CHAPTER XI

BUILDINGS - GENERAL

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ANNE ARUNDEL COUNTY DESIGN MANUAL

CHAPTER XI

BUILDINGS - GENERAL

I. GENERAL

A. Introduction

This guide sets forth general requirements and criteria to be used in the development of a design and the preparation of bidding and construction documents for buildings for Anne Arundel County. It is applicable to all projects for construction, including additions, alterations, rehabilitation and conversion.

B. Definitions

ADA	Americans with Disability Act, Public Law 101-336, a civil rights law that prohibits discrimination on the basis of disability
Bond	A written and sealed obligation guaranteeing completion of a contract in the event that the contractor does not complete his agreement.
Building	Any man-made structure that supports or shelters any occupancy.
CAD	Computer Aided Drafting
Construction	All of the written, graphic and pictorial documents describing the design, Documents location and physical characteristics of the project.
Design Professional	The Architect or Engineer who designs a project
Plans	The drawings by which a project is constructed, including plans, elevations, sections, wall sections, schedules and details.
Specifications	The written standards that set the quality and level of materials and workmanship by which a project is constructed.

Tracing	The original translucent media with the markings that comprise the plans, reproducible by means of a photo-reactive paper, typically diazo or blueprint.

C. Codes

Building	B.O.C.A. 1993 with Amendments
Dwelling	C.A.B.O. 1992 with Amendments
Electrical	N.E.C. 1993 with Amendments
Plumbing	A.A. County 1993 with Amendments A.A. County Water and Sewer Master Plan A.A. County - Plumbing Code Design Manual
Mechanical	B.O.C.A. 1993 with Amendments
Energy	B.O.C.A. 1993
Accessibility	Americans with Disability Act, Public Law 101-336

D. Building Classifications

The classification of a building is used to determine attributes required of a building, such as life safety, permanence, level of finishes and such. It is project specific. Following are the classifications:

1. Public
2. Occupied
3. Unoccupied

E. Useful life

The useful life of a building is used to determine the level of quality of construction of a building and thus indirectly the cost of a building. Useful Life is project specific.

1. Temporary
2. Twenty year or less.
3. Greater than twenty years.

F. Submittals for review

The purpose of submittals for review is to provide the County a chance to see and understand the design of a building, and to then provide direction to the design professional to more closely conform to the County's needs.

1. Schematic Submission

The design professional shall submit a narrative report, conceptual drawings and a cost estimate with written descriptions of the work necessary to provide the required product. The drawings shall include the overall layout of the project, results of any field investigation, a report on any deficiencies noted, preliminary floor plan and all elevations of the building, a narrative description and engineering analysis of alternative HVAC system concepts and energy sources, and indication of source of electrical power.

Drawing requirements shall be in accordance with the provisions for Contract Drawings in Chapter I, Section II of this Manual.

a. Sketch site plan shall be at a minimum of 1"=40'. Plan shall show location of all existing buildings, roads, walks, utilities, flood plain, wetlands or critical areas within 200' of the building. It shall indicate proposed site improvements, grading, access, parking areas, utilities, paving, roads, etc.

b. Floor plans shall be double line and at a scale of 1/16" = 1'-0" or 1/8" = 1'-0". Overall dimensions shall be shown. Major areas, rooms and spaces shall be identified by name, actual net square footage, and programmed net square footage. Each floor plan shall also identify the net square footage and the gross square footage of the building.

c. Elevations of each side of the building shall be shown at 1/16" = 1'0" scale.

d. Dates and project identification shall be shown on each sheet.

e. Sheet size shall be 24 inches by 36 inches.

f. Number of copies shall be project specific.

2. Design Development

The design professional shall provide plans at full size, cost estimate, outline specifications, a fire protection analysis and any other design data or calculations.

Drawing requirements shall be in accordance with the provisions for Contract Drawings in Chapter I, Section II of this Manual, and the following:

a. Site plan shall be a minimum scale of 1" = 40'. Plan shall show location of existing buildings, roads, walks, utilities, flood plains, wetlands and critical areas within 200 feet of the proposed building and/or within the Contract. It shall indicate existing and proposed contours, site improvements, grading, sediment control, storm water management, access, paving, parking, new and existing underground utilities and services and points of entrance to the building.

b. Floor plans shall be double line and at a scale of not less than 1/8" = 1'-0". Overall dimensions shall be shown. Major areas, rooms and spaces shall be identified by name, actual net square footage and programmed net square footage. Each plan shall also identify the net and gross square footage of it; the first floor plan shall identify the net and gross square footage of the entire building.

c. Elevations of all sides of the building shall be shown at 1/8" = 1'0". These elevations shall be developed to a sufficient degree to establish character of design, materials, texture and color.

d. Sections through building shall be sufficient to establish the character and relationship of the spaces. Sections through walls shall be at a sufficiently large scale to illustrate floor-to-floor heights, ceiling heights, changes in height, and typical construction.

e. Engineering drawings shall at a minimum consist of a single line drawing of each system: Structural, Heating, Ventilation and Air conditioning, Plumbing and Electrical distribution. Drawings shall show equipment layouts for specialized rooms such as laboratories, mechanical rooms, kitchens, etc. Lighting, receptacle, telephone and special systems are also required. The single line drawing shall be of sufficient detail to communicate the intent of the system. Plans showing all equipment in the main mechanical rooms, elsewhere inside or outside the building, or on the roof shall be submitted clearly indicating adequacy of space to accommodate service and maintenance of the equipment.

f. Preliminary storm water management plans shall be submitted.

g. Dates and project identification shall be shown on each sheet

h. Sheet size shall be 24 inches by 36 inches.

i. Number of copies shall be project specific.

Outline Specifications:

a. Outline specifications shall clearly define all components of the systems and materials to be used on the project.

b. Number of copies shall be project specific.

Calculations:

a. Building and system load calculations of HVAC and plumbing systems shall be submitted.

b. Electrical calculations shall include:

1) Load and demand analysis
2) Load analysis for stand-by power rating
3) Lighting power budget per ASHRAE/IES 90.1
4) Lightning risk assessment per NFPA 78, Appendix I.

c. Number of copies shall be project specific.

3. Construction Documents (CD's)

The design professional shall prepare and submit plans and specifications to be used to solicit bids, award a contract, build the building, and serve to record what was built. These plans and specifications will be submitted in three phases, 65%, 95%, and Bid Ready. The design professional shall be encouraged to produce drawings on CAD. The system used shall be that currently used by the County. See Chapter I, Section II of this Manual for CAD drafting standards.

a. 65% Submission:

Drawing Requirements:

1) Site Drawings: 65% Contract Drawing (CD) submission is defined as 65% completion of each tracing that will constitute the final set of CD's, showing all existing and proposed conditions, materials, structures, fixtures, elements, furniture, equipment, etc., in sufficient detail to establish location, alignment and grade. The design professional shall mark review sets with "For Review Only, Not For Construction".

2) Architectural and Engineering Drawings: 65% Contract Drawing submission is defined, as 65 % completion of each tracing that will constitute the final set of CD's. The design professional shall mark review sets with "For Review Only, Not For Construction".

3) Building plans and details shall not be less than 1/8" = 1'-0". All drawings shall have graphic scales for each scale used.

4) Floor plans shall show complete arrangements of all spaces, with their relation to structural, mechanical and electrical clearly indicated. Structural, Plumbing, HVAC, and Electrical plans shall be developed to indicate and show complete systems to be used. Duct work shall be double line except in areas where not more than one duct is shown.

5) The elevations shall show and clearly indicate all design elements and the materials to be used, sections and details indicating any and all

requirements of the structure, along with properly shown story heights.

6) Drawings shall contain keys to materials, symbols and abbreviations and sufficient schedules (finishes, door, window, etc.) to provide the proper organization and coordination of drawings with specifications.

7) Structural notes that include the following shall be placed on one of the structural drawings:

   a) Design dead load, partition load and live load for each and every area of the building including the roof.
   b) Design bearing values for all spread footings and caissons, and bearing loads for piles.
   c) Concrete strength required for each part of the building
   d) Steel yield point strength for all structural steel and reinforcing bars.

8) On the first sheet of the mechanical drawings, include the following information:

   a) Total heat loss for the building in BTU, the ventilation load in BTUs, domestic hot water load in BTUs, and heating design temperatures inside and outside.
   b) Total heat gain for the building in BTUs, ventilation load for the building in BTUs, and indoor/outdoor temperature conditions and humidity.
   c) Total plumbing fixture units, domestic water consumption maximum demand in gph, and maximum gas consumption in cu. ft. per hour.

9) On the first sheet of the electrical drawings, include the following information:

   a) Total electrical load in KVA
   b) Total lighting and receptacles in KVA
   c) Total Power in KVA
   d) Largest motor Horsepower
   e) Estimated Emergency Power demand in KVA
   f) Type and size of stand by power units
   g) Telecommunication system description, features, interface, and definitions

Specification Requirements:

1) Specifications shall be prepared in the Construction Specifications Institute (CSI) division numbers Masterformat and Three Part Section format. Where trade names or proprietary items are identified, reference shall be made to approved equals. When approved name products are included, at least three acceptable brands shall be named. Hardware schedules are required. The design professional shall incorporate the keying system of the user.

Calculations:

1) Mechanical calculations shall include final load calculations for the Building, HVAC and plumbing, and equipment selection.

2) Electrical calculation shall include:

a) Load and demand analysis
b) Load analysis for stand-by power system, including sizing calculations for stand by equipment
c) Lighting power budget per latest revision of ASHRAE/IES 90.1.
d) Short-circuit analysis using ohmic or per unit method, depending on complexity of system.
e) Voltage drop analysis
f) Power factor correction
g) Lighting calculations
h) Pole classifications, guy vector diagrams and guy strength when overhead transmission systems are involved.

b. 95% Submission: Contract documents at 95% submission should be complete. At the final review meeting, the CD's shall be reviewed in total, to such an extent that the County and the using agency may be assured that upon submission of the final CD's the required signatures may be applied without delay.

c. Bid Ready Submittal: At the time of Bid Ready submittals, the design professional shall submit the original drawings, sealed and signed by the design professional, along with a minimum of two copies of the specification, one bound and one unbound. They shall also submit any updated calculations, or loads and demands. An updated cost estimate shall also be submitted at this time. The number of copies for this submission shall be job specific.

4. Geotechnical Report

a. Subsurface Exploration: The design professional shall plan and perform the subsurface exploration and evaluation and procure the information relative to the site and subsurface conditions relevant to the project requirements. The data procured shall be adequate, correct and reasonably complete for the intended purposes of planning, design, quantity and cost estimating, and determining the construction feasibility.

The work of subsurface exploration and evaluation shall be performed under the direct guidance, direction and control of the geotechnical engineer. All submittals relating to and including the results of the subsurface exploration, evaluation, and recommendations shall bear the seal of the geotechnical engineer.

b. Report: The design professional shall prepare a Geotechnical Report, which shall at a minimum address each of the following:

1) Geology: Geology and general nature of soil, rock, drainage and ground water conditions of the project area.
2) History: A history of the project site and relevant information relating to nearby foundations, structures, underground springs, etc.
3) Boring Plan: Boring plan to scale, indicating boring and test pit locations referenced to existing physical features, and proposed locations of structures and other facilities.
4) Boring logs: Boring and test pit logs, with soil and rock description, classification, and depth and character of fill, ground water observations, and any other observations, including ground surface elevations at boring and test pit locations.
5) Characteristics: Information relating to soil and rock character, consistency, compressibility, shear strength, safe bearing value, chemical content, corrosiveness, frost penetration depth, permeability and other relevant properties.
6) Rock Line: Rock line elevations with cross-sectional profiles, evidence that rock strata is sound and not underlain by mine cavities or lenses that would affect the stability and support capability.
7) Foundation Analysis: Foundation analysis and recommendations, including the presentation or risk and cost effectiveness considerations.
8) Foundation Information: All relevant foundation information, including design parameters, elevations of bottom of footings or pile tips, related soil bearing or pile capacity, factors of safety and settlement analysis considerations.
9) Recommendations: Recommendations for design and support of floor slab, retaining or basement walls, water or damproofing and drainage, underground utilities, pavements of roadways and parking lots, stability of slopes, ground water seepage control, and other stabilization procedures.

