



**STATE OF NEW HAMPSHIRE
DEPARTMENT OF
ADMINISTRATIVE SERVICES**

DIVISION OF PUBLIC WORKS DESIGN & CONSTRUCTION

DESIGN GUIDELINES

John O. Morton Building Addition, 2001



Photo by Jerry Zoller, NHDOT, 10/27/07

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State of New Hampshire
Department of Administrative Services
Division of Public Works – Design &
Construction John O. Morton Building, Room
250
Box 483, 7 Hazen Drive
Concord, New Hampshire 03302-0483
Telephone: 603-271-3516
Fax: 603-271-3515
TDD: 1-800-735-2964
<http://das.nh.gov/publicworks>

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INTRODUCTION

1. The *Design Guidelines* manual has been prepared by the Division of Public Works Design and Construction (the Division), Department of Administrative Services (the Department), State of New Hampshire.
2. The *Design Guidelines* manual is a working document for use as a guide in the design of buildings and other public works structures and in the preparation of contract plans and specifications. This manual includes design guidelines, intended to promote consistency and continuity of design work practices. This does not constitute a specification or contract document.
3. This manual promotes consistency of practice and represents the current best thinking of the Division, yet at the same time permits the Engineers/Architects to exercise discretionary judgment in its implementation and provides for the incorporation of new ideas. Each Division member is encouraged to participate in keeping this document current as design practices change and improve. The manual should be reviewed and revised periodically as necessary.
4. Revisions and updates to the *Design Guidelines* manual will be posted on the Division's website as they become available: <http://das.nh.gov/publicworks/PWdocuments.asp>
5. Departure from the guidelines may be required for certain building types and land development projects. A building system, product, or design requirement appropriate for office fit-up may not be applicable to hospital, prison, or other work. Requirements may differ from one State agency to another – check with the Using Agency for their requirements.
6. DEPARTURE FROM THE GUIDELINES MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR IN WRITING AND RECORDED IN THE PERMANENT PROJECT RECORDS.
7. “Design guidelines” are herein defined as written procedures, instructions, practices, and “rules-of-thumb” used by the Division in the design of buildings and other public works’ structures during the preparation of contract plans.
8. “Contract Administrator” is herein defined as the Department’s Division of Public Works Project Manager or other appointed representative having specific authority per RSA 21-I:82 to act on the Department’s behalf and shall be responsible for general supervision, control and direction over all matters pertaining to design, construction, maintenance standards, preservation, and administration of the Contract.
9. “Using Agency” is herein defined as any executive department, commission, independent establishment, public corporation which is an instrumentality of a state board, bureau, division, institution, service, office, officer, authority, administration, or other establishment in the executive branch of the government, who are responsible for the facility and/or will occupy the facility after and/or during the Work. The Using Agency(ies) has/have no contractual agreement with the Contractor and therefore shall not direct the Contractor in any way.

SECTION 100 -- GENERAL

A. GENERAL

1. The State must comply with federal and state codes, laws, regulations, and permitting requirements.
2. The State shall make an attempt to comply with local regulations and requirements where possible and work closely with municipalities to meet their needs and requirements to the maximum extent practicable. Refer to NH RSA 674:54, Governmental Land Uses.
3. Thorough and complete code analysis is required on the Drawings or in the Specifications. Include in the analysis, New Hampshire specific amendments to the State Building and Fire Codes. Note that there is a New Hampshire specific amended allowable height and area chart “pdf” that replaces the chart in the State Building Code. Links to these items are provided in this chapter in the following article, “STATE CODES, REGULATIONS, PERMITS.”
4. Meet seismic restraint requirements for special construction, elevators, fire protection, plumbing, mechanical, electrical, communications systems, equipment, and other systems where applicable in accordance with the requirements of the New Hampshire State Building Code. The requirements are site specific and may require testing to determine soil type and seismic design requirements. The seismic design requirement is not limited to structural design; all disciplines must incorporate seismic design. The consultant needs to verify that they are following the State Building Code in regard to seismic design. It may be necessary for the main consultant to hire a specialized seismic consultant on larger or more complicated projects. This should not be left up to the contractor to specify or design.
5. Thoroughly evaluate existing conditions through site investigation and existing documentation for the fullest possible understanding and to determine design requirements.
6. Commissioning is required for some State funded buildings. Review requirements and coordinate with Contract Administrator. Refer to the “High Performance Design Standard” in the following article, “STATE CODES, REGULATIONS, PERMITS.”
7. Refer to “Interior Space Planning Standards” at the Division's website, full title, “Interior Space Planning Standards; For Use With Systems (Panel Based) Office Furniture:”
<http://das.nh.gov/publicworks/PWdocuments.asp>
8. Provide an “Owner Furnished Items” list to the Contract Administrator and Using Agency separated into the following categories:
 - a. Owner Furnished and Installed Items.
 - b. Owner Furnished and Contractor Installed Items.
9. Specifications:
 - a. Make sure all specification sections are coordinated with the Division's General Conditions, Document 000708.
 - b. Series 0 “Documents” And Division 1 “General Requirements” – Review with the Division's Contract Administrator.
 - c. Substitution requirements are required in every Specification Section, in Part 2 Products (as the first item). Include the following language: “SUBSTITUTIONS – Materials shall be as specified herein, except, consideration shall be given to other products that meet or exceed

- those specified if requested five (5) business days prior to the date of bid opening in accordance with SECTION 01600 -- PRODUCT REQUIREMENTS. (Or, "SECTION 016000..." – coordinate with Contract Administrator.)
- d. A single manufacturer should only be listed when a sole source justification can be made, then indicate: " No Substitutions will be allowed."
 - e. The design can be based on a specific brand or make of material or apparatus. Strive to list a minimum of two additional manufacturers for products or equipment that are an acceptable substitute. It is the contractor's responsibility to submit information showing that the proposed product or equipment meets or exceeds the quality, performance, functions, features and contract requirements of the specified equipment. It is the responsibility of the Consultant to review the product or equipment for conformity with the specifications.
10. Drawings:
- a. The Division's project number must be in the lower right hand corner of the drawings.
 - b. Drawings require licensed architect and/or engineer's (as applicable) stamp and signature.
 - c. All drawings require submittal to the Division in electronic format, compatible with the most current version of AutoCAD.
11. For all courthouse projects refer to court design standards compiled by the Administrative Office of the Courts. Coordinate with the Contract Administrator to obtain the most current edition.
12. Projects with known hazardous materials are generally addressed by the building owner under a separate contract or through a separate contract administered by the Division. Review with the Contract Administrator at the beginning of services on a project-by-project basis.
13. FAA Notifications: Review scope, lead-time, etc, with Contract Administrator.
14. Review utility easement requirements (if any) with the Contract Administrator at the beginning of the project. Contract Administrator shall check whether utility easements are required to provide service to building(s), including for electrical and telephone infrastructure. This is a lengthy process requiring The Council on Resources and Development (CORD) review, Long Range Capital Planning & Utilization Committee approval and Governor and Executive Council (G&C) approval.
- B. STATE CODES, REGULATIONS, PERMITS**
1. Buildings and other Public Works' related structures should be designed in accordance with applicable state codes, regulations, and permits including but not limited to the following:
 - a. Alteration of Terrain (AOT) permit:
http://des.nh.gov/organization/divisions/water/aot/permit_aot.htm
 - b. Stormwater Pollution Prevention Plan (SWPPP)
<http://des.nh.gov/organization/divisions/water/stormwater/index.htm>
 - c. NH State Building Code and Amendments:
<http://www.nh.gov/safety/boardsandcommissions/bldgcode/index.html>
 - d. NH State Fire Code and Amendments:
<http://www.nh.gov/safety/divisions/firesafety/index.html>
 - e. NH Governor's Commission on Disability, Architectural Barrier Free-Design Committee:
<http://www.nh.gov/disability/about/abcommittee.htm>
 - f. NH Division of Historical Resources, State Historic Preservation Office – Project Review:
<http://www.nh.gov/nhdhr/review/>

- g. NH High Performance Design Standard (linked at):
<https://admin.state.nh.us/purchasing/publicworks/PWdocuments.asp>
 - 1) Building Requirements for State Funded Buildings, NH RSA 155-A:13:
<http://www.gencourt.state.nh.us/rsa/html/XII/155-A/155-A-13.htm>
- h. NH Clean Air in State Buildings, RSA 10-B, ENV-A 2200:
<http://des.nh.gov/organization/commissioner/legal/rules/documents/env-a2200.pdf>
- i. New Hampshire's Percent for Art Program, 19-A:9, 19-A:10:
<http://www.nh.gov/nharts/programservices/percentforart.htm>
- j. New Hampshire Outdoor Lighting Efficiency and Dark Sky Policy, RSA 9-E:
<http://nhrsa.org/law/chapter/9-e/>

SECTION 200 -- CIVIL

A. GENERAL

1. This section outlines general requirements for civil designs to be performed for the Division. This standard is intended to establish a baseline of design. The designer shall apply the principles of this section in order to achieve a level of quality and consistency in the design and the construction of State facilities.
2. Every Specification Section is required to include in Part 2 (as the first item), "SUBSTITUTIONS: Materials shall be as specified..." (refer to "SECTION 100 -- GENERAL" for the entire statement).
3. Make sure all specification sections are coordinated with the Division's General Conditions, Document 000708.
4. Salvage of materials in general (excess loam, trees, wood chips, etc) shall be coordinated with the Using Agency. Identify materials to be salvaged by the Using Agency and/or by the Contractor for the Using Agency.

