

## STUDY OF ANTITERRORISM/ FORCE PROTECTION (ATFP) BASE ENTRANCE IMPROVEMENTS IN A HISTORIC DISTRICT

FINAL REPORT

SEPTEMBER 2003



Naval Facilities Engineering Command  
Southern Division



**Study of Antiterrorism/  
Force Protection (ATFP)  
Base Entrance Improvements in a  
Historic District**

**Final Report**

\* \* \* \* \*

Submitted By:

**Hardlines Design Company**  
4608 Indianola Avenue  
Columbus, Ohio 43214  
(614) 784 - 8733

\* \* \* \* \*

Submitted to:

Southern Division  
Naval Facilities Engineering Command  
Department of the Navy  
North Charleston, South Carolina

\* \* \* \* \*

September 2003



## **EXECUTIVE SUMMARY**

In June 2003, Naval Facilities Engineering Command–Southern Division commissioned Hardlines Design Company (HDC) to complete an Antiterrorism Force Protection Base Entrance Improvements Study in a National Register Historic District at two Department of Defense (DoD) installations: one Army installation and one Navy installation. Lindbergh Associates provided security design consultation.

This report provides recommendations and cost estimates for the improvement of an entrance at each installation. The recommendations are intended for use by the individual installations as well as to provide general information for use by other bases considering security upgrades to gates located in or adjacent to historic districts. Each installation received two proposed solutions, one of which is a minimal and lower-cost option.

The first case study involves a small Naval installation where the historic main gate provides direct access to the historic district. The second case study involves an Army post with a secondary gate adjacent to the historic district, and with National Register eligible structures outside the district but still in the immediate area.

Fieldwork took place between 21 June and 24 June 2003. Fieldwork consisted of inspection of the gate conditions, a design charette, and archeological literature review and excavations. The design charette resulted in sketches of two proposed solutions for each installation, which have been refined and included in this report. The archeological work concluded that there were no significant cultural resources present in the gate areas, and no additional work is recommended. A summary of this work has been included in the Appendix.

Each base is discussed individually. First, existing conditions are analyzed with respect to traffic flow, pedestrian access, current security procedures, and deficiencies with respect to current ATFP standards. Next, each proposed solution is presented. Each solution considers the following:

- Acceptable standoff distances
- Vehicle inspection areas
- Sentry booths and gatehouse placement
- Visitor parking
- Traffic flow for various vehicular situations
- Pedestrian access and control
- Separation of access control point from the main base
- Control of vehicle's ability to charge and bypass the checkpoint

Historic preservation concerns incorporated into each solution include:

- Retention of historic old-growth trees
- Gatehouse design compatible with materials and scale of buildings in historic district
- Retention of historic gate features

**This page intentionally left blank.**

## **TABLE OF CONTENTS**

Executive Summary .....	i
Table of Contents .....	iii
List of Photos .....	v
List of Maps .....	v
List of Acronyms.....	vi

### **SECTION A – METHODOLOGY**

#### **SECTION B – INSTALLATION A**

Description .....	B-1
Historic Background .....	B-1
Current Entrance Conditions.....	B-2
Entrance 1 Current Conditions.....	B-3
Entrance 1 Current Practices .....	B-4
Existing Distances to the Controlled Perimeter .....	B-5
Existing Traffic and Traffic Flow .....	B-6
Entrance 1 Current Deficiencies .....	B-6
Historic Preservation Concerns .....	B-7
Entrance 1 Recommendations.....	B-7
Large Tractor-Trailer Entrances.....	B-8
Emergency Vehicles.....	B-8
Lighting Recommendations .....	B-9
Clear Zones .....	B-9
Solution 1 – Separate Visitor Parking Facility and Vehicle Inspection Area .....	B-10
Vehicular Access Scenarios .....	B-12
Pedestrian Access Scenarios .....	B-13
Solution 2 – Shared Visitors Parking and Vehicle Inspection Area .....	B-13
Vehicular Access Scenarios .....	B-15
Pedestrian Access Scenarios .....	B-16
Installation A Cost Estimates .....	B-16
Summary Comparison of the Two Solutions .....	B-17

#### **SECTION C – INSTALLATION B**

Description .....	C-1
Historic Background .....	C-1
Historic District Considerations .....	C-2
Current Entrance Conditions.....	C-2
Entrance 1 Current Conditions.....	C-4
Entrance 1 Current Practices .....	C-5
Existing Distances to the Controlled Perimeter .....	C-5
Existing Traffic and Traffic Flow .....	C-5
Potential Users of Entrance 1 .....	C-6

Entrance 1 Current Deficiencies .....	C-6
Historic Preservation Concerns.....	C-7
Entrance 1 Recommendations.....	C-7
Lighting Recommendations .....	C-8
Clear Zones .....	C-9
Solution 1 – Long Approach Zone.....	C-9
Vehicular Access Scenarios.....	C-11
Pedestrian Access Scenarios.....	C-12
Solution 2 – Short Approach Zone .....	C-12
Vehicular Access Scenarios.....	C-14
Pedestrian Access Scenarios.....	C-14
Installation B Cost Estimates .....	C-15
Solution 1 Costs .....	C-15
Solution 2 Costs .....	C-15
Summary Comparison of the Two Solutions.....	C-15

## **SECTION D – CONCLUSIONS**

## **SECTION E – BIBLIOGRAPHY**

### **APPENDIX 1 – FIGURES**

Figure 1. Cross Section of Sentry Booth Canopy Example.....	1-1
Figure 2. Cross Section of Vehicle Inspection Area Canopy Example .....	1-1
Figure 3. Longitudinal Section of Vehicle Inspection Area Canopy Example.....	1-2
Figure 4. Example of gatehouse suitable for a historic district.....	1-3
Figure 5. Example of retracting bollards .....	1-4
Figure 6. Example of crash beam .....	1-5
Figure 7. Example of sliding gate .....	1-6

### **APPENDIX 2 – COST ESTIMATES**

### **APPENDIX 3 – ARCHEOLOGICAL INVESTIGATIONS**

<b>Installation A</b>	
Introduction.....	3-1
Methodology.....	3-1
Results.....	3-2
Conclusion .....	3-5
<b>Installation B</b>	
Introduction.....	3-6
Methodology .....	3-6
Entrance 2 .....	3-6
Entrance 1 .....	3-13
Conclusion .....	3-19
References.....	3-20

## **LIST OF PHOTOS**

Photo 1. Approach from Avenue B showing historic gate piers and existing steel perimeter fence .....	B-4
Photo 2. Approach zone .....	B-4
Photo 3. Historic view of original gate (Entrance 2) as seen from off base.....	C-3
Photo 4. View of Entrance 2 (original gate) showing planting bed in pedestrian plaza .....	C-3
Photo 5. View of Entrance 1 from off-base intersection.....	C-4
Photo 6. View from on post of Entrance 1 from access road, with existing sentry booth .....	C-4

## **LIST OF MAPS**

Map 1. Installation A, Existing Conditions.....	B-19
Map 2. Installation A, Existing Conditions.....	B-20
Map 3. Installation A, Existing Traffic Flow – Personnel with Proper ID .....	B-21
Map 4. Installation A, Existing Traffic Flow – Visitors Granted Access .....	B-22
Map 5. Installation A, Existing Traffic Flow – Visitors Denied Access .....	B-23
Map 6. Installation A, Existing Standoff Distances to the Controlled Perimeter .....	B-24
Map 7. Installation A, Solution 1 .....	B-25
Map 8. Installation A, Solution 1 Traffic Flow – Personnel with Proper ID .....	B-26
Map 9. Installation A, Solution 1 Traffic Flow – Visitors Granted Access.....	B-27
Map 10. Installation A, Solution 1 Traffic Flow – Visitors Denied Access .....	B-28
Map 11. Installation A, Solution 2 .....	B-29
Map 12. Installation A, Solution 2 Traffic Flow – Personnel with Proper ID .....	B-30
Map 13. Installation A, Solution 2 Traffic Flow – Visitors Granted Access .....	B-31
Map 14. Installation A, Solution 2 Traffic Flow – Visitors Denied Access .....	B-32
Map 15. Installation B, Existing Conditions .....	C-17
Map 16. Installation B, Existing Standoff Distances at Entrance 2 .....	C-18
Map 17. Installation B, Existing Standoff Distances to the Controlled Perimeter at Entrance 1 .....	C-19
Map 18. Installation B, Existing Conditions at Entrance 1 .....	C-20
Map 19. Installation B, Solution 1 .....	C-21
Map 20. Installation B, Solution 1 Traffic Flow – Personnel with Proper ID and Dignitaries .....	C-22
Map 21. Installation B, Solution 1 Traffic Flow – Visitors Granted Access .....	C-23
Map 22. Installation B, Solution 1 Traffic Flow – Visitors Denied Access .....	C-24
Map 23. Installation B, Solution 2 .....	C-25
Map 24. Installation B, Solution 2 Traffic Flow – Personnel with Proper ID .....	C-26
Map 25. Installation B, Solution 2 Traffic Flow – Visitors Granted Access .....	C-27
Map 26. Installation B, Solution 2 Traffic Flow – Visitors Denied Access .....	C-28

## **LIST OF ACRONYMS**

AT	Antiterrorism
FP	Force Protection
HDC	Hardlines Design Company
L&A	Lindbergh & Associates
NRHP	National Register of Historic Places
SHPO	State Historic Preservation Office

**SECTION A**  
**METHODOLOGY**



## **METHODOLOGY**

Hardlines Design Company (HDC) and Lindbergh & Associates (L&A) worked in conjunction with Naval Facilities Engineering Command–Southern Division (NAVFAC) to complete this study to design Antiterrorism/Force Protection (ATFP) base entrance improvements within a historic district. A team of four individuals (two from HDC and one each from L&A and NAVFAC) went to each installation for a one-and-one-half-day design charette. These charettes took place from 21 July through 24 July 2003.

The design team included an architect, historic architect, preservation planner, and security engineer. Base personnel at each installation were included in the charettes. These individuals included public works officers, security personnel, and architects. Because this project involves improvements within historic districts, two representatives from the State Historic Preservation Office were in attendance during one day of each charette.

The team began each charette with a general overview of the project, which is funded by a Department of Defense (DoD) Legacy grant. The grant was originally written to include base entrance improvements at one installation of each military branch. However, funding was provided for only two installations, with the hope that future funding will be available to complete the other two branches.

After the initial overview and remarks, the group conducted a site visit of the existing entrances where improvements were to be designed. The group walked the site and observed conditions from both within the installation and from off base. In both instances, the group walked along the perimeter of the installation to collect information about the surrounding neighborhood and traffic patterns. The team members recorded their observations using notes and photographs, which were used later in the design charette and in the completion of this report.

During the field visit, two archeologists from HDC conducted literature review at base and area repositories, and completed fieldwork in the vicinity of the selected gates. Fieldwork consisted of shovel test units and screening. A management summary of this work has been included in the Appendix.

After the completion of these site visits, the group reconvened and began the design charette process. The team discussed limitations, opportunities, and solutions for each entrance area. These discussions covered design, historic preservation, practicality, and security issues, and were conducted in an open forum. The various considerations led to the team sketching ideas onto a drawing of the existing entrances. These ideas were refined many times over and led to the development of two solutions per entrance per installation. The final sketches were then presented to base personnel prior to the design team's departure.

During the charettes, and throughout the entire project, the team consulted the following security documents: ITG 03-03 (Interim Technical Guidance, Entry Control Facilities), MIL-HDBK-1013/14 (Selection and Application of Vehicle Barriers), and UFC 4-010-01 (DoD Minimum Antiterrorism Standards for Buildings). The team attempted to meet all the standards defined in these documents. However, due to various site constraints and historic

district concerns, the team was unable to meet every requirement and therefore attempted to meet the “spirit” of the requirements. The team conducted internal discussions concerning the shortfalls and also discussed these with NAVFAC – Southern Division security engineers. The team incorporated various compensatory measures to compensate for some of these shortfalls.

Additionally, due to the sensitive nature of this endeavor, it was determined during fieldwork that each installation should remain anonymous and each location should be undisclosed. Building numbers, street names, and other unique identifiers were therefore changed to generic titles. The team attempted to provide an adequate overview of each installation’s security concerns and subsequent solutions while clearly attempting to keep specific detailed information about the installation as private as possible.

The scope of this project focused solely on the overall design and incorporation of the entry design standards into a historic district. The team therefore did not consider administrative issues such as staffing, operations, or funding. It was assumed that these measures would be adequately funded and staffed by the installation’s own security forces.

After the completion of fieldwork, the team further developed and refined the designs, developed a detailed narrative, discussed findings, and made recommendations for inclusion in the draft report. A draft review was then held at each installation to review the concepts and obtain comments from each installation’s security personnel. After these meetings, the team incorporated the various comments and recommendations and developed this final document.

**SECTION B**  
**INSTALLATION A**



## **INSTALLATION A DESCRIPTION**

Installation A is a small Navy service school located within a mid-sized municipality with a county population of approximately 100,000 (See Map 1). The school is located northwest of downtown in an established neighborhood and occupies a pie-shaped piece of property that covers approximately 60 acres, 20 acres of which are located in a National Register Eligible Historic District. A State Highway (Avenue A) running southeast to northwest forms the eastern edge of the installation. The highway contains multiple traffic signals with a typical speed of 35 mph. Multiple commercial strip facilities are located on the opposite side of the highway. Beyond the commercial strip is a residential area. The southern border of the installation is a collector street (Avenue B) that runs east to west, and a residential district lies on the other side of this street. The western edge of the installation is bordered by residential and open spaces.

The installation contains approximately 25 administrative, educational, and service facilities. Housing, which includes approximately 20 additional buildings on the base, consists of multi-family and single-family quarters. Multiple athletic facilities, including a swimming pool, basketball court, tennis courts, and ballfields, are located in the northwestern section of the installation.

Seven facilities and approximately 20 acres within the perimeter boundary of the installation are listed in a National Register Eligible Historic District. The district includes five administrative buildings, two single-family quarters, and the parade ground, in addition to the many off-base private Victorian-era residences south of Avenue B. The parade ground is the only significant open space within the district and includes many old-growth water oaks.

## **HISTORIC BACKGROUND OF INSTALLATION A**

The land on which Installation A is located has a rich history as an educational facility. Beginning in 1860, a local university established a college preparatory high school on the site. At the end of the Civil War, the school was opened to Confederate veterans under the age of 30 who desired an education. By 1872, the university established a college of agriculture and mechanical arts at the location.

In 1891, the state decided to establish a normal school that offered professional courses for teacher training. The university sold the land to the state for the opening of this school. Over the next three decades, the school expanded through organizational and private donations. Many of the contributing buildings in the historic district were constructed during this time period. The school operated independently until 1932, when control passed to the local university, which subsequently converted buildings into women's housing. Enrollment in the school declined during World War II, and many facilities were left vacant. By 1953, the campus had fallen into disrepair.

The Navy service school dates back to 1795, but the first permanent housing for the school was only established in 1921. The school was moved to various locations over the next 30 years until 1953, when a State Representative, who was a Commander in the U.S. Navy

Reserves, heard of a proposed relocation of the school. He introduced a resolution in the state assembly to invite the Navy to acquire a permanent site at the campus and end the school's "nomadic" existence.

The school was commissioned on the current site on January 15, 1954, and the first class graduated that summer. New building construction began soon after the Navy's acquisition and continued well into the 1960s. Today, the school provides Navy officers with training for their roles as "The Navy's Business Managers" afloat and ashore. The school also provides advanced logistics training for U.S. Naval personnel and military officers from other nations.

Installation A serves the staff and student populations, and is a support center for active-duty personnel stationed at ROTC units and recruiting stations, and for military retirees in the area. The school is also responsible for two detachments of its own to train enlisted personnel as postal clerks and to operate and maintain satellite communications equipment.

### **CURRENT ENTRANCE CONDITIONS**

The installation has three vehicle entrances (Entrances 1–3, Map 1) that serve the main administrative area. Two of these entrances are located inside the historic district. Three additional entrances (Entrances 4-6) provide access to areas that are separate from the main administrative section of the installation. Two of these entrances lead to separate housing areas, while the third provides access to the Base Exchange. Only the three main administrative entrances were examined for potential study since they are located within or near the historic district.

Entrance 1 is located on Avenue C, which ends at Avenue B, approximately 1,400 feet from the intersection of Avenues A and B. Entrance 2 is located off Avenue B and is located approximately 800 feet from the same intersection. Entrance 3 is located along Avenue A and is 800 feet from the intersection. Since September 11, 2001, Entrances 2 and 3 have been closed to daily traffic, and Entrance 1 has provided the only access to the administrative area. Entrance 3 is occasionally opened to accommodate large semi tractor-trailers, but only on an as-needed basis and by scheduled appointment.

The field team determined that Entrance 1 should be further investigated for ATRP improvements. This decision was based upon discussions with base personnel, review of existing conditions, and issues of concern with the other entrances. Entrance 2 was eliminated from consideration for several reasons, including:

- Proximity to nearby Buildings 4 and 5.
- Close proximity to intersection of Avenues A and B. Additionally, this entrance is immediately following a curve at the crest of a hill potentially creating a blind exit condition in front of accelerating traffic.
- Poor vehicle circulation and difficult turning radii for larger vehicles.

- Inadequate vehicle stacking space, potentially spilling traffic onto Avenue B.
- Inadequate space available for vehicle inspection area.
- Significant impact on historic parade ground in front of Building 4.

Entrance 3 was also eliminated from consideration for multiple reasons, including:

- Proximity to Buildings 6 and 7.
- Proximity to intersection of Avenues A and B.
- Inadequate space for guard and sentry booths.
- Significant traffic on a high-speed, four-lane road, with no space available for turning lanes along Avenue A, that makes entering or exiting difficult.
- Inadequate vehicle stacking space, potentially spilling traffic onto Avenue A.
- Close proximity to existing buildings allow inadequate space for vehicle inspection area.

### **ENTRANCE 1 CURRENT CONDITIONS**

From Avenue B (see Photo 1), Entrance 1 currently has an approach zone and access control zone, but no response zone (see Map 2). The approach zone is approximately 140 feet long and provides a single straight lane for traffic entering the installation and a single lane for exiting traffic. To the west of the approach zone is a newly constructed parking lot. This parking lot accommodates overflow parking for personnel or visitors at the installation. The lot is also used by guests of the commanding officer, whose residence (Building 1) is approximately 130 feet from the western edge of the parking lot.

The access control zone consists of two concrete jersey barriers placed along the centerline of the roadway, to serve the safety of the guards and for entry control. A small 4' x 6' sentry booth, located on the west side (exit lane) of the Avenue C, serves as the only shelter for the guards. Two armed guards per 12-hour shift check identification for each individual or vehicle that enters the base. These guards also write temporary passes, provide directions to individual buildings, and conduct vehicle inspections, if necessary. There is no visitor center or gatehouse, and guards must call for backup in order to use the restrooms at a nearby building.

The entrance lacks a true response zone. There are no barriers of any kind located beyond the access control zone. The facility also lacks any type of active barrier.



**Photo 1. Approach from Avenue B showing historic gate piers and existing steel perimeter fence.**



**Photo 2. Approach zone. Note that sentry booth has since been moved to a new location on the other side of the parking lot drive.**

## **ENTRANCE 1 CURRENT PRACTICES**

The installation typically handles three types of individuals and vehicles at the main gates. These include:

- Military or contractor personnel with proper personal and vehicle identification.
- Visitors with no identification.
- Truck deliveries.

Each category requires a different type of action from the guards at the sentry booth (See Maps 3, 4, and 5). Individuals with proper identification show their identification to the guard, and are typically waved through the gate with little delay (See Map 3).

Visitors can include retired military personnel using the medical center, minor museum traffic, visitors with meetings on base, incoming students with military IDs, guests of residents, contractors, conference attendees, and suppliers making deliveries. Visitor access results in one of three scenarios. The first scenario involves the visitor with proper identification and a legitimate reason for being on base (See Map 4). The guard issues this visitor a temporary pass. The first-time visitor often asks for directions, delaying the entrance of vehicles in line behind him/her.

In the second scenario, the guards need to inspect a visitor's vehicle (See Map 4). In this case, the visitor is requested to pull forward along Avenue C and turn into a vehicle inspection area on Avenue D, a cross street. By directing this individual further onto the installation, the visitor is now within the recommended 148' standoff distance from Building 3, a billeting facility. Also, the visitor could easily continue along Avenue C without stopping for inspection. If the visitor is granted access, he/she can proceed throughout the

installation. If refused entry at this point, the visitor must turn around and then exit the installation.

The third scenario involves the guard refusing entry to a visitor for lack of proper identification, lack of need to be on the installation, or suspicious behavior (See Map 5). If the visitor is refused entry, he/she must back the vehicle from the sentry booth and drive through the existing parking lot to exit the base. By requiring the rejected visitor to back their vehicle from the sentry booth, vehicles waiting in line may also have to back up, potentially creating a hazard on the access road.

The delivery/service vehicle has options similar to the visitor: acceptance, refusal, and inspection. In the case of a rejected tractor-trailer, the tractor-trailer and its driver must be escorted through the base before finding a suitable location to turn around. This creates a potentially dangerous situation.

### **EXISTING DISTANCES TO THE CONTROLLED PERIMETER**

The installation considers the exterior fence located along Avenue B as the controlled perimeter. Entry control facilities, however, are generally considered to be outside of the controlled perimeter. Until a vehicle has been inspected, it cannot be considered to be within a controlled perimeter. The exterior fence at Installation A therefore cannot be considered a true controlled perimeter. The team has defined the controlled perimeter as the edge of the parking lot and the intersection of Avenues C and D. These locations are considered to be the innermost points of the installation accessible to a vehicle before the visitor would be inspected or stopped.

UFC 4-010-01 has defined standard standoff distances for various types of facilities. For primary gathering buildings and billeting facilities, the recommended distance from a controlled perimeter is 148', while a distance of 82' is recommended for parking and roadways within a controlled facility. Due to the limited space available in this particular historic district, it is very difficult to achieve either of the recommended standoff distances.

In reviewing the standoff distances to the controlled perimeter, the team reviewed the uses of each of the nearby buildings. Building 1, a historic housing unit, is located approximately 94' from the perimeter fence, and approximately 130' from the existing parking lot. However, Building 1 is a single-family housing unit that is exempt from the standoff provisions defined in UFC 4-010-01. Building 2 is a pool house that is located approximately 66' from the parking lot. Because 10 or more people do not regularly occupy Building 2, this facility can be considered uninhabited and therefore exempt from UFC 4-010-01 provisions.

Building 3 is a billeting facility located approximately 106' from the intersection of Avenues C and D. This building stands within the recommended 148' standoff distance from a controlled perimeter. In addition, the current vehicle inspection area along Avenue D is located within 82' of Building 3. Building 4 is a historic primary gathering building and is approximately 136' from the perimeter fence and 346' from the curb of Avenue C.

Because it is an existing facility, Building 3 is not required to maintain recommended standoff distances according to UFC 4-010-01. However, if an Explosive Weight 1 blast were to occur inside this distance, the explosion could cause property damage and casualties. In addition, future renovations of this facility may be required for compliance with UFC 4-010-01. A reduced standoff distance does not preclude major renovation of a facility, but it would mean additional costs for further analysis and hardening, if necessary.

### **EXISTING TRAFFIC AND TRAFFIC FLOW**

The installation recently requested that the surrounding municipality conduct a traffic study of Entrance 1 and Avenue B. The municipality subsequently determined that the amount of traffic on Avenue B did not warrant an additional study. Internal traffic counts found that on a typical day, between 230 and 260 cars enter the facility during morning peak traffic (defined as 0600 to 0800). During the field visit, the team conducted an informal count of vehicles entering the facility between 0730 and 0800 on a Tuesday morning. The team found that 32 vehicles entered the installation. During this time, cars backed up onto Avenue B only once. This backup consisted of only two to three cars waiting to turn into the installation from Avenue B.

Traffic patterns on the installation include two-way traffic on Avenue C and Avenue D. Avenue E is currently one-way with traffic flowing west to east. According to base personnel, plans are in process to change traffic patterns. Avenue E will accommodate two-way traffic, while Avenue D will become one-way with traffic flowing westward.

### **ENTRANCE 1 CURRENT DEFICIENCIES**

The current design and security practices contain multiple deficiencies, including:

- No physical vehicle or pedestrian barrier between the sentry booth/guard and the installation.
- Visitors are on the installation and past the controlled perimeter before passing security.
- Vehicles to be inspected are on the installation and past the controlled perimeter before being approved. They are also within close proximity to Building 3, a billeting type building.
- In the past, traffic problems have occurred when vehicles are forced to back up if they do not have proper ID. However, smaller vehicles can make a U-turn, and larger vehicles can now use the new parking lot.
- Tractor-trailers denied access must be escorted through the base.
- Temporary passes are completed while the cars are in line, which can cause a backup during peak hours.

- Visitors who stop at the booth with questions can cause a backup.
- Low lighting levels from a single light on the sentry booth and a single parking lot pole light.
- Pedestrians walk up the road with the vehicles.
- Sentry booth is located adjacent to the exit lane, not between the entry and exit lanes.
- No restroom facilities.
- No weather protection (canopies) over the sentry booth and inspection areas.
- No reinforcement to prevent high-speed vehicles from ramming the fence directly opposite Avenue H.

### **HISTORIC PRESERVATION CONCERNS**

The existing historic district has many unique features, including the fact that the buildings within the district are located both on and off the installation. The State Historic Preservation Office stressed many concerns about the proposed actions, mostly limited to the aesthetics of the design rather than to the need for such a project. These concerns include:

- Maintaining as much of the parade ground as possible, since it is the district's only large open green space.
- Development of a gatehouse and sentry booth that is consistent with the surrounding architecture and remains low to the ground.
- Retention of as many existing older water oak trees as possible. If retention is not possible, then trees should be replaced with similar species (current replacement species is scarlet oak). A tree inventory completed by a certified arborist noted that the water oaks appear to be 70 years old.
- Use of historic lighting fixtures that do not cause light pollution for the neighbors within the historic district.

### **ENTRANCE 1 RECOMMENDATIONS**

During the charette, the field team developed multiple sketches and designs to implement the highest level of security possible within the constraints of the historic district. Based upon the sketches and revisions, the team developed two concepts for Entrance 1. Both concepts incorporate an approach zone, access control zone, and response zone. The concepts also have other similar features:

- Reinforced steel fence around the entire entry of similar appearance to the existing perimeter fence, in order to secure the area.

- Gatehouse where visitors can check in, obtain a temporary pass, and ask for directions. The gatehouse will separate visitors from those that regularly enter the installation.
- Sentry booth for guards checking personal and vehicular identification.
- Active barriers in the response zone that can be activated by either the guard at the sentry booth or in the gatehouse.
- A curved exit lane that will inhibit individuals from entering the installation through high-speed entry along the exit lane.
- Use of median islands and rumble strips as traffic-calming devices.
- Use of tire shredders to direct traffic into desired directions.
- Sidewalks for base personnel to enter the installation using turnstiles and electronic key cards.
- Designated vehicle inspection area.
- Canopies at sentry booth and vehicle inspection areas.

### **LARGE TRACTOR-TRAILER ENTRANCES**

Based upon discussions with base personnel and the design limitations afforded by the various DoD ATFP design standards, the design team determined that allowing truck deliveries through Entrance 1 is no longer a feasible option. The design limitations that led to this decision included:

- Lack of adequate space for a truck inspection area.
- Difficulty removing a rejected truck from the installation without driving the vehicle onto the installation.
- Lane widths that are incompatible with larger vehicles.
- Tight turning radii at the intersection of Avenues B and C.

It is recommended that all companies schedule weekly deliveries in advance through Entrance 3, preferably during off-peak hours. Since the same drivers make many deliveries on a regular basis, truck inspections would not need to occur regularly.

### **EMERGENCY VEHICLES**

The installation uses the municipality's emergency services, including fire and medical care. Currently, fire trucks and ambulances enter the installation through Entrance 1. The new improved entry must continue to allow fire trucks and ambulances easy access to the installation.

## **LIGHTING RECOMMENDATIONS**

Two lighting systems are recommended to provide ambient lighting throughout the entry control facility. Lighting systems include a pulse-start metal halide primary lighting source and an incandescent secondary backup (emergency) lighting source. The lighting for the approach and response zones will provide a street surface ambient 50 foot candles (ftc) with a backup capability of 40 ftc. The access control zone will have a concentrated 100 ftc with a secondary source of 80 ftc.

Pulse-start metal halide lamps produce 110 lumens per watt (LPW) and a color rendering index (CRI) of 80. The pulse type lamp produces approximately 40 percent more LPW than a standard metal halide lamp, warms to full brightness more rapidly, and has a quicker restrike time. Although pulse-start costs more than conventional metal halide lamps, the facility will benefit from lower installation, operating, and maintenance costs.

During power interruptions, the incandescent lighting source will provide immediate illumination until the primary lighting is restored to full operation. During a power surge or outage, for example, metal halides require 10 to 15 minutes to cool, plus an additional 2 to 5 minutes to heat up. By comparison, an incandescent system relights immediately.

Both lighting systems should provide elements of uplight to help create a more uniform environment. Glass luminaries should provide 15 to 20 percent uplight, which illuminates the ceiling and eliminates the cavern effect that can occur when a ceiling is dark. With a white or light-colored canopy ceiling surface, uplight bounces off the ceiling to create a more uniformly illuminated environment and reduce glare.

Within the access control zone, fixtures will be placed in a symmetrical pattern attached to the canopies, and supplemental luminaries will also be installed there. Within the approach zone and response zone, these lights should be mounted on streetlight poles.

## **CLEAR ZONES**

Clear zones are defined as areas around the controlled perimeter where no obstructions exist. The clear zone allows guards to adequately scan and observe the perimeter fence, and encompasses a 30' internal buffer and 20' external buffer. Existing trees may prevent a base from attaining these clear zones; however, man-made incursions into the clear zone, such as planting vegetation or locating parking areas, should not occur. When existing trees are located within the clear zone, their lower branches can be appropriately trimmed and pruned to limit a person's ability to breach a fence by using the tree. Additionally, alternative measures can be used to offset incursions into the clear zone.

The existing clear zones at Installation A do not necessarily meet current standards. Existing shrubs along the perimeter fence limit the effectiveness of the exterior clear zone, while existing trees within the interior clear zone also limit its effectiveness.

In both design concepts, clear zone requirements are not always met. Parking lots are located more than 20' from the controlled perimeter, and new trees or other vegetation are not planted in the clear zones. However, in some instances, roadways are located within the required clear zones. Existing trees would also need to be pruned to remove lower branches.

