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Office of Construction & Facilities Management
Office of Facilities Planning
Facilities Standards Service



National Cemetery Administration

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designguide

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1.0 INTRODUCTION

1.1. FOREWORD

The goal of the Design Guide is to facilitate the design process and ensure excellent quality, effectiveness, efficiency, and consistency of VA facilities while controlling the construction and operating costs of the National Cemetery Administration (NCA).

This Design Guide supplements current VA guides, technical manuals, and other VA criteria with specific NCA criteria. The use of this Design Guide does not preclude the need for a tailor-made functional and physical design program for each particular project. The Project Architect / Project Engineer's responsibility is to develop a complete and accurate project design that best meets the users' needs and applicable VA NCA standards, criteria, and applicable code requirements.

The material contained in the NCA Design Guide is the culmination of a partnering effort within the National Cemetery Administration, Design and Construction Service (DCS) and Department of Veterans Affairs, Construction & Facilities Management (CFM).

This document replaces the National Cemetery Design Guide, Chapters 1-4 dated June 1999 and Chapter 5 dated November 2016.



1.2. DESIGN GUIDE INTRODUCTION

The National Cemetery Administration Design Guide was developed as the master reference document for planning and designing Department of Veteran's Affairs, National Cemetery Administration (NCA) facilities. NCA's facilities are of significant importance to our nation. NCA's mission is to honor Veterans and their eligible family members by providing final resting places in national shrines. VA NCA National Cemeteries commemorate veterans' service and sacrifice to our nation. The development of national cemeteries dates back to the civil war, and a significant number of cemeteries are listed in the Nation Register of Historic Places.

This Design Guide is not intended to be project-specific. It addresses the general functional and technical requirements of the facilities required to support NCA operations. While this Guide incorporates strategies to address adaptability, it is not possible to foresee all future needs. The project-specific Program for Design (PFD) is the basis for an individual project design.

The NCA Design Guide includes graphic consolidation of data from existing VA standards and criteria. Refer to *PG-18-3 Design and Construction Procedures, Topic 1* (<https://www.cfm.va.gov/TIL/cPro.asp>) for the latest editions of the codes and standards adopted by VA as a minimum for all projects performed, including the modernization, alteration, addition, or improvement of its real property and the construction of new structures. VA Design Manuals and Master Specifications specify other codes and standards that VA follows on its projects.

The project A/E shall read and be familiar with the most current editions of the applicable codes, standards, guides, and manuals. This Design Guide refers to the sources mentioned above for more detail on VA NCA design standards and criteria. These sources can be accessed at the VA Office of Construction and Facilities Management's *Technical Information Library (TIL)* (<https://www.cfm.va.gov/TIL/>).

This Design Guide does not supersede the project A/E's responsibilities to develop a complete and accurate design that meets the user needs and applicable code requirements.



2.0 GENERAL PLANNING CONSIDERATIONS

2.1. MISSION AND BACKGROUND

The mission of the National Cemetery Administration (NCA) is as follows: to provide burial space for veterans at Department of Veterans Affairs national cemeteries; to provide headstones and markers for veteran graves; to provide Presidential Memorial Certificates; to administer the State Cemetery Grants Program assisting states in building or improving state-owned cemeteries for veterans.

2.2. NCA TRENDS

Service Area Expansion: NCA aims to expand the existing service area to a national cemetery within a 1-hour drive of major populated centers.

2.3. OPERATIONAL ASPECTS

Each National Cemetery is managed by VA National Cemetery Administration (NCA) personnel conforming with national and area office policies, priorities, goals, and objectives. At most cemeteries, there is a staff of administrative and maintenance personnel under the supervision of a cemetery director.

National cemeteries commonly open from 8:00 a.m. to 5:00 p.m. daily and on Memorial Day from 8:00 a.m. to 7:00 p.m. Generally, Interment Service corteges are received from 9:00 a.m. to 3:00 p.m., Monday through Friday. Burials at national cemeteries do generally not occur on weekends or Federal holidays.

Many national cemeteries are remotely located from the people they serve, requiring Interment Service visitors to travel long distances. A Public Information Center with Cortège Assembly Area may be situated near the main cemetery entrance to provide a central point for vehicles joining an Interment Service procession to assemble and receive final instructions before proceeding to a Committal Service Shelter for an Interment service. The Public Information Center is usually occupied by cemetery personnel or volunteers. Cemetery visitors can obtain gravesite locator information there, and Public Rest Rooms are also often located there.

The Public Information Center and Rest Rooms should be near the main entrance to the cemetery and adjacent to the Cortège Assembly Area. Committal Service Shelters and Administration/Maintenance Complex should be centrally located on the site.

Contractors providing miscellaneous services to the cemetery usually require storage space within the Administration/Maintenance Complex. This complex should be located away from burial areas or shielded from view.



2.4. FUNCTIONAL CONSIDERATIONS

The functions of a national cemetery include the operation and maintenance of all aspects of the cemetery. National cemetery directors and staff verify eligibility for burial and schedule the time and date of Interment Services. They attend funerals, gravesite care, overall cemetery appearance and host ceremonies on Memorial Day, Veterans Day, and other special occasions. Cemetery facility users are typical:

- Interment Service attendees,
- Visitors,
- Cemetery staff, and visiting VA staff,
- Volunteers, who provide honors at interment services and assist cemetery staff in administration and maintenance activities,
- Contractors who provide maintenance and construction, sales representatives, and vendors

2.4.1. SPACE PLANNING

Program for Design: Refer to *VA Space Planning Criteria (PG-18-9), Chapter 701 & 703 - National Cemetery Administration (<https://www.cfm.va.gov/til/space.asp>)* for net square footages. The Program for Design (PFD) for a specific project varies according to facility Net Square Feet (NSF), Facility Management Systems (FMS) systems and equipment, and the size and scope of the cemetery mission. The design A/E is responsible for accommodating the project's specific program for design and functional requirements.

Space planning criteria have been developed based on cemetery activities in functional areas. These criteria are predicated on established and anticipated best practice standards.

Quantities and sizes of spaces required in the Reception Area, Administrative Areas, Staff Lounge, Lockers, Restrooms, and other functional areas are determined by working with on-site staff and VA NCA stakeholders.

Gravesite Planning: NCA Cemetery Operations track cemetery gravesite usage numbers on a cemetery-by-cemetery basis. The numbers identify when each gravesite type is depleted. Cemetery capacity should be analyzed during the master planning process. Specific information may be obtained from the Project Manager.

2.5. FUNCTIONAL AREAS

A Functional Area is the grouping of rooms and spaces based on their function within the cemetery. There are seven (7) Functional Areas, identified as follows:

- FA1, Entrance Area
- FA2, Public Information Center Area



- FA3, Administrative Area
- FA4, Interment Areas
- FA5, Memorial / Donations Area(s)
- FA6, Maintenance Area(s)
- FA7, Honor Guard Area

All functional areas are critical to the cemetery's mission. All functional areas include specific criteria and requirements such as roads, utilities, landscaping/ irrigation, and site furnishings. Refer to the Technical Requirements section of this guide for additional information.

2.5.1. FA1, ENTRANCE AREA

The Entrance area is located at the entry to the cemetery to accommodate visitors and staff. It includes:

- Entrance Road
- Main Entrance Gateway
- Main Cemetery Signage
- Decorative Fence
- Decorative Gate
- Wayfinding
- Avenue of Flags

2.5.2. FA2, PUBLIC INFORMATION CENTER AREA

The Information Center Area includes the necessary support functions to receive visitors and stage Interment Service processions. This functional area shall consist of:

- Public Information Center
- Public Rest Rooms
- Visitor Parking (Pull-off)
- Cortège Assembly Area (Parallel Parking Lanes)
- Gravesite Locator

Smaller National Cemeteries may not have a physical Public Information Center (PIC). Whether a PIC is needed should be determined at the planning/design stage. If there is no physical PIC, a standalone gravesite locator is required for cemeteries lacking a Public Information Center Building. This gravesite locator must be protected from the weather and updated as interments occur.



A. Public Information Center

The following spaces are to be located within the Public Information Center.

- Lobby
- Telephone Reception/ Cortege Control
- Public Restrooms
- Storage
- IT Server Room
- HVAC and Electrical Equipment
- Gravesite Locator

2.5.3. FA3, ADMINISTRATIVE AREA

Administrative areas are combined or distinct areas for cemetery operations, NCA staff, and services contractors.

Commonly, a combined Public Information Center and Administration Complex have been used to accommodate staff workstations (in offices or cubicles), Staff conference and workrooms, multipurpose areas for training classroom or conference room, spaces for office equipment, and storage of files, forms, supplies, training materials, and housekeeping aides. This functional area may include:

- Lobby
- Multipurpose Room
- Office, Cemetery Director
- Office, Assistant Cemetery Director (as required)
- Office, General
- Operations Center
- Staff and Public Toilets
- Copy Room
- General Storage
- File Storage
- IT Server Room
- Lunchroom / Lounge & Vending
- HVAC and Electrical Equipment
- Staff and Operations Vehicle Parking

2.5.4. FA4, INTERMENT AREA

The interment area serves as the primary function of the cemetery. This functional area may include:



- Casketed Remains
 - Traditional Gravesites
 - Pre-placed Crypts
- Cremated Remains
 - Columbarium
 - In-ground Cremains
- Memorial Walls with or without ossuaries
- Committal Service Shelter
- Green burial sites (at some cemeteries)
- Scatter garden (at some cemeteries)

2.5.5. FA5, DONATIONS & ASSEMBLY AREA

A separate and distinct area from interment areas for reflection, ceremony, and the collective display of memorials donated by various recognized veterans' groups. This functional area may include:

- Memorial Walkway / Donations Area
 - Veterans Memorials (Private Organizations)
 - Carillon Tower
 - Rostrum
- Flag/ Assembly Area

2.5.6. FA6, MAINTENANCE AREA(S)

Maintenance areas are separate for cemetery maintenance operations. These areas may need to be separated or duplicated in multiple locations due to each cemetery's unique size, layout, and function.

A. Maintenance and Storage Area

Maintenance and Storage Area accommodates staff work areas and activities related to all cemetery operations. Areas shall be provided to accommodate staff breakroom, toilets, and lockers. This functional area may include:

- Lounge
- Locker Rooms with shower
- Restrooms
- Boot Vestibule
- Maintenance Office
- Mechanic's / Clerk's Desk
- Workshop(s)



- Vehicle & Equipment Maintenance
 - Routine Maintenance Bay
 - Heavy Maintenance Bay
- Parts and Tools storage
- Maintenance Yard
- Vehicle Wash
- Loading Dock
- Fuel Storage Tanks & Pumps
- Hazardous Material Storage
- Pesticide Storage, Mixing, & Loading
- Vehicle, Equipment, and Materials Storage
 - Unsheltered
 - Sheltered
 - Enclosed
- Headstone Storage
- Grave Liner storage
- Sand, Gravel, and Materials Storage

Special Requirements: Special requirements must be evaluated and applied on a per-project basis.

2.5.7. FA7, HONOR GUARD AREA

The Honor Guard area accommodates volunteer honor guard members and equipment. This functional area may be provided in the Public Information Center, within the Administrative Area, or as a standalone building, as specified per planning factors. Space includes:

- Locker rooms
- Firearms storage
- Lounge area

2.6. FUNCTIONAL RELATIONSHIPS

Organizational Concepts: The Functional Diagrams in Section 23 of this document respond to functional, organizational, adjacency, and operational issues. They should not be interpreted as preliminary floor plans or site plans.



2.7. FUNCTIONAL AREA PLANNING DESCRIPTIONS / CONSIDERATIONS

2.7.1. FA1, ENTRANCE AREA

A. Main Entrance

The primary objective of a national cemetery's main entrance area is to create a sense of arrival at a national shrine. The Main Entrance shall include hardscape and landscape features that portray the significance and dignity of the national cemetery. The design shall incorporate trees and include colorful plantings. The entrance area design and use of materials shall align with the historical context and elements of the existing cemetery and the character of regional architectural features, and the current cultural landscape.

Main cemetery entrances typically provide a means to restrict vehicle access during certain times. Depending on the location and size of the cemetery, gates or chains are used to control vehicle access. A median is typically included in the main entrance gate design and may continue down the roadway. Curbs or other barriers are to be provided to keep cars on the roadway. Changes in color and texture of paving are encouraged to provide a feeling of transition for visitors arriving at or departing from the cemetery.

B. Entrance Road

The entrance "boulevard" is a road divided by a median; the median length varies depending on available space. Preferably, the median runs the entire length of the entrance boulevard. Each side of the boulevard supports one-way traffic and includes a passing lane. When entrance boulevards are used as Interment Service Cortege Assembly Areas, they must be long and wide enough to accommodate parked cars cued up for Interment Services without blocking access to the cemetery.

C. Avenue of Flags

Cemeteries shall include an "avenue of flags" where donated American burial flags are displayed on special days. The entrance boulevard is typically utilized for the avenue of flags.

2.7.2. FA2, PUBLIC INFORMATION CENTER

A. Public Information Center

The Public Information Center is for Visitors, includes public restrooms, has a sheltered outdoor area and committal service orientation. Public rest rooms shall be directly accessible from the outside and separate from the general indoor reception area. A gravesite locator may be placed indoors or in a sheltered outdoor area. The building includes a public reception area



occupied by cemetery staff or volunteers to assist visitors. The reception area shall consist of securable counter space or desk for personnel. Veteran and cemetery-related historical items are displayed in the reception area. The reception area must include a telephone for visitors and staff to communicate directly with the administrative office. The Public Information Center must also be connected to the Administration and Maintenance Complex IT network.

Visibility and accessibility of the Public Information Center from the main entrance boulevard are required. The Public Information Center is a visitor orientation and information facility and should serve the public before cemetery activities. The facility must be located adjacent to the Cortège Assembly Area. The building and outdoor space should be constructed of durable materials and finishes that require little maintenance. The structure shall have a residential scale and a non-institutional character.

(1.) Lobby

Provides public reception, waiting, and information for visitors and Interment Service parties; Receptionist(s) greets visitors, Interment Service parties; Dispenses information, handout maps

Users – Interment Service Parties; Cemetery Visitors; Receptionist (Personnel assigned to this area as needed; may be staffed by volunteers).

Interior Design / Furniture – Minimal visitor seating, in small grouping(s); Lounge seating should not be crossed with major circulation routes; Circulation control for all building functions; Character of the space should be non-institutional. Receptionist workstation at 750 mm (30") desk height with the surface for visitors at a 1050 mm (42") height; workstation may be free-standing or built-in.

Special Requirements – Provide a public image for the cemetery and the National Cemetery Administration. The scale, volume, and parts must create a significant space that invites and welcomes the public. Walls and display cases for veteran memorabilia. Possible display location of Great Seal of the U.S. and possible display location of service seals, if not in assembly area or committal service shelter.

(2.) Reception / Cortège Control

The reception area provides temporary administrative space for the public reception and cortège lane control.

Users – Interment Service Directors, Interment Service Parties, and Cemetery Visitors.

Interior Design / Furniture – Counter height writing surface.

Special Requirements – Telephone having direct connections to the Administrative/Maintenance Complex as well as a public telephone in the vicinity.



B. Public Rest Rooms

The public restrooms are part of the Public Information Center. The rest rooms should have durable, easy to clean and maintain interior finishes for heavy public use. Provide separate male and female facilities also provide a family restroom where space and budget permit. The capacity of the rest rooms, i.e., how many persons are accommodated in a specified time, is determined on an individual project basis. Future expansion of this area is a possibility. The location should provide easy pedestrian access to vehicle pull-off used for cortege assembly.

Users – Interment Service Parties; Cemetery Visitors.

Interior Design / Furniture – Housekeeping aids closet adjacent to rest rooms; Ceiling hung toilet partitions preferred.

Special Requirements – Lighting operated by motion detector switches (occupancy sensors).

C. Visitor Parking

Public Information Center visitors park in an area adjacent to the main entrance to the building; this parking must be distinctly separate from the Cortege Assembly Area.

Users – Cemetery Visitors

Special Requirements – Parallel pull-off along Entrance Boulevard; Flush curbing and walkway along pull-off; Location of Site Directory sign; Location of Floral Regulation/Visitor Information sign

D. Cortege Assembly Area

The Cortege Assembly Area is located adjacent to the Public Information Center, on or near the entrance road. It consists of one or more lanes for vehicles to line up before proceeding to a Committal Service Shelter. Access to the Public Information Center and rest rooms from the Cortege Assembly Area is imperative. Interment Service corteges average 30 vehicles with three (3) persons per vehicle.

Planning Factors:

The quantity of cortege lanes aligns with the number of committal service shelters; however, the number of committal service shelters shall not be the only determining factor. Factors such as future expansion projects and other elements shall be considered. Recently NCA designs have exceeded the criteria below to allow for future growth and accommodate areas with high veteran populations.



- One (1) cortege lane area is the preferred minimum. Older historic cemeteries may not meet this requirement due to space limitations. However, space should be analyzed to prevent the need to use the existing road system for assembly.
- Two (2) cortege lane areas are the preferred minimum for cemeteries, with two (2) or more committal service shelters allowing simultaneous services in the same time slot.
- Three (3) cortege lane areas are the preferred minimum for cemeteries with three (3) committal service shelters.
- Four or more cortege lane areas are reserved for large and active cemeteries with four or more committal service shelters.

Users – Interment Service Parties

Special Requirements – Location of Committal Service Status Board sign; Flush curbing and walkway along pull-off at Public Information Building; Separate from Visitor Parking

E. Gravesite Locator

One type of gravesite locator is a book stand that holds an 8-1/2" x 11" book-type listing of individuals interred in the cemetery and the corresponding gravesite numbers; this stand should accommodate public use of the document and protect it from the elements.

Another type of gravesite locator is an ATM-style electronic database that includes a keyboard and monitor. This gravesite locator is mounted in an interior or exterior wall or a free-standing cabinet in a lobby or reception area. Gravesite Locator is typically accessible at all times.

Typically, the gravesite locator is located within the layout of the Public Information Center; however, it may be a standalone kiosk if a building does not exist. The location varies based on the configuration of each cemetery.

Users – Cemetery Visitors

Special Requirements – Area sheltered from the weather, screened or shielded from glare / direct sunlight.

Book / Electronic Locator Equipment and Stand, if applicable, are provided by the NCA.

2.7.3. FA3, ADMINISTRATIVE AREA

The staff and administrative area house the offices, workspaces, and a personnel area for cemetery support staff and contractors involved in direct and indirect services to veterans, families, and other cemetery visitors. This function may be combined with the Public Information Center (PIC). When required, the building should have fire detection and security



systems. It should be constructed of durable building materials and have finishes that require little maintenance.

There are essential functional aspects that are common to all national cemetery administrative facilities. The design of cemetery structures shall align with regional architectural uniqueness and the local cultural landscape.

Flexibility is an essential consideration in the design. Changing workload can require additional or reconfigured administrative space. Personnel changes may also generate changes in office layout. The interior design should permit adaptation to change needs at minimal cost, without large-scale remodeling. The facility footprint design and siting of administration space should allow future expansion, primarily in the general office area.

The Public Information Center and Administration operations areas are viewed as complex and situated to encourage their interaction. They may be physically attached or located close to each other on the site in a way that facilitates the necessary exchange. Total integration of the building with the site is essential to keep the building from being a dominant cemetery feature. However, the administration area is not a place of regular visitor contact.

A. Staff and Administrative Area

Visitors enter the building through the "front door" and are greeted in the office adjacent to the general office. Areas open to the public include the director's office, the General Office, and the Multipurpose Room. A unisex toilet to serve the Administrative staff also serves infrequent use by visitors. The Operations Center is the hub of the office, containing shared office equipment and files. The staff and volunteers enter the administration building through the "back door," or employee entrance, adjacent to the employee parking lot. The Lunchroom should be isolated from public view and serve as the connector for Administration and Maintenance "wings."

Space planning criteria for National Cemetery administration buildings are addressed below. It provides the net square footage recommended to meet the needs of national cemetery buildings. The scope of work for a particular project should include the building program based on the cemetery workload staffing and the space planning criteria.

Cemeteries having less than one burial/day must be planned on an individual project basis.

Administrative Offices

Office, Director

- **1-6 burials/day** 13.9 NSM (150 NSF)
- **Over 6 burials/day** 18.6 NSM (200 NSF)

Office, Secretary (When staffed, workstation) 5.2 NSM (56 NSF)



General Office

**Office, Assistant Director/Administrative Officer
or Assistant (When staffed)** 9.3 NSM (100 NSF)

Workstations - Cemetery Representative, Clerk, Receptionist 5.2 NSM (56 NSF)
per person

(The receptionist workstation should be contiguous to the lobby. If a receptionist is not provided, one of the other workstations should be contiguous to the lobby to serve as a receptionist.)

IT Closet - Min. 10’x14’ 13 NSM (140 NSF)

Operational Center (includes ADP capability)

Consolidated center for communications filing, reference, reproduction, and storage supporting the administrative and general office staff requires.

- **1-6 burials/day** 18.6 NSM (200 NSF)

NOTE: 2.3-3.7 NSM (35-40 NSF) of the 18.6 NSM (200 NSF) may be allocated as a storage closet.

- **7-15 burials/day** 22.3 NSM (240 NSF)

NOTE: 7.4-9.3 NSM (80-100 NSF) of the 22.3 NSM (240 NSF) may be allocated as a storage closet.

- **Over 15 burials/day** 26.0 NSM (280 NSF)

NOTE: 7.4-9.3 NSM (80-100 NSF) of the 26 NSM (280 NSF) may be allocated as a storage closet.

Lunch Area with Kitchen Unit

- **1-6 burials/day** 4.2 NSM (45 NSF)

(Space is provided for a kitchen unit only.)

For cemeteries with 1-3 burials/day, the kitchen unit may be combined with the operational center, increasing the space to 22.8 NSM (245 NSF).

For cemeteries with 4-6 burials/day, the kitchen unit may be combined with the multipurpose room increasing the space to 18.1 NSM (195 NSF).

- **Over 6 burials/day** 15.3 NSM (165 NSF)

Storage - Cemetery Representatives' Uniforms 001.0 NSM (1 NSF) per
Cemetery
representative
(Minimum = 0.2 NSM
(2 NSF))

Provide a closet for Government-issued blazers, pants, and skirts for cemetery representatives.

Housekeeping Aides Closet 3.7 NSM (40 NSF)



Multipurpose Room

(Conference room, family room)

- **1-3 burials/day**

NOTE: The need for the room and the space required is determined on an individual project basis.

- **4-6 Burials/Day** 13.9 NSM (150 NSF)

(Will also function as lunchroom)

- **Over 7-15 Burials/Day** 18.6 NSM (200 NSF)

- **Over 15 Burials/Day**..... 26.0 NSM (280 NSF)

Lobby

- **1-6 Burials/Day** 22.3 NSM (240 NSF)

- **7-15 Burials/Day** 29.7 NSM (320 NSF)

- **Over 15 Burials/Day** 37.2 NSM (400 NSF)

Toilet (Wheelchair) 4.8 NSM (52 NSF)
 (Minimum 1,
 Maximum 2)

NOTE: The number of toilets required is determined on an individual project basis depending on the proximity of public toilet facilities to the administration building. These facilities are for use by staff and visitors as required.

(1.) Lobby

Users – Cemetery Visitors (non-Public); NCA Administrative Personnel

Interior Design / Furniture – Lounge seating

Special Requirements – Lounge seating should not be crossed with major circulation routes; Circulation control for all building functions; Provides a public image for the cemetery and the National Cemetery Administration; Character of the space should be non-institutional

(2.) Multipurpose Room

Users – Cemetery Visitors (non-Public); NCA Administrative Personnel

Interior Design / Furniture – Informal lounge seating, or combination (if large enough) of a conference table with seating and separate lounge seating; Storage for supplies, VCR, television, and projection equipment is required - may be provided by built-in credenza or storage unit



Special Requirements – Writing, tack, and projection surface; If windows are provided, light control is necessary for operating video equipment; Will be used for public functions at night

(3.) Director

Receives visitors, dignitaries and meets with one or more employees or family members

Users – Director, General Public, Dignitaries

Interior Design / Furniture – Workstation (desk/table and credenza); Worksurfaces (2); 2 file drawers; 2 box drawers; 1 pencil drawer; keyboard drawer; Conference seating for four (4) at desk/table; Lounge seating for four (4) to six (6); Shelving and wall surface for display of mementos and awards; Credenza may be used as a worksurface 600 mm (24") deep and may be built-in; Desk may be a conference table

Special Requirements – Built-in fire-proof safe for ADP backup tapes, checks, and other essential items

(4.) Assistant Director

Users – Assistant Director; General Public

Interior Design / Furniture – Guest seating for two (2) at a desk; Workstation; Worksurface; File drawer; Box drawer; Reference shelves/cabinet; Typing return or keyboard drawer

Special Requirements –

(5.) General Office

The general office is the center for filing and reference and shared use of office equipment.

Users – Clerk, Program Assistant, Cemetery Representative, Visitors

Interior Design / Furniture – Systems furniture preferred, providing semi-privacy; Workstation; File drawer; Box drawers, pencil drawer; Reference shelves/cabinets; Visitor seating at a desk for one; two at cemetery representative workstation(s)

Special Requirements – Windows should not interfere with efficient workstation planning; Administrative Assistant requires partial audio and visual privacy; Coat closet for users



(6.) Operations Center

Users – Administrative Personnel, Maintenance Foreman.

Interior Design / Furniture – Below counter lateral file cabinets are included as construction contractor-furnished equipment; interment file drawers are government-furnished, but enclosure built-in in the building contract; adjustable shelving above; Interment records (drawers for 125 mm x 200 mm (5" x 8") cards); Personnel files; Correspondence files; Supplies (locked storage base cabinets or full height closets); Work surfaces - 600 mm (24") deep, at least 1200 (48") length to be 750 mm (30") deep for drawing reference surface; Paper cutter, hole punches, stapler, and other office items; Wall-mounted or other flat file systems for 750 mm x 1050 mm (30" x 42") cemetery maps; Tack board.

Special Requirements – Maximum use of volume for storage and work surfaces with minimum but efficient circulation; Most components built-in. Floor to ceiling enclosure may be required to contain equipment noise; in any case, walls should be not less than 1800 mm (72") high; Single 120 V (volt) receptacles (plug strips) are required above all work counters (Space receptacles 300 mm (12" on center); Conduit and outlets as are necessary for all ADP and telecommunications equipment located here; Supplies (locked storage base cabinets or full height closets).

(7.) Lunchroom / Lounge & Vending

Provides space for cemetery staff meetings, training sessions (in person and on video)

Users – All Administrative and Maintenance Staff.

Interior Design / Furniture – Small built-in food preparation center; Overhead storage cabinets; Base cabinet storage with a counter surface; Overhead cabinet-mounted microwave oven; Four-person tables with individual chairs; Tack surface for employee notices (may be located in hallway).

Special Requirements – Maximum natural light: should be bright, relaxing, non-institutional atmosphere; Easy maintenance finishes; Lunchroom may serve as circulation to Locker Room and other areas used by staff; Space does not necessarily require a total enclosure, but should not be remote from Lobby and not visible to the public.

B. Staff and Operations Vehicle Parking

Public parking at the administrative area should include a parking pull-off parallel to the road to accommodate an average of three (3) cars for cemetery visitors.



Employee parking should be in a lot obscured from public view for cemetery employees, official cemetery vehicles, visiting staff, and vendor vehicles. Locate the access drive to the parking lot beyond the public entrance to the building and outside the secured Maintenance Yard. Provide only pedestrian access from the parking lot to the Maintenance Yard. Approximately 3% of employee parking spaces shall be accessible to the physically disabled or a minimum of one parking space.

The parking lot should accommodate all employees, plus one to three cemetery vehicles, one volunteer, one vendor, one visiting staff, and seven honor guard vehicles. The siting of the parking lot must allow for future expansion.

Planning Factors:

Paved Parking

Provide parking space for maintenance and service employees following appropriate Department of Veterans Affairs (VA) standards.

Users – Administration and Maintenance Staff; Vendors/Contractors/Visitors (not Public); Volunteers.

Special Requirements – 3% of spaces must meet ADA accessibility requirements.

2.7.4. FA4, INTERMENT AREAS [BURIAL SECTIONS]

Interment areas are those portions of the cemetery acreage developed for burials of either full casket or cremated remains. Interment areas may be subdivided into Burial Sections of varying sizes and shapes. Burial sections are visually separate, broken by vegetation (woods), roads, walks, and topography.

A single burial section should have one predominant slope. In-ground interment areas for casketed or cremated remains shall generally conform to the existing terrain. Final grades shall range from 2%, the minimum to achieve positive drainage, to a maximum of 10% only when necessary; no more than a 7% slope is preferred. Avoid casket burials on steep slopes. Avoid extensive grading to achieve these criteria where such grading has an adverse impact on adjoining land or where such grading substantially alters or destroys natural features. Define interment areas by natural terrain features like ridges, valleys, or natural breaks in the topography.

Edges of burial sections shall be a minimum of 3 m (10 ft) from edges of roads, drives, and tree lines; a minimum of 6 m (20 ft) from property boundaries or fence lines. The maximum distance from the edge of a road to the farthest gravesite within a burial section shall be no further than 120 m (400 ft) over relatively level land. In areas with steep slopes, the distance



from the road to the farthest gravesite shall be considerably shorter. Generally, for higher than a 5% slope, there should be a decrease of 30 m (100 ft) or more in the distance.

The topography is the primary factor in determining the direction graves face within a burial section. Where the topography is not significant, road layout and accessibility determine the direction graves face. The head of a gravesite is typically higher than the foot of the gravesite. Burial sections should slope upward from front of the section to back or be level from front to back. Headstones shall face in the direction of the road, which accesses the burial section whenever possible. Headstones in adjacent burial sections should align and be in the same orthogonal orientation to the greatest extent possible within terrain limitations.

Section markers indicate the limits of each burial section in the cemetery.

A. Interment of Casketed Remains

The National Cemetery Administration is committed to providing burial benefits to as many veterans as possible and achieving the maximum development of gravesites within national cemeteries. The standard gravesite size is the smallest size practical to accommodate the marker type and ensure appropriate gravesite appearance. Each gravesite is marked with one marker, consistent with the requirements of applicable law and NCA policy. Full-casket remains are accommodated in below-grade burial sites. Casketed remains in new gravesites are placed in an outer container vault or pre-placed crypt/vault to prevent sunken graves. Burial sections for full casket gravesites shall be no larger than 3 acres.

B. Interment of Cremated Remains

As with full casket gravesites, NCA is committed to achieving the maximum development of cremains sites within national cemeteries. NCA intends to provide cremains sites in all cemeteries, including those not available to the interment of casketed remains. The standard cremains site size is the smallest size practical to accommodate the type of marker used to ensure that the cremains site appearance is appropriate and consistent with any adjacent gravesite section. Each gravesite is marked with one marker, consistent with applicable law and NCA policy requirements. Cremated remains are accommodated through in-ground burial, columbarium interment, or designated landscape areas such as scattering gardens. Burial sections for cremated remains shall typically have no more than 999 sites (approximately 1/4 acre). However, this size can be increased subject to design and topography consideration.

