Appendix D

Doing Business with A&E

Ontario Region

Standing Offer

Table of Content:

SECTION 1 GENERAL DOCUMENTATION AND SUBMISSION STANDARDS

1.1 Introduction:

The purpose of this document is to help the consultants to perform their work while dealing with the Ontario Region of PWGSC. It is to complement the requirements stated in the main body of the RFP or the RFSO, in particular in the Project Brief and the Required Services sections. This document elaborate on specific items that are particular to the Ontario Region but in no way does in supercedes the main clauses of the RFP or the RFSO.

1.2 Document Management:

All project documents are to be electronically distributed to project stakeholders through the use of a commercially available, secure internet, web based browser software application system. Documents must be distributed in pdf format, with an e-mail notification system to stakeholders. Version and document control features are required to enable review of previous documents issued. The document system must be managed and operated by the consultant, who shall control secure access rights to project stakeholders identified by the PWGSC project manager.

1.3 Sustainability:

1. New construction projects are to meet the standards of LEED Gold.
2. Major renovation projects (±5M of construction cost) are to meet the standards of LEED Silver.
3. Heritage building projects are to meet the standards of "Sustainability Rating System for Heritage Buildings and Sites.
4. For all other projects, the principles of sustainability shall be followed.

1.4 Drawings:

The drawings are complementary to the specification. They should describe the extent of work. Do not rely on a mandatory site visit to complete the information. Notes such as "verify on site","as instructed","to be determined on site by Departmental Representative", will not generate accurate bids and may result in unnecessarily high bid prices. The drawings shall allow the Bidders to bid accurately and calculate all quantities. If quantities are impossible to show (i.e. cracks to be repaired) give a quantity for bid purposes.

Construction drawings should be strictly technical drawings, fully detailed and dimensioned, clearly and accurately drawn, complete with all necessary descriptive notes. On all drawings present the work to be done as clearly as possible. Draw details at sufficient scales to eliminate doubt as to the method of construction, materials, and quantities required. Required sheet order: plans; elevations; main sections; and details. Avoid waste space but ensure that sheets are not overcrowded or difficult to read.

The terminology used should be consistent throughout the drawings and specification.

Design on a modular basis to take advantage of dimensional standardization and co-ordination.

Drawings have to be in metric only even if the project is to renovate an old building. Any references to imperial units will not be accepted.

Consultants MUST follow the “PWGSC CADD Standards” attached at the end or available electronically at:

- PWGSC's ftp site: ftp://ftp.pwgsc.gc.ca/rps/Specifications/Drawings/CADD%20Standards/
- On the web, at: http://http://www.tpsgc-pwgsc.gc.ca/biens-property/cdao-cadd/index-eng.html

When prepared by Consultants, the final drawings (original) shall bear the Professional's seal and signature.

1.5 Standard Drawing Information:

PWGSC will provide the following standard items to the consultants with respect to CADD

AutoCAD format Borders (14 sizes)
Drawing with PWGSC layers
Site legend w/ symbols
AutoCAD plotting ctb (colour table) files
Graphic Bar Scales and North Arrow in AutoCAD format
AutoCAD template files for Architectural and Engineering drawings

These are also available by e-mail in a zip file, on disk or from PWGSC's ftp site at ftp://ftp.pwgsc.gc.ca/ Internally the files can be found at S:\RPS\CAD\Standards\CONSULT\PWGSC CADD Package

1.6 Drawing numbers:

Number drawings in sets according to the discipline involved as follows:

A-xxx	Architecture
S-xxx	Structure
M-xxx	Mechanical
E-xxx	Electrical
I-xxx	Interior Design
L-xxx	Landscaping
C-xxx	Civil Engineering / Site Work

Where "xxx" is a one, two or three digit number depending on the number of sheets

1.7 Detail / Section numbers:

The supplied borders show graphically how to reference details, sections and the likes. Basically, the 3-part "bubble" will contain the detail / section number, the number of the drawing where it is required and the number of the drawing where it is detailed. This pattern MUST be adhered to.

1.8 Presentation Requirements:

Present drawings in sets comprising the applicable architectural, interior design, structural, mechanical, electrical, landscaping and civil drawings in that order. All drawings shall be of uniform standard size. Print with black lines on white paper. Staple or otherwise bind prints into sets. Where presentations exceed 20 sheets, the drawings for each discipline may be bound separately for convenience and ease of handling.

1.9 Title Sheets:

Title sheets may be used at the Consultant's discretion, for design presentations or on large sets of Construction drawings.

1.10 Indices:

Provide an index at the front of each set of drawings. Where a large number of sheets are involved, place the index on a title sheet or at the front of each set of the various disciplines. Drawing indices to be included in the specifications after the Table of Contents.

1.11 Legends:

Provide a legend of symbols, abbreviations, references, etc.., on the front sheet of each set of drawings or, in large sets of drawings, immediately after the title sheet and index sheets.

1.12 Drawing Notes:

Indicate all materials, systems and products on the drawings by means of numbered notes.

Demolition Notes:	note number in a 7mm square box
Construction Notes:	note number in a 7mm diameter circle
Revision Notes:	note number in a 7mm triangle
Assembly Notes:	note number in a 10mm hexagon

adjacent to the appropriate location on the plan, section or detail with an arrow connecting the box, circle, triangle or hexagon to the specific material, system or product indicated on the drawing. Provide a list of drawing notes relating to the sequentially numbered notes on the right hand side of the drawing sheet adjacent to the title block.

1.13 North Points:

On all plans include a north point. Orient all plans in the same direction for easy cross referencing. Wherever possible, lay out plans so that the north point is at the top of the sheet.

1.14 Abbreviation Standards:

Use text abbreviations with discretion, to ensure that there will be no misunderstanding on the drawings. Follow abbreviation list provided as part of specification standards from the ftp site.

1.15 Drawing Symbols:

Follow generally accepted drawing conventions, understandable by the construction trades, if more symbols are required than are provided by PWGSC.

1.16 As-Built and Record Information:

As-built information is received from the Contractor. It contains drawings, specifications, shop drawings, submittals, samples, etc. It is noted as such by the Contractor.

Record drawings and specifications are updated originals prepared by the Consultants based on the information supplied by the Contractor in the as-built.

1.17 Bid Documents Format:

That part of the bid documents provided by the consultant will be submitted also in ".pdf" format, as follows:

Drawings:
1. Each drawing is to be converted to a PDF file. 1 drawing per file.
2. The file shall be named with the drawing number and then the title of the drawing from the drawing title block (e.g. A01 - Architectural Cover Page)

Specifications:
1. The complete Project Specification is to be converted to a PDF file. 1 PDF per complete project specification, all Divisions. The file shall be named with the project number and then the word Specification (e.g. 123456 - Specification).
2. The first (few) page(s) of the specification entitled "Plans and Specifications" shall be converted to a PDF file. This one file shall be entitled "Plans and Specifications - Table of Contents".
3. Any addenda shall be converted to a PDF file. Text should be converted into one file. Drawings shall be one drawing per PDF file. The name for each text file shall be "Addendum Number #." The name for each addendum drawing file shall be "Addendum Number # - Drawing XXX" (where XXX is the name of the drawing).

Creation of CDs (when specifically requested):
1. The files above shall be burned onto CD(s).
2. When the PDFs are burned onto the CD, folders shall be created. The folders will be "Drawings", "Specifications", and "Addenda". The Plans and Specifications - Table of Contents PDF will reside at the uppermost level with the three folders.
3. CDs should be labeled with the following information:
   a) Description from the Drawing Title Block
   b) Project Number
   c) Solicitation Number
   d) "Original Solicitation" OR "Addenda # X"
   e) Number of CDs in this grouping (e.g. 1 of 3)

SECTION 2 ARCHITECTURAL DESIGN

2.1 Review

All designs must be reviewed by the Department and conform to the requirements of the Project Brief.

2.2 Principles

The Department expects the Consultant to maintain a high standard of architectural design, based upon recognized contemporary design principles. All design elements, planning, architectural, engineering and landscaping, must be fully co-ordinated, and consistent in adherence to good design principles.

2.3 Economy

Design strictly within the budget and in accordance with sound investment economics and operating and maintenance expenditures.

Design for the optimum ratio of net usable space to outside gross areas.

2.4 Flexibility

Design for maximum flexibility in immediate and future use of space. Where possible, devise a building grid with column spacing, fenestration and service runs suited to flexible interior space arrangements.

2.5 Future Extension

Design for future extension as determined by the Departmental Representative and ensure that permanent spaces, such as service rooms and duct spaces, etc., are sized for future additional capacity.

2.6 Quality

Quality of materials and construction methods shall be commensurate with the type of building and the budget. Avoid experimental materials. Take into account the total life-cycling of the building.

2.7 Regulations

Design shall comply with applicable Federal, Provincial and Municipal regulations and codes. In case of conflict, the most stringent requirements apply.

2.8 Design

The Department expects imaginative design and good aesthetic expression throughout all projects. Design shall be compatible with adjacent buildings, or with the existing building in extension work.

2.9 Required Space

Provide all rooms required to within 10% of the approved areas. Deviation from this requirement may entail redesign.

2.10 Ancillary Space

Provide washrooms, janitor's rooms, furnace rooms, electrical panel and transformer rooms, storage rooms, freight and garbage holding areas, duct spaces and other building service space not specifically listed in the Project Brief, but essential to the efficient operation of the building.

2.11 Fit-up Standards

The design for general-purpose office space accommodation for all Government of Canada departments or agencies is to follow and conform to the latest Fit-Up Standards including the selection of systems, materials, furnishings and equipment. For the latest version of the "Fit-Up Standards: Technical Reference Manual" refer to the web site: http://publiservice.pwgsc.gc.ca/fitup/.

Note that the breakdown of the cost estimate at each stage of delivery should reflect the funding accountabilities for the components of an accommodation project as described in the "Fit-Up Components and Funding Accountabilities" chart in the "Fit-Up Standards: Technical Reference Manual" i.e. Base building cost vs. Fit-Up Standard cost vs. other cost.

2.12 Heritage Value

The Treasury Board Heritage Building Policy states "Departments must manage buildings they administer so as to conserve their heritage character throughout their life cycles." Any modification considered to a Government of Canada building or site should value its architectural character, no matter how old or how new the building or site may be.

2.13 Design for Disabled

Design buildings and grounds to make them accessible and usable by disabled persons, unless otherwise required in the Project Brief. Conform to CAN/CSA-B651-04, Accessible Design for the Built Environment and Correctional Service Canada (CSC) policy on accessibility for CSC projects.

2.14 Drawings

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- On the web, at: http://www.pwgsc.gc.ca/realproperty/text/pubs_cadd/pubs_cadd_toc-e.html (this document refers to NCR contacts)

When prepared by Consultants, the final drawings (original) shall bear the Professional's seal and signature.

2.15 Colour Schemes

All colour schemes require PWGSC approval. Submit schemes in duplicate well in advance and so as not to delay the work of the Contractor. Colour schemes should include all surfaces and materials to be coloured on site, plus any items provided with a colour finish or texture during prefabrication. Indicate any untreated or natural-finish surfaces contributing to the overall aesthetic appearance of the project. To fully illustrate the scheme, provide PWGSC with actual samples (colour chips, material samples, etc..) of interior finishes that are to be installed. Revise the scheme if necessary to obtain final PWGSC approval. Ensure that the Contractor carries out the approved scheme. One copy of the approved scheme will be retained by PWGSC for verification of the final results on site.

2.16 As-Built and Record Information

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SECTION 3 LANDSCAPING AND SITE DEVELOPMENT

3.1 General Design

The general design of the site and the landscaping layout is subject to the overall design requirements covered in the Project Brief.

Although the Department does not require elaborate and costly landscape layouts, the visual appearance of the external environment is considered of functional importance, forming a logical continuation of the building design. Relate all elements to each other, to human scale and to their general surroundings.

Include with concept submission a realistic representation of the proposed site lay-out. Provide cross-sections to indicate the 3-dimensional relationship.

3.2 Existing Features

Preserve existing site features and integrate them with the new site design. This pertains not only to the use of existing trees, shrubs, rock and water, but also includes those elements, vistas, other buildings, outside the property lines which may have influence on the total space composition.

Insure preservation of all useful topsoil and the protection of all areas, grades, etc. which should not be interfered with during construction operations.

The use of existing trees must depend on their health, life expectancy and risk of damage during construction. Their root systems, and the immediate grade above, should remain undisturbed. If changes of grade are required close to a tree, provide the proper measures for its continued health.

Obtain copy of "Tree and Shrub Preservation" Section 32 01 90.33 from the NMS Specification System and use as part of project specification.

3.3 Site Layout

Design the site layout simultaneously with that of the building(s) to ensure optimum compatibility. Take into account all services, and areas scheduled for future building expansion, etc.

Use hard and soft landscaping to create desirable space organization, open and close areas, privacy, enclosure, exposure or emphasis of certain site aspects, views, etc. Co-ordinate the character and massing of grading, trees, shrubs, site structures, etc. with that of the building(s) and adjacent property.

Employ water efficient landscaping, maximize open space to reduce heat island effect in keeping with sustainable site guidelines. Take into account climatic factors, orientation, prevailing winds, snow drifting and the microclimate.

Control soil erosion, airborne dust generation and waterway sedimentation during construction activities.

Provide proper access and clearance to suit FCC and local fire regulations.
Face main entrances and main walkways towards the sun (south) to maximize ice- free conditions. This also applies to entrance canopies, balconies, and barrier-free parking.

3.4 Maintenance

Design to assure easy economical maintenance to suit an equipment-oriented maintenance program.

Arrange grading to ensure fast drainage, but avoid steep slopes. If these are inevitable, use a ground cover that reduces maintenance to a minimum. Avoid deep ditches with steep sides.

Where possible arrange planting, screening, berms, etc. to inhibit snow drifting that may occur across walkways, roads and parking areas.

In regions subject to heavy snowfall arrange roads and parking areas to allow maneuvering of fast moving snow plows. Provide storage space for snow beside parking lots.

Allow sufficient room for tractor power mowers, snow removers, etc. to maneuver. Keep grass areas large and simple with no awkward inaccessible corners.

Consider the use of mowing strips adjacent to all buildings, fences, etc. These are paved strips 380 mm wide to accommodate power mower wheels.

Provide adequate watering facilities. Generally hose bibbs, strategically placed, are sufficient for Federal projects. Underground sprinkler systems may only be used where justified by the complexity of the design, importance of the project, drought possibilities, etc. and as approved by the Departmental Representative.

Provide adequate on-site, under-cover storage facilities for maintenance equipment.

3.5 Circulation

Design the site circulation to provide for:

.1 Pedestrian movement, including the disabled.
.2 Automobile movement, unloading and parking, convenient highway access.
.3 Service vehicles, convenient highway access, loading, unloading, turning and short term parking.
.4 Bicycle parking.
.5 Public transportation, drop-off and loading zones, when required.

Provide sufficient pedestrian areas to accommodate all traffic during peak circulation periods.

Keep the road system for vehicles to a minimum and avoid unnecessary paving of large areas. Provide visitors parking and barrier-free parking near main entrances, with convenient drop-off zones. Public transportation loading zones should preferably be close to building entrances. Bus traffic, when planned for on the site, should not interfere with peak traffic flow from parking areas.

3.6 Walkways

Walkways, including pedestrian ramps, shall be of non-slip concrete or asphalt, minimum 1500 mm wide; 1800 mm wide where mechanical snow removal equipment is to be used.

At least one walkway should give adequate access for disabled persons to each building. Basically this means that a wheelchair can travel easily from the street or parking lot right into the building without having to negotiate raised curbs, steps or steep gradients, etc. Conform to CAN/CSA-B651-04, Accessible Design for the Built Environment.

Provide ample hard surfacing at building entrances. Consider the use of alternative surfacing such as hard-baked bricks, asphalt, paving blocks, concrete slabs with coloured or textured finishes. Surfaces shall stand up to snow removal operations and de-icing agents.

3.7 Parking

Conform to local zoning ordinances.

Provide adequate parking for staff, visitors and service vehicles, and as required in the Project Brief.

Locate parking areas where they will not detract from the aesthetics of the building and landscaping, but will still be easily accessible and functional. Limit the walking distance to building entrances to 150 m. Up to 250 m may be approved in extreme circumstances.

Avoid large single parking lots. Use landscaped islands, screen planting and trees, providing they do not interfere with driver's vision or with snow removal and storage. Locate walks clear of the overhang of cars parked up to curbs. Use hard surfacing under such overhangs. Provide preferred parking for vanpools and carpools. Provide service areas large enough to maneuver trucks without excessive pavement. Minimize the need for backing-up.

At major bus stops with frequent stops and starts, consider concrete paving the bus stop if the street has asphalt paving.

3.8 Snow Clearing

Design for ease of snow removal. Incorporate adequate snow storage areas, clear of low planting and graded for good run-off. Avoid the use of unnecessary curbs where snowfall is heavy, limit parking lots to 175 cars or less, and not more than 60 m in length, with storage areas at one end and/or on grass covered islands. Where snow storage space is limited, design lots slightly oversize to allow for temporary snow storage. Artificial mounds should not aggravate snow drifting problems, particularly across walks or paved areas.

3.9 Grading and Drainage

Design finished grades to provide positive drainage of all lawns and paved areas, with a minimum of 2% for lawn areas. Allow no drainage of surface water onto neighbouring property unless approved by the Department.

Use stormwater design principles for quality and quantity control of stormwater run off and ensure accepted pre-development peak discharges are not exceeded while promoting infiltration.

Treat unpaved slopes steeper than 3:1 (33%) with ground cover, riprap or use retaining walls. Grass is not recommended.

Consider the design value of grading to enhance visual effects and to achieve economy in the use of on-site material, although this may not be the prime consideration. Avoid the need to move large volumes of soil.

On-site material may be used to create visual barriers or mounds, acting as screens for the deflection of wind and noise, and for the guiding of traffic in desired directions. Use mounds only if the site is large

enough to permit long naturally blending slopes. Round off the tops and bottoms of all slopes to avoid sharp transitions.

Design for fast drainage of areas where snow will be stockpiled. Direct the drainage towards gutters to minimize the effect of de- icing agents on lawns. Allow no drainage over sidewalks.

Locate ditches, swales and flumes where they will not detract from the visual effect of the site. Where their use or depths would be excessive, provide catchbasins. Design ditches to handle maximum run-off, but make them as shallow as possible for ease of maintenance.

Provide against possible ice blocking of drain/catch basin by having two drains not too far apart, thereby mitigating ponding of water on driveways and parking lots.

3.10 Retaining Walls

Maintain a realistic cost relationship between foundation and above-ground construction of low retaining walls and walls for planters. Consider alternatives such as dry stone walls, concrete cribbing, flat foundation on gravel filled trench. Riprap may be used if compatible with the project.