B. STANDARDS

1. NHDOT *Standard Specifications for Road and Bridge Construction* (SSRBC), latest edition.
 - a. All divisions of the SSRBC shall apply to the Division's projects and be referenced in the contract documents. SSRBC divisions apply to the Division's projects as indicated in the following:
 - 1) Division 100 -- General Provisions: Not applicable except where referenced in Divisions 200 through 700, to the extent that those provisions do not conflict with other express provisions of the contract specifications.
 - 2) Divisions 200 – 700: Applicable to the extent that those provisions do not conflict with other express provisions of the contract specifications.
 - 3) Any portion of the SSRBC relating to "Basis of Payment" and "Method of Measurement" is not applicable.
 - b. All applicable technical provisions of the SSRBC shall be considered effective for the exterior work unless some sections of the SSRBC are modified by individual specification sections. Any such modifications shall take precedence over the SSRBC provisions.
 - c. If there are any conflicts between references, the most stringent reference, as determined by the Contract Administrator, shall apply.
 - d. A quality of assurance program including frequency and method of testing shall be as defined by the Engineer of Record. At a minimum, the SSRBC "Frequency of Sampling and Testing" shall be incorporated as found in the following tables:
 - 1) "Frequency of Sampling & Testing – Soil Items Method Specifications."
 - 2) "Frequency of Sampling & Testing – Asphalt Items, Method Specification."
 - 3) Refer to:
<http://www.nh.gov/dot/org/projectdevelopment/planning/documents/QA-QCMaterialStandards-2010.pdf>

C. EARTHWORK -- Reserved for future use.

D. EXTERIOR IMPROVEMENTS

1. Granite curbing is preferred in lieu of precast concrete. Vertical granite curb is preferred in lieu of sloped granite edging. Asphalt berm or edging is allowed only by written permission of the Contract Administrator. Refer to *Standard Specifications for Road and Bridge Construction, State of New Hampshire, Department of Transportation (SSRBC)*, latest edition, Section 609.
2. Sidewalk accessibility: Include design and details for sidewalk accessibility requirements for detectable warnings, curb ramps, etc. Refer to *Design Guidelines*, "Section 100 – General," article "STATE CODES, REGULATIONS, PERMITS," subparagraph, "NH Governor's Commission on Disability, Architectural Barrier Free-Design Committee."
3. Concrete sidewalks: 4,000 psi compressive strength.
 - a. Minimum width: 5'-0".
 - b. Control joints: 5'-0" on center, maximum spacing.
 - c. Expansion joints: 30'-0" on center, maximum spacing. Asphalt-saturated cellulosic fiber is permitted, terminated not less than ½ inch or more than 1 inch below finished surface. During concrete placement, protect to edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
4. Asphalt sidewalks: Allowed only by written permission of Contract Administrator.
 - a. Provide minimum 3" depth in two courses.
 - b. Refer to SSRBC, latest edition, Section 608.

E. UTILITIES

1. Catch basin frames:
 - a. Set in concrete.
 - b. Provide detail drawings.
 - c. Refer to SSRBC, latest edition, Section 604.3.4.
2. Manholes:
 - a. Provide detail drawings.
 - b. Refer to SSRBC, latest edition, Section 604.

SECTION 300 -- STRUCTURAL

A. GENERAL

1. Every Specification Section is required to include in Part 2 (as the first item), "SUBSTITUTIONS: Materials shall be as specified..." (refer to "SECTION 100 -- GENERAL" for the entire statement).
2. Make sure all specification sections are coordinated with the Division's General Conditions, Document 000708.

B. CONCRETE

1. Refer to "SECTION 400 -- ARCHITECTURAL," "CONCRETE" article.
2. Include requirement in the Specifications that the Contractor is responsible to meet moisture content requirements in concrete slabs for finish flooring. Refer to *Design Guidelines* "Section 400 -- Architectural," article "Finishes," paragraph pertaining to concrete slab moisture content for finish flooring and required moisture testing.
3. Provide "flat" wire-mesh reinforcing (where used) and not "rolled."
4. Concrete testing to include (and is not limited to) testing for slump, compressive strength, temperature, and air content.
5. Mock-up panels for concrete and masonry or other exterior walls may be combined as one unit and are to remain on-site for the duration of the work.
6. Provide supports for wire mesh in concrete slabs consisting of chairs, bolsters, and/or masonry. Allow no concrete placement without proper supports in place. Red brick supports are not permitted.
7. A concrete slab vapor barrier is required, consistent with good design practice, design guidelines and building codes where applicable.
8. Engineer of record shall determine appropriate design criteria. Include the following items in the contract documents.
 - a. Concrete plant inspections - NHDOT inspection and approval required.
 - b. Concrete truck inspections - NHDOT inspection and approval required.
 - c. Concrete mixers: Contract administrator reserves the right to reject the continued use of concrete mixers and concrete delivered with the mixers. Refer to *Standard Specifications for Road and Bridge Construction, State of New Hampshire, Department of Transportation* (SSRBC), Section 520-3.4.2.3.
9. Include the following in the contract documents. Additional tests consisting of nondestructive testing and drilled core testing resulting from low strength test results may be permitted by the Contract Administrator. Notwithstanding ASTM C42 and ACI 318, Section 5.6.5 references to core tests equaling 85% of compressive strength being "considered structurally adequate," the Contract Administrator shall determine acceptability of the concrete based on core tests equaling 100% of design strength.

10. Structural testing requirements are determined by the structural engineer and are to be noted in the Specifications.

C. MASONRY

1. Refer to “SECTION 400 -- ARCHITECTURAL,” “MASONRY” article.
2. Retempering of mortar is not permitted after two hours of original mixture – include in Specifications.
3. Avoid the use of concrete block as an exposed exterior wall surface unless used with a fully warranted waterproofing system.
4. Structural testing requirements are determined by the structural engineer and are to be noted in the Specifications.

D. METALS

1. Refer to “SECTION 400 -- ARCHITECTURAL,” “METALS” article.
2. Structural testing requirements are determined by the structural engineer and are to be noted in the Specifications.
3. Specify hot dip galvanized products where applicable, incorporating thickness requirements.
4. Incorporate design solutions for dissimilar metals where applicable.

E. WOOD

1. Refer to “SECTION 400 -- ARCHITECTURAL,” “WOOD, PLASTICS, AND COMPOSITES” article.
2. Protect plywood roof and wall sheathing from rain and snow.
3. Power actuated nailing of roof and wall sheathing is permitted. Staples are not permitted.
4. Structural testing requirements are determined by the structural engineer and are to be noted in the Specifications.

SECTION 400 -- ARCHITECTURAL

A. GENERAL

1. Every Specification Section is required to include in Part 2 (as the first item), "SUBSTITUTIONS: Materials shall be as specified..." (refer to "SECTION 100 -- GENERAL" for the entire statement).
2. Make sure all specification sections are coordinated with the Division's General Conditions, Document 000708.

B. CONCRETE

1. Refer to "SECTION 300 -- STRUCTURAL," "CONCRETE" article.
2. Require that concrete face panels be same as sample panel for duration of the work. Mock-ups for concrete face panels shall remain in place for the duration of the work. A concrete face panel mock-up including window unit with head flashing, sill detail, etc, may be specified and required.

C. MASONRY

1. Refer to "SECTION 300 -- STRUCTURAL," "MASONRY" article.
2. Weep holes: Specify honeycomb types, full head height. Do not use rope or tube weeps.
3. Specify and/or require that all through-wall and head flashings be extended beyond surface for proper drip (not cut back). Require all such details on drawings. Provide flashing end-dams where applicable. Provide mesh to fill air-space at through-wall flashing locations.
4. Require that face brick be same as sample panel for duration of the work. Mock-ups shall remain in place for the duration of the work. A masonry mock-up including window unit with head flashing, sill detail, etc, may be specified and required.
5. Brick veneer walls: Specify and require the use of adjustable ties.
6. Exterior sheathing behind masonry: Some products are not waterproof, resulting in moisture damage. Field verify product specifications and warranties for weather exposure prior to installation. Provide water-resistant exterior rated sheathing.
7. Brickwork: Specify and/or require through-wall flashing and weeps at maximum three story intervals unless otherwise required or recommended by code or design guidelines. Provide complete drawing details for all masonry flashings.
8. Provide drawing details of all caulking at lintels, window and door frames, miscellaneous wall penetrations, horizontal joints, flashings, etc., and enforce their use in the field. Show control joints in the drawings; on floor plans and elevations.
9. Mock-up panels for concrete and masonry or other exterior walls may be combined as one unit and are to remain on-site for the duration of the work.