10) Site Evaluation: relating to excavation and earthwork feasibility. If rock excavation is involved, indicate definition, removal and handling equipment, blasting requirements, etc. If earthwork, indicate shrinkage factors, suitability of on-site/off-site material, and borrow requirements. Include groundwater observations, elevations and recommendations for temporary and permanent dewatering. Note effects of seasonal variations.
11) Potential Problems: Identify problems, which may affect the cost of construction and/or may cause delays, and furnish construction precautions and recommendations. Identify inspection testing and quality control requirements for construction.
12) Stormwater Management Recommendations: As to type of stormwater management facilities suitable for the site and design parameters to be used for system sizing.

II. DESIGN CRITERIA

A. Pre-Design Meeting

Prior to commencing any design work on a capital project, a pre-design meeting shall be held as provided in Chapter I, General Instructions. This meeting will discuss, at a minimum, the following design criteria pertinent to this Chapter, in addition to any items, which pertain to any other Chapters, which will govern the design of the project:

- Building Program, including programmed square footage for all spaces of the building.
- Number of Floors, Basement(s), Vertical Circulation
- Use or Occupancy Classification for the building, such as Assembly, Business, Educational, Institutional, etc.
- Programmed Number of Occupants
- Type of Construction for the fire rating of the building, such as Noncombustible, Type 1 Protected, Type 2 Protected, Type 2 Unprotected; Noncombustible/Combustible, Type 3 Protected, etc.
- Fire Protection Criteria: i.e. fully sprinklered, partially sprinklered, etc.
- Utilities to be provided/extended: water, sewer system (private or public), storm water, fuel source, power, communications, alarm and security systems, etc..
- Property Zoning
- Project Budget
- Project Schedule
- Energy Budget (if applicable)
- Vehicle Parking: Type, Location, Size, Number of Spaces
- Critical Review Submittal Schedule: i.e., MDE, SHA, County Highway, etc.
- Special Criteria: i.e. Passive Solar Design, Ice Storage, "Green Building" Criteria, Historic District, Special Aesthetic goals, etc.

B. Site Plan

1. General

The building should be simply designed and sited as appropriate to the project. The location should provide for any future expansion requirements. Building location shall comply with all local requirements for setbacks.

2. Landscape Design

Landscaping provides an opportunity for aesthetic improvement and can provide an opportunity to enhance the energy efficiency of the building. Solar orientation, planting and berming should be considered during the early stages of design.

Plant and tree selection should provide permanent, low maintenance vegetation appropriate to the location. Consideration should be given to adjacent property and structures to prevent adverse impact. Trees shall be carefully selected to prevent clogged gutters and drains from leaves and blocked sewer lines from root infiltration. The planting design should be simple and orderly using a minimum of plant types and materials for framing and background aesthetics, and the screening of service areas, parking areas, and other objectionable views. Selected plant material shall be of local, hardy species that are tolerant of specific site conditions.

Planting shall be included as an integral part of the design of the project, and the location, size and quantity shall be clearly indicated on the plans.

C. Design Loadings

1. Wind: Follow applicable building codes, unless there are project specific requirements.

2. Snow: Follow applicable building codes, unless there are project specific requirements.

3. Public Areas: 125 lbs per sq. ft. of floor, unless there are project specific requirements.

4. Non-Public Areas: Follow applicable building codes, unless there are project specific requirements

5. Other

D. Concrete

1. Mixes

   a. All concrete shall have a minimum compressive strength of 4,000 psi at 28 days unless superseded by project specific requirements.

   b. All exterior concrete shall be air entrained up to 6% air entrainment.

2. Reinforcement

   a. All reinforcing bars shall conform to ASTM A-615-94, deformed bars, Grade 60.

   b. All welded wire fabric shall conform to ASTM A-185-94.

3. Cast-in-Place Concrete

   a. Reinforced concrete shall be detailed and installed in accordance with American Concrete Institute publication, ACI 301-89 "Specification for Structural Concrete for Buildings".

   b. Reinforcing steel shall be detailed in accordance with American Concrete Institute publication ACI 315-92 "Details and Detailing of Concrete Reinforcement" and ACI 315R-94, "New Manual of Engineering and Placing Drawings for Reinforced Concrete Structures".

4. Precast Concrete

   a. Architectural pre-cast concrete shall be designed and installed in compliance with Precast/Prestressed Concrete Institute publication "Architectural Precast Concrete", Second Edition, 1989.

   b. Structural pre-cast concrete shall be designed and installed in compliance with Precast/Prestressed Concrete Industry publication "PCI Design Handbook-Precast and Prestressed Concrete", Fourth Edition, 1992.

5. Parking Decks

   a. Parking structures shall be designed and installed in compliance with Precast/Prestressed Concrete Industry publication "Parking Structures: Recommended Practice for Design and Construction", 1988.

   b. Evaluation of epoxy-coated reinforcing should be performed in light of life cycle cost related to actual maintenance and replacement costs for existing structures.

c. Evaluation of special top coatings for both exposed decks and other decks should be performed in light of life cycle costs, coefficient of friction (slipperiness), and appearance.

E. Masonry

1. Mortar Mixes

a. Mortar mixes for brick shall be selected in accordance with the recommendations of "Technical Notes on Brick Construction No.8, Rev.2, 1989", published by the Brick Institute of America.

b. Mortar mixes for concrete masonry units shall be selected in accordance with the recommendations of the "Concrete Masonry Handbook for Architects, Engineers and Builders", 1991, published by the Portland Cement Association.

c. Use of other specialized mortars may be indicated by project specific conditions, such as refractory brick or high sulfate conditions.

2. Exterior Walls

a. For exterior walls with a life of more than twenty years, all masonry cavity wall construction is appropriate. For exterior walls that are temporary in nature, masonry is generally not appropriate. For other cases, masonry cavity or solid walls are preferable to masonry faced stud construction.

b. Use of walls as shear walls for seismic and wind loads is acceptable; additional bond beams and reinforced pilasters may be required.

3. Interior Walls

a. Interior walls of masonry are acceptable, though sometimes not cost effective.

b. Verify adequate lateral support for interior walls, as well as height/thickness ratios.

4. Decorative Finishes

a. Exterior Walls: Decorative finishes for exterior walls should come from the character of the materials, i.e. brick color and pattern, mortar color, block texture, etc. Application of paint or other decorative material, e.g. stucco, should be reserved only for the most utilitarian concrete masonry structures.

b. Interior walls: In occupied areas, C.M.U. walls may be painted.

F. Structural Steel

1. Applicability of Various Grades

The selection of steel grades for buildings will be project specific. Normal grade of steel for building construction is A.S.T.M. A-36.

2. Shop Coatings

a. Insure that shop coatings are compatible with finish coating specified, particularly if high-performance finish coat is specified.

b. Avoid the use of primers that contain environmentally unacceptable metals, i.e. lead, chrome, mercury, etc.

3. Finishes

a. Exposed steel should be painted. In highly corrosive conditions, a high-performance coating system should be selected.

b. Tight-rust steel requires special design consideration. Constraints include exposure, atmosphere, run off of rust stains, and life of structure.

c. Aluminum finishes will be considered job specific.

d. Other more noble metals, such as copper, brass or bronze, generally do not require finishes. Use of a finish shall be project specific.

G. Wood and Plastics

1. Fasteners and Adhesives

a. Use of fasteners and adhesives shall be in compliance with the recommendations of the species grading criteria agency.

b. Use of adhesives should be carefully considered in the construction of fire rated construction.

2. Timber Construction

Timber construction shall be in compliance with the requirements of the "Timber Construction Manual", Third Edition, 1985, published by the American Institute of Timber Construction.

3. Wood Preservatives

a. Wood treated with preservatives shall be in compliance with the requirements of the "AWPA Standards for Softwood Lumber and Plywood", published by

the American Wood Preservers Association. Specification shall be appropriate of use of the wood.

b. Disposal of preservative treated wood scrap shall conform to all local ordinances.

4. Prefabricated Wood Structural Members

a. Prefabricated wooden trusses shall be in compliance with the requirements of the "Design Specification for Metal Plate Connected Wood Trusses (Roof), TPI-85", or "Design Specification for Metal Plate Connected Parallel Chord Wood Trusses (Floor), PKCT-80", published by the Truss Plate Institute.

b. Erection of prefabricated wooden trusses shall be in compliance with the requirements of the "Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses, HIB-91", published by the Truss Plate Institute.

c. Glued laminated timber shall be in compliance with the requirements of "Standard Specification for Structural Glued Laminated Timber of Softwood Species, AITC 117" or "Standard Specification for Hardwood Glued Laminated Timber, AITC 119", published by the American Institute of Timber Construction.

5. Prefabricated Structural Plastics

Use of prefabricated structural plastics shall be carefully coordinated with the design of the fire protection system used, due to the potential combustibility of such construction.

H. Thermal and Moisture Protection

1. Roofing

a. Roofing shall be installed in compliance with the recommendations of "The NRCA Roofing and Waterproofing Manual", 1990, published by the National Roofing Contractors Association.

b. Minimum roof pitch shall be 1/8 inch per foot. Dead level roofs are prohibited. A greater pitch is preferable.

2. Wall Systems

In the selection of a wall system to resist thermal and moisture migration, it is preferable to have redundant layer of resistance, i.e., a cavity wall rather than a single width, or a double gasketed panel system rather then a single sealant joint.

3. Dampproofing and Waterproofing

   All occupied spaces that are below final grade shall be protected by exterior applied waterproofing. Type of waterproofing shall be project specific. Addition of a water conveyance system at the bottom of the waterproofing is necessary.

I. Doors and Windows

1. Hollow metal doors and frames shall comply with the requirements of the appropriate specification HMMA 860 through 865 of the Hollow Metal Manufacturers Association. Hollow metal doors shall not be used in sewage treatment facilities, water treatment facilities, and in water and sewage pump stations.

2. Wooden doors and frames shall comply with the requirements of the American Wood Institute Specifications, Section 1300, 6th edition. Wood doors shall be warranted for the life of the installation for non-rated interior doors, one year for rated interior doors, and one year for exterior doors.

3. Fiberglass doors and frames shall be used in sewage treatment facilities, water treatment facilities, and water and sewage pump stations.

4. Aluminum window unit shall bear the AAMA label warranting that the window complies with ANSI/AAMA 101-1985, “Aluminum Prime Windows and Sliding Doors”.

5. Wood windows shall comply with the appropriate grade of the ANSI/NWWDA “Standards for Wood Window Units I.S. 2 - 87".

6. Hardware: Key to using agency’s standard keyway.

J. Finishes

1. Walls

   Wall finishes should be selected considering traffic and the wear the wall will see. Protection such as rub rails or protective plates shall be used if appropriate. Generally wall finishes are project specific.

2. Flooring

   Selection of flooring shall be project specific.

3. Ceilings

   Selection of a ceiling system shall take into consideration access to building systems concealed within the system, and the probability of changes to those systems for the life of the building.

4. Special Surfaces

   Finishes for special surfaces shall be project specific.

5. Painting

   a. VOC content of paints specified shall comply with current standards for the State of Maryland.

   b. Painting systems shall be project specific.

6. Coatings for Corrosion Protection

   a. The level of performance for coatings in corrosive environments should be appropriate for the level of potential risk.

   b. Increased quality control, such as increased inspection, film thickness tests, etc. may be necessary to ascertain the level of performance of these systems.

K. Specialties

1. Signage and Identifying Devices

   Signage systems shall comply with ADA requirements for size, tactile surface, Braille strips, contrast, mounting height, etc.

2. Pedestrian Control

   Pedestrian control devices shall comply with all ADA requirements for clearances, operating force, etc. If devices do not comply, provide a easily operated means of bypass around the device. The bypass shall comply with all ADA requirements, but can be supervised locally or remotely.

3. Fire Protection

   a. Fire protection requirements shall conform to the requirements of the applicable building code for occupancy and type of construction.

   b. Public and occupied buildings other than temporary shall be fully sprinklered.

   c. Extinguisher type and location shall conform to the requirements of NFPA 10-94.

d. Automatic fire detection systems shall conform to the requirements of the applicable building code.

4. Exterior Sun Control Devices

a. The use of exterior sun control devices shall be investigated when fenestration area exceeds 15% of the exterior wall area on the south and west walls, or 25% on the north and east walls. An analysis of the use of exterior sun control devices versus the use of high performance glazing systems shall be performed.

b. Integration of exterior sun control devices and day lighting assemblies is desirable.

