Len Evans Centre

SECTION 3

GREEN BUILDING PROGRAM GUIDELINES

GREEN BUILDING PROGRAM MANUAL

MANITOBA GREEN BUILDING PROGRAM

GREEN BUILDING PROGRAM GUIDELINES

The Green Building Program (GBP) guidelines were developed by the Green Building Co-ordination Team (GBCT) with help from Manitoba Hydro Power Smart New Business Program and industry consultants. The guidelines help building owners, government organizations and project teams interpret and apply green building program criteria.

The guidelines supplement other resources and should not be considered the primary source of information on the subject. Information in the guidelines is only intended to provide background, resource and guidance to support of the Green Building Program criteria.

CONTENTS PAGE

3.1
Project Co-ordination

What is the purpose of the Project Co-ordination Guideline?

The Green Building Project Co-ordination Guideline helps building owners and project professionals understand and co-ordinate the requirements of the Manitoba GBP. It highlights the program milestones at pre-design, design, construction and post occupancy stages.

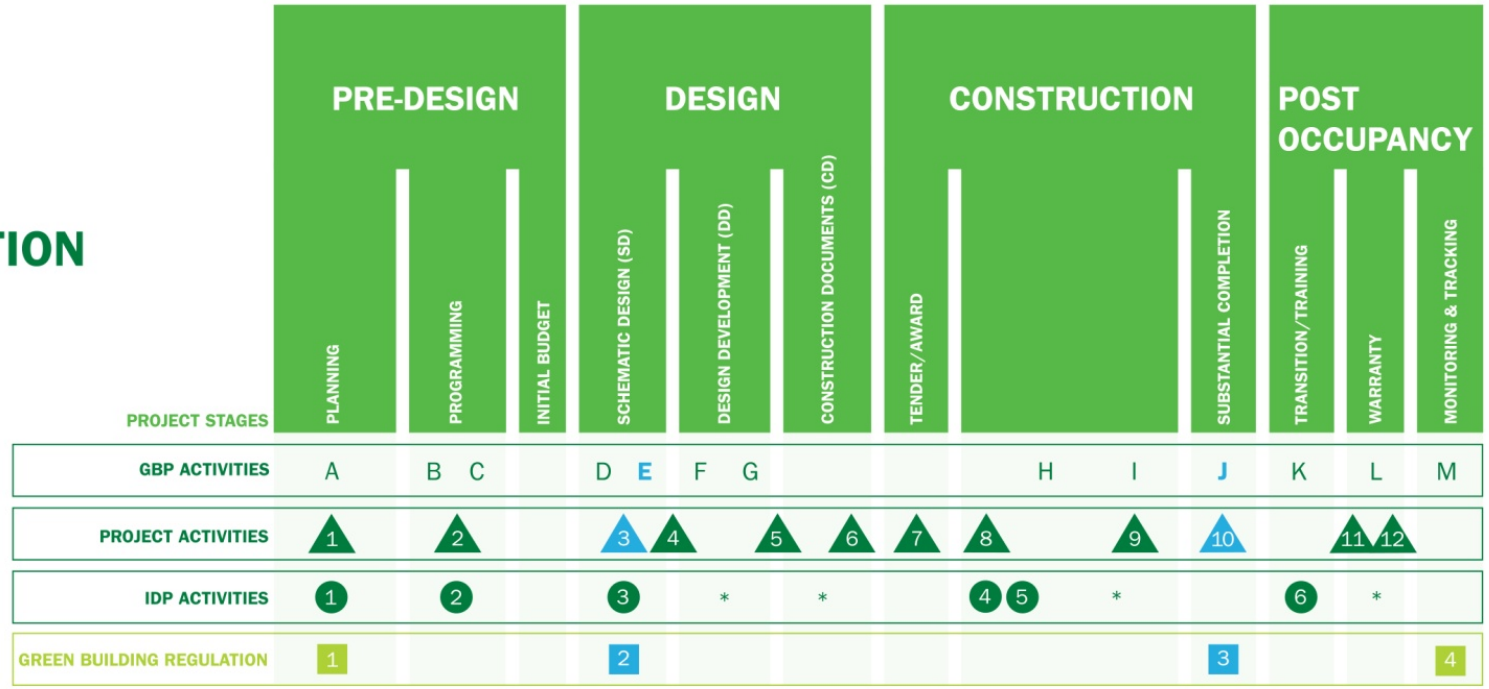
While the guideline is based on a conventional project delivery model of design, bid and build, the milestones and activities can be applied to other models (ex; construction management or design build). Management may adjust the guideline as appropriate to the specifics of each project and integrate it into the project schedule.

It is important to ensure that the timing of green milestones and activities align with specific project stages and activities. Approvals, reports and documentation must be completed in time to ensure the project's eligibility for designations, certifications and financial incentives (if applicable).

Print the Green Building Project Co-ordination Guideline and attach it to the Owner's Project Requirements (OPR) document. Review it with the project team throughout the project's design and construction to ensure the GBP criteria are implemented and that reporting is on track.

