Section 5
Design Criteria

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5.1 SITE DEVELOPMENT DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. CRITERIA UNIQUE TO VA:

1.1 Refer to ARCHITECTURAL DESIGN CRITERIA - DRAWINGS (ATTACHMENT) for general requirements and classification of drawings ("L-Series").

1.2 A licensed Landscape Architect or Civil Engineer shall develop the site drawings. A Landscape Architect shall develop the landscape planting plans.

1.3. Consolidate notes as much as possible and place them on the right-hand side of the sheet.

1.4 Show scale, compass point, orientation, key plan, title, column grids and numbers, room numbers and titles corresponding to the architectural drawings.

1.5 Show room titles and numbers on each plan. If this information is not shown it could result in rejection of the submission.

1.6 Provide drawings generated in AutoCAD©.

2. GENERAL:

2.1 This Criteria; and the current edition of VA Handbooks, Program Guides, Master Specifications; and the Statement of Task for the project is presented as general guidance for the site engineering and landscaping.

2.2 Each area of the country has localized construction, design criteria, and materials. VA standard details are presented for guidance. The intent is not to restrict the designer's overall freedom of design. Consult with regional NCA Memorial Service Network (MSN) office regarding unique local requirements.

2.3 The following sources, including government organizations, trade association manuals, suppliers, industrial standards, and handbooks were utilized for obtaining site criteria:

A. American Association of State Highway and Transportation Officials (AASHTO)
B. American Institute of Architects (AIA)
C. AmericanHort (AH) [The Consolidation of ANLA and OFA]
D. American National Standards Institute (ANSI)
E. American Society of Civil Engineers (ASCE)
F. American Society of Landscape Architects (ASLA)
G. American Society for Testing Materials (ASTM)
H. American Trucking Associations (ATA)
I. Architectural Barriers Act Accessibility Guideline (ABAAG)
J. Brick Industry Association (BIA)
K. Environmental Protection Agency (EPA)
L. Federal Highway Administration, Department of Transportation (FHWA)

M. Transportation Research Board (TRB)
N. National Concrete Masonry Association (NCMA)
O. National Stone, Sand & Gravel Association (NSSGA)
P. National Fire Protection Association (NFPA)
Q. Portland Cement Association (PCA)
R. The Asphalt Institute (TAI)
S. Civil Engineering Handbooks
T. County Agriculture Extension Agent, Soil Conservation Service, Storm Water Control and other local services
U. Data Book for Civil Engineers
V. Site Engineering and Landscape Architectural Program Guides
W. State Highway Department Standards and Specifications
X. U. S. Department of Agriculture, Natural Resources Conservation
Y. United States Access Board (USAB)
Z. U. S. Department of Agriculture, Bio-preferred Program

3. BUILDING NUMBER ASSIGNMENTS: The National Cemetery Administration Office of Construction Management will assign building numbers and street names during the review meetings.

4. PARKING: VA will furnish the quantity of parking spaces necessary for visitors, cortege assembly, and employees.

5. SITE DEVELOPMENT AND LANDSCAPING: During the Master Plan or Schematic Design phase, the A/E and VA team members will collaborate in solving any problems for the grading, drainage, paving and landscaping before the subsequent design phase.

6. TOPOGRAPHIC/LANDSCAPE, ELECTRICAL, CIVIL/MECHANICAL, AND SOIL SURVEY:
Check against section 02 21 00 site surveys, project-specific statement of work and supplement B-NCA 41F1 specifications for site survey for conflicts.

6.1 General:

A. These surveys are the basis for making site design decisions. Obtain these surveys and determine the survey limits that will include a sufficient area to cover the complete project. Refer all vertical elevations to permanent bench marks based on actual geodetic datum (not assumed datum).

Produce the Topographic/Landscape, Electrical, and Civil/Mechanical Surveys on Mylar sheets using VA standard size sheet as specified in Section 5.11 Graphic Standards. CERTIFY on drawings that all information was obtained or verified by actual field investigation. Provide surveys at an engineering scale not less than 1:400 (1" = 30').

B. Master Plan, Design Development, and Construction Documents shall be based on these surveys. Prepare the Design Development phase and ensuing design drawings at the same engineering scale as the surveys. Show detail layouts at a scale sufficient to indicate the required work.

C. Resubmit the survey documents at each design phase review and include them with the bidding documents

6.2 On the Topographic/Landscape Survey, include features affecting site development, such as:

A. Contours at a maximum interval of 500 mm when using SI units and 1 foot when using IP units.

B. Location and elevation of all roads, walks, underground and overhead utilities, existing buildings and structures, all property lines, building line set-backs, leases, or easements, trees, and

C. Identification of landscape material by size and species.

6.3 On the Electrical Survey, include the locations of all underground, overhead, and surface electrical utilities and structures. Show size, depth, and top elevation of all electrical structures, based on actual site investigation. For electric utility lines, indicate type of service (primary or secondary), number of ducts, voltage, phase and other electrical data.

6.4 On the Civil/Mechanical Survey, include the locations of all underground and surface civil and mechanical utilities and structures. Show size, depth, invert and top elevation of all utility structures, based on actual site investigation. Indicate direction of flow and size of pipe for all sewers, drains, and connecting lines between manholes.

6.5 Include a Soil Survey as part of the subsurface investigation in the A/E Submission Instructions, PG-18-15D (Schematics 2). Analyze the soil fertility, organic content, and pH measurement. Reference ASTM D5268 of local District Office of the U.S. Natural Resources Conservation Service Standards for procedures in obtaining the above information. Utilize results from the study in making design decision that include:

A. Selection of soil amendments for growing turf.

B. Selection of landscape materials.

6.6 Perform a subsurface investigation to determine the suitability of the proposed project area for developing new burial sections, columbaria complexes or building sites for the Department of Veterans Affairs.

A. All borings shall be carried to a depth of 2400 mm (8 ft.) or refusal. If refusal occurs at a depth of less than 2400 mm (8 ft.) core rock with a diamond core drill for a minimum 1500 mm (5 ft.).

B. Conduct “Standard Penetration Tests” and obtain samples at each change in stratum with a maximum interval of 1500 mm (5 ft.). The Standard Penetration Test shall be performed in accordance with ASTM-D1586.

C. Obtain bulk samples of shallow soil layers for laboratory testing of soil

characteristics, including bearing strength, compressibility, swell potential, optimum moisture, maximum density and other data needed to make design decisions regarding:

1. Earthwork handling techniques such as benching, compaction and erosion control.

2. Selection of pavement type and cross section.

D. 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, and unconfined compressive strength as applicable to the soil type encountered.

E. 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.

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

7. ENVIRONMENTAL PROTECTION AND DOCUMENT CHECKING, AGENCY CONSULTING/REVIEW/APPROVAL SERVICES:

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

7.2 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 Specification, Environmental Protection). VA, as owner, will sign permits and pay necessary fees appropriate to the owner. Investigate the following regulatory categories:

A. Storm water 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 landscape.

E. Protection of water resources, wetlands, and areas preserved for wildlife.

7.3 Prepare any required written reports, forms, and graphics.

7.4 Submit permit forms on behalf of the government.

7.5 Represent the government at agency and community meetings.

7.6 Ensure that the drawings and specifications include necessary information to mitigate any adverse environmental impacts. Ensure that:

A. Surface water, during and after construction, will not adversely impact the site or areas downstream from the site;

B. Grading, seeding, erosion control measures, and storm sewers are used to avoid the above;

C. Air and noise pollution is minimized;

D. Destruction of land resources is minimized; and

E. Interference with the normal function of the VA cemetery and the surrounding community during construction is minimized.

F. See section 01 57 19 Temporary Environmental Controls.

8. SITE PREPARATION:

8.1 General: The level of detail for site and landscape elements to be demolished shall be consistent with the degree of completeness of the drawings being submitted. Schematic design phase demolition shall indicate those major elements that will affect the project cost estimate. After the required site surveys are procured, the elements will be shown in detail on the site preparation plan. These drawings shall be a screened background image of the survey.

8.2 Provide site preparation design showing the following:

A. Area of construction, and surface objects to be cleared, grubbed, and removed, topsoil stripping, trees, shrubs, stumps, fencing, foundations, incidental structures, and other protruding obstructions planned for demolition and removal.

B. Site and landscape surface elements to remain and be preserved from injury or defacement. Include mechanical and electrical elements. These are shown on their respective discipline classified drawings.

C. Refinement of the Final Schematic environmental consideration components referenced in Article 7 and Article 9.

D. Construction phasing including:

1) Contractor's access and staging area;

2) Construction sign location (see VA Architectural Standard Detail Number SD010000-01, PG-18-4);

3) Provisions for a temporary construction fence enclosing the construction site and contractor's staging area (see NCA Master Specifications, General Requirements);

4) Construction limits and construction access;

5) Stockpiles for stripped topsoil, earthwork, borrow and waste;

6) Temporary phasing solutions to maintain existing cemetery operations and avoid unnecessary construction conflicts (see VA Program Guide PG-18-15, Vol. D Critical Path Method (CPM) Phasing Requirements).

9. SITE DEVELOPMENT: The design for a VA National cemetery shall conform to the following site planning criteria:

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

9.2 Consider impacts on existing natural and man-made storm water drainage patterns and systems. VA is committed to the control of storm-water by the Federal Water Pollution Control Act, the Federal Flood Disaster Protection Act, the Energy Independence and Security Act and other Environmental Protection Agency (EPA) regulations that are implemented by Federal, State, and municipal jurisdictions (see Article 7, and the NCA Sanitary Design Criteria).

9.3 Ensure that construction causes minimal interference with the normal functioning of VA cemetery and surrounding community (see Program Guide PG-18-15, Vol. D, Critical Path Method (CPM) Phasing).

9.4 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

10. GRADING DESIGN:

10.1 Final Master Plan or Schematics. Include earthwork cut and fill, surface drainage design, pavement grading, and other spot elevations at critical design areas. Coordinate surface grades with architectural, structural, and mechanical design to

provide proper surface drainage. Storm sewer criteria is specified in the Sanitary Design Criteria.

10.2 Consult soil classification data in the subsurface investigation (geotechnical report), required by the Structural requirements for subsurface investigation in the A/E Submission Instructions, PG-18-15, Schematics 2.

10.3 Contours shall show grading of the entire project site. Utilize spot elevations at buildings, critical areas, and other site features for grading control.

10.4 Show any temporary (construction period) or permanent erosion control.

10.5 Include on the grading drawings:

A. Bench Mark location;

B. Spot elevations at structure corners, entrances, all first floor elevations of new buildings and, if appropriate, of existing buildings.

C. Spot elevations of all walks and paved surfaces, corners in parking lots, high and low points, top and bottom of walls, steps, curbs, and other areas of grade change.

D. Accessible routes used by people with disabilities.

E. Flow lines/center lines of drainage ways with slope gradient.

F. Intake elevations of the storm drainage system. Show all utility storm sewerage new work on "W" Drawings.

G. Grading limits.

H. The quantity of rock excavation, if required, for the site grading.

I. Non-utility shoring required by major site excavation.

J. Profiles of roads, including:

1) All changes in grade connected by parabolic vertical curves of such lengths as to provide safe sight distance. Minimize vertical curves between relatively flat grades to ensure proper drainage. Avoid sharp horizontal curves at the apex of peak vertical curves.

2) Vertical curve data consisting of:

a. Total length of curve (L);
b. Stationing at the point of vertical curve (PVC), point of vertical tangents intersection (PVI), point of vertical tangent (PVT), low point (LP), and high point (HP) of the curve;
c. Curve elevations for all stations in **b** above;
d. Tangent gradients; and

e. Vertical curve number for identification.

10.6 Grading guidelines:

Condition	Maximum Slope		Minimum Slope		Preferred
Crypts	3%	(33.3:1)	2%	(50:1)	2-3%
Lawns (Interment Areas)	15%	(6.7:1)	2%	(50:1)	2- 10%
Mowed slopes	25%	(4:1)(A)	2%	(50:1)	
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. 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%. Ideal maximum sustained grade for safe operation of trucks and automobiles is 6%. On roads subject to frequent icing and winter conditions, the maximum sustained grade is 5%.

11. LAYOUT DESIGN:

11.1 General: Provide complete dimensioned layouts for vehicular and pedestrian pavement, interment areas, structures, and other components of the site and landscape design. Establish control for the layout by a base control line with dimensions from this line. Larger projects require coordinates on a grid system.

11.2 Include on the layout drawings:

A. Beginning point (P.O.B.)

B. Dimension, angles, coordinates, and curve data for:

1) Roads, interment areas, walks, ramps, walls, fences, landscape components and accessories, curb ramps, lawn mower crossings, corners of buildings, entrances and other critical elements.

2) Storm drainage inlets, detention ponds, open drainage systems, and other surface storm water management components.

3) Service areas.

4) Parking areas, parking striping and other pavement marking.

5) Existing buildings and other structures to remain within the project area.

6) Exterior signage system.

7) Site furniture.

C. Road alignment including:

1) Horizontal curve data:

a. Included angle (I);
b. Radius (R);
c. Tangent distance (T);
d. Length of curve (L);
e. Station points for PC and PT;
f. Bearings for tangent lines;
g. Length and bearing of chord (C); and
h. Horizontal curve number for identification.

2) Road centerline with stations and station references for locating main building entrances, service drives, drainage inlets and other site features.

D. Where applicable, provide horizontal and vertical curve data for extensive walk layouts.

12. DESIGN OF VEHICULAR AND PEDESTRIAN PAVEMENT:

12.1 General: Design the pavement to reflect topography, soils, climate, local materials, function, and other requirements and specific situations. Provide details to construct all pavement elements. Consider local materials and design details.

12.2 Public Road Intersections: Intersection design of VA roads with public roads must receive joint approval of VA Office of Construction Facilities Management, the NCA and the local municipal authorities.

12.3 Pavement Construction:

A. Design pavement sections of all roads, service areas, fire apparatus vehicle accessibility areas, and parking areas for the maximum anticipated traffic loads and existing soil conditions.

B. Design reinforced concrete service aprons at the service/maintenance complex.

C. Where required, provide a concrete paving joint pattern plan and details.

D. Provide recommendations for materials to construct roads and maintenance areas. Use permeable pavements where possible, dependent on soil

conditions and climatic conditions to assist in storm water control to meet EPA NPDES requirements.

12.4 Provide recommendations for use of integral concrete curb and gutters along roadways.

A. Curbing: All curbing must be mountable (slope faced or rolled) except where vertical curb is required for vehicular control.

B. Curb Radii: The radii of curbs at road intersections should be consistent with the requirements given on Section 12.7 through 12.11 of this section.

C. Curb Cuts: Provide curb ramps to accommodate people with disabilities as well as lawn mowers.

12.5 Pavement Marking: Provide locations and details of pavement stripping for employee parking and accessible walkways.

12.6 Pedestrian Pavement Construction:

A. Design walkways to provide clearly defined, unobstructed, routes to site features, interconnecting site and building entryways, curb ramps, and parking areas. Design in accordance with Architectural Barriers Act Accessibility Guidelines (ABAAG).

B. New pavement material should be compatible with and complement the existing installations.

C. Pedestrian wearing course material may be rigid unit pavers (bricks, stone set's, concrete units, large paving slabs, etc.) and appropriate to the locale. To facilitate use by people with disabilities, design a rigid base of concrete or asphaltic concrete beneath pavers.

12.7 Road Width and Road Minimum Radius

A. Entrance Road: (Divide Road, One Way In, One Way Out)

5.4 meters (18 feet), face to face of curb;
7.2 meters (24 feet), edge to edge, with no curb
15 meters (50 feet) minimum radius

B. Primary Road: (Two-Way)

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

C. Secondary Roads: (Two-Way)

6 meters (20 feet), face to face of curb;
7.2 meters (24 feet), edge to edge, with no curb
9 meters (30 feet) minimum radius

D. Service Roads: (Two-Way)

1. Service Entrance:
   7.2 meters (24 feet), face to face of curb;
   7.2 meters (24 feet), edge to edge, with no curb
   15 meters (50 feet) minimum radius

2. Service to Buildings:

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

E. Committal Service Shelter Drives: (One-Way)

   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 throat
   9 meters (30 feet) minimum radius

F. Maximum Design Speed is 24 KPH (15 MPH)

13. ENTRANCES TO BUILDING: 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%.

14. MAINTENANCE YARD: Design adequate space for truck maneuverability and parking of facility equipment, including trash dumpsters. NCA will provide information on volume of truck activity and projection of future activity.

15. PARKING FACILITIES:

15.1 National Cemetery Administration will provide information on number of required spaces.

15.2 Acceptable dimensions for parking areas follows for employee/visitor lots:

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

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

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

15.4 Design parking facilities to accommodate people with disabilities.

16. EQUIPMENT PADS: Locate transformers and generators in accordance with VA requirements.

17. LANDSCAPING DESIGN:

17.1 General: 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.

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

17.3 Provide open lawn spaces (interment areas) framed by groups of upper and mid story canopies trees.

17.4 Limit the use of shrubs to buildings, screening, and control of pedestrian traffic.

17.5 Select plants that are indigenous to the area, require little maintenance, and are both disease and insect resistant.

17.6 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.

17.7 Plant bed outlines curvature shall have minimum radii of 3m (10 feet).

17.8 Utilize ground cover on slopes steeper than 3:1, i.e. 3m horizontally to 1m vertically (3 feet to 1 foot).

17.9 Include on landscape drawings:

A. A planting plan showing the location of all the landscape elements.

B. All plant material with the spread they will attain at maturity.

C. Outline of shrub planting beds.

D. Existing plants to be removed, transplanted, or to remain.

E. Lawn limits.

F. A complete plant list giving key number, botanical name, common name, condition, size, quantity, and special characteristics required.

G. Plant materials that conform to the standardized system of the AmericanHort, current edition of American Standards for Nursery Stock, ANSI Z60.1. The plant materials must be indigenous to the locale and be available locally or in areas of the nation with similar climatic conditions.

H. Areas to be irrigated and the quantity of water in inches per week. Refer to section 5.3 of this Criterion, Irrigation Design.

I. Details for all the landscape elements.

18. EXTERIOR SIGNAGE: Indicate the location of the exterior signage on the contract drawings. VA will furnish exterior signage components, based on NCA Signage Standards.

The NCA specifies emblems, not seals, to be provided and installed by the Contractor. The authorized vendors have the emblem details and the mounting requirements for all the available sizes manufactured by Matthews Bronze.

These should be 18-inch Diameter Bronze Emblems representing each of the 5 services, (do not use Service Seals which require written authority from each service to have the actual service seal posted). The emblems should mount 5'-5" to center AFF, left to right - ARMY, MARINES, NAVY, AIR FORCE, COAST GUARD; typically these are located in the assembly area. The VA Seal (typically 24" diameter) is incorporated in the cemetery entrance area/gate.

19. SITE IMPROVEMENTS

19.1 FLAGPOLES

Typically two flag poles are used in National Cemeteries:
1 United States Flag – height is project specific, typ. 60-80'.
1 POW/MIA Flag – height is project specific, 15-30'.
The structural engineer shall design the footings for the flag pole, taking into account the site's wind load zone, pole height and flag size.

19.2 FLAG SLEEVES

Flag sleeves are those to be used, in the Avenue of Flags, for periodic placement and display of Donated Burial Flags, on poles 15'-30' high; these are placed along the entry route into a National Veterans Cemetery.
Flag sleeves are typically for flags that are affixed to the flagpoles, are not raised and lowered, and are not removed or lit at night for the short term duration they are displayed. Flag sleeves shall be designed and installed to handle the flag poles to be used for the specific site. For existing facilities, the flag sleeves shall match the existing, unless specific direction is received from the Cemetery operations staff indicating desired modifications due to operational issues with the existing design.

19.3 COLUMBARIUM DESIGN

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 of precast units.

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

Coordinate with the Geotechnical Engineer as to who MUST provide recommendations for the base material beneath the columbarium footings, especially should 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 take into consideration whether there will be any differential movement of the columbarium walls and if so, are control joints (for controlled cracking) required. This will 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. In order to minimize the impact of water in the gravel strips; separate the soil below by the installation of 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.

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 originally designed/intended. The detailing is especially important when the design incorporates irregular stone work against straight precast concrete units. Designer shall detail the joints for stone where it comes against 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 make 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.

20. PRE-PLACED CRYPT FIELDS:

20.1 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.

20.2 Unless directed otherwise, design of the crypt fields shall contain irrigation isles that are the same width as the plot size. The spacing of the irrigation isles shall be based upon the irrigation system design. Refer to the Irrigation Design section.

20.3 Single plots shall not be designed at the end of an irrigation isle. The minimum number of plots that are laid out side by side is two.

20.4 The following criteria are to be used as a guide for plant massing within pre-placed crypt fields. These are minimum standards to be applied to cemetery expansion projects at sites where availability of land permits such practices. Designer shall confirm with the Project Manager regarding 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.

1. 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.

2. 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 gravesite including irrigation aisles.

3. Tree selection shall match existing plant palette within the site to look as natural as possible ensuring minimal use of unique ornate trees.

4. Clusters shall be aligned with or next to irrigation aisles to allow for maximum grave counts.

5. Plant selection shall avoid or carefully consider selection of plants with excessive fruit clutter or other maintenance concerns.

6. In sections where there are 2 or more groups, groups should be located no more than 61 linear meter (200 linear feet) apart.

7. In sites where availability of land is limited or where the visual aesthetic will improve site, clusters may be aligned to the perimeter of the crypt fields near the roads. This will allow the maximum gravesite counts while still providing the visual aesthetic benefits of the trees.

8. Root barrier shall be considered around tree plantings to reduce impacts on crypts.

20.5 Crypts shall be designed to be set on grades 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.

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

20.7 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 will be 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 irrigations isles.

20.8 Crypt fields are generally constructed by excavation into existing soil, thereby creating a bowl. Unless specifically excluded in a geotechnical report, based upon very well drained soil conditions below the crypt field, an under drainage system shall be designed and constructed below the crypts. One of the fundamental design principals 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 crypt field under drains are connected to site storm drainage systems. Designer shall ensure that backflow from the storm-water system, including ponds, cannot back up into the crypt fields to levels that will introduce water into the lowest crypt in the field.

20.9 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 major crypt installers for a recommendation of the gradation that should be included for the specific project. The object for the stone base, is to provide a free draining base for supporting the crypts, that is workable by the installers during installation and will allow them the easily set the crypts to the allowed installation tolerances.

20.10 Crypt field design can be either sloped, 3% maximum, or stepped with the pre-placed crypts placed level, with the change in grade being created by stepping the crypt field. Steps shall be created so the depth of material at the headstone location, is between 20 and 22 inches.

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

21. APPLICABLE SITE ENGINEERING AND LANDSCAPING MASTER SPECIFICATIONS INDEX: Use the latest edition of NCA Master Specifications.

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01 57 19	Temporary Environmental Controls
01 74 19	Construction Waste Management
	DIVISION 2 – EXISTING CONDITIONS
02 21 00	Site Surveys
02 41 10	Demolition and Site Clearing
	DIVISION 3 – CONCRETE
03 28 41	Precast Concrete Crypts
03 30 53	Short Form Cast-in-Place Concrete
03 45 00	Precast Architectural Concrete
03 48 24	Precast Columbarium Concrete Units
03 48 26	Precast Concrete Memorial Wall Units
	DIVISION 04 – Masonry
04 05 13	Masonry Mortaring
04 05 16	Masonry Grouting
04 05 31	Masonry Tuck Pointing
04 20 00	Unit Masonry
04 43 00	Natural Stone Veneer
04 73 00	Memorial Markers- Granite
04 73 01	Memorial Markers-Marble
04 72 00	Cast Stone Masonry
04 73 10	Niche Covers- Granite
04 73 11	Niche Covers-Marble
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION
07 92 00	Joint Sealants
	DIVISION 10 – SPECIALTIES
10 14 00	Exterior Signage
10 75 00	Flagpoles
	DIVISION 31 – EARTHWORK
31 20 00	Earth Moving
31 20 11	Earth Moving (Short Form)
31 23 19	Dewatering
31 23 23.33	Flowable Fill
31 32 23	Drilled Caissons
31 62 00	Driven Piles
31 63 16	Auger Cast Grout Piles
31 63 26	Pressure Grouting Soil Stabilization

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 05 23	Cement and Concrete for Exterior Improvements
32 12 16	Asphalt Paving
32 14 16	Brick Unit Paving
32 17 23	Pavement Marking
32 30 00	Site furnishings
32 31 13	Chain Link Fences and Gates
32 31 00	Ornamental Fencing
32 84 00	Planting Irrigation
32 90 00	Planting

DIVISION 33 – UTILITIES

33 10 00	Water Utilities
33 30 00	Sanitary Sewerage Utilities
33 40 00	Storm Drainage Utilities
33 46 13	Foundation Drainage
33 51 00	Natural-Gas Distribution

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5.2 SANITARY DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

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7. SEWAGE PUMPING EQUIPMENT (EXTERNAL)
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5.2 SANITARY DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. CRITERIA UNIQUE TO VA:

1.1 Refer to Section 5.11 GRAPHIC STANDARDS for general requirements and classification of drawings ("W-Series"). An exception is storm drainage piping and structures which shall be indicated on the Site Grading and Drainage ("L-Series") drawings.

1.2 Design of building foundation drains is the responsibility of the Architect. Do not show details on Sanitary ("W-Series") drawings. However, pipe design from low point of foundation drainage system to storm sewerage system is the responsibility of the Sanitary Engineer.

1.3 Do not cross gravesites with utilities. Route the main distribution systems for utilities immediately under or adjacent to roadways. To avoid obstruction of gravesites within burial sections, route utility lines in interment areas between sections, in order 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 excessive cost or remoteness of source from developed areas of the cemetery.

1.4 Consolidate notes as much as possible and place them on the right-hand side of the sheet.

1.5 Show scale, compass point, orientation, key plan, title, column grids and numbers, room numbers and titles corresponding to the architectural drawings.

1.6 Show room titles and numbers on each plan. If this information is not shown it could result in rejection of the submission.

1.7 Provide drawings generated in AutoCAD©.

2. GENERAL:

2.1 In the design of the sanitary systems, follow this criteria and NCA Master Specifications.

2.2 Sanitary design drawings (W-Series) consists of sanitary sewerage, water, irrigation (I-Series) and gas systems, but may also include the storm drainage and drainage structures.

2.3 Estimate quantity, in cubic meters (yards), of rock excavation for sewers, water lines, and gas lines. Refer to Specification 31 20 00 for definition of rock.

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

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

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

C. Where practical, 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.

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

2.6 Maintain a horizontal distance of at least 3000 mm (ten feet) between parallel sewer and water lines.

3. WATER SUPPLY:

3.1 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, etc.). Use potable water as a last resort. Coordinate with Section 5.3 Irrigation Design Criteria.

3.2 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 will follow cemetery signage design.

4. WATER DISTRIBUTION SYSTEM:

4.1 Design system to provide water service for maximum domestic and irrigation requirements. Fire hydrants will be provided if an adequate water supply is available. Flow velocity shall not exceed 3 m/s (10 feet-per-second).

