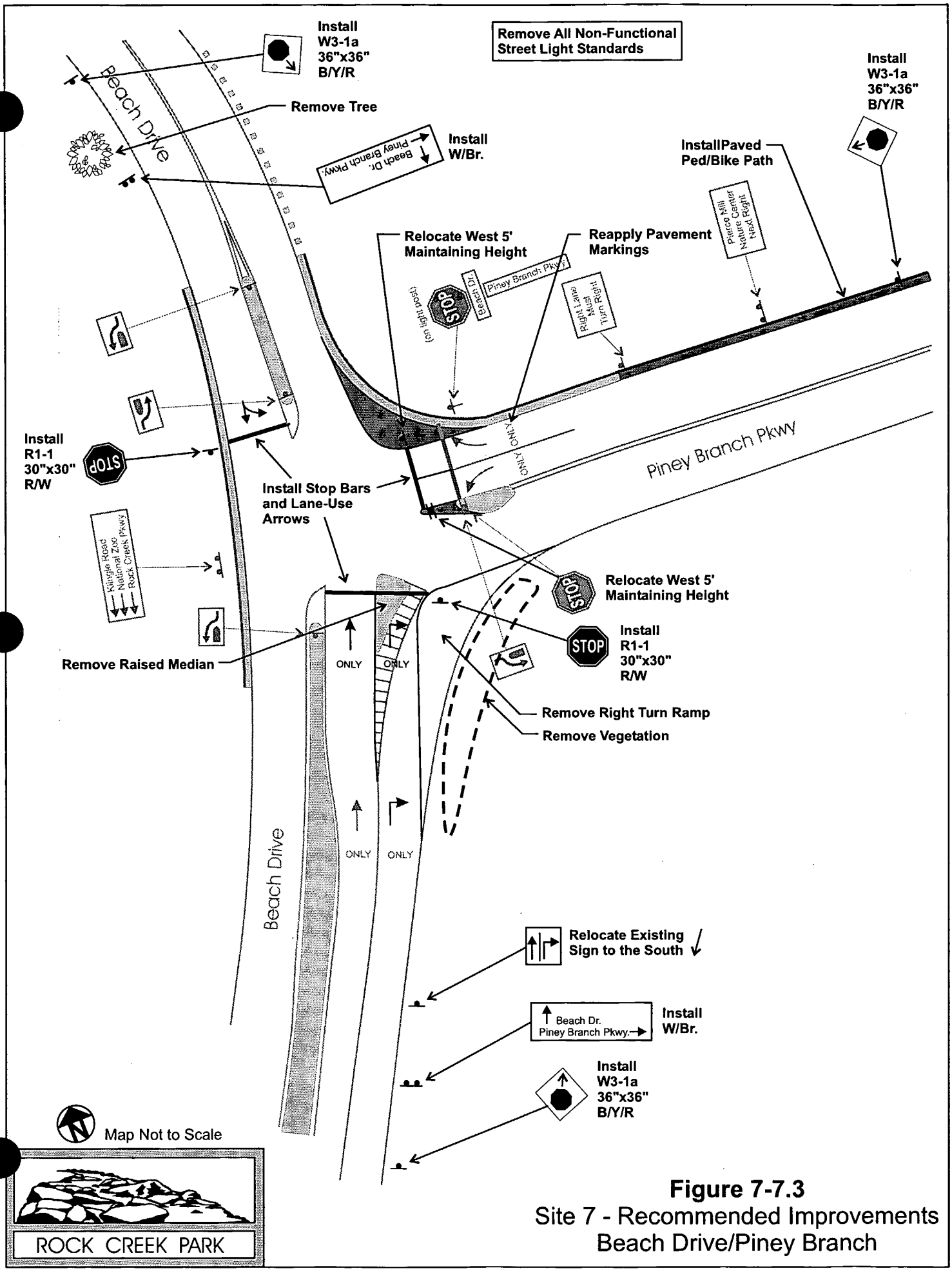


Figure 7-7.3
Site 7 - Recommended Improvements
Beach Drive/Piney Branch

- Remove all vegetation on the inside of the curve on the southeast corner of the intersection.
  Estimated Cost: $ 500

- Install a paved pedestrian path on the north side of Piney Branch Parkway.
  Estimated Cost: Unknown

Total Estimated Cost: $54,900

7.4.8 Site 8 - Intersection of Beach Drive and Klingle Road

Site Description:
This site is comprised of the "T" intersection formed at the junction of Beach Drive and Klingle Road. As shown in **FIGURE 7-0**, the intersection is immediately south of Site 7. Beach Drive curves to the north and south along the east bank of Rock Creek at this location, with Klingle Road approaching over a bridge from the west. There are sidewalks along the bridge, but there are no other at-grade pedestrian or bicycle facilities at this site. **FIGURE 7-8.1** is a sketch of the site layout, and a collection of site photos can be found in **FIGURE 7-8.2**.

Four raised medians channelize traffic through this intersection. The north approach of Beach Drive is divided into a through lane and a right turn lane with a ramp, while the south approach has a through lane and a left turn lane. Klingle Road has one lane for left turning traffic and a right turn ramp, which are controlled by a stop sign and a yield sign, respectively. Appendix A contains peak hour turning movement counts for this intersection.

Accident History:
A total of 27 accidents were reported at Site 8 during the study period. There were no fatal accidents reported at this intersection. Six (22%) of the 27 accidents at the site resulted in a total of 13 injuries (more than two injuries averaged per injury accident). Accidents occurred sporadically throughout the day, with a definite peak between 3:00 and 5:00 p.m. Monday, Tuesday and Saturday had the most reported accidents. The winter months of December and January were a seasonal peak in accident occurrence. A complete summary of accident statistics at Site 8 is shown in **TABLE 7-8**. Some important characteristics of accidents occurring at this site are noted below:

- On average, nine accidents occurred at this intersection each year. The accident rate was 1.25 accidents/MVE, with a severity rate of 1.22.
- 1994 had the lowest accident rate of the three years examined, with only four accidents reported that year.
- Accident severity showed a marked increase in 1995, with four injury accidents resulting in ten injuries during that year, compared to a single injury accident for each of the preceding years.
- Two-vehicle accidents (78%) were the most common, with single-vehicle and more than two-vehicle accidents accounting for only 11% each.
- 23 (85%) of the 27 accidents were collisions with another motor vehicle.
- Of the 23 motor vehicle collisions: angle and sideswipe collisions between opposing vehicles accounted for seven each, six were rear-end collisions, and four were head-on collisions.
- 13 (48%) of the 27 accidents occurred on dry roads, 37% occurred when roads were wet, and 11% happened on icy, slushy or snowy roadway surfaces.
- Six (22%) accidents occurred at night, dawn or dusk.
- No accidents reported at the intersection involved animals, pedestrians or bicyclists.
- The most common contributing factor listed was "driver failed to yield right of way" (five accidents), followed by "followed too closely" (four accidents).
- Driving "under the influence of alcohol" was listed as a contributing factor in two accidents.

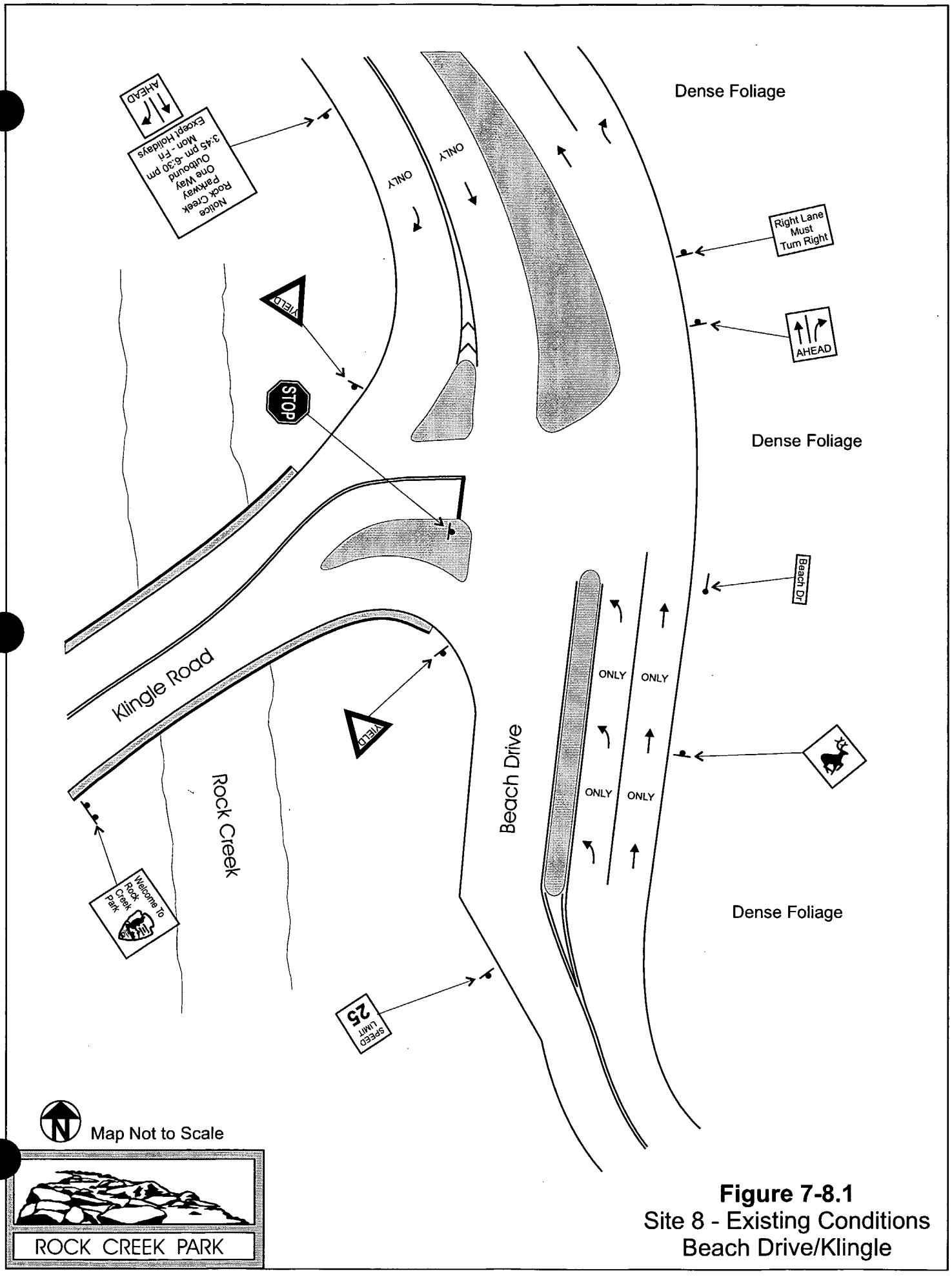
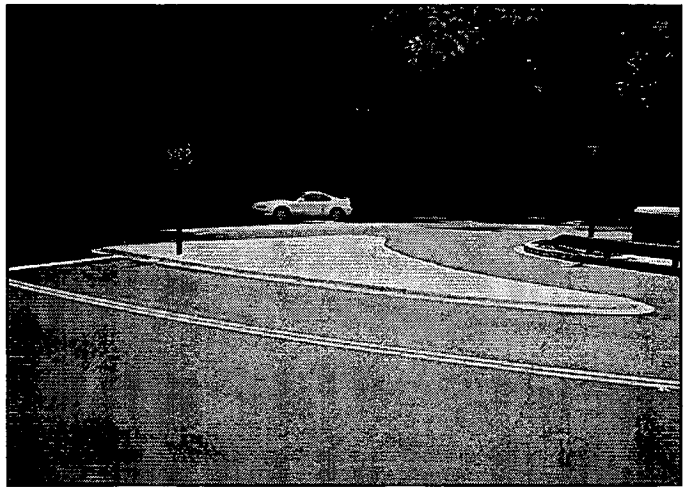


Figure 7-8.1
Site 8 - Existing Conditions
Beach Drive/Klingle

The newly constructed raised channelization median on the southwest side of the intersection protrudes out into the traffic lane causing traffic to turn hard at this point in the intersection. Vehicles were observed driving over the end of this median. Screeching tires are often heard when vehicles pass this point in the road.

The north approach to the intersection has lane use pavement markings. The intersection is visible to approaching motorists.

This is a view of the intersection from the south approach. This approach is equipped with lane-use pavement markings.



This photo shows the median island that separates the through and right turn lanes on the west approach. When a vehicle is waiting at the stop sign, vehicles on the right ramp can not see the north approach to the intersection.

ROCK CREEK PARK

Figure 7-8.2
Site 8 - Photo Page
Beach Drive/Klingle

TABLE 7-8
Rock Creek Park Accident Information
Site #8 - Int. Beach Dr. & Klingle Rd.

site8sum.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	0	0	0	0
(Number of Fatalities)	0	0	0	0
Injury Accidents	1	1	4	6
(Number of Injuries)	1	2	10	13
P.D.O. Accidents	12	3	6	21
Totals	13	4	10	**27**

Summary by Hour (TIMEACC)

000-059	1
100-159	0
200-259	1
300-359	0
400-459	0
500-559	0
600-659	0
700-759	1
800-859	0
900-959	0
1000-1059	3
1100-1159	0
1200-1259	2
1300-1359	0
1400-1459	1
1500-1559	4
1600-1659	6
1700-1759	0
1800-1859	3
1900-1959	2
2000-2059	1
2100-2159	2
2200-2259	0
2300-2359	0
Total	27

Summary by Month (ACCDATE)

January	5
February	0
March	2
April	4
May	1
June	1
July	3
August	1
September	2
October	2
November	1
December	5
Total	27

Summary by Day of Week (DAY)

Sunday (01)	1
Monday (02)	6
Tuesday (03)	7
Wednesday (04)	2
Thursday (05)	2
Friday (06)	2
Saturday (07)	7
Total	27

Surface Condition (SURFCOND)

Dry (01)	13
Wet (02)	10
Icy/slushy (03)	2
Snowy (04)	1
Muddy (05)	0
Debris(06)	0
Other (88)	0
Unknown (99)	1
Total	27

Pedestrian (PED)

(Y)	0

Accident Class (ACCLASS)

	Totals
Non-collision (00)	1
Collision with other motor vehicle (01)	23
Collision with fixed object (02)	2
Collision with pedestrian (03)	0
Collision with pedacycle -bicycle (04)	0
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	0
Collision with other object (88)	0
Collision -unknown (99)	1
Total	27

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Single-Veh	Fatalities	Injuries	Animals	Total	
Daylight (01)	2	0	6	0		21 (13 inj.)
Dawn (02)	0	0	0	0		0
Dusk (03)	0	0	0	0		1
Dark-lighted (04)	0	0	0	0		1
Dark-not lighted (05)	1	0	0	0		4
Unknown (99)	0	0	0	0		0
Totals	3	0	6	0		27 (13 inj.)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	11
On roadway -parking/driveway access (12)	0
On roadway -interchange (13)	1
On roadway -bridge (14)	0
On roadway -workzone (15)	0
On roadway -other (16)	11
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	1
Off roadway -median (24)	0
Off roadway -other (25)	1
Unknown (99)	2
Total	27

Weather (WEATHER)

Clear (01)	16
Cloudy (02)	3
Rain (03)	6
Snow (04)	1
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	1
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	0
Unknown (99)	0
Total	27

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	3
Head on (01)	4
Rear end (02)	6
Angle (03)	7
Sideswipe -opposing (04)	7
Sideswipe -overtaking (05)	0
Other (88)	0
Unknown (99)	0
Total	27

Road Character (ROADCHAR)

Straight & level (01)	5
Straight on grade (02)	1
Curved & level (03)	11
Curved on grade (04)	10
Unknown (99)	0
Total	27

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	25
Guardrail/Barrier (01)	1
Rock/Stone Wall (02)	1
Pole (03)	0
Tree/Shrub (04)	0
Culvert End Wall (05)	0
Drainage Structure (06)	0
Bridge Structure (07)	0
Sign (08)	0
Barricade (09)	0
Boulder (10)	0
Ditch (11)	0
Backslope (12)	0
Other fixed object (88)	0
Total	27

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	2
Exceeding Speed Limit (A05)	3
Too Fast for Conditions (A06)	0
Ped/Bike Contributing (D**)	0
Animal Contributing (B06)	0
*Failed to yield R/W (A03)	5
*Followed too closely (A09)	4
*Failed to give full time & attention (A16)	3

Number of Vehicles Involved (UNITU)

Single Vehicle (1)	3
Two-Vehicle (2)	21
more than 2-vehicles (>2)	3
Total	27

Problems:

- The raised median that separates the left turn lane and the right ramp on Klingle Road sticks out too far into the southbound through driving lane. Although this median island is relatively new it shows evidence of repeated strikes by traffic.
- There are no "Keep Right" signs on the ends of the raised medians.
- Because of the unique grades, a vehicle sitting in the right turn lane on the west approach cannot see the approaching traffic from the north when a left turning vehicle is at the stop bar on the west approach.
- During the morning peak period the traffic entering the Parkway south of the Zoo often backs up through this site.

Recommendations:

The recommended improvements for Site 8 are presented in **FIGURE 7-8.3**.

- Remove the right ramp on the west approach and provide a left lane and a short right turn lane. Control both lanes with a stop sign. This geometric modification will enable right turning traffic to see the traffic approaching from the north.

  Estimated Cost: $40,000

- Install a stop ahead warning sign on the west approach. When the intersection is converted to a three way stop, add stop ahead warning signs on the north and south approaches.

  Estimated Cost: $ 600

- Install guidance signs on all approaches.

  Estimated Cost: $ 900

- Install silver object markers on the ends of the bridge guardrails on the west approach, and install silver "cat eye" reflectors along the face of the guardrails.

  Estimated Cost: $ 800

- Install "Keep Right" signs on the three unmarked median noses, one on the north approach and two on the south approach.

  Estimated Cost: $ 600

- Install lane use signs on the south and west approaches.

  Estimated Cost: $ 400

- Relocate the deer crossing sign on the east side of the intersection 3/8 mile south.

  Estimated Cost: $ 200

- Install an object marker on the end of the rock wall located on the west side of the south approach to the intersection.