C. Memorial Section

A memorial section may be located in areas of a cemetery not otherwise suitable for burial sites. The size and configuration of the memorial section depend on the demand for memorial sites at that particular cemetery, the terrain, road network, and walkways. Memorial sites within the Memorial Section shall be marked with a flat granite marker or bronze or upright



headstones. Bronze memorial plaques may be mounted on walls designated for that purpose instead of placing a marker in a memorial section. These walls may be portions of other features of the Memorial Section, such as retaining walls and terraces appropriate for memorial purposes.

D. Committal Service Shelter

Normal operations at the national cemetery provide for away-from-gravesite interment services. These services are held in a sheltered area visually isolated from the administrative, maintenance, and burial operations. The shelters are dispersed throughout the cemetery to provide privacy when multiple services are held.

A Committal shelter is considered a facility that serves the family and friends of one veteran at any given time and is not intended to be a focal point or a vital visual element of the total cemetery experience. Each shelter should accommodate approximately (60) Interment Service attendees and one (1) casket. More significant numbers of attendees are accommodated by "overflow" areas of paving and adjacent turf areas.

Locate Committal shelters far enough apart to preserve the privacy of committal services. The design of the shelters shall mitigate the impact of surrounding operational procedures that may be occurring during interment services. Utilize the existing terrain, trees, and vegetation to obscure views between shelters and other on-site facilities.

A Committal Shelter should not be the defining feature of burial areas. The burial areas surrounding or near the committal shelters are what is essential. Design the Committal Shelter to be relatively simple and consistent with the style and materials of other structures and elements within the cemetery. The building is a covered structure that is open or partially enclosed on the sides and provides limited shelter from wind, rain, and sun. Provide a lockable storage room at the shelter for a broom, shovel, twelve stacking chairs, and two biers.

Provide a firing area for seven (7) Honor Guard members to stand near the shelter and provide adequate standoff distance to the Honor Guard firing area. Do not provide heating or air conditioning. Some shelters often require electrical power and plumbing if feasible and as required for other considerations.

Site features such as windbreakers for the predominant wind direction and, if authorized, a partially enclosed structure at sites with extreme weather should be provided. Full enclosure, lighting, heating, and other enhancements are not authorized. A wind break berm with landscape buffer might also be considered part of the design in some extreme weather locations.



Planning Factors:

Committal shelters can accommodate six interments per day.

- One shelter equals 1-6 services per day
- Two shelters equal 7-12 services per day
- Three shelters equal 13-18 services per day

Many cemeteries with active burials may require a minimum of two committal service shelters. One is always available if the other needs to be shut down for maintenance or provide greater schedule flexibility, such as accommodating more than one service when necessary. The need for multiple burials should be discussed with the cemetery staff and NCA Operations.

Users – Interment Service Parties, Families, Clergy; Cemetery Representatives and Maintenance Staff; and Volunteer Honor Guard.

Interior Design / Furniture – Provide storage door outside of the view of seating/assembly area, benches.

Special Requirements – Area sheltered from the weather; Hose bib on the exterior of the building; Built-in speakers for a sound system; Lockable closet for storage of equipment containing: Folding bier, 600 mm x 600 mm x 1050 mm (24" x 24" x 42"), Portable bier (Casket carrier), 625 mm x 1800 mm x 625 mm (25" x 72" x 25"), Stacking chairs (12), Broom, shelf for a sound system, 120 V (volt) duplex receptacle.

E. Committal Service Shelter Drive

Dedicated committal service shelter drives or pull-offs provide parallel parking for interment services, where space allows these parking areas are similar to cortege assembly areas. Separate drives should be provided for parking access at each committal shelter. A small loop drive adjacent to the shelter, wide enough for parking three vehicles abreast, works well. The entire drive should accommodate an average of thirty vehicles. The layout of roads and shelters should allow a cortege to proceed to the designated shelter without passing another interment service cortege on the road or driving by active burial operations.

2.7.5. FA5, DONATIONS & ASSEMBLY AREA

A. Memorial Walkway / Donations Area

Each cemetery should have areas separate from interment to display memorials donated by various recognized veterans' groups. The area(s) may consist of a path or terrace and should provide a place for quiet walks and contemplation for cemetery visitors. An established wooded setting provides the best location for the donation area(s) or memorial path to the extent possible. If developed as a walkway, it should have the character of a meandering path,



should originate in the vicinity of the Flag / Assembly Area, and have one other access point. A memorial walkway should have optimal locations designated along the path for donated memorials, plaques, and benches. The donations area may also be the location of the POW/ MIA flag.

Donated memorials are typically 450 mm (18") deep x 600 mm (24") wide x 600 mm (24") high, granite bases, or natural boulders, and are placed in small cleared areas adjacent to a path. The walkway or donations area must appear complete as a feature in its own right while without any donated memorials. As with all cemetery features, the memorial walkway/donations area must be accessible to disabled persons. Although some form of paving is necessary to meet accessibility standards, minimize the visual impact of the paved surface.

B. Veterans Memorial

The cemetery development plan typically includes designing and siting a potential significant memorial donation by a veteran service organization. This memorial to all veterans (for example, a statue or wall) would occupy approximately 72 m² (800 square feet). Select a site in a prominent area, perhaps in the general vicinity of the Flag / Assembly Area or the Memorial Walkway / Donations Area. The location need not be adjacent to a roadway, but pedestrian access to the memorial site is required. The cemetery development plan should show a location for a memorial, ingress and egress to the site, and the memorial's design. The cemetery development must appear complete even if the potential memorial is never installed.

C. Carillon Tower

The cemetery master plan should include a potential site designated for a carillon tower, potentially donated to the national cemetery. The tower would be approximately 13.5 m (45 feet) high and 2.4 m x 2.4 m (8' x 8') at the base.

D. Flag/ Assembly Area

The flag is the single most significant feature and focal point at the cemetery. The flagpole and surrounding areas shall uniquely align with the cemetery's natural surroundings, features, and elements. Provide trees/plantings that enhance the setting and are appropriate to the site (native, low maintenance). Use good quality, durable, and low-maintenance building materials, such as stone, brick, or concrete. Avoid locating the flagpole in conjunction with an operational area or facility such as the Administration Building.

There shall be one primary flagpole (aluminum or stainless steel) with an internal halyard, tall enough to be visible from major adjacent roadways where practical. Provide ample and unobtrusive flag lighting. Do not use in-ground or below-ground light fixtures. The flag is flown every day, 24 hours a day, when illuminated after dark. During interment services, the flag is lowered to half-staff. The flag should remain visible to the maximum extent possible even



when lowered to half-staff. The flagpole shall meet FAA regulations for height and flight safety requirements. Cemetery personnel must be able to easily access the flagpole to raise and lower the flag for services. A shorter flagpole, 4500 mm to 6000 mm (15' to 30'), in another location may display the POW/ MIA flag and is frequently located along the Memorial Walkway.

Artificial turf or enhanced pavement assembly area should be developed for significant gatherings on holidays. Terrain and landscaping should define the space and create a scale that is also comfortable for smaller gatherings. The assembly area should be located to take advantage of views both on and off-site. The immediate surroundings should include a distinct open space for assemblies and ceremonies, an attractive year-round feature. The assembly area should utilize a land area that is not otherwise ideal for burial sections. The design should not include permanent seating. However, it may include seating design elements such as arched walkways for ADA seating accessibility

The assembly area should incorporate a focal point, an architectural, hardscape, or landscape feature used as a speaker's platform. The feature should accommodate portable seating placement for twenty dignitaries. An area adjacent to the speakers' platform should accommodate portable seating placement for a forty-piece band. Provide adequate electrical service to meet ceremonial and maintenance needs. Electrical J-boxes should be out of sight and blend into their surroundings. Provide water supply and hose bibs in this area. Parking for special events and programs is accommodated on roadways and sometimes on the turf in undeveloped interment areas near the flag assembly area.

2.7.6. FA6, MAINTENANCE AREA

The maintenance area houses the offices, workspaces, and a personnel area for cemetery support staff and contractors involved in cemetery operations. Contact with visitors at the Maintenance Complex is usually minimal. When required, the building should have fire detection and security systems. It should be constructed of durable building materials and have finishes that require little maintenance.

There are essential functional aspects that are common to all national cemetery maintenance facilities. The design of cemetery structures shall align with regional architectural uniqueness and the local cultural landscape.

The desired location for the complex is central to the site. Locate the maintenance areas so that they are not readily visible to the public. Maintenance activities that take place at the building must be sheltered from public view. Site the complex optimally for functional operations separate from the Public Information Center and Interment Areas. Utilizing the terrain and landscape in the design should lessen the visual impact of this facility on the cemetery.



Planning Factors:

Space planning criteria for National Cemetery administration and maintenance buildings are addressed below. It provides the net square footage recommended to meet the needs of national cemetery buildings. The scope of work for a particular project should contain the building program based on the cemetery workload staffing and the space planning criteria.

Cemeteries having less than one burial/day must be planned on an individual project basis.

A. Maintenance Personnel Facilities

Office, Foreman

- **1-6 burials/day** 12.1 NSM (130 NSF)

Includes 2.8 NSM (30 NSF) for the plan file.

- **Over 6 burials/day** 15.8 NSM (170 NSF)

Includes 2.8 NSM (30 NSF) for plan file and 3.7 NSM (40 NSF) for drafting table.

Additional Foremen 5.2 NSM (56 NSF)

Parts and Tools Clerk 5.2 NSM (56 NSF)

(Provided only in cemeteries with over six burials/day.)

Space for this function may be located in Parts and Tools Storage.

Lunchroom 1.4 NSM (15 NSF)
 per FTE (Minimum = 16.3 NSM (175 NSF))
 (Maximum = 53.5 NSM (575 NSF))

Space is based on the minimum and the maximum number of employees occupying the room during any one lunch shift.

Kitchen Unit 4.2 NSM (45 NSF)

Vending Machines 4.7 NSM (50 NSF)

Housekeeping Aids Closet 3.7 NSM (40 NSF)

B. Lockers, Toilets, Showers

Lockers 0.8 NSM (9 NSF)
 per FTE

The area per locker is based on a locker size of (380 mm x 460 mm) (15" x 18") bench space.

Toilets

1. Male

Water Closets - One for each 18 FTEs or fraction thereof for the first 40 FTEs; one for each 25 FTEs or fraction thereof for FTEs over 40.



One water closet must be class "B" to accommodate the disabled, except when the Administration Building and Maintenance and Service Building are connected in cemeteries with 1-6 burials/day.

Urinals - One for each 10 FTEs or fraction thereof for the first 20 FTEs; one for each 18 FTEs or fraction thereof over 20.

Lavatories (Cemeteries with 20 or fewer total FTEs). One for each 10 FTEs or a fraction thereof.

Wash Fountains (Cemeteries with over 20 total FTEs). One for each 24 FTEs or fraction thereof.

2. **Female** - One water closet and one lavatory.

3. Area Required

Water Closet, Handicapped (Class B) 3.0 NSM (32 NSF)

Water Closet, Standard; Lavatory or Urinal 2.0 NSM (22 NSF)

Wash Fountain 4.3 NSM (46 NSF)

Shower 2.3 NSM (25 NSF)

(One for males and one for females.)

Boot and Raincoat Holding Area 0.1 NSM (1.5 NSF) per FTE

Boot Wash 2.8 NSM (30 NSF)

(Provide indoors only in cemeteries where the winter climate is too severe to wash boots outside. Otherwise, provided at exterior entry from a service yard to lockers.)

(1.) **Locker Room, Toilets, and Shower**

Users – Maintenance staff.

Interior Design / Furniture – Easy maintenance finishes; A common entry "vestibule" for male and female facilities is desirable. The "vestibule" may serve as the boot room; Separate locker rooms are provided to accommodate male and female maintenance staff. As the staffing mix changes, separate facilities may not always be required. Therefore, the locker rooms should be designed to accommodate this change. Both rooms are designed the same except for size. A connection between the two should be provided to accommodate the changing staff needs; Lockers 450 mm wide x 525 mm deep x 1800 mm high (18" x 21" x 72").

Special Requirements –

C. Boot Vestibule

Users – Maintenance staff.



Interior Design / Furniture – Easy maintenance finishes; Provide hooks for raincoats and shelves for boots.

Special Requirements – Exterior boot cleaning at the entry to personnel area: Flexible hose, Mud scrape, Floor drain.

D. Maintenance and Storage Area

The Administration/Maintenance Complex includes the building that houses the personnel areas for the cemetery maintenance staff, the workshops, vehicle and equipment maintenance areas, storage areas, and the Maintenance Yard, which contains out-of-doors maintenance activities. Limited space may be available for volunteers engaged in honor guard activities and equipment parking at the cemetery. Portions of the maintenance facility may be categorized for use by contractors. Contractor access to this space should not require passing through VA-controlled space or vice versa. Both the building and the Yard shall be physically secured. The entire complex should have fire detection and security systems.

The building should have durable materials and finishes that require little maintenance. The design and siting of the building should allow for future expansion, primarily in the personnel and equipment storage areas. The Administration/ Maintenance Complex should have separate secured vehicular access from the public road if possible.

(1.) Maintenance Office

Tasks – Supervise maintenance personnel and operations; Meet visitors/vendors; Meet with one or more maintenance staff; May issue parts and tools; Keep equipment inventory; Keep equipment maintenance records; Prepare supply requests; File maps and records; May control fuel pumps remotely if not programmed for Maintenance Bay; May control irrigation remotely.

Users – Foremen / Field Supervisors/ Team Leaders; Clerk if programmed (alternate location in Parts & Tools Storage).

Interior Design / Furniture – Maximum wall storage; Shelves for catalogues; Tack surface for maps, minimum 750 mm x 1050 mm (30" x 42"); Plan file, minimum 750 mm x 1050 mm (30" x 42"), with 1050 mm (42") high work counter; Drafting table, minimum 750 mm x 1050 mm (30" x 42"); File cabinet(s) may be under work counter; Workstation(s): File drawer(s), Box drawer(s), Pencil drawer, Typing surface; Wall mounted (book-type) map rack or flat file; Secured supply cabinets; Lateral file cabinets; Secured key cabinet; Desk chair; Side chair; Drafting stool.



(2.) Mechanics / Clerks Desk

Tasks – Maintenance inventory records; May issue parts and tools; Type, write, and telephone at the workstation; Prepare supply requests

Users – Automotive mechanic, Parts and Tools Clerk (if programmed)

Interior Design / Furniture – Shelves for catalogues and maintenance manuals; File cabinet(s); Workstation(s): File drawer(s), Box drawer(s), Pencil drawer(s), Typing surface

(3.) Maintenance Yard

The development of the Maintenance "Yard" should provide for (1) storage and movement of equipment, supplies, grave liners, and headstones that are kept outdoors, and (2) above-ground fuel tanks and pumps. Provide security fencing to maintenance yard adjacent to maintenance buildings. Provide the ability to separate the yard into NCA/ Contractor storage to accommodate contracted contractor maintenance services changes. Contractor yards shall include electrical, water, and sewer hookup for a job site trailer. The size of the yard must accommodate the unloading of delivery from a tractor-trailer truck.

- Design adequate space for truck maneuverability and parking of facility equipment, including trash dumpsters. NCA provides information on the volume of truck activity and the projection of future activity.
- Stormwater drainage output should include an oil/water separator for environmental compliance.

Special Requirements – Fuel Tanks and Pumps: Above ground storage tank with pumps, 3790 L (1000 gallon) total capacity, divided per program; Compressed air outlet at or near fuel pumps; Loading dock: freestanding platform with a ramp for forklift access to trucks, per program; Vehicle and Equipment Storage, sheltered or open per program; Headstone Storage, per program; Tractor-trailers must be able to negotiate this area; Vehicle wash area for steam cleaning, with oil/water separator drain to meet current EPA regulations or with recycling equipment, per program; Four 3600 mm (12') wide x 10 800 mm (36') deep x 1500 mm (5') high open bins for sand, gravel, and other aggregates. Alternate location may be soil spoils area; Mixing pad/containment area for chemical mixing/loading, if not located within Herbicide/Insecticide/pesticides. Storage Area; space and access for a trash dumpster and oil-water separator required for maintenance yard stormwater runoff.

(4.) Vehicle Maintenance

The Vehicle and Equipment Maintenance Area should have a minimum depth of 9145 mm (30') and be provided with a system to remove vehicle exhaust.



Planning Factors:

Maintenance and Equipment Facilities

Vehicle and Equipment Maintenance and Storage - Enclosed (Heated) Facilities

Vehicle and Equipment Maintenance Area

(Hydraulic vehicle servicing lifts should be provided on an individual project basis.)

1. Routine Maintenance

Maintenance (oil change, tune-up, lubrication, belt, and hose replacement) that does not require removing a significant vehicle component.

- **Up to 15 burials/day** 44.6 NSM (480 NSF)
- **Over 15 burials/day** 89.2 NSM (960 NSF)

2. Heavy Maintenance

Maintenance that necessitates removing a vehicle's significant components (engine, transmission, and large components).

- **1-6 burials/day** None
- **Over 6 burials/day** 65.0 NSM (700 NSF)

NOTE: Space for this function is not required if the cemetery contracts out heavy maintenance.

a. Routine Maintenance Bay

Tasks – Minor vehicle and equipment service, including oil changes, engine tune-ups, tire changes, small-engine repairs.

Users – Automotive Mechanic; Equipment Operator.

Special Requirements – Work counter with maximum storage and electrical outlets every 900 mm (36"); Hose bibb, air outlet, and 120 V (volt) duplex required on the exterior; Pedestrian access directly to Parts & Tools; Vehicular access to Maintenance Yard; 3600 mm (12') garage door width, 4200 mm (14 ') height; coil type roll-up door preferred with electric opener; vision lights desirable; Air outlet @ 862 kPa (125 psi) and hose bibb required on the interior; Floor drains required which meet EPA standards for waste oil disposal, i.e., oil/water separator; 120 V (volt) duplex receptacles (plug strip) 600 mm (24" on center); minimum two 240 V (volt) receptacles.

b. Heavy Maintenance Bay

Requirements for a hydraulic lift must be coordinated for each project to suit the size and weights of the equipment. The preferred equipment is a surface-mounted 4-post drive-on lift with a rolling jack. Adequate clearances must be provided on all sides of the lift.



Tasks – Major vehicle and equipment service, including tune-up, engine overhauls, standard engine maintenance, and repairs.

Users – Automotive Mechanic; Equipment Operator.

Special Requirements – Where a lubrication distribution system is required. it shall accommodate: hydraulic fluid, 10 weight oil, 30 weight oil, gear oil, grease; Where a vehicle is noted on space requirements, it is to be surface mounted 4-post drive -on the lift, 9.1 - 10.9 metric ton (12-16 ton) capacity and rolling jack; Lubrication distribution system required in conjunction with lift; Work counter with maximum storage and electrical outlets every 900 mm (36"); Hose bibb, Air outlet @ 862 kPa (125 psi) and hose bibb required on the interior; Floor drains required which meet EPA standards for waste oil disposal, i.e., oil/water separator; 120 V (volt) duplex required on the exterior; Pedestrian access directly to Parts & Tools; Vehicular access to Maintenance Yard; 3600 mm (12') garage door width, 4200 mm (14 ') height; coil type roll-up door preferred with electric opener; vision lights desirable; Where hoist is required, provide beam with 1815 kg (4,000 lb.) concentrated load capacity; Waste oil storage area should be incorporated within or adjacent to Maintenance Bay.

(5.) Vehicle Wash

Provide floor drains and hose bibs at the wash rack, as appropriate, so that dirt and mud can be washed off vehicles and equipment after use. Drains shall be sized to accommodate frequent washing without clogging. NCA prefers to use self-contained wash water recycling systems. These are available on Federal Supply Schedule for purchase and installation by the contractor.

Planning Factors:

Wash Rack 22.3 NSM (240 NSF)

Special Requirements – Enclosed, sheltered, or open, per program and equipment requirements: Must accommodate backhoe and dump truck; Space heated to allow for vehicle drying without freezing if enclosed. Must meet EPA standards for wastewater disposal, i.e., oil/water separator or water recycling system.

(6.) Loading Dock

A loading dock is considered on a project-by-project basis. The preferred solution is utilizing natural topography to facilitate off-loading tractor-trailers.

Planning Factors:

Loading Dock 4.7 NSM (50 NSF)



(7.) Fuel Storage Tanks and Pumps

NCA uses above-ground fuel storage tanks and dispensing system. A divided tank is required, one tank for unleaded and one for diesel fuel, with a mounting pad and electrical service for the pumps. These are available on Federal Supply Schedule for purchase and installation by the contractor. Provide security fencing to control access.

Vehicle/Equipment Lift

Planning Factors:

Fuel Island 93.0 NSM (1,000 NSF)

(Three pumps and storage tanks for gasoline and diesel fuel.)

(The requirements for a fuel island and the number of pumps and storage are justified on an individual project basis.)

(8.) Hazardous Material Storage

Provide a prefabricated storage building for flammable materials (fuels, oils, solvents, and other hazardous materials) and non-flammable hazardous materials (fertilizers, pesticides, paints, cleaning products, and other non-flammable materials). The building should be OSHA compliant allow for storage of multiple types of hazards. Coordinate with cemetery Operations on required material classification and quantity for storage.

Planning Factors:

Hazardous Storage - Enclosed (Unheated)

- **1-6 burials/day** 9.3 NSM (100 NSF)
- **Over 6 burials/day** 18.6 NSM (200 NSF)

Special Requirements - May be provided as a standalone commercial off the shelf product; Designed to meet local building codes for flammable storage; Explosion-proof lighting; Appropriate signage; Secondary containment; Positive ventilation; Dry stack sprinkler head.

(9.) Workshops

Provide workshop areas in addition to routine maintenance space.

Planning Factors:

Workshops

- **1-6 burials/day** 9.3 NSM (100 NSF)
(Added to Routine Maintenance space.)
- **7-15 burials/day** 40.2 NSM (432 NSF)



- **Over 15 burials/day** 53.5 NSM (576 NSF)

Tasks – Welding, repair, and fabrication of carpentry, electrical, and plumbing for cemetery operations; limited degree of complexity.

Users – Building Maintenance Worker; Carpenter, Plumber, Electrician, if programmed.

Interior Design / Furniture – Maximum workspace/ counters and storage; 750 mm (30") and 600 mm (24") deep woodwork counters.

Special Requirements – 2400 mm x 3000 mm (8' - 10') wide garage door; Pedestrian access directly to Maintenance Yard and Parts & Tools; Pipe and lumber storage; Covered exterior work area when possible; 120 V (volt) duplex receptacles (plug strip) along work counter 600 mm (24" on center); minimum two 240 V (volt) receptacles; 120 V (volt) GFI duplex receptacle exterior; Compressed air outlet @ 862 kPa (125 psi) required on interior.

(10.) Parts and Tool Storage

Provide storage for parts and tools. Parts and Tools Storage should be easily accessible from the Foreman's office and the Vehicle and Equipment Maintenance Area. The volume of space over 3135 mm (7') high should be utilized to the greatest extent possible mezzanine storage.

Planning Factors:

Parts and Tools Storage

- **1-3 burials/day** 31.2 NSM (336 NSF)
(Includes Insecticide Storage)
- **4-6 burials/day** 41.8 NSM (450 NSF)
(Includes Insecticide Storage)
- **7-15 burials/day** **72.5 NSM (780 NSF)**
- **Over 15 burials/day** **96.3 NSM (1,035 NSF)**

Tasks –Clerk or other maintenance personnel issues supplies, uniforms, equipment, parts, small tools, and insecticides; Tools and field equipment issued and recorded; Orders for parts and tools prepared; Records reports about parts, tools, equipment, supplies, and vehicles prepared.

Users –Parts and Tools Clerk, if programmed; Mechanic, if programmed; Foreman or Maintenance Team Leader.

Interior Design / Furniture – Mechanic may control Parts & Tools; desk may be located in Maintenance Bay rather than in Parts & Tools; Counter, cage enclosure, secured where staff exceeds ten (10). Must have locked cabinet 1500 mm (60") wide x 500 mm



(20") deep x 2100 mm (84") height, with adjustable shelves where staff is ten (10) or less.

Special Requirements – Ice machine at or near pedestrian door if not programmed for Lunchroom; 2400 mm - 3000 mm (8' - 10') wide garage door for loading/unloading trucks; 1800 mm (6') wide double doors may be used instead of garage door and pedestrian door; Pedestrian access directly to Maintenance Yard and Maintenance Bay; Maximum storage utilizing all available volume (loft); metal shelving for parts; storage for supplies and uniforms supplied by the cemetery; Exterior hose bibb; Exterior 120 V (volt) duplex outlet; Requires desk with typing return and telephone where staff exceeds ten (10).

(11.) Pesticide Storage, Mixing, & Loading

Provide storage and mixing area as prescribed by authorities having jurisdiction (EPA, state, and other code officials). At a minimum, storage areas have chemical-resistant coated surfaces and secondary containment areas. Also, provide dust and explosion-proof lighting, positive ventilation, appropriate signage, and an eye wash/emergency shower. Coordinate with cemetery Operations on required type and quantity for storage.

Planning Factors:

Pesticide Storage

- **1-6 burials/day** Combined in Hazardous Material Storage
- **Over 6 burials/day** 9.3 NSM (100 NSF)

Special Requirements – Designed to meet current EPA regulations for chemical storage and containment; Designed to meet local building codes and pesticide storage regulations; Fire-proof construction; Positive ventilation, with explosion-proof motor(s); Impermeable floor surface; Chemical resistant coated surfaces; sealed concrete floors; Explosion and dust proof lighting; Key locking doors; Metal storage shelving; Secondary containment area to prevent spill leakage; Mix and load area adjacent to storage, under roof with containment area; Eyewash/emergency shower; SS sink with foot controls and SS drainboard; Dry stack sprinkler head.

(12.) Vehicle, Equipment, and Materials Storage

Provide uncovered and covered storage per specific cemetery and operations guidance. NCA typically designs enclosed storage buildings, open front-pole barn-type structures, or roof cover carports to keep those items from direct sun and weather elements. In cold weather climates, an enclosed building is typically used. In milder climates, an open front pole barn structure or carport-type roof is used. Enclosed equipment storage areas are not generally heated. However, convenient electrical outlets should be provided for engine block heaters to protect the equipment in extreme cold weather areas. Facility heating may be utilized as long as it is



controlled adequately through schedules and occupancy sensors to avoid wasting energy during evenings weekends. The area must be shielded from view or located away from gravesites.

Planning Factors:

Vehicle and Equipment Storage – Enclosed (Unheated), Sheltered, Paved

Vehicles and Grounds Maintenance Equipment -

The total storage space (NSM/NSF) required is determined from the following equipment index. The total space to be enclosed, sheltered, or paved is determined on an individual project basis.

1. Back Hoes	26.8 NSM (288 NSF)
2. Utility Truck (one only)	22.3 NSM (240 NSF)
3. Dump Trucks	22.3 NSM (240 NSF)
4. Pickup Trucks	22.3 NSM (240 NSF)
5. Truck Trailers	22.3 NSM (240 NSF)
6. Automobiles	22.3 NSM (240 NSF)
7. Plow Blades	11.2 NSM (120 NSF)
8. Street Sweeper (one only)	11.2 NSM (120 NSF)
9. Industrial Tractors	8.9 NSM (96 NSF)
10. Agricultural/Garden and Lawn Tractors	3.0 NSM (32 NSF)
11. Trailers (Tractor)	3.0 NSM (32 NSF)
12. Fork Lift	8.9 NSM (96 NSF)
13. Tractor-Mounted Gang Mower	37.2 NSM (400 NSF)
14. Hand Mowers and Trimmers (per 2)	1.1 NSM (12 NSF)
15. Toro Mower (Grounds Master)	4.5 NSM (48 NSF)
16. Tank Sprayer (Tractor)	6.5 NSM (70 NSF)
17. Air Compressor	6.5 NSM (70 NSF)
18. Wood Chipper	9.3 NSM (100 NSF)
19. Seeder	7.4 NSM (80 NSF)
20. Spreader	7.4 NSM (80 NSF)
21. Equipment Attachments (auger, power rake, core aerator, etc.)	1.1 NSM (12 NSF) each

Grounds Maintenance Storage - Enclosed (Unheated)

- **1-3 burials/day** None
- **4-6 burials/day** 9.3 NSM (100 NSF)
- **7-15 burials/day** 26.8 NSM (288 NSF)



- **Over 15 burials/day** 37.2 NSM (400 NSF)

Vehicle and Equipment Storage - Definitions.

1. Enclosed (E)- the structure has a roof and is enclosed on all four sides.
2. Sheltered (S) - the structure has a roof and is enclosed on three sides.
 - (a) Exception - the structure has a roof and be open on all sides in a geographical location where climate permits.
3. Paved (P) – The area does not have a structure.

Vehicle and Grounds Maintenance Equipment Storage - Guidelines for determining the proportion of the total storage space to be Enclosed (E), Sheltered (S), and Paved (P). These general guidelines should be used in conjunction with specific climatic data for the cemetery.

Vehicle/ Equipment	Storage by Weather Conditions/Location	
	Warmer	Colder
(1) Back Hoes	S	E
(2) Utility Trucks	S (or exception)	S
(3) Dump Trucks	One S All others P	One E All others S
(4) Pickup Trucks	P	S
(5) Truck Trailers	S (or exception)	S
(6) Automobiles	P	S
(7) Plow Blades	P	P
(8) Street Sweeper	S	E
(9) Industrial Tractors	S (or exception)	E
(10) Agricultural and Garden and Lawn Tractors	S (or exception)	S
(11) Trailers (Tractor)	P	P
(12) Forklift	S (or exception)	E
(13) Tractor-mounted Gang Mower	S	S
(14) Hand Mowers and Trimmers	E	E
(15) Toro Mower (Grounds Master)	S	S
(16) Tank Sprayer (tractor)	S (or exception)	E



Vehicle/ Equipment	Storage by Weather Conditions/Location	
	Warmer	Colder
(17) Air Compressor	E	E
(18) Wood Chipper	S	S
(19) Seeder	E	E
(20) Spreader	E	E

Special Requirements – Material storage 6' double doors may be used instead of garage door; 10' - 12' garage door width, 10' - 12' height; coil type roll-up door preferred with electric opener; vision lights desirable; Pedestrian access to Maintenance Yard; Compressed air outlets @ 862 kPa (125 psi).

(13.) Headstone Storage

Provide an area for headstone storage. The area must be shielded from view or located away from gravesites.

Planning Factors:

Headstones (Paved)

- **1-6 burials/day** 11.2 NSM (120 NSF)
- **7-15 burials/day** 22.3 NSM (240 NSF)
- **Over 15 burials/day** 33.5 NSM (360 NSF)

(14.) Sand & Gravel Storage Bins

Provide sand, topsoil, gravel, compost, decomposed granite, and salt storage areas separated to prevent mixing. NCA typically includes a 3-bin roof/wall-covered materials storage structure with each new national cemetery design. Each of those three bins is typically 12'-14' in width and 24'-30' in depth. The bins include structural concrete walls to 6' height so that materials can be pushed up against the walls without fear of damage. Concrete masonry units (CMU) are prohibited due to cracking or crushing with the prolonged operation. The slabs of the bins are concrete (not asphalt). An 8-ft. apron on the front side of the bins allows the materials to be scraped and pushed onto the slab. The roof cover is typically designed to have about 18' vertical clearance in front of bins for dump trucks to dump materials into the bins with their beds raised or for backhoes to maneuver without hitting the roof. That roofline is typically pitched on a single slope to a 12' height at the backside of the bins. Roofs and sidewalls are typically metal panels. Coordinate with cemetery Operations on required type and quantity for storage.