4.2 Place isolation valves to provide control over reasonably sized area. In addition, designate valves in fire hydrant branches and building service lines, near their connection to feeder mains. If irrigation water is used for fire protection coordinate with Section 5.3 Irrigation Design Criteria.

4.3 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 un-sprinklered administration buildings.

5. DOMESTIC WATER PUMPING SYSTEM:

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

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

6. SANITARY AND STORM SEWERAGE SYSTEMS:

6.1 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, etc., and all appurtenances. Storm drainage system shall serve all areas under construction or affected by construction.

6.2 Storm-water management shall be provided as necessary to comply with the requirements of 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 with regard to the temperature, rate, volume and duration of flow. The footprint is considered to include all horizontal hard surfaces and disturbed areas within the project site including both building area and vehicular and pedestrian pavements. Additional information can be obtained from the EPA publication, Technical Guidance on Implementing the Storm-water Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act (EPA 841-B-09-001).

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

6.4 Do not connect storm drainage system to sanitary sewerage systems.

6.5 To extent feasible, locate sewer pipes and manholes under pavement at the centerline. Provide manholes at junctions, changes in direction, changes in 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 manholes to 90 m (300 feet), except 150 m (500 foot) spacing is permitted in straight runs of long outfall sewers.

6.6 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, manholes, inlets, and other appurtenances.

6.7 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 minimum velocity of 0.6 m per second (two feet per second) when pipe is flowing full; maximum slope shall be ten percent, unless there

are unusual circumstances; provide drop manholes when difference between incoming and outgoing inverts is greater than 18 inches.

6.8 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 minimum velocity of 0.6 m per second (two feet-per-second) when pipe is flowing full. Maximum storm sewer design velocity shall be in non-erosive range for specified pipe material.

6.9 Storm drainage curb and gutter inlets shall be designed to match the profile of the curb and/or curb and gutter. 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.

6.10 Use State or local standard details for manholes, inlets, endwalls, and pipe cradles. Adjust master specification as necessary. Design curb and gutter inlets with a grade to match the profile of the curb and gutter with no part of the inlet behind the curb.

6.11 Use septic tanks to treat building waste if connection to public sewer is not possible and soil percolation is adequate. Provide details and installation instructions in accordance with the State or local Health Department and others having jurisdiction. If percolation is poor, provide an alternate solution of treatment.

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

7. SEWAGE PUMPING EQUIPMENT (EXTERNAL):

7.1 Design pumping system to discharge at maximum sewage flow rate with largest pump not operating. Provide emergency power.

7.2 Wet well shall be large enough to allow an interval of at least 6 minutes between successive starts of same pump motor throughout entire range of estimated flow rates. Include high water level alarm system in wet well, and place 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.

8. GAS DISTRIBUTION SYSTEM: Coordinate with Gas Company concerning housing and/or fencing for gas metering and regulating equipment. Comply with all gas company requirements.

9. FUEL FOR MAINTENANCE EQUIPMENT: The tanks, one for gasoline and one for Diesel oil, will be above ground type, government furnished, and contractor installed (VC). Provide air, water, and electrical utilities to complete the installation. Provide tank protection from vehicles by bollards or curbs. Provide emergency power.

10. CALCULATIONS: Calculations are required for the following systems:

Water	Storm Drainage
Irrigation	Gas
Sanitary Sewerage	Ancillary Associated Equipment

11. APPLICABLE SANITARY MASTER SPECIFICATIONS INDEX: Use the latest edition of NCA Master Specifications.

SECTION	**TITLE**
	DIVISION 22-PLUMBING
22 05 11	Common Work Results for Plumbing
22 12 16	Facility Elevated, Potable Water Storage Tanks
22 13 00	Facility Sanitary Sewerage
22 13 23	Sanitary Waste Interceptors
22 13 29	Sanitary Sewerage Pumps
22 13 33	Packaged, Submersible Sewerage Pump Units
22 13 36	Packaged, Wastewater Pump Units
23 13 23	Concrete Above Ground Fuel Storage
	DIVISION 31 – EARTHWORK
31 20 00	Earth Moving
31 20 11	Earth Moving (short form)
31 23 19	Dewatering
31 23 23.33	Flowable Fill
	DIVISION 32 – EXTERIOR IMPROVEMENTS
32 05 23	Cement and Concrete for Exterior Improvements
32 84 00	Planting Irrigation
32 90 00	Planting
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33 10 00	Water Utilities
33 30 00	Sanitary Sewerage Utilities
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5.3 IRRIGATION DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

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7. APPLICABLE IRRIGATION MASTER SPECIFICATIONS INDEX

5.3 IRRIGATION DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. CRITERIA UNIQUE TO VA:

1.1 Refer to SECTION 5-11 GRAPHIC STANDARDS for general requirements and classification of drawings ("I-Series").

1.2 Irrigation lateral pipes and sprinkler heads to be installed within burial areas require the design of irrigation utility aisles. The purpose for 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 lateral pipes and sprinklers should be designed to 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. For a 3'x8' plot layout, the sprinkler head will be positioned approximately 58" from the top of the 8' burial plot. For upright headstones, the irrigation heads should be spaced equidistant (within 1-2") between the adjoining headstones. Provide a sample burial section layout in Design Development, prior to designing the entire irrigation system. Alternate methods of design will be considered at this review.

1.3 Design layout distance between irrigation utility aisles should normally be based upon application efficiency for the sprinklers. Typically, the best sprinkler efficiency occurs with spacing of between 54 and 72 feet. The irrigation aisle spacing should be designed within the above range and should be set based upon a multiple of the width 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 will be 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. If the designed spacing between irrigation aisles is greater than 72' this results in the use of 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 pressure of 80-90 psi, as compared to 50-60 psi, can have adverse impacts on nearby trees and headstones.

1.4 For purposes of automatic watering based on ET the control system ideally may be connected to an onsite weather station to automatically adjust run times based upon real time weather conditions. This decision should be clarified in the design review process as part of the Design Development process.

1.5 Do not cross gravesites with irrigation mainline or lateral pipes. 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 to be 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 system, or control wiring for the irrigation system shall cross the roads or any other hardscape, inside of appropriate buried conduits. This will allow for the repair and/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.

The second route for irrigation mains is to be immediately adjacent to roadways, whenever possible. For irrigation mains outside of the roadways they should be located between the roadway and interment sections or in 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. Where the irrigation mains cross the roadways or other hardscape in sleeves, provide separate parallel conduits for use of the power and control wiring for the irrigation system.

NOTE: The suggested location for the mainline pipe is at least 3' (preferably 10' to avoid street trees) in back of curb or edge of road set so that the mainline does not pass under flower water stations and so that street trees are not planted on top of the mainline pipe.

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.

1.6 Consolidate notes as much as possible and place them on the right-hand side of the sheet.

1.7 Show scale, compass point, orientation, key plan, title, column grids and numbers, room numbers and titles corresponding to the architectural drawings.

1.8 Show room titles and numbers on each plan. If this information is not shown it could result in rejection of the submission.

1.9 Provide drawings generated in AutoCAD©.

2. GENERAL:

2.1 Design criteria for existing systems are unique to that system and the first design discussion should be to identify what the existing system is and to find out what is or isn't working at the existing facility. Generally matching what is existing and/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 and the problems and objectives for the system improvements, and appropriate design should be created, integrating the existing with the new. These situations are unique and as such are 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 Specifications in creation of the project irrigation system design.

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

A. Minimum cover for main lines under traffic areas shall be 900 mm (36”) from the bottom of road subgrade.

B. Top of irrigation lines, other than laterals, shall be at least 600 mm (24”) below grade in turf areas.

C. Top of lateral lines shall be at least 450 mm (18”) below grade to allow for proper installation of swing joints or rotary sprinklers.

D. The pipes entering the control valve boxes shall be adjusted so the top of the control valve is at least 50 mm (2 inches) below the inside bottom of the box lid.

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

2.4 Designer shall carefully evaluate the impacts of providing fire protection, through fire hydrants, or connections to building sprinkler systems, with the irrigation water supply source. This is specifically of concern in project locations were frost is present in the ground during the winter. At the locations where the system has to be drained during the winter to keep elements from freezing, the decision to provide fire protection from the irrigation system becomes more complicated. Before designing such a system, the decision must be approved by the NCA, and specific requirements discussed with the local fire department responders. If any portion of the irrigation system is to be used for fire protection, the pipes, valves and appurtenances in the portion of the system to remain operational in the winter need to be installed below the frost depth for the location. If not applicable, follow the above minimums. If there is an irrigation pump station, the sizing of the pump station must give consideration to required fire flows not just the irrigation water requirements. Fire flows may be greater than irrigation water requirements and the pump station and mainline piping need to upsized to meet fire code.

3. IRRIGATION WATER SUPPLY:

3.1 The evaluation of the source(s) of irrigation water should be investigated during the all of 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.

A. Irrigation water supply source for a NCA facility needs to be developed, at least conceptually, to provide potential for sufficient water supply source for the full 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. In this case, it may be better to have a separate water supply for the future phase. This is especially true if a pond is required as part of the irrigation water supply source. The specific requirements for water supply source are site and project specific and decisions as to appropriate source or sources for a particular project shall be based upon engineering evaluation, including life cycle costs, with the alternatives being evaluated as early in the project process as possible.

B. 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 facility won't have to be fully 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.

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

D. Generally all water sources, other than those from potable municipal water supply sources are preferable to municipal potable water sources. Only when there are no alternatives for municipal potable water sources, should they be considered as 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. First priority for sources should be those determined from investigation of non-potable water sources for irrigation.

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

F. 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.

G. Where possible ensure that the irrigation water source is uninterruptible. Where not possible, an alternative source to function as a backup source of

supply 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.

H. 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 will follow cemetery signage design. Reclaimed tertiary treated effluent water may be utilized where available, with proper signage and color coding.

4. IRRIGATION WATER DISTRIBUTION SYSTEM:

The distribution system for NCA irrigation systems shall be designed using a computerized hydraulic network analysis to ensure that the pipe sizes are adequate to 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. Design objective shall be to have all main lines designed initially so they will not have to be replaced as the facility expands. Designs shall be in accordance with the following:

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

4.2 Place isolation valves to provide control over all sections of branched main lines. Valve locations shall be sufficient to allow adequate isolation of the system for flushing and blowing out the system.

4.3 Design system to minimize high points and provide air release valves at high points for the system piping where air will not be released through other nearby piping or facilities.

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

5. IRRIGATION WATER PUMP SYSTEM:

Design for irrigation water pump systems shall be based upon the flow rate required to meet the peak season evapo-transpiration rate, applied during a programmed watering cycle for the irrigated area. The pipe network should then be sized to carry the volume of water provided by the pumping system, without exceeding the maximum flow velocity in the pipes. The pipe network shall be looped, whenever possible, and contain isolation valves to facilitate flushing the system at flow velocities of at least 0.6 m/s (2.5 fps). 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 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 are to provide information on functional and performance criteria that should be 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:

5.1 Adequate pump capacity to meet the peak season water requirement for the irrigation system.

5.2 Multiple pumps are recommended, to achieve the maximum design flow rate. 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.

5.3 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.

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

5.5 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 as a result of a pressure drop caused by a mainline pipe break or leak in the system, and not because of irrigation demands. Communication between the irrigation control system and the pump system should be provided so the operation of the pump system is operating only when irrigation is required.

5.6 Pump system shall be designed so that it has a long design life, except for the wearing equipment. This includes, the mounting, housing, control system enclosures, etc.

6. IRRIGATION SYSTEM:

6.1 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 irrigation system shall be designed, as a minimum, to be installed and operated in

accordance with guidelines, standards and recommendations set forth by the product manufacturers and overall shall comply with the up to date industry standards.

A. Design irrigation system components for NCA expansion projects based upon the existing system and match the existing whenever possible, provide the existing system has been function without any major problems. Verify the operations of the existing system before proceeding with the design for and expansion of an existing NCA facility,

B. 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 shall be designed to minimize overspray and excess runoff during the irrigation cycle.

C. Systems shall be designed to provide either a minimum of 60% Distribution Uniformity (DU) for spray type heads and 70% DU for rotor type heads, or shall be designed to have an application efficiency based upon the Scheduling Coefficient (SC). As an example, if the system is designed with an SC of 1.2 or less you can achieve a DU 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 also be utilized. The designer needs to provide documentation of the DU and SC are part of the design submittal.

D. Pressure regulation devices shall be included in the system design to allow 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 more accurately provide flow control functions, which in turn allows for more consistent, efficient and predictable operation of the water supply source(s). Pressure regulation devices may include one or all of the following:
1 - pressure regulation device on/at remote control valve,
2 - pressure regulation device on individual sprinkler heads.
3 - pressure regulation of low volume drip/micro systems.

E. Systems shall be designed to complete the watering schedule for the entire facility by watering in daily increments of 12 hours maximum.

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

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

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

I. Design shall provide separate zones for 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 taken into consideration as part of the design. Design the laterals on slopes to run parallel to the slope.

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

K. Where there are clearly identifiable differing soil types in the areas to be irrigated (that have different absorption and runoff characteristics) design separate irrigation zones. 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.

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

M. Design each irrigation zone to have its own station on the controller. When retrofitting and adding a zone becomes necessary, combining irrigation zones of the same soil and sprinkler types, is acceptable, to minimize disruption of the existing cemetery to install additional control wiring, or if there is not an additional station on the controller.

N. 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.)

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

P. Design irrigation systems with 25 mm (1”) point of connection (POC) or larger, or with landscape area of 2500 square feet and larger, 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.

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

6.2 POINT OF CONNECTION:

A. Design new systems with a normally closed master valve. Where necessary,

the master valve shall be capable of manual operation to allow manual use of the irrigation system. A normally open master valve is acceptable. A flow sensor is required that connects to the controller and is capable shutoff shutting the valve off in event of unscheduled flow (line break). If flower water stations are provided on the irrigation system, use normally open master valve with a flow sensor.

B. Design new systems, which are to use non-potable water, to include 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 following analysis of the water quality characteristics and identification of 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 to be discussed during the design process, is staining of the headstones caused by particles in the irrigation water.

6.3 CONTROLLER / WIRE:

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

A. Controller shall be able to provide separate programs for turf zones, shrub zones, and drip zones.

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

C. Controller shall be programmable for multiple start times for cycle and soak and shall be capable of water budget adjustment.

D. 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.

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

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

G. All wire connections shall be made with watertight connectors and contained

in valve box.

H. Provide 450 mm (18”) length of loop of control wire at all change in directions.

I. Provide 600 mm (24)” of slack wire at each remote control valve in valve box.

J. Remote control valve wiring shall be installed with the main line pipe where possible.

K. Remote control valve wiring shall have separate colors 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.

L. As a general guideline, it is desirable to provide a minimum of one spare wire for every five remote control valves in system. 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 being installed. One or two spare wires should be provided for each new burial area.

M. Outdoor controllers shall be lockable and weather resistant.

N. All wiring under hardscaping shall be contained in conduits.

O. All wiring shall be identified at each end to provide indication as to which location the wire is connected.

6.4 GROUNDING:

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

6.5 PIPING / FITTINGS:

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

A. All PVC pipe shall be rated ASTM D 1784 or 1785.

B. Minimum recommended standards for PVC pipe: Schedule 40 for sizes 3/4” through 3”, Class 200 for sizes 4” and up. ½” PVC pipe is not allowed.

C. Maximum flow velocity in any mainline pipe shall not exceed 1.52 m/s (5 ft/s). Pressure polyethylene pipe shall be ASTM D2239 rated, lateral and

drip tubing excluded. Note: We do not allow the use of polyethylene lateral pipe for sprinklers on VA projects.

D. All piping will be capable of winterization by compressed air blowout.

E. Manual drains may be used in main line pipe applications.

F. All piping will be backfilled with clean material, settled and compacted to proper finish grade.

G. All solvent weld joints to be installed according to manufacturer specifications.

H. Insert fittings shall be not be installed on sprinkler laterals.

I. PVC Main lines 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 ½”).

J. Push on ductile or Mechanical cast iron fittings shall be used on PVC main line fittings 75 mm (3)” and larger.

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

6.6 FLOWER WATER STATIONS:

A. 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.

B. Flower water station spigot shall be of a type suitable for the climate and operation of the irrigation system. Recommend use of spigots that are self-draining and have water feed installed below frost depth.

C. Match existing, when the existing spigots are to permanently remain and currently meet standards.

E. Install a direct bury pressure regulator and an isolation valve on the water supply to the spigot in an accessible location that won’t require removal of the concrete base for the flower watering station.

F. 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.

6.7 VALVES:

Design of irrigation system valves shall match any existing components, unless during the design development, or in the initial project scope it is specifically

indicated to do otherwise. The design for the valves shall meet or exceed the following:

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

B. All remote control valves shall have flow control adjustment.

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

D. Control valves will be installed in a Standard or larger, manufactured, valve/meter box, capable of being locked closed after installation.

E. Remote control valves in valve boxes shall have ample space for service and to remove valve cover.

6.8 SPRINKLER HEADS

Design of irrigation system sprinkler heads shall match any existing components, unless during the design development, or in the initial project scope it is specifically indicated to do otherwise. The design for the sprinkler heads shall meet or exceed the following:

A. All sprinkler heads shall be attached to lateral line pipe with a flexible joint swing assembly.

B. Sprinkler heads adjacent to hardscape paving shall be spaced 25 mm to 75 mm (1" to 3") away from paving. Sprinklers adjacent to walls, buildings, fences or other structures shall be spaced a min. 150 mm (6") away from structures.

C. All sprinklers within a zone shall have matched precipitation rates.

D. Shrub heads located adjacent to pedestrian areas shall be pop up variety.

E. Sprinklers in turf areas shall be fully spring retractable and pop up a minimum of 125 mm (5"), to the centerline of orifice; trajectory should be in excess of 21° to clear grave headstone.

7. APPLICABLE MASTER SPECIFICATIONS INDEX: Use the latest edition of NCA Master Specifications.

SECTION	TITLE
	DIVISION 32-EXTERIOR IMPROVEMENTS
32 84 00	Planting Irrigation

- - - END - - -

5.4 ARCHITECTURAL AND INTERIOR DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

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5.4 ARCHITECTURAL AND INTERIOR DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. GENERAL:

1.1 OVERVIEW

A. This section provides the VA architectural and interior design requirements and criteria to follow in executing your contract. Experience has shown that firms who study the criteria in the A/E package prior to starting work on their projects have a better understanding of the level of effort expected of them by VA and, hence, do a better job with fewer mistakes or conflicts with VA standards or criteria.

B. VA has found that the best design solution for a project occurs when the complete project team formed by the A/E has input at the time of early schematics.

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

1.2 CODES:

A. The latest editions of the National Fire Codes including the Life Safety Code (NFPA 101);

B. The latest adopted editions of the International Building Code (IBC);

C. The requirements of the latest Occupational Safety and Health Standards (OSHA) published by the Secretary of Labor;

D. All VA National Cemetery facilities follow the Architectural Barriers Act Accessibility Guideline (ABAAG), and this design criterion for buildings and site accessibility.

E. Refer to PG 18-3 Topic 01 for all applicable Codes, Standards and Executive Orders.

1.3 CRITERIA UNIQUE TO VA

A. Consolidate notes as much as possible and place them on the right-hand side of the sheet.

B. Show scale, compass point, orientation, key plan, title, column grids and numbers, room numbers and titles corresponding to the architectural drawings.

C. Show room titles and numbers on each plan. If this information is not shown it could result in rejection of the submission.

D. Provide drawings generated in AutoCAD©.

1.4 INTERIOR DESIGN SOLUTION

A. Goal: To provide a supportive interior environment that is respectful of the public monies, and expresses high quality design.

B. Concept: The design is to pivot from the National Cemetery mission, its staff and the veteran clientele. The solution must provide an interior that responds to the regional elements, supports human performance, one that reflects individual characters well as relationship to the group, and to the organization as a whole. The interior design should be as user friendly to those they serve, the veterans and their families.

The color, texture, finish and materials need to be selected with the priorities of cost, appearance retention, and maintenance. Optimum principles of good design need to be expressed.

C. Function:

1) Functional requirements dictate maintainable colors, textures, patterns, material selections, combination of materials and installation techniques. Materials must be chosen for longevity and good appearance retention.
2) A 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/or patching qualities of the material. New materials that contain different maintenance procedures and/or training for required patching are not typically not appropriate but may be considered on an individual project basis.

D. Costs:

1) As stewards of public monies, every design and selection is to employ the priorities of cost-savings. Information on first term vs. life cycle cost, for applicable items, needs to be presented in order that an informed judgment can be made. Design and/or materials that impart dollars wisely spent are to be pursued while avoiding opulence or the illusion thereof.
2) Passive cost savings is also recognized as working smart, producing favorable contractual procurement and leaving the client with a good value as towards future replacement. Examples of this are consolidation of selections with design planning that produces variety. Other design systems that follow the above practices and offer saving are encouraged.

E. Guidelines:

1) Consult Equipment Information (PG-18-5) for furnishings and surface materials.
2) Colors, patterns and designs that transcend time are endorsed. Trendy colors and patterns are to be avoided.
3) Color and pattern considerations need to include:
   a. Neutral background colors. Eliminate bright values for major surfaces such as walls or floors.
   b. Pattern and textures are good for interest, maintenance and sound.

1.5 THE DESIGN PROCESS:

A. The participation between the Architect/Engineer's Designer, Facilities Management Architectural staff and the National Cemetery Administration (NCA) will occur at each review and as needed between reviews. Significant benefits can be gained by managing the process into a team effort which can lead to better decisions and an expansion of the design.

B. The interior design during the developmental stage, until approval, needs to remain fluid enough that comments are possible and responses do not jeopardize the accomplished working hours and the project remains on a positive progression.

C. Interior design is to be considered an essential tool and is to be integrated into the three-dimensional development of the building design.

D. Diagrams for patterns or directions for installation may be located as interior details on the architectural drawings.

1.6 CONSTRUCTION MATERIALS:

A. Your proposal may include the use of any building material and any method of assembly and should be in harmony with the existing environment.

Proposal for use of relatively untried materials or of unusual methods of construction, however, shall be discussed with the Office of Facilities Management and the NCA Technical Support Service as early as possible.

B. THE BUY AMERICAN ACT:

1) VA adheres to Buy American Act.

2) There are three possible exceptions to the Act's requirements. All have to be documented and approved by VA General Counsel.

3) Unreasonable cost of the domestic materials, foreign product plus six percent is cheaper than the domestic.

4) Unavailability of domestic material.

5) Impracticable to use domestic material, public interest such as delay to complete project, disruption to operations.

6) Many interior 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 properly justified, follow these requirements.

7) Complete definition of selected terms can be found at Federal Acquisition Regulation (FAR) 25.201.

1.7 SPECIFICATIONS

A. Manufacturers' names are used to reference, describe and identify color, texture or pattern. This is not to be construed as an endorsement of proprietary selections. Refer to specification 09 06 00 Schedule for Finishes, Part 1- General, manufacturers, and article 4, Proprietary.

B. The specifying of all architectural finishing materials with color, textures and patterns before the contract documents are issued to include as fixtures, millwork, and items requiring a selection of color.

C. PROPRIETARY:

1) Brand name, manufacturers pattern numbers are used as identification and "or equal" will be accepted as long as they meet all the technical requirements of the specifications. COLOR, PATTERN AND TEXTURE ARE A PART OF THE REQUIREMENTS. Proprietary specifying is possible but must be done within the appropriate means.

2) The Federal Acquisition Regulation (FAR) contract clause provides information on the issue of proprietary specifying.

1.8 BUILDING ENVELOPE ENERGY CONSERVATION DESIGN:

A. Building envelope refers to building elements which enclose conditioned spaces and through which thermal energy is transmitted to or from the outdoors. A building envelope includes exterior walls, windows, exterior doors, roof/ceiling, peripheral edges of floors over heated spaces, floors over unheated spaces, slab-on grade floors and foundation walls.

B. The building thermal envelope for cemetery buildings shall be energy efficient to minimize the heat gain and due to conduction and solar radiation. The building envelope shall minimize the air leakage to and from the occupied space and shall also ensure condensation control.

C. The design of all new VA buildings must comply with mandatory EPACT 2005 requirements and employ sustainable design principles. The EPACT 2005 mandates that all new federal facilities shall reduce the energy cost budget by 30 percent compared to the baseline building performance rating per the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 90.1-2010, Energy Standard for Buildings except Low-rise Residential Buildings or International Energy Conservation Code (IECC), and employ sustainable design principles. ALL NEW FEDERAL BUILDINGS WILL BE DESIGNED TO ACHIEVE ENERGY CONSUMPTION LEVELS THIRTY PERCENT BELOW THOSE OF THE CURRENT VERSION OF THE APPLICABLE ASHRAE STANDARD OR THE IECC,

D. VA requires mandatory compliance with Executive Order 13423 and Federal Leadership in High Performance and Sustainable Buildings: Memorandum of Understanding (MOU). Article on Building Envelope Energy Conservation Design.

E. VA policy is to encourage the use of biobased materials in projects. See USDA bio-preferred website http://www.biopreferred.gov.

1.9 SEISMIC DESIGN:

A. Design cemetery facilities in accordance with the seismic provisions of the current International Building Code (IBC) and local building code and H-18-8 Seismic Design Handbook

2. DRAWINGS:

2.1 Refer to 5.11 GRAPHIC STANDARDS in this criterion for general requirements and classification of drawings.

2.2 Refer to VA Equipment Reference Manual, Program Guide PG-18-5 National Cemetery Administration, and the Equipment Guide List, Program Guide for the proper symbols for all fixed items of equipment.

2.3 Show plumbing fixture symbols (numbers) on plumbing drawings only, not on architectural drawings.

2.4 Use VA Program Guide PG-18-4, Standard Details, as a guide only. However, use the VA Door Schedule, Standard Detail SD080000-01,-02.

2.5 Use fire protection symbols for fire-rated and smoke-barrier partitions, as indicated in PG-18-4, on the **1:100** (1/8") architectural floor plan, where the partition types are designated, and on the fire protection plans (FP drawings).

2.6 Minimize the number of floor drains, because of possible problems from sewer gases. Locate floor drains where indicated in the Equipment Guide List, and in the Plumbing Design Criteria.

2.7. Provide finish schedule and color schedules on the architectural drawings. Color schedules are to include Interior and exterior.

3. BUILDING PERIMETER FOUNDATION DRAINAGE

3.1 Subsoil (foundation) drainage provides a means of removing water which may percolate to the footing level of a building foundation system. Establish the need for a subsoil drainage system by an analysis of the climate, topography, soil character, water table, geological factors and the judgment of the designer. Where topographical or other factors exist which would lead to uncertainty regarding the ability of natural drainage to function and avoid damage by subsurface water, provide a subsoil drainage system and show it on the architectural basement floor plans. Sections must show relative elevations compared to basement floor level.

3.2 Provide subsoil drains, when judged advantageous and where individually required, at building perimeter wall footings adjacent to basement, crawl spaces, or pipe basements below grade.

3.3 Subsoil drains shall maintain a pitch as uniform as possible and shall drain to suitable outfall. Minimum pitch shall be 0.5%.