3.11 Miscellaneous Site Features

Design miscellaneous site features to complement the overall site treatment and relate their design and use of material to the main building(s). Common items are as follows:

Site structures: Co-ordinate the design, location and elevation of all supporting site structures such as transformers, kiosks, gas valves, storage bins for sand, de-icing agents, etc., to ensure compatibility with all project features. Large projects may require storage space for maintenance equipment and covered lunchroom facilities for personnel.

Planters: These may be included on large paved areas near entrances and in courtyards. Where they form part of a permanent structure, specify sufficient insulation to reduce frost penetration from the sides. Provide for a 150 mm layer of clean gravel and drainage holes. Locate holes to avoid straining walls or pavement and specify a geotextile to separate gravel and topsoil.

Fencing and walls: Co-ordinate the design of perimeter fencing, walls, site screens, decorative walls, etc., with the general landscaping treatment.

For ease of grass cutting, avoid use of retaining walls. Consider “sloping green carpet”.

Furniture: Cater for public and/or personnel use of the site by provision of seating facilities, litter bins, drinking fountains, etc., as anticipated.

Car heater outlets: These should be inconspicuous and solidly supported. Their location shall not interfere with parking and snow removal. Use only when special permission for their use has been granted.

Signs: Base traffic signs on the “FIP - Federal Identity Program Manual” and the "Canadian Uniform Sign Manual" available from "Roads and Transportation Association of Canada", 875 Carling Avenue, Ottawa, Ontario. Conform to sign requirements for disabled persons. All signs shall be binlingual, simple, easy to read, consistent in mounting heights and not used unnecessarily.

Outdoor lighting: Provide outdoor lighting at strategic points, near entrance steps, walkways, loading ways, parking areas, and at those locations where regular evening traffic can be expected. Refer to the

Project Directive for any special requirements for floodlighting, emergency and security lighting, etc. that may be required. Employ light pollution reduction strategies and apply zone specific classifications to determine site lighting criteria for safe light levels.

Flagpoles: Locate in prominent positions clearly visible to the public and generally related to the main entrance - at grade or attached to the face of the building directly above or near the main entrance, preferably inclined at approximately 45° from the wall face or where this is not possible, vertical to the wall face. Flagpoles must be easily accessible to permit operation under all weather conditions, and may require either paved approaches and steps if at grade level, or simple window or wall opening access if mounted on the building and not directly accessible from grade.

Select flagpole size from the following list, as appropriate:

Flagpole	Flagpole Length	Flag Size (NIC)
Free Standing	5 m to 7.750 m	914 mm x 1829 mm
Flagpole	9 m to 10.750 m	1143 mm x 2286 mm
Wall mounted	12.250 m to 13.750 m	1372 mm x 2793 mm
(Vertical)	15.250 m to 16.750 m	1600 mm x 3200 mm
Wall mounted	2.500 m to 3.750 m	914 mm x 1829 mm
(Outrigger, non braced)	4.500 m	1143 mm x 2286 mm

Flags shall not be included in construction contract (NIC).

Use only standard aluminum manufactured products complete with standard non-fouling hardware for ease of operation. Ensure that all flagpoles are properly protected against lightning. Illumination of flags: Not required on non-designated buildings. Designation shall be given by the Under Secretary of State, through Departmental Representative.

Special Features: Any special design features such as fountains, pools, elaborate courtyards, etc., require justification in terms of the project size, importance, prestige value, location and use, etc. and must be approved by the Departmental Representative.

3.12 Fine Artwork

Where fine artwork is planned for the building exterior or to be free-standing on the site, its location and surroundings must be properly and continuously co-ordinated by the Consultant with the Artist. The location of the artwork and the nature of its surroundings, approaches, viewpoints, etc., must achieve the optimum artistic effect. As a general rule, keep the artwork's surroundings simple and inconspicuous.

3.13 Topsoil, Lawns and Planting

Refer to appropriate sections of the PWGSC Ontario Region amended National Master Specification and PWGSC In House Specification Sections 31 14 11, 32 10 00 and 32 90 00. Copies are available on request.

Existing site topsoil shall be re-used.

Plant material must be from areas with similar climatic conditions to the site, unless otherwise permitted in writing by the Departmental Representative. Planting plans should incorporate plant types best suited to the site, and most likely to transplant successfully and to give vigorous growth within the second year following transplant. The use of container stock is encouraged.

Avoid using trees for foundation planting, especially trees with long fibrous roots.

3.14 Instant Landscaping

This is preferred, and means basically the special use of plant material to achieve an immediate landscaped effect as follows:

By planting trees and shrubs sufficiently large to guarantee quick establishment and vigorous growth. Do not, however, specify trees of such sizes that cost becomes prohibitive and survival doubtful.

By mass-planting of limited varieties.

By close spacing plant, etc. which can be thinned out later.

By planting fast growing trees in combination with slower growing, more permanent varieties. The faster growing trees may be thinned out or removed in later years when the permanent planting is large enough.

Reduce potable water consumption for landscape irrigation by adopting sustainable site principles such as recycled rainwater, and plant species factor.

SECTION 4 SPECIFICATION BRIEF

4.1 Purpose of Section

The purpose of this document is to state specification policy and to provide a framework, format and reference information to assist the specifier in developing the project specifications.

4.2 Definition

A specification is a written instruction describing type and quality of materials, products, equipment and fixtures; quality of workmanship; methods of fabrication, installation and erection; standards, test and code requirements; and specific sizes of materials. By contrast, the construction drawings present quantities of work and materials, dimensions, locations, form and building details, and show the scope of work.

4.3 Legal Status

Specifications are part of the legal contract between the Contractor and the Owner. They provide the basis for accepting or rejecting workmanship or products on site.

4.4 General Conditions

Standard Construction Contract Documents for Major Works: by Department, consisting of:

General Instructions to Bidders, SACC Manual Clause ID R2710T
Articles of Agreement, SACC Manual Clause ID R0412D
GC1 General Provisions, SACC Manual Clause ID R2810D
GC2 Administration of the Contract, SACC Manual Clause ID R2820D
GC3 Execution and Control of the Work, SACC Manual Clause ID R2830D
GC4 Protective Measures, SACC Manual Clause ID R2840D
GC5 Terms of Payment, SACC Manual Clause ID R2850D
GC6 Delays and Changes in the Work, SACC Manual Clause ID R2860D
GC7 Default, Suspension or Termintion of the Contract, SACC Manual Clause ID R2870D
GC8 Dispute Resolution – Arbitration (Generally for Contracts between $100,000 and $5,000,000), SACC Manual Clause ID R2880D
GC8 Dispute Resolution – Mediation (Generally for Contracts greater than $5,000,000), SACC Manual Clause ID R2882D
GC9 Contract Security, SACC Manual Clause ID R2890D
Insurance Terms, SACC Manual Clause ID R2910D
Fair Wages and Hours of Labour - Labour Conditions, SACC Manual Clause ID R2940D (formerly R0203D Labour Conditions “D”)
Allowable Costs for Contract Changes Under GC6.4.1, SACC Manual Clause ID R2950D

and for Minor Works: by Department, consisting of:

General Instructions to Bidders under $100,000, SACC Manual Clause ID R2410T
Articles of Agreement, SACC Manual Clause ID R0412D
GC1 General Provisions, SACC Manual Clause ID R2810D
GC2 Administration of the Contract, SACC Manual Clause ID R2820D
GC3 Execution and Control of the Work, SACC Manual Clause ID R2830D
GC4 Protective Measures, SACC Manual Clause ID R2840D

GC5 Terms of Payment under $100,000, SACC Manual Clause ID R2550D
GC6 Delays and Changes in the Work, SACC Manual Clause ID R2860D
GC7 Default, Suspension or Termintion of the Contract, SACC Manual Clause ID R2870D
GC8 Dispute Resolution (Generally for Contracts under $100,000), SACC Manual Clause ID R2884D
GC9 Insurance under $100,000, SACC Manual Clause ID R2590D
Fair Wages and Hours of Labour - Labour Conditions SACC Manual Clause ID R2940D (formerly R0203D Labour Conditions "D")
Allowable Costs for Contract Changes Under GC6.4.1, SACC Manual Clause ID R2950D

The SACC Manual references for Division 00 are available on the internet at http://sacc.pwgsc.gc.ca/sacc/query-e.jsp or http://pwgsc.gc.ca/sacc/choice-e.html

4.5 National Master Specification

The National Master Specification (NMS) is a bilingual (English and French) database of master construction specification sections which is owned and managed by PWGSC. It was created in 1975 as a joint effort between several Government of Canada departments and Construction Specifications Canada. The text consists of wording likely to be required for a wide range of construction and/or renovation projects.

In preparing project specifications, the Consultant shall use the latest release of the NMS amended by PWGSC Ontario Region to the maximum extent to which it is applicable, as per Departmental Policy 039/2001-05-01, TB Minute 732202, subject to the Consultant's overriding responsibility for the final content of the project specification. Use PWGSC Ontario Region amended NMS sections and PWGSC Ontario Region Master Specifications: Architectural, Structural, Mechanical and Civil Minor Works and In-House specification masters available by copying down from the ftp site. The Consultant shall edit, amend, and supplement the NMS as the Consultant deems necessary to produce an appropriate project specification free from conflict and ambiguity. New sections not presently included in the NMS database may be required. The Consultant shall be responsible for the cost of processing the project specifications in NMS Professional Specification Editing Software using the Consultant's own or sub-contracted typing/word processing facilities. The Consultant shall be responsible for all proofreading. Both the NMS and PWGSC Ontario Region Master Specifications follow CSC/CSI Masterformat numbering. As of January 2005, the NMS renumbered the entire database in line with Masterformat 2004 which uses 6 digit sections numbers instead of the previous 5 digit numbers, consisting of two numbers, a hard or connecting space, two more numbers, a hard or connecting space and two more numbers (for example, 01 11 00 instead of 01110). Masterformat 2004 divides the work into 50 divisions instead of the previous 16 divisions (for example, 01 11 00.00).

The Consultant is responsible for obtaining from any authorized supplier, the NMS User's Guide, and an updated version of the NMS specification sections that the Consultant requires in preparing the project specification.

Use of the NMS system shall not relieve the Consultant of the responsibility for conforming to the approved time schedule.

4.6 Regional Guide Specifications

The Centre of Expertise maintains abridged versions of some NMS specifications and a number of other short form guide specifications. These are available from the regional Specifications Offices.

The Consultant shall obtain the region's amended version of Division One, which also includes requirements peculiar to the Region. The Consultant shall ensure that the Regional requirements of

Division 01, appropriate to the project, are incorporated in appropriate NMS Division One sections. Other regional abridged and short form specifications may be used at the Consultant's or the department's option.

As in the case with the NMS, the Consultant shall be entirely responsible for project specification accuracy, applicability of content, completeness, and correctness, whether or not prepared using the abridged or short form guide specifications referred to herein.

4.7 Specification Organization

Section Titles and Numbers: Since its inception, the NMS structure has been and continues to be based on the "Masterformat" Master List of Section Titles and Numbers which is jointly produced by the Construction Specifications Institution of the United States and Construction Specifications Canada. The 2009 NMS is currently based on Masterformat 2004 (50 Divisions, 6 and 8 digit Section Numbers).

Type of Section: Narrowscope sections describing single units of work are preferred for more complex work; Broadscope sections may be more suitable for less complex work.

Format: Use the NMS wide page or 1/3 - 2/3 format consistently throughout the specification.

4.8 Specifying Materials

The practice of specifying actual brand names, trade names, model numbers, etc., is against departmental policy except for very special circumstances. Some NMS sections incorporate trade names. For PWGSC delete the trade names. The method of specifying materials and the use of trade names shall be as stated hereunder, and in the following order of preference:

- Specify by using recognized standards such as those produced by CGA, CGSB, CSA, and ULC, or by trade associations such as CRCA and TTMAC. Use Canadian standards wherever possible.
- Where CGSB Qualified Product Lists are available that identify materials that meet requirements of relevant CGSB Standards, specify to restrict supply of materials to those on such lists.
- Current lists are available from: Canadian General Standards Board Sales Centre,
  OTTAWA, Ontario K1A 1G6
  Telephone: (613) 941-8703
  Fax: (613) 941-8705
- Where no standards exist, specify by a non-restrictive, non-trade name "prescription" specification or by a "required performance" specification.
- Where no standards exist and where a suitable non-restrictive, non-trade name "prescription" specification or a "required performance" specification cannot be developed, specify by trade name. Include all trade names available under WTO, NAFTA and other trade agreements, of materials acceptable for the purpose intended, and in the case of equipment, identify by model number. The name, telephone number and web site of the manufacturer and distributor must also be included.
- Obtain written approval from the Departmental Representative before; adding or deleting from list of trade names specified in NMS sections or PWGSC master specifications; specifying trade names in lieu of "prescription" or "performance" method used in NMS sections; or specifying trade names when writing "custom" (not NMS) sections.

Additionally, use trade names:

- Where only one specific material will fulfill the exact requirements of the project.
- Where specific materials are required to match existing materials.

- On projects of a special nature due to an unusual function or timing requirement such as emergency repairs.

List all trade names of materials acceptable for the purpose and make reference to the Instructions to Bidders for the method of approving alternative materials. Where trade names are specified in an 'Acceptable material' sub-paragraph following the complete generic performance criteria specification, list all available WTO, NAFTA and other trade agreements (not just Canadian) manufacturer's, their model numbers, the distributors and the complete telephone numbers including area code, fax number and website.

The Consultant shall read and apply the trade agreement clauses applicable to the project which are listed in the NAFTA article 1007 Techncial Specifications, the WTO article VI Technical Specifications, and in the Agreement on Internal Trade Chapter 4 - General Rules Article 401: Reciprocal Non-Discrimination.

On certain projects, trade names or manufacturers' numbers may be included in the Hardware Section, as specifically instructed in writing by the RCMP Security Engineering Branch or Correctional Services Canada. Use the following format as a sub paragraph following the performance criteria paragraphs. Set up trade name acceptable material specifications as follows:

Acceptable Material:

1. ABC Co. Model [___], manufactured by 123 Inc. 416-555-1234 fax 416-555-2234 www.123.com, distributed by 456 Inc 416-555-5678 fax 416-555-5566 www.456.com.
2. DEF Co. Model [___], manufactured by 123 Inc. 416-555-1234 fax 416-555-2234 www.123.com, distributed by 456 Inc 416-555-5678 fax 416-555-5566 www.456.com.
3. GHI Co. Model [___], manufactured by 123 Inc. 416-555-1234 fax 416-555-2234 www.123.com, distributed by 456 Inc 416-555-5678 fax 416-555-5566 www.456.com.
4. Alternative Materials: Approved by addendum in accordance with Instructions to Bidders. (Or instead of this wording with each list of trade names, include the following in Part 1 of Specification Sections in which trade names appear: "Acceptable Materials: Where materials are specified by trade name refer to the General Instructions to Bidders SACC Manual Clause ID R0001T for procedure to be followed in applying for approval of alternatives.")

The reference to the General Instructions to Bidders in the above examples is necessary to remove any suggestion of partiality and to ensure that all suppliers are aware of the provision for alternative proposals during the bidding period. Do not use such phrases as "or equal", "similar to", "equivalent to","to match" to provide for alternative materials. Use language identified in the NMS User's Guide.

Identify material as in product literature. Specific types and model numbers are required.

Do not use variations on above methods of specifying by trade name. One example is use of the phrase "Acceptable Manufacturers".

While this establishes the names of manufacturers who are acceptable it does not ensure that the actual material involved will be acceptable. Moreover, it does not allow for competition because there is no tie-in with the Instructions to Bidders which deal only with alternative "materials".

4.9 Standards

The following is a list of internet websites that may be used to check for the most current publications of standards that might be referenced in the construction specification document.

AA: www.aluminum.org

AAMA: www.aamanet.org
AMCA: www.amca.org
ANSI: www.ansi.org
API: www.techstreet.com/info/api.html#hist
ARI: www.ari.org
ASHRAE: www.ashrae.org
ASME: www.asme.org
ASTM: www.astm.org
AWMAC: www.awmac.com
BIFMA: www.bifma.com
CGA: www.cga.ca
CGSB: www.pwgsc.gc.ca/cgsb/home/estore-e.html
CRCA: www.roofingcanada.com
CSA: www.csa.ca
CSDMA: www.csdma.org
EIA: www.eia.org
IEEE: www.ieee.ca
ISA: www.isa.org
ISO: www.iso.ch
OPSS and OPSD: http://www.raqsa.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage
MIA: www.marble-institute.com
NAAMM: www.naamm.org
NEMA: www.nema.org/
NFPA: www.nfpa.org/catalog/catalog_home.asp?cookie%5Ftest=1
NLGA: www.nlga.org
NSSN: www.nssnorg
SAE: www.sae.org
SCC: www.scc.ca/indexe.html
SMACNA: www.smacna.org
SSPC: www.sspc.org
TIA: www.tiaonline.org
TTMAC: www.ttmac.com
ULC: www.ulc.ca/standards
UL: www.ul.com

General reference of standards: www.cssinfo.com/search.html and www.techstreet.com

For metal manufacturers: www.retailsource.com/index.html

For other website addresses of industry trade and manufacturer associations, use internet advanced searches.

Standards within NMS sections are not always the most current. The responsibility to ensure that the latest standards current as of the date of tendering are used remains the responsibility of the consultant; include standard designation, date, title and technical content.

The NMS Secretariat can also be reached on the web at www.nms-ddn.ca

4.10 Canadian Materials

Specify Canadian materials to the fullest extent procurable, consistent with proper economy and the expeditious carrying out of the work.

4.11 Cash Allowances

Specifications and Drawings should be complete and contain requirements for all work of the Contract. Use cash allowances only under exceptional circumstances where no other method of specifying is appropriate. Obtain Departmental Representative's approval to use cash allowances. Use Section 01 21 00 Allowances (formerly section 01210 in Masterformat 1995) of the NMS to specify cash allowances.

Refer to Section 6 Risk Management and Sections 11 & 12 Cost Planning and Control.

4.12 Extended Warranties

It is the policy of PWGSC's Real Property Contracting Directorate (RPCD) to avoid extending warranties more than 24 months. Where it is necessary to extend the twelve month warranty period provided for in the General Conditions of the Contract, use the following wording in Part 1 of the applicable technical sections, under the heading "Warranty":

- "For the work of this Section [___] the 12 months warranty period prescribed in GC3.13 of General Conditions is extended to 24 months."

- Where the extended warranty is intended to apply to a particular part of a specification section modify the above as follows: "For [insulating glass units] the 12 month ... [___] months."

Parts of the work for which extended warranties may be required are those, such as roofing and waterproofing, in which, based on past performance, defects are likely to appear after the twelve month warranty period provided for in the General Conditions.

4.13 Terminology

Use the term "Departmental Representative" instead of PWGSC, Owner, Consultant or Architect. Departmental Representative means the officer or employee of Her Majesty who is designated pursuant to the Articles of Agreement and includes a person specially authorized by the Departmental Representative to perform, on the Departmental Representative's behalf, any of the Departmental Representative's functions under the contract and is so designated in writing to the Contractor. Wherever options: [Architect], [Consultant], [Owner], [Design Builder], [Departmental Representative] appears in NMS Sections, select the word "Departmental Representative".