  Estimated Cost: $ 200

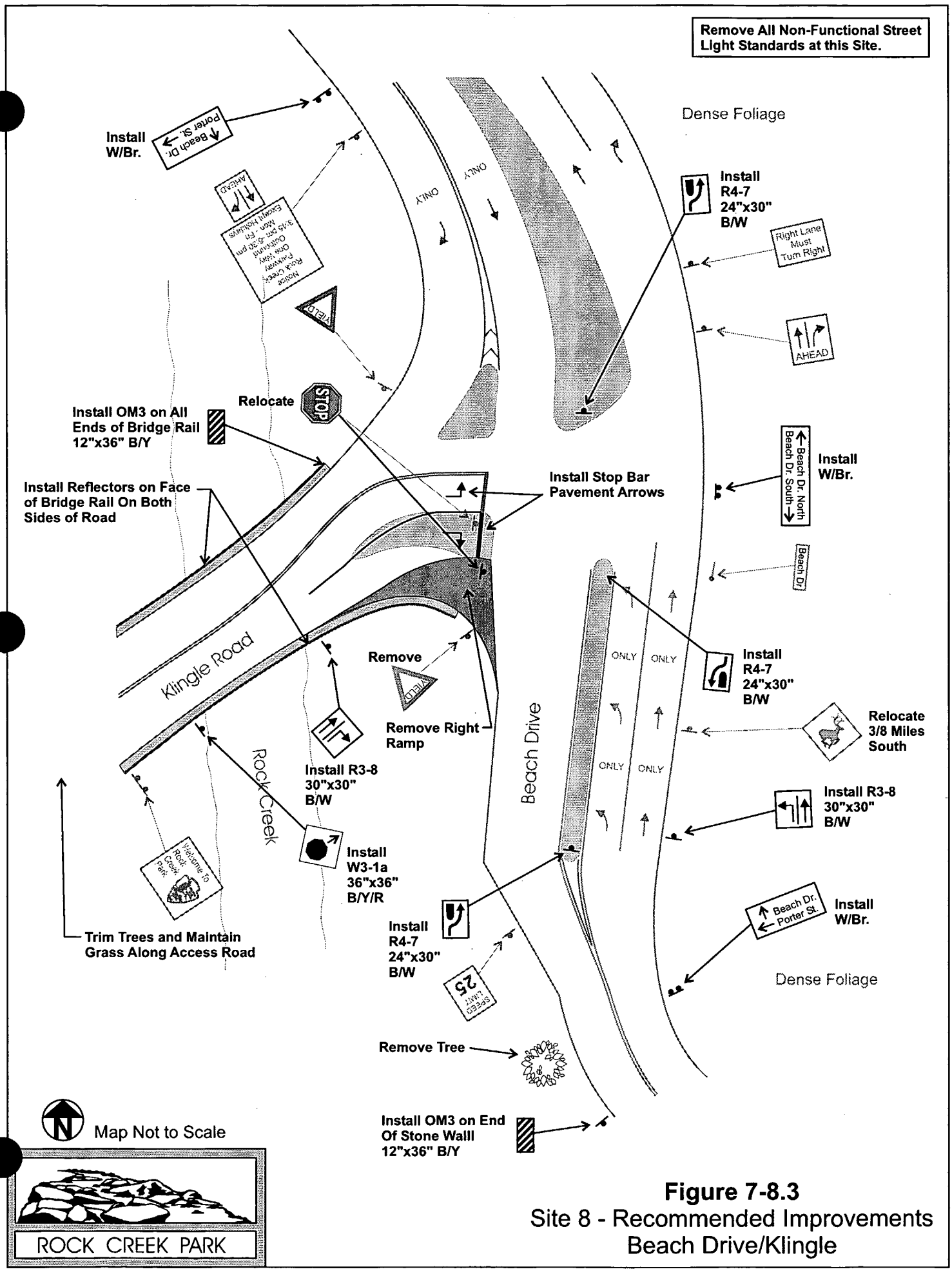


Figure 7-8.3
Site 8 - Recommended Improvements
Beach Drive/Klingle

- Remove the tree on the west side of the south approach. The tree is within one foot of the edge of the driving lane and shows evidence of repeated vehicle strikes.

  Estimated Cost: $ 300

- Remove all of the non-functional street lights at this site.

  Estimated Cost: $ 2,000

- Trim the trees and weed the curb line west of the bridge on Klingle Road. This area looks unkempt and the trees block the signs and obstruct the driver's view of the road alignment west of the site.

  Estimated Cost: $ 500

Total Estimated Cost: $46,500

Long-Term Recommendation:

- This intersection does not meet the MUTCD warrants for multiway stop signs at this time. The intersection should be monitored in the future and converted to a three-way stop operation when the warrants are met.

  Estimated Cost: $ 1,800

7.4.9 Site 9 - Intersections of Beach Drive and Cathedral Avenue with Rock Creek and Potomac Parkway

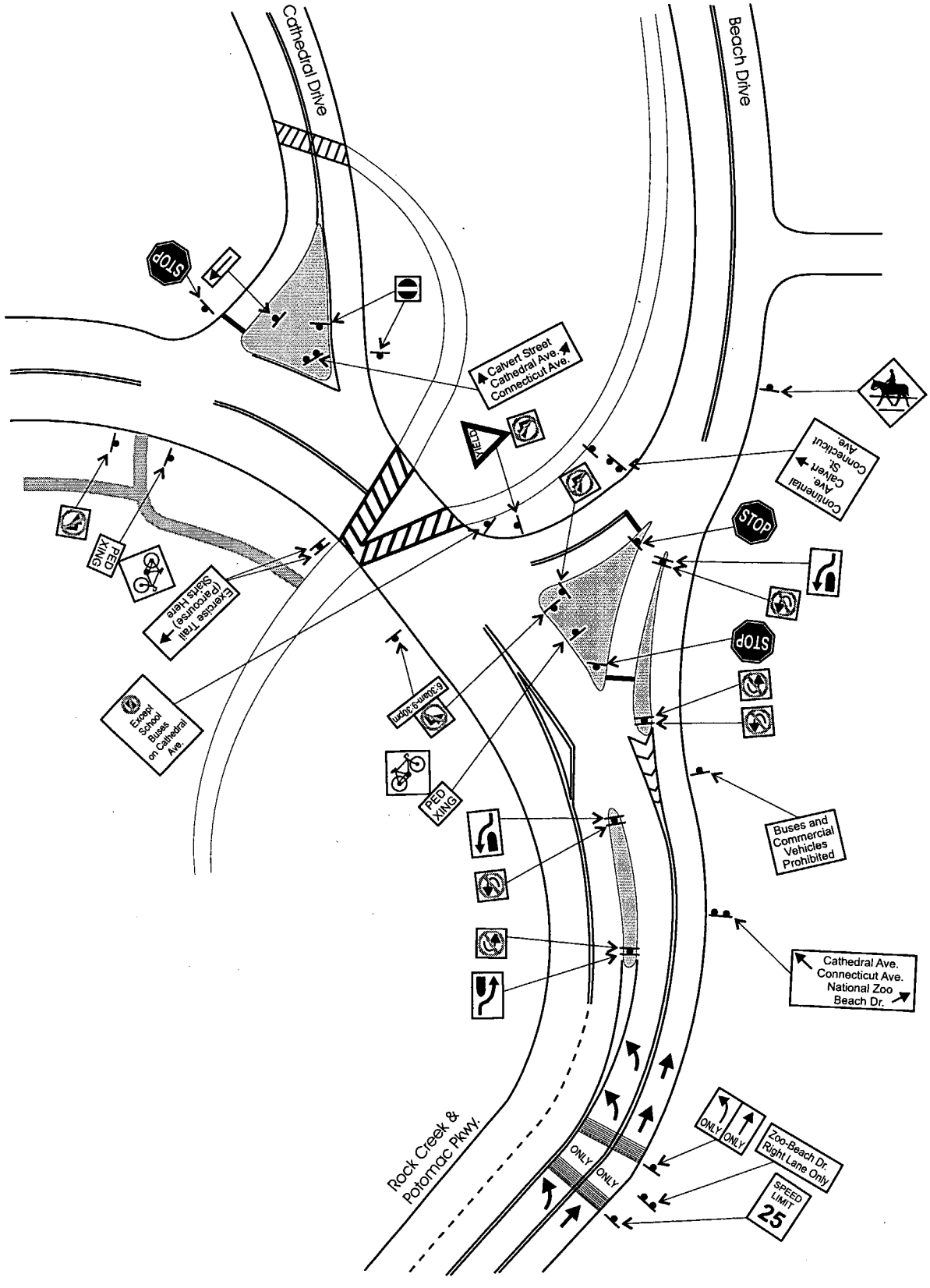
Site Description:
This site includes two "Y"-shaped intersections along the Rock Creek and Potomac Parkway. These intersections are south of the National Zoological Park, as indicated in **FIGURE 7-0**. Cathedral Avenue and Beach Drive both approach Rock Creek and Potomac Parkway from the east, and a curved section of the Parkway constitutes the north and south approaches of each intersection. Cathedral Avenue intersects the Parkway directly north and uphill of the Beach Drive intersection. Both intersections have functional street lighting. A sketch and photos of the site are provided in **FIGURES 7-9.1**, **7-9.2A**, and **7-9.2B**.

There are paved pedestrian/bicycle paths running alongside both Cathedral and Beach as they approach the Parkway. Both paths cross the Parkway between the two intersections, joining to form a path leading south along the west side of the Parkway. Both crossings are marked on the pavement, and highlighted by 2-sided pedestrian/bicycle crossing warning signs located adjacent to the crosswalks. A third crossing of the Parkway is implied by the existence of an older asphalt path that leads north along the west side of the Parkway. This path turns to the curb just above the Cathedral intersection, but there is not a corresponding path on the opposite side of the street. The crossing is not marked on the pavement. There is a path worn into the dirt which continues north along the Parkway from this location.

Each leg of the intersection of Cathedral Avenue and the Parkway has one approaching traffic lane. There is also a northbound right turn ramp, which is separated from the westbound lane by a median island. Approach traffic on Cathedral is controlled by a stop sign. Due to the one-way nature of the Parkway during rush hours, right turns from Cathedral are prohibited during the morning peak, and left turns are prohibited during the evening peak. Southbound left turns onto Cathedral are not allowed at any time.

There are three raised medians at the intersection of Beach Drive and the Parkway. The south approach has a through lane and a right turn lane which ramps onto Beach. One lane of traffic approaches the intersection from the north. There is also a southbound left turn ramp, where drivers are required to yield to through traffic on Beach. This ramp is barricaded during the morning peak. The lane of traffic approaching from Beach Drive is divided into left and right ramps. Left turns are controlled by a stop sign and right turns by a yield sign, except during the peak traffic hours. Right turns are not allowed during the morning peak, when there is no northbound traffic on the Parkway. On the left turn ramp, the hinged stop sign is opened to reveal a "Keep Moving - Through Traffic" message. Cones are placed in the road to channelize the outgoing southbound traffic. Left turns are prohibited from Beach Drive during the evening peak.

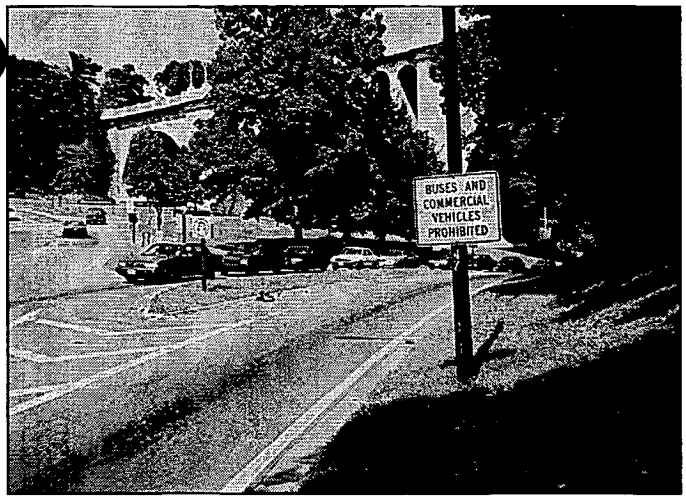
Of the traffic driving south on the Parkway from this location during the morning peak, approximately 25% originates at Cathedral Avenue, 45% at Beach Drive, and the remaining 30% from Calvert Street. In the evenings, about 50% of the northbound traffic on the Parkway exits at Beach, and 30% turns off at Cathedral. At mid-day, Cathedral and Beach introduce 10% and 55% of southbound vehicles, respectively, while bleeding off 15% and 65% of northbound vehicles. Turning movement counts for both intersections are presented in Appendix A. There are frequent



Map Not to Scale

ROCK CREEK PARK

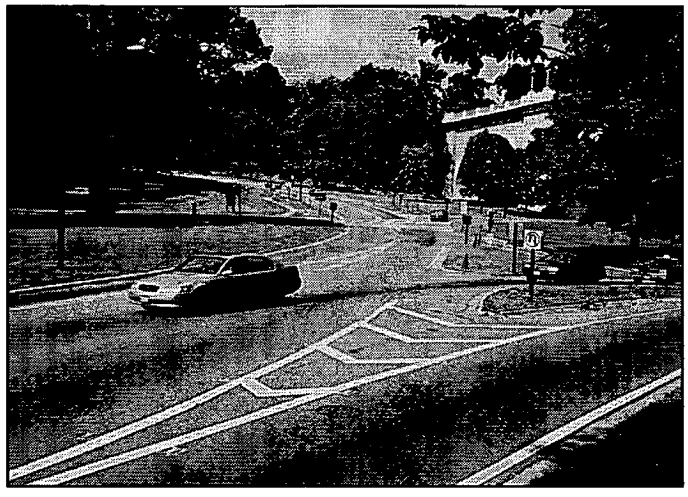
Figure 7-9.1
Site 9 - Existing Conditions
Beach Dr./Parkway & 24th St.



Traffic often backs up on the north approach to the intersection on Beach Drive.

A pedestrian crosswalk is located across the parkway between the Beach and Cathedral intersections. Vehicles stopping abruptly at this crosswalk cause rear-end accidents.

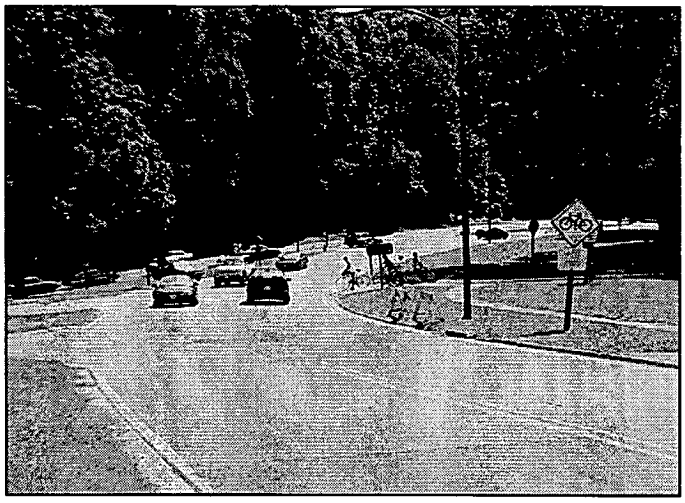
This photo shows the north approach to the intersection. Notice the paved pedestrian path on the right side of the road.



This photo shows the skewed alignment of the intersection of the Parkway and Beach Drive.

ROCK CREEK PARK

Figure 7-9.2A
Site 9 - Photo Page 1
Beach Drive/Rock Creek Parkway/Cathedral



A bicycle crossing warning sign is used in advance of the crossing for traffic approaching from the north. This crossing is heavily used.

This photo shows the lane-use sign and pavement markings on the south approach to the intersection. Notice the rumble strips on this approach. They are constructed of Thermoplastic pavement lines across the roadway. They are not considered severe enough to adequately slow traffic.

Rough pavement exists in the southbound lane of the Parkway across from the Beach Drive intersection.

An old paved pedestrian path exists on the west side of the Parkway. This path leads to an unmarked crossing near the Cathedral intersection.

ROCK CREEK PARK

Figure 7-9.2B
Site 9 - Photo Page 2
Beach Drive/Rock Creek Parkway/Cathedral

conflicts between vehicles and pedestrians and/or bicyclists crossing at this location, particularly on weekends. During a brief Sunday afternoon observation, such a conflict occurred every 37 seconds on average.

Accident History:

A total of 143 accidents were reported at this site from January 1, 1993 through December 31, 1995. None of the accidents reported at this location were fatalities. Of the 143 accidents, 31 (22%) resulted in injuries. The time of accident occurrence shows a definite peak between the hours of 2:00 and 4:00 p.m., with smaller peaks during the 10:00 a.m. and 10:00 p.m. hours. More accidents occurred on Friday and Saturday than any other day of the week. The months with the most accidents occurring were July and November. A complete summary of accident statistics at Site 9 is shown in **TABLE 7-9**. Characteristics of note for the accidents occurring at these busy intersections are listed below:

- The average accident frequency for the site was 48 accidents per year, with an accident rate of 2.49 accidents/MVE and a severity rate of 1.22.
- 115 (80%) of the 143 accidents were collisions with another motor vehicle; collisions with fixed objects were next prevalent, with 19 accidents (13%).
- Of the 115 motor vehicle collisions: 47 were rear-end collisions, 27 were angle collisions, 21 were head-on collisions, and sideswipe collisions between overtaking and opposing vehicles accounted for ten and eight of the accidents, respectively.
- 78 (55%) of the 143 accidents occurred on dry roads, while 38% occurred on wet roadway surfaces, and 5% happened during icy/slushy or snowy road conditions.
- A total of 55 (38%) accidents at the site occurred during low-light conditions.
- Two accidents were reported involving animals; one of these was an animal-vehicle collision.
- Three accidents involved collision with a bicycle, and one involved a pedestrian collision. All three of the bicycle collisions resulted in injuries, one of which caused injury to a bicyclist.
- Excessive speed contributed to 26 (18%) accidents, with 81% of these due to driving "too fast for conditions". Other common contributing factors were "driver followed too closely" (22 accidents), "driver failed to yield right of way" (19 accidents), and "driver failed to give full time and attention" (16 accidents).
- Three accidents were attributed to "driver under the influence of alcohol".

Problems:

- There is a great deal of conflicting traffic at this site. The Parkway is often difficult to access from Beach when there is two-way traffic. As a result, Beach traffic has to be overly aggressive when entering the traffic flow on the Parkway.
- Aggressive commuter traffic is likely to intimidate the out-of-towners in the fleet mix.
- There are frequent late lane changes by northbound vehicles during the evening peak, which causes confusion.
- A large volume of pedestrian and bike traffic crosses the Parkway near these two intersections, particularly on weekends. These crossings create conflicts and disrupt the flow of traffic.

TABLE 7-9
Rock Creek Park Accident Information
Site #9 - Ints. Rock Creek Pkwy. w/ Beach Dr. & Cathedral Ave.

site9sum.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	0	0	0	0
(Number of Fatalities)	0	0	0	0
Injury Accidents	9	11	11	31
(Number of Injuries)	11	16	16	43
P.D.O. Accidents	44	25	43	112
Totals	53	36	54	**143**

Summary by Hour (TIMEACC)

000-059	1
100-159	0
200-259	1
300-359	0
400-459	0
500-559	1
600-659	7
700-759	5
800-859	5
900-959	3
1000-1059	12
1100-1159	4
1200-1259	8
1300-1359	5
1400-1459	12
1500-1559	16
1600-1659	5
1700-1759	7
1800-1859	8
1900-1959	9
2000-2059	6
2100-2159	9
2200-2259	11
2300-2359	8
Total	143

Summary by Month (ACCDATE)

January	8
February	3
March	11
April	7
May	11
June	13
July	19
August	14
September	11
October	14
November	19
December	13
Total	143

Summary by Day of Week (DAY)

Sunday (01)	16
Monday (02)	11
Tuesday (03)	19
Wednesday (04)	20
Thursday (05)	23
Friday (06)	27
Saturday (07)	27
Total	143

Surface Condition (SURFCOND)

Dry (01)	78
Wet (02)	55
Icy/slushy (03)	5
Snowy (04)	2
Muddy (05)	0
Debris(06)	0
Other (88)	0
Unknown (99)	3
Total	143

Pedestrian (PED)

(Y)	1

Accident Class (ACCLASS)

	Totals
Non-collision (00)	3
Collision with other motor vehicle (01)	115
Collision with fixed object (02)	19
Collision with pedestrian (03)	1
Collision with pedacycle -bicycle (04)	3
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	1
Collision with other object (88)	1
Collision -unknown (99)	0
Total	143

animal coll.-PDO,clear,dry,daylight,Nov.