GREEN BUILDING PROJECT CO-ORDINATION GUIDELINE

October 2013



Applies to the Building Construction Project Team

Applies to Government Departments, Agencies and Crown Corporations.

Indicates Green Building Program Milestones

NOTE:

This chart is typical of conventional design/bid/ project delivery model. Timing for each phase may vary according to project size and scope. Other project delivery models need to adjust the steps and processes to accommodate project conditions.

MANITOBA GREEN BUILDING PROGRAM

greenbuilding@gov.mb.ca

GBP ACTIVITIES LEGEND
(Guide for building owners/ building representatives and funding recipients)

A. Review the Green Building Program (GBP) standards and practices
B. Submit MB Hydro Power Smart for Business New Buildings Program (PSNBP) application
C. Complete Owner's Project Requirements (OPR) with consultant
D. Have building simulation (energy) baseline model prepared
E. Submit GBP Form 1
F. Have building simulation model(s) prepared (at least 3 tested design scenarios)
G. Ensure Basis of Design (BoD) is prepared
H. Ensure building simulation compliance model is prepared
I. Receive Power Smart Designation
J. Submit GBP Form 2 and attachments
K. Receive commissioning documentation
L. Complete PSNBP Proven Performance Incentive forms (if applicable)
M. Attend post occupancy interview with GBP Representative

PROJECT ACTIVITIES LEGEND
(Guide for project managers)

1. Review IDP activities GBP and reporting mechanisms
2. Engage commissioning and programming consultants
3. Review GBP Form 1 (and variance considerations)
4. SD- Update Owner/Review/Obtain Owner Approval
5. DD- Update/Review/Approval
6. CD- Update/Review/Approval
7. Tender/ Award
8. Construction Start-up
9. System Commissioning
10. Substantial Completion/ Beginning of warranty period. Review GBP Form 2 (confirm variance conditions were satisfied)
11. Warranty review at 10 months
12. Warranty period ends

INTEGRATED DESIGN PROCESS (IDP) ACTIVITIES
(Guide for Consultant /IDP facilitator)

1. Schedule and conduct Business/Project Planning Meeting(s)
2. Schedule and conduct Programming Meeting(s)
3. Schedule and conduct Facility Performance/Multidisciplinary Team Start Up Meetings
4. Schedule and conduct General Contractor and Sub-contractor Start Up Meeting(s)
5. Schedule and conduct Construction Meeting(s)
6. Schedule and conduct Post Occupancy Deliverable Meeting(s)

* Schedule and conduct Multidisciplinary Team Meeting(s) at least one in each phase

NOTE:

This Schedule indicates the approximate timing of "first" meetings for the IDP Protocol. It is presumed subsequent meetings will be scheduled as appropriate to the project.

GREEN BUILDING REGULATION*
(Guide for Government Departments, Agencies and Crown Corporations)

1. GBP Liaison will advise agencies and branches who fund affected projects to include green building requirements in contracts and agreements and to report using GBP Forms.
2. Agency/branch will return completed GBP Form 1 to GBP Liaison. The Liaison confirms GBP Form 1 is also sent to Director of GBP.
3. Agency/branch does completeness check and returns completed GBP Form 2 to GBP liaison. The Liaison does performance and compliance review for organization. Then sends copy of Form 2 to Director of GBP.
4. GBP Liaison retains copies of GBP Forms in the event the organization (government department, agency or Crown Corp.) is audited for compliance to legislation or Green Building Policy directive.

* The Climate Change and Emissions Reductions Act, Green Building Regulation (C135-M.R. 38/2013)

3.2
Energy Modelling

What is energy modelling?

Energy modelling uses computer software to approximate the energy use of a building before it is built. It can help optimize the building design and support design team decisions that yield the greatest efficiency in the building's energy use.

Modelling has limitations:

It does not accurately predict the future. A design or compliance model doesn't accurately predict the actual energy use of the building. It estimates energy use under certain scenarios. An energy model provides information that should be used in the same way as a mileage rating for a new vehicle. The mileage rating is used to compare vehicles that have been subjected to similar testing standards. the rating sticker doesn't guarantee the vehicle's actual fuel-use. A building's energy model is not precise because there are too many variables to anticipate Examples include:

- The building may not get built exactly as designed.
- The occupants may use the building in ways other than predicted.
- The weather conditions may vary from the conditions used for the model.

Energy modelling is a tool that provides comparative scenarios that guides design decisions.

It is only as good as the inputs. Energy modelling is effective for supporting design decisions and assessing the life cycle costs of various options of the building design. However computer modelling relies heavily on the inputs provided by the project team. The adage "garbage in – garbage out" applies.

It requires commitment to an energy target. For best results identify the energy target early and stick to it, especially where an energy target is a requirement of a regulation, a funding agreement or certification program.

Despite the limitations, energy modelling is the most cost effective method of testing a proposed building design for energy use. It is irreplaceable when used in an iterative design process.

Why do I need an energy model?