If a clear zone cannot be achieved, there are a variety of compensatory measures that can be applied. These measures include higher fences, CCTV monitoring, increased guard patrols, additional lighting, top guards on the fences, and larger internal clear zones. Should a threat arise, additional security personnel could be positioned in nearby buildings. It appears that in the case of Installation A, there is a significant amount of internal clear zone that could be applied to offset the limited external clear zone.

### **SOLUTION 1 – SEPARATE VISITOR PARKING FACILITY AND VEHICLE INSPECTION AREA**

Map 7 shows that the approach zone in this solution includes a channelization island just north of the installation entrance gates. This island serves as a traffic-calming device. The island will also impede vehicles entering the installation at high speeds when turning at the existing gate. Signage would be located on the east side of Avenue C, across from the island. The signage would direct visitors into the parking lot to the right (east) while directing properly identified vehicles to continue straight ahead. Additional signage would need to be located outside the perimeter fence to alert trucker drivers that all deliveries are now being handled through Entrance 3.

The existing parking lot to the left (west) has been slightly modified. To limit the ability of an individual to bypass the sentry booth, the current turn lane to the south of the sentry booth has been modified to allow only one lane of exiting traffic. The single lane includes a traffic arm to deter vehicles from entering the parking lot and bypassing the sentry booth. In addition, this solution removes six parking spaces at the eastern side of the center aisle, which allows vehicles to complete a loop in the parking lot without having to pass again through the entry control zone. One parking space on the north row has also been eliminated to allow pedestrian access from this controlled parking lot.

The access control zone includes a center channelization island with a sentry booth. The island features vehicle-resistant barricades both north and south of the sentry booth. The booth protects the guards from the elements and provides housing for computer, communication, and active barrier control equipment. The access control zone also features a canopy to protect both guards and visitors from the elements during identification screening. The canopy extends over both the entry and exit lanes, and is designed to respect the features of the historic district while adding a modern look (see Figure 1 in Appendix 1). The canopy will also house lights (see lighting discussion, page B-9) to illuminate these areas without causing significant light pollution in other areas. The central island also bows outward to the west, creating a curved exit lane that slows exiting vehicles and impedes high-speed vehicles from entering through the exit lane.

The access control zone also includes a visitor gatehouse (see Figure 4 in Appendix 1), a small building located east of the entry drive that serves as a catchall for visitors. It is anticipated that a guard will staff the gatehouse, and will issue passes and provide directions to visitors entering the installation. A small parking lot is located directly east of the gatehouse, and provides spaces that replace those removed from the existing lot.

A vehicle inspection area is located just north and east of the sentry booth. This inspection area is designed so vehicles can pull off the main entrance drive, and the area is sized to allow guards room to walk around and inspect a vehicle. Another canopy is located here to shield guards from the elements while they conduct the inspection.

The response zone includes a rumble strip and a cable-reinforced crash beam (see Figure 6 in Appendix 1) in each lane. Due to the short length of the response zone, it is anticipated that available response times to address a threat and subsequently activate a normally “open” barrier will be inadequate. The active barriers will therefore need to remain in the “closed” position, and it will be necessary to open the barrier for each entering vehicle. This arrangement is necessary because of a variety of factors, including:

- The crash beams are located approximately 90' from the sentry booth.
- The average guard response time (the time it takes a guard to activate a barrier) is typically 4 seconds, with an additional 1 second to activate the barrier. It therefore takes a total of 5 seconds to activate the barrier.
- In 5 seconds, the standard car threat can travel 141' from a dead stop. At an initial velocity of 5 mph, the threat can travel 178'. With only 90' available at this site, gates must remain in the closed position.

While it is desirable to provide a K12/L3 crash-rated barrier (15,000-lb vehicle at 50 mph with a penetration of 3 feet or less) in this type of entry control facility, the fastest cycle times associated with these types of barriers are approximately 20 seconds per vehicle with a retracting bollard (see Figure 5 in Appendix 1). To achieve a quicker cycle time of approximately 10 seconds per vehicle, a less robust active barrier could be used that would provide a K4/L2 crash-rating (15,000-lb vehicle at 30 mph with a penetration between 3 and 30 feet), such as a cable-reinforced crash beam (see Figure 6 in Appendix 1). Although it can be seen that the ultimate stopping capacity of a cable-reinforced crash beam would be for a 15,000-lb vehicle traveling faster than 30 mph, there is no available supporting data. Also, significant penetration distance or complete barrier failure could be a critical issue at higher vehicle speeds. However, with the site limitations, including a 90° turn into the entry control facility, high-speed entry attempts are not envisioned.

This solution requires the removal of four existing water oak trees that contribute to the historic character of the access drive and the historic district. It also requires the removal of two scarlet oaks that were planted approximately 10 years ago. According to a 2002 tree inventory conducted by a certified arborist, the four water oaks have less than 15 years of viable life remaining, since each tree is approximately 70 years old. For a typical mitigation, it would be recommended that the installation plant replacement trees around the entry

control facility. In this case, however, this is not recommended. Due to current security standards with regards to clear zones (see page B-9), trees and other obstructions cannot be placed in these areas. With the controlled perimeter fence installed 20' east of the new parking lot, these trees would also need to be planted an additional 30' from the fence, which would locate the trees in the middle of the parade ground. The planting of the trees this far from Avenue C would not recreate the appearance or feelings associated with the current alley of trees along Avenue C.

Although not part of the entry area, it is highly recommended that the base provide reinforcement at the fence directly opposite Avenue H. Avenue H is of sufficient length to allow a vehicle to gain enough speed to crash through the fence and access the parade ground. Reinforcement could consist of steel cable restraints or bollards discretely located between the existing shrubs and the fence. The installation of bollards or cabling is not recommended along the entire perimeter fence, but rather only in those areas where an exterior road terminates at the installation. An exterior road terminates at the installation on both the south and east sides of the installation. A cable barrier system has minimal energy dissipation capacity when compared to bollards. Additionally, the installation of a limited number of fixed bollards into a concrete foundation should not be cost-prohibitive.

### **Vehicular Access Scenarios**

As discussed earlier, there are usually three types of individuals and vehicles entering through the main gate of Installation A (See Maps 8, 9, and 10). They are:

- Military or contractor personnel with proper personal and vehicle identification.
- Visitors.
- Truck deliveries, which, as discussed earlier, will now enter the installation through a separate gate.

Individuals with proper personal and vehicle identification will have straightforward access to the installation (See Map 8). With current procedures, these individuals will arrive at the sentry booth, the guards will check their identification, and they will be allowed to proceed onto the installation.

Visitors may experience any of three scenarios (See Map 9). The first scenario involves visitors entering the approach zone, noticing the directional sign, entering the parking lot, and proceeding to the gatehouse. At the gatehouse, visitors obtain temporary passes and directions to their destination. Upon receipt of a pass, they would exit the parking lot, re-enter the entrance line, proceed to the sentry booth, and enter the installation.

A second visitor scenario involves those who missed the directional sign and pull up to the sentry booth without a pass. These visitors are directed to the turnaround lane located just north and east of the vehicle inspection area. The visitor makes this right turn and enters the gatehouse parking lot, after which the visitor proceeds to the gatehouse, obtains the necessary paperwork, returns to the entry line, and enters the installation.

The third visitor scenario involves visitors who are denied entry to the installation even after stopping at the gatehouse (See Map 10). These visitors exit the visitor parking lot, turn left onto the Avenue B access road, and exit the installation at the intersection of Avenues A and B.

A vehicle inspection may be necessary in any of these scenarios. For an inspection, the vehicle and passengers pull off to the side of the entrance lane into the designated vehicle inspection area. If the vehicle is allowed to continue, the driver pulls forward and proceeds onto the installation. If the vehicle is denied entry, the driver turns into the gatehouse access road and exits the base through the gatehouse parking lot.

### **Pedestrian Access Scenarios**

Pedestrians arriving at the installation by public transportation enter the control facility through a walkway and gate just east of Avenue C. Individuals would be required to stop at the gatehouse and check in, then proceed to the north and pass through another gate. This second gate would be locked at all times and be “opened” by the guard in the gatehouse checking credentials.

Pedestrians who would park in the existing parking lot would be able to use a sidewalk and gate positioned just west of the cable-reinforced crash beams. Because the existing parking lot is a controlled parking lot, where users have already been properly identified, this entrance can include a gate that is not locked at all times.

A third scenario involves the pedestrian entrance that is located at the far western edge of the parking lot. The existing parking lot serves as visitor parking for events held at Building 1. The gate at this location would be locked at all times unless activities were ongoing at Building 1. A guard would have to ensure that this gate was unlocked prior to the event and then relocked when the event was concluded.

### **SOLUTION 2 – SHARED VISITORS PARKING AND VEHICLE INSPECTION AREA**

Map 11 shows an alternate, less expensive solution. The approach zone includes a channelization island just north of the gates that serves as a traffic-calming device and impedes vehicles entering the installation at high speeds when turning at the gate.

The existing parking lot to the left (west) has been somewhat modified. To limit the ability of vehicles to bypass the sentry booth, the current turn lane to the south of the gatehouse allows only one lane of exiting traffic. The single lane includes a traffic arm to deter vehicles from entering the parking lot and bypassing the sentry booth. In addition, this solution removes six parking spaces at the eastern side of the center aisle, which allows vehicles to complete a loop in the parking lot without passing again through the entry control zone. An additional five parking spaces on the southernmost aisle would be removed to allow for a vehicle inspection area, which would be equipped with a canopy for weather protection. The vehicle inspection area is located in this far corner to ensure that the vehicle subject to inspection remains at a maximum distance from any adjacent buildings.

The access control zone includes a center channelization island with curved edges for traffic flow control. This shape allows both the entry and exit lanes to follow an arc that forces vehicles to slow down and impedes vehicles from entering the installation at high speed in either lane. The island features a sentry booth with vehicle-resistant barricades on the north and south sides. The booth protects the guards from the elements and provides housing for computer, communication, and active barrier control equipment. The access control zone also features a canopy to protect both guards and visitors from the elements during identification screening. The canopy extends over both the entry and exit lanes, and is designed to respect the features of the historic district while adding a modern look (see Figure 1 in Appendix 1). The canopy will also house lights (see lighting discussion, page B-9) to illuminate these areas without causing significant light pollution to other areas.

The access control zone also includes the visitor gatehouse. This small building is located to the west of the entry drive and serves as a catchall for visitors. It is anticipated that a guard will staff the gatehouse, and will issue passes and provide directions to visitors entering the installation. The existing parking lot will accommodate visitor parking.

The response zone includes a rumble strip and a cable-reinforced crash beam (see Figure 6 in Appendix 1) in each lane. Due to the short length of the response zone, it is anticipated that available response times to address a threat and subsequently activate a normally “open” barrier will be inadequate. The active barriers will therefore need to remain in the “closed” position, and it will be necessary to open the barrier for each entering vehicle. This arrangement is necessary because of a variety of factors, including:

- The crash beams are located approximately 90' from the sentry booth.
- The average guard response time (the time it takes a guard to activate a barrier) is typically 4 seconds, with an additional 1 second to activate the barrier. It therefore takes a total of 5 seconds to activate the barrier.
- In 5 seconds, the standard car threat can travel 141' from a dead stop. At an initial velocity of 5 mph, the threat can travel 178'. With only 90' available at this site, gates must remain in the closed position.

While it is desirable to provide a K12/L3 crash-rated barrier (15,000-lb vehicle at 50 mph with a penetration of 3 feet or less) in this type of entry control facility, the fastest cycle times associated with these types of barriers are approximately 20 seconds per vehicle with a retracting bollard (see Figure 5 in Appendix 1). To achieve a quicker cycle time of approximately 10 seconds per vehicle, a less robust active barrier could be used that would provide a K4/L2 crash-rating (15,000-lb vehicle at 30 mph with a penetration between 3 and 30 feet), such as a cable-reinforced crash beam (see Figure 6 in Appendix 1). Although it can be seen that the ultimate stopping capacity of a cable-reinforced crash beam would be for a 15,000-lb vehicle traveling faster than 30 mph, there is no available supporting data. Also, significant penetration distance or complete barrier failure could be a critical issue at higher vehicle speeds. However, with the site limitations, including a 90° turn into the entry control facility, high-speed entry attempts are not envisioned.

This solution requires the removal of one existing water oak tree that contributes to the historic character of the access drive and the historic district. According to a 2002 tree inventory conducted by a certified arborist, this water oak has less than 15 years of viable life remaining, since it is approximately 70 years old. Three other water oaks have already been removed for the construction of the parking lot.

Although not part of the entry area, it is highly recommended that the base provide reinforcement at the fence directly opposite Avenue H. Avenue H is of sufficient length to allow a vehicle to gain enough speed to crash through the fence and access the parade ground. Reinforcement can consist of steel cable restraints or bollards discretely located between the existing shrubs and the fence. The installation of bollards or cabling is not recommended along the entire perimeter fence, but rather only in those areas where an exterior road terminates at the installation. An exterior road terminates at the installation on both the south and east sides of the installation. A cable barrier system has minimal energy dissipation capacity when compared to bollards. Additionally, the installation of a limited number of fixed bollards into a concrete foundation should not be cost-prohibitive.

### **Vehicular Access Scenarios**

As discussed earlier, there are usually three types of individuals and vehicles entering through the main gate of Installation A (See Maps 12, 13, and 14). They are:

- Military and contractor personnel with proper personal and vehicle identification.
- Visitors.
- Truck deliveries, which, as discussed earlier, will now enter the installation through a separate gate.

Individuals with proper personal and vehicle identification will have straightforward access to the installation (See Map 12). With current procedures, these individuals will arrive at the sentry booth, the guards will check their identification, and they will be allowed to proceed onto the installation.

Visitors without passes are directed at the sentry booth to turn left into the parking lot and proceed to the gatehouse (See Map 13). In the first scenario, upon receipt of a pass and directions, these visitors re-enter the access line, proceed to the sentry booth, and enter the installation.

The second visitor scenario involves visitors denied entry to the installation even after stopping at the gatehouse (See Map 14). These visitors exit the visitor parking lot, turn right onto the Avenue C access road, and exit the installation onto Avenue B.

In any of these scenarios a vehicle inspection may be necessary. For an inspection, the vehicle and passengers turn into the parking lot and proceed to the designated vehicle inspection area in the southeast corner of the parking lot. If the vehicle is allowed to continue, the driver pulls forward and proceeds onto the installation. If the vehicle is denied

entry, the driver turns into the gatehouse access road and exits the base through the gatehouse parking lot.

### **Pedestrian Access Scenarios**

Individuals arriving at the installation by public transportation enter the entry control facility through a walkway and gate just west of Avenue C. Individuals would be required to stop at the gatehouse and check in, then proceed north and pass through another gate. It is assumed that this gate would be locked at all times and be “opened” by the guard in the gatehouse checking credentials.

Pedestrians who would park in the existing parking lot would be able to use the same sidewalk. Because the gate would be locked, the guard would have to “open” the gate.

A third scenario involves the pedestrian entrance that is located at the far western edge of the parking lot. The existing parking lot serves as visitor parking for events held at Building 1. The gate at this location would be locked at all times unless there were activities taking place in Building 1. A guard would have to ensure that this gate was unlocked prior to the event and then relocked when the event was concluded.

## **INSTALLATION A COST ESTIMATES**

### **Solution 1 Costs**

The estimated cost to construct Solution 1 is \$667,926 (see Appendix 2 for detailed Cost Estimates). The estimate includes all associated costs with the development of this concept. The costliest items include the two canopies and sentry booth (\$86,883), cable reinforced crash beams, fencing, and a traffic arm (\$148,000), and other site work including excavation, roadways, and sidewalks (\$131,500). The addition of a significant amount of roadways substantially added costs to this solution compared to Solution 2.

### **Solution 2 Costs**

The estimated cost to construct Solution 2 is approximately \$597,200 (see Appendix 2 for detailed Cost Estimates). This solution is less expensive than Solution 1 and this is mainly due the amount of sitework that must be completed in Solution 1. Solution 2 would utilize the existing parking lot more extensively and not result in the construction of a significant amount of pavement. The costliest items include two canopies and a sentry booth (\$86,883), bollards, fencing, and gates (\$139,00), and other site work including excavation, roadways, and sidewalks (\$90,000).

## **SUMMARY COMPARISON OF THE TWO SOLUTIONS**

### Advantages to Solution 1:

- Provides a high level of security.
- Meets all clear zone requirements.
- Provides good traffic flow.
- Removes parking spaces in existing parking lot, but adds parking by gatehouse.
- Limits opportunities for unauthorized entries.
- Vehicle inspection area is centrally located.
- Visitors do not have to go through sentry booth before going to gatehouse.

### Disadvantages to Solution 1:

- Expands into parade ground.
- Removes multiple historic old-growth oaks.
- More costly than Solution 2.

### Advantages to Solution 2:

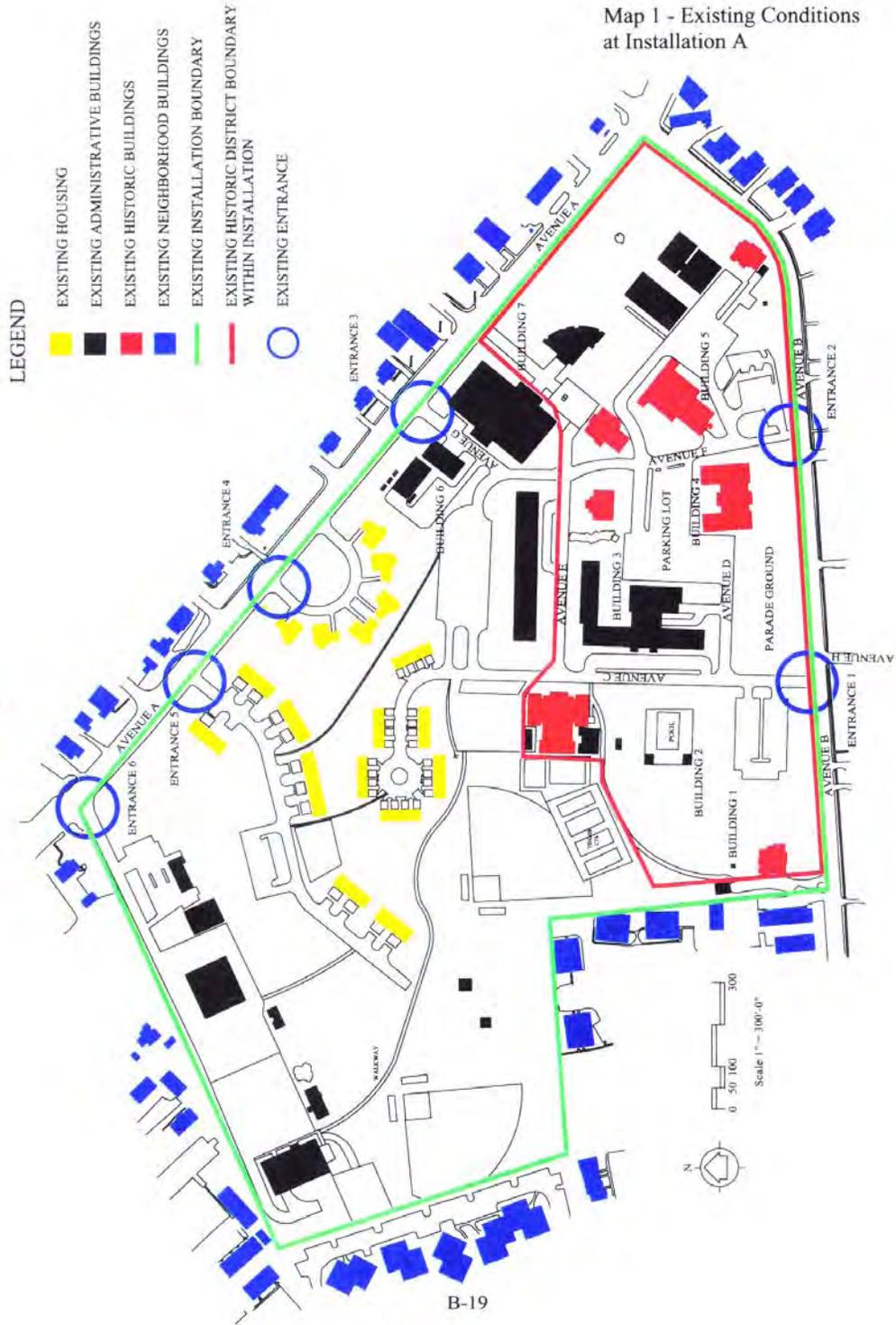
- Provides a high level of security.
- Meets all clear zone requirements.
- Limited disturbance of historic district.
- Does not intrude on the parade ground and removes only one old-growth oak.
- Less expensive than Solution 1.

### Disadvantages to Solution 2:

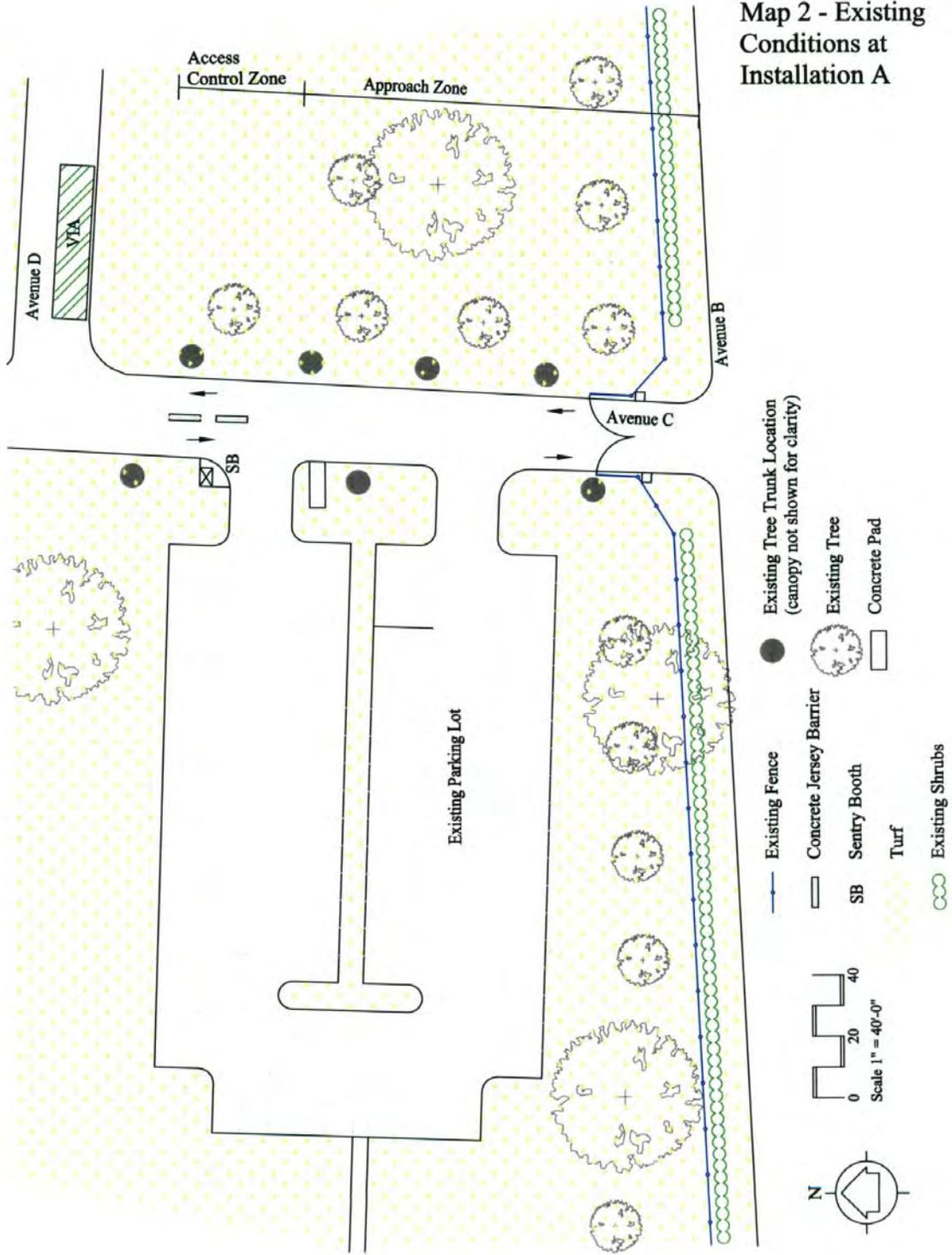
- Vehicle inspection area is not centrally located.
- All visitors must pass by the sentry booth before obtaining a pass.
- Traffic patterns are more difficult.
- Removes 13 parking spaces in the existing parking lot.

**This page left intentionally blank.**

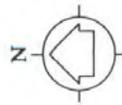
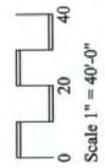
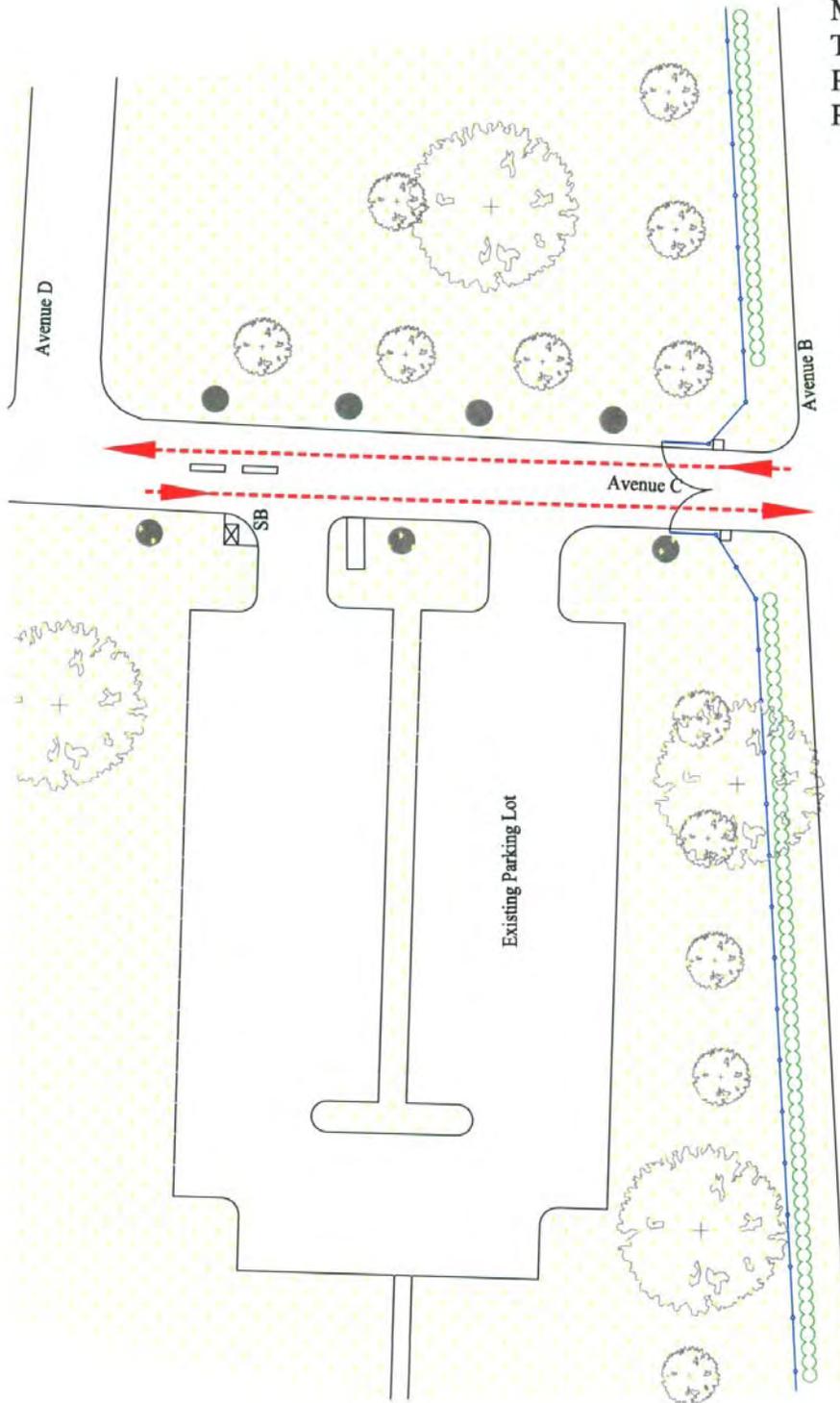
Map 1 - Existing Conditions at Installation A



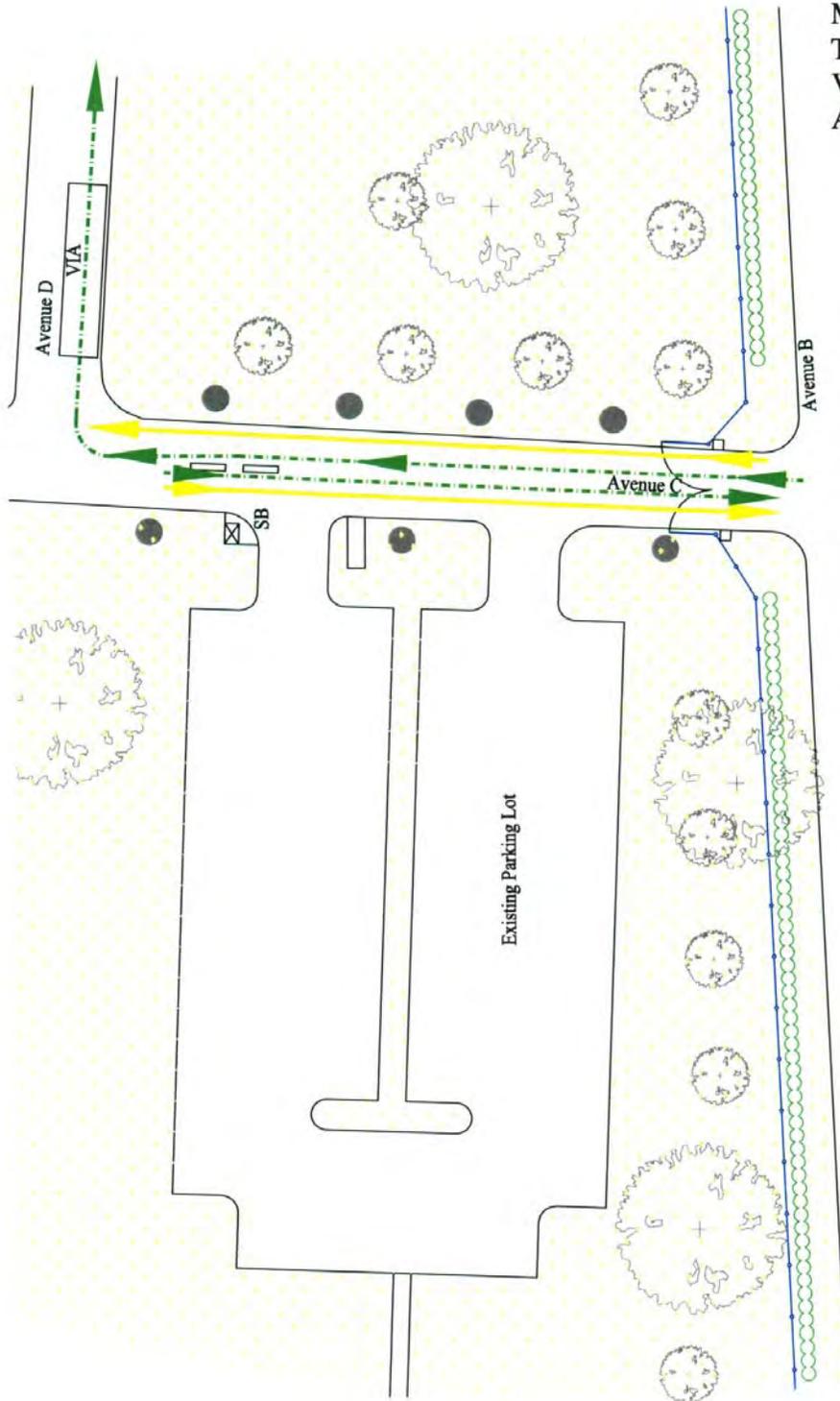
Map 2 - Existing Conditions at Installation A