3.4 Unless site conditions otherwise dictate, no subsoil drainage piping shall traverse a building area to reach an outfall. Where a condition makes this imperative, use solid pipe with sealed joints to traverse a building area.

3.5 Subsoil drains shall in no case be lower in elevation than the base of adjacent footings. When an abrupt change in elevation of footings occurs, drain tile shall lead away from building at the higher elevation of the transition. The lower level shall be separately drained.

4. DOORS:

4.1 Provide solid core wood or hollow metal interior doors. Wood is preferred, however, except for locations where metal is required for functional reasons. Provide metal door frames, except for special conditions. Coordinate Room Finishes, Door and

Hardware Schedule, for sizes, types and symbols of doors with VA Project Manager.

4.2 Verify that all door hardware meets all the minimum accessibility requirements and clearances.

5. EXTERIOR WINDOWS:

5.1 While designing to meet the project goals, use the Secretary of the Interior's "Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings" as a guide. Copies of this booklet are available at this website. http://www.nps.gov/hps/tps/tax/rhb/index.htm.

5.2 For double-glazed windows, provide a continuous thermal break between inner and outer sash; also between inner and outer frame components including window sill.

5.3 When in open position for ventilation, window sash shall not project into the room beyond edge of stool or face of convector, nor beyond exterior reveals of window sills within 2000 mm (6'-6") of grade.

6. PARTITIONS:

6.1 For interior partition framing use 100 mm (four-inch) metal or wood studs. For special requirements, use other sizes or systems as appropriate. Where pipe spaces are provided, size partition framing thickness to conceal piping.

6.2 Use 16 mm (5/8 inch)-thick type-x gypsum wallboard for partitions, except for special conditions.

6.3 Extend all layers of gypsum board from floor to underside of structure overhead on the following partitions:

A. Fire rated partitions.

B. Smoke partitions.

C. Sound rated partitions.

6.4 In locations, extend gypsum board from floor as follows:

A. Not less than 100 mm (four inches) above suspended acoustical ceilings.

B. At ceiling of suspended gypsum board or plaster ceilings.

C. At existing ceilings.

7. FINISHES:

7.1 Coordinate Room Finishes, Door and Hardware Schedule with the project management team prior to start of construction document phase.

7.2 Combine the finish schedule and color design schedule and include them on the drawings. Use the finish schedule format included in Schedule for Finishes NCA Master Specification 09 06 00. Demolition plans must show the existing finishes.

8. CEILINGS:

8.1 Use Gypsum Board ceilings in spaces subject to moisture.

8.2 All suspended acoustic tile ceilings, if used, shall be 600 by 600 mm (2 feet x 2 feet) lay-in panels with tegular edge (rabbited edge) in a standard 25 mm (1 inch) grid.

9. LOW SLOPE ROOF SYSTEMS:

9.1 Low-slope roof systems include but are not limited to the following roofing membranes with roof insulation:

A. Bituminous built-up roofing systems

B. Modified bituminous roofing systems

C. Single-ply sheet roofing systems

D. Fluid-applied roofing systems

9.2 Design low slope roof systems in accordance with the recommendations of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual and this Criteria.

9.3 Design all roofs with slope to roof drains or gutters.

9.4 Reroofed areas shall conform to this Article.

9.5 Design low-slope roof systems with a positive slope a minimum of 1:50 (0.25 inch per foot) up to a maximum of 1:12 (1.0 inch per foot) to drains:

A. Use tapered insulation, sloped structural systems, or level structural system with sloped fill to achieve the required slope.

B. Do not use NRCA defined "One-way slope" (Sloping to a level valley). See NRCA - "Tapered Roof Insulation Systems."

C. Use NRCA defined "Two-Way slope" (actually sloping in four directions).

9.6 Use a uniform square grid to lay out roof slopes to drains. Roofs shall not slope to level valleys, but may have one-way slopes to gutters at gravel-stop edges.

9.7 Locate drains at points of maximum deck deflection; generally at midspan of the deck between supports where possible.

9.8 Design single-ply ballasted roofing systems using Factory Mutual Criteria for wind force resistance. The following are Factory Mutual Criteria:

A. FMG 1-28: Loss Prevention Data Sheet, Design Wind Loads

B. FMG 1-29: Loss Prevention Data Sheet, Above Deck Roof Components.

C. FMG 1-49: Loss Prevention Data Sheet, Perimeter Flashing."

9.9 Anchor insulation to deck. Loose laid insulation is not permitted except for protective membrane roof insulation system.

9.10 Specify quality of ballast material in NCA Master Specifications

9.11 Locate overflow scuppers in parapet walls at top of membrane so that ponding does not exceed high point of slopes

9.12 Use 200 mm (8 inch) high base flashing at walls and penetrations. Do not use pitch pockets or similar penetration seals

10. PLUMBING FIXTURES, TOILETS AND BATHS:

10.1 Do not use toilet stalls or divider partitions in single-user toilet rooms in which only a lavatory and water closet are provided.

10.2 In planning the layouts of toilet rooms and bathrooms, use hinged doors or provide visual screening, so as to block the view from the corridors into such rooms. (See VA Standard Detail 12A.)

10.3 Verify that restroom layouts meet all the minimum accessibility clearances.

11. SHOWERS:

11.1 Use ceramic tile applied with thin set Portland cement to concrete-fiber reinforced backer board for shower enclosures and partitions of contiguous areas.

11.2 Provide grab bars for all showers.

11.3 Verify that shower meets all minimum accessibility clearances.

12. SIGNS, PLAQUES AND EMBLEMS:

12.1 For safety sign and construction sign, see General Requirements, Specification Section 01 00 00.

12.2 VA may furnish a dedication plaque and the contractor will install it. The plaque will be located as shown on contract drawings.

12.3 For other signage, see NCA Program Guide, Signage Standards.

12.4 Verify that all directional and informational signage meets the minimum accessibility guidelines.

The NCA specifies emblems, not seals, to be provided and installed by the Contractor. These should be 18-inch Diameter Bronze Emblems representing each of the five services, not Service Seals (it requires written authority from each service to have the actual service seal posted). The emblems should mount 5'-5" to center AFF, left to right - ARMY, MARINES, NAVY, AIR FORCE, COAST GUARD.

13. EQUIPMENT:

13.1 After completion of the design development drawings, the A/E firm shall provide a listing which itemizes the VA furnished and contractor installed (VC) personal property equipment 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 award of the construction contract, the equipment list shall be updated by the A/E firm and submitted to the contracting officer.

13.2 We recommend that the architect start the equipment list chronologically on a room-by-room and drawing-by-drawing basis.

13.3 The following equipment is not required to be shown on the equipment list:

A. Plumbing fixtures (P-numbers, such as P-104, P-113, P-411, etc.).

B. Equipment shown in toilets and bathrooms, unless otherwise noted.

C. Electrical equipment, such as TV outlets, electrical receptacles, junction boxes, light fixtures, alarm system, etc.

14. EARTHQUAKE-RESISTIVE DESIGN OF NONSTRUCTURAL ELEMENTS OF BUILDINGS:

14.1 See VA Design and Construction Procedures (formerly Construction Standards CD-54), VA Handbook H-18-8, and Uniform Building Code.

A. Provide seismic restraints for equipment where 'Z' value is equal

15. APPLICABLE ARCHITECTURAL STANDARD DETAIL INDEX:

15.1 The designer shall obtain a copy of the Standard Details and use the applicable details for the project after doing the necessary editing work.

16. APPLICABLE ARCHITECTURAL MASTER SPECIFICATIONS INDEX:

16.1 INTERIOR DESIGN MASTER SPECIFICATION INDEX:

A. Use the latest edition of NCA Master Specifications.

SECTION	TITLE
	DIVISION 9-FINISHES
09 06 00	Schedule for Finishes
09 30 13	Ceramic/Porcelain Tiling
09 51 00	Acoustical Ceilings
09 54 23	Linear Metal Ceilings
09 63 13	Brick Flooring
09 63 40	Stone Flooring
09 65 13	Resilient Base and Accessories
09 65 16	Resilient Sheet Flooring
09 65 19	Resilient Tile Flooring
09 65 13	Portland Cement Terrazzo Flooring
09 66 16	Terrazzo Tile Flooring
09 67 00	Fluid Applied Flooring
09 67 23	Resinous Flooring
09 68 00	Carpeting
09 91 00	Painting
	DIVISION 10 - SPECIALTIES
10 11 13	Chalkboards
10 11 23	Tackboards
10 13 00	Directories
10 14 10	Interior Signage
10 21 13	Toilet Compartments
10 28 00	Toilet, Bath, and Laundry Accessories
10 44 13	Fire Extinguisher Cabinets
10 51 13	Metal Lockers
10 56 13	Steel Shelving
	DIVISION 11 - SPECIALTIES
	DIVISION 12 - FURNISHINGS
12 24 00	Window Shades

** The A/E Interior Designer will edit the specifications and send them back to VA Project Team for review.

16.2 ARCHITECTURE MASTER SPECIFICATION INDEX:

A. Use the latest edition of NCA Master Specifications.

SECTION	TITLE
	DIVISION 4-MASONRY
04 05 13	Masonry Mortaring
04 05 16	Masonry Grouting
04 05 31	Masonry Tuck Pointing
04 20 00	Unit Masonry
04 72 00	Cast Stone Masonry

DIVISION 5-METALS

05 50 00	Metal Fabrications
05 51 00	Metal Stairs

DIVISION 6-WOOD, PLASTICS, AND COMPOSITES

06 10 00	Rough Carpentry
06 20 00	Finish Carpentry and Millwork

DIVISION 7-THERMAL AND MOISTURE PROTECTION

07 11 13	Bituminous Dampproofing
07 12 00	Built-Up Bituminous Waterproofing
07 13 00	Sheet Waterproofing
07 13 52	Modified Bituminous Sheet Waterproofing
07 21 13	Thermal Insulation
07 21 23	Loose-Fill Insulation
07 22 00	Roof and Deck Insulation
07 24 00	Exterior Insulation and Finish Systems
07 31 13	Asphalt Shingles
07 31 26	Slate Shingles
07 31 29.13	Wood Shingles
07 32 13	Clay Roof Tiles
07 40 00	Roofing and Siding Panels
07 51 00	Built-Up Bituminous Roofing
07 52 16	Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing
07 53 23	Ethylene-Propylene-Diene-Monomer Roofing
07 54 19	Polyvinyl-Chloride Roofing
07 56 00	Fluid-Applied Roofing
07 57 13	Sprayed Polyurethane Foam Roofing
07 60 00	Flashing and Sheet Metal
07 61 16	Batten Seam Sheet Metal Roofing
07 71 00	Roof Specialties
07 72 00	Roof Accessories
07 81 00	Applied Fireproofing
07 84 00	Firestopping
07 92 00	Joint Sealants

DIVISION 8-OPENINGS

08 11 13	Hollow Metal Doors and Frames
08 14 00	Wood Doors
08 31 13	Access Doors and Frames
08 33 00	Coiling Doors and Grilles
08 36 13	Sectional Doors
08 41 13	Aluminum-Framed Entrances and Storefronts
08 51 13	Aluminum Windows
08 51 23	Steel Windows
08 51 69.11	Aluminum Storm Windows
08 63 00	Metal-Framed Skylights
08 71 00	Door Hardware
08 71 13.11	Low Energy Power Assist Door Operators

08 80 00	Glazing
08 90 00	Louvers and Vents

DIVISION 9-FINISHES

09 22 16	Non-Structural Metal Framing
09 24 00	Portland Cement Plastering
09 29 00	Gypsum Board

DIVISION 10-SPECIALTIES

10 21 13	Toilet Compartments
10 28 00	Toilet, Bath, and Laundry Accessories
10 44 13	Fire Extinguisher Cabinets
10 75 00	Flagpoles

DIVISION 11-EQUIPMENT

11 11 14	Motor Vehicle Lifts
11 11 16	Vehicle Washing Equipment
11 11 26	Vehicle Service Equipment

DIVISION 12-FURNISHINGS

12 24 00	Window Shades
12 32 00	Manufactured Wood Casework

DIVISION 13-SPECIAL CONSTRUCTION

13 05 41	Seismic Restraint Requirements for Non-Structural Components
13 34 19	Metal Building Systems

- - - END - - -

5.5 STRUCTURAL DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

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1. GENERAL

2. APPLICABLE STRUCTURAL MASTER SPECIFICATIONS INDEX

5.5 STRUCTURAL DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. GENERAL:

1.1 Refer to 5.4 ARCHITECTURAL DESIGN CRITERIA AND 5.11 GRAPHIC STANDARDS for general requirements and classification of drawings ("S-Series").

A. For the structural design, follow the latest editions of:

B. Reinforced concrete design - ACI Standard 318, "Building Code Requirements for Reinforced Concrete", American Concrete Institute.

C. Structural steel design - "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", American Institute of Steel Construction.

D. Unless otherwise noted above - "International Building Code", International Conference of Building Officials.

E. Consolidate notes as much as possible and place them on the right-hand side of the sheet.

F. Show scale, compass point, orientation, key plan, title, column grids and numbers, room numbers and titles corresponding to the architectural drawings.

G. Show room titles and numbers on each plan. If this information is not shown it could result in rejection of the submission.

H. Provide drawings generated in AutoCAD©.

2. APPLICABLE STRUCTURAL MASTER SPECIFICATIONS INDEX:

Use the latest edition of NCA Master Specifications.

SECTION	TITLE
	DIVISION 1-GENERAL REQUIREMENTS
01 45 29	Testing Laboratory Services
	DIVISION 2-EXISTING CONDITIONS
02 41 10	Demolition
	DIVISION 3-CONCRETE
03 30 53	Cast-In-Place Concrete (Short Form)
03 41 33	Precast Structural Pretension Concrete
	DIVISION 5-METALS

05 12 00	Structural Steel Framing
05 21 00	Steel Joist Framing
05 31 00	Steel Decking
05 36 00	Composite Metal Decking
05 40 00	Cold-Formed Metal Framing\
05 50 00	Metal Fabrications

DIVISION 31-EARTHWORK

31 23 19	Dewatering
31 20 00	Earthwork
31 63 16	Auger Cast Grout Piles
31 63 26	Drilled Caissons

- - -END - - -

5.6 HVAC DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

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1. CRITERIA UNIQUE TO VA
2. BASIC DESIGN PARAMETERS
3. HVAC SYSTEMS
4. SEISMIC REQUIREMENTS (HVAC)
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7. HVAC STANDARD DETAILS INDEX
8. APPLICABLE HVAC MASTER SPECIFICATION INDEX

5.6 HVAC DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. CRITERIA UNIQUE TO VA:

1.1 GENERAL: In this article requirements unique to the VA are described.

A. Consolidate notes as much as possible and place them on the right-hand side of the sheet.

B. Show scale, compass point, orientation, key plan, title, column grids and numbers, room numbers and titles corresponding to the architectural drawings.

C. Show room titles and numbers on each plan. If this information is not shown it could result in rejection of the submission.

D. Provide drawings generated in AutoCAD©.

1.2 Refer to Graphic Standards Section 5.11 for general requirements and classification of drawings ("H-Series").

1.3 CLIMATIC CONDITIONS: Base the outdoor climatic conditions for the facility on the data listed in the latest ASHRAE Guide for the weather stations which closely represent the climatic conditions of the locations of the National Cemeteries. For the purpose of calculating the cooling and heating loads, use the following mean coincident temperatures values:

A. SUMMER: 2-1/2 percent design dry bulb 2-1/2 percent design wet bulb

B. WINTER: 97-1/2 percent design dry bulb

1.4 DUCTWORK: In the final design drawings (Construction Documents Phase), show all ductwork in double line regardless of sizes and/or complexity of layouts.

1.5 INTERDISCIPLINE COORDINATION: Coordinate HVAC design with all other disciplines, such as Architectural, Structural, Electrical, Plumbing and Site Planning. The following HVAC related work is generally shown by other disciplines:

A. Architectural drawings and specifications provide all louvers and attached screens in exterior walls, all flashing for ducts and piping penetrating roofs and exterior walls, finish and identification painting, walls and ceilings, access panels, chases, furred spaces, door grilles, mechanical equipment rooms, and penthouses.

B. Structural drawings and specifications provide all concrete and structural steel work, including catwalks, concrete housekeeping pads, lintel supports around openings, and platforms for access to HVAC equipment and supports for mechanical equipment.

C. Electrical drawings and specifications provide motor starters and disconnects, not furnished as part of HVAC equipment, smoke detectors (duct and/or space mounted), all power wiring to HVAC smoke dampers, motors, heating cable, and controls for winterizing piping.

D. Plumbing drawings and specifications provide all floor drain outlets.

2. BASIC DESIGN PARAMETERS:

2.1 INDOOR DESIGN CONDITIONS: Degrees C (F) dry bulb and percent relative humidity.

TABLE 2.1 BASIC DESIGN PARAMETERS

ROOM or AREA	SUMMER		WINTER	
	Db.	%RH	Db.	%RH
Multipurpose Room	23-25 (74-78)	50-60	21-23 (70-74)	20-30
Offices, Operational Center	23-25 (74-78)	50-60	21-23 (70-74)	20-30
Lunch Room	23-25 (74-78)	50-60	21-23 (70-74)	20-30
Reception	23-25 (74-78)	50-60	21-23 (70-74)	20-30
Equipment Storage Area	(No Mech. Cooling)		20 (68)	20-30
Toilets, Locker Room	23-25 (74-78)	50-60	21-23 (70-74)	20-30
Electrical Closets	(See Note D. Below)			
Telephone Closets	(See Note D. Below)			
Flammable Storage	(See Room Data Sheet)			
Pesticide Storage	(See Room Data Sheet)			
Maintenance Shops	(See Room Data Sheet)			

NOTES ON INDOOR DESIGN CONDITIONS

A. The indoor design conditions are not operating limits. All room thermostats shall be adjustable between 15°C (60°F) and 29°C (85°F) with an adjustable dead band of 3°C (6°F). Exception: Areas where mechanical cooling is not required.

B. The summer inside design relative humidity listed in table 2.1 need not be maintained by any humidity control. This value merely represents the design reference point and, in actual practice, could vary with the prevailing internal heat loads and coil leaving conditions.

C. Toilets do not require individual room temperature control in the cooling mode. For exterior single toilets, provide thermostatically controlled heating terminal devices to maintain space temperature in the winter mode.

D. In the absence of any heat producing equipment, cooling or heating is not required for small electrical and telephone closets. Storage closets, with areas less than 6 m^2 (60 sq. ft.) need not be ventilated, cooled or heated.

2.2 BUILDING THERMAL ENVELOPE: The building thermal envelope for cemetery buildings shall be energy efficient to minimize the heat gain and loss due to conduction and solar radiation. The building envelope shall minimize the air leakage to and from the occupied space and shall also ensure condensation control.

The design of all new VA buildings must comply with mandatory EPACT 2005 requirements and employ sustainable design principles. The EPACT 2005 mandates that all new federal facilities shall 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 (ASHRAE) Standard 90.1-2004, Energy Standard for Buildings except Low-rise Residential Buildings or International Energy Conservation Code (IECC), and employ sustainable design principles. ALL NEW FEDERAL BUILDINGS WILL BE DESIGNED TO ACHIEVE ENERGY CONSUMPTION LEVELS THIRTY PERCENT BELOW THOSE OF THE CURRENT VERSION OF THE APPLICABLE ASHRAE STANDARD OR THE IECC.

A. EXISTING CONSTRUCTION: The designer shall examine the existing building envelope and recommend the ways and means to improve its thermal efficiency. It is recognized that retrofitting the existing walls with new insulation, and replacing existing windows, is expensive; however, it should be evaluated if it is economically and technically feasible.

2.3 ENERGY CONSERVATION:

A. ECONOMIZER CYCLE: Depending on the system configuration and facility location, evaluate the use of an economizer cycle to obtain "free cooling" during mild climate.

B. ENERGY EFFICIENT MOTORS: Motors shall be high efficiency type complying with NEMA 1993 nominal efficiency values and meeting EPACT requirements.

2.4 OUTSIDE AIR REQUIREMENTS:

A. MECHANICAL COOLING: For occupied areas scheduled to be cooled mechanically, outside air for ventilation shall be based on ASHRAE Standard 62.1-2004 Ventilation for Acceptable Indoor Air Quality.

B. Provide makeup air for hazardous exhaust systems at a rate approximately equal to the rate that air is exhausted. Makeup air intakes shall be located so as to avoid recirculation of contaminated air.

2.5 ENGINEERING CALCULATIONS:

A. LOAD CALCULATIONS: Calculate the cooling/heating loads in accordance with the method outlined in ASHRAE Handbook of Fundamentals.

B. SAFETY MARGIN: A safety margin of 10% shall be added to the calculated internal heat gain and loss to allow for any future increase in internal heat gain or other load demand. The calculated air quantities for the occupied spaces shall be based on the addition of the safety margin.

C. AIR LEAKAGE: An allowance of 4% shall be made for the leakage of air through the ductwork before it reaches the occupied spaces. The leakage allowance shall be applied to the sum of all individual peak air quantities without any diversity.

D. STATIC PRESSURE: Add a safety margin of 10% to the fan total static pressure of the system. The static pressure calculations shall be based on:

1) Actual take-offs from the system layout drawings, that is, without any approximation for fittings, system components, etc.
2) Equal friction or static regain method.

E. FAN AND MOTOR SELECTION: Increase the KW (HP), calculated on the basis of total air quantity and fan static pressure, by 10% to account for drive losses and field conditions. The motor selection shall make an allowance for:

1) Altitude
2) Temperature
3) Inlet/Outlet Conditions
4) System Effect Factors per AMCA 210

The fan(s) shall be selected to operate in the stable region at near the maximum static efficiency.

2.6 DUCT SIZING CRITERIA: As far as possible, design all supply, return, and exhaust air ductwork as low velocity/low pressure type with a limiting maximum velocity of 7.6 m/s (1500 fpm) and a static pressure drop of 25 Pa (0.1-inch water gage) per 30 m (100 equivalent feet) of duct length.

2.7 NOISE CRITERIA: In all occupied areas to be mechanically cooled, maintain NC 40 in all octave bands. The systems must be engineered and the use of acoustic sound lining and sound attenuators shall be considered to achieve the design sound levels. For vehicular maintenance areas NC 50 shall be the maximum design noise level in all octave bands.

2.8 SEISMIC BRACING CRITERIA: Refer to article 4, Applicable Construction Criteria, and VA Standard Details.

2.9 VIBRATION CRITERIA: Refer to the NCA Master Specifications section 23 05 41 NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, AND ATTACHMENT NO. 1 SELECTION GUIDE FOR VIBRATION ISOLATORS.

3. HVAC SYSTEMS:

3.1 CEMETERY BUILDINGS:

A. GENERAL: The type and number of HVAC systems shall depend upon the configuration and size of the cemetery buildings. Evaluate a natural gas system for all facilities. If natural gas is not available a factory fabricated self-contained, direct expansion (DX) cooling unit, with electric resistance heat, or, an air-to-air heat pump (for locations with minimum 2°C (35°F) winter outdoor temperature) unit shall be evaluated. Depending upon the available space and building layout, the unit shall be a single piece or a split system configuration. For relatively larger facilities, evaluate the use of a chilled water cooling system (with air cooled chillers). Ground source heat pumps are ideal candidates for locations with minimum -6.6°C (20°F) winter outdoor temperature.

B. SYSTEM FEATURES:

1) For outdoor installations, the unit shall be fully weatherized.
2) Equip the HVAC unit with an economizer cycle to get "free cooling" during mild weather.
3) Equip the unit with at least MERV 8 filters.
4) Complete the air distribution arrangement with supply and return air ductwork, supply and return air outlets, and duct mounted heating coils or air terminal units. While the conditioned supply air shall be distributed to each occupied space by the network of air supply ducts, the extent of the return air duct shall depend upon the layout of the building. Exhaust air shall be ducted from each area to be exhausted. Transfer of supply, return, and exhaust air from one occupied area to another is not permitted without ducted connections. Exception; Toilets and Janitor Closets.
5) Perimeter Heating: Provide perimeter heat for all locations where winter outdoor temperature is -17°C (0°F) and lower. If the building thermal envelope is not in compliance with the parameters outlined in Article 2, provide the perimeter heat for all locations where winter outdoor temperature is -6°C (20°F) and lower. With perimeter heat, the automatic temperature control sequence can be set up to maintain the desired set back temperature during unoccupied hours of winter nights and holidays without turning on the HVAC systems to do so. Provide the perimeter heat by baseboard radiation or radiant ceiling panels or other suitable terminal devices.

6) Temperature Control Criteria: The automatic temperature controls shall be direct digital control (DDC) with electric or electronic operators for the controlled devices. Evaluate the HVAC system design as required.

MULTIPURPOSE ROOM & CONFERENCE ROOMS - ROOM DATA SHEET	
Inside Design Conditions	•Cooling 75F, 50% RH •Heating 70F, 30% RH
Minimum Supply Air Changes per Hour	6
Return Air	Permitted
Exhaust Air	Not Required
Room Noise Level	NC 40
Filtration	MERV 8
Individual Room Temperature Control	•Note 1
Room Air Balance	Neutral (0)
Note 1: The temperature control strategy shall depend upon the size and configuration of the building. For smaller projects, in a cooling mode, a single room or return air thermostat shall start or stop the refrigeration compressor(s) without requiring any individual room temperature control. Control the heating accordingly; by treating the HVAC unit as a single zone. For large projects, provide individual room temperature control for the Multipurpose Rooms and Conference Rooms.	

OFFICES, RECEPTION & OPERATIONAL CENTER - ROOM DATA SHEET	
Inside Design Conditions	•Cooling 75F, 50% RH •Heating 70F, 30% RH
Minimum Supply Air Changes per Hour	4
Return Air	Permitted
Exhaust Air	Not Required
Room Noise Level	•NC 35 - Private Offices •NC 40 - General/Open Offices
Filtration	MERV 8
Individual Room Temperature Control	Not Required •Note 1
Room Air Balance	Neutral (0)
Note 1: For larger projects, ensure that the perimeter and internal spaces are not grouped together as one temperature control zone.	

LUNCH ROOM - ROOM DATA SHEET	
Inside Design Conditions	•Cooling 75F, 50% RH •Heating 70F, 30% RH
Minimum Supply Air Changes per Hour	4
Return Air	Permitted
Exhaust Air	•Note 1
Room Noise Level	•NC 40
Filtration	MERV 8
Individual Room Temperature Control	Not Required
Room Air Balance	Negative (-)
Note 1: When the Lunch Room is equipped with food warming equipment, refrigerator, sink or vending machine, exhaust 50% of the supply air through the general exhaust system. Return remaining supply air. Return all supply air if the Lunch Room does not include equipment described above.	