The terminology used shall be consistent throughout the drawings and specifications.

4.14 Drawings

Drawings and specifications have to be in metric only, even if the project is to renovate an old building. Any references to imperial units will not be accepted.

The terminology used should be consistent throughout the drawings and specification.

4.15 Specification Documentation

Front and Back Cover: by Department.

Amendments (if required): by Consultant. Department to provide format, and to sign and distribute.

Special amendments: by Department, copies of the current special amendments are available from the regional Specifications Section.

Instructions to Bidders: by Department.

Bid Form: by Department.

Standard Construction Contract Documents for Major Works: by Department.
(See section 4.4)

and for Minor Works: by Department.
(See section 4.4)

Documents listed are incorporated by reference only. The SACC Manual references for Division 00 are available on the internet as specified in clause 4.4.

List of Contents, Index of Specification and Divisions 01 to 50 (Masterformat 2004) (formerly 1 to 16 under Masterformat 95) and Drawings: by Consultant based on attached examples.

4.16 Typing Format

Refer to the NMS for approved wide page and 1/3-2/3 page format and numbering method. Use consistent format throughout the project specification.

Start each Section on a new page.

Print on 216 mm x 280 mm (8-1/2" x 11") white bond paper, 11 or 12 point TT Courier New font. Do not use smaller fonts as they are not legible on microfilmed documents.

Every page shall have the Project Number, the Section title, the five digit Section number, the page number and the project date. Obtain sample from the specification reviewer before proceeding with specifications. The header and/or footer shall not show the consultant's name and address.

The Consultant shall hand over specifications in both hard paper copy and soft electronic copy compatible with **NMS Professional version 2.06.00** on CD/USB or on the ftp site of the project specifications, title page, amendments, etc. Submit small drawings, ie, abbreviations, room, colour, door and hardware schedules, notes, unit price tables when applicable, etc. in Lotus 123 or MS Excel/Word as per PWGSC Ontario Region electronic masters.

4.17 FTP File Transfer Protocol Internet Site

PWGSC Ontario Region master specifications and PWGSC Ontario Region amended NMS sections are available on the internet from our ftp site at **ftp://ftp.pwgsc.gc.ca.** These are only compatible with NMS Professional software. Copy or download the files.

4.18 Printing and Binding

The Department is responsible for printing and binding. Provide Department with one sided, camera ready paper original of specification. With 11 point font use binding margins 0.75 Left and 0.75 right. With 12 point font use binding margins 0.50 Left and 0.50 right. Ensure pdf files have the correct binding margins for two sided printing. Ensure page width is set to 6.74 not 6.60.

4.19 Bidding Information

Instructions to Bidders: Provide Department with a list of significant trades including costs. The Department will then determine which trades, if any, will be bid through the Bid Depository.

Bid Form: Provide Department with a list of unit, separate, and alternative prices to be included.

Addenda: Provide Department with addenda in Departmental format.

4.20 PWGSC Ontario Region Master Specifications

One electronic copy of each applicable PWGSC section will be provided by PWGSC, Ontario Region, by ftp site. The PWGSC Ontario Region Master Specifications and Ontario Region amended NMS master specifications are available by copying/downloading from ftp.pwgsc.gc.ca/rps/specifications. These specifications are only compatible with **NMS Professional v2.06.00** specification processing software. Verify software version currently in use at PWGSC on award of consulting contract.

PWGSC Ontario Region will supply small drawing masters, i.e., abbreviations, room, colour, door and hardware schedules, notes, etc. in Lotus 123 and MS Excel/Word.

Contact PWGSC Ontario Region, Senior Specification Officer, Cathy Ferren-Palmer at 416-512-5971 or by email at Cathy.Ferren-Palmer@pwgsc-tpsgc.gc.ca or Dan Covey at 416-512-5942 or by email at Dan.Covey@pwgsc-tpsgc.gc.ca. Files are stored in NMS Professional specification writing software and are not available in any other word processing formats. You can save the specifications in other formats but you must submit your projects specifications to PWGSC Ontario Region in file formats compatible with NMS Professional as a *.spp file. You can download or copy, but not open or view, the PWGSC specification masters from the ftp site specified in 4.17 above.

4.21 Fixed Price Contract

Delete all "Measurement for Payment", "Measurement Procedures" and "Payment Procedures" paragraphs from Heavy Civil Engineering sections of NMS, if such sections are used with other sections of NMS for Fixed Price Contracts.

4.22 Unit Price Contract

The majority of Heavy Civil engineering projects are bid as Unit Pricce Contracts. To accommodate this, the Heavy Civil sections of the NMS include unit price measurements under Part one of each section in “Payment Procedures”.

The remaining sections of the NMS and PWGSC Ontario Region in-house masters are written for fixed prie contracts and therefore do not include “Payment Proceedures” clauses.

When combining both systems in a project, ensure only one method of payment is specified.

Unless otherwise instructed by the Departmental Representative, contracts are written for heavy civil engineering are written on the Unit Price basis and Payment Procedures paragraphs apply. Add the Payment Procedures paragraphs to the remaining sections when combining with Heavy Civil Engineering sections.

4.23 Combined Lump Sump and Unit Price Contract

Use the 'Bid and Acceptance Form - Combined Price' when a portion of the work involves unit prices. The unit price table should only be used for labour, tooling or materials when the quantity cannot be accurately determined prior to execution of the work. The unit price table is not to be used to obtain a cost breakdown for lump sum work.

4.24 Designated Substances

For existing buildings and all sites, include the Designated Substances Survey report in Division 01. Bind into the specification following Section 01 11 01 in Masterformat 2004 (formerly 01010) for minor works or 02 61 00.01 in Masterformat 2004 (formerly 01357) for major works projects. This will satisfy the requirements of the Occupational Health and Safety Act and Regulations for Construction Projects, Revised Statutes of Ontario 1990, Chapter O.1 as amended, O. Reg. 213/91 as amended by O. Reg. 631/94, R.R.O. 1990, Reg. 834.

4.25 WHMIS

Comply with the requirements of the Workplace Hazardous Materials Information Systems (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of material safety data sheets acceptable to Labour Canada.

4.26 PCB Disposal

Comply with Ontario Regulation 309. Use PWGSC amended NMS specification Section 02 84 10 Management of Toxic Waste, formerly Section 01358.

4.27 Environmental Requirements

Comply with Federal and Provincial Acts, Codes, Regulations, Guidelines and Codes of Practice including but not limited to:

- CEPA - Canadian Environmental Protection Act 1988.
- Guidelines for Emissions from Commercial/Industrial Boilers and Process Heaters; Code of Practice for the Reduction of CFC Emissions from Refrigeration and Air Conditioning Systems 1990; New Source Performance Standards for Stationary Combustion Turbines 1990; CEPA Guidelines for Storage Tanks Containing Petroleum Products 1992; CCME Code of Practice for UST Systems Containing Petroleum Products 1989.
- FA - Fisheries Act.
- TDGA - Transportation of Dangerous Goods Act.
- NWPA - Navigable Waters Protection Act.
- MBCA - Migratory Birds Convention Act.
- PCPA - Pest Control Products Act.
- IRIA - International River Improvements Act.
- ECOLOGO - Environment Canada, Environmental Choice Program, Guidelines and Certified Products Lists. These are available from the Environmental Choice Program, TerraChoice Environmental Services Inc., 613-247-1900.

4.28 Waste Disposal

Comply with waste reduction plans, recycling, reuse, sale to reuse stores, etc. as specified in PWGSC Ontario Region masters. Co-ordinate section 01 11 01 with 02 42 92 in Masterformat 2004 (formerly 01010

with 02221) for minor works and sections 01 74 20, 02 42 92, etc in Masterformat 2004 (formerly 01355, 01356, 01357, 01358) with 02 41 17, 02 41 16 and 02 41 23 in Masterformat 2004 (formerly 02221, 02222 and 02223) for major works.

Use deconstruction rather than demolition to the maximum extent possible. The goal is to divert 90 to 95% of deconstruction, demolition and construction waste from landfill. Carefully deconstructed items shall be reused, recycled, sold to reuse stores, factory refurbished, etc. in accordance with the waste reduction workplan. Specify as many details as possible of the waste reduction workplan in the Contract Documents. Do not leave it up to the Contractor to decide. Where the destination of products is known, specify where the material is going with name, complete street address, phone number and email address. Refer to PWGSC Ontario Region Section 02 42 92 Deconstruction of Structures (formerly 02228) for detailed deconstruction specs.

4.29 Door Hardware

Door hardware shall be specified and scheduled using the ANSI/BHMA numbers and symbols for type, grade, function, finish, etc. in accordance with PWGSC specifications, NMS specifications, and the Door and Hardware Institute - DHI "Sequence and Format for the Hardware Schedule, June 1984"

Use the Lotus 123 small drawing files listed above. Other formats WILL NOT be accepted. Project files must be compatible with our storage and retrieval systems such as EDRM (TIDIS).

Do not use trade names and/or manufacturer's model numbers in the hardware specifications or schedules unless directed to do so IN WRITING by the Departmental Representative for specialty hardware items.

4.30 Epoxy Coatings

Use PWGSC Ontario Region Section 09 96 00 (formerly 09820) for all epoxy and urethane floor, wall and ceiling coatings.

4.31 Painting

Specify paint products manufactured in accordance with 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-07-89 for Water Borne Surface Coatings and ECP/PCE-12-89 for Solvent Based Paints. Wherever possible, specify 0 VOC products. Refer to Section 09 91 00, para. 2.1.1 (formerly 09900).

Specify paints meeting VOC - volatile organic compound limits specified in PWGSC amended master specs.

Specify paints using the CPCA - Canadian Painting Contractor's Association, Architectural Specifications Manual, 2000 edition. Use the exterior and interior finish system codes as specified in Chapters 4A and 4B, and in the PWGSC master specification section 09 91 00 (formerly 09900).

Lead paint: use PWGSC Section 02 83 20 Lead Paint Removal (formerly 02085).

Repainting of heavy civil structures/bridges, etc., use Section 09 97 17 with MOT and SSPC/NACE standards.

4.32 Sealants

Use PWGSC Section 07 90 00 Joint Sealing (formerly 07900) and Lotus 123 spreadsheet 07900.wk4. Specify Environmental Choice Program, Ecologo sealants.

Edit 07900.wk4 to suit the project and attach to the specification after the last page of Section 07 90 00.

4.33 Asbestos Abatement

Comply with Ontario Regulations 278/05 for asbestos abatement and Regulation 309 to transport, deliver and deposit asbestos waste. Use PWGSC amended NMS specification Sections 02 82 00.01, 02 82 00.02 and 02 82 00.03 (formerly 13281, 13282 or 13283) as required.

4.34 Dredging

Obtain PWGSC Ontario Region Dredging master specifications package from the FTP site.

4.35 Projects With a 33%, 66% and 100% Submission

33% Submission: submit hard copy for:

- List of Contents for all divisions.

66% Submission: submit hard copy and electronic copy to the Departmental Representative for:

- List of Contents for all divisions, Division 1 sections and a rough edit of specialty sections, such as, Asbestos Abatement, Guano Removal, Removal and Disposal of Underground Fuel Oil Tanks, Lead Paint Removal, Finish Hardware, Epoxy Flooring and Automatic Controls.
- One hard copy of the Designated Substances Survey Report.
- One copy of draft Hardware Schedule, Door and Frame Schedule, and Door and Frame Types.
- One hard copy of window calculations from AAMA/WDMA/CSA-101/I.S.2/A440-08, Standard/ Specification for Windows, Doors and Unit Skylights and AAMA/WDMA/CSA-101/I.S.2/ A440S1-07, Canadian Supplement to AAMA/WDMA/CSA-101/I.S.2/A440-05, Standard/ Specification for Windows, Doors and Unit Skylights - Figure A.1 Checklist for selecting performance levels for windows, doors, and unit skylights, revised March 2007.

100% Submission: submit hard copy and electronic copy compatible with NMSEDIT PROFESSIONAL and in PDF format for:

- Final Specification Title Sheet, List of Contents and all specification sections.

4.36 Projects With a 50% and 100% Submission

50% Submission: submit hard copy for:

- List of Contents for all divisions, Division 1 sections and a rough edit of specialty sections, such as, Asbestos Abatement, Guano Removal, Removal and Disposal of Underground Fuel Oil Tanks, Lead Paint Removal, Finish Hardware, Epoxy Flooring and Automatic Controls.
- One hard copy of the Designated Substances Survey Report.
- One copy of draft Hardware Schedule, Door and Frame Schedule, and Door and Frame Types.
- One hard copy of window calculations from AAMA/WDMA/CSA-101/I.S.2/A440-08, Standard/ Specification for Windows, Doors and Unit Skylights and AAMA/WDMA/CSA-101/I.S.2/ A440S1-07, Canadian Supplement to AAMA/WDMA/CSA-101/I.S.2/A440-05, Standard/ Specification for Windows, Doors and Unit Skylights - Figure A.1 Checklist for selecting performance levels for windows, doors, and unit skylights, revised March 2007.

100% Submission: submit hard copy and electronic copy compatible with NMSEDIT PROFESSIONAL and in PDF format for:

- Final Specification Title Sheet, List of Contents and all specification sections.

4.37 As-Built and Record Specifications

Submit paper copy and electronic copy compatible with NMSEDIT PROFESSIONAL and in PDF format of as-built and record specifications.

4.38 Example of Major Works Index: Plans and Specifications "A".

This document is the document referred to as "Plans and Specifications" marked "A" in the Articles of Agreement entered into

on the _____ day of _____ 20____

between Her Majesty the Queen

and _____

Signed _____
(Authorized Signing Officer)

_____
(Contractor)

SPECIFICATIONS:

DIVISION	SECTION	NO. OF PAGES
DIVISION 1	01110 - SUMMARY OF WORK.	
DIVISION 2	**List all Sections and number of pages.**	
DIVISION 3		
DIVISION 4	List all division 1-50.	

PLANS: List all Drawings - Architectural, Structural, etc.. including titles.

SECTION 5 MARINE

5.1 General

All design criteria shall be in accordance with the current edition of reference codes and standards.

For material properties (both physical and chemical), methods of fabrication, tests, etc. reference should be made to the latest editions of CSA the Canadian Standards Association Standards and CGSB the Canadian General Standards Board Specifications, give the standard number and date of the issue, etc.

5.2 Regulations

Design shall comply with applicable Federal, Provincial and Municipal regulations and codes. In case of conflict, the most stringent requirements apply.

5.3 Design for Marine Engineering

PWGSC Review: The design alternatives and costs shall first be reviewed by PWGSC who will involve other regulatory bodies in the review as required.

All Marine Engineering Designs must comply with current Federal and Provincial Acts, Codes, Regulations, Guidelines and Codes of Practice including but not limited to:

- National Building Code of Canada (NBC).
- Ontario Building Code (OBC) .
- Canadian Concrete, Steel, Wood, Aluminum, other relevent Codes and marine and dredging best practices.

The Consultant shall discuss design loads with Public Works and Government Services Canada Marine Engineers before formulating his proposals.

The Consultant shall submit marine proposals for consideration and review by Public Works and Government Services Canada. These proposals shall contain the following information:

- General description of the project.
- Design loads.
- Comparative cost analysis of alternative layouts.
- Recommended layout.

Prior to commencement of working drawings, the Consultant shall submit for consideration by Departmental Representative the following data:

- Design criteria for marine structures.
- Site access and dredging and dredge disposal alternatives.
- Other relevant information as necessary.

The Consultant shall include on the drawings:

- Design criteria and assumptions.
- Design live loads, including berthing and mooring loads for the structures.
- Foundation design bearing pressures..

5.4 Soils Investigation

A soils report and/or sediment sampling report will be prepared for PWGSC. PWGSC will require the marine consultant to establish what additional soil testing information is required immediately after approval of the concept design. The consultant shall arrange for final soils investigator acceptable to the Department.

5.5 Drawings

Drawings shall be produced in accordance with Section 1.

5.6 Specifications

Specifications in accordance with Section 4.

Comply with Section 4.22 for lump sum contracts, Section 4.23 for unit price contracts. Or 4.24 for combined lump sum and unit price contract.

5.7 Testing and Inspection

A resident departmental representative may be appointed and paid by PWGSC to ensure that the work is performed in accordance with Plans and Specifications and to maintain records of the blow counts for each pile (if applicable).

A testing company will be engaged for testing materials material used in the works, including enviromental testing, where necessary.

5.8 As-Built and Record Information

As-built information is received from the Contractor. It contains drawings, specifications, shop drawings, submittals, samples, etc. It is noted as such by the Contractor.

Record drawings and specifications are updated originals prepared by the Consultants based on the information supplied by the Contractor in the as-built.

Provide an Environmental Mitigation Record report for the project.

5.9 Work Measurement for Unit Price Contracts

Measure and record quantities of labour and materials involved, if work is based on unit prices, for verfication of monthly progress claims and the Final Certificate of Measurement.

When a Contemplated Change Notice is to be issued based on Unit Prices, keep accurate account of the work. Record dimensions and quantities.

Record number of workers on site and hours worked daily.

5.10 Bid Documents Format:

Bid documents format shall be produced in accordance with Section 1.

SECTION 6 RISK MANAGEMENT

The Consultant will provide the necessary information required by the Departmental Representative to create and update the Risk Management Plan throughout the project.

6.1 Definitions

Procurement Plan:
Formal submission for approval to enter into a contract and composed of a (1) cost estimate of the requirement (including cash allowances, and design, estimating and inflation allowances), (2) a contingency and, (3) an anticipated amendment amount.

Allowances:
Additional resources included in an estimate to cover the cost of known but undefined requirements for an individual activity, work item, account or sub account: design allowance, estimating allowance, inflation allowance and other allowances specifically identified are part of a cost estimate

Cash Allowances:
A specific amount to be used for specific work item or service.

- Cash Allowance Construction: additional resources included in an estimate to cover the cost of known but undefined requirements whose probability of occurrence is high. this allowance is specifically identified in a cost estimate.
- Cash Allowance Consultant: additional services included in an estimate to cover the cost of known but undefined requirements whose probability of occurrence is high. this allowance is specifically identified in a cost estimate.

Risk Allowance:
Anticipated monetary value of risk events, due to the complexity of the project, market conditions, competiveness, and timing of project; contingencies are likely to happen and do not form part of cost estimates.

Anticipated Amendments:
This is basically the pre-authorization of amending authority to a certain level. Individual contract amendments within this authority must still be approved by the appropiate level of contracting authority.

The total amount of the Anticipated Amendment to a project cost estimate is determined as the summation of the Expected Monetary Value of risk events reasonably expected to occur during the life cycle of a project.