2.7.7. FA7, HONOR GUARD AREA

Provide a space dedicated to Honor Guard support of burial services. Space includes locker rooms, firearms storage, and lounge area. See [Section 19.0 X - Other](#) and [VA's Physical Security and Resiliency Design Manual](#) for additional considerations pertaining to storage and security of ceremonial firearms.

Users – Volunteer Honor Guard.

Interior Design / Furniture – Locker 450 mm wide x 525 mm deep x 1800 mm high (18" x 21" x 72" or 36"); Lockable cabinet; Firearms cabinet.

Special Requirements – Firearms storage space must meet Federal Storage Regulations.



3.0 GENERAL REQUIREMENTS

3.1. INTEGRATED DESIGN PROCESS (IDP)

VA is a proponent of the Integrated Design Process. IDP is a project delivery method, following closely upon the heels of CM-at-large, Design/Build, and LEAN construction. But IDP goes beyond these other delivery methods in that it binds the parties into a contractual arrangement where risk and reward are genuinely shared. IDP also goes well beyond typical collaboration and team-building efforts.

The VA's preparation for a project identifies the need for a building based on quantifiable requirements for space and budgetary capacity to undertake the activity. A needs assessment accompanies this planning activity—it describes space use; develops estimates of requirements both spatial and technical; initiates evaluation of possible environmental impacts,

The A/E's team, planners, architects, landscape architects, engineers, and consultants must work together from the project's inception. They must make sure that all engineering disciplines coordinate with the architectural programming requirements of the project. Exercise care to provide design solutions that meet the construction standards, space requirements, equipment layouts, and vertical and horizontal clearances shall resolve by the final design development submission. Where possible, incorporate the mechanical equipment space into the building envelope to avoid the need for a screen.

3.2. SUSTAINABLE DESIGN

The Federal Government has issued three Federal Mandates (one law and two Executive Branch policies) for Executive Branch agencies that outline sustainable and energy goals. In addition, on March 30, 2007, the VA signed a Green Buildings Action Plan that guides compliance.

The *VA Sustainable Design Manual* (<https://www.cfm.va.gov/til/sustain.asp>) is the agency's guidance to define a methodology to achieve these Federal Mandates. The Manual guides in incorporating sustainable design on every phase of a project, from proposals, goal setting, and preliminary planning through design and construction for projects of all sizes. Recognizing that each space acquisition project is unique and requires different strategies, all projects must meet the Federal Mandates appropriately given the project scope and budget.

3.2.1. OPTIMIZE ENERGY PERFORMANCE

- **Energy Efficiency:** Establish a whole building performance target that considers the intended use, occupancy, operations, plug loads, other energy demands, and design to earn the Energy Star® targets for new construction



and significant renovation where applicable. For new construction, reduce the energy cost budget by 30 percent compared to the baseline building performance rating per the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., (ASHRAE) and the Illuminating Engineering Society of North America (IESNA) Standard 90.1-2004, Energy Standard for Buildings except Low-Rise Residential. For major renovations, reduce the energy cost budget by 20 percent below pre-renovations 2003 building performance baseline.

- **Measurement and Verification:** Following DOE guidelines issued under *Section 103 of the Energy Policy Act of 2005* (EP Act), install building-level utility meters in new major construction and renovation projects to track and continuously optimize performance. Compare actual performance data from the first year of operation with the energy design target. After one year of occupancy, measure all-new major installations using the Energy Star® Benchmarking Tool for building and space types covered by Energy Star®. Enter data and lessons learned from sustainable buildings into the High-Performance Buildings Database.

3.2.2. PROTECT AND CONSERVE WATER

- **Indoor Water:** Employ strategies that aggregate use a minimum of 20 percent less potable water than the indoor water use baseline calculated for the building after meeting the Energy Policy Act of 1992 fixture performance requirements.
- **Outdoor Water:** Use water-efficient landscape and irrigation strategies, including water reuse and recycling, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities). Employ design and construction strategies that reduce stormwater runoff and polluted site water runoff.
- Consider areas of irrigation and options of areas not irrigated during design and planning.

3.2.3. EXECUTIVE ORDER 13514, REDUCTION OF GREENHOUSE GASES

This Executive Order requires agencies to measure, manage, and reduce greenhouse gas emissions toward agency-defined targets. It describes a process by which agency goals are set and reported. Additionally, the Executive Order requires all Federal agencies to meet energy, water, and waste reduction targets, including:

- 30% reduction in vehicle fleet petroleum use by 2020;
- 26% improvement in water efficiency by 2020;



- 50% recycling and waste diversion by 2015;
- 95% of all applicable contracts must meet sustainability requirements;
- Implementation of the 2030 net-zero-energy building requirement;
- Implementation of the stormwater provisions of the *Energy Independence and Security Act of 2007, section 438*.
- Development of guidance for sustainable Federal building locations must align with the Livability Principles put forward by the Department of Housing and Urban Development, the Department of Transportation, and the Environmental Protection Agency.

It is the intent and responsibility that all A/E's designing projects for the VA, whether minor or major projects in scope, meet this Executive Order's goals to reduce costs, reduce air and water pollution, and utilize clean energy. Implementation of the Executive Order shall focus on integrating sustainability goals with agency mission and strategic planning to optimize performance and minimize implementation costs.

Implementation is managed through the previously established Office of the Federal Environmental Executive, working in close partnership with the Office of Management and Budget (OMB) and Council on Environmental Quality (CEQ).

U.S. Department of Energy has developed a series of initiatives to implement "cool" roof technologies more broadly on U.S. Government Facilities and Buildings. Cool roofs use lighter-colored roofing surfaces or special coatings to reflect more of the sun's heat, helping improve building efficiency by reducing cooling costs and offsetting carbon emissions.

Cool roofs are one of the quickest and lowest-cost ways to reduce global carbon emissions. Demonstrating the benefits of cool roofs on our VA facilities can lead the nation toward more sustainable building practices while reducing taxpayers' federal carbon footprint and saving money.

Roofs and road pavement cover 50 to 65 percent of urban areas. Because they absorb so much heat, dark-colored roofs and roadways create the "urban heat island effect," where a city is significantly warmer than its surrounding rural areas. Cool roofs considerably reduce the heat island effect and improve air quality by reducing emissions. A recent DOE initiative indicates that using cool roofs and cool pavements in cities can help reduce the demand for air conditioning, entire cool cities and potentially cancel the heating effect of up to two years of worldwide carbon dioxide emissions.

3.2.4. ENHANCE INDOOR ENVIRONMENTAL QUALITY

The A/E shall implement and comply with the VA Green Buildings Action Plan: Implementing the Memorandum of Understanding on Federal Leadership in High Performance and Sustainable Buildings, dated February 28, 2006.



- **Ventilation and Thermal Comfort:** Meet the current ASHRAE Standards, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone, and ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality.
- **Moisture Control:** Establish and implement a moisture control strategy according to ASHRAE Standards 55-2004 and 62-2004 for controlling moisture flows and condensation to prevent building damage and mold contamination.
- **Daylighting:** Achieve a minimum daylight factor of 2 percent (excluding all direct sunlight penetration) in 75 percent of all space occupied for critical visual tasks. Provide automatic dimming controls or accessible manual lighting controls and appropriate glare control.
- **Low-Emitting Materials:** Specify materials and products with low pollutant emissions, including adhesives, sealants, paints, carpet systems, and furnishings.
- **Protect Indoor Air Quality during Construction:** Follow the recommended approach of the Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction, 1995. After construction and before occupancy, conduct a minimum 72-hour flush-out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent. After occupancy, continue flush-out as necessary to minimize exposure to contaminants from new building materials.

3.2.5. REDUCE ENVIRONMENTAL IMPACT OF MATERIALS

- **Recycled Content:** For EPA-designated products, use products meeting or exceeding EPA's recycled content recommendations. For other products, use materials with recycled content. The sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the project.
- **Bio-based Content:** For USDA-designated products, use materials meeting or exceeding USDA's biobased content recommendations. For other products, use biobased products made from rapidly renewable resources and certified sustainable wood products.
- **Construction Waste:** During a project's planning stage, identify local recycling and salvage operations to process site-related waste. Program the design to recycle or salvage at least 50 percent construction, demolition, and land clearing waste, excluding soil, where markets or onsite recycling opportunities exist.
- **Ozone Depleting Compounds:** Eliminate the use of ozone-depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with Title VI



of the Clean Air Act Amendments of 1990 or equivalent. Overall, air quality benefits take into account life cycle impacts.

3.2.6. PRIORITY TO RENOVATION OF EXISTING FACILITIES.

- If not inconsistent with mission needs, priority should be given to renovating existing buildings and other facilities over new construction. Renovation saves energy and physical resources and is often more cost-effective than new construction.
- Where historic buildings or building complexes are present, special efforts should be made to rehabilitate and reuse them under the National Historic Preservation Act of 1966, as amended, provided doing so achieves VA's mission requirements.

3.3. ACCESSIBILITY

All features constructed, except turf-covered gravesites, shall be fully accessible to physically disabled persons, in compliance with the Americans With Disabilities Act-1990 (ADA), Architectural Barriers Act of 1968 (ABA), as amended other applicable policies governing barrier-free access. To achieve compliance, the National Cemetery Administration uses the Architectural Barriers Act Accessibility Standard (ABAAS) as its standard for building and facility design. The standards are found at the following URLs: <http://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-aba-standards/aba-standards> and <https://www.cfm.va.gov/til/accessibility.asp>. The criteria of these standards should be considered a minimum in providing access for the physically disabled. Dimensions that are not stated as “maximum” or “minimum” are absolute. All dimensions are subject to conventional industry construction tolerances except the requirement as a range with specific minimum and maximum endpoints. All aspects of compliance are to be discussed, and exceptions may apply based on on-site specific conditions.

Refer to the TIL – *VA’s Barrier-Free Design Standard, PG-18-13*
(<https://www.cfm.va.gov/til/accessibility.asp>)

3.4. HISTORIC PRESERVATION, ARCHAEOLOGY, CULTURAL RESOURCE MANAGEMENT

NCA locations may be listed in the National Register of Historic Places and subject to Section 106 of the National Historic Preservation Act (P.L. 89-665, as amended). Sites may contain historic features such as Lodges or walls in which character and appearance should be maintained.

Refer to: *Directive 7545* and *Section 5.12 of this Manual*



3.5. ENVIRONMENTAL COMPLIANCE

Environmental compliance is based upon the Department of Veterans Affairs “Environmental Effects of VA Actions,” 38 CFR Part 26.

See also Section 5.11. of this manual for more information

3.6. PHYSICAL SECURITY

VA facilities owned, leased, managed, constructed, modernized, or purchased shall have countermeasures designed into the facility’s infrastructure to abate potential threats.

Refer to the TIL – *VA’s Physical Security Design Manual*
(<https://www.cfm.va.gov/til/dManual.asp#PSR>)

CONSIDERATIONS

- Providing a secure design that meets all facility requirements is often a challenge. Providing the most secure facility, architecturally expressive design, or energy-efficient building envelope with limited resources is not always feasible. All project or design stakeholders must work cooperatively to ensure a balanced design from the planning and concept stages through construction documents. Successful designs must consider all competing design objectives and make the best selections.
- Care should be taken to implement physical security measures that allow Fire Protection forces access to sites, buildings, and building occupants with adequate means of emergency egress.
- Consideration should be given to integrating various stand-alone security systems, integrating systems across remote locations, and integrating security systems with other communications and fire and emergency management systems.

3.6.1. PHYSICAL SECURITY MASTER PLANNING REQUIREMENTS

As part of the master plan development, conduct appropriate risk and vulnerability assessments for the facility or campus being planned. The findings of these assessments shall be incorporated into the master plan. For facilities with master plans, these plans shall include physical security design guidelines and parameters consistent with those included in, or referenced by, this document. At a minimum, master plans shall include standoff distances, provisions for perimeter security, site access control, applicable Crime Prevention Through Environmental Design (CPTED) principles, site utility entrances and distribution, a mass evacuation plan, and a schedule for implementation of design guidelines and parameters or approved risk mitigation alternatives.



3.7. SEISMIC AND OTHER NATURAL HAZARDS

Consideration should be given to seismic and blast-resistant design as they share some standard analytical methodologies and a performance-based design philosophy that accepts varying levels of damage in response to varying levels of dynamic excitation. Both design approaches recognize that it is cost-prohibitive to provide comprehensive protection against all conceivable events. An appropriate level of protection that lessens the risk of mass casualties can be provided at a reasonable cost. Both seismic and blast-resistant design approaches benefit from a risk assessment that evaluates the functionality, criticality, occupancy, site conditions, and design features. Weather-related (hurricane and tornado) protection requires blast-resistant design. Blast-resistant facade systems require the glass to satisfy the debris hazard conditions in response to the specified blast loading.

In contrast, the mullions and anchors must resist the collected forces within the specified deflection and flexibility limits. In addition to resisting the specified blast loads, the criteria often require the designer to consider the more extreme blast loading damages. The criterion requires a balanced design. The mullions must develop the capacity of the selected glass within allowable deformation limits, and the anchors must develop the capacity of the selected mullions.

- **Window Fenestration:** The total fenestration openings are not limited; however, a maximum of 40 percent per structural bay is a preferred design goal. In the renovation of older buildings and new construction in older buildings' ensembles, the impacts of fenestration design on historic buildings and views must be considered and addressed in planning.
- **Window Frames:** The frame system should develop the maximum capacity of the chosen glazing up to 750 breaks per 1000 and provide the required level of protection without failure; this can be shown through design calculations or approved testing methods.
- **Anchorage:** The anchorage should remain attached to the facility's walls during an explosive event without failure. The capacity of the anchorage system can be shown through design calculations or approved tests that demonstrate that failure of the proposed anchorage does not occur and that the required performance level specified is provided.

Refer to the TIL – *VA's Seismic Design Handbook, H-18-8*
(<https://www.cfm.va.gov/til/seismic.asp>)

3.8. COMMISSIONING

In 2006, the VA co-signed the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (MOU) and many other federal agencies, which was subsequently included in Executive Order 13423 – Strengthening Federal Environmental Energy,



and Transportation Management. One of the requirements of this MOU is for total building commissioning (Cx) practices for federal buildings.

Total building commissioning practices shall be employed in a project's design, construction, and guarantee phases; the VA identifies a Commissioning Agent (CxA) who works directly for VA at the pre-design phase. The A/E shall work collaboratively with the CxA in all aspects of commissioning work from the pre-design, Schematic, Design Development, and Construction Document phases of the design work. Moreover, the A/E shall work collaboratively with the CxA during the construction phase of the project.

The VA utilizes the services of an independent third-party commissioning authority to oversee the project from design to construction documents and Post Occupancy commissioning plan to verify the design and engineering performance, including the installation and performance of systems to be commissioned, providing the VA with a commissioning report.

The A/E shall use and follow the *NCA's Commissioning Process Manual* (<https://www.cfm.va.gov/til/NCA.asp>) TIL as a guide for the commissioning work.

The A/E shall use and modify, as needed, the VA General Commissioning Specifications, located in TIL – *Master Construction Specifications edited for NCA construction projects, Div 01, General Requirements, Section 01 91 00* (<https://www.cfm.va.gov/til/ncaSpec.asp>), to suit the design criteria, size, and complexity of a project.



4.0 DESIGNER REQUIREMENTS

4.1. RESPONSIBILITY

The A/E shall provide all necessary professional services to perform the planning and design of the systems for the project. The A/E is responsible and liable for the professional design per Scope of Work (SOW), the contract, sound engineering practices, VA standards, VA project-specific requirements, if any, and all applicable codes.

4.2. AUTHORITY HAVING JURISDICTION

Unless otherwise directed by VA, the Authority Having Jurisdiction is the NCA Operations Director.

4.3. COORDINATION

4.3.1. DESIGN QUALITY CONTROL:

The Architect-Engineer shall coordinate planning and design work with the architectural, landscape, structural, civil, plumbing, mechanical, fire protection, and LEED/Sustainable designs.

The A/E shall implement and maintain a quality-control program assuring that all services, designs, drawings, and specifications required by the contract are performed and provided in a manner that meets professional architectural and engineering quality standards adopted and utilized by the Department of Veterans Affairs.

The design documents shall be systematically and thoroughly reviewed for compliance with VA's project requirements and applicable codes, commitments made in EIA documents, and agreements entered into under environmental and historic preservation regulations. VA-approved deviations in the design documents shall be documented. T. The A/E shall be held responsible for ensuring that all sub-consultants comply with the design requirements. Likewise, all Sub-consultants shall be held responsible for ensuring that their portion of the project complies with the design requirements.

4.4. DOCUMENT CHECKING, AGENCY CONSULTING/ REVIEW/ APPROVAL SERVICES

Provide environmental coordination between the A/E, NCA, and the VA Contracting Officer. – See VA Environmental Compliance Manual.



Provide historical and cultural resource coordination between the A/E, NCA, and the VA Contracting Officer.

Research Federal, State, and municipal laws, regulations, and permits concerning design and construction controls for environmental protection of aesthetics, air, water, and land. See *NCA Master Construction Specifications, Environmental Protection* (<https://www.cfm.va.gov/ti/ncaSpec.asp>). VA, as owner, signs permits and pays necessary fees appropriate to the owner. Investigate the following regulatory categories:

- A. Stormwater permits, e.g., National Pollutant Discharge Elimination System (NPDES).
- B. Pollution control and solid waste disposal.
- C. Erosion control and protection of land resources.
- D. Protection of the landscape.
- E. Protection of water resources, wetlands, and areas preserved for wildlife.

4.5. EXISTING CONDITIONS

The A/E shall investigate the building to determine if sufficient structural, mechanical, plumbing, site utilities, and electrical capacity can accommodate the renovations or additions to existing buildings. Particular attention should be directed towards structural loads and HVAC and electrical systems. If applicable, the A/E shall inform the VA Project Manager if additional structural, mechanical, plumbing and electrical capacity is required.



5.0 VA DESIGN REQUIREMENTS AND STANDARDS

The following are requirements and standards of VA's Office of Construction and Facilities Management's Technical Information Library (TIL):

5.1. NCA MASTER CONSTRUCTION SPECIFICATIONS (PG-18-1)

Located in TIL <https://www.cfm.va.gov/til/ncaSpec.asp#01>

Purpose: Defines a standardized method for the A/E to assure that the contractor provides equipment and systems that meet the design intent in terms of performance, quality, and cost

The Specifications accomplish this by:

- Providing specific narrative descriptions of required equipment, salient elements, and system construction
- Listing applicable standards and codes and references
- Requiring individual submittal of equipment and systems for review and approval before contractor's purchase
- Defining specific installation methods to be used

5.2. DESIGN AND CONSTRUCTION PROCEDURES (PG-18-3)

Located in TIL <https://www.cfm.va.gov/til/cPro.asp>

Purpose: Establishes minimum consistent design/construction practices of all VA units. Planners and Designers should be aware of what topics of (PG-18-3) apply to NCA construction or are scaled down to meet the needs of NCA.

The Procedures section accomplishes this by:

- Referencing applicable codes and policies
- Describing standard drawing formats
- Listing security strategies
- Including miscellaneous design details

5.3. NATIONAL CAD STANDARD, VHA/NCA APPLICATION GUIDE & STANDARD DETAILS (PG-18-4)

Located in TIL <https://www.cfm.va.gov/til/projReq.asp>

<https://www.cfm.va.gov/til/sDetail.asp>



Purpose: The VHA Application Guide adopts the NIBS National CAD Standard, establishes VA-specific drafting standards for preparing design and construction documents, and provides utility and sheet template files and standard construction details organized by discipline for use in design and construction documents of VA projects.

5.4. EQUIPMENT GUIDE LIST (PG-18-5)

Located in TIL, <https://www.cfm.va.gov/TIL/equip.asp>

See Excel spreadsheets equip701 & equip703 for administrative and maintenance areas, respectively.

Purpose: Provides information for planning and developing all equipment and furnishings requirements in all VA rooms/spaces.

5.5. SEISMIC DESIGN HANDBOOK (H-18-8)

Located in TIL <https://www.cfm.va.gov/TIL/seismic.asp>

Purpose: Provides the A/E with specific requirements and design parameters for seismic design and addresses the following topics of concern:

- New Critical and Essential Facilities
- New Ancillary Facilities
- Existing Facilities for evaluation or rehabilitation include alternative seismic approaches.
- Spectral Response Acceleration
- Special Provisions for Structures in Seismic Categories C, D, E, and F
- Limitations on Steel Structures and Reinforced Concrete Structures
- Drift Limitations, including Modifications of IBC requirements for new Critical and Essential facilities in high seismic design categories.

5.6. DESIGN MANUALS (PG-18-10)

Located in TIL <https://www.cfm.va.gov/til/dManual.asp>

Purpose: To convey the general and specific VA design philosophy for the HVAC, Electrical, Plumbing, Fire Protection, and other systems for VA medical and support facilities, the Manuals accomplish this purpose by:

- Explaining specific design methodologies
- Listing acceptable system types
- Setting the overall energy consumption target



- Codifying certain code interpretations
- Listing values for design parameters
- Referencing certain sections of the Master Specification and Standard Details
- Containing examples of specific design elements

Note: The A/E shall submit to VA a list of Design Manuals and the TIL posted dates in effect on the contract award date.

5.7. DESIGN GUIDES (PG-18-12)

Located in TIL <https://www.cfm.va.gov/til/dGuide.asp>

Applicability: Although centered around VA medical facilities, design disciplines shall follow guidance for similar administrative and facility support/maintenance functions. Information Technology, Electrical, Plumbing, Mechanical, and other systems have applicability.

Purpose: Provides the A/E with specific layout templates for all spaces/uses and specific design parameters for structural, electrical, and mechanical service. The Design Guides accomplish this by:

- Design Guides contain descriptive and graphical concepts of specialized services provided by the VA. They are instrumental in describing and graphically annotating components and relationships to one another specific to the area of specialization. Additionally, they contain:
 - Design narratives
 - Functional diagrams and room guide plates
 - Identifies baseline room finishes and engineering design requirements
 - Updated on a three to five-year cycle.
- The User of the Design Guides should be aware that significant updates and revisions to the VA Design Guides are a work in progress that is continually changing based on advances in changing cemetery practices. Updates and revisions are incremental, and where significant updates occur, design alerts are issued and remain effective until the Guide is updated. Completed Guides are posted on the Technical Information Library (TIL) and noted as current. Information in the Design Guides may be dated, and it is recommended to use it with moderate caution to assure that current standards of the health care industry are addressed in meeting VA's needs.
- Design Guides are intended to help speed the design process, control cost, avoid errors and omissions, and get value for dollars spent. Design guides are developed in partnership with the using service and are benchmarked with similar private-sector guides. They are to be applied flexibly, not as rigid standards.



5.8. BARRIER-FREE DESIGN STANDARD (PG-18-13)

Located in TIL <https://www.cfm.va.gov/TIL/accessibility.asp>

Purpose: Provides the A/E with VA standards that exceed the minimums of the Architectural Barriers Act (ABA) and the Americans with Disabilities Act (ADA) for all VA/NCA facilities users. These standards relate to specific Veteran population needs.

5.9. ROOM FINISHES, DOOR, AND HARDWARE SCHEDULES (PG-18-14)

Located in TIL <https://www.cfm.va.gov/til/spclRqmts.asp#room>

Applicability: Although centered around VA medical facilities, this guide shall aid the designer in choosing appropriate finishes, doors, and hardware for similar administrative functions. NCA is working on adding criteria to this manual in the future.

Purpose: This document provides guidelines for VA Facility Interior finishes, doors, and hardware for new or renovated facilities constructed within the Department of Veterans Affairs. The essential criteria for selecting products/materials are their appropriateness for function and space, sustainability, life cycle costs, durability, and ease of maintenance.

5.10. MINIMUM REQUIREMENTS FOR A/E SUBMISSIONS (PG-18-15)

Located in TIL <https://www.cfm.va.gov/til/aeDesSubReq.asp>

Purpose: To provide a staged listing of tasks in various design categories as a way to define the A/E scope to assure thorough and timely completion of the final design package and bid documents

The Instructions accomplishes this purpose by:

- Progressively listing tasks as Schematic, Design Development, and Construction Documents stages
- Requiring task completion and submission for each stage according to a Critical Path Method (CPM) calendar
- Implementation of a QA/QC process to assure a quality design product
- Requiring life cycle analysis of alternatives to optimize the design/cost tradeoff
- Listing and detailing all the drawings, calculations, and specifications required for a complete design package indicating the final distribution of bid documents



5.11. ENVIRONMENTAL COMPLIANCE MANUAL (PG-18-17)

Located in CFM Website <https://www.cfm.va.gov/environmental/index.asp>

Purpose: This manual provides guidance to VA project proponents for ensuring the required evaluation of potential impacts under the National Environmental Policy Act (NEPA) is technically adequate and legally sufficient. This evaluation may be concluded at one of three levels of evaluation as appropriate: a Categorical Exclusion (CATEX) for projects meeting one of the definitions in VA's Implementing Regulations (Title 38 CFR Part 26) with no extraordinary circumstances; an Environmental Assessment (EA) resulting in a Finding of No Significant Impact (FONSI) for projects which do not meet a CATEX definition; or an Environmental Impact Statement (EIS) for those projects which have an impact(s), but still make sense to proceed with legally binding Mitigation Measures to be implemented. This document also guides concerning the interaction of the NEPA evaluation and other environmental/historical regulatory requirements.

See also Section 3.5. of this manual for additional information.

5.12. THE NCA CULTURAL RESOURCE MANAGEMENT (NCA DIRECTIVE 7545)

Directive 7545 and Section 3.4 of this Manual

Purpose:

This directive describes the NCA's procedures to meet Federal preservation requirements for all program and construction activities affecting cultural resources. Cultural resources include historic buildings, landscapes and districts, archaeological sites, Indian tribal spiritual sites and burial places, historical documents and artifacts, and neighborhoods and communities' cultural and historical values, all of which may be affected by NCA construction projects.

5.13. DESIGN REVIEW CHECKLISTS

Located in TIL <https://www.cfm.va.gov/til/aeDesSubReq.asp>

Purpose: Provides the VA Peer Reviewer with a minimum list of critical items, which must be included in each A/E submission

The Checklist accomplishes this by referring to all applicable VA design tools, included but are not necessarily limited to the listed checklists, which apply to the specific project

- Site and Landscape
- Architecture
- Detailing Life Safety and coordination requirements
- Structural



- Heating, Ventilating, and Air Conditioning
- Plumbing / Fire Protection / Sanitary
- Steam Distribution
- Steam Generation
- Boiler Safety Devices - Operation Checklist
- Electrical
- Incineration

5.14. DESIGN ALERTS

Located in TIL <https://www.cfm.va.gov/til/alert.asp>

Purpose: Communicates current design issues and solutions by:

- Publishing periodic alert memos
- Summarizing design solutions

5.15. STANDARDS ALERTS

Located in TIL <https://www.cfm.va.gov/til/alert.asp>

Purpose: Identify innovative and broad ranging Standards and Design processes and procedures that have a major impact on the VA's goal of delivering world-class facilities by:

- Publishing periodic alert memos
- Summarizing design solutions

5.16. COST ESTIMATING MANUAL

Located in TIL <https://www.cfm.va.gov/cost/>

Purpose: To convey the general and specific VA cost estimating philosophy for VA facilities

The Manual accomplishes this by:

- Explaining specific estimating methodologies
- Containing examples of certain design elements
- Provides proper format
- Integrates the General Accountability Office (GAO) Estimating Process *GAO-09-3SP GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs* and GAO audit recommendations. and GAO Cost Estimating and Assessment Guide *Cost*



Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs (gao.gov)

5.17. SUSTAINABLE DESIGN

Located in TIL <https://www.cfm.va.gov/til/sustain.asp>

Purpose: This manual identifies the seven sustainability goals outlined in the Federal Mandates and maps each goal to the appropriate LEED strategy for implementation. Methods for consideration to achieve the goals, budget considerations, case studies, and checklists are also included.

The Manual accomplishes this by:

- Prescribing the use of integrated design practices
- Providing strategies for optimization of energy performance
- Providing strategies for the protection and conservation of water resources
- Providing strategies for enhancement of indoor environmental quality
- Providing strategies for reduction of the environmental impact of materials

5.18. PHYSICAL SECURITY AND RESILIENCY DESIGN MANUAL (PG-18-10)

Located in TIL <https://www.cfm.va.gov/til/dManual.asp#PSR>

Purpose: Design Manual for VA Facilities sets physical security standards for facilities required to continue operation during a natural or human-made extreme event and for facilities required to protect staff life safety in an emergency.

The Manuals accomplish this by:

- Setting objectives for physical security
- Providing strategies for use in design and construction to protect VA facilities
- Providing cost-effective design criteria

Please contact your project manager for any interim physical security guidance, such as applicable cemetery-related updates to the manual.

5.19. FIRE PROTECTION DESIGN MANUAL (PG-18-10)

Located in TIL <https://www.cfm.va.gov/til/spclRqmts.asp#FS>

Purpose: This document provides fire protection design criteria for all VA facilities, including fire alarm requirements.



5.20. SIGNAGE DESIGN MANUAL (PG-18-10)

Located in TIL <https://www.cfm.va.gov/til/dManual.asp#SIGN>

Purpose: This document provides signage design criteria for all VA facilities.

5.21. FACILITIES DEDICATION PLAQUES & SEALS (PG-18-13)

Located in TIL <https://www.cfm.va.gov/til/topicSpecific.asp#PS>

Purpose: This document provides design and procurement criteria for all specific VA plaques and seals.

