# Table of Contents

0.0 General Requirements ........................................................................................................pdf 4  
   Design Principles ................................................................................................................pdf 7

1.0 Sustainability ....................................................................................................................pdf 27

2.0 Building Envelope .............................................................................................................pdf 32

3.0 Interior Design ..................................................................................................................pdf 47

4.0 Structural ........................................................................................................................pdf 70

5.0 Mechanical .......................................................................................................................pdf 87

6.0 Electrical ..........................................................................................................................pdf 166

7.0 Acoustical .........................................................................................................................pdf 216

8.0 Barrier-Free ......................................................................................................................pdf 242

9.0 Municipal and Environmental Engineering .....................................................................pdf 248

10.0 Landscape Development ...............................................................................................pdf 255

11.0 Environmental Hazards .................................................................................................pdf 260

12.0 Crime Prevention Through Environmental Design (CPTED) .......................................pdf 265

13.0 Digital Project Delivery ..................................................................................................pdf 266

Appendix A – Acronyms .......................................................................................................pdf 268

Appendix B – Flood Risk Management Guidelines ..............................................................pdf 271
Appendix C – Guideline for Wildfire Protection of Institutional Buildings in Forested Regions of Alberta ..........................................................pdf 272

Appendix D – Standard Envelope Details..........................................................................................pdf 273

Appendix E – Standard Millwork Details .........................................................................................pdf 347

Appendix F – Standard Interior Partition Details ..............................................................................pdf 360

Appendix G - Green Building Standards..........................................................................................pdf 383

Appendix H - Transportation and Site Requirements .........................................................................pdf 413

Appendix I – Workspace Furniture Typical.......................................................................................pdf 415
# 0.0 General Requirements

## 0.1 Introduction
- Design Principles for Publicly Funded Infrastructure .............................................. 2
- Functionality Standards ............................................................................................... 2
- Statement of Design Objectives (SDO) ......................................................................... 2

## 0.2 Design Principles for Publicly Funded Infrastructure ........................................ 3
- Background ................................................................................................................. 3
- Functionality ............................................................................................................... 3
- Sustainability ............................................................................................................. 4
- Flexibility and Adaptability ....................................................................................... 5
- Affordability ............................................................................................................... 6
- Accessibility .............................................................................................................. 6
- Form .......................................................................................................................... 6
- Summary ................................................................................................................... 7

## 0.3 Functionality Standards ....................................................................................... 8
- Preamble .................................................................................................................... 8
- A Principle (a general subject or theme) .................................................................... 8
  .1 Health and Wellness of Building Users .................................................................. 8
  .2 Flexibility/Adaptability ......................................................................................... 9
  .3 Sustainability ......................................................................................................... 9
  .4 Durability ............................................................................................................... 10
  .5 Constructability .................................................................................................... 10
  .6 Rational Planning ................................................................................................ 11
  .7 Roofing ................................................................................................................ 11
  .8 Building Science for Life Cycle Value .................................................................... 12
  .9 Passive Climatic Response .................................................................................... 13
  .10 Community ......................................................................................................... 13
  .11 Responsible Architecture ................................................................................... 13
  .12 Value by Design .................................................................................................. 14
  .13 Integrated Design ............................................................................................... 14
  .14 Codes/ Life Safety .............................................................................................. 15
.15 Universal, Active and Accessible Design ................................................................. 15
.16 Inspiration .................................................................................................................. 15
.17 Acoustics .................................................................................................................... 16
.18 Security ....................................................................................................................... 17
Links .............................................................................................................................. 17

0.4 Statement of Design Objectives (SDO) ................................................................ 19

Sample Statement of Design Objectives ...................................................................... 20
0.1 Introduction

The purpose of the Technical Design Requirements for Alberta Infrastructure Facilities (TDR) document is to provide architects, engineers, contractors, client groups, facility administrators and operators involved in designing and building facilities with a comprehensive set of requirements.

The requirements have been developed by Alberta Infrastructure Technical Services and Procurement Branch by consolidating best practices information, from the position of knowledgeable owner, as well as national and international subject matter experts. They are based on components and systems which have proven to be reliable and efficient, to meet the needs of the users, and to have acceptable life cycle costs.

The requirements are intended as a minimum for planning new facilities and renovating and operating existing facilities. Innovative designs, products, systems and technology are encouraged after thorough evaluation of potential benefits and risks, value analysis and life cycle cost. Early and regular involvement by Technical Services staff is recommended when proposing alternatives.

The Crime Prevention through Environmental Design (CPTED) Principles of natural access control, natural surveillance, territorial reinforcement and maintainability shall be applied to all Alberta Infrastructure projects. At the request of Alberta Infrastructure, a written CPTED Assessment may be required. See Section 12.0 for more information.

The Technical Design Requirements for Alberta Infrastructure Facilities is a “living document” and will be updated to address ongoing changes in facilities design and technology. The latest version can be viewed or downloaded in electronic format, through the Infrastructure Technical Resources (ITR) website. (https://www.alberta.ca/infrastructure-technical-resources.aspx)

Your input to the progressive updating of this document is invited. Please direct comments to the undersigned:
Standards and Specifications Specialist
Technical Services and Procurement Branch
Alberta Infrastructure
3rd Floor, 6950 - 113 Street
Edmonton, AB T6H 5V7
T | 780-422-7456
F | 780-422-7479
infras.trc@gov.ab.ca

Publication Version: v6

Effective Date of Publication: September 30th, 2020
Design Principles

Introduction

Infrastructure is responsible for the provision of public facilities that meet stakeholder requirements, as well as the Province’s environmental, social, and economic values. Regardless of building type, the overall mandate of Infrastructure is to design, construct, and operate publicly funded facilities in a manner that is valuable and accountable to Albertans.

This document is comprised of three sections that outline the broad design priorities of the Government of Alberta (GoA), and establishes specific criteria for a project-appropriate design response. Infrastructure seeks to inform project teams of these expectations in order to deliver efficient, functional buildings and to avoid time, cost, and quality concerns.

.1 Design Principles for Publicly Funded Infrastructure

All GoA projects shall receive a high degree of design consideration; however, distinctions must be made between signature, above average, and more routine buildings. *Design Principles for Publicly Funded Infrastructure* provides an overview of the outcomes required for the design, construction, operation, and maintenance of all GoA funded facilities. The purpose of this disciplined planning approach is to achieve balanced and holistic outcomes that are mutually beneficial to the short term goals of the Project Team and the long-term requirements of the Owner.

.2 Functionality Standards

As a knowledgeable owner, Infrastructure has extensive experience with the design, construction, and operation of its facilities. Based on this experience, Infrastructure has developed a set of *Functionality Standards* that provide specific planning, technical, and operational strategies for the guidance of Project Teams. These strategies serve to ensure that the facility performs optimally throughout its lifecycle.

.3 Statement of Design Objectives (SDO)

The SDO is developed by the Owner for inclusion in the project Request for Proposals (RFP) and Project Charter. It states the Owner’s design and functional priorities for the Project Team, including the Project Manager, Consultants, and key stakeholders. The SDO should be included and responded to by the Consultant in the Schematic Design and Design Development phases, through written narrative and graphic representation.
0.2 Design Principles for Publicly Funded Infrastructure

The Infrastructure Design Principles are intended to influence the design, construction, operation, and maintenance of all GoA funded projects. They guide the level of design for each project to be appropriate for its purpose, place, and use. The Design Principles are outcome focused to ensure an integrated approach is adopted by all stakeholders throughout each design phase.

Background

The design, delivery, operation, and maintenance of quality infrastructure is central to the Government’s commitments to Albertans. Infrastructure is responsible for the provision of public facilities that meet stakeholder needs in a cost effective and efficient manner, consistent with the Province’s environmental, social, and economic values. In collaboration with boards, agencies, and industry, the Ministry aims to enhance the value of building infrastructure by leveraging the collective technical experience of all related subject areas, including planning, design, construction, acquisition, and renovation.

The design process offers opportunities to reduce emissions and to optimize energy efficiency and climate resilience. Facilities should be flexible and adaptable over the long-term, well integrated into their context, and accessible to all Albertans.

Consistent with the Government’s priorities, Infrastructure projects must achieve effective and efficient program outcomes within the parameters of time, budget, scope, and quality. The optimization of infrastructure and asset management requires overarching principles to align practices, standards, and programs in order to deliver effective, affordable, and sustainable publicly funded facilities.

The Design Principles emphasize building performance and use over the life of a facility; this fosters innovative solutions that are fiscally responsible, functionally appropriate, and operationally efficient. A clear understanding of the functional, physical, and operational requirements of a project is essential to ensuring its success. The principles are: functionality; sustainability; flexibility and adaptability; affordability; accessibility; and form.

Functionality

Every design is expected to perform a primary function. Most functions can be achieved in a variety of ways, but there are some basic elements that must be taken into account in order to create a solution that best fulfills the building’s intended function. The intent to develop a project is derived from an endorsed need, purpose, or mission, and a desired outcome. When the design of a facility satisfies the technical, operational, emotional, cognitive, cultural, and accessibility needs of the people who use it, the project is functionally successful. One of the key indicators of a quality building is the ability to function as intended over its life span.
Functional design is both a process and an outcome. As a process, functional design is a set of practices guided by the principles that produce a positive outcome; as an outcome, it describes facilities that work well in the performance of their required tasks. Functionality must be considered in conjunction with all other principles to ensure that the overall approach is fully integrated and effective, even when faced with the certainty of compromises and trade-offs.

**Sustainability**

Low-carbon design and planning is a priority. Sustainable designs reduce negative impacts on the environment, promote the health and comfort of building occupants, and optimize the life-cycle operation and maintenance of a facility, thereby improving the building’s performance. Approximately 90% of a building’s life-cycle cost can be attributed to operation and maintenance; strategically invested capital premiums may be offset many times over a building’s lifespan.

Sustainable design principles include:

- **Optimize site selection:** the location, orientation, and landscaping of a building affects local ecosystems, transportation methods, and energy use. Soil condition, proximity to flood plains, geography, and availability of offsite services can all impact the cost and complexity of construction. Consider and give priority to the reuse or rehabilitation of existing buildings and sites over new construction.

- **Minimize energy consumption:** it is essential to reduce energy loads, increase efficiency, and replace conventional energy sources with renewables where possible. Minimize energy use in new buildings and improve energy performance in existing buildings to reduce environmental impacts; targeting net zero energy use may be appropriate for certain projects. Close the gap between design energy targets and actual energy consumption through integrated monitoring to inform the evolution of future design standards.

- **Protect and conserve water:** the environmental and financial costs of water and sewage treatment, as well as stormwater management are significant. Sustainable buildings (and sites) use water efficiently and reuse or recycle water for on-site use wherever feasible.

- **Responsibly manage materials:** it is critical to achieve an integrated and intelligent use of materials that maximizes their value, prevents upstream and downstream pollution, conserves resources, and minimizes water consumption; tools are readily available for this purpose.

- **Optimize operational and maintenance practices:** consider the life-cycle operation and maintenance of a building and its systems during the preliminary design phase to contribute to the improvement of working environments, higher productivity, reduced energy and resource costs, and prevention of system failures.

- **Enhance indoor environmental quality:** the indoor environmental quality of a building has a major impact on occupants, productivity and outcomes. A building that is highly sustainable maximizes and controls natural light, has appropriate enhanced ventilation and moisture control, avoids the use of materials with high emissions, and optimizes acoustic performance. Occupant comfort and quality of experience is a priority.
• The intent of a sustainable design approach is to encourage decisions at each phase of the design process that reduce negative impacts on the environment and occupant health, and do not compromise the affordability nor the long-term operation and maintenance of a building.

• Integrate sustainability in a collaborative, consistent manner from the outset of a project, and take a holistic approach that evaluates all design options for practicality, economy, and best value to the project and to the environment. A meaningful, holistic approach to sustainability should result in an integrated solution that positively impacts all phases of a building’s life-cycle. Sustainability principles are most effective and valuable when integrated from project initiation.

• Consider the durability of the building and its various systems and utilities, so that degradation and obsolescence is minimized. Compare the incremental cost and associated life-cycle of more durable materials to the availability, cost, resource implications, and maintenance for less durable items. For a durable structure it is possible to reconfigure, retrofit, and adapt for future program needs to avoid the energy and waste associated with traditional demolition and new construction. The deconstruction (systematic removal, sorting, and reuse of materials, systems, and fixtures) of a building is a more sustainable alternative than traditional demolition.

**Flexibility and Adaptability**

While most major public infrastructure is intended to have a very long lifespan, it is nearly impossible to anticipate what social, technological, or functional requirements a facility will need to respond to in the future. As a result, today’s well-intentioned design decisions may not appropriately address the changing demands of a facility over its expected lifespan. The key principles of designing for the long-term are adaptability, flexibility, and durability; apply these principles to a new building to ensure that the building and its systems remain functional and effective throughout their expected service lives. A flexible design effectively permits the reconfiguration of space to support a similar use; an adaptable design supports a change of building use (e.g. school to office). *Incorporate flexibility and adaptability where cost-effective to promote future-proofing.*

Two examples of effective strategies for designing for future flexibility are the use of modularity and standardization in the planning of program spaces. Modularity allows the duplication of building spaces and provides adaptability, while standardization creates common spaces that can be used or reconfigured easily for multiple uses. Wherever possible, design flexible floor plans to allow for multiple uses and easy reconfiguration.

In order to evolve with changes in technology and new programs, a facility must be able to adapt to different uses and needs over its lifetime. Open floor plans, grid layouts, and adaptable systems all assist in enabling a facility to be reconfigured or renovated over its service life. Select furniture, movable modular walls, and other smaller scale components with dimensional logic that is harmonious with the architectural form. Operating systems need to allow portions of a building to be used efficiently, while others are unoccupied or closed, thus permitting a variety of uses and functions over the building’s anticipated life-cycle. Floor plans should be valued as much for their flexibility as for their overall area.
**Affordability**

Alberta continues to be one of Canada’s fastest growing provinces; between 2004 and 2014, Alberta’s population increased by 27%, the highest increase of any province or state in North America. Today, Alberta is home to just over four million people, and by 2040 that number is expected to jump to more than six million. It is crucial that the expansion and replacement of the Province’s infrastructure is done in a fiscally responsible and environmentally sustainable way to ensure that the best quality outcomes can be delivered with the limited resources available.

Financial comparisons involve more than initial construction costs. Projected annual operating and maintenance costs, component life cycle costs, and ease of operation and maintenance all directly impact the long term cost and performance of a facility. Operating and maintenance costs alone may be many times greater than the initial capital investment; by ensuring that life-cycle costs are considered early in the design and planning phase, a project’s total cost can be minimized, and scarce resources (environmental, human, and financial) can be used more efficiently. Design energy modeling and verification of building performance post-construction provides comparison metrics that improve the accuracy of model data, thereby improving the accuracy of both capital and operational costs.

**Accessibility**

The term accessibility has traditionally referred to the physical access and circulation of people into and within a building. While accessibility has typically focused on Barrier-Free and Universal Design guidelines, this definition has been expanded to encompass other definitions of inclusivity, such as gender (e.g. inclusive washroom design), cultural (e.g. smudge rooms), and religious identity (e.g. prayer rooms).

**Form**

A well-designed building reflects the site, climate, culture, and materials of the location in which it is constructed. Accessibility, circulation, solar orientation, program, and topography may all affect the design of a project; the building form should respond to each in a meaningful fashion.

All GoA projects are to receive a high level of design consideration; however, important distinctions are to be made between three key typologies: 1) *Signature* buildings, such as museums and capital buildings, are those where form, materials, scale, and public profile are to be best in class; 2) *Above average* buildings, such as hospitals and university facilities, are ones where the form, materials, and scale of the project are of above average aesthetics and quality; and 3) *Routine* buildings, such as schools and offices, are those where the values of functionality and durability are key. Building form needs to be appropriate to its typology, and should favour simple, efficient designs that maximize durability, economy, efficiency, and operations.

Reflect a uniquely Albertan ‘pride of place’. Historical, cultural, and physical features, existing buildings and patterns, and the scales of neighbourhood and city inform a good fit and identity for new interventions. Design teams are to create attractive and engaging public spaces that complement the building and enhance the community.
Landscaping should incorporate native, resilient vegetation and include public art in the project scope where possible, or enable future art through proactive identification of natural focal points and provision of structural or utility rough-ins.

Pursue value through innovation; not every building requires a completely custom design. With a standardized approach (e.g. modularity and prefabrication), unique and site-specific features can be incorporated without incurring additional costs. A refined, limited selection of materials (utilizing local materials where possible), provides a facility with a lower carbon footprint and better fit within its surroundings. A re-use, not replace approach, whereby existing facilities are incorporated into a new project, may feasibly and functionally enhance the overall outcome and improve the ability of the facility to meet the needs of its users.

Summary

Good design is a process that delivers long-term value, function, innovation, and inspiration. Design provides value by delivering high quality, sustainable facilities that enhance the quality of lives while meeting the challenges of user requirements. This can be through:

- Functional value – meets and adapts to the long-term needs of all users;
- Environmental value – efficient and responsible use of resources;
- Viability – provides good value for money;
- Social value – develops a positive sense of identity and community; and
- Physical value – enhances a setting.

Optimizing life-cycle costs while ensuring the long life of building and site components, designing features with easy access to systems and equipment for routine maintenance, repairs, and replacement, and providing durable and low-maintenance design elements are all crucial to the longevity, sustainability, and affordability of a facility over its full life cycle.

These Design Principles will typically apply to GoA funded projects, and are intended to guide the development of facility design and operation for the benefit of the Province’s environmental, social, and economic goals. While it is not possible that they can address every potential condition or eventuality, the Design Principles attempt to identify key factors that must be considered from the outset of a project to ensure an integrated and sustainable solution. The Principles enhance, but do not replace, all contracted Consultant’s professional responsibilities, duties or due diligence; they must be used in conjunction with professional judgment to ensure they are followed to the extent appropriate for each specific project.
0.3 Functionality Standards

Preamble

As a knowledgeable owner, Infrastructure has extensive experience with the design, construction, and operation of its facilities. Based on this experience, the following Functionality Standards provide specific planning, design, technical, and operational strategies for the guidance of Project Teams. Consistent with the Ministry’s objective of Project Delivery Standardization, these standards are intended to be universal, ensuring that new construction and modernization projects perform optimally throughout their lifecycles. It is expected that Consultants review and apply the Functionality Standards to Infrastructure projects in conjunction with professional judgement and Owner consultation.

Each Standard consists of four parts:

A Principle (a general subject or theme)

1) Its Concepts (project specific elements that support the broad scope of the Principles)
   - Its Routine Applications (the common strategies that achieve the intent of the Concept)
     - Any Relevant Standards (or recommended actions)

*This document comprises part of the Technical Design Requirements for Infrastructure Facilities, available at:*

[https://www.alberta.ca/assets/documents/infra-technical-design-requirements.pdf](https://www.alberta.ca/assets/documents/infra-technical-design-requirements.pdf)

.1 Health and Wellness of Building Users

1) Democratization of office space
   - Fair access to light and view for the majority of users
   - Flexibility in work areas to suit focused vs social tasks
     - LEED, WELL Building Standard (all points above)

2) Long corridors
   - End in light and view (or art feature)
   - Visually group zones or areas to assist wayfinding
     - WELL Building Standard
   - Enable future expansion (e.g. modular classrooms)

3) Light Quality
   - Electric Light and Sun Glare Control, shading, and dimming
   - Use photo cells to harvest daylight near window areas and motion sensors (occupancy and vacancy)
   - Daylighting Fenestration – appropriate window sizes
     - WELL Building Standard (all points above)
4) Comfort Features
   - Ergonomics
   - Acoustics
   - Thermal comfort – including individual control
     - WELL Building Standard (all points above), TDR

5) Air Quality
   - Air quality standards, VOC reduction, pollution control, filtration
     - LEED, WELL Building Standard, TDR
     - If provided, designate smoking areas away from public entrances and air intakes; prioritize smoke and scent free zones

.2 Flexibility/Adaptability

1) Loose fit plans; general vs specific fit
   - Adaptive grids and geometries using planning modules
   - Rectilinear rooms: various furniture orientation and layout options
     - Have a greater focus on functionality than on gross area

2) Indicate future growth
   - Consider site drainage and uniform tie-in of floor levels (e.g. accommodation of modular classrooms)
   - Siting for future growth for both building and parking

.3 Sustainability

1) Renewable Energy
   - Apply photovoltaic (PV) to suitable building surfaces: consider locations for PV other than flat on the roof (e.g. BIPV, covered parking)
   - Angled vs. horizontal installation avoids accumulation of dirt

2) Consider Deeper Greening alternatives (e.g. wind, geoexchange, etc.)
   - Consider the building as an ecosystem and choose the best of all standards
     - NetZero (required by 2030), Living Building Challenge (LBC), LEEDv4, etc.

3) Consider education and communication strategies in concert with technologies

4) Support greener transportation options
   - Provide electric vehicle parking and charging stations
Provide secure, supervised, sheltered bicycle storage

.4 Durability

1) Strengths and Properties of Materials
   • Know and practice using inert materials: metal, glass, stucco, stone, concrete
   • Avoid plastics and unusual composites: no face sealed approaches (no foam or sealant)
   • Understand metallurgy and dissimilar materials
   • Avoid sole sourced and unproven technologies
   • Understand the effects of Alberta’s climate on exterior materials; flood and wildfire

2) Vandalism, weather, and maintenance will damage inappropriate materials
   • Use robust, durable materials (e.g. masonry, concrete, etc.) at grade
   • Avoid climbable features
     ○ Understand and practice Crime Prevention Through Environmental Design (CPTED)
   • Alberta Flood and Wildfire risk: low combustibility roofing, materials, and details; flood resilient design
     ○ ITR white papers on flood and wildfire mitigation
     ○ Resilient Design Institute
     ○ Institute for Catastrophic Loss Reduction

3) Material redundancy
   • Protect sensitive materials and finishes (e.g. rubber nosings, metal corner guards, etc.)
   • Understand user behaviour and select materials accordingly (e.g. plywood millwork, masonry at grade, reinforced drywall, etc.)

.5 Constructability

1) Seek order and value through repetition and modulation

2) Enable modularity and pre-fabrication
   • Repetitive design elements
   • Rational (e.g. conventional grid) building layout: coordination with modular components for dimensional compatibility and flexibility

3) Maintainability
   • Common component sizing (e.g. rectangular vs. raked windows)
   • Rectilinear geometries
   • Accessibility (provide stairs to roof, not ladders)
Ease of component replacement: consider access, cleaning, and future maintenance (e.g. re-roofing)

4) Component Design
- Standardized vs. customized components (minimize waste, maximize flexibility)

.6 Rational Planning
1) Purposeful (rectilinear) geometries in plan and in massing
2) Constructible systems and details
   - Understand (imagine) the rational sequence of the construction process
3) Avoid over articulation of forms (needless complexity and cost)
4) Use site to inform building layout and form
   - Solar direction, prevailing winds, site geometry and topography
   - Pedestrian, bicycle, passenger, and service vehicle access
   - Shadow studies with correct solar orientation
   - Positive drainage away from building: avoid natural low-points of site
   - Favour natural light at building entrances (e.g. schools)

.7 Roofing
1) Design roof/parapet details to facilitate future roofing replacement
2) Design roof to promote longevity
   - Uniform insulation, sloped structure
   - Redundant drains and scuppers to handle normal and extreme rainfall events
   - Direct water away from walls/parapets, walks/ramps, sensitive landscaping, etc.
   - Steep flashing slopes over porous materials for shedding (e.g. brick sills)
   - Wear surfaces in traffic areas, stair access for servicing
     - Reference ARCA standards
   - Wildfire risk: low combustibility materials and details
     - ITR whitepapers on flood and wildfire mitigation
   - Avoid cascading roofs and waterfall roof edges.
     - ARCA, ITR
3) PV standards for best practice, efficiency, warranty, safety, and durability
   - ARCA, ITR
4) Design for safety of workers
   - Design controls for snow slides, icicle prevention, and over-flowing water at gutters

5) Avoid complexity in roof design
   - Two-way slopes with counter-slopes rather than four-way structural
   - Avoid curves in multiple directions

.8 Building Science for Life Cycle Value

1) Membrane continuity
   - Achieve mechanically fastened and air-tight tie-ins
   - Provide details for penetrations, avoid spray foam
   - Use rain screen and PERSIST methods

2) Insulation continuity
   - Spray foam contracts, leading to air barrier failure
   - Design cold (vented) soffits vs. conditioned soffits
   - Minimize thermal bridging at penetrations (canopies, balconies, etc.)
   - Detail assemblies that can be realistically constructed

3) Control unwanted air ingress with careful detailing

4) Control unwanted water ingress
   - Grading and grade separation
   - Control water run-off from downspouts or scuppers
   - Flashing considerations
   - Rainscreen method for management of water penetration

5) Clerestory
   - No sloped glass or sloped walls (unless designed like a roof)
     - Some exceptions (e.g. modernizations - TSPB approval required).

6) Window in wall vs. full curtainwall
   - Full height glazing wastes energy and materials while reducing durability
   - Strategic window sizing and placement, prioritize long-term performance (e.g. triple glazed or better) over short-term capital savings
   - Tie-in membranes (do not spray foam), no structural silicone glazing
     - NECB
     - Test with air pressure and infrared thermography
     - Request and test-commission envelope mock-ups
.9 Passive Climatic Response
1) Orientation for energy conservation, possible harvest of renewables
2) Building-defined outdoor microclimates
   • Outdoor instructional areas, defensible space
3) Minimal glazing to prevailing winter winds
   □ Open up to southerly exposures: protect against winter winds
   ○ NECB and energy modelling

.10 Community
1) Appropriate response, in scale, material, and cadence, to the community served
2) Appropriate (dignified) sense of entrance, circumstance, and occasion
   □ Include (secure) opportunities for after-hours uses by community
   □ Provide plenary spaces: coats, concession, queueing, etc.
   □ Prioritize naturally-lit east, south, east, or west entrances vs. northern orientation
3) Vertical elements (shapes) engaging the sky/breaking the horizon for distinction
   □ Distinguish places of gathering and assembly, entrances, etc.
4) Develop hard and soft landscape features connecting the building to its community
   □ Provision of flags, signage, furnishings
   □ Follow GoA signage standards
   □ Rational circulation paths for pedestrians, cyclists, and vehicles
   □ Covered, secure bicycle parking near entrances and sightlines
   □ Specify landscaping for durability and ability to thrive with minimal maintenance
   ○ CPTED, LEED
5) Accessibility
   □ Gentler ramps, assisted doors
   □ Featured stairs/hidden elevators
     ○ Active Design Guidelines and WELL standards
     ○ 7 Principles of Universal Design

.11 Responsible Architecture
1) Aspire to good design: appropriate to typology, notable in community (e.g. school)
   • Promote values of social progress and public betterment
   • Not world class or spectacle of design, unless directed
2) Restained elegance
   - Refined, disciplined, and purposeful in material use, form, and detailing
   - Valuable and accountable to Albertans served by its design
3) Evaluate the merits of reusing existing structures
   - Understand cultural values of existing facilities to community identity
     - Determine the environmental impact of demolition and landfilling materials vs. adaptive reuse
     - Provide a fair evaluation of the pros and cons of building retention (beyond immediate concerns of budget and schedule)
   - Consider opportunities to enhance project outcomes through careful integration of old and new

12 Value by Design
1) Consider first cost, life-cycle cost (e.g. 50 year), GHG, and energy metrics
2) Design/construction is a fraction of lifecycle
   - Ensure sufficient time to understand (pre-plan) and optimize design
   - Know the long-term impacts of short-term gains
3) Early involvement can integrate systems and save first cost
   - Develop sustainability strategies in-step with design
     - MacLeamy curve of time/influence/costs

13 Integrated Design
1) Sharing design, planning, and technical systems values
   - BIPV achieves greater efficiency by greater panel density and supplants cladding
     - Plan for the shared use of spaces with community and after hours uses
       - WELL Building Standard
2) Model outcomes in BIM and/or use IPD for coordination and performance verification
   - Energy and GHG models to inform design and siting
     - LEED
     - Athena Impact Estimator
3) Optimize building performance
   - Close the gap between theoretical (modeled) vs. actual (occupied) building performance through monitoring and optimization of systems
   - Undertake formal (LEED) or informal (mockups, infrared, etc.) building envelope commissioning
4) Integration with engineering systems
   - Minimize building maintenance costs through elimination of unnecessary space and maximizing efficiency of engineering systems
   - Plan/model major equipment maintenance space and replacement routes

.14 Codes/ Life Safety
1) For GoA Tier 2 or 3 projects, do not grandfather non-complying safety issues
   - Scope of work may need to adapt
   - Affected areas could include: sprinklering; alarm systems; firewalls; fire compartments; egress widths; door count; and door swing direction, etc.

.15 Universal, Active and Accessible Design
1) Consider Universal Design Principles, Active Design, and Barrier Free Principles
   - Provide equal, dignified access to all users
   - Promote physical activity through building and site design
   - Implement best practices for barrier-free access
     - The 7 Principles of Universal Design
     - Active Design Guidelines
     - WELL Building Standard
     - Fitwel

2) Diversity and Inclusivity
   - Policy, procedure, and best practice are in evolution
3) Go beyond legislated minimums (e.g. NBC); TDR exceeds code minimum.
   - On the good-better-best scale, aim for the best (e.g. ramps use 1:20 (best) vs 1:16 (better) or 1:12 (good)

.16 Inspiration
1) Experience
   - Envision how the end user will cognitively, socially, emotionally, and physically experience the building and site, and design to enhance this experience
   - Inspire students and teachers (for example)
     - Community fit and pride (e.g. views from and towards)
2) Beauty and Delight

- Value beauty, art, and nature, and incorporate where possible
- Know the Architectural expression of public institutions and their buildings
  - WELL Building Standard
- Celebrate culture, spirit, and beauty
  - Living Building Challenge (LBC) - Beauty and Inspiration petals

17 Acoustics

1) Non-Progressive Moveable Walls

- Not suitable for quiet spaces requiring high levels of speech privacy/sound isolation
- Leaks in construction joints at ceiling, floor, and wall intersections are common
- Costlier than “standard” construction; requires specialized technicians for relocation

2) Operable Partitions

- Minimize use: challenging to properly install, require routine maintenance, limit future use of the space, and are expensive
- Avoid use where sound isolation is a priority

3) Glazing in Interior Walls

- Minimize size, maximize pane thickness
- Use laminated glass and double glazing with maximum air space thickness
- Correct design will provide acoustic separation and allow light/views

4) Mechanical Room Locations

- Typically the loudest sources of noise in a facility
- Do not locate above or adjacent to quiet spaces (e.g. classrooms, patient rooms)
- Mechanical equipment sound and vibration can be challenging and expensive to attenuate post-construction

5) Acoustically Absorbent Building Materials

- Integrate surfaces with high acoustical absorption properties into the architectural design. This can reduce acoustical reverberation, decrease noise, and create comfortable environments with good speech communication
- Provide ceiling tiles with high sound absorption, acoustical roof deck, and sound absorbing block wall. These surfaces are typically easy to refresh, are abuse-resistant, and cost-effective
- Open plan spaces (e.g. classrooms, offices) require ceilings with very high sound absorption; minimum standards may be too low for some situations
- Provide high quality flanking walls and ceiling baffles. This mitigates against future acoustic degradation if acoustic panels are replaced with conventional construction
.18 Security

1) Sightlines
   - Integrate passive security, views to main entrances by frontline staff
   - Utilize landscaping features to direct visitors towards desired entrances
   - Locate vulnerable fixtures and features (e.g. bike racks) in highly conspicuous, supervised, and well lit locations

2) Physical security
   - Where necessary, incorporate hardening of site and building into architectural and landscape design
   - CPTED

Links

1. Infrastructure Technical Resources
   https://www.alberta.ca/infrastructure-technical-resources.aspx

2. Technical Design Requirements for Infrastructure Facilities
   https://www.alberta.ca/assets/documents/infra-technical-design-requirements.pdf

3. Leadership in Energy and Environmental Design (LEED)
   https://www.cagbc.org/

4. WELL Building Standard
   https://www.wellcertified.com/

5. Technical Services and Procurement Branch Solar Guidelines

6. NetZero
   https://living-future.org/net-zero/

7. Living Building Challenge
   https://living-future.org/lbc/

8. Crime Prevention Through Environmental Design (CPTED)
   http://www.cpted.net/
9. Technical Services and Procurement Branch Flood Guidelines  
https://www.alberta.ca/assets/documents/tr/tr-floodriskmgmt.pdf

10. Technical Services and Procurement Branch Wildfire Guidelines  
https://www.alberta.ca/assets/documents/tr/tr-wildfireprotection.pdf

11. Resilient Design Institute  
https://www.resilientdesign.org/

12. Institute for Catastrophic Loss Reduction  
https://www.iclr.org/

13. Alberta Roofing Contractors Association  
https://arcaonline.ca/

14. Active Design Guidelines  
https://centerforactivedesign.org/guidelines/

15. 7 Principles of Universal Design  
http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/7-Principals-.pdf

16. MacLeamy Curve  
https://thebimhub.com/2015/06/22/bim-aids-process-but-further-promise-lies-in-inter/#.W3sodYpKjRY

17. Athena Impact Estimator  
http://www.athenasmi.org/our-software-data/impact-estimator/

http://www.safetycodes.ab.ca/Public/Pages/Publications.aspx

19. Fitwell  
https://fitwel.org/
0.4 Statement of Design Objectives (SDO)

The SDO provides the Project Team with a concise summary of the fundamental values that will inform the eventual design solution. The sample SDO that follows is to be adapted by the Owner to state each project’s unique design and functional priorities. The SDO should be included and evaluated in the RFP and Project Charter, and should be included and responded to by the Consultant in the Schematic Design and Design Development phases through written narrative and graphic representation.

Technical Services and Procurement Branch is available as a planning and architectural resource to the Project Team as the design develops.

Contact:

Standards and Specifications Specialist
Technical Services and Procurement Branch
Alberta Infrastructure
3rd Floor, 6950 - 113 Street
Edmonton, AB T6H 5V7
T | 780-422-7456
F | 780-422-7479
infra.trc@gov.ab.ca
Sample Statement of Design Objectives

Date

Infrastructure is responsible for the provision of public facilities that meet stakeholder requirements as well as the Province’s environmental, social, and economic values. The design of the <Project> must meet these objectives in a refined, responsive, and publicly defensible manner. This document outlines the design priorities of the <Project> and establishes criteria for an appropriate architectural response.

Functionality

The <Project> must prioritize operational efficiency. Efficient building layout and circulation will facilitate and enhance the ability of users to effectively communicate, collaborate, and perform tasks.

Flexibility, Adaptability, and Durability

Applying the principles of flexibility, adaptability, and durability to the <Project> will ensure that the facility functions optimally throughout its expected service life. Designing for flexibility allows the building and site to anticipate future user needs and unexpected events (future proofing). Evaluate design decisions based on a cost benefit analysis of the capital vs. life-cycle cost of materials and systems, incremental costs for increased durability and innovative approaches to design, construction, and sustainability.

The <Project> must adapt to changes in technology and new programs, both immediate and future. Open floor plans, grid layouts, and adaptable interiors support quick and economical reconfigurations to serve single or multiple/concurrent functions. Zoning of building systems and floor plans permits expansion and contraction of building operation and energy footprint relative to peak and baseline use.

Ensure resilience. Incorporate redundant systems and grid-independence for uninterrupted use during extreme circumstances such as weather events and utility outages. Apply appropriate hardening of the building and site for security, and post-disaster building requirements. Consider the durability of the facility, its systems and utilities, to minimize degradation, maintenance, and obsolescence over time.

Sustainability

Low-carbon design is a priority. Integrate sustainability in a collaborative, consistent, and holistic manner. Explore innovative methods for reducing the carbon footprint of the <Project> through Deeper Greening; evaluate options for practicality and value to the project and to the environment.

Architectural Approach

The <Project> must achieve a high level of functionality, flexibility, adaptability, durability, and sustainability. A careful design approach can meet these goals and can create quality architecture that is appropriate for the building typology and respectful of the limitations of budget and schedule.
The <Project> should respond to its site, climate, and context. Accessibility, circulation, solar orientation, program, and topography may inform the design approach; the building form should respond to each in a meaningful and appropriate way. *Favour simplified, rational designs that maximize the project values.* Utilize a refined selection of materials and design details. The Consultant should provide multiple options based on a sound understanding of the functional program, site, and GoA standards.

End of Design Principles
1.0 Sustainability

Section Contents

1.1 References.................................................................................................................................1
1.2 General........................................................................................................................................1
1.3 LEED v4 Certification..................................................................................................................2
1.4 Integrated Design Process .........................................................................................................3
1.5 Energy Modeling .........................................................................................................................4
1.6 Specific Requirements for Healthcare Facilities ........................................................................4
1.1 References


.3 National Energy Code for Buildings 2011. (NECB), National Research Council Canada, Ottawa, ON.

1.2 General

.1 The Province endeavours to promote the health, productivity, and safety of Albertans through the design and maintenance of the built environment. Each new project should promote all aspects of sustainability that includes measures to increase efficiency, use of renewable resources, considers future adaptations/expansions and a decrease in production of waste and hazardous materials.

.2 “Sustainable Design” is an integrated approach to building design, construction, and operation that focuses on the efficient use and choice of resources and materials in such a way as to be economical while not compromising the health of the environment or the associated health and wellbeing of the building’s occupants, builders, the general public, or future generations.

.3 Alberta Infrastructure projects, including new building, building additions, major renovations, building modernizations, interior fit-outs, and limited scope projects both with energy and limited energy impacts, shall meet our prescriptive sustainable requirements as defined in Appendix G - Green Building Standards (GBS). Project types are defined by Tiers described in the GBS.

.4 All projects should incorporate principles of ‘universal design’ where appropriate. “Universal Design” describes the concept of designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, gender, ability or status in life.

.5 All projects should incorporate principles of ‘active living by design’. “Active Living by Design” aims to increase physical activity in daily life through community and thoughtful design, public policies and communication strategies.
The use of forest, wood or engineered wood products locally manufactured under all recognized certification systems is encouraged. For reference purposes and without endorsement, the forest and wood product certification systems available in Alberta include Forest Stewardship Council (FSC), Canadian Standards Association (CSA), Sustainable Forestry Initiative (SFI) and Forest Care. Certified wood products can be used to fulfil LEED requirements for the Material & Resources credit Building Disclosure and Optimization Sourcing of Raw Materials.

1.3 LEED v4 Certification

1. New construction and major renovation projects (Tier 1) are required to register and achieve Silver certification using version 4 of the U.S. Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED®) green building rating system (LEED v4). The project teams are required to utilize GBS as a reference tool to assess their particular projects in relation to the most feasible sustainable objectives (Tier 1, 2, 3, or 4), and submit their LEED Checklist early in the process to validate their assessment.

2. The Province requires a number of LEED v4 credits to be mandatory credits for its projects. For the mandatory LEED v4 credits, the focus is to reduce CO2 emissions through optimizing energy performance with commissioning and metering, to track and monitor this energy reduction/performance, as well as further reduce CO2 emissions by sourcing regional and environmentally responsible materials. See the mandatory LEED v4 credits summarized on the chart on the following page:
### 1.4 Integrated Design Process

.1 The Integrated Design Process is a collaborative team approach with the client group, including occupants and operating staff, and a multi-disciplinary design team, focusing on the design, construction, operation, and occupancy of a building over its complete life cycle. The GBS identifies the requirements for Tier 1 and 2 projects and encourages all projects to review the process.

.2 Life Cycle Costing (LCC) ensures that operations and maintenance cost projections are established and effective comparative analyses are conducted for targeted building elements, and supported with energy modeling and consideration of environmental impacts. The GBS identifies the LCC deliverables at throughout the project.

.3 Alberta Infrastructure projects, including new building, building additions, major renovations, building modernizations, interior fit-outs, and limited scope projects both with energy and limited energy impacts, shall meet our prescriptive sustainable requirements as defined in Appendix G - Green Building Standards (GBS).
1.5 Energy Modeling

.1 Design teams are encouraged to initiate energy modeling in the conceptual design or schematic design phase to inform design discussions and minimize life cycle energy use most effectively. The energy model can establish total energy performance and dually serve to demonstrate compliance with National Energy Code for Buildings (NECB) 2011, versus a prescriptive approach, for AHJs.

.2 The Province requires that an Energy Modeling Consultant be an integral part of every design team for Tier 1 projects, as well as for complex Tier 2 projects. The Energy Modeling Consultant is to develop the Baseline and Proposed energy models to true performance quality by using, but not limited to, the following resources:
   a. ASHRAE Standards 90.1-2010
   b. ASHRAE 90.1-2010 User’s Manual
   c. LEED v4 Reference Guide
   d. LEED v4 Canadian Alternative Compliance Paths (ACPs)
   e. COMNET Commercial Buildings Energy Modeling Guidelines

1.6 Specific Requirements for Healthcare Facilities

.1 For new health facilities, the goal is to build with improved sustainability throughout the planning, design, construction, and operations and maintenance practices that are consistent with the purpose of the facility, to provide services that aim to improve human health and health of the environment.

.2 Integrated Project Planning and Design is now a prerequisite for all LEED v4 Healthcare projects. Healthcare projects are typically very complex with diverse user group providing services to the broad public. The Integrated Design Process promotes a stronger incorporation and definition of project goals through ongoing discussions achieving increasing levels of specificity, and optimally integrated solutions.

End of Sustainability Section
2.0 Building Envelope

Section Contents

.1 References ......................................................................................................................1
.2 General ..........................................................................................................................1
.3 High Interior Humidity ................................................................................................2
.4 Air Barrier .....................................................................................................................3
    A. Specific Requirements for Healthcare Facilities .........................................................4
.5 Insulation ........................................................................................................................4
.6 Roofs ................................................................................................................................5
    .1 General ......................................................................................................................5
    .2 Near-Flat Roofs .........................................................................................................5
    .3 Steep Roofs ..............................................................................................................7
    .4 Green Roofs ............................................................................................................8
.7 Re-Roofing ....................................................................................................................8
.8 Walls ..............................................................................................................................11
.9 Windows, Doors and Glass ...........................................................................................11
.10 Skylights and Sloped Glazing ......................................................................................13
.11 Concealed Spaces .......................................................................................................13
.12 Crawl Spaces ..............................................................................................................14
.1 References


.3 CSC TEK-AID, 07195 AIR BARRIERS, Construction Specifications Canada.

.4 CSA S478-95(R2007), Guideline on Durability of Buildings.

.5 Building Science for a Cold Climate, Hutcheon, N, Handegord, G, (1989).


.2 General

.1 Building envelope assemblies separate spaces requiring differing environmental conditions by controlling the flow of air, water and energy.

.2 The design approach generally recommended by Alberta Infrastructure (AI) may be described as the “Pressure Equalized Rain Screen Insulated Structure Technique”, or “PERSIST”. This approach is characterized by the following:

.1 Exterior cladding covering an air space that is pressure equalized with the exterior.

.2 Insulation mainly located to the exterior of structural components, in direct contact with and exterior to the air barrier system.
.3 An air barrier system that also functions as a vapour retarder installed exterior to and supported by the structure.

.3 While other design approaches are possible, AI recommends the PERSIST approach because, properly implemented, it is relatively forgiving and minimizes the following:

1. Moisture deteriorating the building envelope due to ingress of exterior bulk moisture and trapping of condensation from relatively humid air introduced into the envelope by air exfiltration.

2. Detrimental effects on air barrier from exposure to:
   .1 UV radiation,
   .2 Extreme temperature fluctuations, and
   .3 Moisture.

3. Thermally induced movement of structural elements and any connected air barrier.

4. Detail the building envelope to ensure that water, snow and ice sheds safely from exterior surfaces and is not trapped on or allowed to build up or to enter the assembly to cause deterioration or staining. Any non-vertical surface should be protected with flashing sloped a minimum 1:6 and include a drip edge.

5. Materials used in the building envelope assembly should be suitable for the environmental conditions to which each will be exposed, including during the construction period. Materials should provide a service life consistent with accessibility for maintenance of building components and planned building life.

6. Select envelope assemblies and materials to minimize maintenance requirements. Inert materials that are timeless, durable and non-stainable are preferred. Obtain prior AI approval before using exterior cladding materials requiring frequent maintenance.

7. Avoid combining design approaches, for example, the Airtight Drywall Approach (ADA) in combination with the PERSIST approach. Where different systems come together, renovations for example, complete detailing should be provided to show continuity, compatibility, and constructability.

.3 High Interior Humidity

1. Indoor relative humidity higher than specified in Section 5.0 – Mechanical (30%RH reducing to 15% at -30°C), can result in excessive condensation on or within the building envelope during the winter.
Where feasible, provide lower humidity “buffer spaces” to separate spaces with high relative humidity from the building envelope. To make such separation effective, design partitions and mechanical system air pressure differentials to minimize humid air transfer to the buffer spaces.

Where high humidity space cannot be “buffered” from the building envelope, avoid condensation with carefully detailing of the building envelope assembly.

.4 Air Barrier

Design building envelope components to meet the characteristics of an air barrier system as discussed in Construction Specifications Canada’s TEK-AID 01795 AIR BARRIERS.

Locate the plane of the sealing element (usually an SBS sheet membrane) exterior to the major structural elements.

The air barrier typically consists of a number of materials acting together as a system. Minimize the number of materials used to form the air barrier.

Minimize changes of plane in the air barrier system. Avoid changes of plane at air barrier membrane connections to windows and other fenestrations. Where unavoidable, detail a method of supporting the transition such as galvanized sheet metal transition strips (mechanically fastened) to assist in bridging abrupt changes.

Minimize penetrations through the air barrier system. Where unavoidable, detail a continuous air barrier that is easily constructed, such as transition plates around steel elements, and membrane collars or collared sleeves at pipe and conduit. Do not use materials that cannot be sealed, armored electrical cable for example, if alternatives are available.

Do not extend roof deck through the air barrier at canopies and overhangs. Provide separate structure outside the envelope, and minimize penetrating structure. Separate exterior structure may be required.

Air barrier detail continuity and constructability should be given particular attention at:

1. Window and door frames,
2. Mechanical, electrical and structural penetrations,
3. Wall/roof connections,
4. Changes in plane,
.5 Joints between dissimilar materials, and

.6 Building expansion and movement joint locations.

.8 Identify in drawings all the elements that make up the continuous air barrier. Provide large scale details to show how air barrier continuity will be achieved, how differential movements will be accommodated, and where construction sequence must be considered.

.9 Do not use foamed-in-place insulation as a substitution for a continuous, well detailed air barrier membrane.

.10 Do not consider polypropylene and polyethylene woven/non-woven films, or plastic film as air barrier elements.

.11 Avoid the use of systems or details that rely on caulking and sealants as air barrier elements. Consult Technical Services and Procurement Branch before considering these systems.

**A. Specific Requirements for Healthcare Facilities**

.1 Where indoor humidity levels will be maintained at levels higher than the design criteria in Section 5.0 – Mechanical, provide more robust air barrier systems such as thicker torch applied membranes or thicker self-adhesive membranes with fusible laps.

.5 Insulation

.1 Design insulation to be secured mechanically and in direct contact with the air barrier system.

.2 Specify effective RSI values for envelope components as part of an integrated design to provide the mandatory LEED® credits, and minimum effective RSI value from the National Energy Code for Buildings (NECB). An adjustment of the thickness and RSI value for various locations may be required based on energy modeling results and targeted LEED® credits sought in optimizing energy performance per Section 1.0 – Sustainability, paragraph 1.2.4. Consider all elements bridging the envelope in energy modeling.

.3 Minimize thermal bridging at penetrations and connections, considering methods such as structural thermal breaks and thermally improved cladding systems. Design to prevent condensation on interior surfaces due to thermal bridging. For example, along concrete fins projecting from the interior of the insulated structural plane, extend insulation out four times fin thickness, use structural thermal breaks for minor projecting steel elements, and use insulated double Z-bars or thermal clips to support cladding and metal roofing. (refer to Appendix D – Standard Envelope Details.)
.6 Roofs

.1 General

.1 Design the roof and provide details to meet or exceed the requirements of the ARCA Roofing Application Standard Manual.


.3 Prepare roof plans that identify roof slope elevations from high points to drains. Indicate locations of drains, overflow scuppers, roof mounted equipment and roof penetrations. Reference roofing detail drawings to the roof plan.

.4 For additional requirements related to roof drainage, (refer to Section 5.0 – Mechanical).

.2 Near-Flat Roofs

.1 Generally, the roofing membrane should consist of two-ply modified bituminous membrane (MBM). Before specifying other roofing systems such as single-ply (EPDM, PVC, etc.), consult Technical Services and Procurement regarding building usage, issues of durability, maintainability, access and safety.

.2 Slope roof surfaces to drains, including valleys and transverse slopes across top of parapets.

.3 Form roof drainage slopes (minimum 1:50) with the structure, not with insulation. Insulation thickness that varies from less than average to more than average results in temperature variance across the roof surface and a shorter service life for the roofing membrane. A consistent insulation thickness reduces waste during reroofing and results in lower life cycle costs.

.4 Backslopes, in a conventional application, may be formed using sloped insulation, provided the vapour retarder membrane continue to envelope the backslope insulation. Where tapered insulation is needed utilize the structural slope of the roof deck by applying wide cricket insulation layouts.

.5 Where practical, maintain a constant elevation along the perimeter of contained roof areas. This does not include roof to high wall transitions. Dimensioned details should be provide where varying perimeter elevation cannot be avoided, indicating low and high perimeter conditions.

.6 Each contained roof area must be designed to have a minimum of two drains. The intent is that if one drain is blocked, water can flow into an adjacent drain. Provide overflow scuppers where a structural hazard would result from a blocked drainage. Do not locate scuppers at roof expansion joints and over building access points.
7 Use scuppers only as overflow devices, typically located 25 mm to 50 mm above membrane at roof perimeters. Do not use scuppers to replace roof drains. Minimum size of scupper to be determined by a rational analysis of expected maximum one day rainfall but should not be less than 150 mm x 300 mm.

8 Minimize penetrations through the roof. Provide curbs at all roof penetrations other than drains (refer to Appendix D – Standard Envelope Details). Exceptions will be considered if utilizing an ARCA approved, pre-engineered device (spun aluminum plumbing vent flashing, tie off anchor, etc.). Vapour retarder membrane continuity is still required if using a pre-engineered device.

9 Detail top of curbs at minimum 200 mm above the adjacent roof membrane.

10 Provide minimum 1.0 m clearance around and between curbs and parapets to facilitate roofing application and drainage.

11 Locate all movement joints (expansion joints, etc.) on curbs, minimum 200 mm above the adjacent membrane.

12 Coordinate waterproofing of mechanical equipment and related supply lines, on roof curbs or on raised steel structure, with other members of the design team. For curbed designs, determine whether voids below equipment are to be treated as interior or exterior space.

13 Where a roof joins a wall extending above the roof, locate window sills, door thresholds, louvers, wall cladding, and other wall penetrations a minimum of 300 mm above the roofing assembly. Consult Technical Services and Procurement Branch for approval of variance requests due to design constraints.

14 Design transitions from roofs to walls projecting above roofs as protected membrane transitions (refer to Appendix D – Standard Envelope Details, Series 01, Sketch 3).

15 For protected membrane systems, use gravel ballast with filter fabric. Provide removable precast paver units around roof perimeters, curb (greater than 3 m any side) and for access paths and plaza decks (plaza decks require the use of paver pedestals to ensure uniform surface). A drainage mat is required between the insulation layer and the membrane.

16 When the exposed surface of a roof assembly (for example, a plaza-type deck) is required to be cast-in-place concrete, provide the following:

.1 Drains at both deck and membrane levels, designed to allow for differential movement between those levels.

.2 Venting of insulation layer and concrete above roof membrane, and

.3 Geotechnical type filter fabric between concrete and insulation below, to prevent concrete penetrating into insulation layer.
.4 A drainage mat between the insulation layer and membrane. This acts as both an uninhibited drainage plane, as well as a separator sheet between the insulation and membrane.

.17 If equipment on the roof requires servicing and/or the building height is 3m or taller, provide main access to rooftop from inside the building by way of a stair assembly. Where practical, connect additional separate roof levels with external wall mounted caged ladders designed to meet or exceed safety regulations.

.3 Steep Roofs

.1 Design steep roofs (slopes 1:6 and greater) with a plane of waterproofing membrane beneath the plane of ventilated roof cladding. Normally, use the PERSIST approach with SBS (2-ply styrene-butadiene-styrene modified bitumen) membrane on sheathing, with insulation, air space and cladding. Avoid ventilated attics.

.2 Provide roofing membrane below all metal roofing and flashings. Consider metal roofing and flashings to perform a water-shedding function and not be a waterproofing cladding.

.3 Configure steep roofs and perimeters so that snow, ice and rainwater will not create safety, maintenance or appearance problems. Design to prevent ice and snow from sliding onto areas intended for use by vehicles or pedestrians.

.4 Size eavestroughs to accommodate water from contributory roof and wall areas and to resist expected snow and ice loads. Off-the-shelf eavestroughs typically do not provide adequate resistance to dynamic loads from ice and snow. Eavestroughs to be a minimum of 125 mm wide.

.5 Locate rainwater leaders along with the use of splashpads and positively sloped grading to direct discharge at grade so that water does not flow onto walks or paved areas where it could freeze, or onto areas where it could cause erosion damage.

.6 Locate eavestroughs and rainwater leaders so they are accessible for maintenance and will not cause leakage into the building.

.7 Comply with the following minimum slopes for applications of shingles and shakes:

.1 1:3 for asphalt laminate shingle applications,

.2 1:2.4 for cedar shingles, and

.3 1:2 for cedar shakes.
.8 Minimize thermal bridging and provide sufficient insulation to prevent ice damming on steep roofs.

.4 Green Roofs

.1 Plants should be low maintenance, native to the region or adapted to the local climate zone. Plants should not require water beyond what is typically available in the climate zone (except for the initial placement and nurturing for the first 90 days).

.2 A preference should be given for ‘intensive systems’ that have a minimum soil depth of 200 mm.

.3 Incorporate the requirements of a sloped structure and the methodology for placement of roof drains for near-flat roofs per paragraphs in 2.6.2.

.4 Incorporate a leak detection system with capability for remote monitoring by facility management staff, particularly if minimum roof slopes are compromised.

.5 Ensure additional live and dead loads are accounted for in the overall design of green roofs. Consider additional live and dead loads in the overall design of green roofs. (whether new construction or as part of a major renovation), per Section 4.0 – Structural.

.7 Re-Roofing

.1 Re-roofing report from a knowledgeable roofing consultant to be forwarded to Technical Services and Procurement. The report conclusions and recommendations should be reviewed by Technical Services and Procurement staff before proceeding with re-roof specifications and details.

.2 Re-roofing should only be done after actual repairs and troubleshooting has confirmed that further repairs would not be cost effective, or the deteriorated condition of the roofing system makes repairs difficult or impossible to complete.

.3 If a roof requires replacement prior to the normal life expectancy, the roof condition report should summarize the cause of the failure, for example, poor initial installation, material failure, design defect, etc.
.4 On structurally sloped roofs the re-roofing design may consider leaving existing primary insulation and cover panels in place if they are found to be in a dry condition. The existing vapour barrier which should be equivalent to two plies of built up roofing must be tied into adjacent wall air seals or vapour barriers. Generally, provide a minimum slope to drain of 1:50. Where this is not practical, for example, where existing flashing heights or details limit maximum thickness of sloped insulation, consider adding drains to reduce maximum insulation heights. Where adding drains is not practical, consult with the owner or Technical Services and Procurement regarding the likelihood of ponding and reduced service life.

.5 Auxiliary leveling surface is required over metal deck substrates.

.6 New parapet construction should be built with a minimum of 38 mm x 140 mm wood framing with cap sloped towards the roof.

.7 Under normal building humidity and operation PWF lumber should be specified only for ARCA sleepers supporting mechanical roof top equipment.