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Fatalities	Injuries	Animals	Total
Daylight (01)	0	23	2	87 (33 inj.)
Dawn (02)	0	0	0	1
Dusk (03)	0	0	0	3
Dark-lighted (04)	0	7	0	37 (9 inj.)
Dark-not lighted (05)	0	1	0	14 (1 inj.)
Unknown (99)	0	0	0	1
Totals	0	31	2	143 (43 inj.)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	43
On roadway -parking/driveway access (12)	2
On roadway -interchange (13)	7
On roadway -bridge (14)	0
On roadway -workzone (15)	0
On roadway -other (16)	77
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	8
Off roadway -median (24)	0
Off roadway -other (25)	3
Unknown (99)	3
Total	143

Weather (WEATHER)

Clear (01)	78
Cloudy (02)	12
Rain (03)	42
Snow (04)	2
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	4
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	1
Unknown (99)	4
Total	143

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	25
Head on (01)	21
Rear end (02)	47
Angle (03)	27
Sideswipe -opposing (04)	8
Sideswipe -overtaking (05)	10
Other (88)	2
Unknown (99)	3
Total	143

Road Character (ROADCHAR)

Straight & Level (01)	6
Straight on grade (02)	12
Curved & level (03)	28
Curved on grade (04)	93
Unknown (99)	4
Total	143

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	119
Guardrail/Barrier (01)	1
Rock/Stone Wall (02)	1
Pole (03)	8
Tree/Shrub (04)	10
Culvert End Wall (05)	0
Drainage Structure (06)	0
Bridge Structure (07)	0
Sign (08)	0
Barricade (09)	1
Boulder (10)	0
Ditch (11)	0
Backslope (12)	0
Other fixed object (88)	3

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	3
Exceeding Speed Limit (A05)	5
Too Fast for Conditions (A06)	21
Ped/Bike Contributing (D**)	2
Animal Contributing (B06)	2
*Followed too closely (A09)	22
*Failed to yield R/W (A03)	19
*Failed to give full time & attention (A16)	16
*Improper lane change (A10)	7
*Wrong side or wrong way (A08)	7
*Disregarded traffic signs, signals or road	5

- There are several places within the site that have damaged pavement. These areas have been dug out and patched in the past, but the patches are being pushed out of the holes, creating an uneven driving surface.
- Traffic backs up past Piney Branch to the north on Beach Drive when the the Parkway is operating in both directions during the middle of the day, especially between 9:45 a.m. and noon.

Recommendations:
The recommended improvements for this site are shown in **FIGURE 7-9.3**.

- Use more aggressive rumble strips, such as the type that are grooved into the pavement, on the south approach.
  Estimated Cost: $ 2,000

- Install white candlestick delineators between the right and through lanes on the south approach. Delineate the southbound through lane with white candlesticks as well.
  Estimated Cost: $ 2,000

- Install a "Right Lane Keep Moving" sign on the right side of the south approach.
  Estimated Cost: $ 200

- Remove the "No Buses" sign from the north side of the intersection.
  Estimated Cost: $ 50

- Relocate the "Exercise Trail" sign on the west side of the intersection to another location farther from the intersection.
  Estimated Cost: $ 100

- Repair the damaged spots in the pavement at this site.
  Estimated Cost: $ 2,000

- Fill in the low areas behind the curb line throughout this site.
  Estimated Cost: $ 1,000

- Install an object marker on the north end of the wall along the west side of the Parkway south of the intersection with Beach.
  Estimated Cost: $ 200

- Install an object marker on the rock wall around the base of the tree located at the end of the northbound right turn ramp onto Beach.
  Estimated Cost: $ 200

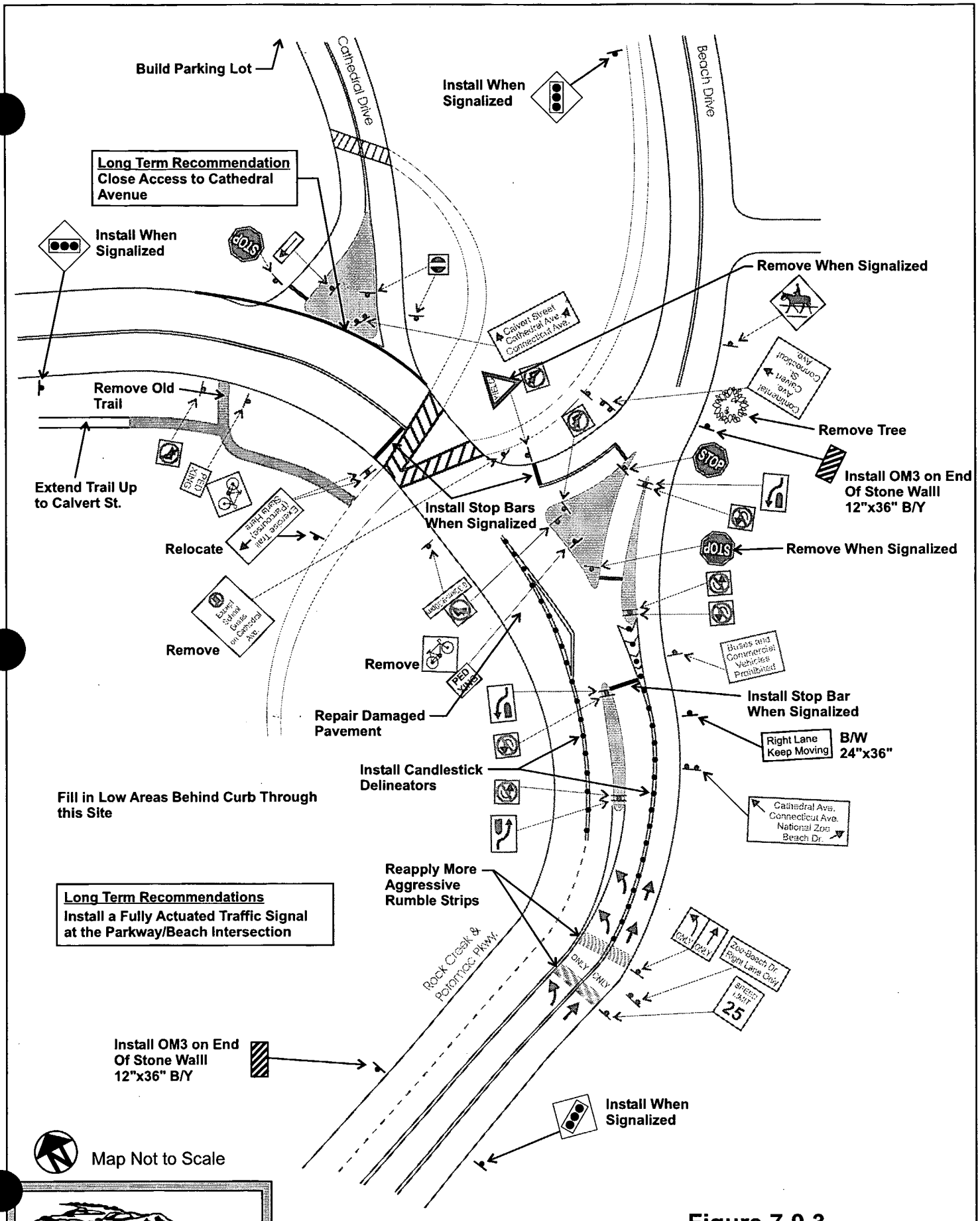


Figure 7-9.3
Site 9 - Recommended Improvements
Beach Dr./Parkway & 24th St.

- Extend the trail on the west side of the Parkway up to the intersection at Calvert Street. Eliminate all indications of a crossing north of the Cathedral Street Intersection. If necessary install a fence along the west side of the Parkway on the hill to enforce the no crossing zone.
  Estimated Cost: $ 5,000

Total Estimated Cost: $12,750

Long-Term Recommendations:

- Close the Cathedral Avenue access to the Parkway and build a parking area under the Connecticut Avenue Bridge that is accessible only from Cathedral Avenue.
  Estimated Cost: $ 75,000

- Install a fully actuated traffic signal at the intersection of Beach and the Parkway. This intersection meets the volume warrants for signalization as outlined in the *Manual on Uniform Traffic Control Devices*. All traffic lanes should be controlled by the signal. The signal should provide a separate phase for pedestrian traffic that is actuated by push-buttons located on both sides of the crosswalk across the Parkway. During the pedestrian phase all traffic on the north Parkway approach and the through traffic from the south should stop, while northbound right turning traffic and left turning Beach traffic would continue to flow. The northbound right should always be presented with a green arrow indication. The southbound through traffic on the Parkway should get a green indication at all times except during the pedestrian phase. The westbound right ramp on Beach should also be controlled by this signal. The signal should have an totally different phase for the morning and evening one-way operations. Install signal ahead warning signs on all approaches.
  Estimated Cost: $150,000

Total Estimated Cost: $225,000

7.4.10 Site 10 - Intersection of Rock Creek and Potomac Parkway with P Street

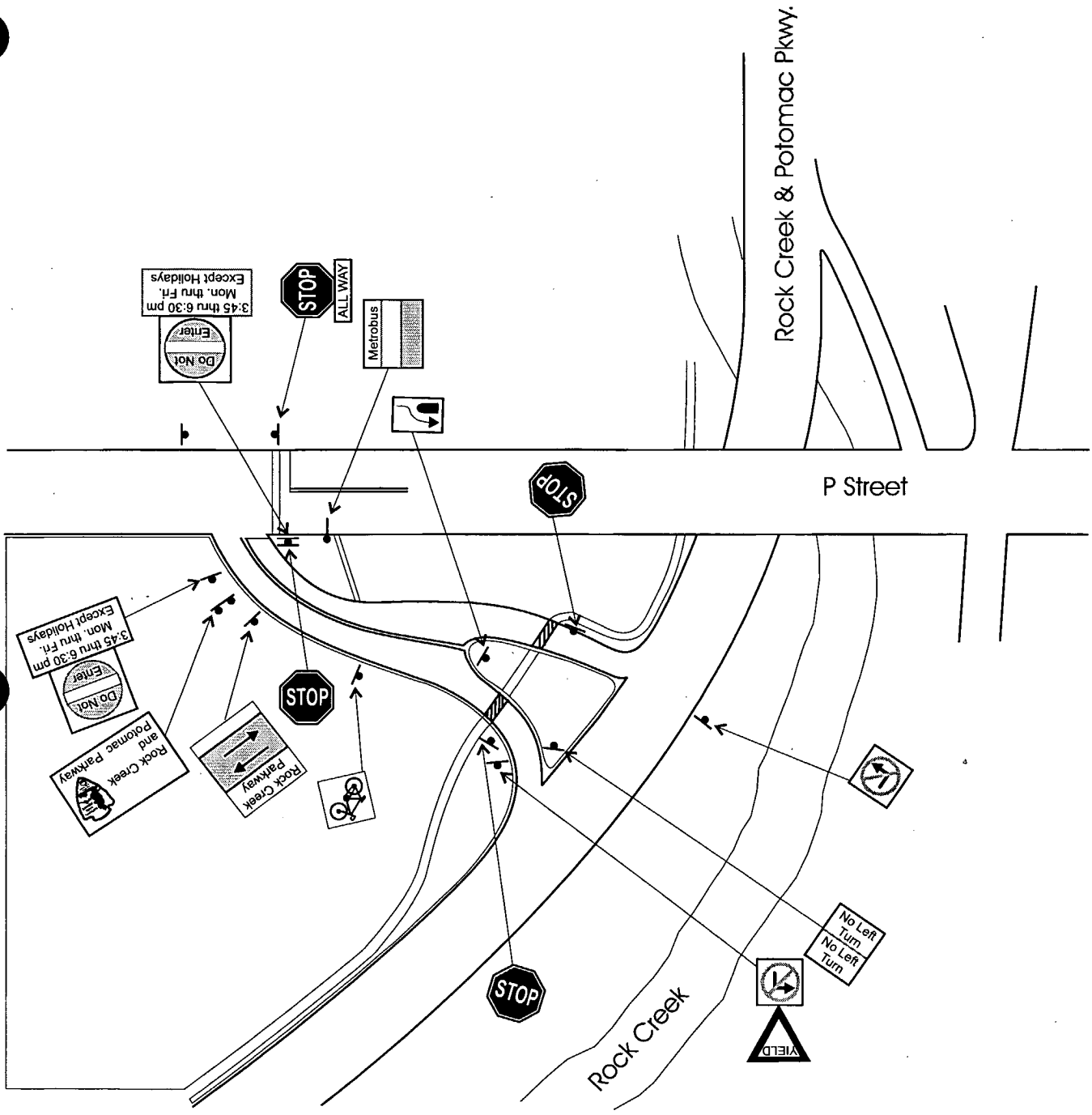
Site Description:
This site consists of the junction between the Rock Creek and Potomac Parkway and the southbound exit and entry ramps located at P Street. As shown in **FIGURE 7-0**, this intersection lies on a curved section of the Parkway. Immediately north of the site, the Parkway crosses under the P Street Bridge, then over Rock Creek.

The Parkway is an undivided four-lane facility at this location. The southbound ramps form one lane of traffic in each direction on the P Street access road with no deceleration or acceleration lanes at their junction with the Parkway. A heavily used asphalt pedestrian and bicycle path runs along the west side of the Parkway, curving up the sides of the access road before crossing both lanes of traffic. There are also dirt paths worn into the grass extending up both sides of the access road all the way to P Street. **FIGURE 7-10.1** represents the site layout, and photographs of the site are displayed in **FIGURE 7-10.2**.

The exit and entry ramps of the P Street access road are divided by a large raised median. The pedestrian and bicycle path, which crosses the median, is controlled by a total of four stop signs facing the pedestrian/bicycle traffic: one on either side of the access road, and one on each side of the center median. There is a three-way stop at the top of the access road where it intersects with P Street. Traffic on the entrance ramp must yield to traffic on the Parkway. The ramp is closed during peak evening hours. With the exception of signs prohibiting northbound left turns on to the ramp, there is no traffic control on the Parkway at this location. Field observations indicate that northbound drivers occasionally turn left at this site despite the left turn restriction.

Accident History:
A total of 140 accidents were reported at this site during the study period. No fatal accidents were reported at the intersection. 47 (34%) of the 140 accidents caused 95 injuries, resulting in an average of 2.0 injuries for each injury accident. Accidents occurred during nearly every hour of the day, with the highest number of accidents reported between 5:00 and 7:00 p.m. Tuesday had the highest accident occurrence during the week. The months with the most reported accidents were September and October. A complete summary of accident statistics at Site 10 is shown in **TABLE 7-10**. Some notable accident characteristics for this site are listed below:

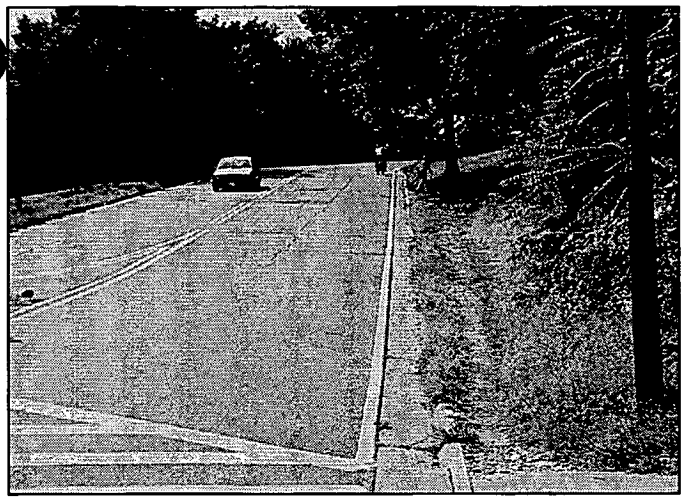
- On average, 47 accidents occurred at this intersection each year. The accident rate was 1.97 accidents/MVE and the severity rate 1.34.
- Total number of accidents varies from year to year, with the highest number (55) occurring in 1995.
- Most of the accidents at the site were collisions with another motor vehicle (108 accidents, 77%); 27 accidents were classified as collisions with fixed objects.
- Of the 108 motor vehicle collisions, 49 were rear-end collisions, 12 were head-on collisions, 12 were angle collisions, and 15 involved sideswipes (nine between opposing vehicles and six by an overtaking vehicle).
- 55% of all accidents occurred on dry road surfaces, 41% occurred on wet roads (88% of these while it was raining), and 4% occurred when it was snowy.
- 39% of all accidents occurred during low-light conditions, including 40% of all injury accidents at the site.



Map Not to Scale

ROCK CREEK PARK

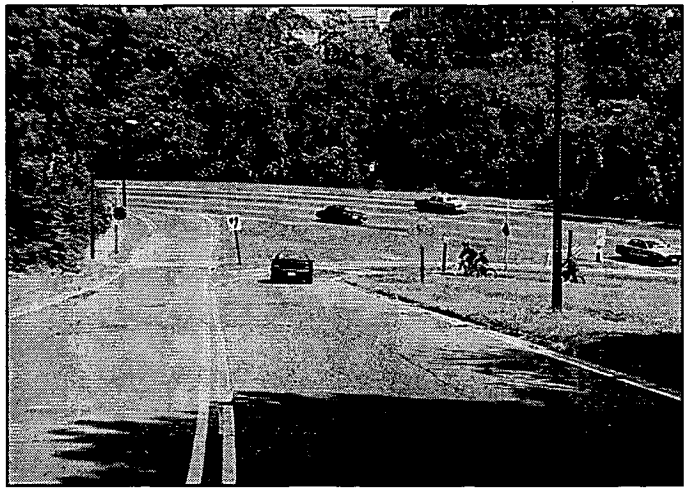
Figure 7-10.1
Site 10 - Existing Conditions
Rock Creek & Potomac Pkwy./P Street



The dirt path on the north side of the access road demonstrates the need for a paved path at this location.

This view from the P Street Bridge shows the alignment of the exit ramp. This ramp has a maximum safe speed of 15 mph. Traffic approaches this ramp at speeds in excess of 50 mph.

The driver can not see the exit ramp due to the bridge when approaching from the north.



The pedestrian crossing at the bottom of the access ramp causes conflicts and near rear-end accidents. This crossing is heavily used. Drivers exiting the Parkway have very little visual advance notice of the crossing due to limited sight distance caused by vegetation growing on the inside of the curve.