5.22. THERMAL DESIGN CRITERIA

5.22.1. ENERGY CONSERVATION

The Federal Government mandates the need to conserve energy by Executive Order and by Law enacted by Congress. In addition, 19 Federal Agencies have signed a Memorandum of Understanding (MOU) outlining specific goals and targets for energy conservation and sustainable design. VA is one of the signatory agencies. The following paragraphs list references and details of various requirements, and compliance with VA energy conservation and water management is defined. Facilities designed shall comply with:

- VA Directive 0055, VA Energy and Water Management Program
- Energy Policy Act of 1992
- Energy Policy Act of 2005
- Executive Order 14057, Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability
- Executive Order 13514, Federal Leadership in Environmental, Energy and Economic Performance
- National Energy Conservation Policy Act (NECPA)
- 41 CFR 102-74, Energy Conservation
- 10 CFR 433, Energy Efficiency Standards for New Federal Commercial and Multi-Family High-Rise Residential Buildings
- 10 CFR 435, Energy Conservation Voluntary Performance Standards for New Buildings: Mandatory for Federal Buildings, Subpart C, Mandatory Performance for New Federal Low-rise Residential Buildings
- 10 CFR 436, Federal Energy Management and Planning Programs, Life Cycle Cost Analysis, Subpart A – Methodology and Procedures
- VA Energy Management Action Plan and Secretary's Decision Statement
- EPA's Energy Star Program



5.22.2. DOE INTERIM FINAL RULE

In the Federal Register (Volume 71, No. 232) dated December 4, 2006, the Department of Energy (DOE) issued mandatory energy conservation guidelines as the interim final rule for implementing provisions in the Energy Policy Act (EPACT 2005). Provisions of the interim final rule are as follows:

5.22.3. ASHRAE STANDARDS

A. ASHRAE STANDARD 90.1

- **ANSI/ASHRAE/IESNA Standard 90.1 – 2019:** ASHRAE Standard 90.1 –is a component of the DOE final rule. Provisions of this standard shall be used as a baseline for computing energy savings. By reference, DOE has incorporated Standard 90.1 – 2004 into 10 CFR Part 433. Also, the U.S. Congress has prescribed this standard in section 109 of the Energy Policy Act of 2005 (EPACT).
- **ANSI/ASHRAE/IESNA Standard 90.1 – 2019:** ASHRAE has published the revised Standard 90.1. HVAC systems shall be designed to comply with the ANSI/ASHRAE/IESNA Standard 90.1 for Buildings except for Low-Rise Residential Buildings. The A/E is expected to comprehend and implement the practices dictated in ASHRAE 90.1 entirely.
- **ASHRAE/IESNA/USGBC Standard 189.1 – 2017:** Standard for High-Performance Green Buildings Design except for Low-Rise Residential Buildings.
- **ANSI/ASHRAE Standard 62.1 – 2019:** Ventilation for Acceptable Indoor Air Quality
- **ASHRAE Guideline 1.1 – 2007:** HVAC & R Technical requirements for the Commissioning Process
- **ASHRAE Guideline 0 – 2019:** The Commissioning Process
- **ANSI/ASHRAE Standard 55 – 2017:** Thermal Environmental Conditions for Human occupancy
- **ASHRAE:** An Introduction to Building Information Modeling (BIM)

5.22.4. ADDITIONAL MANDATED ENERGY CONSERVATION MEASURES

In addition to complying with the ASHRAE Standard, DOE has mandated that a new Federal building must be designed to achieve an energy consumption level at least 30 percent below the level achieved under Standard 90.1-2004 *if life-cycle is cost-effective*. Use the Performance Rating Method – Appendix G of ASHRAE Standard 90.1 -2004 to document the energy savings.



- **Life-Cycle Cost (LCC) Analysis (Requirements):** If an additional 30 percent reduction in energy consumption is not lifecycle cost-effective, the A/E must evaluate alternate designs; at successive decrements (e.g., 25 %, 20 %, or lower) to identify the most energy-efficient design that is lifecycle cost-effective. To do so, the A/E shall consider and evaluate readily available energy conservation measures which the industry is generally familiar with and should be considered and evaluated. DOE further stipulates that the “agencies must estimate the life-cycle costs and energy consumption of the planned building as designed and an otherwise building just meeting the minimum criteria outlined in the baseline, ASHRAE Standard.” This measure is meant to demonstrate and record the mandated compliance and the extent of it.
- **Life-Cycle Cost Analysis (Methodology):** An engineering economic analysis, to comply with the Public Law 95-619, shall be performed following the procedure outlined by the Department of Energy (DOE) in the National Institute of Standards and Technology (NIST) Handbook 135 dated February 1996 (or the latest version) - Life Cycle Costing Manual for the Federal Energy Management Program.

Use the following parameters when performing the analysis:

- 20-year life cycle period for system comparison
- Other features are:
- 7 percent discount factor
- No taxes or insurance, while computing cost

5.22.5. EXECUTIVE ORDER 14057 - CATALYZING CLEAN ENERGY INDUSTRIES AND JOBS THROUGH FEDERAL SUSTAINABILITY, DATED DECEMBER 8, 2021

Outlines Government-wide goals to net-zero emissions by 2050. Mandatory energy and water efficiency, pollution and waste reduction requirements are also published in the above Executive Order. Federal agency goals are:

- Achieving net-zero emission buildings
- Increase facility energy efficiency and water efficiency; establish agency-wide targets
- Minimize waste, including the generation of wastes requiring disposal; provide advanced pollution prevention; diverting at least 50% non-hazardous solid waste from landfills including construction and demolition waste by fiscal year 2025 and 75% by fiscal year 2030.



- Utilize sustainable acquisition and procurement to reduce emissions by prioritizing use of recycled or energy efficient products as identified by the Environmental Protection Agency (EPA)
- Buy clean; expand consideration of embodied emissions and pollutants of construction materials in Federal procurement and federally funded projects
- Achieve and maintain annual reductions in building energy use and implement energy efficiency measures that reduce costs;
- Meet statutory requirements relating to the consumption of renewable energy and electricity;
- Reduce potable and non-potable water consumption, and comply with stormwater management requirements;
- Ensure that new construction and major renovations conform to applicable building energy efficiency requirements and sustainable design principles; implement space utilization and optimization practices

5.22.6. VA POLICY: ENERGY AND WATER MANAGEMENT PROGRAM

VA Directive 0055, dated December 10, 2014: The directive updates VA's Green Management Program energy policy to include new and updated executive orders and legislation requirements. This document also expands the scope and applicability of this policy to water management.

5.22.7. VA POLICY: ENVIRONMENTAL MANAGEMENT PROGRAM

VA Directive 0057, dated October 25, 2021: The directive updates VA's Environmental Management Program to include new and updated executive orders and legislation requirements. The document includes Green Purchasing, Chemical Management and Pollution Prevention, Electronics Stewardship, Environmental Compliance, and Waste Prevention and Recycling.

5.22.8. ADDITIONAL MEASURES (MOU)

MOU also addresses related issues, such as commissioning and measurement, and verification. These issues are described below.

5.22.9. MEASUREMENTS AND VERIFICATION

Per DOE Guidelines issued under Section 103 of EPACT, install building-level utility meters in new major construction and renovation projects to track and continuously optimize performance. MOU mandates that the actual performance data from the first year of operation be compared with the energy design target. After one year of occupancy, measure all-new



major installations using the Energy Star® Benchmarking Tool for building and space types covered by ENERGY STAR® or FEMP designated equipment.

Install building-level utility meters in new major construction and renovation projects to track and continuously optimize performance to measure the consumption of potable water, gas, steam, electricity, and thermal energy in federal buildings and other facilities and grounds. Metering systems should be coordinated with the VA facility and the VA national metering reporting system. Meters shall be installed per the VA Sustainable Design Manual.

5.23. BUY AMERICA ACT

Many products have both American-made and foreign-made products in the same series or book or collection. Many American companies have items that are not American-made. Ensure that all selections, unless adequately justified, follow the requirements as found in Federal Acquisition Regulation (FAR) 25.201.

5.24. APPLICABLE CODES AND STANDARDS

5.24.1. GENERAL

Use the latest edition of Codes, Regulations, and Standards as a basis of design. Refer to *Design and Construction Procedures, PG-18-3, Topic 1, Codes, Standards, and Executive Orders* (<https://www.cfm.va.gov/til/cPro.asp>). Unless otherwise indicated by VA criteria, use the Codes and Standards of the following organizations:

- American National Standards Institute (ANSI)
- American Society for Testing Materials (ASTM)
- Building Industry Consulting Service International (BICSI)
- Federal Communications Commission (FCC), all Regulations, Procedures, and Standards for Two-Way Radio Equipment, Systems, and Operation
- Illuminating Engineering Society of North America (IESNA)
- Institute of Electrical and Electronics Engineers (IEEE)
- International Organization for Standardization (ISO), Standards for Protocols and Interfaces that include Open System Interconnections (OSI)
- Facilities Guidelines Institute (FGI): 2010, *or most current issue*, Guidelines for the Design and Construction of Health Care Facilities
- U.S. Green Building Council (USGBC) LEED Program & Sustainable Building Design Council
- The Green Building Initiative (GBI), Green Globes Environmental Assessment and Rating System
- The American Institute of Architects (AIA) and National Society of Professional Engineers (NSPE) recent additions to their professional codes of ethics encouraging ***“environmentally responsible design.”***



- National Fire Protection Association (NFPA): A/E shall pay particular attention to the following publications:
- NFPA 20 – Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 70 – National Electrical Code
- NFPA 70 E – Standard for Electrical Safety Requirements for Employee Workplaces
- NFPA 72 – National Fire Alarm Code
- NFPA 75 – Standard for the Protection of Electronic Computer/Data Processing Equipment
- NFPA 77 – Recommended Practice on Static Electricity
- NFPA 80 – Standard for Fire Doors and Fire Windows
- NFPA92A– Recommended Practice for Smoke-Control Systems
- NFPA 101 – Life Safety Code
- NFPA 110 – Standard for Emergency and Standby Power Systems
- NFPA 780 – Standard for the Installation of Lightning Protection Systems
- National Electrical Manufacturers Association (NEMA)
- Underwriters' Laboratories, Inc. (UL)
- Telecommunications Industry Association and Electronic Alliance Standards Association (EIA/TIA) 568 and 569A, Communications Cabling Circuits and Equipment
- Building Industry Consulting Service International, Inc. (BICSI): A/E shall pay particular attention to the following publications:
- Outside Plant Design Reference Manual
- Telecommunications Distribution Methods Manual
- Network Design Reference Manual
- ANSI/TIA/EIA-942 – Telecommunications Infrastructure Design for Data Centers.
- United States Department of Commerce, National Telecommunications and Information Administration (NTIA), Manual of Regulations and Procedures for Federal Radio Frequency Management for all Two-Way Radio and Radio Paging Systems, all Narrow-Band and Frequency Use Standards
- International Plumbing Code (IPC)
- ASHRAE, see Thermal Design Criteria Section, above
- ASHRAE: Handbook HVAC Applications
- American Society of Plumbing Engineers (ASPE) – Data Books

5.24.2. LOCAL CODES AND CONDITIONS

The A/E shall bring local and regional climatic and geographic conditions and provisions of local building codes that are significantly different from the codes and standards listed above to the attention of VA and shall provide specific information on how the proposed design reflects



these conditions and codes. Of particular focus shall be local codes, code amendments, and conditions related to coastal, hurricane-prone, arctic, or seismically active regions or other climatic or regional conditions that warrant additional measures to protect the integrity of systems.



6.0 TECHNICAL REQUIREMENTS

6.1. PURPOSE

This manual serves as the master reference document for architecture, planning, and design at the Veterans Affairs (VA) National Cemetery Administration (NCA) facilities. Architectural requirements and criteria in this manual are expected to be followed in the planning of VA facilities.

A. RESPONSIBILITY

VA's Office of Construction and Facilities Management (CFM) is responsible for all built environment components (buildings, open spaces, and infrastructure, including VBA and NCA) for Major Construction projects over \$20 million. NCA's Design and Construction Service (DCS) is responsible for Minor Construction, Sustainment, Renovation, and Modernization projects under \$20 million.

B. BUILDING GOALS

CFM and DCS are entrusted with providing VA with facilities that incorporate the highest degree of cemetery planning, design, and construction which reflect:

- Functional Efficiency
- Innovative but appropriate design
- Contextual harmony with the site
- Appropriately selected materials and systems
- Health and safety characteristics
- Accessibility for the Disabled
- Life Cycle Value

C. APPLICABILITY

These Architectural and Engineering Design Standards have been compiled to establish general and, in some cases, specific design policies to guide consultant architects and engineers (A/E) to design new facilities and alter or renovate existing structures.



6.1.1. DESIGN PRINCIPLES:

A. GENERAL

New and renovated facilities must provide the VA's functional, aesthetic, environmental, and safety needs with a reasonable balance between initial cost and life-cycle value. The VA is dedicated to improving the quality of its facilities through architectural, planning and engineering services, which must:

- Ensure the highest degree of professionalism from the A/E Team to develop and implement innovative and functional design concepts in harmony with the site environment and appropriate to the project needs.
- Implement reliable procedures for controlling project estimates, construction costs, life-cycle factors, and time schedules.
- Establish thorough quality-control coordination during all phases of the A/E Scope of Services
- Respond to governing codes and standards ensuring environmental health and safety.
- Ensure that design concepts for repair, alterations, and renovations are executed with professional consideration as new facilities.

The NCA's expectations are that landscape and architectural components, elements, and facilities designed using this manual meet their primary objective of providing an everlasting shrine to our nation's veterans and a welcoming place for their families, staff, and visitors. The cemetery design shall meet all NCA design criteria, NCA/VA design requirements, applicable codes, technical requirements and coordinate well with other trades and disciplines.

Deviations can be made from the requirements of this manual to accommodate new concepts, methods of construction, and design enhancements. NCA shall approve such deviations. Deviations are not permitted from those requirements, including federal regulations, public laws, executive orders, and other applicable codes and standards.

Throughout this manual, the statement is made: to obtain approval from NCA Authorities.

Authority is defined as the CFM/NCA Project Manager with consultation with NCA Operations and District Staff.

6.1.2. CHANGES DURING DESIGN

Do not withhold proposals for changes in plan arrangement, materials of construction, or architectural design for the periodic scheduled reviews. Changes shall be discussed with the Project Manager by telephone and correspondence and forward drawings for review as soon as they are sufficiently developed for consideration.



6.1.3. COORDINATION OF DOCUMENTS

The drawings and specifications shall be complete, precise, and coordinated. The Construction Contractor only agrees to produce what is depicted on the drawings and described in the specifications and performs within the precise scope of the contract documents. The A/E is responsible for coordinating the various documents to eliminate ambiguous requirements.

6.1.4. CONSTRUCTION TERMINOLOGY

To avoid conflicts over ambiguous terms and statements, use identical terms on drawings and specifications. For example, the "roofing system" in the specifications should not be called a "built-up roof" on the drawings.

6.1.5. NAMES OF SPACES

Names of rooms and departments also play an essential role in coordination. The names on the drawings must be the same as in the Program for Design, as they impact finishes and equipment and construction details and mechanical & electrical systems. All room names should be placed on the drawings within the specific rooms named as far as possible.

A. EXISTING FACILITIES

- The design shall coordinate interior design solutions, wayfinding and signage, and fixtures and equipment at existing facilities.
- Provide existing finishes on demolition plans.

6.2. SCHEDULED PROGRESS REVIEWS

The A/E contract includes designated specific intervals for the review of the development of the work. These reviews are joint consultations between the CFM/VA Project Manager, NCA Operations, NCA District Staff, CFM Consulting Support Service, and other NCA/VA Services. Concurring reviews help exchange information, reconcile differing views on objectives, judge the quality and completeness at each stage, assure that previously noted changes have been incorporated, and warn of unacceptable departures from criteria or standards during the design development. The design review encompasses all disciplines. They are not to discover errors or omissions in detail. The contract documents' quality, accuracy, coordination, and completeness remain the A/E's responsibility; Refer to TIL - [VA Program Guide, A/E Submission Instructions \(PG-18-15\), Volume D – Cemetery Projects](#).



6.3. DESIGN DOCUMENTATION

6.3.1. DRAWINGS

A. GENERAL

All drawings sheets shall use the standard VA/NCA title block containing the following information: Project Title, Location / Address, and Project Number. The sheet size is 30" x 42".

Each drawing sheet is arranged and labeled per the *VA Drawings Deliverable Requirement (DDR), Appendix A - Sheet Identification* (<https://www.cfm.va.gov/ti/projReq.asp>) which follows the National CAD Standards (NCS) Format with VA specific modifications.

Each drawing sheet (as well as all other materials submitted) is clearly and consistently labeled above the title block, what submission it is, corresponding to the required submissions in this statement of work, i.e., "Design Development 1 Submission [DD1]," "Construction Document Submission[CD]," and other labels as need it. The label is changed after each review. Drawings shall be labeled "NOT FOR CONSTRUCTION." The labels are removed before printing and signing/stamping/sealing the bid sets.

Drawing Cover Sheet: Each set of drawings have a cover sheet that indicates: current VA signature, project title, VA project number, index of drawings in the set with sheet numbers and sequence, names, addresses, and phone numbers of all associated A/E firms, vicinity map, site location map, cemetery map showing project location and other pertinent project information to include a table of the gravesite inventory developed in this project. The table identifies the burial section/columbarium wall, the net acreage of each burial section, the sizes and quantities of the gravesites (i.e., casket and cremated remains), and the number of niches in the court and each wall. A second table provides Site Summary Information showing the phase's overall site development area and the breakdown of each major element within the project (i.e., irrigated turf, landscape beds, walkways, roads, building footprint, and other elements.). A comprehensive legend of drawing abbreviations and drafting symbols for the drawings (all disciplines) are included either on the cover sheet or a second sheet immediately following the cover.

Graphic Standards: Drawings shall have graphic scales, a north arrow (either true north or plan north; orientation shall be consistent throughout drawings unless approved by the VA Project Manager, title block, and key plan identifying the drawing component within the overall plan. Each drawing, booklet, and other supporting submittals, including cover sheets, shall be clearly and consistently identified with the project title, location, building, phase, section, and segment throughout the design process. Submission labels are removed before printing bid documents. Each sheet has a keymap for locating and orienting individual drawing sheets to the whole site. The current sheet shall be shaded on each keymap. Each drawing title is unique. If multiple sheets should have the same drawing title, add a unique number or letter to the title to make it unique (example, Survey Area A, Survey Area B, Site Details 1, Site Details 2)



Plans must demonstrate what is new work and what is existing and what is to be demolished. New work must be graphically bolder than existing work. For example, existing items to remain may be screened, with new work shown solid. Dashed lines shall show demolition work.

When more than one continuous plan is required, match lines shall identify adjoining plans. When match lines are required, an overall plan sheet shall be provided as the first sheet in the sequence, showing the sheet's breakdown to follow and the location of corresponding match lines identifying adjoining plans. Each match line shall be referenced to the adjacent corresponding plan by sheet name and number. Drawings using match lines must not overlap information. All information must stop at the match line and resume at the corresponding match line. Match lines must not obscure information on the plans.

Detail sheets should be organized logically and present the material intended in an orderly way; for example, the head, jamb, and sill should be arranged from top to bottom, not randomly placed on the sheet. Items with the plan, front and side views should be arranged in that context to one another. Each detail must be clearly labeled and the scale indicated. There should be one door schedule and one window schedule for all buildings in the project. Each building should have a color and finish schedule on the same sheet with the individual floor plan.

A legend that applies to multiple drawings in the set should appear on each drawing in that series. For example, the Plant Legend must appear on every Planting Plan sheet, not only on the first sheet in that series. If the standard legend contains a significant amount of information that does not fit on each sheet, a reference legend sheet can be provided as the first sheet in the series; however, a legend with specifically referenced items should appear on every sheet.

Material notes and labels on the drawings must correspond to the terminology in the specifications. The item's name in the specifications is used as the label on the drawings, and the labels and notes are consistent from sheet to sheet.

B. COMPUTER-AIDED DESIGN AND DRAFTING (CADD)

For general drawing requirements, including organization, size, scales, and Computer-Aided Design and Drafting (CADD) format, refer to *TIL - Standard Details, VA CAD Standards PG-18-4. Presentation of Design* (<https://www.cfm.va.gov/til/sDetail.asp>)

When reviewing the design, suitable exterior illustrations should be presented, which address the relationship to adjacent buildings and surroundings. Elevations may suffice, but any drawings, sketches, or models that clearly show the design intentions of massing, fenestration, and materials are encouraged. If future vertical expansion is planned, the building must be illustrated with and without the future floors. A written description of the design concept and intent may be helpful, especially for unusual or complex solutions.

If the Architect/Engineer office performs their project design work in two different CADD formats, the electronic file compact disk submission to the National Cemetery Administration



shall be in only one unified CADD format. The conversion and the integrity of the drawings are solely the responsibility of the Architect/Engineer. All CADD files created for this project shall be the property of the Department of Veterans Affairs and the National Cemetery Administration.

The external label for the electronic submittal shall contain at a minimum:

- VA Project Number
- Format and version of the operating system software used
- Name and version of utility software used for preparation (e.g., compression/decompression, if applicable) and copying files to media
- The sequence number of the digital media
- The index of the filenames on the digital media, as space on the label permits.

6.3.2. REPORTS/ CALCULATIONS / STUDIES / ANALYSES / ESTIMATES & SPECIFICATIONS

Submit 8 ½" x 11" copies of all required calculations, cost estimates, and specifications. All letter reports must be labeled with the project name, project number, name(s) of A/E firm(s), date, and title of the report or estimate. The final submittal of specifications shall be in Microsoft Word and Portable Document (PDF) format on the compact disc. For graphics that may be incorporated in the reports, foldout sheets up to 11" x 17" are acceptable.

Specifications shall be prepared using National Cemetery Administration (NCA) Master Construction Specifications. Subsequent submissions shall show changes to master specifications by using the "Track Changes" function. Each submission shall indicate changes from the previous submission, not all changes to the master.

6.3.3. COLOR RENDERINGS

If required by the contract, Renderings shall show the true colors of the materials to be used to construct the project and the surroundings, including road systems and planting groups, in sufficient detail to predict the project's final appearance. Show all penthouses, architectural screens, roof enclosures, skylights, stacks, and breechings visible from the station point by accurate perspective projection. Show roof-mounted equipment unless hidden by architectural screens. From aerial perspectives, show major masses of mechanical equipment located behind architectural screens in block form. If the exact size, color, and appearance of exposed roof-mounted equipment are unknown, show as accurately as possible or provide a drawing of similar equipment on the rendering(s). Rendering(s) should be mounted on 750 mm high by 1000 mm wide (30 in. by 40 in.) "Bristol" board. Provide borders of 125 mm (5 in.) at the top and sides and 150 mm (6 in.) at the bottom. The Project Manager advises the A/E on the appropriate labeling for renderings. Renderings are lettered on the mat rather than on the rendering itself.



6.3.4. SPECIFICATIONS

The VA's Master Construction Specifications, broken down by division, has been edited for use on VA National Cemetery construction projects, refer to TIL – *NCA Master Construction Specifications* (<https://www.cfm.va.gov/til/ncaSpec.asp>)

6.3.5. PROPRIETARY ITEMS

The use of trade names or other indications that identify a product of an individual manufacturer on any project shall not be used under any circumstance unless specifically approved by VA. Where VA authorizes specific products, the following shall be identified:

- Where necessary to identify existing equipment,
- Where an existing system is to be extended and competitive manufacturers cannot meet performance or dimensional requirements,
- Where required by a public utility or municipal system as a condition of service shall be stated explicitly in the specifications.

6.3.6. DISTRIBUTION / RETENTION

This section applies to major construction and minor construction projects regardless of execution agent within the VA or an external party like the US Army Corps of Engineers.

As each project design reaches 100% and Bid Set documents are produced, NCA Design and Construction and the appropriate NCA District office shall receive an electronic, hard copy of the final design documentation. Including native drawings in AutoCAD, .dwg, and Portable Document Format, .pdf, formats, and all other final products produced under contract with the VA. AutoCAD drawing transmittal shall be “relative pathed,” contain all references, line weight (ctb/stb) data, and maintain original cross-reference (xref) drawing structure.

As each project construction is complete and final inspection has occurred, NCA Design and Construction and appropriate NCA District office shall receive an electronic, hard copy of the final As-Built documentation, Operation and Maintenance Manuals, and construction inspection documentation (to include specific material selection information) for permanent retention. Including As-Built drawing files in AutoCAD, .dwg, and Portable Document Format, .pdf, formats.



6.4. PROJECT-SPECIFIC REQUIREMENTS AND INFORMATION

6.4.1. VA PROVIDED MATERIALS

The VA/NCA Project Manager provides the following data to the A/E on a project-by-project basis:

- Master Plan, if available
- Building number / Street Name assignments
- All existing drawings of the site, especially any utility plans, if available
- Design objectives
- Limitations
- Design criteria specific to the project
- Site requirements



NOTE: The following sections of this guide are arranged per the *VA Drawings Deliverable Requirement (DDR), Appendix A - Sheet Identification* (<https://www.cfm.va.gov/til/projReq.asp>) which follows the National CAD Standards (NCS) Format with VA specific modifications.

7.0 G – GENERAL

7.1. SIGNS, PLAQUES, AND EMBLEMS

Refer to TIL – *Signage and Wayfinding: Signage Design Manual* (<https://www.cfm.va.gov/til/dManual.asp#SIGN>)

A. SAFETY SIGN

Provide a safety sign for each NCA construction project over \$2 million in cost.

Refer to TIL – *NCA Master Construction Specifications* (<https://www.cfm.va.gov/til/ncaSpec.asp>)

Refer to TIL – *Standard Details (PG-18-4) Division-1, General Requirements* (<https://www.cfm.va.gov/til/sDetail.asp>)

B. CONSTRUCTION SIGN

Provide a construction sign at the site of VA construction projects over \$2 million in cost.

Refer to TIL – *NCA Master Construction Specifications* (<https://www.cfm.va.gov/til/ncaSpec.asp>)

Refer to TIL – *Standard Details (PG-18-4) Division-1, General Requirements* (<https://www.cfm.va.gov/til/sDetail.asp>)

C. DEDICATION PLAQUE

For new cemeteries, NCA furnishes a dedication plaque, and the contractor installs it. The plaque is located in the Public Information Center or Gravesite Locator and is shown on contract drawings.

Refer to TIL – *Topic Specific Standards and Criteria (PG-18-13), Facilities Dedication Plaques & Seals, VA Facilities Dedication Plaques and Seals Procurement* (<https://www.cfm.va.gov/til/topicSpecific.asp#PS>) and *NCA Master Construction Specifications Division-10, Specialties* (<https://www.cfm.va.gov/til/ncaSpec.asp>)



D. VA SEAL

The VA seal is prominently displayed on all Public Information Center and Main Administrative/Maintenance buildings. Replicas are available in bronze in three sizes. Incorporate the seal in the design near the main entrance—persons approaching either vehicles or foot see the emblem.

Refer to TIL – *VA Signage Design Manual* (<https://www.cfm.va.gov/til/dManual.asp#SIGN>) *NCA Master Construction Specifications and Standard Details (PG-18-4) Division 10 – Specialties* (<https://www.cfm.va.gov/til/ncaSpec.asp>) (<https://www.cfm.va.gov/til/sDetail.asp>)

E. SERVICE SEALS

Service Seals may be provided at either Flag /Assembly Area; service shelters; or PIC Building. The seals should not be placed at all locations. Seals should be 18-inch Diameter Bronze representing each of the six services. The seals should mount 5'-5" to center above the finished floor, left to right - ARMY, MARINES, NAVY, AIR FORCE, SPACE FORCE, COAST GUARD.

Refer to TIL – *NCA Master Construction Specifications Division-10, Specialties* (<https://www.cfm.va.gov/til/ncaSpec.asp>)

F. OTHER PLAQUES

Refer to TIL – *NCA Master Construction Specifications Division-10, Specialties* (<https://www.cfm.va.gov/til/ncaSpec.asp>)

Each VA-managed national cemetery shall contain a historic (1909) or a replica (2009) Gettysburg Address (GA) tablet produced at the Army's Rock Island Arsenal (RIA). Refer to https://www.cem.va.gov/cem/pdf/Exhibit-Gettysburg_Address.pdf and <https://www.cem.va.gov/cem/history/LincBic.asp>. The tablet shall be incorporated near the Public Information Center or Gravesite Locator.

Each VA-managed national cemetery shall contain a Bivouac of the Dead plaque near the Public Information Center or Gravesite Locator.

G. SITE / BUILDING SIGNAGE

Refer to Civil and Architectural / Interior sections for other applicable signage/wayfinding requirements.

7.2. PHASING

Ensure that construction causes minimal interference with the normal functioning of the VA cemetery and surrounding community



Refer to TIL – *Minimum Requirements for A/E Submissions (PG-18-15), Vol. D, Critical Path Method (CPM) Phasing* (<https://www.cfm.va.gov/til/aeDesSubReq.asp>)



8.0 V – SURVEY / MAPPING

8.1. SITE, TOPOGRAPHIC, UTILITY, LANDSCAPE SURVEY

Contours Crossing Roadways: When crossing roads, contour lines shall clearly illustrate the crown, grade, and height of curbs. Spot elevations shall be shown on approximate 50-foot centers along the centerline of roads, the edges of roads, and the bottom and top of curbs.

Trees & Shrubs: Locate and identify all freestanding trees of 3” caliper and larger by botanical and common names and by trunk caliper. Locate all trees of 15” caliper and larger within wooded areas.

Illustrate the perimeters of all shrubbed and wooded masses, ground cover, and plant beds. Describe the predominant vegetation located within these outlines, if known. Indicate the height and diameter of freestanding shrubs. Identify turf and lawn areas.

Locate major hedge lines and delineate tree trunk sizes, locations, and canopies.

Location of Borings and Grave Test Pits: The Surveyor shall locate and stake in the field and illustrate the location of all borings and test pits on the final survey drawings.

Reference *NCA Master Specifications, Division 2, Existing Conditions*
(<https://www.cfm.va.gov/ti/ncaSpec.asp>)

8.2. GIS DATA / NATIONAL INVENTORY INTEGRATION

Interment shall be documented under procedures for the mandatory uniform electronic inventory control of gravesites. NCA requires that the A/E designer convert their electronic CAD design files into a usable GIS format to achieve this.

8.2.1. DELIVERABLES FOR ALL GRAVESITE EXPANSION PROJECTS

Interment sections shall be documented under procedures for the mandatory uniform electronic inventory control of gravesites. NCA requires that the A/E designer convert their electronic CAD design files into a usable GIS format. For Burial, Columbarium, and Memorial Sections, convert all AutoCAD as built files to closed polylines (i.e., GIS Polygons) in a NCA provided ESRI ArcGIS File Geodatabase format. The local SPCS should be used as the spatial reference in the GIS file. Section and gravesite numbers should be attributed for each polygon gravesite feature. All Columbaria and Memorial Walls should be drawn birds’ eyes, with real-world corner locations representing the outermost edges of each wall. Each wall is divided into equal-sized polygons totaling the number of niches/plaques available for each wall. Columbaria niche and memorial wall plaques should be numbered from top left to bottom right as if



standing in front facing the wall, with the closest row in GIS being the bottom (as if laid down on its back). Submit the file geodatabase electronically or as an eHDD/thumb drive.

8.2.2. DELIVERABLES FOR MAJOR EXPANSION PROJECTS

Projects funded through the major program may also include new or replacement RTK reference stations, additional GNSS data collection equipment, training, etc. Requirements defined in specification sections from the NCA Technical Information Library (TIL) 11 83 00 and 11 83 02 should be considered and included with consultation from NCA's GIS Program Manager.



9.0 B – GEOTECHNICAL

9.1. GENERAL

9.2. SOIL SURVEY / SUB-SURFACE INVESTIGATION

A licensed geotechnical engineer makes a site survey to locate any surface conditions that indicate specific areas of concern for building the proposed structure(s). The geotechnical engineer shall be responsible for obtaining all necessary clearances from the Department of Veterans Affairs National Cemetery Administration and all agencies and utility surveyors having facilities in the vicinity of the work.

Subsurface test borings shall be done in a quantity and location to be determined by the A/E. These locations are staked in the field and elevations marked. A digital site plan is utilized for the report and other exhibits.

Borings shall be carried to a depth as determined by the A/E based upon site-specific conditions.

The A/E shall perform the Standard Penetration Test per ASTM-D1586.

Laboratory examination/verification and testing shall be made of the representative portions of the samples to establish moisture content, density, Atterberg limits, grain size and distribution, unconsolidated triaxial compression, and unconfined compressive strength as applicable to the soil type encountered.

Chemical analysis shall be performed to determine if site conditions exist which might be detrimental to buried concrete, steel, cast iron, or ductile iron, such as the presence of sulfates or carbon dioxide.

Perform tests required to comment on groundwater control during the construction phase and for the completed building. Provide specific methods and conceptual layout for any dewatering that may be required to facilitate construction, along with the order of magnitude estimates for dewatering.