.8 Roof curbs for hot pipes, as in standby engine exhaust or other hot roof penetrations, should have metal curbs and additional clearances to combustible construction.

.9 Insulation should have a minimum depth of 50 mm at the roof drains.

.10 Maximum thickness of sloped insulation should be approximately 150 mm. The limitation of sloped roofing primary insulation maximum thickness may require additional roof drains.

.11 Review actual depths of ponding water on roof, generally over 50mm, and locations of roof deck depressions prior to designing a new sloped insulation roofing system.

.12 Provide a minimum of two 100 mm roof drains per roof zone. Exceptions could include small canopy roofs with low parapets. Provide overflow scuppers where plugged roof drains could create ponding water depths over 150 mm. The overflow scuppers should be approximately 25 mm to 50 mm above the roofing membrane and not located over entrances or other locations that could become a hazard during overflow conditions. Size of opening to be determined by a rational analysis of expected maximum one day rainfall, but should not be less than 150 mm x 300 mm.

.13 All re-roofing drawing details and specifications should meet or exceed the ARCA’s Roofing Application Standards Manual.

.14 Cut tests should be done on all roof zones prior to preparation of re-roofing specifications and drawing details.

.15 Determine if the roof to wall tie-ins have an adequate air seal. If the existing wall air seal membrane is weak or non-existent, provide the roof to wall connection membrane stripping that could be tied into if the wall if re-cladded at a later date.
16. Generally the re-roofing membrane would consist of two-ply modified bituminous membrane (MBM). Consult Technical Services and Procurement before specifying other systems. Where there is a potential fire hazard with the original building construction or building occupancy creates an unacceptable fire risk, a flameless roofing system (cold applied SBS membranes, single ply membranes, etc.) should be specified.

17. Review controlled flow roof drainage system with a mechanical engineer to investigate alternate water drainage options. Review size of overflow scuppers to prevent overloading the building structure.

18. At each drain location provide a new roof drain, conventional roof drain complete with sump receiver, aluminum dome, and under-deck clamping rings. Lead sheets are not to be used in any drain assemblies. Sleeved re-roof drains with u-flow connectors are not to be used. Check if existing roof drain piping or the underside of the existing roof drain is covered with insulation containing asbestos. Test that the insulation is asbestos free, and if so, make arrangements to remove the asbestos materials before the re-roofing is tendered.

19. If the existing rainwater leaders direct water to grade through an exterior wall, check that there are no freezing problems associated with the existing construction. Correct any inherent flaws found in the existing construction.

20. Remove and reinstall all mechanical roof top equipment to accommodate re-roofing. Raise curbs, ductwork, mechanical piping and electrical services to accommodate roof slopes.

21. Reinstall mechanical roof top units and pipe supports using precast pavers set on 25 mm, Type 4, extruded polystyrene insulation on isolation sheet. Leave 50% of the space under the pavers open for drainage. Install a loose laid 250 granular cap sheet under the new mechanical supports. Review of structure by a structural engineer is required prior to utilizing pavers as support. Do not use pavers as support without prior review by a structural engineer.

22. Install walkways of 250 granular MBM cap sheet in a contrasting colour around mechanical roof top units and in paths with direct lines to stairwell or roof hatches. Leave 25 mm gaps in the MBM cap sheet walkway every meter to not impede drainage to the roof drains.

23. Eliminate any pitch pans (gum boxes) found and install curbed roof openings with metal enclosures that have removable tops that will allow adding or deleting of mechanical equipment (refer to Appendix D – Standard Envelope Details, Sketch 12).

24. Provide a minimum of 610 mm clearance between mechanical curbs.

25. Include mechanical instructions for removal and replacement of roof top units in the design.
.26 Include mechanical plumbing instructions for adding and removing roof drains and associated piping.

.27 Specify removal of all redundant rainwater leader piping and hangers if any roof drains are abandoned during the re-roof.

.8 Walls

.1 Design exterior walls as “PERSIST” assemblies consisting of:

.1 Exterior cladding,

.2 Ventilated air space,

.3 Thermal insulation with a fastening system designed to minimize thermal bridging,

.4 Air/vapour barrier system.

.2 Wall cavities should be sized to provide minimum 25 mm clearance (air space) between exterior face of insulation and back face of exterior cladding. Provide additional clearance where construction tolerances are greater (for example, in concrete structures and high-rise buildings).

.3 Provide appropriately located openings (weep holes) in the cladding to permit drainage and to allow pressure equalization of the air space.

.4 Compartmentalize air spaces in the wall cavity to restrict air flow around corners. Compartments should not measure more than 4m in any direction within the cavity generally. Detail and show the location of control joints and compartmentalization baffles in cladding.

.5 Allow for deflection where walls are associated with structurally framed systems (as opposed to load-bearing systems). Locate and detail the deflection joints.

.9 Windows, Doors and Glass

.1 Specify window performance and fenestration ratios using modeling for NECB and LEED®, and to prevent condensation from forming at design criteria specified in Section 5.0 – Mechanical.
These Technical Design Requirements are based on the use of pressure equalized rain screen, exterior glazed curtain wall systems for punch and strip windows. These systems integrate well with PERSIST assemblies, with a single plane of air and moisture barrier, and the insulating elements exterior to the structure. Consult Technical Services and Procurement for approval before specifying other systems. For isometric details refer to Appendix D – Standard Envelope Details.

Minimize the use of spandrel framing and other opaque glazing approaches. PERSIST wall assemblies provide superior performance, durability, and service life.

The design of the curtain wall should have mechanically keyed gaskets in the box section and pressure plate. Avoid structural silicone glazing. Consult Technical Services and Procurement for approval before specifying these systems.

Anchors for the framing must be located within the vertical tube sections or at the interior so they DO NOT INTERFERE with adhesion of the membrane from the wall directly to the tube face of the aluminum frame.

Mechanically retain the membrane with a thermally improved anti-rotation device.

Do not project the main mass of window frames beyond the exterior plane of the air barrier. Bridge the cavity of the wall by means of flashing (not the frame or cover-cap). Do not caulk cover-caps to flashings or perimeter.

Do not extend curtain wall to within 150mm of exterior grade or interior floor. At the exterior, a curb or other durable construction should be provided to minimize damage due to weather, maintenance and abuse. At the interior, the frame should be protected, or should be above the floor for safety, durability and maintainability.

Avoid using curtain wall as building envelope at parapets. Consult Technical Services and Procurement for approval before including these details. (refer to Appendix D – Standard Envelope Details, Series Curtain Wall Details, # 5 & 6).

Design windows, window treatment and interior surrounds to allow uniform, unobstructed movement of heated room air across glass and frame.

Provide vestibules at building entrances where significant travel is expected, where interior humidity may otherwise result in frost buildup on doors and frames, to minimize cold drafts, and to minimize energy use. Vestibules should be a minimum of 3 m in the direction of travel to facilitate walk off mats that reduce pollutant contamination of interior spaces. All other doors require adequate mechanical treatment to minimize ice buildup.

Coordinate the selection of glazing with lighting, mechanical and other systems to avoid glare and solar overheating.
.13 Specify low emissivity coating(s) for the insulating glass units selecting surfaces to be coated that provides optimum benefit in the climate zone where project is located as part of the design for energy use and comfort.

.14 Specify window spacer and edge seal systems with improved thermal performance.

.10 Skylights and Sloped Glazing

.1 When light is to be introduced through the roof, vertical clerestory glazing is preferred over skylights and sloped glazing. Such designs allow for better control of overheating, condensation control and solar glare.

.2 Skylights and sloped glazing systems frequently become building envelope problems, triggering significant operation and maintenance costs to building owners.

.3 Skylights or sloped glazing may be appropriate for some projects, for example, modernizations where structural capacity makes a clerestory configuration impractical.

.4 Before including skylights or sloped glazing in a new or modernization project, contact Technical Services and Procurement for approval and for advice to help minimize adverse consequences.

.11 Concealed Spaces

.1 Avoid sealed cavities and "dead space" as part of or adjacent to the building envelope. Enclosed spaces inside the envelope require heat and circulation to avoid the formation of condensation. Any unheated cavities created by minor architectural features should be vented to the exterior. Avoid detailing spaces beneath or adjacent roof mounted mechanical components without access for maintenance.

.2 Provide access to any heated concealed spaces from the interior (for example, heated overhangs). Anticipate necessary related requirements such as detection devices, sprinklering and compartmentalization.

.3 Provide access to unheated ventilated concealed spaces from the exterior (for example, unheated soffits with recessed lights).
.12 Crawl Spaces

.1 Design crawl spaces as dry, insulated and conditioned space inside the building envelope, and not vented to the exterior. Unconditioned (naturally ventilated) crawl spaces should only be used in conjunction with temporary and re-locatable structures.

.2 Crawl spaces must be accessible, cleanable and inspectable (floor slab, mud slab, or inspectable ground cover). Sand on polyethylene often becomes contaminated and often before construction is completed.

.3 If durable floor ground covers are provided, ensure there are additional pathway covers to protect the ground covers.

.4 Do not design spaces without basic lighting needed for safety and to make the crawl space inspectable. (refer to Section 6.0 – Electrical).

.5 Mechanical ventilation is required (refer to Section 5.0 – Mechanical) to condition the space with heat and air changes to control moisture.

.6 For new health facilities, design of crawl spaces should include a full concrete floor slab to ensure cleanability (to assist with infection control and risk mitigation).

End of Building Envelope Section
3.0 Interior Design

Section Contents

3.1 Interior Design Definition ........................................................................................................ 1

3.2 Fit-Up Design Guidelines and Requirements .............................................................................. 1
  .1 References ................................................................................................................................. 1
  .2 Guiding Principles - Interior Design .......................................................................................... 1
  .3 Interior Finish and Materials ...................................................................................................... 2
  .4 Ceilings ........................................................................................................................................ 4
  .5 Walls .......................................................................................................................................... 5
  .6 Architectural Woodwork .............................................................................................................. 6
  .7 Signage and Wayfinding .............................................................................................................. 7

3.3 Accommodation Guidelines and Requirements ............................................................................. 8
  .1 Overview ...................................................................................................................................... 8
  .2 Spatial Definitions and Density ................................................................................................... 8

3.4 Workspace Allocations and Planning Criteria ............................................................................ 10
  .1 Workspaces ............................................................................................................................... 10
  .2 Alternate Workspace Arrangements (AWA) ................................................................................. 12

3.5 Support Space Allocations and Planning Criteria ...................................................................... 13
  .1 Overview ...................................................................................................................................... 13
  .2 Waiting Area ............................................................................................................................. 13
  .3 Open Collaborative Area ............................................................................................................ 14
  .4 Enclosed Meeting Spaces ............................................................................................................ 14
  .5 Java (Coffee) Centre .................................................................................................................... 15

3.6 Document Management Allocations and Planning Criteria ...................................................... 16
  .1 Print Areas ................................................................................................................................... 16
  .2 Resource Area ............................................................................................................................ 17
  .3 File Storage Area ......................................................................................................................... 17

3.7 Special Purpose Spaces ............................................................................................................ 18

3.8 Security ..................................................................................................................................... 18

3.9 Acoustics ................................................................................................................................. 18
3.10 Furniture ........................................................................................................19

.1 Overview ..............................................................................................................19
.2 Asset Management’s Approach to Furniture Management ....................................19
.3 Standing Offer Furniture ......................................................................................20
.4 Non-Standing Offer Furniture .............................................................................20
.5 Equipment ...........................................................................................................21

Appendices:

- Appendix E – Standard Millwork Details.................................................................pdf 347
- Appendix F – Standard Interior Partition Details...................................................pdf 360
- Appendix I – Workspace FurnitureTypicals..........................................................pdf 415
3.1 Interior Design Definition:

.1 Interior Design is a distinct discipline with specialized knowledge applied to the planning and design of interior environments that promote health, safety, and welfare while supporting and enhancing the human experience.

3.2 Fit-Up Design Guidelines and Requirements

.1 References

.1 Meet or exceed the following guidelines and standards:

.4 Alberta Infrastructure Technical Specifications (as a basis for developing project specifications), https://www.alberta.ca/basic-master-and-technical-specifications.aspx

.2 Guiding Principles – Interior Design

.1 Refer to 0.2 Design Principles for Publicly Funded Infrastructure, and 0.3 Functionality Standards, in the 0.0 General Requirements Section

.2 Support function-based needs and workspace allocation.
.3 Reduce renovation and reconfiguration costs.
.4 Allocate space consistently and equitably.
.5 Provide flexible and adaptable work environments.
.6 Promote the flow of natural light into the space (right-to-light).
.7 Promote and support user control, productivity and effectiveness.
.8 Support common collaborative tools and technology.
.9 Promote the safety, health and wellness of building users.
.10 Incorporate biophilia (elements of nature) in the interior environment.
.11 Support LEED Silver standards and sustainable initiatives.
.12 Promote staff satisfaction, retention and recruitment.
.13 Support the Asset Management Plan.
.14 Improve density.
.15 Standardize furniture and finishes within each building.
.3 Interior Finishes and Materials

.1 The selection of interior finishes and materials are important to GoA upgrades, renovations and new construction, and as such, consideration should be taken when selecting finishes.

.2 Finishes and materials should:
   .1 be durable, low maintenance, readily available, and aesthetically pleasing.
   .2 be environmentally friendly and sustainable, whenever possible.
   .3 allow for future adaptability and flexibility so as to not cause major impact to the finish design concept.
   .4 be clearly identified on the applicable finishes plan. A schedule of finishes is to be in the working drawings or specifications.

.3 The interior environment should convey a modern corporate ambience. Select colours in a neutral range that will not become dated quickly. Accent colours are permitted on pieces that are easy and inexpensive to change (such as seat cushions).

.4 Paint
   .1 Select paint products that are maintainable and suitable to the site conditions.
   .2 Keep multiple paint colour locations to a minimum.
   .3 The finish schedule is to have manufacturer information, paint name and number (and within brackets a description of the colour), sheen and any special instructions.
   .4 Consider the location of paint colours, i.e. dark colours may not be appropriate in areas that subject to scuff marks and chipping.
   .5 Select colours from the manufacturer’s standard running line. Custom paint colours are not acceptable.
   .6 Consider the use of corner guards to protect corners in high traffic areas. Corner guards must be minimum 2438mm high, stainless steel, or of a manufacturer’s standard colour to match the walls, and adhered (not mechanically fastened) to the wall.

.5 Wallcovering
   .1 Site applied wallcovering to be Type II commercial grade.

   .2 Multiple wallcovering locations are to be clearly identified on the finishes plan or finishes schedule.
The finish schedule is to have manufacturer information, pattern number, colour number and any special instructions with regards to pattern repeat and/or direction.

Vinyl graphic images are acceptable solutions for wallcoverings, when used in limited locations as an accent.

Carpet

Modular carpet tile shall be used in open work environments, offices, meeting spaces, support space and any other areas required by the program.

Broadloom carpet should only be used in locations where modular carpet is not practical.

Carpet is not recommended to be used in wet areas.

Soil and stain hiding capabilities, colour, tone value and pattern, must be considered.

Accent carpet to be single colour, tone-on-tone.

Heights must be consistent when one carpet butts up to another.

Resilient Flooring

Use resilient flooring in areas that require daily maintenance such as kitchens, washrooms, custodial, data rooms, vestibules or specialty spaces.

Flooring Accessories

Accessories may include, but are not limited to: edging, transition strips, stair nosings, and wall base etc.

Carpet edge guards to be non-metallic, extruded or molded heavy-duty rubber "T" shaped cap insert and extruded aluminum anchorage flange, profiled to accept cap.

Stair nosings to be barrier free. Carpet stair nosing shall be one piece.

Carpet base cap strip may be extruded vinyl or metal cap strip to accommodate carpet base thickness. Base cap may wrap over the top edge of the base; colour is to match carpet.

Carpet base to be the same material, colour, pattern and texture as adjoining carpet. Exposed edges to be bound.

Resilient base may be rubber, thermoplastic, solid, cove, and 3.2 mm x 102mm (in most cases). Resilient base to be installed in one continuous piece length. Base edge shall end at inside corners only.

Porcelain/ceramic tile floors shall have wall base of the same material; 102mm high (in most cases); complete with factory edge; edge protection profile, or a metal trim cap.
.9 Interior Glazing and Glazing Treatments

.1 Glazing is encouraged to allow natural light to flow into the work environment; however, limit the amount of glazing when constructing rooms that require a high acoustic separation.

.2 Apply privacy film to glazing in offices, meeting rooms and support spaces.

.3 Privacy film should obscure items from being visible at eye level between a seated and standing position. A white 20% opacity film is a basis of design but may be more or less, dependent on program privacy requirements.

.4 If security film is needed, based on program requirements, it may be used in combination with a privacy film. Refer to the Physical Security Guidelines for Government of Alberta Facilities.

.5 A cloaking film that blocks the visibility of digital screens can be considered, based on the program requirements.

.6 Coloured film may be used as part of a pattern, for wayfinding or room identification.

.7 The use of interior glazing treatments other than film (such as horizontal blinds) is restricted to program areas requiring variable visual privacy (for example, observation rooms).

.10 Perimeter Window Treatments

.1 Perimeter windowcoverings are typically Landlord or base building standard.

.2 The use of perimeter windowcoverings in lieu of Landlord or base building standard, must be similar in colour, or lined to appear compatible from the exterior.

.4 Ceilings

.1 Reuse existing acoustic ceiling tile and T-bar ceiling grid if in good condition, whenever possible.

.2 Acoustic ceiling treatments, whether new or reused/re-furbished, shall meet the acoustical performance requirements as set out in Section 7.0 – Acoustical.

.3 Choose ceiling products based on acoustic requirements, security objectives, aesthetics, end use requirements and the base building standard.

.4 Reconfiguration of the space should impact the ceiling as minimally as possible.

.5 Bulkheads, specialty and suspended ceiling elements shall be limited, and serve a functional purpose.
.6 Design ceiling plans and treatments in consideration of mechanical, electrical, or structural elements. Coordination at an early stage of design is essential. Refer to Sections 4.0 Structural, 5.0 Mechanical and 6.0 Electrical.

.7 Specialty and Accent Light Fixtures
  .1 Determine the usage of specialty and/or accent light fixtures for meeting spaces on specific program requirements.
  .2 Include accent perimeter lighting to support and enhance presentations. Perimeter lighting to be on a separate switch and be dimmable.
  .3 Indicate the location and heights of specialty and accent light fixtures in the construction documents.

.5 Walls

.1 Conventional Construction (gypsum board and stud)
  .1 Provide adequate support in partition cavity for wall hung equipment and displays.
  .2 Refer to Appendix F for interior standard partition details.

.2 Modular Wall Systems (formerly referred to as Moveable Walls)
  .1 Modular wall systems allow maximum flexibility, adaptability and re-configurability of the work environment and should be used where appropriate.
  .2 Modular wall system shall:
    .1 be a non-progressive, unitized panel, or frame and tile system from a single manufacturer, whereas each wall section can be removed, relocated, re-installed or reassembled in a different location without disruption to adjacent sections, with all parts reusable.
    .2 be fabricated off-site in a controlled factory environment and delivered to site for installation with no construction or finishing required.
    .3 have adequate support for wall-hung equipment.
    .4 comply with Al’s acoustic requirements.
    .5 incorporate full height or clerestory glass to allow natural light to flow into the space, where suitable.
    .6 include factory installed modular power and voice/data distribution in unitized panel systems.
    .7 not require a mechanical connection or attachment to the floor or ceiling.
    .8 be able to integrate furniture systems, modular millwork and incorporate plumbing as required for Java Centers.
.3 Demountable Wall Systems
   .1 Demountable wall systems are an economical alternate to gypsum board walls and can be considered for use in warehouse or other industrial environments.
   .2 Demountable walls differ from modular walls, whereby the parts are delivered to site and assembled to create the wall on site.
   .3 Provide adequate support in the demountable wall cavity for wall hung equipment and displays.

.4 Tackable and Writeable Surfaces
   .1 Tackable and writeable surfaces shall be:
      .1 located to suit program requirements.
      .2 easily removable should the future function of the room change.
      .3 magnetic to allow for dual purposes.
      .4 of a commercial-grade material that is suitable for non-permanent dry-erase markers. The material must not scratch, stain, or leave “ghost” marks over time. Acceptable materials are polypropylene/vinyl film (for large surfaces) and tempered glass or enameled porcelain steel (for smaller areas). Unacceptable materials are melamine, laminate, or painted metal.
      .5 white in colour with a gloss level acceptable for projected images.
      .6 seamless if size permits; if a large area is to be covered, minimize seams by using the largest dimensional size possible and locate the seams higher or lower or to the side of the primary writing surface.
   .2 It must be easily distinguishable which surfaces are intended for writing on and which are not. The colour and sheen of non-writeable painted wall surfaces should be different from the writeable wall surface. Any decorative film applied to glass surfaces should be on the non-writeable side.

.6 Architectural Woodwork

   .1 Modular millwork is acceptable based on the program requirements.
   .2 Casework shall allow for barrier-free access at counter height and above.
   .3 Casework shall allow for client specific equipment and standard equipment. Confirm all sizes prior to fabrication.
   .4 Casework shall have a plastic laminate countertop, or a more durable material if required to suit program requirements.
.5 Comply with current Architectural Woodwork Manufacturer’s Association of Canada (AWMAC) and North American Architectural Woodwork Standards (NAAWS).

.6 Base casework hardware selection on utility, aesthetics, security objectives and end user performance requirements.

.7 Countertops shall have a backsplash when installed in wet areas.

.8 Refer to Appendix E, for standard interior millwork details.

.7 Signage and Wayfinding

.1 Wayfinding is a design strategy used to influence the navigation of building occupants and visitors in unfamiliar surroundings and may include signage, landmarks, or interior elements to guide them.

.2 Plan wayfinding strategies in the early stages of a project.


.4 Signage

.1 For signage in a leased building, confirm with Landlord the requirements to match existing base building signage.

.2 Clearly identify location, type, and installation dimensions on signage plans.

.5 Intuitive Wayfinding

.1 The intuitive wayfinding system should be simple, uncluttered, consistent, coordinated and comprehensive throughout the space.

.2 Ensure destination points and intersections are well lit.

.3 Where applicable, the reception, or main entrance should be clearly visible upon arrival.

.4 Incorporate alternate materials, colours, textures, or interior architectural features (such as a wall with a contrasting colour or graphic) to differentiate the main path of travel and/or act as landmarks upon which people can orientate themselves in the space.
3.3 Accommodation Guidelines and Requirements

.1 Overview
   .1 Refer to 0.0.2 Design Principles for Publicly Funded Architecture
   .2 Plan space so that short term space requirements are isolated from longer term requirements to enable future space reductions.

.2 Spatial Definitions and Density

   .2 Density
      .1 Density is the average area allocated by position. It is based on all the useable office space and the GoA occupants in the entire owned or leased space (allocated to the Client Ministry).
      .2 The GoA wide density target is a maximum of 18 useable metres squared (um$^2$) per occupant of useable office space. The density target is a guide for all upgrading, renovation and new development of GoA office accommodations.
      .3 A density calculation shall be used for all occupant open and enclosed workspace and support space.
         .1 Density (um$^2$ per occupant) = useable area m$^2$/total number of occupants

   .4 Circulation space is included in the density calculation
      .1 The total square metres of programmed workspaces and support spaces should be multiplied by a factor of 1.43 to achieve 30 percent circulation (typical).

   .5 NOT included in the useable density calculation:
      .1 staff visiting from other sites
      .2 special purpose spaces as defined below
      .3 public interaction service areas (front-end), such as Alberta Work Support Centres. (However office areas (back-end) are to be included in density calculations).

   .3 Occupants are defined as:
      .1 full-time employees (FTE’s) (obtained from the HR system)
      .2 vacancies
      .3 positions for individuals on long-term disability
      .4 contracted and seasonal staff that occupy the space
      .5 practicum and summer students
      .6 interns
.4 Support space examples are:

.1 Hoteling
.2 Quiet rooms
.3 Waiting and reception areas
.4 Open collaborative space
.5 Resource and print areas
.6 Meeting rooms
.7 Training rooms
.8 Therapy rooms
.9 Interview rooms
.10 Java centers
.11 File/storage rooms
.12 Hearing rooms
.13 First-aid rooms
.14 Mailrooms
.15 Children’s play areas

.5 Special Purpose Examples are:

.1 Large ventilated server rooms
.2 Warehouses
.3 Trade shops
.4 Laboratories
.5 Necropsy rooms
.6 Wash bays
.7 Weld test centers
.8 Courtrooms
.9 Detention rooms

.6 In situations where the density target cannot be met (e.g. very small groups in rural locations), space requirements may be based on the programmed functional needs.

3.4 Workspace Allocations

.1 Workspaces
## Workspace Allocation Chart:

<table>
<thead>
<tr>
<th>Occupant</th>
<th>Workspace Allocation</th>
<th>Workspace Type/ Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hoteling Staff</strong></td>
<td>2.3 m²</td>
<td>Open/Core (if possible)</td>
<td>Unassigned workspace. Space allocation does not include a storage tower (panel hung coat hook to be used). Space permitting, an optional storage tower could be provided within (not in addition to) the circulation space outside of the hoteling workstation.</td>
</tr>
<tr>
<td><strong>Rover Staff</strong></td>
<td>5.0 m²</td>
<td>Open/Core</td>
<td>Assigned, unassigned, or oversubscribed depending on staffing requirements.</td>
</tr>
<tr>
<td><strong>Resident Staff</strong></td>
<td>6.7 m²</td>
<td>Open/Perimeter</td>
<td></td>
</tr>
<tr>
<td><strong>Director (and Equivalent)</strong></td>
<td>10.1 m²</td>
<td>Open/Perimeter</td>
<td></td>
</tr>
<tr>
<td><strong>Executive Director (and Equivalent)</strong></td>
<td>14.0 m²</td>
<td>Open/Perimeter; or Closed/Core</td>
<td></td>
</tr>
<tr>
<td><strong>Assistant Deputy Minister (and Equivalent)</strong></td>
<td>20.9 m²</td>
<td>Closed/Core</td>
<td>Modular walls are permitted to create restrictive workspaces (enclosed offices) for Assistant Deputy Ministers; however, they must adhere to AI’s acoustic requirements.</td>
</tr>
<tr>
<td>Occupant</td>
<td>Workspace Allocation</td>
<td>Workspace Type/Location</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------------------</td>
<td>-------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Deputy Minister (and Equivalent)</td>
<td>27.9 m²</td>
<td>Closed/Core (if possible)</td>
<td>When located in an executive suite and space is limited, an office is permitted on the perimeter if no core location is possible. Modular walls are permitted to create restrictive workspaces (enclosed offices) for Deputy Ministers; however, they must adhere to AI’s acoustic requirements.</td>
</tr>
</tbody>
</table>

.1 Refer to Appendix I for typical details of each workspace type.

.2 Refer to the Interior Design Guiding Principles 3.2.1

.3 Workstations located in high traffic areas are permitted to have the panel height increased by one stack (up to a maximum overall height of 1676mm [66”]) and/or privacy film applied to the glazed panels, on the corridor side.

.4 A restrictive workspace is an enclosed office and is allocated to the positions of Deputy Minister, Assistant Deputy Minister, Executive Director (optional) and their equivalents. Positions that are not entitled to a restrictive workspace must receive approval based on the Restrictive Workspace Questionnaire as provided by the Client Ministry Accommodation Contact to the Infrastructure Accommodation Planner.

.5 Staff that are permitted an enclosed office as an exception, based on the restrictive workspace questionnaire, may receive an office of the equivalent size to their open workspace allocation, located along the core and consolidated/zoned together for maximum flexibility and functionality of the space.

.6 Principles of the office allocation standards apply to demised suite spaces. Offices in a demised space are to be located along the core to allow natural light to be accessible to open workstations.
.7 Permitted Demised Suites:
.1 Deputy Minister
.2 Human Resources
.3 Case/Investigations
.4 Finance is not eligible for a demised suite. However, it is acceptable for HR and Finance to jointly share a demised suite, if desired. Provide separation between the two units through zoning solutions. Support space such as meeting rooms etc. shall be shared. No individual support space will be allocated to specific units within a demised space.

.2 Alternative Workplace Arrangements (AWA)
.1 AWA shall:
.1 be based on the functional program requirements.
.2 be determined by the client ministry.
.3 involve new and different ways to work by supporting mobility and collaboration.
.4 be supported with appropriate technology and furniture.
.5 allow users to move from workplace to workplace.

.2 AWA Space Planning Criteria:
.1 On-site AWA may include desk sharing or touching down in hoteling workstations or quiet rooms.
.2 Off-site AWA to support mobility includes:
.1 Telework/Telecommuting: working from remote locations (e.g. home offices).
.2 Satellite Office: small office centers with support staff that act as extensions of the main office, normally located more conveniently to employees’ homes.
.3 Mobile Office: work in specific non-stationary places (e.g. vehicles),
.4 Third Places: public space (e.g. coffee shops).
.5 Virtual Office: work anywhere, anytime.

Note: Activity-based work (ABW) environments, in which varieties of spaces are provided to accommodate different types of activities for staff that work flexibly, are currently being studied.
3.5 Support Space Allocations and Planning Criteria

.1 Overview

.1 Support space shall:
.1 be allocated to one group alone or may be shared between multiple groups based on the functional program requirements.
.2 be distributed throughout the work environment.
.3 be located on the core.
.4 maximize the amount of glazing used, allowing natural light to flow into the space.
.5 have dimensional logic, allowing for maximum utilization and reconfiguration for current and future groups.
.6 be clustered together, support growth and change through the adoption and removal of parts and pieces allowing change in size and usage.
.7 accommodate a person in a wheelchair and be barrier-free.
.8 use modular walls that adhere to AI's acoustic requirements, if required.
.9 have an acoustical mobile room divider to subdivide large meeting space if applicable, based on the functional requirements allowed for meeting rooms.
.10 meet security requirements based on the functional program requirements for secure support spaces.

.2 Examples of support spaces are listed in 3.3.2.4

.3 Current AutoCAD blocks and details are available for standard furniture layouts and support spaces. Contact Technical Service Branch for information.

.2 Waiting Area

Waiting Area Space Allocation:

<table>
<thead>
<tr>
<th>No. of Seats</th>
<th>Approximate Dimensions</th>
<th>Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1829 mm x 1829 mm (6'-0&quot; x 6'-0&quot;)</td>
<td>3.3</td>
</tr>
<tr>
<td>4</td>
<td>2743 mm x 2743 mm (9'-0&quot; x 9'-0&quot;)</td>
<td>7.5</td>
</tr>
<tr>
<td>6</td>
<td>3658 mm x 3658 mm (12'-0&quot; x 12'-0&quot;)</td>
<td>13.4</td>
</tr>
</tbody>
</table>

Note: If program requirements exceed 6 seats for a waiting area, allow 1.5 – 2m² per visitor.

.1 Waiting areas shall:
.1 be near large collaboration/meeting spaces and/or reception areas and where passive supervision is required.
.2 have appropriate seating (size, scale, maintenance, durability and function).
.3 have a minimum of 1-duplex outlet, 1- voice/data.
3 Open Collaborative Areas

1 Open collaborative areas:
   1. act as meeting space for quick informal team meetings.
   2. are not enclosed.
   3. have the ability to be converted into an alternate type of support space or workspace.
   4. are non-bookable.
   5. have flexible furniture that can be arranged in a variety of configurations.
   6. should be located in open workspace, in areas that shall not cause disruption to nearby staff.
   7. may be equipped with technology (e.g. monitors) or whiteboards, based on functional program requirements.
   8. may not be applicable to all user groups.

2 For programming purposes, allocate approximately 5% (max.) of the Ministry Program floor area for open collaborative area(s).

4 Enclosed Meeting Spaces

1 Includes Meeting Rooms, Quiet Rooms, Interview Rooms and Training Rooms.

2 Enclosed Meeting Spaces:
   1. are shareable. If dedicated usage is requested by a primary user group, it must be demonstrated in the functional program requirements and typical optimization verified by booking statistics.
   2. should be located for easy access by other groups (limiting outside individuals from access into the open work environment).
   3. shall be allocated consistently and equally.
   4. maximize the amount of glazing used to allow natural light to flow into the workspace.
   5. comply with AI’s acoustical requirements.
   6. accommodate a person in a wheelchair and are barrier-free.
   7. have a minimum of one writeable surface.
   8. have a modular wall system where feasible to allow for a flexible and adaptable workspace, allowing for reconfiguration and growth.
   9. shall incorporate electrical, data, and video conferencing technology as recommended by Service Alberta.
   10. have a minimum of 1-duplex outlet on at least three walls and a minimum of 1-voice/data on a least one wall. Additional electrical, voice/data outlets to be identified in the functional program requirements.
   11. have modular table components sized for the functional requirement of the room.
Allocation and size of Enclosed Meeting Spaces:

<table>
<thead>
<tr>
<th>GoA Occupants per Building</th>
<th>1-2 Person Quiet Room (X-SMALL)**</th>
<th>3-6 Person Room (SMALL)</th>
<th>7-10 Person Room (MEDIUM)</th>
<th>11-14 Person Room (LARGE)*</th>
<th>Total # of rooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 m² (75 sf)</td>
<td>13.9 m² (150 sf)</td>
<td>23.2 m² (250 sf)</td>
<td>29 m² (312 sf)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximate size:</td>
<td>Approximate size:</td>
<td>Approximate size:</td>
<td>Approximate size:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2286 mm (7'-6&quot;) x 3048 mm (10'-0&quot;)</td>
<td>3048 mm (10'-0&quot;) x 4572 mm (15'-0&quot;)</td>
<td>6096 mm (20'-0&quot;) x 3810 mm (12'-6&quot;)</td>
<td>7620 mm (25'-0&quot;) x 3810 mm (12'-6&quot;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-25</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>26-50</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>51-75</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>76-100</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1*</td>
<td>7</td>
</tr>
<tr>
<td>101-150</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1*</td>
<td>9*</td>
</tr>
<tr>
<td>151-200</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>1*</td>
<td>11*</td>
</tr>
</tbody>
</table>

Notes:
- Verify seating capacity for rooms that are set up classroom-style for training purposes.
- If centralized conference centres are available, the number of large meeting rooms could be reduced or eliminated, as the ability to share would increase.
- Quiet (x-small) Rooms:
  - Provide an environment to facilitate private phone conversations, a higher level of concentration and/or impromptu 2-person meetings.
  - The number of quiet rooms may be increased based on the functional requirements for support spaces of the primary user group.
  - Are non-reservable.

.5 Java (Coffee) Centre

Java Centre Space Allocation:

<table>
<thead>
<tr>
<th>GoA Occupants per Building</th>
<th>Dimensions (counter, upper/lower storage &amp; Aisle access)</th>
<th>Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>1524 mm x 2134 mm (5'-0&quot; x 7'-0&quot;)</td>
<td>3.3</td>
</tr>
<tr>
<td>11-25</td>
<td>2438 mm x 2134 mm (8'-0&quot; x 7'-0&quot;)</td>
<td>5.2</td>
</tr>
<tr>
<td>26-50</td>
<td>3048 mm x 2134 mm (10'-0&quot; x 7'-0&quot;)</td>
<td>6.5</td>
</tr>
</tbody>
</table>
.1 Java Centres shall:
  .1 be located throughout the building appropriately, equally for easy shared access for all staff.
  .2 include space for a fridge, microwave, garbage/recycling area and sink. A dishwasher and/or a filtered hot/cold water dispenser may be provided depending on the requirements of the user group. Ministries are typically responsible for their own appliances.
  .3 have modular millwork, whenever possible.
  .4 have microwaves located on or below the counter to be accessible to all users.
  .5 have upper cabinets accessible to all users.
  .6 have cabinets raised over the sink location to accommodate for the faucet.
  .7 allow for barrier-free access in the millwork at the sink (for at least one of the Java Centre’s on the floor).
  .8 have visual division from the work environment, to minimize disruption to staff.
  .9 have grommets concealed behind coffee machines and other small appliances.
  .10 have pullout recycle and waste units in the cabinets for odour control.
  .11 accommodate electrical requirements for equipment, plus have a minimum of two GFI outlets above the counter. Functional program requirements may necessitate additional outlets.
  .12 Refer to Appendix E for interior standard millwork details.

3.6 Document Management Allocations and Planning Criteria

.1 Print Areas

Print Area Allocation:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Dimensions</th>
<th>Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 per 35 people</td>
<td>2743 mm x 1524 mm (9'-0&quot; x 5'-0&quot;)</td>
<td>4.2</td>
</tr>
</tbody>
</table>

.1 Print areas shall:
  .1 be based on the functional program requirements for low quantity printing.
  .2 be distributed throughout the space to allow for convenient access.
  .3 consist of a multi-functional unit (MFU) adjacent to a freestanding furniture cabinet for a work area and paper/supply storage; or alternatively, tabletop printers can sit on a low (2 high) closed storage cabinet with a durable top.
  .4 be provided in addition to a centrally located resource area.
have appropriate operational space in front of equipment.
be located in areas where the noise generated will minimally disturb nearby occupants.

.2 Resource Area

Resource Area Allocation:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Dimensions</th>
<th>Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 per 50 people</td>
<td>3048 mm x 4572 mm (10'0&quot; x 15'0&quot;)</td>
<td>13.9</td>
</tr>
</tbody>
</table>

.1 Resource area shall:
.1 be provided, if necessary, for mass production and document assembly.
.2 be located on the core, away from open workspaces, to minimize disruption to staff.
.3 be shareable amongst program groups unless there is a confidential requirement stating otherwise.
.4 include space for general storage, paper storage (boxes and recycling containers) and document handling (plotter, laminators, collating, sorting, binding, etc.).
.5 contain a minimum of one multi-function unit (MFU).

.3 File Storage Area

Typical storage cabinet widths and depths (provided for information only, to assist in planning the total filing space required):

<table>
<thead>
<tr>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Storage</td>
<td>Width - 914 mm (36”), 1067 mm (42”), 1219 mm (48”)</td>
</tr>
<tr>
<td>General Storage</td>
<td>Depth – 305 mm (12”), 457 mm (18”), 610 mm (24”)</td>
</tr>
<tr>
<td>High-density storage (Various types)</td>
<td>Various heights and widths</td>
</tr>
</tbody>
</table>

.1 Filing areas shall:
.1 have the amount of physical files that are required on site verified through site visits. Off site storage is the ministry’s responsibility.
.2 be appropriately secured to suit program requirements.
3.7 Special Purpose Spaces

.1 Special-Purpose Space shall:
   .1 be sharable and available to various users or groups (in consideration of security requirements).
   .2 be otherwise unable to meet the operational, functional or personal needs of other allotted workspace.
   .3 meet a program delivery need that may involve significant and frequent service to the general public.

.2 Examples of Special Purpose spaces are listed in 3.3.2.5.

3.8 Security


.2 Refer to Section 6.0 – Electrical, paragraph 6.5 – Electronic Safety and Security Systems.

3.9 Acoustics

.1 Refer to Section 7.0 – Acoustics
3.10 Furniture

.1 Overview

.1 Furniture is an important part of AI facilities for upgrades, renovations and new development, and as such, the use of existing and/or recycled furniture or new must be determined at the onset of all projects.

.2 Workspaces have been developed with a Kit-of-Parts, which will allow users and groups the opportunity to reconfigure their work environment. Workspaces shall have dimensional logic and consistency in sizes of parts and pieces, and material finishes. Refer to Appendix I – *Workspace Furniture Typicals*.

.3 Logically plan workspaces to suit the building grid/infrastructure. Modifications to the workspace components may be considered if the building has physical constraints (such as column locations) that prevent an efficient layout, although this should kept to a minimum and addressed on a case by case basis.

.4 AutoCAD blocks and details for standard furniture layouts and support spaces are available through the Infrastructure Technical Resources website.

.5 Floor load issues and space limitations must be considered prior to proceeding with any acquisitions.

.6 Furniture and workspace equipment must be designed and adaptable to support the principles of office ergonomics in order that users can perform their work and activities safely, comfortably, and efficiently. Refer to *Workplace Ergonomics* in the Infrastructure Technical Resources website. Further information is available in CSA Workplace Ergonomics Standard Z412-17.

.2 Asset Management’s Approach to Furniture Management

.1 Asset Management (AM) is an integrated, lifecycle approach to effective stewardship of AI assets. This applies to tangible assets, including furniture. The AM approach develops a systematic understanding of needs and demands of Clients, and provides holistic and corporate based solutions. AM recognizes the importance of making the right decision and optimizing value.
In order to maximize the value of furniture, AI has developed a centralized approach to the design of space and the purchase and ownership of furniture to allow flexibility in accommodating Client Ministry needs. A corporate, strategic long-term plan that sets in place furniture guidelines (e.g., consistent procurement and furniture harmonization) ensures reliable service levels and cost-savings (through economies of scale) for AI’s assets.

.3 Standing Offer Furniture

.1 Seating products and systems furniture products have been prequalified and are available on standing offer.

.2 Furniture purchases will be made through AI from the standing offer to ensure compliance with the standards set under the Government Accommodation Review and to allow for greater economies of scale and efficiency.

.3 AI will assess needs and approve all furniture acquisitions to ensure compliance with GoA standards, guidelines and standing offer agreements.

.4 AI will maximize the use of existing inventory and recycled furniture, and work towards gradual harmonization and integration of furniture products.

.5 Specific information on the current standing offers can be obtained through Technical Services and Procurement.

.4 Non-Standing Offer Furniture

.1 Office furniture, which is not on Standing Offer, shall be purchased through the GoA tender process.

.2 For all goods purchases valued at $10,000.00 or greater, a competitive tendering process must be conducted, and a notice of that tender must be posted on the Alberta Purchasing Connection website.

.3 Furniture for net new projects must be acquired through a competitive tendering process and a notice of that tender must be posted on the Alberta Purchasing Connection website, in accordance with the Direct Purchase Administrative Practices, unless a standing offer contract is in place for net new.
.5 Equipment

.1 Appliances and program specific equipment are considered fixed assets and are purchased by the user group from their operating budgets.

End of Interior Design Section
4.0 Structural

Section Contents

4.1 Codes and Material Design Standards ................................................................. 1
4.2 Specified Design Loads and Analysis ................................................................. 1
  A. Specific Requirements for Schools ...................................................................... 2
  B. Specific Requirements for Healthcare Facilities ............................................... 3
  C. Specific Requirements for Government Facilities ............................................. 3
4.3 Foundations and Basements ................................................................................. 3
4.4 Structure ............................................................................................................. 4
  A. Concrete ........................................................................................................... 4
  B. Steel .................................................................................................................. 4
  C. Other ............................................................................................................... 6
4.5 Interaction and Coordination with Other Disciplines ........................................... 6
4.6 Vibration Requirements ...................................................................................... 8
  A. Specific Requirements for Healthcare Facilities ............................................... 9
4.7 Structural Design of Non-Structural Components ............................................... 10
4.8 Information to be Included in the Schematic Design Report ............................... 10
4.9 Information to be Included in the Design Development Report ......................... 12
4.10 Design Information to be Shown on the Contract Drawings ............................... 13
4.11 Contract Specifications ................................................................................... 15
4.12 Construction Inspection and Materials Testing ................................................ 16
4.1 Codes and Material Design Standards

.1 New design, additions, upgrades and repairs shall conform to the code, standards and guides listed below. In case of any discrepancy between these documents and the Technical Design Requirements for Alberta Infrastructure Facilities (TDR), the more stringent requirement shall apply.

.3 CSA S413-14 – Parking structures.
.4 CSA S478-95 (R2007) – Guideline on Durability in Buildings.
.6 CAN/CSA S6-14 – Canadian Highway Bridge Design Code

.2 Material design standards to be as per Section 1.3 of Division B of NBC(AE).

4.2 Specified Design Loads and Analysis

.1 General Office areas (not including record storage and computer rooms) located in the basement and the first storey: Minimum floor occupancy live load 4.8 kPa or 9 kN concentrated, whichever produces the more critical effect. For floors above the first storey, 3.6 kPa or 9 kN concentrated, whichever produces the more critical effect.

.2 Records storage and Library shelving areas: Design live load to be based on type and layout of the proposed storage system, but not less than 7.2 kPa. Note that some compact mobile filing systems and high density mobile storage systems have the potential to impose greater live load depending on the shelving configuration and the media stored. Consider specifying a minimum design live load of 12 kPa for compact mobile filing systems and high density mobile storage systems.

.3 Floors of Interstitial spaces: Minimum live load 1.5 kPa or 1.5 kN concentrated, whichever produces the more critical effect, plus equipment loads.
.4 Mechanical loads: Mechanical units shall be considered as live load. Obtain loads from the mechanical consultant. In mechanical rooms, allow for a minimum of 100 mm thick concrete housekeeping pads or 100 mm thick concrete floating slab above the top of surrounding floor elevation at any location on the floor. Refer to requirements in Section 7.0 - Acoustical and structural sections, and coordinate with the mechanical consultant. Design for installation and future replacement of mechanical or other heavy equipment. This may require knock out wall panels, removable roof panels, and / or heavy loading on floor travel paths. Ensure that the structure has adequate capacity for suspended piping loads.

.5 Minimum roof design live load: 1.5 kPa uniform or 1.5 kN concentrated (over an area of 200 mm by 200 mm), or the snow and rain loads, whichever produces the most critical effect in the members concerned. For roofs over mechanical rooms, increase the concentrated load to 4.5 kN for all elements except metal deck. Roof structures shall be designed for the 1/50 One Day Rain including the effect of ponding and assuming that the roof drains are plugged.

.6 For snow accumulation loads for buildings that are built close to property lines on urban sites, assume the neighboring property will be built higher than the building, to the extent permitted by the local zoning by-law.

.7 When there is a known plan to change the usage of an area in the future, design for the more stringent of current and future live loads.

.8 Provide design calculations if requested.

.9 The design life of new structures to be 75 years (“Long life” per CSA S478), or 40 years (“Medium life” per CSA S478) for parking structures not integral with long life structures.

**A. Specific Requirements for Schools**

.1 Classrooms: Minimum floor occupancy live load 2.4 kPa or 4.5 kN concentrated, whichever produces the more critical effect.

.2 Corridors, Assembly Areas, Auditoriums, Gymnasiums, Stages and Dining Areas: Minimum floor occupancy live load 4.8 kPa or 9 kN concentrated, whichever produces the more critical effect.

.3 Gymnasium roof structures shall be designed with special consideration for suspended loads. This includes moveable partitions in the extended and stacked position, and basketball backboards in the extended and stowed positions. These loads shall be indicated on the structural drawings.
.4 Structural Support for Operable Partitions. The weight of the operable partition, in addition to all dead loads, shall be taken into consideration when designing the supporting member. Deflection under maximum anticipated load shall not exceed 3.2 mm per 3.658 m of opening width. If greater deflection is anticipated, either a structural member independent of the roof / floor structure above should be installed to support the operable partition, or an operable partition with bottom seals designed to accommodate the larger deflection should be specified.

B. Specific Requirements for Healthcare Facilities

.1 Patient bedrooms: Minimum floor occupancy live load 2.4 kPa or 9 kN concentrated, whichever produces the more critical effect.

.2 Obtain information on loads due to heavy medical equipment, such as diagnostic imaging equipment, X-ray equipment, surgical lights, and surgical tables, etc. Provide adequate capacity in affected structural elements of walls, floors and ceilings, including those on access routes.

C. Specific Requirements for Government Facilities

.1 Multi-service facilities (e.g. Provincial Buildings): Minimum floor occupancy live load shall be as per Item 4.2.1.

4.3 Foundations and Basements

.1 Aspects of design and construction that depend on soil or groundwater conditions shall be reviewed and approved by a geotechnical engineer.

.2 Maintain the integrity of existing structures and service lines on adjacent properties.

.3 Do not incorporate "tie-back" earth retaining system as an essential part of the permanent structure.

.4 The weight of soil fill and the associated lateral earth pressure shall be treated as a live load, with a load factor of 1.5. If the weight of the soil is used to counter-act uplift or overturning, it shall be treated as a dead load with a load factor of 0.85.

.5 In the design of basement walls, consider the horizontal and vertical force effects due to live load surcharge from vehicles located within a distance from the exterior face of the basement wall equal to its depth.
.6 Below-grade Extensions. The roof of basements extending beyond the exterior façade of the building shall be designed to support the live load of firefighting equipment and maintenance vehicles, such as boom lifts that may be required to access the façade or roof of a building for inspection and maintenance. The specified live load on such roofs shall not be less than the uniformly distributed live load of 12 kPa per Table 4.1.5.3 of NBC(AE) or the concentrated loads listed in Item 4.1.5.9 of NBC(AE), whichever produces the most critical effect. For distribution of vehicle wheel loads through fill, refer to Clause 6.12.6 of CAN/CSA S6-14, “Canadian Highway Bridge Design Code.”

4.4 Structure

A. Concrete

.1 Do not use unbonded post-tensioned reinforcement as an essential reinforcing element of a structural member.

.2 Frost heave on exterior apron slabs may cause binding of doors or water drainage towards the building. Design measures to mitigate such effects.

.3 Provide minimum 10 mil (0.25 mm) thick (15 mil [0.38 mm] preferred) poly vapour barrier between the underside of interior slab-on-grade and the compacted crushed gravel. Coordinate with requirements for the Radon gas mitigation system.

.4 When a combination of the dimensions of the member being cast, the boundary conditions, the characteristics of the concrete mix, and the ambient conditions can lead to undesirable thermal stresses, cracking, deleterious chemical reactions, or reduction in the long-term strength as a result of elevated concrete temperature due to heat of hydration, the concrete shall be considered mass concrete. Any placement of normal structural concrete that has a minimum thickness of 1000 mm or greater shall also be considered mass concrete. Provide appropriate mitigation measures in the specifications, such as, a thermal control plan.

B. Steel

.1 Design cantilever or continuous steel roof beams according to “Roof Framing with Cantilever (Gerber) Girders and Open Web Steel Joists”, published by the Canadian Institute of Steel Construction, July 1989. Do not use Gerber design for floor construction.
.2 Any long span roof structures and other longer span structures using joists or trusses shall be proportioned in consideration of the deflection adjacent to rigid end walls. The deflection shall be limited to ensure the integrity of the roof diaphragm and to keep roof deck stresses to an acceptable level. Refer to Clause 16.12.2.5 of CSA S16 for maximum deviation requirements for structural steel joists.

.3 Where metal deck is to be exposed, consider avoiding the use of 0.76 mm or thinner metal deck, as this deck may be subject to damage, including possible footprint marks from workers.

.4 When designing HSS trusses, proportion members and select wall thicknesses in consideration of accepted HSS connection design principles. Refer to the CISC publication “Hollow Structural Section Connections and Trusses – A Design Guide” by J.A. Packer and J.E. Henderson for practical details. In particular, avoid flare bevel welds and provide gap connections with positive eccentricity, when possible.

.5 For all HSS members subject to freezing, provide drain holes at lowest point to allow the release of water and provide neoprene seals around all fastening penetrations exposed to water.

.6 Trusses with W-shaped members for chords and diagonals may be a cost effective alternate to HSS trusses and should be given consideration.

.7 Tension-only concentrically braced frames shall not be used for the Lateral Load Resisting System (LLRS) for buildings with Importance Category of High and Post-disaster.

.8 When structural steel is to be welded, consider specifying a boron content of less than 0.0008%. Higher levels of boron can affect weld quality.

.9 When structural steel is to be galvanized, consider specifying a silicon content either less than 0.04% or between 0.15% to 0.25%. Other levels of silicon can affect the quality of the galvanizing.

.10 When mill test reports originate from a mill outside of Canada or the United States of America, consider specifying that mill test reports are to be verified by a certified laboratory in Canada by testing the material to the specified material standards, including boron content. Steel procured from outside of Canada or the United States of America may have a high boron content.
C. Other

.1 Structural systems for Parkades: Design according to CSA S413, Parking Structures. Provide protection against corrosion of reinforcing steel, including a positive slope and drainage system with adequate allowances for construction tolerances and deflections.

.2 Provide protection against corrosion for structural elements that may be subject to spills or leaks of corrosive solutions (e.g., mechanical room floors supporting brine tanks and water softeners).

.3 Aluminum in contact with concrete, masonry, wood, or metals other than steel shall be coated with an appropriate coating system, or an inert separator (e.g., neoprene) shall be provided between the aluminum and these materials. Steel in contact with aluminum shall be coated with an appropriate coating system or zinc-coated. Aluminum shall not be placed where runoff from other metals might come in contact with the aluminum.

.4 Design expansion joints, including those between existing and new structures, so that an abrupt change in floor elevation is prevented.

.5 In major renovations of existing facilities, investigate safety with respect to current seismic loading in areas where this is applicable. Upgrade as deemed appropriate for the specific project. At a minimum, ensure adequate lateral support for all non-structural components.

4.5 Interaction and Coordination with Other Disciplines

.1 The Prime Structural Consultant (Structural Engineer of Record, SER) is responsible for the integrity of the primary structural system of the building including the LLRS. This includes both the Horizontal LLRS and the Vertical LLRS. Although the SER may rely on other structural engineers to be responsible for primary structural elements, the SER has overall responsibility to verify that the designs achieve a primary structural system that meets applicable standards.

.2 Where possible, avoid thermal bridging. Where this is not possible, incorporate measures to mitigate its effect. Refer to Section 2.0 - Building Envelope.

.3 Structurally design and detail the fastening, support, and back-up systems for exterior walls, brick veneers, cladding, and attachments. Specify galvanizing of steel connections outside the air barrier and shop welding of welded connections.
.4 In the design of exterior wall back-up systems, limit deflections according to the properties of the cladding or veneer material being used.

.5 Provide details that allow for all building movements including deflections.

.6 Advise the prime consultant, if applicable, of expected movements of the structure, including those due to deflection, shrinkage, settlement, and volume changes in the soil. Provide adequate allowances in all affected elements, including partitions and mechanical systems.

.7 Where a grade supported floor slab will be constructed over a significant depth of backfill or replacement fill (> 1 m), even if the fill is engineered, determine the probable long term settlement with the Geotechnical Consultant. If the expected movements of a grade-supported floor slab cannot justifiably be accommodated or tolerated, use a structural slab. A crawl space is generally not necessary and should be provided only in cases where there are specific known benefits that justify the extra cost. Structural slabs constructed over a degradable void-form shall not be used where a significant amount of buried piping will be provided below the floor. The piping shall be protected within trenching or other means to isolate the piping from soil. If there is a significant amount of piping, a crawl space should be considered.

.8 Ensure that sub-surface weeping tile drainage system design, drawing and specification responsibilities are delineated between consultants and satisfied.

.9 Radon Gas Mitigation. Construction of new buildings should employ techniques to minimize entry of Radon gas and allow for Radon removal. Coordinate with Section 2.0 - Building Envelope, Section 5.0 - Mechanical, and Section 11.0 – Environmental Hazards.

.10 A recessed entry mat system may be provided at entrance vestibules. This requires a recess in the floor slab and possibly measures to drain the recess. Coordinate requirements with Architect.

.11 Specify concrete floor flatness that is consistent with the flooring material to be applied and the architect's aesthetic requirements. Because of the higher placing and finishing cost involved, specify unconventionally stringent flatness and levelness only for areas where there is a justifiable benefit.

.12 Check the structural adequacy of support systems for ceilings, particularly heavy plaster ceilings, and follow up with on-site inspection.
.13 Ensure adequate stiffness of lightweight roof or other structure that supports mechanical equipment with spring isolators. Resonance problems can usually be avoided if the additional structural deflection caused by the equipment load, does not exceed 6 mm or 7% of the vibration isolator static deflection, whichever is less. Coordinate with the mechanical consultant.

.14 Consider specifying a steel hoist beam at the roof above elevator cores to facilitate erection and maintenance of the elevator equipment.

.15 Ballasted Solar PV Systems require a mechanical connection to resist earthquake forces (cannot rely on friction alone), as mentioned in Item 4.3.3.2 of CSA SPE-900-13. This requirement comes from Item 4.1.8.18.7(a) of NBC(AE).