ROCK CREEK PARK

Figure 7-10.2
Site 10 - Photo Page
R.C.P./P Street

TABLE 7-10
Rock Creek Park Accident Information
Site #10 - Int. Rock Creek Pkwy. & P St.

site10su.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	0	0	0	0
(Number of Fatalities)	0	0	0	0
Injury Accidents	15	14	18	47
(Number of Injuries)	33	24	38	95
P.D.O. Accidents	32	24	37	93
Totals	47	38	55	**140**

Summary by Hour (TIMEACC)

000-059	3
100-159	1
200-259	0
300-359	1
400-459	4
500-559	0
600-659	6
700-759	2
800-859	3
900-959	6
1000-1059	8
1100-1159	7
1200-1259	5
1300-1359	4
1400-1459	11
1500-1559	9
1600-1659	8
1700-1759	16
1800-1859	13
1900-1959	9
2000-2059	6
2100-2159	8
2200-2259	6
2300-2359	4
Total	140

Summary by Month (ACCDATE)

January	11
February	9
March	9
April	12
May	14
June	6
July	9
August	9
September	17
October	20
November	13
December	11
Total	140

Summary by Day of Week (DAY)

Sunday (01)	11
Monday (02)	19
Tuesday (03)	31
Wednesday (04)	19
Thursday (05)	22
Friday (06)	23
Saturday (07)	15
Total	140

Surface Condition (SURFCOND)

Dry (01)	77
Wet (02)	57
Icy/slushy (03)	0
Snowy (04)	5
Muddy (05)	0
Debris(06)	0
Other (88)	0
Unknown (99)	1
Total	140

Pedestrian (PED)

(Y)	0

Accident Class (ACCLASS)

	Totals
Non-collision (00)	3
Collision with other motor vehicle (01)	108
Collision with fixed object (02)	27
Collision with pedestrian (03)	0
Collision with pedacycle -bicycle (04)	0
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	0
Collision with other object (88)	2
Collision -unknown (99)	0
Total	140

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Fatalities	Injuries	Animals	Total	
Daylight (01)	0	28	0	85	(50 inj.)
Dawn (02)	0	3	0	6	(8 inj.)
Dusk (03)	0	3	1	9	(3 inj.)
Dark-lighted (04)	0	10	0	27	(29 inj.)
Dark-not lighted (05)	0	3	0	13	(5 inj.)
Unknown (99)	0	0	0	0	
Totals	0	47	1	140	(95 inj.)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	5
On roadway -parking/driveway access (12)	2
On roadway -interchange (13)	18
On roadway -bridge (14)	1
On roadway -workzone (15)	2
On roadway -other (16)	102
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	4
Off roadway -median (24)	0
Off roadway -other (25)	5
Unknown (99)	1
Total	140

Weather (WEATHER)

Clear (01)	72
Cloudy (02)	13
Rain (03)	50
Snow (04)	5
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	0
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	0
Unknown (99)	0
Total	140

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	32
Head on (01)	16
Rear end (02)	49
Angle (03)	15
Sideswipe -opposing (04)	11
Sideswipe -overtaking (05)	9
Other (88)	8
Unknown (99)	0
Total	140

Road Character (ROADCHAR)

Straight & level (01)	9
Straight on grade (02)	24
Curved & level (03)	62
Curved on grade (04)	42
Unknown (99)	3
Total	140

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	110
Guardrail/Barrier (01)	1
Rock/Stone Wall (02)	4
Pole (03)	8
Tree/Shrub (04)	6
Culvert End Wall (05)	0
Drainage Structure (06)	0
Bridge Structure (07)	1
Sign (08)	1
Barricade (09)	0
Boulder (10)	0
Ditch (11)	2
Backslope (12)	0
Other fixed object (88)	7
Total	140

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	1
Under Influence of Alcohol (A02,D02)	3
Exceeding Speed Limit (A05)	13
Too Fast for Conditions (A06)	24
Ped/Bike Contributing (D**)	0
Animal Contributing (B06)	1
*Failed to give full time & attention (A16)	27
*Followed too closely (A09)	20
*Improper lane change (A10)	7
*Wrong side or wrong way (A08)	7

- One accident was reported with an animal as a contributing factor.
- None of the accidents reported at the site showed any pedestrian or bicyclist involvement.
- 37 (26%) of the 140 accidents involved excessive speed: driving "too fast for conditions" accounted for 17% while "exceeding speed limit" contributed to 9%. "Driver failed to give full time and attention" was a contributing factor in 27 accidents, and "driver followed too closely" contributed to 20 accidents.
- One accident was reported with "driver under the influence of drugs", and three with "driver under the influence of alcohol".

Problems:

- The pedestrian/bicycle path conflicts with traffic entering and exiting the Parkway.
- The curve in the Parkway south of P Street is the location of many of the head-on collisions and sideswipes caused by vehicles not staying in their designated lanes.
- Northbound left turns on to the P Street exit ramp are prohibited but not at all uncommon, particularly among taxi drivers. The sight distance for this maneuver is very poor.
- Vegetation on the inside of the curve on the north approach limits the sight distance at this location.
- The southbound exit ramp has a maximum safe speed of 15 mph, while the average speed on the Parkway in this area is approximately 50 mph. There is no room available on the Parkway under the P Street bridge for a deceleration lane.

Recommendations:

The recommendations for Site 10 are presented in **FIGURE 7-10.3**.

- Relocate the pedestrian/bicycle path crossing 100 feet further up the access road from the Parkway. Extend the existing raised median through the new crossing. Install a fence (perhaps a section of split rail fence) on the median to force the bicyclists and joggers to use the new trail alignment.

  Estimated Cost: $ 7,000

- Install a raised center median on the Parkway with appropriate signage and guardrail barrier (Jersey rail) through the site. The center barrier should start at least 500 feet south of the curve on the south approach and end 500 feet north of the P Street bridge. After the barrier is installed remove all of the no left turn signs.

  Estimated Cost: $25,000

- Install a guidance sign on the north approach for southbound traffic on the Parkway.

  Estimated Cost: $ 300

- Install an "Exit - 15 mph" sign on the north approach.

  Estimated Cost: $ 200

- Remove all of the vegetation on the inside of the curve between the P Street Bridge and the site. This will benefit the visitors using the path and improve sight distance for the vehicles entering and exiting the Parkway.

  Estimated Cost: $ 500

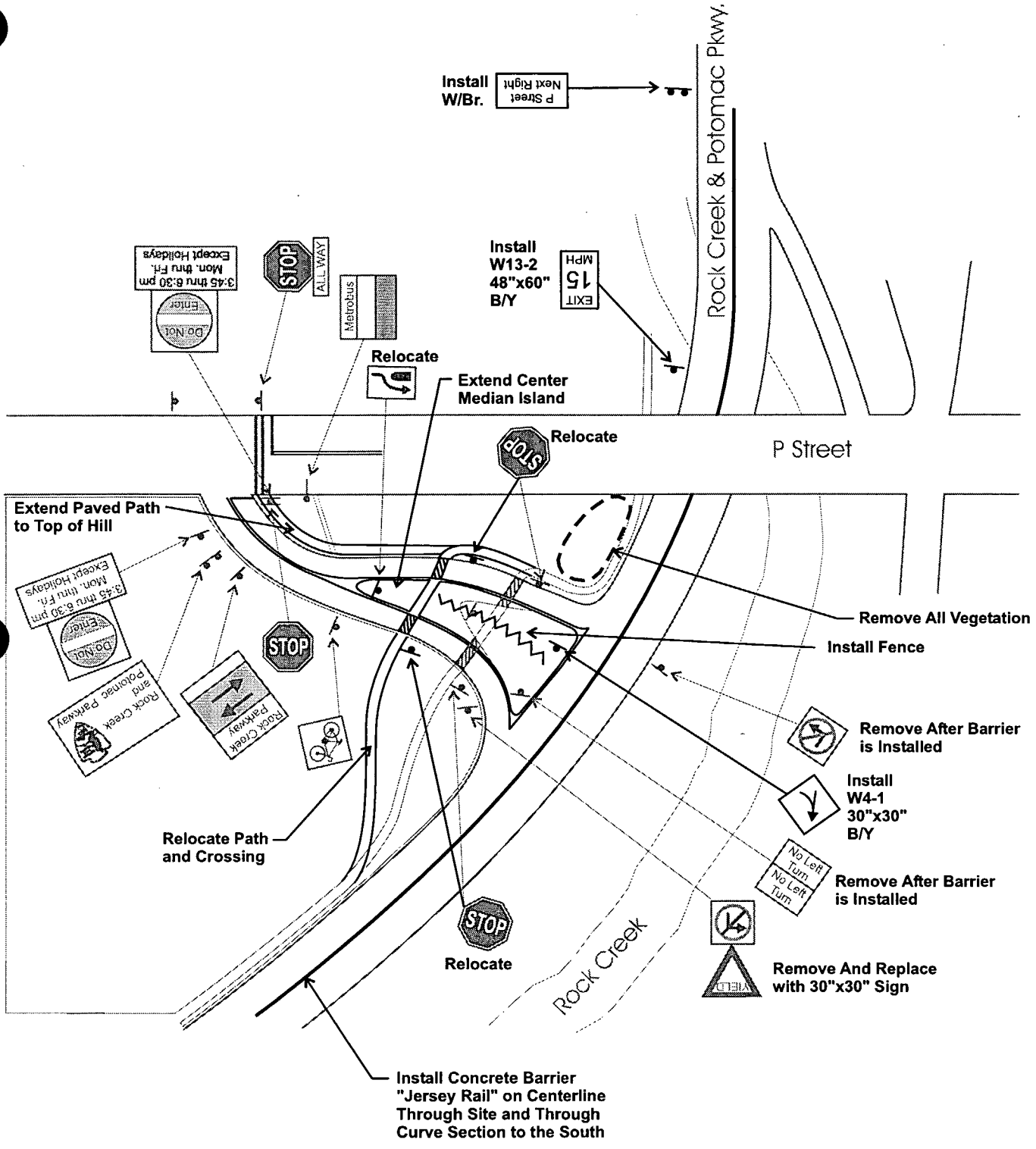


Figure 7-10.3
Site 10 - Recommended Improvements
Rock Creek & Potomac Pkwy./P Street

- Install a paved trail up the access road to P Street. Locate the new trail on the north side of the access ramp.

  Estimated Cost: $ 5,000

- Install a merging traffic sign for southbound Parkway traffic. Locate the sign on the median island that forms the exit and entrance ramps.

  Estimated Cost: $ 200

- Control the access ramp onto the Parkway with a standard-sized yield sign.

  Estimated Cost: $ 200

Total Estimated Cost: $38,400

7.4.11 Site 11 - Intersection of Rock Creek and Potomac Parkway with Virginia Avenue

Site Description:
This site is comprised of the intersection between the Rock Creek and Potomac Parkway and Virginia Avenue, which includes the entrance to the Thompson Boat House parking lot. The intersection lies north of the Kennedy Center, as indicated in **FIGURE 7-0**. The Parkway runs north and south at this location, with Virginia Avenue approaching from the east. The Boat House parking lot entrance makes up the west leg of the intersection. There is a short deceleration lane for southbound traffic turning into the Boat House parking lot. Entrance ramps from K Street and Pennsylvania Avenue lie to the north on the Parkway, and 27th and I Streets intersect Virginia Avenue immediately east of the site. An asphalt pedestrian and bicycle path extends through the site along the west side of the Parkway, with a marked crossing on the Boat House approach. There is also a pedestrian crossing marked on the south leg of the intersection. A sketch of the location can be found in **FIGURE 7-11.1**, and **FIGURE 7-11.2** contains site photos.

This intersection is signalized, with a pedestrian push button on the south leg. Four median islands channelize traffic through the intersection. There are two lanes of traffic approaching from the north, south and east, and the south leg also has a short right turn lane with a ramp on to Virginia. The Boat House approach has just one lane of traffic. Left turns are prohibited on the south and east approaches; right turns on red are restricted on the east and west legs of the intersection. During one-way operation of the Parkway, the signal phases are disregarded by the steady stream of drivers. In the morning, approximately 45% of the traffic exits the Parkway at Virginia, while about half of the evening traffic is introduced there. Peak hour turning movement counts for this intersection can be found in Appendix A. There are frequent conflicts between pedestrians and vehicles at this intersection, and pedestrians are often trapped on the south median island.

Accident History:
A total of 103 accidents were reported at Site 11 during the three-year study period. One fatal accident was reported at this intersection in 1993, causing a single pedestrian fatality. 18 (17%) of the 103 were injury accidents. Accidents occurred throughout the day, with a peak from about 6:00 to 9:00 p.m. The highest numbers of accidents occurred on a Friday or Saturday. Seasonal peaks occurred in the spring (April through June) and fall (September and October). A complete summary of accident statistics at Site 11 is shown in **TABLE 7-11**. Interesting characteristics of accidents occurring at this intersection are noted in the following text:

- The average accident frequency at the site was 34 accidents per year, resulting in an accident rate of 2.35 accidents/MVE and a severity rate of 1.21.
- Accident occurrence has been steadily increasing over the past three years, with 28 accidents reported in 1993, 34 in 1994, and 41 in 1995.
- Nearly all of the 103 accidents were collisions with another motor vehicle (93%); 42 of these were rear-end collisions, followed by 30 angle collisions, and 10 sideswipe accidents between overtaking vehicles.
- Most of the accidents occurred on dry roads (78%).
- 37 (36%) accidents occurred at night, dawn or dusk; including the single fatality accident and half of all injury accidents.
- None of the reported accidents involved animals.

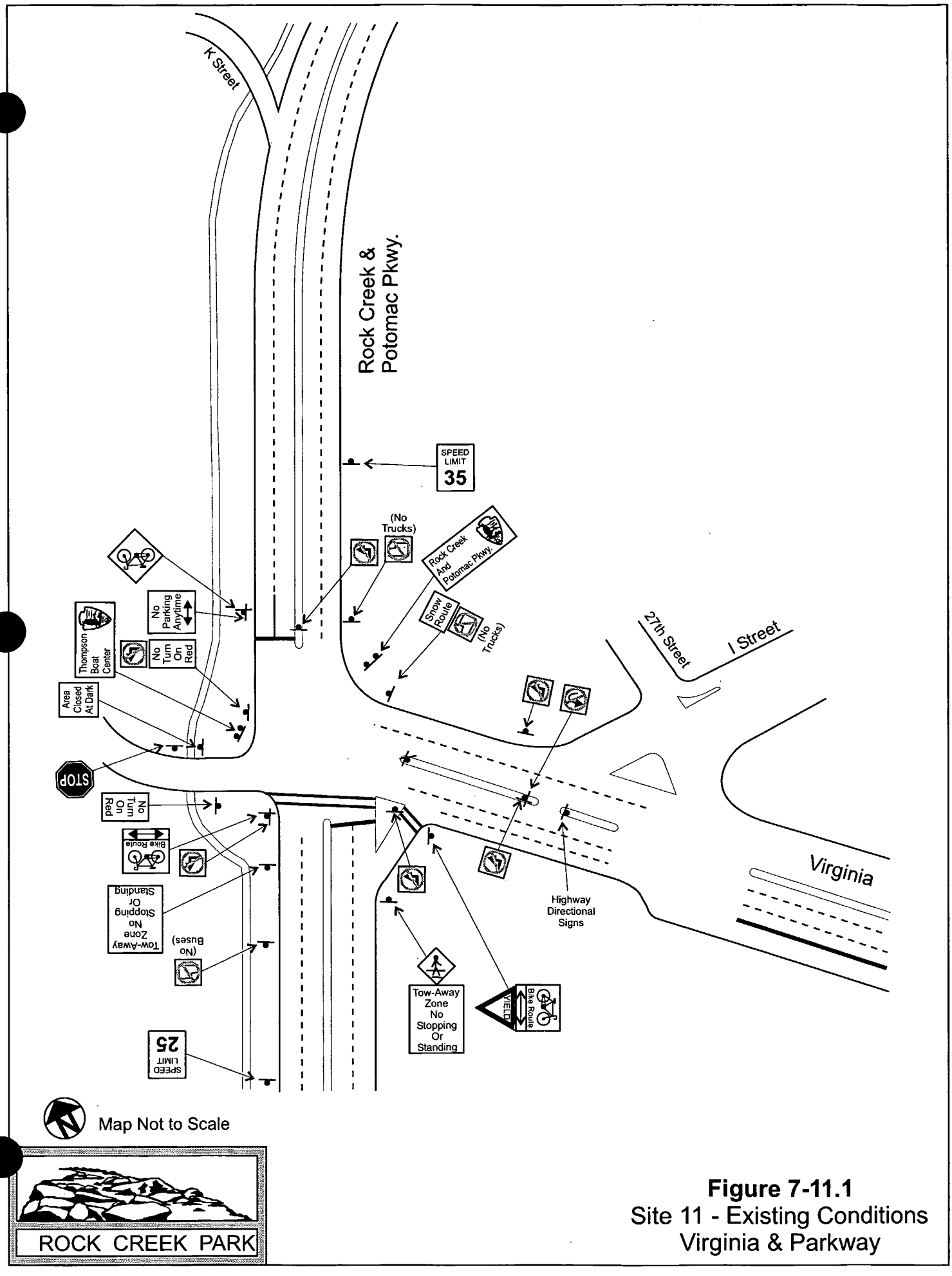
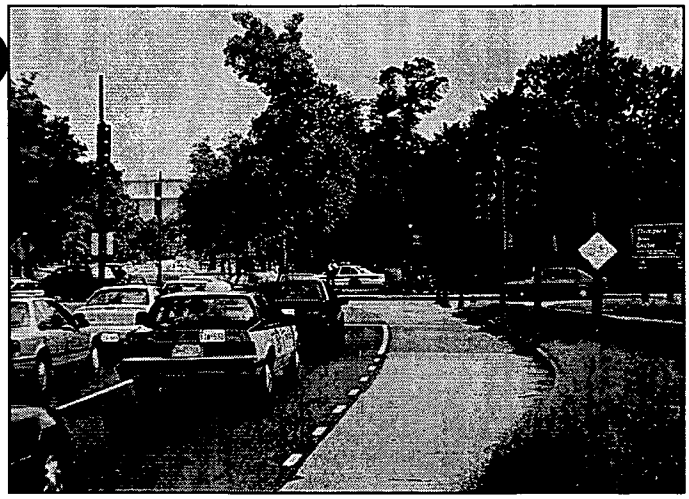
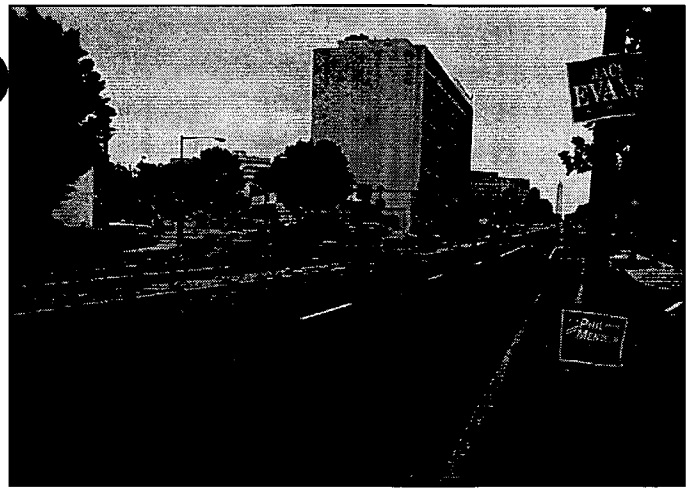


Figure 7-11.1
Site 11 - Existing Conditions
Virginia & Parkway

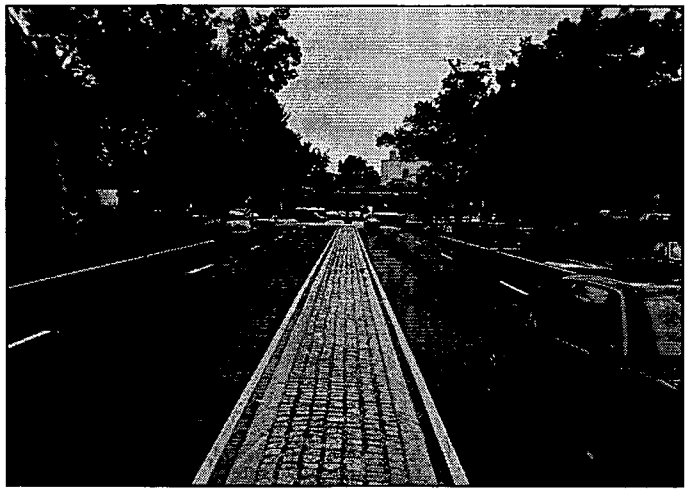


A deceleration/right turn lane is provided for southbound traffic turning into the Thompson Boat House parking area.