L. Special Construction

1. Liquid and Gas Storage Tanks

a. General: Tank capacities, dimensions, construction and thickness shall be in strict accordance with UL-58 and designed for a minimum thirty (30) year life for underground storage of heating oil. Tanks shall meet the requirements of ACT-100 specification. Each tank shall be fitted with welded and coated connections for external and internal piping, sized appropriately for expected consumption rates. Each tank opening shall be designed to withstand a minimum of 150 foot-pounds of torque and 1,000 foot-pounds of bending with a minimum 2 to 1 safety factor and shall be provided with threaded connections conforming to American National Standards Institute Standard B2.1 (ANSI B2.1) and include a full-sized threaded dielectric bushing. Anchor straps shall be provided.

Tank removal shall involve notification to the Maryland Department of the Environment, Hazardous and Solid Waste Management Administration, Underground Storage Tank Division, at least 48 hours prior to commencing any excavation for tank removal. All flammable or combustible liquids, and / or sludge shall be removed from the system and disposed of in accordance with all Federal, State, and Local requirements. All existing supply pipes, vents, filler pipes, etc. shall be completely removed and properly disposed of. All saturated soils found in the tank excavation shall be disposed of in accordance with all Federal, State, and Local requirements.

Reference drawings for liquid and gas storage tanks are available as a separate document from the County DPW. These reference drawings provide the design professional with the minimum notes, details and drawing layouts which the DPW requires on design drawings for liquid and gas storage tank installations.

b. Pre-Design Meeting: Prior to commencing any design work, a pre-design meeting shall be held as provided in Chapter I, General Instructions. This meeting will discuss, at a minimum, the following design parameters pertinent to this Chapter, in addition to the items which pertain to any other Chapter which will govern the design of the project:

1) Tank Construction

2) Fill Connection Details

3) Vapor Recovery Methods

4) Vent Piping Detail

5) Suction Piping

6) Fuel Dispensing Equipment Required

7) Emergency Shutoff Method

8) Monitoring Method

c. Demands: Fuel storage tanks must meet the required storage capacity for the specific application. The design capacity for the underground fuel storage tank shall consider existing and projected fuel consumption rates. Prior to installation, the tank(s) shall be carefully inspected and the coating checked for damage. Any damage shall be repaired in strict accordance with the tank manufacturer's requirements.

Concrete shall be cured per Chapter 8 - "Curing, Weather Protection and Joint Filling" of ACI 1987. All areas disturbed by tank removal or installation shall be restored with sod, gravel driveway shall be restored with CR6 and gravel.

The demolition and installation of underground fuel storage tanks shall conform to the following Regulations, Codes, and Standards:

1) National Fire Protection Association Standard 30 and 30A, "Flammable and Combustible Liquids Code" and "Automotive and Marine Service Station Code"

2) National Fire Protection Association Standard 70, "National Electrical Code"

3) National Fire Protection Association Standard 328, "Flammable and Combustible Liquids and Gases in Manholes, Sewers, and Similar Underground Structures"

4) National Fire Protection Association Standard 329, "Recommended Practice for Handling Underground Leakage of Flammable and Combustible Liquids"

5) American Petroleum Institute Publication 1615, "Installation of Underground Petroleum Storage System"

6) American Petroleum Institute PEI RP-100-87, 1987, "Recommended Practices for the Installation of Underground Liquid Storage Systems"

7) Federal Environmental Protection Agency, "Underground Storage Tank"

8) Underwriter's Laboratories Inc. UL 58, "Specifications for Underground Storage Tanks"

9) Underwriter's Laboratories Inc. UL 412, "Specifications for Aboveground Tanks"

10) The Association for Composite Tanks (ACT)

11) Maryland Department of the Environment, COMAR 26.10.01, "Oil Pollution and Tank Management"

12) Anne Arundel County Building and Fire Codes

d. Finishes: Tanks shall be designed to prevent internal and external corrosion as outlined in Chapter I - General Instructions and Paragraph I of this Chapter. The weight of the tank shall be clearly marked on its exterior.

e. Service Connections: Service connections shall be designed in accordance with the details provided in the Reference Drawings for Liquid and Gas Storage Tanks, and shall, at a minimum, address the following:

1) Overfill prevention shall be provided on underground tanks. A spill container for the fill shall also be provided. The spill container shall be corrosion resistant, be equipped with a removable drain and have a minimum 5-gallon capacity.

2) Above ground storage tanks shall be fitted with containment dikes for spill protection. The dike shall have 110% capacity for the enclosed tank.

3) A vapor recovery connection shall be provided.

4) Tank shall be properly vented and shall have electronic leak detection equipment.

f. Distribution Lines (If Required): Distribution lines, if required, shall be designed in accordance with the details provided in the Reference Drawings for Liquid and Gas Storage Tanks, and shall address, at a minimum, the following:

1) Suction piping shall be provided for connection to dispensing system of choice.

2) Connection from suction piping to the dispensing system shall be equipped with an emergency shut-off valve.

3) Fuel dispensing island (if required).

g. Civil: Civil work shall be designed in accordance with the details provided in the Reference Drawings for Liquid and Gas Storage Tanks, and shall address, at a minimum, the following:

1) Fuel dispensing island (if required) shall be equipped with bollards to prevent potential collision damage.

2) Excavation and support for underground storage tanks.

h. Backfill: Underground tanks shall be backfilled with washed pea gravel, a clean naturally rounded aggregate 1/4" nominal size, ranging from 1/8" to 3/4" diameter. Backfilling and compaction shall be in accordance with tank manufacturers recommendations.

2. Pre-Engineered Structures

Drawings and calculations for pre-engineered structures shall be signed and sealed by a Professional Engineer registered in the state of Maryland.

3. Solar Energy Systems

a. Active solar energy systems shall have an economic payback not to exceed ten years.

b. Passive solar energy systems shall have an economic payback not to exceed twenty years.

4. Fire Suppression Systems

Installation of sprinkler systems shall comply with the requirements of NFPA 13-94, Installation of Sprinkler Systems.

5. Fall Protection

   The design professional shall design and specify temporary and permanent fall protection for all floor and wall openings in buildings in accordance with the requirements of the latest edition of OSHA 29 CFR, Chapter XVII, Paragraph 1910.23. Fall protection includes, but is not limited to railings, toeboards, screens, covers, hatches, grills, slats and fences. Floor openings include, but are not limited to, ladderways, hatchways, trap doors, chute openings, pits and manholes. Wall openings include, but are not limited to chute openings, low windows, temporary openings and openings where there is a hazard of material falling through the opening. Open sided floors, platforms, runways, and stairways shall likewise be protected in accordance with the same OSHA regulations.

M. Mechanical

1. Plumbing

   a. Potable water lines shall be copper, type L, for lines 3 inches and smaller. Larger sizes shall be galvanized steel.

   b. Soil, waste, drain and vent lines below grade shall be standard weight cast iron. Soil, waste, drain and vent lines above the lowest floor shall be standard weight cast iron or galvanized steel.

   c. Heating water lines larger than 3 inches shall be black steel. Smaller sizes shall be the same as potable water lines.

   d. Fuel oil piping shall be black steel, standard weight.

   e. Gas piping, low pressure, shall be black steel, standard weight.

   f. Plumbing fixtures shall be the water conserving type.

2. Heating, Ventilation and Air Conditioning

   a. General: Mechanical systems shall be designed in accordance with the provisions of the ASHRAE Guide and data book.

   b. Selection of energy source for the heating system shall be based on a comparison of all energy sources available at the site. The design professional shall prepare a life cycle cost analysis supporting the type proposed. This analysis shall address the differential in initial construction costs and the annual operating/maintenance costs for all fuels. Calculations shall be in discounted dollars and shall utilize documentable local fuel costs and certain escalation forecasts as prepared by the Department of Commerce.

3. Automatic Temperature Controls

   a. A system of electrically/electronically operated controls shall be provided. If the building is an addition, verify compatibility with existing systems. Systems providing direct digital control (DDC) are preferred.

   b. Zoning shall be used in lieu of individual room controls.

   c. A programmable timer with relays should be used to conserve energy by providing the ability to preset appropriate temperature levels for weekends, holidays and other times of non-occupancy.

   d. An outdoor temperature sensing control shall be used to shut off heating system when the outdoor temperature reaches sixty five (65) degrees Fahrenheit.

4. Testing and Balancing Completed Systems

   a. Upon completion of installation and field testing, performance-test and adjust the supply, return, make-up and exhaust air systems, and hot water heating systems, to provide the air volume and water flow quantities called for in the contract documents. Accomplish all work in accordance with the agenda and procedures specified in the Associated Air Balance Council (AABC) publication #71679 or the Procedural Standards of the National Environmental Balancing Bureau (NEBB).

   b. Provide a report of the testing and balancing work that includes the following:

      1) A general description of each air and water system with their associated equipment, and operation cycles for heating, intermediate and cooling. Where different cycles are used for day and night, they shall be described independently.

      2) A complete listing of all air and water flow and air terminal measurements performed.

      3) Specific test pressures and parameters for determining specific quantities; e.g. flow drafts from the actual field measurements.

      4) Detailed description of performance test procedures and the location of all test openings.

5. Energy Conservation

   a. General: Energy efficiency, selection and availability are a design requirement, which at a minimum will involve consideration of the total least

cost, current and future availability, environmental compatibility and renewability.

b. Buildings shall be sited to utilize winter sun, prevailing winds, and natural landforms. Landscaping and plantings shall be used for shading the summer sun and blocking winter winds.

c. Evaluate the use of earth berms against exterior walls. Decision for use is project specific.

d. Provide enclosed vestibules at high use entrances in heavily occupied buildings.

e. Energy conservation requirements are given in CABO MEC-95, Model Energy Code.

f. Provide destratification fans in high bay spaces that are occupied.

g. If any exhaust hoods are required in kitchens or elsewhere, evaluate the type that supplies untempered make-up air through an outer jacket of the hood, so that minimal conditioned air is exhausted.

N. Electrical

1. Service and Distribution

a. General: The interior electrical distribution should be designed for the most efficient and economical distribution of power, using the highest voltage consistent with the load served. A three (3) phase, 208/120 volt system will be the minimum, with the use of a 480/277 volt system where loads are sufficient to justify it.

b. Ground fault protection shall be used in accordance with NFPA 70.

c. Power and lighting panels, telecommunication and electrical equipment should not be located in the maintenance/custodial area or in storage rooms; provided small electrical closets, or mount discreetly in corridor walls.

2. Lighting

a. General: Energy efficient fluorescent lighting fixtures and tubes should be used throughout. Metal halide fixtures may be used where appropriate, such as in high bays. Lighting levels shall conform to the recommendations of the Illuminating Engineering Society (IES).

b. Emergency egress lighting shall generally be by use of dual purpose fluorescent fixtures at appropriate locations, such as corridors, stairs, and

exitways, in preference to a dedicated battery pack emergency light. If battery packs are used, they shall be hard-wired, not plug-in type.

c. Exterior lighting shall be provided to illuminate sidewalks from parking areas to the building, and other areas as required for safety and security. Exterior lighting type shall by metal halide. Vandal resistant lenses shall be provided where appropriate. Exterior lighting should not be directed onto neighboring properties. The minimum level of exterior lighting shall be a 0.2 foot candle, measured at the point (to be illuminated) farthest from the light fixture. Exterior lighting fixtures should be equipped with photoelectric cells for control. A time clock control system may be provided on a job specific basis.

d. Exterior architectural lighting may be provided on a job specific basis if the architectural character of the building and its prominence in the community make it appropriate.

3. Special Systems

a. Fire alarm systems shall be provided on all occupied buildings; particular type and design shall be job specific. Fire alarm systems shall comply with the requirements of NFPA 72-93, National Fire Alarm Code. Requirements for a fire detection system and type and design shall be job specific.

b. Requirements for intrusion detection and alarm systems shall be job specific.

c. Environmental hazard detection and alarm systems shall be provided if installation of a potential hazard (such as a buried fuel tank) is part of the building project.

4. Communications

a. General: The design professional shall coordinate with the Information Systems Office of Anne Arundel County to determine particular requirements for telephone and telecommunication systems.

b. The design professional shall include in the contract work exterior trenching, conduit and cable to the terminal board, the terminal board, cable tray and/or conduit, outlet boxes, associated wiring, any cabinets and cabinet mounting boards and outlets.

5. Lightning and Surge Protection

a. Requirements for lightning protection are job specific.

b. Requirements for surge protection are job specific.