Energy models are used to:

- **Demonstrate an energy efficiency target is being met in a building design.**
- **Design high performance buildings.** High performance buildings are developed using energy modeling because they provide more accuracy in evaluating design strategies that impact building energy consumption. The models have the capacity to examine strategies (ex: building orientation and shape, day lighting, shading and envelope insulation) in design stages of the project that would be extremely difficult to otherwise predict and costly to modify in later stages of the building process.
- **Provide a level of protection to the building owner.** When used correctly, the model takes a building design or construction idea and simulates how it might affect the building's energy efficiency and operating costs for years to come.

- Qualify building projects for rebate programs, incentives and green building ratings.
- Challenge conventional building systems and practices.
- Evaluate synergies to optimize building system design and equipment sizes.
- Identify areas with the greatest potential impact for energy efficiency.
- Test counter-intuitive building performance relationships.

How do I get an energy model?

Include the energy efficiency design target in the scope of work for the prime consultant (usually the architect) or mechanical engineer and include the expectation that the model will be independently verified by the Manitoba Hydro Power Smart for Business New Buildings Program other independent agency.

Energy modelling is normally performed by an engineer or independent consultant. Energy modelling and software must meet the minimum requirements of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard 90.1-2007 Appendix G, Section 3.

The Manitoba Green Building Program (GBP) recognizes two types of energy models:

- Prescriptive models (an energy model has already tested a series of specifications for a generic building type).
- Custom models (the services of an energy modeller are acquired to model the building's unique specifications).

The models are proof that certain design targets for energy efficiency were met or exceeded. The consultant, architect, engineer or energy modeller will be able to advise which model is best suited to the project.

Prescriptive models apply to simpler building types such as small offices, schools and community halls. They recognize that smaller, less complex buildings may reliably achieve performance gains by applying a set of key features to a building. Prescriptive models are limited to certain defined building types but are a good option to save on the cost of custom modelling.

PRESCRIPTIVE ENERGY MODELS

If a building is being designed using all the prescriptive measures of a recognized building program, there is assurance that the building will perform to a published level of energy efficiency. If a recognized building energy program is used, the services of an energy modeller will not be required and the design team can rely on the prescribed measures published by the program (known as the prescriptive model). NOTE: Prescriptive models MAY not be sufficient if the project is applying for a financial incentive or is pursuing a green building certification. Consult these programs directly to confirm. Examples of prescriptive models and the applicable programs:

Program	
Power Smart Designation (prescriptive design path)	Power Smart Design Standards
LEED® Certification	ASHRAE Advanced Energy Design Guide Advanced Buildings™ Core Performance Guide
NECB 2011	Prescriptive Path

CUSTOM ENERGY MODELS

A custom model is needed if a prescriptive building program does not fit the building because of its complexity, occupancy or size. In these situations, the services of a qualified energy modeller are required. Examples of custom models and the applicable programs:

Program	
Power Smart Designation[1]	Power Smart Custom Design Path
Power Smart Custom Design Path Incentive[1]	Power Smart Custom Design Path
LEED® Certification	ASHRAE 90.1 Model
Green Globes™ Certification (any level)	Custom Model
NECB 2011	Performance Path

[1] *Manitoba Hydro Power Smart for Business New Buildings Program*

What does energy modelling cost?

Costs depend on the building's complexity, size and requirements of the model. The cost of energy modelling services for a simple building project with an area of 1800 m^2 (20,000 ft^2) or less could range between $10,000 and $15,000.

The cost depends on the scope of services being provided and the skill of the modeller. Multiple quotes with details of the scope of work should be obtained to allow comparison. The modeller should at least provide: a baseline model, a compliance model, a minimum of three design scenarios and the reports as outlined in the next section What will I get and when?.

The above estimate does not include the cost of third party verification of the energy model. This is a requirement for some projects affected by the Manitoba GBP). Verification fees are also not included in certification costs if the project pursues, LEED® or Green Globes™. Verification fees may cost about $5,000.

What will I get and when?

These deliverables should be discussed with the project architect and engineer to ensure they are included in the project contracts and documents.

At a **minimum,** the energy modeller should provide:

- A report at each milestone of the project (schematic design, design development, construction documents, occupancy). The report must identify the input variables and the predicted energy performance using the variables at this stage of design.
- A baseline model representing minimum requirements of the Model National Energy Code for Buildings in Canada (MNEBC) (1997) at conceptual design.
- At least three tested design scenarios.
- A compliance model before occupancy simulating the final building design.

Optional requirements (not included in the average energy modelling cost):

A **calibrated model** which aligns the compliance model with actual performance after the building is constructed. This model can be used to effectively represent the real world performance of a new building. It is required if the project is pursuing the Measurement and Verification credit in LEED® or the performance incentive under the Power Smart for Business New Buildings Program.

A **fuel neutral analysis** is useful to provide a performance indicator for the building efficiency, independent of the fuel type. It is required to qualify for designation under Manitoba Hydro's Power Smart for Business New Buildings Program Custom Design Path.