.16 For roof slopes, refer to Section 2.0 - Building Envelope. Structural design must consider the resulting non-uniform loads caused by accumulation of rain water. The removal of rain water at drains can be restricted by hail associated with a major rainfall. The structural design must consider the 1/50 One Day Rain including effect of ponding assuming that roof drains are plugged.

.17 Structurally design and detail required guardrails.

**4.6 Vibration Requirements**

.1 Specify a minimum of 130 mm thick concrete for mechanical room floors to mitigate structural vibration problems. For composite floor deck, this thickness is from underside of steel deck to top of concrete.

.2 Ensure the rooftop mechanical equipment is located on a stiff portion of a lightweight roof to avoid resonance problems. If the dead load of the equipment causes the roof structure to deflect more than 6 mm, additional roof stiffening is recommended.

.3 Allow for a minimum of 100 mm thick concrete housekeeping pad for all mechanical equipment. This shall be in addition to the thickness of the structural floor slab. This shall be indicated as a superimposed dead load (SDL) in addition to any other SDL required for the area. Refer to the mechanical consultant for further requirements.

.5 Locate emergency generators at grade level whenever possible to avoid structural vibration problems. If emergency generators are located on upper floors, specify an inertia base of 1.5 times the weight of the equipment.

.6 Facilities that house vibration-sensitive equipment require an evaluation of the proposed structural framing system. A specialist vibration consultant shall evaluate the compatibility of the proposed structural framing system with the vibration-transmission limitations of the proposed equipment.

.7 Measure to control vibrations transmitted to sensitive areas such as laboratories, include:

.1 Design the structural system with reduced column spacing.
.2 Isolate the laboratory spaces from sources of vibration.
.3 Locate vibration-sensitive equipment on grade-supported slabs.
.4 Locate vibration-sensitive equipment near column on framed floors.
.5 Avoid combining corridor and laboratory spans in the same structural bay on framed floors.

A. Specific Requirements for Healthcare Facilities

.1 Design structural steel floors to prevent floor vibration due to walking from exceeding comfort thresholds for all administrative areas and non-critical areas such as lounges, waiting areas, cafeterias, etc. Typically, a peak acceleration of 0.5% g (4-8 Hz) for office occupancy is acceptable.

.2 Design normal Operation Rooms and sensitive Patient Rooms to limit floor vibration to the tactile perception threshold; typically 0.05 % g (4-8 Hz). Less sensitive Patient Rooms may have slightly higher levels of floor vibration; 0.1% g (4-8 Hz).

.3 Operating rooms and other spaces with sensitive equipment (e.g. microsurgery, neurosurgery, MRI) require much lower levels of floor vibration. When possible, design floors to the specific criteria provided by equipment manufacturers, assuming the most stringent requirements.

.4 Consider supporting vibration sensitive equipment from columns or from a structure spanning between columns to avoid making contact with the floor above. When vibration sensitive equipment must be supported directly from the floor structure above, the vibration criteria also apply to the floor above the concerned space.
4.7 Structural Design of Non-Structural Components

.1 The structural design and field review of non-structural elements, restraints, and anchorages shall be provided by a professional engineer registered in the Province of Alberta. The design shall conform to NBC(AE).

.2 Letters of assurance for design and field review shall be provided by the engineer(s) responsible for the design of non-structural elements, and shall be submitted to the SER.

.3 The SER is not responsible for the design of the non-structural elements. However, the SER remains responsible for designing the primary structural system to accommodate these elements and for allowing for their effects on the primary structural system.

.4 Non-structural elements shall include (but are not limited to) the following:

.1 Cladding, glazing, curtain wall, windows, storefront, interior stud walls exterior wall assemblies.
.2 Architectural precast concrete.
.3 Architectural components, such as, guardrails, handrails, flag posts, ceilings, skylights, interior partitions and millwork.
.4 Mechanical and electrical equipment, components and their attachment.
.5 Window washing equipment and their attachment.
.6 Escalators, elevators, and conveying systems.
.7 Brick, block, or masonry veneers and their attachment.
.8 Non-load bearing masonry.
.9 Glass block and its attachment.
.10 Landscape elements such as benches, light standards, planters, walls, and art installations.
.11 Non-structural concrete topping.

4.8 Information to be Included in the Schematic Design Report

The Schematic Design Report (SDR) shall contain a section for the Structural discipline with a narrative outlining the following information:

.1 Building Code and Design Guidelines used in design, including the edition of the NBC(AE) and the Technical Design Requirements for Alberta Infrastructure Facilities.
.2 CSA Material Design Standards including edition used for design of concrete, cold-formed steel, masonry, steel, wood, and other materials.

.3 The Importance Category for the building per NBC(AE) Table 4.1.2.1 (Low, Normal, High, or Post-Disaster).

.4 Design Gravity Loads – List the specified Dead, Superimposed Dead, and Live loads for each level. The specified uniformly distributed Live loads shall be listed by occupancy, per NBC(AE) Table 4.1.5.3.

.5 Snow Load – List the Importance Factor \( I_s \) for the ULS and SLS, the ground snow load \( S_s \) and the associated rain load \( S_r \). Also mention the impact of snow drift accumulation around roof obstructions and on lower roofs.

.6 Rain Load – List the 1/50 One Day Rain, and mention the effects of ponding assuming the roof drains are plugged.

.7 Wind Load – List the Importance Factor \( I_w \) for the ULS and SLS, the 1/50 hourly wind pressure, Internal Pressure Category (1 or 2 or 3) for \( C_{pi} \), uplift and downward wind pressure on roofs, and the design lateral drift limit for the SLS.

.8 Earthquake Load – List the Importance Factor \( I_E \) for the ULS, the seismic data \( S_{a(t)}, PGA, Site \) Class, \( F_a, F_v \), type of Seismic Force Resisting System (SFRS) used, the force modification factors \( R_d, R_o \) per NBC(AE) Table 4.1.8.9, and the design interstorey drift limit.

.9 Serviceability Criteria for:

.9.1 Deflection Limit under specified live load for floor and roof supporting members.

.9.2 Lateral Drift limit for total drift and interstorey drift under wind loads.

.9.3 Vibration Control for Upper Floors.

.10 Construction Materials – List the proposed materials and grades for structural steel, reinforced concrete (including air %, cement type, etc.), masonry, cold-formed steel, timber, and others.

.11 Geotechnical Report – Provide a narrative summarizing the impact of the geotechnical conditions on design, including groundwater, seismic site class, foundation options, main floor slab options, fill suitability to support a slab on grade, durability (cement type), frost protection measures (void form thickness, minimum depth of burial for foundations), and any other special considerations. In addition, provide the reference to the Geotechnical Report (Title, Consultant’s Name, Date, Report Number).
.12 Structural System – Provide a narrative describing the proposed Structural System (foundation, framing, floor system, roof system, shear cores, etc.) and any alternatives that may have been considered. Provide rationale for why the proposed system was chosen over other systems.

.13 Lateral Load Resisting System (LLRS) – Provide a narrative describing the proposed LLRS, including systems for horizontal (HLLRS) and vertical (VLLRS) transfer of lateral loads. Mention if Diaphragm Action is required of the roof and floor plates.

.14 Delegated Design – Indicate items for which Others (specialty professionals) are responsible for the detailed structural design.

.15 Mention any issues that may require special consideration and note short and long-term risks and assumptions.

4.9 Information to be Included in the Design Development Report

The Design Development Report (DDR) shall contain a section for the Structural discipline. The deliverables shall include a report and drawings. The report shall contain the information listed in Section 4.8 (Information to be included in the Schematic Design Report), but it should be updated to include any information that may not have been provided in the SDR and developed in more detail. The drawings are expected to contain the following information:

.1 General Notes:

.1 Detailed design criteria for the building.
.2 Key geotechnical design parameters.
.3 Material specifications in abridged form.

.2 Three-Dimensional Renderings – Minimum two views from orthogonal directions along with a north arrow for view orientation.

.3 Typical Structural Details proposed for use in the building.

.4 Foundation Plan:

.1 Structural grid with labels and dimensions (applies to all plans and sections).
.2 Foundation layout including location of footings and/or piles, grade beams, basement walls and inclined ramps (with preliminary member sizes).
.3 Locations of braced bays (VLLRS).
.4 Legend and schedules where appropriate (applies to all plans).

.5 Floor Plans:
.1 Top of floor elevation.
.2 Floor system including slab thickness.
.3 Layout of beams, columns, vertical cores, and braced bays (with preliminary member sizes).
.4 Major openings in the floor slab.

.6 Roof Plans:

.7 Building Sections:
.1 Major sections showing relevant conditions.
.2 Sections showing peculiar geometry including partial basements and exterior canopies.
.3 Elevation of each level and finished grade.

4.10 Design Information to beShown on the Contract Drawings

Provide the following design information on the structural drawings, concisely grouped on the first drawing where logical, regardless of whether also included in the specifications:

.1 Building Code and Design Guidelines as per Item 4.8.1.

.2 The CSA Material Design Standards as per Item 4.8.2.

.3 The Importance Category for the building as per Item 4.8.3.

.4 Design Gravity Loads as per Item 4.8.4. In addition, provide a key plan indicating design live load for floors that have varying live loads.

.5 Special loadings, such as due to fire truck, storage areas, landscaped areas, areas with heavy equipment, or other unusual load conditions, shall be identified and located on the drawings.
.6 Snow Load as per Item 4.8.5. In addition, show the loads due to snow drift accumulation around roof obstructions and on lower roofs.

.7 Rain Load as per Item 4.8.6. In addition, show the rain load on the roof including the effect of ponding assuming roof drains are plugged.

.8 Wind Load as per Item 4.8.7. For post-disaster buildings, also list the ULS factored lateral wind load on the building in two orthogonal directions used for design of the LLRS.

.9 Earthquake Load as per Item 4.8.8. For post-disaster buildings, also list the method of analysis used (equivalent static or dynamic), the fundamental period of the building (\( T_a \)) used in the calculation of base shear and the factored ULS base shear in two orthogonal directions.

.10 Description of the LLRS (HLLRS and VLLRS) for transfer of lateral loads, including the \( R_d \) and \( R_o \) used in design.

.11 The deflection limit under specified loads for floor and roof supporting members so that Others designing the Envelope / Finishes may account for these movements in their designs.

.12 Geotechnical design parameters – provide the reference to the geotechnical report (Title, Consultant’s Name, Date, Report Number), the factored ULS bearing capacity for spread footings, factored ULS skin friction and end bearing resistance for pile foundations, and the lateral earth pressure coefficient, assumed density of soil, and surcharge live load for design of basements and retaining walls (if applicable).

.13 Material specifications (abridged) for the proposed construction materials, such as schedule for various concrete elements (see Table 2 of CSA A23.1), rebar, grade for structural steel, wood, masonry and cold-formed steel.

.14 Identify areas of future additions (if any), indicating design loads and assumptions.

.15 Design criteria for any elements to be designed by the Contractor’s Engineer.

.16 Indicate clearly items for which Others are responsible for the detailed structural design (i.e. Delegated Design items).

.17 Elevations of the existing grade, finished grade, foundation, floors and roofs.

.18 Any special construction procedures or sequence assumed in design, if critical to the construction or long-term performance of the structure.
4.11 Contract Specifications

In addition to the abridged specifications provided on the Contract Drawings, the contract documents shall include book specification sections for all structural items in the scope of work for the project. The detailed book specifications not only provide technical requirements for materials, workmanship, and special provisions, but they may also provide criteria for acceptance of materials and workmanship and definition of defects. The detailed book specifications are essential for interpretation of the Contract and help protect all signatories to the Contract. The specifications should generally describe the following items:

.1 Type and quality of materials and equipment.

.2 Quality of workmanship including fabrication and erection tolerances, and definition of defects.

.3 Methods of fabrication, installation and erection.

.4 Test and code requirements.

.5 Allowances.

.6 Alternates and options.

.7 Shop drawings and mock-ups.

.8 Requirements and responsibilities for delegated design items.

For multistory buildings, the Contractor's Engineer shall develop a formwork design, installation and removal sequence plan and submit it to the Consultant for review before the first-level concrete is poured.
4.12 Construction Inspection and Materials Testing

.1 For Design-Bid-Build projects (for other project delivery mechanisms, discuss with the Alberta Infrastructure Project Manager), the contract documents are to note that the Province will engage construction inspection and materials testing agencies for Quality Assurance purpose including:

.1 Professional geotechnical inspection of foundation installation, soil compaction under slab-on-grade and backfill
.2 Sampling of plastic concrete.
.3 Structural steel fabrication and erection.
.4 Sampling and testing of other materials (wood, masonry, etc.)

.2 The Consultant shall provide the material testing requirements including scope of work to the Province.

.3 The purpose of the quality assurance program is to inspect, sample, and test an appropriate number of members, details, quantity of materials and procedures, in order to determine conformance of the work with the contract documents.

.4 Quality Assurance by the Province is not intended to serve as any part of the Contractor’s Quality Control program. The Contractor shall remain responsible for all quality control inspection and testing and shall facilitate the quality assurance testing by the Province’s appointed agencies. The Consultant shall ensure that testing requirements for Quality Control are provided in the contract documents.

End of Structural Section
5.0 Mechanical

Section Contents

5.1 General Mechanical Requirements ................................................................. 1
  .1 Intent ............................................................................................................... 1
  .2 References .................................................................................................... 1
  .A Specific Requirements for Schools .............................................................. 4
  .B Specific Requirements for Healthcare Facilities ......................................... 4
  .3 Schematic Design Submission ...................................................................... 6
  .4 Design Development Submission ............................................................... 6
  .5 Contract Documents ..................................................................................... 8
  B. Specific Requirements for Healthcare Facilities ....................................... 9
  .6 Accessibility .................................................................................................. 10
  .7 Coordination with Other Disciplines ......................................................... 10
  .A Specific Requirements for Schools .............................................................. 11
  .B Specific Requirements for Healthcare Facilities ....................................... 12
  .C Specific Requirements for Continuing Care Facilities ............................ 12
  .8 Commissioning ............................................................................................ 12
  .B Specific Requirements for Healthcare Facilities ....................................... 12
  .C Specific Requirements for Continuing Care Facilities ............................ 13
  .9 Renovations and Additions .......................................................................... 13
  .B Specific Requirements for Healthcare Facilities ....................................... 13
  .C Specific Requirements for Continuing Care Facilities ............................ 13
  .10 Acoustic and Vibration Control ................................................................. 13
  .11 Emergency Power ....................................................................................... 14
  .B Specific Requirements for Healthcare Facilities ....................................... 14
  .C Specific Requirements for Continuing Care Facilities ............................ 14
  .12 Energy Efficiency and Sustainability ......................................................... 14
  .13 Carbon-monoxide (CO) Detection ............................................................. 17

5.2 Mechanical Design Criteria ......................................................................... 17
  .1 HVAC Design Criteria .................................................................................. 17
  .2 HVAC Room Design Parameters ............................................................... 17
5.3 Drainage Systems ................................................................................................. 25
.1 General Requirements ......................................................................................... 25
.2 Sanitary Sewer System ....................................................................................... 25
.B Specific Requirements for Healthcare Facilities ................................................. 26
.C Specific Requirements for Continuing Care Facilities .................................... 27
.3 Laboratory / Hazardous Waste Drainage Systems ............................................. 27
.B Specific Requirements for Healthcare Facilities ................................................. 27
.4 Storm Drainage System ...................................................................................... 27
.B Specific Requirements for Healthcare Facilities ................................................. 28

5.4 Plumbing Fixtures and Equipment ...................................................................... 28
.1 General Requirements ......................................................................................... 28
.A Specific Requirements for Schools .................................................................... 29
.B Specific Requirements for Healthcare Facilities ................................................. 29
.C Specific Requirements for Continuing Care Facilities .................................... 29
.2 Floor Drains ........................................................................................................ 29
.B Specific Requirements for Healthcare Facilities ................................................. 30
.3 Interceptions ....................................................................................................... 30
.4 Water Closets ..................................................................................................... 30
.A Specific Requirements for Schools .................................................................... 30
.B Specific Requirements for Healthcare Facilities ................................................. 30
.C Specific Requirements for Continuing Care Facilities .................................... 31
.5 Urinals .................................................................................................................. 31
.6 Washroom Lavatories ....................................................................................... 31
.A Specific Requirements for Schools .................................................................... 31
.C Specific Requirements for Continuing Care Facilities .................................... 31
.7 Sinks ................................................................................................................... 32
.A Specific Requirements for Schools .................................................................... 32
.B Specific Requirements for Healthcare Facilities ................................................. 32
.C Specific Requirements for Continuing Care Facilities .................................... 32
.8 Emergency Fixtures ............................................................................................ 33
5.5 Domestic Water and Specialty Water Systems ........................................... 34
   .1 General Requirements .............................................................................. 34
   .2 Domestic Cold Water System .................................................................. 34
   .B Specific Requirements for Healthcare Facilities ..................................... 35
   .C Specific Requirements for Continuing Care Facilities .......................... 35
   .3 Domestic Hot Water System .................................................................... 35
   .B Specific Requirements for Healthcare Facilities ..................................... 36
   .C Specific Requirements for Continuing Care Facilities .......................... 37
   .4 Soft Water System .................................................................................... 37
   .B Specific Requirements for Healthcare Facilities ..................................... 38
   .5 Distilled, Demineralized, Pure, and Treated Water Systems .................. 38
   .B Specific Requirements for Healthcare Facilities ..................................... 38
5.6 Fuel Oil Systems ......................................................................................... 39
   .1 General Requirements .............................................................................. 39
   .B Specific Requirements for Healthcare Facilities ..................................... 39
   .C Specific Requirements for Continuing Care Facilities .......................... 39
5.7 Specialty Gases and Vacuum Systems ....................................................... 39
   .1 Laboratory Gas Systems .......................................................................... 39
   .2 Dental Compressed Air System ................................................................ 39
   .3 Dental Vacuum System ............................................................................ 40
   .4 Central Vacuum Cleaning System ............................................................ 40
   .B Specific Requirements for Healthcare Facilities ..................................... 40
5.8 Medical Gas Systems ................................................................................. 41
   .1 General Requirements .............................................................................. 41
   .2 Medical Air System .................................................................................. 42
   .3 Medical Vacuum System ........................................................................... 43
   .4 Medical Oxygen System .......................................................................... 43
   .5 Carbon Dioxide System ............................................................................ 44
5.9 Fire & Life Safety Systems ................................................................. 45
  .1 General Requirements .................................................................. 45
  .B Specific Requirements for Healthcare Facilities .......................... 45
  .2 Fire Pumps .................................................................................... 45
  .3 Standpipe System and Hose Valve cabinets .................................... 45
  .4 Sprinkler System ........................................................................... 46
  .B Specific Requirements for Healthcare Facilities .......................... 46
  .5 Fire Extinguishers ......................................................................... 47
  .A Specific Requirements for Schools .................................................. 47
  .B Specific Requirements for Healthcare Facilities .......................... 47
  .6 Smoke Control System ................................................................... 47
  .B Specific Requirements for Healthcare Facilities .......................... 48
  .C Specific Requirements for Continuing Care Facilities .................. 48
5.10 Heating Systems ............................................................................. 48
  .1 General Requirements .................................................................. 48
  .2 Heating Water System ................................................................... 50
  .A Specific Requirements for Schools .................................................. 51
  .B Specific Requirements for Healthcare Facilities .......................... 51
  .C Specific Requirements for Continuing Care Facilities .................. 51
  .3 Steam heating and Condensate System .......................................... 52
  .B Specific Requirements for Healthcare Facilities .......................... 52
5.11 Cooling Systems .............................................................................. 53
  .1 General Requirements .................................................................. 53
  .A Specific Requirements for Schools .................................................. 54
  .B Specific Requirements for Healthcare Facilities .......................... 54
  .C Specific Requirements for Continuing Care Facilities .................. 55
  .2 Condenser Water System ................................................................. 55
  .3 Chilled Water System ..................................................................... 56
  .4 Critical Cooling System ................................................................. 57
5.12 Ventilation Systems ........................................................................ 57
### 5.13 Exhaust Systems

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1</td>
<td>General Requirements</td>
</tr>
<tr>
<td>.A</td>
<td>Specific Requirements for Schools</td>
</tr>
<tr>
<td>.B</td>
<td>Specific Requirements for Healthcare Facilities</td>
</tr>
<tr>
<td>.C</td>
<td>Specific Requirements for Continuing Care Facilities</td>
</tr>
<tr>
<td>.2</td>
<td>Kitchen Exhaust System</td>
</tr>
<tr>
<td>.3</td>
<td>Smoke Exhaust Systems</td>
</tr>
<tr>
<td>.4</td>
<td>Fume and Process Exhaust Systems</td>
</tr>
<tr>
<td>.5</td>
<td>Radon Gas Exhaust</td>
</tr>
</tbody>
</table>

### 5.14 Energy Management Control Systems (EMCS)

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1</td>
<td>General Requirements</td>
</tr>
<tr>
<td>.2</td>
<td>Requirements for EMCS Major Components</td>
</tr>
<tr>
<td>.3</td>
<td>Control Point Schedule</td>
</tr>
<tr>
<td>.B</td>
<td>Specific Requirements for Healthcare Facilities</td>
</tr>
<tr>
<td>.4</td>
<td>Sequence of Operations</td>
</tr>
</tbody>
</table>
5.1 General Mechanical Requirements

.1 Intent

.1 The intent of this Section is to outline the requirements for the mechanical systems in new and renovated buildings funded by the Province, that are not otherwise covered by applicable codes and standards, to indicate a preference for certain system design elements over others, or to call attention to particular requirements that require careful consideration.

.2 This Section is not intended to address every conceivable condition or situation, to preclude the use of innovative design, as a substitute for good engineering practice, or to prevent the adoption of installation, operations, and maintenance procedures more stringent than those specified in this document. Where issues arise that are not addressed within this Section, or where it is determined that the requirement is not appropriate for a given project, the Design Consultant and the Project Manager shall apply due diligence in determining appropriate measures.

.3 Mechanical systems shall be designed and built to meet or exceed all applicable codes, standards, organizational requirements, and legislations.

.4 All mechanical systems shall be selected and designed taking into consideration their functionality, reliability, efficiency, flexibility, safety, maintainability, ability to be cleaned, potential for vandalism, and expandability/reserve capacity for future modifications where required.

.5 Do not design mechanical systems to accommodate future building expansion except where directed by the Project Manager.

.6 Use life cycle cost considerations when analyzing and selecting mechanical systems and equipment.

.2 References

.1 The Design Consultant shall use the following Codes and Standards as the basis of design. Discuss the use of Standards not listed here with the Province and document decisions in design reports. Where conflicts or omissions exist between various Codes and Standards, indicate in design report which measures were taken including the reasoning to support that decision.

.3 Referenced Documents

.1 Air-Conditioning, Heating, and Refrigeration Institute (AHRI), Standard 885- Procedures for Estimating Occupied Space Sound Levels In The Application of Air Terminals and Air Outlets

.2 Alberta Infrastructure

.1 EMCS Guideline for Logical Point Mnemonics
.2 Alberta Infrastructure Technical Specifications
.3 Alberta Infrastructure Water Treatment Program Manual

.3 Alberta Safety Codes Council, Alberta Safety Codes Act

.4 American Conference of Governmental Industrial Hygienists (ACGIH), Industrial Ventilation – A Manual of Recommended Practice

.5 American National Standards Institute (ANSI),

.1 ANSI/ISEA Z358.1, Emergency Eyewashes and Shower Equipment
.2 ANSI/ASSE Z9.5-2015 American National Standard for Laboratory Ventilation

.6 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Handbooks
.2 ASHRAE 12, Minimizing the Risk of Legionellosis Associated with Building Water Systems
.3 ASHRAE Guideline 1.5-2017 – The Commissioning Process for Smoke Control Systems
.4 ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
.5 ANSI/ASHRAE 55, Thermal Environmental Conditions for Human Occupancy
.6 ANSI/ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality
.7 ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
.8 ASHRAE 110-2016, Method of Testing Performance of Laboratory Fume Hoods
.9 ANSI/ASHRAE Standard 189.1, Standard for the Design of High-Performance Green Buildings
.10 ASHRAE, Laboratory Design Guide- Planning and Operation of Laboratory HVAC Systems

.7 American Society of Plumbing Engineers (ASPE), *Plumbing Engineering Design Handbooks*
.8 Canadian Centre for Occupational Health and Safety (OHS)

.1 Occupational Health and Safety Code
.2 Occupational Health and Safety Regulations

.9 Canadian Commission on Building and Fire Code (CCBFC), National Research Council of Canada (NRC)

.1 National Building Code - Alberta Edition
.2 National Fire Code - Alberta Edition
.3 National Plumbing Code of Canada
.4 National Energy Code of Canada for Buildings

.10 Canadian Council on Animal Care (CCAC), *Guidelines on Laboratory Animal Facilities*
.11 Canadian Green Building Council (CaGBC), *LEED Canada New Construction and Major Renovations*
.12 Canadian Standards Association (CSA)

.1 ASME A17.1/CSA B44, Safety Code for Elevators and Escalators
.2 ASME A112.19.3/CSA B45.4, Stainless Steel Plumbing Fixtures
.3 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code
.4 CSA B52, Mechanical Refrigeration Code
.5 CSA B64.10, Selection and Installation of Backflow Preventers
.6 CSA B64.10.1, Maintenance and Field Testing of Backflow Preventers
.7 CSA B128.1, Design and Installation of Non-Potable Water Systems
.8 CSA B139, Installation Code for Oil-Burning Equipment
.9 CSA B149.1, Natural Gas and Propane Installation Code
.10 CSA B651, Accessible Design for the Built Environment
.11 CSA C390, Test Methods, Marking Requirements, and Energy Efficiency Levels for Three-Phase Induction Motors
.12 CSA C22.1, Canadian Electrical Code, Part 1
.13 CSA Z316.5, Fume Hoods and Associated Exhaust Systems
.14 CSA Z320, Building Commissioning Standard & Check Sheets
.15 CSA Z662, Oil and Gas Pipeline Systems
.13 National Air Duct Cleaners Association (NADCA)

.1 Assessment, Cleaning, and Restoration (ACR) of HVAC Systems

.14 National Fire Protection Association (NFPA)

.1 NFPA 10, Standard for Portable Fire Extinguishers
.2 NFPA 13, Standard for the Installation of Sprinkler Systems
.3 NFPA 14, Standard for the Installation of Standpipe and Hose Systems
.4 NFPA 20, Standard for the Installation of Stationary Pumps for Fire Pumps
.5 NFPA 51, Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting and Allied Processes
.6 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilation Systems
.7 NFPA 92, Standard for Smoke Control Systems
.8 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
.9 NFPA 214, Standard on Water-Cooling Towers

.15 Sheet Metal & Air Conditioning Contractor’s National Association (SMACNA), HVAC Duct Construction Standards
.16 Underwriters’ Laboratories of Canada (ULC)
.17 Province of Alberta, Public Health Act: Food Regulation

.A Specific Requirements for Schools

.1 National Fire Protection Association (NFPA)

.1 NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

.B Specific Requirements for Healthcare Facilities

.1 Alberta Health Services (AHS)

.1 Infection Prevention and Control, Health Care Facility Design Guidelines and Preventive Measures for Construction, Renovation and Maintenance Activities
.2 Design Guideline and Infection Control Risk Assessment (ICRA) Guideline and Toolkit
.3 Best Practice Guidelines: Selection of Sinks and Faucet Fixtures for Dedicated Hand Washing Stations
.4 Design Guidelines for Continuing Care Facilities in Alberta, October 2014 (Draft)
.5 Standards for Cleaning, Disinfection, and Sterilization of Reusable Medical Devices for Health Care Facilities and Settings
.6 AHS POLICY PS-47, Safe Bathing Temperatures and Frequency
.7 AHS PROCEDURE PS-47-01, Safe Bathing Temperatures and Frequency
.8 AHS PROCEDURE PS-47-02, Safe Bathing Temperatures and Frequency – Hottest Flowing Water for Therapeutic Tubs.

.2 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE, HVAC Design Manual for Hospitals and Clinics
.2 ANSI/ASHRAE/ASHE 170, Ventilation of Health Care Facilities

.3 Canadian Standards Association (CSA)

.1 CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities
.2 CAN/CSA Z305.6, Medical Oxygen Concentrator Central Supply System: For Use with Nonflammable Medical Gas Piping Systems
.3 CAN/CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities
.4 CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities
.5 CAN/CSA Z317.10, Handling of Waste Materials Within Health Care Facilities
.6 CSA Z317.13, Infection Control During Construction or Renovation of Health Care Facilities
.7 CAN/CSA Z7396.1, Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases and Vacuum
.8 CSA Z8000, Canadian Health Care Facilities
.9 CSA Z8001, Commissioning of Health Care Facilities

.4 Facility Guidelines Institute (FGI)

.1 Guidelines for Design and Construction of Hospitals and Outpatient Facilities
.2 Guidelines for Design and Construction of Residential Health Care, and Support Facilities
.5 Health Canada Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Facilities and Other Institutional Buildings

.6 National Fire Protection Association (NFPA)
   .1 NFPA 99, Health Care Facilities Code
   .2 NFPA 418, Standard for Heliports

.7 United States Green Building Council (USGBC), LEED For Healthcare

.8 United States Pharmacopeia, USP 797, Pharmaceutical Compounding Sterile Preparations

.3 Schematic Design Submission
   .1 Schematic Design Submission should provide conceptual mechanical design and viable alternatives with recommendations.

   .2 As a minimum, Schematic Design Report needs to include the following:
      .1 Design criteria.
      .2 Applicable codes, regulations, restrictions, environmental issues and other factors affecting the design.
      .3 Deviations from Owner’s Project Requirements and potential impacts.
      .4 Site condition assessment, if needed.
      .5 Utility and/or building system tie-ins.
      .6 Locations of mechanical rooms and major mechanical equipment.
      .7 Preliminary mechanical design layout and system schematics.
      .8 Equipment weights and sizes for coordination with other disciplines.
      .9 Any specialty services e.g. acoustics, code consulting, seismic supports and restraints, medical gas system testing, commissioning, fire protection engineering, exhaust air re-entrainment investigation, wind tunnel study, etc.

.4 Design Development Submission
   .1 Design Development Submission needs to fully convey the design intent of all mechanical systems. All design related issues, technical criteria and performance shall be included in Design Development Report.
.2 As a minimum, the Design Development Report shall include the following:

.1 Written Information:

.1 Referenced Codes and Standards (with applicable version or edition).
.2 Detailed mechanical systems description.
.3 Deviations from Owner’s Project Requirements and potential impacts.
.4 Building overall heating and cooling loads.
.5 Major equipment selections with capacities.
.6 System and equipment redundancies and essential electrical system requirements.
.7 Vibration and noise control.
.8 Seismic supports and restraints for mechanical services and equipment.
.9 Smoke control system.
.10 Energy Management Control System, communication protocol and any interface to subsystems such as security, fire alarm and lighting.
.11 Preliminary plumbing fixtures selections (product data sheets)

.2 Drawings:

.1 Site Plan: all utility service connection locations and sizes, gas meter and fire department connection locations.
.2 Roof Plan: mechanical equipment, air intake and exhaust locations, roof drains.
.3 Plumbing Plan: fixtures, floor drains, cleanouts, plumbing and drainage mains.
.4 Fire Protection Plan: fire mains, fire protection zone boundaries, sprinkler tree location and hazard classifications.
.5 Heating Plan: distribution system and layout of terminal units.
.6 Cooling Plan: distribution system and layout of terminal units.
.7 Ventilation Plan: single line distribution mains and layout of terminal units.
.8 Mechanical Room Plan: equipment layout.
.9 Mechanical Systems Schematics: domestic water, natural gas, medical gas, heating, cooling, ventilation and smoke control.
.5 Contract Documents

.1 Prepare contract document drawings to include, but not limited to the following items:

.1 Title page

.2 Plan drawings:

.1 Locations of existing mechanical systems and equipment.
.2 Locations of valves (isolation valves, balancing valves, etc.).
.3 Locations of dampers (balancing, fire dampers, smoke dampers, control dampers, etc.).
.4 Plan locations of differential pressure sensors for variable flow control loops
.5 Room temperature thermostats and sensors (CO2, humidity, etc.)
.6 Locations of flow measuring devices (airflow stations, etc.).
.7 Equipment access/pull/removal areas.
.8 Locations of fire protection mains, sprinkler tree, fire pump, and sprinkler zone boundaries.
.9 Total connected gas load summary including planned future load.
.10 Seismic supports and restraints for mechanical services and equipment.
.11 Mechanical equipment legend.

.3 Details and sections:

.1 Details of air handling unit showing sections and component order (except for packaged unitary rooftop units).
.2 Sections through congested areas.
.3 Other project specific details

.4 Mechanical system schematics:

.1 Fire protection
.2 Heating and cooling piping
.3 Ventilation
.4 Smoke control
.5 Natural gas and specialty gases (compressed air, medical gas etc.)
.6 Potable and non-potable water piping

.1 EMCS input/output and related end devices (sensors locations e.g. including temperature, humidity, pressure/differential, etc.) should be indicated on mechanical system schematics.
.5 Mechanical equipment schedules for all equipment not defined in the specifications.

.2 Prepare contract document specifications using the Alberta Infrastructure Technical Specifications as a reference. See Section 5.14 for specific EMCS Specification requirements. Edit relevant sections to suit the project. Specifications should include, but not be limited to the following:

.1 Requirements for system demonstration and training for facility operational staff.
.2 Requirements for ‘As-built’ or ‘Record’ drawings.
.3 Requirements for system start up, testing, balancing and commissioning.
.4 Requirements for system cleaning and chemical treatment.
.5 Requirements for O&M manuals including system descriptions, design set points, sequences of operations, maintenance requirements, training literature, performance tests, and shop drawings.
.6 Requirements for duct, pipe, valve, and equipment labeling including identification, colour coding and naming nomenclature.
.7 Requirements for seismic supports and restraints for mechanical services and equipment.
.8 Requirements of Alberta Infrastructure Technical Specification Section 23 09 24 EMCS Network Communication and System Configuration for communication interface between mechanical systems and EMCS.

B. Specific Requirements for Healthcare Facilities

.1 Contract document drawings to include, but not limited to, the following items:

.1 Mechanical system schematics:

.1 Medical gases

.2 Contract document specifications to include, but not limited to, the following:

.1 Requirements for the Contractor to follow CSA Z317.13, Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities for precautionary measures before, during, and after construction in a Health Care Facility.
.6 Accessibility

.1 Provide adequate space around equipment for serviceability, balancing, commissioning, safety, equipment removal, and to accommodate component removal such as tube bundles, filter media, and large motors.

.2 Provide a means to remove large equipment from mechanical areas that may require periodic replacement for maintenance or for future equipment installations (consider door opening sizes such as double doors, elevator size and maximum weights, corridor dimensions and obstructions, etc.).

.1 Provide permanent access platform structure for any major equipment (e.g., AHUs) located above 2000 mm within a mechanical room.

.3 Refer to each section for specific accessibility requirements.

.7 Coordination with Other Disciplines

.1 Coordinate the mechanical systems with other members of the design team as required for consistency and integration with other building components.

.2 The following list of mechanical system coordination items is not intended to be complete, but rather to highlight some of the more common items and issues that typically require coordination.

.1 Base mechanical systems on building code studies to determine occupancy classification, high-rise requirements, and defined areas of refuge.

.2 Base mechanical systems on studies produced by other consultants including geotechnical reports, acoustic requirements, elevator requirements, and helipad requirements.

.3 Coordinate the space requirements for mechanical services with other services sharing the ceiling space for distribution.

.4 Coordinate mechanical equipment weights, locations, and dimensions.

.5 Coordinate the locations, dimensions, and height of roof-mounted mechanical equipment.

.6 Coordinate the location of mechanical equipment mounted within the ceiling system (diffusers, grilles, sprinkler heads, access panels to service equipment, etc.) with other ceiling-mounted components (lights, speakers, signs, etc).

.7 Base heating and cooling load calculations on the actual envelope construction details using actual glazing shading coefficients and thermal resistance values (that account for the thermal bridging through the window frames).
.8 Base seismic and expansion compensators for mechanical systems on the maximum displacement due to the wind or seismic forces where building expansion joints are required.

.9 Base supports and restraints for mechanical systems on the seismic loads as required by the National Building Code - Alberta Edition.

.10 Determine the details of the foundation drainage system and whether or not a sump is required within the building.

.11 Base mechanical system attenuation components on the requirements of the Acoustic Consultant (when involved).

.12 Coordinate noise data emitted from mechanical equipment.

.13 Design duct and pipe distribution on the structural design and the height of the ceiling space.

.14 Coordinate the size, slope, peak flow rate, location, and inverts of the sanitary sewer and storm drainage mains at the building perimeter.

.15 Base distribution piping for irrigation purposes inside the building on the required flow, pressure, and location requirements of the Landscape Architect.

.16 Coordinate the type of fire protection for electrical, server and telecom rooms.

.17 Coordinate design of smoke control system with other disciplines.

.18 Base water and sprinkler pipe designs on the actual available pressure and flow at the design conditions. Conduct fire hydrant flow tests as required.

.19 Coordinate mechanical equipment voltages, motor horsepower, current draw, emergency power requirements, redundancy, and control methodology.

.20 Variable Frequency Drives (VFD) shall comply with the requirements of Technical Design Requirements, Section 6.0 Electrical.

.21 Coordinate the current and future natural gas loads with the utility service provider.

.22 Coordinate treatment for all envelope penetrations such as pipes, ducts, louvers, and exhaust with the requirements of Technical Design Requirements, Section 2.0 - Building Envelope.

.23 Coordinate waterproofing of mechanical equipment and related supply lines, on roof curbs or on raised steel structure, with other members of the design team. For curbed designs, determine whether voids below equipment are to be treated as interior or exterior space.

.A Specific Requirements for Schools

.1 Coordinate mechanical equipment layout (e.g. ductwork, piping, terminal units etc.) in gymnasium storage to avoid potential conflicts with shelf and gym equipment locations.
.B Specific Requirements for Healthcare Facilities

.1 Coordinate the location of mechanical equipment mounted within the ceiling system with patient lifts, vertical headwalls, and booms.

.2 Coordinate to ensure that floors of mechanical rooms other than concrete slabs on grade are waterproof and provided with curbs at all penetrations other than at floor drains.

.3 Coordinate to ensure that interstitial spaces, or service floor areas (other than concrete slabs on grade) that are used as mechanical spaces and that contain significant plumbing or equipment that could pose a risk of leaks or floods are waterproofed and provided with curb penetrations other than at floor drains.

.C Specific Requirements for Continuing Care Facilities

.1 Provide coordination to the same standards as Healthcare Facilities.

.8 Commissioning

.1 The Project Manager will determine the requirement for commissioning on a project.

.2 Comply with CSA Z320, Building commissioning for mechanical systems, or as required by LEED.

.3 Commissioning requirements should be based on size and complexity of the project. Work with the Project Manager to outline the “Mechanical Systems to be Commissioned”.

.4 Include commissioning requirements in the mechanical specifications for the mechanical contractor’s scope of work.

.5 Participate in the commissioning process.

.B Specific Requirements for Healthcare Facilities

.1 Comply with CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities and CSA Z8001, Commissioning of Health Care Facilities for mechanical systems commissioning, or as required by LEED.
.C Specific Requirements for Continuing Care Facilities

.1 Provide commissioning to the same standards as Healthcare Facilities.

.9 Renovations and Additions

.1 Rebalance all new and existing air and water systems that are modified or extended as part of a renovation.

.2 Document capacity and assess overall capability of existing mechanical systems and equipment during schematic design.

.3 Analyze existing mechanical systems serving renovated areas to identify any adverse environmental impacts (e.g. energy use, emissions of greenhouse gases and ozone-depleting substances etc.). Consideration should be given to renewable energy resources and environmentally sustainable practices.

.4 Provide energy efficient equipment and implement energy/water conservation measures when replacing existing equipment and systems at the end of their service life.

.5 Clean all new and existing air ductwork prior to occupancy.

.B Specific Requirements for Healthcare Facilities

.1 Upgrade HVAC systems serving renovated areas in accordance with the requirements of CSA Standards.

.2 Ensure that precautionary and preventative measures take place before and during construction, renovation, and maintenance of Healthcare Facilities in accordance with CSA Z317.13, Infection Control During Construction or Renovation of Health Care Facilities.

.C Specific Requirements for Continuing Care Facilities

.1 Provide commissioning to the same standards as Healthcare Facilities.

.10 Acoustic and Vibration Control

.1 Design mechanical systems in accordance with the design guidelines for HVAC-related background sound in rooms in accordance with ASHRAE, Applications Handbook and AHRI, Standard 885.

.2 Refer to Acoustical Sub-section 7.6 - Mechanical for additional requirements.
.11 Emergency Power

.1 Review with the Project Manager and Facility Administrator during design the mechanical equipment connected to the normal power and essential electrical system (vital, delayed vital, and conditional loads).


.B Specific Requirements for Healthcare Facilities


.C Specific Requirements for Continuing Care Facilities

.1 Provide emergency power to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.12 Energy Efficiency and Sustainability


.2 Energy conservation measures shall not reduce system performance below that required by codes and standards.

.3 Integrate energy conservation and heat recovery strategies into the mechanical design that are supported by economic cost analysis. Discuss energy conservation measures with the Project Manager and the Facility Administrator. Energy Conservation options which should be considered include, but are not limited to:

.1 Plumbing and Drainage Systems:

.1 Rainwater harvesting (cooling tower makeup)
.2 Graywater reuse
.3 Ultra-low flow plumbing fixtures
.4 Condensing water heaters
.5 Control domestic hot water recirculation pumps to stop during non-occupied hours.

.2 Ventilation Systems:

.1 Air-handling units capable of providing free-cooling when ambient conditions permit.
.2 Heat recovery devices in exhaust air streams.
.3 Variable frequency drives on fans, where applicable.
.4 Variable volume terminal devices
.5 Air-handling units controlled to shut down during non-unoccupied hours.
.6 Variable air volume boxes to reduce airflow or shutdown during unoccupied periods
.7 Ventilation airflow based on CO$_2$ demand control
.8 Reduce space temperature set-point during non-occupied hours
.9 Supply air temperature reset based on outdoor temperature or Zone demand

.3 Heating Water Systems:

.1 Heat recovery devices in boiler combustion exhausts
.2 Variable speed drives on pumps to maintain system pressure
.3 Pumps controlled to shut down when heating is not required
.4 Condensing or near-condensing boilers

.4 Chilled Water / Condenser Water Systems:

.1 Airside and/or Waterside economizers.
.2 Variable speed drives on pumps to maintain system pressure.
.3 Pumps controlled to reduce flow rate or shut down during non-occupied hours.
.4 Magnetic bearing chillers
.5 Variable speed chillers
.6 Variable speed cooling tower fans

.5 Control Systems:

.1 Load shedding of non-critical equipment
.2 Refer to 5.14.4 for additional control measures
.4 Leadership in Energy and Environmental Design (LEED):

.1 All Tier 1 projects shall be certified to a minimum LEED V4 Silver rating as required in Section 1.0 – Sustainability.

.2 The Province requires a number of LEED credits to be mandatory for its projects. The credits related to mechanical systems are as follows:

.1 Water Efficiency Credit: Water Metering.
.2 Energy and Atmosphere Credit: Optimize Energy Performance.
.3 Energy and Atmosphere Credit: Enhanced and Monitoring-Based Commissioning.
.4 Energy and Atmosphere Credit: Advanced Energy Metering

.5 Discuss with the Project Manager, Facility Manager and Energy Manager to determine which additional systems shall be monitored as part of the Advanced Energy Metering credit (through the building management system). As a minimum the following systems should be monitored.

.1 Natural Gas:

.1 Heating water
.2 Humidification
.3 Domestic potable hot water
.4 Process heating

.2 Water:

.1 Reverse osmosis makeup water
.2 Cooling tower makeup water

.3 Electrical:

.1 Lighting
.2 Heating plant (boiler, pumps)
.3 Chiller plant (chiller, pumps, cooling towers)
.4 Ventilation (air-handling unit fans, exhaust fans, makeup air units)

.4 Heating Water:

.1 BTU meter installed in heating water loops

.6 Provide high efficiency motors in accordance with CSA 390, Energy Efficient Test Methods for Three-Phase Induction Motors.
When replacing existing equipment and systems due to end of service life, energy efficient equipment shall be provided and energy/water conservation measures shall be implemented.

.13 Carbon-monoxide (CO) Detection

.1 Provide CO detection and monitoring in all mechanical rooms that have fuel-burning equipment to avoid CO exposure in case of equipment malfunction.

5.2 Mechanical Design Criteria

.1 HVAC Design Criteria

.1 Design HVAC systems to contribute to a healthy indoor environment by suitable control of temperature, relative humidity, ventilation rate, ventilation effectiveness, air movement, mean radiant temperature, noise level, relative space pressurization, and indoor air quality.

.2 Design mechanical systems to provide heating and cooling capacities based on the outdoor ambient temperatures given in the National Building Code - Alberta Edition:

- Cooling – July, 2.5% value
- Heating – January, 1% value

.3 Design mechanical systems to provide 30% relative humidity at outdoor temperatures above 0°C; 15% relative humidity below -30°C and reset relative humidity on linear scale between 0 and -30°C unless otherwise required

.4 by the specific space requirements.

.2 HVAC Room Design Parameters

.1 Design mechanical systems to provide an indoor environment (temperature, thermal radiation, humidity, air speed) that meets ASHRAE 55, Thermal Environmental Conditions for Human Occupancy.

.2 Design ventilation systems in compliance with ASHRAE 62, Ventilation for Acceptable Indoor Air Quality.
### A Specific Requirements for Schools

.1 Design mechanical systems in schools to meet the criteria set out in Table 5.2.2.A and Table 5.2.2.B.

.1 Use table 5.2.2.A for spaces with overhead air distribution
.2 Use table 5.2.2.B for spaces with displacement ventilation

#### Table 5.2.2.A: Mechanical System Design Parameters for Schools - Overhead Air Distribution

<table>
<thead>
<tr>
<th>Space</th>
<th>Temperature Range °C (Note 1)</th>
<th>Relative Humidity (Note 2)</th>
<th>Minimum Total ACH (Note 3)</th>
<th>Relative Pressurization (Note 4)</th>
<th>Noise Level RC (N) (Note 5)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditorium</td>
<td>22 - 25</td>
<td>see note 2</td>
<td>4* Neutral (E)</td>
<td>20-25</td>
<td>* See Note 3c</td>
<td></td>
</tr>
<tr>
<td>Cafeteria</td>
<td>22 - 25</td>
<td>see note 2</td>
<td>6* Negative (-)</td>
<td>40</td>
<td>* See Note 3c</td>
<td></td>
</tr>
<tr>
<td>Classrooms</td>
<td>22 - 25</td>
<td>see note 2</td>
<td>4* Neutral (E)</td>
<td>25-30</td>
<td>* See Note 3c</td>
<td></td>
</tr>
<tr>
<td>Computer Classrooms</td>
<td>22 - 25</td>
<td>see note 2</td>
<td>4* Neutral (E)</td>
<td>35</td>
<td>* See Note 3c</td>
<td></td>
</tr>
<tr>
<td>Conference Rooms</td>
<td>22 - 25</td>
<td>see note 2</td>
<td>6* Neutral (E)</td>
<td>30</td>
<td>* See Note 3c</td>
<td></td>
</tr>
<tr>
<td>Corridors</td>
<td>22 - *</td>
<td>see note 2</td>
<td>2</td>
<td>Neutral (E)</td>
<td>40</td>
<td>* See Note 1b</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>22 - *</td>
<td>see note 2</td>
<td>6*** Neutral (E)</td>
<td>35</td>
<td>* mechanical cooling not required</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>** see Note 1b</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*** see Note 6</td>
<td></td>
</tr>
<tr>
<td>Home Economics</td>
<td>22 - 25</td>
<td>see note 2</td>
<td>6* Negative (-)</td>
<td>30</td>
<td>* may require higher ACH to meet exhaust</td>
<td></td>
</tr>
</tbody>
</table>

(Notes:
1) see note 2
2) Neutral (E)
3) see note 2
4) Neutral (E)
5) Neutral (E)
6) see note 2
7) see note 2
8) Neutral (E)
<table>
<thead>
<tr>
<th>Space</th>
<th>Temperature Range °C (Note 1)</th>
<th>Relative Humidity (Note 2)</th>
<th>Minimum Total ACH (Note 3)</th>
<th>Relative Pressurization (Note 4)</th>
<th>Noise Level RC (N) (Note 5)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Arts*</td>
<td>22 – ** see note 2</td>
<td></td>
<td>6 *** Negative (-)</td>
<td>35</td>
<td></td>
<td>* mechanical cooling not required ** see Note 1b *** may require higher ACH to meet exhaust demand</td>
</tr>
<tr>
<td>Kitchen*</td>
<td>22 - ** see Note 2</td>
<td></td>
<td>Negative (-)</td>
<td>45</td>
<td></td>
<td>* mechanical cooling not required ** see Note 1b</td>
</tr>
<tr>
<td>Laboratories</td>
<td>22 - 25 see Note 2</td>
<td></td>
<td>6* Negative (-)</td>
<td>30</td>
<td></td>
<td>*See Note 3c</td>
</tr>
<tr>
<td>Library</td>
<td>22 – 25 see Note 2</td>
<td></td>
<td>6</td>
<td>Neutral (E)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Locker Rooms</td>
<td>22 - * see Note 2</td>
<td></td>
<td>Negative (-)</td>
<td>45</td>
<td></td>
<td>*See Note 1b</td>
</tr>
<tr>
<td>Music Room</td>
<td>22 - 25 see Note 2</td>
<td></td>
<td>4* Neutral (E)</td>
<td>30</td>
<td></td>
<td>*See Note 3c</td>
</tr>
<tr>
<td>Office</td>
<td>22 - 25 see Note 2</td>
<td></td>
<td>4* Neutral (E)</td>
<td>35</td>
<td></td>
<td>*See Note 3c</td>
</tr>
<tr>
<td>Reception</td>
<td>22 - 25 see Note 2</td>
<td></td>
<td>4* Neutral (E)</td>
<td>35</td>
<td></td>
<td>*See Note 3c</td>
</tr>
<tr>
<td>Server Room*</td>
<td>22 - 25 see Note 2</td>
<td></td>
<td></td>
<td>45</td>
<td></td>
<td>*provide stand-alone AC unit *See Note 3c</td>
</tr>
<tr>
<td>Staff Room</td>
<td>22 - 25 see Note 2</td>
<td></td>
<td>6* Negative (-)</td>
<td>40</td>
<td></td>
<td>*See Note 3c</td>
</tr>
<tr>
<td>Gymnasium Storage Room</td>
<td>22 - * see Note 2</td>
<td></td>
<td>4</td>
<td>Negative (-)</td>
<td>45</td>
<td>*see Note 1b</td>
</tr>
<tr>
<td>Washrooms</td>
<td>22 - * see Note 2</td>
<td></td>
<td>Negative (-)</td>
<td>45</td>
<td></td>
<td>*see Note 1b</td>
</tr>
</tbody>
</table>
Table 5.2.2.A Notes:

.1 Temperature Range:
   a. Where a temperature range is shown (i.e. 22°C-25°C), select the upper value as the maximum summer design temperature and the lower value as the minimum winter design temperature.
   b. No requirement for maximum summer design temperature.

.2 Relative Humidity:
   a. Maintain minimum 30% RH at outdoor temperatures above 0°C; 15% RH below -30°C and reset RH on linear scale between 0 and -30°C.
   b. Notwithstanding point a. above; lower humidity levels may be needed in existing buildings; coordinate with Architect the humidification capability of existing buildings in renovation projects.
   c. Maintain the humidity level for gymnasiums to meet the manufacturer’s requirements for the wood flooring.

.3 Total Air Changes Per Hour (ACH):
   a. Refers to total mechanical air circulation provided to a space. May be comprised of outdoor air, return air or transferred air. Outdoor air for ventilation must be provided per applicable codes.
   b. Values listed are minimum values and do not preclude the use of higher or more appropriate values based on more stringent standards or cooling requirements.
   c. Where no mechanical cooling is provided, a minimum 6 ACH should be provided for higher air circulation in the learning and administration areas; 8 ACH in the music room and staff room; 10 ACH in the conference rooms and laboratories; 12 ACH in the cafeteria.
   d. Values refer to occupied spaces; ventilation can be reduced when space is unoccupied except where specifically noted otherwise.

.4 Relative Pressure:
   a. “E” denotes equal or neutral relative pressure to surrounding spaces.
   b. “+” denotes positive relative pressure to surrounding spaces.
   c. “-” denotes negative relative pressure to surrounding spaces.

.5 Noise Level: This number indicates the acceptable range of background noise level in terms of room criteria (RC) assuming a neutral (N) spectrum. Refer also to Section 7.0 – Acoustics.

.6 Gymnasium normal occupancy 30 to 60 students for outdoor air requirements. Peak occupancy rate to be coordinated with the school board. Air changes to be based on 3m height (i.e. occupied zone).
<table>
<thead>
<tr>
<th>Space</th>
<th>Temperature Range °C</th>
<th>Relative Humidity (Note 2)</th>
<th>Minimum Total ACH (Note 3)</th>
<th>Relative Pressurization (Note 4)</th>
<th>Noise Level RC (N) (Note 5)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditorium</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Neutral (E)</td>
<td>20-25</td>
<td></td>
</tr>
<tr>
<td>Cafeteria</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Negative (-)</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Classrooms</td>
<td>22 – 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Neutral (E)</td>
<td>25-30</td>
<td></td>
</tr>
<tr>
<td>Computer Classrooms</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Neutral (E)</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Conference Rooms</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Neutral (E)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Corridors</td>
<td>22 - *</td>
<td>see Note 2</td>
<td>2</td>
<td>Neutral (E)</td>
<td>40</td>
<td>*see Note 1b</td>
</tr>
<tr>
<td>Gymnasium*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*See Note 6</td>
</tr>
<tr>
<td>Home Economics</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6 *</td>
<td>Negative (-)</td>
<td>30</td>
<td>* may require higher ACH to meet exhaust</td>
</tr>
<tr>
<td>Industrial Arts*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*See Note 6</td>
</tr>
<tr>
<td>Kitchen*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*See Note 6</td>
</tr>
<tr>
<td>Laboratories*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*See Note 6</td>
</tr>
<tr>
<td>Library</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Neutral (E)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Locker Rooms*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*See Note 6</td>
</tr>
<tr>
<td>Music Room</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Neutral (E)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Office</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Neutral (E)</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Reception</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Neutral (E)</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Server Room*</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td></td>
<td>Neutral (E)</td>
<td>45</td>
<td>*Provide stand-alone AC unit</td>
</tr>
<tr>
<td>Staff Room</td>
<td>22 - 25</td>
<td>see Note 2</td>
<td>3.6</td>
<td>Negative (-)</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Storage Room*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*See Note 6</td>
</tr>
<tr>
<td>Washrooms*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*See Note 6</td>
</tr>
</tbody>
</table>
Table 5.2.2.B Notes:

.1 Temperature Range:
   c. Where a temperature range is shown (i.e. 22°C-25°C), select the upper value as the maximum summer design temperature and the lower value as the minimum winter design temperature.
   d. No requirement for maximum summer design temperature.

.2 Relative Humidity:
   a. Maintain minimum 30% RH at outdoor temperatures above 0°C; 15% RH below -30°C and reset RH on linear scale between 0 and -30°C.
   b. Notwithstanding point a. above; lower humidity levels may be needed in existing buildings; coordinate with Architect the humidification capability of existing buildings in renovation projects.
   c. Maintain the humidity level for gymnasiums to meet the manufacturers requirements for the wood flooring

.3 Total Air Changes Per Hour (ACH):
   a. Refers to total mechanical air circulation provided to a space. May be comprised of outdoor air, return air or transferred air. Outdoor air for ventilation must be provided per applicable codes.
   b. Values listed are minimum values and do not preclude the use of higher or more appropriate values based on more stringent standards or cooling requirements.
   c. Values refer to occupied spaces; ventilation can be reduced when space is unoccupied except where specifically noted otherwise.