Map 3 - Existing  
Traffic Flow -  
Personnel with  
Proper ID

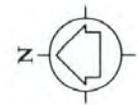
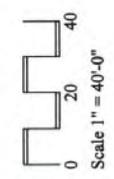


# Map 4 - Existing Traffic Flow - Visitors Granted Access

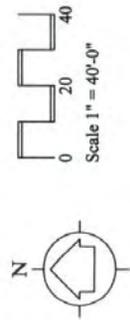
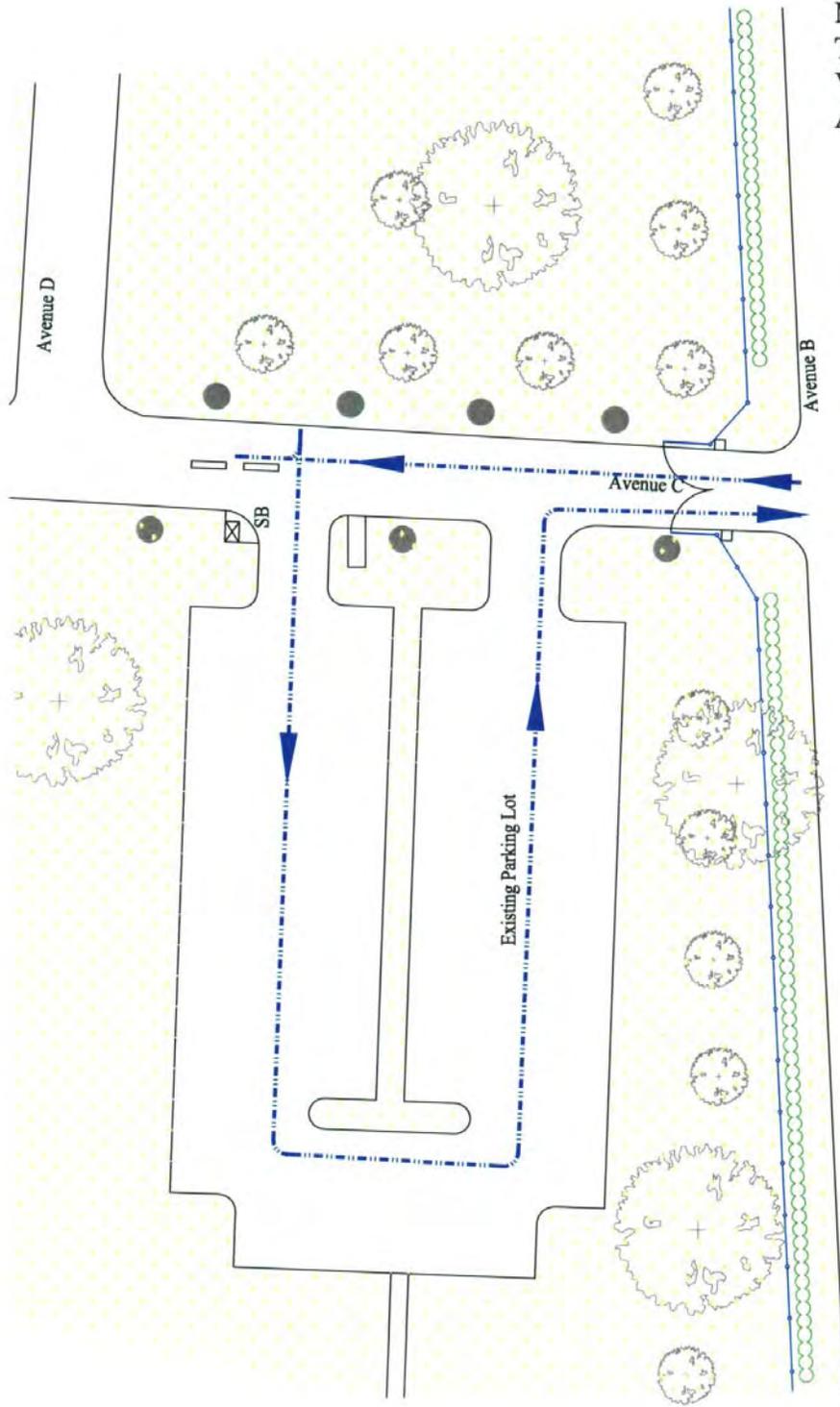


Visitors who stop at the sentry booth, obtain a pass, and proceed onto the installation

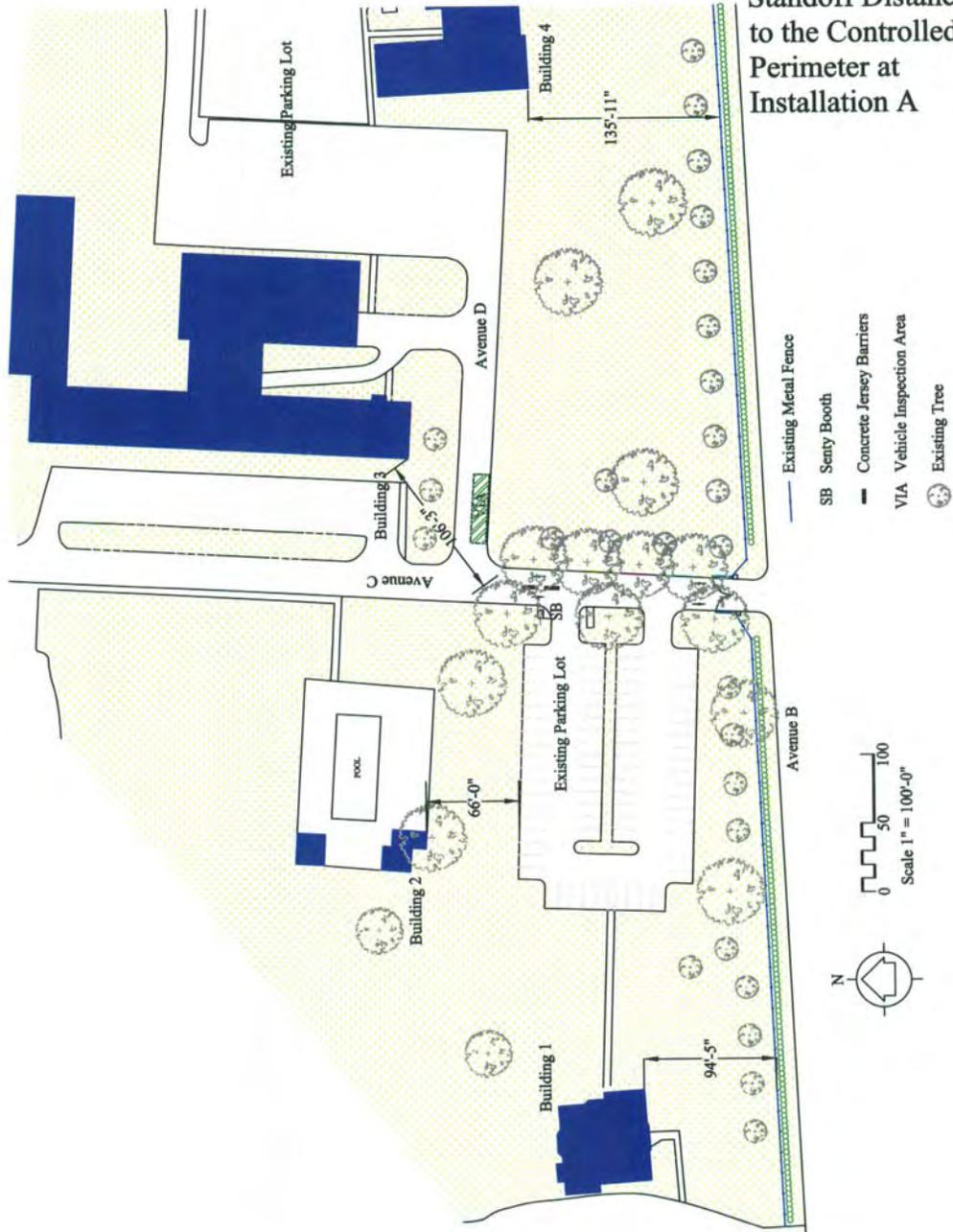
Visitors who stop at the sentry booth, require a vehicle inspection, and then proceed onto the installation



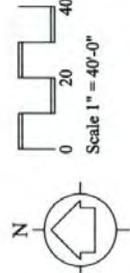
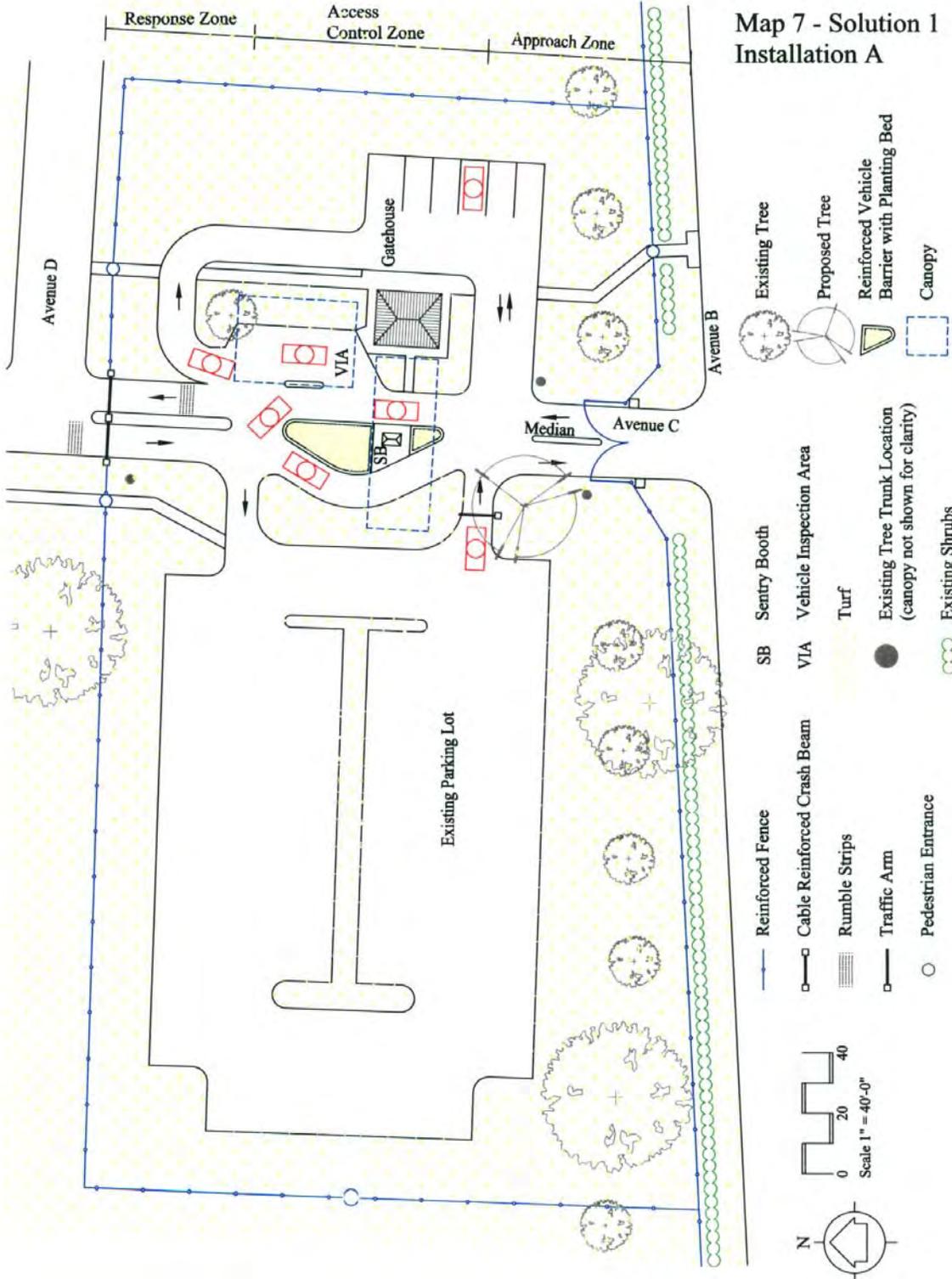
Map 5 - Existing Traffic Flow - Visitors Denied Access



Map 6 - Existing Standoff Distances to the Controlled Perimeter at Installation A

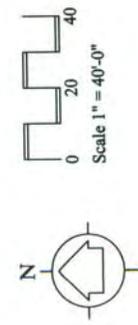
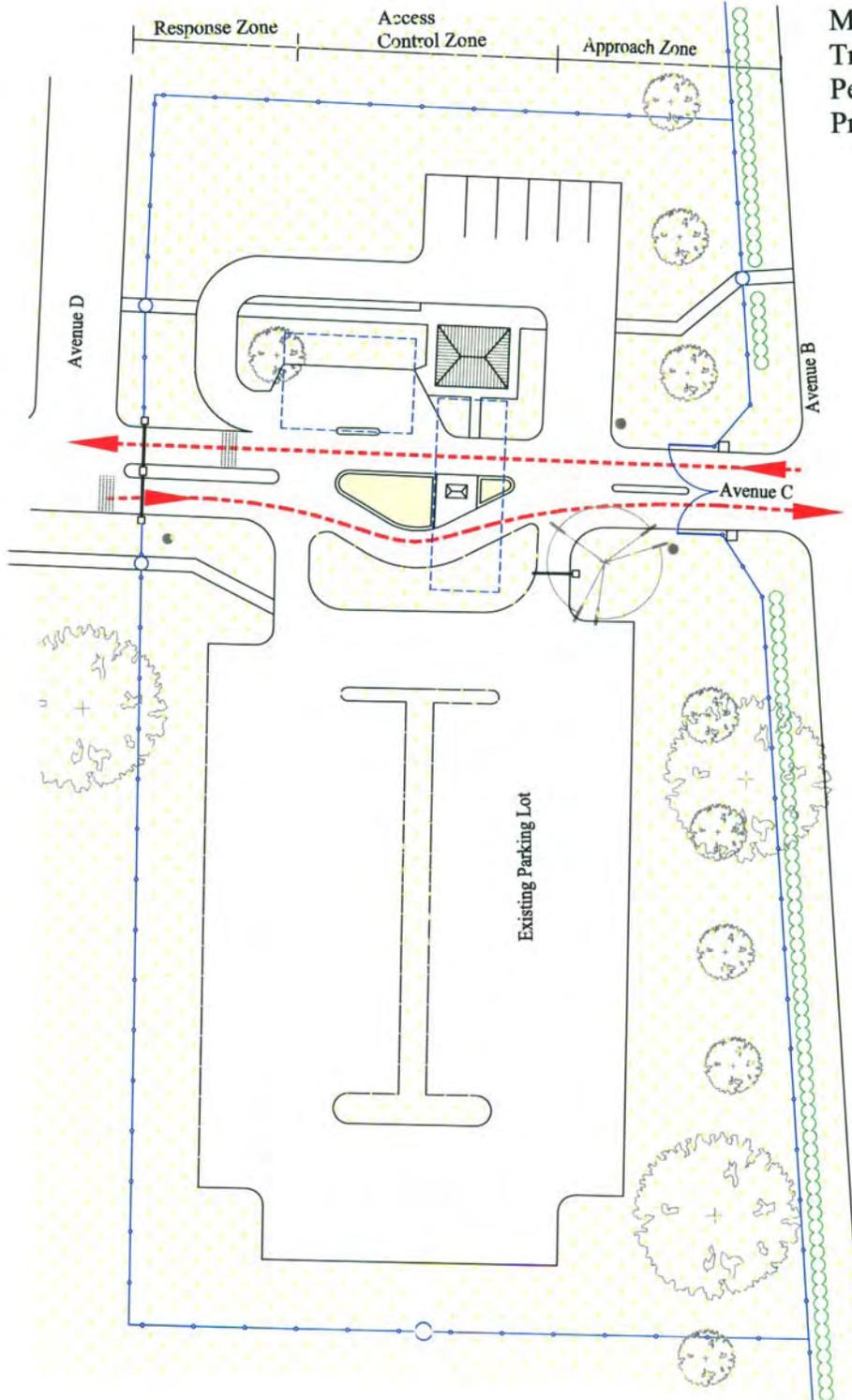


# Map 7 - Solution 1 Installation A

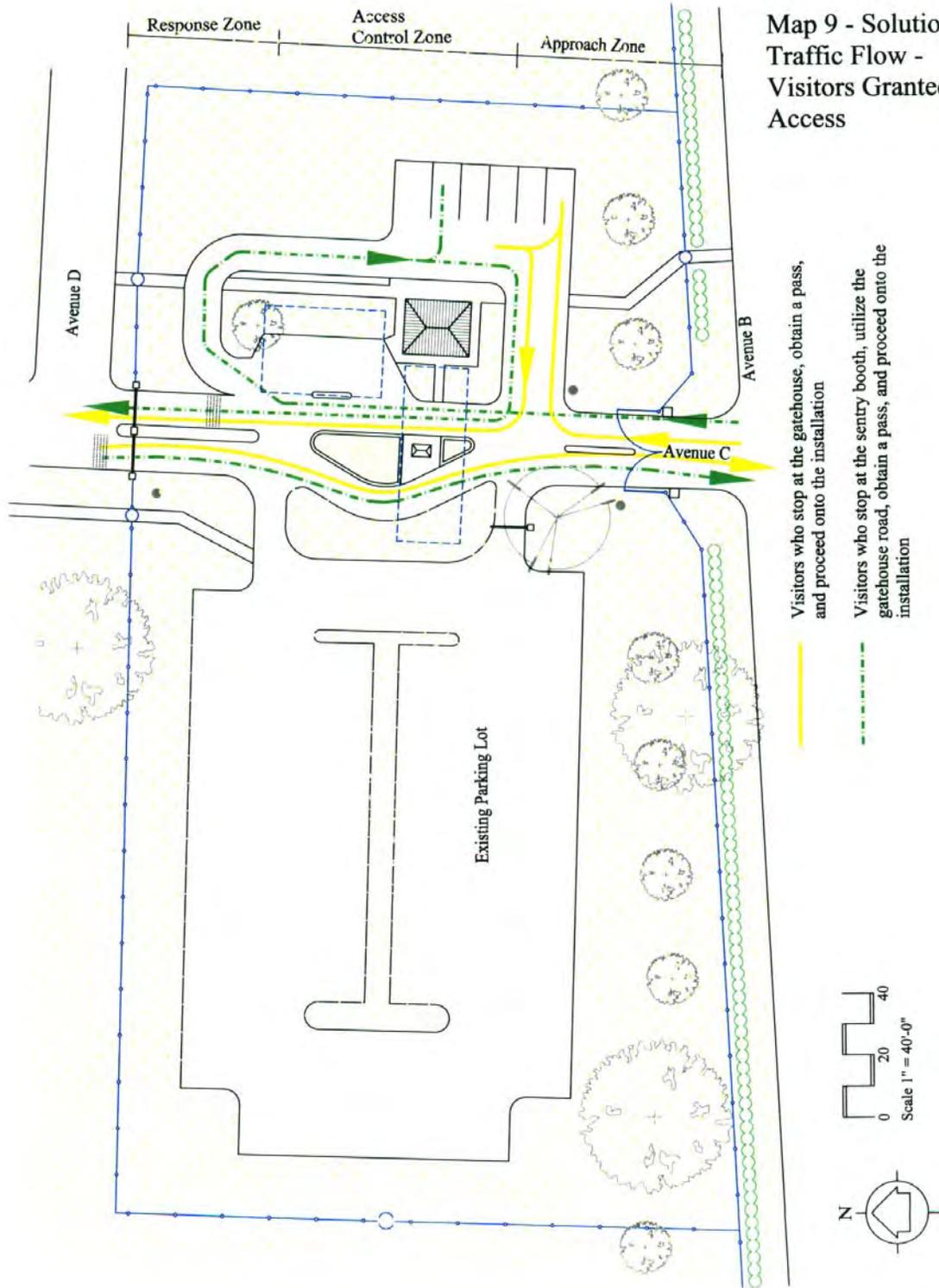


- Reinforced Fence
- Cable Reinforced Crash Beam
- Rumble Strips
- Traffic Arm
- Pedestrian Entrance
- Existing Tree
- Proposed Tree
- Reinforced Vehicle Barrier with Planting Bed
- Canopy
- SB Sentry Booth
- VIA Vehicle Inspection Area
- Turf
- Existing Tree Trunk Location (canopy not shown for clarity)
- Existing Shrubs

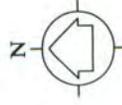
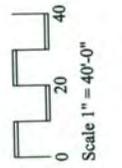
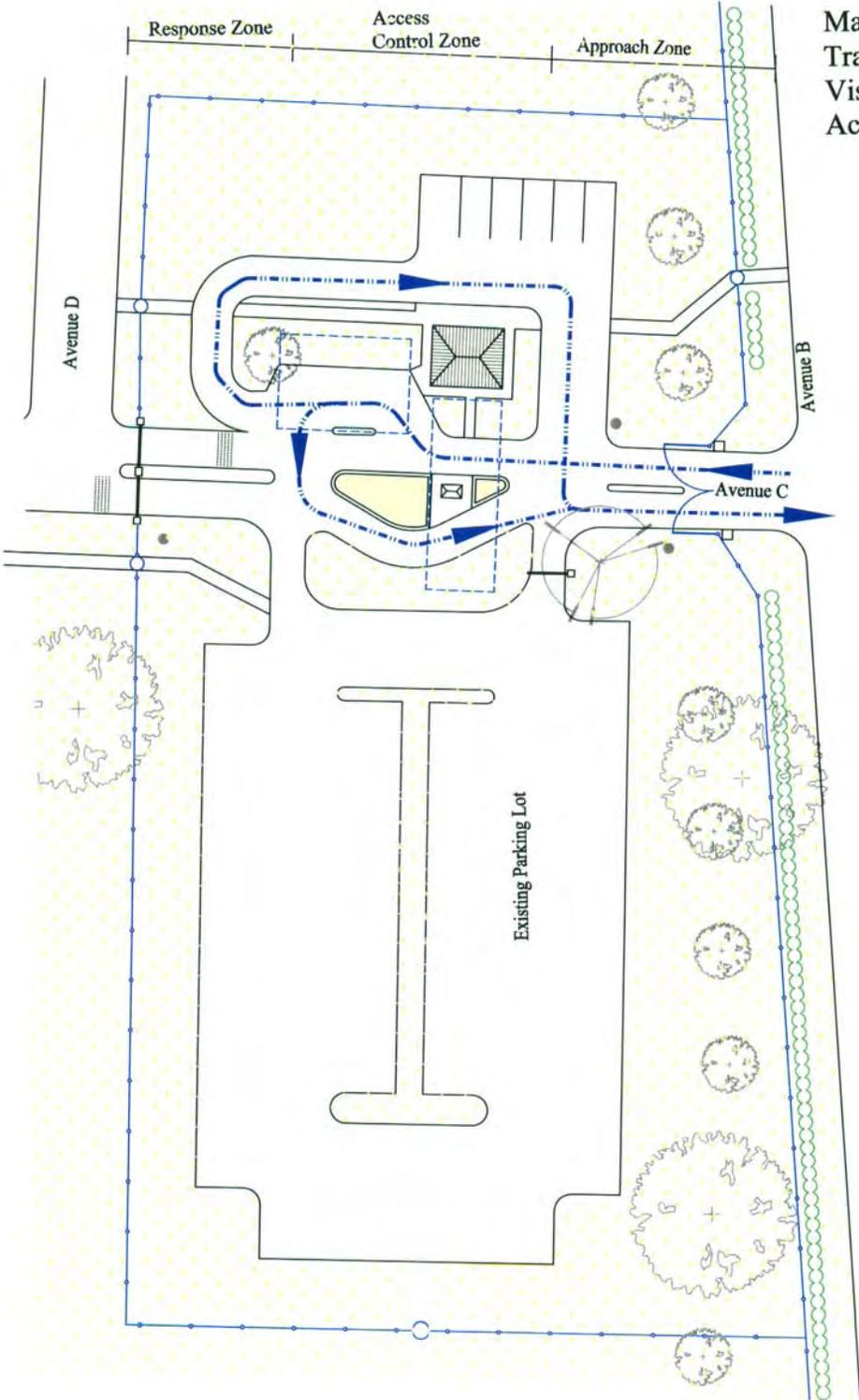
Map 8 - Solution 1  
Traffic Flow -  
Personnel with  
Proper ID



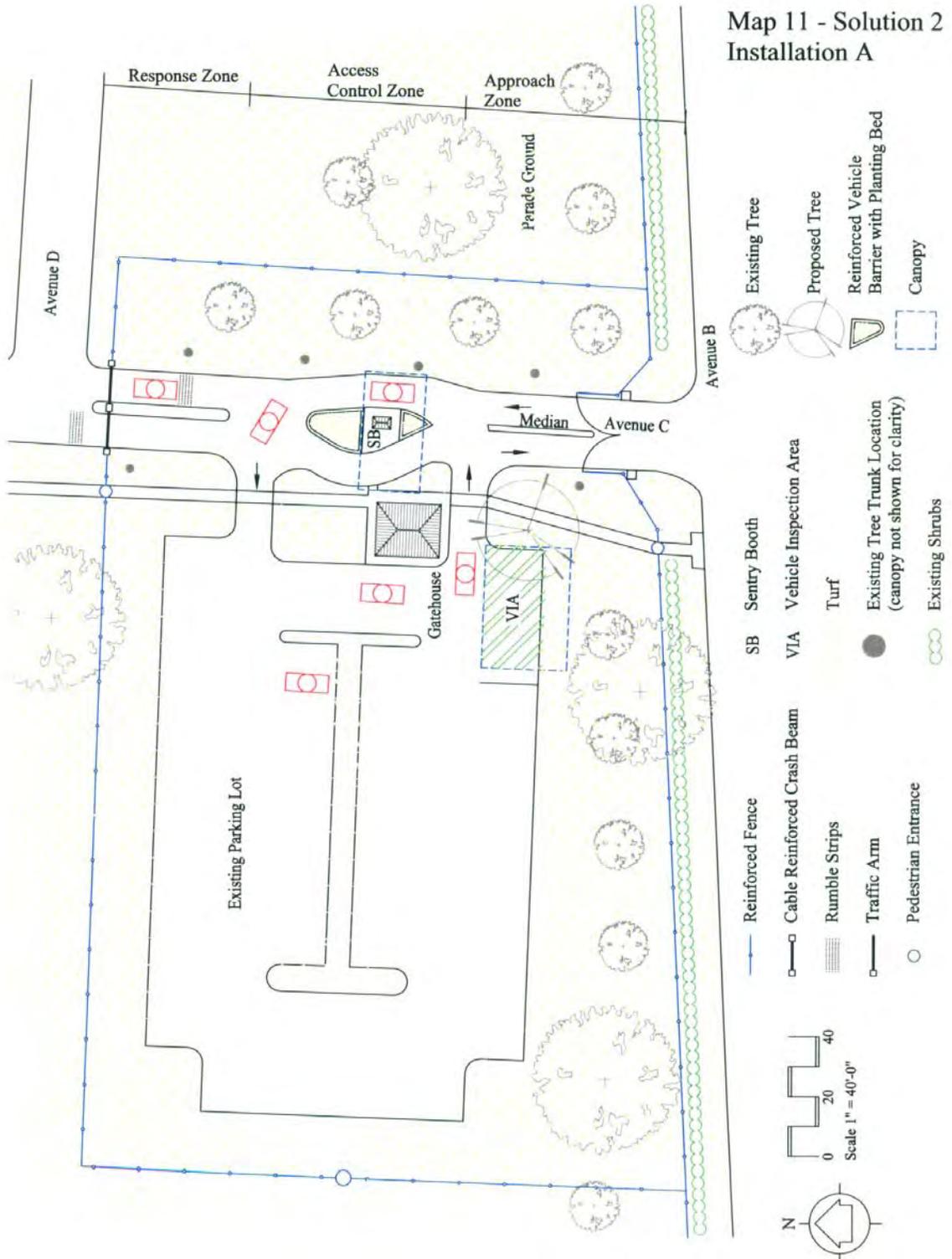
# Map 9 - Solution 1 Traffic Flow - Visitors Granted Access