6. Energy Conservation

   The use of high efficiency lighting and high efficient fluorescent lighting shall be mandatory.

III. CONTRACT DRAWINGS AND DOCUMENTS

A. Reports

1. Required Submittals: See paragraph 1.F.3 of this Chapter.

2. Format

   a. General: All reports shall be standard paper size, 8 ½" x 11", bound, with drawings not to exceed 11" x 17" unfolded. Larger drawings shall not be bound into the report

   b. See Chapter 1, Paragraph II.C.

B. Design Computations

1. Structural calculations shall include:

   a. Roof live, dead and snow loads

   b. Roof uplift restraint

   c. Roof framing

   d. Floor loading

   e. Supported floors

   f. Supported floor framing

   g. Slabs on grade

   h. Columns

   i. Bearing walls

   j. Basement and retaining walls

   k. Foundations

   l. Lateral loading, both wind and seismic

   m. Lateral load resistance system

2. Mechanical calculations shall include final load calculations for the Building, HVAC and plumbing, and equipment selection.

3. Electrical calculation shall include:

   a. Load and demand analysis

   b. Load analysis for stand-by power system, including sizing calculations for stand by equipment

   c. Lighting power budget per latest revision of ASHRAE/IES 90.1.

   d. Short-circuit analysis using ohmic or per unit method, depending on complexity of system.

   e. Voltage drop analysis

   f. Power factor correction

   g. Lighting calculations

   h. Pole classifications, guy vector diagrams and guy strength when overhead transmission systems are involved.

C. Specifications

Specifications shall be prepared in the Construction Specifications Institute (CSI) division numbers Masterformat and Three Part Section format. Where trade names or proprietary items are identified, reference shall be made to approved equals. When approved name products are included, at least three acceptable brands shall be named. Hardware schedules are required. The design professional shall incorporate the keying system of the user.

D. Contract Drawings

Drawing Requirements shall be in accordance with the provisions for Contract Drawings in Chapter I, Section II of this Manual.

E. Estimates

Cost estimates shall be prepared in accordance with the provisions for Cost Estimates in Chapter 1, Section II, Paragraph K of this Manual.

IV. CONSTRUCTION

A. Record of Pre-Construction Condition

It shall be the Contractor's responsibility to keep records of any pre-construction conditions that affect his responsibilities under this contract. Records may be written, photographic, or videotape. The Contractor shall review all records of existing conditions with the County's inspector at the time of recording.

B. Contractor Bonds and Certifications

1. Performance and Payment Bonds are required when the amount of the initial contract award, including base bid and any alternates awarded, is in excess of $100,000.

2. Each of the bonds shall be in the full amount of the contract price.

C. Contractor Safety Requirements

1. The Contractor shall provide and maintain work environments and procedures, which will:

   a. Safeguard the public, workers on site, County personnel, property, materials, supplies and equipment exposed to contractor operations and activities;

   b. Avoid interruptions of County operations and delays in project completion dates; and

   c. Control costs in the performance of this contract.

2. For these purposes, the Contractor shall:

   a. Provide appropriate safety barricades, signs, and signal lights;

   b. Comply with the provisions of the Maryland Occupational Safety and Health Act;

   c. Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

   d. Comply with all the requirements of the contract and any additional safety measures the Country determines to be reasonably necessary.

D. Shop Drawings

1. Shop drawings, product data, samples, etc., shall be submitted as provided for in Chapter I, Section IV, of this Manual.

2. After checking and verifying all field measurements and after complying with applicable procedures specified in the contract documents, contractor shall submit to the architect for review and approval, in accordance with the contractor's schedule, shop drawings and other submittals, which will bear a stamp or specific written indication that the contractor has satisfied its responsibility under the contract documents with respect to the review of such submissions. The data on the shop drawing or submittal must be complete with respect to quantities, dimensions, specified performance and/or design criteria, materials and similar data to enable the architect to review the information as required. These documents shall be prepared in conformance with the best practice and standards of the trade concerned. Due regard shall be given to speed and economy of fabrication and erection.

3. All shop drawings and submittal must show the name of the project and the County's contract number.

4. Size of the drawings: All shop drawings and details submitted to the architect for approval shall be printed on sheets of the same size as the contract drawings prepared by the architect. Sheets larger than the architect's drawings will not be accepted except when specifically approved by the County. It is acceptable to print more than one drawing on a sheet the size of the architect's drawing. It is acceptable to use an 8 ½" x 11" sheet for schedules and small details.

5. Items for which shop drawings will be required: Shop drawings shall be required for all items which are specifically fabricated for the building, or when the assembly of several items is required for a working unit. Shop drawing requirements shall be specified in each specification section.

6. Copies to be required: Contractor shall supply two copies of shop drawings and submittals for the architect's file and two copies for the County, in addition to such copies as the contractor may desire to be returned for his own use.

E. As-Built Record Requirements

1. Record drawings shall be maintained and submitted as provided for in Chapter I, Section IV, of this Manual.

2. The contractor shall be required to compile and prepare Record Drawings, Operations and Maintenance Manuals, and Record and Information Manuals for the building.

   a. Record Drawings: The contractor is to record by drafting all change order items, alterations, and precise locations of underground and other concealed work on a clean, undamaged set of blue or black line prints of the Contract Drawings and shop drawings.

b. Operation and Maintenance Manuals: The contractor is to prepare manuals that contain a complete description of each mechanical, plumbing, and electrical system in the building containing the following:

1) Manufacturer's shop drawing and submittal data, showing all model numbers and equipment capacities and characteristics, and manufacturer's cut sheets on equipment furnished.

2) Manufacturer's installation manual, service manual and parts list, including maintenance and lubrication instructions.

3) Name, address, and telephone number of local or nearest Manufacturer's representative.

4) Name, address, and telephone number of firm or persons to perform service work during guarantee and warranty period.

5) Descriptions of each system installed and operating instructions.

6) "As installed" control diagrams and description of sequence of operation by the Control Manufacturer.

7) Complete "as installed" color-coded wiring diagrams of refrigeration system and all electrical connection of other mechanical equipment.

8) Copies of all valve charts.

9) Copies of pipe, ductwork, and equipment charts.

10) Electrical panel circuit identification charts.

11) Manufacturer's and Contractor's guarantees.

c. Record and Information Manuals: The contractor shall prepare two separate books, one for Division 15 Mechanical, and Division 16 Electrical, which shall contain complete description of each mechanical and electrical system for the building. These shall include the following items:

1) Complete catalog data on each piece of HVAC equipment furnished.

2) Maintenance and lubrication instructions for each piece of HVAC equipment furnished, on the letterhead of the manufacturer of the equipment.

3) "As-built" temperature control diagram by the control manufacturer

4) Complete catalog data of each motor control center furnished.

5) Complete catalog data of each distribution panel.

6) "As-built" motor control center and panel schedules

7) Complete catalog data of fire alarm system, including intercommunication logic.

8) Catalog cuts of all lighting fixtures, showing in which rooms they are installed.

F. Warranty

The contractor shall be obliged to warrant for the period specified below the following:

1. That the work contains no faulty or imperfect material or equipment, nor any imperfect, careless or unskilled workmanship.

2. That all mechanical and electrical equipment, machines, devices, etc., shall be adequate for the use to which they are intended, and shall operate with ordinary care and attention in a satisfactory and efficient manner.

3. That he will re-execute, correct, repair, or remove and replace with proper work without cost to the County any work found not to be as guaranteed by this section or otherwise not in conformity with the contract, and that he will make good all damages caused to other work or materials in the process of complying with this section.

4. That the entire work shall be watertight and leak-proof in every particular.

5. County Projects: Two years

6. Developer Projects: One year

7. Federal Aid Projects: Two years

8. Individual's Projects: To be project specific.

G. Equipment Training, Testing and Start-Up

Upon reaching substantial completion, the contractor shall provide training to County personnel for start-up and operation of all moving equipment. Equipment, number of personnel and duration shall be project specific.

H. Extra Material and Spare Parts

The amount of extra material and spare parts for equipment shall be project specific.

V. APPENDIX

A. References

B. Design Check List

C. Construction Inspection Check List

APPENDIX A

REFERENCES

A. The BOCA National Building Code, 1993
B. The National Electrical Code, 1993 (NFPA 70-93)
C. The BOCA Basic Mechanical Code, 1993
D. The Anne Arundel County Plumbing Code, 1993, with amendments.
E. The BOCA Energy Conservation Code, 1993
F. The Americans with Disabilities Act, 28 CFR Part 36

APPENDIX B

DESIGN CHECK LIST

A. Title Sheet

1. Name of Project
2. Location Map
3. Vicinity Map
4. Index of Drawings
5. Code Information:
    a. Type of Construction
    b. Occupancy
    c. Permitted Area and Height
    d. Permitted Area Increase from sprinkler
    e. Permitted Area Increase from free perimeter
    f. Actual Area & Height
    g. Number of Occupants
    h. Fire Resistance Rating of Building Components
        1) Shafts
        2) Interior bearing walls
        3) Columns
        4) Corridors
        5) Beams supporting walls
        6) Exit enclosure/fire doors
        7) Doors in corridor

B. Basement Plan

1. Note unexcavated areas.
2. Note floor drains; check location for boiler/hot water heater relief valves and drains.
3. Verify egress capacity.
4. Ascertain waterproofing and damp-proofing.
5. Check for curbs, pads and drains for equipment in mechanical/electrical rooms.

C. All Floor Plans

1. Key plan where applicable.
2. Verify dimensions and dimension strings.
3. Verify floor elevations
4. Room names and numbers.

5. Floor recesses for entrance mats, ceramic or quarry tile, or access floor cabinet, hose cabinet, medicine chest, fire alarm annunciator, etc.
6. Exit stairs: check width, riser, tread, railings, enclosure rating, and travel distance.
7. Room finish schedule and patterns.
8. Doors: check opening, identification, types, size, frame, hardware, undercut, louver, label, view window, thresholds.
9. Folding partition or door - check anchorage, stowage, STC rating.
10. North arrow.
11. Scale.
12. Handrails and stoops.
13. Show expansion joints and covers.
14. Window types on all plans.
15. Show safety glass where required at entrance and elsewhere.
16. Public telephone.
17. Vertical chases: ascertain fire stopping, rating if required, clearance at structural frame.

D. Roof Plan

1. Indicate roof material and slope.
2. Show all roof penetrations: equipment, drains, scuppers, walkways, etc.
3. North arrow.
4. Scale.
5. Expansion and contraction joints.
6. Privacy screens for roof top equipment?

E. Exterior Elevation Sheets

1. Show all elevations.
2. Indicate on the drawing all facing material, coping, fascia, gutter and downspout, windows, roof material if visible, doors, stoops, steps, railings, etc.
3. Indicate floor elevations, foundations (dotted), brick ledge elevations.
4. Scale.
5. Column lines (if applicable).
6. Wall hydrants and fire department siamese connection.
7. Show roof access ladders.
8. Show brick relieving angles, joints, horizontal and vertical expansion joints, and brick vents.
9. Louvers

F. Longitudinal, Transverse and Typical Sections

1. Set elevations of floors.
2. Indicate dropped, suspended and furred ceilings.
3. Note materials visible in section.
4. Show slope of grade (new and existing).
5. Indicate lintels and structure as necessary.
6. Scale of drawing.
7. Show relationship of building and foundation.
8. Identify otherwise concealed materials visible in section, such as thru-wall flashing.
9. Indicate gauges of metals seen in section.

G. Details

1. At enlarged toilet plans, verify that build in accessories, mirrors, shelving, counters, grab bars, etc. are shown.
2. Check architectural case work; verify ability to be shipped, moved in and installed.
3. Check head, jamb and sill details for doors, windows and louvers.
4. Ascertain constructability of all details.
5. Ascertain how lockers are attached to floor/curb, how toilet fixtures are supported.

H. Reflected Ceiling Plans

1. Verify key to materials
2. Indicate full height and rated partitions.
3. Verify coordination for the following:
    a. Supply diffusers
    b. Return air grilles
    c. Lights
    d. Exit Lights (if ceiling mounted)
    e. Smoke or other detectors
    f. Speakers
    g. Movable partition tracks, cubicle curtain tracks, lighting tracks
    h. Radiant panels
    i. Sprinkler heads (if critical)
    j. Soffits
4. Verify adequacy of access doors in gypsum board ceilings for all mechanical and electrical equipment in the ceiling, including dampers, VAV boxes, valves, ballasts, etc.

