



UNIVERSITY OF
TORONTO

Facilities & Services

Deliverable standard

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Table of contents

1	Introduction	3
1.1	Purpose	3
1.2	Roles	3
2	Deliverables	4
2.1	Pre-design phase	4
2.2	Design phase	5
2.2.1	Schematic Design (SD)	5
2.2.1.1	Energy model and utility performance	5
2.2.1.2	Authority having jurisdiction permits and approvals	6
2.2.1.3	Preliminary Constructability Report	6
2.2.1.4	3-Dimensional model	6
2.2.2	Design Development Phase (DD)	6
2.2.2.1	Energy model and utility performance	6
2.2.2.2	3-Dimensional model	6
2.2.3	Construction Documents Phase (CD)	7
2.2.3.1	Energy model and utility performance	7
2.2.3.2	3-Dimensional Model Clash Detection Report	7
2.2.3.3	Design standard conformance form	7
2.3	Construction and Procurement (IFC)	8
2.3.1	Addenda	8
2.3.2	Bid evaluation and value engineering	8
2.3.3	Contractor negotiation	8
2.4	Construction Phase	8
2.4.1	Shop drawings	8
2.4.2	Proposed alternates and deviations	9
2.4.3	Factory acceptance tests	9
2.4.4	Air leakage test	10
2.5	Ready-for-Takeover procedures and post-occupancy evaluation	10
2.5.1	Ready-for-Takeover	10
2.5.2	Systems Manual	10
2.5.3	Master Documents	11
2.5.4	Phased or Partial Occupancy	11
2.5.5	Occupancy	11
2.5.5.1	Energy model and utility performance for new construction projects	12
2.5.5.2	Energy model and utility performance for renovation projects	12
2.5.6	Post-Occupancy	12
2.5.6.1	Energy model and utility performance	12
3	Appendices	12

1 Introduction

1.1 Purpose

There are typically seven phases to every project. The definition of the major phases can be described as follows:

- i) Pre-design (PD)
- ii) Schematic Design (SD)
- iii) Design Development (DD)
- iv) Construction Documents (CD)
- v) Construction Procurement
- vi) Construction
- vii) Ready-for-Takeover Procedures and Post-Occupancy Evaluation

Depending on the project size, there will be interim or progress submissions within each phase of the project. However, the purpose of the Deliverable Standard is to convey the University's requirements for deliverables to be provided at each project phase milestone (see Appendix A). The University's project manager shall determine the documentation required for an interim or progress submission.

1.2 Roles

Commissioning Agent (CxA): a third party engaged by the University to ensure compliance with the design documents and the University's standards. Refer to the University of Toronto's Building Commissioning Standard for additional detail.

Design Team: a group of consultants responsible for the design of the project in its entirety. Depending on the project, the design team shall include all core disciplines such as, architectural, mechanical, electrical, structural, and civil. For most projects, the architect is the prime consultant that manages the deliverables for the design team.

F&S Technical Team: representatives of Facilities and Services (F&S) that has experience with the various campus utilities (i.e., electrical, steam, heating water, chilled water, energy, etc.) and with the operation and maintenance of building systems (such as electrical, steam, heating water, chilled water, controls, energy, elevators, fire life safety, etc.).

Project Manager (PM): a representative from the University responsible for the execution of the construction project.

2 Deliverables

2.1 Pre-design phase

The Pre-design Phase is the early stage of defining new project requirements from an end-user perspective. Depending on the complexity of the project, F&S will require a technical Building Systems Investigation (BSI) that thoroughly evaluates the existing mechanical and electrical equipment, components, and systems to identify the efficacy of the existing infrastructure to support the new project. The BSI will be required for all Level 2 and 3 (as defined by the Capital Planning and Capital Project Policy) renovation and expansion projects. Level 1 projects may also require a BSI - to be evaluated on a case-by-case basis. For new projects, the investigation may be scaled back or not required.

The BSI will include a site visit to verify the accuracy of the existing drawings provided by the University in their representation of the premises. In addition, the BSI will identify requirements that have a cost impact.