.4 Relative Pressure:
   a. “E” denotes equal or neutral relative pressure to surrounding spaces
   b. “+” denotes positive relative pressure to surrounding spaces
   c. “-” denotes negative relative pressure to surrounding spaces

.5 Noise Level: This number indicates the acceptable range of background noise level in terms of room criteria (RC) assuming a neutral (N) spectrum. Refer also the Section 7.0 – Acoustics.

.6 This space type is not suitable for displacement ventilation. Use design parameters in Table 5.2.2.A for the corresponding space type.

.B Specific Requirements for Healthcare Facilities

.1 Design mechanical systems in healthcare facilities to meet the criteria set out in CAN/CSA-Z317.2, Special Requirements for Heating, Ventilation, and Air
Conditioning (HVAC) Systems in Health Care Facilities (i.e. temperature range, relative humidity, minimum total air changes per hour, minimum outdoor air changes per hour, relative pressurization, filtration requirements, noise level, etc.).

.C Specific Requirements for Continuing Care Facilities

.1 Design mechanical systems in continuing care facilities to meet the criteria set out in Table 5.2.2.C.

<p>| Table 5.2.2.C: Mechanical System Design Parameters for Continuing Care Facilities |
|-----------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Space                                         | Temperature Range °C (Note 1) | Relative Humidity Range (%) (Note 2) | Minimum Total ACH (Note 3) | Minimum Outdoor ACH (Note 3) | Relative Pressurization (Note 4) | All Air Exhausted Directly to Outdoors | Noise Level RC (N) (Note 5) | Remarks         |
| Activity Rooms                               | 22-24            | 30-60           | 6               | 2               | Neutral (E)            | -                            | 35-40           |
| Administrative/Offices                        | 22-24            | 30-60           | 6               | 2               | Neutral (E)            | -                            | 30-35           |
| Barber/Beauty Parlour                         | 22-24            | 30-60           | 12              | 3               | Negative (-)EE         | Yes                          | 35-45           |
| Assisted Bath                                | 24-27            | 30-60           | 9               | 3               | Negative (-)           | Yes                          | 40-45           |
| Clean Linen Storage                          | 22-24            | 30-60           | 4               | 1               | Positive (+)           | -                            | 40-45           |
| Clean Utility                                | 22-24            | 30-60           | 6               | 2               | Positive (+)           | -                            | 35-40           |
| Conference Rooms                             | 22-24            | 30-60           | 10              | -               | Neutral (E)            | -                            | 30-35           |
| Dining                                       | 22-24            | 30-60           | 6               | 2               | Negative (-)           | -                            | 35-40           |
| Dishwashing                                  | 22-24            | 30-60           | 10              | 2               | Negative (-)           | Yes                          | 40-45           |
| Examination &amp; Treatment                      | 22-24            | 30-60           | 6               | 2               | Neutral (E)            | -                            | 35-40           |</p>
<table>
<thead>
<tr>
<th>Space</th>
<th>Temperature Range °C (Note 1)</th>
<th>Relative Humidity Range (%) (Note 2)</th>
<th>Minimum Total ACH (Note 3)</th>
<th>Minimum Outdoor ACH (Note 3)</th>
<th>Relative Pressurization (Note 4)</th>
<th>All Air Exhausted Directly to Outdoors</th>
<th>Noise Level RC (N) (Note 5)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housekeeping Closets</td>
<td>22-*</td>
<td>30-60</td>
<td>10</td>
<td>-</td>
<td>Negative (-)</td>
<td>Yes</td>
<td>-</td>
<td>*See Note 1b</td>
</tr>
<tr>
<td>Kitchen</td>
<td>22-24</td>
<td>30-60</td>
<td>10</td>
<td>2</td>
<td>Negative (-)</td>
<td>Yes</td>
<td>40-45</td>
<td></td>
</tr>
<tr>
<td>Laundry</td>
<td>22-24</td>
<td>30-60</td>
<td>12</td>
<td>3</td>
<td>Negative (-)</td>
<td>-</td>
<td>40-45</td>
<td></td>
</tr>
<tr>
<td>Lounges</td>
<td>22-24</td>
<td>30-60</td>
<td>6</td>
<td>2</td>
<td>Neutral (E)</td>
<td>-</td>
<td>30-35</td>
<td></td>
</tr>
<tr>
<td>Nursing Stations</td>
<td>22-24</td>
<td>30-60</td>
<td>6</td>
<td>2</td>
<td>Neutral (E)</td>
<td>-</td>
<td>30-35</td>
<td></td>
</tr>
<tr>
<td>Physical Therapy</td>
<td>22-24</td>
<td>30-60</td>
<td>9</td>
<td>3</td>
<td>Neutral (E)</td>
<td>-</td>
<td>35-40</td>
<td></td>
</tr>
<tr>
<td>Public Washrooms</td>
<td>22-*</td>
<td>30-60</td>
<td>9</td>
<td>-</td>
<td>Negative (-)</td>
<td>Yes</td>
<td>40-45</td>
<td>*See Note 1b</td>
</tr>
<tr>
<td>Resident Bedrooms</td>
<td>22-24</td>
<td>30-60</td>
<td>4</td>
<td>2</td>
<td>Neutral (E)</td>
<td>-</td>
<td>30 max</td>
<td></td>
</tr>
<tr>
<td>Corridors</td>
<td>22-24</td>
<td>30-60</td>
<td>3</td>
<td>1</td>
<td>Neutral (E)</td>
<td>-</td>
<td>35-40</td>
<td></td>
</tr>
<tr>
<td>Resident Washrooms</td>
<td>22-24</td>
<td>30-60</td>
<td>9</td>
<td>-</td>
<td>Negative (-)</td>
<td>Yes</td>
<td>35-40</td>
<td></td>
</tr>
<tr>
<td>Soiled Linen Storage</td>
<td>22-24</td>
<td>30-60</td>
<td>10</td>
<td>-</td>
<td>Negative (-)</td>
<td>Yes</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Soiled Utility</td>
<td>22-*</td>
<td>30-60</td>
<td>10</td>
<td>-</td>
<td>Negative (-)</td>
<td>Yes</td>
<td>40-45</td>
<td>*See Note 1b</td>
</tr>
<tr>
<td>Storage - General</td>
<td>22-24</td>
<td>30-60</td>
<td>2</td>
<td>-</td>
<td>Negative (-)</td>
<td>-</td>
<td>40-45</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.2.2.C. Notes:

.1 Temperature Range:
   a. Where a temperature range is shown (i.e. 22°C-24°C), select the upper value as the maximum summer design temperature and the lower value as the minimum winter design temperature.
   b. No requirement for maximum summer design temperature.

.2 Relative Humidity:
   a. Maintain minimum 30% RH at outdoor temperatures above 0°C; 15% RH below -30°C and reset RH on linear scale between 0 and -30°C.
   b. Notwithstanding point a. above; lower humidity levels may be needed in existing buildings; coordinate with Architect the humidification capability of existing buildings in renovation projects.

.3 Total air change rates do not preclude the use of higher or more appropriate values based on more stringent standards or cooling requirements.

.4 Relative Pressure:
   a. E - denotes equal or neutral relative pressure to surrounding spaces
   b. + - denotes positive relative pressure to surrounding spaces
   c. - denotes negative relative pressure to surrounding spaces

.5 This number indicates the acceptable range of background noise level in terms of room criteria (RC) assuming a neutral (N) spectrum. Refer also the Section 7.0 – Acoustics.

5.3 Drainage Systems

.1 General Requirements
   .1 Design plumbing, drainage, and vent systems in accordance with the National Plumbing Code.
   .2 Avoid installation of drainage pipes above the ceiling of electrical, server and telecommunication rooms.

.2 Sanitary Sewer System
   .1 Coordinate the requirement for a sampling manhole with the Authority Having Jurisdiction and the Civil Consultant for facilities containing laboratories.
.2 Provide interceptors and neutralization tanks with adequate service space.

.3 Provide duplex sanitary sump pumps. Size pumps to prevent short cycling. Control to alternate between lead/lag operations and provide with high-level alarm. Design sump sumps with a separate discharge line out of the pit. Do not combine the discharge pipes until out of the sump. Install check valves and shut-off valves outside the sump for easy access.

.4 Where a sump is required for an elevator shaft, locate the sump remotely (outside) from the elevator shaft.

.5 Provide sanitary vents in accordance with the National Plumbing Code and as required by the Authority Having Jurisdiction.

.6 Provide adequate and accessible service space for cleanouts. Where cleanouts must be located in a ceiling space, ensure that fixed furniture does not restrict access or extend them as necessary to ensure accessibility.

.7 Provide interceptors in the waste piping of areas such as:

.1 Dental and other laboratories
.2 Food preparation areas
.3 Hair salons
.4 Science and Science preparation rooms
.5 Art classrooms

.B Specific Requirements for Healthcare Facilities

.1 Design plumbing systems in accordance with CAN/CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

.2 Avoid designing drainage systems to pass over areas where leakage or condensation could cause a hazard (i.e. food preparation areas, electrical areas, and patient care areas).

.3 Locate equipment that requires accessibility outside of patient care areas (i.e. valves, cleanouts, control dampers, fire dampers, etc.).

.4 Provide interceptors in the waste piping of areas such as:

.1 Fracture rooms sinks and other room where casts may be applied or removed.
.2 Autopsy suites.
.5 Provide vapor vents to atmosphere sterilizer units.

.6 Where a sump is required for an elevator shaft, locate the sump remotely (outside) from the elevator shaft.

.C Specific Requirements for Continuing Care Facilities

.1 Design sanitary sewer systems to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.3 Laboratory / Hazardous Waste Drainage Systems

.1 Sanitary waste from buildings containing laboratories and infectious areas shall comply with waste water discharge requirements of local bylaws, codes, and environmental and health regulations.

.2 Evaluate the need for point-of-use dilution or neutralizing traps or central neutralization traps based on the size of the facility and locations where neutralization is required.

.3 Provide large laboratory areas with acid waste drainage to a neutralizing sump equipped with pH probe meter.

.4 Use chemical and fire resistant piping in drainage systems serving laboratories where acids are used.

.5 Drains carrying hazardous or radioactive waste shall be identified as such.

.B Specific Requirements for Healthcare Facilities

.1 Hazardous waste shall meet the requirements of CSA Z317.10, Handling of Waste Materials Within Health Care Facilities and be piped to a neutralizer and treated prior to discharge or collected in a holding tank for off-site disposal.

.4 Storm Drainage System

.1 Pipe storm water separately from sanitary sewer.

.2 Avoid the use of controlled flow roof drainage systems.

.3 Provide internal drainage systems with open flow drains connected to 100 mm (4 in) diameter pipes (minimum).
.4 Provide a minimum of two roof drains per drainage area. Refer to Section 2.0 – Building Envelope.

.5 Provide cast iron or aluminum dome strainers over roof drains.

.6 Provide a min. 25 mm of insulation on the underside of roof drain bodies and the horizontal storm piping from roof drains up to the first vertical drop.

.7 Where storm water is not directly connected to the storm water service main, terminate roof drain exterior discharge outlet with an elbow at least 1.0 m (3 ft) above grade. Provide thermostatically controlled electric heat tracing inside the piping from the discharge back into the building to prevent freeze-up during the winter. Direct the discharge so that it does not flow onto areas designated for pedestrian, play areas or vehicle traffic where it could freeze and become a safety hazard, or onto areas where it could cause erosion damage.

.8 Sumps to consist of two compartments (a settling compartment and a pumping compartment) if the amount of suspended matter is likely to interfere with the operation of the pumps or cause excessive wear. Size the pumping compartment to limit the frequency of pump starts to that recommended by the manufacturer.

.9 Provide duplex/triplex storm sump pumps. Size pumps to prevent short cycling. Control to alternate between lead/lag operations and provide with high-level alarm. Design sump pumps with a separate discharge line out of the pit. Do not combine the discharge pipes until out of the sump. Install check valves and shut-off valves outside the sump for easy access.

.B Specific Requirements for Healthcare Facilities

.1 Provide provisions for fuel spill control in accordance with NFPA 418, Standard for Heliports.

5.4 Plumbing Fixtures and Equipment

.1 General Requirements

.1 Provide plumbing fixtures in accordance with the requirements of the National Plumbing Code.
Provide white fixtures of any one type by the same manufacturer with chrome-plated fixture trim and accessories.


Coordinate to determine the specific mechanical rough-in requirements for Owner Supplied Equipment (i.e. washers and dryers, bedpan washers/disinfectors, kitchen equipment, etc.). Provide back-flow prevention devices as required.

.A Specific Requirements for Schools

Coordinate with respective School Board to determine the desired fixture and trim types (material, wall or floor mount, manual, metered, power or battery operated hands-free activation).

.B Specific Requirements for Healthcare Facilities

All fixtures and fittings shall meet the requirements of CAN/CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

Coordinate with the Facility Administrator to determine the appropriate fixture and trim types.

Coordinate with the Facility Administrator to determine where bariatric plumbing fixtures are required.

Provide provision for regulating the temperature delivered from faucets in accordance with CAN/CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

.C Specific Requirements for Continuing Care Facilities

Provide plumbing fixtures and equipment to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.Floor Drains

Equipment Drains: Provide combination, funnel-type in mechanical or service areas.
.B Specific Requirements for Healthcare Facilities

.1 Floor drains shall not be provided for drench showers located in public and patient care areas.

.3 Interceptions

.1 Provide interceptors such as sediment buckets in floor drains where undesirable material can be discharged into the sanitary drainage system such as in kitchens, garbage rooms, and incinerator rooms.

.4 Water Closets

.1 In general, flush-valve activated water closets are preferred over flush tank types.

.2 Flush Valve Water Closets: Provide hands-free, low flow, quiet-action type.

.3 Flush Tank Water Closets: Provide high performance low-flow or dual-flush water closets to minimize plugging.

.A Specific Requirements for Schools

.1 Student/Staff Washrooms

.1 Provide floor-mounted water closet with hands-free, flush-valve activation.

.2 Early Childhood Services (ECS) Washrooms

.1 Provide high performance residential grade toilets.

.B Specific Requirements for Healthcare Facilities

.1 Bariatric Water Closets

.1 Provide floor-mounted heavy duty water closets, extra wide seat rated for 500 kg (1,120 lbs.), and carriers or supports designed to hold the weight of the patient.
Where bariatric water closets are not desired, but there is still a requirement for bariatric design, coordinate with the Facility Administrator to determine the desired fixture type. Consider the use of a floor-mounted, heavy-duty water closet compatible with a bariatric commode rated for 360 kg (800 lbs.) as an alternative. When a bariatric commode is being used, ensure that the flush valve assembly does not interfere with its operation or provide an unattached flush tank.

.C Specific Requirements for Continuing Care Facilities

.1 Resident Washrooms

.1 Provide all water closets suitable for barrier-free accessibility.

.2 Public Washrooms

.1 Provide at least one wheelchair accessible water closet (in coordination with the Architect).

.5 Urinals

.1 Provide wall-hung urinals with hands-free flush valve activation.

.6 Washroom Lavatories

.1 Provide hands-free, low-flow lavatory faucets.

.A Specific Requirements for Schools

.1 Student/Staff Washrooms

.1 Provide stainless steel basins and hands-free activation.

.C Specific Requirements for Continuing Care Facilities

.1 Resident Washrooms

.1 Provide all lavatories suitable for barrier-free accessibility.
.2 Provide manual hot and cold taps with wrist blade handles at least 100 mm (4 in.) in length. Automatic sensor faucets shall not be used.
.3 In washrooms designed for bariatric residents, provide wheelchair accessible sinks with extra support rated for 135 kg (300 lbs.).
.2 Public Washrooms

.1 Provide at least one sink faucet equipped with wrist-blade handles or infrared activated.

.7 Sinks

.1 Mechanical Rooms

.1 Provide a stainless steel, recessed sink for maintenance purposes within a counter top of sufficient size to allow for water sampling equipment.

.A Specific Requirements for Schools

.1 Classrooms

.1 Where sinks are required by the Functional Program they shall be stainless.

.2 Workshop/CTS

.1 Provide sediment and solids interceptors for sinks.

.B Specific Requirements for Healthcare Facilities

.1 Handwash/Hand Hygiene Sinks

.1 Coordinate with the Project Manager and Facility Administrator to determine the requirements for handwash/hand hygiene sinks.


.C Specific Requirements for Continuing Care Facilities

.1 Handwash/Hand Hygiene Sinks

.1 See Section B – Specific Requirements for Healthcare Facilities.

.2 Beauty Shops

.1 Provide hair wash sinks complete with hair traps.
.8 Emergency Fixtures

.1 Where the eyes or body of any person may be exposed to injurious corrosive materials, provide suitable facilities for quick drenching or flushing of the eyes and body within the work area for immediate use.

.2 Provide a tempered water supply to emergency eyewash and shower fixtures in accordance with ANSI/ISEA Z358.1, *Emergency Eyewashes and Shower Equipment*, American National Standards Institute (ANSI). Coordinate with the facility administrator to determine the desired discharge temperature to emergency fixtures (within the permitted temperature range).

.9 Tubs and Showers

.C Specific Requirements for Continuing Care Facilities

.1 Assisted Care Bathing Rooms

.1 Where specialty tubs are required to be provided as part of the mechanical scope of work, coordinate with Architect and Facility Administrator to determine where bariatric fixtures are required.

.2 Resident Washrooms

.1 Provide all tubs and showers suitable for barrier-free accessibility.

.10 Hose Bibbs

.1 Provide key-operated, non-freeze hose bibbs every 30 m (100 ft) around the building perimeter or as required to suit the irrigation requirements.

.2 Provide non-freeze cold water hose bibbs for roof areas that contain equipment that requires periodic cleaning.

.3 Provide hose bibbs every 30 m (100 ft) in parkades and garages.

.11 Drinking Fountains

.1 Provide refrigerated drinking water sources as required by the Functional Program (bottle filler, water dispensers, drinking fountains, etc.).
.A Specific Requirements for Schools

.1 Core Spaces

.1 Provide drinking fountains with bottle-filler, refrigerated or non-refrigerated as per the School Boards requirements.

5.5 Domestic Water and Specialty Water Systems

.1 General Requirements

.1 Plumbing and water systems shall comply with the National Plumbing Code and the National Building Code - Alberta Edition.

.2 Refer to Alberta Infrastructure’s Technical Specifications, Section 20 20 30 Piping and Equipment Insulation for insulation thickness schedule.

.3 Avoid installation of water pipes above the ceiling of electrical, server and telecommunication rooms.

.2 Domestic Cold Water System

.1 Provide backflow prevention in conformance with the National Plumbing Code or the requirements of the municipality (whichever is more stringent). Install in accordance with CAN/CSA-64 Series.

.2 Do not exceed 2 m/s (6.5 ft/s) velocity for cold water piping to minimize erosion and corrosion.

.3 Isolating valves shall be accessible and identified by marking that are permanent, distinct, and easily recognized and be provided for each:

.1 Building incoming water main.
.2 Branches connected to a water main.
.3 Base of a riser and each floor branch connection on a riser.
.4 Connection at each fixture.
.5 Connection to equipment.

.4 Where pressure-booster systems are required, the number and arrangement of pumps shall be such that peak demand can be met in the event of failure of one pump. Alarms shall be provided to indicate failure of a pumping unit and low primary water supply pressure. Alarms shall be annunciated to the building automation system as well as sounded in a continuous supervised location.
.5 Insulate cold water pipes and provide with a continuous vapor barrier. Plumbing fixture supplies need not be insulated, except fixture supplies on barrier-free lavatories (e.g. stops, supplies, traps, and drains).

.B Specific Requirements for Healthcare Facilities

.1 A reliable and adequate alternative water supply shall be provided such that the service to the healthcare facility is not significantly interrupted in the event of failure of the primary potable water supply in accordance with CAN/CSA Z317.1, *Special Requirements for Plumbing Installations in Health Care Facilities*.

.2 Install parallel, approved backflow prevention devices (each sized for full-flow capacity) on the main water service to ensure water availability during testing and maintenance.

.3 The complete potable water system shall be flushed and treated immediately prior to occupancy in accordance with one of the methods identified in CAN/CSA Z317.1, *Special Requirements for Plumbing Installations in Health Care Facilities*.

.4 Gray water shall not be used within healthcare facilities.

.5 Provide redundancy for potable water distribution pumps, storage tanks and other main components.

.6 Treat and test complete water system prior to occupancy in accordance with CAN/CSA-Z317.1, *Special Requirements for Plumbing Installations in Health Care Facilities*.

.C Specific Requirements for Continuing Care Facilities

.1 Design domestic cold water systems to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.3 Domestic Hot Water System

.1 Consider multiple water heating sources (i.e. 2 water heaters) where redundancy is required. Discuss water heater redundancy with the Facility Administrator.

.2 Provide a domestic water heating system that is separate from the building heating system unless a combined system is fundamental to the energy conservation strategy. Where combined systems are proposed, demonstrate energy savings and discuss the implications of reduced redundancy with the facility administrator.
.3 Provide domestic hot water recirculating pump and piping.

.4 Provide recirculating piping for branches which exceed 8 m (25 ft) in length.

.5 Do not exceed 1.22 m/s (4.0 ft./s) for copper hot water supply and recirculating piping systems operating at 60 °C (140 °F) or less to minimize erosion and corrosion.

.6 Do not exceed 0.76 m/s (2.5 ft./s) for copper hot water supply and recirculating piping systems operating at temperatures greater than 60 °C (140 °F) to minimize erosion and corrosion.

.7 Provide check valves and/or backflow preventers as required by applicable codes and regulations.

.8 Provide water to dishwashers at a temperature in accordance with the manufacturers requirements.

.B Specific Requirements for Healthcare Facilities

.1 Design hot water systems in accordance with CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

.2 Arrange water distribution systems to provide hot water at every hot water outlet on demand (less than 10s).

.3 Hot water is preferred to be generated through instantaneous water heaters.

.4 Design shall prevent dead legs in the piping distribution. Connect hot water recirculation piping as close to the fixture control or mixing valve as possible, running down the wall as necessary.

.5 Hot Water Temperature

.1 Hot water temperature shall be in accordance with Table 1, Hot Water Temperatures of CSA-Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

.2 Provide a means to sanitize the hot water tanks and water distribution system in accordance with CSA-Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.

.3 Provide mixing valves compliant with the applicable ASSE Standard to prevent thermal shock and scalding where required.
.6 Consider copper/silver ionization technology for the domestic hot water system on the recirculation piping for new healthcare facilities.

.C Specific Requirements for Continuing Care Facilities

.1 Design domestic hot water systems to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.2 For safe bathing temperature range and practices on staff assisted bathing in continuing care, refer to the following Alberta Health Services policy and procedure documents:

.1 AHS POLICY PS-47, Safe Bathing Temperatures and Frequency,
.2 AHS PROCEDURE PS-47-01, Safe Bathing Temperatures and Frequency,
.3 AHS PROCEDURE PS-47-02, Safe Bathing Temperatures and Frequency – Hottest Flowing Water for Therapeutic Tubs.

.4 Soft Water System

.1 Obtain a basic water analysis of the facility water supply from the facility administrator to determine the quality of the water service hardness, alkalinity, dissolved iron/copper, conductivity, and pH.

.2 Water softening requirements:

.1 Provide soft water makeup for:

.1 Steam humidification systems (unless specifically prohibited by the humidifier manufacturer).
.2 Laundry
.3 Glass/dishwashing
.4 Commercial dishwashing
.5 Steam boilers
.6 Reverse osmosis systems

.2 Review with the Facility Administrator the requirement for soft water when the municipal water service has a water hardness greater than 120 mg/L.

.3 Use the following as a guide for water softening requirements:
.1 Feed water or make-up water to steam boilers (including humidification steam boilers, gas-fired steam generators, and electrode humidifiers): soften water to 3 mg/l or less.

.2 Hot water to laundry, glass/dishware washing, and commercial dishwashing applications: soften water to 10 mg/l or less.

.3 Domestic hot water: soften domestic water to 10 mg/l or less.

.4 Provide a soft water sample port downstream of the water softener.

.5 Provide piped soft water to sample coolers and blow-down tanks.

.6 Refer to Alberta Infrastructure Technical Specifications, Section 23 25 01 – Cleaning and Chemical Treatment Equipment for soft water connection requirements:

 .1 Detail 23 25 01.03 for typical steam boiler cleaning and chemical treatment equipment installation.

 .2 Detail 23 25 01.06 for a typical packaged steam humidification system installation.

.B Specific Requirements for Healthcare Facilities

 .1 Domestic hot water shall be softened.

.5 Distilled, Demineralized, Pure, and Treated Water Systems

 .1 Establish the quantity and quality of water required with the Facility Administrator. Where demand is low and a reliable commercial source is available, high quality water should be purchased rather than providing in house equipment. Consider central systems for high demand requirements only.

 .2 The materials used in the construction of the pure water distribution system shall not degrade the quality of the water.

.B Specific Requirements for Healthcare Facilities

 .1 Provide distilled, demineralized, and treated water systems in accordance with CAN/CSA-Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.
5.6 Fuel Oil Systems

.1 General Requirements

   .2 Provide fuel oil systems in accordance with CSA B139, *Installation Code for Oil Burning Equipment*.

   .3 Fuel oil tanks located inside buildings is preferred. Where outdoor tanks are provided, they shall be located above ground where possible and in accordance with the *National Fire Code - Alberta Edition*.

.B Specific Requirements for Healthcare Facilities
   .1 Provide fuel oil systems and storage in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.C Specific Requirements for Continuing Care Facilities
   .1 Design fuel-oil systems shall be to the same standard as Section B – Specific Requirements for Healthcare Facilities.

5.7 Specialty Gases and Vacuum Systems

.1 Laboratory Gas Systems
   .1 Where laboratory gases are supplied and distributed from a common manifold system, provide automatic duty/standby capability complete with a relief valve located downstream of the two high pressure regulators and vented to the outdoors.

   .2 Do not combine flammable and non-flammable relief vent discharge piping to the outdoors and clearly label them as such.

.2 Dental Compressed Air System
   .1 Coordinate the system design to accommodate the specific equipment requirements.

   .2 Provide duplex and oil-free type air compressors for dental air systems.
.3 The dental compressed air system shall not be combined with medical compressed air systems.

.3 Dental Vacuum System

.1 Coordinate the system design to accommodate the specific equipment requirements.

.2 Provide duplex dental vacuum pumps designed to provide at least 19 kPa (5.5” of Hg) at the point of use.

.3 Size the distribution piping assuming a 100% usage factor.

.4 Slope distribution piping back to the source equipment.

.5 Provide isolation valves at all risers, branch mains, and at the equipment.

.6 Provide cleanouts for the distribution system.

.7 Discharge vacuum exhaust through the roof away from building intakes.

.4 Central Vacuum Cleaning System

.B Specific Requirements for Healthcare Facilities

.1 Consult with the Facility Administrator to determine the requirement for a central vacuum system.

.2 Where central vacuum systems are required

   .1 Locate central vacuum unit such that the specified room noise levels in adjacent rooms are not exceeded.
   .2 Do not exceed 11m (36 ft.) of hose length.
   .3 Use a minimum of 50mm (2 in) diameter piping.
   .4 Provide heavy brass hose connections.
   .5 Use carbon-steel tubing for dry vacuum system. Maintain required transport velocities.
   .6 Design the distribution system to allow for cleaning and disinfecting.
5.8 Medical Gas Systems

.1 General Requirements

.1 This Section applies only to health care facilities or continuing care facilities where medical gas is used.


.3 Consider capital cost, operating cost, anticipated future expansion, and critical nature of the facility (e.g. regional disaster center) in the selection of the type of primary medical gas service for health care facilities.

.4 Provide nitrogen service to operating rooms with an adjustable pressure regulator and pressure gauge located within each room.

.5 Cylinder Storage rooms shall be heated and ventilated in accordance with the CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases and Vacuum*.

.6 Central equipment (bulk, mini-bulk, and high pressure cylinders) are normally under contract directly with the regional health authority, not through a building construction contract.

.7 Connect medical gas systems to both normal and emergency power supply.

.8 Medical Gas Outlets

.1 Review the number and type of medical gas outlets with the Facility Administrator. Provide the quantity and types of medical gases for a given room in accordance with CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases and Vacuum* as a minimum unless otherwise directed.

.2 Use Diameter Index Safety System (D.I.S.S.) outlets for new construction. Consult with the Users where modifications are made to existing quick connect outlets.
.9 Testing


.10 Renovating Existing Facilities


.2 When adding medical gas or vacuum outlets to existing systems, the Design Consultant should work with the facility operators to determine the actual current demand. Consideration should be given to using compressed gas cylinders to determine usage when run-time data is not available.

.2 Medical Air System

.1 Source of Supply:

.1 The type of central medical air system selected will be based on size and facility, extent of respiratory therapy, projected rate of consumption, remoteness of facility and service from medical gas supplier.

.2 Consider a cylinder manifold system for small facilities with no medical ventilators or anesthesia machines.

.3 For existing facilities with a history of low medical air usage, evaluate the feasibility of converting the medical air compressor system to a cylinder system when it becomes necessary to replace existing compressors.

.4 Air intake for the medical air compressor will be from a non-contaminated location outside the building complete with insect screen and elbow turned downward. Refer to CAN/CSA Z7396.1, Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases and Vacuum for alternate intake locations.
.3 Medical Vacuum System

.1 Source of Supply:

.1 Where medical vacuum outlets are used for the scavenging of waste anesthetic gases, ensure vacuum pumps have oxygen compatible components and sufficient capacity.

.2 Locate exhaust discharge outlets in compliance with minimum requirements.

.3 Vacuum piping shall be a 19 mm (3/4 in) minimum.

.4 Medical vacuum systems shall be used exclusively for patient care and not connected to other vacuum systems.

.4 Medical Oxygen System

.1 Source of Supply:

.1 Base the type of central oxygen system selection on:

.1 The size of facility
.2 The type of facility (i.e. level of care)
.3 Extent of respiratory therapy (i.e. mechanical ventilators or anesthesia machines)
.4 Projected rate of consumption
.5 Remoteness of facility
.6 Frequency of service from medical gas supplier

.2 Use the following tables (5.8.3.A & 5.8.3.B) as a guide to determine the central oxygen source type:

<table>
<thead>
<tr>
<th>Number of Beds</th>
<th>Type of System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 50</td>
<td>A duplex manifold system using high pressure gas cylinders is usually all that is required for small facilities. Review anticipated consumption with facility User Groups before final source type decision.</td>
</tr>
<tr>
<td>50 – 100</td>
<td>A duplex mini-bulk (liquid cylinders) and a reserve supply of high pressure gas cylinders.</td>
</tr>
</tbody>
</table>
### Table 5.8.3.A: Oxygen Source – Bed Rating

<table>
<thead>
<tr>
<th>Number of Beds</th>
<th>Type of System</th>
</tr>
</thead>
<tbody>
<tr>
<td>101 – 500</td>
<td>A bulk storage tank and a reserve supply of high pressure gas cylinders. Include an emergency oxygen inlet to the pipeline distribution system.</td>
</tr>
<tr>
<td>Over 500</td>
<td>A large main bulk storage tank, compete with a smaller (minimum of 24 hour supply) auxiliary bulk storage tank, and high pressure gas cylinders. Include an emergency oxygen inlet to the pipeline distribution system.</td>
</tr>
</tbody>
</table>

### Table 5.8.3.B: Oxygen Source – Known Consumption

<table>
<thead>
<tr>
<th>Consumption Cubic Meters per Month</th>
<th>Type of System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 250</td>
<td>High pressure gas cylinder</td>
</tr>
<tr>
<td>250 - 750</td>
<td>Min-bulk</td>
</tr>
<tr>
<td>Over 750</td>
<td>Bulk</td>
</tr>
</tbody>
</table>

#### 5 Carbon Dioxide System

.1 Source of Supply:

.1 Coordinate with the Facility Administrator to determine the quantity of present and future cylinder quantities for sizing the cylinder manifold.

#### 6 Nitrogen System

.1 Source of Supply:

.1 Coordinate with the Facility Administrator to determine the quantity of present and future cylinder quantities for sizing the cylinder manifold.

.2 Where information on nitrogen usage is not available, consider providing cylinder storage capacity based on one cylinder per bank for each operating room or workroom requiring nitrogen.
.7 Nitrous Oxide System

.1 Source of Supply:

.1 Coordinate with the Facility Administrator to determine the type and quantity of present and future cylinder quantities for sizing the cylinder manifold.

.2 Where information on nitrous oxide usage is not available, consider providing cylinder storage capacity based on one half a cylinder per bank per anesthetizing location, with a minimum of two bottles.

.8 Anesthetic Gas Scavenging System

.1 Source of Supply:

.1 Provide anesthetic gas scavenging in accordance with, CAN/CSA Z7396.1, Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases and Vacuum. Refer to the 2012 version of this standard.

5.9 Fire & Life Safety Systems

.1 General Requirements


.B Specific Requirements for Healthcare Facilities

.1 Refer to CSA-Z317.1, Special Requirements for Plumbing Systems in Health Care Facilities for fire-protection requirements.

.2 Fire Pumps

.1 Provide fire pumps, where required, in accordance with the Alberta Building Code, the Alberta Fire Code, and the requirements of NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection.

.3 Standpipe System and Hose Valve cabinets

.4 Sprinkler System


.2 Electrical Rooms:

.1 To help avoid water-incurred damage to electrical equipment, wet or pre-action sprinkler systems shall not be installed in electrical rooms containing equipment greater than 750 volts. Coordinate with Architectural and Electrical divisions to ensure that the room design complies with all applicable codes.

.2 Coordinate with Electrical Division for electrical rooms containing equipment less than 750 volts.

.3 Provide sprinkler guards for sprinklers subject to damage.

.4 In areas with low ceiling (bulkheads) sprinklers to be of the concealed type.

.B Specific Requirements for Healthcare Facilities

.1 Provide pre-action sprinkler system to avoid accidental discharge in rooms where water damage can affect the operation including operating rooms, delivery rooms, recovery rooms, intensive care units, main electrical rooms, main IT rooms, and rooms containing high value equipment including CT rooms, MRI rooms, linear accelerator rooms and PET scanner rooms.

.2 In areas that require cleaning and sanitation of sprinkler heads, concealed sprinkler heads shall be used.

.3 Sprinkler heads in forensic and mental health facilities should be suitable for such facilities, and in all cases appropriate for patient care areas.

.4 Provide sprinkler head guards in areas where there are no ceilings and there is a risk that the sprinkler head might be damaged.
.5 Fire Extinguishers


.2 Provide recessed, or semi-recessed cabinets for fire extinguishers in public areas. Coordinate the cabinet type with the architect.

.A Specific Requirements for Schools

.1 Fire Extinguishers

.1 Provide 6 mm tempered safety glass or plexiglass for fire extinguisher cabinets in gymnasiums to prevent physical damage.

.B Specific Requirements for Healthcare Facilities

.1 Fire Extinguishers

.1 Provide a 2.27 kg (5 lb) CO₂ fire extinguisher (Class BC) mounted just inside the entrance of each operating room. Do not use water-based, water-mist, dry-powder, or clean agent extinguishers in the OR.

.2 Provide a 9.1 kg (20 lb) dry-powder (Class ABC) type fire extinguisher for the OR suite (not each room) as a minimum.

.3 Fire hose cabinets, where present, shall have recessed hinges and latches to facilitate cleaning.

.6 Smoke Control System

.1 Provide smoke control systems that meet the requirements:

.1 The National Building Code - Alberta Edition
.2 The National Fire Code - Alberta Edition
.3 NFPA 92, Standard for Smoke Control Systems
.4 ASHRAE Guideline 1.5, The Commissioning Process for Smoke Control Systems
.5 CAN/ULC-S527-11-AMD1, Standard for Control Units for Fire Alarm Systems

.2 Coordinate, commission and test smoke control system design in accordance with the applicable standards and the Authority Having Jurisdiction.

.3 Smoke control zones shall correspond to the fire alarm and sprinkler zones.
.B Specific Requirements for Healthcare Facilities

.1 Provide smoke control systems in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.2 Coordinate with the architect to identify the Areas of Refuge and provide smoke-free ventilation in accordance with the National Building Code - Alberta Edition.

.C Specific Requirements for Continuing Care Facilities

.1 Design ventilation systems to the same standards as Healthcare Facilities.

5.10 Heating Systems

.1 General Requirements

.1 Heating Criteria

.1 Select systems on the basis of energy efficiency, controllability, maintainability, and life-cycle costs.
.2 Select equipment to account for the heating load profile, thermal energy storage, equipment reliability, and availability of spare parts for servicing.
.3 Design heating systems to work in conjunction with the ventilation system to prevent condensation on interior surfaces.
.4 Avoid combining copper and aluminum heating components in the same system.
.5 Zone perimeter heating elements to match the variable air volume box zones. Monitor/control the space temperature using the same thermostat/sensor. Match heating and cooling zones to the extent possible.
.6 Provide heating to crawlspaces.
.7 Design coils using the largest temperature drop practical in order to minimize pipe sizes and pump flow rates.
.8 In areas where heat is lost through the roof, provide finned radiation within the ceiling complete with a temperature sensor to maintain a minimum temperature of 18°C (65°F) within the ceiling space. Do not use the room temperature sensor to control heating elements in the ceiling space.
.9 Design the perimeter heating system in coordination with the ventilation system and building envelope to prevent condensation on exterior walls and glazing.
.2 Heating Source

.1 Provide a building heating system that is separate from the domestic hot water heating system unless a combined system is fundamental to the energy conservation strategy. Where combined systems are proposed, demonstrate energy savings and discuss the implications of reduced redundancy with the facility administrator.

.3 System Cleaning and Chemical Treatment

.1 Provide cleaning, degreasing, and chemical treatment on hot water heating systems. Refer to the Alberta Infrastructure Technical Specifications, Section 23 25 00 series.

.2 Provide a chemical pot feeder on each closed loop of water or glycol systems.

.4 Accessibility and Maintenance

.1 Ensure equipment and valves are easily accessible for cleaning and inspection.

.2 Provide isolation valves at all terminal heating equipment, supply and return mains, zone branches, and risers.

.5 Pipe Distribution

.1 Refer to Alberta Infrastructure’s Technical Specifications, Section 20 20 30 Piping and Equipment Insulation for insulation thickness schedule.

.2 Consider primary-secondary pumping systems where they reduce power consumption and provide better control.

.3 Two-pipe, reverse return systems are preferred for heating water piping. Two-pipe, direct-return systems may be used only if the design properly guards against flow imbalance to terminal units and is a small part of the reverse-return system.

.4 Provide reverse-return heating water piping for air handling unit coils that have more than one section such that each section receives the same flow.

.5 Provide means for balancing and flow measuring for all major circuits. Provide balancing valves at each terminal heating unit.

.6 On heating systems, grooved-type pipe joints are permitted within mechanical rooms.

.7 On heating systems, butterfly valves are permitted within mechanical rooms only.
.2 Heating Water System

.1 Heating Water Boilers

.1 Provide a minimum of 2 boilers each sized for a minimum of 60% of the design load.
.2 Size the heating plant to reflect the seasonal nature of the heating load to allow efficient operation under varying loads.
.3 Specify boilers to have a minimum boiler efficiency of 85% and include a packaged control system designed to operate the boiler at peak efficiency possible during non-peak loads.
.4 Provide fully modulating burner controls in all boiler sizes where possible.
.5 Where condensing boilers are used, control the return water temperature to maximize the number of hours condensing is possible.

.2 Antifreeze

.1 Provide glycol antifreeze where freezing conditions exist with a 50/50 water/glycol concentration.

.3 Heating Water Pumps

.1 Use variable speed drives on pumps and two-way control valves on terminal devices to maintain system design pressure under variable flow conditions. Indicate the sensor location(s) on the plans.
.2 Provide 100% redundancy for heating water pumps.

.4 Finned Radiation

.1 Where finned radiation is used behind millwork, ensure there is access for cleaning.

.5 Radiant Panels

.1 Consider the use of radiant panels where perimeter furniture and cabinets restrict the use of finned radiation.
.2 Use special care when locating radiant panel thermostats. Control the radiant panel as first stage heating before the air system reheat coil (where present).
.3 Do not schedule the temperature of the radiant panel water heating system so low as to adversely affect the performance of the panel when combined with other types of terminal heating equipment.
.4 Consider architectural details, window coverings, and perimeter air supply outlets in the use of radiant panel heating systems. Ensure that the glazing is completely exposed to the radiation effect.

.6 Terminal Box Reheat Coils

.1 Where terminal boxes provide makeup air supply for variable exhaust conditions, size the reheat coil (when present) based on the lowest seasonal heating water supply temperature the boiler is controlled to.

.A Specific Requirements for Schools

.1 Design heating system to provide ease of operation and maintenance.

.2 The optimum system is a central boiler plant complete with a heating water distribution system. This does not preclude other options; however, other systems should only be implemented based on sound and clearly identified benefits and in discussion with the Facility Administrator.

.3 Provide individual thermostatic zoning for each instructional space.

.4 Provide gymnasiums with a heating system independent from the gymnasium ventilation system.

.B Specific Requirements for Healthcare Facilities

.1 Heating water systems shall conform to CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.2 Provide separate boilers for the building heating system, process loads (sterilizers, humidification), and the domestic hot water heating system.

.3 Provide an ancillary heating connection on the outside of the building for temporary connection to a portable boiler under emergency conditions and a means to allow for load shedding to match essential loads against available boiler capacity.

.4 Where heating water mains are buried, provide a redundant pipe sized for 100% of the design load complete with valves to allow 50% of the flow through both pipes under normal operation. A loop system with suitable sectional valves may be considered in lieu of two mains.
.C Specific Requirements for Continuing Care Facilities

.1 Provide an ancillary heating connection on the outside of the building for temporary connection to a portable boiler under emergency conditions and a means to allow for load shedding to match essential loads against available boiler capacity.

.3 Steam heating and Condensate System

.1 Steam Boilers

.1 Avoid designing steam boilers that deliver high pressure steam (103 kPa or greater steam pressure). Where high pressure steam systems are proposed, consider system operating costs including mandatory supervision requirements and discuss with the Facility Administrator.

.2 Makeup Water and Chemical Treatment

.1 Feed water to all steam-producing equipment shall be pre-treated and preheated to ensure the water quality meets the minimum requirements of the equipment and to minimize the operations and maintenance requirements for the equipment.

.2 Chemicals used for corrosion control of steam piping shall not be hazardous to health. The level of impurities used for sterilization shall comply with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

.3 Meter chemical treatments for steam system. Avoid batch feed systems.

.3 Steam Pipe Distribution

.1 Refer to Alberta Infrastructure’s Technical Specifications, Section 20 20 30 Piping and Equipment Insulation for insulation thickness schedule.

.2 Use separate pipes for steam and steam condensate return piping.

.3 Where a steam coil could have an entering air temperature less than 4°C (40°F), provide two steam traps that are each sized for full capacity.

.B Specific Requirements for Healthcare Facilities

.1 Where a steam supply main must be buried, provide a redundant pipe sized for 100% of the design load complete with valves to allow 50% of the flow through both pipes under normal operation. A loop system with suitable sectional valves may be considered in lieu of two mains.
5.11 Cooling Systems

.1 General Requirements

.1 Cooling Criteria

.1 Select cooling systems on the basis of energy efficiency, controllability, maintainability, and life-cycle costs.
.2 Design refrigeration systems in conformance with CSA B52, Mechanical Refrigeration Code.
.3 Provide cooling to serve data and server rooms year-round. Where appropriate, provide multiple cooling units for continuous cooling in event of equipment failure.
.4 Do not provide mechanical cooling for mechanical equipment rooms unless specifically required to keep equipment within the ambient temperature conditions recommended by the equipment manufacturer (i.e. electrical panels, etc.). Provide a means to free-cool equipment where possible.

.2 Cooling Source

.1 Chilled water is the preferred means of cooling when the total building cooling load is over 280 kW (80 ton).
.2 Limit the use of direct expansion (DX) refrigeration in air handling units for cooling capacities up to 105 kW (30 ton). Multiple DX air handling units are acceptable for a total cooling load not exceeding 280 kW (80 ton). Provide staged compressors for capacity control in DX systems.
.3 Use outside air for free cooling where ambient conditions permit.

.3 Accessibility and Maintenance

.1 Ensure equipment and valves are easily accessible for cleaning and inspection.
.2 Provide isolation valves at all terminal cooling equipment, supply and return mains, zone branches, and risers.

.4 Pipe Distribution

.1 Refer to Alberta Infrastructure’s Technical Specifications, Section 20 20 30 Piping and Equipment Insulation for insulation thickness schedule.
.2 Consider primary-secondary pumping systems where they reduce power consumption and provide better control.
.3 Two-pipe, reverse return systems are preferred for cooling water piping. Two-pipe, direct-return systems may be used only if the design properly guards against flow imbalance to terminal units and is a small part of the reverse-return system.

.4 Provide reverse-return chilled water piping for air handling unit coils that have more than one section such that each section receives the same flow.

.5 Provide means for balancing and flow measuring for all major circuits. Provide balancing valves at each terminal cooling unit.

.5 System Cleaning and Chemical Treatment

.1 Provide cleaning, degreasing, and chemical treatment on chilled water systems. Refer to the Alberta Infrastructure Technical Specifications, Section 23 25 00 series.

.2 Provide a chemical pot feeder on each closed loop of water or glycol systems.

.A Specific Requirements for Schools

.1 Cooling Criteria

.1 Coordinate with the Project Manager and the School Board to determine where cooling is required to maintain health and comfort conditions (considering local ambient conditions and the School Board’s regional requirements).

.2 Provide cooling in high heat gain areas such as data and server rooms, and computer classrooms.

.2 Displacement ventilation systems

.1 Mechanical cooling shall be provided to maintain supply air temperature within the range 16 - 18°C.

.B Specific Requirements for Healthcare Facilities

.1 Cooling Criteria

.1 Design the cooling plant to maintain comfort conditions in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.
.2 Accessibility and Maintenance

.1 In multi-chiller cooling plants, provide motorized chilled water isolation valves c/w manual wheels to override the valve actuator position.

.C Specific Requirements for Continuing Care Facilities

.1 Cooling Criteria

.1 In continuing care facilities provide a means of limiting interior temperatures in summer such as through the use of operable windows and air conditioning.
.2 Provide mechanical cooling for dining areas, corridors, program/activity areas, lounges, kitchens, and laundry spaces.
.3 Provide individual temperature control for resident bedrooms.

.2 Condenser Water System

.1 Sediment Removal

.1 Provide a centrifugal sediment separator interceptor for condenser water systems.

.2 Cooling Towers

.1 Select cooling tower locations accounting for prevailing wind and locations of building air intakes (to minimize the risk of exposure of building occupants to the cooling tower plume).
.2 Consider fluid coolers only if proximity to air intakes or vapor plume impingement is a problem.
.3 Consider cooling tower effect on neighborhood ambient noise level.
.4 Specify cooling towers with basin heaters to allow reliable operation in shoulder seasons and heat trace makeup water lines.
.5 Winterize cooling towers for chilled water systems which are designed to operate on a year-round basis.
.6 Free Cooling

.1 Consider free cooling heat exchangers interconnected with the cooling tower for systems that have significant cooling requirements in the heating season (such as server rooms) to prevent the need to operate the chiller.
.2 Provide free-cooling technology to the cooling system where possible.
.3 Evaluate both plate type heat exchangers and high performance shell and tube heat exchangers in free cooling applications.

.7 Provide clearances around cooling towers in accordance with the manufacturers’ recommendations accounting for the height of adjacent surfaces.

.8 Provide VFDs on cooling tower fans 5 HP or larger.

.9 Consider specifying stainless steel construction for cooling tower basins.

.10 Consider the radiated noise levels from roof-mounted equipment (fans, fluid coolers, etc.), cooling towers, and transmitted noise from building air intakes/exhausts with respect to adjacent buildings or properties.

.3 Condenser Water Pumps

.1 Ensure adequate net positive suction head on the condenser water pump and suitable piping arrangement to prevent impellor cavitation.

.4 Remote Condenser Water Tank

.1 Where interior condenser water tanks are provided, size the tank to accept the full volume of suspended water (as a minimum) when the condenser water pumps are not running.

.2 Design open condenser water tanks to avoid splashing.

.3 Chilled Water System

.1 Chillers

.1 Base the number, type, and capacity of chillers for a cooling plant on the calculated load, diversity factor, and load profile.

.2 Do not size a chiller plant for future capacity unless approved by the Project Manager.

.3 Size chillers by taking into account the magnitude and duration of the part-load capacity to optimize chiller efficiency.

.4 Locate chillers in a machine room separate from combustion equipment (i.e. boilers).

.2 Chilled Water Pumps

.1 Use variable speed pumps to maintain design system pressure for variable flow distribution systems. Indicate sensor location(s) on the plans.
.4 Critical Cooling System

.1 Provide a separate cooling system to serve equipment that requires cooling during times that are significantly different from that of the building cooling system or requires a different chilled water temperature or requires chilled water year round (MRI rooms/Server Rooms, etc.).

5.12 Ventilation Systems

.1 General Requirements

.1 Duct Distribution

.1 Design ductwork in accordance with SMACNA standards with particular emphasis on minimizing the external static pressure of air handling units.
.2 Provide a minimum of four duct diameters of straight ductwork upstream of VAV terminal boxes inlets (or as recommended by manufacturer’s literature - whichever is greater).
.3 Where low-level displacement diffusers are provided, coordinate locations to prevent obstructions from furniture or millwork.
.4 Do not use mechanical rooms and mechanical shafts as return air plenums.
.5 Public corridors or exit shall not be used as return air plenum.

.2 Ventilation Zones

.1 Design the ventilation zones in coordination with the perimeter heating system and building envelope to prevent condensation on exterior walls and glazing.
.2 Design supply air and return air for any given room should be provided by the same air handling unit.
.3 Provide a separate ventilation zone for corner spaces when cooling requirements are significantly different from adjacent zones.
.4 Zone air systems in accordance with space functions, occupied hours, and air quality requirements.
.5 Provide ventilation to crawlspaces.
.6 Where constant volume air systems are used, consider reheat requirements for interior zones.
.7 To the extent possible, match heating and cooling zones.
.8 Where areas with different occupancy schedules are served by the same air handling unit, provide a means of area isolation to reduce air flow and energy use.
.3 Diffusers, Grilles, and Louvers

.1 Locate ceiling mounted diffusers and grilles to align with lights and other ceiling mounted devices whenever possible.
.2 Locate supply and return air diffusers/grilles to prevent short-cycling.
.3 Design duct distribution systems using appropriate diffuser/grille type, locations, air velocities, and air-flow patterns to maximize occupant comfort.
.4 Install bottom of outdoor air intake louvers at least 2m (6 ft) above grade level. If outdoor air intake is installed above the roof, extend it at least 1 m (3 ft) above roof level or as required due to local snow conditions.

.4 Duct Cleaning

.1 All new and existing air ductwork shall be cleaned prior to occupancy for both new and renovation projects.

.5 Accessibility and Maintenance

.1 Provide access doors upstream of fire dampers.
.2 Provide a minimum of 1 m (3 ft) clearance between the underside of the roof-mounted equipment and the roof surface when the unit is not mounted directly on a curb.
.3 Where possible, install air-handling units within the building rather than on rooftops.
.4 Where motorized dampers are provided separate from a packaged air-handling unit, locate the actuator where it is visible, accessible, and in a heated space.
.5 Provide removable terminal box sensors for periodic cleaning to prevent buildup of lint.
.6 The use of a ships ladder shall not be considered an acceptable means of servicing equipment in high locations where filters or other components need to be replaced.
.7 Consider means to mitigate snow entrainment and hoarfrost on air handling unit intakes.
.8 Provide access doors upstream and downstream of duct-mounted heating coils.

.6 Smoke Management

.1 Smoke management systems shall be designed, commissioned and tested in accordance with the applicable requirements.
.7 Smudging Rooms

  .1 Provide dedicated exhaust and negative pressure relationship to the adjacent spaces to contain, capture and remove smoke.
  .2 At minimum provide 12 air changes per hour (ACH) of dedicated exhaust.
  .3 Provide control damper for isolating the return air from the smudging room during the ceremony.
  .4 Provide a manually operated switch with timer to activate the exhaust fan and close the control damper on the return side during the ceremony.

.8 Carbon-monoxide (CO) Detection

  .1 Provide CO detection system in mechanical rooms with fuel fired equipment.
  .2 CO alarm to be tied to the building Energy Management Control Systems (EMCS).

.A Specific Requirements for Schools

  .1 Gymnasium Ventilation

    .1 Provide a separate air system with free-cooling capability. Mechanical cooling is not required.
    .2 Design air systems to vary outdoor air volume for normal and high occupant usage utilizing CO₂ sensors.
    .3 Provide a system override local control.

  .2 Core Building Ventilation

    .1 Design air distribution at the boot racks and cubbies to avoid potential odor and moisture issues.

.B Specific Requirements for Healthcare Facilities

  .1 Provide ventilation systems in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

  .2 Duct Distribution

    .1 Do not use ceiling spaces as return air plenum.
    .2 Design air distribution systems to limit air velocities or control drafts in special draft-sensitive areas/rooms (dialysis area, certain laboratories, isolation rooms, etc.).
.3 Ventilation systems should be zoned accounting for room/space function, occupied hours and air quality requirements. Ventilation systems may be permitted to serve areas of different use provided that the requirements of the most critical occupancy are satisfied. Consider the requirements for continuous airflow to Areas of Refuge when zoning air-handling systems.

.4 All clinical/patient-care rooms shall have dedicated supply and return air terminal boxes.

.5 Operating room supply and exhaust/return grilles, and air boots shall be manufactured from stainless steel.

.3 Accessibility and Maintenance

.1 Provide HVAC system for Type I areas (as defined in CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities) that are capable of being shut down for maintenance and emergency repair without jeopardizing the relative pressurization of adjoining spaces.

.4 Smoke Management

.1 Areas of refuge (operating rooms, delivery rooms, intensive care units, and other areas where it is impractical to move a patient in an emergency) shall be provided with a mechanical air supply that will continue to operate during a fire to assist in keeping the areas smoke free for the duration required by the National Building Code - Alberta Edition. Ductwork passing through other zones that is required to keep the areas smoke free shall be protected with a fire rating equivalent to the length of time that the areas is required to be kept smoke free.

.2 Sleeping room fire compartments shall be designed, installed and commissioned to prevent smoke from spreading to other compartments or areas of the Healthcare Facility, to allow for horizontal relocation of patients to a smoke-free area. Provide fire and smoke dampers on any duct penetrations and air transfer openings at fire separations in accordance with the National Building Code - Alberta Edition.

.5 Infection, prevention, and control, and health considerations

.1 Provide outside air and total air change rates to all rooms and areas within a healthcare facility to control contaminant levels, temperature, and humidity while minimizing stratification and drafts.

.2 Design ventilation systems that move air from clean to less clean areas and with air patterns designed to direct fresh air towards the breathing zone of the occupants.
.3 Design outdoor air intakes to maintain the minimum separation distances to potential outdoor air contaminant sources in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities. Consider the effect of the predominant wind direction and increase distances as appropriate.

.4 Do not circulate air from an area of low level care to an area of high level care, or high humidity area to low humidity area.

.6 Minimum Operation

.1 Air handling systems shall allow reduced operation during unoccupied periods in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.C Specific Requirements for Continuing Care Facilities

.1 Design ventilation systems to the same standards as Healthcare Facilities.

.2 Resident bedrooms

.1 Provide each resident bedroom with individual air temperature controls that are controllable within a range.

.2 Provide ventilation air directly into each resident room. Transferred air from the corridor into the resident room is not acceptable.

.3 Assisted bathing rooms

.1 Provide assisted bathing rooms with a dedicated temperature control that is separate from other rooms.

.4 Kitchens/Serveries

.1 Provide kitchens/serveries with cooling and dedicated temperature control.