Risk Management:
The art and science of identifying, analyzing, and responding to risk factors throughout the life of a project and in the best interests of its objectives. (PMBOK)

Risk Event:
A discrete occurrence that may effect the project for better or worse (i.e. late delivery of a piece of equipment is a “risk event” that may cause a schedule delay).

Probability:
The likelihood that an event will occur (i.e. Low, Medium, High).

Impact:
The result of the occurrence of an event on the project either positive or negative. (i.e. a schedule delay as a result of late delivery of a piece of equipment may have a high negative impact on a project; increased access to a construction site due to early departure of occupants in an office space may have a positive impact on a project).

The Impact of individual Risk Events can be qualified as low, medium, high or quantified in terms of time, cost (immediate cost or in-service cost (O&M)) or performance.

High risk*: A project (or element of a project) may be assessed as high risk if one or more hazards exist in a significant way and, unless mitigated, would result in probable failure to achieve project objectives.

Medium risk*: A project (or element of a project) may be assessed as medium risk if some hazards exist but have been mitigated to the point that allocated resources and focused risk management planning should prevent significant negative effect on the attainment of project objectives.

Low risk*: A project (or element of a project) should be assessed as low risk if hazards do not exist or have been reduced to the point where routine project management control should be capable of preventing any negative effect on the attainment of project objectives.

*per Treasury Board Secretariat Manuals Chapter 2-2 Project Management

EMV: Expected monetary value of risk event (i.e. cost or saving to the project if risk event occurs)

6.2 Risk Management Checklist

Probability, impact, over all risk, risk response and risk allowance are to be determined for each item listed below which is applicable to the project. Applicable items will be identified by the Departmental Representative.

Resources External to Project Management Team

- Planning Resources and Performance
  - errors and omissions
  - low accuracy of estimates (allowances)
  - data inadequacies
  - level of liability insurance
  - potential for misinterpretation / misunderstanding of documents
  - planning inexperience
- Construction Resources Required & Performance
  - level of liability insurance
  - design versus execution methods
  - suitability of execution methods to design
  - commissioning issues (start up / turnover difficulties)
  - contractor construction strategy
  - reputation of contractor
  - contractor financial stability
  - contractor inexperience
  - resources obtained less qualified than desired
  - availability / suitability / performance of resource

Project Scope Delivery

- Delivery of Specified Requirement
  - accuracy of client requirements in terms of cost/ schedule / performance / quality and ability to interface with existing environment
  - conflicting client priorities
  - low level of client knowledge
  - Y2K compliance
- Unstated Client Requirements
  - completeness of client requirements in terms of cost/ schedule / performance / quality and ability to interface with existing environment
  - restricted working conditions
  - opportunities for changes / positive impact
- Stakeholder Requirements, Stated and Unstated
  - low involvement of user groups in scope of definition
  - interface with existing systems
  - restricted working conditions
  - operational needs

Site / Asset / Building Actual Conditions

- Actual Physical Environment
  - availability / accuracy of as built documentation and existing condition reports
  - high variability / low stability of soils
  - potential for soil contamination
  - presence of hazardous materials
  - availability / access to site
  - presence of other contractors on site
  - climate (winter conditions, rain, wind, water levels)

Government / PWGSC / Client / Context

- Impact on Adjacent Areas Actual
  - impact on adjacent areas (land / tenants/ traffic / operations)
- Impact from External Sources
  - legal lawsuits, patent rights, licensing, etc.
  - political impacts including visibility of project
  - social sensibilities
  - potential strikes
  - market risks
  - bad press (media coverage)
- Impact from Unanticipated Regulatory Change
  - environmental legislation and environmental screening
  - potential changes to Acts, Codes and Regulations
  - municipal building / occupancy permit issues

- Procedures Known
  - suitability of bid documents
  - suitability of contracting method
  - delays in bidding process
  - client internal coordination
  - change order process

Plan Approval / Design Reviews

- approvals may be required from Client, PWGSC, Treasury Board, FHBRO, Fire Commissioner, Police, Emergency Services, Municipalities, Cities, etc.
- absence of Investment Analysis
- unstable / changing client organization
- heritage building issues
- health and safety issues
- potential for “hold orders”
- design review delays (client / PWGSC / TBS / other)
- approval delays (client / PWGSC / TBS / other)

SECTION 7 CIVIL DESIGN

7.1 Review

All designs must be reviewed by the Department and conform to the requirements of the Project Brief or Terms of Reference.

7.2 Principles

The Department expects the Consultant to maintain a high standard of civil design, based upon recognized contemporary design principles. All design elements, planning, civil and municipal engineering and landscaping, must be fully co-ordinated, and consistent in adherence to good design principles.

7.3 Economy

Design strictly within the budget and in accordance with sound investment economics and operating and maintenance expenditures.

7.4 Quality

Quality of materials and construction methods shall be commensurate with the type of infrastructure and the budget. Avoid experimental materials. Take into account the total life-cycling of the infrastructure.

7.5 Regulations

Design shall comply with applicable Federal, Provincial and Municipal regulations and codes. In case of conflict, the most stringent requirements apply.

7.6 Design General

PWGSC Review: The design alternatives and costs shall first be reviewed by PWGSC who will involve other regulatory bodies in the review as required.

Environment Canada Approval: The design shall satisfy Environment Canada. Public Works and Government Services Canada will arrange for a review of the proposed alternative and the design work through the office of Environment Canada, Federal Program Division. Environment Canada will arrange to have the design reviewed by other agencies.

Client Review: As the client is the user of the site and systems, and must maintain it in good working order to the satisfaction of all regulatory agencies, it is essential to involve the client through all the stages of review and decision.

7.7 Design for Civil and Municipal Engineering

All Civil and Municipal Engineering Designs must comply with current Federal and Provincial Acts, Codes, Regulations, Guidelines and Codes of Practice including but not limited to:

- Guidelines for Canadian Drinking Water Quality (GCDWQ), 2008.
- Safe Drinking Water Act 2003-(SDWA).
- Recommended Standards for Water Works, Ten State Standards) - 2007 Edition.
- Recommended Standards for Bathing Beaches, Ten State Standards) - 1990 Edition

- Recommended Standards for Individual Sewage System, Ten State Standards) - 1980 Edition
- Recommended Standards for Waste Water Facilities, Ten State Standards) - 2004 Edition
- Recommended Standards for Swimming Pool Design and Operation, Ten State Standards) - 1996 Edition.
- American Waterworks Association (AWWA) Standards.
- National Building Code of Canada (NBC).
- Ontario Building Code (OBC) .
- Canada Standards Association (CSA)**.**
- American Society for Testing and Materials International (ASTM).
- Canadian Environmental Protection Act (CEPA) -1999.
- Transportation of Dangerous Goods Act (TDGA)-1992.
- Canadian General Standards Board (CGSB).
- OPSS Ontario Provincial Standard Specifications (OPSS).
- OPSD Ontario Provincial Standard Drawings (OPSD).
- Canada Labour Code, Part II.
- National Fire Code of Canada (NFC).
- National Plumbing Code (NPC).
- Underwriter Laboratories of Canada (ULC).
- American National Standards Institute (ANSI) NSF/60 and NSF/61.
- National Fire Protection Association (NFPA).
- Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments, Environment Canada (Most Current version).
- Federal Environmental Assessment Process, Environment Canada.

Use the current versions of Ontario Provincial Standard Specifications (OPSS) and Ontario Provincial Standard Drawings (OPSD) to maximum extent possible.

Province of Ontario:
.1 Occupational Health and Safety Act and Regulations for Construction Projects, Revised Statutes of Ontario 1990, Chapter O.1 as amended, O. Reg. 628/05 as amended,Designated substance-Asbestos on construction projects and in buildings & repairs operations, O. Reg. 278/05.
.2 Workplace Safety and Insurance Act,1997.

Provincial/Territorial guidelines and regulations govern, except where they are less stringent than those of the federal government, such as the following:
• Ontario Ministry of the Environment (MOE) (Effluent criteria, Certificate of Approval of Sewage and Water Works, Air).
• Ontario Ministry of Natural Resources (MNR).
• Ontario Ministry of Labour (MOL).
• Technical Standards and Safety Act (TSSA).
• Digester Gas Code CAN/CGA-B105-M93(R2007).
• Ontario Regulation 346 - General Air Pollution

Ontario Ministry of the Environment Design Guidelines (Most current versions)
1. Guidelines for the Design of Water Treatment Works.
2. Guidelines for the Design of Sewage Treatment Works.
3. Guidelines for the Design of Sanitary Sewage Systems.
4. Guidelines for the Design of Storm Sewers.
5. Guidelines for the Design of Water Distribution Systems.
6. Guidelines for the Design of Water Storage Facilities.
7. Noise and Air Emission Guidelines.

Other Applicable Regulations or Acts
1. Regulations for Construction Projects.
2. Workplace Hazardous Material Information System (WHMIS) Regulation, R.R.O. 1990, Reg. 860 (as amended by O. Reg.356/91; and O. Reg 36/93).
3. Occupational Health and Safety Act, Regulations for Construction projects, O. Reg. 213/91 (as am. By O. Reg. 631/94), Part II – General Construction.
4. Occupational Health and Safety Act, Industrial Establishments Regulation, R.R.O. 1990, Reg. 851 as amended, Part I – Safety Regulations.
5. Canada Labour Code, Canada Occupational Safety and Health Regulations, SOR/86-304, as amended, Part XI – Confined Spaces.
6. Technical Standards and Safety Act, 2000 (TSSA).
7. National Fire Protection Association (NFPA).

7.8 Design for Disabled

Design grounds to make them accessible and usable by disabled persons, unless otherwise required in the Project Brief. Conform to CAN/CSA-B651-04, Accessible Design for the Built Environment and for CSC projects, the Correctional Service Canada policy on accessibility.

7.9 Drawings

Drawings shall be produced in accordance with Section 1.

7.10 Specifications

Specifications in accordance with Section 4.

Comply with Section 4.22 for lump sum contracts and Section 4.23 for unit price contracts.

7.11 As-Built and Record Information

As-built information is received from the Contractor. It contains drawings, specifications, shop drawings, submittals, samples, etc. It is noted as such by the Contractor.

Record drawings and specifications are updated originals prepared by the Consultants based on the information supplied by the Contractor in the as-built.

7.12 Bid Documents Format

As per Section 1.

7.13 Work Measurement for Unit Price Contracts

Measure and record quantities of labour and materials involved, if work is based on unit prices, for verfication of monthly progress claims and the Final Certificate of Measurement.

When a Contemplated Change Notice is to be issued based on Unit Prices, keep accurate account of the work. Record dimensions and quantities.

Record number of workers on site and hours worked daily.

SECTION 8 STRUCTURAL DESIGN GENERAL REQUIREMENTS

8.1 General

All design criteria shall be in accordance with the current edition of reference codes and standards.

For material properties (both physical and chemical), methods of fabrication, tests, etc. reference should be made to the latest editions of CSA the Canadian Standards Association Standards and CGSB the Canadian General Standards Board Specifications, give the standard number and date of the issue, etc.

8.2 Regulations

Design shall comply with applicable Federal, Provincial and Municipal regulations and codes. In case of conflict, the most stringent requirements apply.

8.3 Design

The Consultant shall discuss design loads with Public Works and Government Services Canada Structural Engineers before formulating his proposals.

The Consultant shall submit structural system proposals for consideration and review by Public Works and Government Services Canada. These proposals shall contain the following information:

- General description of the building.
- Design loads.
- Comparative cost analysis of several alternative structural systems, comprising superstructure and foundations.
- Recommended structural systems, compatible with the other systems proposed, i.e., architectural, mechanical, electrical, etc.

Prior to commencement of working drawings, the Consultant shall submit for consideration by Departmental Representative the following data:

- Design and location of expansion joints with temperature ranges, etc. as assumed.
- Design criteria for basement and retaining wall.
- Methods of shoring for excavations.
- Provisions for interfacing for phased construction projects.
- Other relevant information as necessary.

Public Works and Government Services Structural Engineers may require the submission of detailed analysis and design of any structural components, with sufficient time allowed for their review and approval before their inclusion on the drawings.

The Consultant shall submit at the completion of the design, a legible set of neatly bound notes with contents indexed. These notes shall provide the detailed analysis and design of all the significant aspects of the structure including the following.

- Design criteria and assumptions.
- Design live loads and dead loads throughout the structure, in adequate detail to permit the check of individual areas.
- Column, elevator core and footing design gravity loads throughout the building, including separation of dead loads, live loads and reduced live loads.
- Footing loads.
- Lateral forces and lateral forces analysis.

- Torsion analysis.
- Aspects of the design, other than those listed above, which Government Services or the Consultant would place in any especially important category.

8.4 Soils Investigation

A preliminary soils report will be prepared for PWGSC and copies will be made available as soon as they are ready. PWGSC will require the structural consultant to establish what additional soil testing information is required immediately after approval of the concept design. The consultant shall arrange for final soils investigator acceptable to the Department. The cost will be borne by the Department.

The soil consultant's recommendations, discussions, considerations, requirements and conclusions shall be submitted separately from soil data.

Drawings and diagrams forming part of soil data shall not exceed 216 mm x 279 mm in size or multiples thereof.

8.5 Live Loads

Floor areas to be used for General Office purposes, whether open-landscaped or divided by moveable partitions, shall be designed for a uniformly distributed live load of 3 kPa plus a uniformly distributed 1 kPa moveable partition allowance.

In the design of any floor slab, beams or girders, the 3 kPa uniformly distributed live load shall not be modified by reduction factors based on tributary area.

In the calculation of live loads on columns, no reduction factor for tributary area shall be applied to the uniformly distributed live load, for the top two office floors of multi-storey buildings.

Basement, main floor, corridors, assembly areas and fire refuge areas shall be designed for a uniformly distributed live load of 5 kPa.

Normal file registry areas shall be designed for a uniformly distributed live load of 5 kPa.

Mechanical equipment rooms and storage areas shall be designed for a minimum of 7.5 kPa.

For roof snow loading, Wind Exposure Factor shall be taken as 1.0.

8.6 Structural Drawings

Drawings shall be fully dimensioned. Weighted lines shall be employed and sections shall be cross-referenced, using the “PWGSC CADD Standards”.

The following drawings shall be provided:

- Foundation plan.
- Floor and Roof Framing Plans.
- Column schedules containing the following information:
  - Datums as noted on structural plans.
  - Column loads at footings (dead and live).
  - Column sizes.
  - Vertical reinforcement, ties, dowels, etc.
  - Baseplate and anchor bolt details.

    - Size and footings.
- Live loads, partition, ceiling, floor finish and mechanical equipment allowances.
- Type of waterproofing and details to show effectiveness of same.
- General notes, including:
    - Design Codes used.
    - Lateral forces.
    - Allowable bearing pressures.

8.6 Testing and Inspection

A resident Departmental Representative may be appointed and paid by PWGSC to ensure that the structure is built in accordance with Plans and Specifications and to maintain records of the blow counts for each pile (if applicable).

A testing company will be engaged and paid for by PWGSC for testing concrete, soils compaction, pile load tests (if applicable) and structural steel work (e.g. bolting, welding, etc.)

The structural consultant will be expected to make periodic visits to the site, as later agreed with the Departmental Representative.

8.7 As-Built and Record Information

As-built information is received from the Contractor. It contains drawings, specifications, shop drawings, submittals, samples, etc. It is noted as such by the Contractor.

Record drawings and specifications are updated originals prepared by the Consultants based on the information supplied by the Contractor in the as-built.

SECTION 9 MECHANICAL DESIGN

9.1 General

Read and understand the applicable General Conditions listed in Section 4.

This section stipulates the standards for design of building HVAC, fire protection, and plumbing systems.

Provide systems to meet the design requirement with least annual owning and operating cost.

Mechanical systems shall be compatible and co-ordinated with the architectural, structural, electrical and other project systems.

Systems and equipment shall be fail-safe consistent with required reliability of service.

Provide heating, ventilation and air conditioning systems that:

- Have the flexibility and capacity required to meet the requirements of intended use of space after the premises have been occupied.
- Have individual temperature controls and start/stop schedules for each room and each zone which have unique load variations and occupied hours.
- Have the capability of introduction of 100% outside air to permit flushing out the building, dilution of contaminants, and use of "free cooling" for energy conservation.

Provide plumbing systems in compliance with the National Plumbing Code and Ontario Plumbing Code.

Provide fire protection systems to meet the requirements of the Fire Commissioner of Canada Standards, the National Fire Code and Canada Labour Code.

9.2 Project Specifics

Refer to the Project Brief.

The Consultant shall review the operational requirements and applicable code requirements.

The Consultant shall develop alternative schemes with sufficient documentation to support the recommended systems and equipment for providing mechanical services to meet the requirements.

For office renovation projects, the Consultant shall review existing mechanical installation and documentation. Assess, evaluate, and make recommendations, for the upgrade of existing mechanical systems to accommodate new office layout.

9.3 System Applications

In accordance with project requirements, justify system selection and its design on the basis of performance, service and maintenance, and the total owning and operating cost.

Systems shall be capable of automatically maintaining space comfort conditions for all building load variations during the heating and cooling seasons.

Use outdoor air as free cooling source whenever economically feasible.

Avoid recirculation of exhaust air with outside air by properly locating intakes and outlets.

Use heat recovery systems for all air exhausted when such measures prove to be economical, as determined by life cycle costing.

9.4 Building Loads and Energy Estimates

Building load calculations and energy estimates shall be carried out using a computerized load and energy simulation program. This shall be a commercially available program and approved for use by PWGSC. Refer to Required Services (RS) sections for additional requirements.

The energy analysis program shall simulate all energy consumed in the building on a hourly basis for a full year.

The building energy analysis with input and output summaries shall be submitted with the concept design submission; revise and resubmitted with the design development submission and each of the 30%, 66%, and 99% construction document submissions. The updating shall reflect all the latest architectural and engineering changes to the project.

9.5 Energy Consumption Budget

Energy consumption budgets shall be established for all building projects.

Investigate and present for review a minimum of three viable and different concept options for each project. The options shall be evaluated based on building life cycle costs which will include initial capital cost plus annual energy operation and maintenance costs.

The analyses shall be based on annual energy consumptions and take into account climatic data, building architecture, clients' operational requirements and system and equipment data. Total energy consumed in the building shall be expressed in kWh per m^2.

Design HVAC systems to exceed Model National Energy Code of Canada for Building 1997.

9.6 Codes and Standards

The most stringent requirements of the following codes and standards shall apply:

National Building Code of Canada.
National Fire Code of Canada.
Canada Labour Code Part II (Occupational Safety and Health).
Fire Commissioner of Canada Standards.
Federal Boiler Emission Regulations.
Federal Environment Code of Practices.
Canadian Standards Association Specifications, Standards and Guidelines.
ASHRAE Standards, Guidelines and Handbooks.
Provincial Codes and Utility Authority Codes.