At a minimum, the existing conditions to be assessed include:

- i) Existing equipment and systems condition analysis,
- ii) Existing facilities code compliance,
- iii) Existing system air and hydronic balancing report,
- iv) Existing equipment and systems capacity, and
- v) Evaluation of connectivity to Building Automation System and EMRS.

The Client will provide the project with sufficient information (if available) including room data sheets, space plans, number of occupants, possible heat sources, and lab requirements (i.e., exhaust hood count, water, gas, backup power requirements, etc.):

- i) Estimated new heating load,
- ii) Estimated new cooling load,
- iii) Estimate new ventilation load,
- iv) Estimated new normal power,
- v) Estimated new emergency power gap analysis between new and existing conditions,
- vi) Design solutions, if requested, and
- vii) High level Class "D" cost estimate(s).

The BSI may require further details from the following F&S departments, but not limited to:

- i) Sustainability
- ii) Elevator Operations & Maintenance
- iii) Fire Prevention
- iv) Caretaking
- v) Grounds
- vi) Campus Safety

vii) IT

The BSI report will be appended to the U of T Project Planning Report (PPR).

Other Pre-design deliverables that may require F&S input include:

- Building Condition Assessments
- Project Planning Report (by UP)
- Preliminary Project Schedule (by PD)
- Preliminary Project Cost Estimate (by PD)
- Feasibility Study RFP (by PD)
- Feasibility Study
- Architectural Services RFSQ (by PD)
- Architectural Services RFP (by PD)

2.2 Design phase

2.2.1 Schematic Design (SD)

Based on the agreed-upon program of requirements, the Design Team shall prepare the SD documents for the University's review and approval. SD documents shall illustrate the scale and character of the project and how the parts of the project functionally relate to each other. Refer to Appendices A and B for the required F&S deliverables at SD.

2.2.1.1 Energy model and utility performance

The SD shall include sufficient detail for the modeling team to define the preliminary energy and greenhouse gas (GHG) performance to provide sufficient indication of the energy performance direction and if designs require tuning to meet the defined targets. At a minimum, SD submission shall include.

- i) Sustainability Project Charter - Project Charter Submissions Checklist
- ii) Project Charter Signed Design Page
- iii) Energy Simulation Files (new build and expansion projects only)
- iv) Energy Performance Report (including Energy and GHG performance indices)
- v) Scorecard
- vi) Precertification Worksheet
- vii) Water Efficiency Worksheets
- viii) Equipment Cutsheets (including all applicable equipment in the energy model)

For more details on each of the documents mentioned above, the expectations, and responsible parties, refer to the University of Toronto Tri-Campus Energy Modelling and Utility Performance Standard <https://www.fs.utoronto.ca/projects/design-standards-and-project-forms/>. Designer should download a copy of the standard at the commencement of design for future reference.

2.2.1.2 Authority having jurisdiction permits and approvals

Status update on the follow permits and approvals:

- i) Emissions
- ii) Sound and vibration
- iii) Water quality
- iv) Dewatering requirements
- v) University Planning, Design and Construction (UPDC) to provide additional approvals

2.2.1.3 Preliminary Constructability Report

The contractor, when retained, will create their Constructability Report that defines, at a minimum, the following:

- i) Site conditions and construction boundary,
- ii) Connections to existing buildings,
- iii) Land and property access and use, such as easements or rights of way,
- iv) Restrictions by neighbours, third party utilities, affiliated colleges, and authorities having jurisdiction, and
- v) Crane location, staging area for material, equipment and trailers.

2.2.1.4 3-Dimensional model

The Design Team and the University shall determine the parameters of the three-dimensional massing models, including a depiction of the space needed to accommodate structural, mechanical, and electrical systems (including vertical shafts) that need to undergo interference coordination.

2.2.2 Design Development Phase (DD)

After the University approves schematic design documents, the DD documents shall be prepared for review and approval.