High volumes of pedestrians and bicyclists cross the south and west approaches at this intersection.



The gap in the center median island on the east approach to the intersection is heavily used by traffic heading onto E. Street and the Theodore Roosevelt Bridge.



The intersection is clearly visible on the south approach. The four traffic lanes are separated by a raised center median island.

ROCK CREEK PARK

Figure 7-11.2
Site 11 - Photo Page
R.C.P./Virginia

TABLE 7-11
Rock Creek Park Accident Information
Site #11 - Int. Rock Creek Pkwy. & Virginia Ave.

site11su.wk4

Severity Summary (CATEGORY,FATALS,INJURED)

	1993	1994	1995	Totals
Fatal Accidents	1	0	0	1
(Number of Fatalities)	1	0	0	1
Injury Accidents	5	8	5	18
(Number of Injuries)	5	15	5	25
P.D.O. Accidents	22	26	36	84
Totals	28	34	41	**103**

Summary by Hour (TIMEACC)

000-059	1
100-159	1
200-259	2
300-359	1
400-459	0
500-559	0
600-659	3
700-759	4
800-859	2
900-959	9
1000-1059	6
1100-1159	6
1200-1259	5
1300-1359	8
1400-1459	6
1500-1559	5
1600-1659	6
1700-1759	2
1800-1859	7
1900-1959	10
2000-2059	7
2100-2159	6
2200-2259	4
2300-2359	2
Total	103

Summary by Month (ACCDATE)

January	3
February	6
March	5
April	10
May	13
June	11
July	6
August	8
September	13
October	12
November	6
December	10
Total	103

Summary by Day of Week (DAY)

Sunday (01)	11
Monday (02)	11
Tuesday (03)	12
Wednesday (04)	15
Thursday (05)	13
Friday (06)	19
Saturday (07)	22
Total	103

Surface Condition (SURFCOND)

Dry (01)	80
Wet (02)	19
Icy/slushy (03)	1
Snowy (04)	0
Muddy (05)	0
Debris(06)	0
Other (88)	0
Unknown (99)	3
Total	103

Pedestrian (PED)

(Y)	1

Accident Class (ACCLASS)

	Totals
Non-collision (00)	2
Collision with other motor vehicle (01)	96
Collision with fixed object (02)	4
Collision with pedestrian (03)	1
Collision with pedacycle -bicycle (04)	0
Collision with parked motor vehicle (05)	0
Collision with railway train (06)	0
Collision with animal (07)	0
Collision with other object (88)	0
Collision -unknown (99)	0
Total	103

ACCCLASS=07
CONFACT=B06

Light (LIGHT)

	Fatalities	Injuries	Animals	Total	
Daylight (01)	0	9	0	64	(13 inj.)
Dawn (02)	0	0	0	2	
Dusk (03)	0	1	0	3	(2 inj.)
Dark-lighted (04)	1	7	0	28	(1 fat.,9 inj.)
Dark-not lighted (05)	0	1	0	4	(1 inj.)
Unknown (99)	0	0	0	2	
Totals	1	18	0	103	(1 fat,25 inj)

Accident Location (ACCLOCTN)

On roadway -intersection (11)	63
On roadway -parking/driveway access (12)	0
On roadway -interchange (13)	2
On roadway -bridge (14)	0
On roadway -workzone (15)	3
On roadway -other (16)	32
Off roadway -parking lot (21)	0
Off roadway -turnout/overlook (22)	0
Off roadway -roadside *incl. shoulder (23)	0
Off roadway -median (24)	0
Off roadway -other (25)	0
Unknown (99)	3
Total	103

Weather (WEATHER)

Clear (01)	69
Cloudy (02)	13
Rain (03)	18
Snow (04)	0
Fog, smog, smoke (05)	0
Sleet, hail, freezing rain (06)	0
Blowing sand/soil/etc (07)	0
Severe crosswinds (08)	0
Other (88)	0
Unknown (99)	3
Total	103

Type of Collision between vehicles (VEHCOLL)

Not applicable (00)	6
Head on (01)	5
Rear end (02)	42
Angle (03)	30
Sideswipe -opposing (04)	2
Sideswipe -overtaking (05)	10
Other (88)	6
Unknown (99)	2
Total	103

Road Character (ROADCHAR)

Straight & Level (01)	80
Straight on grade (02)	4
Curved & level (03)	13
Curved on grade (04)	4
Unknown (99)	2
Total	103

Type of fixed object struck (OBJSTRUK)

Not applicable (00)	99
Guardrail/Barrier (01)	1
Rock/Stone Wall (02)	0
Pole (03)	0
Tree/Shrub (04)	0
Culvert End Wall (05)	0
Drainage Structure (06)	0
Bridge Structure (07)	0
Sign (08)	1
Barricade (09)	0
Boulder (10)	0
Ditch (11)	0
Backslope (12)	0
Other fixed object (88)	2
Total	103

Contributing Factors (CONFACT1-6)

Under Influence of Drugs (A01,D01)	0
Under Influence of Alcohol (A02,D02)	2
Exceeding Speed Limit (A05)	5
Too Fast for Conditions (A06)	7
Ped/Bike Contributing (D**)	2
Animal Contributing (B06)	0
*Failed to yield R/W (A03)	24
*Failed to give full time & attention (A16)	19
*Followed too closely (A09)	17
*Disregarded traffic signs, signals or road	14
*Improper lane change (A10)	5

- One accident was a collision with a pedestrian; it was the single fatality accident at the site, in which the pedestrian was killed. One other accident listed a pedestrian or bicyclist as a contributing factor.
- The most common contributing factor was "driver failed to yield right of way" (24 accidents), followed by "driver failed to give full time and attention" (19 accidents), and "driver followed too closely" (17 accidents). Excessive speed was cited as contributing to a total of 12 accidents at the site.
- Two accidents at the intersection listed "driver under the influence of alcohol" as a contributing factor.

Problems:

- The signal operation during the AM and PM peaks is disregarded by drivers because it is not appropriate for the current traffic condition.
- Northbound drivers occasionally turn left into the Boat House parking lot although this movement is prohibited.
- Pedestrian safety is a major concern at this site. Several pedestrians have been injured or killed at this location in the last decade.
- Access into the Thompson Boat House parking area is difficult and dangerous at various times of the day due to the congested traffic.

Recommendations:

The recommended improvements for this site are shown in **FIGURE 7.11.3**.

- Modify the signal operation so it is appropriate for the current traffic operation of the Parkway. Provide an exclusive pedestrian signal phase during both two-way and one-way operation of the Parkway to allow pedestrians to cross when the push button is activated. Maintain a green signal in the direction of one-way travel when there is no pedestrian demand. The signal should provide appropriate traffic control for both two-way and one-way operations of the Parkway. The signal should also provide for traffic entering or leaving the Boat House parking area during both two-way and one-way operation of the Parkway.

  Estimated Cost: Unknown

- Relocate the asphalt trail so that it passes between the canal and the parking area. This will eliminate the need for pedestrians to cross the access road into the parking area and it moves the trail users farther away from the Parkway and the impacts of the traffic.

  Estimated Cost: $ 25,000

- Close the gap in the median on the east approach. Estimated Cost: $ 3,000

- Modify the traffic signal at Virginia and 27th Street to provide a protected left turn phase for Parkway traffic heading onto E Street. Install pavement arrows indicating that the left lane leaving the site toward the east is for left turns only at the 27th Street signal.

  Estimated Cost: $35,000

Total Estimated Cost: $63,000

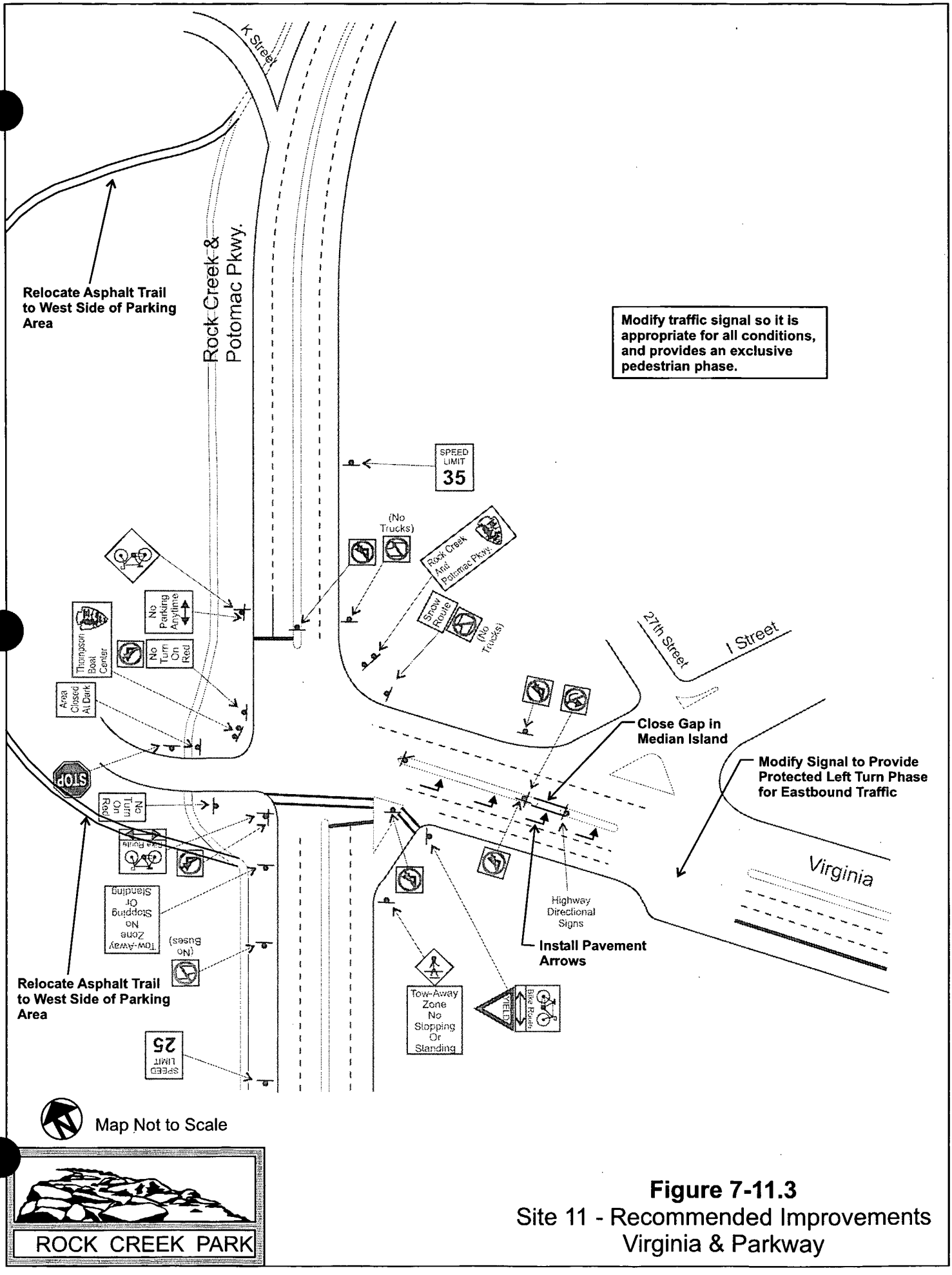


Figure 7-11.3
Site 11 - Recommended Improvements
Virginia & Parkway

Chapter 8. Plan for Implementing Improvements

Chapter 8: Plan for Implementing Improvements

8.1 Recommended Site Improvement Cost Summary

Chapter 7 discussed the problems and recommended both long-term and short-term improvements for each high-accident site. The short-term improvements identified in the previous chapter are relatively small projects involving minor geometric modifications, signing, striping and clearing vegetation. Much of the work included in the short-term improvements can be accomplished with the Park maintenance crews. Of the four recommended long-term improvements two are relatively low cost and involve converting "T" intersections into three-way stop intersections when the appropriate warrants are met. The other two long-term improvement projects involve a grade separation of Park and Tilden Streets over Beach Drive and the signalization of the intersection of Beach Drive and the Parkway.

TABLE 8-1 shows the short-term and long-term improvement costs for each site. As the table indicates, the total estimated cost of the short-term improvements for the eleven sites evaluated in Chapter 7 is $349,350. The long-term improvements discussed in the previous chapter are estimated to cost a total of $4,230,000.

TABLE 8-1
Site Improvement Costs

Site Description	Short-Term Improvement Cost	Long-Term Improvement Cost
Site 1 - Beach/West Beach	$ 8,150	N/A
Site 2 - Wise/Oregon/Chestnut	$ 10,500	N/A
Site 3 - Beach/Broad Branch	$ 7,300	$ 3,200
Site 4 - Beach/Blagden	$ 52,500	N/A
Site 5 - Beach/Tilden/Park	$ 49,750	$4,000,000
Site 6 - Bluff Bridge Curve	$ 5,600	N/A
Site 7 - Beach/Piney Branch	$ 54,900	N/A
Site 8 - Beach/Klingle	$ 46,500	$ 1,800
Site 9 - Parkway/Beach/Cathedral	$ 12,750	$ 225,000
Site 10 - Parkway/P Street	$ 38,400	N/A
Site 11 - Parkway/Virginia	$ 63,000	N/A
TOTAL	**$349,350**	**$4,230,000**

8.2 Establishment of Priorities

Due to the magnitude of the estimated cost of the recommended improvements, it was considered necessary to establish priorities for implementing the proposed improvements. This chapter addresses the priorities only for the short-term improvements due to the many unknowns (NPS acceptance, environmental compatibility, and funding availability) that are associated with the recommended long-term improvement.

The improvements at each site were evaluated according to the criteria below. The considerations for establishing the order of implementing the short-term improvements recommended in Chapter 7 include:

- Accident Rate
- Accident Frequency
- Accident Severity
- Physical and Operational Deficiencies
- Annual Cost per Vehicle
- Ease of Implementation

The first four indicators were chosen because of they will help determine the relative hazardousness of each site. The last two indicators address the cost and the ease of implementation of the short-term improvements. Each of the indicator values are described in the following sections.

8.2.1 Accident Rate

An accident rate was calculated for each site. The rate considered the number of accidents recorded during the four-year study period and the number of vehicles entering the site during the same period. The eleven sites were ranked according the accident rate, with the highest rate receiving a value of one and the lowest rate a value of eleven. Total accident rates for each site are shown in **TABLE 8-2.**

8.2.2 Accident Frequency

Accident frequency was used to prioritize the recommended improvements for the eleven sites. This ranking is based on the number of accidents recorded at each site during the three year study period. The eleven sites were ranked with the highest frequency receiving a value of one and the lowest frequency receiving a value of eleven. All of the other sites were ranked between one and eleven based on their relative accident frequency value. **TABLE 8-2** includes a summary of site accident frequencies.

8.2.3 Accident Severity

An accident severity rate was calculated for each site. This rate is established by assigning a value of one for each property damage accident, a value of two for each injury accident and a value of five for each fatality accident. The average severity of all of the accidents that occurred at each site during the four year study period was developed. The eleven sites were ranked with the highest average severity receiving a value of one and the lowest average severity receiving a value of eleven. A summary of severity rates for each of the sites is included in **TABLE 8-2**.

TABLE 8-2
1993-95 Site Accident Statistics

Site #	Accident Frequency (Acc/Year)	Accident Rate (Acc/MVE)	Accident Severity Rate
1. Beach/West Beach	10	2.91	1.28
2. Wise/Oregon/Chestnut	6	1.87	1.26
3. Beach/Broad Branch	5	0.98	1.20
4. Beach/Blagden	9	1.51	1.29
5. Beach/Park/Tilden	20	2.71	1.28
6. Bluff Bridge Curve*	5	2.95	1.27
7. Beach/Piney Branch	20	2.86	1.22
8. Beach/Klingle	9	1.25	1.22
9. Parkway/Beach/Cathedral	48	2.49	1.22
10. Parkway/P Street	47	1.97	1.34
11. Parkway/Virginia	34	2.35	1.21

* Site #6 is a road segment, therefore the total accident rate is expressed as Acc./MVMT.

8.2.4 Physical and Operational Deficiencies

Each site was evaluated with respect to the physical and operational deficiencies of each site. Sites having the most physical deficiencies and poorest operational characteristics was given a ranked value of eleven. The site with the smallest amount of physical and operational problems received a value of one. All of the other sites were ranked between one and eleven based on their relative deficiencies and problems.

8.2.5 Annual Cost per Vehicle

The cost of the short-term improvements recommended for each site was used to develop a implementation strategy. The short-term improvement costs for a particular site were compared to the number of vehicles that entered that site during 1996. The lowest cost per vehicle was assigned a value of one and the highest cost per vehicle was assigned a value of eleven. All of the other sites were ranked between one and eleven based on their cost per vehicle. The cost per thousand vehicles for the eleven sites ranged from a low of $0.64/TVE for site 9, to a high of $8.50/TVE for site 4.

8.2.6 Ease of Implementation

The ease of implementing the recommended improvements was used to prioritize the individual site work. The short-term improvements for each site were evaluated according to three factors:

- Ability to be implemented with NPS maintenance crews
- Need for NPS Planning/Environmental Documents
- Coordination with other NPS Projects or with D.C. Public Works

The site improvement considered the easiest to implement was given a rating of one and the site improvement that was considered the hardest to implement was given a rating of eleven. All of the other sites were ranked between one and eleven based on their relative ease of implementation.

8.3 Summary of Site Ranking

Each site analyzed in Chapter 7 was evaluated relative to the ranking criteria described above. The scores for each ranking criteria and the total scores for each site is presented in **TABLE 8-3**.