9.7 Fire Protection Requirements

In addition to the National Building Code, Ontario Building Code, National Fire Code and NFPA Standards, fire protection is subject to the requirements of Fire Commissioner of Canada Standards issued by HRDC - Labour Program/Fire Protection for general storage, fire extinguishers and sprinkler systems.

Comply with the requirements of the Fire Commissioner of Canada. Fire protection systems are to be subject to the final inspection and test of the Fire Commissioner of Canada.

9.8 Plumbing Requirements

Provide complete plumbing systems including sanitary and storm drainage, domestic hot and cold water piping, and plumbing fixtures.

Drinking fountains shall be bi-level and shall provide drinking water at less than 13°C and shall be located no more than 30 m from any workstation on each and every floor.

Provide adequate supply of domestic hot water at constant temperature of 38°C to lavatories, showers and sinks.

Plumbing systems shall conform to the requirements of the National Plumbing Code 2005 and Ontario Plumbing Code 1997.

9.9 Heating, Ventilation, and Air Conditioning (HVAC) Requirements

Outside Design Criteria: Take outside design conditions from National Building Code and base on January 1% outdoor Winter design and July 2.5% outdoor Summer design temperatures.

9.10 Space Comfort Standards

General:

- The following comfort standards apply to air conditioning in general office type occupancy where sedentary adult activity may be expected. Requirements for other types of occupancy or for environments related to standards other than for human comfort to be as per latest published data in ASHRAE handbooks.
- Outdoor air ventilation rates shall be based on the latest edition of ASHRAE Standard 62.1-2004 "Ventilation for Acceptable Indoor Air Quality" unless special requirements or regulations dictate otherwise.
- Unless noted otherwise, conform to or exceed CSA Z204-94(R1999), "Guideline for Managing Indoor Air Quality in Office Buildings".

Temperatures:

- During occupied periods, and in the occupied zone, a minimum temperature of 21°C when heating, and a maximum of 24°C when cooling shall be maintained. The rate of change of dry bulb temperature is not to exceed 2°C per hour within the specified limited. The vertical temperature difference measured from 100 mm and 1700 mm above finished floor shall not exceed 3°C.
- The occupied zone is defined as the space volume between the floor and 1800 mm from the floor and more than 600 mm from walls or perimeter heating/cooling equipment.
- The average conductive heat loss at winter design temperature combining both glass and wall heat losses from zone exterior surfaces should not exceed 25 watts/m^2.
- Provide wall fin radiation heaters below all exterior windows in the building.

- Floor surface temperature: between 18°C and 29°C.

Relative Humidity:

- Maintain relative humidity between 30% (winter design) and 60% (summer design) at any point in an occupied zone.
- Rate of change or relative humidity at any point in the occupied zone is not to exceed 20% RH per hour within the above specified limits.

Filtration:

- All supply air (i.e. recirculated air plus outside air) shall pass through filters having ASHRAE minimum efficiency of MERV II or better.

Ventilation:

- Ventilation is defined as the supply of clean, odour and contaminant free air to a space in sufficient quantities to dilute and remove space generated air contaminants and odours and to maintain the occupant oxygen requirements.
- Generally, outside air is considered to be contaminant free air suitable for ventilation purposes. Outside air intakes shall not be located in the vicinity of loading dock or any high pollutant area. Exhaust air outlets shall be properly located to prevent entrainment in outside air intakes.
- Except for outdoor make-up air to replace exhaust air, ventilation requirements are related to people. A ventilation rate of 10.0 L/s of outside air per person is adequate for occupant comfort, provided sufficient total air is circulated in the space to dilute contaminants. The ventilation rate calculated on a per occupant basis is not to be less than 1.0 L/s/m² of gross zone floor area.
- Measurement of CO_2 concentration: Provide CO_2 sensor in the space or in the return air stream for monitoring CO_2 concentration. CO_2 sensor shall not be used by the air flow controls to reduce the outside air flow rate to below the minimum requirement of 10 L/s per person.

Air Circulation:

- Total primary air supply for general occupancy areas to be designed at not less than 4 L/s/m² of floor area or 6 air changes per hour.
- Total primary air supply to high occupant density areas, i.e. conference rooms, board rooms, high density workstation areas (high density occupancy is defined as a workstation with its foot print being less than 10m²), etc. to be designed at not less than 7.7 L/s/m² of floor area or 10 air changes per hour.
- Maintain air motion at velocities between 0.05 m/s and 0.15 m/s during Winter heating operation, and between 0.05 m/s and 0.23 m/s during Summer cooling operation in an occupied zone unless noted otherwise.

Acoustic Duct Liner:

- The air side of duct liner shall be coated with acrylic coating treated with anti-microbial agent to resist microbial growth.

As a minimum, office areas with regular density occupancy (the net occupiable space of each workstation is greater than 10 m²) shall have HVAC zoning as follows for individual zone temperature controls:

- Each private office.
- Maximum of 50 m² perimeter area with the same load profile along the same exposure. Perimeter area is defined as an area within 5 m of the outside wall.
- Maximum of 100 m² interior area with the same load profile.

Mechanical exhaust systems shall be provided to meet the following minimum requirements:

- Washroom or Janitor Closet: 10 L/s per m² of floor area; at least 25 L/s per sanitary fixture.
- Shower Room: 10 L/s per m² of floor area; at least 20 L/s per shower head.

- Enclosed Parking Garage: 7.5 L/s per m^2.
- Conform to current Canada Labour Code Part II.
- Make-up air for the above exhaust systems may be obtained from the adjacent corridors and offices.
- Provide dedicated exhaust systems for photocopier areas to maintain VOCs concentration not to exceed 3mg/ m^3 , and exhaust directly to the outdoors.
- Provide a separate exhaust facility with individual speed control and ON/OFF switch for the lunch room.
- Maintain negative air pressures within the garage area in relation to surrounding building areas.

Mechanical system noise shall conform to the following Noise Criteria (NC) levels:

Conference, meeting rooms	25-35 NC
Teleconference rooms	25 NC max.
Private offices	25-35 NC
General open area offices	30-40 NC
Public area, corridors	40-45 NC

- Noises shall be free from annoying, recognizable characteristics such as rumble, hiss, tones, and variability of noise patterns.

9.11 Lan Room A/C

Provide continuous air conditioning to maintain temperature in LAN rooms and telecommunication rooms not to exceed 24°C at all times (24 hours/7 days per week).

9.12 TAB

Testing, adjusting and balancing of air distribution and hydronic systems performed by the Contractor shall be verified. The Consultant shall verify the results of not less than 20% of all reported measurements.

9.13 Building Automatic Control System Requirements

The networked Building Automation Systems (BAS) including the building Energy Monitoring and Control System (EMCS) shall be designed by a qualified control systems specialist recognized in this field.

As a minimum the drawings and specifications for the controlled systems shall include:

- An English language narrative sequence of operation.
- Mechanical control schematics.
- EMCS network architecture.
- DDC Input/Output Point Schedules in PWGSC format.

At the preliminary design briefing the Consultant shall obtain a copy of the current PWGSC Automatic Control System Master Specification Sections. The Consultant shall review and edit the PWGSC Automatic Control System Master Specifications.

9.14 Commissioning

PWGSC Commissioning Manager (or its representative) will overview all commissioning activities, review and approve all commissioning documents, overview Functional Performance Testing and O&M Training,

and review the accuracy of all reported results. Commissioning shall be done to the approval of the PWGSC Commissioning Manager.

Unless noted otherwise, the Design Consultant shall have an overall responsibility for preparation of design intent and design criteria documents, preparation of Commissioning Specifications, preparation of commissioning plan, system startup verification form, functional performance test forms, review of shop drawings, inspection of construction, verification of commissioning testing including installation testing, equipment starting and testing, system starting and testing, review TAB reports, review and approval of "As built" drawings and O&M Manuals, preparation of Systems Operating Manual, Maintenance Manual, and preparation of Commissioning Report.

Refer to Required Services (RS 7) for the additional commissioning responsibilities and key commissioning activities of the Design Consultant.

9.15 Drawing Requirements

Refer to PWGSC CADD Standards.

Numbering, size, symbols, title blocks, etc.:

- Number sheets consecutively, commencing with the Plot or Site Dwg. as M-1. Show the mechanical subject in the appropriate title block space, e.g. "Plumbing and Drainage", "Heating", "Air Conditioning and Ventilation", "Sprinkler System", "Details", etc.
- Do not combine Plumbing and Heating on one drawing unless the size and simplicity of the project make this feasible.
- Mechanical drawings shall be the same size as the Architectural Final Working Drawings for the project. Generally, the required size of pre-printed sheets for Working Drawings will be determined by the Departmental Representative.
- Room and area reference on mechanical drawings must in all cases show the room designation as used on "Room Finish Schedule".
- Consolidate notes on the right-hand side of the sheet.

Scale and room identification:

- Scale: All drawings must be legible and must include sufficient information to permit accurate bidding and installation.
  - When the scale of plans is 1:50 all branches of the mechanical work (plumbing, air-conditioning, heating, etc.) may be shown on one plan, provided that these systems are not too complex.
  - When the scale of plans is 1:100 a separate set of floor plans shall be made for each branch of the mechanical work, except that heating and air conditioning may be shown on one set of plans.
  - A scale of plans smaller than 1:100 shall not be used.
  - All boiler rooms, machine rooms, equipment rooms, etc. and all congested areas shall be fully detailed on the plans, and sections with all equipment that might be involved in interferences shown, and drawn to a scale not smaller than 1:50.
- Identical floors: Where floors are identical architecturally, typical floor plans may be used for mechanical work only where the complete floor is identical and riser diagrams clearly show all changes involved. Typical plans are not allowed, i.e. no "similar wings", "right-or-left-handed".
- Room numbers: Show all room numbers on mechanical drawings to facilitate co-ordination and cross-reference with those shown on architectural and electrical drawings.

Drawing Requirements:

- Each set of drawings, namely, plumbing, heating, air conditioning, etc. must give scales, floor elevations and compass points, column grids, column numbers and titles. The elevation of the lowest floor shall be shown. Drawings shall show elevation of all main pipes and ducts.
- Piping riser diagrams and system flow diagrams shall be provided for all multi-storey buildings and shall include all piping sizes not clearly indicated on floor plans and details. Single line piping diagrams shall be provided to indicate connections to all system components, together with pipe size schedules where various sizes of units employ the same diagram. Flow diagrams shall show all equipment in true sequence showing pipings, valves, control valves, strainers, pressure gauges, thermostats, etc. Identify equipment on these diagrams using nomenclature corresponding to that used in the appropriate equipment schedules.
- When using three or more similar pieces of equipment, all pertinent information as to size, capacity, etc. shall be shown in a schedule.
- Cross sections of mechanical rooms shall relate to the operator's view in mechanical room. Clearly diagram each system to show intent of system and method of operation and control.

Piping and Ducting Location:

- The piping and ducting shall be shown, as nearly as possible, in the location where it is to be actually installed. Conceal all piping, ducting and other services in ceilings, chases, shafts, furred out spaces or partitions, except in basement or storage areas not occupied by personnel.
- Piping of any description shall not be located in any space used as switchboard (switch-gear) or transformer room or electrical closet.
- As far as possible, no piping or ductwork shall be run above switchboards, motor control centres or surface mounted panelboards located in mechanical equipment rooms. Where piping for any service must run above such equipment, a drip pan shall be specified.
- Water and waste pipes shall not be located in exterior walls where there is danger and freezing.
- Pipes, ducts or other utilities shall not be embedded in the fireproofing of any column or other structural member or between the fireproofing and the structural member protected.

Pipe Sleeves: The structural or the architectural drawings must show the pipe sleeves for all pipes passing through footings of exterior walls below grade. The elevations of sleeves must be given.

Waterproofed Floors:

- Where floors are waterproofed, all pits, cleanout manholes, trenches, etc. shall be kept to a minimum, i.e. thicken slab to contain waste pipes under basement or in the case of large drains, consider waterproofed trenches.
- Drainage piping required in slabs subjected to hydrostatic pressure shall be co-ordinated with the structural design.

Checking of Drawings:

- Drawings must be checked for completeness, clarity, interferences with structural features and with electrical equipment, and agreement with the architectural drawings.
- A large part of the checking, particularly the interferences between the mechanical and electrical systems and the structural features, can be made during the preparation of the drawings.

"As Built" Drawings and Specifications: Specify that each mechanical subcontractor shall record, on one set of white prints all changes, alterations, as well as any additions as covered by authorized "Change Orders" at the same time approval is received from the prime Consultant. This shall include rerouted lines, located ducts, valves and equipment.

9.16 Specification Requirements

The Consultant shall prepare specifications in accordance with Section 4.

At the 33% submission of working documents, provide outline specifications for all systems and principle system components and equipment. Provide the outline specifications with manufacturers literature about principal equipment and system components proposed for use in this project.

The specifications with table of contents shall consist of typed and edited PWGSC Ontario Region amended NMS and in house specification sections.

9.17 Design Submission Requirements

Design Concept Submission:

- Submit design intent and design criteria document. Provide the following information for each room in the building:
  - User's function and requirements.
  - Estimated maximum occupancy.
  - Indoor summer design conditions.
  - Indoor winter design conditions.
  - Outdoor air supply ventilation rate per person.

Provide a description of proposed mechanical options. Provide the following information for each proposed option:

- An economic and technical explanation of the reason for the proposed mechanical systems.
- A copy of building energy analysis with input and output summaries.

Design Development Submission:

- Produce the preliminary designs based on the approved concept.
- Provide system flow diagrams and EMCS network architecture. Describe the mechanical systems, the components of each system, the operation of each system, and the updated energy analysis summaries.

Submissions of Construction Documents:

- The 33% submission shall include floor plans showing routing of major HVAC, plumbing and fire protection systems, piping riser diagrams and system flow diagrams, EMCS network architecture, outline mechanical specifications, and the updated energy analysis summaries.
- The 66% submission shall include updated 33% submission plus mechanical room layout drawings, mechanical control schematics, DDC Input/Output Point Schedules, equipment schedules, and mechanical specification sections, and the updated energy analysis summaries.
- The 99% submission shall include: Plans and Specifications detailing the requirements for the construction. Updated design intent and design criteria document. Updated energy analysis summaries.

Refer to Required Services (RS) for additional requirements.

9.18 As-Built and Record Information

As-built information is received from the Contractor. It contains drawings, specifications, shop drawings, submittals, samples, etc. It is noted as such by the Contractor.

Record drawings and specifications are updated originals prepared by the Consultants based on the information supplied by the Contractor in the as-built.

SECTION 10A ELECTRICAL WORK PROCEDURES

10.1 Site Characteristics

Visit the site and evaluate its characteristics.

10.2 Meetings and Schedule

Attend all meetings throughout the entire Work project development period.

Assist in establishing work schedules for electrical work compatible with other disciplines.

10.3 Concept Submission

Submit information necessary to allow evaluation of the basic design concept with the Concept Submission.

Submit drawings illustrating the final concept including:

- Distribution diagram showing single line diagrams to distribution centres.
- Floor plans complete with locations of major electrical equipment and distribution centres.
- Lighting layouts.
- Power outlets.
- Ceiling distribution systems for lighting, power and telecommunications.
- Elevator control room plan and preliminary details.
- List of standard PWGSC details to be utilized.
- Telephone rooms, conduits and telecommunication cable systems requirements and layout.

Provide draft specification sections. Request PWGSC Ontario Region amended NMS and in house master specification sections suitable for the project for guidance.

Provide the initial cost estimate of electrical work for the Project Cost Plan in accordance with Sections 11 and 12.

10.4 Design Synopsis

Provide a design synopsis with the final concept design, describing the electrical work in sufficient detail for assessment and approval by the Departmental Representative.

10.5 Working Documents

Upon approval of the final design concept start the working documents; drawing sizes, lettering, electrical symbols, etc. to match the architectural.

10.6 Design Submission

Provide drawings showing advanced development of the following:

- Single line diagram of the power circuits with their metering and protection, including:
  - Complete rating of equipment.
  - Ratios and connections of CT's and PT's.
  - Description of relays when used.
  - Maximum short circuit levels on which design is based.

    - Identification and size of services.
    - Connected load and estimated maximum demand on each load centre.
- Electrical plans with:
    - Floor elevations and room identification.
    - Legend of all symbols used.
    - Circuit numbers at outlets and control switching identified.
    - All conduit and wire sizes except for minimum sizes which should be given in the specification.
    - A panel schedule with loadings for each panel.
    - Telephone conduits system layout for ceiling/floor distribution.
    - Intercom system empty conduit layout.
- Riser diagrams for lighting, power, telephone and telecommunication cable systems, fire alarm and other systems.
- Elementary control diagrams for each system.
- Schedule for motor and controls.
- Complete lighting layout and fixture schedule clearly indicating methods of circuiting, switching and fixture mounting.
- Electric heating layout and schedule.

Provide the following data:

- Total connected load.
- Maximum demand and diversity factors.
- Sizing of standby load.
- Short-circuit requirements and calculations showing the ratings of equipment used.

Provide draft specifications.

Provide an intermediate cost estimate in accordance with Sections 11 and 12.

10.7 100% Submission

This should be complete working documents subject to final review by the Departmental Representative. Provide the following:

- Complete working drawings and specification for bidding purposes.
- Final cost estimate in accordance with Sections 11 and 12.

10.8 Final Submission

After review of the 100% documents by the Department, make all required revisions and provide the following:

- Bid documents in accordancw with Section 1.
- Confirmation of final cost estimate in accordance with Sections 11 and 12.

10.9 Inspection Authority Submission

Submit and obtain approval on plans and specifications required by the Inspection Authority before bid call.

10.10 Bid Call Period

Provide necessary advice to the Departmental Representative during bid calls, including amendments, bid evaluation, etc.

10.11 Construction, Instruction and Supervision

Attend the Construction Briefing Meeting and subsequent project meetings as necessary. Inspect electrical work and materials and provide constant supervision of construction to ensure compliance with the contract documents.

Participate in the interim and final inspection process.

Assist in the electrical portion of the project schedule.

10.12 Progress Reports and Payment Claims

Report weekly to the Prime Consultant on the progress of electrical work.

Examine Contractor's claims for electrical work and advise the Prime Consultant.

10.13 Inspection Certificates

Prior to take-over, obtain from the Contractor all inspection certificates confirming that installed electrical work conforms with specifications and regulations.

10.14 Operation and Maintenance Manuals

Review Operation and Maintenance Data Manuals submitted by the Contractor.

Prepare and submit to the Departmental Representative, Preventive Maintenance Manuals and Operation Instructions Manuals, in accordance with RFP.

10.15 As-Built and Record Information

As-built information is received from the Contractor. It contains drawings, specifications, shop drawings, submittals, samples, etc. It is noted as such by the Contractor.

Record drawings and specifications are updated originals prepared by the Consultants based on the information supplied by the Contractor in the as-built.