Resources:

For information about the economic benefits of modelling, go to: facilities net.com and search for:

- Understanding What an Energy Model Can and Can't Do Is Critical To Its Success by Clark Denson (June 2011)
- Realistic Expectations Needed to get Most out of Energy Modeling by Clark Denson (June 2011)
- Energy Modeling Provides Benchmark of Benefits for Investments by Mehdi Jalyerian and David Callan (June 2010)

3.3
Integrated Design Process

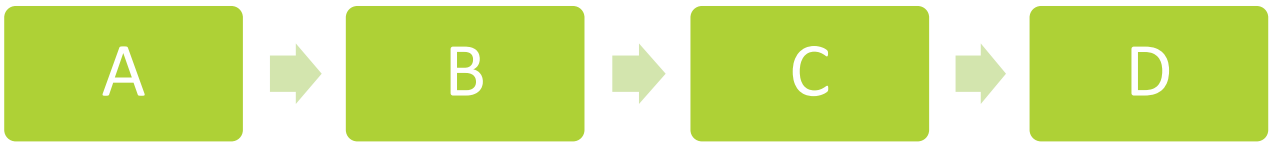
What is IDP?

Integrated design process (IDP) is a collaborative process that emphasizes a holistic approach to building design.

How is IDP different from conventional building design practices?

Conventional design proceeds is a process that is developed in a linear manner. Generally, someone determines what the building will look like. Then someone else decides what the systems will be. Then someone else builds it. Then someone else operates it. Conventional design does not accommodate changes to design without imposing cost or scheduling implications on the project.

The conventional design process is linear

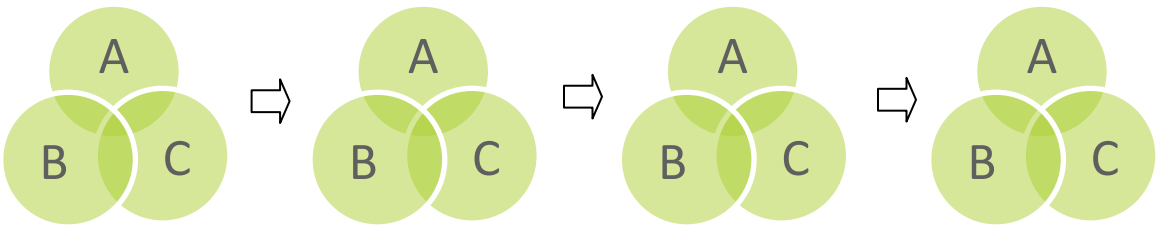


Phase 1 Phase 2 Phase 3 Phase 4

In IDP, a building is treated as an interdependent system. The building's stakeholders are brought together as an interdisciplinary team at the beginning. Their role is to explore, test and evaluate a broad range of solutions to find those with the greatest potential. In IDP, the team actively consult each other and contribute to the development of the final building design. Throughout the process, the team evaluates design suggestions and looks for synergies and tradeoffs that could create savings in the early stages of the building design.

For example: a decision to eliminate windows on the side of a building might justify reducing the size of heating, ventilation and air conditioning (HVAC) equipment. Any savings that result from using a smaller HVAC system and eliminating the windows, identifies funds that will be available for other features of the project, without compromising the building function, comfort or the total budget.

IDP for Decision Making and Design is collaborative



Phase 1 Phase 2 Phase 3 Phase 4

Who should be represented on the interdisciplinary project team?

Representatives should be appointed to the team to represent their speciality, discipline or interest. Team members are appointed by the owner and prime consultant and can include:

A. **owner**: responsible for establishing project goals, budget and expectations
B. **owner's representative**
C. **building commissioning professional**
D. **building occupant representatives**
E. **building maintenance and operation representatives**
F. **architect**
G. **prime consultant**
H. **IDP facilitator**
I. **construction manager**
J. **civil engineer**
K. **landscape architect**
L. **mechanical and electrical engineers**
M. **specialized consultants** (acoustics, lighting, ecology)

What are the components a successful integrated design process?

1. **Establish measureable project goals and expectations.** Identify measurable building goals and expectations for the project early in the pre-design stage (see the Manitoba GBP Criteria and the Project Co-ordination Guideline).

   The owner's goals and project expectations are clearly communicated to the entire project team using a owner's project requirements (OPR) document. Use the OPR to specify that IDP must be used and assign the responsibility to oversee the IDP activities to someone (ex: IDP facilitator). See the OPR Guideline in Section 3.6.

2. **Assemble an interdisciplinary project team.** Assemble a team of stakeholders and professionals with relevant disciplines. Team members should have the relevant skills, knowledge, values and perspectives to satisfy the owner's project expectations. The team must be cohesive and collaborative. Once the membership of the team is established, allocate responsibilities, identify the contracting and reporting responsibilities, discuss the fee structure for services (ex: charrettes or energy modelling) and address risk tolerance and risk management strategies that support the decision making processes.

3. **Consult the interdisciplinary project team at key stages throughout the project.** Appoint an IDP facilitator. The facilitator will run planning and design meetings at key points throughout the project that include all members of the interdisciplinary project team. These meetings are design charrettes.