Include within the report any other factors, i.e., underground utilities, which could influence the proposed construction design.

9.2.1. SOILS REPORT:

The subsurface investigation and related testing results, together with interpretations, discussions, and foundation recommendations, shall be presented in the form of a detailed soil



report. Foundation and soil investigation shall be conducted in conformance with Chapter 18 of the IBC. The report shall include items noted in IBC1802.6 and the following at a minimum:

- a) A boring location plan showing the exact location of each boring on the limits of the project.
- b) Boring profile showing:
 - i) Ground elevations.
 - ii) Classification of soils encountered with depth.
 - iii) A detailed description of any fill material encountered.
 - iv) Groundwater elevation at least 24 hours after boring is completed.
 - v) Rock classification and elevation of bedrock (if applicable).
 - vi) The number of blows required for every 6 inches.
- c) Comment on applicable foundations to support the proposed structures (to include preplaced crypts) and determine the allowable soil bearing value at the recommended depth. Discuss the influence of water tables on design values if deep foundations are recommended, including the allowable skin friction and bearing values for good deep foundations.
- d) If the use of deep foundations is warranted, recommendations shall include installation and testing requirements. Potential construction problems associated with deep foundations suggested installation methods and equipment shall also be discussed. Criteria for lateral load shall be discussed in the report.
- e) Recommend the value of active and passive soil pressures on structures retaining earth, including both segmental and cast-in-place retaining walls.
- f) Determine the depth required for protection from frost.
- g) Site excavation methods, equipment, and difficulties anticipated during excavation shall be discussed. Ensure that excavation/fill requirements for any pre-placed crypt fields are addressed. Include expansion and consolidation volume percentages. Report recommendations to address compaction, trench backfill, sub-surface drainage, unstable cut slopes, setbacks, construction during wet weather, and trenches.
- h) Recommendations for site improvements, pavement cross-sections, walkway cross-sections, groundwater control, and treatment of in-place soils to support slab on grade and pre-placed crypts.



10.0 C – CIVIL

10.1. SITE DESIGN GUIDELINES

The design for a VA National Cemetery shall conform to the following site planning criteria:

When locating the proposed interment areas, buildings, and roads consider topography, adjacent facilities, environmental impacts, and future development to produce a functional and aesthetically successful design.

Consider impacts on existing natural and artificial stormwater drainage patterns and systems.

Provide necessary data and coordinate VA compliance with FAA Regulations for obstructions to air navigation and other navigable air space regulations (see Advisory Circulars 70/7460-1H, Obstruction Marking and Lighting, Federal Aviation Administration (FAA) Advisory Circulars are available free of charge, in writing or by Internet, from:

- U.S. Department of Transportation Federal Aviation Administration 800 Independence Avenue, SW Washington, DC 20591

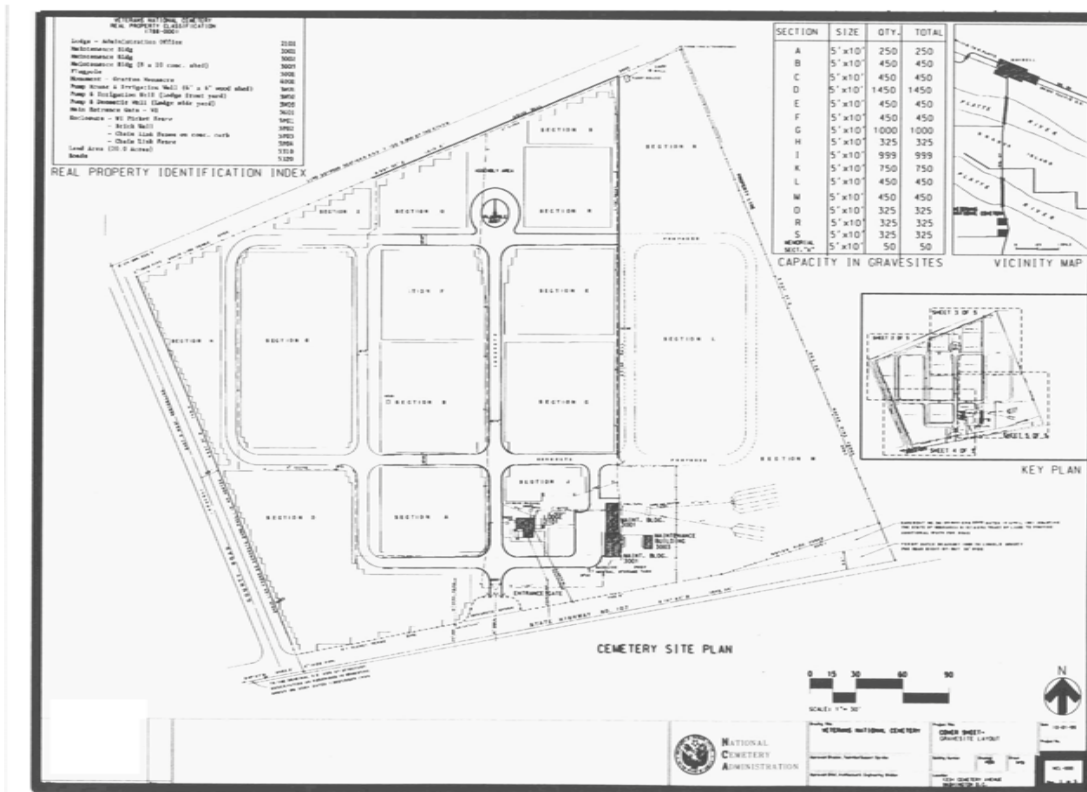


Exhibit 1: Example Cemetery Site Plan



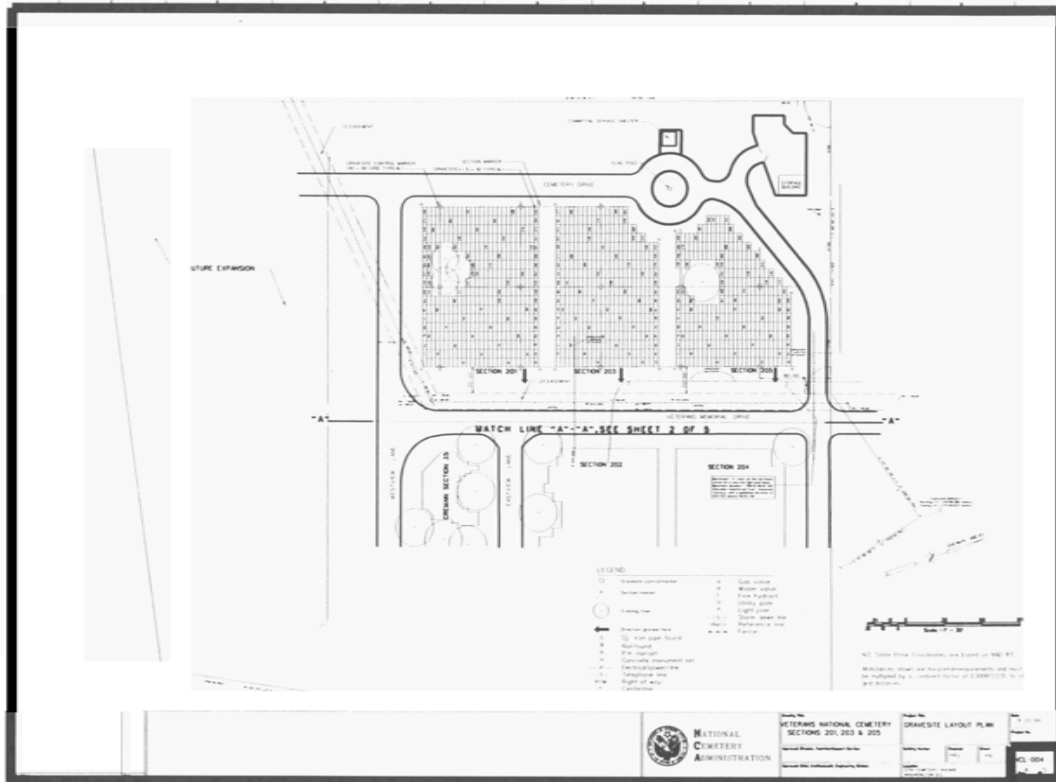


Exhibit 2: Example Gravesite Layout Plan containing gravesite numbering

10.2. CEMETERY SPECIFIC

Headstones and markers are placed per layout standards stated in the current [NCA Handbook 3120 - Interment Area Layout](#).

NCA’s policy is that every interment shall be documented following procedures for the mandatory uniform electronic inventory control of gravesites.

10.2.1. IN-GROUND CASKET

A. GENERAL

Burial sections for full casket gravesites shall be no larger than 3 acres (1.2 hectares).

The size of full-casket gravesites adheres to the standards stated in the current [NCA Handbook 3120 - Interment Area Layout](#). See sizing below.

A minimum of 18 inches (46 cm) of earth covers each casket interred in a national cemetery.



A minimum of 12' feet shall separate adjacent burial sections to define the section boundaries and provide burial operations heavy equipment access. This separation shall not contain irrigation or function as irrigation aisles.

Burial sections shall be laid out to provide a minimum of 10' feet of turf between the headstones and the edge of the turf to provide access for mowers.

B. SIZE

The following standard gravesite sizes are used when conditions warrant:

- The 5 feet x 10 feet gravesite (1.5 m x 3 m) is used where double-depth interments in 7 feet (2.1 m) excavation are possible. These sites are inventoried in NCA Management and Decision Support System (MADSS) as “full casket sites.”
- The 6 feet x 10 feet gravesite (1.8 m x 3 m) is used for single depth side-by-side interments where excavation below 5 feet (1.5 m) is impractical due to soil conditions. These sites are inventoried in MADSS as “full casket sites.”
- The 4 feet x 8 feet gravesite (1.2 m x 2.4 m) may be used in those sections of national cemeteries that, by law, use flat markers. These sites are inventoried in MADSS as “full casket sites.”
- The 3 feet x 8 feet gravesite (0.9 m x 2.4 m) or 3 feet x 10 feet gravesite (0.9 m x 3 m) may be used in those sections of national cemeteries that have been designated for the use of pre-placed crypts. These sites are inventoried in MADSS as “full casket sites.”

10.2.2. IN-GROUND PRE-PLACED CRYPTS (PPC)

A. GENERAL

Pre-placed crypt fields are based upon typical burial plot sizes of 3' x 8', or when space is a premium, a reduced plot size of 3' x 7'-8" or 3' x 7'-7 ½" are the alternative plot layout sizes. Confirm which size is to be used for a specific project with the Project Manager.

Unless directed otherwise, the design of the crypt fields shall contain irrigation isles that are the same width as the plot size. The locations and spacing of the irrigation isles shall be based upon the irrigation system design to achieve the most efficient irrigation water distribution. Refer to the Landscaping Design section, Irrigation Design sub-section of this guide.

Single plots shall not be placed at the end of an irrigation isle.

The minimum number of plots that are laid out side by side is two.



Crypt fields may be constructed with standard double depth crypts or quads (two double depth crypts manufactured in one casting). For those instances where there is a high probability that quads are provided, it is desirable to do the crypt field layout with plots being in even increments in each row, both in partial and complete rows between irrigation isles.

B. NUMBERING

PPC shall be numbered on the lid and interior headwall to match contract requirements. NCA requires photographic verification of all crypt lid numbering sequencing and orientation before backfilling. Provide photographic documentation of the entire crypt field using an aerial vehicle (drone). The entire PPC field(s) of all lid number photos shall be edited as necessary for inserting onto a single sheet of the Record Drawings with all lid number photos easily legible. Number "666" shall not be used and shall be replaced with "665A".

C. GRADING AND DRAINAGE

Crypts shall be designed to be set on surface grade and subgrades that are flat up to a maximum slope of 3%. At a 3% maximum slope, it is still possible to lower a casket vertically and not hang up on the sides of the pre-placed concrete vaults.

Crypt fields shall be designed with finished grades that provide positive drainage. A minimum slope of 2% is required for the finished surface grade over crypt fields.

Crypt fields are generally constructed by excavation into the existing soil, thereby creating a bowl. Unless expressly excluded in a geotechnical report, indicating the existence of a very well-drained soil condition below the crypt field, an under-drainage system shall be designed and constructed below the crypts. One of the fundamental design principles for crypt fields is that water shall not enter into the crypts from the drain holes on the bottom of the crypts at any time following the completion of the field. CAUTION shall be taken when the crypt field underdrains are connected to site storm drainage systems. The designer shall ensure that backflow from the stormwater system, including ponds, cannot back up into the crypt fields to levels that introduce water into the lowest crypt in the field.

Crypts shall be set on a minimum of 6-inches of washed, well-drained stone, with aggregate being 1/8 inch or larger. Stone from 1/8" to 3/8" in size shall be limited to the top inch of the stone bed and shall be used for fine grading while setting the crypts. For the project location, the designer shall check with the local aggregate suppliers to determine what materials are available and check with the knowledgeable crypt installers to recommend the gradation that should be included for the specific project. The object of the stone base is to provide a free-draining base for supporting the crypts that is workable by the installers during installation and allows them the easily set the crypts to the allowed installation tolerances.

Crypt field design can be either sloped, 3% maximum, or stepped with the pre-placed crypts placed level, with the change in the grade being created by stepping the crypt field. Steps shall



be created, so the depth of cover material over the crypt at the headstone location is between 20 and 22 inches.

D. IRRIGATION

Irrigation lines through crypt fields should be installed with the top of the irrigation lateral a minimum of 4-inches below the top of the lid to ensure that the line is not damaged during excavation crypts.

10.2.3. IN-GROUND CREMAINS (IGC)

A. GENERAL

NCA's policy is that in-ground cremation sites adhere to [NCA Handbook 3120 - Interment Area Layout standards](#).

A minimum of 12' feet shall separate adjacent burial sections to define the section boundaries and provide burial operations heavy equipment access. This separation shall not contain irrigation or function as irrigation aisles.

B. SIZE

The standard cremains site sizes are used when conditions warrant:

- **Designated Cremains Section** [In-ground]. A burial site for the interment of cremated remains in a separate cremains section is 3 feet x 3 feet x 2 feet deep (91 cm x 91 cm x 61 cm) and is marked with a 12 inches x 18 inches flat granite marker. A minimum of 12 inches (30 cm) of earth covers cremated remains interred in a national cemetery designated cremains section. Burial sections for cremated remains shall have no more than 999 sites (approximately 0.2 acres) (28 square meters). These sites are inventoried in MADSS as "half-sites." Note that some cremains crypts exist at various sites; the size should match existing burial sites.
- **Garden Niche or Terrace** [In-ground]. A burial site for the interment of cremated remains in a distinct space using a system of paths, walls, and terraces that creates a tranquil garden setting, is 3 feet x 3 feet + 2 feet deep (91 cm x 91 cm x 61 cm) and is marked with a 12 inches x 18 inches VA standard flat granite marker or a wall-mounted bronze plaque. A minimum of 12 inches (30 cm) of earth covers cremated remains interred in a national cemetery garden niche or terrace. These sites are inventoried in MADSS as "half-sites."
- **Half-Site** [In-ground]. A gravesite is usually located on the perimeter of an existing full-casket burial section divided in half and designated "a" and "b,"



creating two cremains sites. Generally, this site is marked with a flat granite marker. These sites are inventoried in MADSS as “half-sites.”

- **Obstructed Gravesite** [In-ground]. A gravesite in a casket burial section that, due to some physical obstruction such as a tree, rock strata, or other obstructions., is usable only for cremated remains. This site is marked with the same headstone or marker as the adjacent gravesites. These sites are inventoried in MADSS as “obstructed sites.”

10.2.4. COLUMBARIUM [INTERMENT]

A. GENERAL

A columbarium is an above-ground structure with vaults or niches for the inurnment of cremated remains.

A niche in an above-ground structure designed for the inurnment of cremated remains is 10-1/2 inches x 15 inches x 20 inches deep (27 cm x 38 cm x 51 cm), measured at the face. Each niche is designed to accept an individual VA standard niche cover. Some columbaria developed earlier in national cemeteries utilized multiple niche covers and various sizes of niches. Columbarium sites are inventoried in MADSS as “niches.” A Columbarium Niche Standard Detail is shown below.

NCA’s policy is that columbarium niches adhere to [NCA Directive 3120 - Interment Area Layout standards](#).

Establish the elevations for each of the columbarium structures that are to be built. Key elevations are bottom of footings, top of foundation, shelf elevations, pier elevations, and top precast units.

If there are steps within a specific columbarium structure, ensure the elevations are checked, and drawings are appropriately annotated with elevations.

Coordinate the placement of reinforcing to be installed in the units with the Structural Engineer. Consider creating a plan drawing showing all of the reinforcing steel throughout the work, especially in the piers when they aren't all the same.

All installation materials should be specified as corrosion-resistant stainless steel to the maximum extent possible. The intent is to prevent deterioration which results in unsightly staining and long-term maintenance issues.

Coordinate with the Geotechnical Engineer to provide recommendations for the base material beneath the columbarium footings, especially if less than ideal soil conditions exist on the site. The Structural Designer for the columbarium footing/foundations shall work closely with the Geotechnical Engineer. The structural design shall consider any differential movement of the



columbarium walls and, if so, are control joints (for controlled cracking) required. Less than ideal soil conditions impact the rest of the design as to whether control joints continue through the upper portions of the structure or not.

The installation of decorative gravel strips (for flower vases) along the columbarium walls is a source for water entering the ground; this could provide a pathway for water to be conducted below the footing. Moisture in the footing zone could result in swelling of expansive soils and foundation instability. Coordinate the design of gravel strips and control the associated impacts of water entering into them. Ensure that if pipes are installed in the gravel strips that they are connected to a drainage system. To minimize the impact of water in the gravel strips, separate the soil below by installing an impermeable geotextile fabric below the stone, directing water to the footing drains.

The designer shall detail the connection(s) of piers and wall units and consider the appearance of adjoining materials in close viewing distances rather than from far away. If unfinished concrete is used, the exposed concrete surfaces are cleaned of surface laitance with acid etching.

NOTE: The detailing is very important and can adversely affect the appearance of the final product. If the Contractors are left with too much latitude, the owner may get a final product that does not appear as initially designed/intended. The detailing is especially important when the design incorporates irregular stonework against straight precast concrete units. The designer shall detail the joints for stone to come against the concrete as a large mortared joint. A caulked joint is prohibited as it results in a poor appearance for the final product.

Consider creating three-dimensional views of the units, especially when the units are interconnected with numbering shown to ensure that the relationships visually make sense in Working Drawings and are constructible. Sometime during the design process, ensure that the construction tolerances of the columbarium assembly can be constructed as indicated.



COLUMBARIUM NICHE STANDARD DETAILS

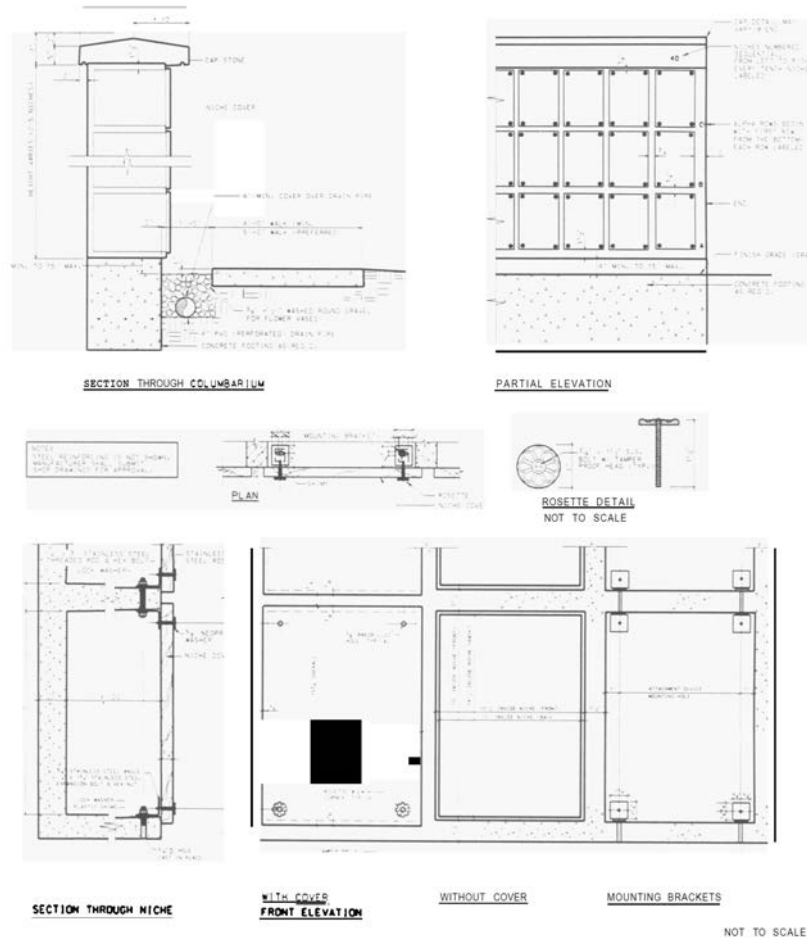


Exhibit 3: Example Columbarium Niche Details

10.2.5. CREMAINS GARDEN [SCATTERING]

A. GENERAL

Cremated remains are scattered at a designated garden-type area in the landscape. A cremains garden should be designed to take advantage of the natural landscape features. It should be located in areas of a cemetery that are unsuitable for conventional interments because of terrain or landscape features. A site used for the scattering of cremated remains is not individually marked. Still, the deceased is acknowledged on a communal bronze plaque in the garden area or by an individual bronze plaque mounted on a wall designated for that purpose or by an appropriate marker on the memorial section of the cemetery.



10.2.6. MEMORIAL SITE

A. GENERAL

Memorial gravesite sizes adhere to the standards stated in *NCA Directive 3120 - Interment Area Layout*. A memorial site is 900 mm x 900 mm (3' x 3'), marked with a 300 mm x 450 mm (12" x 18") flat marker of granite or bronze, except that bronze memorial plaques may be mounted on walls designated for that purpose, instead of placement of a marker in a memorial section. These walls may be portions of other features such as retaining walls, terraces, or similar features.

A memorial site is 3 feet x 3 feet (91 cm x 91 cm), marked with a 12 inches x 18 inches (30 cm x 46 cm) flat granite marker, except that:

- A memorial site in a cemetery with an established memorial section using upright headstones on 5 feet x 5 feet (1.5 m x 1.5 m), 5 feet x 6 feet (1.5 m x 1.8 m), or similar size sites are the same particular size and use an upright headstone to maintain consistency in appearance.

Bronze memorial plaques may be mounted on walls designated for that purpose instead of placing a marker in a memorial section.

10.3. PAVING, GRADING, DRAINAGE

A. GRADING GUIDELINES

Retain the site in as natural a state as possible. Keep grading to a minimum while meeting the functional requirements of the cemetery. To the extent feasible, balance on-site cut and fill. Leave undisturbed such features as natural drainage ways, valuable trees or tree groups, shrubs, ground covers, rock out-cropping, and streams. Changes that may increase siltation or turbidity of natural wetland areas should be avoided to comply with applicable regulations. The design should use construction practices that minimize adverse effects on the natural habitat.

<u>Condition</u>	<u>Maximum Slope</u>	<u>Minimum Slope</u>	<u>Preferred</u>
Crypts	3% (33.3:1) (B)	2% (50:1)	2-3%
Lawns (Interment Areas)	10% (10:1) (B)	2% (50:1)	2- 6%
Xeriscape (Interment Areas)	2% (50:1) (B)	0.5% (200:1)	0.5-1%
Mowed slopes	25% (4:1) (A)	2% (50:1)	



<u>Condition</u>	<u>Maximum Slope</u>	<u>Minimum Slope</u>	<u>Preferred</u>
Road crown	3% (33.3:1)	2% (50:1)	2%
*Roads, longitudinal	10% (10:1)	1% (100:1)	1-10% (C)
Walks, longitudinal	5% (20:1)	1% (100:1)	1-5% (C)
Parking, longitudinal	5% (20:1)	1% (100:1)	1-3% (C)

- A. 25% is the maximum slope for mowing machinery.
- B. Slopes over 5% should have temporary and permanent erosion protection.
- C. Designated accessible routes used by people with disabilities shall conform to Architectural Barriers Act (ABA) Accessibility Standards.

* Payload is drastically reduced on heavy trucks sustaining grades over 3%. The ideal maximum sustained grade for the safe operation of trucks and automobiles is 6%. On roads subject to frequent icing and winter conditions, the maximum sustained grade is 5%.

10.4. ARCHEOLOGICAL / HISTORICAL FEATURES

Refer to TIL - *VA’s Historic Preservation site for Archaeology Requirements, Cultural Resource Management* (<https://www.cfm.va.gov/historic/>)

10.5. TRANSPORTATION

10.5.1. ROADS

A. GENERAL

All the roads should accommodate anticipated traffic volume at a design speed of 24 km/h (15 mph).

Maximum Design Speed is 24 KPH (15 MPH)

Roads designed without curbing have edge reinforcement. Where curbing is used, it must be mountable (rolled, sloped, flush or battered face) for traffic control, equipment access, and drainage control: design storm drainage curb and gutter inlets to match the curb or curb and gutter profile. No part of the inlet shall be behind the curb. Select the grating for inlets based on drainage capacity, ability to screen out harmful debris, ability to pass unobjectionable debris, strength, and permanency. Use vertical curbing on roads within the cemetery only if necessary for traffic control. The maximum road grade is 10 percent. The entrance, primary,



and secondary roads are generally wide enough for two-way traffic to pass a parked vehicle. Preferred minimum road widths and radii are outlined in the table that follows in this section. Quality in initial construction and construction materials is critical to the cemetery roadway system. All roads should support heavy equipment and large trucks loaded with wet dirt, gravel, and headstones.

SUMMARY TABLE:

ROAD TYPE	MINIMUM WIDTH & MINIMUM RADIUS
Entrance Road:	5.4 m (18'), face to face of the curb;(per single lane divided by a median) 7.2 m (24'), edge to edge, with no curb 15 m (50') minimum radius
Primary Road:	7.2 m (24'), face to face of the curb; 7.2 m (24'), edge to edge, with no curb 9 m (30') minimum radius
Secondary Roads:	6 m (20'), face to face of the curb; 7.2 m (24'), edge to edge, with no curb 9 m (30') minimum radius
Service Roads:	
(1) Service Entrance:	7.2 m (24'), face to face of curb; 7.2 m (24'), edge to edge, with no curb 15 m (50') minimum radius
(2) Service to Buildings:	3 m (10'), edge to edge, no curbs 9 m (30') minimum radius
Committal Service Shelter Drives:	8.1 m (27'), face to face of the curb; 9 m (30'), edge to edge, with no curb; Narrow to 3.6 m (12') at the throat 9 m (30') minimum radius
Cortege Lanes:	3 m (10') per lane edge to edge no curbs

B. ENTRANCE ROAD

Entrance Road: (Divided Road, One Way In, One Way Out)

5.4 meters (18 feet) face to face of the curb;

7.2 meters (24 feet), edge to edge, with no curb 15 meters (50 feet) minimum radius

C. PRIMARY ROAD

The main loop is desirable for the primary cemetery road, allowing one to drive through the cemetery without turning around. Other configurations are possible depending on the specifics of the site. The primary road provides access to all other cemetery roads.



Primary Road: (Two-Way)

7.2 meters (24 feet) face to face of the curb;

7.2 meters (24 feet), edge to edge, with no curb 9 meters (30 feet) minimum radius

D. SECONDARY ROAD(S)

Secondary roads may be subordinate loops or connector roads. They provide access primarily to burial sections.

Secondary Roads: (Two-Way)

6 meters (20 feet) face to face of the curb;

7.2 meters (24 feet), edge to edge, with no curb 9 meters (30 feet) minimum radius

E. SERVICE ROADS

The following two types make up the network of service only roads within the cemetery roadway system:

- Service entrance – The road that provides access from the public road (approach road) directly to the cemetery administration/maintenance complex, if possible. Traffic consists of maintenance vehicles and delivery trucks.
- Service drives to buildings – The drives which provide access: (1) to the back of the committal service shelters, for removal of remains after the interment service, and (2) to wells, pump houses, and other appurtenances. These driveways have no curbs and may use alternative paved surfaces to minimize their visual impact on the site. Traffic consists of cemetery maintenance vehicles.

(1.) SERVICE ENTRANCE

7.2 meters (24 feet) face to face of the curb;

7.2 meters (24 feet), edge to edge, with no curb 15 meters (50 feet) minimum radius

Service Drives to Buildings -- The drives which provide access: (1) to the back of the committal service shelters, for removal of remains after the interment service, and (2) to wells, pump houses, and other appurtenant structures. These driveways have no curbs and may use alternative paved surfaces to minimize their visual impact on the site. Traffic consists of cemetery maintenance vehicles.



Service to Buildings - 3 meters (10 feet), edge to edge, no curbs 9 meters (30 feet) minimum radius

(2.) COMMITTAL SERVICE SHELTER DRIVES

Shelter drives shall be one-way in direction with a turn-around feature at the end of the road.

8.1 meters (27 feet), face to face of curb

9 meters (30 feet), edge to edge, with no curb; Narrow to 3.6 meters (12 feet) at the throat

9 meters (30 feet) minimum radius

10.5.2. PARKING

Parking in the cemetery is accommodated in several ways to meet the various needs of staff and visitors, as identified in the design criteria for the specific building/ complex. Typically, cemetery visitors parallel-park along cemetery roads or parallel pull-offs to visit interment areas or cemetery features such as the Flag/Assembly Area, Memorial Walkway, or Public Information Center. Traditional parking lots are not provided for cemetery visitors.

NCA provides information on the number of required spaces.

Acceptable dimensions for parking areas follow for employee/visitor lots:

Minimum Bay Width 18 m (60'-0")

Minimum Stall Width 2700 mm (9'-0")

Public parking in national cemeteries is primarily on-street parallel parking. Visitor/staff parking lots may be provided with head-in stalls.

Design parking facilities to accommodate people with disabilities.

10.5.3. SIDEWALKS

Building Entrances: Analyze special requirements for entrances to buildings, especially accessibility compliance with ABAAG. Walks should be at least 1500 mm (60 inches), except 2400 mm (96 inches) minimum when abutting parallel parking pull-offs occur. Design walk slopes not to exceed 5%.

DOT details are NOT approved for use within the grounds of national cemeteries. However, DOT details are appropriate and approved for use in specific entry and exit locations where cemetery roadways directly intersect with public streets, roads, highways.



Truncated domes (detectable warnings, tactile paving, and other detectable warning means) shall not have bold coloring, such as bright yellow, typically found in DOT standards]. They do not represent NCA's goal to achieve national shrine cemeteries. The specified material color shall meet the contrasting criteria within ABAAG and balance the surrounding cemetery architectural finishes. Detectable warning concrete brick-colored paver material is preferred.

10.6. PAVING

Permeable pavement includes permeable or porous concrete, porous asphalt, single-sized aggregate, and other similar materials shall not be utilized in national cemeteries without a waiver from NCA Operations. Although the material selection lessens the environmental impact, these products have a short lifespan because the equipment used for burial operation tracks soil, requiring more maintenance to keep the required porosity of the pavement to maintain permeability.

The amount of earth cover required over a sewer, water, and gas lines follows:

Minimum cover under traffic areas shall be 900 mm (three feet).