TOILETS (Perimeter) - ROOM DATA SHEET	
Inside Design Conditions	•Cooling 75F, 50% RH •Heating 70F, 30% RH
Minimum Supply Air Changes per Hour	6 •Notes 1 and 2
Return Air	Not Permitted
Exhaust Air	•100% •Highest of: -10 air changes per hour -70 CFM (33.0 Liters/Second) per each water closet and/or urinal •Note 3
Room Noise Level	•NC 40
Filtration	Not Applicable
Individual Room Temperature Control	Not Required
Room Air Balance	Negative (-)
Note 1: For toilets with exhaust volume greater than 300 CFM (141.6 Liters/Second), provide thermostatically controlled make-up air. Note 2: For toilets with exhaust volume less than 300 CFM (141.6 Liters/Second), provide thermostatically controlled perimeter heat delivered by unit heaters, cabinet heaters, convectors or baseboard radiators. Note 3: For toilets with exhaust less than 300 CFM (141.6 Liters/Second) admit make-up air from the adjoining corridor via door undercut and transfer grille.	

TOILETS (Interior) - ROOM DATA SHEET	
Inside Design Conditions	•Cooling 75F, 50% RH •Heating 70F, 30% RH
Minimum Supply Air Changes per Hour	6 •Note 1
Return Air	Not Permitted
Exhaust Air	•100% •Highest of: -10 air changes per hour -70 CFM (33.0 Liters/Second) per each water closet and/or urinal •Note 2
Room Noise Level	•NC 40
Filtration	Not Applicable
Individual Room Temperature Control	Not Required
Room Air Balance	Negative (-)
Note 1: For toilets with exhaust volume greater than 300 CFM (141.6 Liters/Second), provide thermostatically controlled make-up air. Note 2: For toilets with exhaust less than 300 CFM (141.6 Liters/Second) admit make-up air from the adjoining corridor via door undercut and transfer grille.	

LOCKER ROOMS - ROOM DATA SHEET	
Inside Design Conditions	•Cooling 75F, 50% RH •Heating 70F, 30% RH
Minimum Supply Air Changes per Hour	10
Return Air	Not Permitted
Exhaust Air	•100%
Room Noise Level	•NC 40
Filtration	Not Applicable
Individual Room Temperature Control	Not Required
Room Air Balance	Negative (-)

VEHICLE AND EQUIPMENT STORAGE - ROOM DATA SHEET	
Inside Design Conditions	•Heating Only 60F
Room Noise Level	•NC 50
Filtration	Not Applicable
Individual Room Temperature Control	Required

3.2 SPECIAL CONDITIONS:

A. FLAMMABLE STORAGE: Exhaust with Type A spark resistant fan with an explosion resistant motor located outside of the air stream and provide sprinklers. Heat is not required. Exhaust fan shall be rated in accordance with AMCA Standard 99-0401 Classification of Spark Resistant Construction.

FLAMMABLE STORAGE - ROOM DATA SHEET	
Inside Design Conditions	•Ventilation only
Minimum Supply Air Changes per Hour	5 Liters/second/sq. meter (1.0 cfm/sf) •Note 1
Return Air	Not Permitted
Exhaust Air	•100%
Room Noise Level	•NC 50
Filtration	MERV 8 (For Make Up Air)
Individual Room Temperature Control	Not Required
Room Air Balance	Negative (-)
Compliance	International Building Codes
Note 1: See NFPA 30 for additional requirements	

B. PESTICIDE STORAGE: Exhaust with Type A spark resistant fan with an explosion resistant motor located outside of the air stream and provide sprinklers. Provide heat.

PESTICIDE STORAGE - ROOM DATA SHEET	
Inside Design Conditions	•Ventilation for 100% makeup air •Heat 20C (68F)
Minimum Supply Air Changes per Hour	•5 Liters/second/sq. meter (1.0 cfm/sf)
Return Air	Not Permitted
Exhaust Air	100%
Room Noise Level	•NC 50
Filtration	MERV8
Individual Room Temperature Control	Required
Room Air Balance	Negative (-)
Note 1: See NFPA 434 for additional requirements	

3.3 VEHICLE MAINTENANCE:

A. GENERAL: Provide a dedicated makeup air heating and ventilating unit for the maintenance section of the vehicle facility to supply at least 8 air changes per hour or 7.6 Liters/second/sq. meter (1.5 cfm/sf), whichever is

greater, during occupied hours. Also provide a corresponding exhaust system for exhausting all air to the outdoors, whenever the MAU is operating (except as noted below).

B. Additional ventilation is required to exhaust combustion by-products directly outdoors, if it is necessary to operate a vehicle inside the facility. An independent source capture system that connects directly to the exhaust pipe of the vehicle shall be installed. Required flow rates shall be coordinated with the types of vehicles to be maintained at the facility.

C. Low intensity infra-red heaters should be considered by the designer as a source of heating.

D. SYSTEM FEATURES:

1) The makeup air system shall comprise of a fan, MERV 8 filter, and heating section. Investigate the use of gas fired heating sections. Ensure uniform distribution of air by ductwork and supply outlets.
2) The heating shall be thermostatically controlled. The setback temperature during night and holidays shall be maintained by a set of unit heaters or by cycling the supply air system without any outside air and the outside air dampers closed. During this mode of operation, the normal interlock with the exhaust air system shall be overridden.
3) The exhaust air shall be picked up at floor level, 150 mm (6") above the floor uniformly from each service bay.

VEHICLE MAINTENANCE AND WORKSHOPS - ROOM DATA SHEET	
Inside Design Conditions	•Heating and Ventilation Only •Heating Only 15.6C (60F)
Minimum Supply Air Changes per Hour	•7.6 Liters/second/sq. meter (1.5 cfm/sf) •Note 1
Return Air	Not Permitted
Exhaust Air	100%
Room Noise Level	NC 50
Filtration	MERV 8
Individual Room Temperature Control	Required
Room Air Balance	Positive (+)
Compliance	American Council of Governmental Industrial Hygienists (ACGIH)
Note 1: See ASHRAE Applications Handbook (Latest Addition) and NFPA 30A for additional requirements .	

3.4 SMOKE AND FIRE CONTROL: Design the smoke control for the HVAC systems in accordance with NFPA 90A to affect system shutdown in the event of smoke detection. Install a duct mounted smoke detector in the main supply air duct, on the downstream side of the after filters and prior to any duct take-off, of all supply air

systems of capacities greater than 56 m^3/min. (2000 CFM). Upon smoke detection, the duct detector (through its auxiliary contacts) shall:

A. Stop the supply and associated return air fan:
The building exhaust air fans shall continue to run.

B. Sound an alarm at the fire alarm system.

C. Sound an audible alarm.

4. SEISMIC REQUIREMENTS (HVAC):

4.1 GENERAL:

A. Earthquake-resistive design shall comply with the requirements of the International Building Codes and VA Handbook H-18-8, Seismic Design Requirements.

4.2 APPLICATIONS:

A. Earthquake-resistive design for equipment, piping, and ductwork shall be as follows:

1) New Buildings: For new buildings, apply seismic restraints for equipment as indicated in VA Handbook H-18-8.
2) Existing Buildings: For existing buildings, apply seismic restraints for equipment in locations of Moderate High, High, and Very High Seismic activity, as indicated in VA Handbook H-18-8.
3) New and Existing Buildings – Piping: For new and existing buildings, apply seismic restraints for piping and ductwork in locations of Moderate High, High, and Very High Seismic activity, as indicated in H-18-8.
4) Local Codes: Where local Seismic Code is more stringent, comply with local code.

4.3 CONFORMANCE WITH SMACNA:

A. SMACNA does not cover all conditions such as providing bracing details for seismic restraints of equipment, details of flexible joints when crossing seismic or expansion joints, or bracing of in-line equipment, etc. Also, in locations of Very High Seismicity, SMACNA details should be used with special care.

B. Unless otherwise shown by SMACNA, provide detailed structural calculations for VA's review on the design of hangers, supports, anchor bolts, welds, and connections. Show sizes, spacing, and length for securing equipment, piping, and ductwork to structural members. The design calculations shall be prepared and certified by a registered structural engineer.

C. Where SMACNA details are incomplete or not applicable, provide necessary seismic restraint details. Coordinate mechanical, architectural, and structural work.

D. Show locations of required restraints with reference to SMACNA or special restraint details, whichever is applicable.

E. Provide special details (not covered by SMACNA), where required. Provide special attention to the seismic provision for the suspended equipment.

5. DOCUMENTATION AND MISCELLANEOUS REQUIREMENTS:

5.1 GENERAL: Refer to Article 6, APPLICABLE PUBLICATIONS for the applicable requirements. Refer to the VA Standard Details for the symbols and abbreviations which shall be used on all drawings and specifications. To avoid any confusion and dispute, nomenclature on the drawings shall correspond exactly to nomenclature in the NCA Master Specifications.

5.2 EQUIPMENT SCHEDULES:

A. List Equipment Schedules in the following order, vertically, from left to right, to facilitate checking and future reference. Do not show trade names or manufacturer’s model numbers.

1) Air Conditioning Design Data (outdoor design and indoor design conditions for the various occupancies)
2) Air Conditioning Equipment
3) Fans
4) Electric Baseboard Heaters
5) Air Cleaning Devices
6) Pumps
7) Electric Radiant Panels
8) Sound Attenuators
9) Supply, Return and Exhaust Air Diffusers and Registers
10) Unit Heaters
11) Vibration Isolators
12) Other Schedules as Required

B. Equipment performance and capacity data shall correspond to that shown in the calculations, not a particular manufacturer's catalog data, but the data shall be in the range of available manufactured products.

5.3 DUCTWORK DRAWINGS:

A. The minimum duct size shall be 200 mm x 150 mm (8"x 6") or 200 mm (8") round.

B. Provide manual air volume balancing devices in supply, return and exhaust mains, branch mains and terminal branches. Install ceiling access panels,

where required, for access to balancing devices. Show location of balancing devices on the contract drawings.

C. Use dampers on room diffusers and registers only for minor balancing requiring a maximum pressure drop of approximately 25 Pa (0.10 inch) of water gage. Do not locate registers and/or diffusers on main ducts or main branches, but on individual branch ducts with opposed blade balancing dampers to reduce room noise transmission.

D. "Round-off" air quantities on plans to the nearest increment of 0.3 m^3/min. (10 cfm).

E. Smoke detectors for air conditioning systems are specified in the Electrical Specifications, but show the locations at air handling units on the "H" drawing control diagrams and floor plans. Coordinate diffuser location and blow direction with space detector locations shown on the Electrical Drawings to avoid false smoke alarms caused by air discharge.

F. Provide fire dampers and smoke dampers in accordance with ARTICLE 3, HVAC SYSTEMS. Provide a schedule for smoke dampers showing sizes, pressure drops, and compliance with the maximum velocity limit. Show duct transitions on drawings.

5.4 CALCULATIONS:

A. For calculations, include equipment capacities; economic analysis; and sound vibration analysis. Identify, arrange and summarize calculations and analysis in proper format. Index them in a bound folder with each air handling unit as a zone and separate chapters for cooling loads, heating loads, exhaust systems, pumping/piping calculations, fan selections, etc.

B. Provide heat transfer coefficients, solar radiation, psychometrics, duct and pipe sizing, etc., and calculations and analysis in accordance with the ASHRAE Handbook and VA Design Criteria. VA Design Criteria can be found at www.cfm.va.gov/TIL

C. In addition to internal loads for people and lights, include heat gain from equipment. Examples: computer terminals, plug-in equipment, etc.

D. The use of computer programs and calculations is acceptable and desirable. Calculations should, however, be keyed to appropriate room, zone, and unit numbers for each identification.

5.5 ENGINEERING DATA: Prepare copies of the equipment selection engineering data (handwritten worksheets), by unit number, including the following:

A. Air handling unit capacity and sketch of component arrangement with physical dimensions for louvers, dampers, access provisions, filters, coils, fans, vibration isolators, etc.

B. Required performance (pressures, flow rate, horsepower, motor size, etc.) for all air handling units, fans and pumps for intended modes of operation. Include fan and pump performance curves.

C. Coil selections for heating and cooling.

D. Refrigeration equipment loading, performance and selection.

E Sound attenuation for fans and ductwork.

F. Typical catalog cuts of major equipment.

5.6 EQUIPMENT LOCATION AND INSTALLATION:

A. GENERAL: Locate equipment to be accessible for installation, operation and repair. Design the mechanical spaces to be a suitable size to permit inspection and access for maintenance, and to provide space for future equipment when required.

Consider the effect that equipment noise or vibration might have on areas adjacent to, above, and below equipment. Location of equipment remote from sound sensitive areas should be emphasized. Design to specific room sound ratings.

B. HVAC EQUIPMENT: House air handling units and similar equipment in a mechanical equipment room. Ensure close coordination with the architecture and structural disciplines for issues, such as, aesthetics, operating weight, shaft locations, etc.

C. Piping and ducts may be exposed in the following buildings and spaces, unless finished ceilings are present:

1) Storage
2) Fan rooms
3) Mechanical equipment rooms
4) Warehouse buildings or rooms
5) Vehicle Maintenance
6) Vehicle and equipment storage

Conceal piping and ducts in other spaces unless impractical.

Locate vertical runs in pipe spaces, pipe spaces, pipe chases, furred in spaces.

Do not locate pipes and ducts where they will be subject to damage or rupture.

D. COORDINATION: Coordinate and make provisions for all necessary stairs, cat walks, platforms, steps over roof mounted piping and ducts, etc., that will

be required for access, operation and maintenance. Access to roofs by portable ladder is not acceptable.

6. APPLICABLE PUBLICATIONS:

6.1 GENERAL: The HVAC Design Criteria is to be used in conjunction with referenced material listed below. The information in referenced material in not duplicated in the Design Criteria.

A. Department of Veterans Affairs Program Guides:

1) NCA Master Specifications
2) PG-18-4, National CAD Standard, VHA Application Guide & Standard Details, Division 23 HVAC and Steam Standard Details
3) Sustainable Design & Energy Reduction Manual
4) PG-18-15, Volume D, A/E Submission Instructions, provides guidelines for A/E submissions in the production of Schematics, Design Development, and Construction Documents.
5) Physical Security Design Manual for VA Facilities

B. ASHRAE Handbooks

C. National Fire Codes-NFPA

7. HVAC STANDARD DETAIL INDEX: Obtain a copy of the Division 23 HVAC and Steam Standard Details and use the applicable details for the project after doing the necessary editing work.

8. APPLICABLE HVAC MASTER SPECIFICATIONS INDEX: Use the latest edition of NCA Master Specifications.

SECTION	TITLE
	DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
23 05 11	Common Work Results for HVAC
23 05 12	General Motor Requirements for HVAC Equipment
23 05 41	Noise and Vibration Control For HVAC Piping and Equipment
23 05 93	Testing, Adjusting, And Balancing for HVAC
23 07 11	HVAC Insulation
23 09 23	Direct-Digital Control System for HVAC
23 11 23	Facility Natural-Gas Piping
23 13 23	Concrete Above Ground Fuel Storage
23 21 13	Hydronic Piping
23 22 14	Ground Loop Heat Pump Piping
23 21 23	Hydronic Pumps
23 23 00	Refrigerant Piping
23 25 00	HVAC Water Treatment
23 31 00	HVAC Ducts
23 34 00	HVAC Fans

23 36 00	Air Terminal Units
23 37 00	Air Outlets and Inlets
23 40 00	HVAC Air Cleaning Devices
23 55 23	Gas Fired Radiant Heaters
23 55 33	Fuel-Fired Unit Heaters
23 64 00	Packaged Water Chillers
23 81 00	Decentralized Unitary HVAC Equipment
23 81 43	Air-Source Unitary Heat Pumps
23 81 46	Water-Source Unitary Heat Pumps
23 82 16	Air Coils
23 83 23	Radiant-Heating Electric Panels

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5.7 PLUMBING DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

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5.7 PLUMBING DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. CRITERIA UNIQUE TO VA:

1.1 Refer to SECTION 5.11 GRAPHIC STANDARDS for general requirements and classification of drawings ("P-Series").

1.2 Refer to VA Standard Details in the Technical Information Library, PG-18-4 for use of plumbing legend and symbols.

1.3 Show piping on the same plan as the fixtures being served.

1.4 Indicate pipe size on both floor plan and riser diagram.

1.5 Indicate the following on the plumbing drawings:

A. Drainage area in square meters (square footage) and totals for building at outside building wall.

B. Fixture unit count for each sanitary sewer at outside building wall.

C. Invert elevations for all sewers at outside building wall.

D. Centerline elevation for all pressure systems at outside building wall.

E. Floor elevation at each level.

1.6 Install floor drains in all public toilets and the Maintenance Building Toilet/Locker Room. Floor drains are not necessary in staff toilets.

1.7 Indicate sub-soil drainage on architectural drawings since it is not a plumbing item.

1.8 Investigate if credit can be obtained from the public utility company for water consumed, but not discharged into the sanitary sewerage system. If so provide meters for these users. An example of a user is the irrigation system.

1.9 Consolidate notes as much as possible and place them on the right-hand side of the sheet.

1.10 Show scale, compass point, orientation, key plan, title, column grids and numbers, room numbers and titles corresponding to the architectural drawings.

1.11 Show room titles and numbers on each plan. If this information is not shown it could result in rejection of the submission.

1.12 Provide drawings generated in AutoCAD©.

1.13 Reduced flow plumbing fixtures shall be utilized for water reductions greater than 30%.

1.14 Refer to Construction and Facilities management's (CFM's) Technical Information Library (TIL) for details of VA's Sustainable Design Program which includes VA Policies, Handbooks and Design Guidance. Sustainability Goals shall be established by the Integrated Design Team (VA and A/E). Overarching goals may be directed solely by the VA.

2. GENERAL:

2.1 In the design of the plumbing systems, follow this criterion and the current edition of NCA Master Specifications. Also follow the provisions of the current edition at time of design of the International Plumbing Code as published by the International Code Council, and the National Fire Codes as published by the National Fire Protection Association (NFPA), unless VA criteria indicates otherwise. If state or local codes are more stringent than above requirements, discuss with VA Contracting Officer.

2.2 Investigate and if feasible, connect new services to existing; otherwise provide new services.

2.3 Place all equipment on housekeeping pads.

2.4 Due to the space requirements of plumbing systems and ductwork, closely coordinate the layout of these systems. Where areas of interference are apparent, prepare cross section of building showing method of installation.

2.5 Piping over electrical rooms containing main distribution panels or motor control centers shall be avoided. When piping is necessary in these areas, indicate leakage protection on drawings or in specifications.

3. EQUIPMENT SCHEDULES: Schedules including capacity, control settings, services and sizes, for all plumbing equipment and other equipment requiring plumbing services are required but not limited to the following:

Plumbing Fixtures	Air Compressors
Water Heaters	Pumps

4. PLUMBING FIXTURES:

4.1 Plumbing fixture numbers, description, fixture units and minimum branch sizes are indicated in Article, PLUMBING FIXTURE SCHEDULES.

4.2 Locate plumbing fixtures where indicated by VA. In addition to the locations indicated, provide emergency showers and eye/face wash fixtures in hazardous areas such as pesticide storage, mixing areas, and flammable storage.

4.3 A. Wall mounted water closets Type P-103 and P-104 are the primary style to be used in public toilets, with battery powered Type 1 flush valves.

B. Floor mounted water closets Type P-101 and P-102 are to be used only as site specific requirements drive their use. Use battery powered Type 1 flush valves.

C. Floor mounted tank type water closets Type P-105 and P-106 are for use in non-public toilets but are not preferred.

4.4 Urinals shall be ultra-high efficient, 0.5 L (1/8 gallon) per flush, with battery powered Type 4 flush valves.

4.5 Electric water coolers shall be bi-level, Type P-501 with self-contained refrigeration system, or Type P-503 with in wall refrigeration system. Use bi-level freeze proof Type P-502 drinking fountains in exterior locations.

4.6 A. Toilet and urinal stall partitions and room entrance screens shall be stainless steel and ceiling hung. Room entrance screens that double as part of a toilet enclosure shall extend to the floor to provide full screening and shall be full height in typical stud construction with ceramic tile finish.

B. Urinal screen partitions shall be stainless steel.

C. Where wheelchair toilets, staff and visitors, are specified in PG 18-9, “OGC, VBA, NCA Space Planning Criteria”, use ABAAG.

D. Shower enclosures and partitions of contiguous areas shall be ceramic tile applied with thin-set Portland cement to concrete reinforced backer board.

E. Finished floors of showers and contiguous spaces shall be nonslip.

5. WATER DISTRIBUTION SYSTEMS:

5.1 See Article, PLUMBING FIXTURE SCHEDULES, for fixture units and minimum fixture branch sizes.

5.2 Size the piping for the hot and cold water systems not to exceed the maximum velocity allowed by the ICC International Plumbing Code. Provide water hammer arrestors on all piping systems having quick closing valves and as indicated by The Plumbing and Drainage Institute standard PDI-WH 201.

5.3 Provide wall hydrants a maximum of 60 m (200 feet) apart, at loading docks and at building entrances, with minimum of one wall hydrant on every other exterior wall. All exterior wall hydrants shall be freeze proof.

5.4 Provide one hydrant, either wall or yard, on the exterior of each of the Committal Service Shelters, the Assembly Area and Columbaria.

5.5 Maintain minimum 240 kPa (35 psig) at all plumbing fixtures.

5.6 Piping may be exposed in the following buildings and spaces:

A Mechanical equipment rooms

B Service rooms

C. Shop Buildings

D. Storage Buildings

5.7 In other spaces, conceal piping unless impracticable.

5.8 Do not locate piping where it will be subject to damage or rupture.

6. DOMESTIC HOT WATER SYSTEMS:

6.1 Provide simplex, storage or tankless electrical or gas central domestic water heating equipment generating storage and/or flow demand temperatures of 60°C (140°F).

6.2 Solar water heating can be utilized to comply with mandatory EPACT 2005 requirements and sustainable design principles. The EPACT 2005 mandates that all new federal facilities shall reduce the energy cost budget by 30 percent compared to the baseline building performance rating per the latest version of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010, Energy Standard for Buildings except Low-rise Residential Buildings or International Energy Conservation Code (IECC), and employ sustainable design principles. ALL NEW FEDERAL BUILDINGS WILL BE DESIGNED TO ACHIEVE ENERGY CONSUMPTION LEVELS THIRTY PERCENT BELOW THOSE OF THE CURRENT VERSION OF THE APPLICABLE ASHRAE STANDARD OR THE IECC.

6.3 When solar water heaters are used they shall be the primary source for 30% of domestic hot water demand. The secondary source shall be the central electric or gas water heater for 70% of the domestic hot water demand. The secondary source shall be sized at 100% of the domestic hot water demand to serve as a back-up when the solar water heater is down or not providing adequate hot water due to weather conditions.

6.4 Size tankless water heaters using the water supply fixture unit (WSFU) method contained in the ASHRAE Handbook, Applications, Service Water Heating. Plumbing fixture unit counts (WSFU) are indicated in Article 13.1, Plumbing Fixture Schedules. A bathroom group consists of a toilet, lavatory, and shower or bathtub. See IPC for details.

- Size storage tank type heaters using the gallon per hour method for fixtures contained in the ASHRAE Handbook, Applications, Service Water Heating. The ASHRAE Handbook includes fixture rates for a number of end uses and demand factors for several building types including office buildings. For fixtures and building types not listed, designers shall determine the demand based on experience and standard practice.

- The supply of water from the utility provider varies in temperature by season and location. Designers shall obtain the seasonal cold water service temperature from the water provider for the past three years (minimum). The lowest seasonal temperature recorded shall be used to calculate the water heating energy requirements.

6.5 Provide NSF 372 “Lead-Free”, ASSE 1070 Tempering Valves per the IPC for all public and employee lavatories to prevent scald injury. The tempering valves may serve individual or multiple fixtures when properly sized.

6.6 Provide an ASSE 1017 Master Thermostatic Water Mixing Valve to temper water distribution from the hot water source.

6.7 Provide a hot water circulating system when required by the International Plumbing Code. The system shall be designed with a maximum heat loss of -15°C (5°F). An aquatstat controller shall be provided to control circulating pump cycling. Provide a time clock as an option to shut the pump off during non-business hours.

- Hot water supply and recirculation piping shall be in accordance with IPC. Hot-water recirculation systems shall be designed to meet the following requirements:

    - Shall be located as close to the end-use fixture as practical. Domestic hot water must be available at each hot water outlet within 15 seconds of the time of operation. Design hot water not to exceed a velocity of 122-152 cm/sec. [4 - 5 feet per second (fps)].

    - Size the hot water return lines by the heat loss method as outlined in the ASHRAE Applications Handbook, Service Water Heating; or ASPE Data Book Volume 2, Plumbing Systems, Domestic Water Heating Systems.

    - Insulation thickness shall be governed by ASHRAE 90.1-2010.

    - Include provisions for isolating and balancing the system. See article 6.6.2 for more direction on system balancing.

- The use of heat tracing shall not be used in lieu of hot water recirculation systems.

- Provide separate check, isolation and balancing valves in the hot water return circulating lines at the point of connections of the domestic hot water supply line with the hot water recirculation loop. Provide notes in the contract documents for the balance agency to set flow rate to the gpm as calculated by the system designer. The Designer shall use the circulation rates for all parts of the circulating piping and the total circulation rate required. Circulation rates are based on the heat loses in the piping system based on an allowable temperature drop of -15 °C (5 °F). See ASHRAE Handbook, Applications, Service Water Heating, for details on hot-water

recirculation loops and return piping. Velocities in hot water return piping shall be checked to ensure a maximum of 1.5 m/s (5 fps).

6.8 Provide “piped” and insulated heat traps loops on the cold water inlet and hot water outlet piping of storage water heaters as required by the International Energy Conservation Code. Loops should be a minimum of 46 cm (18 in.).

6.9 Provide a thermal tank in the cold water supply line to the water heater downstream of check valves or any other backflow prevention device to prevent damage to the system due to thermal expansion.

6.10 Provide a vacuum relief valve in the cold water supply line to bottom fed water heaters. The valve shall be located above the top of the water heater.

7. DRINKING WATER EQUIPMENT: Interior equipment shall be wall hung, electric, self-contained, wheelchair accessible, and water coolers. Exterior units, when used, shall be dual height, freeze resistant drinking fountains.

8. SANITARY AND STORM DRAINAGE SYSTEMS:

8.1 See Article, PLUMBING FIXTURE SCHEDULES, for waste/vent fixture units and minimum fixture branch sizes.

8.2 The plumbing designer shall coordinate with the civil designer and contact the local authorities having jurisdiction (AHJ) to determine what building effluent is permitted to discharge into the local requirements for storm water drainage. The storm drainage system shall collect clear water from roof drains. Clear water from air conditioning units’ condensate shall be collected by the storm water drainage system unless prohibited by local AHJ.

8.3 The plumbing designer shall submit sizing calculations for area/roof drain systems. Pipe sizing shall be based upon the local rates of rainfall as indicated in the IPC or in accordance with the requirements of the local AHJ, whichever is more conservative

8.4 Do not drain sub-soil or foundation drainage systems to an interior sump pump. If a pump is required, locate it outside of the building. Pumps shall be provided in a redundant configuration and be connected to an emergency power source.