   A list of IDP meeting types, their purpose and the timing are outlined in the following chart. (See the Project Co-ordination Guideline for a recommended schedule of IDP meetings.)

IDP Meeting Chart

Type of IDP Meeting	Purpose	Timing
Comprehensive business/project planning meeting(s)	Identify building project requirements, budget, site issues, schedules or other constraints, etc.	Pre-Design - planning stage
Programming meeting(s)	Determine building's programming requirements.	Pre-Design - program stage
Facility performance meeting(s)	Discuss facility performance requirements.	Within the first 2-3 weeks of the Design - schematic design stage
Multidisciplinary team meetings	Review owner's project goals, discuss design features/building requirements and design options highlighting implications, if any to the interests of areas represented by the team members.	At least once at each stage of the project. Pre-Design, Schematic Design, Design Development, Construction Documents, Construction and Post Occupancy.
General contractor and sub-contractor meetings	Review owner's project goals, objectives, Pollution and Contamination Prevention Plans documentation and reporting requirements.	Pre-Construction
Construction meetings	Review project goals, objectives, Pollution and Contamination Prevention Plans documentation and reporting requirements.	Construction
Post -occupancy deliverable Meetings	Review how operating practices (utility monitoring, commissioning activities), occupant complaints and building maintenance issues will be monitored at occupancy and annually thereafter.	Substantial Completion and Warranty Period

4. **Apprize owner of progress and achievements at key stages of the project.** The prime consultant will monitor how IDP is working; ensure collaboration occurs throughout the design process; and report progress to the project owner at each stage of the project. The reports will highlight design decisions that affect the project's goals, expectations or budget.

Project teams are encouraged to go beyond what is described in the IDP Guideline to recognize the unique conditions of each project. IDP is effective and should be implemented to the extent that is practical for project size, complexity and budget.

What does IDP cost?

IDP is a process and its cost is embedded in the professional services of your project team. Typically, a project team that employs IDP will spend more time in the design stage of a project because design decisions will require more testing and consultation. Benefits may include:

- reduced initial capital cost
- fewer change orders
- fewer construction delays
- lower long term operating costs

Overall, the outcomes of using IDP more than offset the costs of requiring it.

For more information on IDP search the internet for:
Roadmap for the Integrated Design Process, BC Green Building Roundtable, 2007

3.4
Pollution & Contamination Prevention Planning

Construction activities have the potential to pollute and contaminate the environment harming workers, the community, building occupants and ecosystems. It is the responsibility of the building owner and the project team to ensure safeguards are in place to reduce the impact of waste, pollutants and contaminants generated during construction.

What is a Pollution and Contamination Prevention Plan?

A construction Pollution and Contamination Prevention (PCP) plan is a document(s) that outlines safeguards, specific procedures and preventive measures that will be enforced during construction. A PCP plan normally contains three components:

1. Construction waste management plan
2. Construction erosion and sedimentation control plan
3. Construction indoor air quality plan

Collectively, these help to ensure that potential pollution and contamination generated during construction are minimized. Also, if they are discovered, a plan for remediation is in place and executed quickly.

How much does a PCP plan cost?

PCP Plans are not typically included in conventional construction projects so the there will be a small additional cost to have them in place and executed. The cost of a PCP plan will vary based on conditions at each project. For example, the cost for erosion and sediment control measures will based on slope conditions, plant coverage, proximity to natural waterways and neighbouring occupancies. However costs for construction waste diversion in urban areas can be negligible. Generally, PCPs are fairly well established as common construction practice in Manitoba and the associated costs are competitive.

What should the owner expect and when?

Once the design team has reviewed each component of the PCP Plan with the Owner, regular reporting on the status of PCP activities (positive or negative) is essential. It is needed to keep all members of the project team informed of any occurrences that could compromise certification or the health of workers, the community, building occupants or ecosystems. Owners should expect to receive:

- regular reports on the status and activity of each component of the PCP plan during construction
- written summary reports and supporting documents verifying compliance with each component of the PCP plan after construction

If the project is pursuing a green building certification, the contractor and the design team must meet the requirements of the certification program. They must also collaborate to ensure the requirements are communicated to the subcontractors and trades and that the documents and reports are collected in a timely manner. For example: a construction waste diversion report is required for the GBP at substantial completion of the building.

What should be included in each component of a PCP plan?

The PCP Plan is developed by the contractor in response to specifications and site analysis provided by the design team. These activities and measures should be included in each of the component plans.

Note: The component plans are not limited to the described activities and measures.

1. Construction Waste Management Plan (WMP)

The construction WMP establishes practices and procedures to divert construction and demolition waste from municipal landfill. It reduces, recovers, reuses and recycles materials. The contractor (or delegate) develops and implements the plan and provides a diversion report at the end of the project.

The construction WMP should contain:

- The project's construction waste diversion targets can be a statement to maximize opportunities for diversion or state and actual target (ex: a minimum 50% diversion target is very achievable in urban areas).
- The types of construction and demolition waste to be generated during construction should be noted.
- The types of construction and demolition waste to be collected and monitored at the site should be noted.
- Where and how the waste will be collected (ex: separated or mingled) and stored should be stated.
- Destination of waste (where waste will end up) should be stated.
- How waste will be measured (GBP Form 2 reporting requires that waste be measured by the tonne) should be shown.
- Reporting mechanisms, schedules and templates should be outlined.
- There should be descriptions of methods used to inform workers of the site's waste management practices.