The top of potable water and gas lines shall be at least 300 mm (one foot) below frost penetration.

Where practical, the top of sewers shall be at least 300 mm (one foot) below frost penetration. Where such depth below is not practical, provide supporting foundations to such depth and securely fasten sewer.

Do not install more than one utility in the same trench.

Maintain a horizontal distance of at least 3000 mm (ten feet) between parallel sewer and water lines, and parallel potable and non-potable (reclaimed) water lines.

Route the main distribution systems for utilities immediately adjacent to roadways within 3000 mm (10') of the curb or pavement edge. Route any utility lines through interment areas between sections to avoid obstruction of gravesites within burial sections. Install all utility lines, including electric power and communication lines, underground. Exceptions may be made depending upon the high cost or remoteness of the source from developed areas of the cemetery.

10.6.1. WATER

A. WATER SUPPLY:

A connection to a public water company is preferred for potable water. If a potable source is not available, provide on-site water treatment as necessary. Provide potable water to



administration and maintenance buildings, public restrooms, and yard hydrants. Untreated irrigation water (not sewage effluent) may be used at flower water spigots with proper signage. All signage follows the cemetery signage design.

Refer to *VA's Fire Protection Design Manual* (<https://www.cfm.va.gov/til/spclRqmts.asp#FS>) for water supply pressure testing. Coordinate with the Fire Protection Section of this guide.

Investigate the use of non-potable water for irrigation. Effect on health, grass, and irrigation equipment shall be considered. Ensure that water is available either by two sources or on-site storage (lake, tank, or other means of storage.). Use potable water as a last resort. Coordinate with the Landscape Design section, Irrigation Design sub-section of this guide. Provide separate water meter (or deduct meter) for irrigation-only service connections to avoid sewer fees for irrigation water.

B. WATER DISTRIBUTION SYSTEM:

Design system to provide water service for maximum domestic and irrigation requirements. Fire hydrants are provided if an adequate water supply is available. Flow velocity shall not exceed three m/s (10 feet-per-second).

Place isolation valves to provide control over the reasonably sized area. In addition, designate valves in fire hydrant branches and building service lines near their connection to feeder mains.

At a minimum, provide one hydrant for first responders; if adequate supply is available, place a fire hydrant at occupied buildings or at an alternative location to serve the site. NFPA allows non-sprinkler administration buildings.

C. DOMESTIC WATER PUMPING SYSTEM:

Large Systems: Use a three-pump constant pressure system with a pneumatic tank and no-flow shut-down. Use variable speed pumps.

Small Systems: May be two pump systems with a pneumatic tank and operate with an on-off pressure switch. Provide controls that alternate the pumps and allow both pumps to operate at the same time. Use variable speed pumps.

10.6.2. SANITARY SEWER

A. GENERAL

Do not cross gravesites with utilities. Route the main distribution systems for utilities immediately under or adjacent to roadways. To avoid obstructing gravesites within burial sections, route utility lines in interment areas between sections to avoid obstructing gravesites within burial sections. Install all utility lines, including electric power and communication lines,



underground. Exceptions may be made depending upon the high cost or remoteness of the source from developed areas of the cemetery.

B. SANITARY AND STORM SEWERAGE SYSTEMS:

Design separate, underground sanitary and storm sewerage systems, including building connections, manholes, cleanouts, drainage inlets (yard and curb), cooling tower waste lines, open drainage channels, dry wells, and similar structures and fixtures, and all appurtenances. The storm drainage system shall serve all areas under construction or affected by construction.

Storm-water management shall be provided as necessary to comply with the Energy Independence and Security Act (EISA) Section 438 Storm Water Runoff Requirements for Federal Development Projects. Any development or redevelopment project with a facility footprint exceeding 5,000 square feet or expansion of existing facilities by more than 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property concerning the temperature, rate, volume and duration of flow. The footprint includes all horizontal hard surfaces and disturbed areas within the project site, including building and vehicular and pedestrian pavements. Additional information can be obtained from the EPA publication, Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act (EPA 841-B-09-001).

Comply with the NPDES mandated storm-water effluent limitations imposed on off-site municipal or regional receptors of stormwater runoff from the project site. Provide treatment and retention, if required by Agency and local jurisdictions.

Do not connect storm drainage systems to sanitary sewerage systems.

To the extent feasible, locate sewer pipes and manholes under the pavement at the centerline. Provide maintenance holes at junctions, changes in direction, slope, and changes in invert elevations of sewers 200 mm (8-inch) and above. [Cleanouts are required for 100 and 150 mm (4 and 6-inch) sewers]. Limit spacing between maintenance holes (manholes) to 90 m (300 feet), except 150 m (500 foot) spacing is permitted in straight runs of long outfall sewers.

Indicate on drawings where extra strength pipe is required to support anticipated trench and superimposed loads. Include adequate pipe bedding and, if necessary, provide structural supports for sewer pipes, maintenance holes, inlets, and other appurtenances.

Limit sanitary trunk sewers to not less than 200 mm (8-inch) diameter and sanitary sewer building connections to not less than 100 mm (4-inch) diameter. Establish sanitary sewer slopes to provide the minimum velocity of 0.6 m per second (two feet per second) when the pipe is flowing full; maximum slope shall be ten percent unless there are unusual circumstances; provide drop manholes when the difference between incoming and outgoing inverts is greater than 18 inches.



Limit storm sewers serving drainage inlets to not less than 300 mm (12") diameter and building connections to not less than 100 mm (4-inch) diameter. Establish storm sewer slopes to provide a minimum velocity of 0.6 m per second (two feet per second) when the pipe flows full. Maximum storm sewer design velocity shall be in the non-erosive range for specified pipe material.

Storm drainage curb and gutter inlets shall be designed to match the curb and gutter profile. No part of the inlet shall be behind the curb. Grating for inlets shall be selected based on drainage capacity, ability to screen out harmful debris, ability to pass unobjectionable debris, strength, and permanency guidelines.

Use State or local standard details for maintenance holes, inlets, end walls, and pipe cradles. Adjust master specification as necessary. The curb and gutter inlets are designed with a grade to match the profile of the curb and gutter; no parts of the inlet are behind the curb.

Use septic tanks and leach fields to treat building waste if connecting to the public sewer is impossible and soil percolation is adequate. Septic tanks without leach fields shall be equipped with an audio/visual monitoring system. Provide details and installation instructions per the State or local Health Department and others having jurisdiction. If percolation is poor, provide an alternate solution of treatment.

Where required by high groundwater conditions, provide a subsurface drainage system in gravesite areas to ensure the water table is a minimum of 2400 mm (8 feet) below the estimated final grade or 12" below crypt fields.

C. SEWAGE PUMPING EQUIPMENT (EXTERNAL):

The design goal is to maximize the operating life of the pumping equipment by minimizing wear on critical pump components (seals, bearings, and other components), which worsens as pump operation moves farther from the pump's established Best Efficiency Point (BEP). The designer shall perform the hydraulic analysis. This analysis shall be the basis for establishing the number of pumps required and the design operating range (initial and buildout) for each pump to be provided. To the greatest extent possible, pumps shall be selected to maximize their operating efficiency during all hydraulic conditions that may exist, i.e., the curve of the selected pump shall wear back into the best efficiency range of the curve for buildout conditions. Pumps shall be designed for automatic pump alternation with operation at no more than ten times per hour under the worst-case condition (influent flow equals half of the pump capacity). The wet well shall be designed to provide a margin of safety over the net positive suction head required in feet. Include a high water level alarm system in the wet well, and place an alarm panel in the office of the Facility Maintenance Manager, chief, or other appropriate location. Coordinate with facility for proper placement of alarm system in Design Development. Provide emergency power.



10.6.3. GAS SERVICE

A. GAS DISTRIBUTION SYSTEM

Coordinate with Gas Company concerning housing and fencing for gas metering and regulating equipment. Comply with all gas company requirements.

10.6.4. ELECTRICAL SERVICE

Coordinate with Electrical Company concerning A/E estimated electrical service requirements.

All Electrical services should be routed underground via direct bury or conduit with duct banks.

Transformers shall be shielded from view by landscaping or architectural features.

10.6.5. FUEL FOR MAINTENANCE EQUIPMENT

Above ground type tanks are required to accommodate both gasoline and diesel fuels. Design per NFPA 30A, International Fire Code, or Uniform Fire Code, as applicable and match local jurisdictions' requirements. Tanks shall be listed by the manufacturer as protected above-ground type as defined as protection from physical damage and fire-resistive protection from high-intensity liquid pool fire exposure. Provide air, water, and electrical utilities as required to complete the installation. Provide emergency shut-off at a minimum of 20 feet but no more than 100 feet from the dispensing unit. Provide necessary warning signage. Provide tank protection from vehicles by 4" concrete-filled bollards 3' in height above grade, embedded 3' deep in concrete, and space no more than 4' apart. Pump hose(s) shall be able to reach all servicing equipment without excessive strain. Provide secondary containment. Provide emergency power.

10.7. SITE SIGNAGE / WAYFINDING

10.7.1. GENERAL

Signage should be consistent with *VA's Signage Design Manual, National Cemetery Administration Signs* (<https://www.cfm.va.gov/til/dManual.asp#SIGN>) unless there is a compelling reason for a unique design. Design all cemetery signs as a coordinated information system for cemetery visitors, using consistent locations, shapes, sizes, materials, colors, and graphics. The essential purpose of the signage is to communicate information in a legible, clear, and quickly comprehended manner. VA specifies the following sign types should make up the signage system:

- Cemetery Sign
- Orientation Map



- Visitor Information / Regulations
- Traffic Regulations
- Directional
- Street Identification
- Place Identification
- Floral Regulation/Visitor Information
- Burial Section Markers

Coordinate with VA Plaques and Seals Requirements.

DOT style signage and details are NOT approved for use within the grounds of national cemeteries. However, DOT signage is only appropriate and approved in specific entry and exit locations where cemetery roadways directly intersect with public streets, roads, highways.

10.7.2. OFF-SITE WAYFINDING / DIRECTIONAL SIGNAGE

Off-site wayfinding/directional signage shall be considered within all projects to guide visitors to the National Cemetery. Signage may be considered Tourist Oriented Directional (TOD) Signs, Official Signs, or Advanced Notice Signs in some jurisdictions. NCA intends to provide off-site wayfinding/directional signage for all rural areas as these signs provide directional information to the traveling public about places located on non-primary routes. Provision of more signage becomes more critical as more rural cemeteries are opened in remote areas of the country.

The designer is responsible for determining appropriate off-site locations and annotating them on the design plans. Since off-site signs are usually located on State, county, or local road rights-of-way, those agencies may define suitable sign substrates, colors, and letter styles based on their standards. The designer should coordinate with Local/ City, County, and State transportation departments for planning, permitting, and installation requirements.

The designer shall notify project leaders about legal requirements such as entering into Memorandums of Agreement with State or local highway agencies negotiating the terms of construction, installation, maintenance, and access for advance notice signs.

Signage shall conform to the Manual for Uniform Traffic Control Devices (MUTCD), the latest edition. Design standards shall conform to applicable Local/ City, County, and State requirements.

10.7.3. ENTRANCE AREA SIGNAGE

Cemetery identification is a significant component of the entrance area. The entrance area must incorporate the following elements in its design:

The Department of Veterans Affairs Seal, or insignia, at least two feet in diameter;



Using lettering sufficient to be seen from the public street (or approach road), the words, “(NAME of CEMETERY) National Cemetery.”

The design shall also include discreet lighting of the cemetery name.

10.7.4. ASSEMBLY AREA SIGNAGE

The Service Branch emblems are typically located in the assembly area. Note that Service Seals require written authority from each service to be posted; therefore, emblems are used.

10.7.5. SECTION MARKERS

Section markers are permanent section identification labels that are a part of the overall site signage system. Each burial section is marked by one or more section markers bearing either the number or letter assigned to that section. Section markers are positioned at the edge of the section, usually near a road, drive, or walk, readily visible to the public. They serve to identify the corner or boundary of the gravesite and memorial sections. Section markers consist of granite, marble, or concrete posts.

Each burial section in the cemetery shall be identified, with the limits of the burial section indicated by section markers. See paragraph (2) g., of this handbook for placement of section markers. Burial sections are designated by numerals or letters, or if necessary, both numerals and letters, for example, Section 14, Section G, Section AB, or Section 21A. New gravesites are designated by numbers only, and no alpha characters may be used.

When two burial sections are contiguous and are not otherwise separated by a road, drive, or walk, a section marker is placed at the dividing line between the two sections. This marker indicates the numbers or letters of both sections on one post and a directional arrow indicating which section is which.

Design details of the three standard section markers can be found in the *VA Signage Design Manual, National Cemetery Administration Signs* (<https://www.cfm.va.gov/til/dManual.asp#SIGN>).

10.7.6. STREET NAMES AND BUILDING NUMBERS

The NCA assigns street names and building numbers during review meetings.

10.7.7. CONSTRUCTION AND SAFETY SIGNAGE

All projects shall have construction and safety signs outlined in NCA Specifications, General Requirements 01 00 01. The specified size and construction standard are mandatory for projects over \$2,000,000. Projects under \$2,000,000 size and construction standards are determined on a project-by-project basis.



10.8. SITE FURNISHINGS

The components of the site furnishings system should coordinate with and complement each other, the cemetery architectural design, and the site as a whole. Site furnishings, including signage, benches, trash receptacles, and flower container/ water receptacles, shall be simple, standardized, and adequately scaled with the function and character of the site. Design or select all components to be low maintenance and vandal resistant. The placement of site furnishings, i.e., benches, trash receptacles, flower vase receptacles, hydrants, and signage, is concentrated in high-use areas.

Locate and place trash receptacles, flower vase receptacles, and flower watering stations between the front side of adjacent burial sections, or if not possible, in front of irrigation aisles rather than directly in front of gravesites. Front and center location is not desired or preferred because it is somewhat unsightly for visitors and blocks the view of the gravesites behind it.

10.8.1. BENCHES

Design or select a commercially available bench, be placed at selected locations to take advantage of views or vistas, or establish spots for meditation. Donations by veterans service organizations are the primary means for acquiring the benches. Benches shall be mounted on concrete pads with space at the side for a companion wheelchair where accessible.

10.8.2. TRASH RECEPTACLES

The design or selection from commercially available products should coordinate with and complement the overall design scheme. The minimum quantity possible is desired, placed strategically to accommodate the public.

Exhibit 4 shows a typical Flower Watering Station with Flower Vase and Trash Receptacles.



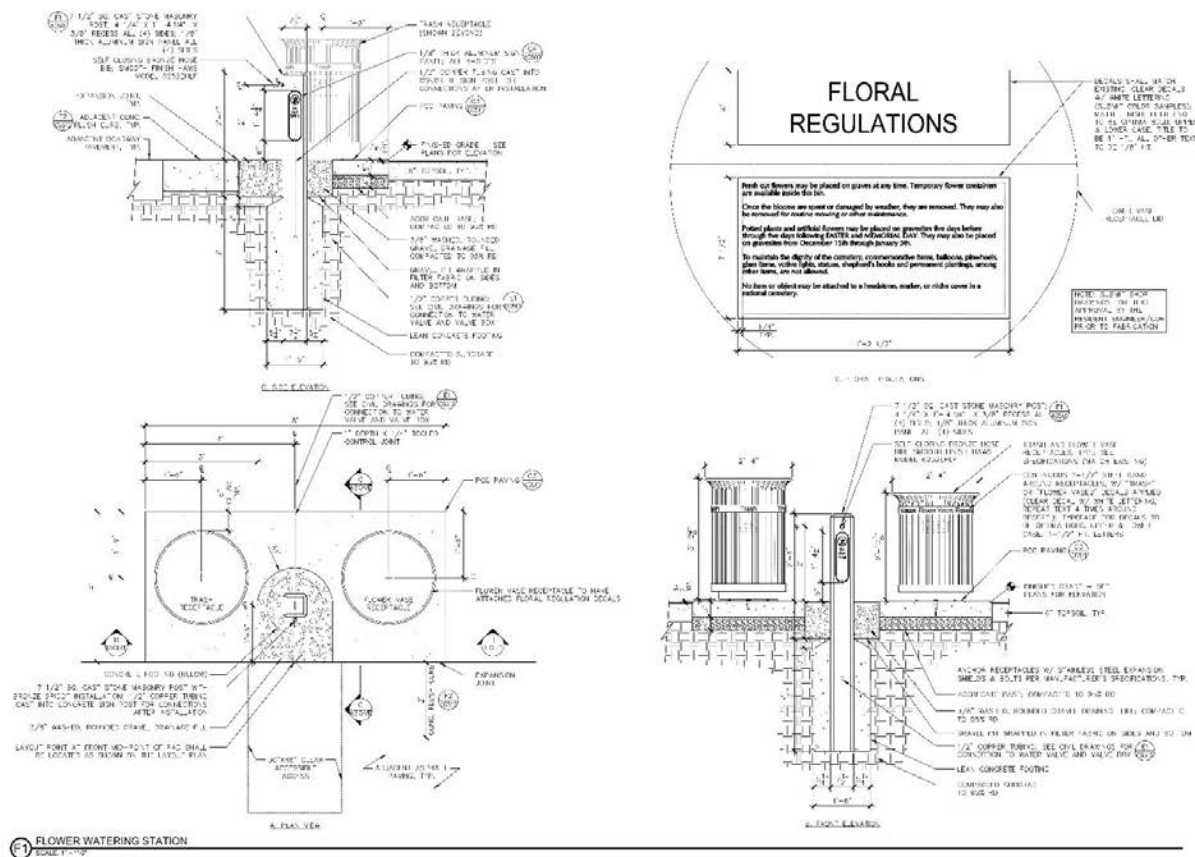


Exhibit 4: Example Flower Watering Station with Flower Vase and Trash Receptacles

10.8.3. FLOWER VASE RECEPTACLES

These storage receptacles hold the conical metal/plastic flower containers available for public use in the cemetery. The receptacle is either placed adjacent to hydrants along the cemetery road or constructed to dispense water from a tank by cemetery visitors for flowers. The design of the receptacle is similar to a trash receptacle and should coordinate with all other site appurtenances. To provide accommodation for reaching into the receptacle, the height of the flower container receptacle shall be lower than the trash receptacles. Floral regulations sign panel should be attached to this container.

Exhibit 4 above shows a typical Flower Watering Station with Flower Container and Trash Receptacles.

10.8.4. FLOWER WATERING STATIONS

These are posts that enclose or adjoin the water standpipes provided along the roads throughout the cemetery. Water is intended to be used for flowers placed on graves by visitors. The post shall: identify the spigot locations, protect the standpipe from being hit by



maintenance equipment, and incorporate a splash block at its base. If non-potable water is used, the fixture shall be clearly labeled on at least three sides. The post design should coordinate with the cemetery signage and all other site appurtenances.

Operation of the flower water station spigot shall be by handle or lever that meets ABAAG requirements of 2.3 kg (5 lbs.) or less force to operate.

Flower water station spigot shall be of a type suitable for the climate and operation of the irrigation system. Recommend use of fixtures that are self-draining and have water feed installed below frost depth. Spigot shall have a laminar flow device to provide even flow.

Match existing when the existing fixtures are to remain permanently and currently meet standards.

Install a brass or bronze pressure regulator and an isolation valve on the water supply to the fixture in an accessible location below grade. The flowering station's concrete base does not need to be removed.

Connect the gravel in the splash box, and below the automatic drain to a storm drain, or to the gravel beneath a crypt field, or other suitable draining location, when the native soil is not a well-drained soil, to prevent saturation of the soil and operation of the automatic drain in water, especially when frost occurs.

Exhibit 4 above shows a typical Flower Watering Station with Flower Container and Trash Receptacles.

10.8.5. GRAVESITE CONTROL MARKERS

Gravesite layout control markers are permanent survey markers installed in a grid in each burial section and used to assist the accurate layout of gravesites. These are typically concrete posts with an embedded metal pin, installed flush with the ground to minimize interference with mowing operations.

Permanent gravesite control monuments, which meet the requirements detailed in [NCA Directive 3120 - Interment Area Layout](#), are installed before using any section (burial, cremains, or memorial) for interment.

The standard grid dimensions are 90 feet x 90 feet (27.4 m x 27.4 m). Other grid dimensions used are 80 feet x 80 feet (24.4 m x 24.4 m) and 100 feet x 100 feet (30.5 m x 30.5 m). For steeply sloping sites, the grid spacing must be close enough that the string level line used for laying out headstones can be held by hand.

Exhibits below show typical Placement of Gravesite Control Markers.



The standard gravesite control marker is a length of 3/4 inch diameter (1.9 cm) iron pipe driven flush with the grade, with an aluminum survey cap on top. Exhibits below show details of the standard Permanent Gravesite Control Marker. Crosshairs are inscribed within the center circle by the surveyor following marker installation. The standard gravesite control markers are installed in each section at all vertical and horizontal grid crossings. Markers shall be embedded in cast-in-place concrete or be precast and grouted in place. Formerly the embedment in concrete was used only in extreme soil conditions and was called the alternative marker. However, the marker cap embedded in concrete is the standard. Exhibit 4 shows the alternate Permanent Gravesite Control Marker.

At least three gravesite control markers are installed in each section (burial, cremains, or memorial). These are placed, one near each end of greater rectilinear dimension, and one at a right angle to this line and at all other intersections of the gravesite layout grid.

All gravesite control markers shall have an integrated magnet embedded in or glued to the marker for location by magnetic locator equipment.

All permanent gravesite control markers are maintained and protected by cemetery personnel.



PLACEMENT OF GRAVESITE CONTROL MARKERS ON 90' GRID

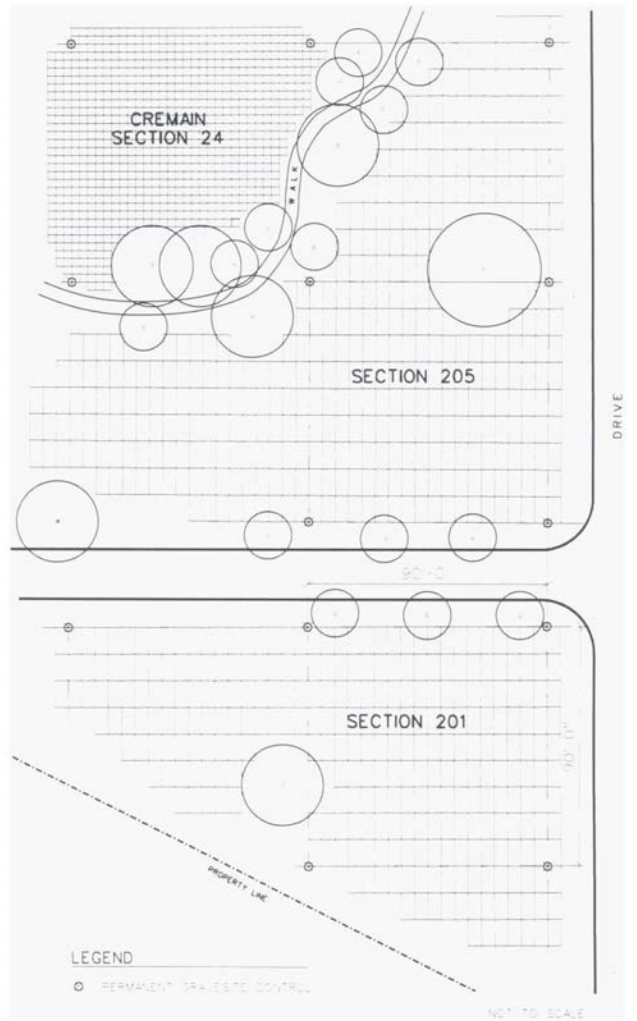


Exhibit 5: Typical Gravesite Control Marker locations





FIELD INSCRIBED IN CIRCLE

PERMANENT GRAVESITE CONTROL MARKER (STANDARD)

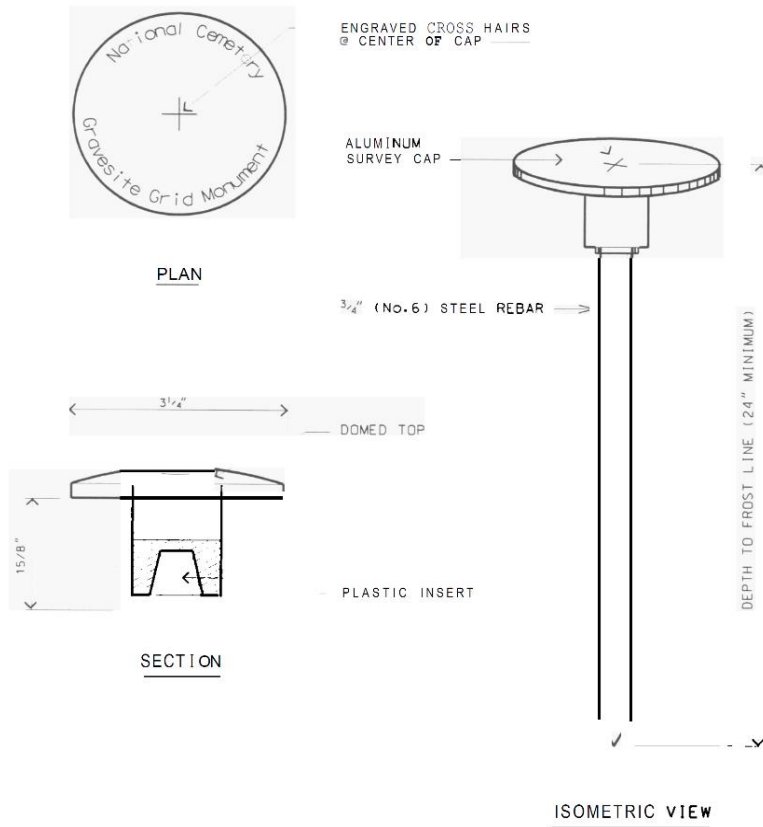


Exhibit 6: Gravesite Control Marker Cap Detail



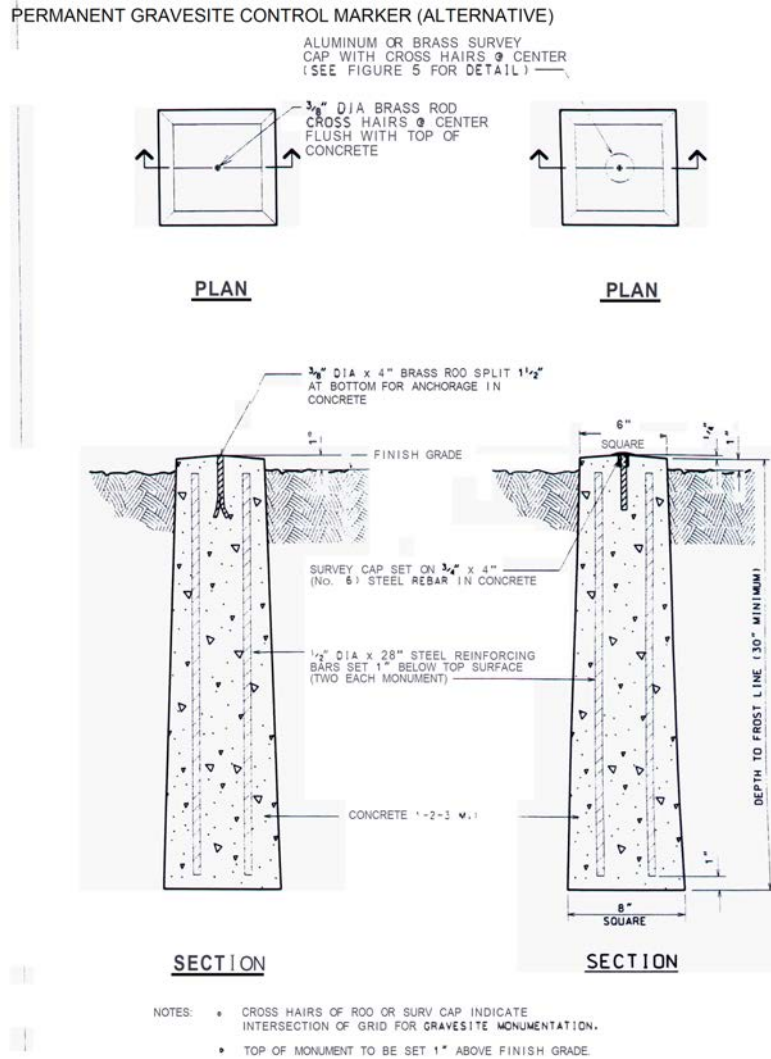


Exhibit 7: Example of one kind of Permanent Gravesite Control Marker

10.8.6. FLAGPOLES

Typically, two flag poles are used in National Cemeteries:

- United States Flag – height is project-specific, typically 60-80’.
- POW/MIA Flag – height is project-specific, 15-30’.

The structural engineer shall design the footings for the flagpole, considering the site’s wind load zone, pole height, and flag size.

Flag size and purchase are the responsibility of cemetery operations.



10.8.7. FLAG SLEEVES

Flag sleeves are used in the Avenue of Flags for periodic placement and display of Donated Burial Flags (5'x 9' size) on poles 15'-30' high; these are placed along the entry route into a National Veterans Cemetery. Spacing shall be 15' to 30' apart, and the number of poles shall be based on available space.

Flag sleeves are typically for flags affixed to the flagpoles, are not raised and lowered, and are not removed or lit at night for the short-term they are displayed. Flag sleeves shall be designed and installed to handle the flag poles for the specific site. The flag sleeves shall match existing facilities unless the Cemetery operations staff receives a specific direction indicating desired modifications due to operational issues with the existing design.

10.8.8. FENCING

Where site conditions allow perimeter or boundary fencing beyond the entrance area is preferred but is a site-specific decision for NCA. An entire cemetery of hundreds of acres may be fenced as it is developed rather than first established.

Provide security fencing to maintenance yard adjacent to maintenance buildings.

Provide security fencing to control access to water supply, fuel supply, and other critical areas.

Per Physical Security Design Manual requirements: Security fencing shall be six feet high, black, vinyl-coated chain link; however, the materials and color shall integrate with the overall cemetery appearance. Refer to *VA's Physical Security and Resiliency Design Manual* (<https://www.cfm.va.gov/til/dManual.asp#PSR>) for required door type, hardware, and access control.



11.0 L – LANDSCAPE

11.1. GENERAL

Begin by referring to the cemetery master plan, if available. Integrate the landscape planting design with the overall design of the site. The landscape planting shall complement and enhance the architecture and site features, facilitate vehicular and pedestrian access, create open areas and vegetative screens, and ensure easy maintenance.

Enhance the established design and the historical character of existing buildings and landscapes. The design should be an outgrowth of site function and building massing. The site, the building, and the landscape should reflect an integrated concept.

Provide open lawn spaces (interment areas) framed by groups of upper and mid-story canopies trees. In drought-prone climates, limit irrigated turf to burial sections and frame the burial sections with planting beds containing naturalized/native landscape treatment. In desert / arid climates, select alternative groundcover whenever possible.

Concentrate the use of shrubs to buildings, screening, a separation between burial sections, and control of pedestrian traffic.

Where practical, select plants indigenous to the area require little maintenance and are disease and insect-resistant. If indigenous plant species are limited, then select plants that are native or well-adapted to the region.

Do not select plants that are poisonous, irritating, thorny, or that drop fruit or sap. Locate plants so they do not interfere with driver or pedestrian visibility, circulation, and safety.