Any deviation from University's Building Design Standards shall be brought to the attention of the PM for review and F&S approval before incorporation into the project. The Request for Variance form shall be submitted to the PM at the end of the DD phase and F&S approval shall be obtained before the application for Permit. Refer to Appendices A and B for the required deliverables at DD.

2.2.2.1 Energy model and utility performance

- i) Provide a summary of changes from the SD submission to current design.
- ii) Compare current model performance to the established energy and GHG performance indices.
- iii) In a presentation, the Design Team shall demonstrate that the design is compliant with the Sustainability Project Charter requirements.

2.2.2.2 3-Dimensional model

The Design Team shall provide a fly-through presentation of their 3-D model showing key spaces, equipment, and services identified by the University. The minimum spaces that should be presented are as follows:

- i) Mechanical rooms,
- ii) Electrical rooms,
- iii) IT rooms,
- iv) Elevator machine room,
- v) Main water room,
- vi) Roof,
- vii) Ceiling spaces that include serviceable equipment,
- viii) Typical laboratory floor,
- ix) Main entrance,
- x) Service tunnels, and
- xi) Functional spaces identified by the University.

2.2.3 Construction Documents Phase (CD)

The CD phase shall have multiple submissions for various stakeholders including:

- i) Issued for 50% CD costing
- ii) Issued for permit/80% CD costing
- iii) Issued for tender (100% CD)

In parallel with the final costing exercise, F&S will conduct a comprehensive review at the 80% CD stage. F&S review comments on the 80% CD submission shall be addressed in the 100% CD submission documents prior to issuing for tender. Refer to Appendices A and B for the required deliverables at CD.

2.2.3.1 Energy model and utility performance

- i) Provide a summary of changes from the DD submission to current design.
- ii) Compare current model performance to the established energy and GHG performance indices.
- iii) Design Team to demonstrate that the design is compliant with the Sustainability Project Charter requirements.
- iv) Submit metering and verification strategy that outlines which loads are to be metered, types of meters to be specified, and calibration certificates.

2.2.3.2 3-Dimensional Model Clash Detection Report

Prepare and present a Clash Detection Report identifying a “clash-free” model with respect to services and service clearances. Any exceptions to a clash-free model will be individually listed and explained why the clash is not an issue or cannot be resolved until the contractor is retained.

2.2.3.3 Design standard conformance form

The design standards conformance form (refer to the Appendix C) shall be completed, signed by the Engineer(s) of Record, and submitted as part of the 100% CD phase submission package.

2.3 Construction and Procurement (IFC)

The design documentation shall be updated by the Design Team to include additional information and clarifications for the construction of the project. The documents must be stamped and sealed by the representative licensed Professional Engineer and/or Architect. The documentation issuance for this phase is Issued for Construction (IFC).

2.3.1 Addenda

Addenda shall be designed and numbered for incorporation into the appropriate drawings or specification sections. Addenda shall be issued to address non-conforming items, omissions, and client additions to the CD submission.

2.3.2 Bid evaluation and value engineering

The PM shall review and evaluate relevant value engineering (VE) alternatives with the F&S Operations Group. An F&S representative may be required to participate in the contractor presentation of relevant VE alternatives.

2.3.3 Contractor negotiation

The UPDC PM will notify relevant F&S parties if their participation is required in contractor negotiation.

2.4 Construction Phase

During the Construction Phase, the Design Team is responsible for reviewing all shop drawings and addressing all RFIs. Additionally, the Design Team shall update the IFC documentation that includes all design changes that occurred during construction. A set of Record Drawing documentation shall be submitted prior to Substantial Completion.

2.4.1 Shop drawings

The Design Team shall review the shop drawings indicated in the list below and stamp to indicate the Design Team's review status prior to the F&S Technical Team's review. If the shop drawing submission is determined to be urgent, F&S can complete their review in parallel with the Design Team. The F&S Technical Team will provide review and comment on the following shop drawings.