Note: Excavation or land-clearing debris is not considered construction, demolition or renovation waste and would not require tracking.

2. Construction Erosion and Sedimentation Control Plan (ESC)

The construction ESC plan describes the activities, practices or devices used to prevent or reduce erosion or sediment. It should cover:

- the release of sediment and other pollutants into receiving water bodies, streams, catch basins, or other environmentally sensitive areas
- the detachment of soil particles at locations on the site into surrounding areas

The roles and responsibilities for an ESC plan depend on the extent and complexity of a project. The owner and design team identify areas of concern and the appropriate extent of erosion and sedimentation control required in the construction drawings and specification. The contractor then prepares a construction ESC plan describing the temporary procedure, vegetation and mechanical control measures to be used during active construction.

Typically, the contractor's ESC plan should describe activities specific to:

- site housekeeping
- erosion control
- transport control
- sedimentation control

Site housekeeping activities are the practices that mitigate the transport of mud or dust generated by activities at the construction site. Practices include:

- designating locations for construction vehicles to enter or exit the site
- gravelling or paving access roads to minimize tracking of mud off-site
- designating internal haul roads and or track packs to reduce offsite tracking
- installing a wash down facility for truck wheels before vehicles leave the site
- protecting catch basins and manholes from sediment and debris
- implementing dust control measures (ex: vegetation, water, windbreaks, screens) and limit vehicle speeds to prevent blowing dust from disturbed soil surfaces
- removing accumulated sediment and debris as required
- removing construction materials and structures when construction is done
- placing dirt and soil stockpiles away from watercourses, environmentally sensitive areas, drainage course, ravings and existing adjacent developments
- placing physical barriers around the perimeter of the construction site to protect surrounding areas from debris, sediment and other particulates

Erosion control activities are the practices that minimize soil detachment from taking place. These activities protect exposed surfaces and control run off by maintaining existing vegetation or applying slope treatments, seeding, mulching, sodding, erosion control blankets or mats and dust control.

Transport control activities are practices that manage the velocity and flow of storm water at the site to minimize erosion and channel sediment to desired locations. Control activities are accomplished by directing storm water away from exposed soils. Typical practices include channelling water into

grassed waterways, creating storm water ditches or channels, or installing silt fences, buffer strips, filters and check dams.

Sedimentation control activities are practices that capture eroded soil by filtration or the deposit of sediment from the water flow. Typical practices may include settling ponds and filters. Measures may be temporary or permanent.

Temporary measures are implemented during construction and ultimately will be removed, or will naturally biodegrade or photo-degrade. Temporary measures include: silt fences and fabrics, sediment control basins, seeding and mulching, use of diversions and install pipes to manage concentrated flows.

Permanent measures are part of the project design, provided by the design team, and become part of the long term site storm water management plan. Permanent ESC plan measures may include: infiltration basins and trenches, grassed swales, vegetation strips, sediment basins, wet ponds and detention ponds and constructed wetlands.

Note: These activities can serve more than one purpose. It is not intended that all the activities need to be used at every job.

3. Construction Indoor Air Quality (IAQ) Management Plan

The indoor air quality (IAQ) of a building can become contaminated with substances that are harmful to human health even before it is occupied. An IAQ Management plan identifies practices and measures during construction to ensure a healthier indoor environment for jobsite workers and future occupants. As a result, the building will be physically cleaner, have a hygienic air handling system and be less prone to mould and moisture.

The owner should include construction indoor air quality management in the OPR. The design team should integrate the requirement into the construction specifications. The contractor will develop the IAQ Management Plan based on the specifications provided. Contractors must audit work activities at least monthly to confirm the IAQ Management Plan is being followed. Photographs should be taken at each inspection to document the practices at the construction site. They will be essential if the project is pursuing a green building certification.

Normally, IAQ Management plans identify the construction practices to protect air quality under[1]:

- HVAC system protection
- contaminant source control
- pathway interruption
- housekeeping
- scheduling

Although no two construction projects are identical, IAQ Management Plans have many similarities. There are many practices or activities that are shared by most plans.

HVAC protection measures:

- Avoid using the installed building HVAC systems during construction and demolition where possible. Consider using temporary ventilation units to protect permanent systems.

[1] Based on Sheet Metal and Air Conditioning Contractors National Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3)

- If using the installed building HVAC systems during construction and demolition:
    - do frequent maintenance while the HVAC system is being used
    - use filters at air intakes and returns
    - replace filters as they become loaded, before building flush out and before occupancy
- Shut down installed HVAC system and seal off the supply diffusers and return air ducts:
    - during any demolition
    - when performing construction activities that produce dust, such as drywall sanding, concrete cutting, masonry work, wood sawing or adding insulation
    - whenever the HVAC system is not in use during construction, to prevent accumulation of dust and debris
- Do not store construction or waste materials in mechanical rooms
- Provide periodic duct inspections during construction. If the ducts are contaminated, clean them professionally in accordance with National Air Duct Cleaning Association (NADCA) Standards.
- The general contractor should take photographs to show the measures are in place.