I. Stairs and Ramps

1. Verify riser height, tread width, handrail height and construction.
2. Verify adequate area if area of refuge is required.

3. Verify run of stair or ramp is less than maximum; verify landing adequacy.

J. Elevators

1. Indicate smoke vent for shaft.
2. Note any projection into shaft greater than 2" must have a 75 degree sloped transitional shape.
3. Verify adequate clearance from top of elevator cab to underside of structure - ANSI A17.1 and Area of Refuge.
4. Verify sump of elevator pit.
5. Verify if elevator is on outside wall, radiation may be needed at bottom of shaft.
6. Verify elevator door details shown for all floors.
7. Verify elevator pit ladders are indicated and detailed.
8. Verify guide rails and brackets are shown, and fastened to solid concrete or solid CMU.
9. Freight elevator - verify loading category of ANSI 17.1 is shown on drawings and specs.
10. Elevator pit walls: verify if waterproofing is necessary or if waterstops are needed.

K. Interior Elevation and Finishes

1. Verify counter top material shown and specified. Indicate backsplash returns if counter top is recessed.
2. Indicate sloping tops on lockers or bring down a fascia and soffit to top of locker.
3. Indicate mounting heights for all toilet fixtures and accessories, including special accessible heights.
4. Verify finish schedule matches plan and elevation information, including room name, number, finishes and ceiling height.
5. Verify that fire-rated walls are denoted; verify presence of smoke/fire dampers on mechanical drawing.
6. Ensure interior and exterior signage as required is provided as part of the package. Include roof signage that complies with ADA requirements for tactile lettering, mounting height and contrast.

L. Design Aids

"Architectural Graphic Standards", Ninth Edition, Ramsey and Sleeper, John R. Hoke, Editor in Chief, John Wiley and Sons, Inc., New York, 1994.

APPENDIX C

CONSTRUCTION INSPECTION CHECK LIST

A. General:

1. Maintain a daily log of operations on the construction site, including:

   a. Record of the weather, including temperature, cloud cover and precipitation.

   b. Record of all construction activities occurring on site daily, including deliveries, visits by state and local inspectors, the Fire Department, and the Architect.

   c. Record any unforseen conditions as they are found.

2. Maintain a file of all on-site testing reports.

3. Maintain a file of all tickets and certifications received with deliveries.

B. Site Preparation

1. Observe construction site at time of turnover to contractor. Note existing conditions to remain undisturbed and document conditions. Note condition of trees and plantings to remain and document. Documentation may include written notes, photographs and videotapes. It is recommended that this occur in cooperation with the contractor.

2. Observe stake out of the work site for concurrence with the contract documents. Record any additional benchmarks the Contractor chooses to establish.

3. Ascertain that existing utilities have been located and protected.

4. Ascertain that any fencing or barricades necessary to protect the public are in place.

C. Sitework

1. Excavation and Grading and Foundation Preparation

   a. Verify that topsoil depth has been established, and that topsoil is being removed free of subsoil, roots, rocks and debris. Verify that topsoil stockpile, if on site, complies with Soil and Sediment Control requirements, or if off site, verify quantities being removed and stored.

   b. Verify that frequent measurements are taken to prevent overgrading.

   c. Verify that compaction tests are being taken in accordance with the specification for areas of fill as specified, but without exception under

buildings, foundations, roadways and walls. Maintain records of results of all tests taken on site.

d. Verify that excavation pits and trench floors are level, or consistent if sloped; that foundation and footing trenches are uniform in width and direction; that excavations are cleaned of debris and loose dirt before concrete is placed.

e. Verify that dust is controlled as specified, and that dirt, rock, etc. that spills onto paving or plantings is immediately removed.

f. Verify that temporary drainage is provided to prevent ponding, erosion or spillover, and that water is not permitted to sit in open excavations.

g. Verify that the contractor has protected as specified all trenches and excavations that are deep or in unstable soil.

2. Utility Installation

a. Verify that utility work has been coordinated between the contractor, the sub-contractors, and the local utilities. Ascertain:

1) Duplicate trenchwork has been eliminated.
2) Open trenchwork is minimized.
3) Sequence of utility installation.
4) Avoidance of crossover trenching.

b. Check utility plans and subcontractor plans to avoid conflict with existing trees or structures.

c. Verify that trenches are protected against bulging soil and cave-ins.

d. Ascertain that full length of pipe and fittings rest soundly on bedding, and that bells are then excavated to make the joint.

e. Ascertain that uncompleted piping is sealed closed during off-hours.

f. Verify that pipe and cable work is installed to comply with manufacturer's recommendations, including coating repair and cathodic protection.

g. Ascertain that valve and water meter boxes are located to be level with final elevation of surface, and that they rest on firmly compacted soil, with no part of box resting on the pipe or valve.

h. Verify that manhole covers will align with finished grade.

i. Verify that manhole inverts are as detailed, and that cleanouts are in place, accessible and capped with caps vertically aligned 4" above finish grade in non-paved areas.

j. Verify that water piping material and installation are as specified. Verify that ties, anchors or thrust blocks are provided as shown at turns, closed ends and at large outlets to prevent pipe movement from the momentum of water flow.

k. Ensure water mains are 10' away from parallel storm and sanitary sewers.

l. Ensure fire hydrants are on sound footings, and that drainage is provided near them.

m. Verify that sterilization and water pressure test results are satisfactory.

n. Verify that gas piping material and type of joint are as specified.

o. Ensure that gas line trenches are not subject to traffic by heavy equipment, and that gas line locations are clearly marked for other excavators.

p. Verify that gas lines slope to main lines, and that main lines slope to drip catchers, to avoid water accumulation. Verify that gas lines do not contact other piping or conduit.

q. Maintain accurate record of drawings of installed location of all underground utilities.

3. Other Sitework

a. Subgrade preparation for paving: Ensure the following for all paving applications:

1) Subgrade elevations and lines are accurate with sufficient stakes to ascertain final alignment.
2) Work is not done when rain or low temperature might interfere.
3) Dated and sitemap-keyed photos of paving preparation and application.

b. Concrete paving:

1) Keep records of all material delivered, dates and times of placement, interruptions, tests and finish work.
2) Verify that reinforcement installation complies with the drawing and specification.
3) Observe placement of the concrete. Monitor finishing work. Ensure that curing methods are as specified.

c. Bituminous Paving:

1) Keep records of material mix and delivery, including plant mix, tests, certificates, and delivery and application temperatures. Verify that material was covered and protected during delivery.
2) Verify that base course materials are uniformly applied and of correct thickness.
3) Ascertain that bituminous materials are applied as per specifications for placement, spreading, raking, rolling and layering.
4) Make record of any damage occurring during application.
5) Verify that paving surface is sloped to drain by observing tests by hosing; verify that low spots are filled.

d. Landscaping and Planting
   1) Verify that topsoil provided is from stockpile or complies with the specification, that the subsoil is tilled and loosened to bond with topsoil that topsoil is compacted evenly, and that finish grade drains properly.
   2) Ascertain that plant material, seed and sod are as specified, are free from damage and are handled as specified.
   3) Verify that planting beds and seed or sod beds drain well, are free of standing water and any debris or rocks, are of proper size of specimen, and have been protected from construction work.
   4) Verify that plants are watered in during planting, that sod is not desiccated and is properly watered in, and that seeding complies with the specification.

4. Concrete Installation - General

   a. Verify that the contractor has design specification and drawings at the site and is using them. Ascertain that all reinforcing is as detailed and shown on the shop drawings.
   b. Verify that all areas or formwork to receive concrete are free of debris and standing water, that subgrade is not frozen, that reinforcement is supported as specified and that formwork is securely supported.

5. Formwork Installation

   a. Verify the following about formwork:
      1) Layout
      2) Materials and support
      3) Form ties, spacers, hangers, inserts and any formliners are as detailed
      4) Chamfer, nailers and rustication strips are set.
      5) Construction joints, includes keys and waterproofing bulbs, are as detailed.
      6) Forms allow space and openings for placing concrete.
      7) Form joints are plumb and tight to prevent leakage; forms are secured against deflection and against movement during placement.
      8) Forms provide for openings, block outs, depressed areas, and contain sleeves for piping, conduit and ducts.
      9) Cleanouts are provided at ends and low points of forms, and vents are provided at potential pockets.
      10) Floor components such as drains, equipment anchors, and cleanouts are set in coordination with finish floor elevations.
      11) Verify that required access openings and sleeves are provided at column forms on each floor.

6. Concrete Reinforcing

   a. Verify the following about steel reinforcing in place:
      1) Reinforcing conforms to shop drawings.
      2) Reinforcing is not in contact with dissimilar metals.
      3) Rebar spacing is adequate to allow concrete flow and complete penetration.
      4) When final surface will be exposed, use rust-free chairs and other rust free formwork.

7. Concrete Placement

   a. Preparation: Verify the following is ready before accepting delivery of concrete:
      1) All requirements of specifications have been met, including tests and mix design.
      2) Site sample test materials are as specified and on site.
      3) The workforce is on hand as required for the workload.
      4) Material handling equipment, such as cranes, buckets, pumps, tremmies, wheelbarrows and approved vibrators and standby vibrators are on hand.

   b. Placement: Verify and/or record the following during concrete placement:
      1) Specified time limits between the addition of water to aggregate mix and placement are obeyed, or that delivered concrete is within specified time limits.
      2) Mix trucks do not stay beyond the allowable waiting period before pouring concrete.
      3) Verify hot and cold weather preparations.
      4) During placement of concrete, observe the following:

         a) grades
         b) elevations
         c) alignment
         d) form joint leaks
         e) formwork deflection or bowing
         f) dislocation of supports and braces
         g) settlement of shoring
         h) Vibration & compaction as specified, with no disturbance of forms.

      5) Record for each pour:

         a) location and extent
         b) time and date
         c) weather and temperature
         d) any actual or suspected instance of non-compliance

      6) Verify correct installation of slab movement and relief joints
      7) On actual placing operation, verify:

a) concrete is dropped no more than specified allowable distance
b) poured concrete does not segregate
c) concrete placing is held back to allow initial shrinkage of lower level concrete.
d) concrete is not placed nor remixed after initial set begins.

8) On formwork removal, verify:

a) newly poured surfaces are protected during form removal
b) wood formwork is removed below grade as well as above
c) form tie clamps are removed before rusting can begin
d) loose nails and other metals be removed before rusting can begin
e) patching and repairs begin promptly after form removal

c. Concrete Finishing and Curing: Verify the following:

1) Finishes are as specified.
2) Floating, troweling and texture finishes are as specified.
3) Slopes are provided for required drainage.
4) Saw-joint work is properly coordinated and joints are straight.
5) Curing methods, covers and wetting are as specified. Maintain special attention to limitations imposed by weather conditions.

8. Precast Concrete

a. Inspection: Inspect precast concrete for damage to individual pieces before moving to set. Verify color and finish of exposed concrete pieces.

b. Installation:

1) Observe handling and placement of precast concrete.
2) Verify installation of connections for conformance to the shop drawings.
3) Verify any patching is satisfactory for performance and appearance.

9. Masonry Installation

a. General Requirements

1) Verify, upon delivery of each load of face brick, face block, and colored or textured block, that ticket for delivery has correct job name and number, and that the pallet of brick or block is marked to match ticket. Maintain log of all brick and face block deliveries, with ticket number and pallet mark and initial columns for contractor's supervisor and for inspector.
2) Verify, upon delivery, that all other masonry materials comply with the specification:

3) Verify that all materials are stored on site in compliance with the specification.
4) Notify the design professional promptly of completion of the sample panel so that timely approval can be obtained.
5) Record the proportions of materials used for all mortars for the approved sample panel. The mix should never be less than a multiple of sacks of cement.
6) Verify that the proportions of materials used for grout are consistent and in compliance with the specification; the mix should never be less than a multiple of sacks of cement.

b. Installation

1) Ascertain that the footing, beam, or floor on which masonry is to be laid is clean and free of dirt, grease, ice, soil or other contaminants.
2) Verify that mortar is mixed in compliance with the specification.
3) Verify that through-wall flashings are placed in proper course, and that they are on correct side of wire joint reinforcing. Insure that corners of flashing over openings are turned up to box each end.
4) Ascertain that masonry wall cavities, as well as cells to be grouted, are kept clean from mortar drippings in accordance with the specification.
5) Ascertain that all walls have adequate lateral bracing, pending completion of work to be installed.
6) Ascertain that drippings from clean up do not flow onto any finished planted or seeded/sodded area.