TABLE 8-3
Summary of Site Ranking (Short-Term Improvements)

Ranking Consideration	Site Number										
	1	2	3	4	5	6	7	8	9	10	11
Accident Rate	3	9	12	10	5	2	4	11	6	8	7
Accident Frequency	7	10	11	8	5	11	5	8	1	2	3
Accident Severity	3	6	11	2	3	5	7	7	7	1	10
Physical/Operational Deficiencies	9	11	1	7	8	12	6	10	2	5	4
Annual Cost per Vehicle	4	5	2	11	9	6	10	8	1	3	7
Ease of Implementation	5	2	3	11	6	1	10	9	4	8	12
TOTAL SCORE	31	43	40	49	36	37	42	53	21	27	43

8.4 Priorities for Implementing Short-Term Improvements

The priorities for implementing short-term improvements were established based on the results of the ranking for each site. These priorities are exhibited in **TABLE 8-4**.

TABLE 8-4
Site Improvement Costs and Priorities

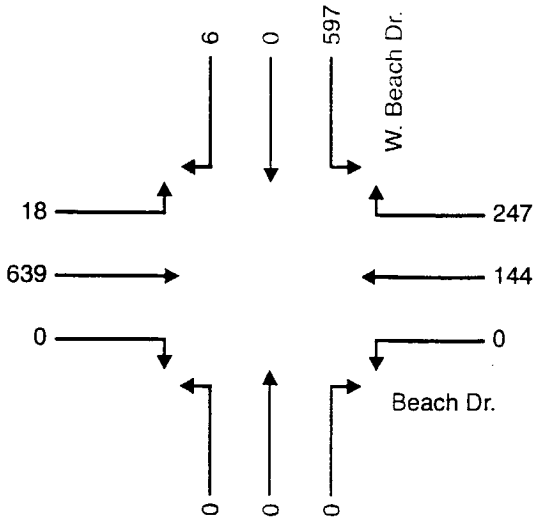
Site Description	Estimated Cost of Short-Term Improvements	Priority Ranking of Short-Term Improvements
Site 9 - Parkway/Beach/Cathedral	$ 12,750	1
Site 10 - Parkway/P Street	$ 38,400	2
Site 1 - Beach/West Beach	$ 8,150	3
Site 5 - Beach/Tilden/Park	$ 49,750	4
Site 6 - Bluff Bridge Curve	$ 5,600	5
Site 3 - Beach/Broad Branch	$ 7,300	6
Site 7 - Beach/Piney Branch	$ 54,900	7
Site 2 - Wise/Oregon/Chestnut	$ 10,500	8
Site 11 - Parkway/Virginia	$ 63,000	8
Site 4 - Beach/Blagden	$ 52,500	10
Site 8 - Beach/Klingle	$ 46,500	11
TOTAL	$349,350	

Appendix

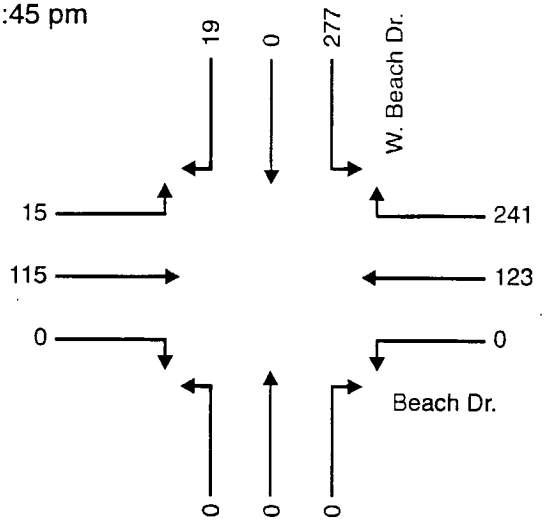
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Beach Drive & West Beach Drive Date: Wed. 12/4/96 & Thurs. 12/5/96

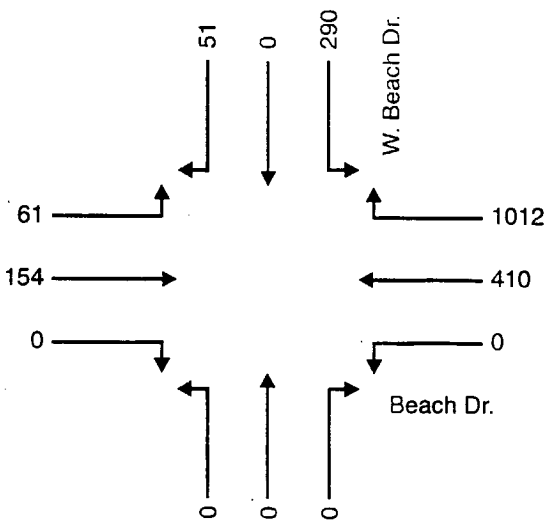
AM Peak: 7:45-8:45 am



Noon Peak: 11:45 am-12:45 pm

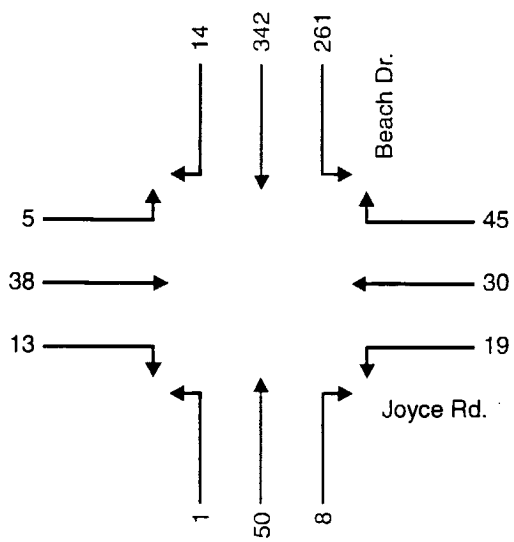


PM Peak: 4:45-5:45 pm

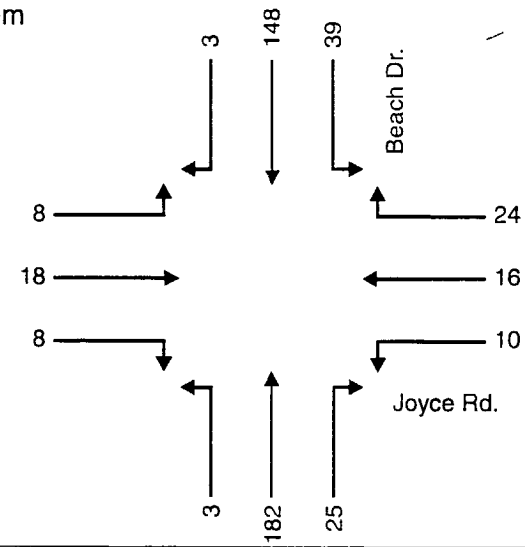


Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.
Intersection: Beach Drive & Joyce Road Date: Wed. 12/4/96 & Thurs. 12/5/96

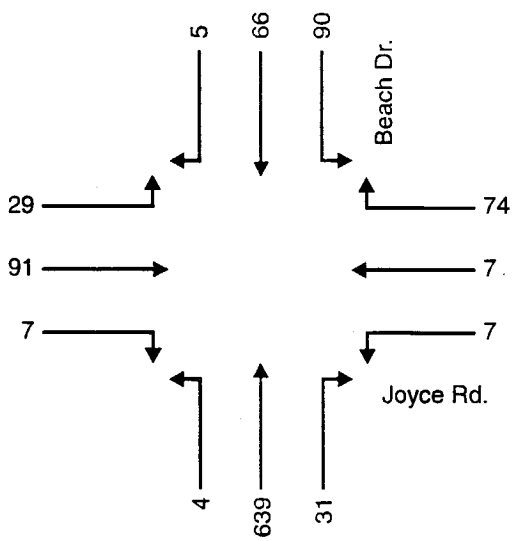
AM Peak: 7:45-8:45 am



Noon Peak: 12:00-1:00 pm



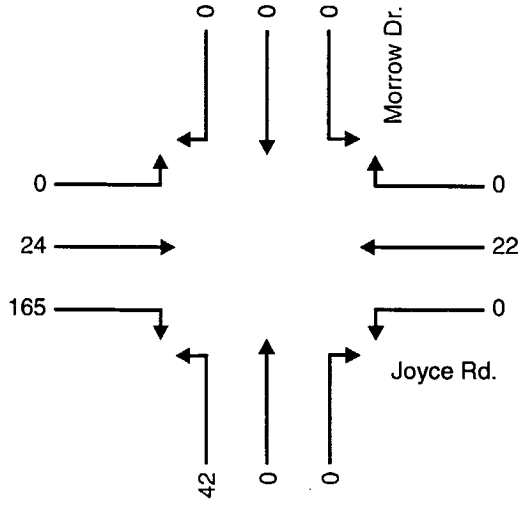
PM Peak: 4:15-5:15 pm



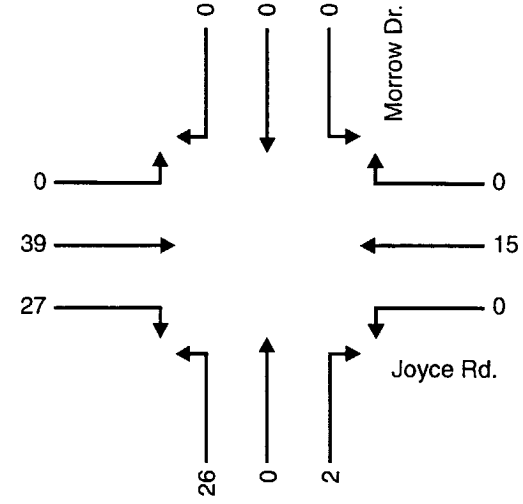
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Joyce Road & Morrow Drive Date: Tues. 8/20/96

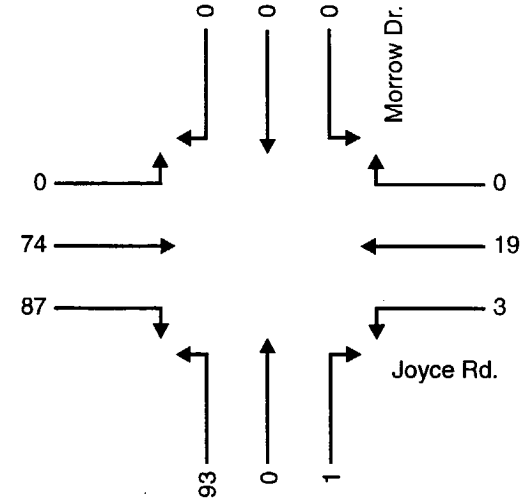
AM Peak: 8:00-9:00 am



Noon Peak: 11:30 am-12:30 pm



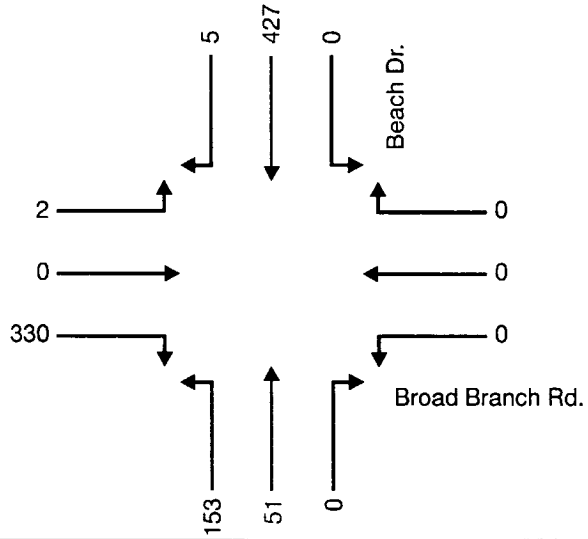
PM Peak: 5:00-6:00 pm



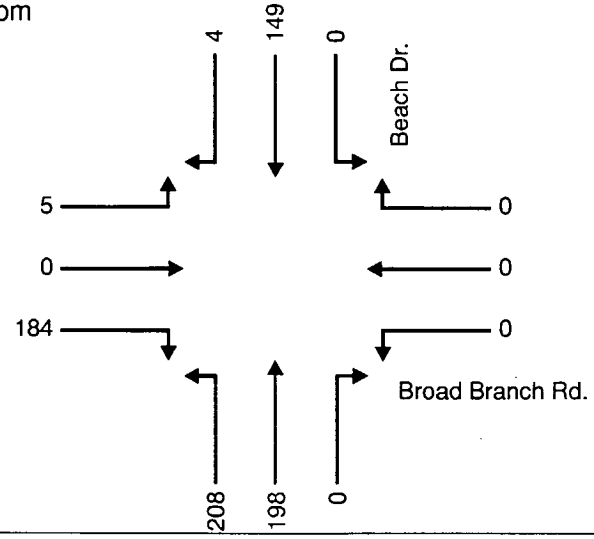
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Beach Drive & Broad Branch Road Date: Tues. 8/20/96

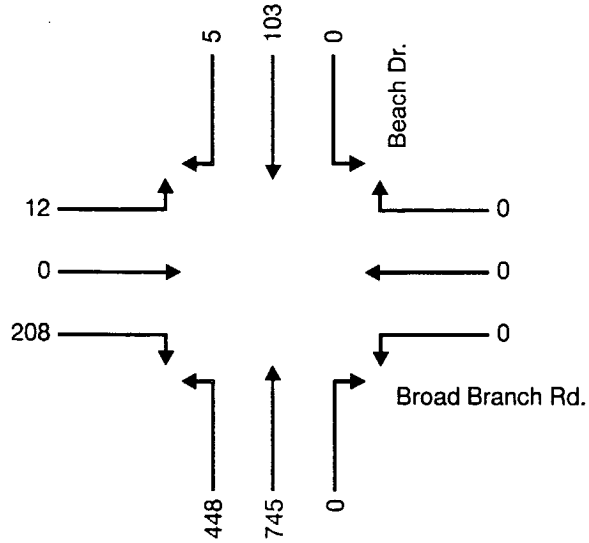
AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm



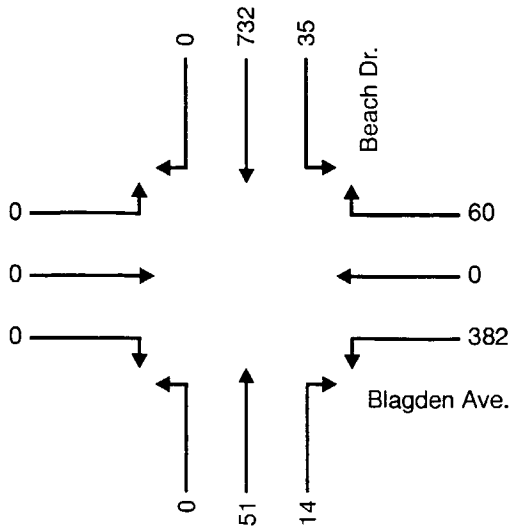
PM Peak: 5:15-6:15 pm



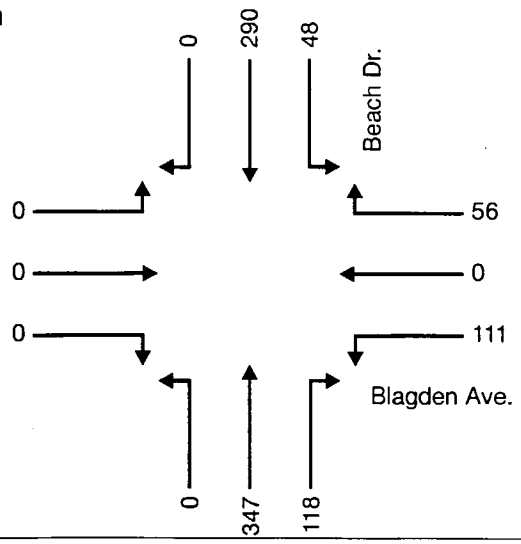
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Beach Drive & Blagden Avenue Date: Tues. 8/20/96

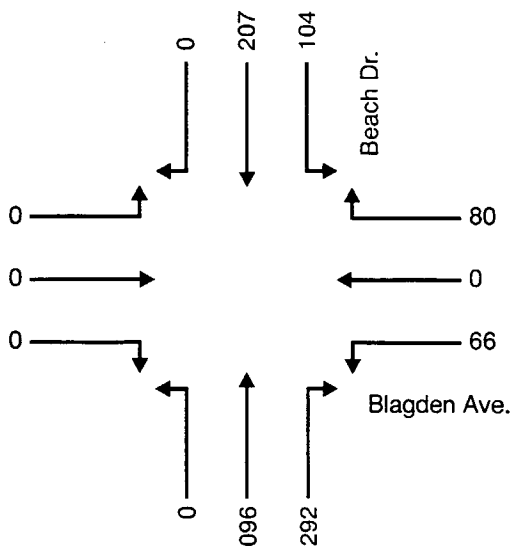
AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm

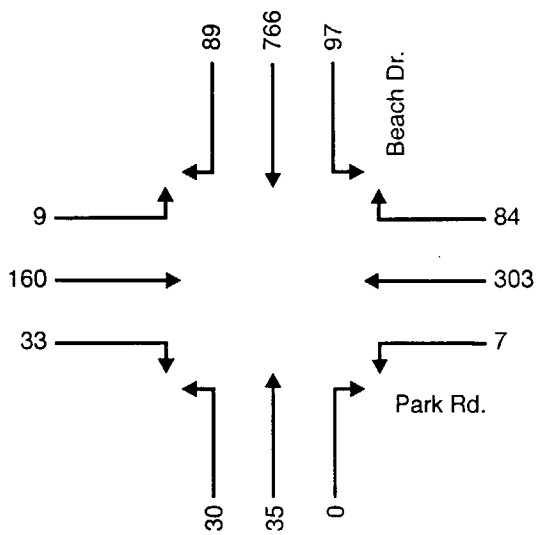


PM Peak: 5:15-6:15 pm

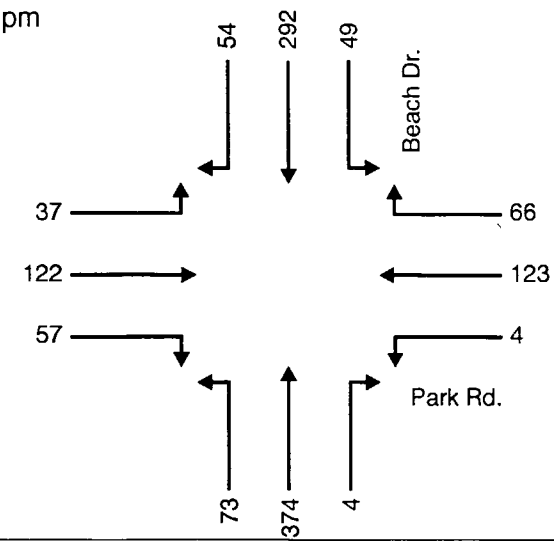


Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.
Intersection: Beach Drive & Park Road Date: Wed. 8/21/96