Mechanical	Electrical
Building automation system	High voltage switchgear
Proposed alternates or deviations	All protection relays and systems
Elevators	High voltage cables

Fire safety systems	Power transformers
High pressure steam and condensate components	Distribution transformers
High temperature heating water components	Low voltage switchgear
	Low voltage distribution
	Access chambers
	Generators
	Automatic transfer switches
	UPS systems
	Variable frequency drives
	Lighting
	Lighting control system
	Metering equipment
	Arc flash and coordination studies
	Proposed alternates to the standard
	Exterior lights and light standards
	Electrical chargers and battery systems
	Inverters
	Motor control centers
	Voltage or power quality mitigation equipment
	High voltage arrestors
	Current transformers used for HV protection applications
	Generator and fuel system control panels

2.4.2 Proposed alternates and deviations

Information on any proposed alternates or deviations (deletion, addition, revision) of F&S-approved design or equipment must be submitted on the form in Appendix D (Building Design Standards Variance Request form) with comments and recommendations from the Design Team prior to F&S acceptance. The comments and recommendations shall include the significant differences, any impact on the designed performance of the equipment and system and lifecycle analysis that includes future maintenance and operating costs.

2.4.3 Factory acceptance tests

As per the article 26 08 00.02 in the Electrical Design Standard, a factory acceptance test (FAT) may be required. The FAT must be identified in the project schedule and the F&S representative shall be

informed within one month of the planned FAT to ensure that an appropriate F&S resource can attend the FAT.

2.4.4 Air leakage test

The Design Team must communicate to the F&S representative, Commissioning Agent (CxA), and construction team when, or if, an air leakage test will be conducted with rationale for the proposed direction.

2.5 Ready-for-Takeover procedures and post-occupancy evaluation

2.5.1 Ready-for-Takeover

The project will be deemed Ready-for-Takeover as defined in the contract. Prior to the Ready-for-Takeover, the necessary documents must be provided to the F&S representative for review; training must be provided to the specific F&S representatives; any remaining deficiencies must be identified and provided for F&S review and comment.

2.5.2 Systems Manual

The Design Team will support the CxA with the gathering of building and systems information to complete a Systems Manual. Ideally, the Systems Manual will be delivered by the CxA prior to Ready-for-Takeover. The following shall be included in the Systems Manual:

Section 1—Executive summary

Section 2—Facility design and construction

2.1 Copy of OPR document

2.2 Copy of BoD document

2.3 Two hard copies of mechanical and one hard copy of electrical as well as electronic copy of Building/Project Design and As-Built documents and drawings

2.4 Updated BIM model to As-Built condition

2.5 Substantial Performance letters stamped and signed by the respective discipline

2.6 Sign off permits (e.g. plumbing, HVAC)

2.7 Certificates from ESA, TSSA, and other authorities having jurisdiction

Section 3—Building, systems, and assemblies information for commissioned systems and assemblies

3.1 Copy of building and equipment specifications

3.2 Copy of approved submittals including final controls sequences of operation

3.3 Copy of manufacturer's operation and maintenance (O&M) data

- 3.4 Copy of warranties
- 3.5 Contractor and supplier listing and contact information
- 3.6 Elevator documents (drawings, logbook, test records, operating licence)
- 3.7 Fire alarm system test report and certification

Section 4—Facility operations

- 4.1 Facility Guide including: operating plan; building and equipment operating schedules, setpoints, ranges and limitations; commissioned systems control sequences of operation; and emergency procedures.

Section 5—Training

- 5.1 Copy of training plan and materials
- 5.2 Training records

Section 6—Final Commissioning Report

- 6.1 Copy of final Cx process plan(s)
- 6.2 Copy of commissioning design and submittal review reports
- 6.3 Copy of testing and start-up reports, evaluation checklists, and testing checklists completed for commissioned systems and assemblies
- 6.4 Copy of All Cx Progress Reports
- 6.5 Copy of deficiencies and resolution logs
- 6.6 Item resolution plan for open items
- 6.7 EMRS integration final report

2.5.3 Master Documents

Where building Master Documents are available for renovation projects, all renovated space, systems and equipment that were renovated, removed, revised, and added to the existing facility or system must be updated by the Design Team in the existing Master Documents. The Design Team must also incorporate all as-built conditions of the project into the Master Documents.