D. METALS

1. Refer to "SECTION 300 -- STRUCTURAL," "METALS" article.
2. Specify fire rating systems where required for structural and miscellaneous steel.

E. WOOD, PLASTICS, AND COMPOSITES

1. Refer to "SECTION 300 -- STRUCTURAL," "WOOD" article.
2. Finger-jointed exterior woodwork and trim is not permitted.
3. Wood studs are not permitted in partitions that are greater than ten-foot (10') height.
4. Provide stainless steel fasteners for exterior wood siding and trim.
5. Provide head, sill, and jamb drawing details at all openings. Refer to "SECTION 400 -- ARCHITECTURAL," "THERMAL AND MOISTURE PROTECTION" article for insulation requirements at openings.
6. Provide drawing details showing welded door frame connections to studs.
7. Provide solid-through color plastic laminate counter-tops.
8. Adhere to standard details and materials for courthouse judge's benches. Standards will be provided by the Division.
9. Provide minimum two-inch (2") wood or three-quarter inch (3/4") plywood wall blocking for stair anchors, toilet partitions, toilet accessories, and other items as required.
10. Provide preservative treated wood for wood to concrete connections and indicate thus on all applicable drawing details. Consider preservative treatment effect on adjacent materials including fasteners.

F. THERMAL AND MOISTURE PROTECTION

1. Include requirements for special inspections for the following items as required in the State Building Code.
 - a. Sprayed fire-resistant materials.
 - b. Mastic and intumescent fire-resistant coatings.
 - c. Exterior insulation and finish systems (EIFS), except where exempted in the building code.
2. Penetration Firestopping: Provide penetration firestopping in fire-resistance-rated walls, horizontal assemblies, and smoke barriers in accordance with building and fire code requirements. Firestop systems will be UL Classified to ASTM E814 (UL 1479). Submittals are required, including for product data, product schedule, qualification data, and product test reports (with locations).
 - a. Projects with Architect: Firestopping specifications are required in Division 7. Include requirement for firestopping in fire sprinkler, plumbing, hvac, electrical, and communications specification sections with reference to the firestopping specification located in Division 7.

- b. Projects with Engineer (and no Architect): For fire sprinkler, plumbing, hvac, electrical, and communication projects where there is no Architect involved in the project, firestopping specifications are required and may be located in and are required to be coordinated with all corresponding specification sections.
3. Fire-Resistive Joint Systems: Provide fire-resistive joint systems including those installed in or between fire-resistance walls, floor or floor-ceiling assemblies in accordance with building and fire code requirements.
 - a. Specification section is required in Division 7 where the building or fire code requires fire-resistive joint systems in the project.
 - b. Fire-resistive joint systems shall be UL Classified to ASTM E1966 (UL 2079).
 - c. Submittals are required, including for product data, product schedule, qualification data, and product test reports (with locations).
4. Provide head, sill, and jamb drawing details at all openings.
5. Specify and note on drawings insulation fill at all voids, including window and door frames. Insulate behind and around electrical boxes. Spray foam shall be minimally expanding and low pressure.
6. Provide architectural drawing details at all flashing conditions. Specification of SMACNA standards “only” is not permitted. Specify metal flashing gauges or thicknesses for all roof and wall flashing conditions.
7. Shingle roofs:
 - a. **Provided that sufficient venting** of sloped roof areas exists, provide bituthene membrane covering over the entire roof deck surface (full-coverage on sheathing). Verify compatibility and warranty issues with the shingle manufacturer.
 - b. Minimum slope for shingle roofs is three units vertical in twelve units horizontal (3:12) with full bituthene membrane coverage, provided that sufficient venting of roof area exists.
 - c. Specify and require six (6) nails per shingle for all shingled roofs.
 - d. Specify and require hand-nailing of shingles – power nailing and stapling is not permitted.
 - e. Specify algae resistant (AR) shingles.
 - f. Specify forty (40) year overall warranty, with the first ten (10) years minimum to include material and labor. Review shingle recommendation and warranty details with Contract Administrator.
8. Low-slope roofs:
 - a. Low-slope definition related to following items is defined as a slope less than or equal to four units vertical in twelve units horizontal (4:12). Building code or roofing manufacturer definition may differ and there is no intent to change those definitions where they apply.
 - b. Provide a vapor barrier in appropriate location or provide an explanation “why not.”
 - c. Specify thirty (30) year total system warranty on roofing systems, including roof edge metal and metal coping systems. Provide warranty for the above from the same manufacturer.
 - d. Specify prefabricated bent or extruded metal roof edge and metal coping systems. Shop bent roof edge and coping systems are not permitted.
 - e. White roof membrane systems are not required.
 - f. EPDM and SBS are preferred low-slope roof materials – review proposed roof system with Contract Administrator and Using Agency.

9. Roofing:
 - a. Wetted roofing felts are not permitted to remain in new roofing work; remove and replace as required. Follow manufacturer's recommendations for bituthene membrane materials.
 - b. Overloading roof systems with temporarily stored roofing, insulation, and related materials is not permitted.
 - c. Specify and require complete weather protection during construction for all roofing, insulation, and related products temporarily stored outside.
10. Specify and detail building envelope materials and products in compliance with New Hampshire State building and energy codes.

G. OPENINGS

1. Provide head, sill, and jamb drawing details at all openings. Refer to "SECTION 400 -- ARCHITECTURAL," "THERMAL AND MOISTURE PROTECTION" article for insulation requirements at openings.
2. Provide complete door and window schedules including frames. Include wood windows and doors in the schedules.
3. Wood doors:
 - a. Specify details of interior solid core wood door materials and quality – do not specify "only" an AWI standard (e.g., include rotary or other cut, birch or other material, veneer details, etc). Include warranty requirements.
 - b. Specify factory finishing. Specify painting and/or sealing for all wood door edges and hardware cutouts after final door fitting.
 - c. Require samples.
4. Steel doors and frames:
 - a. Steel door frames are required to be shop fabricated, welded units. Welded units are required to be die cut mitered and continuously welded. Specify complete descriptions for "fully welded" metal door frames.
 - b. Steel door faces are required to be full flush with each door face formed from a single sheet of steel with no visible seams on the surface of the faces. A full height vertical seam, continuously welded, is permitted on door edges with the seam dressed smooth. Steel door tops are required to be flush and door bottoms are inverted channels, unless detention type, where both edges are flush.
 - c. Specify door vision lite units to be installed on the secure side if screw applied.
 - d. Require samples.
5. Aluminum doors: Provide mechanically fastened and welded corner construction. Require samples.
6. Windows:
 - a. Metal window frames are required to be thermally broken. Sills shall be factory complete with exterior baffled weep holes, with no obstructions (from joint sealant or other materials). Include drawing details showing connections to framing and showing insulation at voids.
 - b. Specify total system warranty on all exterior window units that are furnished glazed. Specify maximum available warranty; overall unit minimum is five (5) years and glass only at ten (10) years.

- c. Specify full-screens at single and double-hung windows.
 - d. Require samples.
7. Hardware:
- a. Coordinate hardware with Using Agency and Contract Administrator. Maintain uniformity of base metal and finish throughout project system. Specify best level of quality products for the longest life. Specify stainless steel hardware and workings at New Hampshire seacoast locations.
 - b. Specify complete system for electronic locking hardware (e.g., electric door locks, frame contactors, secured in-frame wiring, transformers, etc). Cross-reference to electrical drawings and specifications.
 - c. For security hardware, specify coordination of new keying systems with existing where required, including coordination with and review and approval by the State Fire Marshal's office.
 - d. Confirm compatibility of new specified hardware with existing hardware systems that are retained.
 - e. Specify removeable cores at keyed locksets.
8. Coordinate door, window, and other opening requirements at detention units, prisons, and courthouses with Using Agency and Contract Administrator.

H. FINISHES

1. Include requirement in the Specifications that the Contractor is responsible to meet moisture content requirements in concrete slabs for finish flooring. Also include requirement for type and number of moisture tests, requirement for Contractor submittal of test results including locations, and requirement for Contractor to review test results with the Architect / Engineer and Contract Administrator.
2. Finishes: Specify and require complete paint systems, verifying compatibility of products for both new painting and recoat work.
3. For punch list and/or corrective work, require that all "touch-up painting" be from corner to corner and floor to ceiling. No spot painting repair work shall be allowed. Specify and require same.
4. Specify and require proper preparation and paint systems for high-end millwork and built-in furniture, such as courthouse judge's benches and related monumental items.
5. Specify and require that all wall repairs, etc, be complete and approved before final finish coat is applied. All repairs shall be in accordance with minimum Level 4 finish (Gypsum Association: GA 214 - Recommended Levels of Gypsum Board Finish).
6. Specify and require a skim coat on non-paper finish gypsum boards.
7. Specify and require gypsum board on walls must be applied with 1/2" gap between the gypsum board and floor to prevent potential wicking. Include acoustical sealant or caulk in the gap. Review requirements related to fire-rated walls.