Contaminant source control measures:

- Identify control measures for handling and storing materials containing Volatile Organic Compound (VOC) and other toxic ingredients.
- Restrict traffic volume and prohibit idling of motor vehicles where fumes could be drawn into the building.
- Use electric or natural gas alternatives instead of gasoline and diesel equipment, where possible
- Cycle equipment off when not being used or needed.
- Exhaust pollution sources to the outside with portable fan systems. Prevent exhaust from re-circulating back into the building.
- Keep containers of wet products closed as much as possible. Cover or seal containers of waste materials that can release odour or dust.
- Protect porous materials, such as insulation and ceiling tiles, from exposure to moisture.
- The general contractor should take photographs to show measures are in place.

Pathway interruption measures:

- Provide dust curtains and/or differential pressurization to prevent dust and odours from migrating to clean or occupied areas.
- Minimize accumulation of air contaminants in occupied or work spaces by managing ventilation. Shut down supply and exhaust systems to isolate pollution or exhaust contaminated air directly to the outside.
- The general contractor should take photographs to show measures are in place.

Housekeeping measures:

- Clean HVAC equipment and building spaces regularly to remove contaminants from the building prior to occupancy.
- Keep all coils, air filters, fans and ductwork clean during installation and construction. If required, clean before performing the testing, adjusting and balancing of the systems.
- Suppress and minimize dust with wetting agents or sweeping compounds. Use efficient and effective dust collecting methods such as damp cloth, wet mop, or vacuum with particulate filters, or a wet scrubber.
- Remove accumulation of water inside the building.
- Thoroughly clean all interior surfaces before replacing filters and running HVAC system for system balancing, commissioning and building flush out.
- Provide photographs of these activities during construction, to document compliance.

Scheduling measures:

- Schedule activities that use high VOC emitting products (ex: paints, sealers, insulation, adhesives, caulking, cleaners) before installing highly absorbent materials (ex: ceiling tiles, gypsum wall board, fabric furnishings, carpet, insulation. These materials act as sinks for VOCs, odors and other contaminants and will release them later occupancy.

Resources:

Waste Management:

Use an internet search engine to search for Develop a Waste Management Plan BRANZ; or go to: www.branc.co.nz

Erosion and Sedimentation Control:
Use an internet search engine to search for:
Erosion & Sedimentation Control Guideline for Urban Construction (Dec. 2006)
Alberta Transportation Erosion and Sediment control Manual (June 2011)

Indoor Air Quality Management:

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 30)

3.5
BUILDING COMMISSIONING

What is building commissioning?

Commissioning is a process that ensures a building is designed, constructed and operated in accordance with the requirements of the Owner's Project Requirements (OPR) document. The commissioning process will ensure building systems are properly sized and calibrated and that facility operators have the training and resources they need to effectively manage a new building.

Commissioning is determined by project size, complexity and budget. Owners need to evaluate building commissioning decisions carefully. Opting out of commissioning won't save money in the long run. Building commissioning can reduce the risk that something will be missed during planning or construction causing mechanical inefficiencies or increased operating costs over the building's life. Protect your investment and rely on building commissioning to ensure:

- building systems are documented, verified, inventoried and calibrated for performance
- a comprehensive systems manual is assembled
- training is provided for the operations staff so they will know how to operate the building efficiently and economically for years to come

An owner should hire or appoint a building commissioning professional as early as the pre-design stage. Commissioning professionals lead, plan, schedule and co-ordinate the implementation of the project commissioning and can help owners develop a solid OPR document.

What are the qualifications of a building commissioning professional?

A building commissioning professional can be a person or an entity. Commissioning professionals are also known as "Commissioning Authorities (CxA)" or "Commissioning Agents (CxA)". Depending on the complexity of the project, it may involve a team of commissioning agents with different specialties, (ex: building design, construction or testing).

Green building has increased the demand for building commissioning professionals with certifications such as those offered by the University of Wisconsin-Madison (CxAP℠ - Accredited Commissioning Process Authority Professional, CxM℠ - Accredited Commissioning Process Manager, and GCxP℠ - Accredited Green Commissioning Process Provider), or the Building Commissioning Association (CCP – Certified Commissioning Professional, ACP – Associate Commissioning Professional, CCF – Certified Commissioning Firm).

There is a shortage of certified commissioning professionals in Manitoba. Owners must rely on the applicant's experience, reputation and professional resume. At minimum, the professional's resume should confirm they:

- have building commissioning experience with two or more projects of similar occupancy, size and/or complexity
- have technical knowledge of the systems that need to be commissioned
- have a complete understanding of the commissioning process and indicate compliance with a recognized commissioning protocol such as:
    - ASHRAE Guideline 0-2005 - The Commissioning Process

  - ANSI/ASHRAE/IES Standard 202-2013 - Commissioning Process for Buildings and Systems
  - CSA Z320-11 Building Commissioning
- have organization, documentation, communication and team-building skills to lead and coordinate a commissioning team and ensure the OPR is met
- have experience writing commissioning specifications
- have experience verifying training requirements including the development of operations and maintenance systems manuals.