10. Steel Installation

a. General

1) Verify that the contractor has the contract drawings and specifications, as well as approved shop drawings at the site, and is using them. Ascertain that the steel lay-down area is adequate.
2) Review with the contractor laydown locations, crane locations and possible obstructions/hazards/inconveniences. Review crane jack pad locations and sizes and cribbing to assure safety from damage to existing underground work and utilities.
3) Ascertain that rough plumbing below grade and electrical rough in below grade is completed and coordinated with framing; that HVAC and electrical requirements have been coordinated with framing.
4) Verify that the framing plan corresponds to the footings and piers installed.

b. Steel Delivery

1) Verify that mill tests reports are provided with delivered steel as specified

2) Verify that steel framing members are as detailed, that steel columns with milled ends are protected at milled ends, that steel is protected with shop primer or specified coating, that shop welds and bolt holes are as detailed and that steel connectors provided comply with the specification.

c. Steel Erection

1) Verify column bolts are set with accurate templates.
2) Verify that concrete piers and footings where column base or bearing plates are to be installed are cleaned, and grouted and rammed tightly, ram packed with dry pack mortar, or shimmed with leveling plate on grout bed.
3) Verify base and bearing plates are as detailed, and are fully bedded in grout. Verify the fit of the anchor bolts, that the anchor bolts are not bent during erection, and that all anchor bolts are fully connected. Verify that concrete damage is minimal.
4) Verify that vertical members are erected in accordance with the erection plan, that they are plumb within ASTM tolerances, that they are aligned to related members correctly, and that column connectors for beams are aligned and level.

Verify that horizontal members are erected in accordance with the erection plan, that beams and girders are placed with their cambers up, and that beam and column connection points match up.

6) Verify that bearing plates on masonry or concrete walls are exactly level, instrument checked, and fully grouted.
7) Verify that end points of beams and girders bearing on masonry or concrete walls are properly bedded and connected.
8) Ascertain that temporary supports are as specified, that guys have been engineered to follow lines of force, and are not off-angle, that braces are secure and braced members do not move and shake when force is applied, and that wind and storm factors are allowed in all seasons.
9) Wherever members have to be disconnected during erection, there is supervision to assure proper reconnection.

d. Steel Connections

1) Verify that a field log is kept of welder's name, work marks and rejection rates.
2) Verify that a complete welding record is maintained which includes pieces welded, weld location, welder identification, location and extent of defects, repair dates, repair types, retests, and sampling rate.
3) Verify testing laboratory field inspection and certification is as specified.
4) Verify that working conditions for welding conform to required standards, including temperature within working range, no water

on metal surfaces; worker safety and fire safety requirements are met.

5) Verify that welding rod storage in the field conforms to required standards for temperature and humidity.
6) Visually inspect finish welds for conformance to details and shop drawings in size, length, type, spacings, contour and lack of defects.
7) Verify that boltholes are as detailed for number, size, location, alignment, pattern, and spacing of edge and end distance.
8) Do not permit boltholes to be enlarged by burning; misfit holes may only be reamed unless other methods are approved by the design professional.
9) Verify that damaged bolts are replaced, not straightened or deburred
10) Verify that high strength bolts, washers and nuts are as detailed. Verify that when installed, they are clean and unpainted. Bolting shall be as specified.

e. Metal Trusses and Joists (Bar Joists)

1) Verify that trusses and joists are as detailed, that when delivered, have webs and chords free of bends, dents, cuts, twists, and other defects. Verify proper handling and storage to prevent damage. Verify that components are properly shop coated.
2) Verify trusses and joists are picked up and set in accordance to manufacturer's recommendations. Verify installation as detailed for spacing, bearing, temporary and permanent bracing and anchorage.
3) Verify that bridges and anchors are attached promptly as trusses are installed, and that no loads are applied until this occurs. Verify ceiling extensions and end extensions as required.

f. Metal Decking

1) Verify upon delivery that metal decking is of size, shape, gauge, material and finish as specified. If more than one type of metal deck is used, verify that each type is clearly identified and is stored in separate stacks or areas.
2) Verify that decking materials are handled with care to avoid damage in moving, unloading and stacking. Verify that decking is stored as specified to avoid damage.
3) Ascertain that correct decking is used in correct locations.
4) Verify that deck laps adjoining deck easily; assure that bent or deformed edges are straightened before fastening.
5) Verify that closure pieces are provided for edges, tops of walls, end points and changes in direction.
6) Verify that welds comply with the specification, and that welds are certified as specified.

7) Verify that decking is supported continuously as per details, specifications and shop drawings.
8) Verify that joint and seam connections are as detailed. If present, verify that built-in conduit passages are aligned, unobstructed, undamaged and smooth at opening edges.

11. Rough and Finish Carpentry Installation

a. General

1) Verify that all framing lumber is as specified and detailed at the time of delivery for species, grade, length, and dressed size. Verify markings of each bundle.
2) Verify that special lumber, such as preservative treated, fire retardant or special kiln dried for trim, is marked and certified as such, and is stored apart from other lumber.
3) Verify that plywood, particleboard, OSB, and composite board are as specified and detailed for size, thickness, grades, type, and surfacing. Verify they are clearly marked. Identify use for each type of board.
4) Verify type of fasteners for type, gauge, material, corrosion protection and spacings.
5) Verify that lumber, plywood and other sheet wood products are handled and stored as specified.

b. Wood Floor Framing Installation

1) Verify that foundation grade or preservative treated lumber is used near soil, in contact with masonry or concrete, in spaces subject to concentrated moisture, and for all mudsills and pier caps.
2) Verify that foundation anchor bolts are spaced so as to be between studs.
3) Ascertain that no untreated wood wedges, shims, or blocking is used in portions of framing subject to moisture absorption and fungus decay.
4) Verify installation of termite prevention.
5) Verify that floor framing members are as specified or shown for grade, size, spacings, bracing and with minimal notching or drilling.
6) Verify that joist hangers are as specified or shown for types, materials, sizes, gauges, spacings, alignment and straightness, and secured at all connection points with correct size and type of fasteners.
7) Verify that floor joists are set with crown upwards, and set with ample bearing on plates.
8) Verify that floor joists are doubled under parallel partitions, and are as detailed for concentrated floor loads with closer joist spacing, double or triple joists, girder supports and blocking. Verify double joists around openings.

9) Verify bridging is as detailed, with installation to provide full bearing, bridging set at mid point or as shown, and that the bottoms are not nailed until sheathing installation is complete.
10) Verify that floor sheathing is as specified or shown for grade, thickness, joint stagger, nailing and blocking. Ascertain that butt joints are staggered.
11) Verify that subflooring panel edges have full bearing on framing members.
12) Verify that subflooring is glued, or secured to floor joists with screw-type nails to prevent squeaking.
13) Verify the completed subflooring is level, free of depression or crowns, and is properly patched.

c. Wall Framing

1) Verify that stud framing is as specified and detailed for material species, grade, sizes, spacings, plumb, square, alignment, bracing, and secured with correct size and type of fasteners.
2) Verify that fire stops provide complete snug blocking between studs.
3) Verify that special framing is as shown for double walls at chases, separated plates and framing at party walls and at soundproof walls, and is secured with correct size and type of fastener.
4) Verify that studs at corners are positioned to provide ample nailing backing for wall panels.
5) Verify that top plates are lapped and correctly nailed, and provide uninterrupted and ample nailing backing for wall panels.
6) Verify that blocking and double top plate headers are provided for wall openings.
7) Verify that butt joints in double plates do not occur over openings, and that they are staggered and occur over studs.
8) Verify that headers, furring, and lintels are as detailed and shown for width, depth, bearing and connections.
9) Verify and record for each story lumber grade, size, spacing, blocking, fire stops, bridging, laps and splices, connectors, plumb, square, level and aligned.
10) Verify fasteners is as specified for quantity, spacing, minimal bends, predrilled where required, and bent or used nails not reused. Verify that nailing machines and are used in conformance with manufacturer's recommendations. Verify all bolted connections are rechecked and retightened.

d. Ceiling and Roof Framing

1) Verify ceiling and roof framing, soffits and furring is as detailed and specified for grade, size, spacing, and bracing.
2) Verify ceiling and roof joists are set with crowns set upwards, with ample bearing on plates, and securely anchored to plates, with additional tie downs if subject to high winds or hurricanes.

3) Verify roof framing is as detailed for concentrated roof loads, with closer joist spacing, double or triple joists, girder supports and blocking. Verify roof joists are doubled around roof openings. Verify joist hangers are as specified for type, material, gauge, size, spacing, alignment and completely secured at all connection point.
4) Verify that bridging is as specified for full bearing, proper location, and that bottoms are not nailed until sheathing is installed.
5) Verify that anchors, brackets, frames and hangers and other supports are as required for ceiling supported or hung piping, conduit, equipment, ducts and shelving.
6) Verify curbs, anchors, brackets, and other supports for roof mounted platforms, piping, equipment and miscellaneous construction.

e. Wood Sheathing & Siding

1) Verify that wall sheathing butt joints are staggered, that edges have full bearing on framing, and that nail patterns are as specified or noted.
2) Verify that plywood shear wall construction is as specified for thickness and grade of plywood, nail sizes and nail pattern.

f. Prefabricated Wood Trusses and Glu-lam

1) Verify that prefabricated wood trusses and glu-lam members are handled with care during transport, unloading, moving and stacking. Verify that they are stored off the ground, protected from weather and all sources of water, are neatly stacked and stored in accordance with manufacturer's recommendations.
2) Verify that glu-lam members are numbered and certified, that protective wrappings remain undamaged and that wood is specified species, grade, glue and finish.
3) Verify that an erection sequence has been provided, containing a bracing schedule.
4) Verify that required clips and connectors are installed, that shear plates are as detailed and are properly fastened.

12. Thermal and Moisture Protection

a. Below Grade Waterproofing

1) Verify that footing drains are installed as detailed, with a minimum 6" diameter, are continuous line and slope, are on a drain bed of pervious stone, are covered with screen or geotextile to prevent clogging with fines, have a gravel backfill, and are directed to drain as shown on the drawings.
2) Verify that all shop drawings, specifications, details and warranties have been approved, and that materials delivered conform to these requirements. Verify that masonry, concrete and other underground surfaces have been prepared in accordance with

specifications by wire brushing or abrasive blasting. Verify that vertical and horizontal joints are constructed as per drawings and specifications for distribution, depth, widths, backing materials, and continuity. Verify that all below ground expansion joints include uninterrupted waterstops.