.5 Living rooms/activity spaces

.1 Provide living rooms/activity spaces with cooling and dedicated temperature control.
.2 Air Handling Units

.1 General Construction

.1 Provide hinged doors to all compartments within air-handling units (filter banks, coils, etc.) for accessibility. Arrange doors to open against internal air pressure. In negative pressure sections, the doors should open outward; in positive pressure sections, the doors should open inward. Give consideration to door construction and gasketing material to ensure tightness and durability of the seal.

.2 Provide switches to control internal lighting (except for small packaged rooftop units).

.3 Arrange air handling unit compartments to promote good mixing of air streams and uniform air flow through each component. Use factory mounted air blenders to prevent air stratification and provide uniform flow across coils.

.4 Provide a heated and full-sized, enclosed service corridor within rooftop units where practical. Access to the service corridor is preferable from within the building. Coordinate requirements with Project Manager.

.5 Provide non-ferrous materials in locations where condensation or moisture can occur (i.e. drain pans, cooling coil headers, casings and racks, and cooling coil and humidifier sections).

.6 Provide drains in each section of an air-handling unit where water might accumulate. Design air-handling units to continuously drain water present in outdoor air intakes, cooling coil drain pans, and humidifier drain pans to prevent the accumulation of standing water within the unit. Drain pans to be sloped to drain in a minimum of two directions and at a minimum slope of 2%.

.7 Design air handling unit curb/housekeeping pads of a sufficient height to accommodate the drain condensate trap outside of the unit.

.8 Equip air handling units equipped with an economizer and return fan section.

.2 Location

.1 Locate air handling units indoors within designated mechanical rooms unless otherwise permitted by the Project Manager and Facility Administrator.

.2 Locate roof-mounted air handling equipment over corridors or other non-critical areas that are least impacted by noise and vibration transmission.

.3 Design outdoor air intakes to maintain the minimum separation distances to potential outdoor air contaminant sources in accordance with ANSI/ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality. Consider the effect of the predominant wind direction and increase distances as appropriate. Where other codes or standards indicate higher separation distances, use the larger value.
.3 Redundancy and Standby Capacity

.1 Consider parallel air handling units or interconnected air systems for ventilation systems that serve critical areas. Discuss redundancy requirements with Project Manager and the Facility Administrator.

.4 Humidification

.1 Where wetted media type evaporative cooling and humidification is used, it shall be ‘once-through’ type. Arrange the media and water spray headers in sections to achieve a minimum of three stages of capacity control. Provide stainless steel drain pans and adjustable flow control. The air handling unit should be controlled to shut off only when the media is dry.

.2 Steam generated at the central steam plant may be used for humidification provided that the chemical treatment used in the boils is appropriate.

.1 Verify that the boiler water does not contain chemicals which are known to be hazardous to health, or which might contribute to an indoor air quality problem. Chemical concentrations shall not exceed the levels acceptable under the Alberta Occupational Health and Safety Regulations.

.2 Alternatives to using a central boiler to provide direct steam humidification include, a dedicated gas-fired steam boiler, point-of-use gas-fired steam humidifiers, and a steam-to-steam converter system.

.3 Humidifier Feed-Water

.1 Provide an appropriate water treatment system for humidifier feed-water to control mineral scaling.

.4 Electrode and electrical steam generators for humidification should only be considered when the humidification load is less than 45 kilograms of steam per hour.

.5 Air Filtration

.1 Provide ventilation systems equipped with filtration in accordance with ANSI/ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality (as a minimum).

.2 Provide ventilation air filtration systems in accordance with ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (as a minimum).
.3 Provide air-handling units with both summer and winter filters sections where frost may occur.

.4 Provide filtration as required to meet the projects targeted Indoor Environmental Quality credits for LEED projects.

.5 Air filters shall be:

.1 Designed, installed, and located so as to avoid wetting from humidifiers, cooling coils, or other sources of moisture.

.2 Composed of materials that do not pose carcinogenic or other health hazards.

.3 Designed and installed for ease of access to allow for changing of filters.

.4 Equipped with manometers or other pressure-drop monitoring devices.

.5 Provided with gaskets or seals to prevent leakage between filter segments, filter frames adjacent to each other, and the surrounding filter plenum enclosure.

.6 Protected during construction.

.6 Burner

.1 Where natural gas heating is used within air handling units, provide air handling units with a turn down ratio of at least 15:1. Where a large turn down ratio is not available, provide multiple stages of heating.

.A Specific Requirements for Schools

.1 General Construction

.1 Provide protection from vandalism where exterior air handling units are provided (i.e. intake screen, padlocks on access doors, etc.).

.2 Where cooling is not provided, air handling equipment shall be equipped with space for a future cooling coil.

.2 Location

.1 Avoid placing roof-mounted air handling units over instructional spaces.
.3 Humidification

.1 In general, use steam humidifiers in air handling systems. This does not preclude other options which should take into account specific systems within the school district where maintenance and familiarity are important considerations.

.4 Filtration

.1 Provide MERV 8 pre-filters and MERV 13 final filters in air handling units (as a minimum).

.B Specific Requirements for Healthcare Facilities

.1 General

.1 Design air handling units in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.2 Humidification

.1 Use steam humidifiers in all air handling systems injected into the supply air through a steam distribution manifold.
.2 Where feasible, provide lower humidity “buffer spaces” to separate spaces with high relative humidity from the building envelope. Design partitions and mechanical system air pressure differentials to minimize humid air transfer to buffer spaces.
.3 Where high humidity spaces cannot be “buffered” from the building envelope, provide other means to prevent condensation within the building envelope.

.C Specific Requirements for Continuing Care Facilities

.1 Humidification

.1 Provide humidified supply air to resident rooms.

.3 Makeup Air Units

.1 Provide makeup air units with remote control panels that can be interlocked in a supervisory or control capacity to the EMCS system.
.4 Terminal Air Devices

.1 Where variable air flow (VAV) terminal boxes and perimeter heating elements are located within a given zone, provide temperature control using the same temperature sensor.

.5 Furnaces

.1 Provide furnaces with an economizer section.

.6 Emergency Generator Rooms

.1 Provide airflow to emergency generators rooms to satisfy both the cooling and combustion requirements of the emergency generator(s) in accordance with CSA C282, Emergency Electrical Power Supply for Buildings.

.7 Rooms Containing Fuel Oil Storage


5.13 Exhaust Systems

.1 General Requirements

.1 Provide exhaust air systems to remove odors, smoke, fumes, or heat.
.2 Do not use ceiling spaces or mechanical rooms as exhaust air plenums.
.3 All exhaust systems shall be ducted.
.4 The location of exhaust air discharges shall be designed to prevent the re-entrainment of contaminants. Consider the effects of wind when selecting exhaust air discharge locations.

.1 Where re-entrainment is a concern, discuss the need for wind modeling with the Project Manager.
.A Specific Requirements for Schools

.1 Career technology studies (CTS)

.1 Provide exhaust for fume and odor producing equipment and activities (i.e. welding, laboratories, plastic processes, silkscreen, etc.) in accordance with the recommended design practice indicated in Industrial Ventilation – A Manual of Recommended Practice, American Conference of Governmental Industrial Hygienists (ACGIH).

.2 Provide makeup air and exhaust to maintain negative pressurization for CTS, wood working, industrial arts, and home economics areas.

.3 For woodworking areas, provide dust collection equipment that maintains a safe working environment, particularly with respect to noise and exposure to wood dust. Refer to Occupational Health & Safety, Chemical Hazards Regulation publication “Health Effects from Exposure to Wood Dust” for guidance.

.4 Dust Collectors

.1 Non-recirculating (direct-type) dust collectors are preferred over recirculating-type dust collectors.

.2 Where recirculating-type dust collectors are used, ensure NFPA requirements for explosion and fire protection are met.

.3 Where recirculating-type dust collectors are used, return air shall be designed to avoid condensation within the space (e.g. by reheating).

.4 Locate dust collectors outside the building and provide sound attenuation on the return air.

.B Specific Requirements for Healthcare Facilities

.1 Provide exhaust systems to maintain environmental conditions or to achieve pressure relationships in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

.2 Provide exhaust fan redundancy/standby capacity in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

.C Specific Requirements for Continuing Care Facilities

.1 Design ventilation systems to the same standards as Healthcare Facilities.

.2 Provide exhaust in beauty shops to remove odors related to hair styling chemicals.
.3 Provide negative air pressurization with exhaust to the outside in spaces such as washrooms, bathrooms, housekeeping rooms, soiled utility rooms, kitchens, and laundry rooms to control odor and control humidity.

.2 Kitchen Exhaust System


.2 Provide kitchens with makeup air and maintain negative pressurization in the space during cooking periods.

.3 When exhaust hoods are shut down, reduced makeup air flow may be considered.

.3 Smoke Exhaust Systems

.1 Refer to Section 5.9.5 – Smoke Control System.

.4 Fume and Process Exhaust Systems

.1 Design fume exhaust systems in accordance with ASHRAE, Laboratory Design Guide – Planning and Operation of Laboratory HVAC Systems.

.2 Exhaust duct materials:

.1 Use corrosion resistant materials for exhaust ducts conveying corrosive fumes and vapor.
.2 Use stainless steel for exhaust ducts conveying moisture-laden vapors.

.3 Fume Hoods:

.1 Where fume hoods are provided as part of the mechanical scope of work, consider the use of variable speed fume hoods, sash stops, and proximity sensors.
.2 Where fume hoods are provided as part of the mechanical scope of work, provide fume hoods with factory supplied face velocity monitor and alarm.
.5 Radon Gas Exhaust

.1 Refer to Section 11.0 – Environmental for radon mitigation rough-in system requirements.

.2 The design team and the radon mitigation professional shall design a radon rough-in mitigation system to facilitate the building with Active Soil Depressurization (ASD) systems capability. Mechanical considerations for rough-in system include, but not limited to:

.1 Rough-in riser vent pipes.
.2 Future tie-in and venting configurations. Radon venting discharges shall be located away from any building air intake and public spaces.
.3 Future exhaust fan locations and coordination for electrical requirements.

5.14 Energy Management Control System (EMCS)

.1 General Requirements

.1 Provide BACnet compliant Direct Digital Control (DDC) system to:

.1 Control heating, ventilation, and air conditioning systems
.2 Minimize energy consumption
.3 Monitor and record mechanical systems performance
.4 Dial out of alarm signals

.2 Provide commercially available, field proven EMCS that is installed, engineered, and commissioned by trained and qualified personnel, employed by companies that can provide an acceptable level of service after completion of the contract.

.3 Field installation needs to meet applicable requirements specified in Alberta Infrastructure Technical Specifications, 23 09 28 – EMCS Field Work.

.4 Startup and testing needs to meet applicable requirement specified in Alberta Infrastructure Technical Specification, Section 23 08 95 EMCS Start-Up and Testing.

.5 Plan early in the project design schedule to determine the requirements for:

.1 Contract documentation
.2 Vendor acceptance
.3 Design and product approval
.4 System field inspection
.5 Customized control sequences
.6 Commissioning the EMCS

.6 Provide adequate operator training to utilize the EMCS system to its full potential including training on how to interpret energy consumption reading, adjust set points, and modify sequences (where possible).

.7 Provided access to all EMCS field devices for calibration/maintenance or replacement.

.8 Controls for all essential equipment are to be on emergency power. Central Control Stations (CCS) are to include a UPS.

.9 Refer to Section 5.1.5 for EMCS contract document requirements.

.10 Refer to Alberta Infrastructure Technical Specification, Section 23 09 23 EMCS General Requirements for further details.

.11 Refer to Alberta Infrastructure Technical Specification, Section 23 09 10 Control Systems for requirements on projects, where size and complexity do not warrant use of Direct Digital Control system.

.2 Requirements for EMCS Major Components

.1 Network Communication and System Configuration

.1 BACnet only system for all new works. LonMarks devices can be accepted for retrofit projects if circumstances dictate.

.2 Two tiered network separating communication traffic between controls for major mechanical equipment and zone control.

.3 Direct peer-to-peer data sharing between all Remote Control Unit (RCU) on primary network.

.4 Where communication is specified between a unitary equipment controller and the EMCS, ensure that the extent of communication is clearly specified. In particular:

.1 Each point (including virtual points) that is to be communicated.
.2 Between the EMCS and the unitary controller. List each point discreetly on the EMCS points list.
.3 Each communicated point within the specification section pertaining to the relevant unitary equipment and its controller.

.4 Clearly define which points may be read-only by the EMCS and which points must be read/write by the EMCS.

.5 Refer to Alberta Infrastructure Technical Specification, Section 23 09 24 EMCS Network Communication and System Configuration for further details.

.2 Central/Portable Control Station (CCS/PCS)

.1 User-friendly interface and control language that allows user reprogramming of the control sequences.

.2 Program and graphics editing software including operating manuals.

.3 Dynamic graphics for all mechanical systems and interface to any other systems. Include all EMCS controlled space temperatures zoned with associated air system.

.4 Real-time and trended efficiency calculations for heating boilers, steam process boilers, chillers, and domestic hot water heaters by monitoring gas/electrical input and output.

.5 Trend log of actual system demand boilers and chillers through the utilization of BTU meters and maintain data points for peak demand for each component on a year-by-year basis with reference to outdoor air temperature.

.6 Remote access by telephone or internet connectivity.

.7 Trend log, reports to support applicable LEED credit requirements.

.8 No control logic, global schedule command engine or global value transfer function shall reside on CCS and PCS. The loss of PCS and CCS shall not affect EMCS control function.

.9 Discuss with project manager and facility administrator to determine EMCS server redundancy requirement.

.10 Refer to Alberta Infrastructure Technical Specification, Section 23 09 25 EMCS Central/Portable Control Stations and Peripherals for further details.
.3 Remote Control Units (RCU)

.1 Provide each air handling unit with its own remote control unit (RCU). Using one RCU for multiple air handling units is not acceptable.

.2 RCU to have same level of redundancy, backup power and location fire protection rating as equipment being controlled.

.3 Refer to Alberta Infrastructure Technical Specification, Section 23 09 26 – EMCS Remote Control Units for further details.

.4 Terminal Control Units (TCU)

.1 TCU should not be used for control of major equipment (i.e. boilers, air-handling units, etc.).

.2 Floating point control shall not be used for terminal box actuators serving critical care areas. Where floating point control is used, terminal boxes shall not all recalibrate at the same time.

.3 Refer to Alberta Infrastructure Technical Specification, Section 23 09 27 – EMCS Terminal Control Units for further details.

.5 Field Devices

.1 Provide electrically powered actuators to drive all valves, dampers and other control devices, except that central equipment actuators may be pneumatically powered in extensions or renovations to existing facilities where pneumatic power of adequate capacity is available.

.2 Select control valves with proper flow characteristics to match the application. Size so as to maintain reasonably linear control characteristics.

.3 Consider the use of 1/3 and 2/3 sized control valves for coils with large load variations.

.4 Match the damper type. Face area, power of actuator, and method of rod and damper linkage to give a linear volume control characteristic.

.5 Install flow measuring devices according to the manufacturer’s recommendation.
.6 Where variable volume control is being used with non-filtered supply or return air, a true differential pressure sensor shall be utilized. Flow-through sensors shall not be permitted.

.7 Refer to Alberta Infrastructure Technical Specification, Section 23 09 29 – EMCS Sensors, Devices and Actuators for further details.

.3 Control Point Schedule

.1 Identify EMCS control points according to the Alberta Infrastructure EMCS Guideline for Logical Control Point Mnemonics.

.2 Every major mechanical system and piece of equipment (heating plant, cooling plant, major ventilation equipment, medical gas/vacuum pumps, domestic water heaters, etc.) shall be provided with sufficient control points to:

1. Control heating, ventilation, and air conditioning systems.
2. Execute control strategies to minimize energy consumption.
3. Monitor and record mechanical system’s performance and trend data for the current and previous years in operation.
4. Provide dial out of alarm signals.

.3 Connect utility meters or real time monitoring meters to the EMCS to facilitate automatic tracking of energy usage.

.4 Provide necessary points and field devices to meet applicable LEED credit requirements.

.5 For variable air volume systems, monitor the supply and return air flow from the air handling unit.

.B Specific Requirements for Healthcare Facilities

.1 Control Points

1. Track electrical consumption and run time for vacuum pumps and medical air compressors.

.4 Sequence of Operations

.1 Provide custom control sequences and application programs to conserve energy by:

1. Optimizing operation of controlling primary energy consuming equipment.
.2 Specifying optimum start and stop times for equipment and systems that do not operate 24 hours per day.
.3 Resetting air and heating water supply temperatures using feedback from occupied space demand and outside air temperature.
.4 Resetting relative humidity based on outside air temperature.
.5 Using air systems to preheat, pre-cool or purge to achieve the objective space temperature at the start of occupancy.
.6 Controlling variable air flow by using system pressure to control fan and pump VFD speed.
.7 Reset supply air temperature on VAV systems based on feedback from VAV damper position in order to reduce simultaneous heating & cooling.
.8 Schedule VAV terminal boxes where areas with different occupancy schedules are served by the same ventilation system.
.9 Reset supply air temperature on constant volume systems based on feedback from reheat coil/radiant panel/radiation valve position in order to reduce simultaneous heating & cooling.
.10 Controlling car plug power to lock out at -10°C (2°F) and above, and to cycle on/off for 20 minutes intervals at temperatures below.

.2 Provide necessary control logics and functions to meet applicable LEED credit requirements.

.3 Provide control logics and functions to prevent thermal shock to boilers.

End of Mechanical Section
6.0 Electrical

Section Contents

6.1 General Electrical .............................................................................................................. 1
   .1 Intent ................................................................................................................................. 1
   .2 References ......................................................................................................................... 1
   .3 Key Design and Performance Requirements ................................................................. 3
   .4 Identification ....................................................................................................................... 4
   .5 Operation and Maintenance Manuals ............................................................................... 4
   .6 Spare Parts and Maintenance Materials ........................................................................... 4
   .7 Starting and Testing ............................................................................................................ 4
   .8 Equipment and Systems Demonstration .......................................................................... 5
   .9 Commissioning ................................................................................................................... 5
   .10 Submission Requirements ............................................................................................... 5
       A. Specific Requirements for Schools ................................................................................. 6
       B. Specific Requirements for Healthcare Facilities ............................................................ 7

6.2 Power Distribution and Service ...................................................................................... 7
   .1 General .............................................................................................................................. 7
   .2 Single Line Drawings ......................................................................................................... 8
   .3 Protection and Control ...................................................................................................... 9
   .4 Power Service ................................................................................................................... 9
   .5 Switchgear, Switchboards, Distribution Panelboards, Motor Control Centres and Panelboards .................................................................................................................. 11
   .6 Dry Type Distribution Transformers ............................................................................... 13
   .7 Feeders .............................................................................................................................. 14
   .8 Power Factor .................................................................................................................... 14
   .9 Motor Protection and Control ........................................................................................... 14
   .10 Surge Protective Devices .................................................................................................. 15
   .11 Emergency Power ............................................................................................................ 15
   .12 Branch Wiring/Devices .................................................................................................... 17
   .13 Offices and Workstations ............................................................................................... 18
   .14 Lightning Protection ........................................................................................................ 18
6.3 Lighting .............................................................................................................. 22
  .1 General ............................................................................................................ 22
  .2 Lighting Design Parameters ......................................................................... 23
  .3 Uniformity ........................................................................................................ 23
  .4 Interior Landscape Lighting ........................................................................... 23
  .5 Lighting Sources ............................................................................................ 23
  .6 Diffusers .......................................................................................................... 24
  .7 Fluorescent Lamps and Ballasts .................................................................... 24
  .8 LED’s and Drivers .......................................................................................... 24
  .9 Interior Lighting Control ................................................................................ 25
  .10 Emergency and Exit Lighting ......................................................................... 26
  .11 Exterior Lighting ............................................................................................ 26
     A. Specific Requirements for Schools ............................................................. 27
     B. Specific Requirements for Healthcare Facilities ....................................... 27

6.4 Communication .................................................................................................. 28
  .1 Service Entry .................................................................................................. 28
  .2 Structured Cabling – Voice and Data .............................................................. 28
  .3 Paging and Public Address Systems ............................................................... 29
  .4 Sound Masking System ................................................................................ 29
  .5 Assistive Listening Devices .......................................................................... 30
  .6 Clock System .................................................................................................. 30
  .7 Cable Television (CATV) / Radio Frequency Television (RFTV) .................... 30
     A. Specific Requirements for Schools ............................................................. 30
     B. Specific Requirements for Healthcare Facilities ....................................... 31

6.5 Electronic Safety and Security Systems .......................................................... 33
  .1 General ............................................................................................................ 33
  .2 Fire Detection and Alarm .............................................................................. 34
     A. Specific Requirements for Schools ............................................................. 35
     B. Specific Requirements for Healthcare Facilities ....................................... 36
Electrical - Appendix A

1. Reference Standards ........................................................................................................... 1
2. Identification Materials ......................................................................................................... 1
3. Colour Identification of Equipment ...................................................................................... 1
4. Nameplate Identification of Equipment ................................................................................. 1
5. Panelboard Directories .......................................................................................................... 3
6. Communications Cable and Equipment Labeling ................................................................. 3
7. Intermittent Colour Coding of Conduit/Raceway and Cable ................................................... 3
8. Identification of Pull and Junction Boxes .............................................................................. 3
9. Colour Identification of Wiring .............................................................................................. 4
10. Name/Number Identification of Wiring ................................................................................ 4
11. Identification of Receptacles ................................................................................................. 4
12. Equipment Identification Schedule ...................................................................................... 5
13. Colour Schedule .................................................................................................................. 6
14. Communications Cabling Tagging and Naming Conventions .................................................. 7
15. Fire Alarm Identification ....................................................................................................... 9

Electrical – Appendix B

1. Sample Electrical Panel Schedule ....................................................................................... 1

Electrical – Appendix C

1. Coordination, Fault and Arc Flash Incident Energy Analysis Report Requirements .............. 1
6.1 General Electrical

.1 Intent

.1 The intent of these Sections is to outline requirements for electrical systems not otherwise covered by applicable codes and standards. It is not intended as a substitute for good engineering practice or fundamental design principals. The Electrical Systems are to be designed and built to meet or exceed all applicable codes, standards, requirements and legislation.

.2 All electrical systems are to be functional, reliable, efficient, flexible, safe, maintainable and expandable with reserve capacity for future modifications.

.3 Systems are to be documented via as-built or record drawings and operational and maintenance manuals.

.4 Demonstration and training sessions are to be provided for operation staff.

.5 Designs shall demonstrate energy efficiencies and be cognizant of energy usage for all electrical equipment. Utilize energy standards and guidelines as outlined herein to every aspect of the electrical system design. Encourage the use of energy-star labeled equipment as a best practice.

.6 Do not sole source or use proprietary equipment or systems for any new facility or major renovation where existing equipment is being replaced. In cases of renovation, campus or addition type projects, specific equipment or systems may be required. If this is the case, these must be itemized and reviewed with the Infrastructure Project Manager.

.2 References

.1 The Codes and Standards listed below provide the designer with references to be reviewed during design. Application of the Codes and Standards are to be justified by the professional(s) leading the design at the time of design development and shall be clearly stated in design reports. Where conflicts exist between various Codes and Standards, the design report shall indicate the resolution taken and the reasons to support it.

Referenced Documents (Where applicable, Editions currently adopted by the regulations under the Safety Codes Act, otherwise, latest revisions/edition and changes).

.1 National Building Code, Alberta Edition (NBC-AE)
.2 Alberta Fire Code (AFC)
.3 Alberta Infrastructure Technical Design Requirements for Alberta Infrastructure Facilities (TDR)
.4 CSA C22.1 Canadian Electrical Code (CEC) - Part 1
.5 CSA C282 Emergency Electrical Power Supply for Buildings
.6 Telecommunications Referenced Standards:
   .1 ANSI/TIA-568-X.0, Generic Telecommunications Cabling for Customer Premises
   .2 ANSI/TIA-568-X.1, Commercial Building Telecommunications Cabling Standard
   .3 ANSI/TIA-568-X.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard
   .4 ANSI/TIA-568-X.3, Optical Fiber Cabling Components Standard
   .5 ANSI/TIA-569, Telecommunications Pathways and Spaces
   .6 ANSI/TIA-606, Administration Standard for Telecommunications Infrastructure
   .7 ANSI/TIA-607, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
.7 CSA Z462, Workplace Electrical Safety
.8 APEGA Guidelines
.10 CAN/CSA-B651, Barrier-Free Design
.11 CAN/ULC-S524, Installation of Fire Alarm Systems
.12 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems
.13 CAN/ULC-S537, Verification of Fire Alarm Systems
.15 National Energy Code of Canada for Buildings (NECB)
.16 The Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials
.17 Workplace Alberta, Occupational Health and Safety Act and Regulations for Construction Projects
.18 Local Bylaws
.19 Illuminating Engineering Society of North America (IESNA)
.20 Institute of Electrical and Electronic Engineers (IEEE)

For codes and standards currently under regulation in Alberta, only editions/versions of those codes and standards can be specified. If different versions wish to be specified in its entirety, the consultant must apply for an “alternative solution” with the Authority Having Jurisdiction (AHJ) as required by the National Building Code – Alberta Edition (NBC -AE)
.3 Key Design and Performance Requirements

.1 Electrical documents must meet the requirements of the APEGA document entitled Responsibilities for Engineering Services for Building Projects, V1.2 March 2009.

.2 Develop a conduit/raceway schedule and include in specifications/drawings. Provide EMT (Electrical Metallic Tubing) for all interior locations such as ceiling spaces and concealed in walls, except where otherwise indicated in specifications/drawings or required by CEC. Provide details and/or specification for specialized wiring (eg. dedicated neutral circuits) and raceway methods. All low voltage wiring to be installed in a conduit/raceway.

.3 Life Safety Systems: Identification of fire-rated feeders/cables to be shown. Fire-rated feeders/cables to be Mineral Insulated (MI) type.

.4 Building Control Systems: Location, identification, type and approximate sizes of equipment control panels, control devices and outlets for control systems requiring 120V power connections, such to be shown.

.5 Block Diagrams for all electrical systems, Communications and Electronic Safety and Security Systems, to be provided.

.6 The electrical systems are to support the facility’s operation upon initial occupancy and throughout the life of the facility; allowing for reasonable maintenance, equipment replacements, modernizations and expansion.

.7 The systems shall be designed to permit maintenance, repair and replacement of all electrical equipment without requiring work to be done on live equipment (infra-red scanning excluded).

.8 Power distribution and service equipment are to be located in secure, dedicated vaults, rooms and closets with sufficient clearance, access routes and access panels to allow for the installation, removal and replacement of equipment and to provide maximum flexibility for power distribution to floor area served.

.9 For new construction, rooms housing major electrical equipment shall not be located below the established flood plain, and in all cases shall not be located below grade.

.10 Rooms housing electrical distribution equipment shall not contain communications equipment, mechanical equipment, ducts, pipes, shafts or water lines unless the equipment is serving the room. Provide separate communication rooms for major data and electronic equipment.
.11 Electrical equipment shall not be located in or below Janitor rooms, water closets or other rooms with fluids, and shall only be located in mechanical equipment rooms if required to service mechanical equipment. All electrical equipment is to be suitably protected from leakages from the sprinkler system. Any major electrical equipment greater than 750 Volts shall not have sprinkler system or water lines located within the room. Avoid sprinkler systems and water lines in electrical rooms containing equipment less than 750 Volts and greater than 2000 Amps. Coordinate with Architectural and Mechanical divisions to ensure all codes are addressed.

.4 Identification

.1 Equipment to be identified in a clear, consistent manner. Nomenclature describing tagging method shall be shown. Refer to Electrical Appendix A for additional requirements where user groups standards are not in place.

.5 Operation and Maintenance Manuals

.1 Ensure all data required for the operation and maintenance of the equipment is collected and included in the Manuals. Refer to Technical Specifications Section 26 01 10 “Electrical Operation and Maintenance Data” for minimum requirements. Edit the section to make specific to the project.

.2 Refer to Technical Specification Section 26 01 11 “Electrical Operation and Maintenance Manual” for manual requirements and organization. Edit the section to make it specific to the project.

.6 Spare Parts and Maintenance Materials

.1 Include spare parts and maintenance materials to the building operator. Refer to Technical Specification Section 26 01 90 “Electrical Spare Part and Maintenance Materials” for manual requirements and organization. Edit the section to make it specific to the project.

.7 Starting and Testing

.1 Include electrical starting and testing requirements. Refer to Technical Specification Sections: 26 08 10 “Electrical Starting and Testing - General Requirements”, 26 08 20 “Electrical Starting and Testing by Contractor”, and 26 08 30 “Electrical Starting and Testing by Contractor’s Testing Agent”. Edit the sections to make them specific to the project.
.8 Equipment and Systems Demonstration

.1 Ensure that proper demonstration and instruction procedures are performed for the Province’s maintenance personnel. Refer to Technical Specification Section 26 08 40 “Electrical Equipment and Systems Demonstration and Instruction”. Edit the section to make it specific to the project.

.9 Commissioning

.1 It is the intent of the Province to solicit proposals for Commissioning Consultant Services and Independent Commissioning Authority to meet Leadership in Energy and Environmental Design (LEED) Fundamental and Enhanced Commissioning requirements.

.2 Over and above LEED commissioning requirements, the Commissioning Authority is required to undertake commissioning in accordance with CSA Z320 – Building Commissioning for all systems including:

.1 Electrical power and distribution.
.2 Emergency power and distribution.
.3 Transfer Switch operation.
.4 Lighting levels.
.5 Lighting control including daylight sensor calibration, occupancy sensor calibration and astronomical time clock settings and adjustments.
.6 Clock System.
.7 Functional testing of Security and Card Access Systems.
.8 Testing of Surveillance System.
.9 Sound Systems.

.10 Submission Requirements

.1 Schematic Design Report Submission

.1 The Schematic Design Report (SDR) shall contain a section for the Electrical discipline.
.2 The SDR shall include all referenced codes and standards, including the most recent “Technical Design Requirements for Alberta Infrastructure Facilities (TDR)”.
.3 Convey the design intent of all electrical systems proposed. There must be enough information in the descriptions to ensure that the TDR is being followed so that future submissions and design will be compliant with the TDR.
.2 Design Development Report Submission

.1 The Design Development Report (DDR) must fully convey the design intent. All design related issues, technical criteria and performance shall be included. All comments from the SDR are to be responded to prior to the DDR and addressed in the DDR.

.2 The following design related items/issues related to the electrical design to be included, but not limited to:

.1 Anticipated electrical load and allowances for future expansion.
.2 Single Line Diagram (SLD) indicating basic intent. Expected fault levels to be included on the SLD. Include arc flash mitigation strategies.
.3 Requirements of incoming electrical and telecom/data services and location and space requirements for the main service equipment.
.4 Locations of electrical, emergency/standby generator and data rooms/closets and preliminary size of rooms.
.5 Determination of lightning protection and risk assessment as per CSA B72.
.6 Description of lighting for interior and exterior lit spaces, including but not limited to styles and metrics. Include light loss factors that will be used in calculating light levels.
.7 Indicate areas where specialized lighting is expected and description of how lighting will be addressed.
.8 Description of lighting control system being proposed.
.9 For Healthcare Facilities, include preliminary risk classification of patient care areas for review by client group.

.3 Contract Documents (75% Submission)

.1 Include a specification that is 90% complete.
.2 All electrical and data room layouts.
.3 Exit lights and emergency lighting.
.4 Fire Alarm drawings showing zones, zone numbers and names. Show location of all panels and annunciators and as many devices as possible at this stage of design.
.5 Include schematic drawings, details and panel schedules (included, but not necessarily completed).

A. Specific Requirements for Schools

.1 Provide a comprehensive colour coding and identification system for all electrical systems in accordance with the local school board standards.
B. Specific Requirements for Healthcare Facilities

.1 References

.1 Canadian Electrical Code, Part 1, Section 24, Patient Care Areas.
.2 CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities.
.3 CSA Z8000, Canadian Health Care Facilities
.4 CSA Z8001, Commissioning of Health Care Facilities.
.5 CSA Z317.5 Illumination Design in Healthcare Facilities.
.6 ANSI/TIA 1179, Healthcare Facility Telecommunications Infrastructure Standard.
.7 ANSI/IES RP-28 Lighting and the Visual Environment for Seniors and the Low Vision Population
.8 ANSI/IES RP-29 Lighting for Hospitals and Healthcare Facilities
.9 UL 1069 Standard for Safety – Hospital Signaling and Nurse Call Equipment
.10 Design Guidelines for Continuing Care Facilities in Alberta, October 2014 (Draft)

.2 Provide a comprehensive colour coding and identification system for all electrical systems in accordance with the facility standards.

.3 Adopt Infection Prevention and Control (IP&C) requirements as stipulated by Alberta Health Services (AHS), the Health Care Facility and CSA Z317 - Infection Control During Construction, Renovation and Maintenance of Healthcare Facilities.

.4 Include Patient Area Classification drawing(s) indicating Basic, Intermediate and Critical Care areas as defined in CSA Z32 and Canadian Electrical Code.

6.2 Power Distribution and Service

.1 General

.1 This section describes general requirements for power distribution and service. Identify any specialized requirements at the design development stage.

.2 Provide a preliminary short circuit study showing all fault levels prior to completion of design documents. Include this information on the Power Single Line.
.3 Prior to final acceptance of the project, ensure a full coordination study, fault and arc flash incident energy analysis study has been completed and implemented. The maximum arc rating of electrical equipment on the load side of the main breaker is not to exceed 8 cal/cm$^2$. If this cannot be achieved, proposed solution with recommendation shall be submitted to the Province. Labels to meet the requirements of CSA Z462. Refer to Appendix C for minimum report requirements.

.4 Harmonic distortion and noise:

.1 Identify non-linear loads, including Uninterruptible Power Supplies (UPS’s), computers, rectifiers, variable frequency drives, elevator systems (variable speed drives and/or regenerative systems) and electronic ballasts or Light-emitting diode (LED) drivers, and consider their effects on power distribution system. Meet IEEE 519-2014, “Recommended Practice and Requirements for Harmonic Control in Electric Power Systems” at the utility Point of Common Coupling. Provide corrective measures as required.

.5 Obtain acceptance of the Province for the use of fused equipment. Consideration will only be given where fault duties of equipment require the limitation of available fault current.

.2 Single Line Drawings

.1 Provide electrical single line diagrams, as part of the Contract Documents, indicating the following:

.1 Configuration, type, voltage and amperage ratings of switchgear, transformers, panelboards and motor control centres (MCCs).
.2 Type, size and amperage ratings of services and feeders.
.3 Type, frame size and trip rating of overcurrent protective devices.
.4 Available fault current at switchgear, panelboards, transformer secondaries and overcurrent devices.
.5 Service and distribution grounding.

.2 Provide copies of single line diagrams from Record Drawings, recording actual construction as follows:

.1 Incorporate into Operating and Maintenance (O & M) Manuals.
.2 Frame and hang in each major electrical equipment room, with equipment in the room highlighted.
.3 For existing buildings, any changes to the power distribution system is to be reflected on the original or latest building SLD and a new Record Drawing provided with updated revision number and date.

.3 Protection and Control

.1 Ensure priority tripping and coordination of overcurrent and ground fault devices on feeders. Provide final consolidated trip curves for services sized 600 kVA and over and multi-building sites.

.2 Ensure adequate fault duty ratings of all switchgear, panels, MCCs and overcurrent devices. Provide calculation results when requested by Alberta Infrastructure.

.3 Provide all services and feeders with ground fault protection as required by the Canadian Electrical Code. Where ground fault protection is provided on services and feeders, ensure protection is also provided for downstream feeders and loads that are susceptible to nuisance ground faults.

.4 Do not provide undervoltage protection on main breakers. For 3 phase motor starters provide single phase motor protection using differential overloads or phase loss shutdown by the Energy Management Control System (EMCS).

.5 For services over 750V, provide relaying using relay accuracy class CTs with test block and solid state relays with trip indication for each function. Provide a DC battery source for control and tripping power.

.4 Power Service

.1 Sizing

As an aid to determining the electrical service size for a facility, the information provided below can be used as a guide to establish minimum requirements which is to be reflected in the Design Development Report.

.1 For multi-building sites, or sites with service voltages over 750V, coordinate electrical services with the Province.

.2 Single building services with service voltage under 750V shall be sized as follows:

.1 Size main services and service transformers according to connected load with the appropriate load factor applied. Disclose service sizing criteria in design documentation.

.2 Calculate connected load using load factors as dictated by the type of load, plus a minimum 20% allowance for future load growth. Discuss future load allowances with the Province.
.3 Calculate estimated loads based on basic power loads, plus additional loads anticipated for heavy power usage areas.

.4 For initial design basic power load due to lighting, general power, convenience loads and basic mechanical equipment, calculated as follows:

.1 Buildings Over 1,000 m² With Air Conditioning: 60 VA/m² x total building area.
.2 Buildings Under 1,000 m² with Air Conditioning: 70 VA/ m² x total building area.
.3 Buildings Without Air Conditioning: 40 VA/ m² x total building area.

.5 Heavy power usage areas include kitchens, workshops, laboratories and areas with large numbers of electrical equipment connections or receptacles. For these areas, calculate additional loads as follows:

.1 Each Heavy Usage Area (base initial): 100 VA/ m², or,
.2 Connected load at 100% demand, plus
.3 Other loads such as, snow melting, block heater outlets, welders and electric heating. Calculate additional connected load at 100% demand with a seasonal and work flow diversity factor applied.

.2 Transformers and Entry

.1 Location:

.1 Main Building Utility Transformers: Coordinate as typically supplied by the local Utility, and locate outside on concrete pads and with protective bollards and screens where required. Include details of concrete pad, grounding and guard rails on drawings. Review access with utility.
.2 Owned Provincial Primary Service: Dry Type or Liquid Filled transformers located indoors in the main electrical room.

.2 Secondary voltage (listed in order of preference):

.1 347/600V, three phase, four wire.
.2 120/208V, three phase, four wire.
.3 120/240V, single phase, three wire.
.4 Obtain approval of the Province for other voltages and connections.

.3 Service entrance feeders entering the facility, primary and/or secondary service, shall be installed below grade, in conduit/raceway. Provide additional protection where necessary.
.4 Liquid-filled transformers may be used for medium voltage applications and vault installation. Review with the Province.

.1 Use 55°C - 65°C insulation and equip with cooling fan.
.2 Equipment with sudden pressure relays.

.5 Switchgear, Switchboards, Distribution Panelboards, Motor Control Centres and Panelboards

.1 Switching and Overcurrent Devices:

.1 Main Service (750 V or Less):
  .1 Over 1200 A: Main breaker to be industrial duty, power type draw-out circuit breaker, complete with LSI and G if applicable (Long Time, Short Time, Instantaneous or Ground Fault) adjustable trip units and trip indication for each. Fixed mounted with side or front access enclosure products may be considered.
  .2 Over 2400 A: Consider all feeder breakers fed from main breaker to match main breaker type and have the same front to back dimension as the main breaker.
  .3 1200 A and Less: Main breaker to be a molded case breaker with LSI and G (if applicable) adjustable trip units.

.2 Distribution:
  .1 Provide molded case thermal magnetic circuit type breaker for feeders under 400 A.
  .2 For feeders 400 A and over, use molded case breakers complete with LSI and G (if applicable) adjustable trip units and trip indication for each.

.3 Main Service Over 750V:
  .1 Use metalclad switchgear with draw-out air magnetic, vacuum or SF 6 circuit breakers for all medium voltage equipment. The use of metal enclosed switchgear with interrupter switches to be reviewed with the Province.

.2 Bussing: Use solid copper.

.3 Metering: Provide panel mounted digital owner’s metering for all incoming services over 100 A, as follows:
.1 Meter to display true root means square (RMS) values for phase voltage (line to line and line to neutral), phase currents, kVA, kVAR, kW, PF, Hz, MWhr, kWd and kVAd.

.2 Coordinate communicating protocols with EMCS equipment.

.4 Accessories: Provide lifting equipment for all industrial type draw-out breakers, medium voltage switches and stacked medium voltage starters.

.5 Working Clearances: As per Safety Codes Act.

.6 Housekeeping Pads: Provide all floor mounted equipment with a housekeeping pad.

.7 Location: Do not locate main service and distribution equipment in mechanical, storage, janitor rooms, corridors or public spaces.

.8 Branch Circuit Panelboards:

.1 Copper Bussing.

.2 Breakers to be “bolt-on”.

.3 Maximum number of breaker positions in a single tub to be 72. Provide a double wide tub for breaker positions greater than 72 to a maximum of 84 positions. Provide minimum 225A bussing for panelboards with 42 or more positions. Feeder to be sized allowing for the required spares and spaces plus an allowance for future load growth for remaining space unused in the panel.

.4 Do not use feed through.

.5 Do not locate branch circuit panelboards in corridors or public spaces. Use “Closet” in corridor. Avoid locating in Storage Rooms. Do not locate in Janitor Closets.

.6 Include completed Panelboard Schedules with anticipated demand for each circuit. Refer to Sample Detail Sheet in Electrical Appendix B for minimum requirements for the Schedules.

.7 Recessed panelboards: Provide Two 21 mm empty conduits/raceways stubbed to ceiling space.

.8 All doors to be lockable.

.9 Distribution Panelboards:

.1 Provide door-in-door construction.
.10 Spares and Spaces:

.1 Switchgear, switchboards, distribution panelboards: Provide minimum 10% space for future breakers.
.2 Motor Control Centres (MCC’s): Provide minimum 10% space for future use. In addition ensure each MCC can be extended a minimum of one vertical section for future use.
.3 Panelboards: Provide minimum 10% spare breakers and minimum 10% space for future breakers.

.6 Dry Type Distribution Transformers

.1 Location:

.1 Locate distribution transformers, on housekeeping pads, in designated electrical rooms only.
.2 Transformers Over 45 kVA: Floor mounted on vibration isolators. Allow for removal by wheel mounted equipment.
.3 Do not locate distribution transformers in ceiling spaces.
.4 Coordinate transformer heat removal with Mechanical.

.2 Size and Type:

.1 Three-phase delta-wye connected sized such that average demand loading is at least 60% of rating. Windings to be copper.
.2 Temperature rating of 150°C rise.
.3 Maximum 500 kVA. Larger sizes only by exception by the Province.
.4 Equipped with four 2.5% taps; two above and two below nominal for voltage adjustment.
.5 Transformers serving a high percentage of electronic loads shall be K-13 rated at a minimum.
.6 Provide harmonic mitigating transformers for installations which include significant harmonic content in the load.

.3 Secondary voltage (listed in order of preference):

.1 347/600V, three phase, four wire.
.2 120/208V, three phase, four wire.
.3 120/240V, single phase, three wire.
.4 Obtain approval of the Province for other voltages and connections.
.4 Acoustical Considerations:

.1 Ensure adequate acoustic ratings, treatment, location and mounting of transformers. Refer to Section 7.0 – Acoustical for specific requirements and include in project specifications.

.2 Use flexible conduit/raceway connection to transformer for primary and secondary feeders. (Liquid tight flex conduit/raceway in wet areas).

.7 Feeders

.1 Use copper conductors.

.2 All feeders to have a bonding conductor.

.3 Size of neutral conductor to be at least the same size as the phase conductors.

.4 Avoid installing 53 mm (2") conduit/raceway or larger in-slab. If required coordinate with structural.

.8 Power Factor

.1 Correct power factor to at least 0.95 lagging where normal loading yields a power factor of less than 0.90.

.2 In cases where variable frequency drives (VFD) are not used, provide fixed power factor correction capacitors on load side of starter for motors 22.4 kW and larger.

.9 Motor Protection and Control

.1 Group motor starters in common areas within mechanical or electrical rooms.

.2 Starters to be National Electrical Manufacturers Association (NEMA) rated, Size 1 minimum, complete with hand-off-auto selector switch, minimum of 2 N.O. and 2 N.C. auxiliary contacts and pilot lights.

.3 Do not use fuses for individual motor overcurrent protection.

.4 Provide single phase protection for all three phase motors either by relaying, differential overloads or EMCS shutdown.

.5 Ensure EMCS provides time delay between start-up of each motor over 5 kW on emergency power after transfer to emergency generator, starting largest motor first.
.6 Provide time delay on speed change for two-speed starters.

.7 Provide space on backpan of starter or provide separate enclosure for mounting of EMCS current sensors.

.8 Variable Frequency Drives:

.1 Whether supplied by the electrical or mechanical sub-trade, drives to be of six (6)-pulse, pulse-width modulation (PWM) type. Drives 22.4 kW (30 HP) and larger to be rated for 690V +/- 15%. Provide minimum 5% iron core reactor (line side) or equivalent DC Link Reactor built into all drives. Consider passive filter for 29.8 kW (40 HP) and larger at 100% load. Consider active filter for 74.5 kW (100 HP) and larger drives.

.2 Provide drive rated (symmetrical) cable between drive and motor terminals. To obtain maximum benefit ensure this cable is correctly installed as per manufacturer’s instructions.

.10 Surge Protective Devices

.1 Provide surge protective devices (SPD’s) either integral buss mounted or separate mounted on the distribution equipment. Coordinate suppression with anticipated energy levels and sensitive loads.

.2 Provide surge suppression in the following manners:

**Level 1** Install surge suppression on utility incoming mains.

**Level 2** For areas containing a large group of electrically sensitive loads, provide surge protection on panelboards serving the area.

**Level 3** Provide individual pieces of sensitive equipment, not otherwise protected, with local surge suppression module (computer power bar or wall plug-in style – not part of the construction budget).

.3 Coordinate surge protective devices within the same power distribution system.

.4 Provide, as a minimum, Level 1, SPD’s in all buildings.

.11 Emergency Power

.1 Provide emergency power to mechanical loads as outlined in Section 5.0 - Mechanical.
.2 Provide a minimum of one receptacle in electrical and mechanical rooms connected to emergency power where a generator is installed.

.3 Criteria for generator installation:

.1 Dedicated indoor, climate-controlled, fire-rated room. Locate generator room away from noise-sensitive areas and at grade level (to facilitate access).
.2 Provide engine with circulating type coolant fluid heater to maintain optimum starting temperature.
.3 Exclude unrelated electrical and mechanical equipment from generator room.
.4 Provide vibration isolation for generator control panel or remote mount from generator set skid.
.5 Skin tight, weatherproof enclosures are NOT acceptable. In certain instances, sound attenuated, environmentally controlled, walk-in enclosures may be considered upon review and approval of the Province.
.6 Make provisions for connection to load bank to facilitate annual full load testing. Provide a dedicated breaker for the load bank and single pole cam-type connectors in exterior mounted enclosure.

.4 Generator Sizing:

.1 Size generator for peak demand loads, plus 20% spare for identified expansion, if applicable.

.5 Acoustic Considerations:

.1 Refer to Section 7.0 – Acoustical.
.2 Provide hospital grade exhaust silencers.
.3 Mount generator set on combination steel spring and neoprene vibration isolation.

.6 Transfer Equipment:

.1 Provide automatic transfer switch complete with two-sided by-pass.
.2 Select either three-pole or four-pole application based on ground fault protection strategy and neutral current control.
.3 Select open or closed transition based on project load characteristics and application.
.4 Provide time delay or in-phase monitoring in transfer scheme to prevent motor damage upon transfer to utility power.
.5 Provide time delay of major motor loads emergency power for transfer to emergency generator, starting largest motor first.
.12 Branch Wiring/Devices

.1 General

.1 Use copper conductors, minimum size #12 AWG, RW 90 insulation.
.2 Do not use non-metallic sheathed cable (NMD).
.3 Minimum size conduit/raceway to be 21 mm.
.4 Use AC-90(BX) cable only in short lengths for final connections to luminaires and similar equipment.
.5 Consideration will be given for buildings of combustible construction, where AC-90 will be accepted, in wall spaces. Home runs shall be conduit/raceway and wire.
.6 Provide a single receptacle on separate circuits for coffee makers, refrigerators and microwave ovens.
.7 Install a ground conductor in all branch wiring conduits/raceways.
.8 Maximum Circuits: Nine (9) in home run. Ensure grouping of circuits in home runs are as efficient as possible.
.9 Provide 20% spare capacity in home run conduit/raceways.
.10 Switches and receptacles to be minimum specification/commercial grade.
.11 Minimize the use of floor boxes. Where floor boxes are used, they are to be rated for the environment they are located and ensure covers are mounted flush with finished floor.

.2 Block Heater Outlets

.1 For more than 10 and up to 30 parking stalls:

.1 Provide thermostatic controlled contactors designed to shut off all power to outlets when outside temperature is above -10°C.
.2 Provide timer to cycle energized outlets on and off at a maximum 20 minute period.

.2 More than 30 parking stalls:

.1 Provide thermostatic controlled contactors designed to shut off all power to outlets when outside temperature is above -10°C.
.2 Split the load into two groups. Alternately cycle each group on and off with a maximum 20 minute period.

.3 Use the building’s EMCS system to control parking lot loads where possible. Coordinate with Mechanical Section.
.3 Provisions for Mechanical

.1 Provide heat tracing for piping or connect immersion heater in accordance with Section 5.0 - Mechanical.
.2 Coordinate with the control system designer for interface with electrical systems such as lighting and fire alarm.
.3 Coordinate UPS requirements for head end of EMCS in consultation with Mechanical Consultant.
.4 Where there is a three phase service, ensure motors larger than 0.37 kW are three phase, and motors 0.37 kW and smaller are single phase, 120V.
.5 Review connection requirements for electric motor starters, drives and controllers provided packaged with mechanical equipment.
.6 Coordinate fire suppression, smoke control and smoke extraction strategies.

.13 Offices and Workstations

.1 For projects containing electronic office space or electronic equipment such as computers, microprocessors and electronic communications equipment, review the requirements for supplemental electrical protection of electronic equipment with the Province.

.2 Determine the extent and severity of electrical service disturbances including voltage sags, surges, short term and long term transients and outages. Consult with the Utility in order to determine the likely incidence of these disturbances.

.3 Identify electronic equipment and systems likely to be affected by disturbances and the extent of protection necessary for normal operation.

.4 Individual computer work station areas to be supplied with a minimum of two shared circuits.

.5 Indicate dedicated neutral circuits via separate symbol on drawings.

.14 Lightning Protection

.1 Provide lightning arrestors on all primary medium voltage services.
.2 Review requirements for need of a lightning protection system by completing a risk assessment as described in CAN/CSA-B72-M, "Installation Code for Lightning Protection Systems". Based on Table A12.1 “Assessment of Risk” of the CAN/CSA-B72, install Lightning Protection for:
   .1 Hospitals (Regional, Multi-Storey), Museums, Historical Buildings: Assessed over 3.5.
   .2 Court Houses, Multi-Storey Building, Institutional: Assessed over 4.5.
   .3 Province of Alberta Facilities (Owned Infrastructure): Assessed over 5.5.

.3 If lightning protection is required, provide details including plan drawings showing all rods, conductors, down drops and connection points.

.4 Ensure lightning protection is installed by an installation firm with a minimum of five years of experience in lightning protection installation. Upon completion, installers shall provide certification that the system is complete and complies with all applicable standards.

.15 Envelope Penetrations
   .1 Ensure adequate treatment for all envelope penetrations such as generator exhaust piping, lightning down conductors and service masts. Refer to Section 2.0 - Building Envelope for specific requirements.

A. Specific Requirements for Schools
   .1 Generally, emergency generators are not provided in school facilities, however, where freeze protection or other essential motor loads are present or where the facility is also used as a disaster recovery centre, an emergency generator may be required.

   .1 Where an emergency generator is provided, it shall comply with Section 6.2.11 of this document.

   .2 Where schools are located in rural areas, provide Levels 1 and 2 of SPD per Section 6.2.10 of this document.

   .3 Receptacles – do not use any circuits in more than one classroom.

   .4 Switch and receptacle cover plates shall be stainless steel type 302/304, #4 finish, and stainless steel screws.
.5 Gymnasium electrical components shall be protected by recessing in custom housing in wall or wire guard. All clocks, emergency luminaires, exit lights, and any other surface mounted equipment shall be protected by wire guard. All receptacles, switches, fire alarm manual stations, microphone outlets, T.V. outlets and other flush devices shall be recessed into wall. Wall mounted speakers shall have integral speaker protection. Ensure a minimum of three circuits for gymnasium receptacles.

.6 Where emergency shutoff switches are located in rooms to de-energize a panelboard via contactor, the switches are to be complete with a keyed reset.

**B. Specific Requirements for Healthcare Facilities**

.1 Consult with the local Utility to provide the highest level of service reliability and discuss results with AHS and the Province of Alberta Project Manager.

.2 Develop an “Electrical Safety and Essential Electrical Systems” plan based on the CSA-Z32 standard of the same name. Incorporate this plan into the Design Development Report for the facility, and submit to the Province for review at the Design Development stage of the project. The plan shall demonstrate all aspects of the CSA-Z32 standard as follows:

.1 Z32 Risk Classification of all patient care areas.
.2 Details of branch circuitry and grounding.
.3 Design of the Essential Electrical Systems including calculations for generator sizes, fuel storage requirements and justification for redundancy.

.3 Make provisions for fan cooling on main service transformers in excess of 750 kVA. Size transformers for calculated capacity without the use of fan-cooling. Make use of fan-cooled rating of transformer in the design of system redundancy. Liquid-filled transformers may be used for high voltage applications and vault installation with the following provisions:

.1 Use 55°C - 65°C insulation and equip with cooling fan.
.2 Equip with sudden pressure relays.

.4 Do not use Isolated Power Supply in new construction. Refer to CSA-Z32.2 for grounding requirements.

.5 Refer to CSA Z32.2 for essential loads requiring emergency power.
.6 Harmonic Distortion and Variable Frequency Drives:

.1 Identify non-linear loads as identified in item 6.2.1.4.1 and additional equipment in health care facilities such as MRI’s, CT Scanners and X-ray equipment.

.2 Ensure that a harmonic digital simulation is completed to demonstrate that the limits set out in IEEE Standard 519-2014 “Recommended Practice and Requirements for Harmonic Control on Electric Power Systems” are met. Simulation to be from Main Switchboard to Distribution Panels feeding the major/large non-linear loads.

.7 Uninterruptible Power System:

.1 Minimize battery requirements for UPS by feeding unit from emergency power system. Size UPS batteries for maximum 20 minute outage, except in special cases.

.2 Provide local UPS to serve individual loads, or a centralized UPS system for groups of loads. As a minimum provide centralized UPS for IT equipment, Nurse Call and Security (ie. Equipment located in Telecommunication Rooms)

.3 Where larger centralized UPS is used, provide redundancy and a sectionalized load-side distribution system. The UPS shall have hot swappable components.

.8 Batteries for Standby Applications:

.1 Make standby battery provisions for:

.1 Fire alarm system.

.2 Communication systems.

.3 Switchgear station power supply, if applicable.

.4 Engine-generator start-up.

.5 Systems or equipment which require uninterrupted service.

.6 Emergency lights and exit signs (where generator is not provided).

.7 Operating room surgical lights (Review with the Province).

.8 Gas shut off solenoid valves.

.2 Maintain battery operating ambient temperature as per manufacturers recommendations.

.3 Select battery chargers to match battery type.
.9  Wiring Devices:

.1  Use hospital grade receptacles for patient care receptacles and specification grade convenience receptacles.
.2  Identify all receptacles as to panel and circuit number on plastic engraved laminoid tag, permanently affixed to wall directly above device cover plate; tag to be same width as cover plate.

6.3 Lighting

.1 General

.1  This section describes general requirements for lighting. Identify any specialized lighting requirements at the design development stage. The design should also consider maintainability of the lighting and control system, and be cautious with features available in industry. For reliability, consider mean time between failure and mean time to repair over many years. Consider whether additional or replacement devices will be available for the system during this time. Lighting should be reliable, cost-effective, and simple to maintain. Where possible avoid the use of excess technology that could impact reliability and maintenance. With technology and products changing quickly, availability of replacement components is a concern.

.2  Design to be based on current applicable IES recommendations and standards including addenda.

.3  Use the task-ambient approach where work surface and task orientations are predetermined and as agreed to by the Province.

.4  Designs to be generally based on average maintained illuminance targets and luminance values/ratios/gradients as described in the applicable IES recommendations and standards. Designs shall be supported by reference to the appropriate IES recommendations and standards.