SECTION 10B ELECTRICAL DESIGN GENERAL ELECTRICAL DESIGN

10.1 Design Basis

Base the electrical design on providing the following features at the most economical cost, considering both investment and operating expenditures:

- Safety to personnel during operation and maintenance.
- Ease of maintenance for equipment maintained by non-specialized personnel.
- Flexibility and reliability of electrical services.
- Proper co-ordination of all elements of the system as to:
- Insulation levels .
- Interrupting capacities.
- Protective relaying.
- Mechanical strength.
- Energy conservation with respect to system and equipment and their operation.

10.2 Codes and Standards

Electrical work to conform with the Canadian Electrical Code CSA C22.1-09, Part 1, Ontario Electrical Safety Code 2009 and all bulletins, Canada Labour Code Parts IV and VI and applicable local codes and regulations.

Require CSA certification on equipment.

Specify applicable standards for equipment, i.e., EEMAC, CSA, ULC, ASTM, NFPA, ANSI, etc.

10.3 Materials and Equipment

Require Canadian products where economically feasible. Avoid specifying trade names.

Specify that within 30 days after contract award the Contractor submits for approval of the Departmental Representative 5 complete lists of all materials and equipment that he intends to use in the Contract.

10.4 Fees and Permits

Specify that the Contractor pay fees and obtain permits as required by authorities having jurisdiction.

10.5 Nameplates

For major equipment specify plastic white on black sandwich type nameplates be attached with metal screws; letters to be minimum 10 mm high.

Use plastic nameplates (adhesive-applied) for receptacle and switch cover plates in laboratories and other work areas.

Provide the Contractor with co-ordinated nameplate titles.

10.6 Poke Through Wiring

Electrical power to any floor area is to be supplied from electrical panels on that floor to avoid the use of "poke through" wiring.

10.7 Incoming Electrical Services

Underground: generally, underground service is preferred and use where required to conform to local practice. Cable and installation should be to the approval of the local Power Supply and Inspection Authorities. Provide spare ducts for future additions or maintenance.

Overhead: overhead service may be economically acceptable for small buildings.

Carry out economic analysis and submit:

- An analysis of the capital investment on equipment and long-term electrical energy cost for purchasing energy at utility voltage level against purchasing energy at higher voltage levels, taking into account energy losses in equipment such as service transformers.
- An estimate of the equipment and installation cost for the proposed electrical system.
- A calculation for the interest, at the current interest rate as furnished by Bank of Canada, on the difference in investment on alternative concepts of the electrical system.

Primary service equipment: Include protective devices, instrument transformers, metering equipment and other requirements of the local Supply Authority.

Well in advance discuss with the local PUC the size and type of service required. Obtain from the PUC the three phase symmetrical short circuit fault level at the incoming end of their service to determine the interrupting capacity of their service equipment.

Obtain from the local PUC data regarding point of connection, service characteristics and requirements, extent and cost of work provided by the Authority, type of service required (overhead or underground), whether a transformer vault is required and reasons therefore, and the best method of metering (primary or secondary, etc.).

Obtain approval from the local Supply Authority and Inspection Authority having jurisdiction for the proposed service entrance equipment, switchgear, duct-manhole systems, transformers, overhead systems and associated equipment.

Existing services: obtain locations of all buried service such as electrical, telephone lines, water and sewer lines, gas mains, etc. Specify that the Contractor take adequate protective measures before any digging operations commence.

Duct systems: determine the size and location of incoming ducts for electricity, telephones, fire alarms, etc., and indicate them in the working documents.

10.8 Transformer

Dry type transformers are preferred for primary voltages of 5 kV or lower where insulation, co-ordination and protection satisfactory to the Power Supply Authority can be obtained. Provide lightning arrestors.

Liquid cooled transformers are preferable above 5 kV although dry type may be used if approved by the Power Authority. Check BIL requirements.

Establish transformer noise levels which will not cause interference in working areas.

Specify standards to establish quality, tests and performance.

10.9 Capacity of Electrical Service

Allow for 100% lighting load plus an appropriate demand factor on the remaining load based on operating characteristics.

The main service should provide for minimum 50% expansion.

10.10 Transformer Vaults

Allow for future expansion.

Provide an independent ventilation system (gravity where possible) with intake and exhaust direct to the outside.

10.11 Switchgear Assemblies

Use metal-enclosed assemblies with drawout circuit breakers where current, voltage and short circuit characteristics are within their limits.

Incorporate H.R.C. current limiting fuses into circuit breakers on circuits requiring high short circuit protection.

Provide a co-ordination study to justify selection of fuses and breakers.

Specify standards to establish quality, tests and performance.

10.12 Distribution Levels

Submit for Departmental approval a study of load requirements taking into account the overall plan.

120/240 volt power may be required to serve specific items of equipment.

A 208Y/120 volt, three-phase, four-wire system for lighting, receptacles and power is usually satisfactory for smaller buildings.

From the load and type of building make an economic study to determine if the use of a 600/347 volt system is warranted.

10.13 Panelboards

Use circuit breaker type panelboards for motors, power equipment and lighting.

Circuit breakers to be of the bolt-on type. Multipole breakers to have single handle. Tie-bars not allowed.

Switch and fuse units may be used for high short circuit protection.

Specify standards to establish quality, tests and performance.

Mains or bussing to be made of copper.

Specify that each circuit shall be clearly labelled in a typewritten directory with a clear plastic cover.

Branch circuit panelboards to be fitted with lock type doors.

Specify minimum interrupting capacity rating.

Include a minimum of 20% spare breakers, and in laboratory and workshop areas provide space for 30% more.

Recessed panelboards should have additional spare, empty conduits extending to ceiling spaces.

10.14 Wiring Methods

Specify that either rigid steel or aluminum conduit be used for panel feeders, for 600 volt equipment, and in other locations required by the Canadian Electrical Code and local regulations.

PVC or FRE conduit may be used for underground work. Conduit embedded in concrete must not be aluminum.

Electrical metallic tubing, EMT, may be used in locations approved by the Canadian Electrical Code and local regulations. Provide insulated green ground conductor in EMT conduits.

For motors and equipment subject to vibrations or movement provide flexible connections of liquid-tight flexible metal conduit.

Specify conduits to be installed neatly with adequate bracing and clearances from adjacent equipment, and maintaining watertight penetration of walls and floors.

Wire size to be No. 12 AWG minimum for power or lighting circuits. Minimum conduit size for power and lighting circuits shall be 20 mm dia.

Conductors to be copper.

Conceal conduit and wiring in finished areas.

Permanent tags should be provided to feeders at pull and junction boxes.

10.15 Ceiling Distribution System

Power System:

- Provide an electrical distribution system above the suspended T-bar ceiling with duplex receptacles to accommodate downfeed service poles. A minimum of (4) four duplex receptacles shall be spaced at 3.5 m (maximum) center to center, both ways. Connect no more than six (6) receptacles to a 15A circuit.
- Identify each receptacle with the panel and circuit number on red dymo tape.
- Receptacle boxes shall be securely fastened to the slab above and must not be installed more than 600 mm above T-bar ceiling.
- An insulated ground wire shall be installed in each conduit and grounded to the common panel ground.
- Where electrified screens are installed, provide a power distribution system in the ceiling space complete with junction boxes to Code requirement, one for each 40 square meter area with 208/120V, 3 Ph, 8 wire 4 circuit system in each box.

10.16 Equipment Connections

Indicate on the working drawings wiring for motors, control equipment and other electrical equipment installed under other Divisions. Do not include low voltage (below 50 volts) wiring.

Extend wiring to equipment furnished by the Department.

10.17 Switches and Receptacles

Switches for lighting to be specification grade AC rated 15/20 ampere, 120/347 volts, ganged where possible and mounted at maximum 1200 mm centre from finished floor.

Receptacles to be specification grade U-ground type, triple wiping contacts, rated 15 A, 125 volt, mounted minimum 400 mm centre above finished floor.

In lunch room provide above the counter two 15 A, 125 V duplex receptacles; each to be split wired and with a pilot light and switch.

In laboratory and shop areas:

- In areas where benches or counter tops may be located receptacles not part of the furniture should be mounted 1.0 m above the floor and spaced 1.5 m apart.
- Use a minimum of one 30 A, 240 volt receptacle per laboratory.
- Connect not more than 2 duplex receptacles to a circuit for bench receptacles.

Ratings of other receptacles as indicated or required.

10.18 Corrosion Resistant Finishes

Cover plates, surface-mounted outlet boxes, etc., located in areas where corrosive materials may be used must have suitable corrosion resistance. In laboratories, ensure that finishes on electrical equipment cover plates and surface mounted outlet boxes match the finishes on mechanical fittings.

10.19 Motor

Co-ordinate control sequences to provide starters and other auxiliary control equipment with the proper characteristics and features to obtain the performance intended.

Provide disconnect switches, starters and auxiliary control equipment which are not an integral part of packaged units described in equipment specifications but which are required for performance and sequence of operation of equipment specified under other Divisions.

Motors 400 W and over are to be three-phase.

Check that the voltage drop due to motor starting is within limits acceptable to the local utility. If required, use a reduced- voltage starter.

Provide motors with thermal-overload protection of the manual reset type. Built-in overloads in the motor are not acceptable. Specify that protection be co-ordinated with motor characteristics.

Single phase motors to be controlled by manual starters and not by tumbler switches.
Motor starters are not to be supplied from lighting panelboards if at all possible.

Automatic-control devices such as thermostats, floats or pressure switches may control the starting and stopping of motors directly, if designed and rated for that purpose, otherwise use a magnetic starter.

When a manual-automatic operation is required, use a "Manual-off-Automatic" selector switch. Connect the selector switch so that only the normal automatic regulating control devices will be bypassed when the switch is in manual position. Connect safety control devices, such as low or high pressure cutouts, high temperature cutouts, motor overload, etc., in the control circuit in both the Manual and Automatic positions of the selector switch.

For three-phase motor starters provide:

- Magnetically operated motor starter.
- Fused control transformer for all 110 volt control.
- Manual-off-Automatic selector switch where remote control is used.
- Preferred: combination starters. Acceptable: starters with separate disconnect devices.
- Motor starter disconnecting devices to be manually operated and to be load-break fused switches or air circuit breakers.

Control devices in individual special purpose enclosures should be mounted in groups.

Co-ordinate all motor controls with the Mechanical Consultant.

10.20 Motor Control Centres

Use motor control centers where they provide an economical and practical grouping of controls. Centres should be free-standing structures. Use combination starters. Mount centres on continuous mounting channels on raised concrete pads. Wall mount type may be used for groups of up to four starters. Identify each circuit by a black laminated plastic nameplate with white letters. Specify control centres as per EEMAC Standard for class and type.

10.21 Motor Equipment Feeders

In open equipment areas consider the advantages of running motor equipment feeders from overhead rather than up through floor slabs.

10.22 Underfloor Ducts or Raised Floors

Underfloor duct or raised floor systems for power, telephones and intercom may be used in office areas, but not in laboratory areas. Submit a cost estimate and preliminary layout at Concept Stage Submission, if considered feasible.

10.23 Telecommunication Systems

Provide an empty conduit system for voice and data communication systems directly from the main building communications room or the building communications riser room on the same floor to the communications room in the tenant space to suit.

Where plenum cable system is provided for voice and data communication systems in the ceiling space, ensure that these cables are properly supported from the structural ceiling slab and not laid on top of ceiling tiles.

Where required for security and/or physical protection purposes, provide an empty zone conduit system for telephone and data communication systems with each zone conduit serving a bay area of maximum

50 m². Provide 50 mm EMT conduits with plastic end bushings and nylon pull strings. Provide long radius 90a bends and pulling points as required by telecommunication systems companies.

10.24 Intercommunication Systems

Provide an intercom system or empty conduit system only for an intercom system. Submit proposed layout at the Design Stage Submission.

10.25 Elevators

Conform to the National Building Code, Canada Labour Code Part IV, local regulations, ASME A17.1-2007/CSA B44-07 Safety Code for Elevators and Escalators and, CAN/CSA-B651-04 Accessible Design for the Built Environment or CAN/CSA-B355-00 Lifts for Persons with Physical Disabilities and CSA-B355S1-02.

Provide elevators, dumbwaiters, and escalators only where they can be justified as functional requirements of the building.

Where groups of units are involved, submit an elevator analysis to indicate the performance of the system proposed.

Direct plunger hydraulic elevators may be used for elevators serving 2 or 3 stops provided ground conditions do not introduce serious difficulties in installing the cylinder.

Provide fire fighters service if required by the codes.

10.26 Clocks

Provide manual reset clocks and clock outlets in strategic areas such as main lobbies, corridors, general offices and conference rooms. Use an automatically supervised clock system in large buildings where economically justified.

10.27 Fire Alarm System

General: Depending on the size of the building provide a fire alarm system in accordance with the National Building Code and Treasury Board Personnel Management Manual, Occupational Safety and Health, Chapter 3-4 "Standards for Fire Alarm Systems" 01-02-92. Installation to CAN/ULC-S524-01. Verification of Alarm System to CAN/ULC-S537-04. Inspection and Testing of Alarm System to CAN/ULC-S536-04.

Fire alarm system to be multiplex or hardwired to suit the project. Submit cost comparison with preliminary layout at concept stage submission.

10.28 Voice Communication System

Conform to requirements of the National Building Code and the Treasury Board Manual, Personnel Management Manual, Occupational Safety and Health, Chapter 3-4, Standard for Fire Alarm System, 01-02-92. Depending on the size of the building, provide a voice communication system in conjunction with the fire alarm system.

The design, inspection and testing is to be subject to the approval of the FC.

10.29 Standby Power

If a standby electrical generating set is required provide specific requirements here.

Provide a standby electrical generating set to supply emergency power for 12 hours minimum.

Emergency power supply shall be in accordance with CAN/CSA-C282-05, Emergency Electrical Power Supply for Buildings.

Enclose generator room with non-combustible materials having a 2 hour fire rating and by Underwriters Laboratories labelled 1-1/2 hour fire rated doors.

Install diesel engine in accordance with the requirements of the NFPA 37-2006.

Fuel supply and piping system is to be in accordance with National Fire Code of Canada 2005.

Standby lighting, power panels and circuits shall be provided for future connection to standby generator even if generator is not required at the design stage.

Receptacles connected to emergency system to be colour coded red for ready identification.

10.30 Lighting General

Lighting systems to be designed to provide the required illumination levels with ease of luminaire relocation, lighting control and lighting maintenance with no damage occurring to components. Refer to PWGSC Standard Office Lighting RPSB/DG1-1-4:95-1 for detailed information not contained in this section.

Ceiling surfaces to have a 80% minimum reflectance, a minimum NRC rating of 0.8 as per ASTM C423-08a test standard titled Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method and to conform to CAN2-92.1-M77 of the National Standards of Canada, titled Acoustical Units, Prefabricated.

Leave a minimum ceiling depth of 220 mm for ceiling recessed luminaire installation, unless otherwise determined by PWGSC.

Submit co-ordination drawings showing worst cases of ceiling space requirements and clearances for structural, mechanical and electrical components.

Provide exterior security lighting for drives, walks, parking areas, entrance/exit doors and other strategic locations. Exterior lighting to be controlled by timer or photocell. Provide manual by-pass switches.

Provide the Department with detail calculations of light intensities to support the design.

10.31 Lighting Levels

For each room or area determine the task performed and provide minimum maintained average illumination levels to meet Labour Canada Regulations and PWGSC Standard, IESNA recommended lighting levels and Tables 1 and 2 attached at the bottom of this section. These levels may be achieved by using non-uniform task ambient lighting layouts.

In cases where visual task description, furniture layout and office layout is unavailable, a minimum base illumination level of 750 lux average maintained over the entire work space is to be used.

Minimum to average illumination ratio to be 0.8 or better over the entire working area.
Provide local switching for enclosed rooms, e.g., private offices, conference rooms, training rooms, etc.
For large areas provide local switching arrangements to conveniently control and conserve energy.

10.32 Lighting Power Allowances

Conform to ASHRAE/IES 90.1-2007 requirements.

Whilst individual areas may deviate from the ASHRAE/IES recommended values, the total power budget for lighting shall not exceed 22 watts per square metre, unless otherwise determined by PWGSC.

10.33 Energy Consumption

Conform to ASHRAE/IES 90.1-2007 requirements.

10.34 Luminaires

Fluorescent luminaires is preferred for indoor applications. Depending on the luminaire design, these luminaires shall be capable of accommodating up to 76 mm high metal louvres. The use of incandescent luminaires is limited to applications where questions of aesthetics, ultraviolet emission and lighting control requires it. Use compact fluorescent lamps where possible.

The use of HID luminaires is limited to support and utility spaces. Special dispensation of this use limitation can be obtained from the PWGSC Regional Electrical Engineer, provided the requirements of PWGSC requirements are met.

For outdoor applications the use of HID luminaires is preferred.

Illustrate all fixtures on the working drawings or standard details sheets and specify in detail the quality of material, construction and standard of performance required. Manufacturer's name and catalogue numbers are not allowed in contract documents.

Specify fluorescent luminaires either 300 mm or 500 mm width to suit ceiling modules for recessed installation.

10.35 Ballasts

For fluorescent fixtures, use electronic type, rapid start, energy efficient, high power factor, with THD not exceeding 15, and sound rated A ballasts, having low current crest factor (less than 1.8) and wired to maximize energy efficiency. Electronic ballasts must be the type approved by PWGSC, Provincial and local Hydro authorities for energy efficiency and harmonic criteria.

HID's ballasts to meet or exceed the performance requirements of ANSI C82.4-2002, and to be suitable for the lamp and temperature specified.

10.36 Lamps

Provide lamps of the best quality available. Generally, fluorescent lamps to be rapid start, 32 watts T8 3500 K. Incandescent lamps are to be for 130 volt operation. Specify initial and average lumens and rated life.

Specify 3500 K fluorescent lamps for new installations and major renovations.

10.37 Lighting Controls

Manual controls:

- These may be line switches, low voltage switches, time switches, photocontrols and contactors. They should be located to maximize convenience and load control.
- Circuit breakers and light contactors are not to be used as localized manual lighting controls.

Microprocessor lighting controls:

- May be operated from a central master control unit, have field distributed control panels for zone control and local "on-off" controls. Programming functions can be assigned from the main console unit and/or assigned from field control panels. Local control can be achieved via a wall switch or telephone line.

10.38 Emergency Lighting

Provide sufficient emergency lighting to permit a safe evacuation. Emergency lighting systems must be installed in accordance with Canada Labour Code Part IV and PWGSC RPSB/DGS1-1-4:95-1.

Emergency battery lighting units must be performance certified by CSA as meeting CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.

10.39 Exit Signs

Exit and paths of exit travel are to be indicated by electrically illuminated full panel bilingual exit signs. Size of lettering to meet the National Building local Fire Department and CAN/CSA-C860-07 Performance of Internally Lighted Exit signs requirements. Connect Exit Signs to emergency power system.

If there is no provision for a standby generator, connect to emergency battery units.