3) Verify that surface for application is as specified, and that trowel coatings of mortar have been added to fill holes, areas of rough aggregate, and to parge CMU walls.
4) For bituminous membrane, verify the minimum number of felts is three ply, with additional plies as required for ground water hydrostatic head pressure. Verify that primer is used under first coat at 100% coverage. If bubbles and steam appear during the first hot mop coat, the substrata is not sufficiently dry, and the coat shall be removed and the wall is permitted to dry. Verify that no cracks or breaks are allowed in any single ply, that plys are lapped and overlapped so that joints are staggered, and that additional ply reinforcement is added at pipe sleeves, conduit and other penetrations.
5) For elastomeric membranes, verify surface preparation is as specified, and that manufacturers instructions are followed for application of membrane.
6) For fluid applied coatings, verify surface preparation is as specified, and ascertain that material is applied in overlapping coats to assure a build-up of 100% coverage.

b. Roofing-General

1) Verify that approved shop drawings have been received, and that delivered materials comply with the specification and approved shop drawing.
2) Verify that a pre-roofing conference is held on site, and attendance includes the design professional representative, the owner's representative, the general contractor's superintendent, the roofing subcontractor, and the roof deck subcontractor.
3) Verify that roofing materials are kept dry, and that all required accessories such as skylights, hatches, vents, expansion joints, pipe flashings and curbs are on hand and ready for installation.
4) Verify that spacing and sizes of nails and other fasteners, depth of penetration, material, and washer use are as specified or shown.
5) Verify that insulation type(s) are a specified for type, grade, reflective surface, R-value, thickness, and facings.
6) Verify that fasteners are as specified, that batts are installed with tight contact of insulation to framing, that air space is as shown, that reflective surface is positioned properly, and that batts are cleanly cut and tightly fitted to electrical and plumbing components.
7) Upon completion, verify that clean up has satisfactorily been completed, and that all debris, scraps, and leftover nails are removed

and disposed. Verify that drains are left clear and clean. Verify roofing is protected if foot traffic is to be continued.

c. Membrane Roofing

1) Verify that bitumen is of specified type ASTM number, and that melting point is as specified. Verify the perm rating of vapor retarder. Verify that roof decks slope as shown, that deck surface is dry, smooth, free of irregularities, firm and fully supported. Verify that roof deck is broom clean, that concrete decks are primed, and that insulating concrete if used is dried out and vented. Verify that rigid insulation has staggered joints, with no insulation joints over metal deck joints or flutes. Verify nailers, cants, insulation vents, expansion/control joints, and other accessories are in place and properly attached. Verify that piping, vents, drains, conduit, and other penetrations are in place and ready for flashing.
2) Verify as acceptable and record weather, wind, temperature and humidity conditions.
3) Verify that felts are rolled or otherwise laid smoothly, that laps are all required widths, and that nailings are as specified. Verify that quantities of asphalt or cold tar pitch are sufficient for generous coverage of the felts. Verify that bituminous product is maintained at specified temperatures, and is delivered at required temperature. Be watchful for small buckets that are prone to excessive cooling.
4) Verify that base sheets are fastened, spot mopped or fully mopped in as specified. Verify that felts are mopped 100% over the surface and lap lines, as well as over edge strips and flashings. Verify that aggregate if applied is applied on to the hot surface final coat.
5) If a factory made elastomeric membrane, verify that all installation complies with the manufacturer's recommendations. Consider having manufacturer's representative visit the site during installation, and request that he issue a written report on methods of installation observed during the visit.
6) Verify that connections and fabrications of flashing are as detailed for cleaning, soldering, welding, bolting and anchorage. Verify that edge flashing is embedded in the roof membrane if so detailed. Verify that flashing, cement and sealing is as shown and specified.

d. Gutters and Downspouts

1) Verify that materials are as shown for type, shape, gauge, material, finish and support. Verify that gutters have a positive slope unless shown level; that downspouts are plumb, that joints lap to match drainage flow, and that movement joints are provided in gutters and downspouts. Verify that drainage is continued from terminations of downspouts.

e. Shingle & Shake Roofing

1) Verify that material type and grade are as specified. (Note that wood roofing shingles should be heartwood edge grain material. Be wary that lower grade, flat grain siding shingles not be substituted.) Verify fire rating, surface texture, color, size, shape, fasteners and flashing.
2) Check that deck or sheathing slope is as shown, and that deck or sheathing is dry, firm, fully supported, and broom clean. Verify that underlayment material, lapping and installation is as specified. Verify that hip, valley and cricket flashing is properly installed prior to shingling, and that gutters attaching to the deck are installed.
3) Verify that shingle/shake alignment is as specified and visually correct. Verify proper joint stagger, and that shingle exposure to weather is as specified and/or required by code. Verify that nail spacing is as specified, and that nails do not penetrate decking or sheathing that is exposed to view.
4) For synthetic shingle coverings, verify that starter course is aligned correctly. Verify that layer and row alignment is correct, that exposure is as required by specification and/or code, that nailing is as specified in spacing and penetration. Verify that tabbing is as specified, and that self-sealing shingles are as specified.

f. Joint Sealants

1) Verify that sealants are as specified regarding:

a) Plus-or-minus movement capacity
b) Recovery
c) Type of material and class and grade
d) Adhesive strength to joined material & cohesive strength
e) Curing time
f) Shrinkage
g) Stability, flexibility, and hardness
h) Water and chemical resistance

2) Verify that compounds are delivered in sealed, labeled containers.
3) Verify that surface preparation is per manufacturer's recommendations, and that solvents used are applied uniformly with one rag and removed with another.

13. Door and Window Installation

a. Doors

1) Verify that approved shop drawings, the design office specifications and the drawings are all on site and being used by the contractor.

2) Verify that delivered doors and frames are as specified and as per samples and shop drawings for type, size, material, grade, gauge, and finish. Verify presence and rating of fire labels on door and frame as scheduled. Verify presence and rating of louvers, undercuts, vision lights, transoms and sidelights, and hardware preparation.
3) Verify that frames are installed straight and plumb, securely anchored, and with frames being grouted during construction as specified. If push-in-silencers are specified, insure that rabbet is filled with insulation before grouting. Verify that hinge and lock are on correct side of opening.
4) Verify that doors are hung square, level and plumb in frame, and are smooth in operation and smooth and secure in closing.
5) Verify that any damage to factory coat is repaired or retouched, that first coats of paint or sealer are applied to both sides of door during the same painting operation, and that exterior doors are sealed, stained and/or painted before or immediately after installation.

b. Windows

1) Verify that approved window shop drawings, the design office specification and the drawings are all on site and being used by the contractor.
2) Verify that windows delivered are as specified and as per samples and shop drawings for type, size, grade, metal gauge, finish, millwork quality and connections, cladding if applicable, and operation. Verify that window related materials and accessories are provided as specified for glazing beads or stops; add on mullions, trim, bolts, pull-down rods, hooks, screens, and window cleaning bolts. Verify that window hardware is as specified for type, metal, finish and operation.
3) Verify that window storage keeps them upright, off the ground and away from traffic, weather and any other source of moisture.
4) Verify that windows are placed into openings without forcing, and that windows are not used at any time to support ladders or scaffolds.
5) Verify that windows are installed plumb and square, with heads and sills level and at correct elevations, jambs plumb and aligned with other facade elements, and opening sizes correct. Verify that diagonal dimensions for any opening are within 1/8". Verify that required grouting at frames, sill, head and jamb is completely full and solid. Verify that frame braces and anchors are in place and tightly secured. Verify sash is free of warps, bends and dents, and operates freely. Verify that weeps remain clear.
6) Verify that windows are weather tight and allow no air infiltration. Verify that ventilator hardware operates smoothly, and that friction hinges operate smoothly, but do not allow ventilator to slam shut

during wind gusts. Verify closures are uniform and tight when units are closed, and that double hung and sliding windows operate smoothly without rattling and sticking.

7) Verify that glazing is as specified and as per approved samples.

c. Coiling and Sectional Doors

1) Verify that door shop drawings, door specification and contract drawings are on site and being used by the contractor.
2) Verify that rough door openings and drawings agree on size and track location. Verify track is installed as shown. Verify that clearances are adequate for motor operator.
3) Verify door operation when installed. Field verify operation of push buttons, stop buttons, hand chain operator or crank operator, and any safety door bottoms.

d. Glazing

1) Verify material types are as specified and as per samples for material, type, tint, insulating construction, reflectivity, heat-absorbing, tempered, laminated, wire and plastic. Verify accessory materials are as specified for sealant, glazing compound, backing material, putty, gasketing, shims, wedges, and glazing beads or stops.
2) Verify glazing is installed during temperate weather as specified.
3) Verify that setting is clean and free of debris, that setting blocks are at 1/4 points unless specified otherwise, that glazing clearances are as specified or following good practice, and that tinted, low-e, insulating or reflective glazing is installed with the proper side on the exterior.

e. Curtain Walls and Window Walls

1) Verify that curtain wall framing and panels are as specified and detailed and as per approved shop drawings for type, thickness, overall dimension, size and shape of components, metal gauge, extrusion profile, pattern, color, finish and special protective coatings.
2) Verify that support clips, angles and hangers are precisely aligned and checked by the contractor and client representatives prior to installation.
3) Verify that panels are installed, aligned and plumbed according to specifications, drawings and test panels. Verify that dimensional tolerances of size and alignment are within the specified limits. Verify that expansion joints are sized and located as designed, and that they are installed at the mid-range of their potential movement. Verify that weep holes are adequate in size, spacing and are kept clear.

14. Finish Installation

a. General

1) Verify that the approved shop drawings, design specification and drawing, approved samples and color selections are on the site and have been reviewed by the contractor and the appropriate sub-contractors.

2) Verify that sub-strate for finish is prepared as specified, or if not specified, at least broom cleaned for studding, furring, lathing, plastering and gypsum board installation; vacuum cleaned for acoustical ceiling and cabinetry; detergent wash and air dry for ceramic and quarry tile, terrazzo, wood strip, parquet, resilient and rubber tile and sheet goods, and carpet installation.

3) Verify that all sub-strates have been inspected for level and plane, freedom from defects, and sealed as required.

b. Studding, Furring, and Lathing

1) Verify that metal stud partitions are installed per plans and details for partition location, stud spacing, material, gauge, anchors, bracing, flush frame surfaces, plumb, plane, alignment, square, double studs at jamb openings, reinforced/heavy gauge studs at stress points, top plate space allows slab/floor deflection, and staggered stud/double plate installation at soundproofed or party walls. Verify backing plate or anchors at required locations.

2) Verify wood studs are as specified for species, grade, spacing, size, straightness, freedom from defect, and treatment if required. Verify plumb, alignment, square, plane, bracing and fittings. See paragraph 6.3 for further requirements.

3) Verify that furring and lathing areas specified for materials, spacing, alignment, attachment to supporting members, positions, ties, plumb and level surfaces, and spacings of backing and frames to support materials and finishes. Verify that grounds and screeds are as detailed for level, alignment, match to specified plaster thickness, installed in maximum length, and with wood grounds installed where necessary. Verify control, expansion and contraction joints are installed as shown, and verify material, size, type and spacing. Verify that diagonal lath reinforcing is installed at stress points. Verify proper installation of lath accessories such as trim, casings, corner beads and vent screeds. Verify that butt joints are staggered and occur only where supported; and that ribbed lath sections nest together at ribs; and that with foil covered lath, the foil is towards the framing. Verify that gypsum lath if used is dry or staggered as specified and detailed.

c. Plastering

1) Verify that materials are as specified and approved for type, grade, mix proportions and uses new unopened containers.
2) Verify that work area is as specified and adequate for good work, with it being closed in, not exposed to weather, clean, dry, protected from moisture, well ventilated, well lighted, and warm enough to maintain required working temperatures. Ascertain that adjacent work and floor in area of work is adequately protected.
3) Verify that application is as specified for troweling, number of coats, thickness, setting time, and curing time.
4) Ascertain that plaster spills on adjacent materials are cleaned up promptly, that materials are not tracked elsewhere, that cleanup is thorough, and that all plastering debris is promptly removed from the site.
5) Verify that nonconforming work is replaced or repaired before other room finishes are started, and that final patching and repair is imperceptible.

d. Gypsum Wallboard

1) Verify that wallboard materials are as specified for type, fire rating, water resistance rating, overall size, required special lengths, thickness and edge type. Verify that fasteners and accessories are as specified or required, for type, size, gauge, and spacings. Verify that adhesives are as specified and comply with manufacturer's recommendations.
2) Verify that blocking and back ups are in place to support all edges of wallboard. Verify that wood framing to receive wallboard is kiln dried (19%) so that shrinkage and nail popping are eliminated. Verify special nails if specified. Verify that existing floor construction is not overloaded by stockpiled wallboard. Verify that wallboard as stored is dry and free of moisture, and that it is protected from damage to surface and edges.
3) Verify the following installation standards:

a) Applicable trade standards and manufacturer's instructions are followed throughout.
b) Wallboard is held 3/8" to 1/2" above the floor.
c) Wall panels are installed horizontally unless otherwise specified.
d) Panel joints are staggered vertically; panel joints are staggered vertically and back to back if panels are double layered.
e) Long joints of ceiling joints are straight and aligned.
f) Short joints of ceiling joints are staggered at mid point of long side.
g) Door jambs and vertical joints are aligned.

h) Wall board in damp environments is moisture resistant.
i) Metal edges and corner beads shall be installed where finish wallboard edges are subject to damage.