.5  Design a luminous environment minimizing glare (luminance values/ratios/gradients) for visual comfort. Carefully review glare implications and select luminaires cognizant of intensities at user viewing angles.

.6  For maintenance purposes, provide a table in the operations and maintenance manual listing designed average maintained illuminance values for each type of lit space.
.7 Design files shall include the following information which may be requested by the Province for review:

.1 Photometric plot showing illumination values on an appropriate grid scale to demonstrate compliance with IES recommended best practices.
.2 Tabular format of information summarizing the values provided and a description of design assumptions and recommendations.

.2 Lighting Design Parameters

.1 Use the following criteria to select minimum average maintained values within spaces:

.1 Visual Task: Medium contrast or small size
.2 Occupants Ages: 25 to 65 years
.3 Task Duration: Prolonged periods
.4 Reflectances: Coordinate with actual finishes

.2 Maintained Values: Use the following criteria for calculation of maintained values:

.1 Light loss factor: 0.90
.2 Determine the Interior and Exterior Lighting Power Densities and show compliance with current allowances as indicated in the National Energy Code.

.3 Uniformity

.1 All areas in a space need not be to minimum average maintained values if functions permit. Lighting levels may be non-uniform. For example, circulation areas in an office may be of a lower level than recommended for the work surface.

.4 Interior Landscape Lighting

.1 Where interior lighting is required to sustain plant growth, coordinate with the landscape consultant to provide the appropriate illumination levels, light spectra, and control.

.5 Lighting Sources

.1 Only use sources which are readily available from local distributor’s stock.
.2 Fluorescent type lighting is acceptable provided items in Fluorescent Lamps and Ballasts section below are met.

.3 Light-Emitting Diode (LED) type lighting is acceptable provided items in LED’s and Drivers section below are met.

.4 For acoustical and electromagnetic interference considerations, refer to Section 7.0 - Acoustical.

.5 Do not use incandescent sources.

.6 Diffusers

.1 Use framed diffusers in recessed luminaires wider than 305 mm.

.2 Use polycarbonate diffusers for exterior luminaires.

.3 High efficiency, low brightness diffusers are preferred in areas containing electronic work stations.

.7 Fluorescent Lamps and Ballasts

.1 Colour Rendering Index (CRI) to be minimum 85. Generally Correlated Colour Temperature (CCT) to be 3500K. Minimum lamp life of 36,000 hours. (Rated Average Life – 12 hour start). Do not use U shaped lamps.

.2 Use programmed start electronic ballasts with ballast factor less than 1.0, less than 10% Total Harmonic Distortion and Power factor not less than 0.95.

.3 Ballasts for exterior applications shall be suitable for operation to –40°C.

.8 LED’s and Drivers

.1 LED lighting shall be selected from production-proven models available at the time of construction and not prototypical or unproven technology.

.2 LED luminaires shall have photometric data produced by an independent testing agency and tested in accordance with IES LM-79 Electrical and Photometric Measurements of Solid-State Lighting Products.
.3 LED luminaires shall have test results produced by an independent testing agency and tested in accordance with IES LM-80 Measuring Lumen Maintenance of LED Light Sources.

.4 Dimming should only be provided where necessary. Review flicker implications throughout lighting levels for each driver type especially at lower levels. Flicker to be minimized. To help reduce flicker, consider Constant Current Reduction (CCR) instead of Pulse Width Modulation (PWM).

.5 Drivers for exterior applications shall be suitable for operation to –40°C.

.6 For interior general LED lighting, include as a minimum, the following additional items:

.1 Lumen maintenance as per IES TM-21-11 “Projecting Long Term Lumen Maintenance of LED Light Sources” to be minimum of 30,000 hours at L90, 60,000 hours at L80, or 90,000 hours at L70 for integrated LED luminaires, and 60,000 hours at L70 for non-integrated (LED ready) luminaires.

.2 Color Rendering Index (CRI) to be minimum 80. Ideally a CRI of 85 (site measured) or higher should be attainable. Generally Correlated Color Temperature (CCT) to be 3500K.

.3 Luminous efficacy of the source to be a minimum of 85 lumens per watt (delivered fixture lumens).

.4 Where direct type lighting is used, generally use luminaires with larger full area lenses/diffusors/cells to reduce direct glare.

.5 Avoid the use of small aperture luminaires unless luminance ratios can meet IES recommendations and standards.

.6 Obtain acceptance of the Province for the use of tuneable-white systems, which shall be for specific situations only.

.9 Interior Lighting Control

.1 Lighting control to be a dedicated wired system. Do not use breaker switching.

.2 Provide the simplest system to meet the needs of the facility and requirements by code. For example: Automatic Daylight responsive controls to be provided only if required by code. Use low voltage switching for all multiple circuits that require master control. Do not locate relays in ceiling space. Relays to be located in an enclosed panel in an electrical room/closet next to branch circuit panel.

.3 Provide switching for conference rooms, board rooms, groups of common offices and large areas common to a single user.
.4 Provide time clock or programmed switching for large general use areas.

.5 Provide motion sensor control for night lighting, exterior man doors and low use areas where economics are favourable.

.6 Minimize night lighting (unswitched lights) to main entrance, service entrances and key areas where interior lighting control switches are located.

.7 Line voltage control components are acceptable for locations with simple switching requirements. If a low voltage control system is to be provided, conventional type low voltage control systems with non-addressable field devices appear to be proven for maintainability for a building to last for many years.

.10 Emergency and Exit Lighting

.1 Where emergency power is not available, provide battery powered emergency lighting unit equipment.

.2 Unit equipment and circuiting to follow CEC 46-300.

.3 Provide battery powered unit equipment type lighting with a minimum one hour capacity in all electrical, generator and mechanical rooms.

.4 Integral battery power back-up ballasts/drivers in Luminaires are not acceptable.

.5 Exit signs to be LED type

.11 Exterior Lighting

.1 Generally, use LED type lighting. Use fully shielded (zero uplight component) luminaires with a CCT of 3000K or less for building exterior, parking, roadway and area lighting. Where possible select lower drive current to increase LED life and reduce glare. Ensure luminance levels are controlled to help reduce glare for those viewing towards luminaires. The use of warmer color temperatures (eg. 2700K) is encouraged. Where color rendering is of less importance consider amber or narrowband amber LEDs.

.2 Control of exterior luminaires shall be designed, as a minimum, with photosensor “on/off” control. Consider supplementing this control with the use of motion sensors or programmed time control.
Where integrated, include programming of the EMCS for remote control of the exterior lighting.

A. Specific Requirements for Schools

.1 Design to the latest IES standards, including ANSI/IES RP-3 – Standard Practice on Lighting for Educational Facilities.

.2 Design lighting control to have the flexibility required to adjust lighting to suit functions and activities.

.3 Lighting control to be conveniently and appropriately located for each area and allow for control of lighting in their environment.

.4 Provide individual manual on/off switches for lighting in the classrooms and like rooms to control the room lighting, independent of other lighting control systems in the school. Ensure on/off manual switches have the capability to turn lights off and remain off. In rooms where audio/visual presentations are likely, provide at least 2 zone lighting.

.5 Ensure all lighting in communal and administration areas are capable of being operated from a central location.

B. Specific Requirements for Healthcare Facilities

.1 Design to the latest IES standards, specifically refer to ANSI/IES RP-29 – Lighting for Hospitals and Healthcare Facilities

.2 Lighting Controls:

.1 Provide patients or residents with control of the lighting environment in their rooms.

.2 Provide patient corridors with distinct levels to accommodate day, evening, and late night activities.

.3 Provide adjustable lighting control at Nurses’ Station to suit time of day and activities. Design low ambient lighting level with task lighting for night shift.
6.4 Communication

.1 Service Entry

.1 Where applicable, shall be installed below grade in conduit/raceway. Provide additional protection as required.

.2 Structured Cabling – Voice and Data

.1 Review with the Province and Client Groups, requirements of voice (Voice over Internet Protocol (VoIP) or analog) and data communication.

.2 Provide telephone system cables and outlets as part of the building construction contract to meet the needs of the facility.

.3 Design system to meet the referenced TIA standards. Refer to Section 6.1.2 of this document and ensure the installation meets these standards and as follows.

Unless otherwise noted, the following provides an overview of requirements for supply and installation of the cabling system by the Telecommunication Contractor. It will give a general review of the design concepts which is to be read together with the TIA referenced standards.

.1 Provide a complete structured cabling system that is based on a physical star wiring topology.

.2 System is to include details for the supply, installation and termination of all riser (vertical) cabling, horizontal cable from workstation to telecommunications room, racks, power bars, workstation outlets, jacks, Velcro tie-wraps, labelling and testing of all cables and associated items.

.3 Provide a complete wireless network (WiFi) throughout, with no dead spots, which supports any standard network applications.

.4 Utilize standard cross-connect wire, 483 mm, 4 post communication rack(s), power bars, vertical and horizontal cable managers, patch panels and wall mounted connector with Insulation Displacement Connection (IDC) punchdown clips.

.5 Office workstations shall consist of two data cable outlets housed in one wall mounted or systems furniture mounted single gang interface.

.6 All horizontal cable shall be Unshielded Twisted Pair (UTP), Category 6, 4 pair. Modular jack pin pair assignment shall be to T568A requirements.

.7 Backbone cabling for data shall be a combination of UTP Category 6, 4 pair, 6-strand 50 μm core diameter/125 μm cladding diameter multimode fiber and 6-strand single mode fiber.

.8 Backbone cabling for voice shall be multi-pair Category 3 with a grey jacket terminated on IDC distribution connectors.
.9 Labelling and identification of the cables shall conform to facility requirements.

.10 A ground bus shall be provided in each communication room wall mounted with stand-off supports.

.11 For analog voice system, provide applicable identification at ports.

.12 The structured cabling installation shall be performed by a Telecommunications Contractor whose normal business is the installation of voice, data and image cabling systems, and to perform associated testing.

.13 Provide a separate raceway system, separated from power and other low voltage systems.

.14 Provide permanent link type testing as per TIA standards.

.3 Paging and Public Address Systems

.1 Review with the Province and Client Group the requirements of a Paging and Public Address System and the extent of the system area coverage.

.2 Where a Paging and Public Address System is determined to be required it shall consist of microphones, mixer preamplifier, dynamic range limiters, solid state audio power amplifiers, telephone paging interface, loudspeakers, system rack, wiring, remote jacks and controls. In addition, the system will generally conform to the following:

.1 Provisions for multi-point microphone input facilities and provisions for background music.

.2 Provisions to integrate with the facility communications system.

.3 Install all system wiring in conduit/raceway and cable tray.

.4 The paging system shall be supplied and installed by a firm that has provided and installed paging system components for a minimum of five years.

.5 Ensure speech intelligibility reproduced by the installed system, including room reverberance and expected background noise, is part of the design process. Reference IEC 60268, Part 16, Objective Rating of Speech Intelligibility by Speech Transmission Index.

.4 Sound Masking System

.1 Review with the Province and Client Group the requirements of a Sound Masking System and the extent of the system area coverage. Refer to Section 7 – Acoustics, for details of the system.

.2 Coordinate power, raceway and low voltage interface requirement.
.5 Assistive Listening Devices

.1 Provide assistive listening system when required by the Alberta Building Code.

.2 Coordinate with the Province and Client Group the extent of the system.

.6 Clock System

.1 Review with the Province and Client Group the requirements of a Clock System and the extent of the system area coverage. Where a Clock System is required, it shall generally conform to the following:

.1 Synchronized clock system consisting of all necessary equipment, accessories, software, training and support necessary for a complete and reliable operating system.

.2 The clock system shall be either wired, wireless, or a combination wired and wireless system.

.7 Cable Television (CATV) / Radio Frequency Television (RFTV)

.1 Review with the Province and Client Group the requirements of a CATV/RFTV System.

.2 Provide design for RFTV distribution system via coaxial cables for signal strength 6 dBmV to 14 dBmV at each outlet.

.3 Connect CATV service to RFTV distribution system. If CATV is not available at present, ensure that it can be connected when service is available.

A. Specific Requirements for Schools

.1 Public Address

.1 Provide public address to meet the needs of the facility.

.2 Coordinate exterior audible notification devices with the needs of the facility (Class start, recess end, etc.).

.2 Telephone System

.1 The telephone system may be purchased through the construction contract or separately by the School Board.

.2 A small digital PABX system may be used to provide both telephone and intercom services.
.3 Intercom

.1 Provide building intercom requirements through telephone system with the exception of:

   .1 Point-to-point staff entry door intercom
   .2 Separately identified functions

.2 Provide speakers and handsets in all applicable locations.
.3 Provide zoning to suit facility function, i.e., separate zones in wings of school.

.4 Gym Sound Reinforcement

.1 Provide a fixed sound system that is suitable for highly intelligible speech reinforcement and music.
.2 Select loudspeaker directivity and mounting locations to provide uniform sound coverage of the floor area and minimize any spill over to wall surfaces.
.3 For systems that will be used for frequent drama and musical productions, provide 25 mm conduit/raceway from the audio equipment location on stage to a location near the center of the back wall of the gymnasium. Provide recessed junction boxes at both ends. This is to provide a future tie-in for a portable mixer.

.5 Sound Field Systems

.1 Review with the Province and Client Group the requirements of Sound Field Systems. Provide rough-in for system where locations are agreed upon.

.6 Multimedia Systems

.1 Do not specify Media Retrieval Systems.

B. Specific Requirements for Healthcare Facilities

.1 Structured Cabling – Voice and Data

   .1 Referenced standards – refer to Section 6.1.2 of this document and ANSI/TIA 1179, Healthcare Facility Telecommunications Infrastructure Standard.
   .2 Reference AHS Standard – Structured Cabling Requirements Version 2.3 (2016) – This standard is for the design team and is not to be attached into the contract documents.
.3 Design and installation to meet referenced standards. Exceptions may be required based on client group requirements.

.4 Prior to design, a business case will have been developed by AHS. Coordinate design details from the functional program, client group meetings and room data sheets.

.5 Definitions:

.1 End to End Structured Cabling Solution - Same manufacturer/vendor from wall jack and cover plate, cable, cable jack at patch panel, and patch panel.

.2 VoIP - Voice over Internet Protocol.

.6 Cable System Consistency - Only one manufacturer/vendor may provide an end-to-end structured cabling solution (UTP and fibre) for each project. However, for existing sites, once precedence for a manufacturer/vendor has been set for an existing to remain patch panel with cables remaining, that manufacturer/vendor shall be used for the end-to-end structured cabling solution for that patch panel.

.7 Horizontal Copper Cable

.1 Type - As recommended by ANSI/TIA-1179

.2 New Installations (New Patch Panels) - Category 6A unshielded twisted pair (UTP) as defined in ANSI/TIA-586-X.2, 500MHz minimum channel bandwidth

.3 Existing installations - Minimum Category 6 unshielded twisted pair (UTP) as defined in ANSI/TIA-586-X.2, 300MHz minimum channel bandwidth

.2 Nurse Call System:

.1 Design system to functional requirements of facility.

.2 Develop a communications program for the facility to facilitate the operation of, and the response to, the nurse call system.

.3 Provide the simplest system that can satisfy the requirements.

.4 System Features:

.1 Provide wiring in conduit/raceway or in accessible barriered tray section to facilitate system upgrades or modifications.

.2 Provide wandering patient monitoring system in facilities with mentally impaired patients.

.3 Identify all wiring clearly and provide wiring diagram in each cabinet.

.4 Provide power supply to nurse call system from emergency source with battery backup for programmed memory retention.
.3 Multimedia Systems:

.1 Review requirements with client.

.4 Intercom Systems:

.1 Provide building intercom through telephone system with the exception of:

.1 Point-to-point staff entry door intercom
.2 Hands free intercom in operating rooms
.3 Separately identified functions

6.5 Electronic Safety and Security Systems

.1 General

.1 Provide electronic security systems only as required to enhance physical and dynamic security. Primary security is by physical security provisions in the building design and the dynamic security brought about through staff procedures and circulation.

.2 Review security risks with administration and determine needs for each individual project which could include duress alarm, video surveillance, intrusion detection, access control, and various other electronic systems.

.3 Size and level of integration between systems shall be appropriately designed for the facility.

.4 Provide back-up power for all life safety and security systems.

.5 Provide battery back-up for all systems with volatile electronic memory.

.6 Review the use of UPS systems with the Province.

.7 For Government of Alberta Facilities refer to latest version of “Physical Security Guidelines & Standards for Government of Alberta Facilities, Version 2.0”. This document is for the design team and not to be attached into the contract documents. ([https://www.alberta.ca/assets/documents/tr/tr-securityguidelinesstandards.pdf](https://www.alberta.ca/assets/documents/tr/tr-securityguidelinesstandards.pdf))

.8 Do not use electro-magnetic locks unless no other hardware method is available.
.2 Fire Detection and Alarm

.1 Design the most effective fire alarm system to meet the facility’s requirements. Fire alarm system to be a dedicated physically isolated system that operates independently.

.2 System to be designed and tested as per the regulations under the current Safety Codes Act.

.3 Where addressable technology is used for initiating devices use Data Communication Link (DCL) style C as per CAN/ULC-S524. Where fault isolation modules are used, they shall be clearly shown where they are located on the floor plans and clearly described where they are located within a DCL in the verification report.

.4 Avoid the use of optical beam smoke detection where air aspiration type can be used.

.5 Provide static graphic mounted in frame securely fastened to the wall adjacent to annunciator at firefighters entrance. Graphic to clearly show all fire zones, sprinkler valve locations, “You Are Here” indication, and a north arrow.

.6 Fire Alarm System zones to be shown on the fire alarm floor plans and graphic.

.7 Show all devices on floor plans which includes relays, monitoring modules, booster panels, and fault isolation modules, etc. Isolation modules shall only be applied at locations where required. Location of connections to other equipment such as fire dampers, air-handling units, smoke doors, sprinkler pumps, elevators, etc. shall be shown.

.8 Show the wiring routing path between each device for all devices.

.9 All devices shall be labelled on the external fixed portion of the device with applicable loop/address number or circuit number. Refer to Appendix A for identification requirements.

.10 Coordinate smoke duct detectors/sample tubes, quantity and location, with mechanical consultant to ensure air velocities and pressure differentials are compatible.

.11 Program by-pass switches at central panel as coordinated with requirements of user (eg; Smudging).
.12 Provide detailed Sequence of Operation for the Fire Alarm System and related ancillary systems, such as elevators, smoke control, prevention of smoke circulation, release of door hold-open devices, and others.

.13 Coordinate fan shutdown and smoke control system design by Mechanical. For a basic system, both to be controlled by the Fire Alarm system. For complex systems, a dedicated control system may be provided by Mechanical. Coordinate with applicable disciplines.

.14 Clearly indicate in the contract documents which edition of CAN/ULC S524 and CAN/ULC S537 is referenced for Alberta. Refer to Building Code for edition reference (ie. for a project utilizing National Building Code 2019 Alberta Edition, see section 1.3.1.2). Confusion can be remedied for the parties involved if they have the correct standard with them during construction and provide fair preparation for what the expectations will be during verification.

.15 Provide a completed fire alarm verification report reviewed by the electrical engineer of record that includes documentation showing:

.1 Daily attendance record,
.2 Sequence of operations,
.3 Record drawing showing all devices with addresses, loop numbers and wiring routing,
.4 All requirements of CAN-ULC S537,
.5 Other requirements as per the Safety Codes Act.

.16 Provide wiring diagram and sequence of operation on inside of fire alarm panel door or in a separate enclosure next to the panel. Clearly identify wiring at all panels and junction boxes identifying zone/loop numbers/etc.

A. Specific Requirements for Schools

.1 Provide as a minimum, an empty conduit/raceway system for the following electrical systems:

.1 Electronic Access Control System
.2 Video Surveillance System.

.2 Review with the Province Project Management the local school board’s additional requirements.

.3 Determine security needs in accordance with the School Threat and Risk Assessment and in consultation with the School Board.
.4 Provide perimeter intrusion detection system to detect unauthorized entry. Perimeter door monitor system with internal motion sensors is adequate in most applications. Coordinate with School Board.

.5 Coordinate the location of electronic access control doors and door alarms in consultation with the School Board.

.6 Review emergency procedure documentation the school principal will be issued by the school board to ensure empty conduit/raceway for systems/devices for all emergency scenarios will be provided for.

### B Specific Requirements for Healthcare Facilities

.1 Provide complete Intrusion, Electronic Access Control and Video Surveillance Systems in accordance with AHS Provincial Protection Service Security Design Guidelines and Technical Specifications. The referenced document is for the design team and is not to be attached into the contract documents.

.2 For 24 hour facilities without a 24 hour staffed command station: Provide annunciation at each nursing station with summary information for entire facility as well as the required patient room information.

**End of Electrical Section**
Electrical - Appendix A

.1 Reference Standards
   .1 Federal Standard 595C Colours.

.2 Identification Materials
   .1 Lamicoid Nameplates: 3 mm thick plastic engraving sheet, black face, white core, mechanically attached, sizes as follows:
      .1 Size 1: 12 mm high with 5 mm high letters.
      .2 Size 2: 20 mm high with 8 mm high letters.
      .3 Size 3: 25 mm high with 12 mm high letters.

   .2 Wire Identification Materials: Use one of the following:
      .1 Heat shrink sleeves, blank.
      .2 Clear plastic tape wrap-on strips with white writing section.
      .3 Wrap-on strips, pre-numbered.
      .4 Slip-on identification bead markers or sleeves, blank or pre-numbered.

.3 Colour Identification of Equipment
   .1 Electrical equipment shall be prefinished in coded colours designating voltage or system, as indicated.

   .2 All switchgear, distribution centre, panel boards, motor control centre, motor starter cabinets, motor control cabinets, disconnect switches, contractor cabinets, relay cabinets, transformers, termination cabinets, splitter boxes, busduct, cable duct, etc., are to be colour coded as follows:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Colour (See Section 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1 High Voltage (in excess of 750 V):</td>
<td>Brown</td>
</tr>
<tr>
<td>.2 347/600 V:</td>
<td>Sand</td>
</tr>
<tr>
<td>.3 277/480V:</td>
<td>Bronze</td>
</tr>
<tr>
<td>.4 120/208 V:</td>
<td>Grey</td>
</tr>
<tr>
<td>.5 Emergency Power:</td>
<td>Associated Voltage Colour</td>
</tr>
<tr>
<td>.6 Fire Alarm &amp; Firephone:</td>
<td>Red</td>
</tr>
<tr>
<td>System</td>
<td>Colour</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>.7 Security/Intrusion/Surveillance:</td>
<td>Green</td>
</tr>
<tr>
<td>.8 Low Voltage Switching:</td>
<td>Black</td>
</tr>
<tr>
<td>.9 Annunciator Cabinets:</td>
<td>Black</td>
</tr>
<tr>
<td>.10 Data/Telephone Cabinets:</td>
<td>Blue</td>
</tr>
<tr>
<td>.11 Telephone Backboards:</td>
<td>Grey</td>
</tr>
<tr>
<td>.12 Television:</td>
<td>White</td>
</tr>
<tr>
<td>.13 Public Address/Intercom:</td>
<td>Purple</td>
</tr>
</tbody>
</table>

Note: For transformers, colour to be based on highest voltage.

.3 All pull boxes, junction boxes, covers, and conduit/raceway banding shall be finished in the following colours:

<table>
<thead>
<tr>
<th>System</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1 347/600 V:</td>
<td>Sand</td>
</tr>
<tr>
<td>.2 347/600 V Emergency:</td>
<td>Sand (covers marked “EM”)</td>
</tr>
<tr>
<td>.3 277/480V:</td>
<td>Bronze</td>
</tr>
<tr>
<td>.4 277/480 V Emergency:</td>
<td>Bronze (covers marked “EM”)</td>
</tr>
<tr>
<td>.5 120/208 V:</td>
<td>Grey</td>
</tr>
<tr>
<td>.6 120/208 V Emergency:</td>
<td>Grey (covers marked “EM”)</td>
</tr>
<tr>
<td>.7 In Excess of 750 V:</td>
<td>Brown</td>
</tr>
<tr>
<td>.8 In Excess of 750 V – Emergency:</td>
<td>Brown (covers marked “EM”)</td>
</tr>
<tr>
<td>.9 Fire Alarm &amp; Firephone:</td>
<td>Red</td>
</tr>
<tr>
<td>.10 Security/Intrusion/Surveillance:</td>
<td>Green</td>
</tr>
<tr>
<td>.11 Data/Telephone (VoIP):</td>
<td>Blue</td>
</tr>
<tr>
<td>.12 Public Address/Intercom:</td>
<td>Purple</td>
</tr>
<tr>
<td>.13 Sound Masking:</td>
<td>Orange</td>
</tr>
<tr>
<td>.14 Nurse Call:</td>
<td>Yellow</td>
</tr>
<tr>
<td>.15 Television:</td>
<td>White</td>
</tr>
<tr>
<td>.16 Low Voltage Switching:</td>
<td>Black</td>
</tr>
<tr>
<td>.17 Low Voltage Switching – Emergency:</td>
<td>Black (covers marked “EM”)</td>
</tr>
</tbody>
</table>
Note: All cover markings are to be in “Black” lettering with the exception of Low Voltage Switching that is to be marked with “White” lettering.

.4 Nameplate Identification of Equipment
   .1 Identify equipment with lamicoid nameplates, as indicated in Equipment Identification Schedule.

.5 Panelboard Directories
   .1 Identify loads controlled by each overcurrent protective device in each panelboard, by means of a typewritten panelboard directory.

.6 Communications Cable and Equipment Labeling
   .1 Label communication outlets, panels and ports with lamicoid nameplates as specified in Equipment Identification Schedule.

   .2 Label each of cables with other ends address using Wire Identification Materials.

   .3 Label outlets with labels vertically aligned in each row.

   .4 Position panel labels in the same position on each panel.

.7 Intermittent Colour Coding of Conduit/raceway and Cable
   .1 Apply colour banding (tape or paint) in required colours for each voltage or system in 25 mm wide bands all around conduit/raceway or cable as follows:

   .1 At least once in each 3 m (10 ft) of conduit/raceway or cable run.
   .2 Where conduit/raceway or cable enters inaccessible ceiling, wall and floor spaces.
   .3 At least once in each room or area through which a conduit/raceway or cable passes.

.8 Identification of Pull and Junction Boxes
   .1 Identify pull and junction boxes over 100 mm size as follows:

   .1 In ceiling spaces and in service areas, provide exterior colored boxes in coded colours designating voltage or system.
   .2 Apply size 2 lamicoid nameplate to cover of each box. Identify system name. Where sequence identification is required, identify system name and number.
Identify pull and junction boxes 100 mm or less in size as follows:

1. In ceiling spaces and in service areas, provide exterior colored boxes in coded colours designating voltage or system.
2. Apply permanent identifying markings directly to box covers designating voltage or system using indelible black ink.

.9 Colour Identification of Wiring

1. Identify No. 6 AWG wiring and smaller by continuous insulation colour.
2. Identify wiring larger than No. 6 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices.
3. Colour coding shall be in accordance with Canadian Electrical Code.
4. Where multi-conductor cables are used, use same colour coding system for identification of wiring throughout each system.
5. Maintain phase sequence and colour coding throughout each system.

.10 Name/Number Identification of Wiring

1. Identify No. 8 AWG wiring and smaller using one of the wire identification materials specified in 2.2.
2. Type or print on blank wire identification materials using indelible black ink.
3. Identify wiring at all pull boxes, junction boxes, and outlet boxes for all systems.
4. Identify each conductor as to panel and circuit, terminal, terminal numbers, system number scheme, and polarization, as applicable.

.11 Identification of Receptacles

1. For standard duplex receptacles in healthcare or severe areas: provide lamicoid nametag with 6 mm high white lettering on black background (red background for emergency receptacles) indicating circuit and panel designation and locate on wall above receptacle. On all other receptacles provide lamicoid nametag indicating voltage, phase, amps, circuit and panel designations. For all other facilities adhesive thermal plastic labels mounted on cover plate is acceptable.
### .12 Equipment Identification Schedule

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Colour</th>
<th>Nameplate Identification</th>
<th>Lamicoid Nameplate Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Distribution Centre</td>
<td>Voltage Colour</td>
<td>Building name, consulting engineer, date installed, amperage, voltage</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main breaker</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metering cabinet</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Instrument transformer enclosure</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loads controlled by each overcurrent protective device</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metering devices</td>
<td>1</td>
</tr>
<tr>
<td>Distribution Centres</td>
<td>Voltage Colour</td>
<td>Distribution centre designation, amperage, and voltage</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loads controlled by each overcurrent protective device</td>
<td>1</td>
</tr>
<tr>
<td>Panelboards</td>
<td>Voltage Colour</td>
<td>Panelboard designation</td>
<td>2</td>
</tr>
<tr>
<td>Motor Control Centres</td>
<td>Voltage Colour</td>
<td>M.C.C. designation, amperage and voltage</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motors or loads controlled by each unit and mnemonics</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relay terminal and transformer compartments</td>
<td>1</td>
</tr>
<tr>
<td>Manual Motor Starters</td>
<td>N/A</td>
<td>Load controlled and mnemonics</td>
<td>1</td>
</tr>
<tr>
<td>Ground Bus</td>
<td>N/A</td>
<td>System Ground</td>
<td>1</td>
</tr>
<tr>
<td>On/Off Switches</td>
<td>N/A</td>
<td>Load controlled</td>
<td>1</td>
</tr>
<tr>
<td>Disconnect Switches, Magnetic Motor Starters and</td>
<td>Voltage Colour</td>
<td>Voltage and equipment controlled mnemonics</td>
<td>2</td>
</tr>
<tr>
<td>Contactors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transformers</td>
<td>Voltage Colour</td>
<td>Transformer designation, capacity, secondary and primary voltages</td>
<td>2</td>
</tr>
</tbody>
</table>
### Electrical Colours

<table>
<thead>
<tr>
<th>Electrical Colours</th>
<th>Federal Standard 595C Colour Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>15052</td>
</tr>
<tr>
<td>Green</td>
<td>14449</td>
</tr>
<tr>
<td>Brown</td>
<td>10115</td>
</tr>
<tr>
<td>Sand</td>
<td>13613</td>
</tr>
<tr>
<td>Grey</td>
<td>16307 or ANSI(ASA)61 Grey</td>
</tr>
<tr>
<td>Black</td>
<td>17038</td>
</tr>
<tr>
<td>Bronze</td>
<td>13275</td>
</tr>
<tr>
<td>Purple</td>
<td>17100</td>
</tr>
</tbody>
</table>
Orange | 12473
Yellow | 13655
Red | 11350

Note: The intention of these colour numbers is to get colours as close as possible to the number listed and to be consistent throughout the building. With regard to Fire Alarm panels and devices, manufacturers’ “Red” is acceptable, with junction box covers and conduit/raceway banding close to number stated above.

.14 Communications Cabling tagging and Naming Conventions

Use the following identification standard when labeling communications cabling components. Include required cabling designations on the drawings.

IDF Rooms Number: XYZ, where:

- “XY” is floor number represented by two digits.
- “Z” is a sequential letter (A, B, etc.) designating which room. Riser and equipment rooms are considered equivalent.

Outlet Assembly: 000-X where:

- “000” is a three-digit address.
- “X” is one of following outlet types:
  - “A” for telephone outlet.
  - “B” for data (copper) outlet.
  - “C” for data (fiber) outlet.

.1 Panels:

.1 Horizontal Distribution: XYZ-H, where:
  - “XYZ” is room number as described above.
  - “-H” indicates “Horizontal”.
  - Port Labeling: three-digit address of workstation connected.

.2 Equipment: XYZ-E
  - “XYZ” is room number as described above.
  - “E” indicates “Equipment”.
  - Port Labeling: three-digit sequential number

.3 Riser: XYZ-R
- "XYZ" is room number as described above.
- "R" indicates "Riser".
- Port Labeling: three-digit sequential number

.4 RS-232/422: XYZ-RS[232][422]:
- "XYZ" is room number as described above.
- Port Labeling: two-digit sequential number.

.5 Attach inter-room connection to identically numbered panel outlets, and, wherever possible, to outlets at same position on each panel.

.2 Cables:

.1 Horizontal (outlet) Cables:

.1 Outlet End: XYZ, where "XYZ" designates IDF room number as described above to which cable goes.

.2 Room (IDF) End: PQR-[OUTLET TYPE], where:
- PQR is a three-digit outlet address,
- [OUTLET TYPE] is one of the following outlet types:
  - A for telephone
  - B for data
  - C for fiber
  - RS-232
  - RS-422

.3 Equipment Room/Riser/Backbone Cables: destination is another IDF room, MDF room, or outlet.
- TYPE-[MN][XYZ][0][00] where:
  - [TYPE] would be:
    - VUTP for (voice UTP).
    - DUTP for (data UTP).
    - DSTP for (data STP).
    - FO for (fiber optic).
    - COAX (coaxial).
    - RS[232][422]
  - [MN] is sequential number (01, 02, etc.) of cable if multiple runs of same type.
  - XYZ is IDF Or MDF destination room if cable goes to another IDF or MDF room
  - [0]00 is the address of the outlet if cable goes to outlet.
.15 **Fire Alarm Identification**

.1 All devices shall be labeled on the external fixed portion of the device, or next to the device, with applicable node, loop, address, or circuit number.


.2 End-of-line resistors, duct detectors and remote indicators: Identify with 6 mm high white lettering on red background laminoid located on wall next to device.
### Sample Electrical Panel Schedule

**Panel Designation:**
- Mounting: Surface
- Voltage: 120/208V
- Phases: 3
- Feed from: Wire
- Circuits: 42
- Interrupting Capacity: 1,500 A

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1) Complete all fields with relevant project information.
2) Revise panel directory to suit 24, 30, 42, 60, 84 breaker spaces is required. Maximum circuit position height is 42 circuits vertically.
3) Complete load estimates for each phase and total.

---

**SAMPLE ELECTRICAL PANEL SCHEDULE**

---

**ESK-1**
.1 Coordination, Fault and Arc Flash Incident Energy Analysis

Report Requirements:

.1 Include an APEGAlicensed professional authenticated report including items as identified in IEEE 1584.1 "IEEE Guide for the Specification of Scope and Deliverable Requirements for an Arc Flash Hazard Calculation Study in Accordance with IEEE Std 1584.

.2 As a minimum report to include:
- APEGAlicensed professional authenticated cover page.
- Executive Summary
- Scope of Study and Results Summary
- Background Information used such as available utility fault current used, cable sizes, types and lengths etc., including software used, configuration settings and assumptions used. Include copy of building SLD in an Appendix and ensure labelling between software and SLD are compatible. Include all digital back-up, custom files and any custom library files are submitted with the report in a flash drive.
- Short circuit analysis listing all equipment and verifying that equipment is properly rated for the available short circuit rating.
- Coordination study including results and any recommendations. Include all time-current characteristics curves used. Include potential changes to lower incident energy levels for review by Engineer.
- Arc Flash Incident Energy analysis. Include a spreadsheet listing all equipment. Include recommendations for incident energy reduction.
- Conclusion/Recommendations
7.0 Acoustical

Section Contents

7.1 References ............................................................................................................................ 1
7.2 General .................................................................................................................................. 1
7.3 Definitions ............................................................................................................................... 1
7.4 Acoustically Critical Spaces ................................................................................................. 2
7.5 Review Requirements .......................................................................................................... 3
  .1 Schematic Design ................................................................................................................ 3
  .2 Design Development ............................................................................................................ 3
  .3 75% Contract Documents .................................................................................................. 3
  .4 100% Contract Documents ............................................................................................... 4
7.6 Architectural ............................................................................................................................. 5
  .1 General ................................................................................................................................ 5
  .2 Floor Construction ............................................................................................................... 5
  .3 Interior Partitions ................................................................................................................ 6
  .4 Interior Finishes ................................................................................................................... 8
  .5 Open Plan Offices ............................................................................................................... 9
    A. Specific Requirements for Schools .................................................................................. 9
    B. Specific Requirements for Healthcare Facilities ............................................................ 14
    C. Specific Requirements for Court Facilities ....................................................................... 15
7.7 Mechanical .............................................................................................................................. 15
  .1 Background Noise ............................................................................................................... 15
  .2 Ducts, Terminal Devices, Heat Components and Silencers ............................................... 16
  .3 Plumbing Noise .................................................................................................................. 18
  .4 Vibration Isolation ............................................................................................................. 18
  .5 Community Noise .............................................................................................................. 19
    A. Specific Requirements for Schools ............................................................................... 19
    B. Specific Requirements for Healthcare Facilities ............................................................ 20
    C. Specific Requirements for Continuing Care Facilities .................................................... 22
7.8 Electrical/Communication ..................................................................................................... 22
.1 Ballasts .........................................................................................................................22
.2 Transformers ...............................................................................................................22
.3 Sound Masking System ...............................................................................................23

7.9 Structural ......................................................................................................................23

7.10 Exterior Acoustic Insulation .......................................................................................24
7.1 References

.1 Meet or exceed the guidelines and standards of the following, as applicable:

.1 ASHRAE: Applications Handbook (SI) Chapter on Noise and Vibration Control
.2 Alberta Building Code: Division B – Appendix A - 9.10.3.1
.3 Alberta Building Code: Division B, Part 11, Exterior Acoustic Insulation
.4 CISC: Handbook of Steel Construction - Appendix G, Guide for Floor Vibrations
.5 AISC/CISC 1997 Steel Design Guide Series 11, Floor Vibrations Due to Human Activity
.7 ASTM E336-16 Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
.10 CSA Z8000, Canadian Health Care Facilities – 2018 edition

7.2 General

.1 The intent of these requirements is to ensure that the acoustic environment of the building is compatible with the general needs and comfort of the building occupants, and the surrounding residential areas.

7.3 Definitions

.1 The following are definitions of common parameters used to describe the acoustic characteristics of building environments, materials and assemblies:

.1 Apparent Sound Transmission Class (ASTC)—Describes the apparent sound insulation of a partition separating two spaces. All sound transmission, including any flanking transmission, is ascribed to the partition. These are measured in situ and typically are within 5dB of the STC measured in a laboratory.
.2 Sound Transmission Class (STC): a single number rating of the sound transmission loss properties of a wall, floor, window or door. A good reference for wall and floor STC ratings is the Alberta Building Code.

.3 Ceiling Attenuation Class (CAC): this is a single number rating of the sound transmission properties of a suspended ceiling system between two rooms having a common plenum.

.4 Noise Reduction Coefficient (NRC): a single number rating of the sound absorptive properties of a material ranging from 0.01 (negligible absorption) to approximately 1.00 (very high absorption). Manufacturers of ceiling boards, wall panels and various sound absorptive finishes will usually list the NRC rating in their product information.

.5 Articulation Class (AC): a ceiling performance rating specifically used for open-plan offices. Articulation Class is a single number rating describing a ceiling boards’ ability to attenuate speech sounds between workstations.

.6 Noise Criteria (NC): a somewhat dated method of rating HVAC system noise. NC is still often used as a design criterion because many manufacturers of mechanical equipment continue to use it.

.7 Room Criterion (RC): a more recent rating for HVAC system noise. RC is the preferred rating for setting design goals and for qualifying field installations.

.8 Reverberation Time (RT) – an indication of the persistence of sound in a room, measured in seconds. RT is dependent on the volume of the space and the sound absorptive properties of the room surface.

7.4 Acoustically Critical Spaces

.1 Consult with the Province on rooms where speech privacy, sound isolation, background noise or reverberation control is critical. In most cases, more than one of these acoustic conditions will need to be considered for interview and therapy rooms, teleconference rooms, courtrooms, auditoria and lecture halls.

.2 Secure interview rooms in court facilities require specific soundproofing requirements, as outlined in the Province document, Acoustical and Security Requirements for Secure Interview Rooms in Court Facilities.

.3 Consult with the Province on unusual situations, where adjacent occupancies may not be acoustically compatible and special construction is required.

.4 Consult with the Province on large open-plan office projects. There are numerous acoustical requirements associated with this type of space layout.
7.5 Review Requirements

.1 Schematic Design
   .1 Identify the rooms that will require acoustic isolation and the ASTC required
   .2 Identify the ceiling and floor finish anticipated in occupied spaces and possible acoustical wall treatment
   .3 The Schematic Design Report (SDR) shall contain a section for the Acoustical discipline. Convey the design strategy for all acoustical considerations.
   .4 The SDR shall include all referenced codes and standards.

.2 Design Development
   .1 Provide a floor plan or schedule of the rooms and their proposed ASTC performance
   .2 Propose the construction of interior partitions and exterior walls including the STC performance (Alberta building code is a good guide of assemblies and has credible STC and fire ratings)
   .3 Identify (in outline specification) product specification for ceiling and wall finishes and their acoustical performance (NRC), and identify relevant sections required for the project (e.g. sound masking, specialty assemblies such as operable walls, specialty systems such as fume hoods, etc.)

.3 75% Contract Documents
   .1 All partitions on floor plan clearly identified as to assembly and height (i.e. floor to underside of structure, to dropped ceiling height, etc.)
   .2 Any plenum barriers are clearly identified on plans
   .3 Assembly details provided and large scale details of junctions of interior partitions to exterior, floor, structure or dissimilar assemblies showing how the acoustical integrity will be ensured.
   .4 Reflected ceiling plan clearly indicating the materials used
   .5 Floor finish plan clearly indicating the materials used
.6 Room finish schedule indicating finishes and any special acoustical treatment such as wall panels, baffles, acoustic block, acoustic metal deck, etc.

.7 Structural drawings indicating the extent of acoustical deck – preferably with shading (to ensure that it is included by the contractor)

.8 Mechanical plumbing drawings showing the locations of waste water stacks

.9 Mechanical HVAC duct layout with locations of terminal boxes, fans and silencers.

.10 Mechanical schedule of main equipment (fans, chillers, cooling towers, etc.)

.11 Mechanical layout of the mechanical rooms

.12 Mechanical standard details for vibration control and decoupling of pipes

.13 Electrical floor plan showing the extent of sound masking (if required) with shading

.14 Electrical schematics of larger audio-visual systems (e.g. courtroom system)

.15 Specifications: Outline of all the required sections for the project at least in draft form with representative products.

.4 **100% Contract Documents**

.1 All the of the 75% requirements

.2 Clear coordination between specialties (e.g. diffusers are at the same place on the architectural and mechanical drawings, sutural extent of acoustic deck agrees with reflected ceiling plan)

.3 Door schedules with acoustic door seals (if necessary) identifies as well as largescale details of the installation of these.

.4 Largescale assembly details completed

.5 Elevations clearly showing the extent of any required acoustic treatment

.6 Mechanical HVAC drawings showing all the diffusers and their airflow as well as required internal acoustic lining to duct work.

.7 Completed mechanical layout of mechanical room
Completed mechanical schedules with acoustic specifications for silencers, terminal boxes, diffusers, cooling towers, fans, generators, etc.

Mechanical details for unusual or specialty acoustical treatment (e.g. pipes in floating floors, acoustical plenums, etc.)

Electrical plans showing layout of required audio-visual equipment and the required power. In larger audio-visual installations, rack layouts and detailed schematics are also required.

Specifications – completed. Any acoustical absorptive material (e.g. wall panel, baffle) must specify a minimum NRC, specialty barrier material (e.g. operable doors, moveable walls) specify a minimum STC, Ceiling tile must specify at least a minimum NRC and minimum CAC. Mechanical systems must specify maximum noise levels for major equipment and minimum performance of silencers, vibration isolators and such noise control elements.

7.6 Architectural

General

Develop the floor plan so that noise sensitive spaces are not next to high noise areas (e.g. conference rooms adjacent to mechanical rooms). Consider both the horizontal and vertical layouts.

Floor Construction

Evaluate the need for a floating concrete floor to isolate very loud equipment (e.g. chillers; large open-ended fan units) in mechanical areas. A floating floor is rarely necessary except when rooms with low noise criteria (e.g. auditoria and studios) are located directly below such mechanical areas. It is recommended that an acoustic consultant make a preliminary estimate of the mechanical noise and, if required, develop the details for this type of floor.

Evaluate the construction of floors for impact noise. Footstep noise and other impact sounds can be a source of annoyance, particularly through lightweight and uncarpeted floors. Design for impact sound isolation is especially important where areas of high impact (e.g. corridors, exercise rooms, child play areas) are located above or directly adjacent to occupied rooms. Consult with the Province on floor details for reducing impact sound.
### .3 Interior Partitions

.1 Design interior partitions for sound isolation as follows:

<table>
<thead>
<tr>
<th>Space Description</th>
<th>ASTC Rating(^1) (minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Moderate Privacy Requirements</strong></td>
<td></td>
</tr>
<tr>
<td>General Office Space, Small Meeting Rooms</td>
<td>35</td>
</tr>
<tr>
<td><strong>Confidential Privacy Requirements</strong></td>
<td></td>
</tr>
<tr>
<td>Interview rooms, quiet rooms, telephone rooms</td>
<td>40</td>
</tr>
<tr>
<td>Executive Offices</td>
<td></td>
</tr>
<tr>
<td>Large Conference Rooms, Training Rooms</td>
<td></td>
</tr>
<tr>
<td><strong>Acoustically Critical Spaces</strong></td>
<td></td>
</tr>
<tr>
<td>Video conference rooms</td>
<td>45</td>
</tr>
<tr>
<td>Demising wall between departments or GOA and non-GOA space</td>
<td>45</td>
</tr>
<tr>
<td>Washrooms</td>
<td>50</td>
</tr>
<tr>
<td>Mechanical room</td>
<td>50+</td>
</tr>
<tr>
<td><strong>Other Acoustically Critical Spaces (see Section 7.4)</strong></td>
<td>45+ (varies)</td>
</tr>
<tr>
<td>Therapy Rooms, Courtrooms</td>
<td></td>
</tr>
<tr>
<td>Studios, Auditoria, Lecture Halls</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)Typically the ASTC is within 5 points of the laboratory STC rating. Selecting a partition rated at an STC 5 points higher than the minimum ASTC required will typically be enough with proper detailing.

.2 Partitions with ASTC 40 rating should generally be full height or incorporate a gypsum board plenum barrier. Where this is not possible, extend partitions slightly above suspended ceiling and maximize the separation between return air openings. Use ceiling boards with a minimum CAC rating of 40 and a minimum NRC of 0.55.

.3 Use full-height wall construction or drywall ceilings in rooms that require ASTC 45 or greater.

.4 To ensure the ASTC is met, prepare large scale details that show continuous, airtight seals at building component junctions such as:

.1 Partition to perimeter heater cabinet,
.2 Partition to suspended ceiling,
.3 Partition to window mullion at exterior walls.
.4 Partition to underside of structure for full height walls.

.5 Provide a complete, airtight sound seal around piping, duct and conduit/raceway that penetrate partitions and floors. Sealants must comply with fire separation and waterproofing requirements, as applicable.

.6 Provide a solid airtight barrier behind perimeter heater cabinets to prevent sound transfer at common partitions.

.7 Provide a double plumbing wall between washrooms and occupied spaces. Ensure structural separation is maintained between each wall and specify that piping is attached to studs on washroom side only.

.8 Prepare details that show the acoustic treatment at building component junctions, (e.g., partition on metal deck). The objective is to provide a continuous, airtight seal at all junctions.

.9 Non-Progressive Moveable Walls pose significant acoustical challenges. They only extend to the T-bar ceiling and are not necessarily aligned to the grid. The ceiling tile used in these areas shall have a minimum CAC of 35. Consider providing a plenum barrier above the T-bar to the underside of the structure. Consider using a different system for ASTC greater than 35.

.10 Do not use operable partitions between areas that require a high degree of speech privacy. Consider using a different system for ASTC greater than 40. Where operable partitions are deemed necessary for general noise isolation, specify a partition that has a minimum STC 50 rating. In addition to sound transmission through the partition itself, the sound leakage around the partition, through all of the connecting building components, must be minimized. Detail such partitions according to ASTM E557-12, Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions:

.1 floor flatness: ±3.2 mm in 3.7 m non-accumulative
.2 wall plumb and true: ±3.2 mm for every 3.0 m
.3 head track deflection under load < 3.2mm per 3.7m
.4 walls must be smooth, flat, free of surface finishes and resist bowing where they intersect the partition
.5 fixed wall jambs and ceiling/deck support beams must be installed with airtight seals
.6 the floor’s load deflection (under the operable partition’s weight) must be limited to prevent bottom seal leaks
.7 routine maintenance must be conducted to check alignment and sound seal wearing

.8 Sound transmission paths that commonly occur around regular (non-operable) wall construction still need to be considered, such as, sound leaks through ceiling plenum, floor, ceiling slab, walls, etc.

.11 Use massive wall construction (e.g. concrete block, poured concrete, multi-layer drywall) to separate occupied spaces from duct shafts and mechanical rooms.

.12 Use massive wall construction (e.g. concrete block, poured concrete, brick) around areas that produce high levels of low frequency noise. Typically, this includes walls around large duct shafts, or rooms that contain large mechanical equipment, transformers or emergency generators.

.13 Be aware of potential flanking paths at locations where high STC interior partitions intersect with the exterior building envelope. Depending on the construction of the exterior building envelope, there can sometimes be large air cavities which provide a sound flanking path around the high STC partition (through the exterior building envelop). The design of this intersection must be reviewed and appropriate details provided to ensure that there is a proper intersection with no significant flanking path. Often, this requires the high STC interior partition wall to extend into the space within the exterior building envelope and for fibrous sound absorbing batts to be installed within a few stud cavity spaces of the exterior building envelope on each side of the high STC interior partition.

.4 Interior Finishes

.1 Specify ceiling boards that have a minimum CAC rating of 35 for closed office areas or other rooms that require speech privacy. Generally, these boards will be mineral-fibre type.

.2 Provide a sound absorptive ceiling finish in all general office space, corridors, cafeterias, lobbies and large public areas. Ceiling boards or other ceiling finishes should have a minimum NRC of 0.60.

.3 Provide carpet to all occupied floor areas above offices and other noise sensitive areas to minimize impact noise of footsteps.

.4 Consider additional sound absorbing wall/ceiling finishes for spaces where a high degree of noise is expected. Excess reverberation reduces speech intelligibility within the room. This is true for person-to-person communication, as well as the speech intelligibility through any sound system that may be used for announcements. Optimize speech intelligibility, create a healthy work environment and reduce noise fatigue.
.5 High ceilinged spaces (e.g. lobbies, rooms with clerestory fenestration, etc.) require more acoustic treatment. The maximum reverberation time is 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.6 In Correctional Facilities, “Open Concept Pods” and such common use spaces, the reverberation in unoccupied “Pods” must not exceed RT 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.5 Open Plan Offices

.1 The following for open-plan conditions are required (e.g. Call Centers).

.1 Specify ceiling boards that have a minimum AC rating of 170 where most systems furniture is less than 1.8 metres high.
.2 Specify ceiling boards that have a minimum AC rating of 200 where most systems furniture is approximately 1.8 metres. This is required where maximum privacy between workstations is desirable.
.3 Specify foil backing for all glass-fibre ceiling boards: minimum CAC 26.
.4 For a mix of open-plan areas and enclosed offices, different ceiling boards may be required for each type of space. Manufacturers offer boards with identical finishes for both applications.
.5 Consider maintenance requirements in the selection of ceiling boards and other sound absorptive finishes. Avoid cloth-faced glass fibre ceiling boards, soft spray-applied materials and other finishes that are difficult to clean.
.6 Avoid flat light lenses. Parabolic or deep “egg-crate” diffusers are preferable.
.7 Specify electronic sound masking. (See Error! Reference source not found.).

A. Specific Requirements for Schools

.1 Interior Finishes

.1 Classrooms:

.1 Reverberation in unoccupied classrooms shall not exceed RT 0.6 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.
.2 Acceptable reverberation time can typically be achieved by specifying a ceiling with a minimum NRC 0.55. Wall surfaces should generally remain hard to promote the distribution of speech throughout the room.
.3 Consider carpet to reduce distracting noises caused by movement of chairs and desks.
.4 Avoid classrooms with high or vaulted ceilings. Classrooms with ceilings higher than 3m, require additional acoustic treatment on the walls to achieve the RT criterion.
.5 Avoid highly elongated classrooms.

.2 Gymnasium:

.1 Provide acoustic treatment on both the ceiling and walls to control noise and reverberation.
.2 Reverberation in a typical unoccupied gymnasium shall not exceed RT 2.0 seconds, averaged over the frequency range of 500 Hz - 2,000 Hz.
.3 Acoustic treatment on the ceiling is most beneficial for general noise control. Select ceiling treatments with a minimum NRC 0.70.
.4 Consider the use of acoustic roof deck, impact resistant acoustic ceiling panels or suspended baffles.
.5 Acoustic spray-on material can also be used as a ceiling finish if the abuse resistant properties (adhesion, cohesion) of the product are suitable for this environment.
.6 Do not use glue-on ceiling tiles.
.7 Wall treatment should be distributed over at least two adjacent walls. Select wall treatment with a minimum NRC 0.70.
.8 Acoustic wall treatment is especially beneficial when placed on the rear wall (opposite stage) if the gymnasium is used for drama or musical events.
.9 Extend acoustic wall treatment as low as practical.
.10 Consider the use of impact resistant wall panels or acoustic concrete block.
.11 Ensure acoustic concrete block are specified to meet the minimum required NRC 0.70, to avoid problems with selective frequency absorption. Also ensure the minimum STC of 50 is specified.

.3 Music Rooms:

.1 Avoid locating music rooms next to gymnasia, classrooms or other noise sensitive rooms.
.2 Locate non-critical spaces such as corridors and instrument storage rooms around music rooms to provide a buffer.
.3 Consider designing music rooms with two or three exterior walls to minimize sound transmission to other instructional areas.
.4 Reverberation Time in a typical Music Room shall be between RT 0.70 - 0.80 seconds, averaged over the frequency range of 500Hz - 2,000Hz.
Consider a ceiling height of 4m - 5m. Unlike classrooms, music rooms benefit from additional volume.

Avoid concave ceiling profiles or domes.

Consider making portions of the ceiling reflective to promote sound diffusion and ensemble between musicians.

Consider pyramidal or convex ceiling diffuser panels set into the T-bar grid covering approximately 10% - 20% of the ceiling.

Consider non-parallel sidewalls or provide sound diffusing elements on sidewalls such as open instrument storage.

Where the instructor’s teaching position is fixed because of risers, the wall behind the instructor should have acoustic wall treatment.

Acoustic wall treatment should have a minimum NRC 0.80.

Practice Rooms:

Consider using manufactured, modular practice rooms as an alternative to built-in place construction. Practice rooms require many specialized acoustical, mechanical and architectural construction details to function effectively.

Locate practice rooms, where possible, so they do not open directly into a music room. Consider using corridors or vestibules as a buffer.

Reverberation in unoccupied practice rooms shall not exceed RT 0.5 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

Provide acoustic ceiling with minimum NRC 0.80.

Provide acoustic wall treatment with minimum NRC 0.80, distributed over approximately 50% of the total wall area.

Provide insulated metal or solid core door with acoustic door seals.

Common Areas:

Reverberation in unoccupied common areas shall not exceed RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

Typically, corridors and lunchrooms require a ceiling with a minimum NRC 0.55. Note that high ceilinged spaces require higher sound absorption.

Typically, student gathering areas require acoustic ceiling treatment with a minimum NRC 0.70 to control the high noise levels that can occur in these spaces. Consider suspended ceilings, baffles, acoustic deck or spray-on materials.
.4 Student gathering areas with extensive skylights or high ceilings due to clerestory fenestration require additional acoustic wall treatment to compensate for the lack of ceiling absorption. Provide a corresponding area of acoustic wall panels with a minimum NRC 0.70.

.6 Computer Labs, Flex Spaces, Learning Commons, Maker Spaces:

.1 Reverberation in unoccupied computer labs and informal learning spaces shall not exceed RT 0.7 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.
.2 Provide ceiling with minimum NRC 0.70.