10.40 Heating

Co-ordinate heating with mechanical and architectural design. If electrical heating is used, ensure that the heating units specified provide the required wattage but do not exceed specified values. Integrate the heating controls with the total environmental aspect of the building.

10.41 TVSS Transient Voltage Surge Suppressors

PWGSC Ontario Region specification Section 26 43 13 describes pertinent material requirements and installation practices for Low Voltage Transient Voltage Surge Suppressors (TVSS). TVSS equipment having the electrical characteristics, ratings and modifications as specified. TVSS shall be fully applicable for the purpose of protecting all facility AC electrical circuits from the hazardous effects of transient voltages. These transients may be generated externally by lightning induced energies, utility load factor

corrections, and substation switching or they can be internally generated due to inductive and/or capacitive load switching.

10.42 Lightning Protection

Determine the necessity of installing lightning protection. If required, provide protection to meet CAN/CSA-B72-M87(R2008), latest provincial Lightning Rods Act, provincial or local regulation, the requirements of Provincial Fire Marshal.

10.43 Security System

Provide an alarm system against unauthorized entry of the premises and certain secure areas. Use door switches and alarms plus an electronic intrusion alarm system.

Security systems for Correctional Service Canada projects must be in accordance with Correctional Service Canada, Technical Service Branch, Electronics Systems specifications available as PDF files from the Departmental Representative.

10.44 Lighting Levels

Table 1 - Recommended Levels of Illumination (Interior).

TABLE 1

Illumination levels for interior office spaces, expressed as minimum acceptable values of maintained average horizontal lux levels over
a) the working plane at each work station and
b) at floor level for support spaces. Refer to IESNA Illuminance Surveying techniques for field measurements.

Description of Task	Illumination (lx) 10 lx = 1 dalx
High Contrast Visual Task (4) (7)	600
Low Contrast Visual Task (5) (7)	1,000
VDT use (3)	300-500 (1)(2)
Filing work (6)	300
Circulation areas immediate to task areas	200
Public spaces, lounges, waiting areas	100-200
Notice Boards	300
Conference, training rooms	300-600 (1)
Corridors	100
Cafeteria - dining (9)	75
Cafeteria - food display, serving, cashier (9)	300
Food preparation (9)	500
Washrooms (8)	200
Powder room - grooming (8)	300
Stairways	100

Note
(1) Provide flexible and/or dimmable lighting levels.
(2) VDT task in conjunction with paper oriented task requiring greater illumination will conform to the

requirements of the latter.

(3) For guidance in lighting design for VDT spaces see publication PWGSC Design Guide "Office Lighting for Video Display Terminals".
(4) Typically found in private offices, clerical work and accounting offices.
(5) Typically found in drafting offices, mapping and artwork offices.
(6) Typically visual tasks of high contrast and large size, or tasks of intermittent visual nature.
(7) For general office spaces with undetermined task use 750 lux and a minimum to average ratio of 0.8. and is the actual sink top.
(8) The reference plane is the actual sink top.
(9) The reference plane is the actual table top, counter top or serving surface.

10.44 Lighting Levels

Table 2 - Recommended Levels of Illumination (Exterior).

TABLE 2

Illumination levels for exterior commercial office building spaces, expressed as minimum acceptable values of maintained average horizontal lux levels over usable area and at pavement level. Refer to IESNA Illuminance Survey techniques for field measurements.

Description of Task	Illumination Level (lux) (1)	Uniformity Ratio
OPEN PARKING		
Vehicular traffic low activity	10	4:1
Vehicular traffic, moderate-high activity	20	4:1
Vehicular intersections	30	3:1
Pedestrian walkways	10	N/A
Pedestrian walkways and vehicular intersection	30	3:1
Other area	10	N/A
COVERED PARKING		
General parking and pedestrian areas	50	4:1
Ramps and corners	100	3:1
Entrance area (Note 2)	500	N/A
BUILDING FLOODLIGHTING		
Building façade (vertical illumination)	100-300	4:1

Note
1. Provide photocell control with manual bypass.

2. The entrance area is defined as the portal or physical entrance to the covered portion of the parking structure and 15 m beyond the edge of the covering into the structure.

10.45 As-Built and Record Information

As-built information is received from the Contractor. It contains drawings, specifications, shop drawings, submittals, samples, etc. It is noted as such by the Contractor.

Record drawings and specifications are updated originals prepared by the Consultants based on the information supplied by the Contractor in the as-built.

SECTION 11 CONSTRUCTION COST PLANNING AND CONTROL

11.1 Agreement Requirements

The Consultant Agreement requires the Consultant to monitor the project construction cost from commencement of his work through to post- construction evaluation of the completed project.

11.2 Cost Plan

The project cost plan is an application of cost criteria to the design, establishing a reasonable economic relationship between cost, quality, utility and appearance. It confirms the feasibility of producing the required accommodation within the construction cost limit, and provides a means of subsequent checking and control of overall expenditure.

The Cost Plan defines a certain amount of money for a certain quality of project in relation to the Basic Requirements.

11.3 Cost Control

Provide cost control services during the design and construction documents development and during Bid period and initiate corrective action to ensure that the estimated project construction cost remains within the approved construction cost limit/budget.

Advise the Departmental Representative immediately if changes are required due to revised client requirements, etc. impact the Construction Cost Limit. Do not proceed with these changes until authorized by the Departmental Representative.

11.4 Classes of Estimates - Definitions

CLASSES OF CONSTRUCTION COST ESTIMATES USED BY PWGSC

A- PWGSC and Treasury Board

In its dealings with Treasury Board on matters of project approvals, PWGSC uses two classes of estimates: indicative and substantive. The indicative estimate is the first one that is used (chronology-wise) and serves as the basis of Preliminary Project Approval by the Treasury Board. This estimate is also referred, within PWGSC, as a class “D” estimate. The substantive estimate is the second one that is used (again, chronology-wise) and serves as the basis of Effective Project Approval by the Treasury Board. This estimate is also referred, within PWGSC, as a class “B” estimate.

B- PWGSC and Consultant Agreements (for architects and engineers)

In its dealings with architects and engineers, PWGSC uses four classes of estimates: classes “D”, “C”, “B” and “A”. The Class “D” estimate is the first one that is used (chronology wise) and serves as the basis of the Construction Cost Estimate upon which an agreement between PWGSC and an architectural/engineering (A&E) consulting firm is entered into. The class “D” estimate is prepared by PWGSC and is used by the A&E firm during its performance of the ‘Analysis of the Project Brief’. (This estimate compares to the indicative estimate). The Class “C” estimate is prepared by the firm as part of the ‘Design Concept’. The Class “B” estimate is prepared by the firm as part of the ‘Design Development’. (This estimate compares to the substantive estimate).

The Class “A” estimate is prepared by the firm as part of the ‘Construction Documents, Pre-Bid Construction Cost Estimate and Project Schedule’.
Definitions of classes “D”, “C”, “B” and “A” are as follows.

DESCRIPTION OF THE CLASSES OF ESTIMATES USED BY PWGSC FOR CONSTRUCTION COSTING OF BUILDINGS PROJECTS

Class “D” Estimate

This estimate provides an indication of the total cost of the project, based on the user’s functional requirements to the degree known at the time. It is based on historical cost data for similar work, suitably adjusted for such factors as: effect of inflation, location, risk, quality, size, and time. All related factors affecting cost are considered to the extent possible. Such an estimate is strictly an indication (rough order of magnitude) of the project total cost and completion date. This estimate is used to establish the indicative estimate required by the Treasury Board for Preliminary Project Approval. Expected degree of accuracy: 20%.
PWGSC Doing Business With A&ES - Ontario Region

Class “C” Estimate

This estimate is prepared at the end of the Design Concept stage and is based on updated user requirements, general description of the end built works, preliminary site information and existing conditions, production, and takes into consideration construction experience and market conditions as well as basic implementation logistics. It includes costs for design, documentation, and construction supervision. Expected degree of accuracy: 15%.

Class “B” Estimate

This estimate is prepared at the end of Preliminary Design and is based upon data (on cost, time and construction) of a level of precision as is typically available when the design of the major systems and sub-systems of the facility (including outline specifications and preliminary drawings and models), as well as when the results of all site or installation investigations are completed. This estimates also makes allowance for all costs resulting from the anticipated schedule, expected market conditions and suitable level of contingencies. This estimate is used to establish the substantive estimate required by Treasury Board for Effective Project Approval. Expected degree of accuracy: 10%.

Class “A” Estimate

This estimate is based on the “B” estimate which has been updated concurrently with the development of Construction Documents and is submitted as a final pre-bid estimate. It requires that project systems be designed and specified to near completion, and is based on a realistic construction schedule and accurate labour and material costs. This is the final estimate before bid call or construction start. Typically, the total forecast is presented in elemental format and includes all actual associated fees and costs. Expected degree of accuracy: 5%.

The Cost Plan must be within the authorized budget. Intermediate and Final Estimates should remain within the Cost Plan, unless (changes due to revised client requirements, etc., are authorized by the Department. Advise the Department immediately such changes occur.

11.5 Construction Cost Estimate Submissions

Provide the following Construction Cost Estimate Submissions:

- A Class "C" Estimate with each Design Concept Submission. The Consultant will also submit Class 'C' estimate for various options thus facilitating Departmental Representative's decision re: selecting the best options. The Consultant's submission will include variance analysis between the construction cost limit and Consultant's Class 'C' estimate with justification/substantiation of variances.
- A Class "B" Estimate with the Design Development and Outline Specifications of Design Systems Submission. The Consultant's submission will include variance analysis between the construction cost limit and Consultant's Class 'C' estimate with justification/substantiation of variances.
- An updated Class "B" Estimate with each submission of the updated Construction Documents at each stage of production specified, i.e. at 66% completion. Each submission will include variance analysis.
- A Class "A" Estimate with the 100% complete stage Construction Document.
- Each Class "C" Estimate shall consist of a completed Elemental Cost Analysis Form.
- Each Class "A" or "B" Estimate submission shall comprise of a completed Elemental Cost Analysis Form and the back-up sheets showing each Sub-Element Item of the work quantified and priced.

11.6 Cost Advice

Provide cost advice, during the design stage, between cost estimate submissions. Evaluate cost of various options, as required, to facilitate Department's decision.

Provide cost advice during the construction stage. Prepare cost estimates for every change based on Contemplated Change Notice and submit to Departmental Representatives. This will assist in deciding on whether to proceed with a change or to assess Contractor's quotation. Evaluate Contractor's quotation and recommend for approval by Departmental Representatives.

11.7 Cost Estimating Specialist

A Cost Consultant, employing Quantity Surveyors, shall provide the cost planning and estimating service for this project.
or
On staff or sub-consultant Quantity Surveyors or other Cost Estimating Specialists shall be used to perform the cost planning service for this project.

Provide details of the Cost Estimating Specialist's qualifications and experience for approval.

11.8 Cost Plan - Definition

The Cost Plan is the construction cost estimate approved for funding for this project. This is the Class "B" Estimate that is prepared from the Preliminary Drawings and Outline of Design Systems.

The Cost Plan defines a certain amount of money for a certain quality of building in relation to the Basic Floor Area Requirements.

11.9 Classes of Estimates - Definitions

Classes of Estimates are defined as follows:

- Class "D" Estimate: a cost estimate based upon unit costs derived from another building of similar type.
- Class "C" Estimate: a cost estimate based upon concept drawings, which represent one possible solution to the design of the project.
- Class "B" Estimate: a cost estimate based upon design development documents and an outline of design systems, or, 25%, 66%, to 95% complete Construction documents.
- Class "A" Estimate: a cost estimate based upon 100% complete construction documents, or, bid documents.

The Cost Plan must be within the authorized budget. Intermediate and Final Estimates should remain within the Cost Plan, unless (changes due to revised client requirements, etc., are authorized by the Department. Advise the Department immediately such changes occur.

11.10 Project Cost Analysis Form

Submit costing information on the standard Analysis Form Project Cost Analysis form (see Sample). Include as much detail as possible, including back-up sheets showing each Sub-Element Item of the work quantified and priced.

11.11 Outside Gross Area and Volume Measurement

To be measured in accordance with publication by the Canadian Institute of Quantity Surveyors "Measurement of Buildings by Area and Volume".

11.12 Construction Elements

The following clauses provide a brief explanation of the construction elements listed in the Project Cost form Elemental Analysis.

11.13 Element No. A1 Substructure

A11 Normal foundations: foundation walls, footings and associated items, below lowest floor level.

A12 Basement: excavation and backfill.

A13 Special foundations: foundation items of a costly or abnormal nature that are customarily kept separate from Elements 1.1 and 1.2. These include: dewatering, underpinning; shoring; sheet piling; caissons; waterproofing; extra cost for rock excavation.

11.14 Element No. A2 Structure

A21 Lowest floor: lowest structural floor construction, including supporting beds and layers.

A22 Upper floor: upper floor construction, including columns.

A23 Roof: structural roof construction, including columns.

11.15 Element No. A3 Exterior Cladding

A31 Walls below ground floor: exterior walls, from top of the normal foundations level to ground floor level. Basement walls may be taken down to footings, provided that this dimension is not more than 300 mm. below basement floor level.

A32 Walls above ground floor: exterior walls, from ground floor level to roof level. Include opening forming items. Parapet walls may be included, when materials are similar.

A33 Windows: windows and associated items, installed into openings in exterior walls.

A34 Roof covering: weatherproof roof finish and other items applied to roof structure, including parapets.

Exterior doors and screens: exterior doors, frames, hardware and associated items, together with glazed screens at entrances, installed into openings in exterior walls.

A35 Projections and recessed: items of work resulting from projections to, or recesses from, the general line of the exterior wall face. Typical items include: projecting balconies in their entirety; additional items resulting from recess balconies; canopies attached to the building; sunshades; soffits and framing to building overhangs; soffits, fascias and associated framing; eavestroughs and downpipes.

11.16 Element No. B1 Interior Partitions and Doors

B11 Permanent partitions: internal permanent walls and partitions, and the framing component of framed partitions. Include opening forming items.

Glazed partitions: interior glazed partitions and screens, including doors and frames of similar materials.

B12 Movable partitions: interior movable partitions, including doors and frames of similar materials and the same proprietary make.

B12 Interior doors: interior doors, frames, hardware and associated items, installed into openings in interior walls and partitions.

11.17 Element No. B2 Interior Finishes

B21 Floor finishes: floor finishes, other items and sleepers, applied on floor structures, in an interior space.

B22 Ceiling finishes: ceiling finishes, other items strapping and framing, applied to underside of, or beneath, structures, over an interior space.

B23 Wall finishes: wall finishes, other items and strapping, applied to exterior walls, interior walls, partitions or partition framing, in an interior space.

11.18 Element No. B3 Fittings and Equipment

B31 Fittings and fixtures: built in items of a general nature. These include: miscellaneous metal items; cabinet work; chalkboards; tackboards; toilet partitions; washroom accessories; directories; lockers; shelving; rolling shutters; loading dock devices.

B32 Equipment: built in items to provide a specialized service. These include: kitchen and cafeteria; laboratory; hospital; gymnasium; cranes and hoists.

B33 Elevators and escalators: elevators and B34 escalators and other similar devices to move people and materials within a building.

11.19 Element No. C1 Mechanical

C11 Plumbing and drainage: service systems to supply, heat, condition, distribute, use, collect and discharge water.

C12 Fire protection: service systems to provide built-in fire protection.

C13 Heating: service systems to provide heating for the building.

C13 Ventilating and air conditioning: service systems to supply, condition, distribute, ventilate and exhaust air.

C13 Refrigeration: service systems to provide refrigeration.

C13 Special equipment and piping: specialized service systems. These include: vacuum; compressed air; medical gases; fuel storage and supply; engine exhaust; central lubrication equipment; central liquid soap dispensing.

C14 Building controls: provision of controls to other service systems.

Mechanical overhead and profit: Mechanical Subcontractors's overhead and profit items, which include applicable General Conditions items.

11.20 Element No. C2 Electrical

C21 Service systems provided by the Electrical Subtrade, for a building.

C21 Electric power: service systems to generate, supply, distribute and ground electric power.

C21 Uninterrupted power: service systems to provide an uninterrupted supply of electrical power.

C22 Electric lighting: service systems to provide electric lighting.

C22 Electric heating: service systems to provide electric heating for the building.

C23 Fire alarm: service systems to provide fire detection and alarm.

C23 Communications: service systems to provide for sound, imaging and data communication by electronic means.

Electrical overhead and profit: Electrical Subcontractor's overhead and profit items, which include applicable General Condition items.

11.21 Element No. D1 Site Development

D11 Site work: development of the site, outside the building footprint area, of an Architectural or Structural nature.

D12 Mechanical site services: service systems of a Mechanical Subtrade type, including associated items, to the site, and up to one metre from the building perimeter.

D13 Electrical site services: service systems provided by the Electrical Subtrade, including associated items, to the site, and up to the exterior surface of the building.

11.22 Element No. D2 Ancillary Work

D21 Demolition: demolition of existing buildings on site to make way for new construction work.

D22 Alterations: alterations to an existing building, which will become part of, or all of, the new facility.

11.23 Element No. Z1 Overhead and Profit

Z11/Z12 General Contractor's overhead and profit items, which include General Condition items.

11.24 Element No. Z2 Contingencies

Z21 Design development contingency: an allowance to provide for changes to, and development of, the project design, from the date of the estimate to the 100% complete working drawings and specifications stage. This contingency does not include for a basic and substantial change to the project initiated by the building owner.

Z22 Escalation contingency: an allowance to provide for forecasted variation in cost due to passing of time, from the date of the estimate to the anticipated bid date.

Z23 Escalation-during Construction: Once the Contract is signed, no escalation is applied.

Z24 Permits/Approvals: Municipal Building Permit; TSSA approval; HVAC permit, etc.

Z25 Construction Contingency-during construction. Department's allowance to cover unforeseen conditions and changes occurring during construction.

Z26 LEED Gold: 12% of Construction cost.