8.5 Provide interior roof drainpipes for all buildings having flat roofs except exterior gutters and downspouts may be used as follows:

A. Buildings up to three stories where lowest outside temperature is 0°C (32°F) or above.

B. Utility and warehouse buildings.

C. Isolated buildings remotely located from storm sewerage system.

D. Buildings with pitched roofs.

E. Where additions or alterations are made to buildings having exterior gutters and downspouts.

F. Unheated buildings.

G. Snow guards shall be provided on pitched roofs of heated buildings above entrances and foundation plantings in geographical areas subject to heavy rainfall.

8.6 Provide primary and secondary (emergency) roof drain systems for buildings with flat roofs as required by the International Plumbing Code.

8.7 Provide downspout nozzles for piped secondary storm drain systems terminating above grade, in a location that would normally be observed by the building occupants or maintenance personnel.

8.8 Provide splash blocks for all exterior downspouts.

8.9 Provide cast iron leader boots for all exterior downspouts connecting to a site storm drain system.

8.10 Provide insulation for all interior, above floor, horizontal storm drain piping including roof drain bowls and vertical branch from the roof drain.

8.11 In locations where the ASHRAE winter 1% dry bulb temperature is below 0 °C (32 °F), insulate and heat trace the roof drain basins, roof drain leaders and overflows above lay-in or hard ceilings.

8.12 Provide backwater valves where backflow of storm water into the building is anticipated.

9. SHOP COMPRESSED AIR SYSTEM: Provide simplex air compressor to serve maintenance equipment, minimum of one outlet on each interior wall of maintenance bay and workshop, and minimum of one exterior outlet on overhead door wall. Interior outlets shall be no farther apart than 7.6 m (25 feet).

10. RISER DIAGRAMS:

10.1 Riser diagrams are required for the following systems installed within the buildings: Soil, waste and vent; cold water; hot water; and fuel gas.

10.2 Riser diagrams may be shown flat or in isometric projection. Diagrams include story heights, size of all horizontal and vertical piping, fixture numbers being served, and means of connection between fixtures and the stacks and mains. Each system shall be complete and continuous.

11. WATER SOFTENING SYSTEM:

11.1 Softeners: Design simplex vertical, pressure type, sodium cycle water softeners to comply with the following and NCA Master Specifications 22 31 11, WATER SOFTENERS. Regeneration shall occur no more than once per day. Provide hardwater bypass.

11.2 Provide softening equipment when total hardness exceeds 170 mg/L [parts per million (ppm)] as CaCO3. Blend equipment effluent to a hardness of approximately 50 mg/L (ppm). Do not treat irrigation water.

11.3 Designate interior floor space for 180 kg (400 pounds) of salt near softener.

12. CALCULATIONS AND ANALYSIS:

12.1 Calculations are required for the following systems and equipment:

Soil, Waste and Vent	Hot Water Generation	Air Compressors
Storm Drainage	Domestic Water	Water Softening
Pumps	Fuel Gas	

12.2 Determine if it is necessary to install insulation on the domestic water and horizontal storm drainage piping for the prevention of condensation.

12.3 Develop a water analysis, including pH, total hardness as CaCO3, total dissolved solids, and alkalinity.

13. PLUMBING FIXTURE SCHEDULES: Use the following data for design of water and drainage systems, in conjunction with and superseding data found in the reference plumbing code. Fixtures are described in Master Specification 22 40 00, Plumbing Fixtures

13.1 FIXTURE UNITS:

P-No.	DESCRIPTION	DRAIN	SUPPLY		
			CW	HW	TOTAL
101, 102 103, 104	Water Closet, Floor Mounted Water Closet, Wall Hung	4	10	-	10
105, 1	Water Closet, Tank type, Floor Mounted	4	5		5
201, 202,	Urinal, Wall Hung Urinal, Wall Hung, Handicapped	2	5	-	5
301, 302, 303, 304, 305, 403	Lavatory	1	1.5	1.5	2
404, 405	Service Sink	2	2.25	2.25	3

P-No.	DESCRIPTION	DRAIN	SUPPLY		
			CW	HW	TOTAL
401, 402	Sink, CRS	2	1	1	1.4
501, 502	Two Station Electric Water Cooler, and Drinking Fountain	1	0.5	-	0.5
503	Drinking Fountain	0.5	0.25	-	0.25
601	Shower	2	3.0	3.0	4.0
801	Wall Hydrant	-	-	-	-
802	Hose Bibb	-	-	-	-
803	Lawn Faucet	-	-	-	-
804	Flower Watering Station Spigot				

13.2 MINIMUM FIXTURE BRANCH SIZES (mm):

	DESCRIPTION			SUPPLY	
		WP	VP	CW	HW
101, 102 103, 104	Water Closet, Flush Valve, Floor Mounted Water Closet, Flush Valve, Wall Mounted	100	50	25	-
105, 106	Water Closet, Tank Type	100	50	15	-
201, 202	Urinal (Regular) Urinal (Handicapped)	50	50	20	-
301, 302, 303, 304, 305, 403	Lavatory	50	40	15	15
404, 405	Service Sink	80	50	20	20
401, 402	Sink, CRS	50	40	15	15
501, 502, 503	Electric Water Cooler, Drinking Fountain	40	40	15	-
601	Shower	50	40	15	15
801	Wall Hydrant	-	-	20	-
802	Hose Bibb	-	-	20	-
803	Lawn Faucet	-	-	25	-
804	Flower Watering Station Spigot			20	

SI Conversions: 15 mm = 1/2", 20 mm = 3/4", 25 mm = 1",
40 mm = 1 1/2", 50 mm = 2", 80 mm = 3", and 100 mm = 4"

14. SCHEDULE OF FLOOR DRAINS: Indicate size and type of all floor drains on the plans and diagrams. See NCA Master Specifications 22 13 00, FACILITY SANITARY AND VENT PIPING, for floor drain descriptions.

Location	Type	(mm) Size	Sewer	Remarks
Areaway	B	80 (3”)	ST	
Mechanical Room	E	100 (4”)	S	1/2 grate when adjacent to equip.
Vehicle Wash Area	C	100 (4”)	S	
Maintenance Bay	A	100 (4”)	S	
Boot Wash (interior)	A	80 (3”)	S	
Public Toilets	B	50 (2”)	S	
Locker Room/Toilet Room	B	50 (2”)	S	

Legend:
S = Sanitary Sewer
ST = Storm Sewer

Types:
A and B-CI W/NB Grate
C-CI W/NB Grate and Sediment Bucket
E- Heavy cast iron body with non-tilting nickel bronze or ductile iron grate, removable sediment bucket, min. 300 mm (12 in.) square. Extra heavy duty grate for traffic use.

NOTES:

1. All floor drains shall comply with ANSI A112.6.3
2. Floor drains for general floor drainage are located by architect. Use Type "B" in finished areas.
3. The Vehicle Wash Area floor drain will connect to the recycling equipment.
4. All floor drains shall have cast iron (CI) bodies unless stated otherwise.
5. Provide trap primer for all drains not receiving a direct discharge. Waterless trap seal devices may be used when approved by the NCA.

15. PLUMBING STANDARD DETAILS INDEX: Obtain a copy of the Standard Details, PG-18-4 and use the applicable details for the project after doing the necessary editing work.

TITLE	NUMBER
PIPE PENETRATION THROUGH WALLS BELOW GRADE	SD220511-01
PLUMBING ABBREVIATIONS	SD220511-02
PLUMBING ABBREVIATIONS	SD220511-03
PLUMBING ABBREVIATIONS	SD220511-04
DRAWING SYMBOLS	SD220511-05
PLUMBING PIPING SYMBOLS	SD220511-06
GENERAL PLUMBING SYMBOLS	SD220511-07

PLUMBING VALVE SYMBOLS	SD220511-08
BACKFLOW PREVENTER PIPING DETAIL	SD221100-01
HUB DRAIN STANDPIPE	SD221300-02
WHEELCHAIR LAVATORY DETAIL	SD224000-08
INSTALLATION OF HANGER SUPPORT FOOT	SD224000-20
INSTALLATION OF HANGER ROD SUPPORT FOOT	SD224000-21
LAVATORY MOUNTING DETAIL	SD224000-22

16. APPLICABLE PLUMBING MASTER SPECIFICATION INDEX: Use the latest edition of NCA Master Specifications designated for use on only NCA Projects.

SECTION	TITLE
	DIVISION 22-PLUMBING
22 05 11	Common Work Results for Plumbing
22 05 12	General Motor Requirements for Plumbing Equipment
22 05 19	Meters and Gages for Plumbing Piping
22 05 23	General Duty Valves for Plumbing Piping
22 05 33	Heat Tracing for Plumbing Piping
22 11 00	Facility Water Distribution
22 11 23	Domestic Water Pumps
22 13 00	Facility Sanitary Sewerage
22 13 23	Sanitary Waste Interceptors
22 13 29	Sanitary Sewerage Pumps
22 13 33	Packaged, Submersible Sewerage Pump Units
22 13 36	Packaged, Wastewater Pump Units
22 14 00	Facility Storm Drainage
22 14 29	Sump Pumps
22 14 33	Packaged, Pedestal Drainage Pump Units
22 14 36	Packaged, Submersible, Drainage Pump Units
22 15 00	General Service Compressed-Air Systems
22 31 11	Water Softeners
22 33 00	Electric Domestic Water Heaters
22 34 00	Fuel-Fired Domestic Water Heaters
22 40 00	Plumbing Fixtures

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5.8 ELECTRICAL DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

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5.8 ELECTRICAL DESIGN CRITERIA FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. CRITERIA UNIQUE TO VA:

1.1 Refer to SECTION 5.11 GRAPHIC STANDARDS for general requirements and classification of drawings ("E-Series"):

A. Consolidate notes as much as possible and place them on the right-hand side of the sheet.

B. Show scale, compass point, orientation, key plan, title, column grids and numbers, room numbers and titles corresponding to the architectural drawings.

C. Show room titles and numbers on each plan. If this information is not shown it could result in rejection of the submission.

D. Provide drawings generated in AutoCAD©.

E. For areas such as electrical rooms/closets and mechanical equipment rooms, use larger scale part plans for improved clarity.

F. Show the number of wires in each branch circuit conduit on the plans. Include the number of wires in all interconnecting conduits for all wiring devices, fixtures and equipment. Use tick marks as per the electrical symbols shown in Standard Details.

G. Sequence of Electrical Drawings:

1) Symbols and abbreviations.
2) Electrical site plan/s.
3) Lighting drawings.
4) Power drawings.
5) Signal or other drawings (if applicable).
6) One-line diagrams and risers.
7) Details.
8) Schedules.

H. Provide separate floor plans for lighting, power, and signal systems. The systems may be combined on projects with a minimum number of devices.

I. Show room titles and numbers on each plan. If this information is not shown it could result in rejection of the submission.

1.2 Proprietary Indication: Do not use trade names or other indications tending to identify a product of an individual manufacturer on any project, unless specifically approved, and except as follows:

A. Where necessary to identify existing equipment.

B. Where an existing system is to be extended and competitive manufacturers cannot meet performance or dimensional requirements.

C. Where required by a public utility or municipal system as a condition of its services. Specifications should state this condition.

2. GENERAL:

2.1 This Criteria is presented as general guidance. It is for the guidance of electrical engineers and others in the design and renovation of NCA facilities for the Department of Veterans Affairs (VA). In order to provide the latitude needed for design, new concepts, etc., deviations may be made from the technical requirements provided professional judgment is made that a safe, adequate, quality design will result, and approval is obtained from VA. Deviations from those requirements included in Public laws, Federal Regulations, Executive Orders, and similar regulations are not permitted.

2.2 Responsibility: The designer is responsible for the project design in accordance with his contract, guidance and criteria provided by VA, and good engineering practices. The designer shall provide all professional services for planning and designing the electrical work necessary for the project including interface with the utility company and preparation of the necessary bidding documents.

2.3 Coordination: Coordinate the electrical design work with the architectural, structural, site, and mechanical design.

2.4 Design the electrical systems following this criteria, and the current edition of VA Construction Standards, VA Handbooks and Program Guides, and NCA Master Specifications. Design shall also meet the provisions of the current editions of the National Fire Codes as published by the National Fire Protection Association (NFPA), unless VA criteria indicates otherwise.

2.5 Applicable VA criteria affecting electrical design and construction are as follows:

* Consultants Notice: Many of the documents are large and contain interdisciplinary information and might be retained by the lead Architect. Contact your Architect for copies of the electrical portions.

A. Program Guide PG-18-1, NCA Master Specifications, Electrical Specifications (26 00 00 series) are mandatory for use on all electrical projects. See Article 15.

B. Program Guide PG-18-4, Standard Details are for reference purposes only. Volume 4 contains these electrical details, schedules and symbols. See Article 14.

C. Program Guide 7610, Equipment Guide List provides equipment required on a room by room basis. Certain equipment is furnished or installed by the VA. References such as VV, VC, and CC, which are defined in the handbook shall be noted and appropriately followed in the design. References are also made to locations of additional information.

D. Program Guide PG-18-5, Equipment Guide List provides detail description of equipment using standard VA equipment numbers. Descriptions give the voltage, amperes, power, etc.

E. Program Guide PG-18-15, Volume D, A/E Submission Instructions for National Cemetery Projects.

2.6 Applicable Codes and Standards:

A. Unless otherwise indicated by VA criteria for NCA projects, use the latest edition of all codes, regulations and standards, including amendments, of the following organizations:

1) National Fire Protection Association (NFPA). Particular attention to NFPA 20, 70, 72, 78, 101 and 110.
2) Underwriters' Laboratories, Inc. (UL).
3) Institute of Electrical and Electronic Engineers (IEEE).
4) National Electrical Manufacturers Association (NEMA).
5) American National Standards Institute (ANSI).
6) American Society for Testing Materials (ASTM).
7) Illuminating Engineering Society of North America (IES).
8) National Fire Codes
9) Uniform Building Code
10) OSHA Standards

B. Bring provisions of local building codes which are significantly different from the codes and standards listed in 'A' above to the attention of the Project Manager. Provide specific recommendations concerning these local codes.

C. Follow the rules and regulations of the local electric company, where applicable. Investigate potential rebates, etc., offered by the local electric company for the use of energy saving devices. (See "Instruction to Architect-Engineer Concerning Development of Utilities and other Site Facility Resources....." in the A/E package).

2.7 Provide all the necessary electrical facilities for the project. The work will include, but is not limited to, new power source connections, primary or secondary power distribution, emergency electrical systems, lighting systems, receptacles and power connections for all equipment, fire alarm, telephone and other required signal systems.

2.8 Use the Equipment Guide List (PG-18-5) and A/E Submission Instruction (PG-18-15, Volume D).

2.9 Visit the site to ascertain and verify all existing conditions which will affect the design. Verify the use and accuracy of "as-built" drawings at the time of the site visit.

2.10 Investigate the lightning protection system requirements for the new building. Evaluate the need for lightning protection.

A. For lightning protection, follow the Lightning Protection Code, NFPA No. 78, and the National Electric Code, NFPA No. 70, published by the National Fire Protection Association.

B. Evaluate the risk of loss due to lightning and local practices to determine the need for lightning protection.

2.11 Investigate the existing electrical distribution system and determine the adequacy of the system concerning the addition of the new loads. Inform the electric utility company of the new service requirements or additional loads being added for this project. Copies of all correspondence and minutes of all meetings with the utility company's representatives shall be forwarded to the Project Manager, VA Central Office. VA Central Office will accomplish any negotiations for new or changes to the existing utility services.

2.12 Design Requirements:

A. Provide the following for underground utility services to the Administration/Maintenance Complex and Remote Buildings:

1) Power: Minimum of 2 - 4" PVC conduits (1 active, 1 spare). If more active conduits are required, ensure that at least 1-4” empty conduit is provided as a spare.
2) Telephone: 1 - 2" PVC (Direct burial cabling should be considered).
3) Data: 1 - 2" PVC (Direct burial cabling should be considered).
4) Other: 1 - 2" PVC spare.
5) Nylon pull string in each spare.

B. Use 3 phase motors for motors 1/2 HP and above. Specify 200 volt motors for 208 volt systems, 460 volt motors for 480 volt systems.

C. Show on the plans schedules for switchboards and panelboards using VA standard formats. Indicate, on the schedules, the connected and demand loads for each circuit, with the total per phase. Also show front elevation views of switchboards.

D. Locate all equipment to facilitate removal in the event of equipment failure. This also includes large equipment such as transformers.

E. Provide an equipment grounding conductor with each circuit.

F. Show in detail, special equipment spaces, such as electrical equipment rooms/closets and mechanical rooms on 1:50 (1/4-inch) scale floor plans.

G. Show on the plans, diagrams of the following systems:

1) Primary service and system distribution (one-line diagram)
2) Secondary system distribution (riser diagram).
3) Fire Alarm System (riser diagram).
4) Telephone, MATV, computer, and other signal systems (riser diagrams).

H. Indicate the following information on the power riser diagrams or in applicable schedules:

1) Size and voltage characteristics of transformer.
2) Size of feeders (cable and raceway sizes).
3) Size of motors and other loads.
4) Interrupting rating of circuit breakers.

I. Show the architectural smoke partitions on the signal plans. Identify each fire alarm zone.

J. Design Calculations: Prepare load, demand, voltage drop, lighting, short circuit, and motor starting calculations for each project to substantiate the design.

K. Specifications:

1) NCA Master Specifications have been developed for most electrical work. Where applicable, edit and use them in preparing the project specifications.
2) Develop specifications for any system or equipment required for which a NCA Master Specifications is not available. The system or equipment specified must be available from at least three manufacturers.

3. PROTECTIVE DEVICE STUDY: Prepare and submit to VA, short circuit calculations to justify selection of equipment for the project.

4. RACEWAYS:

4.1 General: All wiring shall be contained in raceways.

4.2 Concealed and Exposed:

A. Locate electrical conduits in compliance with the National Fire Codes, Uniform Building Code, and OSHA Standards. Bring provisions of local building codes which are significantly different from the VA listed governing codes by the architect engineer.

B. Electrical conduits may be exposed in the following buildings and spaces, unless finished ceilings are present:

1) Storage Buildings
2) Mechanical equipment rooms
3) Service rooms
4) Shop buildings
5) Garages

C. Electrical conduits may be exposed in electrical rooms and wire closets (electric, telephone, and signal).

D. Electrical conduits may be placed in concrete floors and walls.

E. Locate vertical runs in pipe spaces, pipe chases, or in furred-in space, preferably adjacent to permanent structures.

F. Do not locate electrical conduits where they will be subjected to damage or rupture. Where unavoidable conditions require that they will be so located, provide suitable protection.

G. Metal clad cable (type MC) is not acceptable for use.

4.3 Underground Ducts and Conduits: Generally, encase underground ducts and conduits in concrete. Under buildings and roads, direct burial conduit may be used for feeder and branch circuits where not exposed to risks of damage or difficult replacement.

5. WIRING AND EQUIPMENT:

5.1 Cable and Wiring:

A. Power and Lighting: Use No. 12 minimum size for 600 V (volts) or less. Sizes No. 10 and 12 shall be solid conduit, sizes No. 8 and larger shall be stranded.

B. Signal: Refer to Article 10 and 11 for telephone and ADP cabling.

C. Metal clad cable (Type MC) is not acceptable for use.

5.2 Insulation: Coordinate with NCA Master Specifications.

5.3 Equipment Grounding Conductors: Coordinate with NCA Master Specifications and show on the plans.

5.4 Motor Disconnect Switches: Provide all motors with a local disconnect switch located at the motor or within sight of the motor, in accordance with the National Electrical Code. Clearly indicate this requirement on the contract drawings.

6. RECEPTACLE AND POWER REQUIREMENTS:

6.1 General: This article establishes specific requirements for the selection of electrical receptacles and power circuits by the designer on the basis of location and service. The term "receptacle" refers to power receptacles except where signal types are specifically indicated. Provide polarized receptacles which accept attachment plugs having separate grounding prongs. Provide safety receptacles, isolated ground receptacles, weatherproof receptacles, ground fault interrupter receptacles or other special purpose receptacles as required in this document. All receptacles shall be duplex (NEMA #5-20) unless otherwise noted or not commercially available in a particular size. All installations shall be in accordance with the National Electrical Code requirements.

6.2 Applications: The following provides the specific receptacle and power requirements for each area or type of service:

A. EXTERIOR ELECTRICAL RECEPTACLES: Provide exterior weatherproof GFI receptacles at appropriate locations such as follows:

1) Major entrances to buildings.
2) Courtyards and enclosed (or partially enclosed) garden areas.
3) Loading docks and maintenance yards.
4) Major mechanical equipment enclosures.
5) Major service equipment enclosures.
6) Flag/Assembly Area for portable sound equipment.

B. AC POWER IN CEMETERY - COMMITTAL SHELTERS: Provide AC power by two units each consisting of a ground fault interrupter with a heavy-duty, general use, receptacle wired to it and housed in common cast metal, weatherproof box with gasketed cover. Cover shall include permanently attached caps. Each unit shall be wired to a separate 20A, 1P circuit breaker from the nearest source. Install both units at the same centralized location in the committal shelter. Utilize 5 #12's in 19 mm (3/4 inch) coated rigid steel conduit or IMC buried a minimum of 600 mm (24 inches) in general and 750 mm (30 inches) under roads or paved areas. Identify conduit location with plastic marker tape. For distances beyond 30 m (100 feet), consider using larger conductors to keep voltage drops not to exceed values as described in the National Electrical Code, or consider a 480-volt feeder with a step-down transformer and branch circuit protection.

C. CORRIDORS: Provide receptacles for cleaning machines. The receptacles shall be no more than 23 m (75 feet) apart. These receptacles shall be on a dedicated circuit serving only corridor receptacles.

D. OFFICES AND ADMINISTRATIVE AREAS: Provide receptacles with spacing not to exceed 3000 mm (10 feet) as measured around the floor line, excluding doorways. All linear wall space 1500 mm (5 feet) and longer shall have at least one receptacle. Provide a 120-volt quadraplex receptacle for each work station. Connect 1 duplex on a dedicated circuit for computer

equipment (maximum 3 per circuit) for each workstation. Receptacles for large administrative rooms may be installed in underfloor raceways.

E. ELECTRICAL CLOSETS: Provide a receptacle with its centerline located 1000 mm (40 inches) above the finished floor adjacent to the room door.

F. TELEPHONE/SIGNAL CLOSETS: Provide 19 mm (3/4") thick fire retardant plywood on rear wall for mounting data and telephone equipment. Provide a 120 V (volt) quadraplex receptacle for data equipment and one duplex receptacle with its centerline located 450 mm (18 ") above finished floor below plywood backboard, for telephone equipment.

G. GROUND FAULT INTERRUPTER RECEPTACLES: Provide GFI receptacles (or those protected thereby) at all lavatory-mirror locations in toilets. Also provide GFI receptacles for all exterior locations.

6.3 Sound Retarding Provisions for Resisting Sound Transmission: Use sealing compound to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude in stud-framed partitions. Do not locate receptacles on opposite sides of the stud-framed partitions in the same stud-space.

7. ELECTRICAL SUB-METERING:

7.1 The Department of Energy Guidelines for Building Plans; Title 10, Code of Federal Regulations, Part 436 entitled "Federal Energy Management and Planning Programs", paragraph 436.51(a)(1), requires the metering of energy in new Federal Buildings.

7.2 Scope and Purpose: Provide individual electrical sub-metering equipment to record consumption of electrical energy in each building for economic analyses and checking energy conversion measures.

A. Install sub-metering equipment with the building's service entrance equipment.

B. Provide indicating type kilowatt-hour meter at the low voltage switchboard to measure electrical energy consumption.

8. LIGHTING:

8.1 Intent: This article covers the lighting requirements for VA cemetery facilities. Where lighting situations are encountered which are not covered by this article, exercise good engineering judgment.

8.2 Standards:

A. IES Lighting Handbook

B. NFPA 101, Life Safety Code

C. NFPA 70, National Electrical Code

8.3 Lighting Calculations:

A. Perform all lighting calculations based on the IES applications. (See IES Lighting Handbook). All calculations shall use one or more of the techniques described.

B. Include the following information in all submitted calculations:

1) Room Name
2) Room Number
3) Fixture type chosen for the room
4) Number and type of lamps to be used in the room
5) Required illumination level (VA or IES)
6). Calculated illumination level

8.4 Details and Specifications:

A. Provide a schedule for all lighting fixtures. As a minimum the schedule shall include the following: Fixture type, description, voltage, mounting, number, and size of lamps and notes. Other information for the lighting fixtures (such as metal thickness, construction, finishes, etc.) shall be included in the specifications. As an option, lighting fixture details may be included on the drawings. All fixture details are subject to the approval of the NCA team reviewers.

B. Use NCA Master Specifications. Edit each section for the particular application. Do not use manufacturer's names or model numbers in any specification.

1) Section 26 51 00, Interior Lighting.
2) Section 26 56 00, Exterior Lighting.

8.5 Design Approach:

A. The designer is expected to be knowledgeable of all current lighting design requirements included in the IES, NFPA and the NEC. Note any requirements which deviate from VA's standards for NCA projects and/or design guides and bring them to VA's attention. When such deviations occur, provide recommendations which are applicable to that specific project.

B. The designer is encouraged to inform VA and request approval for the implementation of any different, new or improved lighting products and/or systems which may be beneficial to VA in providing more suitable lighting, more energy efficient lighting or other cost savings.

C. The designer shall provide an analysis and a recommendation concerning the possible use of Specular Reflector Light Fixtures (SRLF) at the S2 (schematic) submission.

1) The analysis shall compare the installation of standard fluorescent fixtures (without specular reflectors) with those which include specular reflectors. Determine the cost effectiveness of the specular reflector light fixtures by initial cost and energy consumption comparisons and any other applicable method(s).
2) The fixture and reflector must be a standard product with published photometric characteristics from at least three manufacturers.
3) The areas of consideration shall be corridors, offices and any other areas where non-uniform lighting would be acceptable. Provide typical calculations if adequate to make the comparisons.

8.6 Light Sources:

A. Avoid the use of incandescent light sources for general illumination except in pipe basements, small closets, lobbies, and special requirement areas. Compact fluorescent lamps may be used in lieu of incandescent where appropriate.

B. Use fluorescent lamps as the principal interior lighting source.

C. Utilize high intensity discharge (HID) sources for large interior utility spaces having relatively high ceilings or where maintenance is difficult (i.e. mechanical equipment rooms.) Metal Halide is preferable.

D. Utilize F32T8 (32 watts only) rapid start, fluorescent lamps with a color temperature of 3500 degrees K, a color rendering index (CIE) not less than 69 and an initial lumen output of 3050 minimum.

8.7 Ballasts:

A. Specify electronic high-frequency type ballasts for all fluorescent lighting that utilizes type F32T8 lamps.

8.8 Fixtures:

A. Specify fixtures having high efficiency (output/bare lamp lumens) where practicable within the visual constraints dictated by the application.

B. Specify fixture types which utilize controlling elements (lenses, louvers, reflectors, etc.) designed to provide the best utilization of emitted light at the task location. Use parabolic louver equipped fixtures in office areas, and similar spaces where CRT equipment is generally used.

C. In addition to two-lamp and four-lamp fluorescent fixtures, utilize three-lamp fixtures as required to tailor the lighting design closer to the required illumination levels.