.7 Drama Theatre:

.1 Large theatres used for drama presentations have numerous acoustical requirements and should be reviewed by an acoustical consultant.
.2 Reverberation time in unoccupied drama theatre shall not exceed RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.8 CTS shops – Wood working, Fabrication, Automotive, etc:

.1 Reverberation in unoccupied spaces shall not exceed RT 1.0 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.2 Interior Walls – Sound Isolation

.1 Use the following table for determining minimum wall actual sound transmission loss requirements. Refer to the Alberta Building Code Division B – Appendix A - 9.10.3.1 to assist in selecting wall assemblies with the STC lab values which are typically 5 points higher than those within the table on the following page:
<table>
<thead>
<tr>
<th>Space Description</th>
<th>ASTC Rating² (minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offices</td>
<td>40</td>
</tr>
<tr>
<td>Classrooms, Computer Labs, Libraries</td>
<td>45</td>
</tr>
<tr>
<td>Gathering Spaces, Drama Rooms, Washrooms, Maker space</td>
<td>50</td>
</tr>
<tr>
<td>Music Rooms (Elem.), Practice Rooms, Gymnasium/Fitness Rooms, Mechanical room</td>
<td>55</td>
</tr>
<tr>
<td>Music Rooms (Jr./Sr.), Woodshop, Automotive, Metal work</td>
<td>60</td>
</tr>
</tbody>
</table>

¹ Typically the ASTC is within 5 points of the laboratory STC rating. Selecting a partition rated at an STC 5 points higher than the minimum ASTC required will typically be enough with proper detailing.

.1 Avoid continuous drywall bulkhead construction between classrooms. Provide a complete structural discontinuity of the bulkhead at all common walls between classrooms.

.2 Provide a complete air-tight seal around piping, duct and conduit/raceway penetration through walls.

.3 Use massive wall construction (e.g. concrete block) around areas that produce high levels of low frequency sound such as mechanical rooms and gymnasium.

.4 Do not locate duct shafts in classrooms.

.5 Avoid locating doors in the common wall between classrooms. Where this is necessary, consider double doors with full perimeter acoustic seals.

.6 Consider reducing the number of operable walls between classrooms and gathering spaces. The flexibility they provide in opening up the space is outweighed by the poor acoustic performance users must cope with when they are using the classrooms as individual teaching spaces. When installed, moveable partitions typically provide an ASTC 8-12 points less than the laboratory tested STC rating provided by the manufacturer. See Section 7.5.3.7

.7 Glazed partitions typically have poor acoustic performance. To achieve ASTC 45 requires expensive multi-pane glazing.

.2 Site Planning

.1 Assess the noise impact of nearby major arterial roads, highways, rail roads and airports.
2 Orientate the school and locate instructional space to minimize the impact of traffic noise on classrooms.

3 Design building envelopes, to reduce transportation noise in classrooms to a maximum hourly Leq of 35 dB(A) maximum LAeq of 50dBA. An acoustic consultant should review noise assessment and abatement techniques.

4 Do not locate classrooms so that exterior windows are exposed to busy loading docks.

B. Specific Requirements for Healthcare Facilities

As a minimum CSA Z 8000 requirements are to be met. Consider meeting FGI recommendations.

.1 Sound Isolation:

.1 Comply with Z-8000 12.2.7.2 “Architectural sound insulation”

.2 For long-term care resident suites or rooms the acoustic separation of ASTC 45 is required (this aligns with NBC:AE 9.11.2.1)

.2 Reverberation and Noise Control

.1 Comply with Z-8000 12.2.7.3 “Reverberation and noise control”

.2 Provide a sound absorptive ceiling finish in nurse stations, offices, corridors, cafeterias, large public areas and especially in areas that require voice paging. Reverberation shall be less than RT 0.5 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. Typically, ceiling boards or other ceiling finishes should have a minimum NRC of 0.55.

.3 Provide a highly sound absorptive ceiling for open offices – see requirements outlined in 7.5.5 Open Plan Offices.

.4 Consider additional sound absorbing wall finishes for nurse stations, special care nurseries, recreation rooms and other patient activity areas, especially within continuing care facilities.

.5 Consider the noise interference from common sources such as televisions, washers dryers, ice machines, vending machines. Provide isolated areas for activities associated with this equipment.

.3 Community Noise (Architectural)

.1 Orientate the hospital on the site so that the noise impact of emergency/supply vehicles, helicopter activity and new traffic routes in the neighbourhood will be minimized.
.2 Prepare a survey of existing ambient noise conditions if the Health Care Facility is to be built near an established residential community. A minimum twenty-four hour noise measurement around the site is required to determine meaningful design criteria to minimize impact on the community.

.3 Consider the impact of nearby major arterial roads, rail lines or other transportation noise sources. Design the building envelope to attenuate exterior noise to provide a comfortable interior environment. Acceptable noise levels for various occupancies are defined by the mechanical background noise criteria (Section B of 7.7 Mechanical).

C. Specific Requirements for Court Facilities

.1 Sound Isolation

.1 Courtrooms must provide a minimum ASTC 60 to adjacent spaces
.2 Judicial offices require
.3 a minimum ASTC 50 to adjacent spaces

.2 Reverberation and Noise Control

.1 Reverberation in unoccupied courtrooms shall be less than RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

7.7 Mechanical

.1 Background Noise

.1 Design mechanical systems to provide background noise levels, as follows:

<table>
<thead>
<tr>
<th>Space Description</th>
<th>Room Criterion (RC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio/Recording Studio, Auditorium</td>
<td>20 Maximum</td>
</tr>
<tr>
<td>Audio/Visual Room, Courtroom, Teleconference Room</td>
<td>25 Maximum</td>
</tr>
<tr>
<td>Large Conference Room, Observation/Therapy Room, Classroom, Lecture Hall, Secure Interview rooms</td>
<td>25-30</td>
</tr>
<tr>
<td>Enclosed Office, Meeting Room, Open-Plan Areas</td>
<td>30-35</td>
</tr>
</tbody>
</table>
### 16

| Library, Cafeteria, Reception/Waiting Areas | 35-40 |
| **Computer Room, Kitchen** | 45 Maximum |
| **Light Maintenance Shop** | 50 Maximum |

.2 In most office settings, a neutral, unobtrusive background noise helps to increase speech privacy. Therefore, over-silencing is undesirable.

.3 Consult with the Province on spaces that require a noise level of RC 25 or less.

### .2 Ducts, Terminal Devices, Heat Components and Silencers

.1 Whenever possible, design the system layout so that any medium and high velocity ducts and terminal boxes are above service space such as corridors.

.2 Do not locate exhaust fans directly above meeting rooms and conference rooms serving such spaces. Locate these fans in the ceiling plenum above a less critical area (e.g. Waiting/Reception or Corridor) and provide acoustically-lined duct on the fan intake.

.3 Avoid placing rooftop equipment over noise-sensitive areas. Provide details describing acoustic treatment, duct configuration and roof penetration seals for any rooftop installations.

.4 Design main air distribution systems to minimize the use of acoustic duct lining, whenever possible.

.5 Select acoustic silencers with the lowest static pressure loss, when a selection of two or more silencers exist.

.6 Use flexible connections between fans, plenums and all related ductwork.

.7 Provide smooth air flow conditions near fan units to minimize air turbulence. Large, rectangular ductwork with medium and high air velocities can create low frequency duct rumble. Spiral-wound, round duct is preferred for air velocities over 9 m/s or where excessive turbulence is anticipated.

.8 Use non-continuous perimeter heat cabinets that allow acoustic barriers to be installed behind the cabinet at all window mullion locations. Provide easy access at these locations.
.9 Select terminal boxes on basis of both induct and radiated noise level. Manufacturer’s VAV box noise data often assumes the equipment is located above a mineral fibre suspended ceiling and that there is use of acoustically-lined duct. Ensure that the design includes the effect of these elements.

.10 Select diffusers/air outlets so that the combined noise from all diffusers in a room meet the design criterion. Noise from a single diffuser will typically need to be specified 6 - 10 dB lower than the RC(N) goal or max. NC 20 when several diffusers are in the same room.

.11 Locate balancing dampers at least 2 m away from diffusers and preferably at the tee where the supply air branch connects to the main to reduce transmitted noise through the diffuser. Avoid specifying diffusers/grilles with integral balancing dampers unless required.

.12 Provide straight ductwork for at least 3 duct diameters upstream of the diffuser inlet. Abrupt bends at the inlet can increase noise levels substantially beyond the manufacturers rating.

.13 Do not use Z shape return air transfer ducts (sound traps) for offices with enclosed plenum spaces. A simple rectangular opening in the plenum barrier, located above the office door, will generally be adequate. Where it is necessary to return air directly between critical areas (i.e. two offices) use a 1.5 m long straight rectangular duct with acoustic duct liner.

.14 Catalogue sound ratings for Terminal boxes often assume the use of additional noise attenuating elements, such as lined flex duct or acoustically lined duct, in the downstream duct work. Eliminating these elements can have a large impact on the resultant noise levels. Ensure that these elements are provided in the design or accommodate the necessary in-duct attenuation through other means.

.15 Design ductwork to promote uniform air flow through fans and filter banks to the extent possible.

.16 Provide at least 1m (3 ft) of flexible acoustic duct at diffuser inlet for acoustically critical spaces. Flexible duct is not to be used for significant changes of duct direction. Exception - do not use flexible acoustic duct in Healthcare Facilities.

.17 Avoid ducting that starts from within one space, spans entirely across an acoustically sensitive space, and then terminates within a third space (i.e. start in a hallway, run through an acoustically sensitive space, and then terminate in an adjacent space). This will minimize the noise that transmits through the ductwork into the acoustically sensitive space.
.3 Plumbing Noise

.1 Use a resilient sleeve around supply pipes with oversize clamps fastened to structure, in areas where water flow noise may be a disturbance. Sleeves comprised of 12 mm thick closed-cell elastomeric pipe insulation or proprietary resilient pipe fasteners are acceptable. Do not use hard plastic sleeves.

.2 Ensure that pipes penetrating through drywall partitions are not rigidly connected. Provide a sleeve at the wall opening, leaving an air space around the pipe, and seal with a resilient (non-hardening or low modulus) caulking.

.3 Where double plumbing walls are used (e.g. washrooms), attach supply piping only to the fixture side of the wall structure.

.4 Consider the use of pressure reducing valves (PRV’s) in the system to minimize plumbing noise for noise sensitive areas. Size PRV’s to limit the pressure at fixtures to 375 kPa.

.5 Install water hammer arrester adjacent to any quick-acting solenoid valves.

.4 Vibration Isolation

.1 Use the current ASHRAE Applications Handbook, as a guide for selecting vibration isolation of mechanical equipment.

.2 Provide vibration isolators for all vibrating pipes and ducts in mechanical chases and walls common to noise sensitive areas.

.3 Use flexible connectors on pumps that require vibration isolation from piping. Twin sphere neoprene rubber flex connectors are preferred.

.4 Use flexible connections between fans, plenums and all related ductwork.

.5 For rooftop equipment, vibration problems can usually be avoided if the static deflection of each spring isolator is at least 15 times the structural deflection of the roof due to the equipment loading. Typically, this requires springs with a static deflection of 50 to 100 mm.

.6 For additional structural vibration requirements, refer to section 4.0 – Structural.
.5 Community Noise

.1 Determine the community noise impact of large outdoor mechanical equipment, e.g. cooling towers, chillers, and large fan units with louvres to outside. Occupants of residences within 1000 metres of such equipment can be annoyed by mechanical noise, particularly at night. Ideally conduct a noise survey of existing conditions in the area.

.2 Silence or strategically locate outdoor mechanical equipment and intake/exhaust openings to ensure the existing noise level is not increased or at least meet local municipal noise by-law requirements. In the absence of a noise by-law, design systems to a maximum level of 50 dBA for neutral sounding equipment and 45 dBA if the equipment has a tonal noise (e.g. axial fans). These levels are determined at the residential property line nearest to the equipment.

A. Specific Requirements for Schools

.1 Background Noise

.1 See Mechanical Section Table 5.2.2.b.(1) for Noise Level RC (N) criteria.

.1 Locate furnaces outside of classrooms or in a suitable closet designed to achieve the specified background noise criteria for a given room type. Provide silencing of supply and return air from furnaces. Utilize acoustically lined plenum ducting or transfer ducts as applicable.

.2 Locate mechanical room or main air handling equipment away from instructional spaces or other noise sensitive areas.
B. Specific Requirements for Healthcare Facilities

As a minimum FGI guidelines are to be met

.1 Background Noise

.1 Design mechanical systems to provide background noise levels, as follows:

<table>
<thead>
<tr>
<th>Space Description</th>
<th>Room Criterion (RC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Room</td>
<td>30</td>
</tr>
<tr>
<td>Medication Room</td>
<td>40</td>
</tr>
<tr>
<td>Multiple occupant patient care areas</td>
<td>35</td>
</tr>
<tr>
<td>NICU sleep areas</td>
<td>25</td>
</tr>
<tr>
<td>NICU staff and family areas</td>
<td>30</td>
</tr>
<tr>
<td>Operating rooms</td>
<td>35</td>
</tr>
<tr>
<td>Corridors and public spaces</td>
<td>40</td>
</tr>
<tr>
<td>Private offices, exam rooms</td>
<td>35</td>
</tr>
<tr>
<td>Conference rooms</td>
<td>30</td>
</tr>
<tr>
<td>Teleconference rooms</td>
<td>25</td>
</tr>
<tr>
<td>Auditoria, large lecture rooms</td>
<td>30</td>
</tr>
</tbody>
</table>

.2 The noise level requirements are considered optimum for areas where speech privacy is important such as examinations rooms and offices. Do not over silence because the presence of background noise helps to mask conversation and distracting noises from adjacent rooms.

.2 Ducts, Terminal Devices and Silencers

.1 Whenever possible, design the system layout so that medium and high velocity ducts and terminal boxes are located in non-critical areas such as corridors. Only connecting branches that serve a particular patient area should be allowed to enter the room.
Avoid acoustic duct linings exposed to air movement in ducts serving operating rooms, delivery rooms, LDR rooms, nurseries, and critical care units. This requirement shall not apply to mixing boxes and acoustical silencers that have special coverings over acoustic lining.

Specify terminal boxes with the manufacturer’s sound attenuation package. In critical areas listed in Tables 3.2-1 to 3.2-6, Mechanical System Design Parameters, terminal boxes and attenuators must use foil-faced acoustic lining.

Use reactive (packless), Mylar lined, or foam lined silencers for all clean room applications.

Specify terminal boxes with the manufacturer’s sound attenuation package. In critical areas listed in Tables 3.2-1 to 3.2-6, Mechanical System Design Parameters, terminal boxes and attenuators must use foil-faced acoustic lining.

Use reactive (packless), Mylar lined, or foam lined silencers for all clean room applications.

Plumbing Noise

Divide water supply lines at the riser with each room fed separately. Tee takeoffs serving back-to-back fixtures in separate washrooms are undesirable.

Specify cast iron waste pipe if it is located near noise sensitive areas, such as patient rooms, offices and auditoriums. Waste connections from fixtures may be copper to the waste stack.

Vibration Isolation

Consider the effects of vibration on medical equipment. Refer to Structural Section 4.5 A.

Community Noise (Mechanical)

Silence and strategically locate mechanical equipment (e.g. cooling towers, exhaust fans, etc.) so as not to exceed the minimum, averaged hourly ambient noise level in the community. This requirement may be more stringent than local municipal noise by-laws.

Silence the outside air intake and discharge openings, and the engine exhaust for emergency generators. The resultant noise shall be no more than 10 dB(A) above the maximum hourly averaged daytime noise level measured at the nearest residential property, but should not exceed 70 dB(A).

Ensure that mechanical noise level in outdoor patient lounge areas and public sidewalks does not exceed 55 dB(A).
C. Specific Requirements for Continuing Care Facilities

As a minimum FGI guidelines are to be met

.1 Background Noise

.1 See Mechanical Section Table 5.2.2.c for Noise Level RC (N) criteria.

7.8 Electrical/Communication

.1 Ballasts

.1 Electronic ballasts can cause severe interference with infrared sound systems. Consult with the Province when electronic ballasts are being considered for spaces with infrared assistive listening systems.

.2 Transformers

.1 Avoid locating transformers within ceiling spaces above noise sensitive spaces.

.2 Provide vibration isolators for transformers located near occupied spaces. Use the following table as a guide for selecting vibration isolators:

<table>
<thead>
<tr>
<th>Size (kVA)</th>
<th>Near Non-Critical Areas</th>
<th>Near Critical Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Isolator Type</td>
<td>Min. Static Deflection</td>
</tr>
<tr>
<td>Under 50</td>
<td>Neoprene pad</td>
<td>3 mm</td>
</tr>
<tr>
<td>50 - 250</td>
<td>Neoprene isolator</td>
<td>10 mm</td>
</tr>
<tr>
<td>Over 250</td>
<td>Spring isolator or hanger</td>
<td>19 mm</td>
</tr>
</tbody>
</table>

.3 Provide flexible conduit/raceway to make the connection to the transformer.
.3 Sound Masking System

.1 Review with the Infrastructure Project Manager the requirements for a Sound Masking System and the extent of the system area coverage.

.2 Where a Sound Masking System is required, determine the type of system to be utilized; preferably an addressable decentralized system or for smaller spaces self-contained. It shall generally conform to one of the following:

.1 Description of a Self-Contained System:

.1 An electronic sound masking system installed above suspended acoustic tile ceiling in areas indicated, typically used in smaller office environments.

.2 System shall be comprised of strategically located self-contained units in a master and/or master-slave arrangement which generate a unique, diffuse, and unobtrusive sound with a spectrum shape designed to mask speech and unwanted noise.

.2 Description of an Addressable Decentralized System:

.1 An addressable decentralized sound masking network is appropriate for projects where maximum flexibility is required in masking layout, loudspeaker location and orientation, sound level and sound contour adjustments. Each loudspeaker node (primary network device) is individually addressable via a central control to provide full adjustment of sound level and spectral output of the attached loudspeaker(s).

.1 Strategically located speaker assemblies above the suspended ceiling system in areas indicated.

.2 Provides diffuse and unobtrusive sound with spatial and temporal uniformity, and having a spectrum shape designed to mask speech and low level, unwanted noise.

7.9 Structural

Refer to Section 4.0 - Structural
7.10 Exterior Acoustic Insulation

.1 Design adequate exterior acoustic insulation for all occupied buildings built within an Airport Vicinity Protection Area established by an APV regulation. Use Part 11 of the most recent Alberta Building Code to develop exterior construction details.

.2 For classrooms ensure the exterior noise from any transportation noise does not exceed Leq1hr of 35 dBA at any time during operational hours.

End of Acoustical Section
8.0 Barrier-Free

Section Contents
8.1 Introduction ......................................................................................................................... 1
8.2 References .......................................................................................................................... 1
8.3 Level of Barrier-Free Accessibility ...................................................................................... 2
8.4 Design Requirements ......................................................................................................... 3
   .1 Use of Reference Documents .......................................................................................... 3
   .2 Level of Accessibility ...................................................................................................... 3
   .3 Code Analysis .................................................................................................................. 3
   .4 Design Development ....................................................................................................... 4
8.1 Introduction

.1 Barrier-Free (BF) accessibility in our existing and new buildings is important to the Province. All requirements of the latest edition of the National Building Code, Alberta Edition (NBC:AE) must be considered and incorporated accordingly in our new and renovation projects. In addition to the BF code minimum requirements, and issues mentioned herein, all designs are to ensure the maintenance of safety and universal usability of our public buildings.

.2 To determine the level of accessibility required for new or existing buildings, refer to the current NBC:AE for the minimums, and then refer to the particular requirements of the project. For example, seniors housing will require more BF integration items than the minimums stated in the NBC:AE; as will various other projects. Use the remainder of this section judiciously to establish a means of providing the appropriate accessibility.

.3 This Section identifies items to be considered when addressing the issue of barrier-free accessibility for existing buildings for persons with physical, sensory, developmental and mobility challenges. These items are broken down so as to be readily accessible for small projects or combined as required to suit large projects.

.4 Requirements are described in conformance with the “critical path method” which provides the order in which requirements should follow in sequence. If the sequence is not followed, portions of the building may be upgraded to barrier-free status but may not be accessible. For example, a washroom may have been upgraded, including all washroom items including door opening size, but if there is not the required space adjacent to the door to accommodate operation of the door by persons with disabilities the washroom is not barrier-free accessible.

.5 An updated guide, “Design Aid for Barrier-Free Accessibility in Existing Buildings” is available to provide tips to the Designer to help avoid some problems that may arise when addressing Barrier-Free Accessibility in existing buildings. https://www.alberta.ca/assets/documents/tr/tr-barrierfree.pdf

8.2 References


.2 Barrier-free Design Guide 2017, prepared by the Barrier-free Design Advisory Committee of the Safety Codes Council and with the assistance of Alberta Municipal Affairs.
8.3 Level of Barrier-Free Accessibility

.1 The first step in developing a barrier-free accessibility upgrading project is to set the level of accessibility based on general objectives and funding available. Select a level for each of the three variables below:

Number of Floors

- Main Floor only
- Main Floor plus other floor(s)
- All Floors

Extent of Upgrade

- Public Areas Only
- Throughout

Standard of Upgrade

- To meet the National Building Code, Alberta Edition
- To meet the NBC:AE plus CSA Standard B651

.2 Thus the minimum level of accessibility upgrade, based on this classification system, is Main Floor/Public Areas Only, as indicated in the Alberta Building Code and the maximum level of upgrade is All Floors/Throughout/NBC:AE plus CSA-B651.

.3 Notwithstanding the foregoing, the level of barrier-free accessibility or portions thereof, shall be determined by the Province in consultation with the project stakeholders, on an individual project basis.
8.4 Design Requirements

.1 Use of Reference Documents

.1 Refer to Section 3.8 of the National Building Code, Alberta Edition (NBC:AE), which provides the minimum requirements for Barrier-Free Design. As all projects are unique, some may require minimal renovations to achieve the project’s and the NBC:AE barrier free requirements, while in other cases, extensive renovations may be necessary. These circumstances should be identified early in the pre-design/programming phase, so as to be appropriately defined in the scope of work.

.2 Refer to the “Barrier-Free Design Guide 2017” for graphic and written examples to illustrate code requirements and elements of good Barrier-Free Design. This is available on GoA intranet for project managers and at www.safetycodes.ab.ca for consultants to order.

.3 Refer to the CSA Standard B-651 for design assistance. Wherever possible, incorporate the requirements of this standard into the design, within the scope of work of the individual project.

.4 Where the NBC:AE and CSA Standard B-651 address the same issues, when practical, the more stringent recommendations should govern.

.2 Level of Accessibility

.1 Consult with Alberta’s Infrastructure to determine level of accessibility required for the project and in consultation with the project stakeholders and/or pre-design parameters.

.3 Code Analysis

.1 Perform a comprehensive building code analysis of the particular building including building occupancy, occupant load, fire resistance rating requirements, corridor and stair widths, exit requirements, and required number of water closets and lavatories based on occupant load. With this analysis, provide the particulars of the code pertaining to Barrier Free design and section 3.8 of the current NBC:AE, as these relate to the building to be renovated.

Note: the occupant load is based upon area available for people, not number of persons using the building. Optimally all concerns should be addressed.
.4 Design Development

.1 Ensure all the following issues are addressed in order, unless directed otherwise by the Province or as dictated by the project circumstances.

.1 Site Accessibility

.1 Consider barrier-free parking, complete with curb cuts/ramps, textile surfacing, exterior lighting, and signage.

.2 Building Access

.1 Building Entrance Accessibility: consider method of accessing the building entrance from the street, parking areas and walkways.
.2 Building Entrance: consider thresholds, powered door operators, location of controls, guard rails and required number of barrier-free entrances. Consider appropriateness of location, dignity and prominence of barrier free devices.
.3 Consider appropriateness of location, dignity and prominence of barrier free devices.

.3 Accessibility of Path of Travel within Main Level

.1 Access to Facilities: consider width of corridors and exits, differing elevations of floor levels, flooring requirements, door width and door location requirements, door hardware requirements.
.2 The project program can impact the BF requirements beyond code minimums. As an example, seniors housing should have wider than minimum BF required corridors to accommodate the higher use of mobility devices by seniors.

.4 Personal Facilities

.1 Hygienic Facilities: determine if existing washrooms can be modified or if it is more feasible to introduce new separate washrooms to meet barrier-free requirements. Then consider required sizes of facilities, building plumbing fixture requirements, washroom accessories and mounting heights.
.2 Personal Use Facilities: consider requirements for drinking fountains and service counters.
.3 Consider the value added function of a universal barrier free washroom that can serve as baby change room, and a trans-gender washroom.
.5 Accessibility to Other Levels

.1 Stairwells: consider stair width, landing sizes, stair surfaces and nosings, handrails and guardrails, and lighting.

.2 Areas of refuge: consider where and to what extent the areas of refuge are required. Often these are provided within stairwells, but not always. Coordinate the Barrier Free fire escape planning with the local fire chief or authority having jurisdiction.

.3 Chair Lifts: determine if chair lifts can be used to provide access to other levels while ensuring the required exit width is not minimized when chair lift is in operation.

.4 Platform Lifts: consider the travel distance limits and location. Generally, platform lifts are only acceptable for use within one floor level.

.5 Enclosed Platform Lifts: consider use restrictions, travel distance limits, requirements for shaft and machine room, and location.

.6 Elevators: consider size, travel distances and speed, suitability of various types, location, accessibility and design of controls.

.6 Accessibility of Path of Travel Within Other Levels

.1 Consider the requirements of Section 8.4.4.4 for each accessible floor to provide at least the same level of barrier-free accessibility provided on the first barrier-free level.

.7 Emergency Services: Emergency Lighting, Exit Signs, Fire Alarm, Area of Refuge

.8 Signage within the Barrier-Free Path of Travel

.1 Minimum NBC:AE Requirements: provide signage for barrier-free services and facilities provided.

.9 Building Security

.1 User Actuated Systems: consider mounting heights of actuation devices and requirements for audible and visual signals to indicate when door lock is released.

.2 Remote Actuated Systems: consider mounting heights of call devices and requirements for audible and visual signals to indicate when door lock is released.

End of Barrier-Free Section
## 9.0 Municipal and Environmental Engineering

### Section Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1 References</td>
<td>1</td>
</tr>
<tr>
<td>9.2 Site Selection</td>
<td>1</td>
</tr>
<tr>
<td>9.3 Site Plan</td>
<td>2</td>
</tr>
<tr>
<td>9.3.1 Survey Plan</td>
<td>2</td>
</tr>
<tr>
<td>9.3.2 Access</td>
<td>2</td>
</tr>
<tr>
<td>9.3.3 Signage</td>
<td>3</td>
</tr>
<tr>
<td>9.3.4 Roads, Walks and Parking</td>
<td>3</td>
</tr>
<tr>
<td>9.3.5 Grading</td>
<td>3</td>
</tr>
<tr>
<td>9.4 Site Servicing</td>
<td>4</td>
</tr>
<tr>
<td>9.4.1 General Requirements for Utilities</td>
<td>4</td>
</tr>
<tr>
<td>9.4.2 Stormwater Management System</td>
<td>4</td>
</tr>
<tr>
<td>9.4.3 Sanitary Sewer Services</td>
<td>5</td>
</tr>
<tr>
<td>9.4.4 Water Services</td>
<td>5</td>
</tr>
<tr>
<td>9.4.5 Cross Connections</td>
<td>5</td>
</tr>
<tr>
<td>9.5 Environmental Site Assessment</td>
<td>5</td>
</tr>
<tr>
<td>9.5.1 Investigation, Remediation, and Risk Management</td>
<td>5</td>
</tr>
<tr>
<td>9.5.2 Tanks for Petroleum Products</td>
<td>6</td>
</tr>
</tbody>
</table>
9.1 References


.2 Alberta Environment and Parks:

.1 Standards and Guidelines for Municipal Waterworks; Wastewater and Storm Drainage Systems.
.2 Stormwater Management Guidelines for the Province of Alberta
.3 Alberta Environmental Site Assessment Standards
.4 Alberta Soil and Groundwater Remediation Guidelines
.5 Alberta Exposure Control Guide
.6 Alberta Risk Management Plan Guide
.7 Contaminated Sites Policy Framework

.3 Alberta Fire Code, by the Alberta Fire Prevention Council.

.4 Local municipal standards, guidelines and bylaws

.5 Flood Risk management Guidelines, by Alberta Infrastructure (June 2017)


.7 Alberta Energy Regulator (AER) Guidelines

.8 Alberta Utilities Commission

.9 Guideline for Wildfire Protection of Institutional Buildings in Forested Regions, by Alberta Infrastructure (Appendix C)

9.2 Site Selection

.1 Site investigations on proposed sites are including the following:

.1 Land Status / Zoning requirements
.2 Services to the Site and Capacities
.3 Traffic Impact Assessment
.4 Geotechnical Studies
.5 Phase I Environmental Site Assessment
.6 Topographic Survey
.7 Floodplain Studies
.8 Archeological Sensitivity Assessment
.9 Digital Photographs
.10 Additional Information: Identify and significant features on and off site within 2 km that could affect the proposed development.

.2 Design elevation is above the design flood elevation for the proposed development as per the attached Table A in Appendix B (Exert from “Flood Risk Management Guidelines for Location of New Facilities Funded by Alberta Infrastructure”).

.3 Sites and development are located at an acceptable distance from high voltage power lines, sour gas wells or pipelines, and “High Pressure and Large Diameter/High Pressure Hydrocarbon Pipelines”.

.4 Sites and development are located at a minimum of 450 meters away from an operating landfill and a hazardous waste management facility, and a minimum of 300 meters away from a non-operating landfill.

9.3 Site Plan

.1 Survey Plan

.1 From the information on the site survey plan, items to be shown on the site plan in the contract documents, but not limited to:

.1 Legal description and address of the property, property lines and their legal dimensions, and legal pins,
.2 Adjacent trees, sidewalks, roadways, utilities, easements and how the new development will tie to them,
.3 Work of the contract and any work by other forces and contracts,
.4 Main floor elevations, and
.5 All utilities including power and telephone

.2 Access

.1 Locations of site access in consideration to driveways and intersections adjacent to and opposite the site.
.3 Signage

.1 Locations of all signs with due consideration to vehicular and pedestrian sightlines.

.4 Roads, Walks and Parking

.1 Driveways and off-site walks meet local municipal standards.

.2 Barrier free access walkways, entrances and parking spaces, along with appropriate surfaces do not restrict the mobility of physically challenged people.

.3 Parking lots and parking appurtenances are to facilitate snow removal and to prevent damage by snow moving equipment.

.4 A concrete pad is need for garbage bin and recycling bin, and locate bins for ease of access and safety.

.5 In order to address potential safety concern, efforts should be made to separate main vehicular traffic from main pedestrian traffic.

.6 Alberta Infrastructure (AI) might accept that asphalt mix design contains a maximum of 10% Reclaimed Asphalt Pavement (RAP) by weight. AI does not accept any asphalt mix design containing Recycled Asphalt Shingles (RAS).

.5 Grading

.1 Maintain minimum grade of 1% and maximum grade of 4% for concrete and asphalt surfaces in parking lots, and grade of 2% for graveled surfaces.

.2 Provide roadways with a 2% crown or crossfall and sidewalks with 2% crossfall.

.3 A positive sloped surface is to effectively drain water away from the foundation walls. Minimum grade requirements are:

.1 10% for 2 meters (Foundation with basement) – Minimum 20 cm drop for final grade on soft landscaping;

.2 5% for the first 2 meters (Slab-on-grade) – Minimum 10 cm drop for final grade on soft landscaping;

.3 1% for concrete, asphalt or other impervious surface treatment
.4 Drainage Swales: minimum swale slope requirements:

.1 1.5% for a grass drainage swale

.2 1% for a concrete drainage swale

.5 Address potential ponding and icing problems associated with downspouts. Provide splash pads under downspouts. The recommended minimum standard size for concrete splash pad is 30 cm X 107 cm.

.6 Design considerations for surface ponding:

.1 The maximum depth should not exceed 0.5 m. For school sites, the maximum depth should not exceed 0.3 m.

.2 Trap low should be a minimum of 0.3 m lower than foundation elevations.

.3 Ponding areas should be located a minimum of 4 m away from building foundations.

9.4 Site Servicing

.1 General Requirements for Utilities

.1 Dimensions of utilities to property lines or use a grid co-ordinate system.

.2 Adequate capacities to service proposed site.

.3 Any restrictions on stormwater discharge rates.

.4 The municipal water pressure available; an on-site boosting is required or not for a fire sprinkler system.

.5 On large sites, locate utilities in utility corridors keeping in mind any potential for future development.

.2 Stormwater Management System

.1 Stormwater Management System is designed in accordance with Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems and Local Municipal Standards, whichever set higher standards.
.2 Running the storm mains under buildings is not permitted.

.3 To prevent any potential freezing issues, catch basin manholes are not permitted on site, except that catch basin manholes are located at the end of pipes.

.3 Sanitary Sewer Services

.1 Sanitary Sewer system is designed in accordance with Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems and Local Municipal Standards, whichever set higher standards.

.4 Water Services

.1 Water systems comply with Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems and Local Municipal Standards, whichever set higher standards.

.2 Fire department connection and fire hydrants are in accordance with the Alberta Building Code and the Alberta Fire Code.

.5 Cross Connections

.1 Comply with Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems and Local Municipal Standards, whichever set higher standards.

9.5 Environmental Site Assessment

.1 Investigation, Remediation, and Risk Management

.1 Conduct all Environmental Site Assessments (ESAs) according to the Contaminated Sites Policy Framework.

.2 Phase I and II ESAs are to be conducted according to the Alberta Environmental Site Assessment Standard.

.3 If the Phase I ESA identifies any potential environmental concerns and it recommends further investigation, proceed with a Phase II ESA.
.4 Remediation is to be conducted according to the applicable Tier of the Alberta Soil and Groundwater Remediation Guidelines.

.5 In circumstances where remediation is not viable under present circumstances, and the site can be managed through administrative controls or exposure barriers, the exposure control approach can be used to manage the contaminated site.

.6 Risk Management Plan are to be developed in accordance with the Alberta Exposure Control Guide, and the Alberta Risk Management Plan Guide.

.2 Tanks for Petroleum Products

.1 Comply with the requirements of the Alberta Fire Code, Alberta Fire Prevention Council.

.2 Consider using day tanks for emergency generators.

End of Municipal and Environmental Engineering Section
10.0 Landscape Development

Section Contents

10.1 References ................................................................................................................................. 1
10.2 Landscape Development Guidelines .......................................................................................... 1
10.3 Physical Security Guidelines & Standards for Government of Alberta Facilities... 3
10.4 Irrigation Systems ....................................................................................................................... 3
10.5 Environmental and Conservation Considerations ................................................................. 4
10.1 References

.1 Alberta Yards and Gardens: What to Grow; Backyard Pest Management; Pruning in Alberta; by the Alberta Agriculture and Rural.

.2 Manual for Maintenance of Grounds, by Alberta Infrastructure.

.3 Local municipality landscape requirements.

10.2 Landscape Development Guidelines

.1 Landscape development includes municipal boulevards and easement areas.

.2 Provide a minimum 2% gradient away from buildings and other hard surfaces.

.3 Identify and preserve healthy suitable trees and other plants on site, where feasible. Where necessary, properly prune existing trees that remain using the services of a certified arborist. Adequately protect existing trees that remain including exposed roots to prevent damage during construction. Maintain existing grades to the drip lines of existing trees. Existing trees and other plants that are deemed dead, unhealthy, or unsuitable and which are considered hazardous to property and public safety can be removed complete with removal of the stump.

.4 Use a variety of hardy trees, shrubs and other plants in a cohesive landscape design layout that are tolerant of drought and other local growing conditions. Locate selected plant species to avoid overcrowding and to ensure plants reach their natural form at maturity. Avoid monoculture plantings when designing the plant layout. Emphasize species diversity in the landscape design.

.5 Provide a landscape design that respects and improves site visibility and security through selection and layout of plant material. Consider future plant maturity size of selected plants to avoid interfering with security camera sightlines or building lighting. Select plant species that do not hinder the natural surveillance from windows.

.6 Provide a landscape design that emphasizes ease of maintenance. Design with consideration as to whether the on-site owner has the means and resources to provide adequate and proper plant and turf care.
Selected plant species that are susceptible to pest infestations considered difficult to control or eliminate must not be installed. Avoid planting trees and shrubs that possess significant nuisance problems on site. Avoid specifying plants that are prone to branch and other structural failures.

Ensure good planting design features are incorporated into tree and shrub planting requirements to maintain a sustainable landscape. Provide tree planting pits with ample growing space and sufficient suitable growing media. For trees located in hard surfaces with metal grated coverings ensure that appropriate structured soil mixes, extended planting depths and proper drainage are provided to ensure healthy growing conditions. Construct continuous shrub beds with minimum 450 mm depth of acceptable soil mix.

Select appropriate plant species along parking structures, retaining walls and other wall structures that reduce opportunities for graffiti vandalism.

Specify a minimum 60 mm caliper for deciduous trees and a minimum 200 cm height for coniferous trees. Specify a minimum #2 container size for shrubs and a minimum #1 container size for perennials.

Keep all plantings clear of utilities, services, walkways and buildings.

Provide minimum 1.5 m setback from edge of parking curb to edge of planting beds and tree locations to allow for vehicle overhang and snow accumulation.

Provide adequate setback to ensure plants are not located where light standards, site signage, hydrants, utilities and other site features will be obscured from view.

Spread shredded coniferous bark mulch on all plant beds and tree pits to a minimum depth of 100 mm. Under building overhangs and along building foundations install appropriate and more durable mulch covering.

Spread nursery grown sod in vicinity of buildings, parking areas, and other areas of high pedestrian traffic where turf seed establishment would be difficult and subject to continuous damage. Where turf seed is required use appropriate custom seed mixtures to suit local soil conditions, water availability and maintenance requirements for site.

Landscape development projects require a minimum one year of maintenance/warranty services which commence from date of completion and approval of the landscape works. However, landscape projects larger in scope require an extended maintenance/warranty period of two years minimum. Consult with Owner to determine an appropriate maintenance/warranty period.
10.3 Physical Security Guidelines & Standards for Government of Alberta Facilities

.1 Review Section 12.0 Crime Prevention through Environmental Design (CPTED).

.2 Coordinate future mature size of trees and shrubs to not interfere with security camera sightlines and building lighting.

.3 Shrub and tree varieties should be chosen so that, at maturity, they do not hinder natural surveillance from windows.

.4 Landscaping at walls (parking structures, retaining walls, etc.) can be used to reduce graffiti.

.5 Thorny bushes and shrubs can be used to discourage access and hiding spots.

10.4 Irrigation Systems

.1 Where geotechnical information indicates the presence of highly plastic clay, avoid locating irrigation outlets close to buildings. Changes in moisture content in this type of clay results in volume changes and movement that can damage floors and foundations.

.2 Choose efficient irrigation systems. Minimize losses due to evaporation, wind and overspray onto non-landscaped areas. Incorporate rain sensors or soil moisture sensors.

.3 Contain the irrigation system and equipment, as reasonably feasible, within the property lines of the project.

.4 Provide pipe sleeves for irrigation systems under roadways and sidewalks. Design irrigation systems to allow for emptying water from distribution pipes.

.5 In municipalities where sewage treatment charges are based on water consumption, provide separate meter if cost efficient.

.6 Consult with user department before incorporating irrigation systems into the design for landscape areas.
10.5 Environmental and Conservation Considerations

.1 Design to minimize maintenance requirements. Consider cost efficiencies for irrigation, mowing, trimming, pruning, fertilizing, pesticide application and general clean up requirements.

.2 Use mulches to reduce maintenance and watering requirements for trees and shrubs.

.3 Choose native or adapted plants that are hardy, have low water demand, are reasonably free of pest infestations, and are compatible with the soil on site. Use low maintenance ground cover, including low maintenance grass mixes.

.4 Where some of the plants require irrigation, group the plants that have similar water demand.

.5 Promote infiltration of surface water, through the use of bioswales, rain gardens, and minimal slopes on land that is not adjacent to buildings.

.6 Design teams are encouraged to utilize alternative sources of water to potable water, such as harvested rainwater and treated wastewater.

.7 Use plant material to reduce heating and cooling requirements for buildings.

.8 Use plant material to control snow drifting.

End of Landscape Development Section
# 11. Environmental Hazards

## Section Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.1</td>
<td>Site Considerations – Hazardous Materials</td>
<td>1</td>
</tr>
<tr>
<td>11.2</td>
<td>Building Considerations- Hazardous Materials</td>
<td>1</td>
</tr>
<tr>
<td>11.3</td>
<td>Other Building Considerations</td>
<td>2</td>
</tr>
<tr>
<td>11.4</td>
<td>Radon Mitigation Rough-in Requirements</td>
<td>3</td>
</tr>
</tbody>
</table>
11.1 Site Considerations – Hazardous Materials

.1 Prior to acquiring a property, complete a Phase I Environmental Site Assessment (ESA), to determine if there have been any site historic activities that led to soil and/or groundwater contamination. Contact Site Services Section, Technical Services and Procurement, Government of Alberta, Ministry of Infrastructure. If the Phase I ESA indicates that there is a potential for contamination on site, a Phase II and/or a Phase III may be necessary.

.2 If the property contains buildings, refer to paragraph 11.2 - Building Considerations – Hazardous Materials below:

11.2 Building Considerations - Hazardous Materials

.1 For existing facilities a comprehensive hazardous building materials assessment is to occur whenever a building will be maintained, renovated, sold or demolished, and when suspect hazardous building materials are in poor condition (i.e. severely damaged, deteriorated or delaminated). The area of the assessment should reflect the project scope. The assessment is to be conducted by an Environmental Consultant experienced in the hazardous materials identified in this section including a competent understanding of the methodologies and procedures involved in inspecting and testing hazardous materials or by the Building Environment Unit Section, Technical Services and Procurement Branch, Ministry of Infrastructure, Government of Alberta

.2 A hazardous building materials assessment should include identification, recommendations, and order of magnitude removal budget cost estimate for the following:

.1 Asbestos-containing building materials (refer to Bulletin No. 20B, Alberta Infrastructure, Technical Resource Centre, Technical Bulletins https://www.alberta.ca/guidelines-and-standards-owned-and-supported.aspx that describes typical building materials that contain asbestos). The assessment is to include the verification and location of any vermiculite insulation in wall cavities or attic spaces and built-up roofing materials;

.2 Lead based paints/glazes, sheeting and miscellaneous lead-containing materials;

.3 Mercury-containing equipment and fixtures (fluorescent/mercury light bulbs);

.4 Ozone-depleting substances in equipment (CFC’s);

.5 Polychlorinated Biphenyl (PCB) containing equipment;

.6 Urea formaldehyde foam insulation (UFFI);
.7 Radioactive building components;
.8 Visible mould on building materials;
.9 Biohazards; and
.10 Building Use Chemicals.

.3 All identified hazardous building materials that will be, or has the potential to be, disturbed during maintenance or in a renovation/demolition must be completely removed. Hazardous materials removal/disposal is usually the first component of work in a renovation/demolition.

.4 When there is a concern whether an existing building material is asbestos, lead or mould-containing, it is to be considered potentially harmful, unless laboratory testing confirms the material to be non-asbestos, non-lead or non-mould. Consult with the BEU Section, Technical Services and Procurement for accredited laboratories specializing in hazardous materials analysis.

.5 For additional hazardous materials information refer to Division 02 – Existing Conditions, Technical Specifications, Infrastructure Technical Resources website, https://www.alberta.ca/facility-construction-sub-group.aspx

11.3 Other Building Considerations

.1 When selecting materials for a new building or an existing building renovation, no asbestos-containing materials are to be chosen or installed. Also, consider mould resistant products as they are becoming readily available.

.2 When selecting materials for a new building or an existing building renovation, avoid the potential for harmful chemical off-gassing wherever possible. Examples include materials or products such as carpeting, glues, paints, particleboard furniture, etc., that may contain formaldehyde or volatile organic compounds. These materials or products should be off-gassed off site, prior to installing them in the building. As well it is recommended that the Air Handling Units flush the area with 100% outdoor air post installation to reduce possible emissions from newly installed products.

.3 Construction dust control and clean-up procedures should be implemented to assure building occupants are not overexposed to dust. Controls would include dust barriers, negative air pressure within the construction area, and sealing/isolation of mechanical ventilation ductwork. Clean-up procedures would include HEPA vacuuming, wet wiping techniques and ductwork cleaning. It is also recommended to conduct a review of the Air Handling Units and associated ductwork.
11.4 Radon Mitigation Rough-in Requirements

.1 Consult with the Alberta Infrastructure Building Environment Unit Section, Technical Services and Procurement if in doubt.

.2 A radon mitigation “rough-in” system is required to be installed in new Government of Alberta owned or supported permanent buildings and it is a requirement of the Province as of February 2016. The 2019 National Building Code - Alberta Edition references this installation.

.3 The decision to install a radon rough-in mitigation system during construction is that, if not installed, costs would significantly increase should installation be necessary after radon air testing.

.4 The building design team is to retain a Certified Radon Mitigation Professional in good standing from the Canadian National Radon Proficiency Program (C-NRPP) to design the radon “rough-in” mitigation system. The radon mitigation system is to be designed for a possible future Active Sub-Slab Depressurization (ASD). The design is to follow the Province’s Radon Mitigation Rough-in Master Specifications: 31 21 13B or Radon Mitigation Rough-in System - Alternative Void Space Technology 31 21 13.03B. The radon mitigation rough-in system design is to be signed off by the Canadian National Radon Proficiency Program (C-NRPP) Certified Mitigation Professional obtained by the Consultant.

.5 The Province is open to proposed system design alternatives proposed by the Certified Radon Mitigation Professional, as there are conditions that could better support the alternative solution than the rough-in. The Infrastructure rough-in systems are to be considered the benchmark, with alternatives providing at least the equivalent performance or greater safety measures. The proposed alternatives may be applied in addition to the rough-in. When considering alternative solutions consider the overall cost of the solution. Alternative solutions include:

.1 Building Pressurization,
.2 Sealing Radon Entry Routes.

.6 All installation work is to be inspected, photographed, tested and signed off by the Certified Radon Mitigation Professional.
.7 After the radon “rough-in” system and building completion, the Building Owner is to retain a C-NRPP Certified Radon Measurement Professional conduct air testing to determine the radon levels in the building. Consult the BEU Section, Technical Services and Procurement Branch if in doubt.


.9 If radon air testing after building construction determines that average radon concentration exceeds the Health Canada guideline level of 200 Becquerel's per cubic metre (Bq/m³), radon mitigation is required. The “rough-in” system piping is to be extended to mechanically vent the radon gas to the outside of the building so that radon levels are controlled within the building using Active Sub-Slab Depressurization (ASD). Typically a suction fan is installed along the pipe for mechanical venting. The outside exhaust outlets are to be located to not allow the radon gas to re-enter the building.

.10 Active Sub-Slab Depressurization (ASD) is the most common and usually the most reliable radon reduction method according to Health Canada and the United States Environmental Protection Agency. The radon mitigation “rough-in” allows for this method to be used.

.11 Refer to Section 5.0 – Mechanical, paragraph 5.13.5 for additional information on radon gas exhaust.

End of Environmental Hazards Section
Crime Prevention through Environmental Design (CPTED) is a proactive design philosophy built around a core set of principles that is based on the belief that the proper design and effective use of the built environment can lead to a reduction in the fear and incidence of crime as well as an improvement in the quality of life. These principles of natural access control, natural surveillance, and territorial reinforcement; when applied early, can be integrated into any facility providing layers of protection for clients, visitors, and staff.

Government of Alberta facilities are to be designed with these principles in mind. For more information on how to apply these principles, refer to the following document:

“Physical Security Design Requirements for Government of Alberta Facilities”:
https://www.alberta.ca/assets/documents/tr/tr-securityguidelinesstandards.pdf
13.0 Digital Project Delivery

.1 General Digital Project Delivery Requirements

The intent of the Digital Project Delivery Requirements are to ensure that the Province receives contracted deliverables from Architects, Engineers and Contractors in a clear, concise and structured manner.

All projects where required by the contract shall comply with the Province’s Digital Project Delivery requirements.

Alberta Infrastructure’s Digital Project Delivery requirements are modular requirements and shall be included based on project size, complexity and type. Refer to the project contract for applicable Digital Project Delivery requirements.

.1 Specific Requirements for Government Facilities

All projects shall comply with Alberta Infrastructure’s Asset Information Requirements. Refer to Project contract for applicable Building Information Modelling Requirements.

.2 Specific Requirements for Health Care Facilities

Coordinate with Alberta Health Services and the Project Manager to determine the desired Digital Project Delivery requirements.

.3 Specific Requirements for Education Facilities

Coordinate with the School Board and Project Manager to determine the desired Digital Project Delivery requirements.

Descriptions of the various documents and their intended usage are listed below. The documents themselves are attached to the Technical Design Requirements as appendices.

.2 Document Descriptions

Digital Project Delivery – Asset Information Management – Consultant Requirements

○ These documents are for use by all design consultants contracted to the Province, on all forms of project delivery, excluding Design-Build, on all capital projects.
Digital Project Delivery-Asset Information Management-Contractor Requirements
  ○ These documents are for use by all contractors contracted to the Province, on all forms of project delivery, excluding Design-Build, on all capital projects.

Digital Project Delivery-Asset Information Management-Design Builder Requirements
  ○ These documents are for use by consultants and contractors contracted to the Province, on projects using the Design-Build form of project delivery, on all capital projects.

Digital Project Delivery-Building Information Modelling-Consultant Requirements
  ○ These documents are for use by all design consultants contracted to the Province, on all forms of project delivery, excluding Design-Build, on all capital projects.

Digital Project Delivery-Building Information Modelling-Design-Build Requirements
  ○ These documents are for use by consultants and contractors contracted to the Province, on projects using the Design-Build form of project delivery, on all capital projects.

Digital Project Delivery-COBie Requirements
  ○ These documents are for use by consultants and contractors contracted to the Province, on projects using all forms of project delivery, on all capital projects.

3 References

NBIMS-US V3 COBie Standard
## Appendix A – Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/h (also ACH)</td>
<td>air changes per hour</td>
</tr>
<tr>
<td>ADA</td>
<td>Americans with Disabilities Act</td>
</tr>
<tr>
<td>APEGA</td>
<td>Association of Professional Engineers, Geologists and Geophysicists of Alberta</td>
</tr>
<tr>
<td>ARCA</td>
<td>Alberta Roofing Contractors Association</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>CAC</td>
<td>ceiling attenuation class</td>
</tr>
<tr>
<td>CCU</td>
<td>central control unit</td>
</tr>
<tr>
<td>CFC</td>
<td>chlorinated fluorocarbon</td>
</tr>
<tr>
<td>CISC</td>
<td>Canadian Institute of Steel Construction</td>
</tr>
<tr>
<td>CMHC</td>
<td>Canada Mortgage and Housing Corporation</td>
</tr>
<tr>
<td>CSA</td>
<td>Canadian Standards Association</td>
</tr>
<tr>
<td>CSC</td>
<td>Construction Specifications Canada</td>
</tr>
<tr>
<td>CSTC</td>
<td>ceiling sound transmission class</td>
</tr>
<tr>
<td>DDC</td>
<td>distributed digital control</td>
</tr>
<tr>
<td>EMCS</td>
<td>energy management control system</td>
</tr>
<tr>
<td>HID</td>
<td>high intensity discharge</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>HVAC</td>
<td>heating, ventilating &amp; air conditioning</td>
</tr>
<tr>
<td>IEEE</td>
<td>Illumination, Electrical and Electronic Engineers</td>
</tr>
<tr>
<td>IES</td>
<td>see IESNA</td>
</tr>
<tr>
<td>IESNA</td>
<td>Illuminating Engineering Society of North America</td>
</tr>
<tr>
<td>ITR</td>
<td>Infrastructure Technical Resources website</td>
</tr>
<tr>
<td>LAN</td>
<td>local area network</td>
</tr>
<tr>
<td>LED</td>
<td>light emitting diode</td>
</tr>
<tr>
<td>MBM</td>
<td>modified bituminous membrane</td>
</tr>
<tr>
<td>MCC</td>
<td>motor control centre</td>
</tr>
<tr>
<td>NC</td>
<td>noise criteria</td>
</tr>
<tr>
<td>NRC</td>
<td>noise reduction coefficient (also National Research Council)</td>
</tr>
<tr>
<td>PERSIST</td>
<td>Pressure Equalized Rain Screen Insulated Structure Technique</td>
</tr>
<tr>
<td>RC</td>
<td>room criterion (acoustics)</td>
</tr>
<tr>
<td>RCU</td>
<td>remote control unit</td>
</tr>
<tr>
<td>RSI</td>
<td>thermal resistance in SI units</td>
</tr>
<tr>
<td>SI</td>
<td>Système Internationale (metric system)</td>
</tr>
<tr>
<td>SMACNA</td>
<td>Sheet Metal &amp; Air Conditioning Contractors National Association</td>
</tr>
<tr>
<td>STC</td>
<td>sound transmission class</td>
</tr>
<tr>
<td>TCU</td>
<td>terminal control unit</td>
</tr>
<tr>
<td>TDR</td>
<td>Technical Design Requirements for Alberta Infrastructure Facilities</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>ULC</td>
<td>Underwriters Laboratories of Canada</td>
</tr>
<tr>
<td>UPS</td>
<td>uninterruptible power supply</td>
</tr>
<tr>
<td>UV</td>
<td>ultraviolet</td>
</tr>
<tr>
<td>VAV</td>
<td>variable air volume</td>
</tr>
</tbody>
</table>

End of Appendix A
<table>
<thead>
<tr>
<th>CLASS</th>
<th>IMPORTANCE OF AVOIDING MAJOR DAMAGE DURING A FLOOD EMERGENCY</th>
<th>DESIGN FLOOD LEVEL</th>
<th>EXAMPLES OF FACILITIES</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Critical to the ability to save and avoid loss of human life.</td>
<td>1:1000</td>
<td>Legislative buildings</td>
<td>Including computing centres</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Communication centres</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Critical to the ability to rescue and treat the injured and to prevent secondary hazards.</td>
<td>1:1000</td>
<td>Hospitals and medical facilities</td>
<td>Including ancillary facilities such as power plants, service and maintenance facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Extended care facilities</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Critical urban linkages important to the maintenance of public order and welfare.</td>
<td>1:500</td>
<td>Courthouses</td>
<td>Serve as government centres for communication in event of emergency</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Provincial Buildings</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Critical to the ongoing housing of substantial populations.</td>
<td>1:500</td>
<td>Schools</td>
<td>Schools and post-secondary educational facilities may be required to serve as emergency relief centres</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Post-secondary educational facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Seniors Residences</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High-rise buildings</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Correctional facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rehabilitation treatment centres</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Critical to the orderly return to long term social and economic welfare.</td>
<td>1:500</td>
<td>Airports</td>
<td>Critical for access for supplies and support</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Important to the ability to avoid endangering human life and environment.</td>
<td>1:1000</td>
<td>Hazardous waste disposal and treatment facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High risk research facilities</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Important to retention of documented historical data and artifacts.</td>
<td>1:1000</td>
<td>Museums, archives, cultural centres</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Important to provide threshold level of protection.</td>
<td>1:100</td>
<td>Offices</td>
<td>Other than those associated with facilities in the higher Design Flood Level categories</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Retail facilities</td>
<td>See comments under Site Selection for short-term use facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Warehouse</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Service &amp; maintenance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Parking</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

* Water and Wastewater Facilities are not included in Table A. Contact Alberta Environment and Sustainable Resource Development for guidelines, related to the location of Water and Wastewater Facilities.

Alberta Infrastructure – December 2013
Appendix C – Guideline for Wildfire Protection of Institutional Buildings in Forested Regions of Alberta

March 2013

"Introduction

Wildfires are named as such for a reason; they are often uncontrollable. What is controllable is the preparation and planning taken to protect buildings from damage and loss when a wildfire occurs.”