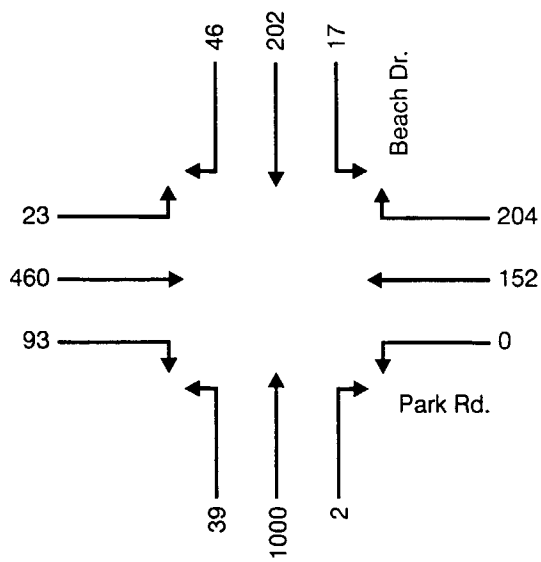
AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm

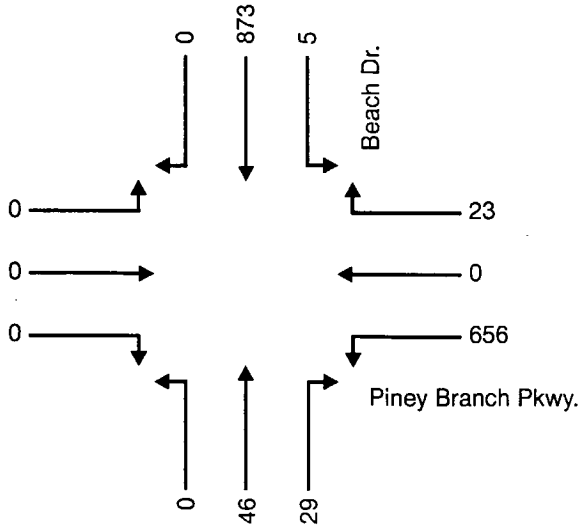


PM Peak: 5:30-6:30 pm

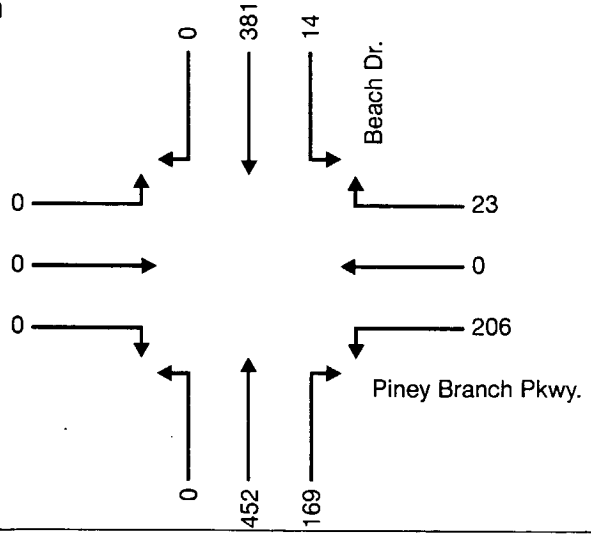


Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.
Intersection: Beach Drive & Piney Branch Parkway Date: Wed. 8/21/96

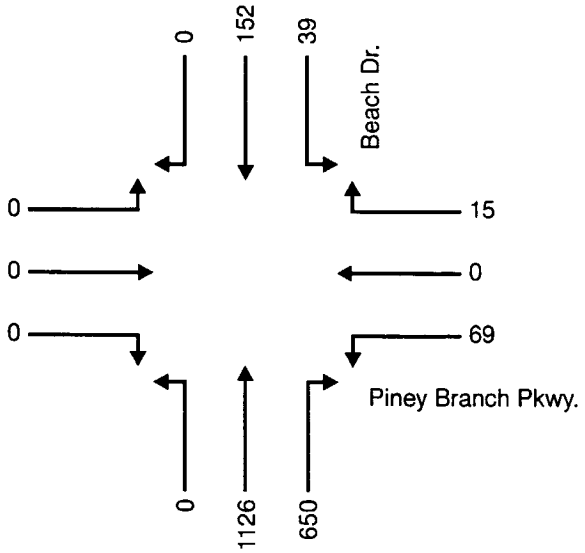
AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm



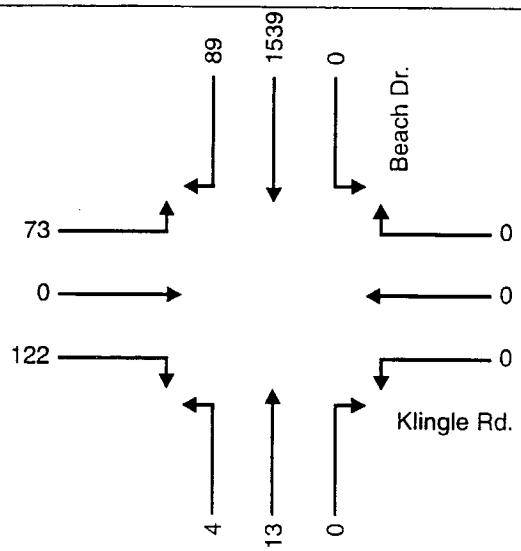
PM Peak: 4:45-5:45 pm



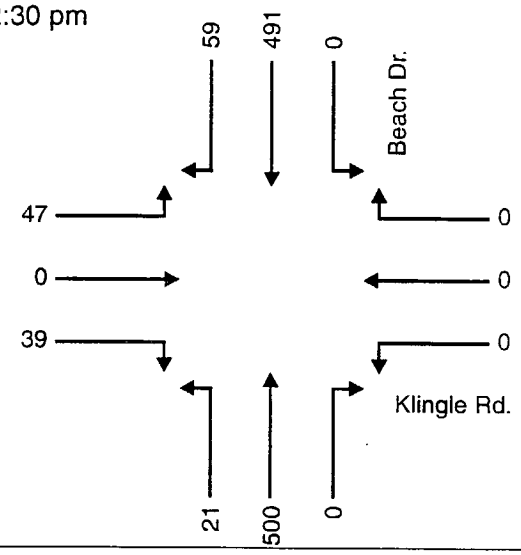
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Beach Drive & Klingle Road Date: Wed. 8/21/96

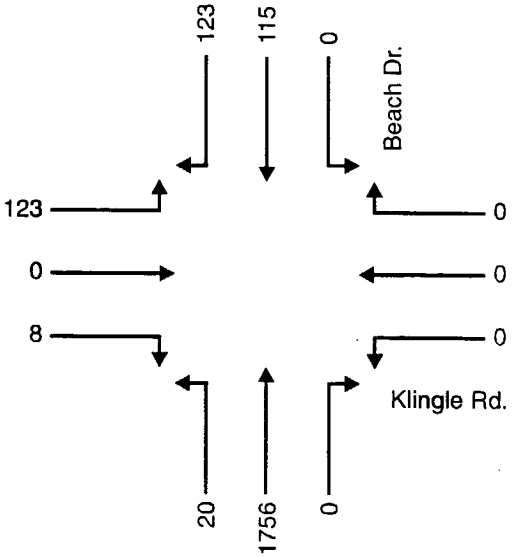
AM Peak: 8:00-9:00 am



Noon Peak: 11:30 am-12:30 pm

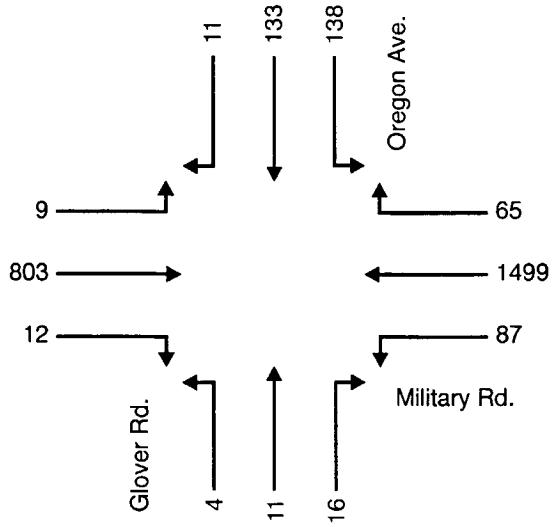


PM Peak: 5:15-6:15 pm

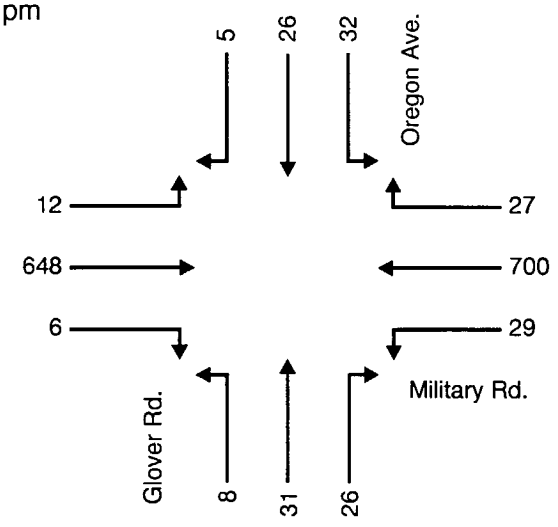


Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.
Intersection: Military Road & Glover Road/Oregon Avenue Date: Tues. 8/20/96

AM Peak: 7:45-8:45 am



Noon Peak: 12:00-1:00 pm



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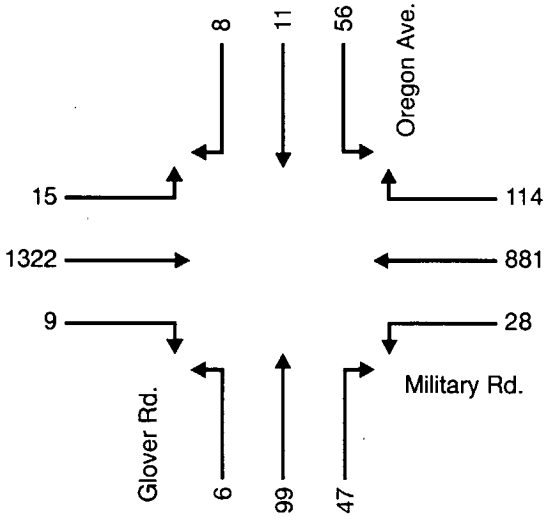
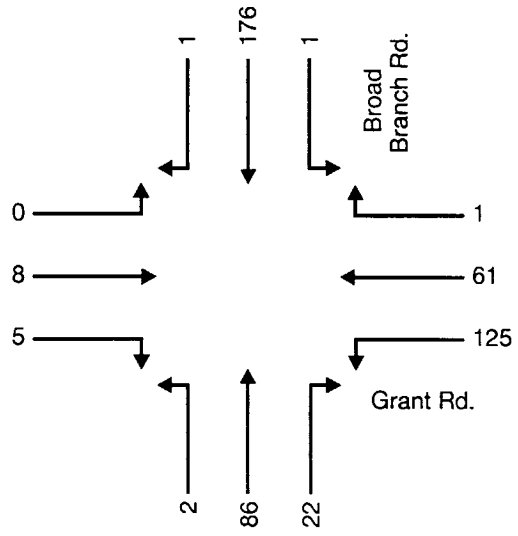
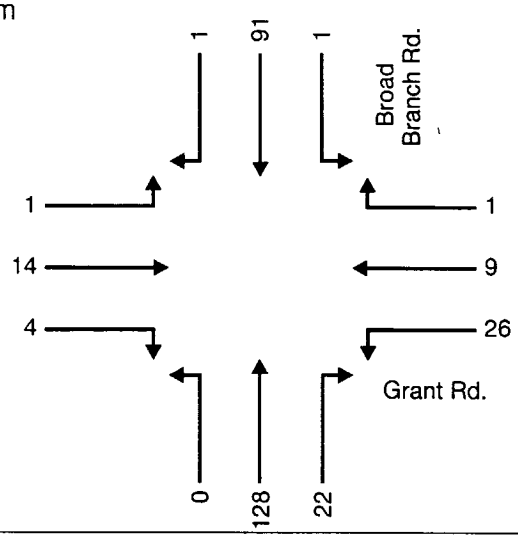


Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.
Intersection: Broad Branch Road & Grant Road Date: Tues. 8/20/96

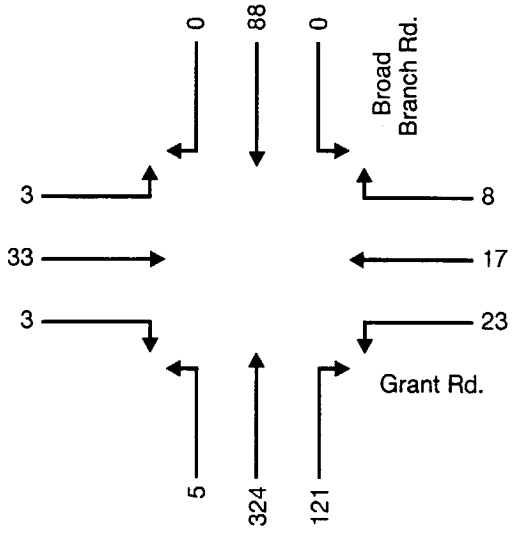
AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm



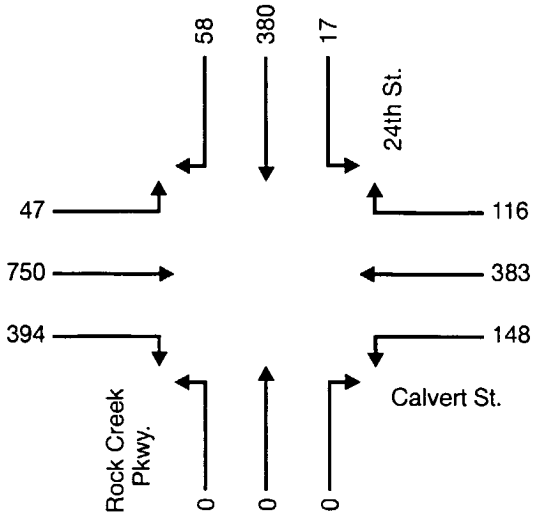
PM Peak: 5:30-6:30 pm



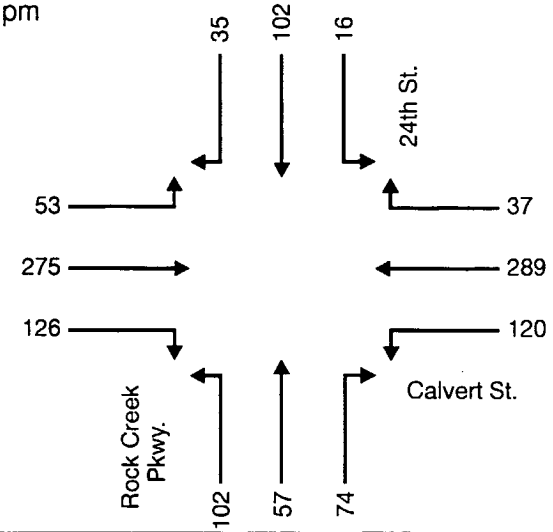
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Rock Creek Parkway/24th Street & Calvert Street Date: Wed. 8/21/96

AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm



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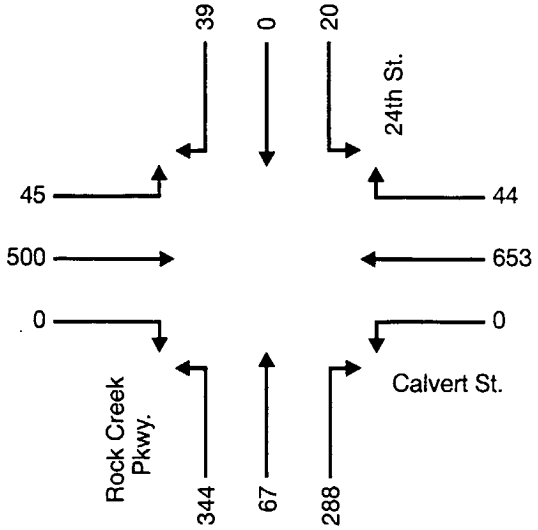
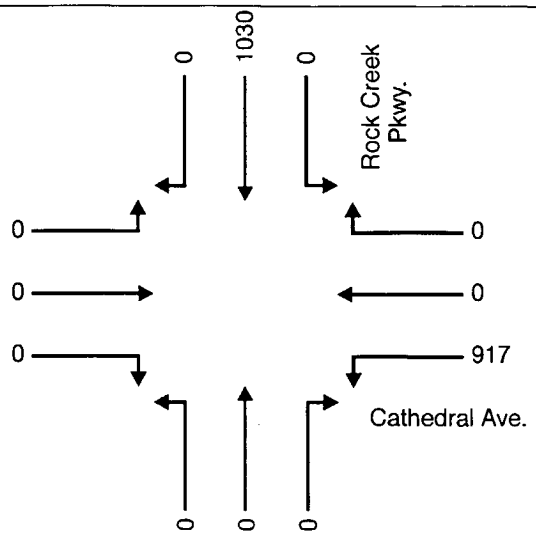


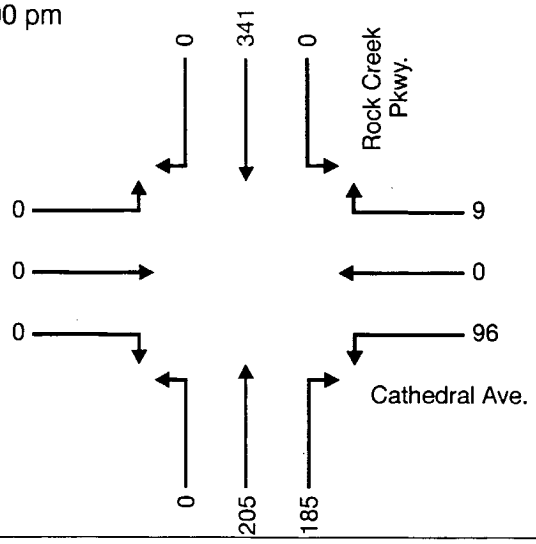
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Rock Creek Parkway & Cathedral Avenue Date: Wed. 8/21/96