8. Acoustical Ceilings: Specify and require that all fixtures, etc, mounted in lay-in acoustical ceiling systems, be supported at all four corners. Coordinate this requirement in Division 23 Mechanical and Division 26 - Electrical.
 9. Specify and require fifteen-foot wide carpet goods for large rooms or areas. Require seaming diagrams in submittals.
 10. Special fasteners are required at abuse resistant gypsum board (as per manufacturer).
 11. Specify rolled (not sections) rubber or vinyl for base with pre-moulded corners. Specify rubber, one-piece stair treads and risers, and rubber radial flooring.
- I. SPECIALTIES -- Reserved for future use.
- J. EQUIPMENT -- Reserved for future use.
- K. FURNISHINGS -- Reserved for future use.
- L. SPECIAL CONSTRUCTION -- Reserved for future use.
- M. CONVEYING EQUIPMENT -- Reserved for future use.

SECTION 500 -- FIRE PROTECTION

A. GENERAL

1. Every Specification Section is required to include in Part 2 (as the first item), “SUBSTITUTIONS: Materials shall be as specified...” (refer to “SECTION 100 -- GENERAL” for the entire statement).
2. Make sure all specification sections are coordinated with the Division's General Conditions, Document 000708.
3. Penetration Firestopping: Provide penetration firestopping in fire-resistance-rated walls, horizontal assemblies, and smoke barriers in accordance with building and fire code requirements. Firestop systems will be UL Classified to ASTM E814 (UL 1479). Submittals are required, including for product data, product schedule, qualification data, and product test reports (with locations).
 - a. Projects with Architect: Firestopping specifications are required in Division 7. Include requirement for firestopping in fire sprinkler, plumbing, hvac, electrical, and communications specification sections with reference to the firestopping specification located in Division 7.
 - b. Projects with Engineer (and no Architect): For fire sprinkler, plumbing, hvac, electrical, and communication projects where there is no Architect involved in the project, firestopping specifications are required and may be located in and are required to be coordinated with all corresponding specification sections.
4. Additional guidelines: Refer to “SECTION 700 -- MECHANICAL.”

SECTION 600 -- PLUMBING

A. GENERAL

1. Every Specification Section is required to include in Part 2 (as the first item), “SUBSTITUTIONS: Materials shall be as specified...” (refer to “SECTION 100 -- GENERAL” for the entire statement).
2. Make sure all specification sections are coordinated with the Division's General Conditions, Document 000708.
3. Penetration Firestopping: Provide penetration firestopping in fire-resistance-rated walls, horizontal assemblies, and smoke barriers in accordance with building and fire code requirements. Firestop systems will be UL Classified to ASTM E814 (UL 1479). Submittals are required, including for product data, product schedule, qualification data, and product test reports (with locations).
 - a. Projects with Architect: Firestopping specifications are required in Division 7. Include requirement for firestopping in fire sprinkler, plumbing, hvac, electrical, and communications specification sections with reference to the firestopping specification located in Division 7.
 - b. Projects with Engineer (and no Architect): For fire sprinkler, plumbing, hvac, electrical, and communication projects where there is no Architect involved in the project, firestopping specifications are required and may be located in and are required to be coordinated with all corresponding specification sections.
4. Additional guidelines: Refer to “SECTION 700 -- MECHANICAL.”

SECTION 700 -- MECHANICAL

A. GENERAL

1. Every Specification Section is required to include in Part 2 (as the first item), “SUBSTITUTIONS: Materials shall be as specified...” (refer to “SECTION 100 -- GENERAL” for the entire statement).
2. Make sure all specification sections are coordinated with the Division's General Conditions, Document 000708.
3. Penetration Firestopping: Provide penetration firestopping in fire-resistance-rated walls, horizontal assemblies, and smoke barriers in accordance with building and fire code requirements. Firestop systems will be UL Classified to ASTM E814 (UL 1479). Submittals are required, including for product data, product schedule, qualification data, and product test reports (with locations).
 - a. Projects with Architect: Firestopping specifications are required in Division 7. Include requirement for firestopping in fire sprinkler, plumbing, hvac, electrical, and communications specification sections with reference to the firestopping specification located in Division 7.
 - b. Projects with Engineer (and no Architect): For fire sprinkler, plumbing, hvac, electrical, and communication projects where there is no Architect involved in the project, firestopping specifications are required and may be located in and are required to be coordinated with all corresponding specification sections.

B. APPLICABLE DESIGN CODES AND STANDARDS

1. New Hampshire Building Code as defined in RSA 155-A with amendments as adopted by the Building Code Review Board and may (can) be found at the following link: www.nh.gov/safety/boardsandcommissions/bldgcode.
2. Meet seismic restraint requirements for fire-protection, plumbing, and mechanical equipment and systems in accordance with the requirements of the New Hampshire State Building Code. Refer to *Design Guidelines* “Section 100 -- General” paragraph pertaining to seismic requirements.
3. State Fire Code, Saf-C-6000 in accordance with RSA 153:5. Copies may (can) be found at the following link: www.nh.gov/safety/divisions/firesafety.
4. State Fire Marshal’s Office - Department of Safety, Local city and town construction Standards, Rules and Ordinances.
5. The design and construction must comply with all required codes and laws, not just those listed herein.

C. DESIGN GUIDELINES

1. Ductwork construction shall at a minimum comply with most current editions of SMACNA *HVAC Systems-Duct Design* and SMACNA *HVAC Duct Construction Standards – Metal and Flexible*. Unless otherwise required to meet a higher pressure standard, all ductwork shall be 2”w.g., with all joints sealed to class “C.”
2. Mechanical system design temperatures shall be based on ASHRAE 99% heating and 1% cooling temperature and coincident humidity. Indoor design temperatures shall be based on the most

recent edition of ASHRAE standards unless otherwise indicated in the program. Coordinate with the Contract Administrator and Using Agency.

3. In general, ducted returns are to be used on all ventilation systems, use insulated double wall air handlers where possible to promote indoor air quality. Flexible duct runs should be restricted to less than 6 feet; round duct shall be spiral seam construction unless specified otherwise; take offs from duct main branches or trunks shall be with 45° take offs with volume dampers located here to reduce noise. Provide flex connections at all vibrating equipment and on VAV boxes with coils to allow maintenance; black paint inside of duct at all duct termination devices; reinforce ductwork as required for the design duct pressure. Minimum centerline duct radius of elbows shall be 1.0. Rooftop equipment closer than 10' to roof's edge shall have a railing. Consider lining ductwork where noise is a concern.
4. The Contractor shall employ the services of a Certified Industrial Hygienist using a laboratory accredited by the American Industrial Hygiene Association to comply with RSA 10-B, ENV-A 2200, Clean Air in State Buildings Rules (New Hampshire Air Program Rules). Certification of properly collected and analyzed data that demonstrates compliance with said standards will be made by the Department of Environmental Services, Bureau of Environmental and Occupational Health, Radon Indoor Air Quality Program, 29 Hazen Drive, Concord, NH 03302-0095, telephone 603/271-3911) upon receipt of data submitted by the Certified Industrial Hygienist.
5. In accordance with Env-A 2200 & Env-A 2205 Standards, the following must be addressed:
 - a. Ventilation.
 - b. Noise.
 - c. Radon.
 - d. Carbon Dioxide.
 - e. Asbestos.
 - f. Formaldehyde.
 - g. Carbon Monoxide
6. Where possible the HVAC systems shall be designed with an economizer. Automatic temperature and environmental control systems shall be digital, except for renovation projects where existing systems are electrical or pneumatic, no new pneumatic control shall be used unless specifically approved by the Division. In general for new digital control systems, a graphical representation of the equipment on a provided computer shall be required for complicated systems and systems controlling a building of over 25,000 square feet.
7. Careful consideration of temperature control zoning is critical. Temperatures shall be adjustable from the control computer and wall sensor/thermostat.
8. Require the Contractor to coordinate submittals and the purchase and installation of HVAC and electrical equipment with the Using Agency and Contract Administrator and with the mechanical and electrical subcontractors.
9. Controls: Careful coordination of the DDC controls with the Division's Contract Administrator and the Using Agency is required since each situation is unique.
 - a. Automatic temperature controls field monitoring and control system using field programmable microprocessor based units with communications to Building Automation and Control System.
 - b. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