Plant bed outline curvature shall have a minimum radius of 3m (10 feet) to accommodate riding mowers.,

Utilize an appropriate mixture of trees, shrubs, and ground cover plants of varying root depths to stabilize slopes steeper than 3:1, i.e., 3m horizontally to 1m vertically (3 feet to 1 foot). Slope planting shall provide 100 percent vegetative cover in 10 years.

Locate shrubs so that they can grow to their full natural spread without trimming, except for hedges. Locate individual ground cover plants 1-1/2 times their full spread away from curb lines, so they do not need edging. Do not locate shrubs over 2' height within the visibility triangle at road intersections.

The master plan should designate a location for the storage of soil spoils from interments. The area should not be visible to cemetery visitors. This same area may be used to process and store grave liners not too far away from active burial sections.



11.2. PLANTING

The planting design should articulate and strengthen the site layout. Develop interrelated patterns of open, closed, or semi-enclosed spaces to suit the planned function. Concentrate planting in non-burial areas, such as trees along streets, buffer planting to screen unsightly views, and plantings to separate burial sections. Each plant used should serve a purpose and contribute to the function and overall design intent of the cemetery master plan. The development should use regionally native plants and employ landscaping practices and technologies that conserve water and prevent pollution.

Prepare interment areas for seeding, sprigging, and sodding with topsoil and proper nutrients. In non-burial areas, consider alternatives to standard turf that are suitable to drought conditions. Plant cleared slopes steeper than three to one (3:1) with ground cover other than turf. The amount of annual rainfall and the type of irrigation system determine the plant material selected.

The following criteria are to be used as a guide for plant massing within pre-placed crypt fields. These are minimum standards for cemetery expansion projects at sites where the availability of land permits such practices. The designer shall confirm with the project manager the applicability of installing plants and trees within crypt fields before proceeding, as this determination is to be made on a project-by-project basis.

- Burial fields containing at least 1,600 crypts are allotted one (1) cluster of trees. Fields containing at least 2,000 crypts are allotted two (2) clusters of trees.
- Clusters of trees may be defined as a grouping of 3 or more trees. Clusters should be in the range of approximately 1,300sf and 1,800sf or approximately the equivalent of 60-80 gravesites, including irrigation aisles.
- Clusters shall be aligned with or next to irrigation aisles to allow for maximum grave counts.
- Alternatively, in cemeteries with a historical pattern of individual trees planted within burial sections, remove a block of 3 pre-placed crypts to provide a 9' x 8' planting pocket for one specimen tree while maintaining the overall crypt count. During design, locate the tree planting pockets in a natural pattern adjacent to the irrigation aisles to provide additional space for root growth. The number of individual tree plantings within each crypt field shall match the density of the historic tree plantings within burial sections.
- Tree selection shall match the existing plant palette within the site to look as natural as possible, ensuring minimal use of unique ornate trees.
- Avoid overuse of a single tree species to avoid mass loss of tree canopy in the event of a pathogen that attacks a specific species (e.g., Dutch Elm disease, Emerald Ash Borer, and other tree diseases)
- Plant selection shall avoid or carefully consider a selection of plants with excessive fruit clutter or other maintenance concerns.



- In sections with two or more groups, groups should be located no more than 61 linear meters (200 linear feet) apart.
- In sites where the availability of land is limited or where the visual aesthetic improves site, clusters may be aligned to the perimeter of the crypt fields near the roads allowing the maximum gravesite counts while still providing the visual aesthetic benefits of the trees.
- Locate linear root barrier against the crypt walls where trees are planted to reduce impacts on crypts.
- Locate trees a minimum of 5' from hardscape (e.g., curbs, walls, walks, other paving) to prevent root damage. All trees planted closer than 5' shall have a linear root barrier against the structure for ten lineal feet centered on the tree trunk. Locate trees no closer than 10' from utilities (storm-sewer, electrical, domestic water, or other utilities)

11.3. IRRIGATION

Irrigation is usually necessary to keep the landscape at an aesthetically pleasing level. Although sufficient rainfall may be received to sustain indigenous plants, situations involving introduced species or plants in stressful conditions may require irrigation. Evaluate the landscape environment, including turf grasses, and determine whether an irrigation system should be installed in the cemetery. The report should include a cost analysis of irrigation versus non-irrigation, on-site, and off-site water supply sources, including quality of available water, annual rainfall, and water quantity needed to sustain healthy plants. If an irrigation system is recommended, design and specify an efficient irrigation system that is automated, easily operated, and maintained. Irrigation lateral lines in burial sections should run parallel with the length of the gravesites. Water-efficient design methods shall be incorporated into the design.

11.3.1. GENERAL:

Design criteria for existing systems are unique to that system. The first design discussion should identify the existing system and determine what is or isn't working at the existing facility. Generally matching what is existing or modifying, expanding, or replacing what is existing are to be clarified during the design development for the project. As the designer becomes familiar with the operation of the existing system, the problems and objectives for the system improvements and appropriate design should be created, integrating the existing with the new. When the existing landscaping area changes, the existing sprinkler system must be modified to accommodate a practical and efficient irrigation design. These situations are unique and beyond the scope of the standard facilities design criteria, other than as a general guide.

Design criteria for irrigation systems shall, to the greatest extent possible incorporate water conservation and application efficiency. Irrigation system designs shall follow the current Federal and Local water conservation directives.



In the design of new irrigation systems, follow this facility design criterion and utilize the *NCA Master Construction Specifications* (<https://www.cfm.va.gov/til/ncaSpec.asp>)

Unless otherwise noted on a project basis, design the system to require the amount of earth cover over mainline irrigation pipes, sub mainline pipes, and lateral pipes as follows:

- Minimum cover for main lines under traffic areas shall be 900 mm (36") from the bottom of the road subgrade.
- Top of irrigation lines, other than laterals, shall be at least 600 mm (24") below grade in turf areas.
- The top lateral lines shall be at least 450 mm (18") below grade to install swing joints or rotary sprinklers properly.
- The pipes entering the control valve boxes shall be site-specific based on local frost depths and winterizing requirements.

Maintain a minimum horizontal distance of at least 3000 mm (10 feet) between parallel potable water and irrigation lines, mainly when the irrigation water source is reclaimed water or water from non-potable sources.

Fire protection systems including, hydrants and building sprinklers, should not be connected to irrigation systems.

11.3.2. IRRIGATION UTILITY AISLES

Irrigation lateral pipes and sprinkler heads to be installed within burial areas require the design of irrigation utility aisles. The purpose of the aisle is to allow the internment activities to occur without disturbing the irrigation system components. Irrigation aisles should be designed to be the same width at the burial plots for the specific burial area; this is critical where upright headstones are to be used to keep the diagonals for the headstones aligned. The irrigation aisles are equidistant from the edge of the landscape area, including the 10' buffer between the street and burial section.

The lateral pipes and sprinklers should be located generally in the approximate center of the aisle, except where it is necessary to deviate to not interfere with layout monuments. Sprinkler heads should be located in the center of the irrigation aisles positioned perpendicular to the long axis of the burial plots at the mid-point between headstone rows for adjoining burial plots. Burial sections with upright headstones have a negative impact on efficiency since the headstones intermittently block the spray regardless of the location of the head. Therefore, sprinkler heads must be precisely located to minimize this interference.

For 3'x8' pre-placed crypts with upright headstones, the sprinkler head is positioned in the center of the irrigation aisle equidistant between four upright headstones (approximately 58" from the top of the 8' burial plot).



The irrigation heads should be spaced equidistant between the adjacent headstones for traditional burial sites with upright headstones and no irrigation aisles.

For 3'x4' or 4'x4' in-ground cremains sections with upright headstones, the irrigation head should be placed in the center of the irrigation aisle equidistant between four upright headstones. Use 12" high pop-up rotor heads.

The irrigation laterals should be run underneath the markers with heads spaced equidistant between the adjacent headstones for traditional burial sites with flat markers and no irrigation aisles.

Provide a sample burial section layout in Design Development before designing the entire irrigation system. Alternate methods of design are considered in this review.

Design layout distance between irrigation utility aisles is typically based upon application efficiency for the sprinklers. The size and shape of the landscape area drive the sprinkler selection and spacing, which determines the distance between irrigation aisles. Design the irrigation aisle spacing based upon multiple widths for the plots in the specific field. As an example, for pre-placed crypt fields, where plot width is 3', the design distance between irrigation aisles are a multiple of 3 feet, with the distance between aisles limited based upon the irrigation system characteristics, the type of sprinkler head, the available operating pressure, the available nozzles, and the efficiency metrics. Designed spacing between irrigation aisles greater than 63', resulting in higher pressure at the sprinkler heads and lower application efficiency metrics. These conditions have higher cost impacts on the pumping and distribution system. In addition, operating sprinkler heads with a pressure of 80-90 psi, compared to 50-60 psi, can adversely impact nearby trees and headstones. The most efficient head spacing for 3'x8' crypt fields with upright headstones is between 48 and 51 feet. For windy sites, this spacing should be further reduced.

11.3.3. IRRIGATION WATER SUPPLY:

The evaluation of irrigation water source(s) should be investigated during all the project development phases. Each site location has unique issues regarding the location and development of irrigation water supply sources. The methods for developing water at a specific site are not covered in the facilities' design guides. The source of irrigation water should follow the general design concepts in this design guide.

An irrigation water supply source for an NCA facility needs to be developed conceptually to provide the potential for a good water supply source for the entire build-out of the facility; this is not necessarily true at locations where a future phase is separated by a physical boundary such as a river or stream. It may be better to have a separate water supply for the future phase in the latter case; this is especially true if a pond is required as part of the irrigation water supply source. The specific requirements for water supply sources are site, project-specific, and



appropriate sources for a particular project based upon engineering evaluation, including life cycle costs. The alternatives are evaluated as early in the project process as possible.

The infrastructure designed for the current phase of the project should, wherever possible, be designed to be adequate for the future expansion of the facility as the project expands so that all of the facilities won't have to be entirely replaced during each expansion phase. There are many factors to be considered when designing the infrastructure for specific projects, and the above considerations should be addressed on a project-by-project basis.

Irrigation water sources being considered for development should be evaluated based upon the most cost-effective source based upon life cycle costing.

Generally, all water sources other than potable municipal water supply are preferable to municipal potable water sources. When there are no alternatives for municipal potable water sources, they should be considered the primary irrigation water supply source. Municipal potable water sources are considered viable on a case-by-case basis, during the development of alternative sources, and as a redundant source, on a project-by-project basis. The priority for sources should be those determined from an investigation of non-potable water sources for irrigation.

Public health concerns are of primary concern when designing an irrigation system using non-potable water sources.

Water quality that affects turf (nutrients and other constituents), headstone staining, and impacts on irrigation equipment must be considered, and adverse long-term impacts minimized as part of the design for these supply sources.

Where possible, ensure that the irrigation water source is uninterrupted. Where not possible, an alternative source to function as a backup supply source should also be provided. The backup source shall be adequate, should the primary source become unavailable to supply the irrigation water source of supply water in sufficient volume and duration to ensure that the landscaped areas within the cemetery do not become permanently stressed or die. The duration of the irrigation period shall be until either the other source is re-established or there is sufficient rain to maintain the landscaped areas of the cemetery.

Untreated irrigation water from surface water, or untreated well-water, may be used at flower water spigots, with proper signage and color-coding. All signage follows cemetery signage design.

Reclaimed tertiary treated effluent water may not be utilized at flower water spigots. In this case, a separate potable water source must be provided.



11.3.4. IRRIGATION WATER DISTRIBUTION SYSTEM

The water distribution system for cemetery irrigation systems generally consists of mains and sub-mains. Mains distribute water to a defined irrigation region [e.g., burial section(s)] to supply a sub-main to service remote control valves for that irrigation region. The connection of the sub-main to the main requires a service tee, an isolation valve, a normally-open master valve with pressure regulation, and a flow sensor. Each irrigation region often is under the control of a single satellite irrigation controller.

Mainlines and sub-mains shall be looped wherever feasible to provide the best system hydraulics and reduce pressure loss.

Do not cross gravesites with irrigation mainline or lateral pipes. Do not run irrigation mainlines behind columbaria walls when used as retaining walls. A mainline break could flood the remains within niches. Irrigation system mainline pipes for routing purposes are those that are larger than 6-inch diameter. There are two acceptable routes for the irrigation mains within new cemeteries or expansions in existing cemeteries, where new roads are constructed. The first route is in the new road network. For this construction, the installation of the irrigation main shall be designed to be constructed like public water mains in municipal streets. The water main shall be backfilled with flowable fill that can be excavated by hand or light equipment. Any other irrigation lines, power for the irrigation controllers, or control wiring for the irrigation system shall cross under the roads or any other hardscape inside appropriately buried pipe sleeves and electrical conduits for wires/cables; this allows for the repair or replacement of the facilities without disturbing the in-place hardscape. Where the decision for the project is to perform the general installation of the irrigation mains outside of the roads, any crossing of roads or hardscape with the irrigation mains shall be in sleeves with restrained casing spacers.

The second route for irrigation mains is to be immediately adjacent to roadways, whenever possible. For irrigation mains outside the roadways, they should be located between the roadway and interment sections or irrigation aisles to avoid obstruction of gravesites. Install electric power and control lines underground in the same trench as the irrigation pipes, with the wires below the top of the pipes, generally following the same path as the irrigation mains, at locations where the irrigation mains cross the roadways or other hardscape in sleeves, provide separate parallel conduits to run the power and control wiring for the irrigation system.

Mainline pipe sizes 3," and larger are PVC with ductile iron fittings and joint restraints; or HDPE pipe with HDPE fusion-weld fittings.

NOTE: The suggested location for the mainline pipe is 3' or 10' from the back of the curb or edge of the road. The goal is that the mainline does not pass under flower water stations and so that street trees are not planted on top of the mainline pipe. The designer shall provide a cross-section through this region to show all elements' locations (i.e., mainline, lateral line, valves, trees, burial sites, flower watering station, and other elements.).



NOTE: The decision as to whether the irrigation mains are to be designed to be inside or outside of the roadways has not been adopted as a standard for all locations in the NCA; therefore, this determination shall be on a project-by-project basis and should be determined during the Concept Design or Design Development Phase of the project development.

The distribution system for NCA irrigation systems shall be designed using computerized hydraulic network analysis to ensure that the pipe sizes meet the specified design parameters. The mainline pipe elements shall be checked for correct sizing based upon the anticipated build-out of the facility, from Master planning documents or more current sources as the project is built. The design objective shall be to have all mainline designed to be not replaced as the facility expands. Designs shall be per the following:

Design system to provide water service for maximum requirements. Flow velocity in the irrigation system pipes shall be designed not to exceed 1.52 m/s (5 feet-per-second).

Place isolation valves to provide control over all three branches of a mainline tee intersection. Provide isolation valves at all road crossings. Isolation valve locations shall be sufficient to allow adequate system isolation for flushing and blowing out the system. Provide flush valves/blow-off valves at ends and low points in the mainline.

Design system to minimize high points and provide combination valves (air release and air/vacuum valves) at high points for the system piping where the air is released through other nearby piping or facilities.

When possible, design the irrigation system to contain at least one redundant pressure release valve to prevent damage to the pipe system under any equipment failure scenarios.

11.3.5. IRRIGATION WATER PUMP SYSTEM:

Design for irrigation water pump systems shall be based upon the flow rate required to meet the peak season evapotranspiration rate applied during a programmed watering cycle for the irrigated area. The pipe network should then be sized to carry the pumping system's volume without exceeding the maximum flow velocity in the pipes. Whenever possible, the pipe network shall be looped and contain isolation valves to facilitate flushing the system at flow velocities of at least 0.6 m/s (2.5 feet-per-second). The specific requirements of an irrigation water pump system are site and project-specific, based upon the source(s) of irrigation water determined to be viable for the project. A viable water supply has an adequate volume of water available at the interval required for irrigation to maintain the landscape materials at the facility when water is not available from natural sources. Depending upon the source of irrigation supply, a storage system may be required; this is especially true when the water supply volume is not enough to meet the irrigation system's peak season water requirement.

The facilities design guide is not intended to provide specific design parameters for the site and project-specific irrigation pump system. The design criteria herein provide information on functional and performance criteria incorporated into the facility design. Regardless of the type



of source for irrigation water supply, irrigation water pump systems shall be designed to include the following:

The irrigation system should have an adequate pump capacity to meet the peak season's water requirement.

Multiple pumps are required to achieve the maximum design flow rate and act as a backup when pumps require repair or replacement. Use identical pumps. The control system for the pumps must include lead-lag operation with the pump with the least hours of operation being the next lead pump.

The normal operating point for the pumps shall be so that the pumps, when operating at the design flow rate, shall operate as close to the maximum pump efficiency as possible. The pump system shall be designed to deliver the required system pressure at all flow conditions.

Variable frequency drive control systems are required for all pumps as a means of energy conservation. Pumps shall operate on and off based upon the pressure in the system.

The pump system shall have built-in safeguards in its control system to minimize the potential for damage to the site if the pumps run due to a pressure drop caused by a mainline pipe break or leak in the system, not because of irrigation demands. Communication between the irrigation control system and the pump system should be provided, so the pump system operates only when irrigation is required.

The pump system shall have a long design life, except for the wearing equipment; this includes the mounting, housing, control system enclosures, and other parts.

11.3.6. IRRIGATION SYSTEM

A. SYSTEM CHARACTERISTICS:

Design of new irrigation system shall be performed to meet the most up-to-date industry standards and techniques incorporating maximization of operating efficiency and applicable water conservation directives. Expansion or modification projects are not required to completely retrofit existing facilities and bring them into compliance with up-to-date industry design standards. The amount of upgrading of the existing facilities shall be handled on a project-by-project basis. All components of the irrigation system shall be designed, as a minimum, to be installed and operated by guidelines, standards, and recommendations set forth by the product manufacturers and overall shall comply with the up-to-date industry standards.

Design irrigation system components for NCA expansion projects based upon the existing system and match the existing whenever possible, providing the existing system has been



functioning without any significant problems. Verify the operations of the existing system before proceeding with the design for and expansion of an existing NCA facility.

Spray or rotary type sprinkler systems shall be designed to provide efficient watering cycles applicable to the sprinkler types being utilized. Timing for application shall be based upon specific characteristics for the areas being watered and designed to minimize overspray and excess runoff during the irrigation cycle.

Systems shall be designed to provide either a minimum of 60% Distribution Uniformity-low quarter (DU_{LQ}) for spray type heads and 70% DU_{LQ} for rotor type heads or designed to have an application efficiency based upon the Scheduling Coefficient (SC). For example, if the system is designed with an SC of 1.2 or less, you can achieve a DU_{LQ} of 70% or greater. Since the SC can be directly used to calculate the run times on the controllers, it is recommended that this method be utilized. The designer needs to provide documentation that the DU and SC are part of the design submittal.

Pressure regulation devices shall be included in the system design to allow the entire system, including all remote-control valves and all sprinkler heads, to operate at design pressure. Operation of the remote-control valves, based upon regulated pressure, allows for efficient water application. It also allows the advanced irrigation control systems to provide flow control functions more accurately, allowing for more consistent, efficient, and predictable operation of the water supply source(s). Pressure regulation devices may include one or all the following:

- pressure regulation device on/at the remote-control valve
- pressure regulation device on individual sprinkler heads
- pressure regulation of low volume drip/microsystems

Systems shall be designed to complete the watering schedule for the entire facility by watering in daily increments of 12 hours maximum. Verify actual irrigation water window with individual cemeteries.

System design shall provide separate irrigation zones for areas of turf, shrubs, and drip-type application devices.

Turf rotor zones shall be designed with full circle heads on separate zones from part circle heads.

Design irrigation zones to provide separate zones for different exposures (i.e., north and east side of building vs. south and west side) and topographic slopes.

Design irrigation zones to be appropriate for plant material to be irrigated.

The design shall provide separate zones for the top and bottom of sloped areas. The design shall minimize runoff of the slopes, and accumulation of runoff at the bottom of slopes shall be considered part of the design. Design the laterals on slopes to run parallel to the slope.



System design shall include checking valves in the sprinklers, wherever necessary, to prevent low point drainage where applicable.

Design separate irrigation zones if identifiable differing soil types are irrigated (with different absorption and runoff characteristics); this would typically apply to crypt fields where the soil utilized for backfill over the crypts is significantly different from the characteristics of the surrounding soils outside of the crypt fields.

Design system layout with reduced head spacing or low angle nozzles where prevailing windy conditions prevent anticipated coverage with higher angle or wider spacing of heads. The exception to low-angle nozzles is for irrigation in burial sections with upright monuments, where low-angle trajectories cause too much interference/potential damage to the monuments.

Design each irrigation zone to have its station on the controller. When retrofitting and adding a zone becomes necessary, combining irrigation zones of the same soil and sprinkler types is acceptable, minimizing disruption of the existing cemetery to install additional control wiring, or if there is no additional station on the controller. Leave 2 to 3 open stations on each new controller to allow for unplanned expansion.

No single zone shall be designed or installed with sprinklers of differing pressure requirements or precipitation rates. (Rotors, spray heads, drip emitters may not be mixed within a zone.)

Computerized software that evaluates the SC and DU must design sprinkler head type and spacing based on the water application metrics. Sprinkler spacing should achieve an SC of less than 1.2 and a DU of 70% or greater rotary sprinklers. The design head spacing shall be at a maximum of 50% of the design performance diameter for spray sprinklers because there is not sufficient distribution rate curve data to evaluate SC/DU accurately in the design phase.

Design irrigation systems with 25 mm (1") point of connection (POC) or larger, or with a landscape area of 2500 square feet and more extensive, to include a master valve. A master valve/flow sensor system is beneficial on larger tap sizes because the larger POC are more likely to be used for burial sections, and there is a greater risk of damage if there is a mainline pipe break.

Use non-potable color indicators (equipment) for heads, valves, valve boxes, quick couplers, piping, and other equipment, when irrigation systems are designed to be supplied by secondary or other non-potable water sources.

B. POINT OF CONNECTION:

Design new systems with normally open master valves with flow sensors. Where necessary, the master valve shall be capable of manual operation to allow manual use of the irrigation system. A flow sensor connected to the controller is required and can shut the valve off in unscheduled flow (line break). If flower water stations are serviced off the irrigation system, use a normally



open master valve. A normally closed valve is acceptable only where flower watering stations are not serviced off the irrigation system.

Design new systems to use non-potable water, including filtration system equipment to clean the source water and protect irrigation system components. Design filtering equipment to be self-cleaning to minimize maintenance requirements. Provide accessible pressure gauges immediately upstream and downstream of the filtration device. The sizing for the filtration shall be determined by analyzing the water quality characteristics and identifying the products to be filtered out. The objective for the filtration system shall be to provide the irrigation water quality that does not adversely impact the operation of the irrigation system components and results in high maintenance costs. Secondary consideration during the design process is staining the headstones caused by particles (iron) in the irrigation water.

If reclaimed water sources contain highly corrosive compounds, such as chlorides, consider using non-corrosive, non-metallic components, such as stainless steel for pump stations/piping and HDPE mainline with HDPE fusion-welded joints.

C. CONTROLLER / WIRE:

For purposes of automatic watering based on ET, the control system shall be connected to an onsite weather station to adjust run times based upon real-time weather conditions automatically. This decision should be clarified in the design review process as part of the Design Development process. Minimally, the controller shall be capable of downloading real-time weather data utilizing a subscription service provided by the controller manufacturer. The project shall provide a minimum of 3 years/ maximum of 5 years subscription.

The design of the irrigation system controller shall match any existing components unless specifically indicated otherwise during the design development or initial project scope. The design for the controller and wire shall meet or exceed the following and follow ASIC Guideline 101-2003 For Communication Cable:

Provide broadband internet service to central controller/ irrigation computer for remote access and software updates. The project shall provide a minimum of 3 years/ maximum of 5 years of internet service.

The controller shall provide separate programs for turf zones, shrub zones, and drip zones.

Controllers shall be capable of temporarily shutting down the system by utilizing internal/external options (such as rain, wind, freeze devices, and flow sensors in conjunction with master valves).

The controller shall be programmable for multiple start times for “cycle and soak” and capable of water budget adjustment.



Power wire and control wire shall be designed to be installed in the same trench, on opposite sides of the mainline pipe, to minimize construction costs.

Controller wiring with outside exposure shall be contained in PVC conduit. EMT conduit shall be used for inside installations.

Use 2-wire decoder control systems when possible. Run the 2-wire cable in Sch. 80 PVC electrical conduit. Provide Decoder Cable Fuse Device (DCFD) at all 3-way splits in the 2-wire cable.

For communication cable between central irrigation computer and satellite controllers, run the cable in Sch. 80 PVC electrical conduit.

Remote-control valve wiring shall be a minimum of 14 gauge, UF UL, or PE UL rated.

All wire connections shall be made with watertight connectors and contained in the valve box.

Provide 450 mm (18") length of the loop of control wire at all changes in directions.

Provide 600 mm (24") of slack wire at each remote-control valve in the valve box.

Remote-control valve wiring shall be installed with the mainline pipe where possible.

Remote-control valve wiring shall have colored jackets for common, control, spare, master valve, and flow sensor. Follow ASIC Guideline 102-2004 Wire & Cable Color Code for Irrigation System Equipment for color-coding.

Spare wire shall be available at all valve manifolds or clusters. All spare wires shall be "home run" to the respective controller. The distribution of spare wires shall be arranged to facilitate extension into future burial areas, especially when the future burial areas adjoin areas where irrigation systems are installed.

Provide spare control and single common wire to all mainline runs equal to the number of unused stations on the controller.

Run one dedicated spare control wire (yellow jacket) to each remote-control valve, terminate one end in the controller, and label "Spare/Sta-No."

Run dedicated common wire (white jacket) to each master valve on the project.

Outdoor controllers shall be lockable and weather resistant. Locate controllers in shrub beds near the edge of lawn areas.

All wiring under hardscaping shall be contained in conduits.

All wiring shall be identified at each end with labels to indicate which location the wire is connected to.



D. GROUNDING:

Ground irrigation equipment following procedures identified in ASIC Guideline 100-2002 for Earth Grounding Electronic Equipment in Irrigation Systems.

E. PIPING / FITTINGS:

Design of irrigation system pipes and fittings shall match any existing components unless it is specifically indicated to do otherwise during the design development or initial project scope. The design for the piping and fittings wire shall meet or exceed the following:

All PVC pipes shall be rated ASTM D 1784 or 1785.

Minimum recommended standards for PVC pipe: Schedule 40 for sizes 3/4" through 2-1/2", Class 200 for sizes 3" and up. 1/2" PVC pipe is not allowed.

Maximum flow velocity in any mainline pipe shall not exceed 1.52 m/s (5 ft/s). Pressure high-density polyethylene (HDPE) pipe shall be ASTM D2239 rated, lateral and drip tubing excluded.

All piping should be capable of winterization by compressed air blowout.

Manual drains may be used in mainline pipe applications.

All piping is backfilled with sand up to 2" above the top of the pipe, with the remaining backfill being clean material settled and compacted to proper finish grade.

All solvent-weld joints are to be installed according to manufacturer specifications.

Insert fittings shall be not be installed on sprinkler laterals.

PVC Mainlines shall use a minimum of Schedule 40 fittings for 20 mm (3/4") through 40 mm (1 1/2") and Schedule 80 or better for pipes over 40 mm (1 1/2").

Push on ductile or Mechanical cast iron fittings shall be used on 75 mm (3") and larger PVC mainline fittings.

Proper thrust blocking shall be installed on all fittings 3" and larger.

Design the irrigation system where the pressure at the base of all sprinklers within a zone does not vary more than 10 percent of design operating pressure to ensure a uniform water application.

Indicate pipe sizes on the drawing at all tees and changes in size; charts are not acceptable as a replacement.



Size all laterals for overhead irrigation three-quarter inch in diameter or larger; one-half inch lateral pipe is not allowed.

F. REMOTE-CONTROL VALVES:

Design of irrigation system valves shall match any existing components unless specifically indicated otherwise during the design development or initial project scope. The design for the valves shall meet or exceed the following:

Remote-control valves shall be sized according to the zone demand requirement, lateral piping downstream, and manufacturer's recommendations.

Remote-control valves shall have flow control adjustment.

Remote-control valves shall have pressure-regulation.

Non-potable (secondary) systems shall use compatible (dirty water) remote-control valves.

Exposed pipe and fittings within valve boxes shall be Sch. 80 PVC.

Size valve box to allow a minimum distance of four inches between any control valve, manual valve, filter, or union and the valve box to maintain enclosed components without excavation.

Locate remote control valves in shrub beds wherever possible to avoid damage from mowers and excavation equipment. Locate irrigation sub-mains in turf areas adjacent to shrub beds.

Control valves are installed in a Jumbo size or larger, manufactured valve/meter box, capable of being locked closed after installation. Use polymer concrete or Fibrelite[®] valve boxes installed in turf areas. HDPE valve boxes are allowed when installed in planting beds.

G. SPRINKLER HEADS

Design of irrigation system sprinkler heads shall match any existing components unless it is specifically indicated to do otherwise during the design development or initial project scope. The design for the sprinkler heads shall meet or exceed the following:

All sprinkler heads shall be attached to lateral line pipe with a flexible joint swing assembly. Turf rotor heads shall be equipped with an Sch. 40 PVC triple swing joint.

Sprinkler heads adjacent to hardscape paving shall be spaced 25 mm to 75 mm (1" to 3") away from paving. An exception is for installation in concrete sprinkler collars. Sprinkler heads adjacent to rolled curbs shall be protected with a 14"x14" precast concrete collar. Turf rotor heads shall be protected with a 14"x14" precast concrete collar. Sprinklers adjacent to walls, buildings, fences, or other structures shall be spaced 150 mm (6" to 12") away from structures.



All sprinklers within a zone shall have matched precipitation rates. Matched precipitation rates for rotors may be achieved with nozzle selection or irrigation timing.

Shrub heads located adjacent to pedestrian areas shall be pop-up variety.

Sprinklers in turf areas shall be fully spring-retractable and pop up a minimum of 125 mm (5") to the centerline of the orifice; trajectory should be more than 21° to clear grave headstone.

Space sprinklers are equidistant from one another for the given lengths and widths of the area to achieve uniform coverage.

For spray heads, use fixed arc nozzles whenever possible; only use adjustable arc nozzles when odd arcs are required and use special pattern nozzles with considerable caution.

Select spray nozzles with the closest practical radius to the design spacing; do not allow for adjustment of more than 10 percent reduction in radius to prevent distortion of the spray.



12.0 S – STRUCTURAL

12.1. GENERAL

Refer to TIL - *VA's Structural Design Manual* (<https://www.cfm.va.gov/til/dManual.asp>)

12.2. SEISMIC / WIND HAZARD VULNERABILITY

Refer to TIL - *VA's Seismic Design Handbook, H-18-8* (<https://www.cfm.va.gov/til/seismic.asp>)

Coordinate required equipment/structure bracing and support with other design disciplines.



13.0 A – ARCHITECTURAL

13.1. GENERAL

Refer to TIL - *VA's Architectural Design Manual* (<https://www.cfm.va.gov/til/dManual.asp>)

The Architecture should coordinate with the existing architectural style, interior design solution, wayfinding and signage, and fixtures and equipment with existing.

Provide existing finishes on demolition plans.

The following sections supplement the referenced VA design manual with NCA Specific Criteria.