Map 10 - Solution 1  
Traffic Flow -  
Visitors Denied  
Access



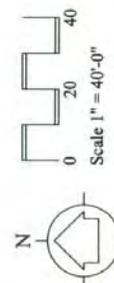
# Map 11 - Solution 2 Installation A



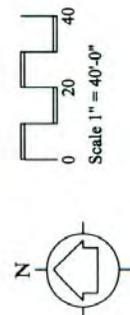
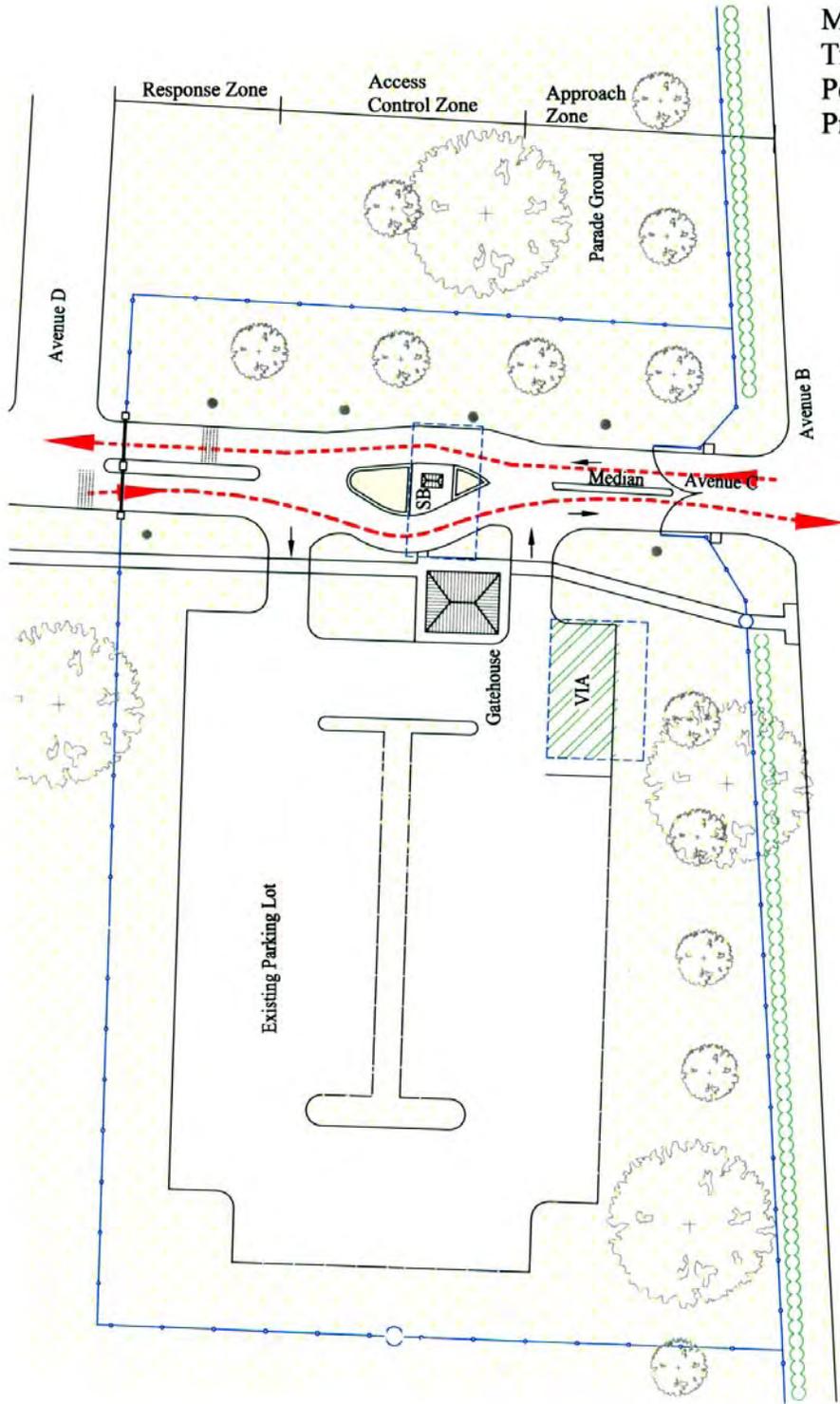
- Existing Tree
- Proposed Tree
- Reinforced Vehicle Barrier with Planting Bed
- Canopy

- SB Sentry Booth
- VIA Vehicle Inspection Area
- Turf
- Existing Tree Trunk Location (canopy not shown for clarity)
- Existing Shrubs

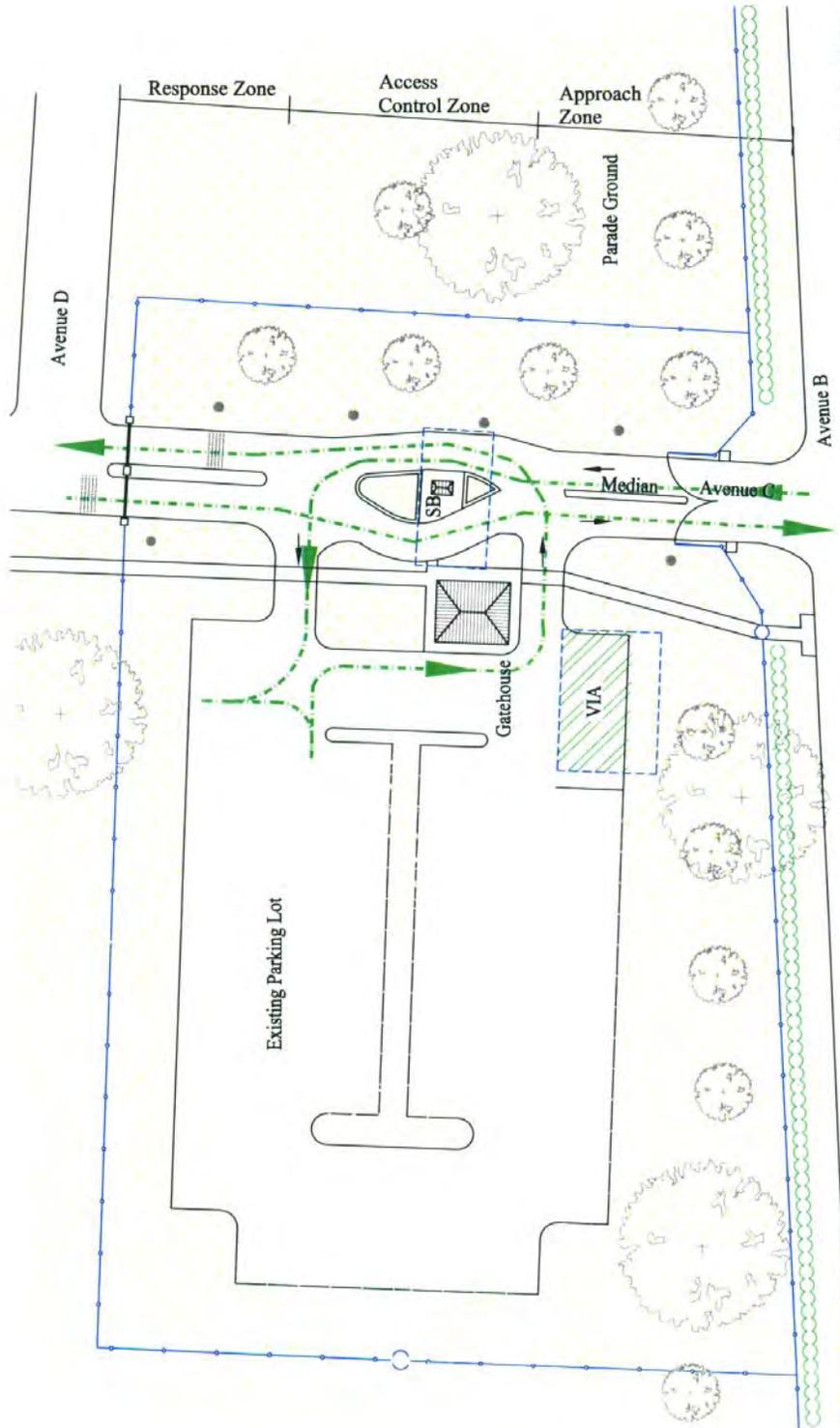
- Reinforced Fence
- Cable Reinforced Crash Beam
- Rumble Strips
- Traffic Arm
- Pedestrian Entrance

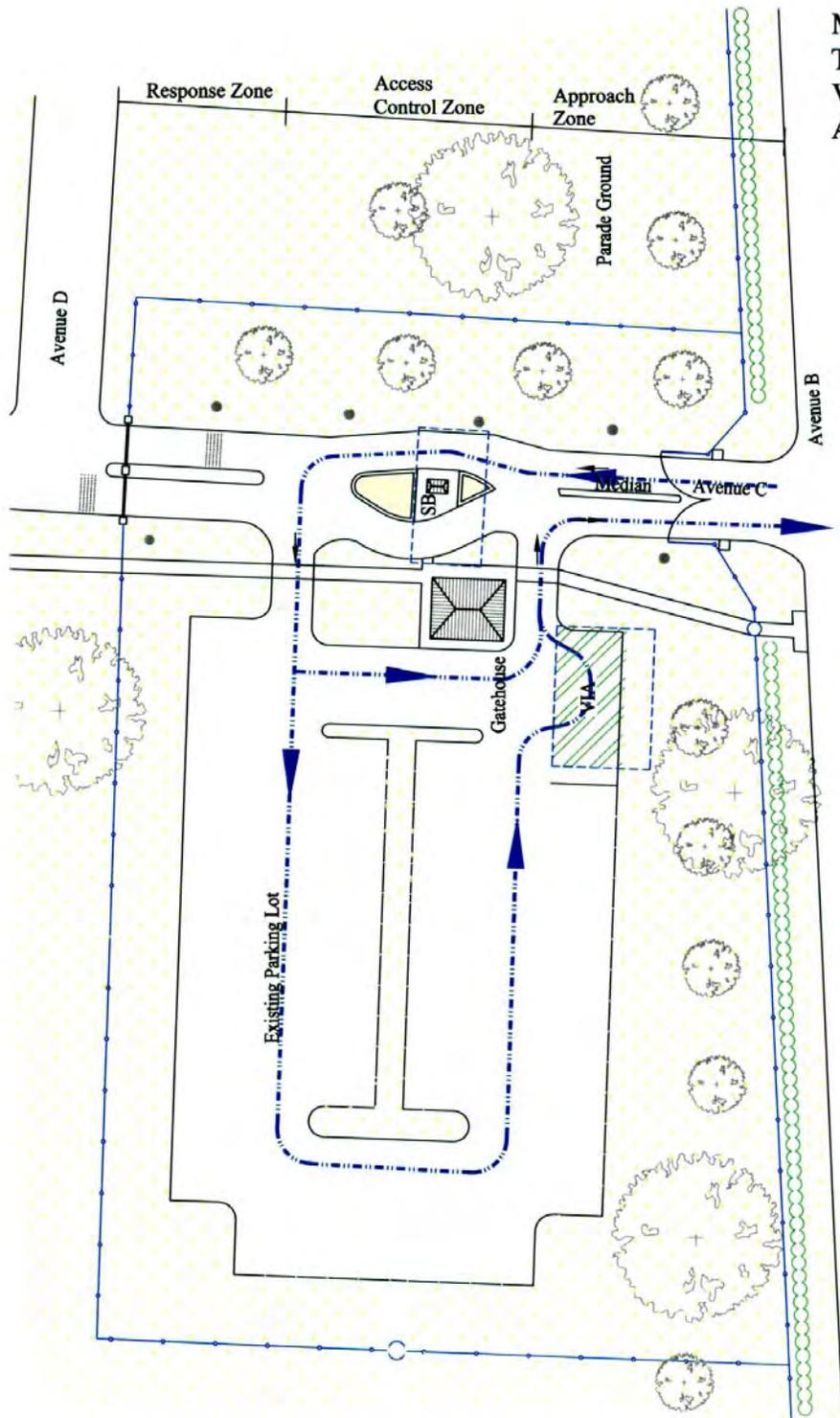


Map 12 - Solution 2  
Traffic Flow -  
Personnel with  
Proper ID

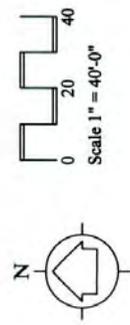


Map 13 - Solution 2  
Traffic Flow -  
Visitors Granted  
Access





Map 14 - Solution 2  
 Traffic Flow -  
 Visitors Denied  
 Access



**SECTION C**  
**INSTALLATION B**



## **INSTALLATION B DESCRIPTION**

Installation B is an army post that is home to two army commands and an army reserve command, and is located within a major United States metropolitan area. The base is located south of downtown, along a major north-south United States Highway, and near a mass transit center (passenger rail) and bus stops. The installation covers approximately 500 acres (See Map 15). A National Register of Historic Places historic district is located in the northeastern corner of the installation.

The eastern edge of the installation is bordered by a major thoroughfare (Highway A) that carries four lanes of traffic with a posted speed limit of 45 mph. On the opposite side of Highway A is a light-rail and other commercial rail lines. A mass transit center is located at the southeastern corner of the installation along Highway A. Local streets and residential areas border the southern, western, and northern edges of the installation. The northern boundary has a collector street (Avenue B) that runs from the western edge of the base to Entrance 1 and then continues on a straight path to intersect with Highway A. Avenue B is lined by a combination of residential areas and strip commercial development.

The installation contains numerous administrative, educational, and service facilities. On-base housing consists of both multi-family and single-family quarters. Multiple athletic facilities, including basketball and tennis courts, ballfields, and a golf course are located in the western section of the installation.

Forty buildings on 33 acres of land are listed in a National Register Historic District. The district was formally listed in 1982 and includes 20 administrative buildings, a former bachelor officer quarters, 19 officer's quarters, and a parade ground.

## **HISTORIC BACKGROUND OF INSTALLATION B**

The history of Installation B dates back to 1867. In its early years, the post was garrisoned by elements of the 18<sup>th</sup> U.S. Infantry Regiments and the 5<sup>th</sup> Artillery. These units were used to enforce Union regulations during the reconstruction period following the Civil War.

In 1881, it was directed that the site be surrendered and the buildings sold at public auction. The American Baptist Missionary Society purchased part of the site for use as a female seminary. In 1885, Congress passed the Sundry Civil Bill for the purchase of land and the erection of a 10-company post. One hundred and forty acres were purchased in September 1885 for this installation.

During the Spanish-American War, this new post served as a general hospital and recruit-training center and later became a POW facility. During World War I, the installation again became an internment camp, this time for German POWs, and served as a base hospital and officers' training camp.

In 1917, it was directed that the permanent barracks be made available for general or base hospital use. The post transformed itself into a general hospital with a capacity of 2,400

beds. In the 1930s, the post hospital was expanded to serve as a rehabilitation center and headquarters of the Civilian Conservation Corps.

With the outbreak of World War II, the post's activities again expanded, to include a reception center to process thousands of men for entry into the service. The post also continued to serve as a major hospital center. After the war, the post was transformed into a separation center for almost 200,000 soldiers. Today, the historic post is home to two army commands and an army reserve command.

### **HISTORIC DISTRICT CONSIDERATIONS**

The current historic district covers 33 acres and 40 facilities. The post currently has an approved plan to expand the district to the south to include various other facilities that were constructed after the initial post opened.

The post is also considering the possibility of expanding the historic district to include additional eligible buildings and open space. The expansion would be designed to include the open spaces to the north of the current district along the property boundary and westward to include the various single-family housing units. The proposed expansion would include within the historic district the entire portion of the original post as established in the nineteenth century.

### **CURRENT ENTRANCE CONDITIONS**

The installation has five vehicle entrances (Entrances 1-5), of which only two are currently active (See Map 15). Entrance 4, located in the far southeastern corner, serves as the main installation entrance and exit, and features a visitor center. Entrance 3, located near the middle of the eastern boundary, is open during peak traffic hours. Entrances 1, 2, and 5 are no longer operational. Entrance 5 serves the western section and golf course of the installation and can be opened on an as-needed basis. Entrance 2, the original historic entrance to the installation, is permanently closed, and a plaza has been constructed over the location of the former entrance road (see Photo 4). Entrance 1, located on the northern border just outside of the historic district, originally served as a secondary entrance to the installation during its formative years and is now closed.

Due to the nature of this project, Entrances 3, 4, and 5 were not considered for study. Entrance 5 is a significant distance from the historic district and traditionally has not accommodated a significant amount of traffic. Entrance 4 currently serves as the main entrance and is also situated a significant distance from the historic district. In addition the installation is moving forward with a new entry design that incorporates the current practices in Antiterrorism/Force Protection. Entrance 3 was initially considered for study, but the entrance is located outside the historic district, and there are no additional plans to expand the historic district in this direction. Entrance 1 and 2 therefore became the two gates considered for this study.

Entrance 2 (see Map 16) was considered the best study option early in the process because it was the historic entrance to the installation. However, during the field visit, the team determined that reopening this entrance was not possible for several reasons, including:

- Close proximity to nearby Buildings 1, 2, and 3, thereby increasing these buildings' exposure to an Explosive Weight 1 blast, which is typically associated with buildings adjacent to a controlled perimeter. Buildings 1 and 2 are actually both inside the perimeter clear zone.
- Highway A is a significant thoroughfare with periodically high traffic that would require the construction of a turning lane in each direction to accommodate vehicles entering and exiting the installation.
- Due to anticipated traffic volume through this entrance, a traffic signaling device would likely be required on Highway A.
- Regular pedestrian traffic would not pass through this entrance since the existing mass transit center is located close to Entrance 4.
- Inadequate vehicle stacking space, potentially spilling traffic onto Highway A.
- Inadequate space available for a vehicle inspection area.



**Photo 3. Historic view of original gate (Entrance 2) as seen from off base.**



**Photo 4. View of Entrance 2 (original gate) showing planting bed in the pedestrian plaza.**

Entrance 1 (see Map 17) was then determined to be the most practical for study for a variety of reasons:

- Location is in what would be in an expanded historic district.
- Adequate standoff distances from nearby buildings.
- Adequate vehicle stacking space.

- Adequate space for a vehicle inspection area.
- Entrance is located along a bus route with an alternative mass transit station at a nearby intersection.
- Residents of historic district housing and their guests, as well as visitors to the historic district, museum, and recreational facilities, could use this entrance.
- Entrance 1 is on the opposite side of the base from the main entrance (Entrance 4) and can therefore help relieve traffic congestion during rush hours.
- Entrance could be used for special public events that take place on the parade ground (which is in the historic district).

### **ENTRANCE 1 CURRENT CONDITIONS**

Entrance 1 is currently closed to all traffic (See Map 18). From the exterior of the base, the entrance has multiple bollards located along both the entry and exit lanes (see Photo 5). A chain-link fence with barbed wire forms the passive barrier at the controlled perimeter. Directly behind the chain-link fence is an additional sight-blocking sheet metal fence. The fences contain small gates that could potentially be opened in case of an emergency.

The entrance currently has a small approach zone and an access control zone, but lacks a response zone. The approach zone consists of a large paved area without channelization lanes. The access control zone consists of a vacant sentry booth. There are neither active barriers nor canopies to facilitate guard and inspection operations.

The access drive to this gate is part of a five-way intersection and is served by a traffic signal. The alignment of the intersection could allow vehicles to ram the gate at high speeds.



**Photo 5. View of Entrance 1 from off-base intersection.**



**Photo 6. View from on post of Entrance 1 from access road, with existing sentry booth.**

## **ENTRANCE 1 CURRENT PRACTICES**

Neither vehicles nor pedestrians are currently allowed to use this entrance. There are no guards stationed at this entrance.

## **EXISTING DISTANCES TO THE CONTROLLED PERIMETER**

The installation considers the exterior fence located along Avenue B as the controlled perimeter; however, entry control facilities are considered to be outside of the controlled perimeter. Until a vehicle has been inspected, it cannot be considered to be within a controlled perimeter. The existing exterior fence therefore would not function as a true controlled perimeter if this gate were reopened. The team has defined the controlled perimeter as the southern edge of the island in which the sentry booth is located. This location is considered to be the innermost point of the installation accessible to a vehicle before the visitor would be inspected or stopped.

UFC 4-010-01 has defined standard standoff distances for various types of facilities. For primary gathering buildings and billeting facilities, the recommended distance from a controlled perimeter is 148', and a distance of 82' is recommended from parking and roadways within a controlled facility.

In reviewing the standoff distances to the controlled perimeter (see Map 17), the team reviewed the uses of each nearby building. Building 4 is a billeting facility and is located approximately 72' away from the island. Building 5 is a storage building that stands about 160' from the island. Because 10 or more people do not regularly occupy Building 5, this facility can be considered uninhabitable and would be exempt from UFC 4-010-01 provisions. Both Buildings 4 and 5 are neither eligible nor contributing structures to the historic district and could easily be removed or modified.

Existing buildings such as Building 4 and Building 5 are not required to maintain recommended standoff distances according to UFC-4-010-01. However, if an Explosive Weight 1 blast were to occur inside this distance, the explosion could cause property damage and casualties. Future renovations of these facilities may be required for compliance with UFC 4-010-01. A reduced standoff distance does not preclude major renovation of a facility, but it would mean additional costs for further analysis and hardening, if necessary.

## **EXISTING TRAFFIC AND TRAFFIC FLOW**

Currently, no traffic accesses Entrance 1 (See Map 18). Avenue C is a significant two-way road that runs from Entrance 1 to Entrance 4. Based on the location of the main facilities, Avenue C is not heavily traveled near Entrance 1, and is primarily used by personnel who are housed in the northeastern quadrant of the installation. If Entrance 1 were to be reopened, traffic would moderately increase on Avenue C at select times.

Avenue D is also a two-way road. This road is not as heavily traveled since a major gathering facility was demolished just south of the parking lot west of Entrance 1. However, this road would also see increased traffic with the opening of Entrance 1.

### **POTENTIAL USERS OF ENTRANCE 1**

Because the entrance is currently closed, the team and installation personnel had to determine what type of traffic would potentially use this newly opened gate. It was determined that the main users of this gate would be decaled personnel, including residents and employees, and visitors. The proximity of this gate to historic and other housing could potentially make it a heavily used entrance for residents. Employees traveling south along Highway A may also find it easier to use this entrance compared to the busier Entrances 3 or 4. Visitors to the museum and the historic district would also find Entrance 1 a convenient gate.

It was noted that the installation also hosts events on the parade ground on a regular basis that are open to the public. By opening this entrance, the installation could funnel all traffic to this entrance and allow all the visitors to park in the existing large lot to the west of the entrance and walk to the parade ground. This would eliminate numerous privately owned vehicles from driving through a major portion of the installation from Entrance 4 during these public ceremonies. Additionally, this added traffic would not disrupt normal operations at Entrance 4.

Based upon discussions with base personnel regarding the installation's decision to construct a new state-of-the-art entrance at Entrance 4, it is recommended that Entrance 4 handle all truck traffic. Entrance 4 has sufficient space and will be adequately staffed to handle this load. Therefore, no truck traffic will be allowed into Entrance 1.

### **ENTRANCE 1 CURRENT DEFICIENCIES**

The current design and security practices contain multiple deficiencies, including:

- No physical vehicle or pedestrian barrier between the sentry booth/guard and installation.
- No barrier to prevent high-speed ramming from off-base streets.
- Lack of channelization islands.
- Visitors are on the installation and past the controlled perimeter before passing security.
- Lack of a vehicle inspection area.
- Lack of adequate lighting of entry.
- Lack of fencing around gate/entry area.
- Lack of pedestrian walkways.

- Lack of active barriers.
- Lack of canopies to facilitate guard and inspection operations.
- Lack of a gatehouse to issue passes or field questions to prevent traffic backups.

### **HISTORIC PRESERVATION CONCERNS**

The existing historic district remains in good condition and offers many positive contributions to the installation. The State Historic Preservation Office stressed many concerns about the proposed actions, mostly limited to the aesthetics of the design rather than the need for such a project. These concerns include:

- Development of a gatehouse and sentry booth that is consistent with the surrounding architecture and respects the character of the historic district with high quality design and appropriate scale.
- Use of canopies with custom bases in neutral colors to blend in with historic buildings.
- Retention of as many existing trees as possible. If retention is not possible, the trees should be replaced with similar species.
- Use of historic lighting fixtures that do not cause light pollution for the neighboring buildings within the historic district.

### **ENTRANCE 1 RECOMMENDATIONS**

During the charette, the field team developed multiple sketches and designs to implement the highest level of security possible within the constraints of the historic district. Based upon the sketches and revisions, the team developed two concepts for Entrance 1. Both concepts incorporate an approach zone, access control zone, and response zone. The concepts also have other similar features:

- Reinforced fence around the entire entry control facility, in order to secure the area.
- Gatehouse where visitors can check in, receive a temporary pass, and ask for directions. The gatehouse will separate visitors from those that regularly enter the installation. The gatehouse will also incorporate a restroom facility for guard use only.
- Sentry booth located between the entry and exit lanes for guards checking personal and vehicular identification.
- Auxiliary sentry booth or guard/fighting position for security personnel to facilitate response to a threat. The auxiliary sentry booth will not be manned at all times, but will provide a secondary source of security during elevated threat levels.

- Active barriers in the response zone that can be activated by either the guard at the sentry booth or the one in the gatehouse.
- A curved exit lane that will inhibit individuals from entering the installation at high speed through the exit lane.
- Separate single-lane entrance and exit lanes.
- Sidewalks for base personnel to enter the installation using turnstiles and electronic key cards.
- Crash-rated (DOS rating of K12/L3) sliding gates with motorized operation (see Figure 7 in Appendix 1).
- Tire shredders located at select positions to prevent vehicles from bypassing the sentry booth.

## **LIGHTING RECOMMENDATIONS**

Two systems are recommended to provide ambient lighting throughout the entry control facility. Lighting systems include a pulse-start metal halide primary lighting source and an incandescent secondary backup (emergency) lighting source. The lighting for the approach and response zones will provide a street surface ambient 50 foot candles (ftc) with a backup capability of 40 ftc. The access control zone will have a concentrated 100 ftc with a secondary source of 80 ftc.

Pulse-start metal halide lamps produce 110 lumens per watt (LPW) and a color rendering index (CRI) of 80. The pulse type lamp produces approximately 40 percent more LPW than a standard metal halide lamp, warms to full brightness more rapidly, and has a quicker restrike time. Although pulse-start costs more than conventional metal halide lamps, the facility will benefit from lower installation, operating, and maintenance costs.

During power interruptions, the incandescent lighting source will provide immediate illumination until the primary lighting is restored to full operation. During a power surge or outage, for example, metal halides require 10 to 15 minutes to cool, plus an additional 2 to 5 minutes to heat up. By comparison, an incandescent system relights immediately.

Both lighting systems should provide elements of uplight to help create a more uniform environment. Glass luminaries should provide 15 to 20 percent uplight, which illuminates the ceiling and eliminates the cavern effect that can occur when a ceiling is dark. With a white or light-colored canopy ceiling surface, uplight bounces off the ceiling to create a more uniform illuminated environment and reduces glare.

Within the access control zone, fixtures will be placed in a symmetrical pattern attached to the canopies, and supplemental luminaries will also be installed there. Within the approach zone and response zone, these lights should be mounted on streetlight poles.

## **CLEAR ZONES**

Clear zones are defined as areas around the controlled perimeter where no obstructions exist. The clear zone allows guards to adequately scan and observe the perimeter fence and encompasses a 30' internal buffer and 20' external buffer. Existing trees may prevent a base from attaining these clear zones; however, man-made incursions into the clear zone, such as planting vegetation or locating parking areas, should not occur. When existing trees are located within the clear zone, their lower branches can be appropriately trimmed and pruned to limit a person's ability to breach a fence by using the tree. Additionally, alternative measures can be used to offset incursions into the clear zone.

Clear zones at Entrance 1 may not be attainable, especially in Solution 1. The difficulty arises in the width of the existing green space in which the new entry control facility will be located. The width of the existing space (between Avenues B and D) is approximately 170' at the eastern edge and tapers to 150' at the western edge. Incorporating the respective clear zones results in a buildable area of only 70' at the eastern edge and 50' at the western edge. This would not be adequate to accommodate the required functions.

One possible solution would be the relocation of Avenue D further south. This would require extensive redevelopment of the large open space south of Avenue D. It would also most likely be cost-prohibitive to move a road of this size simply to obtain clear spaces when compensatory measures would be more cost-effective. Another option would be to remove Avenue D and use the additional 25' to establish clear zones. This could also involve significant expense, in addition to having to clear this road closure through traffic planners at the installation.

Another issue is the extensive existing vegetation along the public south side of Avenue B. For the most part, this vegetation consists of overgrown grasses and some large shrubs. These shrubs should be removed, and the grass should be maintained through mowing. The removal of this vegetation, none of which is considered a contributing historic feature, will assist in establishing some segment of the clear zone.

If a clear zone cannot be achieved, there are a variety of compensatory measures that can be applied. These measures include higher fences, CCTV monitoring, increased guard patrols, additional lighting, top guards on the fences, and larger internal clear zones. Should a threat arise, additional security personnel could be positioned in nearby buildings. In this instance, it is recommended that the fence height be increased to 10' in order to provide the additional security without compromising overall design concepts.

## **SOLUTION 1 – LONG APPROACH ZONE**

Solution 1 uses the large expanse of green space just west of the current entrance (see Map 19). Due to the moderate increase in traffic flow, only separate single entrance and exit lanes are required. Crash-rated sliding gates will be installed at the entrance and exit of the installation. The gates would remain open during normal hours of operation but could be closed during high threat levels or if the entrance was closed. The gates at this location must

be crash-rated because a threat vehicle could gain significant speed along Avenue E in an attempt to effect a high-speed entrance.

The long approach zone will include signs directing visitors into a parking lot to the right (north) while directing properly identified vehicles to continue straight ahead towards the sentry booth. Signs should also be posted outside of the gate, directing all truck traffic to Entrance 4.

The access control zone includes a gatehouse, sentry booth, and a vehicle inspection area. The booth is directly south of the gatehouse and located in a central island that incorporates vehicle-resistant barricades to prevent oncoming traffic from ramming the booth. The booth protects the guards from the elements and provides housing for computer, communication, and gate/barrier control equipment. An overhead canopy will be provided over the sentry booth to improve lighting and protect the guards and drivers from inclement weather during identification screening. The canopy extends over both the entry and exit lanes, and should be designed to incorporate materials/features of the historic district without being a direct imitation (see Figure 1 in Appendix 1). The canopy will also house lights (see lighting discussion, page C-8) to illuminate these areas without causing significant light pollution to other areas.

The small gatehouse is located north of the entry drive, and will serve as a catchall for visitors (see Figure 4 in Appendix 1). It is anticipated that a guard will staff the gatehouse, and will issue passes and provide directions to visitors entering the installation. A small parking lot serving the gatehouse is located directly to the east of the gatehouse.

A designated vehicle inspection area is located just west of the sentry booth. This area is located off the main entrance drive and is large enough to allow guards room to inspect a vehicle. An overhead canopy will also be provided at this location (see Figure 1 in Appendix 1).

The response zone includes an auxiliary sentry booth and a rising-bollard type active barrier (see Figure 5 in Appendix 1). This response zone allows guards to activate the active barrier should an unauthorized entrance to the installation be attempted. It is anticipated that the rising bollards can remain in an open position during regular threat conditions. This is due to a variety of factors:

- The average guard response time (the time it takes a guard to activate a barrier) is typically 4 seconds, with an additional 1 second to activate the barrier. It therefore takes a total of 5 seconds to activate the barrier.
- In 5 seconds, the standard car threat can travel 141' from a dead stop. At an initial velocity of 5 mph, the threat can travel 178'.
- The paved distance from the barriers to the sentry booth is approximately 160'.