- c. Provide computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
 - d. Provide controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, when directly connected to control units.
 - e. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories to operate mechanical systems, and to perform functions specified.
 - f. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.
 - g. Consideration shall be carefully given when integrating with the State's existing Building Management Systems and Universal Network Controllers, of which there are many.
10. The operating cost of the mechanical systems is a high concern. The designer shall evaluate and present to the Division, options with life cycle costs when selecting mechanical systems. The designer will be asked to economically justify the system selection. While other building and occupancy factors contribute to system selection, these need to be discussed with the Division during the design process. HVAC systems shall incorporate high-energy efficiency equipment and systems and energy recovery systems. Always use premium efficiency motors.
 11. Adequate space shall be provided to service mechanical equipment. Consideration shall be given for removing and replacing mechanical equipment.
 12. Mechanical systems shall be designed to comply with the appropriate structural requirements of the New Hampshire State Building Code, including snow, wind, and seismic loading.
 13. Approved smoke, fire, and combination dampers shall be provided in accordance with the requirements of NFPA 90A *Installation of Air-Conditioning and Ventilation Systems*, NFPA 90B *Installation of Warm Air Heating and Air-Condition Systems*, NFPA 101 *Life Safety Code*, *International Building Code*, and *International Mechanical Code*.
 14. Consideration of freeze protection and thermal shock shall be given in hydronic systems.
 15. An Order for State Government to Continue to Lead by Example in Energy Efficiency, Executive Order 2011-1 (supersedes EO 2005-4), shall apply to new buildings that are estimated to exceed \$1 million in construction cost; building additions that add 25 percent or greater gross floor area to the existing building and/or those that are estimated to exceed \$1 million in construction costs; and/or building renovations that exceed 25 percent of the gross floor area.
 16. New Hampshire High Performance Design Standard linked at <https://admin.state.nh.us/purchasing/publicworks/PWdocuments.asp> is to be implemented in the design and construction of State funded projects for State owned properties per the State Building Code, Section 155-A:13.
 17. Dry automatic sprinkler systems shall be designed to utilize internally galvanized pipe and fittings. Galvanized pipe shall be in accordance with ANSI/ASTM A53 *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*; ANSI/ASTM A 795 *Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use*.
 18. On wet pipe sprinkler systems, sprinkler pipes shall be permitted to be installed level. In dry pipe systems, branch lines shall be pitched at least ½ inch per 10 feet and mains shall be pitched at least ¼ inch per 10 feet. In preaction systems where a portion of the piping is subject to freezing,

branch lines shall be pitched at least ½ inch per 10 feet and mains shall be pitched at least ¼ inch per 10 feet.

- 19. Provisions shall be made to properly drain all parts of the system.
- 20. Sprinkler pipe sizing shall be specified as follows. Review with Contract Administrator on a project-by-project basis. Contract Administrator must approve any deviation.

	Wet	Wet	Dry	Dry
Pipe Line	Mains	Branchlines	Mains	Branchlines
Sizes	2" and larger	2" and Smaller	2" and Larger	2" and Smaller
Type	Black Steel	Black Steel	Galvanized Steel	Galvanized Steel
Schedule	Schedule 10	Schedule 40	Schedule 10	Schedule 40
Joints	Grooved	Threaded	Grooved	Threaded
Fitting	Grv Weld and Hole Cut	Black Cast Iron	Grv Weld and Hole Cut	Galvanized Mall Iron

SECTION 800 -- INTEGRATED AUTOMATION FACILITY CONTROLS

(Reserved for future use)

SECTION 900 -- ELECTRICAL

A. GENERAL

1. Every Specification Section is required to include in Part 2 (as the first item), “SUBSTITUTIONS: Materials shall be as specified...” (refer to “SECTION 100 -- GENERAL” for the entire statement).
2. Make sure all specification sections are coordinated with the Division's General Conditions, Document 000708.
3. Penetration Firestopping: Provide penetration firestopping in fire-resistance-rated walls, horizontal assemblies, and smoke barriers in accordance with building and fire code requirements. Firestop systems will be UL Classified to ASTM E814 (UL 1479). Submittals are required, including for product data, product schedule, qualification data, and product test reports (with locations).
 - a. Projects with Architect: Firestopping specifications are required in Division 7. Include requirement for firestopping in fire sprinkler, plumbing, hvac, electrical, and communications specification sections with reference to the firestopping specification located in Division 7.
 - b. Projects with Engineer (and no Architect): For fire sprinkler, plumbing, hvac, electrical, and communication projects where there is no Architect involved in the project, firestopping specifications are required and may be located in and are required to be coordinated with all corresponding specification sections.

B. ELECTRICAL DESIGN GUIDE AND STANDARDS

1. General:
 - a. This section of the design standard outlines general requirements for electrical and telecommunications designs to be performed for the State of New Hampshire, Division of Public Works, Design and Construction (the Division). This standard is intended to provide useful information to the design firm to establish a baseline of design. The responsibility of the engineer is to apply the principles of this section and to achieve a level of quality and consistency in the design and the construction of State facilities.
 - b. This standard is tailored to design of prototypical office facilities. The design shall consist of detailed specifications, as well as detailed drawings that reflect project specific requirements.
 - c. Renovation projects with increased electrical load require electrical engineer verification for overall panel/service capacity.
2. Codes And Standards: Use of the following Codes and Standards as a baseline for programming and should not be considered as a complete requirement.
 - a. New Hampshire State Building Codes.
 - b. New Hampshire State Fire Codes.
 - c. NEC National Electrical Code.
 - d. IESNA Illumination Engineering Society (of North America).
 - e. New Hampshire Energy Code (IECC).
 - f. NH State Accessibility Codes.
 - g. EIA/TIA 568, 569, 607 - Telecommunications Standards.
 - h. Local City and Town construction standards and ordinances.
3. Design/Drawing Requirements: In addition to the specific requirements of the sections of the standard that follow, use the following as baseline programming guidelines. A typical Division 26

designed project shall include, but not be limited to the design and specifications for the following guidelines.

- a. Electrical and Telecommunications Ductbank Design up to the building electrical and telecommunications service entrance.
 - b. Main Electrical Service Entrance Equipment.
 - c. Building Electrical Distribution Design.
 - d. Emergency Power Systems.
 - e. Special Systems Design: Include Fire Alarm, Access and Security Systems. These systems need to be carefully coordinated with the Division's Contract Administrator and Using Agency for how they are to be bid and what systems are acceptable.
4. Electrical Standards:
- a. Energy conservation should be a primary objective. Comply with the New Hampshire Energy Code as mandated.
 - b. Wiring Method for all systems shall be in conduit or metal raceway. MC Cable may be allowed. However, pre-approval is required from the Division. Where MC cable is approved for use, all homeruns shall be in conduit.
 - c. Conductors shall be copper unless pre-approval is obtained from the Division to use aluminum conductors. This includes service entrance cabling.
 - d. Voltage drop calculations are required to be performed for all feeders and branch circuits and the wire sized accordingly.
 - e. Fault current calculations are required before selecting electrical equipment.
 - f. Coordination studies shall be performed on all buildings where in the judgment of the consultant, the safety of the occupants would require that breakers and fuses be selectively coordinated.
 - g. All electrical equipment shall be listed for its use.
 - h. Panelboards shall be dead front with bolt-on thermal magnetic circuit breakers with copper busses. Panelboard trims shall have front hinged to box.
 - i. All devices shall be specification grade, as a minimum, with heavy-duty industrial grade to be considered.
 - j. All outlet boxes, device boxes and supports shall be steel or cast aluminum.
 - k. Grounding systems in all cases shall include the main water service, grounding electrodes, building steel and concrete encased electrode (in new construction). A separate equipment grounding conductor shall be pulled in all feeder and branch circuit conduits. Provide a comprehensive diagram of the grounding system for both new and existing electrical systems.
 - l. All ballasts (for maintenance purposes) shall be individually fused.
 - m. Meet seismic restraint requirements for electrical equipment and conduit in accordance with the requirements of the New Hampshire State Building Code. Refer to *Design Guidelines* "Section 100 -- General" paragraph pertaining to seismic requirements.
 - n. Adequate space shall be provided around electrical equipment.
 - o. Telecommunications Systems Design: Refer to *Design Guidelines* "Section 1000 -- Communications." Voice, Data and Communications wiring should typically be installed in conduit.
 - p. All Fire Alarm Equipment and Manufacturers shall be pre-approved by the Division. Fire alarm wiring should typically be installed in conduit.
 - q. Coordinate fire-alarm monitoring company requirements with the Contract Administrator and Using Agency and specify one-year monitoring period following Substantial Completion.
 - r. Power Quality and PC's: The following guidelines shall be used when addressing this issue. Any considered deviation from this shall be addressed with the Division's Electrical Engineer.