11.25 Contact

For more information contact Mr. Spencer Jeyarajan 416-512-5945, fax 416-512-5535. Internet e-mail: spencer.jeyarajan@pwgsc.gc.ca

SECTION 12 ELEMENTAL COST ANALYSIS

Project Name: _____

_____

_____

Project Number: _____ Region: _____

Project Manager: _____

Consultants - Architectural: _____

Structural: _____

Mechanical: _____

Electrical: _____

Cost: _____

Design Stage Submission: _____

Class of Estimate: _____

Date of Cost Estimate Submission: _____

Basic Floor Area Requirements: _____

Gross Floor Area of New Construction: _____

Gross Floor Area of Renovations: _____

Project:	**PUBLIC WORKS AND GOVERNMENT SERVICES CANADA**					Report Date:		
Location:	**Ontario Region**					Page No.:		
Owner:	**ELEMENTAL CONSTRUCTION COST SUMMARY**					Bldg. Type:		
Consultant:						GFA		m2
	Ratio	Elemental Cost		Elemental Amount		Rate per m2		
Element	GFA	Quantity	Unit Rate	Sub-Total	Total	Sub-Total	Total	%
A SHELL					-			
A1 SUBSTRUCTURE					-		-	
A11 Foundations		0	0	-		-		
A12 Basement Excavation				-		-		
A13 Special Conditions				-		-		
A2 STRUCTURE					-		-	
A21 Lowest Floor Construction		0	0	-		-		
A22 Upper Floor Construction				-		-		
A23 Roof Construction		0	0	-		-		
A3 EXTERIOR ENCLOSURE					-		-	
A31 Walls Below Grade				-				
A32 Wall Above Grade		0	0	-		-		
A33 Windows & Entrances		0	0	-		-		
A34 Roof Coverings		0	0	-		-		
A35 Projections		0	0	-		-		
B INTERIORS					-		-	
B1 PARTITIONS & DOORS					-		-	
B11 Partitions		0	0	-		-		
B12 Doors		0	0	-		-		
B2 FINISHES					-		-	
B21 Floor Finishes		0	0	-		-		
B22 Ceiling Finishes		0	0	-		-		
B23 Wall Finishes		0	0	-		-		
B3 FITTINGS & EQUIPMENT					-		-	
B31 Fittings & Fixtures		0	0	-		-		
B32 Equipment				-		-		
B33 Elevators				-		-		
B34 Escalators				-		-		
C SERVICES					-		-	
C1 MECHANICAL					-		-	
C11 Plumbing & Drainage								
C12 Fire Protection		0	0	-				
C13 HVAC								
C14 Controls								
C2 ELECTRICAL					-		-	
C21 Services & Distribution								
C22 Lighting, Devices & Heating		0	0	-				
C23 Systems & Ancillaries								
NET BUILDING CONSTRUCTION ESTIMATED COST - EXCLUDING SITE					-		-	
D SITE & ANCILLARY WORK								
D1 SITE WORK					-		-	
D11 Site Development		0	0	-		-		
D12 Mechanical Site Services		0	0	-		-		
D13 Electrical Site Services		0	0	-		-		
D2 ANCILLARY WORK					-			
D21 Demolition				0				
D22 Alterations				0				
NET BUILDING CONSTRUCTION ESTIMATED COST - INCLUDING SITE					-		-	
Z1 GENERAL REQUIREMENTS & FEE					-		-	
Z11 General Requirements %		8		-		-		
Z12 Fee		4		-		-		
TOTAL CONSTRUCTION COST ESTIMATE - EXCLUDING CONTINGENCIE					-		-	
Z2 ALLOWANCES					-		-	
Z21 Design & Pricing Allowance		10		-		-		
Z22 Escalation-until tender call		8		-		-		
Z23 Escalation-during construction		6		-		-		
Z24 Permits/Approvals		1		-		-		
Z25 Construction Contingency		10		-		-		
Z26 Leed Gold		8		-		-		
ADD +/ -				-				
Risk Factors								
TOTAL CONSTRUCTION COST ESTIMATE -INCLUDING CONTINGENCIES					**$ -**		**-**	
GOODS & SERVICES TAX								
AP-7A (REV)								

SECTION 13 TIME MANAGEMENT

13.1 Time Management, Planning, and Control

The Time Management, Planning, and Control Specialist (scheduler) shall provide a Project Planning and Control System (Control System) for Planning, Scheduling, Progress Monitoring and Reporting and a Time Management, Planning, and Control Report (Progress Report). It is required that a fully qualified and experienced Scheduler play a major role in providing services in the development and monitoring of the project schedule.

The scheduler will follow good industry practices for schedule development and maintenance as recognized by the Project Management Institute (PMI).

PWGSC - Ontario Rregion, presently utilizes MicroSoft Project for it's current Control Systems and any software used by the consultant should be fully integrated with these, using one of the many commercially available software packages.

13.2 Schedule Design

Project Schedules are used as a guide for execution of the project as well as to communicate to the project team when activities are to happen, based on network techniques using Critical Path Method (CPM).

When building a Control System you must consider:

1. The level of detail required for control and reporting;
2. The reporting cycle- monthly and what is identified in the Terms of Reference, but also includes Exception Reports;
3. That the duration must be in days;
4. What is required for reporting in the Project Teams Communications Plan and
5. The nomenclature and coding structure for naming and reporting requirements of activities, schedules and reports.

13.3 Schedule Development

For purposes of monitoring and reporting of project progress and ease of schedule review it is important to maintain a standard for all schedules and reports starting with the Work Breakdown Structure (WBS), identification of Milestones, naming of activities as well as schedule outputs and paper sizing and orientation.

13.4 Work Breakdown Structure

When developing the schedule the consultant needs to use PWGSC standards and practices. Two basic requirements are the National Project Management System (NPMS) and a Work Breakdown Structure (WBS), structured supporting the NPMS (Levels 1-4).

The WBS is as follows:

Level 1	Project Title (NPMS)
Level 2	Project Stage (NPMS)
Level 3	Project Phase (NPMS)
Level 4	Processes to meet Deliverables/Control Points Milestones (NPMS)

Level 5 Sub-Processes and Deliverables in support of Level 4
Level 6 Discrete activities. (Work Package)

Not all the Stages, Phases and Processes in the NPMS will be required on all the projects, however the structure remains the same.

13.5 Major and Minor Milestones

The Major Milestones are standard Deliverables and Control Points within NPMS and are required in all schedule development. These Milestones will be used in Management Reporting within PWGSC as well as used for monitoring project progress using Variance Analysis. The Minor milestones are process deliverables (Level 4) or sub-process deliverables (level 5) also used in Variance Analysis.

Each Milestone will also be assigned appropriate coding for Status Reporting and Management Reporting.

Milestones must have zero duration and are used for measuring project progress.

Milestones may also be external constraints such as the completion of an activity, exterior to the project, affecting the project.

13.6 Activities

All activities will need to be developed based on Project Objectives, Project Scope , Major and Minor Milestones, meetings with the project team and the scheduler's full understanding of the project and it's processes.

Subdivide the elements down into smaller more manageable pieces that organize and define the total scope of work in Levels 5-6 that can be scheduled, costed, monitored and controlled. This process will develop the Activity List for the project.

Each activity is a discrete element of work and is the responsibility of one person to perform.

Each activity will describe the work to be performed using a verb and noun combination (i.e. Review Design Development Report).

Activities should not have durations longer that 2 update cycles, with exception of activities not yet defined in a "Rolling Wave".

Each activity will be assigned at WBS level 6 and appropriately coded for Status Reporting and Management Reporting.

These elements will become activities, interdependently linked in Project Schedules.

13.7 Project Logic

Once the WBS, Milestones and Activity List have been developed the activities and milestones can be linked in a logical manner starting with a Project Start Milestone. Every activity and milestone must be linked in a logical manner using either a Finish to Start (FS), Finish to Finish (FF), Start to Start (SS) or Start to Finish (SF) relationship. There can be no open-ended activities or milestones.

A Finish to Start (FS) is the preferred relationship.

When developing relationships avoid the use of lags and constraints in place of activities and logic.

13.8 Activity Duration

The activity duration (in days) is the estimated length of time it will take to accomplish a task.

Consideration needs to be taken in how many resources are needed and are available, to accomplish any activity. (Example: availability of Framers during a “Housing Boom”.) Other factors are the type or skill level of the available resources, available hours of work, weather etc.

There will be several types of lists and schedules produced from this process, which will form part of the Progress Report.

13.9 Activity List

An Activity List identifies all activities including milestones required to complete the whole project.

13.10 Milestone List

A Milestone List identifies all project Major and Minor milestones.

13.11 Master Schedule

A Master Schedule is a schedule used for reporting to management at WBS level 4 and 5 that identifies the major activities and milestones derived from the detailed schedule. Cash Flow projections can be assigned at WBS level 5 for monitoring the Spending Plan.

13.12 Detailed Project Schedule

A Detailed Project Schedule is a schedule in reasonable detail (down to WBS Level 6 and 7) for progress monitoring and control, this will ensure that the schedule shall be in sufficient detail to ensure adequate planning and control.

13.13 Schedule Review and Approval

Once the scheduler has identified and properly coded all the activities; put them into a logical order and then determined the appropriate durations. The scheduler can then analyze the schedule to see if the milestone dates meet the contractual requirements and then adjust the schedule accordingly by changing durations, resource leveling or changing logic.

When the schedule has been satisfactorily prepared the scheduler can present the detailed schedule to the Project Team for approval and be Baselined. There may be several iterations before the schedule meets with the Project Teams agreement and the contractual requirements.

The final agreed version must be copied and saved as the Baseline to monitor variances for reporting purposes.

13.14 Schedule Monitoring and Control

Once Baselined the schedule can be better monitored, controlled and reports can be produced.

Monitoring is performed by, comparing the baseline activities % complete and milestone dates to the actual and forecast dates to identify the variance and record any potential delays, outstanding issues and concerns and provide options for dealing with any serious planning and scheduling issues in report form.

Analyze and report from early start sequence on all activities due to start, underway, or finished for the complete project.

There will be several reports generated from the analysis of the baseline schedule and will form part of the Time Management Report in the Required Services Sections (RS)

13.15 Progress Reports

A Progress Report reflects the progress of each activity to the date of the report, any logic changes, both historic and planned, projections of progress and completion the actual start and finish dates of all activities being monitored.

The Progress Report includes:

A Narrative Report, detailing the work performed to date, comparing work progress to planned, and presenting current forecasts. This report should summarize the progress to date, explaining current and possible deviations and delays and the required actions to resolve delays and problems with respect to the Detail Schedule, and Critical Paths.

Narrative reporting begins with a statement on the general status of the project followed by a summarization of delays, potential problems and project status criticality, any potential delays, outstanding issues and concerns and options for dealing with any serious planning and scheduling issues.

A Variance Report, with supporting schedule documentation, detailing the work performed to date, comparing work progress to planned. This report should summarize the progress to date, explaining all causes of deviations and delays and the required actions to resolve delays and problems with respect to the Detail Schedule, and Critical Paths.

A Criticality Report identifying all activities and milestones with negative, zero and up to five days Total Float used as a first sort for ready identification of the critical, or near critical paths through the entire project.
Included in the Progress Report as attachments are: WBS chart, Activity Lists, Milestone Lists, Master Schedules, Detailed Project Schedule

13.16 Exception Report

The Scheduler is to provide continuous monitoring and control, timely identification and early warning of all unforeseen or critical issues that affect or potentially affect the project.

If unforeseen or critical issues arise, the Scheduler will advise the Project Manager and submit proposed alternative solutions in the form of an Exception Report.

An Exception Report will include sufficient description and detail to clearly identify:

1. Scope Change: Identifying the nature, reason and total impact of all identified and potential project scope changes affecting the project.
2. Delays and accelerations: Identifying the nature, the reason and the total impact of all identified and potential duration variations.

3. Options Enabling a Return to the project baseline: Identifying the nature and potential effects of all identified options proposed to return the project within baselined duration.

13.17 Standard Submissions

At each submission or deliverable stage provide a complete and updated Progress Report, the contents of each report will vary with requirements and at each project phase. Typically a Progress Report has:

1. Executive Summary;
2. Narrative Report;
3. Variances Report;
4. Criticality Report;
5. Exception Report (as required)
6. Work Breakdown Structure Chart;
7. Activity List;
8. Milestone List;
9. Master Schedule with Cash Flow Projections;
10. Detail Project Schedule (Network Diagram or Bar Charts)

13.18 Schedule Outputs and Reporting Formats

The sheet sizing and orientation is more a suggestion that a role, changes to the paper format may vary to accommodate the information and column information required.

Progress Reports:
Paper Size: Letter
Paper Format: Portrait
Title Format: Project Title; Report Type; Print Date; Data Date; Revision Block
Body Text: Narratives for each report to match other reports generated in the D.S.S.
Variance Report Columns: Activity ID, Activity Name, Planned Finish, Revised Finish, Variance, Activity % Complete,
Criticality Report Columns: Activity ID, Activity Name, Duration, Start, Finish, Activity % Complete, Total Float.

Exception Reports:

Paper Size: Letter
Paper Format: Portrait
Title Format: Project Title; Report Type; Print Date; Data Date; Revision
Body Text: Narrative to match other reports generated in the D.S.S.

Paper Size: Letter
Paper Format: Landscape
Title Format: Project Title; Report Type; Print Date; Data Date; Revision
Columns: Activity ID, Activity Name, Duration, Remaining Duration, Start, Finish, Total Float.

Work Breakdown Structure (indent tree):

Paper Size: Letter
Paper Format: Portrait
Columns: WBS Code, WBS Name, Duration, Cost estimate, start and finish dates.
Footer Format: Project Title; Report Type; Print Date; Data Date; Revision Block

Activity Lists:

Paper Size: Letter
Paper Format: Portrait
Columns: Activity ID, Activity Name, Start, Finish, Predecessor, Successor.
Footer Format: Project Title; Report Type; Print Date; Data Date; Revision Block

Sort with Early Start, then Early Finish, then Activity ID and with the WBS.

Milestone Lists:

Paper Size: Letter
Paper Format: Portrait
Footer Format: Project Title; Report Type; Print Date; Data Date; Revision Block
Columns: Activity ID, Activity Name, Start, Finish.

Sort with Early Start, then Early Finish, then Activity ID and without the WBS.

Master Schedule (Bar Chart):

Paper Size: 11X17
Paper Format: Landscape
Footer Format: Project Title; Report Type; Print Date; Data Date; Revision Block
Columns: Activity ID, Activity Name, Duration, Activity % Complete, Start, Finish, Total Float.

Sort with Early Start, then Early Finish, then Activity ID and with the WBS.

Detailed Project Schedules (Bar Chart):

Paper Size: 11X17
Paper Format: Landscape
Footer Format: Project Title; Report Type; Print Date; Data Date; Revision Block
Columns: Activity ID, Activity Name, Duration, Activity % Complete, Start, Finish, Total Float.

Sort with Early Start, then Early Finish, then Activity ID and with the WBS.

SECTION 14 DRAWING CONVERSION TO PORTABLE DOCUMENT FORMAT (PDF)

Issued by: Real Property Contracting Directorate
PWGSC
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Preface

Portable Document Format (PDF) is the standard format for documents that are posted on the Government Electronic Tendering System (GETS). There is therefore a need to obtain from architectural and engineering consultants an electronic copy of drawings and specifications in PDF for tendering Government of Canada (GoC) construction projects.

In order to have the highest quality in term of resolution and printing, consultants should to the greatest extent possible have the PDF drawing and specification files derived from the native software in which they were created. Scanning is permissible but only in special circumstances, for example when there is no electronic version of a drawing being included in a construction tender package.

The purpose of this document is to provide basic information on the conversion of Computer Aided Design and Drafting (CADD) drawings in PDF. Creating a PDF file from a CADD drawing is a relatively simple process once all the necessary configurations and settings are in place. It actually should not take any longer than it would take to create a plot file or to send a drawing to a printer. The information in this guide is not intended to cover all technical aspects of the conversion, which can be done using various methods, but rather to highlight important points about the process and file settings. The conversion of specifications is not covered in this basic reference guide since it does not require any special configuration or setting.

The information provided in this basic reference guide is not an indication that consultants are relieved from following the established standards for the production of drawings and specifications. The sole purpose of this guide is to provide basic information on the PDF conversion process bearing in mind that additional detailed technical information is available from the various software manufacturers.

14.1 Printer Drivers

Adobe Acrobat provides two different printer drivers that are able to convert CADD drawing into PDF format, Acrobat PDF Writer and Acrobat Distiller. Before creating a PDF file from a CADD drawing, a choice must be made as to which one will be used.

Acrobat PDF Writer is a non-PostScript printer driver that works best with documents that don't contain complex graphics.

Acrobat Distiller is a PostScript printer driver that works best with documents that contain PostScript fills, Encapsulated PostScript (EPS) graphics, or other complex elements.

It is recommended that Acrobat Distiller be used to create PDF file of architectural and engineering drawings due to their size and complex graphical nature.

14.2 Printer Configuration

Before converting a CADD drawing to PDF, an Acrobat printer configuration file for the PDF paper size needs to be created. This function can be done in the CADD software rather than using a custom paper size defined for the Acrobat distiller feature. The recommended method is to add a PostScript Adobe plotter in the CADD software and making the necessary setting in terms of media source and size, scale

and orientation. The configuration can then be re-used to simplify the conversion process for future files that use the same page size.

As an alternative, although not recommended, a custom-defined size can be created in Acrobat Distiller in the properties menu.

14.3 Creating PDF Files

Once the printer configuration has been done in the CADD software, open up Acrobat Distiller and make the necessary settings in the preferences and job options sub-menu. Ensure that the page size match the sheet size selected in the CADD software to create the file. Particular settings can be saved under different names for future use.

With the Acrobat Distiller application open, ensure the required sheet size is displayed in the job options window. Then it is simply a matter of bringing the CADD file into the Acrobat Distiller creation box.

A progress bar will show during the conversion and the newly converted PDF file should open up and be displayed for verification.

14.3 PDF Files Settings

Security:

Adobe Acrobat contains security features that can de used to secure the files by restricting any changes to the files. However, since the files will be posted on GETS and will be used for printing copies, the files must not be password protected and must allow printing.

Drawing Orientation:

The final PDF drawing files must be displayed on the screen in the same direction that the users are intended to view them. This can be achieved by adjusting the setup of the plotter. If the drawing is not oriented properly after the conversion, it can be rotated manually within Adobe Acrobat.

Font Type:

In order to avoid any problems during the conversion and to minimize the potential for font display errors, the fonts used for the production of construction drawings must be PostScript or True Type fonts.

Resolution:

Since the PDF files will be used for printing, it is important that a proper resolution be selected. It is recommended to select 600 dots per inch (dpi).

Scale:

When choosing the Plot scale in Adobe, it is important to choose the 1:1 scale to ensure the integrity of the scale from which the drawings were created in the CADD software.

14.4 Scanning

Scanning is not recommended and should be done only when the drawing is not available electronically. When scanning a drawing, it is important that it be done in real size (scale 1:1) to ensure that the scale

remains intact in subsequent printing. It is recommended that each scanned drawing be opened and verified to ensure that the resolution, scale and border are of an acceptable quality.

14.5 Final Checklist

When the drawing file has gone trough the PDF conversion, it is recommended to open it and verify the following:

- That the sheet size displayed is what was intended to be created (the size is viewable in the lower left corner of the drawing).
- That the orientation of the sheet is correct.
- That the line types, line weights and fonts match the CADD drawing.
- That the PDF file is in black and white.
- That each drawing is a single PDF file.
- That the PDF file is not password protected and printable.

If all the items are verified, the PDF file is useable.

14.6 Additional Information

For more information about the creation of PostScript and EPS files please refer to the User's Guide of the CADD software being used to produce the drawings. For more information about creating PDF file please refer to the Acrobat Distiller User's Guide and/or visit the Adobe Web site at www.adobe.com .