- The road makes a 90° turn approximately 120' from the sentry booth. This turn will preclude a threat vehicle from gaining sufficient speed to make the turn and pass through the opening.

The response zone also includes a sliding gate that would cover both lanes of traffic. This gate is located to the south of the rising bollards. Because the bollards are providing the necessary crash-rated protection, the gates would remain open during normal hours of operation but could be closed during high threat levels or if the entrance was closed.

This scenario also includes an auxiliary entrance and exit lane that uses the existing access road. Blocked to normal traffic by manually removable bollards, these lanes could be opened during special events or when dignitaries are entering/exiting the installation. The opening of these auxiliary lanes would require additional guards to man the entrance due to a lack of response zone, gatehouse, or active barriers. The exit lane could also be used if base personnel are required to exit the installation quickly during an emergency. The guards would use the existing sentry booth during this situation. Additionally, crash-rated gates are provided along the auxiliary lanes. These gates should remain closed during normal operations of the entry control facility, but can be opened during special events. If the auxiliary lanes were being used, the gates could be closed to keep out unauthorized traffic, while the bollards were removed. These gates need to be crash-rated, to ensure protection against a high-speed entry attempt.

This solution requires the relocation of an existing tornado siren. It also requires the removal of one tree in the middle of the green space. Some minor trees along the existing perimeter fence will also need to be removed in order to install the new perimeter fence. The new fence replaces the existing sight-blocking sheet metal fence with a low brick wall, which acts as a vehicle deterrent, topped with a steel fence compatible with historic fence configurations. A steel fence completely surrounds the access area with sliding gates at roads and separate entries for pedestrians. The fences should reach a height of 10'.

### **Vehicular Access Scenarios**

Because all truck traffic will be directed to Entrance 4, Entrance 1 will be primarily used by:

- Base personnel with proper personal and vehicle identification who are housed on the north side of the base.
- Visitors, including those touring the museum and historic district or those attending special events.
- Dignitaries.

Those with proper personal and vehicle identification have direct access to the installation (see Map 20). These individuals arrive at the sentry booth, the guards check their identification, and they are allowed to proceed onto the installation. Dignitaries have the option of using the auxiliary entrance road. This arrangement requires additional guards to facilitate the transition from the normal entrance to the auxiliary entrance configuration,

higher-volume traffic control, and personnel and vehicle inspections. If the installation is under higher levels of force protection conditions when the auxiliary entrance is open, additional temporary barriers may also need to be installed to create an appropriate response zone.

Visitors may experience three scenarios. The first involves visitors entering the approach zone, observing the directional sign, entering the gatehouse parking lot, and proceeding to the gatehouse (see Map 21). At the gatehouse, visitors can obtain temporary passes and directions to their destination. These visitors then return to the entry line, proceed to the sentry booth, and enter the installation.

The second scenario involves visitors that miss the directional sign and approach the sentry booth without a proper pass (see Map 21). These visitors are directed to the turnaround located just west of the vehicle inspection area, where they make a right turn and enter the gatehouse parking lot. Here, they proceed to the gatehouse, obtain the necessary paperwork, return to the entry line, proceed to the sentry booth, and enter the installation.

The third visitor scenario involves visitors denied entry to the installation even after stopping at the gatehouse (See Map 22). Visitors who proceed past the sentry booth have the option of turning into the gatehouse parking lot to obtain a pass, or turning left into a U-turn to proceed out of the installation through the exit lane. Those leaving the base from the gatehouse turn left out of the parking lot and leave the base through the exit lane.

In any of these scenarios a vehicle inspection may be necessary. Vehicles and passengers pull off to the side of the entry lane into the designated inspection area. If the vehicle is allowed to continue, the driver pulls forward and proceeds onto the installation. If the vehicle is denied entry, the driver turns right into the gatehouse access road, drives through the gatehouse parking lot, makes a left, and proceeds out the exit lane.

### **Pedestrian Access Scenarios**

Individuals arriving at the installation by public transportation enter the control facility through a walkway and gate just west of Avenue C. Individuals would be required to stop at the gatehouse and check in, then proceed to the south and pass through another gate onto the installation. This gate would be locked at all times, and the guard in the gatehouse who checks credentials would “open” the gate.

### **SOLUTION 2 – SHORT APPROACH ZONE**

This solution, illustrated on Map 23, also calls for separate entry and exit lanes. The relatively short approach zone includes a single lane of traffic entering the installation. Signage would need to be located just outside the gates to direct visitors into the parking lot to the right (west) while directing properly identified vehicles to continue straight ahead. Additional signage would need to alert trucker drivers that all deliveries are now being handled through Entrance 3.

The access control zone includes a sentry booth, a gatehouse, and a designated vehicle inspection area. The booth is located directly east of the gatehouse. Overhead canopies at the sentry booth and designated vehicle inspection area improve lighting (see lighting discussion, page C-8), provide directional signage for incoming vehicles, and protect guards and drivers from inclement weather.

The small gatehouse and associated visitor parking lot, located west of the entry drive, serves as a catchall for visitors. It is anticipated that a guard will staff the gatehouse, and issue passes and provide directions to visitors entering the installation.

The response zone includes a rumble strip and retractable bollards (see Figure 5 in Appendix 1) in each lane. Due to the short length of the response zone, it is anticipated that available response times to address a threat and subsequently activate a normally “open” barrier will be inadequate. The active barriers will therefore need to remain in the “closed” position, and it will be necessary to open the barrier for each entering vehicle. This arrangement is necessary because of a variety of factors, including:

- The bollards are located approximately 125' from the sentry booth.
- The average guard response time (the time it takes a guard to activate a barrier) is typically 4 seconds, with an additional 1 second to activate the barrier. It therefore takes a total of 5 seconds to activate the barrier.
- In 5 seconds, the standard car threat can travel 141' from a dead stop. At an initial velocity of 5mph, the threat can travel 178'.
- Threat vehicles would be able to gain speed along Avenue E and race towards and through the entry control facility before the guards would be able to activate the barriers.

Due to this last factor, it is desirable to provide a K12/L3 crash-rated barrier (15,000-lb vehicle at 50 mph with a penetration of 3 feet or less) in this type of entry control facility. The fastest cycle times associated with these types of barriers are approximately 20 seconds per vehicle with a retracting bollard (see Figure 5 in Appendix 1). While this solution will provide an inconvenience to normal users, it is necessary to provide this type of security due to the site constraints.

Some minor trees along the existing perimeter fence will need to be removed in order to install the new perimeter fence. The new fence replaces the existing sight-blocking sheet metal fence with a low brick wall, which acts as a vehicle deterrent, topped with a steel fence compatible with historic fence configurations. A steel fence completely surrounds the access area with sliding gates at roads and separate entries for pedestrians.

## **Vehicular Access Scenarios**

As with the previous solution, traffic entering the installation is most likely to consist of:

- Base personnel with proper personal and vehicle identification who are housed on the north side of the base.
- Visitors, including those touring the museum and historic district, or those attending special events.
- Dignitaries.

Individuals and dignitaries with proper personal and vehicle identification have direct access to the installation (See Map 24). These individuals arrive at the sentry booth, the guards check their identification, and they are allowed to proceed onto the installation.

Visitors may experience three scenarios. The first involves visitors entering the approach zone, observing the directional signs, entering and parking in the gatehouse parking lot, and proceeding to the gatehouse (See Map 25). At the gatehouse, visitors can obtain temporary passes and directions to their destination. These visitors then return to the entry lane, proceed to the sentry booth, and enter the installation.

The second scenario involves visitors who enter the approach zone, miss the directional signs, and proceed to the sentry booth (See Map 25). These visitors are then directed to the gatehouse, where they can obtain temporary passes and directions to their destination. These visitors then return to the entry lane, proceed to the sentry booth, and enter the installation.

The third scenario involves the visitor who is denied entry onto the installation even after stopping at the gatehouse (See Map 26). These visitors exit the gatehouse parking lot, turn left, and proceed out of the installation through the exit lane.

In any of these scenarios a vehicle inspection may be necessary. Vehicles and passengers enter the gatehouse parking lot and proceed to the designated vehicle inspection area in the southern section of the lot. Vehicles that pass inspection may obtain passes from the gatehouse, return to the entry lane, and proceed past the sentry booth. Vehicles denied entry proceed through the parking lot, make a left turn, and proceed out the exit lane.

## **Pedestrian Access Scenarios**

Individuals arriving at the installation by public transportation would enter the control facility through a walkway and gate just west of Avenue C. Individuals would be required to stop at the gatehouse and check in, then proceed to the south and pass through another gate onto the installation. The second gate would be locked at all times, and the guard in the gatehouse checking credentials would “open” the gate.

## **INSTALLATION B COST ESTIMATES**

### **Solution 1 Costs**

The estimated cost to construct Solution 1 is \$1,432,000 (see Appendix 2 for detailed Cost Estimates). The estimate includes all associated costs with the development of this concept. The costliest items include the three canopies and sentry booth (\$115,710), bollards, fencing, and gates (\$292,600), and other site work including excavation, sewers, roadways, and sidewalks (\$417,000). The addition of a significant amount of roadways substantially added costs to this solution.

### **Solution 2 Costs**

The estimated cost to construct Solution 2 is approximately \$1,200,000 (see Appendix 2 for detailed Cost Estimates). This solution is less expensive than Solution 1 and this is mainly due the amount of sitework that must be completed in Solution 1. Solution 2 would not involve the construction of nearly as much new pavement, and would use the existing roadways. The costliest items include two canopies and a sentry booth (\$86,900), bollards, fencing, and gates (\$204,200), and other site work including excavation, sewers, roadways, and sidewalks (\$142,000).

## **SUMMARY COMPARISON OF THE TWO SOLUTIONS**

### Advantages to Solution 1:

- Provides a high level of security.
- Provides good traffic flow.
- Provides a large stacking space for vehicles entering the installation.
- Limits opportunities for high-speed unauthorized entries.
- Vehicle inspection area is centrally located.
- Visitors do not have to go through sentry booth before going to gatehouse.
- A large response zone that allows rising barriers to be in the “open” position.

### Disadvantages to Solution 1:

- Removes a significant amount of green space.
- More costly than Solution 2.
- Inconvenient traffic flow.

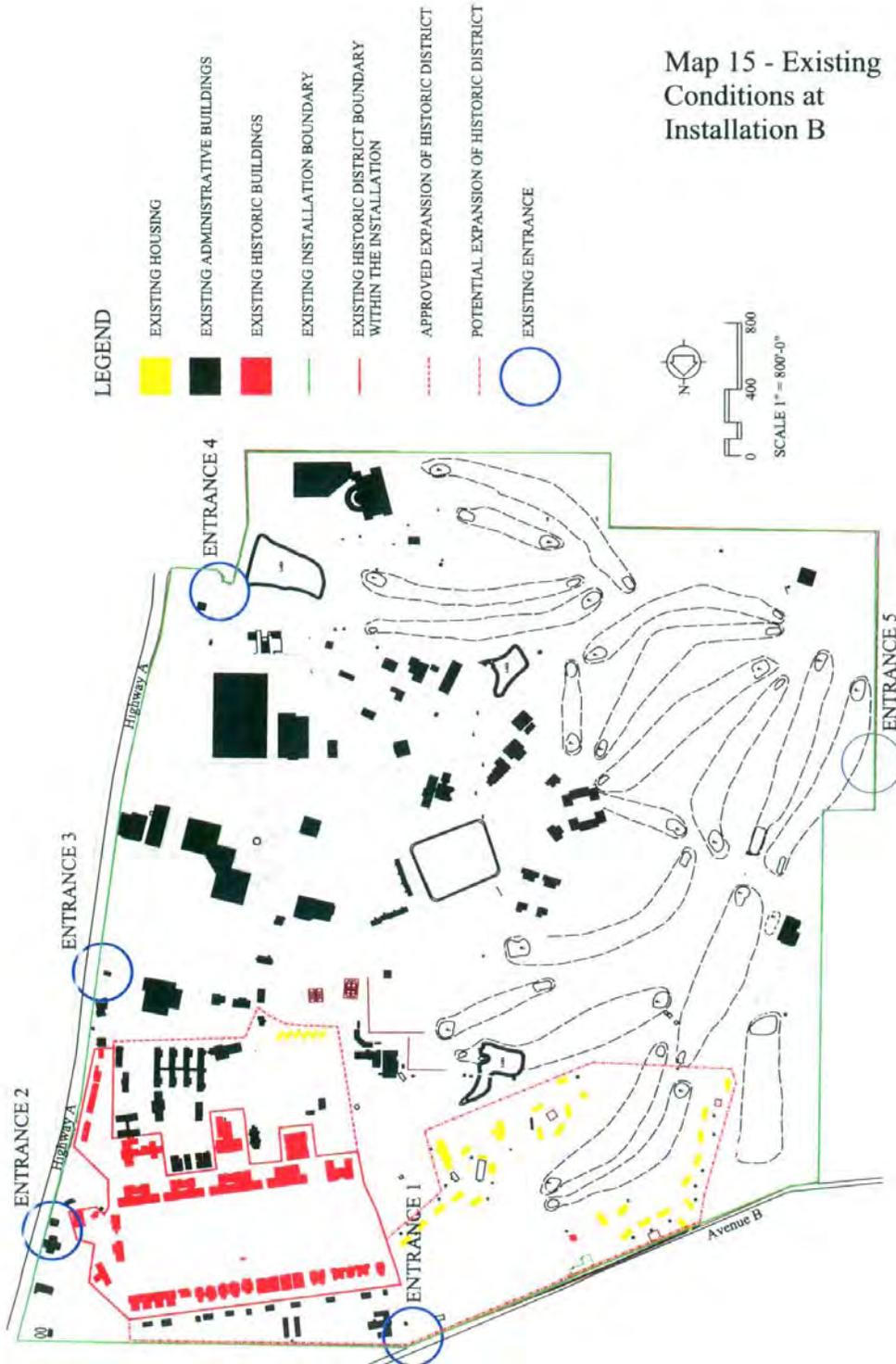
Advantages to Solution 2:

- Provides a high level of security.
- Uses existing roadways.
- Limited removal of green space.
- Less costly than Solution 1.
- Retains all existing trees within the green space.

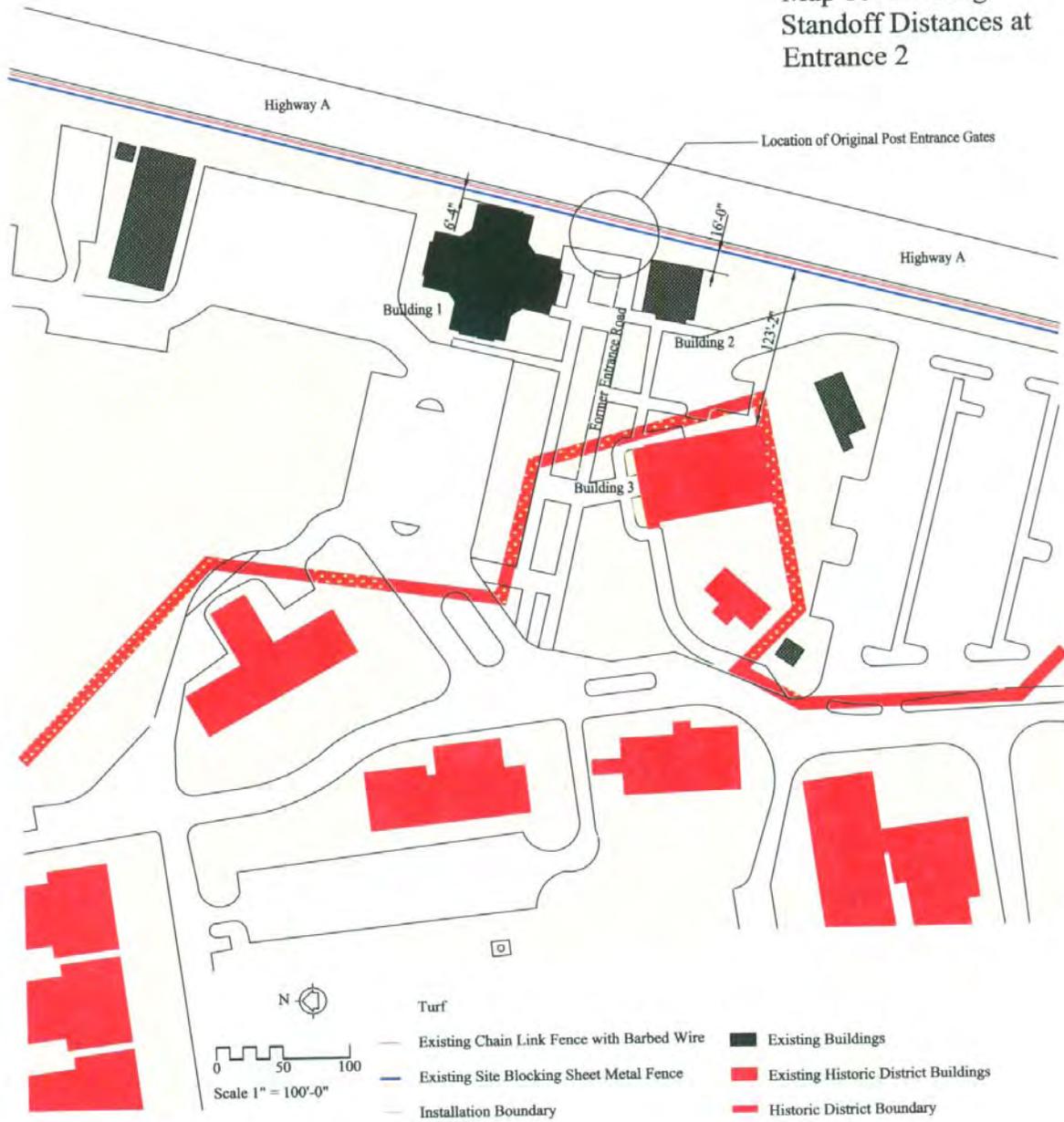
Disadvantages to Solution 2:

- Vehicle inspection area not centrally located.
- Response zone is smaller.
- Retractable bollards must be in the closed position, requiring them to be opened for each vehicle entering the installation. This could cause traffic backups.
- Less stacking space than Solution 1.

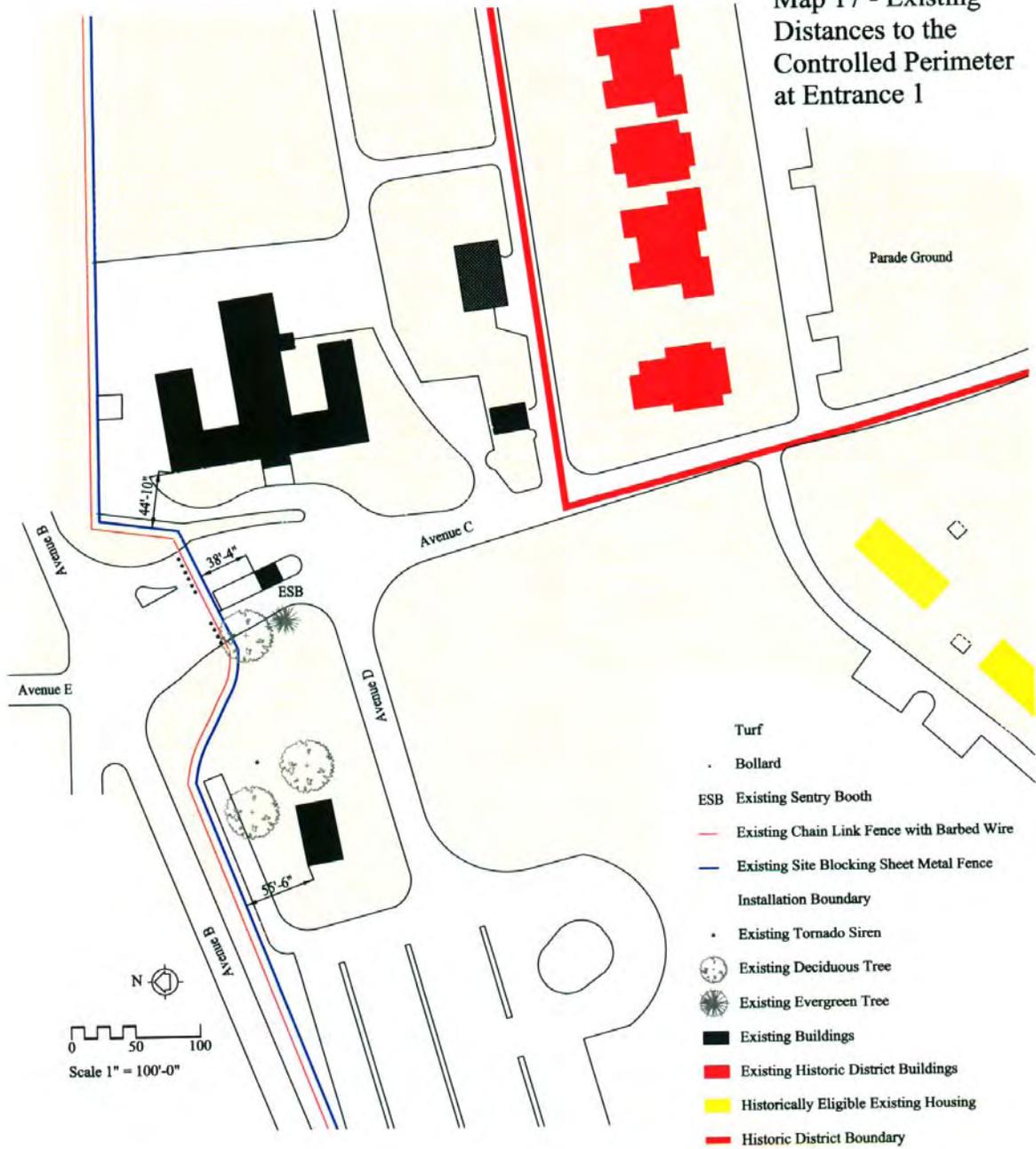
Map 15 - Existing Conditions at Installation B



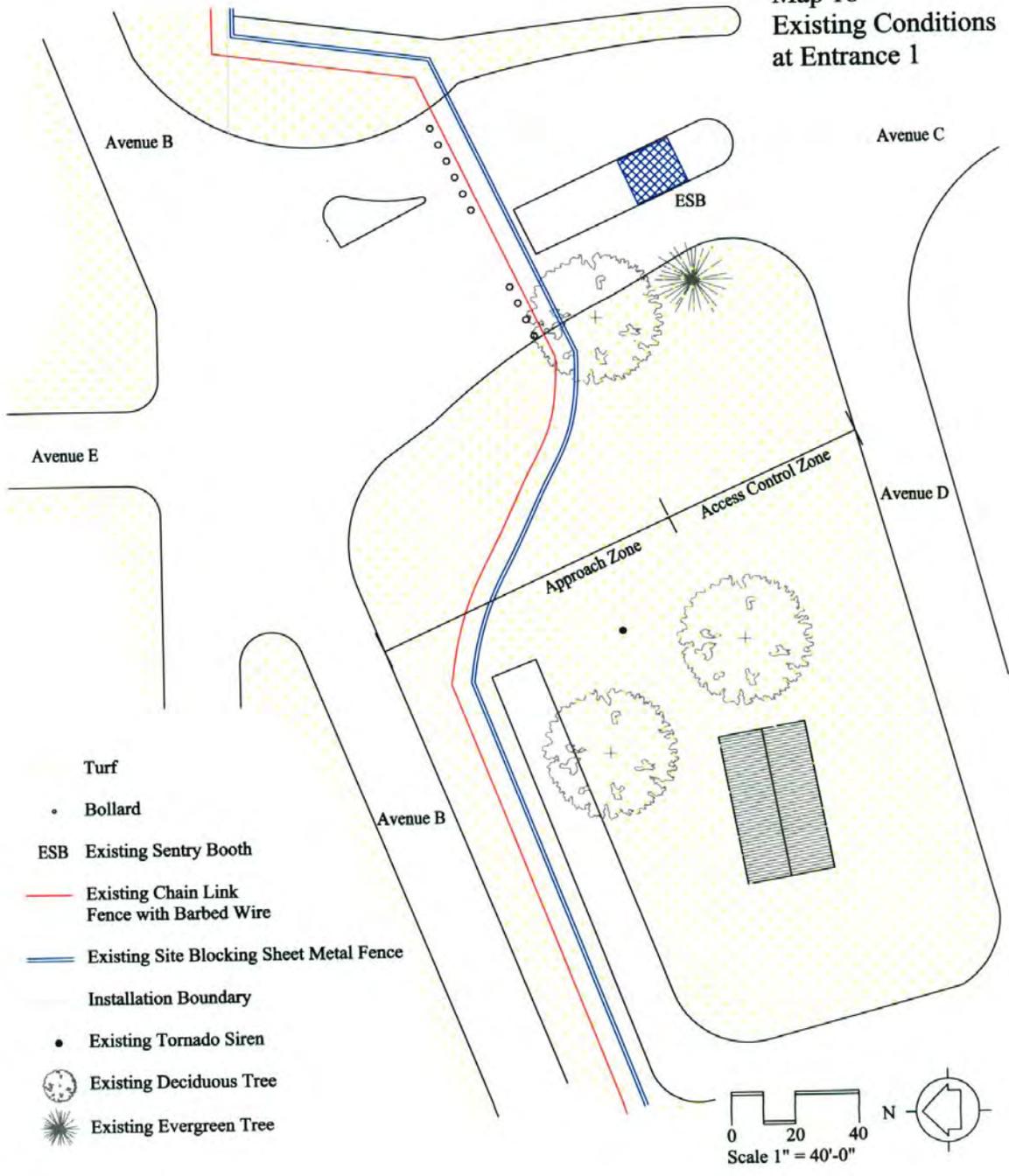
# Map 16 -Existing Standoff Distances at Entrance 2



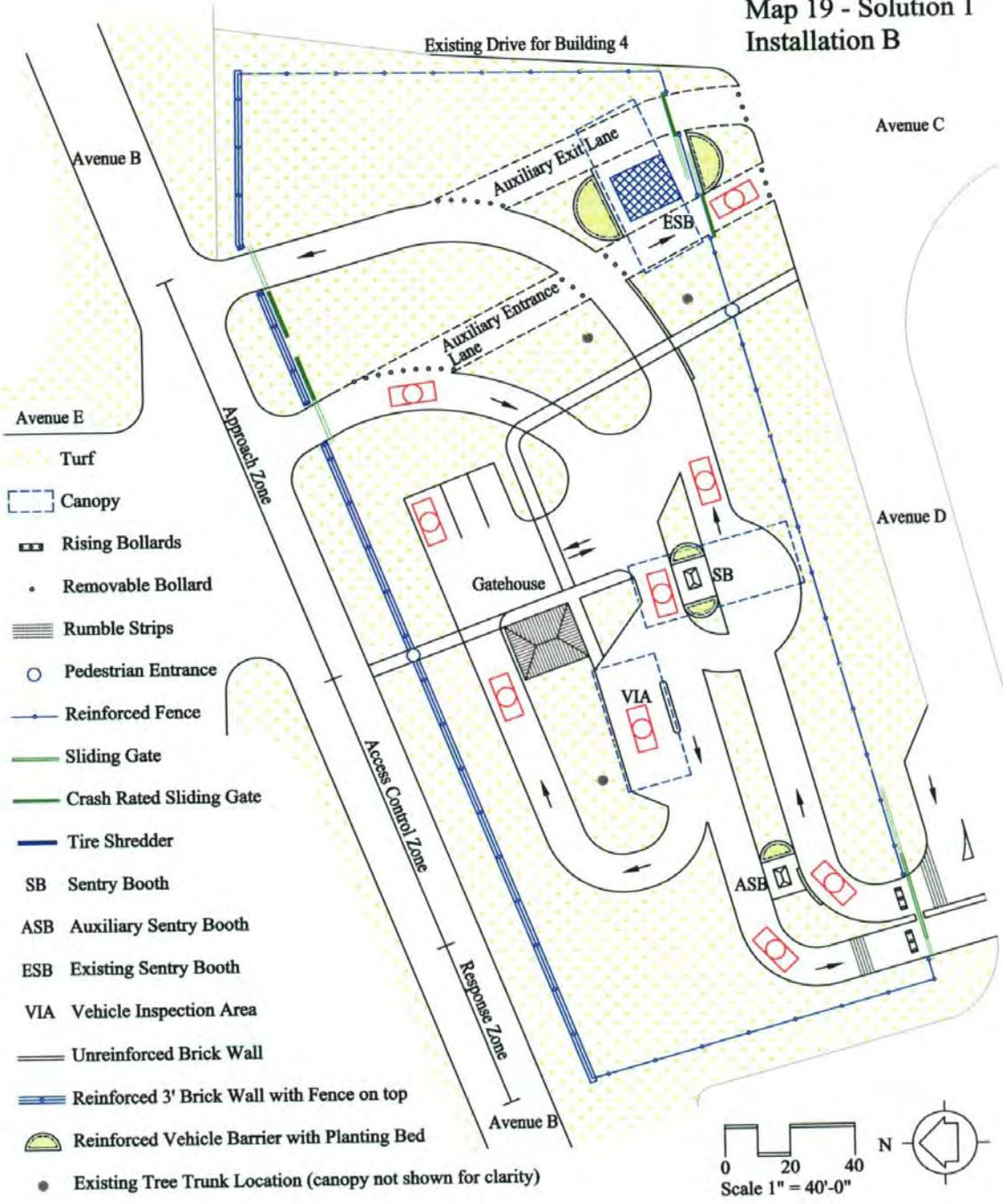
Map 17 - Existing Distances to the Controlled Perimeter at Entrance 1