- 1) TVSS Devices: If the design engineer feels that such device are warranted, they shall be installed as close to the supply transformer. One TVSS at the supply point will generally suffice for a facility.
- 2) Dedicated Computer Circuit Panels (no motors): Where known computer connections are part of a project, the design engineer shall provide for dedicated computer panels.
- 3) Convenience outlets for offices, which may be used for desktop computers, are limited to four desktop computers per circuit.
- 4) Consider using K-rated transformers and panelboards with 200% neutrals.
- s. Systems Furniture: Many office spaces are currently being designed utilizing a Systems Furniture approach. The following guidelines should be utilized when designing for such systems.
 - 1) Thorough coordination between the electrical designer, architect, and the interior designer is critical during the design process. If proper coordination has not occurred during the design process, field interface problems could be very costly.
 - 2) Systems Furniture is prewired to a wiring harness. The standard harness configuration is a 3 circuit, 8-wire (3 circuit conductors, 3 neutral conductors and 2 equipment grounding conductors). Typically, an 8-wire harness is adequate for up to 12 cubicles. Care needs to be taken to allow proper circuiting for actual layout and electrical loads involved. Connect each circuit to a different phase and balance loads between phases.
 - 3) A single circuit should serve no more than three computer stations.
 - 4) Provide a junction box detail showing the interface between the Systems Furniture harness and branch circuit wiring. Specify that a licensed electrician make the final connections.
 - 5) Consider using K-rated transformers and panelboards with 200% neutrals.
5. Design Considerations:
 - a. Energy conservation should be a primary objective.
 - b. Voice and Data systems shall be furnished and installed as part of any new or renovation of State owned buildings. The design shall be based on EIA/TIA commercial building standards. The design shall consist of detailed specifications, as well as detailed drawings that reflect specific project requirements. Refer to *Design Guidelines* "Section 1000 -- Communications."
 - c. It is the responsibility of the architectural and engineering team to prepare reflected ceiling drawings that accurately locate ceiling panels, lighting fixtures, A/C supply and return grilles, automatic sprinkler heads, fire alarm system devices, access doors, cctv, security and any other ceiling located devices.
 - d. Require the Contractor to coordinate submittals and the purchase and installation of HVAC and electrical equipment with the Using Agency and Contract Administrator and with the mechanical and electrical subcontractors.
6. Drawings: Refer to *Design Guidelines* "Section 100 -- General" paragraph pertaining to drawings.
 - a. Drawings shall have the appropriate schedules and risers as required for a complete design.
7. Specifications: Refer to *Design Guidelines* "Section 100 -- General" paragraphs pertaining to specifications and substitutions.
 - a. Provide an electrical system testing specification, describing tests to be performed, acceptance criteria, and provide timely notice to the owner to witness testing, and furnish test results to the owner.

C. LIGHTING DESIGN GUIDE AND STANDARDS

1. General:

- a. This section of the design standard outlines general requirements for lighting designs to be performed for the Division. This standard is intended to provide useful information to the design firm to establish a baseline of design. The responsibility of the engineer is to apply the principles of this section and to achieve a level of quality and consistency in the design and the construction of State facilities.
- b. This standard is tailored to design of prototypical office facilities. The design shall consist of detailed specifications, as well as detailed drawings that reflect project specific requirements.

2. Codes And Standards:

- a. The lighting design and luminaire selection shall meet applicable ANSI Standards. All Luminaires shall be UL listed for the application. The overall design shall be in accordance with the State of New Hampshire Energy Code (IECC, ASHRAE 90.1).
- b. Lighting levels shall be in accordance with the guidelines outlined in the Illuminating Engineering Society of North America (IESNA) *IES Lighting Handbook*. Light levels shall be closely coordinated with the Division.
- c. Lighting calculations shall be performed to verify that the light levels meet the requirements indicated in 2.b above. The professional is responsible for coordinating with the Architect and any required field investigation to develop parameters required for the calculations.
- d. Energy conservation should be a primary objective. The professional is responsible for investigating and designing an energy efficient system. This includes the ballast, lamps and overall system performance (i.e. electronic ballast/T-8) lamps.
- e. The use of incandescent lighting is discouraged and shall only be used with prior approval.
- f. The Professional Engineer in coordination with the Division shall design all central lighting control systems, including daylight sensors and dimming systems.
- g. Light levels shall be closely coordinated with the Division and Using Agency.
- h. Consider lower general light levels with task lighting in areas where people are working at computer stations.
- i. Selection of luminaires and lamp type shall minimize the different lamp types utilized and required to be stocked by maintenance.

3. Controls:

- a. Each area enclosed by ceiling height partitions shall have at least one accessible lighting control to independently control lighting within the area.
- b. All enclosed areas larger than 500 square feet shall have an accessible lighting control so that general lighting may be reduced by at least one half throughout the area.
- c. The total number of accessible lighting controls within an enclosed area shall not be less than one for each 500 square feet, exceptions being made on case by case basis for large spaces used as a whole, spaces served by automatic or programmable lighting controls, and controls for security or safety.
- d. The use of occupancy sensors shall be investigated for all offices, restrooms, conference rooms, and other areas of intermittent use.
- e. For normal lighting in common, un-occupied, and corridor areas, the goal is minimum of 30 percent of building lighting load.
- f. Selection of luminaires and lamp types shall minimize the different lamp types utilized and required to be stocked by maintenance.

4. Lighting Design:
 - a. Sufficient area lighting shall be provided for safe pedestrian transit under all conditions.
 - b. Mercury vapor lamps shall not be used. LED, Metal halide and high-pressure sodium lamps shall be considered.
 - c. Provide control with local over-ride for all exterior lighting except Code required egress lighting. Photocells may be used for architectural accent lighting only (not for transit lighting).
 - d. Dimming lighting control systems for exterior lighting is prohibited.
 - e. Mounting heights of pole and exterior building luminaires should be limited to 36 feet above accessible grade for re-lamping purposes.
 - f. All outdoor site fixtures shall be “dark sky compliant.” Refer to New Hampshire Outdoor Lighting Efficiency and Dark Sky Policy, RSA 9-E: <http://nhrsa.org/law/chapter/9-e/>.

D. ELECTRICAL REVIEW CHECKLIST

1. Refer to “APPENDIX A -- ELECTRICAL REVIEW CHECKLIST” (for reference).

SECTION 1000 -- COMMUNICATIONS

A. GENERAL

1. Every Specification Section is required to include in Part 2 (as the first item), “SUBSTITUTIONS: Materials shall be as specified...” (refer to “SECTION 100 -- GENERAL” for the entire statement).
2. Make sure all specification sections are coordinated with the Division's General Conditions, Document 000708.
3. Penetration Firestopping: Provide penetration firestopping in fire-resistance-rated walls, horizontal assemblies, and smoke barriers in accordance with building and fire code requirements. Firestop systems will be UL Classified to ASTM E814 (UL 1479). Submittals are required, including for product data, product schedule, qualification data, and product test reports (with locations).
 - a. Projects with Architect: Firestopping specifications are required in Division 7. Include requirement for firestopping in fire sprinkler, plumbing, HVAC, electrical, and communications specification sections with reference to the firestopping specification located in Division 7.
 - b. Projects with Engineer (and no Architect): For fire sprinkler, plumbing, HVAC, electrical, and communication projects where there is no Architect involved in the project, firestopping specifications are required and may be located in and are required to be coordinated with all corresponding specification sections.
4. For additions and renovation work, specify that the Contractor shall be responsible to remove any and all cable, which is removed from equipment terminations and/or no longer services the facility.

B. COMMUNICATIONS DESIGN GUIDELINES

1. The goal of the communications design is to describe dedicated spaces for telecommunications equipment and a system of pathways from every communications outlet in the building to the nearest horizontal cross-connect (HC) and from every HC to an intermediate cross-connect (IC) or the main cross-connect (MC). This design shall be based on nationally recognized ANSI/EIA/TIA commercial building standards and current NEC code (New Hampshire State Electrical Code with amendments) described further below.
2. Meet seismic restraint requirements for communications equipment and systems in accordance with the requirements of the New Hampshire State Building Code. Refer to *Design Guidelines* “Section 100 -- General” paragraph pertaining to seismic requirements.
3. The Architectural and Engineering Firm (A&E) will design the Communications Infrastructure and Cable Plant. For some projects the cable plant may be handled as a separate contract, but telecommunications spaces should always be handled as part of the A&E design.
4. Coordinate the design with the Using Agency and the Department of Safety, Bureau of Statewide Telecommunications, Division of Emergency Services, Communications and Management, through the Contract Administrator.