4) Verify that penetrations in fire rated construction are thoroughly sealed, and recesses are boxed in.
5) Verify that spackling is performed as specified and when temperature is above minimum (usually 55 degrees Fahrenheit). Verify no bubbles, bumps or dimples in spackle coats. Verify that finish coat is sanded smooth, and feathered outwards by 12" to 16" from any joint.
6) Verify that cleaning is thorough and complete, with all debris being removed from the site. Recheck work for necessary repairs before painting.

e. Suspended Acoustical Ceilings

1) Verify that acoustical ceiling tiles are as specified for material, type, fire rating, size, thickness, pattern, surface condition, edge condition, and are clean, stored dry and have correct mounting. Verify for each type of ceiling tile, and identify area of use for each. Verify that channels, hangers and grid are as specified for material, gauge, spacing, ties, clips, anchors and size. Verify ceiling grid space pattern is as designed.
2) Verify that ceiling is adjusted to specified tolerances for level, alignment to walls, and grid spacing. Verify special attachments as required, including extra intermediate hanger wires, sway bracing, turnbuckles, isolators, and hold down clips as required for fire rated or other ceilings.
3) Verify that ceiling provides access for inspection and maintenance of equipment. Verify that any acoustic treatment above the ceiling is as specified for material, thickness and installation.

f. Ceramic Tile - Walls and Floors

1) Verify that ceramic tile are as per approved samples and specifications for type, shape, size, thickness, pattern, color, glazing, consistency in size, color and appearance, and are undamaged and certified as required. Verify for each type of ceramic tile and identify area of use. Verify that grout, adhesives and sealing materials are as per specifications and/or tile manufacturer's recommendations. Verify that tile accessories match field tile for trim, accessories and bases.
2) Verify that framing, furring and backing are complete for plumb, square, alignment and they are well secured. Verify that floors to receive tile are level or sloped to drain, with floor recesses as shown or required. Verify that work of related trades are in place and properly positioned, such as electrical receptacle and switch

boxes, plumbing and electrical stub-ups, drains and plumbing rough ins.

3) Verify that lath is as specified, with zinc coating, lapped properly, and tied with zinc-coated wire. Verify that wire mesh is positioned and secured as detailed or specified.

4) Verify that supports for fixtures and other related construction are prepared with the required wall blocking, chairs, backing, inserts, anchors and bracing.

5) Verify that waterproofing and backing are as specified, for primer, felt, waterproof membrane, waterproof sheet metal work, underlayment and sealant.

6) Verify that setting bed, scratch coat, and float coat are as per specification, applicable trade standards, and/or tile manufacturer's instructions for reinforcing, materials, thicknesses, and method of application. Verify that thin-set tile is as specified and is applied as specified to clean, dry plane substrate in accordance with manufacturer's recommendations.

7) Verify that all tile joints are straight, level horizontally, aligned and exact vertically, uniform is size, and carefully done at difficult areas such as corners, fixture locations, at wall openings and recesses, and at penetrations and door trim.

g. Terrazzo, Wood, and Resilient Flooring and Carpet Finish

1) General: Verify that subfloor is level, without humps and depressions, well nailed and secured against moving and squeaking, patched and repaired at defects and sanded smooth, with tight and sealed joints and vacuumed clean. Verify that concrete floors are level, without humps and depressions, dry, troweled smooth, patched and repaired at defects, non-powdery, and vacuumed clean.

2) Verify that floor materials are as per specification for type, size, thickness, cove shape, color, pattern, finish quality, and consistency in color, pattern, size and appearance. Verify that substrate construction is as specified. Verify that primers, sealers, cements and adhesives are as specified for manufacture, type, unopened, and any special application requirements. Verify that materials have been stored as specified. Verify that the area of work is clean, dry, well ventilated, free of construction dust, at a comfortable working temperature, and has sufficient light to properly install the work.

3) Terrazzo: Verify that joint materials are positioned and of the correct height for beads, temporary screeds and expansion strips. Verify that the curing operation is exactly per specifications and manufacturers trade standards. Verify that contractor is properly equipped for the grinding operation, with adequate crew, correct equipment and a grinder dust control system. Verify that the finish terrazzo is level, without irregularities, and smooth and true

throughout. After cleaning and grinding, verify that the flooring is completely cleaned, finished sealed as specified, and protected from construction work.

4) Wood flooring: Verify that sleepers if used are as detailed and specified. Review with the installer the position of any vapor barrier, location and fastening of any resilient component of the sub-floor, nailing spacing, nailing at strip end, predrilling if required, diagonal nailing, and nail type required. Verify that after work is complete, the work area is completely cleaned and all scrap removed before commencing further work. Ascertain sanding is done immediately after cleaning, and is scheduled to avoid contaminating other work, and is consistently smooth, without lumps, depressions and gouges, and is free of burn marks. Verify all sanding dust is vacuumed, and that final finish is applied immediately after sanding.

5) Resilient Tile Floors: Verify that tile start points as selected will result in even, balanced tile pattern as shown on drawings. Verify that material lots are not mixed for any single floor area. Verify that special border tiles will fit with no cuts. Verify that adhesive is applied as specified for quantity, coverage, that it reaches dry tack before tiles are laid, and that once laid, no tiles can be moved or loosened.

6) Resilient Sheet Floors: Verify that resilient sheet goods are installed so that all portions are laid in one uniform direction, with minimal seams, and seam joints are cleanly cut, straight, matched, aligned and level. Verify that rolled material is unrolled 24 hours ahead of installation, if the manufacturer's instructions so require. Verify that compression rolling over sheet flooring starts in middle and moves outward to press out all air bubbles.

7) Carpeting: Verify that materials are delivered undamaged and stored protected from weather, moisture, construction dirt and damage. Ascertain that if used, the carpet pad is applied per specification and is protected from moisture before installation, perfectly dry when installed, adhered thoroughly, and adhered with materials specified. Verify that carpet and pad are unrolled 24 hours before installation. Verify that seam layout is planned in detail prior to installation. Verify that carpet is planned and installed so that all portions are laid in one uniform direction, with number of seams minimized, seams are avoided in high visibility areas and in heavy traffic areas, and there are no cross seams. Verify that cuts for seams are made only on the weave line, that they are not visible at lines of walls, doorjambs, and base cabinets. Verify that seam joints are straight, matched, aligned and level. Verify that carpet installation is coordinated with all trades, such as base installation, floor mounted fixtures and floor mounted cabinets and furnishings. Verify that carpeted areas are thoroughly

cleaned of scraps, threads and dust, are protected from traffic, and are not left exposed to weather or moisture.

15. Specialties

    a. General

        1) Verify that specialties provided comply with the specification, approved shop drawings, approved samples, and applicable trade standards. Verify that materials are stored in compliance with the specification. Verify that specialties are installed plumb, level and square, with adequate backing, blocking, anchors, inserts, hangers and brackets. Verify that all doors, drawers and moving pieces operate smoothly in opening and closing. Verify all specialties are protected from damage during construction until final occupancy.
        2) Details of specialty installation are job-specific for each project and the specialty being installed.

16. Equipment

    a. General

        1) Verify that equipment provided complies with the specifications, approved shop drawings, approved samples, and applicable trade standards. Verify that equipment is handled and stored in compliance with the specification. Verify that equipment is installed plumb and level, with adequate backing, support, anchors, hangers and brackets. Verify that plumbing supply and drain lines are of sufficient size for the equipment connection furnished. Verify that necessary power connections are of the proper voltage and amperage for the equipment being installed. Verify that all start-up procedures comply with the specification, and that any owner training has been scheduled or completed. Verify that all equipment is protected from damage during construction until final occupancy.
        2) Details of equipment installation are job-specific for each project and the equipment being installed.

17. Furnishings

    a. General

        1) Verify that furnishings provided comply with the specification, approved shop drawings, and approved samples. Verify that furnishings are handled and stored in compliance with the specification. Verify that due care is taken during move-in to protect both the furnishings and the completed work. Verify that repairs to all damaged construction are complete, and that damaged furnishings are satisfactorily repaired or replaced. Verify that all

furnishings are protected from damage during construction until final occupancy.

b. Details of furnishings installation and move-in are job-specific for each project and the kinds of furnishings being provided.

18. Special Construction

a. General

1) Verify that special construction provided complies with the specification, approved shop drawings, approved samples, and manufacturer's recommended installation procedures. Verify that the components of special construction items are handled and stored in compliance with the specification. Verify that assembly and construction proceed in accordance with recommended installation instructions. Witness and verify all performance testing specified or required by the manufacturer. Verify that all special construction is protected from damage until final move in.

2) Detailed installation of special construction items is job-specific for each project and for each item of special construction.

3) Note that for some items of special construction, such as acoustic enclosures, EMF shielded rooms, X-ray shielded rooms, etc., specific performance testing will be required. Results of such testing will be significantly dependent on the means and methods of assembly and the care taken in so doing. Maintain accurate records of assembly activities, and note any difficulties encountered.

19. Conveying Systems

a. General

1) Verify that all conveying systems and components thereof comply with the specification, approved shop drawings, approved samples, applicable local, state and other statutes, and manufacturer's recommendations. Verify that components of conveying systems are handled and stored in compliance with the specification. Verify that floor openings for conveying systems maintain their protection during construction and installation. Observe any drilling operations and record any unusual conditions. Verify that installation sequence follows manufacturer's recommended instructions. Verify that all conveying systems are protected from damage until final move-in.

2) Detailed installation of conveying systems is job-specific for each project and each conveying system.

20. Mechanical and Plumbing Systems

a. General

1) Verify that all material, equipment, and products comply with the specifications, approved shop drawings, approved samples, and applicable trade standards and manufacturer's instructions. Verify that materials, components, equipment and products are handled and stored in compliance with the specifications.
2) Verify that all structural supports for mechanical and plumbing equipment are in place and ready to receive pads or equipment.

b. Plumbing

1) Verify that all rough-in connections for plumbing fixtures and equipment are in compliance with contract drawings and utility coordination drawings.
2) Verify that all supports for plumbing fixtures and equipment are in place and permanently secured to substrate. Verify that supports for plumbing lines and equipment comply with the specification.
3) Ascertain that when plumbing lines change material, such as black iron to copper, or galvanized to steel, a dielectric coupling has been provided at the material transition.
4) Witness the start and conclusion of all tests, including pressure tests and sanitizing procedures and tests. Include intermediate observations of all time/pressure leak testing.

c. Heating, Ventilating, and Air Conditioning

1) Verify that each piece of HVAC equipment, including air handlers, exhaust fans, unit heaters, through the wall HVAC units, chillers, cooling towers, heat exchangers and energy recovery units are in the correct location according to the plans and approved shop drawings.
2) Verify that ductwork is of the specified gauge and material. Verify type of insulation required and verify clear size of duct if insulation is internally mounted. Ascertain that ductwork is supported as specified, and that supports attach to structural steel members or auxiliary steel members provided for this purpose.
3) Verify that access panels are provided for all balancing points of the system.
4) Verify that all equipment is mechanically secured to its supporting structure as shown on the drawings and as specified.
5) Ascertain that the length of flex duct from a rigid duct to an inlet/outlet device is minimized. Verify that stretching and kinking do not occur; if they so do, re-locate collar in rigid ductwork to prevent from occurring.
6) Verify that training for the owner for operation of all HVAC equipment has occurred or been scheduled before final turn over.

7) Verify that all filters have been replaced (or cleaned, if permitted by specification) after testing and balancing and before final turn over to the owner.

21. Electrical Systems

a. Verify that electrical equipment delivered to the site complies with contract documents, approved shop drawings, and approved samples. Verify that each transformer, switchboard, switchgear, and panelboard is installed in the proper location shown on the drawings.

b. Verify that all direct buried cables are buried at the specified depth, have bedding as specified, and are marked with plastic marking tape as specified. Protect direct buried cables as specified.

c. Verify that all underground duct bank has proper connections and spacers before permitting concrete to be poured. Verify that depth of duct bank is adequate to be below finish grade. Ascertain that ends are plugged with temporary closures. Verify that duct banks have clear raceways and are fitted with pull ropes.

d. Verify that all pull boxes, junction boxes, wireways and conduits are securely mounted to underlying construction.

e. Verify that all conductors are marked with cable labels as specified.

f. Verify that pulling lubricant complies with specification.

g. Witness all testing and high potential (high - pot) testing of conductors as specified. Witness all testing of grounding and ground resistance for ground rods, conductors and connections.

h. Verify that switchboard testing is in compliance with the specification.

i. Verify that all maintenance training for the owner's employees for all special equipment such as the UPS, the emergency generators, and the fire alarm and smoke detection systems, has occurred or has been scheduled before final turnover.

j. Visually inspect the lightning protection system, the air terminals, the main and bonding conductors, the ground rods, and all connections and terminations for continuity and proper connections. Verify that grounding tests have performed per specification.

k. Verify that all high voltage cable splices are performed by persons having a certificate of competency from an approved testing agency. The qualifications of the cable splicer/terminator shall be submitted 30 days prior to any splices in medium voltage cables.