2.5.4 Phased or Partial Occupancy

In the event that phased occupancy is planned or partial occupancy is necessary, F&S will provide an Interim Take-Over Checklist for discussion and agreement with the Design Team and the Contractor. All documentation listed in this checklist shall be collected by the UPDC PM.

2.5.5 Occupancy



2.5.5.1 Energy model and utility performance for new construction projects

When the building is commissioned and being used for its intended purpose, F&S will complete a post-occupancy energy performance evaluation. In parallel, the Design Team will update the energy model with any changes during commissioning and the revised model will be the adjusted baseline.

Refer to University of Toronto Tri-Campus Energy Modelling and Utility Performance Standard Section 5.2.1 New Construction: Documentation Submission Requirements by Project Milestone for required deliverables.

Each documentation item, the expectations, and responsible parties is outlined in the University of Toronto Tri-Campus Energy Modelling and Utility Performance Standard.

2.5.5.2 Energy model and utility performance for renovation projects

For renovation projects, the following documents shall be delivered to the University at occupancy. Each documentation item, the expectations and responsible parties are outlined in the University of Toronto Tri-Campus Energy Modelling and Utility Performance Standard.

Refer to University of Toronto Tri-Campus Energy Modelling and Utility Performance Standard Section 6.4.1 Renovation Documentation Submission Requirements by Project Stage for required deliverables.

2.5.6 Post-Occupancy

2.5.6.1 Energy model and utility performance

If the actual energy performance after 12 months of continuous operation exceeds the predicted performance by more than 15%, the Design team/modelers will be asked to comment and assist the University to determine the possible reasons for the variation.

3 Appendices

Appendix A– Design deliverable documentation check sheets

The check sheets for drawings and the Basis of Design (BOD) shall be utilized as a consistent design quality control tool. The intent of this checklist is to capture the minimum level of detail for each milestone. Additional items can be added to the checklist as required. The check sheets need to be completed, verified and signed-off in Appendix C by the Consultant and then accepted by F&S to meet the requirements of each design milestone and to proceed to the next phase.

Refer to the [check sheets spreadsheet](#) that is required to be completed and included in every milestone package.

Appendix B – Basis of design report format and checklist

A Basis of Design (BOD) report or design brief is a “living document” that is updated at each phase of design to the appropriate level of detail required for that phase. It is the document that conveys the understanding of the project and how the design solution will address the user requirements. It is also a record of the assumptions and decision-making process driving the design.

The BOD serves as a communication tool between the Client, the F&S team, the Project Manager, and the Design team. It is used as the foundation for the System Operation narrative prepared by the Cx agent and included in the Systems Manual (refer to Commissioning Process – Overall Building Commissioning document for details). The items delineated in the BOD should evolve from proposed or estimated components to actual components.

For renovations projects (building or systems) include an interpretation or an analysis of the existing conditions that includes supporting documents such as, existing drawings, existing controls, existing sequence of operations, load on the electrical panels, air balancing reports, assumptions, items to be confirmed, etc. In addition, an impact analysis shall be included to determine the adequacy of the existing infrastructure to support the new systems. It should also include an updated inventory list to understand what equipment has been removed, replaced, or added.

Refer to the [checklist spreadsheet](#) that is required to be completed.

Appendix C – Design standards conformance form

The design standards conformance form shall be completed, signed by the Engineer(s) of Record, and submitted as part of the 100% CD phase submission package.

Refer to the [design standards conformance form](#) that is required to be completed.

Appendix D – Building design standard variance request

Information on any proposed alternates or deviations (deletion, addition, revision) of F&S-approved design or equipment must be submitted on the form with comments and recommendations from the Design Team prior to F&S acceptance. The comments and recommendations shall include the significant differences, any impact on the designed performance of the equipment and system and lifecycle analysis that includes future maintenance and operating costs.

Refer to the [building design standard variance request](#) that is required to be completed.