A building commissioning professional should not be directly involved in the design or construction of the project. Independent parties are more objective and are able to play a quality assurance role. If the available commissioning professional, happens to be an employee of the design or construction firm involved in your project, they should not be directly involved in the design or construction aspects of the project.

What does a building commissioning professional do?

It is up to the owner to set the commissioning professional's scope of work. At the very least, the commissioning professional should be hired to:

- contribute to the development of the OPR
- develop the Commissioning Plan
- compare the Basis of Design (BoD) to the OPR
- do a design review
- ensure commissioning requirements are included in project specifications
- develop construction checklists and functional test requirements
- verify/spot check submittals
- run commissioning team meetings
- do periodic site visits to meet with team members, review construction and verify/spot check the completion of construction checklists by the trades
- witness start-up and execution of functional testing
- co-ordinate and verify training and training manuals for operator, maintenance and building occupants
- assemble the systems manual
- issue a commissioning report

Optional: An owner may also ask the commissioning professional to:

- conduct seasonal testing
- establish an ongoing commissioning program for the building/facility

The involvement of the commissioning professional and the degree of detail identified in the commissioning plan, depends on the commissioning professional's assessment of the project's complexity, budget and the owner's expectations, experience, resources and risk tolerance.

The commissioning professional's role during planning, design, construction and occupancy may also be affected by the requirements of funding agreements or building certification programs (ex: LEED®, Green Globes, Power Smart).

Green building certification and quality assurance programs (ex: LEED® and Power Smart New Buildings Program) require building commissioning for baseline participation. Discuss the commissioning process and hire a commissioning professional before the pre-design stage.

What does building commissioning cost?

The cost of commissioning a building depends on the requested commissioning activities, the size of the building, and the number, type and complexity of systems. Generally, the cost of commissioning new buildings will range from .5% of the total construction cost (for relatively simple projects such as an office building) to 1.5% for complex laboratories and medical facilities. This would include the services of the building commissioning professional.

For system based commissioning, budget 2% and 4% of the construction cost of each system being commissioned.

Commissioning is an essential component of the project budget and reduces the costs of change orders during construction and the costs of operating the building once it is occupied. The commissioning professional provides quality assurance on your investment, so allocate the project budget appropriately.

The National Institute of Building Sciences reports commissioning can create savings of $4 for every $1 invested over the first five years of occupancy. This represents the cost of correcting deficiencies plus the cost of inefficient operations.

Commissioning adds tangible value to the building project and delivers assurance that it will perform to the owner's expectations throughout occupancy. Commissioning affects the project from design to occupancy and the pay-off occurs after the building is built.

Resources:

Use an internet search engine to find:

The Whole Building Design Guide: Building Commissioning, National Institute of Building Sciences;
Commissioning Guide for New Buildings, Natural Resources Canada, 2010

3.6
OWNER'S PROJECT REQUIREMENTS

What is the Owner's Project Requirements?

An Owner's Project Requirements (OPR) is a document that describes the building owner's goals, expectations and requirements for the building project and its commissioned systems. It is used throughout the project delivery and commissioning process as a reference for baseline decision making. It contains the owner's performance expectations. It is consulted during design development and at occupancy it is used to verify that the building systems' energy and environmental performance meet the original criteria of the owner.

An OPR needs to be completed in consultation with the design team during pre-design on a new construction project. The document becomes an integral guideline and design tool during the project.

Updates to the OPR will be made by members of the project team throughout the course of project. The updates reflect new decisions and agreements co-ordinated with, and agreed to, by the owner and the design team.

Why do I need an OPR?

The OPR contains the owner's requirements. Without an OPR, members of the project team will not have the information they need to satisfy the owner`s expectations.

At the end of the project, the OPR document should be passed onto the building operations and maintenance staff as part of the systems manual. Operation and maintenance staff will refer to the OPR to answer questions about the building, systems and equipment so they can be maintained optimally over their useful life.

What is included in an OPR?

As a minimum, an OPR should provide clear, concise instructions for:

- owner and user requirements
- environmental and sustainability goals
- energy efficiency goals
- indoor environmental quality requirements
- equipment and systems expectations
- building occupant expectations and
- operation and maintenance personnel expectations

If your organization does not have an OPR template, you can download a template from the Manitoba Green Building Program website at: www.gov.mb.ca/mit/greenbuilding/index.html

The OPR template was developed by the Manitoba Hydro Power Smart Program and is provided with their permission.

Resources:

Manitoba Hydro New Buildings Program, Custom Design Path Program Guide, 2013 (request the Manitoba Hydro Owner's Project Requirements template or download it from the Manitoba Green Building Program website: www.gov.mb.ca/mit/greenbuilding/index.html