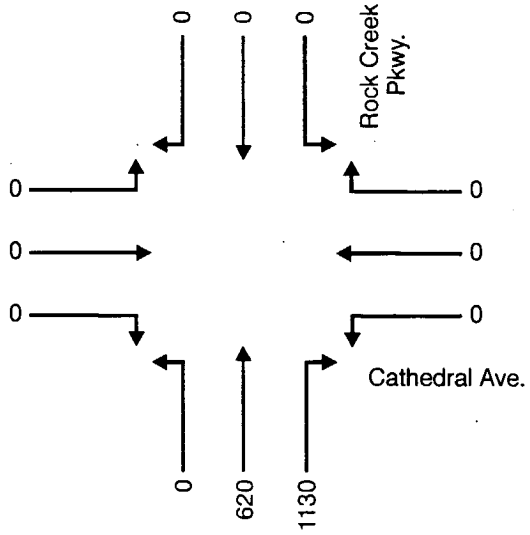
AM Peak: 8:00-9:00 am



Noon Peak: 11:00 am-12:00 pm



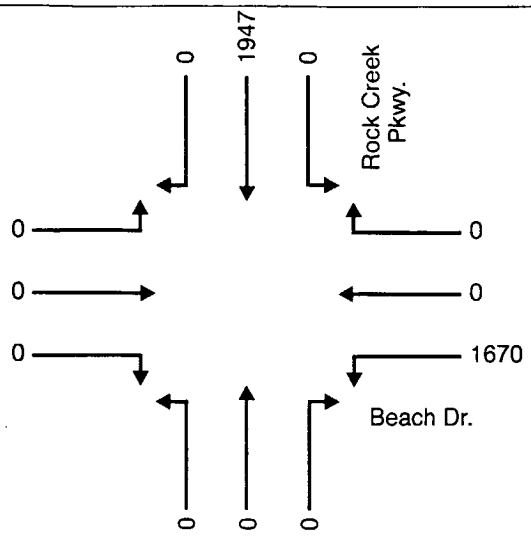
PM Peak: 5:15-6:15 pm



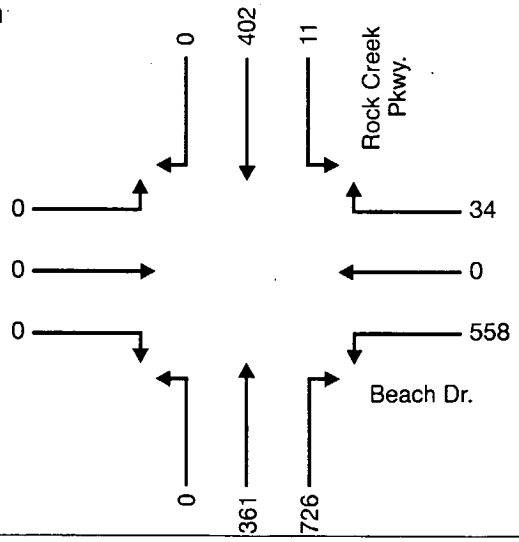
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Rock Creek Parkway & Beach Drive Date: Wed. 8/21/96

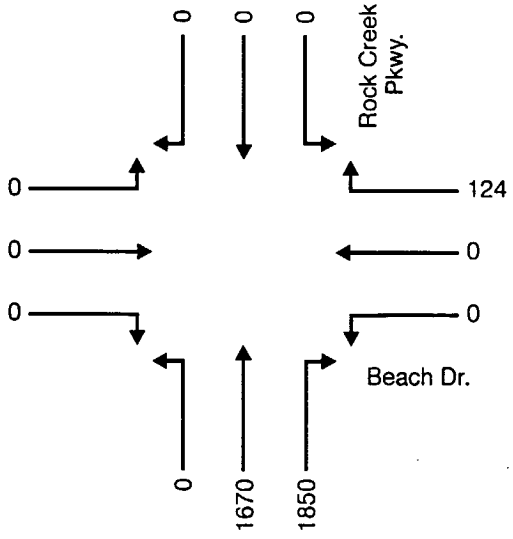
AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm



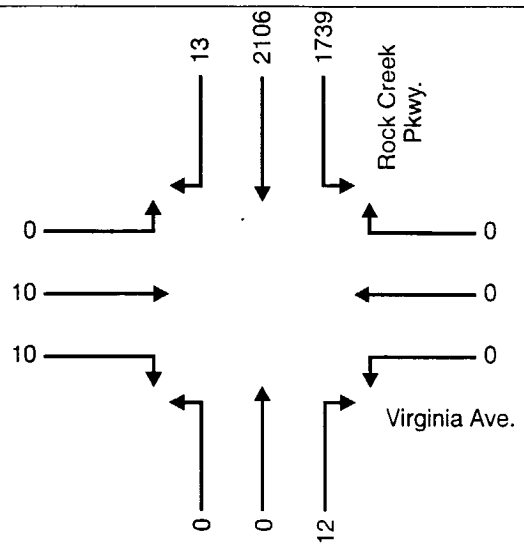
PM Peak: 5:15-6:15 pm



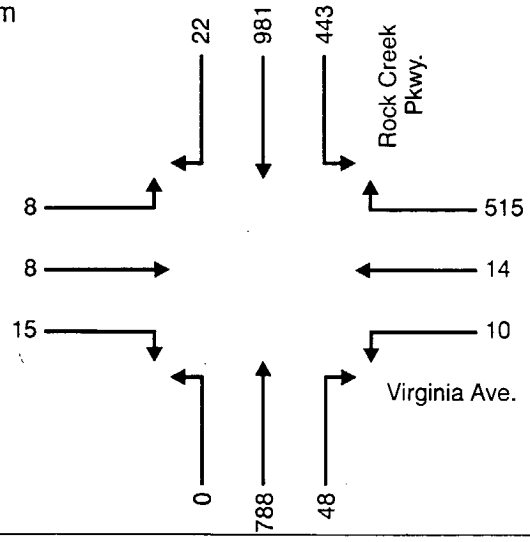
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Rock Creek Parkway & Virginia Avenue Date: Wed. 8/21/96

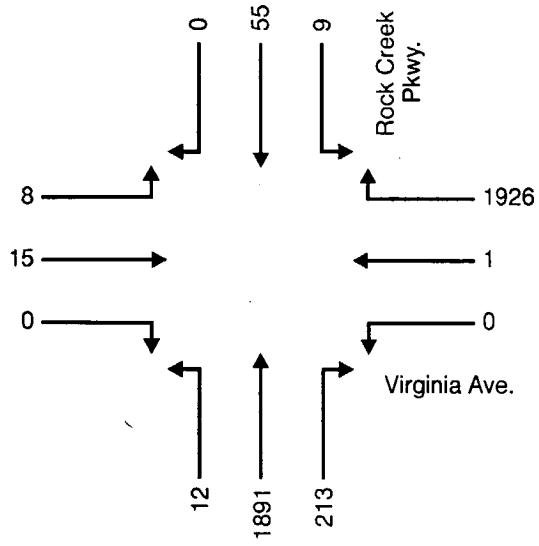
AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm

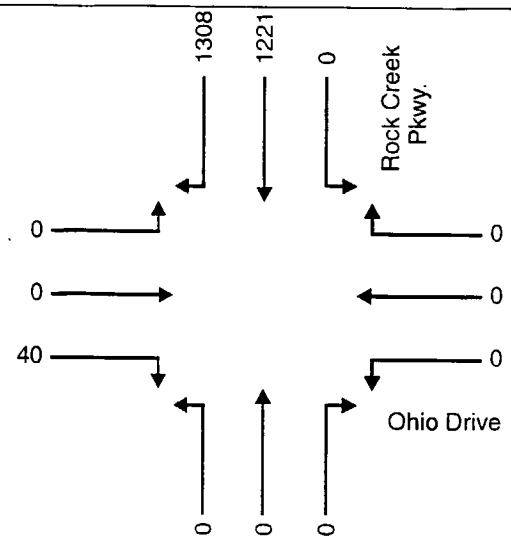


PM Peak: 5:30-6:30 pm

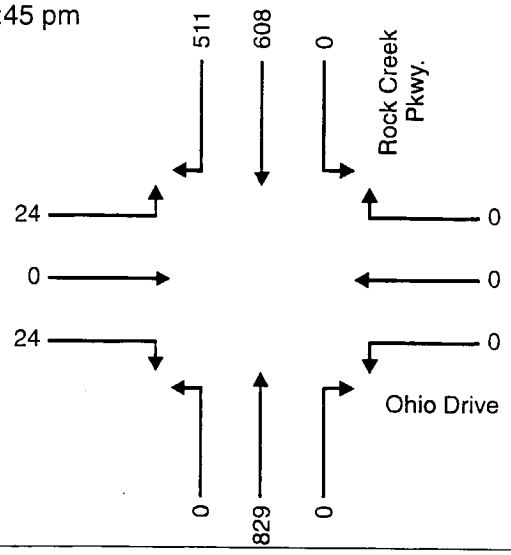


Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.
Intersection: Rock Creek Parkway & Ohio Drive Date: Wed. 8/21/96

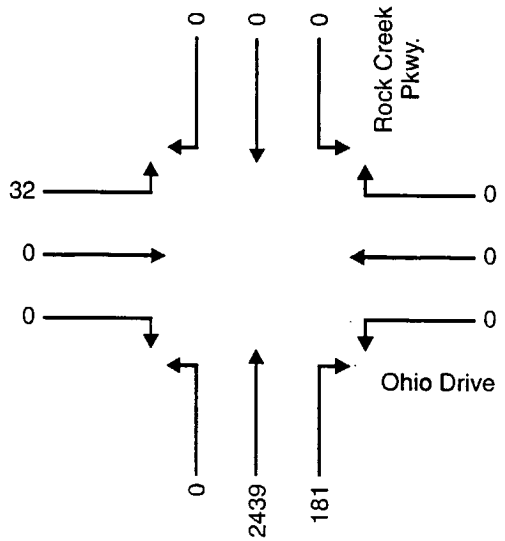
AM Peak: 8:00-9:00 am



Noon Peak: 11:45 am-12:45 pm

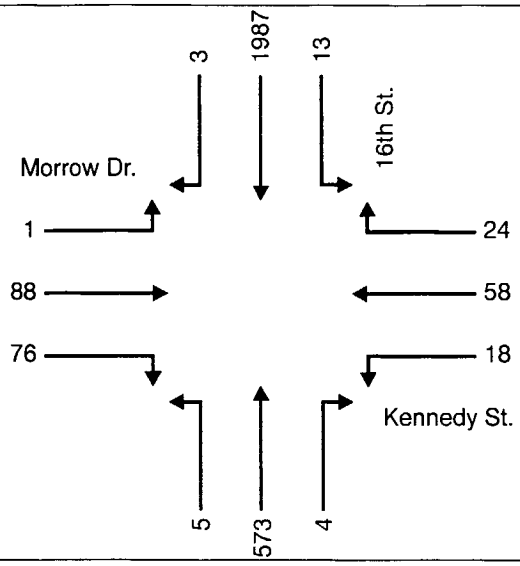


PM Peak: 5:00-6:00 pm

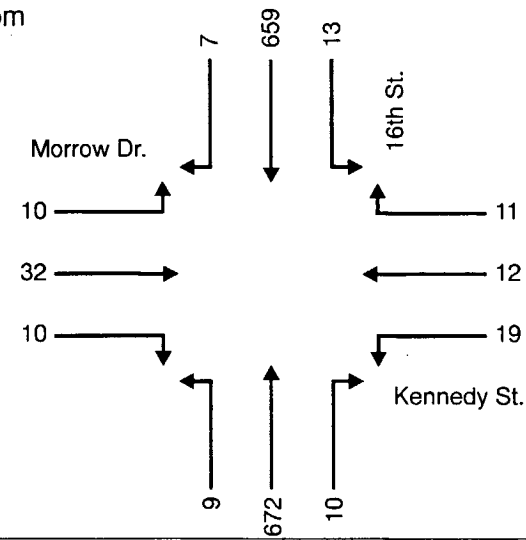


Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.
Intersection: 16th Street & Morrow Drive/Kennedy Street Date: Tues. 8/20/96

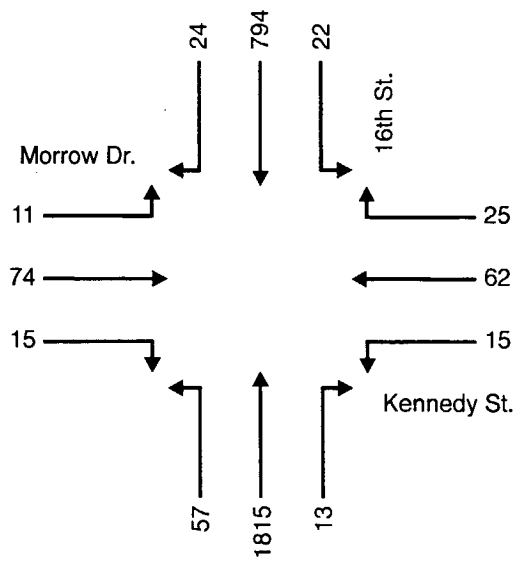
AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm



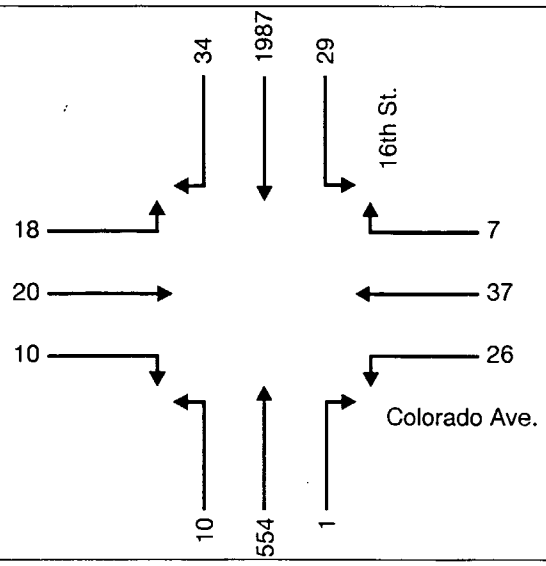
PM Peak: 5:15-6:15 pm



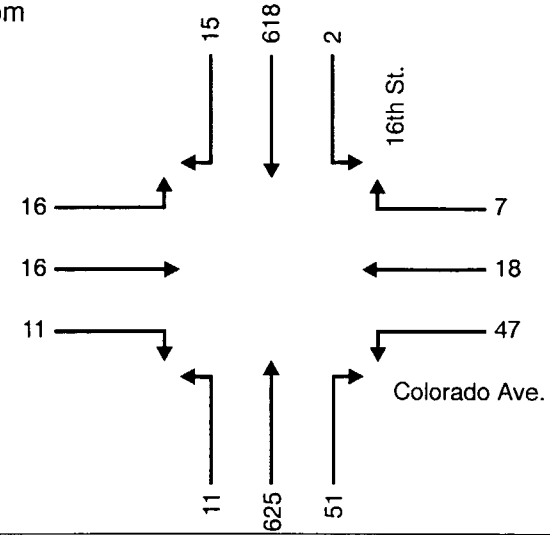
Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: 16th Street & Colorado Avenue Date: Tues. 8/20/96

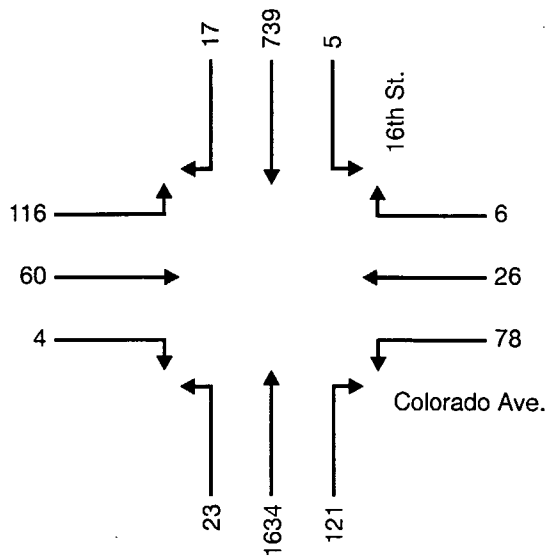
AM Peak: 8:00-9:00 am



Noon Peak: 12:00-1:00 pm



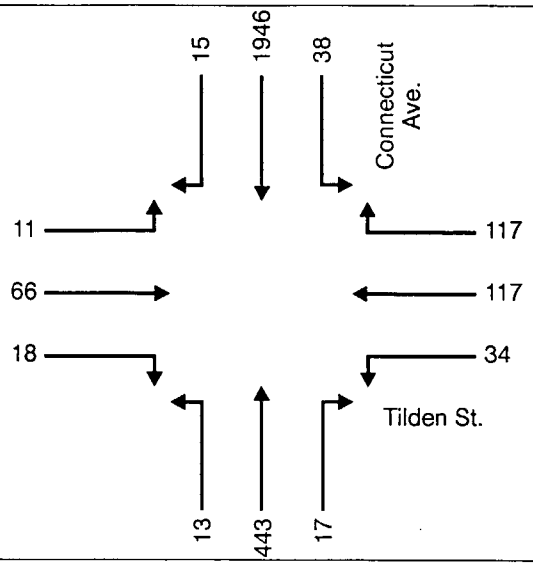
PM Peak: 5:00-6:00 pm



Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

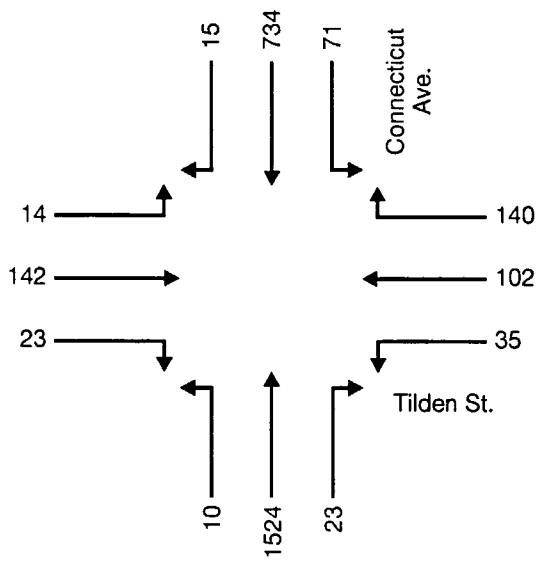
Intersection: Connecticut Avenue & Tilden Street Date: Fri. 8/23/96

AM Peak: 7:00-8:00 am



Noon Peak: (not counted)

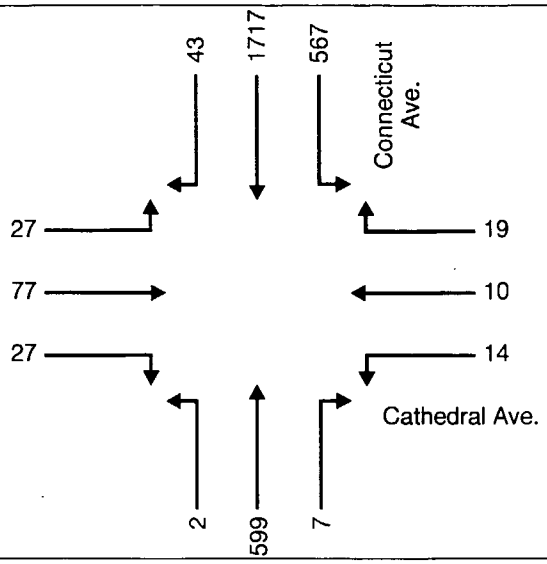
PM Peak: 4:00-5:00 pm



Turning Movement Count Summary - Peak Hour Volumes
Rock Creek Park, Washington D.C.

Intersection: Connecticut Avenue & Cathedral Avenue Date: Fri. 8/23/96

AM Peak: 8:15-9:15 am



Noon Peak: (not counted)

PM Peak: 5:15-6:15 pm