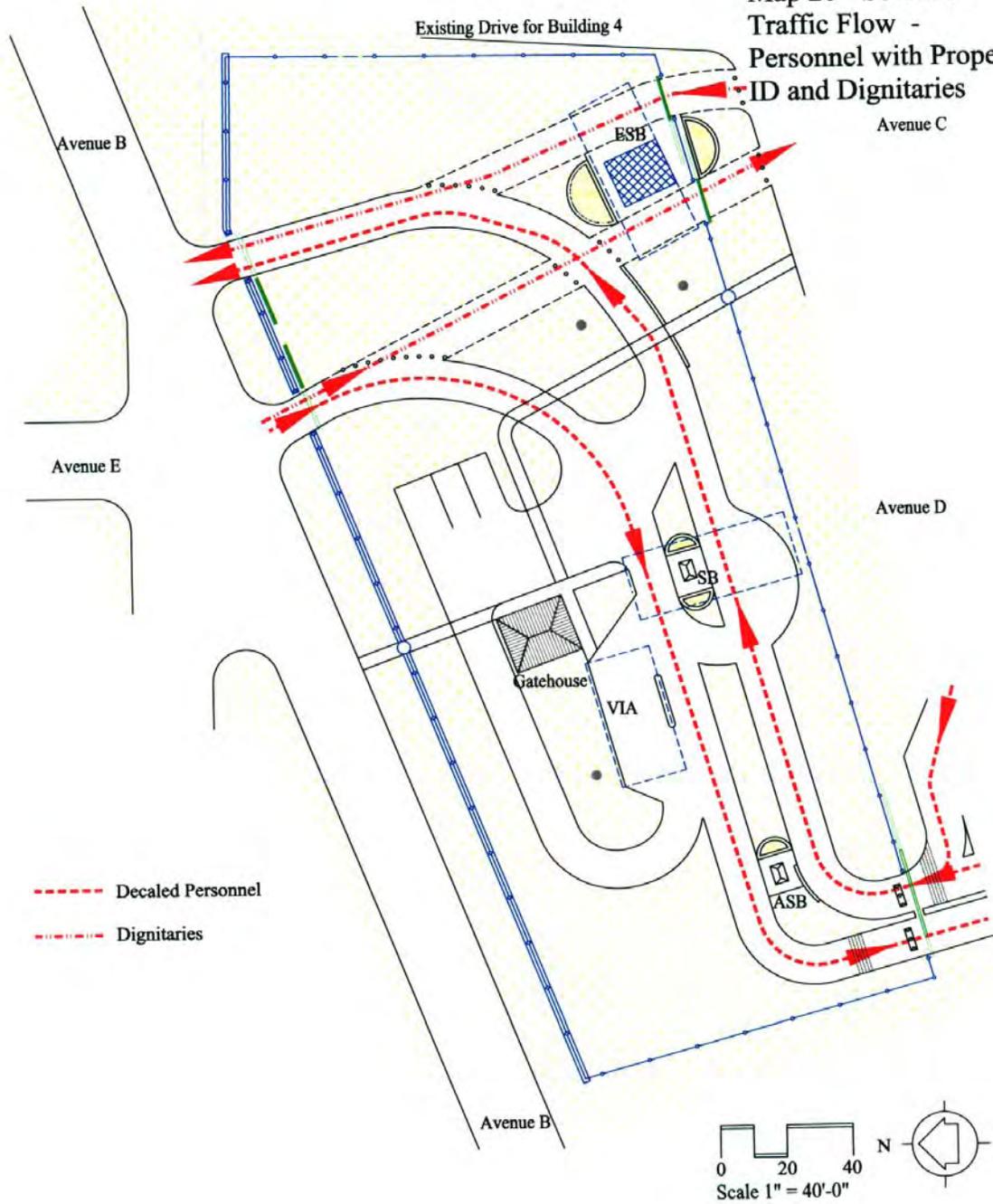
**Map 18 -  
Existing Conditions  
at Entrance 1**



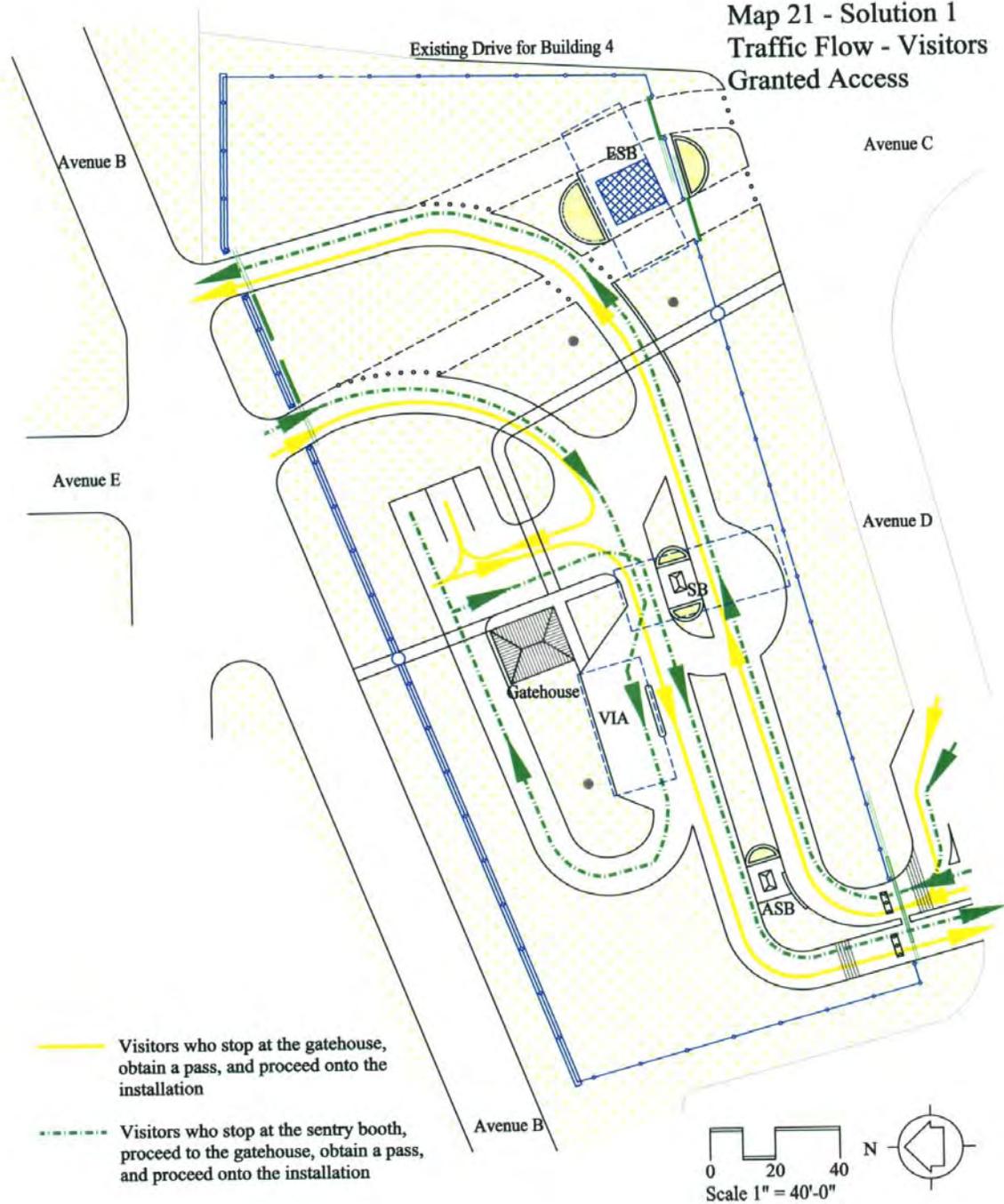
# Map 19 - Solution 1 Installation B



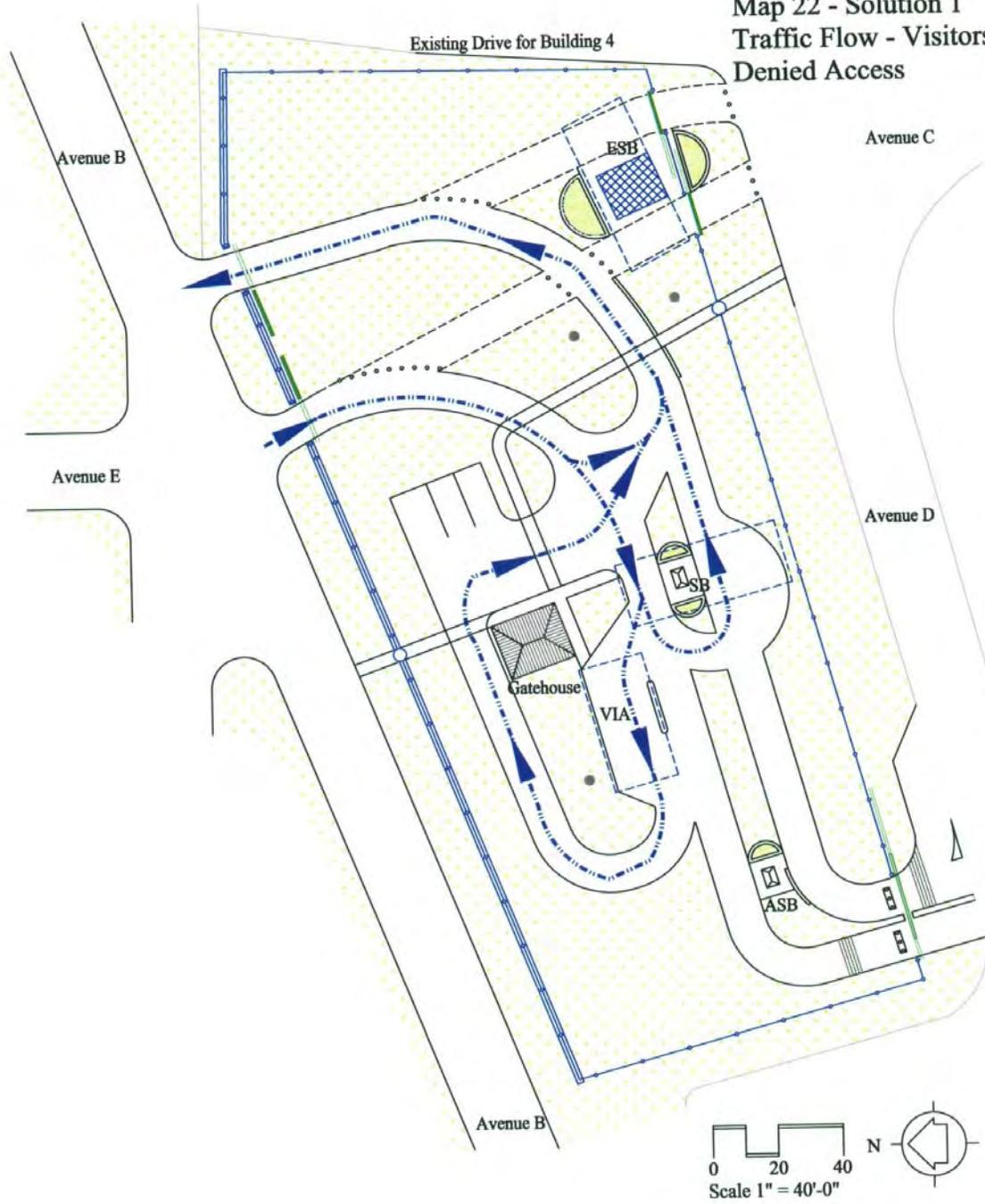
Map 20 - Solution 1  
Traffic Flow -  
Personnel with Proper  
ID and Dignitaries



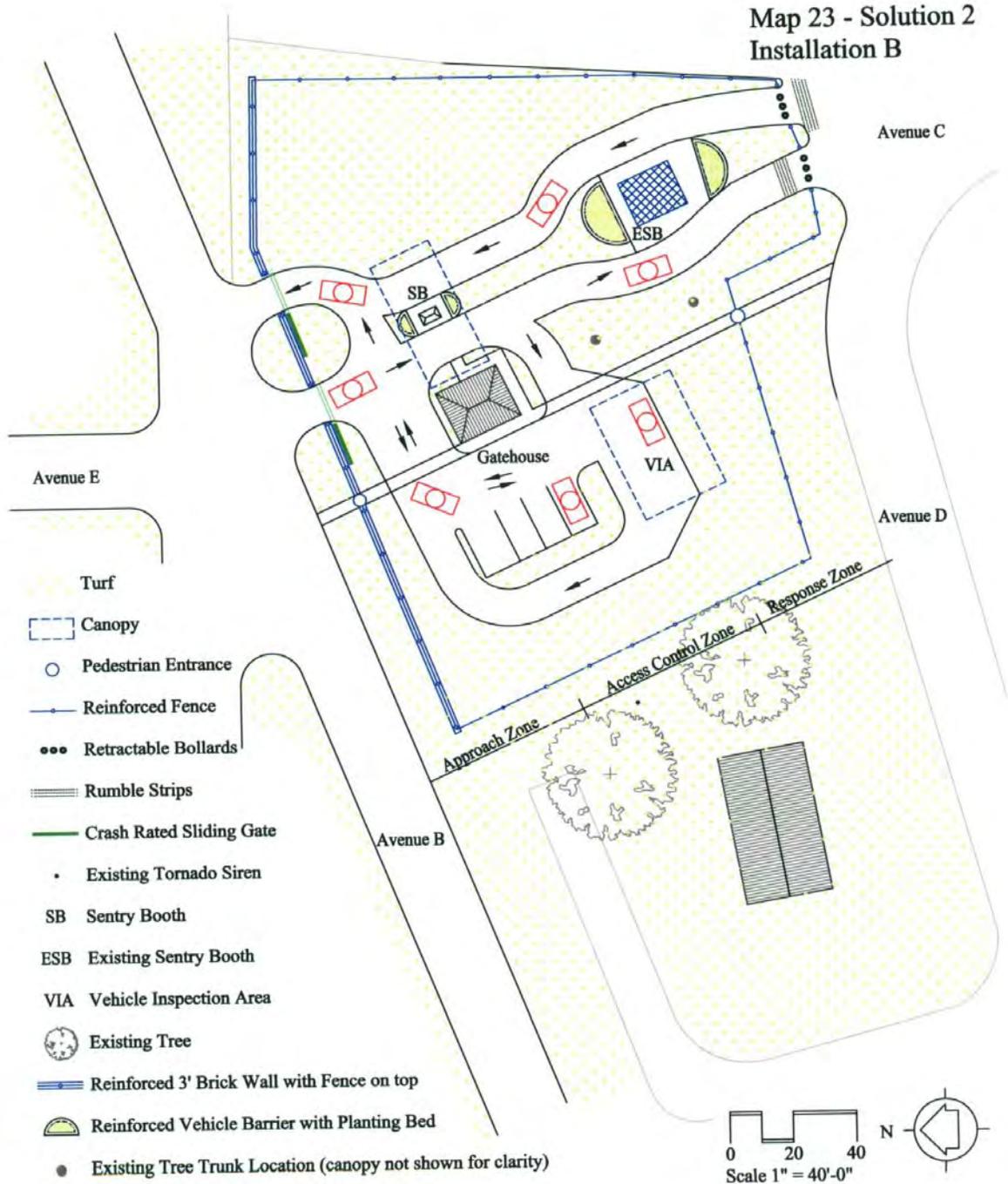
**Map 21 - Solution 1  
Traffic Flow - Visitors  
Granted Access**



Map 22 - Solution 1  
Traffic Flow - Visitors  
Denied Access



# Map 23 - Solution 2 Installation B



Avenue E

Avenue C

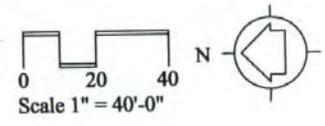
Avenue D

Avenue B

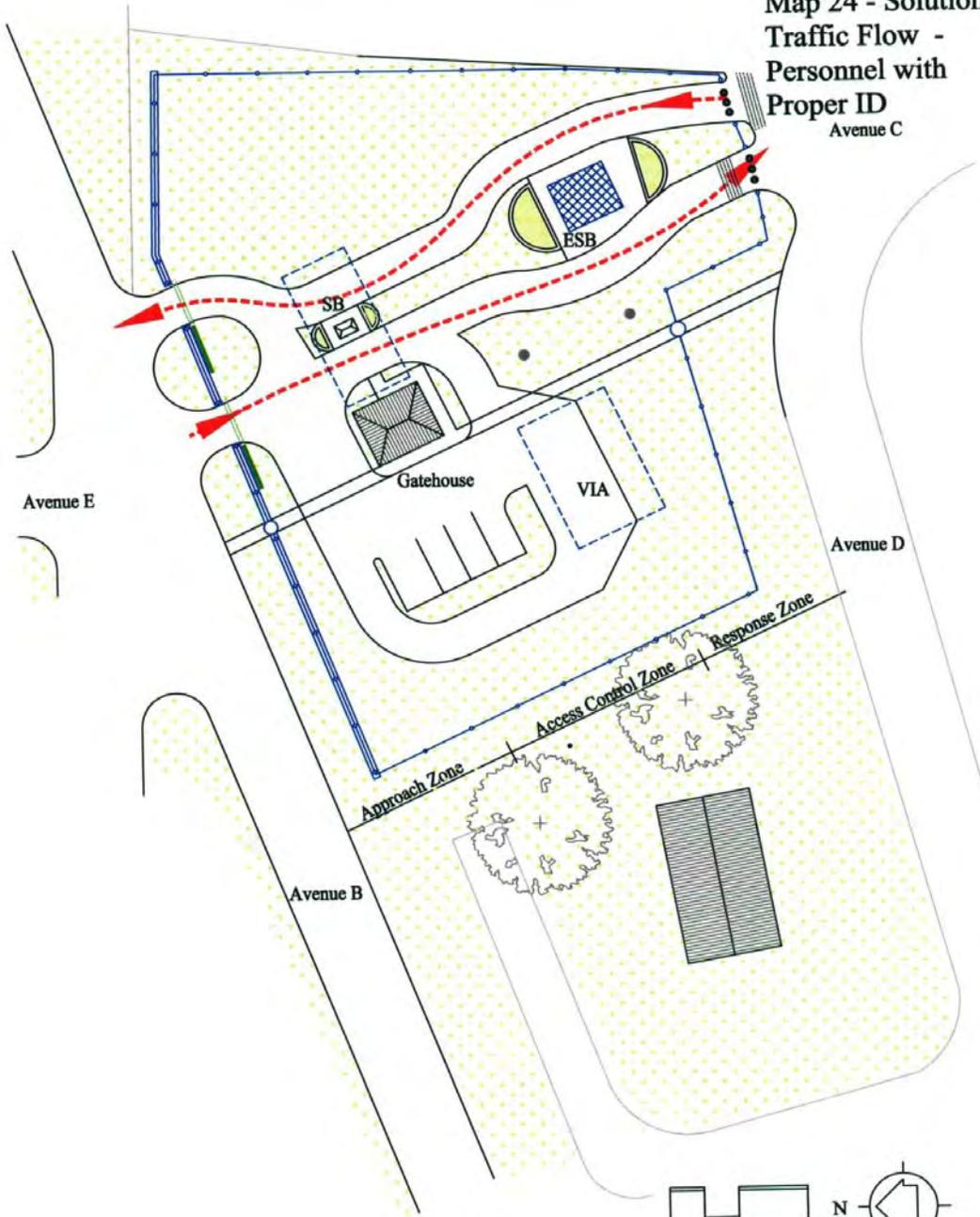
- Turf
- Canopy
- Pedestrian Entrance
- Reinforced Fence
- Retractable Bollards
- Rumble Strips
- Crash Rated Sliding Gate
- Existing Tornado Siren
- SB Sentry Booth
- ESB Existing Sentry Booth
- VIA Vehicle Inspection Area
- Existing Tree
- Reinforced 3' Brick Wall with Fence on top
- Reinforced Vehicle Barrier with Planting Bed
- Existing Tree Trunk Location (canopy not shown for clarity)

Approach Zone | Access Control Zone | Response Zone

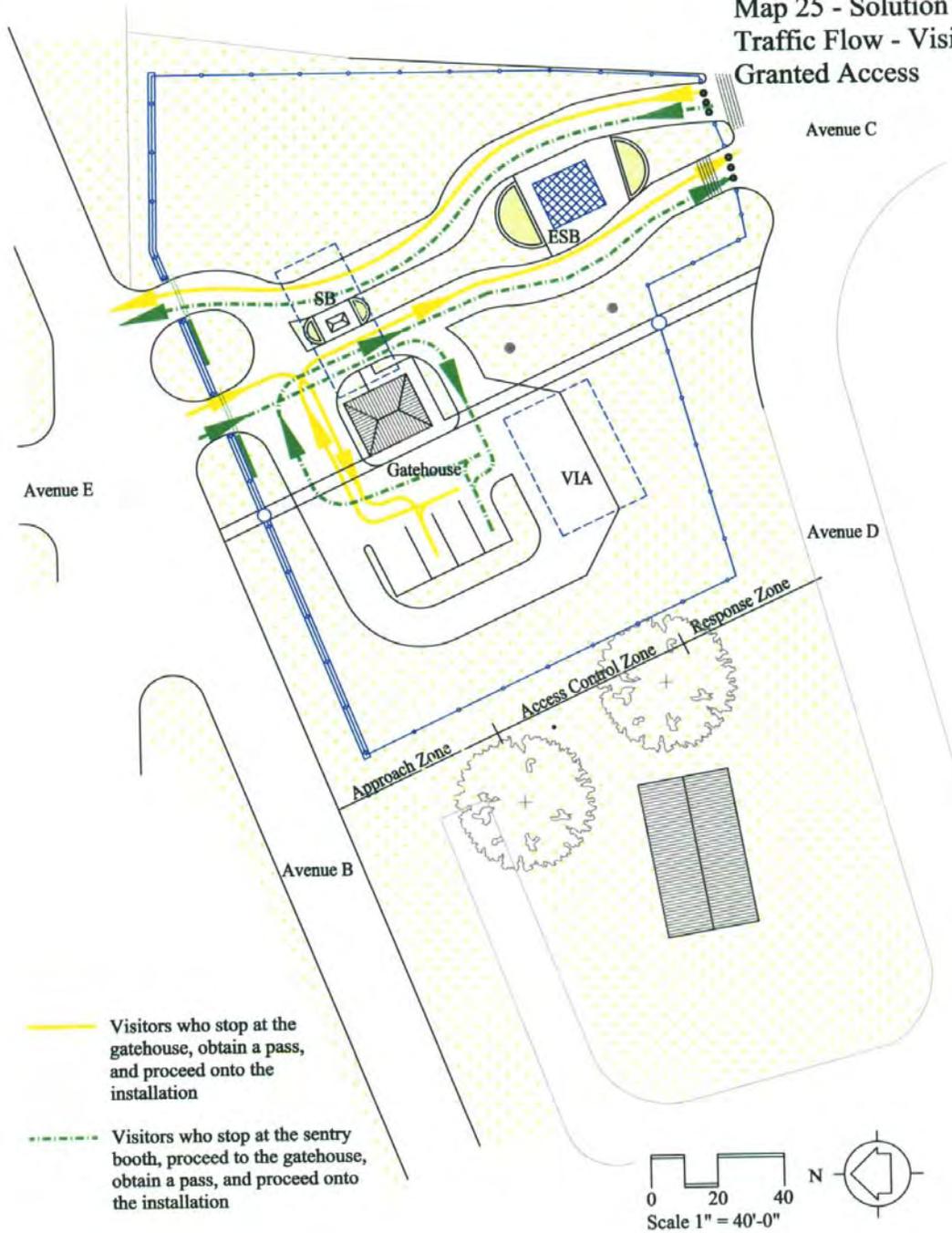
Gatehouse



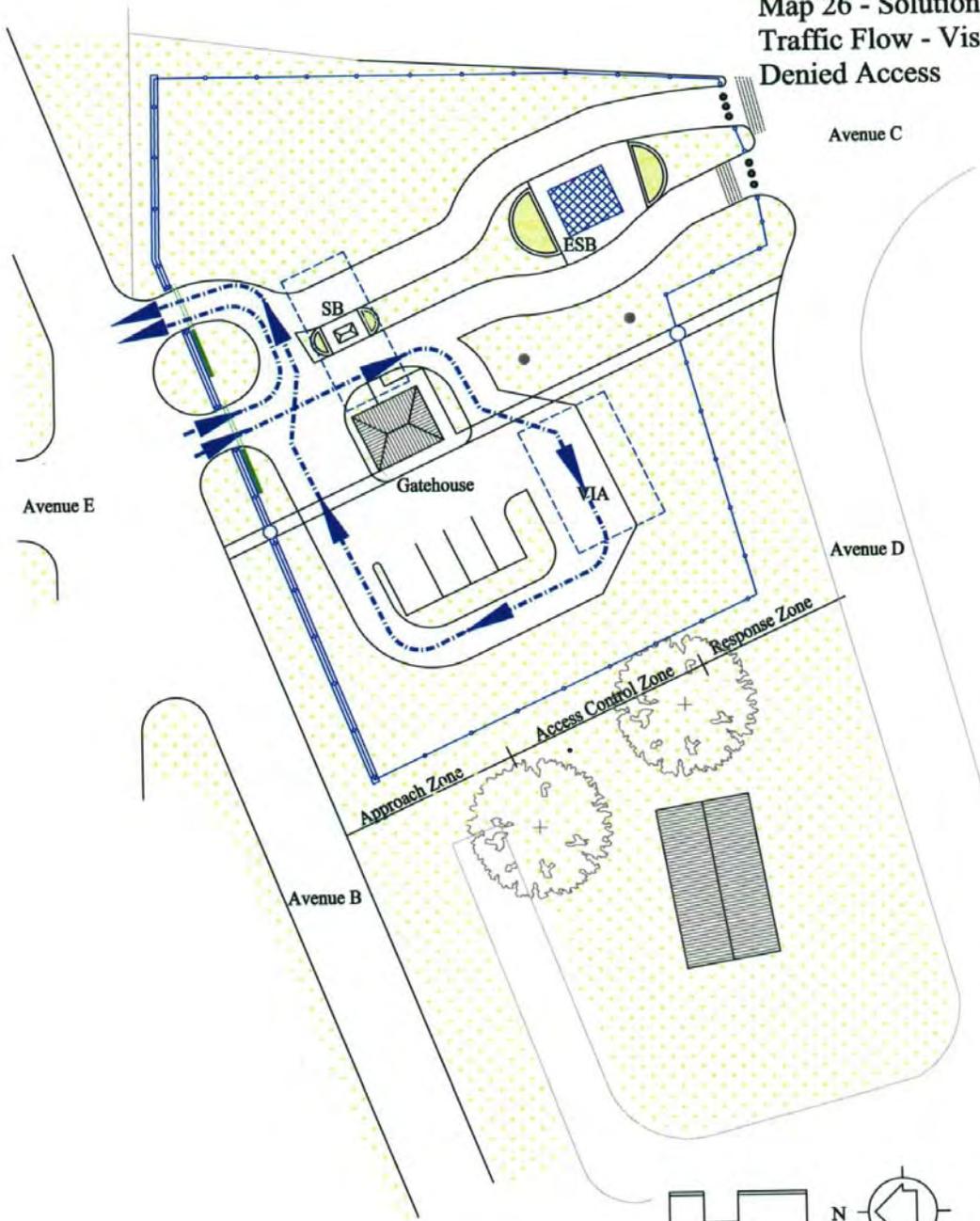
Map 24 - Solution 2  
Traffic Flow -  
Personnel with  
Proper ID  
Avenue C



**Map 25 - Solution 2  
Traffic Flow - Visitors  
Granted Access**



**Map 26 - Solution 2  
Traffic Flow - Visitors  
Denied Access**



**SECTION D**  
**CONCLUSIONS**



In June 2003, Naval Facilities Engineering Command–Southern Division commissioned Hardlines Design Company (HDC) to complete an Antiterrorism Force Protection Base Entrance Improvements Study in a National Register Historic District at two Department of Defense (DoD) installations: one Army installation and one Navy installation. Lindbergh Associates provided security design consultation.

The team analyzed existing physical and traffic conditions at a gate in or adjacent to an existing historic district. Common deficiencies encountered included:

- Entry area is not physically separated from the rest of the installation. Visitors are on the installation and past the controlled perimeter before passing security.
- Inspection areas are inside acceptable standoff distances.
- No provisions to prevent vehicles ramming the installation at high speed from roads sited perpendicular to the perimeter fence.
- Lack of adequate lighting levels for nighttime inspections.
- Pedestrians must share the road with vehicles.
- No restroom facilities for guards, which requires calling for backup to take breaks.
- No weather protection (canopies) over the sentry booth and inspection areas.

Each base received two proposed solutions to remedy the above deficiencies. Recommendations covered the following:

- Acceptable standoff distances.
- Vehicle inspection areas.
- Sentry booths and gatehouse placement.
- Visitor parking.
- Traffic flow for various vehicular situations.
- Pedestrian access and control.
- Separation of access control point from the main base.
- Control of vehicle's ability to charge and bypass the checkpoint.

Historic preservation concerns incorporated into each solution include:

- Retention of older, mature, large trees.
- Gatehouse design compatible with materials and scale of buildings in historic district.
- Canopy design that incorporates materials that respect the character and quality of the materials associated with buildings in historic district.
- Retention or reconstruction of historic gate features.
- Do not attempt to replicate or mimic historic features or elements. Respect the existing historic character by contrasting or complimenting it.
- Do not introduce structures or features that dominate or distract from the view of the historic district.
- Consult with the SHPO for their input early in the design (or RFP) process.

- Results of Phase I archeology survey determined that no significant cultural resources were likely to be impacted by ground-disturbing construction activities in the entry areas.

**SECTION E**  
**BIBLIOGRAPHY**



Atlantic Division, Naval Facilities Engineering Command

2003 *ITG 03-03. Interim Technical Guidance (ITG) Entry Control Facilities.*  
Norfolk, VA.

United States Department of Defense

1999 *MIL-HDBK-1013/14. Selection and Application of Vehicle Barriers.*  
Washington, D.C.

2002 *UFC 4-010-01. Unified Facilities Criteria (UFC) DoD Minimum  
Antiterrorism Standards for Buildings.* Washington, D.C.