5. The Design shall consist of detailed specifications, as well as detailed drawings that reflect project specific requirements. As in Division 27 (CSI Master Format), the A&E design shall include and is not limited to:
 - 1) Separate infrastructure specifications and drawings where applicable.
 - 2) Entrance Facility (EF), MC/IC/HC room locations and layout.
 - 3) Vertical and Horizontal Riser Distribution Schematic.
 - 4) Construction Details to include:
 - a) T1 - Site Plan.
 - b) T2 - Serving Zones.
 - c) T3 - Communications Equipment Rooms.
 - d) T4 - Typical Detail (faceplates/cable tray/power poles/patch panels/etc).
6. The A&E design responsibility does NOT include:
 - 1) Provision of active data or multimedia services.
 - 2) Specifying voice, data, or multimedia equipment.
 - 3) Arranging public network access for telephone or multimedia.
7. Industry References: The A&E shall refer to the following industry standards for a more complete understanding of communications requirements:
 - a. NEC - Article 800 Communications Circuits.
 - b. EIA/TIA - 568 Commercial Building Wiring Standard.
 - c. EIA/TIA - 569 Communications Standard for Telecommunication Pathways and Spaces.
 - d. EIA/TIA - 607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
 - e. BICSI Telecommunications Distribution Methods Manual.
 - f. ADA - The Americans with Disabilities Act may also affect design.
 - g. ANSI/NFPA-70: National Electrical Code (NH State electrical code with amendments).
 - h. ANSI/NFPA-780: Lightning Protection Code.

C. TELECOMMUNICATIONS ENTRANCE FACILITY (TEF)

1. The Entrance Facility (EF) is the point where the LEC, campus backbone, or wireless telecommunications cabling physically enter the building and interface with the internal backbone cabling. After the exact building location is selected, the A&E must meet with the Local Exchange Carrier (LEC) or Service Provider engineer regarding building access. At that time, the following LEC or service provider responsibilities and requirements must be decided including the following.
 - a. Floor and wall space needed for equipment:
 - 1) Rack space approximately equivalent to the size of an 18 cubic foot refrigerator must be provided for equipment. If a digital fiber interface is to be installed, average floor space required is 6 feet x 5 feet. For buildings with over 200 occupants, increase the size of the room accordingly.
 - b. EF shall allow space for UPS equipment sized to meet operating requirements of future equipment. Space shall be estimated at the above requirements.
 - c. Electrical power (120V and/or 208/240V) (to be verified with the equipment) and environmental needs of equipment:
 - 1) Back-up power circuit is required if building is provided with a backup power generator.
 - 2) Central Office based Local Exchange Interfaces require 120V, 20 or 30A feed provided through a NEMA standard L5 twist-lock power connector per the discretion of the building owner or tenant. Coordinate NEMA configuration with the equipment.
 - d. Method of access (underground is preferred).

- e. Conduit(s) for building access including size, type, and quantity.
- f. Interface type (fiber or copper). Also, consider roof antennae or dishes for wireless communications.

D. TELECOMMUNICATIONS EQUIPMENT ROOM (ER)

1. An equipment room (ER) usually houses equipment of higher complexity than a telecommunications closet (TC), but may serve as both. The design aspects of the equipment room are defined by the Owner and the EIA/TIA-569 Standard.
 - a. Continuous HVAC shall be designed for 24 hr, 365 day, 70 deg - 75 deg room temperature, 30%-55% humidity, and positive pressure. This will require the collection of environmental specifications for the Owner's equipment to be placed in that room.
 - b. ERs shall be centrally located for the following reasons:
 - 1) Minimize horizontal cable length (cannot exceed 90m or 295ft). Distance shall be actual cable distance, not straight line, including vertical wall and horizontal pathway.
 - 2) Reduced heat load on HVAC system (heat gained through building exterior walls and windows).
 - c. Each ER shall be provided with at least one dedicated 120V, 20A, quad outlet per wall. Back-up power circuit is required if building is provided with a backup power generator.
 - d. Each ER shall be provided with a telecommunications grounding busbar (TGB) connected to the TMGB via the telecommunications bonding backbone (TBB), a No. 6 AWG stranded copper cable with green insulation.
 - e. The ER may be combined with the MC.
 - f. Each ER shall be provided with a fire extinguisher outside of the door. Fire suppression systems should be considered.
 - g. Two walls each with the minimum coverage of 4' x 8', 3/4" thickness, A-C grade plywood, painted with two coats black fire retardant paint. If fire-retardant plywood is used (for code purposes and/or where required by authorities having jurisdiction), one of the stamps indicating fire retardant certification must not be painted.
 - h. Rack height cable ladder connecting to each equipment rack and fastened to opposite walls for support. One of the opposite walls must be the same location as the entrance conduit.
 - i. ER shall allow space for UPS equipment sized to meet operating requirements of future equipment. Space shall be similar to that estimated for the EF.

E. TELECOMMUNICATIONS CLOSET (TC)

1. Telecommunications closets (TC) are dedicated to telecommunications function and support closets within the building that houses the telecommunications cabling and system equipment. This includes the mechanical terminations and or cross-connect for the horizontal and backbone cabling system. The design aspects of the telecommunications closet are specified in the EIA/TIA-569 Standard.
 - a. Continuous HVAC shall be designed for 24 hr, 365 day, 64 deg - 75 deg room temperature, 30%-55% humidity, and positive pressure. This will require the collection of environmental specifications for the Owner's equipment.
 - b. TCs shall be centrally located for the following reasons:
 - 1) Minimize horizontal cable length (can not exceed 90m or 295 feet).
 - a) Distance shall be actual cable distance, not straight line, including vertical wall and horizontal pathway.
 - b) Buildings must contain two TCs or more per floor if the distance from a considered TC to the extreme outside building wall, in any direction from the TC, is greater than 150 feet or building design will require cabling pathways to be beyond 200 feet.

- 2) Reduced heat load on HVAC system (heat gained through building exterior walls and windows).
 - c. Each TC shall be provided with at least one dedicated 120V, 20A, quad outlet per wall. Back-up power circuit is required if building is provided with a backup power generator.
 - d. Each TC shall be provided with a telecommunications grounding busbar (TGB) connected to the TMGB via the telecommunications bonding backbone (TBB), a No. 6 AWG stranded copper cable with green insulation.
 - e. TCs should be stacked, one above the other, or located to allow the least expense in conduit, cable installation and future maintenance.
 - 1) There should be a minimum of two 4" EMT conduits from the MC to each IC and to the ER.
 - 2) There should also be a minimum of one 4" EMT conduit or cable tray from each IC to each of its respective floor HCs.
 - 3) Each conduit shall be marked as to the origin and termination points. The floor and room number must be included.
 - 4) Conduit from lower levels shall appear near the floor in each TC.
 - 5) Conduit from upper levels shall appear near the ceiling of each TC.
 - 6) Conduit shall be bonded to multiground neutral using No. 6 AWG stranded copper cable (with green insulation preferred).
 - f. TCs should have four 4" conduit sleeves or 12" tray shall be installed as penetration openings to accessible hallway ceilings to each TC. This opening shall be used for communications station cable installation.
 - g. Telephone backboards (located per Owner's requests) should be 4' x 8', 5/8" or 3/4" thickness, A-C grade plywood painted with two coats fire retardant paint. If fire-retardant plywood is used (for code purposes and/or where required by authorities having jurisdiction), one of the stamps indicating fire retardant certification must not be painted.
 - h. Include specific information regarding room size, quantity and size of riser sleeves, and cable tray size.
 - i. Floor and wall space needed for equipment:
 - 1) Rack space approximately equivalent to the size of an 18 cubic foot refrigerator must be provided for equipment. If a digital fiber interface is to be installed, average floor space required is 6 feet x 5 feet. For buildings with over 200 occupants, increase the size of the room accordingly.
 - j. EF shall allow space for UPS equipment sized to meet operating requirements of future equipment. Space shall be estimated at the above requirements.
2. There are three types of Telecommunications Closets:
- a. Main Cross-connect (MC): This room is the center of the hierarchical star topology for backbone cabling.
 - 1) There is only one per building but it may also serve as the EF, an ER, and/or a HC.
 - 2) Provide for a grounding busbar with #6 AWG stranded copper cable with green insulation.
 - b. Intermediate Cross-connect (IC): This room is the center of the hierarchical star topology on each floor for backbone cabling to be distributed to each HC
 - 1) Minimum of one closet per floor and it may also serve as the HC
 - c. Horizontal Cross-connect (HC): This room is the furthest point from the center of the hierarchical star topology for backbone cabling, but it is the central distribution point for horizontal cabling to all workstations and offices.