D. Exit Fixtures:

1) Provide exit light fixtures in accordance with NFPA 101, Life Safety Code, and the following:
   a. Fixture types will consist of top-mounted, end-mounted, surface-mounted, or recessed as applicable for the project.
   b. Fixtures shall be illuminated by the use of fluorescent lamps or LEDs.
2) Indicate double faced fixtures and/or directional arrows on the drawings where required.

8.9 Lighting Layouts:

A. Use VA lighting level requirements as design values and not as minimums. The designer should attempt to select the number of lamps and the fixture type given the specific finishes being specified in each area to ensure lighting designs will produce the intended lighting levels.

B. The following rule applies to offices and similar spaces with non-fixed task locations where a 64.584 LX (60 foot-candle) or greater lighting level is required. Position ends of fluorescent fixtures (or rows) within 750 mm (2-1/2 feet) of abutting walls, selecting fixture and lamp quantities to provide the required lighting level.

C. Omit lighting fixtures from established general lighting layouts which are non-task areas and which contribute little to the illumination of task areas. This may include aisle space or other traffic locations such as in front of doorways. Generally, for rooms over 9.2 m^2 (100 square feet) in area, if a door swing arc intercepts a lighting fixture on the floor plans, the fixture should be omitted.

D. In shops and similar areas having work tables and benches, run continuous rows of three-lamp fluorescent fixtures centered over the front edge of wall-mounted benches and crosswise to double-sided benches. This procedure should take precedence over the ceiling system orientation. Omit or reduce the quantity of fixtures over open floor areas.

E. Provide recessed fluorescent fixtures at wall along mirror in all toilets. A version using two 30 watt or two 32 watt lamps is appropriate. The fixture length need not be confined to the width of the mirror and should be sized to double as general illumination in the case of small toilets. If a shower is included, a ceiling light should be installed also.

F. In storage, shelf, or bin areas, mount fixtures in rows lengthwise over aisles between rows of shelves to make the most efficient use of the lighting. In areas over 37 m^2 (400 sq. ft.) where stack or shelving row locations are not known or reasonably permanent, consider running continuous fixture rows at

45 degrees to the general room dimensions coordinating the layout with the ceiling system design.

G. Special lighting treatment of decorative areas such as lobbies, waiting rooms, patios, etc., for architectural purposes shall be conservative and limited to efficiently controlled light sources which are intended for use only on special occasions or to double as general illumination. Decorative lighting of exterior areas is not permitted except where it is incidental to a functional lighting system. The use of compact fluorescent or HID lamps should be considered.

H. Corridor lighting energy levels generally shall not exceed one (1) watt per square foot. This would allow consideration for special areas such as public corridors, lobbies or entrances to the building.

I. Lighting for main gates, flagpoles, and committal shelters shall meet the needs of the specific project.

8.10 Control:

A. Where fixtures are used which have three, four, or more lamps, switch the fixture lamps symmetrically for two (or three) lighting levels.

B. If large window areas are present, switch fixture (or fixture rows) nearest to the window separately.

C. Provide three or four-way switching of all room lights where two or three-room entrances are not immediately adjacent to each other.

D. Provide occupant sensor (ultrasonic/infrared) controls for room lights in public toilets and similar spaces. Include a conventional wall switch at doors to provide override "OFF" and active "OFF-ON" functioning.

E. Control exterior lighting by photoelectric controls and overriding astronomical time switches. Some security lighting must be retained.

F. In relatively large, infrequently used rooms or areas such as crawl spaces, attics, etc., where lights can be left on unnoticed, provide a pilot light outside the area which indicates when the lights are on.

8.11 Wet and Damp Locations: Provide "Enclosed and Gasketed" lighting fixtures in showers and similar areas of high humidity to ensure proper fixture operation and longevity.

8.12 Exterior Light Sources:

A. Utilize metal halide light sources for exterior lighting.

B. Where a specific detail is to be highlighted (i.e. a Flag), use a halogen source.

8.13 Exterior Fixtures:

A. Where there are existing exterior fixtures, match them if possible.

B. On new work where there are no existing fixtures, provide a schedule for all lighting fixtures used for the project.

8.14 Exterior Fixture Control:

A. Use photoelectric sensors and/or astronomical time clocks as appropriate for each application.

9. FIRE ALARM SYSTEMS:

9.1 General Requirements:

A. Investigate and provide a fire alarm system to meet the requirements of NFPA.

B. Fire alarm system may be a manual non-coded, audible/visual type system with a tie-in to the local municipal fire alarm system.

10. TELEPHONE SYSTEMS:

10.1 Requirements:

A. Investigate and provide facilities (underground conduits) as required for the installation of the telephone service. See Article 2.

B. Provide a minimum 19 mm (3/4") conduit and outlet box with a triple phone jack (one RJ 11 and two RJ 45) at each workstation in each building where required. Install junction box above ceiling for drops to printers. Provide conduit and outlet box with one phone jack (RJ 11) in the main telephone closet.

C. Provide incoming telephone cabling as required to accommodate one line per workstation, fax lines, and spares from local telephone company point of connection to the main telephone closet of the Administration/Maintenance Complex. Refer to Article 2.12 for incoming conduit requirements.

1) Provide one Category 6 telephone cable - 19 gauge/standard color code cable between the Administration/Maintenance Complex (main telephone closet) and Remote Buildings to accommodate one line per workstation plus spares.
2) Provide one Category 6 telephone cable - 19 gauge/standard color code/ 2 pair, labeled "T" between telephone closet and each workstation.

11. AUTOMATIC DATA PROCESSING (ADP) SYSTEMS:

11.1 Requirements:

A. Investigate and provide facilities (underground conduits as required for the installation of the ADP service. See Article 2.

B. Install data service cabling in the same conduit with telephone wiring to each workstation within the building. The incoming data lines and lines between buildings shall be installed in separate conduits.

C. Provide incoming data cabling as required to accommodate two lines per workstation (one High Speed digital circuit) from the local company point of connection to the main telephone closet of the Administration/ Maintenance Complex. Refer to Article 2.12 for incoming conduit requirements.

1) Provide the following cables between the Administration Building (main telephone closet) and the Maintenance Building (two lines per workstation):
   a. Distances less than 100 m (300 linear feet): 10 Baset, UTP level 5, 24 AWG plenum 4 pair cable.
   b. Distances less than 2 km (1.24 miles) multimode fiber cable, 2 strand, 62.5 x 1.25 microns.
2) Provide one Category 65 cable - 100 Baset, UTP Level 5, 24 AWG plenum 4 pair cable, labeled "P1, P2, P3..." between computer printer and each workstation (maximum 7 workstation connections to a printer). Provide 19 mm (3/4") conduit, with outlet box as appropriate for the number of workstations connected to each printer, between each workstation and printer.

12. SECURITY SYSTEMS:

12.1 Requirements;

A. Provide a motion detection system for the following:

1) Entrances to all buildings
2) Information Center Lobby (If separate from Administration Building)
3) Maintenance Yard(s) (Personnel entrances)
4) Administrative Offices

B. Provide a single control panel with annunciator from each motion detector.

C. Install all wiring in conduits (minimum 19 mm (3/4")). Provide conduit and wiring from control panel to the main telephone closet and make provisions for tie-in to a local alarm monitoring company.

13. ALTERATIONS TO EXISTING BUILDINGS:

13.1 Application:

A. This article applies to the design of projects involving the construction of alterations to existing buildings, and secondary distribution upgrading.

13.2 Calculations:

A. Submit calculations indicating complete load analysis of the areas involved in the alterations and the pertinent impact on existing building transformer and feeders.

B. Calculations shall indicate a breakdown of lighting and power, connected loads, demands and other factors used by the designer to determine equipment ratings.

13.3 Drawings: For alteration projects, separate demolition drawings might be helpful for areas involved. Specific detailing of interfaces between alterations and existing to remain shall be clearly indicated on the drawings.

13.4 Modification verses Replacement:

A. Where equipment must be modified in order to be physically utilized in a project, evaluate the following questions:

1) Can the Government look to one manufacturer for final responsibility of the modified equipment?
2) Is there a legitimate cost savings by modifying the existing equipment rather than installing new? If both answers are yes, then modification should be considered.

13.5 Age and Physical Condition:

A. Review the length of time in service of the wiring, devices, and equipment prior to considering reuse.

B. The equipment should be capable of remaining in use for a minimum of 15 years of additional life.

C. Where equipment has been in operation for a number years, the designer shall physically inspect the terminals, insulation, switching contacts, control wiring, etc.

D. Replace any equipment found to be outdated, obsolete or not having 15 years of additional life,

13.6 Parts Availability:

A. After the designer's site surveys, determine the availability of spare parts for existing equipment.

B. Where the project involves extending an existing system and the existing equipment spare parts are not available, the designer should inform the Project Manager in writing. Specific directions will be given at that time.

13.7 Conduit and Boxes:

A. Remove conduit and boxes in existing walls to be demolished.

B. Abandon conduit and boxes in existing walls to remain in place (if not reused) and provide the box with a blank cover.

C. Remove conduit in existing or new ceilings that is not intended for reuse back to the panel from which it originates.

D. Saw cut off conduits that had been run in the existing concrete slab as it enters the slab and seal it to prevent moisture access.

13.8 Conductors:

A. Replace conductors with deteriorated or damaged insulation. The designer may wish to have the conductors meggered to assure insulation integrity.

B. Remove conductors that are not deemed reusable back to the nearest junction box. Where the entire circuit is to removed, remove the conductors back to the panelboard from which they emanate.

C. Disconnection and removal of telephone cabling may not be the responsibility of the contractor. Verify with the Project Manager.

D. Disconnection and removal of communication, fire alarm wiring, etc., shall be the responsibility of the contractor.

E. Contractor shall not attempt to fish new conductors through an existing conduit with existing conductors. Replace all conductors.

13.9 Wiring Devices:

A. Remove devices that are not reusable. Boxes shall be blanked.

B. Reuse existing receptacles and switches which are located in walls to remain and are effective in the desired layout if determined to be physically acceptable.

13.10 Lighting Fixtures:

A. Remove lighting fixtures that cannot be reused, including associated wiring to ceiling mounted junction boxes.

B. Where fixtures are determined to be reusable in new or existing ceilings, they shall be taken down, cleaned, and relamped prior to reinstallation. An economic analysis of labor costs shall be reviewed in determining if the fixture should be reused or replaced.

C. Inform contractor of his responsibility in the storage and reassembly of reused fixtures as far as damage.

13.11 Panelboards:

A. Consider panelboards for reuse if physical condition, ratings and circuit capacity requirements are met.

B. Install panelboards in new or existing electrical closets. Corridor mounted panelboards shall not be employed unless given specific instructions. Refer to other articles of this Criteria for closet requirements.

C. In major secondary distribution renovation projects, existing panelboard back boxes may be used as pull boxes for branch circuit transfer. Tag all branch circuit conductors to identify which circuit number they are being transferred to in the new panel. Provide a requirement, in the contract documents, for the contractor to develop and type an accurate circuit directory.

D. Provide in the contract documents for the contractor to balance the loads during the branch circuit transfer.

13.12 Government Retained Equipment: The designer should determine which of the following items the government should retain, after consultation with the local staff:

A. Special receptacles

B. Transformers

C. Disconnects of 100 amperes and larger

D. Panelboards and circuit breakers

E. Fire Alarm devices

F. Special lighting fixtures

13.13 Concealed or Exposed:

A. All work should be installed concealed. In areas where it is determined that it is physically impractical to install conduit concealed, or where economic considerations prevail, consult with VA to determine acceptable alternatives.

B. Install all conductors in conduit or in surface metal raceway.

C. Where permission is granted, flexible metal conduit may be used to fish down to outlets in existing walls as long as lengths do not exceed 3 m (10 feet). Locate a junction box directly above ceiling for the conduit drop to the new outlet. Metal clad cable (type MC) is not acceptable for use.

D. Do not install surface metal raceways on the floor. Service to equipment in open areas from under the slab or through tele/power poles wired from the ceiling.

13.14 Continuity of Service:

A. Maintain services passing thru areas of remodeling throughout construction.

B. Circuits that are modified, as part of the remodeling project, which serve areas adjacent to the construction area shall be re-circuited as part of this project.

13.15 Compatibility: Equipment installed shall be compatible to existing components and systems to which they interface.

14. ELECTRICAL STANDARD DETAILS: Obtain a copy of the Standard Details, Electrical Engineering, and use the applicable details for the project after doing the necessary editing work.

15. APPLICABLE ELECTRICAL MASTER SPECIFICATIONS INDEX: Use the latest edition of NCA Master Specifications.

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26 05 11	Requirements for Electrical Installations
26 05 21	Low Voltage Electrical Power Conductors (600 Volts and Below)
26 05 26	Grounding and Bonding for Electrical Systems
26 05 33	Raceway and Boxes for Electrical Systems
26 05 41	Underground Electrical Construction
26 05 71	Electrical System Protective Device Study
26 22 00	Low Voltage Transformers
26 24 11	Distribution Switchboards
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26 27 13	Electricity Metering
26 27 26	Wiring Devices
26 29 11	Low-Voltage Motor Starters

26 29 21	Disconnect Switches
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26 41 00	Facility Lightning Protection
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DIVISION 27-COMMUNICATIONS

27 05 11	Requirements for Communications Installations
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27 10 00	Structured Cabling
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DIVISION 28-ELECTRONIC SAFETY AND SECURITY

28 05 11	Requirements for Electronic Safety and Security Installations
28 05 13	Conductors and Cables for Electronic Safety and Security
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28 23 00	Video Surveillance
28 31 00	Fire Detection and Alarm

- - - END - - -

5.9 CRITERIA FOR PREPARATION OF COST ESTIMATES FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

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5.9 CRITERIA FOR PREPARATION OF COST ESTIMATES FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. CRITERIA UNIQUE TO VA:

1.1 Presentation:

A. Provide a separate estimate with different summary sheets and supporting take-off worksheets for each building.

B. Provide separate estimates for new construction and alteration work.

C. A recapitulation sheet listing each new building and each renovated building shall precede the summary sheets.

D. Show the project sitework cost in the Sitework Section 12 for the largest building. Sitework Section 12 for the remaining buildings will include sitework cost only out to the 1500 mm (5 foot) building line.

1.2 Submit building gross area computations with sketch as shown in Attachment F, PROCEDURE FOR COMPUTATION OF BUILDING GROSS AREAS FOR NEW AND ALTERATION.

1.3 Computerized estimates are acceptable if all data is shown in the same format as the VA Forms.

2. GENERAL: For a project estimate, show the current cost of construction on the date of the estimate. The level of detail for this estimate should be consistent with the degree of completeness of the drawings being submitted. Simply stated, this means that if a construction element is shown, it should be priced; if it is shown in detail, it should be priced in detail. For detailed elements, "lump sum" or "allowance" figures are **not** acceptable. Submission requirements are indicated in VA Program Guide PG-18-15, Volume D.

3. CODING AND UNITS OF MEASURE CHARTS: Charts provided in Attachment E.

3.1 Use the units of measure indicated in Attachment E. Use these charts for the quantity take-off with the units of measure shown, then apply prices to those units of measure. If no unit of measure is given for a particular cost item, choose a unit of measure consistent with the item.

3.2 Use codes to provide levels of detail required under "CODE" on Form CEM-18a, TRADE ITEM TAKE-OFF WORKSHEET; Form CEM-18b, ESTIMATING WORKSHEET; Form CEM-18c, COST SUMMARY SHEET; and CODING AND UNITS OF MEASURE CHARTS.

A. Code Level A: Major system. Example: Mechanical Systems.

B. Code Level B: Level A further divided. Example: Plumbing and HVAC.

C. Code Level C: Level B with subsections further divided. Example: Plumbing divided into domestic water, storm-water, sanitary waste and vent, fuel gas, fuel oil, and plumbing fixtures.

D. Code Level D: Level C with sub-subsections further divided. Example: HVAC distribution divided into ductwork, HVAC piping (Int), and AHU & Term. units.

3.3 For items which do not logically fit under any of the systems or sub-systems on Attachment E, place a 99 in the code section of the VA Form CEM-18b under the level detail represented by the new item. This will alert the VA estimator that a new or unusual item is included in the estimate which is not stored in the computer data bank.

4. BUILDING SYSTEM DESCRIPTIONS: See Attachment D.

5. FORMS: Forms provided in Attachment A.

5.1 Project Data Sheet No. 1: A two-page form used to supply quantitative as well as qualitative information about each building in the project.

5.2 Project Data Sheet No. 2: A one-page form used to supply current labor rates for 12 selected building trades.

5.3 VA Form CEM-18a, Trade Item Take-off Worksheet: The use of this form is optional. It is intended to facilitate the take-off of plans in trade sequence (16-element CSI format) and the subsequent rearrangement into the 12-category Building System Form. They may also be used for applying insurance and taxes to labor, sales taxes to material and subcontractor markup as applicable. Another system for quantity take-off is acceptable provided the end result is an estimate arranged in the required format (s).

5.4 VA Form CEM-18b, Estimate Worksheet: This form indicates the division of cost between labor and material for each cost item, and extends the level of estimate beyond Form CEM-18c (see Attachment C).

5.5 VA Form CEM-18c, Cost Summary Sheet: A two-page form used to summarize costs, the level of detail "A", "B", "C", or "D" to be consistent with VA design requirements.

6. MATRIX: Form provided in Attachment B. Prepare a Matrix cost breakdown by project building and site work major items.

7. DETAILED TAKE-OFF: Form provided in Attachment C. Prepare a detailed take-off using CSI Format. Each line item shall indicate unit of measure, quantity, labor cost per unit, material (including any equipment) cost per unit, and a total cost. Each specification section shall be broken down into sub-sections of the Building Systems format and each sub-section sub-totaled. The level of breakdown to be consistent with the VA design requirements. The sub-section sub-totals shall be entered in the

appropriate Matrix section. This will also allow cross-checking to assure that all areas affected by the specification sections have been estimated.

8. MASTER PLAN COST ESTIMATING SUMMARY SHEET: See Attachment "G".

8.1 The Master Plan Cost Estimate Summary Sheet should be used as a recapitulation sheet on all cemetery estimates. The line item, BLDGS, refers to buildings that are enclosed and could be air conditioned as opposed to committal service shelters and columbarium.

8.2 The requirements for cemeteries are essentially the same as for other construction projects except that there are 5 additional Master Plan reviews. The Schematic Reviews 1 and 2 for Phase I are accomplished during the Master Plan reviews. See Program Guide PG-18-15D for which documents to submit at each of the Master Plan reviews.

9. COSTS: All costs shown on Attachment A, VA Form CEM-18c, COST SUMMARY SHEET, and on the extended summary as outlined under Design Development 2 & Construction Document 1 submissions, shall include all labor insurance and taxes, sales taxes on material and applicable contractor markup.

10. SUBMISSION REQUIREMENTS: Use the following requirements with submission requirements for cemetery projects indicated for Program Guide PG-18-15D.

10.1 **Market Survey:**

A. The consultant shall conduct a "Local Market Survey", exploring all factors influencing construction costs at each stage of design. Pertinent data shall be gathered by interviewing local firms having knowledge of the construction activity in the area. Possible sources are, but not limited to, the following: general and subcontractors, contractors and builders' associations, local government officials, architectural and engineering firms, builders' exchange and construction-reporting firms, and bankers and commercial mortgage firms. Particular emphasis should be placed on ascertaining the availability of earthwork and land development sub-contractors. The survey report, which will list sources of data, should reflect the recent and expected future bidding conditions that may influence the cost of VA construction.

B. Schematics (S-1 & S-2)

C. The following is a **minimum** listing of pertinent items to be investigated:

1) Labor supply, strike possibility and pending or imminent contractual negotiations, and availability of skilled labor and its associated cost
2) Material availability - shortages, oversupply, or normal market
3) Amount of planned and on-going construction - listing of future projects bidding during the same time frame as VA's project
4) Cost of construction money
5) "Hunger Factor" among general and sub-contractors
6) Union Shop versus Open Shop competition - labor cost differential

7) Number of prospective bidders - general contractors and major sub-contractors and their respective experience on similar projects

D. Design Development (DD-1 & DD-2)

E. Re-survey, verify, refine, and report the previously gathered data and make all necessary changes as required to reflect the current and anticipated local market conditions, noting all outside forces, such as regional building booms, i.e. 2005 Hurricane Katrina affecting all southeastern US projects. The required estimate submissions shall include the survey findings as reflected by the cost of materials, labor, and equipment along with all mark-ups associated with the general and appropriate sub-contractors.

F. Construction Document (CD-1)

G. Intensify the survey process and report all data gathered. The report shall clearly depict the pending current market conditions noting all outside influences. The final estimate should incorporate the survey's conclusions and reflect the current bidding climate, including information on the expected number of bidders, both general and sub-contractors, the grade of competition among contractors, and other conditions that may have impact on VA's construction project.

10.2 **General:**

A. A new gross area take-off is required with each estimate submission. See Attachment F.

B. Each estimate must be broken down by building with new construction and alteration separated.

C. Schematics 1 (S1) and Schematics 2 (S2): As a minimum, the S1 submittal shall include a LEVEL "A" breakdown of the base construction cost, i.e., divided into 12 major systems. The S2 submittal shall be broken down to Level "B". Included in both of these submittals shall be a copy of VA Form CEM-18c, and PROJECT DATA SHEET NO. 1 with the available items filled in for the total project as well as for each building. Alteration costs shall be reported separately from the cost of new construction.

D. Design Development 1 (DD1): This submission shall include a two-page VA Form CEM-18c, LEVEL "B" detail and a PROJECT DATA SHEET NO. 1 with the available items filled in for the entire project, as well as separately for each building. A single PROJECT DATA SHEET No. 2 containing current local labor rates is also required. Alteration costs shall be reported separately from the cost for new construction. Supplement each VA Form CEM-18c with VA Form CEM-18a or b, which shows the division of costs between labor and material.

E. Design Development 2 (DD2):

1) Provide Matrix described in Article 5; VA Form CEM-18c, COST SUMMARY SHEET, completed to level "B" detail; VA Form CEM-18b, COST ESTIMATE WORKSHEETS, to show the division of costs between labor and material; a detailed PROJECT DATA SHEET NO. 1 completed in its entirety with all applicable items filled in for the entire project as well as separately for each building; and PROJECT DATA SHEET No. 2 containing local labor rates.
2) Alteration costs shall be reported separately from the cost of new construction. The amount of detail provided in this submission must be consistent with the completeness of the drawings. Quantities such as "LS" or "LOT" should be a minimum.
3) For proper coding beyond LEVEL "B", the A/E shall refer to Attachment E, CODING AND UNIT OF MEASURE REFERENCE CHART.
4) Asbestos Abatement Estimate: Show total costs for asbestos abatement provided by the Professional Industrial Hygienist (PIH) as a separate cost item below the total base construction cost on the COST SUMMARY SHEET.

F. Construction Document 1 (CD1): This submission shall include everything required in the DD2 Submission. It differs from the DD2 Submission only in the level of detail required. Provide a complete quantity survey estimate. No lump sums will be permitted without explanation. (Note: Lump sums shown on Attachment E, CODING AND UNIT MEASURE CHARTS, are permitted due to summation of dissimilar items).

PROJECT DATA SHEET NO. 1 (2 pages) DATE: _____

LOCATION: _____ PROJECT NO: _____

TITLE:

_____

DESIGNER:

_____

SUBMISSION NO: _____ BUILDING NO.: _____BOECKH INDEX: _____

AREA CALCULATIONS

BASEMENT: _____m^2 (GSF) MECHANICAL: _____m^2 (SF)

SUB-BSMT: _____m^2 (GSF) CIRCULATION: _____m^2 (SF)

PENTHOUSE: _____m^2 (GSF) CONSTRUCTION: _____m^2 (SF)

FLOORS (TOTAL): _____m^2 (GSF) DESIGN NET: _____m^2 (SF)

AREA OF BLDG: _____m^2 (GSF) AREA OF BLDG: _____m^2 (SF)
(SUM OF ABOVE) (SUM OF ABOVE)

PIPE SPACE: _____m^2 (GSF) PROGRAM NET: _____m^2 (SF)

HEIGHT OF PIPE SPACE: ____mm (FT) ALTERATION: _____m^2 (SF)

CONN. CORR.: _____m^2 (GSF)

QUANTITATIVE BUILDING DESCRIPTION

ROOF: _____m^2 (SF) WINDOWS: _____m^2 (SF)

EXT. WALL: _____m^2 (SF) EST. DOORS: _____LEAVES
(INCLUDE WINDOWS & DOORS)

INT. WALL: _____m^2 (SF) INT. DOORS: _____LEAVES
(INCLUDE DOORS)

NO. OF FLOORS: _____ (EXCLUDE BSMT, SUB-BSMT,PENT,ETC)

NO. OF ELEVATORS: _____ STOPS EACH: _____

CALCULATED A/C LOAD: ____KW (TONS)

NO. OF CHILLERS: _____ TOTAL KW (TONS): _____

NO. OF COOLING TOWERS: _____ TOTAL KW (TONS): _____

SOLAR PANELS: _____m^2 (SF)

NO. OF BOILERS: _____ TOTAL kg/h (LBS/HR): _____

NO. OF FUEL OIL TANKS: _____ TOTAL CAPACITY: _____

PROJECT DATA SHEET NO 1 (CONT'D)

ELECTRICAL LOAD: _____KVA

NO OF EMER. GEN: _____ TOTAL KW:_____

NO. OF PLUMBING FIXTURES: _____TOTAL

QUALITATIVE BUILDING DESCRIPTION (TYPE & MATERIAL)

FOUNDATION:

SUB STRUCTURE:

SUPER STRUCTURE:

EXTERIOR CLOSURE:

ROOFING:

INTERIOR WALLS:

REMARKS (DESCRIBE UNUSUAL FEATURES)

PROJECT DATA SHEET NO. 2

LABOR RATES AS OF _____

(Including Fringe Benefits)

LABOR _____

EQUIPMENT OPERATOR _____

CEMENT MASON _____

BRICK MASON _____

STRUCTURAL IRON WORKER _____

ROOFER _____

PAINTER _____

CARPENTER _____

PLUMBER _____

STEAMFITTER_____

SHEETMETAL WORKER _____

ELECTRICIAN _____

TRADE ITEM TAKE-OFF WORKSHEET

UCI ELEMENT	DATE	SHEET NO.

PROJECT NO.	LOCATION	PROJECT NAME

TYPE OF ESTIMATE	ESTIMATOR	NEW	ALT.	INDEX NO.	BUILDING NO./NOS.	ESTIMATE NO.

TRADE ITEM	CODE				LABOR				MATERIALS				TOTAL COST
	A	B	C	D	QUANTITY	UNIT	$/UNIT	TOTAL	QUANTITY	UNIT	$/UNIT	TOTAL	

NOTE: This form is used to make a quantity take-off from plans in the 33 element MF 04 Spec format. It may be used for applying mark-ups to various trades and as a worksheet to facilitate the groupings of various trade-elements into the 12 category building system format.