13.2. EXTERIOR

13.2.1. COMPARISON OF EXTERIOR MATERIALS

If a primary exterior material is proposed that differs from the primary material of existing buildings, submit studies and sketches of the exterior with both the existing and the proposed materials and analyze the costs of the different exteriors.

13.3. INTERIOR DESIGN SOLUTION

Interior Design is a multi-faceted profession in which creative and technical solutions are applied within a structure to achieve a built interior environment. These solutions are functional, enhance the occupants' quality of life and culture, and are aesthetically attractive. Designs are created in response to and coordinated with the building shell and acknowledge the project's physical location and social context. Designs must adhere to code and regulatory requirements and encourage the principles of environmental sustainability. The interior design process follows a systematic and coordinated methodology, including research, analysis, and integration of knowledge into the creative process, whereby the needs and resources of the client are satisfied to produce an interior space that fulfills the project goals. Interior design includes a scope of services performed by a professional design practitioner, qualified through education, experience, and examination, to protect and enhance the public's life, health, safety, and welfare.

A. VISION

To provide a supportive interior environment that is respectful of the public monies and expresses high-quality design.



B. CONCEPT AND INTENTION

The design is to reflect the National Cemetery mission, its staff, and the veteran clientele. The solution must provide an interior that responds to the regional elements and supports human performance, reflecting individual characters and their relationship to the group and the organization as a whole. The interior design should be user-friendly to those they serve, the veterans, and their families.

C. MATERIALS

The finish materials should be selected by using the following criteria:

- Meets project interior design concepts and intentions while supporting the exterior design
- Follows application/code requirements
- Provides durability and maintenance
- Supports sustainability and evidence-based design principles
- Minimizes initial costs/life cycle cost

D. DURABILITY / MAINTENANCE

Functional requirements dictate maintainable colors, textures, patterns, material selections, a combination of materials and installation techniques. Materials must be chosen for longevity and good appearance retention.

Working knowledge of the properties of all materials is a necessary tool; this includes the installation procedure, and the forgiveness of the materials as installed in a lower bidder situation, the replacement and patching qualities of the material. New materials that contain different maintenance procedures and training for required patching are typically not appropriate but may be considered on an individual project basis.

E. COST

As stewards of public monies, every design and selection are to employ the priorities of cost-savings. Information on the first term vs. life cycle cost, for applicable items, needs to be presented to make an informed judgment. Design or materials that impart dollars wisely spent are to be pursued while avoiding opulence or the illusion thereof.

Passive cost savings is also recognized as working smart, producing favorable contractual procurement, and leaving the client with a good value towards future replacement. Examples of this are a consolidation of selections with design planning that produces variety. Other design systems that follow the above practices and offer saving are encouraged.



All material choices should be decided with the overall project budget in mind. Break the budget down into floors, walls, and ceiling costs—factor in price escalation for future material purchases.

Create a cost analysis for each planned functional area.

Refer to the *VA Manual for Preparation of Cost Estimates for VA Facilities*. (<https://www.cfm.va.gov/cost/index.asp>)

F. MATERIAL APPROPRIATENESS

- All projects should follow the schedule for finishes found in *NCA Master Specifications, Division 9, Finishes* (<https://www.cfm.va.gov/til/ncaSpec.asp>).
- Life-cycle maintenance costs and extended warranties strongly support the consideration of using this type of product.
- Colors, patterns, and designs that transcend time are endorsed. Trendy colors and patterns are to be avoided.
- Color and pattern considerations need to include:
 - Neutral background colors. Eliminate bright values for major surfaces such as walls or floors.
 - Pattern and textures are suitable for interest, maintenance, and sound.
- Occasional deviation for the *NCA Master Specifications* (<https://www.cfm.va.gov/til/ncaSpec.asp>) may be required. The design team and VA staff participating in interior design projects should justify the deviation and build the evidence to support the modification.
- Material deviations should also be coordinated with the local facility's environmental maintenance abilities, facility site and local repair abilities, local manufacturer relationships, and project budget.
- Material modifications would be expected if the deviation was to support Sustainable or Green Guidelines. Reference *NCA Master Specifications, Division 1, General Requirements* (<https://www.cfm.va.gov/til/ncaSpec.asp>) as well as the *VA Sustainable Design Manual* (<https://www.cfm.va.gov/til/sustain.asp>) for sustainability issues.
- Discuss the proposed deviation with the VA project manager and project team. Provide all backup material to support the rationale of the deviation.

G. VA GUIDE TO ROOM FINISHES

All interior finishes are indicated in the specifications. The project management team must review any deviation from the finishes described in VA Guidance documents before starting the construction document phase. The A/E shall combine the finish schedule and color design schedule and include them in the specifications. Do not indicate on the drawings. Use the finish schedule format included in Room Finishes, Door, and Hardware Schedule.



- Comply with TIL - *VA Standards for Construction, Room Finishes, Door and Hardware Schedule (PG-18-14)* (<https://www.cfm.va.gov/til/spclRqmts.asp#room>), for sizes, types, and symbols of doors. Provide solid core wood or hollow metal interior doors. Wood is preferred, except for locations where metal is required for functional reasons.
- Comply with TIL - *Physical Security and Resiliency Design Manual* (<https://www.cfm.va.gov/til/dManual.asp#PSR>) requirements for door hardware and access control.
- Comply with TIL - *Equipment Guide List (PG-18-5)* (<https://www.cfm.va.gov/til/equip.asp>)
- Refer to *NCA Master Specifications* (<https://www.cfm.va.gov/til/ncaSpec.asp>) for format and additional requirements.

13.4. SIGNAGE AND WAYFINDING

Refer to TIL - *VA Signage Design Manual* (<https://www.cfm.va.gov/til/dManual.asp#SIGN>) for general VA guidelines and National Cemetery Administration Signage Drawings for specific NCA requirements.

Verify that all directional and informational signage meets the minimum accessibility guidelines.

Coordinate Occupant Egress Plan signage with the *Fire Protection Design Manual* (<https://www.cfm.va.gov/til/spclRqmts.asp#FS>).

13.5. FIXTURES AND EQUIPMENT

After completion of the design development drawings, the A/E firm shall provide a listing that itemizes the government-furnished and installed (VV), government-furnished and contractor installed (VC), and the contractor furnished and installed (CC) personal property equipment. This listing applies to all fixed equipment installed as part of initial construction. One month after the construction contract award, the equipment list shall be updated by the A/E firm and submitted to the contracting officer.

We recommend that the architect organizes the equipment list chronologically on a room-by-room and drawing-by-drawing basis.

Refer to TIL – *Equipment Guide List (PG-18-5)* (<https://www.cfm.va.gov/til/equip.asp>) for required equipment.



14.0 F – FIRE PROTECTION

14.1. GENERAL

Refer to TIL - *VA's Fire Protection Design Manual* (<https://www.cfm.va.gov/til/dManual.asp>) and *Fire & Safety Guidance* (<https://www.cfm.va.gov/til/spclRqmts.asp#FS>)

The following sections supplement the referenced VA design manual with NCA Specific Criteria.

14.2. DETECTION AND ALARM

RESERVED

14.3. SUPPRESSION

RESERVED



15.0 P – PLUMBING

15.1. GENERAL

Refer to TIL - *VA's Plumbing Design Manual* (<https://www.cfm.va.gov/til/dManual.asp>)

Due to the space requirements of plumbing systems and ductwork, closely coordinate the layout of these systems. Where areas of interference are apparent, prepare a cross-section of the building showing a method of installation.

Investigate and, if feasible, connect new services to existing; otherwise, provide new services.

Piping may be exposed in the following buildings and spaces:

Mechanical equipment rooms

- Service rooms
- Shop Buildings
- Storage Buildings

In other spaces, conceal piping unless impracticable.

The following sections supplement the referenced VA design manual with NCA Specific Criteria.

15.2. FIXTURES AND EQUIPMENT

Comply with *NCA Master Construction Specifications Division 22, Plumbing* (<https://www.cfm.va.gov/til/ncaSpec.asp>)

Provide equipment schedules, including capacity, control settings, services, and sizes, for plumbing equipment and other requiring plumbing services.

Refer to TIL - *Equipment Guide List (PG-18-5)* (<https://www.cfm.va.gov/til/equip.asp>) for required fixtures and equipment.



16.0 M – MECHANICAL

16.1. GENERAL

Refer to TIL - *VA's HVAC Design Manual* (<https://www.cfm.va.gov/til/dManual.asp>)

The following sections supplement the referenced VA design manual with NCA Specific Criteria.

Due to the space requirements of plumbing systems and ductwork, closely coordinate the layout of these systems. Where areas of interference are apparent, prepare a cross-section of the building showing a method of installation.

Structural drawings and specifications provide all concrete and structural steelwork, including catwalks, concrete housekeeping pads, lintel supports around openings, and platforms for access to HVAC equipment and supports for mechanical equipment.

Electrical drawings and specifications provide motor starters and disconnects, not furnished as part of HVAC equipment, smoke detectors (duct or space mounted), all power wiring to HVAC smoke dampers, motors, heating cable, and controls for winterizing piping.

Plumbing drawings and specifications provide all floor drain outlets.



17.0 E – ELECTRICAL

17.1. GENERAL

Refer to TIL - *VA's Electrical Design Manual* (<https://www.cfm.va.gov/til/dManual.asp>)

Route the main distribution systems for utilities immediately adjacent to roadways within 3000 mm (10') of the curb or pavement edge. Route any utility lines through interment areas between sections to avoid obstruction of gravesites within burial sections. Install all utility lines, including electric power and communication lines, underground. Exceptions may be made depending upon the high cost or remoteness of the source from developed areas of the cemetery.

The following sections supplement the referenced VA design manual with NCA Specific Criteria.

17.2. LIGHTING

Refer to TIL – *VA's Lighting Design Manual* (<https://www.cfm.va.gov/til/dManual.asp>)

Lighting needs to be functional, and it should enhance the visual appeal of the built environment. The well-planned layering of the ambient, task, and accent lighting is critical in creating effective, efficient, and aesthetically pleasing lighting. Keeping current with the fast-changing lighting technology is most important for practicing interior designers.

- Public area lighting can be more decorative and can be image-building.
- Lighting in staff offices and areas needs to be functional and task-oriented.

17.2.1. EXTERIOR LIGHTING (CEMETERY SPECIFIC)

Exterior building lighting is only provided around buildings to support Physical Security, Electronic Security Systems.

Exterior site lighting is not required except at Cemetery Entrance Signage.

17.3. GENERATORS

NCA recommends emergency generators for all new cemeteries and existing cemeteries with over 1,500 burials per year. Existing cemeteries with less than 1,500 burials per year require a joint determination by DCS, District Engineer, and Cemetery Director. They will collectively determine whether sufficient risk exists for regional natural events (tornadoes, hurricanes, earthquakes, etc.) that may require the addition of emergency generators. As part of that



business decision, the Cemetery should provide historical information from the past 5 years detailing how many times the Cemetery has experienced power outages along with the duration and cause of those outages.

Emergency generators should support the Admin/PIC building and the Maintenance Staff building. Other cemetery outbuildings that don't provide critical mission support for interment operations (such as stand-alone PICs, storage buildings, and committal shelters) do not typically require generators. The Cemetery Director may request consideration for other buildings that are mission critical, provided adequate justification is provided to their District office.

Cemetery operations at high-volume cemeteries are critical to the community and the VA's mission. A final business decision will be based on business risk analysis for various regional natural events or other relevant events with the potential to cause extended power outages and should ensure cemeteries' ongoing functionality during any unexpected loss of primary power. For cemeteries not eligible for the Directive's threshold for requiring permanently installed emergency generators, the project should consider installing emergency power connection points that can connect portable emergency generator equipment as the need arises quickly. This substantially more cost-effective option provides an elevated level of system readiness, eliminating the maintenance and operational issues associated with a fixed emergency generator. It should ensure cemeteries' ongoing functionality during a severe weather event or other emergencies, which is critical to the community and VA's mission.

17.4. DECORATIVE WATER FEATURES

The use of decorative and ornamental water features does not align with VA's energy conservation requirements, which include reducing overall water use wherever possible.

Additionally, NCA considers the use of illumination systems for either type of water feature to be unnecessary since VA national cemeteries are closed from dusk to dawn.

Definitions:

Decorative or ornamental water feature. Any water feature intended solely for the purpose of enhancing the appearance or aesthetic of a cemetery, providing no functional support to the facility's engineered irrigation or storm water management infrastructure. Examples of decorative or ornamental water features include (but are not limited to): reflective water pools or ponds; decorative water fountains or water statues; waterfalls; and stream features.

Integral water feature. Any water feature that is a necessary part of a cemetery's engineered irrigation or storm water management infrastructure. Examples of integral water features include (but are not be limited to): storm water retention ponds; storm water outfalls; and pond aeration fountains specifically required for water quality improvement purposes.



18.0 T – TELECOMMUNICATIONS

18.1. GENERAL

Refer to TIL – *VA’s Telecommunications and Special Telecommunications Systems Design Manual* (<https://www.cfm.va.gov/til/spclRqmts.asp#TelecomInfraStds>)

Refer to TIL – *NCA’s Network Cabling Specifications NCACableSpec20100901.pdf* (<https://www.cfm.va.gov/til/nca/>)

Refer to TIL – *Office of Information Technology Design Guide* (<https://www.cfm.va.gov/til/spclRqmts.asp#TelecomInfraStds>)

In addition to the Electrical and Telecommunications Service required by the cemetery, requirements include one 56 k digital circuit. The need for conduit or direct burial is determined on a project-by-project basis. However, spare conduits are installed between buildings to accommodate future, unknown needs.

Route the main distribution systems for utilities immediately adjacent to roadways within 3000 mm (10') of the curb or pavement edge. Route any utility lines through interment areas between sections to avoid obstruction of gravesites within burial sections. Install all utility lines, including electric power and communication lines, underground. Exceptions may be made depending upon the high cost or remoteness of the source from developed areas of the cemetery.

The following sections supplement the referenced VA design manual with NCA Specific Criteria.

18.2. AUDIOVISUAL

Audiovisual equipment is to be provided within the Multipurpose Rooms at the Cemetery. NCA Cemetery Operations outline specific requirements.

18.3. DATA NETWORKS

RESERVED

18.4. TELEPHONE

RESERVED



18.5. SECURITY

Refer to *VA's Physical Security and Resiliency Design Manual*
(<https://www.cfm.va.gov/til/dManual.asp#PSR>)



19.0 X – OTHER

19.1. FIREARMS CONSIDERATIONS

Refer to *M1 Garand Operation, Safety, and Maintenance for Veteran and Civilian Service Organizations, Law Enforcement, and National Cemeteries prepared by Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal NJ 07806-5000, latest edition* (<https://www.mortuary.af.mil/Portals/31/documents/AFD-130702-050.pdf?ver=2016-08-01-144721-273>)

19.1.1. STORAGE

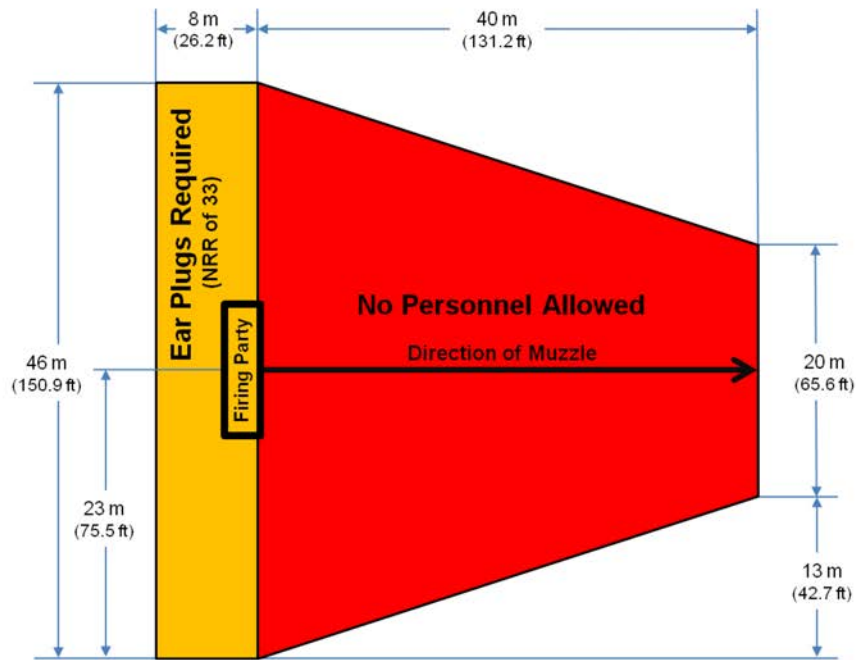
Provide space for storage cabinet/safe per project requirements. Refer to Physical Security requirements for required security system monitoring requirements.

19.1.2. STANDOFF DISTANCE

Provide adequate safety for spectators or Next of Kin (NOK) during firing salutes. It is strongly recommended that an appropriate standoff distance between the firing party and any spectators/Next of Kin is established while conducting these ceremonies.



Appendix A: SAFETY AREA TEMPLATE



Note: Personnel outside of the Safety Area do not need hearing protection

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20.0 Z – CONTRACTOR / SHOP DRAWINGS

RESERVED



21.0 O – OPERATIONS

RESERVED



22.0 COST ESTIMATING

Refer to TIL – *VA’s Manual for the Preparation of Cost Estimates*
(<https://www.cfm.va.gov/cost/index.asp>)

The A/E shall fully prepare a detailed estimate of construction consistent with the level of detail shown on the drawings (at every stage of the design and final submission) that fully incorporate the 12 steps identified in the GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs found at <https://www.gao.gov/new.items/d093sp.pdf>. All items must be accounted for, and Lump-sum items for things that are quantifiable are not acceptable.



23.0 FUNCTIONAL DIAGRAMS

23.1. GENERAL CONSIDERATIONS

Cemetery operations and equipment can be anticipated to change during the life of the building in response to new developments in technology or to change burial needs. Modular spaces and designs are encouraged to facilitate changes and minimize remodeling. The diagrams in this section illustrate typical concepts applicable to the design and development of space for NCA.

The diagrams illustrate the relationships between the functional areas defined in *VA’s Space Planning Criteria (PG-18-9), Chapter 701 & 703 - National Cemetery Administration* (<https://www.cfm.va.gov/til/space.asp>). The following diagrams are provided to illustrate the relationships for the spaces within each of the functional areas.

Functional diagrams represent key adjacencies and hierarchies between the functional areas and significant spaces defined by the Program for Design. They are not intended as suggested floor plans or layouts, or site plans. The blocks representing functional areas or spaces are generally proportional but are not drawn to scale. Space allocations for a particular project shall be per the project’s approved Program for Design. The A/E is responsible for final space layouts.

Legend for Functional Diagrams



Functional area
(Used in Functional Diagram)



Adjacent functional area
(Used in Functional Area diagrams)



Room within a functional area

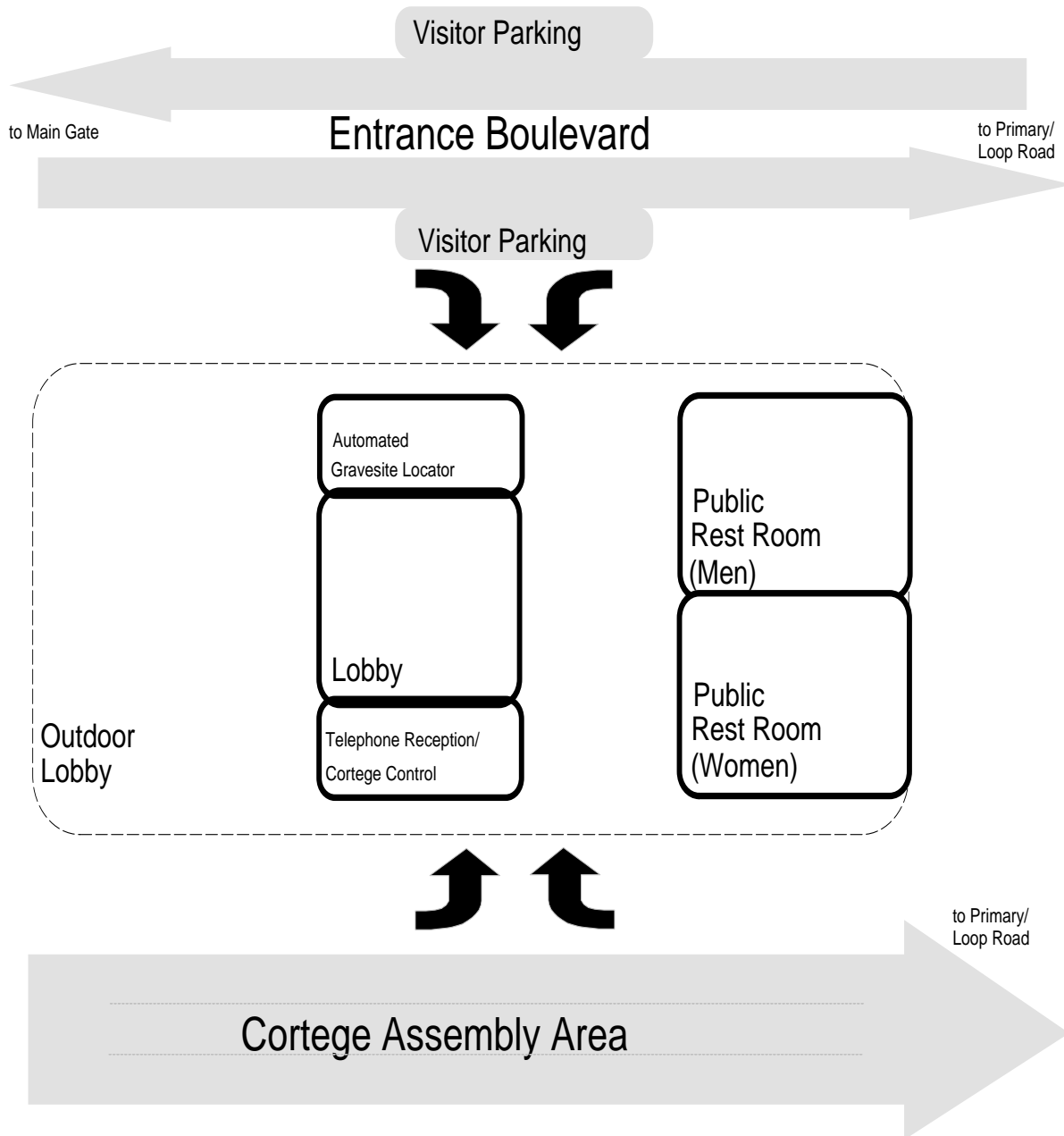


Designates subdivision within a room



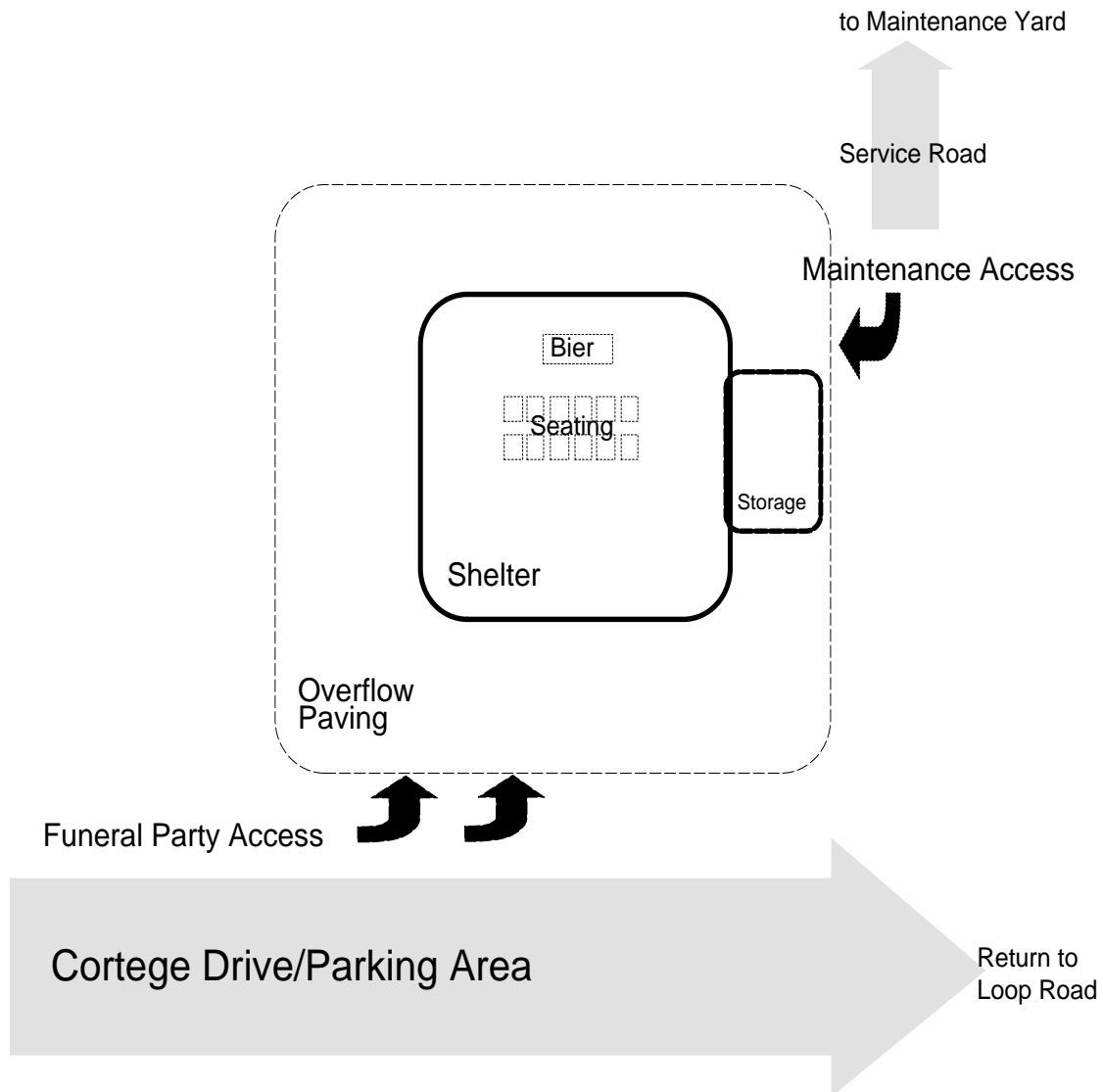
Functional Area Diagram

Public Information Center



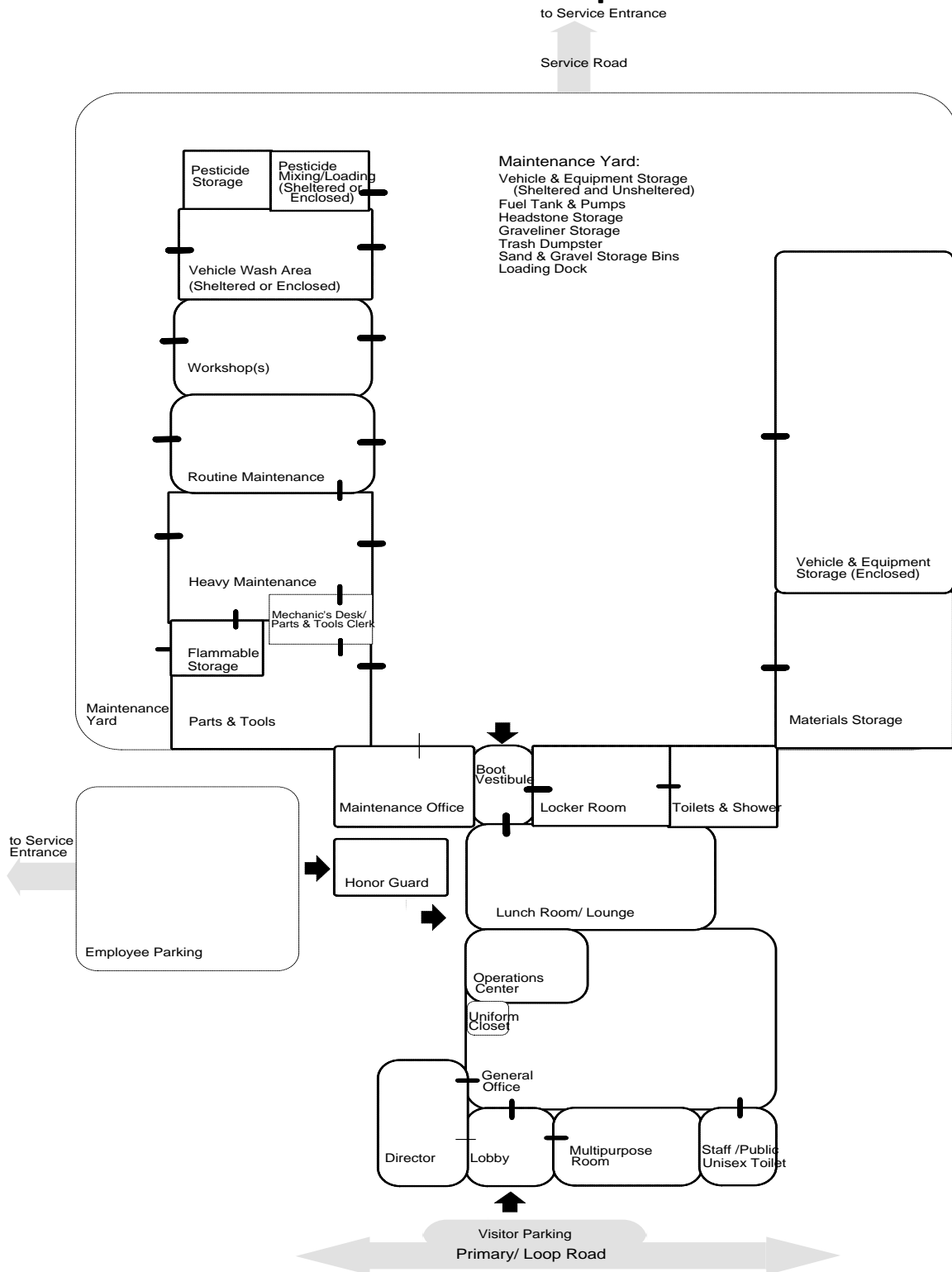
Functional Area Diagram

Committal Service Shelter



Functional Area Diagram

Administration and Maintenance Complex



24.0 FUNCTIONAL RELATIONSHIPS MATRIX

The following diagram presents the proximity relationships of various functional areas or spaces in a matrix format.

Proximity Codes for Matrix

The degree of optimal proximity to other areas that share a functional relationship is indicated by a scale of 1 to 4 (1 representing the greatest level of adjacency). An “X” entered in the diagram indicates that separation from the departments or areas in question is preferable.

Code Proximity Relationship

- 1 Very Strong: Adjacent
- 2 Strong: Close, Nearby
- 3 Moderate: Convenient
- 4 Weak: Maybe separated; limited traffic or communication necessary

- Neutral or no relationship
- X Separation required or preferable

Table 1.0 Functional Area Relationships

Functional Areas Relationship Values	Entrance Area	Public Information Center Area	Memorial / Dedications Area	Interment Areas	Administrative and Maintenance Area
Entrance Area	--	2	3	4	X
Public Information Center Area	2	--	2	3	X
Memorial / Dedications Area	3	3	--	3	3
Interment Areas	4	4	3	--	2
Administrative and Maintenance Area	X	X	3	2	--



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