**This page intentionally left blank.**

**APPENDIX 1**  
**FIGURES**



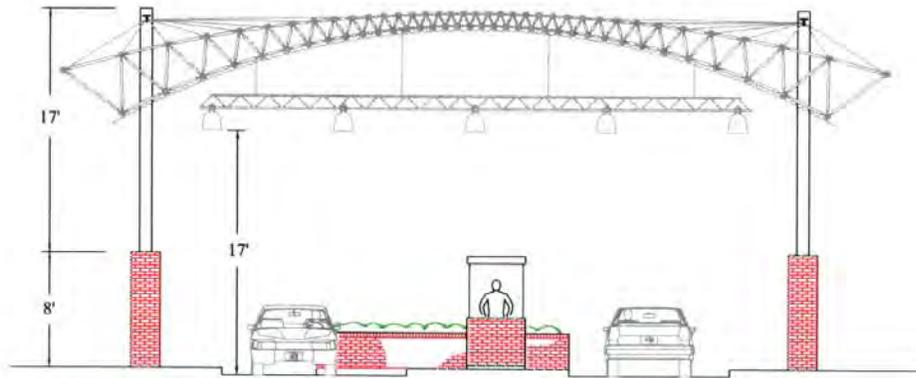


Figure 1. Cross Section of Sentry Booth Canopy Example

Scale 1" = 10'-0"

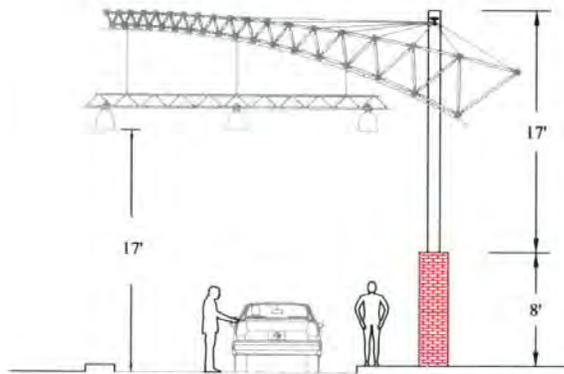
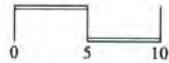
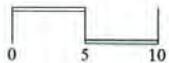


Figure 2. Cross Section of Vehicle Inspection Canopy Example

Scale 1" = 10'-0"



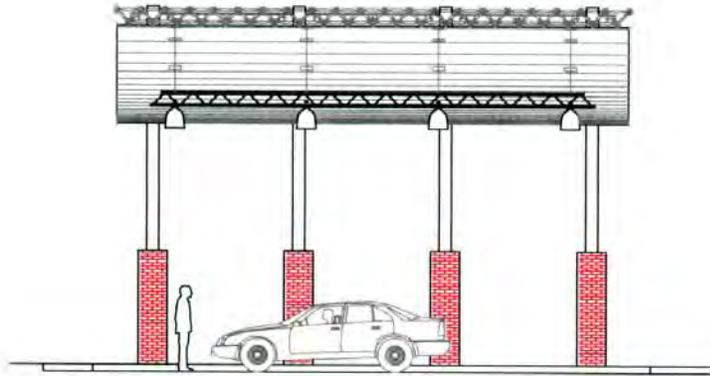
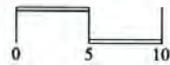
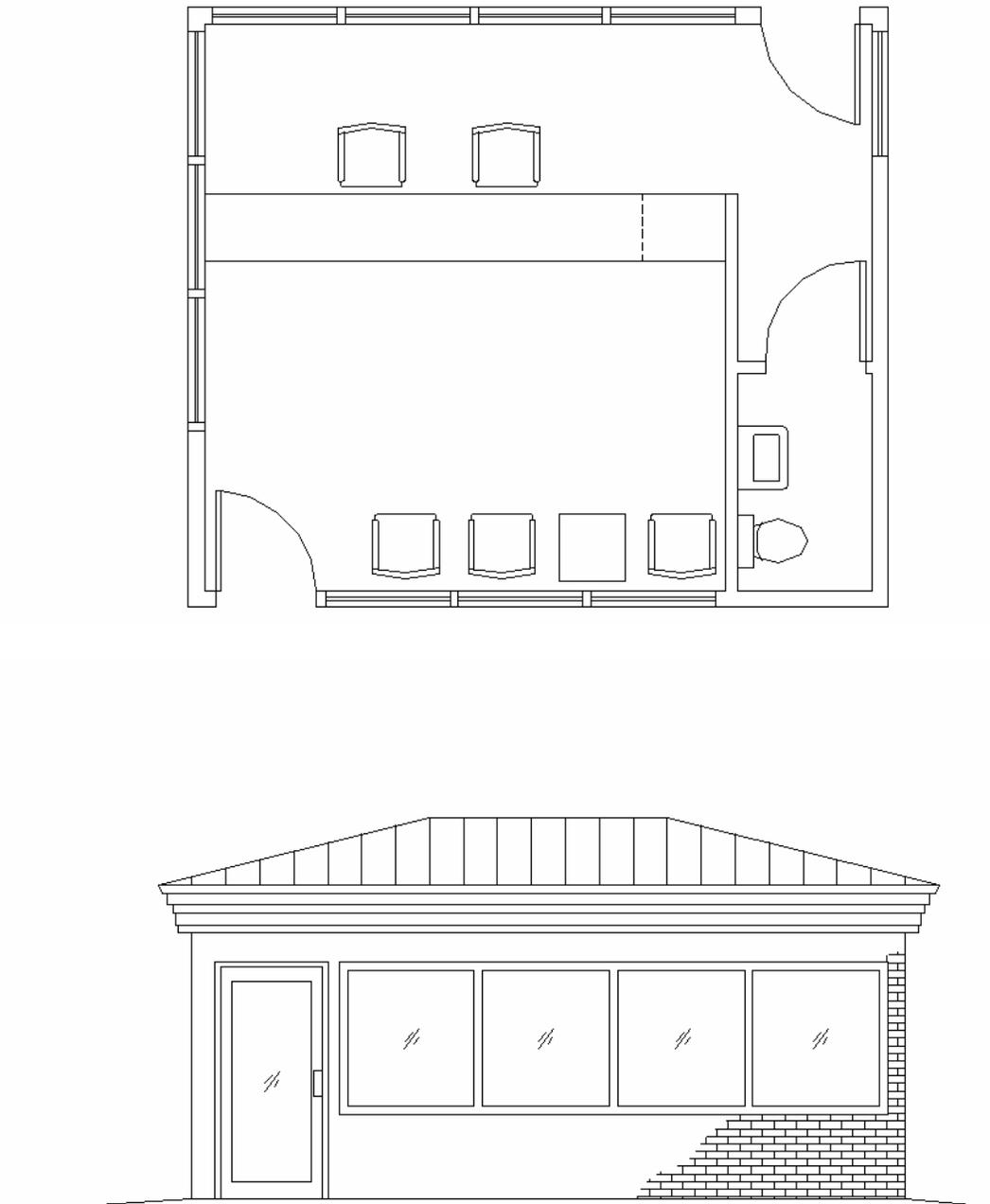


Figure 3. Longitudinal Section of Vehicle Inspection Canopy Example

Scale 1" = 10'-0"





**Figure 4. Example of gatehouse suitable for a historic district.**

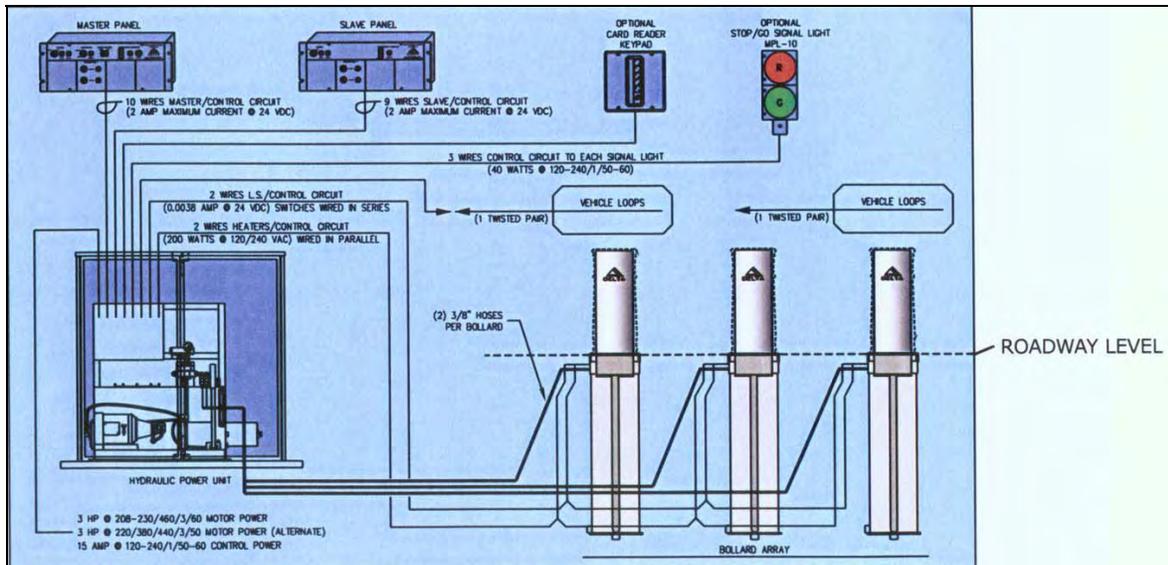


Figure 5. Example of retracting bollards.



**Figure 6. Example of crash beam.**



**Figure 7. Example of sliding gate.**

**APPENDIX 2**  
**COST ESTIMATES**



## INSTALLATION A – SOLUTION 1 COST ESTIMATE

	Unit	Unit Cost	Total Unit	Total Cost
<u>Demolition</u>				
Curbs, concrete, reinforced	LF	\$ 5.49	390	\$ 2,141.10
Sidewalk, concrete	SY	\$ 10.20	15	\$ 153.00
Pavement removal, bituminous road, 6" thick	SY	\$ 5.50	1231	\$ 6,770.50
Tree, 24 inch diameter	EA	\$ 500.00	5	\$ 2,500.00
Tree, 12 inch diameter	EA	\$ 400.00	3	\$ 1,200.00
Shrubs	EA	\$ 125.00	12	\$ 1,500.00
 <u>Sitework</u>				
<b>Excavation and Backfill</b>				
Excavating, mobilization, earthmoving equip	CY	\$ 2.21	1704	\$ 3,765.84
Excavating, soil, medium grade	CY	\$ 5.80	1704	\$ 9,883.20
Hauling, 6 CY truck, 4 mile round trip	CY	\$ 11.30	120	\$ 1,356.00
Manual, excavation, hand	CY	\$ 18.90	15	\$ 283.50
Erosion control, silt fence	LF	\$ 0.91	480	\$ 436.80
Backfill, common earth	CY	\$ 1.09	410	\$ 446.90
Backfill, stone, structural	CY	\$ 3.55	284	\$ 1,008.20
Compaction, wheel roller, common fill	CY	\$ 2.90	180	\$ 522.00
Compaction, wheel roller, select fill	CY	\$ 2.15	210	\$ 451.50
Lawn and Grass	SY	\$ 0.44	16500	\$ 7,260.00
 <b>Bases, Ballasts and Pavement</b>				
Base Course, crushed 3/4", 6" deep	SY	\$ 5.09	1704	\$ 8,673.36
Asphalt concrete pavement, roads	SY	\$ 14.50	1704	\$ 24,708.00
Pavement markings, thermoplastic	LF	\$ 2.30	940	\$ 2,162.00
 <b>Curb and Gutters (Road and Guard Station)</b>				
Steel forms, straight	LF	\$ 12.80	1200	\$ 15,360.00
Concrete, 3000 psi, 3-#4 bars	CY	\$ 286.00	150	\$ 42,900.00
 <b>Sidewalk, Concrete</b>				
Concrete, 3000 psi, 6x6 - W1.4 mesh, 6" thick	SF	\$ 7.08	1500	\$ 10,620.00
 <b>Masonry unit pavers, pedestrian walk</b>				
	SF	\$ 10.75	150	\$ 1,612.50
 <b>Fence and Gates, Industrial including</b>				
<b>2" Post @ 10' O.C., cable</b>				
<b>braced, set in Concrete, 6' High</b>				
<b>6 ga. Wire, aluminized steel</b>				
	LF	\$ 62.00	1050	\$ 65,100.00
Revolving gate, steel, galvanized, 6' diameter	EA	\$ 3,100.00	4	\$ 12,400.00
Double swing gates, incl. posts & hardware	Opng	\$ 3,200.00	1	\$ 3,200.00
Automatic fence gate operator	Opng	\$ 5,200.00	1	\$ 5,200.00
 <b>Cable Reinforced Crash Beam</b>				
	EA	\$ 30,000.00	2	\$ 60,000.00
 <b>Traffic arm</b>				
	EA	\$ 3,000.00	1	\$ 3,000.00

	Unit	Unit Cost	Total Unit	Total Cost
<u>Concrete</u>				
RETAINING WALL				
Expansion joint, polyurethane, rigid	LF	\$ 7.65	60 \$	459.00
Concrete Planter-retainer wall, 3500 psi, incl forms	CY	\$ 287.00	15 \$	4,305.00
GATEHOUSE				
Footings, strip, 18" x 9", reinforced	CY	\$ 242.00	3 \$	726.00
Slab, floor, on grade, #6 W1.4 reinforced, 6" thick	SF	\$ 3.32	4 \$	13.28
GATEHOUSE				
Floor slab, reinforced	CY	\$ 242.00	2.5 \$	605.00
<u>Masonry (Gatehouse)</u>				
Brick, veneer, face, standard modular with 8" concrete masonry unit back-up	SF	\$ 25.05	350 \$	8,767.50
Masonry cleaning, brush and wash, minimum	SF	\$ 0.85	350 \$	297.50
<u>Metals (Gatehouse)</u>				
Lintel, window, steel angle, 9' long	EA	\$ 68.50	4 \$	274.00
Lintel, door, steel angle, 4'-6" long	EA	\$ 32.00	2 \$	64.00
<u>Wood (Gatehouse)</u>				
Roof, truss, 2 x 8, 16" o.c. with 5/8" plywood sheathing	SF	\$ 4.50	600 \$	2,700.00
Top plate, double, 2 x 6, treated	LF	\$ 4.86	50 \$	243.00
CASEWORK				
Counter	LF	\$ 85.00	16 \$	1,360.00
Cabinets including base and wall mount	LF	\$ 225.00	15 \$	3,375.00
<u>Thermal and Moisture Protection (Gatehouse)</u>				
INSULATION				
Insulation, batt, ceiling, R30	SF	\$ 1.15	500 \$	575.00
ROOFING				
Metal, standing seam	SF	\$ 9.50	500 \$	4,750.00
Vapor barrier, felt, #15	SF	\$ 1.85	550 \$	1,017.50
Cornice incl. fascia, soffit and frieze, sheet metal	LF	\$ 22.35	50 \$	1,117.50
ROOF DRAINAGE				
Downspout, metal, copper, 16 oz.	LF	\$ 12.10	22 \$	266.20
Guttering, metal, copper, 16 oz	LF	\$ 8.75	50 \$	437.50
SEALANTS				
Polyurethane, gun grade, exterior exposure	LF	\$ 3.15	320 \$	1,008.00

	Unit	Unit Cost	Total Unit	Total Cost
<u>Doors and Windows (Gatehouse)</u>				
DOORS				
Entrance, aluminum frame and door, 3' x 7'	Opng	\$ 1,450.00	2 \$	2,900.00
Hardware, door, entrance	Opng	\$ 2,100.00	2 \$	4,200.00
WINDOWS				
Exterior, aluminum, commercial grade, fixed	SF	\$ 28.00	120 \$	3,360.00
GLAZING				
Glass, polycarbonate content, bullet-proof	SF	\$ 40.00	120 \$	4,800.00
<u>Finishes (Gatehouse)</u>				
GYPSUM BOARD CEILINGS AND WALLS				
5/8" gypsum board, taped and finished, ceiling	SF	\$ 2.95	500 \$	1,475.00
5/8" gypsum board, taped and finished, walls incl. furring	SF	\$ 3.25	250 \$	812.50
TILE, CERAMIC, RESTROOM				
Porcelain tile, floor, 2"x2" mud set	SF	\$ 9.10	120 \$	1,092.00
Walls, interior, thin set, 4-1/4"x1-1/4" tile	SF	\$ 6.10	250 \$	1,525.00
TILE, RESILIENT				
Vinyl composition, 12"x12", floor tile	SF	\$ 2.80	350 \$	980.00
PAINTING				
Interior, gypsum walls and ceilings	SF	\$ 0.72	500 \$	360.00
Interior, concrete masonry units	SF	\$ 1.10	750 \$	825.00
<u>Special Construction</u>				
Sentry Booth	EA	\$ 24,000.00	1 \$	24,000.00
<b><u>Metal Canopies (2 Total)</u></b>				
Spread Footings	CY	\$ 275.00	5.31 \$	1,460.25
Cylinder Concrete Columns	CY	\$ 385.00	8.4 \$	3,234.00
W6 x 9 Steel Beams	LF	\$ 14.75	53 \$	781.75
W10 x 21 Steel Columns	LF	\$ 26.50	136 \$	3,604.00
Space Frame Roof Structure	SF	\$ 26.50	1939 \$	48,760.00
Corrugated Roof Decking	SF	\$ 3.55	1954 \$	6,656.25
3/4" Stainless Steel Tension Cable	LF	\$ 8.50	75 \$	637.50
Lighting, 400 Watt, Metal Halide	EA	\$ 725.00	30 \$	21,750.00
<u>Plumbing (Gatehouse)</u>				
Single occupant restroom including all associated plumbing and fixtures	Allow	\$ 8,500.00	1 \$	8,500.00
<u>Heating, Ventilation and Air Conditioning (Gatehouse)</u>				
Complete heating, ventilation and air conditioning system	Allow	\$ 15,000.00	1 \$	15,000.00
<u>Electrical (Gatehouse)</u>				
Complete electrical system including power, lighting, and devices	Allow	\$ 18,750.00	1 \$	18,750.00

Subtotal	\$ 502,438.63
Contractor G&A @ 15%	\$ 75,365.79
Contingency @ 5%	\$ 25,121.93
Surveys, tests, permits	\$ 15,000.00
Architect/Engineer Fees	\$ 50,000.00
<b>Total</b>	<b>\$ 667,926.36</b>

## INSTALLATION A – SOLUTION 2 COST ESTIMATE

	Unit	Unit Cost	Total Unit	Total Cost
<u>Demolition</u>				
Curbs, concrete, reinforced	LF	\$ 5.49	390	\$ 2,141.10
Pavement removal, bituminous road, 6" thick	SY	\$ 5.50	665	\$ 3,657.50
Tree, 24 inch diameter	EA	\$ 500.00	1	\$ 500.00
 <u>Sitework</u>				
<b>Excavation and Backfill</b>				
Excavating, mobilization, earthmoving equip	CY	\$ 2.21	467	\$ 1,032.07
Excavating, soil, medium grade	CY	\$ 5.80	467	\$ 180.00
Hauling, 6 CY truck, 4 mile round trip	CY	\$ 11.30	180	\$ 2,034.00
Manual, excavation, hand	CY	\$ 18.90	15	\$ 283.50
Erosion control, silt fence	LF	\$ 0.91	800	\$ 728.00
Backfill, common earth	CY	\$ 1.09	210	\$ 228.90
Backfill, stone, structural	CY	\$ 3.55	234	\$ 830.70
Compaction, wheel roller, common fill	CY	\$ 2.90	200	\$ 580.00
Compaction, wheel roller, select fill	CY	\$ 2.15	250	\$ 537.50
Lawn and Grass	SY	\$ 0.44	6036	\$ 2,655.84
 <b>Bases, Ballasts and Pavement</b>				
Base Course, crushed 3/4", 6" deep	SY	\$ 5.09	1650	\$ 8,398.50
Asphalt concrete pavement, roads	SY	\$ 14.50	1300	\$ 18,850.00
Pavement markings, thermoplastic	LF	\$ 2.30	410	\$ 943.00
 <b>Curb and Gutters (Road and Guard Station)</b>				
Steel forms, straight	LF	\$ 12.80	700	\$ 8,960.00
Concrete, 3000 psi, 3-#4 bars	CY	\$ 286.00	123	\$ 35,178.00
 <b>Sidewalk, Concrete</b>				
Concrete, 3000 psi, 6x6 - W1.4 mesh, 6" thick	SF	\$ 7.08	1000	\$ 7,080.00
 <b>Masonry unit pavers, pedestrian walk</b>				
	SF	\$ 10.75	120	\$ 1,290.00
 <b>Fence and Gates, Industrial including 2" Post @ 10' O.C., cable braced, set in Concrete, 6' High 6 ga. Wire, aluminized steel</b>				
Revolving gate, steel, galvanized, 6' diameter	EA	\$ 3,100.00	3	\$ 9,300.00
Double swing gates, incl. posts & hardware	Opng	\$ 3,200.00	1	\$ 3,200.00
Automatic fence gate operator	Opng	\$ 5,200.00	1	\$ 5,200.00
 <b>Cable Reinforced Crash Beam</b>				
	EA	\$ 30,000.00	2	\$ 60,000.00
 <b>Traffic arm</b>				
	EA	\$ 3,000.00	1	\$ 3,000.00

	Unit	Unit Cost	Total Unit	Total Cost
<u>Concrete</u>				
RETAINING WALL				
Expansion joint, polyurethane, rigid	LF	\$ 7.65	60	\$ 459.00
Concrete Planter-retainer wall, 3500 psi, incl forms	CY	\$ 287.00	15	\$ 4,305.00
GATEHOUSE				
Footings, strip, 18" x 9", reinforced	CY	\$ 242.00	3	\$ 726.00
Slab, floor, on grade, #6 W1.4 reinforced, 6" thick	SF	\$ 3.32	4	\$ 13.28
GATEHOUSE				
Floor slab, reinforced	CY	\$ 242.00	2.5	\$ 605.00
<u>Masonry (Gate House)</u>				
Brick, veneer, face, standard modular with 8" concrete masonry unit back-up				
	SF	\$ 25.05	350	\$ 8,767.50
Masonry cleaning, brush and wash, minimum	SF	\$ 0.85	350	\$ 297.50
<u>Metals (Gate House)</u>				
Lintel, window, steel angle, 9' long	EA	\$ 68.50	4	\$ 274.00
Lintel, door, steel angle, 4'-6" long	EA	\$ 32.00	2	\$ 64.00
<u>Wood (Gate House)</u>				
Roof, truss, 2 x 8, 16" o.c. with 5/8" plywood sheathing	SF	\$ 4.50	600	\$ 2,700.00
Top plate, double, 2 x 6, treated	LF	\$ 4.86	50	\$ 243.00
CASEWORK				
Counter	LF	\$ 85.00	16	\$ 1,360.00
Cabinets including base and wall mount	LF	\$ 225.00	15	\$ 3,375.00
<u>Thermal and Moisture Protection (Gate House)</u>				
INSULATION				
Insulation, batt, ceiling, R30	SF	\$ 1.15	500	\$ 575.00
ROOFING				
Metal, standing seam	SF	\$ 9.50	500	\$ 4,750.00
Vapor barrier, felt, #15	SF	\$ 1.85	550	\$ 1,017.50
Cornice incl. fascia, soffit and frieze, sheet metal	LF	\$ 22.35	50	\$ 1,117.50
ROOF DRAINAGE				
Downspout, metal, copper, 16 oz.	LF	\$ 12.10	22	\$ 266.20
Guttering, metal, copper, 16 oz	LF	\$ 8.75	50	\$ 437.50
SEALANTS				
Polyurethane, gun grade, exterior exposure	LF	\$ 3.15	320	\$ 1,008.00
<u>Doors and Windows (Gatehouse)</u>				
DOORS				
Entrance, aluminum frame and door, 3' x 7'	Opng	\$ 1,450.00	2	\$ 2,900.00
Hardware, door, entrance	Opng	\$ 2,100.00	2	\$ 4,200.00
WINDOWS				
Exterior, aluminum, commercial grade, fixed	SF	\$ 28.00	120	\$ 3,360.00
GLAZING				
Glass, polycarbonate content, bullet-proof	SF	\$ 40.00	120	\$ 4,800.00

	Unit	Unit Cost	Total Unit	Total Cost
<u>Finishes (Gatehouse)</u>				
GYPSUM BOARD CEILINGS AND WALLS				
5/8" gypsum board, taped and finished, ceiling	SF	\$ 2.95	500	\$ 1,475.00
5/8" gypsum board, taped and finished, walls incl. furring	SF	\$ 3.25	250	\$ 812.50
TILE, CERAMIC, RESTROOM				
Porcelain tile, floor, 2"x2" mud set	SF	\$ 9.10	120	\$ 1,092.00
Walls, interior, thin set, 4-1/4"x1-1/4" tile	SF	\$ 6.10	250	\$ 1,525.00
TILE, RESILIENT				
Vinyl composition, 12"x12", floor tile	SF	\$ 2.80	350	\$ 980.00
PAINTING				
Interior, gypsum walls and ceilings	SF	\$ 0.72	500	\$ 360.00
Interior, concrete masonry units	SF	\$ 1.10	750	\$ 825.00
<u>Special Construction</u>				
<b><u>Sentry Booth</u></b>	EA	\$ 24,000.00	1	\$ 24,000.00
<b><u>Metal Canopies (2 Total)</u></b>				
Spread Footings	CY	\$ 275.00	5.31	\$ 1,460.25
Cylinder Concrete Columns	CY	\$ 385.00	8.4	\$ 3,234.00
W6 x 9 Steel Beams	LF	\$ 14.75	53	\$ 781.75
W10 x 21 Steel Columns	LF	\$ 26.50	136	\$ 3,604.00
Space Frame Roof Structure	SF	\$ 26.50	1840	\$ 48,760.00
Corrugated Roof Decking	SF	\$ 3.55	1875	\$ 6,656.25
3/4" Stainless Steel Tension Cable	LF	\$ 8.50	75	\$ 637.50
Lighting, 400 Watt, Metal Halide	EA	\$ 725.00	30	\$ 21,750.00
<u>Plumbing (Gatehouse)</u>				
Single occupant restroom including all associated plumbing and fixtures	Allow	\$ 8,500.00	1	\$ 8,500.00
<u>Heating, Ventilation and Air Conditioning (Gatehouse)</u>				
Complete heating, ventilation and air conditioning system	Allow	\$ 15,000.00	1	\$ 15,000.00
<u>Electrical (Gatehouse)</u>				
Complete electrical system including power, lighting, and devices	Allow	\$ 18,750.00	1	\$ 18,750.00
	Subtotal			\$ 443,512.84
	Contractor G&A @ 15%			\$ 66,526.93
	Contingency @ 5%			\$ 22,175.64
	Surveys, tests, permits			\$ 15,000.00
	Architect/Engineer Fees			\$ 50,000.00
	<b>Total</b>			<b>\$ 597,215.41</b>

**This page intentionally left blank.**

## INSTALLATION B – SOLUTION 1 COST ESTIMATE

	Unit	Unit Cost	Total Unit	Total Cost
<b>Demolition</b>				
Curbs, concrete, reinforced	LF	\$ 5.49	390	\$ 2,141.10
Pavement removal, bituminous road, 6" thick	SY	\$ 5.50	4250	\$ 23,375.00
Sidewalk, concrete, reinforced	LF	\$ 10.00	500	\$ 5,000.00
Tree, removal	EA	\$ 450.00	1	\$ 450.00
Utility Pole	EA	\$ 175.00	2	\$ 350.00
Retaining wall, concrete, reinforced	CY	\$ 81.50	100	\$ 8,150.00
Shrubs	allow	\$ 3,500.00	1	\$ 3,500.00
Fencing, panel, aluminum	SF	\$ 3.50	4800	\$ 16,800.00
Existing street lights and poles, save for resale	allow	\$ 3,400.00	1	\$ 3,400.00
<b>Sitework</b>				
<b>Excavation and Backfill</b>				
Excavating, mobilization, earthmoving equip	CY	\$ 2.21	980	\$ 2,165.80
Excavating, soil, medium grade	CY	\$ 5.80	980	\$ 5,684.00
Hauling, 6 CY truck, 4 mile round trip	CY	\$ 11.30	350	\$ 3,955.00
Manual, excavation, hand	CY	\$ 18.90	15	\$ 283.50
Erosion control, silt fence	LF	\$ 0.91	2500	\$ 2,275.00
Backfill, common earth	CY	\$ 1.09	450	\$ 490.50
Backfill, stone, structural	CY	\$ 3.55	550	\$ 1,952.50
Compaction, wheel roller, common fill	CY	\$ 2.90	1050	\$ 3,045.00
Compaction, wheel roller, select fill	CY	\$ 2.15	1200	\$ 2,580.00
Lawn and Grass	SY	\$ 0.44	20000	\$ 8,800.00
<b>Storm Sewer</b>				
Trenching, piping and manholes	CY	\$ 95.00	230	\$ 21,850.00
Concrete piping, 15 inch, underdrain	LF	\$ 24.00	420	\$ 10,080.00
Culver, concrete piping including retaining bulkhead	EA	\$ 2,800.00	2	\$ 5,600.00
Catch basin, including footing, frame and cover	EA	\$ 4,210.00	2	\$ 8,420.00
Back fill including soil and gravel	CY	\$ 125.00	250	\$ 31,250.00
<b>Bases, Ballasts and Pavement</b>				
Base Course, crushed 3/4", 6" deep	SY	\$ 5.09	13100	\$ 66,679.00
Asphalt concrete pavement, roads	SY	\$ 14.50	11300	\$ 163,850.00
Asphalt concrete pavement, parking lot	SY	\$ 4.27	1800	\$ 7,686.00
Pavement markings, thermoplastic	LF	\$ 2.30	1600	\$ 3,680.00
<b>Curb and Gutters (Road and Guard Station)</b>				
Steel forms, straight	LF	\$ 12.80	1200	\$ 15,360.00
Concrete, 3000 psi, 3-#4 bars	CY	\$ 286.00	145	\$ 41,470.00
<b>Sidewalk, Concrete</b>				
Concrete, 3000 psi, 6x6 - W1.4 mesh, 6" thick	SF	\$ 7.08	1000	\$ 7,080.00
<b>Masonry unit pavers, pedestrian walk</b>				
	SF	\$ 10.75	300	\$ 3,225.00
<b>Fence and Gates, Industrial including</b>				
<b>2" Post @ 10' O.C., cable braced, set in concrete,</b>				
<b>10' High, 6 ga. Wire, aluminized steel</b>	LF	\$ 84.00	500	\$ 42,000.00
<b>North Masonry/Concrete Metal Fence</b>				
Industrial grade fencing including 2" post @10' oc, cable braced set into reinforced conc wall, 6' high,				
6 ga. Wire, aluminized steel	LF	\$ 64.00	350	\$ 22,400.00