VA FORM
DEC 1995

CEM-18a

ESTIMATE WORKSHEET

DATE	SHEET NO. OF

PROJECT NO.	LOCATION	PROJECT NAME

TYPE OF ESTIMATE	ESTIMATOR	NEW	ALT.	INDEX NO.	BUILDING NO./NOS.	ESTIMATE NO.

CODE				SYSTEM/SUBSYSTEM	LABOR				MATERIALS				TOTAL COST
A	B	C	D		QUANTITY	UNIT	$/UNIT	TOTAL	QUANTITY	UNIT	$/UNIT	TOTAL	

NOTE: This form is to be used to extend the detail estimate beyond level "B" and to show the division of costs between labor and material. Labor costs shall include all applicable insurance and taxes material costs shall include sales or other taxes and both shall include all applicable subcontractor's markups.

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COST SUMMARY SHEET

DATE

PROJECT NO.	LOCATION	PROJECT NAME

TYPE OF ESTIMATE	ESTIMATOR	GROSS AREA (New)	GROSS AREA (Alt)	INDEX NO.	BUILDING NO./NOS.	ESTIMATE NO.
		m^2 (SQ.FT.)	m^2 (SQ.FT.)			

CODE A	CODE B	CODE C	CODE D	SYSTEM/SUBSYSTEM	QUANTITY	UNIT	$/UNIT	$/$m^2$ ($/GSF)	SUBSYSTEM COST	SYSTEM COST
01				**FOUNDATION**						
	10			STANDARD						
	20			SPECIAL						
02				**SUBSTRUCTURE**						
	10			SLAB ON GRADE						
	20			BASEMENT EXCAVATION						
	30			BASEMENT WALLS						
03				**SUPERSTRUCTURE**						
	10			FLOOR CONSTRUCTION						
	20			ROOF CONSTRUCTION						
	30			STAIR CONSTRUCTION						
04				**EXTERIOR CLOSURE**						
	10			EXTERIOR WALLS						
	20			EXTERIOR DOORS AND WINDOWS						
05				**ROOFING**						
06				**INTERIOR CONSTRUCTION**						
	10			PARTITIONS						
	20			INTERIOR FINISHES						
	30			SPECIALTIES						

COST SUMMARY SHEET *(Continued)*

PROJECT NAME AND LOCATION

DATE

CODE A	CODE B	CODE C	CODE D	SYSTEM/SUBSYSTEM	QUANTITY	UNIT	$/UNIT	$/m² ($/GSF)	SUBSYSTEM COST	SYSTEM COST
08				**MECHANICAL**						
	10			PLUMBING						
	20			HVAC						
	30			FIRE PROTECTION						
	50			SEWAGE TREATMENT *(New)*						
	55			SEWAGE TREATMENT *(Alterations)*						
09				**ELECTRICAL SYSTEMS**						
	10			BASIC MATERIALS AND METHODS						
	20			LIGHTING - POWER						
	30			SPECIAL ELECTRICAL SYSTEMS						
	40			COMMUNICATIONS SYSTEMS						
	50			ELECTRICAL HEATING SYSTEMS						
10				**GENERAL CONDITIONS**						
11				**EQUIPMENT**						
	10			SPECIAL EQUIPMENT						
	20			FURNISHINGS						
	30			SPECIAL CONSTRUCTION						
				TOTAL BUILDING COSTS						
12				**SITEWORK**						
	10			SITE PREPARATION						
	20			SITE IMPROVEMENTS						
	30			SITE UTILITIES						
	40			OFF SITE WORK						
				TOTAL BASE CONSTRUCTION COST						

REMARKS

ATTACHMENT "B"

MATRIX - VA BUILDING SYSTEMS

TITLE: PROJECT NO: LOCATION:

SPEC SECT	ADMIN BLDG	MAINT BLDG	COMM. SHELTERS	PUBLIC RESTROOMS	STORAGE BLDG	COUMBARIA	MAIN ENTRANCE	ROADS	BURIAL AREA	ASSEMBLY AREA	FLAGPOLE AREA	COMMEM. AREA	WALKWAY	DRAINAGE SYSTEM	WATER SYSTEMS	SANITARY SYSTEMS	SITE ELECT.	PONDS	TOTAL PROJECT

ESTIMATE WORKSHEET

DATE	SHEET NO.
	OF

PROJECT NO.	LOCATION	PROJECT NAME
101-001	ANY NATIONAL CEMETERY, USA	SAMPLE PROJECT

TYPE OF ESTIMATE	ESTIMATOR	NEW	ALT.	INDEX NO.	BUILDING NO./NOS.	ESTIMATE NO.
DD1	JOHN DOE	X		1000.0	ADMINISTRATION BUILDING	CD-1

CODE				SYSTEM/SUBSYSTEM	LABOR				MATERIALS				TOTAL COST
A	B	C	D		QUANTITY	UNIT	$/UNIT	TOTAL	QUANTITY	UNIT	$/UNIT	TOTAL	
01				FOUNDATION	55,255	SF	1.74	96,177	55,255	SF	1.78	98,235	194,412
	10			STANDARD	55,255	SF	.62	34,171	55,255	SF	.60	33,416	67,587
		01		EXCAVATION	1,273	CY	2.00	2,546	1,273	CY	1.00		3,819
		02		CONCRETE 4000 PSI	314		14.00	4,396	2,980	CY	50.50	15,857	20,253
		03		FORMWORK	8,000	SF	2.00	16,000	8,000	SF	1.00	8,000	24,000
		04		REINFORCING	16	T	200	3,200	16	T	450	7,200	10,400
		05		FINISH	7,579	SF		2,425	7,579	SF	.02	152	2,577
		06		BACKFILL	959	CY	5.84	5,604	959	CY	.97	934	6538
	20			SPECIAL	55,255	SF	1.12	68,006	55,255	SF	1.17	64,819	126,825
		01		DRILL 20"/60 PIER	2,862	LF	3.25	9,302	2,862	LF	1.75	5,009	14,311
		02		DRILL 24"/72 PIER	1,890	LF	3.75	7,088	1,890	LF	2.00	3,780	10,868
		03		DRILL 28"/84 BELLED PIER	252	LF	4.50	1,134	252	LF	2.50	630	1,764
		04		HAUL OFF SPOIL	1,162	CY	3.00	3,486	1,162	CY	3.00	3,486	6,972
		05		400 PSI CONCRETE	1,028	CY	7.00	7,196	1,028	CY	50.50	51,914	59,110
		06		REBAR	52	T	200.0	10,400	52	T	450.0	23,400	33,800

ATTACHMENT "C" PAGE 1 OF 2

SAMPLE

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CEM-18a

ESTIMATE WORKSHEET

DATE	SHEET NO.
	OF

PROJECT NO.	LOCATION	PROJECT NAME
101-001	ANY NATIONAL CEMETERY, USA	SAMPLE PROJECT

TYPE OF ESTIMATE	ESTIMATOR	NEW	ALT.	INDEX NO.	BUILDING NO./NOS.	ESTIMATE NO.
DD1	JOHN DOE	X		1000.0	ADMINISTRATION BUILDING	CD-1

CODE				SYSTEM/SUBSYSTEM	LABOR				MATERIALS				TOTAL COST
A	B	C	D		QUANTITY	UNIT	$/UNIT	TOTAL	QUANTITY	UNIT	$/UNIT	TOTAL	
02				SUBSTRUCTURE	55,255	SF	.49	27,217	55,255	SF	.92	50,858	78,075
	10			SLAB ON GRADE	55,255	SF	.49	27,217	55,255	SF	.92	50,858	78,075
		01		10 MIL POLY	55,255	SF	.02	1,105	55,255	SF	.05	2,763	3,868
		02		EDGE FORM	3,350	LF	2.00	6,700	3,330	LF	.50	1,675	8,375
		03		4000 PSI CONC. CURED	844	CY	23.05	19,454	844	CY	54.00	46,158	65,612
	30			BASEMENT WALLS									-0-
03				SUPERSTRUCTURE									
	10			FLOOR (AT MECHANICAL	2,980	SF	.47	1,406	2,980	SF	.93	3,194	4,600
		01		WIRE MESH	32	SF	8	256	32	SF	16.00	512	768
		02		4000 PSI CONC.	49	CY					50.50	2,475	2,475
		03		PUMP CONC.	49	CY	4.00	196	49	CY	3.00	147	343
		04		PLACE, FINISH, CURE	2,980	SF	.32	954	2,980	SF	.02	60	1,014

ATTACHMENT "C" PAGE 2 OF 2

SAMPLE

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CEM-18a

ATTACHMENT D – BUILDING SYSTEMS DESCRIPTIONS

GENERAL

The following material is provided as the description of work to be included in Estimate Worksheets prepared for projects. Examples of some work elements are included in the sample Estimate Worksheets included in Attachment C. The number designation for the paragraphs that follow correspond with the Code designations in Column A of the Estimate Worksheets in “Attachment C”, and are referred to as Sections in the body of the text for this attachment. The description that follows the paragraph number corresponds with the designation for the column “System/Subsystem” in the same Estimate worksheets. Further breakdown of the work is described in the following:

01. FOUNDATIONS

This element includes all work below the level of the lowest floor construction (usually slab on grade).

At level B it is subdivided into:

- Standard Foundations - which includes regular type spread footing foundations

- Special Foundations Conditions - which includes piling and caissons, underpinning, dewatering, raft foundations, etc.

The section includes foundation walls up to the top of the lowest floor construction, but excludes slab on grade. Includes any excavation necessary to reduce levels or to form basements, or any backfilling to generally raise levels.

Note that rock excavation is considered a special abnormal condition and is to be included with special foundation work.

All earth work associated with site development is included in section 12 (Site Work).

02. SUBSTRUCTURE

This element includes the enclosing horizontal and vertical elements required to form a basement, together with the necessary mass excavation.

At level B it is subdivided into:

-Slab on Grade - including all underfill, foundation drainage, trenches in slab, pits and bases.

- Basement Walls - including required moisture protection.

The section does not include any suspended structural slabs and supporting interior walls and columns contained within basements, which are to be carried in section 03.

In cases where slopping site conditions create variable basement levels, note that only basement walls below grade are to be carried in this section. All other walls above grade are to be included in section 04.

The items included in this section can perhaps best be described by the term "bath tub", comprising essentially basement walls.

ATTACHMENT D – BUILDING SYSTEMS DESCRIPTIONS

03. SUPERSTRUCTURE

This element includes all structural slabs, decks and supports within basements and above grade (see sketch 02 substructure).

At level Bit is subdivided into :

- Floor Construction - including balconies and ramps

- Roof Construction - both pitched and flat and including canopies and special roofing systems

- Stair Construction

Note that the structural work will include both horizontal items (slabs, decks, etc.) and vertical structural components, columns and interior structural walls. Exterior load bearing walls are not included in this section but section 04.
Stair finishes are included in section 06.

04. EXTERIOR CLOSURE

This element includes all vertical and horizontal closure features.
It is subdivided at level B into:

- Exterior Walls - being the solid exterior closure element
- Exterior Doors and Windows - also including curtain walls

Loading bearing exterior walls will be included here and not in section 03. Structural frame elements at exterior such as columns, beams, spandrels, etc., would be included in section 03, with only applied exterior finishes (e.g. paint, stucco, etc.) being included here.

Finishes to the inside face of walls which are not an integral part of the wall construction, will be included in 0620.

05. ROOFING

This element includes all waterproof roof coverings and insulation, together with skylights, hatches, ventilators and all required trim. The system proceeds directly to a level C breakdown.

In addition to roof coverings, the element includes all waterproof membranes and traffic toppings over below grade enclosed areas, balconies and the like.

ATTACHMENT D – BUILDING SYSTEMS DESCRIPTIONS

06. INTERIOR CONSTRUCTION

This element includes all architectural interior construction.
At level B it is subdivided into:

- Partitions- which also includes toilet partitions, interior balus-trades, doors and frames

- Interior Finishes - to walls, floors and ceilings

- Specialties- standard built-in items and specialties, such as toilet accessories and other built-ins, which would commonly be found in most building types

The element does not include interior structural walls, which are included in section 03.

Any special equipment, built-in or movable, will be found in section 11.

07. CONVEYING SYSTEMS (DOES NOT APPLY TO NCA PROJECTS)

08. MECHANICAL

This element closely parallels CSI Division 21, 22 ,and 23.
At level B it is subdivided into:

- Plumbing - including drainage

- Heating, Ventilating and Air Conditioning

- Fire Protection - including sprinklers

Exterior site utilities are to be included in Division 33.

ATTACHMENT D – BUILDING SYSTEMS DESCRIPTIONS

09. ELECTRICAL

This element closely parallels CSI Division 26, 27, and 28. It is subdivided at level B into the following:

- BASIC MATERIALS AND METHODS

Distribution and Panelboards
Include: Switchboards, panelboards, starters, motor connections, motor control centers, circuit breakers, wires/conduits, equipment transformers, bus duct

Branch Wiring and Devices
Include: Receptacles outlet boxes, raceways, junction boxes-pull boxes, cable trough, wires/conduits

- LIGHTING AND POWER

Lighting Fixtures
Include: Interior lights, exit lights, entrance lights switches, wire/conduits

- SPECIAL ELECTRICAL SYSTEMS

Emergency Power and Lights
Include: Emergency light fixtures, switches, panels and wires/conduits, battery powered emergency lights

- OTHER SPECIAL ELECTRICAL SYSTEMS

Include: Lightning protection, grounding system, wires/conduits, uninterruptable power system

- COMMUNICATIONS SYSTEMS

Fire Alarm System:	Devices and Wiring
Telephone/IC and	
Closed Circuit TV:	Devices and Wiring

- SECURITY SYSTEMS

- ELECTRICAL HEATING SYSTEMS

Include: Control devices and wiring to boilers, baseboard heaters and HVAC Systems

ATTACHMENT “D” PAGE 4 OF 6

ATTACHMENT D – BUILDING SYSTEMS DESCRIPTIONS

10. GENERAL CONDITIONS AND PROFIT

This element includes all site overhead items, mobilization, demobilization, together with a pro rata charge of the general contractor's head office overhead expense and a profit mark-up. When construction management contracts are used, the later often becomes a fee and may be carried elsewhere.

For convenience, estimators-have traditionally included in General Conditions certain costs which could be considered distributable to a work section (e.g. sales taxes, labor fringe benefits, equipment for placing concrete, etc.). In this breakdown, such items shall be distributed to the work sections.

Note that this section includes only general contractor's or construction managers' general condition items and that all subcontractors' overheads and profit should be included in each respective work section.

CLARIFICATION

In filling out the project cost data sheets, the general contractor's overhead and profit on subcontractors' work should be included in General Conditions and Profit. However, the general contractor's overhead and profit on his own work and the subcontractors' overhead and profit should be included in the cost of each item of work.

11. EQUIPMENT

This element accords fairly closely with CSI Divisions 12, 13 and 22. It is subdivided at level B into:

- Specialized Equipment
- Furnishings
- Special Construction

As furniture is funded from separate sources, there is no further development of this sub-element here.

ATTACHMENT D – BUILDING SYSTEMS DESCRIPTIONS

12. SITE WORK

A. This element includes all work outside the immediate building confines and is subdivided at level B into the following:

- Site Preparation - clearing, demolition and earth moving

- Site Improvement - landscaping, paving, parking, roads, etc.

- Site utilities - sewers, water, power, etc.

  Storm & sanitary sewers
  Domestic water, fire protection water, hot & chilled water
  Electrical
  Utilities
  Substations, etc.

- Off-site work - for special highway and utility work and any other off-site construction required

Note that general grading to reduce levels over the site occupied by the building will be included in this section.

This site utilities sub-section does not include the following elements:

Heat Generating System
Cooling Generating System
Geo-Thermal System

These elements are contained within the Mechanical (08) section of the Logic Tree.

The Site Utility sections of the Logic Tree, therefore, contain distribution elements only, with source elements being contained within buildings.

ATTACHMENT E – Cost Estimating Section Details, Level A thru C

SYSTEM OR SUBSYSTEM NAME	CODE				UNIT OF MEASURE
	A	B	C	D	
FOUNDATION	01				FOOT PRINT AREA
STANDARD		10			FOOT PRINT AREA
EXCAVATION-BACKFILL (FOUND)			01		m^3 (CU YDS) EXCAVATION
CONCRETE-FORMS-RB (FOUND)			02		m^3 (CU YDS) CONCRETE
MASONRY			03		m^2 (SQ FT) MASONRY
SPECIAL		20			FOOT PRINT AREA
ROCK EXCAVATION			01		m^3 (CU YDS) EXCAVATION
DEWATERING			02		LUMP SUM
STRUCTURAL STEEL (FOUND)			03		t (TONS) OF STEEL
PILES AND CAISSONS			04		m (LF) PILES & CAISSONS
UNDERPINNING			05		m^3 (CU YDS) CONCRETE
SUB-STRUCTURE	02				m^2 (SQ FT) (SOG)
SLAB ON GRADE		10			m^2 (SQ FT) (SOG)
GRANULAR FILL BELOW			01		t (TONS) OF FILL
FOUND OR UNDERSLAB DRAIN			02		m (LF) PIPE
CONCRETE-FORMS-RB (SOG)			03		m^3 (CU YDS) CONCRETE
WATER DAMPROOFING (SOG)			04		m^2 (SQ FT) CONTACT AREA
THERMO-INSULATION			05		m^2 (SQ FT) CONTACT AREA
BASEMENT WALLS		30			m^2 (SQ FT) WALL
CONCRETE-FORMS-RB (BSMT WALL)			01		m^3 (CU YDS) CONCRETE
MASONRY (BSMT WALL)			02		m^2 (SQ FT) MASONRY
WATER-DAMPROOFING (BSMT WALL)			03		m^2 (SQ FT) CONTACT AREA
SUPER-STRUCTURE	03				m^2 (SQ FT) AREA FL & RF
FLOOR CONSTRUCTION		10			m^2 (SQ FT) AREA FLOOR
CONCRETE-FORMS-RB (FLOOR)			01		m^3 (CU YDS) CONCRETE
PRECAST STRUCT COMP FLOOR			02		m^2 (SQ FT) AREA COMPS
STRUCTURAL STEEL (FLOOR)			03		t (TONS) OF STEEL
ROUGH CARPENTRY FRM DECK			04		m (BOARD FT) OF LUMBER
HVY. TIMBER PREFAB STR (FLOOR)			05		m (BOARD FT) OF LUMBER
CEMENTITIOUS DECKS (FLOOR)			06		m^2 (SQ FT) DECK
ROOF CONSTRUCTION		20			m^2 (SQ FT) AREA ROOF
CONCRETE-FORMS-RB (ROOF)			01		m^3 (CU YDS) CONCRETE
PRECAST STRUCT. COMPONENTS (RF)			02		m^2 (SQ FT) AREA OF COMPS
STRUCTURAL STEEL (ROOF)			03		t (TONS) OF STEEL
ROUGH CARP FRAME-DECK (ROOF)			04		m (BOARD FT) OF LUMBER
HVY TIMBER PREFAB STR.			05		m (BOARD FT) OF LUMBER
CEMENTITIOUS DECKS (ROOF)			06		m^2 (SQ FT) DECK
STAIR CONSTRUCTION		30			RISERS
CONCRETE-FORMS-RMS (STAIRS)			01		# OF RISERS
METAL STAIRS			02		FLIGHTS
WOOD STAIRS			03		# OF RISERS
SOLAR ENERGY (STRUCTURAL STEEL)		40			t (TONS) OF STEEL OR m^3 (CU YDS) CONCRETE

ATTACHMENT "E" PAGE 1 OF 5

ATTACHMENT E – Cost Estimating Section Details, Level A thru C

SYSTEM OR SUBSYSTEM NAME	CODE A	CODE B	CODE C	CODE D	UNIT OF MEASURE
EXTERIOR CLOSURE	04				m^2 (SQ FT) WALLS & OPENS
EXTERIOR WALL		10			m^2 (SQ FT) WALL
CONCRETE-FORMS-RB (EXT WALL)			01		m^3 (CU YDS) CONCRETE
PRECAST CONCRETE (EXT WALL)			02		m^3 (CU FT) CONCRETE
MASONRY (EXT WALL)			03		m^2 (SQ FT) MASONRY
ROUGH CARPENTRY (EXT WALL)			04		m (BOARD FT) LUMBER
EXT WOOD SIDING & TRIM			05		m^2 (SQ FT) SIDING
WATER-DAMPROOFING (EXT WALL)			06		m^2 (SQ FT) CONTACT AREA
THERMAL INSULATION (EXT WALL)			07		m^2 (SQ FT) CONTACT AREA
PREFORM SIDING PNLS. (EXCLD MAT.)			08		m^2 (SQ FT) WALL
PREFORM SIDING PNLS. (MATERIAL)			09		m^2 (SQ FT) WALL
SEALANT-CAULKS			10		LUMP SUM
WALL FINISHES (EXT)			11		m^2 (SQ FT) WALL
SUN-CONTROL DEVICES			12		LUMP SUM
MISC METAL (EXT WALL)			13		POUNDS METAL
EXTERIOR DOORS & WINDOWS		20			m^2 (SQ FT) AREA OPENINGS
DOOR-FRAME-HDWARE (EXT)			01		# OF LEAVES
WINDOWS (EXT)			02		m^2 (SQ FT) WINDOWS
CURTAIN WALLS (INCLD STRE FRT)			03		m^2 (SQ FT) CURTAIN WALLS
ROOFING	05				m^2 (SQ FT) AREA ROOF
ROUGH CARP EXCPT FRME. & DECK		00	01		m (BOARD FT) LUMBER
THERMAL INSULATION (ROOF)			02		m^2 (SQ FT) CONTACT AREA
ROOFING (SHINGLES, TILES, ETC.)			03		m^2 (SQ FT) AREA ROOF
MEMBRANE-TOPPING (INCLD BLT-UP)			04		m^2 (SQ FT) AREA ROOF
SHEET-METAL & ACCESSORIES (ROOF)			05		LUMP SUM
INTERIOR CONSTRUCTION	06				m^2 (SQ FT) FLOOR AREA
PARTITIONS		10			m^2 (SQ FT) AREA PARTNS
PARTITIONS (FIXED)			01		m^2 (SQ FT) AREA PARTNS
ROUGH CARPENTRY (PARTITIONS)			02		m (BOARD FT) LUMBER
DOOR-FRAMES-HDWARE (INTERIOR)			03		# OF LEAVES
WINDOWS (INTERIOR)			04		m^2 (SQ FT) AREA WINDOWS
COMPARTMENTS & CUBICLES			05		LUMP SUM
PARTITIONS (MOVABLE)			06		m^2 (SQ FT) AREA PARTNS
INTERIOR FINISHES		20			m^2 (SQ FT) FINISH SURFACE
CONCRETE FINISH			01		m^2 (SQ FT) FINISH SURFACE
WOOD PANELING			02		m^2 (SQ FT) PANEL
WALL FINISHES (INTERIOR)			03		m^2 (SQ FT) FINISH SURFACE
FLOOR COVERING (RESILIENT)			04		m^2 (SQ FT) FLOOR AREA
ACOUSTICAL CEIL TREATMENT			05		m^2 (SQ FT) ACOUST CEIL
SPECIAL FLOOR-MAR, TERRAZZO, ETC			06		m^2 (SQ FT) FLOOR AREA
SPECIAL FLOOR COVERING-COAT			07		m^2 (SQ FT) FLOOR AREA
PAINTING (INTERIOR)			08		m^2 (SQ FT) PAINT SURFACE
CEILING (OTHER THAN ACOUST)			09		m^2 (SQ FT) CEILING

ATTACHMENT E – Cost Estimating Section Details, Level A thru C

SYSTEM OR SUBSYSTEM NAME	CODE A	CODE B	CODE C	CODE D	UNIT OF MEASURE
SPECIALTIES	06	30			m^2 (SQ FT) FLOOR AREA
MISC ORNAMENTAL MTL (BLDG)			01		kg (POUNDS) OF METAL
FINISH CARP-MILLWORK-CABINETS			02		LUMP SUM
PLASTIC FABRICATION			03		LUMP SUM
CHALK-TACK-BOARDS			04		LUMP SUM
SIGNS			05		LUMP SUM
TOILET-BATH-WARDROBE ACCESS			06		LUMP SUM
ACCESS FLOORING			07		m^2 (SQ FT) FLOOR AREA
LOCKERS			08		# OF LOCKERS
SHELVING			09		# OF SHELVES
MISC. SPECIALTIES			10		LUMP SUM
CONVEYING SYSTEMS	07				
OTHER CONVEYING SYSTEMS		50			
HOISTS & CRANES			01		CAPACITY IN kg (POUNDS)
MATERIAL HANDLING			02		
CHUTES			03		
CONVEYORS (BELT, ROLLER, ETC.)			04		LENGTH IN m (FT)
MECHANICAL SYSTEMS					
PLUMBING		10			# OF FIXTURES
DOMESTIC WATER SUPPLY			01		LENGTH OF PIPE IN m (FT)
SANITARY WASTE & VENT			02		LENGTH OF PIPE IN m (FT)
PLUMBING EQUIPMENT	08		03		LUMP SUM
PLUMBING FIXTURES			04		# OF FIXTURES
RAIN WATER DRAINS (NIT)			05		LENGTH OF PIPE m (FT)
HVAC		20			kW (TONS) FEVER/J (BTU)
HEAT GENERATING SYSTEM			02		J (BTU) OR kg/s (LBS /HR)
HEAT GENERATING SYSTEM			03		KW (TONS) OF REFRIG.
DISTRIBUTION SYSTEM			04		KW (TONS) FEFR/J (MBTU)
DUCTWORK				01	kg (LBS) OF SHEET METAL
HVAC PIPING (NIT)				02	LENGTH OF PIPE IN m (FT)
AU & THERMAL UNITS				03	# OF UNITS
CONTROLS TEST & BALANCE			05		KW (TONS) REFR/J (MBTU) ONLY
FIRE PROTECTION		30			
AUTOMATIC SPRINKLER SYSTEM			01		m^2 (SQ FT) PROTECTED AREA
OTHER FIRE PROTECTION SYSTEM			02		# OF HEADS
SPECIFY:					
SEWAGE TREATMENT (NEW)		55			

ATTACHMENT "E" PAGE 3 OF 5

ATTACHMENT E – Cost Estimating Section Details, Level A thru C

SYSTEM OR SUBSYSTEM NAME	CODE A	CODE B	CODE C	CODE D	UNIT OF MEASURE
SEWAGE TREATMENT (ALT)					
SOLAR ENERGY MECH SYSTEM (BLDG)		60			m^2 (SQ FT) SOLAR PANEL
ELECTRICAL SYSTEM	09				KW SEE
BASIC MATERIALS & METHODS		10			KVA ATTACHMENT
DISTRIBUTION & PANEL BOARDS			01		KVA "D"
BRANCH WIRING & DEVICES			02		KVA FIG. NO.1
LIGHTING		20			m^2 (SQ FT) SERVED
LIGHTING FIXTURES			01		m^2 (SQ FT) SERVED
SPECIAL ELECTRICAL SYSTEMS		30			m^2 (SQ FT) SERVED
EMERGENCY POWER & LIGHTS			01		m^2 (SQ FT) SERVED
OTHER SPECIFY:			02		m^2 (SQ FT) SERVED
COMMUNICATION SYSTEM		40			m^2 (SQ FT) SERVED
CCTV & TELEPHONE			01		m^2 (SQ FT) SERVED
SECURITY SYSTEMS			02		
ELECTRICAL HEATING SYSTEM		50			LUMP SUM
GENERAL CONDITIONS	10				DURATION OF CONTRACT
GENERAL REQUIREMENTS					DURA. OF CONT. WEEKS
EQUIPMENT	11				# OF PIECES OF EQUIPMENT
SPECIAL EQUIPMENT		10			# OF PIECES OF EQUIPMENT
BUILT IN MAINT EQUIPMENT			01		# OF PIECES OF EQUIPMENT
FOOD SERVICE			02		# OF PIECES OF EQUIPMENT
VENDING			03		# OF PIECES OF EQUIPMENT
WASTE HANDLING			04		# OF PIECES OF EQUIPMENT
POSTAL			05		# OF PIECES OF EQUIPMENT
WATER TREATMENT			06		# OF PIECES OF EQUIPMENT
FINISHES		20			
SPECIFY:					

ATTACHMENT "E" PAGE 4 OF 5

ATTACHMENT E – Cost Estimating Section Details, Level A thru C

SYSTEM OR SUBSYSTEM NAME	CODE A	CODE B	CODE C	CODE D	UNIT OF MEASURE
SPECIAL CONSTRUCTION	11	30			
SPECIFY:					
TOTAL BUILDING COST	__	__	__	__	DESIGN NET AREA
SITEWORK	12				m^2 (SQ FT)(INCL IN PROJ)
SITE PREPARATION		10			m^2 (SQ FT)(INCL IN PROJ)
CLEARING			01	__	m^2 (SQ FT)(CLEARED)
DEMOLITION (GENERAL)			02		LUMP SUM
DEMOLITION (BUILDING)			03		m^3 (CU FT) BUILDING
EARTHWORK (SITE)			04		m^2 (SQ FT)(INVOLVED)
SITE IMPROVEMENTS		20			m^2 (SQ FT)(INCL IN PROJ)
PAVING (OTHER THAN MASONRY)			01		m^2 (SQ YDS) SURFACE
LANDSCAPING			02		m^2 (SQ FT) LANDSCAPING
CONCRETE-FORM-RB (SITE)			03		m^3 (CU YDS) CONCRETE
PRECAST COMPONENTS (SITE)			04		LUMP SUM
MASONRY PAVING (SITE)			05		m^2 (SQ FT) SURFACE
MISC ORNAMENTAL MTLS (SITE)			06		kg (POUNDS) METAL
FLAG POLES			07		# OF POLES
SITE UTILITIES		30			m^2 (SQ FT)(INCL IN PROJ)
LAWN SPRINKLERS			01		m^2 (SQ FT) SPRINKLED
MECH UTILITIES			02		LENGTH OF PIPE
ELEC UTILITIES			03		KVA
TRANSFORMERS			04		KVA
ENCLOS (UNLESS SELF CONTAINED)			05		m^2 (SQ FT) OF BLDG/ENCLOS
EMERGENCY GENERATORS			06		
EMER GEN BLDG/ENCLOSURE					KW OF GENERATOR
CONVENTIONAL ENERGY SUPPLY			07		m^2 (SQ FT) BUILDING
(OIL TANKS, GAS METERS, ETC.)			08		
SOLAR ENERGY SYSTEM (SITE)			09		
(COLLECTION, DISTR, STORAGE)			10		m^2 (SQ FT) SOLAR PANEL
OFF SITE WORK		40			LUMP SUM
SPECIFY:					
TOTAL BASE CONSTRUCTION COST	__	__	__	__	

ATTACHMENT "E" PAGE 5 OF 5

ATTACHMENT F – Procedure for Computation of Building Gross Areas for New and Alteration

l. The A/E shall submit to the Contracting Officer a report of the gross area of his design at each of his submissions.