F. OTHER CONSIDERATIONS FOR ALL TELECOMMUNICATIONS SPACES

1. Non-associated plumbing or HVAC piping shall not run through or over any telecommunications space. No plumbing, HVAC, or electrical conduit shall pass through, or be directly above, the communications room. In renovation projects where new Communications rooms are established, all overhead utilities will be relocated out of room.
2. All communications rooms shall be environmentally controlled to maintain the room environment at a temperature range of 65 to 75 degrees Fahrenheit, with a maximum relative humidity level of 50 percent. Communications rooms shall be conditioned with a fresh air exchange of four (4) air changes per hour. Room cooling ability must be provided to remove a minimum of 7000 BTUs per hour 24 hours a day, 7 days a week.
3. Use of fluorescent lighting (3500K lamping) or LED lighting in telecommunications spaces is acceptable, but shall be kept clear of trays and close proximity to major cabling pathways.
4. Three walls of communications rooms should be covered with 4' x 8', 5/8" or 3/4" thickness, A-C grade, plywood painted with two coats fire retardant paint. If fire-retardant plywood is used (for code purposes and/or where required by authorities having jurisdiction), one of the stamps indicating fire retardant certification must not be painted.
5. The EF may contain electronic equipment (requiring HVAC) and primary protection devices required by the LEC or service provider. The EF should also contain the Telecommunications Main Grounding Busbar (TMGB) for the grounding and bonding requirements of all telecommunications closets (TC) and equipment rooms (ER) per the EIA/TIA-607 Standard.
6. No. 6 AWG stranded copper cable with green insulation shall be provided from the TMGB to the Main Cross-connect (MC).
7. The EF may be combined with the Main Cross-connect (MC).
8. Detailed physical requirements of the EF room equipment and layout are defined by the Owner and the EIA/TIA-569 Standard. Provide for a minimum of 0.75 sq ft of equipment floor space for every 100 square feet of user space.

G. GENERAL TELECOMMUNICATIONS REQUIREMENTS

1. Communications Facilities: Unless directed otherwise, the design shall include all cable and materials necessary for the installation of a communications system. This shall encompass cable, cable attachment and support devices, jacks, termination blocks, patch panels, backboards, equipment racks, and any and all items necessary for a complete installation.
2. Station Location Requirements:
 - a. A minimum of one 3/4" conduit shall be installed from each station to accessible ceiling locations. Accessible ceilings are those with maintenance access hatches within 5 feet of the conduit end or drop ceilings with removable tiles.
 - b. Conduits shall terminate in a 4x4 workbox with single gang mud ring, providing adequate space for two telephone jacks and two computer jacks at each location.
 - c. Conduits shall not be installed with elbow connections; all directional transitions shall be accomplished with a minimum of 3" sweeps.

3. Station Outlet and Device Jacks:
 - a. Communication work station outlets should be agreed upon with the Using Agency. At a minimum each communication work station location, except as noted otherwise, shall consist of the following.
 - 1) Two each double gang bezel. Bezels must have label strips and clear label strip plastic covers top or bottom. Machine lettering is required, hand lettering WILL NOT be accepted.
NOTE: The bezel for the communication cable shall be the same color and height above the floor (approximately 18 in.) as the electrical face plate. Only one color shall be used throughout the project. Only flush mount type jacks are to be used on this project, unless otherwise noted on the drawings.
 - 2) Two each Category 6 110 style double modular jacks, T568B, with wire caps to provide strain relief and contamination protection.
 - b. One dual data station jack, colored differently than telephone jacks. Tenant may have a color preference; confirm color with Contract Administrator and Using Agency.
NOTE: All jacks shall be terminated using a single position 110 punchdown tool. Stuffer caps shall be affixed after termination has been affected, in order to provide strain relief to each conductor at the point of termination.
4. Communications Cabling:
 - a. Unshielded twisted pair, 24 gauge, Category 6 cable must be installed from each TC to each Station location. Plenum rated cable must be used where required by code. Contractor and installer shall abide by NEC code, BICSI and EIA/TIA standards to distinguish application requirements.
 - b. Station cabling shall be terminated utilizing Category 6 568B configuration jacks.
 - c. All computer / data cabling terminating in any TC shall be punched down on Category 6 patch panels utilizing a 110 style IDC interface supported with a hinged wall mount bracket, equipment cabinet, or floor mounted equipment rack.
 - d. Fiber optic riser cabling must be placed from the EF to the MC and to each subsequent TC.
 - 1) Pair count to each TC should be 4 or more single mode fiber pairs further defined by the building occupants.
 - 2) All telephone riser cabling shall be terminated on 6 pin 66 type 25 pair cross-connect blocks mounted on standoff brackets, unless otherwise requested by Owner.
 - e. Fiber optic cabling pathways shall include use of (orange) inner duct when not installed within conduit and caution tags at entrance and exit points.
 - f. Copper rise cable should also be installed from the EF to each ER and each TC. Cable shall be 25 pair rise rated, terminating on 110 blocks in each room. Cable shall be dedicated to analog service operation and require horizontal station cabling prior to tenant occupancy.
5. Labeling:
 - a. All cables must be labeled using indelible ink, printed labels.
 - b. Each cable must be labeled at each terminating end.
 - c. All cables must be labeled as follows:
 - 1) First two characters indicating floor level (00 for basement, 01 for first level, 02 for second level, etc.).
 - 2) Third character indicating the TC (A, B, C, etc., on the noted building level).
 - 3) Fourth, fifth, and sixth characters listing the station number.
 - 4) Seventh and eighth characters listing the jack identifier.
 - 5) Example: 01-B-012-A meaning 1st level, closet B, station 12, jack A

6. Cable Installation:
 - a. All cable shall be supported utilizing cable tray, J-hooks, conduit, or surface mount raceway. Proper radius bends must be maintained at all points. The contractor shall provide as-built diagrams defining cable paths throughout the building upon completion.
 - b. No cable shall be laid upon or tie-wrapped to ceiling tiles, pipes, conduits or other building facilities.
 - c. All cable shall be laid at least 18 inch away from electrical services including power duplexes, power feeds, lighting, AC security systems, cable television, and other services creating harmonics, which may bleed into the communications cable.
 - d. Provide penetration fire-stopping at all penetration holes made for cable installation through fire-resistance rated walls, horizontal assemblies, and smoke barriers. Architect / Engineer to coordinate fire-stopping description and location(s) in the Specification. Refer to Article A "General" in this Section for more information.
 - e. All computer station runs must be tested for Category 6 compliance. Printed test results must be provided upon completion.
 - f. All cabling and associated equipment shall be installed by qualified technicians only. The Contractor shall provide proof of the above prior to construction.

APPENDIX A -- ELECTRICAL REVIEW CHECKLIST

(For Reference)

ELECTRICAL REVIEW CHECKLIST

Project: _____ D.P.W. Project #: _____ Contract: _____

Consultant: _____ Plan Date: _____ Spec Date: _____ Review Date: _____

The items below detail the minimum requirements for electrical design being reviewed by the Division's Project Manager. Electrical consultants shall provide these items in electrical designs, as applicable, in addition to the specific requirements of the project scope. This list is not all-inclusive and will be utilized only as a review checklist.

Specifications

- CSI Format
- NEC, REA568A, REA568B as applicable
- Section 16 00 00 to include substitution clause.
- Substitution clause in every specification section, in Divisions 2 – 50, in Part 2 (as the first item).
- Applicable to the project, having the correct voltage, products, and wiring methods for particular work at hand.
- All equipment utilized in the design is specified.
 Conduit: NM MC IMC RGS EMT Other: _____
 Lighting: Individually fused lighting ballasts LED exit lights
 (EB) End of Life Detection Circuitry

Drawings

- General** title and title block information shall pertain to the info on that sheet and include the Division's Project #.
- Legend** which includes all symbols and descriptions utilized in the design. Legend shall not include specifications for equipment.
- Single-line diagram** with all the primary and secondary distribution equipment and loads, including feeder identification with conductor and raceway size and type. The sizing, voltage, and type of equipment shall be noted on the single-line diagram.
 Transformers Panelboards Switches OC Devices Ground Wire
 Computer Devices Telephone Equipment Other _____
- All distribution equipment** and all other loads located, with initial spatial coordination to scale.
- Service entrance** arrangements made and local utility requirements confirmed and noted by the design professional.
 Electric Utility Telephone Company Local Fire Department
 Electric Interconnect Co. Telephone Interconnect Co.
 CCTV Security Other _____
- Specify Bonding Requirements:** Show the entire electrode grounding system.
 Service Entrance Subpanels Transformers
 Separately derived systems

- Branch circuiting** with voltage drop considerations, for both power and lighting, including switching, dimming, special controls and homerun designations in the direction of the source.

- Panelboard or Switchboard schedules** shall include:
 - Amperage Voltage Main lugs or breaker
 - Minimum AIC rating # of Poles Calculated Load
 - Enclosure type and mounting Designation
 - Note for electrical contractor to provide as built pole connection numbers.

- Lighting design** shall include:
 - Show EX/EM fed from lights in area being served.
 - Fixture Schedules** located on drawings including:
 - fixture symbol manufacturer/catalog numbers, # of lamps
 - type of lamp mounting type general description.

- Mechanical equipment** power requirements and physical locations, including special information as to who mounts, connects, tests, etc.

- Control diagrams and schematic** revealing interactive relationships as well as operating logic for all systems.

- Communications Systems** layout, riser and raceway details.
 - Telephone System Computer System

- Fire Alarm System** layout and riser
 - Conventional Voice Existing
 - Connected: City HVAC Waterflow Elevator

- Layout and Riser** for miscellaneous systems
 - Audio Video Other _____

Cost Estimate

- Engineer's Opinion of Probable Costs** shall be provided each design phase submittal or as otherwise required in the Agreement.