	Unit	Unit Cost	Total Unit	Total Cost
<b>Barrier gate, mechanical</b>	EA	\$ 18,000.00	1	\$ 18,000.00
<b>Crash-proof barrier gate, mechanical</b>	EA	\$ 32,000.00	4	\$ 128,000.00
<b>Rising Bollards</b>	3 Per	\$ 33,000.00	2	\$ 66,000.00
<b>Removable Bollards</b>	EA	\$ 600.00	27	\$ 16,200.00
<u>Concrete</u>				
<b>RETAINING WALL</b>				
Expansion joint, polyurethane, rigid	LF	\$ 7.65	60	\$ 459.00
Concrete Planter-retainer wall, 3500 psi, incl forms	CY	\$ 287.00	15	\$ 4,305.00
Concrete retaining wall, traffic, reinforced	CY	\$ 292.00		
<b>North Masonry Fence Coping</b>				
Cast-in-place reinforced fence coping	CY	\$ 225.00	15	\$ 3,375.00
<b>GATEHOUSE</b>				
Footings, strip, 18" x 9", reinforced	CY	\$ 242.00	3	\$ 726.00
Slab, floor, on grade, #6 W1.4 reinforced, 6" thick	SF	\$ 3.32	4	\$ 13.28
<b>GATEHOUSE</b>				
Floor slab, reinforced	CY	\$ 242.00	3	\$ 726.00
<u>Masonry</u>				
<b>Masonry (Gatehouse)</b>				
Brick, veneer, face, standard modular with 8" concrete masonry unit back-up	SF	\$ 25.05	420	\$ 10,521.00
Masonry cleaning, brush and wash, minimum	SF	\$ 0.85	420	\$ 357.00
<b>North Masonry/Concrete Fence</b>				
Solid brick retaining wall including concrete footing	CF	\$ 45.00	528	\$ 23,760.00
<u>Metals (Gatehouse)</u>				
Lintel, window, steel angle, 9' long	EA	\$ 68.50	4	\$ 274.00
Lintel, door, steel angle, 4'-6" long	EA	\$ 32.00	2	\$ 64.00
<u>Wood (Gatehouse)</u>				
Roof, truss, 2 x 8, 16" o.c. with 5/8" plywood sheathing	SF	\$ 4.50	800	\$ 3,600.00
Top plate, double, 2 x 6, treated	LF	\$ 4.86	65	\$ 315.90
<b>CASEWORK</b>				
Counter	LF	\$ 85.00	16	\$ 1,360.00
Cabinets including base and wall mount	LF	\$ 225.00	15	\$ 3,375.00
<u>Thermal and Moisture Protection (Gatehouse)</u>				
<b>INSULATION</b>				
Insulation, batt, ceiling, R30	SF	\$ 1.15	600	\$ 690.00
<b>ROOFING</b>				
Metal, standing seam	SF	\$ 9.50	600	\$ 5,700.00
Vapor barrier, felt, #15	SF	\$ 1.85	620	\$ 1,147.00
Cornice incl. fascia, soffit and frieze, sheet metal	LF	\$ 22.35	65	\$ 1,452.75
<b>ROOF DRAINAGE</b>				
Downspout, metal, copper, 16 oz.	LF	\$ 12.10	22	\$ 266.20
Guttering, metal, copper, 16 oz	LF	\$ 8.75	62	\$ 542.50

	Unit	Unit Cost	Total Unit	Total Cost
SEALANTS				
Polyurethane, gun grade, exterior exposure	LF	\$ 3.15	320	\$ 1,008.00
<u>Doors and Windows (Gatehouse)</u>				
DOORS				
Entrance, aluminum frame and door, 3' x 7'	Opng	\$ 1,450.00	2	\$ 2,900.00
Hardware, door, entrance	Opng	\$ 2,100.00	2	\$ 4,200.00
WINDOWS				
Exterior, aluminum, commerical grade, fixed	SF	\$ 28.00	120	\$ 3,360.00
GLAZING				
Glass, polycarbonate content, bullet-proof	SF	\$ 40.00	120	\$ 4,800.00
<u>Finishes (Gatehouse)</u>				
GYPSUM BOARD CEILINGS AND WALLS				
5/8" gypsum board, taped and finished, ceiling	SF	\$ 2.95	620	\$ 1,829.00
5/8" gypsum board, taped and finished, walls incl. furring	SF	\$ 3.25	310	\$ 1,007.50
TILE, CERAMIC, RESTROOM				
Porcelain tile, floor, 2"x2" mud set	SF	\$ 9.10	120	\$ 1,092.00
Walls, interior, thin set, 4-1/4"x1-1/4" tile	SF	\$ 6.10	250	\$ 1,525.00
TILE, RESILIENT				
Vinyl composition, 12"x12", floor tile	SF	\$ 2.80	350	\$ 980.00
PAINTING				
Interior, gypsum walls and ceilings	SF	\$ 0.72	620	\$ 446.40
Interior, concrete masonry units	SF	\$ 1.10	750	\$ 825.00
<u>Special Construction</u>				
<b>Sentry Booth</b>	EA	\$ 24,000.00	1	\$ 24,000.00
<b><u>Metal Canopies (3 Total)</u></b>				
Spread Footings	CY	\$ 275.00	8.4	\$ 2,310.00
Cylinder Concrete Columns	CY	\$ 385.00	10.3	\$ 3,965.50
W6 x 9 Steel Beams	LF	\$ 14.75	87	\$ 1,283.25
W10 x 21 Steel Columns	LF	\$ 26.50	202	\$ 5,353.00
Space Frame Roof Structure	SF	\$ 26.50	1984	\$ 52,576.00
Corrugated Roof Decking	SF	\$ 3.55	2010	\$ 7,135.50
3/4" Stainless Steel Tension Cable	LF	\$ 8.50	122	\$ 1,037.00
Lighting, 400 Watt, Metal Halide	EA	\$ 725.00	58	\$ 42,050.00
<u>Plumbing (Gatehouse)</u>				
Single occupant restroom including all associated plumbing and fixtures	Allow	\$ 8,500.00	1	\$ 8,500.00
<u>Heating, Ventilation and Air Conditioning (Gatehouse)</u>				
Complete heating, ventilation and air conditioning system	Allow	\$ 15,000.00	1	\$ 15,000.00
<u>Electrical (Gatehouse)</u>				
Complete electrical system including power, lighting, and devices	Allow	\$ 18,750.00	1	\$ 18,750.00
Reinstall existing street lights	Allow	\$ 17,000.00	1	\$ 17,000.00

Subtotal	\$ 1,059,190.18
Contractor G&A @ 15%	\$ 158,878.53
Contingency @ 5%	\$ 52,959.51
Surveys, tests, permits	\$ 28,000.00
Architect/Engineer Fees	\$ 133,000.00
<b>Total</b>	<b>\$ 1,432,028.22</b>

## INSTALLATION B – SOLUTION 2 COST ESTIMATE

	Unit	Unit Cost	Total Unit	Total Cost
<u>Demolition</u>				
Curbs, concrete, reinforced	LF	\$ 5.49	350	\$ 1,921.50
Pavement removal, bituminous road, 6" thick	SY	\$ 5.50	3230	\$ 17,765.00
Sidewalk, concrete, reinforced	LF	\$ 10.00	500	\$ 5,000.00
Utility Pole	EA	\$ 175.00	2	\$ 350.00
Retaining wall, concrete, reinforced	CY	\$ 81.50	100	\$ 8,150.00
Shrubs	allow	\$ 3,500.00	1	\$ 3,500.00
Fencing, panel, aluminum	SF	\$ 3.50	3500	\$ 12,250.00
Existing street lights and poles, save for resale	allow	\$ 3,400.00	1	\$ 3,400.00
 <u>Sitework</u>				
<b>Excavation and Backfill</b>				
Excavating, mobilization, earthmoving equip	CY	\$ 2.21	1350	\$ 2,983.50
Excavating, soil, medium grade	CY	\$ 5.80	1567	\$ 9,088.60
Hauling, 6 CY truck, 4 mile round trip	CY	\$ 11.30	230	\$ 2,599.00
Manual, excavation, hand	CY	\$ 18.90	15	\$ 283.50
Erosion control, silt fence	LF	\$ 0.91	780	\$ 709.80
Backfill, common earth	CY	\$ 1.09	320	\$ 348.80
Backfill, stone, structural	CY	\$ 3.55	160	\$ 568.00
Compaction, wheel roller, common fill	CY	\$ 2.90	320	\$ 928.00
Compaction, wheel roller, select fill	CY	\$ 2.15	500	\$ 1,075.00
Lawn and Grass	SY	\$ 0.44	21300	\$ 9,372.00
 <b>Storm Sewer</b>				
Trenching, piping and manholes	CY	\$ 95.00	140	\$ 13,300.00
Concrete piping, 15 inch, underdrain	LF	\$ 24.00	200	\$ 4,800.00
Culver, concrete piping including retaining bulkhead	EA	\$ 2,800.00	1	\$ 2,800.00
Catch basin, including footing, frame and cover	EA	\$ 4,210.00	1	\$ 4,210.00
Back fill including soil and gravel	CY	\$ 125.00	150	\$ 18,750.00
 <b>Bases, Ballasts and Pavement</b>				
Base Course, crushed 3/4", 6" deep	SY	\$ 5.09	750	\$ 3,817.50
Asphalt concrete pavement, roads	SY	\$ 14.50	615	\$ 8,917.50
Asphalt concrete pavement, parking lot	SY	\$ 4.27	520	\$ 2,220.40
Pavement markings, thermoplastic	LF	\$ 2.30	950	\$ 2,185.00
 <b>Curb and Gutters (Road and Guard Station)</b>				
Steel forms, straight	LF	\$ 12.80	1100	\$ 14,080.00
Concrete, 3000 psi, 3-#4 bars	CY	\$ 286.00	120	\$ 34,320.00
 <b>Sidewalk, Concrete</b>				
Concrete, 3000 psi, 6x6 - W1.4 mesh, 6" thick	SF	\$ 7.08	320	\$ 2,265.60
 <b>Masonry unit pavers, pedestrian walk</b>				
	SF	\$ 10.75	240	\$ 2,580.00
 <b>Fence and Gates, Industrial including</b>				
<b>2" Post @ 10' O.C., cable braced, set in concrete,</b>				
<b>10' High, 6 ga. Wire, Aluminized steel</b>	LF	\$ 84.00	450	\$ 37,800.00

	Unit	Unit Cost	Total Unit	Total Cost
<b>North Masonry/Concrete Metal Fence</b>				
Industrial grade fencing including 2" post @ 10' O.C., cable braced set into reinforced concrete wall, 6' High 6 ga. Wire, aluminized steel	LF	\$ 64.00	225 \$	14,400.00
<b>Crash-proof barrier gate, mechanical</b>	EA	\$ 32,000.00	2 \$	64,000.00
<b>Retractable Bollards</b>	3 Per	\$ 44,000.00	2 \$	88,000.00
<u>Concrete</u>				
<b>RETAINING WALL</b>				
Expansion joint, polyurethane, rigid	LF	\$ 7.65	25 \$	191.25
Concrete Planter-retainer wall, 3500 psi, incl forms	CY	\$ 287.00	12 \$	3,444.00
<b>North Masonry Fence Coping</b>				
Cast-in-place reinforced fence coping	CY	\$ 225.00	3 \$	675.00
<b>GATEHOUSE</b>				
Footings, strip, 18" x 9", reinforced	CY	\$ 242.00	3 \$	726.00
Slab, floor, on grade, #6 W1.4 reinforced, 6" thick	SF	\$ 3.32	4 \$	13.28
<b>GATEHOUSE</b>				
Floor slab, reinforced	CY	\$ 242.00	3 \$	726.00
<u>Masonry</u>				
<b>Masonry (Gatehouse)</b>				
Brick, veneer, face, standard modular with 8" concrete masonry unit back-up	SF	\$ 25.05	420 \$	10,521.00
Masonry cleaning, brush and wash, minimum	SF	\$ 0.85	420 \$	357.00
<b>North Masonry/Concrete Fence</b>				
Solid brick retaining wall including concrete footing	CF	\$ 45.00	164 \$	237,600.00
<u>Metals (Gatehouse)</u>				
Lintel, window, steel angle, 9' long	EA	\$ 68.50	4 \$	274.00
Lintel, door, steel angle, 4'-6" long	EA	\$ 32.00	2 \$	64.00
<u>Wood (Gatehouse)</u>				
Roof, truss, 2 x 8, 16" o.c. with 5/8" plywood sheathing	SF	\$ 4.50	800 \$	3,600.00
Top plate, double, 2 x 6, treated	LF	\$ 4.86	65 \$	315.90
<b>CASEWORK</b>				
Counter	LF	\$ 85.00	16 \$	1,360.00
Cabinets including base and wall mount	LF	\$ 225.00	15 \$	3,375.00
<u>Thermal and Moisture Protection (Gatehouse)</u>				
<b>INSULATION</b>				
Insulation, batt, ceiling, R30	SF	\$ 1.15	600 \$	690.00
<b>ROOFING</b>				
Metal, standing seam	SF	\$ 9.50	600 \$	5,700.00
Vapor barrier, felt, #15	SF	\$ 1.85	620 \$	1,147.00
Cornice incl. fascia, soffit and frieze, sheet metal	LF	\$ 22.35	65 \$	1,452.75
<b>ROOF DRAINAGE</b>				
Downspout, metal, copper, 16 oz.	LF	\$ 12.10	22 \$	266.20
Guttering, metal, copper, 16 oz	LF	\$ 8.75	62 \$	542.50

	Unit	Unit Cost	Total Unit	Total Cost
SEALANTS				
Polyurethane, gun grade, exterior exposure	LF	\$ 3.15	320	\$ 1,008.00
<u>Doors and Windows (Gatehouse)</u>				
DOORS				
Entrance, aluminum frame and door, 3' x 7'	Opng	\$ 1,450.00	2	\$ 2,900.00
Hardware, door, entrance	Opng	\$ 2,100.00	2	\$ 4,200.00
WINDOWS				
Exterior, aluminum, commercial grade, fixed	SF	\$ 28.00	120	\$ 3,360.00
GLAZING				
Glass, polycarbonate content, bullet-proof	SF	\$ 40.00	120	\$ 4,800.00
<u>Finishes (Gatehouse)</u>				
GYPSUM BOARD CEILINGS AND WALLS				
5/8" gypsum board, taped and finished, ceiling	SF	\$ 2.95	620	\$ 1,829.00
5/8" gypsum board, taped and finished, walls incl. furring	SF	\$ 3.25	310	\$ 1,007.50
TILE, CERAMIC, RESTROOM				
Porcelain tile, floor, 2"x2" mud set	SF	\$ 9.10	120	\$ 1,092.00
Walls, interior, thin set, 4-1/4"x1-1/4" tile	SF	\$ 6.10	250	\$ 1,525.00
TILE, RESILIENT				
Vinyl composition, 12"x12", floor tile	SF	\$ 2.80	350	\$ 980.00
PAINTING				
Interior, gypsum walls and ceilings	SF	\$ 0.72	620	\$ 446.40
Interior, concrete masonry units	SF	\$ 1.10	750	\$ 825.00
<u>Special Construction</u>				
<b>Sentry Booth</b>	EA	\$ 24,000.00	1	\$ 24,000.00
<b>Metal Canopies (2 Total)</b>				
Spread Footings	CY	\$ 275.00	5.3	\$ 1,457.50
Cylinder Concrete Columns	CY	\$ 385.00	8.4	\$ 3,234.00
W6 x 9 Steel Beams	LF	\$ 14.75	53	\$ 781.75
W10 x 21 Steel Columns	LF	\$ 26.50	136	\$ 3,604.00
Space Frame Roof Structure	SF	\$ 26.50	1840	\$ 48,760.00
Corrugated Roof Decking	SF	\$ 3.55	1875	\$ 6,656.25
3/4" Stainless Steel Tension Cable	LF	\$ 8.50	75	\$ 637.50
Lighting, 400 Watt, Metal Halide	EA	\$ 725.00	30	\$ 21,750.00
<u>Plumbing (Gatehouse)</u>				
Single occupant restroom including all associated plumbing and fixtures	Allow	\$ 8,500.00	1	\$ 8,500.00
<u>Heating, Ventilation and Air Conditioning (Gatehouse)</u>				
Complete heating, ventilation and air conditioning system	Allow	\$ 15,000.00	1	\$ 15,000.00
<u>Electrical (Gatehouse)</u>				
Complete electrical system including power, lighting, and devices	Allow	\$ 18,750.00	1	\$ 18,750.00
Reinstall existing street lights	Allow	\$ 17,000.00	1	\$ 17,000.00

Subtotal	\$ 865,883.48
Contractor G&A @ 15%	\$ 129,882.52
Contingency @ 5%	\$ 43,294.17
Surveys, tests, permits	\$ 28,000.00
Architect/Engineer Fees	\$ 133,000.00
<b>Total</b>	<b>\$ 1,200,060.18</b>

**APPENDIX 3**  
**ARCHEOLOGICAL INVESTIGATIONS**



## **INTRODUCTION – INSTALLATION A**

On 23 July 2003, Hardlines Design Company (HDC) performed a reconnaissance survey at Installation A. The project area is a flat, manicured grass lawn that measures approximately 120 feet (37 meters) by 181 feet (55 meters), and is located immediately west of Entrance 1 and south of Avenue D within the installation proper. A linear planting bed runs parallel to Avenue C to the east, and there is a fence line south of the project area (Figure 3-1). The project area was investigated as part of an Antiterrorism/Force Protection Study (Map 2 on page B-20).



**Figure 3-1. Project area looking south.<sup>1</sup>**

## **METHODOLOGY**

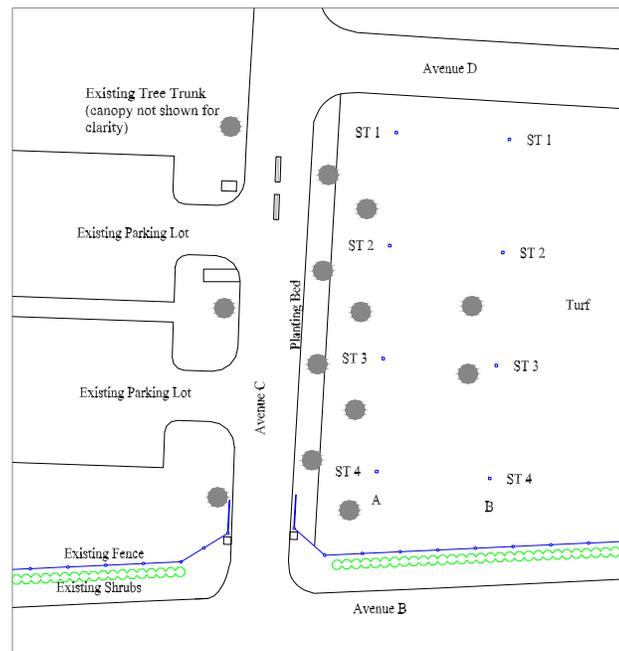
A visual inspection was conducted to assess the archeological potential of the project area as part of the reconnaissance survey. During the visual inspection, HDC noted the presence of several large trees and a sanitary cleanout within the project area. After viewing utility maps supplied by the installation, HDC was also aware of a sanitary main that runs north-south (Figure 3-2).

The reconnaissance survey was performed in accordance with the *State Standards and Guidelines for Archaeological Surveys* (2001). All shovel test units (STUs) were 1 x 1 feet (30 x 30 cm) in size and were excavated until subsoil was reached, or to a depth of approximately 2 feet (80 cm). The field crew halted excavation once disturbed soils were uncovered, or when excavation reached 4 inches (10 cm) into sterile subsoil. The STUs were excavated according to stratigraphy, and the soils were recorded according to a *Munsell Soil*

---

<sup>1</sup> The resolution of all photos has been digitally enhanced.

*Color Chart* (2000). The field team photographed a representative sample of the STUs. All artifacts were recorded according to the stratigraphy from which they were recovered, the timeframe of the artifact (prehistoric, historic, or modern), and the artifact type and material (e.g., clear glass fragment, unidentified metal item, plastic, etc.)



**Figure 3-2. Project area with transects and shovel test locations.**

## **RESULTS**

Two parallel transects were placed 15 meters apart across the long axis of the project area, and STUs were excavated along the transects at 15-meter intervals, for a total of eight STUs (Figure 3-2). Transect A began 20 feet (6 meters) east from the planting bed, and extended north to south from the curb of Avenue D to the fence line. The first STU on Transect A was 16 feet (5 meters) south from the curb of Avenue D. The following STUs on Transect A were placed 50 feet (15 meters) apart. There were a total of four STUs on Transect A. Transect B was placed 50 feet east of Transect A, and the first STU on Transect B began 16 feet from the curb of Avenue D, and succeeding STUs were placed at 50-foot intervals. There were a total of four STUs on Transect B.

Of the eight STUs excavated, five were positive for cultural debris, including glass, plastic, and brick. HDC determined that the debris were associated with modern use of the area, and originated from either the installation of the north-south sanitary main or the landscaping of the project area. The following table lists the modern materials recorded and their proveniences (Table 3-1).

**Table 3-1. Modern Materials Observed from Transect A and B.**

<b>STU</b>	<b>Strat.</b>	<b>Depth (cm BS)</b>	<b>Modern Materials</b>
A-3	I	0–10	Two clear bottle glass fragments
B-1	II	14–32	One rebar, two brick fragments, four clear glass fragments, one plastic item
B-2	I	0–12	One small brown glass fragment
B-3	II	12–24	One clear glass fragment
B-4	II	15–32	One small clear glass fragment

The modern materials from approximately 0–4 inches (10 cm) below surface in the STUs (the sod layer) related to discarded rubbish, construction of adjacent buildings, and landscaping of the project area. The soil between 4–20 inches (10–50 cm) below surface, where most of the modern materials were observed, was determined to be a disturbed fill of clayey loam associated either with the landscaping or the installation of the north-south sanitary line (Figure 3-3). The fill was most evident in STU A-3, which was excavated near the sanitary cleanout.



**Figure 3-3. East profile of STU A-1.**

## **CONCLUSION**

The reconnaissance survey of Installation A did not result in the discovery of any significant archeological resources. Visual inspection and subsurface testing demonstrated that landscaping and the sanitary main installation has substantially modified the project area. The STU excavations uncovered modern materials in disturbed soil contexts. The project area therefore has very low potential for any future discovery of significant archeological resources.

## **INTRODUCTION – INSTALLATION B**

On 24 July 2003, Hardlines Design Company (HDC) performed an archeological reconnaissance survey at two areas within Installation B. The project areas are at Entrances 1 and 2, and were undertaken as part of an Antiterrorism/Force Protection study (See Map 15 on page C-17).

## **METHODOLOGY**

A visual inspection was conducted to assess the archeological potential of the project area as part of the reconnaissance. It was determined that formal transects could not be used because of heavy historic and modern modification of the project area over the last 100 years. STUs were instead placed at locations that were deemed to have undergone minimal prior disturbance, and where encounter with subsurface utility lines was unlikely. The STUs were excavated to determine the extent of disturbance and to assess archeological potential within the project area.

The reconnaissance survey was performed in accordance with the *State Standards and Guidelines for Archaeological Surveys* (2001). All STUs were at least 1 x 1 feet (30 x 30 cm) in size and were excavated until a culturally sterile subsoil was reached, or until a depth of approximately 2 feet (80 cm) was attained. The field crew also halted excavation if disturbed soils were identified, or once excavation reached 20 cm below the level of the last artifact found in the subsoil. The STUs were excavated according to stratigraphy, and the soil colors were recorded with a *Munsell Soil Color Chart* (2000). All of the STUs were photographed. All artifacts were recorded according to the soil provenience from which they were recovered, the temporal context of artifact (prehistoric, historic, or modern), and the artifact type and material (e.g., clear glass fragment, unidentified metal item, plastic, etc.)

## **ENTRANCE 2**

This entrance is the location of the original base entrance at the northeastern section of the historic district. The project area covers approximately 138,000 square feet (12,821 square meters), or approximately 3 acres (Figure 3-4). Three historic buildings are located inside the project area: Buildings 1, 2, and 3. Building 3 is the only one of the three that is listed in the historic district (Figures 3-5, 3-6, and 3-7).



**Figure 3-4. Entrance 2 project area looking east.<sup>2</sup>**



**Figure 3-5. Building 3, built in 1893.**

---

<sup>2</sup> The resolution of all the photos was digitally enhanced.



**Figure 3-6. Building 2, built in 1918.**



**Figure 3-7. Building 1, built in 1918.**

In addition to the historic buildings, the project area is heavily landscaped and features paved sidewalks, subsurface utility lines, and planting beds. In addition, photographs show that the project area has been heavily used since the 1890s (Figures 3-8 through 3-11). A map from approximately the 1980s shows that a large building once stood inside the project area, but this structure has since been demolished (Figure 3-12).



**Figure 3-8. Entrance 2, 1890s.<sup>3</sup>**



**Figure 3-9. Entrance 2, 1918.**

---

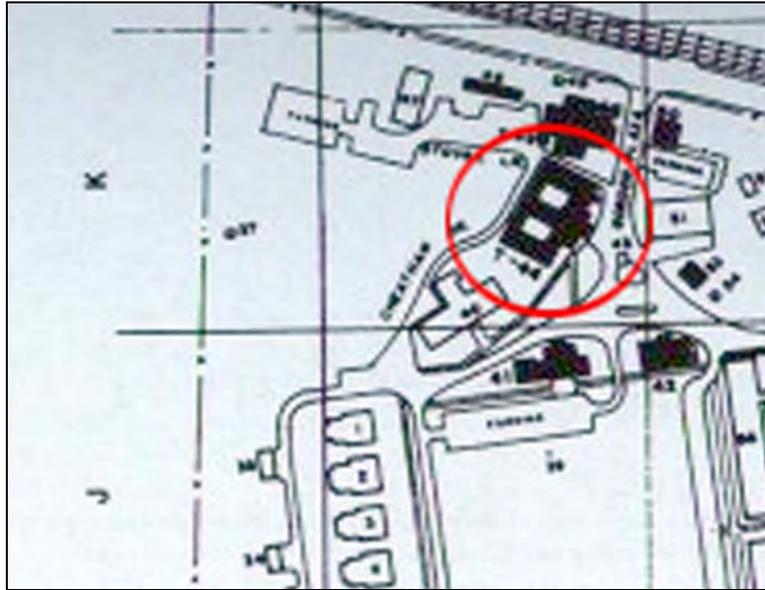
<sup>3</sup> Figures 3-8 through 3-12 were digitally scanned from Morton (2001). The resolution of all figures was enhanced, and the contrast levels were altered to improve clarity. Figure 3-8 of this report corresponds with figure 6 on page 14 of Morton (2001); 3-9 with figure 14 on page 27; 3-10 with figure 40 on page 48; 3-11 with figure 49 on page 74; and 3-12 with figure 70 on page 144.



**Figure 3-10. Entrance 2, 1935.**

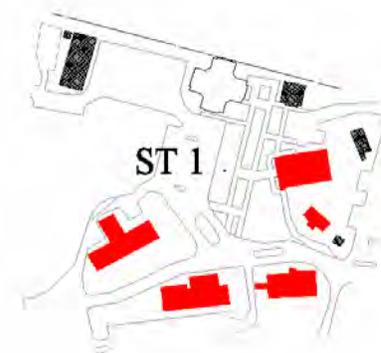


**Figure 3-11. Entrance 2, 1950.**



**Figure 3-12. 1980s map showing building (circled in red) that was once located at Entrance 2.**

Only one STU could be placed because of the heavy modifications and paving of the project area. This STU was situated on a manicured grass meridian between a pedestrian walkway and a parking lot (Figure 3-13). The STU revealed a soil that consisted of sandy fill mixed with assorted materials, including unsorted rocks, gravel, and chunks of asphalt to a depth of 17 inches (42 cm) (Figure 3-14). The materials were most likely the result of landscaping and previous episodes of construction and demolition in the project area. No prehistoric or historic period artifacts were present.



**Figure 3-13. Location of STU 1.**



**Figure 3-14. Disturbed north profile of STU at Entrance 2.**

## **ENTRANCE 1**

Entrance 1 is located outside the historic district in the north section of the base. The project area covers approximately 170,000 square feet (15,794 square meters), or approximately 4 acres (see Map 17, page C-19). Two buildings, Building 4 and the sentry booth, are located inside the project area. Both of these structures are of contemporary design (Figures 3-15 and 3-16). Today, the Entrance 1 thoroughfare is closed.



**Figure 3-15. Building 4.**



**Figure 3-16. Entrance 1, looking north with existing sentry booth.**

Like the area around Entrance 2, the project area is heavily landscaped and built-up. This area has also been paved, and subsurface utility lines have been installed (note pavement in Figures 3-15 and 3-16). An undated map published by Morton (2001:39) showed three buildings on the project site: Building 4, the sentry booth, and an unidentified building that was once located across the street from Building 4 (Figure 3-17). No other information has been found about the unidentified building, and only architectural debris and remnants of its foundation remain (Figure 3-18).



Figure 3-17. 1980s map showing building (circled in red) that was once located at Entrance 1.<sup>4</sup>

---

<sup>4</sup> Figure 3-17 was digitally reprinted from Morton (2001). The resolution and contrast levels were modified to increase image clarity. Figure 3-17 of this report corresponds with figure 31 on page 39 in Morton (2001).



**Figure 3-18. Remnants of building at Entrance 1.**

Two STUs were placed southwest of Building 4 and Entrance 1, in a manicured grass lawn (Figure 3-19). Trees, three water utility main openings, a light pole, and other structures related to the drainage system are located on this lawn. No other information is known about this area (Figure 3-20). Landscaping, subsurface utility installation, and road construction appear to have extensively modified the grassy area.



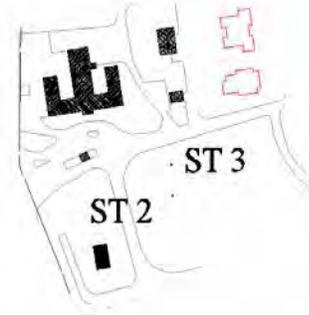
**Figure 3-19. Water main openings south of the project area.**



**Figure 3-20. Entrance 1 grass lawn where the two STUs were placed.**

The first STU was placed in the flattest area of the grass lawn (Figure 3-21). No artifacts were found, but charcoal flecks were noted at a depth of approximately 6 inches (36 cm) below surface (Figure 3-22). The soils reflect modification, most likely from landscaping. The second STU was placed about 215 feet (20 meters) east of the first STU, near the base of

the slope from Entrance 1. Road gravel was observed 8 inches (20 cm) below surface before subsoil. The soils indicate disturbance from road construction (Figure 3-23).



**Figure 3-21. Location of STU's.**



**Figure 3-22. North profile of STU 1 at Entrance 1.**



**Figure 3-23. North profile of STU 2 at Entrance 1.**

## **CONCLUSION**

Results of the reconnaissance survey indicate that both project areas exhibit significant soil disturbance as a result of more than 100 years of construction activity and landscape modifications on post. Based upon visual inspection, historic photographs, and the results of shovel testing, the Entrance 1 and Entrance 2 project areas have very low potential for any intact archeological resources.

## **REFERENCES**

Morton, Ronald

2001 *Installation B The First Hundred and Sixteen Years 1885-2001*. Installation B.

Munsell Soil Color Charts

2000 *Munsell Soil Color Charts*. GretagMacbeth, New Windsor, New York.

State Council of Professional Archaeologists

2002 *State Standards and Guidelines for Archaeological Surveys*. State Council of Professional Archaeologists, State.