2. The A/E shall prepare the gross area computation as follows: Submit a small-scale plan of each individual floor. Subdivide each floor into rectangle with each rectangle designated by a capital letter. List all the letters on one floor alphabetically. Clearly indicate length and width of each lettered area and the total square meters (footage) of each lettered area in tabular form. Show the sum of these areas as the "Designed Gross Area".

3. Area Computation: (See Attached Diagram)

4. List of Computations:

First Floor

Area	L	W.	m^2 (s.f.).
A	X	Y	= m^2 (s.f.)
B	"	"	=
C	"	"	=
etc.	"	"	=

Design Gross Area for the first floor: s.f.
(Similar computation for every floor)
Recapitulation
Basement m^2 (s.f.)
1st floor m^2 (s.f.)
Penthouse m^2 (s.f.)
Total Designed Gross Area _____m^2 (s.f.) Target Gross Area _____ m^2 (s.f.)

5. Special Areas To Be Considered:

a. Areas Which Are Not Counted in Gross Area

Outside ramps or steps (without cover)
Exposed mechanical equipment enclosed with a screen wall but not roofed
Fuel tanks or pneumatic tanks placed underground
Fuel storage tanks placed on a slab at ground level enclosed by a fence or screen
Areaways
Other roofed areas or passage without enclosing walls

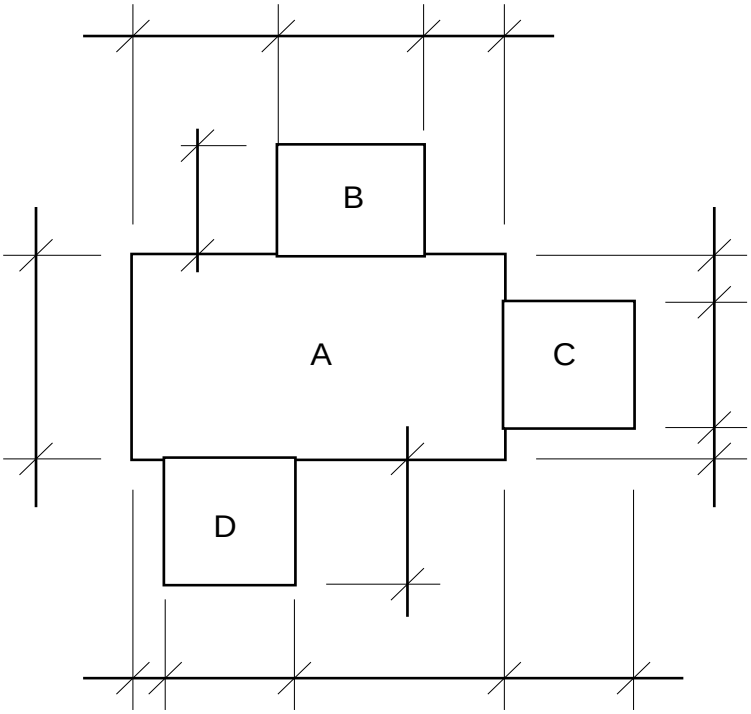


DIAGRAM SHOWING METHOD OF SUBDIVIDING BUILDING FOR GROSS AREA CONSTRUCTION

ATTACHMENT "F" PAGE 2 OF 2

ATTACHMENT "G"

MASTER PLAN COST ESTIMATE SUMMARY SHEET

LOCATION: _____ TITLE: _____

PROJ. NO.: _____ EST FIRM.: _____ PHONE NO.: _____

TOTAL ACRES: _____ PHASE 1 ACRES: _____

	DATE PREP.	BOECHK INDEX	BLDGS	SITE	TOTAL	TOTAL PROJECT BLDGS	TOTAL PROJECT SITE	TOTAL PROJECT TOTAL
MP1			XXXXXX	XXXXXX	XXXXXX			
MP2			XXXXXX	XXXXXX	XXXXXX			
MP3								
MP4								

5.10 CRITERIA FOR DEVELOPMENT OF CPM PHASING FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

TABLE-OF-CONTENTS

1. GENERAL
2. PHASING NARRATIVE
3. PHASING PLANS
4. EXAMPLE 1A
5. EXAMPLE 1B

5.10 CRITERIA FOR DEVELOPMENT OF CPM PHASING FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

1. GENERAL:

1.1 Follow this criterion and the current edition of VA Construction Standards, VA Handbooks, VA Program Guides, and NCA Master Specifications in development of CPM phasing.

2. PHASING NARRATIVE (Example 1A attached): Provide a narrative to outline phasing requirements and sequence. Identify all areas of the project as a part of some phase. Each phase description shall include constraints particular to that phase, what other phases must precede it, and any VA moves which must precede the start of the phase or phases. If equipment and other removable items require storage and relocation by the Government, these requirements shall be listed in the phasing narrative. List special phasing constraints, which may be common to the project, at the end of the narrative and not within each individual phase description.

3. PHASING PLANS:

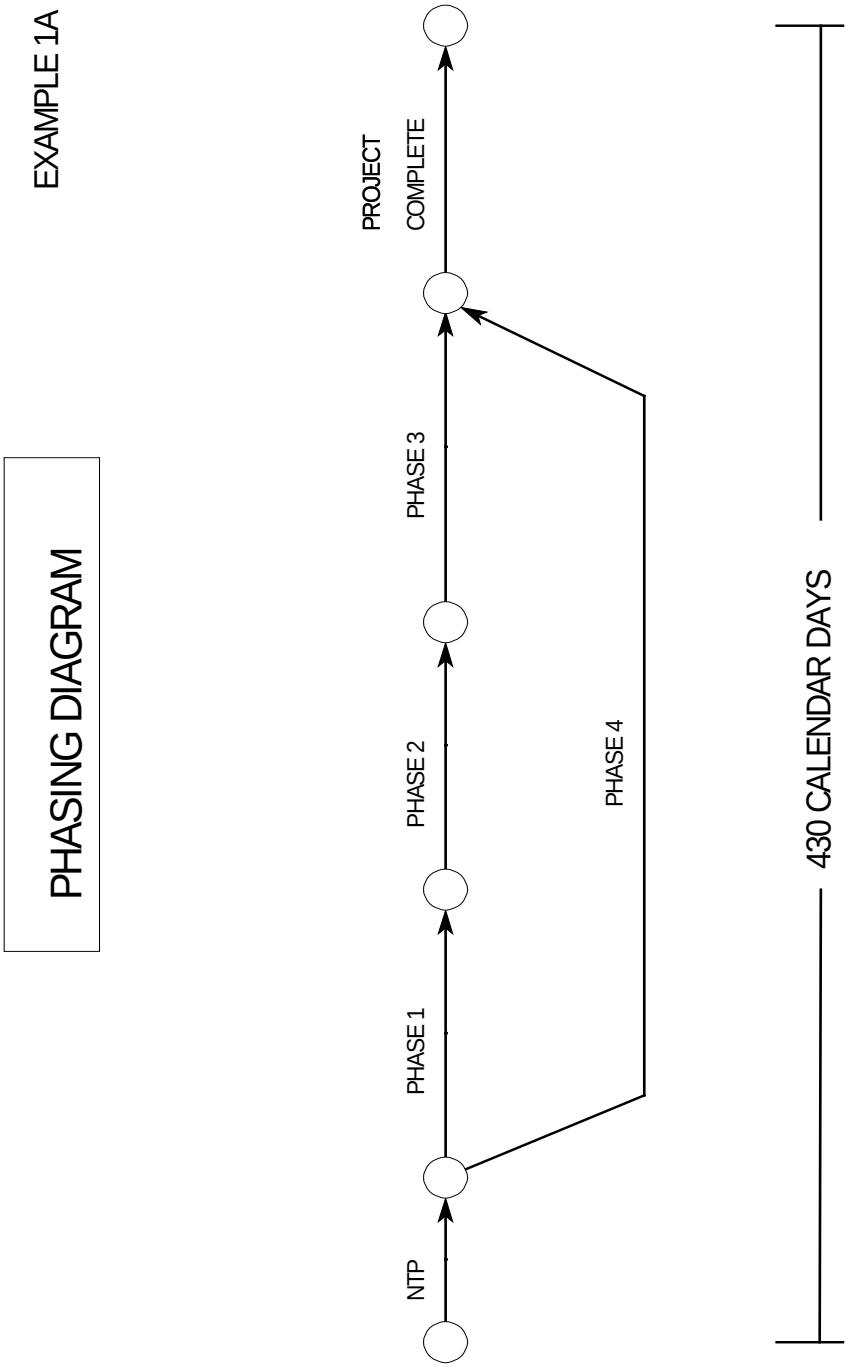
3.1 Individual Phases: Outline and label individual phases on all the submitted schematics and first design development plans including site, architectural, structural, HVAC, plumbing, sanitary, steam, and electrical drawings. NOTE: outline phases on the submitted full size drawings. Prepare a separate set of phasing plans (Example "1B" of phasing drawings is attached).

3.2 Engineering Systems: Design so that, upon completion of a particular phase, VA personnel can occupy the entire area covered by that phase with all systems functioning properly.

3.3 Temporary System: The design may be such that a temporary system is necessary, which will be changed to a permanent system at some later point in the project. This temporary system must be satisfactory to provide proper functional and environmental conditions within the occupied space or the facility until the final system can be installed without major interruption of service. The A/E's submission shall highlight in writing (by technical discipline) for each phase all solutions including temporary solution(s) required to accommodate the phasing plan while keeping all systems functioning properly.

3.4 Phasing Diagram: An arrow diagram that shows the sequence and dependency of phases within the project.

4. EXAMPLE 1A:


PHASING DIAGRAM
EXAMPLE 1A
NTP
PHASE 1
PHASE 2
PHASE 3
PHASE 4
PROJECT
COMPLETE
430 CALENDAR DAYS

GENERAL: Work under this contract shall be divided into four (4) phases. The contractor shall perform the work in each phase in the logic sequence shown on the phasing network (Drawing CPM-2).

PHASE 1: Consists of alterations to the Maintenance Complex, alterations to Committal Service Shelters, and the development of gravesites.

PHASE 2: This phase shall begin after completion of Phase 1. Phase 2 consists of renovation to the existing assembly area, construction of the restroom building, and the development of gravesites.

PHASE 3: This phase shall begin after completion of Phase 2. Phase 3 consists of construction of the Garden Niche area, and the development of gravesites.

PHASE 4: This phase shall begin at Notice to Proceed and complete at the completion of the project. Phase 4 consists of the construction of the new lake B bypass channel and the development of gravesites.

5. SPECIAL PHASING REQUIREMENTS

A. Contractor shall construct dust partitions prior to the start of demolition and they must remain in place until the completion of that phase or subsequent phases where required.

B. Contractor shall perform all work in or adjacent to VA occupied areas in such a manner to ensure:

1) The continuous and uninterrupted use of all occupied areas, including the applicable mechanical and electrical systems serving these areas.

2) Protection of personnel in occupied areas from the hazards and dust associated with a construction environment.

3) The work areas are to be kept clear, clean, and free of loose debris, construction materials, and partially installed work which would create a safety hazard or interfere with personnel duties and traffic. The contractor shall sweep the areas clean at the end of each work day and make every effort to keep dust and noise to a minimum at all times.

C. Temporary interruptions or shutdown of any utility or electrical/mechanical system should be requested from the R/E 48 hours prior to the desired time, and should be performed at times other than the cemetery's normal hours of operation or as directed by the R/E.

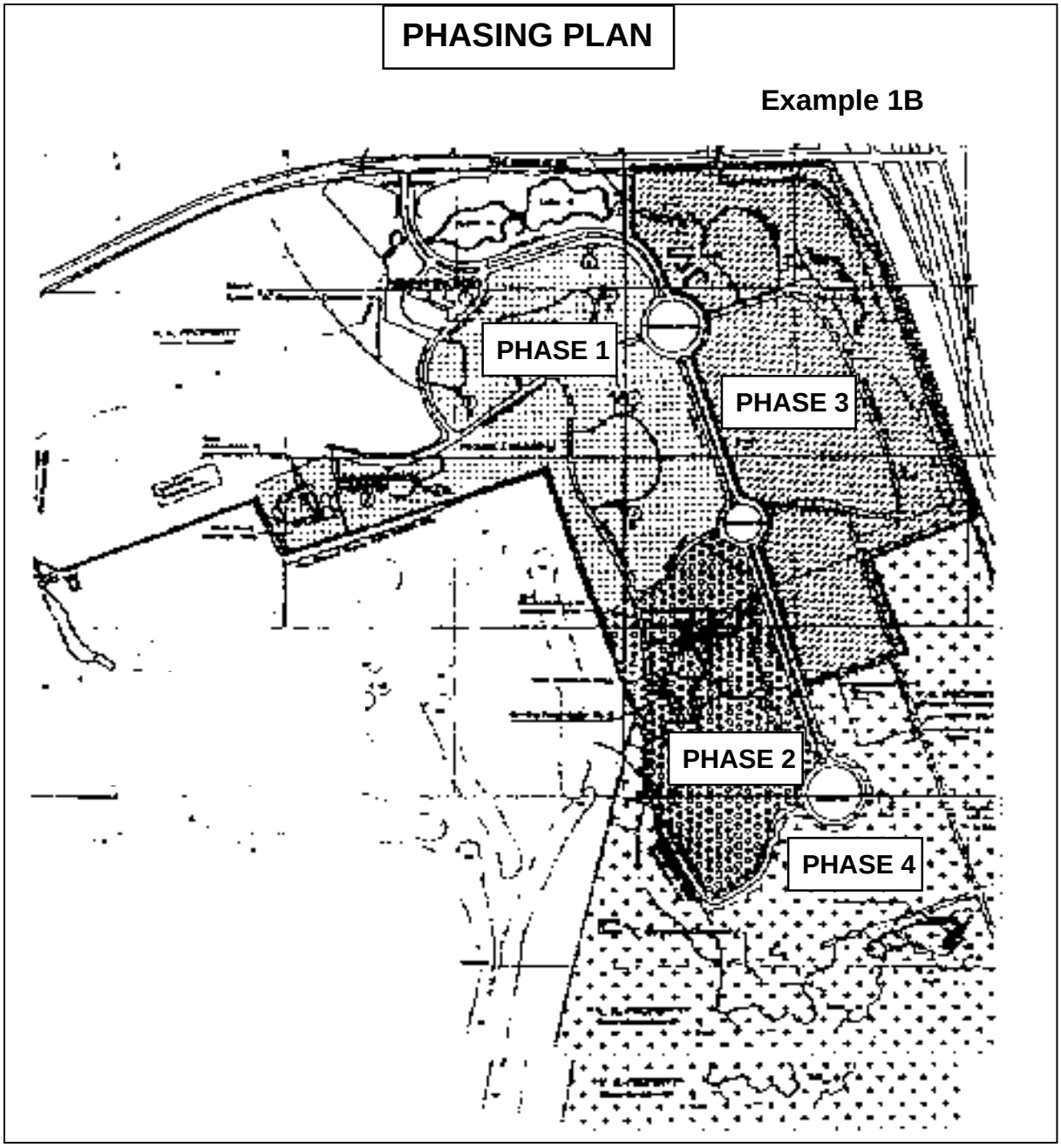
D. Two weeks (14 calendar days) prior to starting work in any phase, the contractor shall notify the R/E, in writing, of date he plans to complete the preceding phase. In no case will be contractor begin work in any phase without obtaining written approval from the R/E.

E. The sequence of work and duration as shown on the phasing diagram on Drawing CPM-___ are contractual and the contractor must complete all work

in each phase with VA inspecting and accepting the work, prior to the contractor proceeding to the next scheduled phase.

F. The sample CPM Network Drawing CPM-1 is for the contractor's information. The sample network indicates the level of detail and technique which will be required on the contractor's network and described in the NAS Section of the Specifications. The CPM notes and legend on Drawing CPM-1 are contractual.

5. EXAMPLE 1B: (See below)



5.11 GRAPHIC STANDARDS FOR NATIONAL CEMETERY PROJECTS DEPARTMENT OF VETERANS AFFAIRS

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1. DRAFTING STANDARDS

2. CAD SOFTWARE

3. SHEET BORDERS AND DRAWING TEMPLATE

4. DRAWING MATERIAL AND SIZE

5. SIZE AND SCALE

6. GENERAL INFORMATION

7. IDENTIFICATION OF DRAWINGS

5.11 GRAPHIC STANDARDS

FOR NATIONAL CEMETERY PROJECTS
DEPARTMENT OF VETERANS AFFAIRS

1. DRAFTING STANDARDS

A. In order to establish drafting standards for the preparation of design and construction documents using Computer Aided Drafting, the VA has adopted the entire National CAD Standard, latest release, and amended by “VHA National CAD Standard Application Guide”.

2. CAD SOFTWARE

A. The recommended CAD software platform is AutoCAD by AutoDesk, Inc. The most recent AutoCAD release is acceptable, with downward compatibility to the AutoCAD 2000 release

B. Other CAD software platforms are acceptable if their output files are convertible to .DWG format with an acceptable level of accuracy.

3. SHEET BORDERS AND DRAWING TEMPLATE

A. The standard VA title block, a template drawing sheet, and a standard AutoCAD .ctb file may be found on the TIL.

B. For Schematics and Design Development Drawings, stamp tracings or sepias above the title block in large font stating as appropriate either "Schematics ONLY" or "Design Development ONLY", and in small font "NOT for Construction".

4. DRAWING MATERIAL AND SIZE

A. Plot VA drawings on Mylar reproducible [photographic polyester base film, 76 µm (0.003 inch) minimum thickness], moist erasable image of high resolution.

B. Standard size sheets are 1069 mm (42 inches) long by 762 mm (30 inches) wide.

5. SIZE AND SCALE

A. Use minimum lettering height of 3 mm (1/8 inch) to permit microfilming at 1:30 and future enlargement of the microfilm to full size. Typewritten notes are preferable, although not required. Hold screening, shading, crosshatching and other indications of materials or locations to a minimum. Place symbols and lettering so that they are not confused with dimension lines, arrowheads, or other indications.

6. GENERAL INFORMATION

A. Organize and number drawings into technical classifications as listed in Item 5.11.7, Identification of Drawings.

B. Indicate scales by note for each plan, section and detail on each drawing. Provide graphic scales.

C. Show north arrow indicators on plan sheets.

D. Orient plans with North toward the top of the drawing.

E. Note section symbol on the referenced sheet location.

F. Indicate the relationship of details, plans, elevations, and sections, other than standard details, by cross-reference. Note the sheet number and drawing location of detailed feature on details and sections. Provide key plans on stair-section sheets to indicate the location of the stairs in the buildings.

G. Provide a key plan to show the location of a portion of a plan or elevation with respect to the total project.

H. Use standard VA legends, abbreviations, and symbols provided in VA documents PG-18-4, PG-18-5, and PG-18-14 when developing VA drawings and specifications.

I. Do not write specification information on contract drawings. Show notes or dimension information on the 1:100 (1/8 inch) scale drawings or 1:50 (1/4 inch) scale drawings, but not on both. Do not repeat drawing information on plans, elevations or details.

J. Clearly distinguish between new, existing, and replacement items of work.

K. Locate room names and room numbers within the spaces to which they apply and locate equipment symbols or names adjacent to the equipment shown on the floor plans, unless specific approval is obtained from the project manager to do otherwise.

L. Indicate all smoke barriers and fire-rated partitions only on architectural, HVAC, plumbing, and electrical 1:100 (1/8-inch) scale floor plans.

M. Show future expansions (both vertical and horizontal) by dotted lines on site plans, architectural floor plans, engineering floor plans, and in elevations and sections.

7. IDENTIFICATION OF DRAWINGS

A. Bind all drawings into sets and identify drawing classification, relative order of issue, amendment, and change order by symbols placed on drawing title blocks as described below:

Cover sheet (include Index to Drawings on small projects)
Index to Drawings start with X1
Sub-Surface Investigation start with B1
Site Development (including Irrigation and Demolition) start with L1
Sanitary start with W1
Irrigation.....I1
Demolition..... D1
Asbestos Removal start with ASB1
Architectural start with.....1
Structural start with S1
Heating, Ventilating, and Air Conditioning start with H1
Plumbing start with.....P1
Electrical start with E1
National Cemetery Master Plans start with.....MP1

1) Drawings for each new project shall begin with number one. The drawings will be distinguished by their project titles and dates.

2) The preferred method for classifying drawings is by identification of technical information shown on drawing, for example, Architectural or Electrical. However, an exception is made when one design discipline has limited work. Show this limited work on a drawing with another classification. The drawing number shall show the symbol for the major work classification; indicate that other work is shown on the same drawing by a description, such as in Plumbing, above the title block.

3) When work including two or more buildings is described on a single drawing, the sheet shall bear the number of the building involving the work of the major magnitude; indicate that work on other buildings is shown on the same drawing by a note above the title block.

B. Amendment Construction Drawings

1) Issue a drawing which is produced to supersede an original working drawing as a corrected photocopy Mylar reproduction of the original drawing, if practicable. Identify the number of this amendment drawing with the number of the sheet it replaces plus the suffix "R".

Identify additional replacements of the same drawing as - "R2"-"R3", etc. Note the revisions dates. Place the words "Amendment Drawing" above the title block with a statement of the original drawing which it supersedes.

2) Give a drawing, which supersedes a portion of an original working drawing, a new number in sequence with other drawing numbers. Place the notation Amendment Drawing above the title block with a statement of the drawing number of the original drawing it modifies. Insert the date of the amendment on the drawing. Place a cross reference note, on the superseded drawing, calling attention to the amendments.

C. Change Order Construction Drawings. Give a drawing, which describes the work involved in a "Change Order", a number in sequence with the original drawings. Place the words "CHANGE ORDER" above the title block with a statement of the drawing which it modifies or supersedes. Insert the date of the change order on the drawing. Place a cross reference note calling attention to the change order on the superseded or modified tracing. For reference prints in Central Office or on the project site in the possession of the Resident Engineer, stamp drawings with; "See Change Order Drawing No._____, dated_____."

D. Reissue Construction Drawings

1) When a complete set of working drawings is to be reissued without change, remove the original date and insert the new date of the reissue.
2) When a complete set of working drawings is to be reissued with changes, provide a photocopy Mylar reproduction of the original drawings, where feasible, with changes incorporated. These reproductions (or drawings) shall retain original dates and drawing numbers with the suffix - "R", but the reissue date shall appear in the Revision column.
3) When some drawings only of an entire set are changed, the entire set shall retain original dates and drawing numbers with the suffix "R" added; and the reissue date shall appear in Revision column of the changed drawings only.

E. Completion Item Construction Drawings. Completion Items are additional work required beyond the original contract and after its completion.

1) Provide drawings prepared to describe Completion Items with drawing numbers in sequence with last working drawing of a series, i.e., "Architectural", "Structural", "Electrical", etc., and earlier Change Order and Completion Item drawings. The Project Manager shall assign the drawing numbers. Insert the words, "COMPLETION ITEM NO._____" above the title block. The VA Project Manager shall assign the Completion Item numbers and drawing numbers.
2) Title blocks of Completion Item drawings shall bear the same project titles and project numbers as the original working drawings. A sheet title shall appear in the top spaces of the title block. Date the drawings to reflect the date on which prints and sepias were ordered for the VA Project Manager.

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