This document is housed on the Infrastructure Technical Resources website:
https://www.alberta.ca/infrastructure-technical-resources.aspx

The document direct link:
https://www.alberta.ca/assets/documents/tr/tr-wildfireprotection.pdf
Appendix D – Standard Envelope Details
Insulation installed on exterior side of the membrane, extending higher than roof (min. 200mm).

Building paper installed to shed water while allowing the parapet construction to breathe.

Weep holes for ventilation.

Continuous 150mm x 150mm galvanized sheet metal backing for membrane at wall/roof junction.

Masonry tie with insulation support.

Strip of reinforcing membrane installed over expansion joints. Use of elastic slip sheet or bent sheet metal backing are alternative options.

Maximum 1500mm length parapet cap with exterior clips.

Internally reinforced peel and stick air seal membrane continues below parapet. Membrane must be compatible with roof vapour barrier and wall air barrier.

Plywood used at perimeter for durability during construction.

Leg of metal deck support angle turned down to not interfere with the plane of the air seal.

Supporting structure. Allow for structural deflection.

Air seal membrane on sheathing. Plane of air seal membrane should be exterior of the structure.
Insulation must be installed exterior of the roof membrane.

Mastic.

Internally reinforced peel and stick air seal membrane forms connection between wall air barrier membrane and roof base sheet stripping.

Wood used as a leveling surface for proper adhesion of the membrane.

Double Z-bar system for fastening wall cladding. Or, alternatively, use thermal clips.

Removable flashing and insulation for future re-roofing. Attached using hat channels or Z-bars.

Plywood used at perimeter for durability during construction.
Inverted roof / wall details used to protect roof construction if there is a failure at the tie-in between the roof and wall air seal membrane.

The removeable flashing configuration allows for re-roofing without compromising the air barrier or the through-wall flashing.

Plywood used at perimeter for durability during construction.

Termination bar outside with mastic

Plywood installed to provide a good adhesion substrate for the roofing membrane.

Insulation attached using a hat channel or z-bar fastened a minimum of 200mm above the roof membrane.
Masonry tie with insulation support.

Membrane flashed over shelf angle.

Through-wall flashing.

Weep holes for ventilation.

Continuous galvanized angle.

Insulation protection. Cement board or parging with galvanized mesh, mechanically fastened with z-bars to foundation.

Metal plate at the plane of the sheathing to maintain continuity of the air seal. Metal plate should extend 50mm on all sides of the knife plate for a proper tie-in of the air barrier membrane (see STANDARD ENVELOPE DETAILS - SERIES 02).

15 mil polyolefin sheet (vapour protection ground sheet and radon intrusion membrane)
Membrane flashed over shelf angle.

Through-wall flashing.

Knife plate installed to support steel angle while allowing air barrier membrane tie-in to the window frame.

Weep holes for ventilation.

Do not caulk flashing to cap.

Metal plate at the plane of the sheathing to maintain continuity of the air seal. Metal plate should extend 50 mm on all sides of the knife plate for a proper tie-in of the air barrier membrane (see STANDARD ENVELOPE DETAILS - SERIES 02).

Supporting structural member and knife plate.

Slip anchor at the head to allow for deflection.

Mechanically keyed-in gaskets installed both interior and exterior.

Drainage slots.

Line of sill flashing up-turn at ends (25mm) (behind jamb flashing)

Sloped sill flashing.

Fixed anchor at sill inside the vertical window member.

Membrane sealed directly to the tube face and mechanically fastened with an anti-rotation channel.

SERIES 01
STANDARD ENVELOPE DETAILS
PUNCHED WINDOW

TECHNICAL SERVICES BRANCH

DRAWN BY
E. RIVERA / M. WHITE
DATE
2016-10-04
CHECKED BY
V. SOLBAK
SCALE
1:5

5

TDR | Appendix D – Standard Envelope Details
The structure should be designed to minimize changes in plane of the exterior sheathing. Features such as overhangs, canopies, and parapets should be added on exterior of the air barrier.
Allow for structural deflection
Plywood strips used at perimeter locations for durability during the construction process (shown shaded)

Roof sheathing
Continuous 150mm x 150mm galvanized sheet metal backing for membrane at wall/roof junction.
Lapped downward (these laps are covered later).
For structural steel penetrations of the air barrier, a metal plate at the plane of the sheathing is used to maintain the continuity of the air seal. The metal plate should extend a minimum of 50mm on all sides of the gusset to allow for a proper tie-in of the air barrier membrane.

Exterior gypsum sheathing layer added.

Movement joints in the exterior sheathing.
An internally reinforced peel and stick air seal membrane used as a transition membrane from the roof air/vapour barrier to the wall air barrier. The membrane must be compatible with both the roof air/vapour barrier and the wall air barrier. The transition membrane must be installed not only at the roof level, but between the parapet construction and the wall as well.

Strip of reinforcing membrane installed over movement joints. Depending on the amount of expected deflection, a slip sheet or sheet metal backing are alternative options, or consider a higher performing material such as silicone transition strips that have better expansion characteristics.
Min. 200mm insulation must be installed exterior of the air barrier.
Roofing membrane lapped up the back of parapet

Building paper installed to shed water while allowing the parapet construction to breathe (as in Detail 1, Series 01).
Double layer of insulation, mechanically fastened.
Primary insulation cover board installed to protect roof insulation
It is preferred that the tie-in between the roof and the wall membrane be shingle lapped. Depending on construction schedule this may not occur. If a reverse lap is encountered, proper buttering and mechanical tying of the top edge of the roof membrane is recommended.

Supporting knife plate

Termination bar fastened at 300mm o.c. and sealed with mastic or approved sealant
Insulation attached using a hat channel or z-bar fastened a minimum of 200mm above the roof membrane.
Flashing installed to protect insulation. Bottom 300 mm designed to be removable without disruption to the rest of the wall cladding to allow for future re-roofing.
Supporting knife plate

Insulation installed tight to the air barrier and mechanically fastened in place.

Allow for structural deflection.
Steel shelf angle to support masonry veneer (not shown earlier for clarity of the details).

Maximum 1500mm length parapet cap with exterior clips.
Slip anchor installed into the vertical tube at the window head to allow differential movement from expansion and contraction of the various materials.

Portion of the screw spline removed to allow for membrane tie-in to the tube face of the section.

Butt joint between the horizontal and the vertical mullions should be sealed with butyl tape*.

Predrilled holes for screw attachment should be slightly offset from the shear block to ensure a tight joint between the two box sections.

(* Butyl tape is preferred over silicone sealant because silicone will set up over time and if the seal fails it will not re-seal. Butyl will remain tacky and will re-seal when the temperature of the frame is increased.)
Window frame tilted up into the rough opening and the slip anchor at the head is fastened into the structure. The frame is positioned so the tube face of the box curtain-wall section is in plane with the face of the exterior sheathing.

Flange on the slip anchor needs to extend far enough beyond the frame to allow for fastening into the head of the rough opening after the frame is set in place.
Metal plate at the plane of the sheathing used to maintain the continuity of the air seal. Metal plate should extend 50 mm on all side of the knife plate to allow for a proper tie-in of the air barrier membrane (see structural penetration details).

Shelf angle to support the masonry veneer.

Knife plate configured at an angle to provide room for the air barrier membrane tie-in to the window frame.
Neoprene corner plugs are installed to compartmentalize the glazing rabbet.

The installed length of the gaskets must be greater than the opening to accommodate shrinkage.

Knife plate.

The head membrane tie-in is installed and lapped over top of the jamb membrane tie-in.

Corner junctions of the gaskets should be sealed with sealant or heat welded.
Knife plate.

Aluminum anti-rotation channels installed to mechanically fasten the membrane tie-in to the tube face of the box section.
Insulating glass sealed unit installed into the window frame.
Flashings installed around the window opening to close off the cavity behind the cladding. This shown out of sequence for purposes of clarity. The flashing is usually installed after the cladding is in place.
Pressure plates installed to hold the flashing and insulating glass sealed unit in place.
Cover caps installed to complete the finished look of the window system.

Membrane flashing installed over the shelf angle to drain any water from the cavity out at the window head.

Insulation installed tight to the air barrier.
Completed installation.
Portion of the screw spline removed to allow for membrane tie-in to the tube face of the section.

Butt joint between the horizontal and the vertical mullions should be sealed with butyl tape*.

Predrilled holes for screw attachment should be slightly offset from the shear block to ensure a tight joint between the two box sections. Cap bead with butyl sealant.

(* Butyl tape is preferred over silicone sealant because silicone will set up over time and if the seal fails it will not re-seal. Butyl will remain tacky and will re-seal when the temperature of the frame is increased.)
Anchor fastened into the rough opening. The anchor is positioned so the tube face of the box curtain-wall section will be in plane with the face of exterior sheathing.
The deflection anchor will be raised and fastened into the rough opening after alignment of the frame. The top anchor is designed to sit in the tube and slide if any movement occurs.

The vertical tube of the preassembled frame is slipped over the anchor, shimmed, then fastened through the front of the tube face to the anchor.
Install the sill membrane tie-in first. If the wall air barrier is not installed before the window tie-in membrane, leave a 100mm flap of membrane unadhered so that the wall air barrier can be installed underneath in a shingle fashion.

The jamb membrane tie-in is installed and lapped over top of the sill membrane tie-in.

Neoprene corner plugs are installed to compartmentalize the glazing rabbet.
The installed length of the gaskets must be greater than the opening to accommodate shrinkage.

Corner junctions should be sealed with sealant or heat welded.

Aluminum anti-rotation channels installed to mechanically fasten the membrane tie-in to the tube face of the box section.
Air seal membrane stripped in over head flashing.

Bead of low expansion urethane foam used to deflect exterior moisture from penetrating into the rough opening.

Second bead of low expansion urethane foam used to complete the air seal between the air seal membrane and the window frame.

Heal bead to complete the air seal between the frame and the sealed unit.

Many options are available for flashings and brick moulds depending on window manufacturer. Flashing and brick moulds should be installed after installation of urethane foam. Preferred concealed fastener option shown.

Interior durable trim installed after installation of the urethane foam.

Drainage.

No exterior bead of urethane foam at sill to allow the rough opening to drain to the exterior.
Sheathing [secondary] membrane.

Bead of low expansion urethane foam used to complete the air seal between the air seal membrane and the window frame [all around].

Air seal membrane stripped in over head flashing.

Rain screen drainage plane.

Many options are available for flashings and brick moulds depending on window manufacturer. Flashing and brick moulds should be installed after installation of urethane foam. Preferred concealed fastener option shown.

Moisture protection membrane [compatible with air seal membrane].

Sheathing [secondary] membrane.
Sill membrane installed first.

If wall air seal membrane is not installed prior to window membrane, a flap of membrane at the sill should be left to allow for the wall membrane to be installed underneath creating a shingle lapped joint.

A small piece of membrane should be used in the corner at the transition between the sill and the jamb. Small pieces of membrane are easier to work with for detail work. It is important that the membrane be installed tight into the corner as this is the most critical location for water entry.

A small amount of mastic that is compatible with the membrane should be used in the corner where the membranes meet.

Jamb membrane installed after sill and transition strips.
Continue jamb air seal membrane to top in single piece, if possible, or shingle lapped if not practical to do in a single piece. Extend past top of opening as indicated.

A small piece of membrane should be used in the corner at the transition between the head and the jamb. Small pieces of membrane are easier to work with for detail work. It is important that the membrane be installed tight into the corner as this is the most critical location for water entry.

A small amount of mastic that is compatible with the membrane should be used in the corner where the membranes meet.

Head membrane installed last.
Membrane stripped in over flashing.

Weep holes for drainage

300mm removable flashing and insulation to allow for future re-roofing.

Termination bar to attach base membrane

Insulation attached using a cantilevered hat channel or z-bar fastened a minimum of 200mm above the roof membrane.

Plywood used at perimeter locations for durability during the construction process.

Knife plate to attach canopy roof framing.

[Refer to Detail 2, Series 06 for isometric details.]

The air barrier is continuous at the canopy connection. A steel plate in plane with the exterior sheathing welded to the knife plate forms part of the air barrier.
STEP 1

Sheathing board installed flush with steel plate.

Supporting steel structure.

Knife plate welded to supporting steel structure.

STEP 2

Steel plate sleeved over and welded to knife plate.

min. 50mm all around

STEP 3

Steel stud framing

Second layer of air barrier membrane laps over min. 50 mm

STEP 4

Air barrier membrane to u/s of knife plate

Alberta Infrastructure

STRUCT. PENETRATION DETAILS - SERIES 06
ISOMETRIC PLATE SEQUENCING DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER

2

DRAWN BY E. RIVERA DATE 2012-02-23

CHECKED BY V. SOLBAK DATE 2012-02-23

45 TDR | Appendix D – Standard Envelope Details
Min. 50 mm drip edge
[Note: Use flashing support to prevent shingle curling where flexible shingles used.]

Cold attic space vented to the exterior.

Plywood used at perimeter locations for durability during the construction process.

Continuous 150x150mm sheet metal backing for membrane at wall/roof junction.

Steel plate in plane with the exterior sheathing welded to knife plate forms part of the air barrier. [Refer Detail 2, Series 06 for isometric details].

Masonry tie.

Insulation support.
Clip angle used to minimize thermal bridging of the insulation. Clip spacing dependent on the structural requirements of the cladding system.
Second layer of z-bars should be installed perpendicular to the first layer. Orientation of the two layers will depend on the requirements of the cladding attachment system.

First layer of z-bars embedded in the insulation layer. Should the first layer be installed horizontally, the exterior leg should be turned down to promote drainage to the exterior.
Masonry tie.

Integral insulation retaining device.

Clip system used to minimize thermal bridging.
Water and air leakage problems. Most severe at expansion joints.

Insulated back pan.

Glass or metal spandrel.

Pressure plate.

Cover cap.

Expansion joint.

Fixed anchor.

Pre assembled frame.
Water and air leakage problems. Most severe at expansion joints.

Fixed anchor.

Factory assembled system.

Pressure plate (site).

Cover cap (site).

Expansion joint.
Insulate exterior of the air barrier membrane.

Air seal membrane supported by sheet metal. The sheet metal is installed in plane with, but does not overlap, the tube face of the curtainwall section, allowing for the air seal membrane to be sealed directly to the tube face of the curtainwall.

Even though the parapet is insulated the construction surfaces may reach the dew point temperature resulting in condensation. An air space between the parapet curb and the curtainwall may allow for some air movement to reduce cooling of the parapet.

THIS DETAIL SHOULD BE USED FOR LOW HUMIDITY BUILDINGS ONLY!
Depending on the height of the parapet the curtain wall may require to be tied back to the structure.

Insulate exterior of the air barrier membrane.

Sheet metal to minimize water from penetrating into the parapet construction and to contain insulation. This must be drained at the bottom through the curtainwall system.

Air seal continued below parapet construction and sealed to curtain wall frame.

Bend in sheet metal to allow for differential movement between structure and curtain wall.

Plywood used at perimeter locations for durability during the construction process.
Top of curtain wall at roof deck elevation.

Install sheet metal and air seal membrane from roof vapour barrier and seal to the front face of the tube section. Any membrane overlaps should occur at mid points between verticals.

Slip anchor installed over air seal membrane.

Install extra curtain wall framing to the height of the parapet.
Expansion joint. If large movements are expected within the system then a double mullion horizontal should be used.

Convectoer cabinet

Spandrel construction consists of cladding (glass, metal, or stone), and air space, and a back pan.

Firestop.

Retainer sheet to prevent the firestop insulation from dropping.

Minimum 50mm tolerance between the slab edge and the back of the curtainwall.
Ventilation providing air movement across the curtainwall to prevent cooling of the surfaces and condensation.

Anchor in the vertical tubes.

Drainage of the system.

Protection for the insulation.

SBS waterproofing membrane.

Grade sloped away from the building.
Insulation must be installed exterior of the membrane.
(min 200mm)

Building paper installed to shed water while allowing the parapet construction to dry to exterior.

An internally reinforced peel and stick air seal membrane continues below parapet construction. Membrane must be compatible with both roof vapour barrier and wall air barrier.

Deflection anchor at window head to accommodate movement.

Possible location of finished ceiling.
Spandrel panel with back-pan option, shown dotted-in.

Perimeter radiant heating option.

Fixed anchor at the sill. (inside vertical mullions)

Insulation installed exterior of the air seal membrane.

Membrane sealed directly to the structural tube face of the curtain wall section and mechanically fastened with an anti-rotation channel.

Tube face of curtain wall section in plane with the face of the slab edge to allow for a single plane of air seal membrane.

Deflection anchor at window head to accommodate movement. (inside vertical mullion)
Spandrel panel with back pan option, shown dotted-in.

Perimeter radiant heating option.

Membrane sealed directly to the structural tube face of the curtain wall section and mechanically fastened with an anti-rotation channel.

Fixed anchor at the sill. (inside vertical mullion)

Insulation protection. Cement board or parging with galvanized mesh, mechanically fastened with Z-Bars to foundation.
Mechanically keyed-in gaskets both interior and exterior.

Setting block designed to support the sealed unit without blocking the drainage from the system.

Purlin.

Rafter drainage gutter elevated off of the plane of water proofing and air seal and extended beyond the purlin to carry water beyond the joints of the system.

Sheet metal support for air seal membrane. Exterior surface of the sheet metal is aligned with the mutin to allow for a smooth transition for the air barrier membrane.

Anchorage system should provide sufficient adjustment in all directions to accommodate the tolerances of the structural steel.

Condensation gutter.

Structural steel support system

Mechanical induced air movement (required for higher humidity buildings).
Mechanically keyed-in gaskets both interior and exterior.

Setting block designed to support the sealed unit without blocking the drainage from the system.

Purlin.

Sheet metal is used along with aluminum angles to support the air seal membrane from the curtainwall glazing rabbet to the skylight sill purlin framing. The sheet metal should not interfere with the sealing of the membrane to the aluminum sections.

Flashing on membrane directs the majority of water to the exterior.

Anchorage system should provide sufficient adjustment in all directions to accommodate the tolerances of the structural steel.

Condensation gutter.

Structural steel support system
Vertical wall should be drained at the termination of the cladding. Sufficient access for skylight the tie-in will provide separation of trade scopes.

Sheet metal and supports are connected from the frame to the wall to provide a backing for the air barrier membrane. The air barrier must be sealed from the keyway of the purlin to the air seal of the wall to ensure continuity of the air barrier.

Depending on span, additional structural support may be required. Slip anchor used at the head to allow for movement of the system.

Rafter extended above purlin to facilitate tie-in and sealing. Rafter gutter must be plugged and sealed to ensure continuity of the air barrier.
Air seal membrane sealed directly to the key-way of the frame. Butt sheet metal up against the frame. Do not overlap sheet metal onto key-ways.

Insulation installed exterior of the air barrier.

Depending on span, additional structural support may be required. Slip anchor used at the ridge to allow for movement of the system.

End of rafter gutters need to be plugged and sealed to ensure the continuity of the air seal.

Fasten angle bracket into the tube of the purlin below the plane of drainage and air seal.
Sheet metal is used along with aluminum angles to support the air seal membrane from the curtainwall glazing rabbet to the skylight rafter framing. The sheet metal should not interfere with the sealing of the membrane to the aluminum sections.
Mechanically fastened overlap of the purlin on the rafter.

Butyl tape seal.

Drip edge created.

Rafter.

Purlin.

Condensation gutter.

Seal all penetrations through the condensation gutter.

Curb construction.
Angle used to support the sheet metal fastened into the tube section of the rafter.

Maximize the surface area of the face of the purin for adhesion of the air barrier membrane.

Sheet metal plug in the end of the aluminum tube section.

Sheet metal back up for air seal membrane.
Glazing can be installed and temporarily retained.

A small strip of air barrier membrane is used to seal at the location below the extended gutter of the rafter. The membrane is cut so that it can seal to the underside of the drainage gutter as well as to the vertical faces on either side of the extension.
Completion of the membrane seal.
Aluminum anti-rotation channel retains membrane to the gasket keyway.

Small block of insulation installed to hold the membrane to the underside of the drainage extension.

Strip of insulation left off to prevent ice build up at the outlet of the drainage extension.

Insulation installed to the exterior of the air barrier membrane.
Appendix E – Standard Millwork Detail
**DETAIL NOTES:**

- Construct to meet AWIDAC and NAHAS standards.
- Where applicable, barrier-free requirements must conform to the current version of the Alberta Building Code.
- Provide clear silicone sealant at backsplash and counter.
- Refer to specifications for pulls and hardware.
- Refer to finish schedule and specifications.
- Waste/recycle bins by general contractor. Refer to specifications.
- Alternate finishes may be considered in appropriate applications.
- For millwork panel edges (doors, gables, ends, shelves, drawer fronts, etc.) use solid 3.0mm colour matched PVC edging rather than plastic laminate or melamine edging. For durability - or use solid 3.0mm species matched wood edging with wood veneer faces.
DETAIL NOTES:

- Construct to meet AWMAC and NAAMAS standards.
- Where applicable, barrier-free requirements must conform to the current version of the Alberta Building Code.
- Provide clear silicone sealant at backsplash and counter.
- Refer to specifications for pulls and hardware.
- Refer to finish schedule and specifications.
- Alternate finishes may be considered in appropriate applications.

For Millwork panel edges (doors, gables, ends, shelves, drawer fronts, etc.), use solid 34mm colour matched PVC edging rather than plastic laminate or melamine edging. For durability, or use solid 34mm species matched wood edging with wood veneer faces.
**3 COUNTER WITH DISHWASHER**

Scale 1:7,5

**DETAIL NOTES:**

- Construct to meet AWMAC and NAAMSA standards.
- Where applicable, barriere-free requirements must conform to the current version of the Alberta Building Code.
- Provide clear silicone sealant at backsplash and counter.
- Refer to specifications for pulls and hardware.
- Refer to finish schedule and specifications.
- Alternate finishes may be considered in appropriate applications.
- For millwork panel edges (doors, gables, ends, shelves, drawer fronts, etc.) use solid 30mm colour matched PVC edging rather than plastic laminate or melamine edging. For durability, or use solid 30mm species matched wood edging with wood veneer faces.
DETAIL NOTES:

- Construct to meet AWMA and NAAWS standards.
- Where applicable, barrier-free requirements must conform to the current version of the Alberta Building Code.
- Provide clear silicone sealant at backsplash and counter.
- Refer to specifications for pulls and hardware.
- Refer to Finish Schedule and Specifications.
- Alternate finishes may be considered in appropriate applications.
- For millwork panel edges (doors, gables, ends, shelves, drawer fronts, etc.), use solid 24mm Colour Matched PVC edging rather than plastic laminate or melamine edging for durability, or use solid 24mm Species Matched Wood Edging with wood veneer faces.

COUNTER WITH SINGLE DRAWER
Scale 1:10

MILLWORK SECTION

<table>
<thead>
<tr>
<th>MILLWORK SECTION</th>
<th>INTERIOR DESIGN SECTION</th>
<th>DETAIL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAWN BY</td>
<td>DATE</td>
<td>CHECKED BY</td>
</tr>
<tr>
<td>LJ</td>
<td>2019-09-15</td>
<td>LJ</td>
</tr>
</tbody>
</table>

TDR Appendix E – Standard Millwork Details
DETAIL NOTES:

- Construct to meet AWMA and NAAWS Standards.
- Where applicable, barrier-free requirements must conform to the current version of the Alberta Building Code.
- Provide clear silicone sealant at backsplash and counter.
- Refer to specifications for pulls and hardware.
- Refer to finish schedule and specifications.
- Alternate finishes may be considered in appropriate applications.
- For millwork panel edges (doors, cabinets, doors, shelving, drawer fronts, etc.), use Solid 24mm colour-matched PVC edging rather than plastic laminate or melamine edging. For durability, or use solid 24mm species matched wood edging with wood veneer faces.
**DETAIL NOTES:**

- **CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.**
- **WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE ALBERTA BUILDING CODE.**
- **PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER,**
- **REFER TO SPECIFICATIONS FOR PULLS AND HARDWARE,**
- **REFER TO FINISH SCHEDULE AND SPECIFICATIONS,**
- **ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS,**
- **FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 24mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY OR USE SOLID 24mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.**

---

**MILLWORK SECTION**

<table>
<thead>
<tr>
<th>DRAWN BY</th>
<th>DATE</th>
<th>CHECKED BY</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LJ</td>
<td>2019-09-16</td>
<td>LJ</td>
<td>2019-09-16</td>
</tr>
</tbody>
</table>

---

**Alberta Infrastructure**

**TDR | Appendix E – Standard Millwork Details**
**DETAIL NOTES:**

- Construct to meet AWMAC and NAAMSA Standards.
- Where applicable, barrier-free requirements must conform to the current version of the Alberta Building Code.
- Provide clear silicone sealant at backsplash and counter.
- Refer to specifications for pulls and hardware.
- Refer to finish schedule and specifications.
- Alternate finishes may be considered in appropriate applications.
- For millwork panel edges (doors, gables, ends, shelves, drawer fronts, etc.) use solid 20mm colour matched PVC edging rather than plastic laminate or melamine edging, for durability or use solid 20mm species matched wood edging with wood veneer faces.
OVERHEAD CABINET

Scale: 1:50

PLASTIC LAMINATE TO ALL EXPOSED SURFACES, TYPICAL.

BLOCKING AND BACKING TO SUIT AWAMC STANDARDS

MELAMINE THROUGHOUT INTERIOR CABINET, TYPICAL.

ADJUSTABLE SHELVES MELAMINE FINISH w/ LINE SORED HOLES 5mm DIA. @ 32mm O.C. INCLUDE SHELF SUPPORT RINGS.

PLASTIC LAMINATE FINISH, TYPICAL.

**DETAIL NOTES:**

- CONSTRUCT TO MEET AWAMC AND NAAWS STANDARDS.
- REFER TO SPECIFICATIONS FOR PULLS AND HARDWARE.
- REFER TO FINISH SCHEDULE AND SPECIFICATIONS.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING.
  - FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.
OVERHEAD CABINET WITH GLASS

DETAIL NOTES:
- Construct to meet AWAC and NAAMAS Standards,
- Refer to specifications for pulls and hardware,
- Refer to finish schedule and specifications,
- Alternate finishes may be considered in appropriate applications,
- For millwork panel edges (doors, gables, ends, shelves, drawer fronts, etc.) use solid 24mm Colour Matched PVC edging rather than plastic laminate or melamine edging, for durability or use solid 24mm Species Matched Wood edging with wood veneer faces.
**DETAIL NOTES:**

- Construct to meet AWMAC and NAAMSA standards.
- Where applicable, barrier-free requirements must conform to the current version of the Alberta Building Code.
- Provide clear silicone sealant at backsplash and counter.
- Confirm microwave size with client.
- Refer to specifications for pulls and hardware.
- Refer to finish schedule and specifications.
- Alternate finishes may be considered in appropriate applications.
- For millwork panel edges (doors, gables, ends, shelves, drawer fronts, etc.) use solid 3x3mm colour matched PVC edging rather than plastic laminate or melamine edging, for durability or use solid 3x3mm species matched wood edging with wood veneer faces.
**DOUBLE MICROWAVE CABINET**

**Scale:** NJ, S

**MILLWORK SECTION**

- **DRAWN BY:** LJ  
  **DATE:** 2019-09-16

**INTERIOR DESIGN SECTION**

- **CHECKED BY:** LJ  
  **DATE:** 2019-09-16

**DETAIL NOTES:**

- Construct to meet AWMA and MANS Standards.
- Where applicable, barrier-free requirements must conform to the current version of the Alberta Building Code.
- Provide clear silicone sealant at backsplash and countertop.
- Confirm microwave size with client.
- Refer to specifications for pulls and hardware.
- Refer to finish schedule and specifications.
- Alternate finishes may be considered in appropriate applications.
- For millwork panel edges (doors, gables, ends, shelves, drawer fronts, etc.) use solid 3mm colour matched PVC edging rather than plastic laminate or melamine edging. For durability, use solid 3mm spruce matched wood edging with wood veneer faces.

---

**Alberta Infrastructure**

TDR | Appendix E – Standard Millwork Details
Appendix F – Standard Interior Partition Details
TYPICAL DEMOUNTABLE PARTITION

SCALE: 1:2

INTERIOR DETAILS

DRAWN BY E. GOZDZIK
DATE 2014-11-28
CHECKED BY A. FARHALL
DATE 2014-11-28
DEMOUNTABLE PARTITION C/W INSULATION

SCALE: 1:2

INTERIOR DETAILS

T- BAR CEILING
CEILING ASSEMBLY MINIMUM CAC 35
STAGGER T- BAR FASTENERS MINIMUM 1200 mm O.C., DO NOT DAMAGE T- BAR.
P.V.C. CEILING TRIM.
STEEL CEILING RUNNER.

12.5 mm VINYL FACED GYPSUM BOARD ON 64 mm STEEL STUDS AT 400 mm O.C.

R.S.I. 1.4 BATT INSULATION

100 mm P.V.C. CLIP-ON BASE

84 mm STEEL BASE TRACK

TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE. USE PARTITION SYSTEMS #5-2, NORSEAL V730, OR EQUAL.

FLOOR MATERIAL

BOTTOM PLATE FASTENED 1200 mm O.C.
T-Bar Ceiling

Two continuous strips closed cell foam tape. Use partition system #S-2, NorSeal V730, or equal.

DETAIL OF T-BAR AND CLIP CONNECTION

Scale: 1:1

INTERIOR DETAILS

DRAWN BY
E. GOZDZIK

DATE
2014-11-28

CHECKED BY
A. FARHALL

DATE
2014-11-28

INTERIOR DESIGN SECTION

B

DETAIL NUMBER
NOTE:
PROVIDE AIRTIGHT SEALS AROUND ALL MECHANICAL PENETRATIONS THROUGH ASSEMBLY. ALL JOINTS TO BE TAPE AND FILLED.

SILICONE CAULKING (CGSB-19.15-M87) TO EACH SIDE

2 LAYERS 16 mm TYPE X GYPSUM BOARD FASTENED TOGETHER AT TOP AND AT T-BAR

CEILING ASSEMBLY. ALL JOINTS WHERE CROSS-T S PENETRATE DRYWALL MUST BE SEALED WITH CAULKING

T-BAR FASTENERS MINIMUM 1200 mm O.C. DO NOT DAMAGE T-BAR

C2

U/S OF STRUCTURE

U-CHANNEL OR DOUBLE L-TRIMS FASTENED TO STRUCTURE, ALLOWING FOR DEFLECTION WHILE STILL MAINTAINING WALL STABILITY.

BATT INSULATION, PROVIDE A TIGHT SEAL

CEILING ASSEMBLY MINIMUM CAD 35

PVC CEILING TRIM

STEEL CEILING RUNNER

12.5 mm VINYL FACED GYPSUM BOARD ON 64 mm STEEL STUDS AT 400 mm O.C.

R.S.I. 1.4 BATT INSULATION

100 mm P.V.C. CLIP-ON BASE

64 mm STEEL BASE TRACK

TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE. USE PARTITION SYSTEMS #S-2, NORSEAL VT360, OR EQUAL.

FLOOR MATERIAL

BOTTOM PLATE FASTENED AT 1200 mm O.C.

C1 DEMOUNTABLE PARTITION C/W PLENUM SOUND BARRIER
SCALE: 1:2

Alberta Infrastructure

INTERIOR DETAILS

<table>
<thead>
<tr>
<th>DRAWN BY</th>
<th>DATE</th>
<th>CHECKED BY</th>
<th>DATE</th>
</tr>
</thead>
</table>

TDR | Appendix F – Standard Interior Partition Details
TWO CONTINUOUS STRIPS CLOSED CELL FOAM TAPE
USE PARTITION SYSTEM #S-2, NORSEAL V730, OR EQUAL.

DETAIL OF T-BAR AND CLIP CONNECTION
SCALE: 1:1
NOTE:
PARTITION TYPE SHALL NOT BE USED WHERE CONFIDENTIAL SPEECH PRIVACY BETWEEN ROOMS IS REQUIRED.

12.7 mm VINYL FACED G.W.B.
84 mm STEEL TRACK
WOOD BLOCKING
9 mm x 38 mm WOOD CASING
19 mm x 90 mm WOOD FRAME
19 mm x 19 mm WOOD GLAZING STOP
6 mm CLEAR TEMPERED GLASS SET ON NEOPRENE BLOCKS AT 1/4 POINTS MINIMUM 6 mm THICK
BLACK CLOSED CELL NEOPRENE FOAM TAPE TYPICAL
SILICONE CAULKING (CGSB-19.3-M87) C/W ETHAFOAM ROD
INVERTED 84 mm STEEL TRACK
100 mm RUBBER BASE
12.5 mm PLYWOOD BLOCKING @ 1200 mm O.C.
FRICITION FIT BATT INSULATION TO STUD CAVITY
FLOORING MATERIAL
PROVIDE TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE. USE PARTITION SYSTEM #5-2, NORSEAL V730, OR EQUAL
BOTTOM PLATE FASTENED @ 1200 mm O.C.

INSULATED GYPSUM WALL BOARD PARTITION C/W SINGLE GLAZING

SCALE: 1:2

Alberta Infrastructure

INTERIOR DETAILS

DRAWN BY
E. GOZDZIK
DATE
2014-11-28

INTERIOR DESIGN SECTION

CHECKED BY
A. FARHALL
DATE
2014-11-28
DOOR & SIDELIGHT C/W WOOD FRAMES
SCALE: 1:50

DOOR & SIDELIGHT C/W DEMOUNTABLE PARTITION FRAME
SCALE: 1:50

GLAZING C/W DEMOUNTABLE PARTITION FRAME
SCALE: 1:50

NOTE: OPTIONAL ELEVATION FOR GLAZING WITHIN TYPE D OR E

TDR | Appendix F – Standard Interior Partition Details
NOTE:
NOT TO BE USED WITHIN WALLS THAT DIVIDE ROOMS REQUIRING CONFIDENTIAL SPEECH PRIVACY

T-BAR CEILING
CEILING ASSEMBLY MINIMUM CAC 35
STAGGER T-BAR FASTENERS MINIMUM 1200 mm. DO NOT DAMAGE T-BAR.
P.V.C. CEILING TRIM
STEEL CEILING RUNNER
12.5 mm VINYL FACED GYPSUM BOARD ON 64 mm STEEL STUDS AT 400 mm O.C.
64 mm STEEL TRACK
P.V.C. COVER
ANODIZED ALUMINIUM FRAME SECTION
GLASS STOP
CLEAR TEMPERED GLASS
GLAZING BEAD
ANODIZED ALUMINIUM FRAME INSERT
INVERTED 64 mm STEEL TRACK
100 mm P.V.C. CLIP-ON BASE
12.5 mm PLYWOOD BLOCKING 1200 mm O.C.
TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE. USE PARTITION SYSTEMS #5-2, NORSEAL V730, OR EQUAL.
FLOOR MATERIAL
BOTTOM PLATE FASTENED 1200 mm O.C.

E1
DEMOUNTABLE PARTITION C/W SINGLE GLAZING
SCALE: 1:2

Alberta Infrastructure

INTERIOR DETAILS

<table>
<thead>
<tr>
<th>DRAWN BY</th>
<th>DATE</th>
<th>CHECKED BY</th>
<th>DATE</th>
</tr>
</thead>
</table>

TDR | Appendix F – Standard Interior Partition Details
TWO CONTINUOUS STRIPS
CLOSED CELL FOAM TAPE
USE PARTITION SYSTEM #S-2,
NORSEAL V730, OR EQUAL.

DETAIL OF T-BAR AND CLIP CONNECTION
SCALE: 1:1
CEILING ASSEMBLY MINIMUM
CAC 35

STAGGER T-BAR'S FASTENERS
@ MINIMUM 1200 mm O.C.
DO NOT DAMAGE T-BAR

P.V.C. CEILING TRIM

PROVIDE TWO CONTINUOUS
STRIPS OF CLOSED CELL
FOAM TAPE

12.5 mm GYPSUM BOARD BOTH
SIDES ON 84 mm STEEL STUDS
(CEILING & BASE) AT 400 mm O.C.,
TAPE, FILLED, SAND AND MADE
READY TO ACCEPT FINISH

FLOOR SLAB

FLOOR FINISH

100 mm RUBBER BASE

PROVIDE TWO CONTINUOUS
STRIPS OF CLOSED CELL
FOAM TAPE

BOTTOM PLATE FASTENED
@ 1200 mm O.C.
CEILING ASSEMBLY MINIMUM CAC 35

STAGGER T-BARS FASTENERS @ MINIMUM 1200 mm O.C.
DO NOT DAMAGE T-BAR

P.V.C. CEILING TRIM

PROVIDE TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE

12.5 mm GYPSUM BOARD BOTH SIDES ON 64 mm STEEL STUDS (CEILING & BASE) AT 400 mm O.C., TAPED, FILLED, SANDED AND MADE READY TO ACCEPT FINISH

100 mm RUBBER BASE

FLOOR FINISH

FLOOR SLAB

PROVIDE TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE

BOTTOM PLATE FASTENED @ 1200 mm O.C.

GYPSUM BOARD PARTITION C/W INSULATION
SCALE: 1:2
G2 DETAIL OF T-BAR AND CLIP CONNECTION
SCALE: 1:1

PROVIDE TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE

T-BAR CEILING
NOTE:
PROVIDE AIR TIGHT SEALS AROUND ALL PIPING AND OTHER MECHANICAL PENETRATIONS THROUGH WALL CEILING ASSEMBLY

NOTE:
CONSULTANT IS RESPONSIBLE FOR DETAILING FIRE RATED PARTITION AS APPLICABLE UNDER CODE.

FIRE RATED PARTITION
SCALE: 1:2

INTERIOR DETAILS

<table>
<thead>
<tr>
<th>DRAWN BY</th>
<th>DATE</th>
<th>CHECKED BY</th>
<th>DATE</th>
</tr>
</thead>
</table>
NOTE:
PROVIDE AIR TIGHT SEALS AROUND ALL PIPING AND OTHER MECHANICAL PENETRATIONS THROUGH WALL CEILING ASSEMBLY.

U/S OF STRUCTURE

SILICONE CAULKING (CGSB-19-GP-9M) AND ETHAFOAM ROD

DO NOT FASTEN TOP PLATE TO GYPSUM BOARD

12.5 mm GYPSUM BOARD ON 64 mm STEEL STUDS AT 400 mm O.C., TAPED, FILLED Sanded AND MADE READY TO ACCEPT FINISH

WALL ANGLE

CEILING ASSEMBLY MINIMUM CAC 35

R.S.I. 1.4 BATT INSULATION.

100 mm RUBBER BASE

64 mm STEEL BASE TRACK

FLOOR MATERIAL

TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE, USE PARTITION SYSTEMS #6-2, NORTSEAL V730, OR EQUAL.

BOTTOM PLATE FASTENED 1200 mm O.C.

GYPSUM BOARD PARTITION TO U/S OF DECK

SCALE: 1:2

INTERIOR DETAILS

INTERIOR DESIGN SECTION

DETAIL NUMBER

1

DRAWN BY
E. GOZDZIK
DATE
2014-11-28
CHECKED BY
A. FARHALL
DATE
2014-11-28
NOTE:
REFER TO "TECHNICAL CRITERIA" DOCUMENT FOR HIGHER LEVELS OF SECURITY NEEDS.

CEILING ASSEMBLY

19 mm PLYWOOD

9 GAUGE 100 mm WIRE MESH

13 mm GYPSUM BOARD ON 92 mm STEEL STUDS @ 400 mm O.C. TAPED, FILLED, SANDED AND MADE READY TO ACCEPT FINISH

19 mm PLYWOOD APPLIED TO BOTH SIDES OF STUDS

100 mm RUBBER BASE

FLOOR MATERIAL

BOTTOM PLATE FASTENED @ 1200 mm O.C.

GYPSUM BOARD/PLYWOOD PARTITION AND CEILING - SECURE STORAGE

SCALE: 1:2

INTERIOR DETAILS

INTERIOR DESIGN SECTION

DETAIL NUMBER

DRAWN BY E. GOZDZIK DATE 2014-11-28

CHECKED BY A. FARHALL DATE 2014-11-28

TDR | Appendix F – Standard Interior Partition Details
NOTE:
PREFINISH WOOD BLOCKING IN ORDER TO PREVENT LEACHING OF THE CAULKING INTO ADJACENT MATERIALS.

THERAPY SIDE - 6 mm ONE WAY LAMINATED GLASS MIRROR
AND
OBSERVATION SIDE - 6 mm CLEAR TEMPERED GLASS. REFER TO PARTITION SECTION FOR REPLACEMENT GLASS SET ON NEOPRENE SETTING BLOCKS AT 1/4 POINTS MINIMUM 6 mm THICK.

25 mm HIGH WOOD BLOCKING

16 mm X 56 mm WOOD CASING

SILICONE CAULKING IN THE CAVITY AROUND THE PERIMETER OF THE GLASS

SILICONE CAULKING (CGSB-18.13-M87) AND ETHAFOAM ROD

RESILIENT FURRING CHANNEL PLACED ALONG THE PERIMETER OF THE ROUGH OPENING

WOOD BLOCKING PAINTED BLACK (25 mm HIGH)

25 mm BLACK (NEOPRENE) COATED GLASS FIBRE DUCT INSULATION (BLACK COATING FACING UPWARDS) OR BLACK OPEN-CELL FOAM. ADHERE TO FRAME.

K2
GLAZING DETAIL - THERAPY/OBSERVATION ROOM
SCALE: 1:1

Alberta Infrastructure

INTERIOR DETAILS

DRAWN BY: E. GOZDZIK
DATE: 2014-11-28

INTERIOR DESIGN SECTION

CHECKED BY: A. FARHALL
DATE: 2014-11-28
1 mm HIGH PRESSURE PLASTIC LAMINATE ON 19 mm PLYWOOD C/W PLASTIC LAMINATE EDGES.

38 mm x 38 mm WOOD SUPPORTS FULL LENGTH OF TOP AND HEIGHT OF SUPPORTS

ISOMETRIC

3 mm PVC COLOR MATCHING EDGE - ALL EDGES

279 mm
760 mm AFF

SECTION OF COUNTER IN DROP POSITION

PARTITION WALL (DETAIL K or N).

HINGE SUPPORT 1 mm PLASTIC LAMINATE ON 19 mm PLYWOOD C/W PLASTIC LAMINATE EDGES.

PIANO HINGE

DROP DOWN COUNTER (OBSERVATION ROOM ONLY)

SCALE: NTS

DRAWWN BY: E. GOZDZIK
DATE: 2014-11-28
CHECKED BY: A. FARHALL
DATE: 2014-11-28

TDR | Appendix F – Standard Interior Partition Details
CONDUIT & ELECTRICAL REQUIREMENTS
FOR AUDIO SYSTEM (OBSERVATION/ THERAPY ROOM)

SCALE: NTS

INTERIOR DETAILS

INTERIOR DESIGN SECTION

DETAIL NUMBER

M

19

TDR | Appendix F – Standard Interior Partition Details
TpD F – Standard Interior Partition Details

**Gypsum Board Partition, Full Height (Therapy/Observation Room)**

- **Scale**: 1:2

**Materials and Details**

- **12.5 mm Gypsum Board on Resilient Channels @ 400 mm O.C.**
- **60 mm Clear Tempered Glass**
- **100 mm Rubber Base**
- **60 mm One Way Laminated Glass Mirror, Site Applied with Mirror Side to Therapy Room**
- **25 mm High Wood Blocking**
- **25 mm Black Neoprene Coated Glass Fibre or Black Open Cell Foam**
- **1-Layer of 16 mm and 1-Layer of 12.5 mm Gypsum Board on 152 mm Steel Studs @ 400 mm O.C. Insulated with R.S.I. 3.5 Batt Insulation**
- **Two Continuous Strips of Closed Cell Foam Tape, Use Partition Systems #2-2, NorSeal V730, or Equal**
- **Floor Material**
- **Bottom Plate Fastened @ 1200 mm O.C.**

**NOTE:**
Provide air tight seals around all piping and other mechanical penetrations through wall-ceiling assembly.

**Technical Drawings and Specifications**

- **Drawn by**: E. Gozdzik
- **Date**: 2014-11-28
- **Checked by**: A. Farhall
- **Date**: 2014-11-28

**Alberta Infrastructure**
NOTE:
PROVIDE AIRTIGHT SEALS AROUND ALL MECHANICAL PENETRATIONS THROUGH ASSEMBLY. ALL JOINTS TO BE TAPE AND FILLED.

SILICONE CAULKING
(CGSS-18.15-M87) TO EACH SIDE

2 LAYERS 16 mm TYPE X GYPSUM BOARD FASTENED TOGETHER AT TOP AND AT T-BAR

CEILING ASSEMBLY, ALL JOINTS WHERE CROSS-T'S PENETRATE DRYWALL MUST BE SEALED WITH CAULKING

ETHAFOAM ROD BACKER AND CAULKING

R.S.I. 1.4 BATT INSULATION

1-LAYER OF 12.5 mm AND 1-LAYER OF 16 mm GYPSUM BOARD ON METAL RESILIENT CHANNELS @ 800 mm O.C. TAPED, FILLED, Sanded AND MADE READY TO ACCEPT FINISH

ETHAFOAM ROD BACKER AND CAULKING

RUBBER BASE

FLOOR MATERIAL

BOTTOM PLATE FASTENED AT 1200 mm O.C.

TWO CONTINUOUS STRIPS OF CLOSED CELL FOAM TAPE, USE PARTITION SYSTEMS #3-2 NORSEAL V730, OR EQUAL

GYPSUM BOARD PARTITION
C/W PLENUM SOUND BARRIER - SERVER ROOM

SCALE: 1:2

INTERIOR DETAILS

DRAWN BY E. GOZDZIK
DATE 2014-11-28

CHECKED BY A. FARHALL
DATE 2014-11-28

INTERIOR DESIGN SECTION

DETAIL NUMBER
Note: Sound seals to be mitred where horizontal and vertical members meet.

Caulk joint between door stop and sound seal with silicone caulking (CGSB-19-GP-9M).

Anodized aluminum door seal.

Head/jamb sound seal detail: sound seal shall be Reese 599.

Automatic door bottom details: door bottoms shall be either PEMKO 430, REESE 521, or REESE 330.

NOTE: Use knob where a minimum 127 mm backset can be specified. Use a lever handle where backset is less than 127 mm.

Door elevation:
- Distance from corner to first adjustment screw (typical for horizontal and vertical sound stops)
- Sound stops to be mitred and the joint caulked
- Lever handle
- Anodized aluminum door bottom
- Closed-cell sponge neoprene gasket
- Low profile threshold, PEMKO 161, or REESE 263

Surface mounted door bottom seal:
- Max. 75mm

Steel door frame.
Solid core door.
Closed-cell sponge neoprene gasket.

Sound - rated door seals:
Scale: NTS
Appendix G – Green Building Standards
Appendix G – Green Building Standards

Section Contents

Overview............................................................................................................................................. 1
Green Building Standards Deliverables Checklist .............................................................................. 2

How to Use This Document.............................................................................................................. 2
Integrated Design.............................................................................................................................. 2
Deeper Greening Analysis ................................................................................................................ 3
Life Cycle Costing ............................................................................................................................ 3
Energy Modeling ............................................................................................................................... 3
LEED v4 Requirements ..................................................................................................................... 3
Close-Out Documentation/O&M Readiness ...................................................................................... 4

Tier 1 – New Buildings, Major Building Additions and Major Renovations ..................................... 5
T1.1 Integrated Design...................................................................................................................... 5
Deeper Greening Analysis ................................................................................................................ 5
Net Zero Assessment: .................................................................................................................... 5
Alternative Certification Paths .......................................................................................................... 5
Building Life-Cycle Impact Reduction ............................................................................................ 6
Life Cycle Costing ........................................................................................................................... 6
Energy Modeling .............................................................................................................................. 6

T1.2 LEED Certification ................................................................................................................... 7
Mandatory Credits............................................................................................................................ 7
Recommended Credits .................................................................................................................. 8

T1.3 Close-out Documentation and O&M Readiness ..................................................................... 9

Tier 2 – Renovations, Building Additions, and Interior Fit-outs ...................................................... 10
T2.1 Integrated Design..................................................................................................................... 10
Deeper Greening Analysis ................................................................................................................ 10
Life Cycle Costing ........................................................................................................................... 10

T2.2 LEED Certification .................................................................................................................. 11
Mandatory Credits........................................................................................................................... 12
Recommended Credits .................................................................................................................. 13

T2.3 Close-out Documentation and O&M Readiness ................................................................... 13
Tier 3 – Limited Scope System Upgrades with Energy and GHG Impact..................15

T3.1 Integrated Design.................................................................................................15
  Deeper Greening Analysis..........................................................................................15
  Life Cycle Costing....................................................................................................15

T3.2 LEED Certification ...............................................................................................15
  Mandatory Credits....................................................................................................16
  Recommended Credits...............................................................................................16

T3.3 Close-out Documentation and O&M Readiness ....................................................17

Tier 4 – Limited Scope with No or Limited Energy/ GHG Impact.........................18

T4.1 Integrated Design.................................................................................................18
  Deeper Greening Analysis..........................................................................................18

T4.2 LEED Certification ...............................................................................................18
  Recommended Credits...............................................................................................19

T4.3 Close-out Documentation and O&M Readiness ....................................................19

References ....................................................................................................................20

Deliverables Checklists and Spreadsheet Tools .........................................................21

Related Documents:
Green Building Standards Deliverables Checklist: https://www.alberta.ca/assets/documents/tr/tr-appendix-checklist.xlsx
Overview

The Technical Design Requirements for Alberta Infrastructure Facilities (TDR), Appendix G – Green Building Standards (GBS) apply to all capital projects and should be included in all Requests for Proposals issued for new projects and referenced in contracts for design consultants and construction managers. These standards are intended to assist in establishing Alberta Infrastructure as an internationally recognized leader in green building and are an essential component of the Province’s commitment to sustainability through the Climate Leadership Plan¹.

The GBS identify a minimum level of design and process requirements for all new construction and renovation projects, while providing enough flexibility for individual project teams to meet project goals. The GBS also include recommendations that project teams should attempt to achieve. Sustainability requirements and recommendations are organized within four categories of project types, called Tiers in this document. Infrastructure’s four project Tiers are described below.

| Tier 1: New Buildings, Major Building Additions, and Major Renovations (> or = $5 Million) | New Buildings, Major Building Additions and Major Renovations with energy and GHG impacts, including Building Envelope, Mechanical and Electrical Systems, and Occupant Density. |
| Tier 2: Renovations, Minor Building Additions, and Interior Fit-outs (>=$1million) | Partial Building Renovations and Building Additions with one or more Mechanical and Electrical System or Building Envelope within the project scope, as well as Interior Fit-Outs. |
| Tier 3: Limited Scope System Upgrades with an Energy and GHG Impact (<$1million) | Limited Scope Projects with Energy impact but are focused on those systems such as controls, AHU replacement, lighting replacement, etc. |
| Tier 4: Limited Scope with No or Limited Energy/GHG Impact | Limited Scope Projects with no or Limited Energy and GHG Impacts such as a Landscape project or a project that only renovates finishes and furnishings. |

¹ [https://www.alberta.ca/climate-leadership-plan.aspx](https://www.alberta.ca/climate-leadership-plan.aspx)
The GBS were developed by Technical Services and Procurement Branch (TSPB) by consolidating best practices information, from the position of knowledgeable owner, as well as by adapting portions of Harvard University’s Green Building Standards (Harvard University, 2016) – [used with permission]. They are based on components and systems that have proven to be reliable and efficient, to meet the needs of users, and to have acceptable life cycle costs. They build upon the TDR and will be formally updated periodically as required.

For additional resources regarding projects with unique requirements or projects that do not fall into the Tiers as defined above, contact the TSPB (780-422-7456).

Green Building Standards Deliverables Checklist

All projects are required to submit documentation to support adherence to the GBS at the following milestones:

- Schematic Design
- Design Development
- Contract Documents (approx. 75%)

The Green Building Standards Deliverables Checklist\(^2\) is a spreadsheet tool to assist project teams in milestone tracking throughout the project phases.

How to Use This Document

In the pages to follow, each Tier is broken down into subsections. These subsections are ordered according to the sequence in which they occur within project development. Integrated Design for example, occurs before Close-Out Documentation/O&M Readiness. The below sections briefly describe each subsection.

Integrated Design

In order to help project teams in the vetting and setting of sustainability goals and objectives, Infrastructure has identified different levels of formal integrated design requirements for projects depending on their scope of work/Tier.

\(^2\) [https://www.alberta.ca/assets/documents/tr/tr-appendix-checklist.xlsx](https://www.alberta.ca/assets/documents/tr/tr-appendix-checklist.xlsx)
Deeper Greening Analysis

Deeper Greening Analysis is the exploration of sustainability initiatives beyond LEED v4 Silver certification and the TDR. Its intent is to describe the stretch goals that further reduce energy use, material consumption, and greenhouse gas/carbon production.

There are numerous “net-zero” design goals such as those defined by ASHRAE and the National Renewable Energy Laboratory (NREL):

- Net-Zero Ready: 50% less energy use relative to ASHRAE Standard 90.1-2010 baseline (Pless, 2014).
- Net Zero Carbon (Energy Emissions): Produces at least as much emissions-free renewable energy as it uses from emissions-producing energy sources (Crawley, 2009).
- Net Zero (Site) Energy: Produces as much energy as it uses in a year (Crawley, 2009).

It is recommended that projects pursue certification through a governing body, such as the CaGBC or the International Living Future Institute (ILFI). Note that the ILFI certifications require 1 year of operating data for compliance, which requires commitment during operations from the client/stakeholder group.

Life Cycle Costing

In order to assist project teams with assessing the total cost of ownership impacts that decisions have throughout the course of design, Infrastructure has identified various levels of Life Cycle Cost (LCC) analysis for projects depending on their scope of work. Responsible LCC includes an analysis of (any) utility rebates, grants, stimulus funding, or other alternative funding sources. It is best practice to include building operations staff in all LCC and value engineering review.

Energy Modeling

In order to assist project teams in creating energy efficient designs that yield reduced or zero greenhouse gas (GHG) emissions, Alberta Infrastructure has identified requirements in the Enhanced Energy credit that must be achieved through Option 1, depending on their scope of work.

LEED v4 Requirements

Infrastructure requires projects to achieve prescriptive levels of environmental performance according to project size and scope. New construction and major renovation projects (Tier 1) are required to register and achieve Silver certification using version 4 of the U.S. Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED®) green building rating system (LEED v4). All projects are encouraged to pursue higher levels of energy efficiency and sustainable design using recognized performance standards as design minimums.
LEEDv4 is used as a tool to measure green building performance, where certification is not suitable, project teams are expected to meet applicable mandatory credit requirements. Mandatory and recommended credits are identified for each Tier.

Additional resources are available through the Canadian Green Building Council (CaGBC) website, who hold the license for LEED v4 in Canada.

**Close-Out Documentation/O&M Readiness**

In order to capture critical project data and ensure building managers have the necessary tools to reduce facility emissions at optimal levels, Infrastructure has identified various levels of Closeout Documentation / Operations and Maintenance Readiness for projects.

---

3 [https://www.cagbc.org/CAGBC/Programs/LEED/LEED_v4/LEED_v4_Resources.aspx](https://www.cagbc.org/CAGBC/Programs/LEED/LEED_v4/LEED_v4_Resources.aspx)
Tier 1 – New Buildings, Major Building Additions and Major Renovations

T1.1 Integrated Design

At least three integrated design charrettes are required, the first of which should happen at the time of conceptual design or early in the Schematic Design phase. Charrettes should include representation of major stakeholders including occupants and operations staff. At minimum, the initial charrette should strive to bring the design team and major stakeholders together to identify a shared understanding of the project goals with respect to sustainability. A Deeper Greening Analysis shall be conducted early in the process, Life-cycle costing of potential options should be included in integrated design discussions.

It is recommended that project teams adhere to the requirements of LEED v4 BD+C Integrative Process credit to formalize the inclusion of simple box energy modeling and water budgeting into the integrated design process. See the appropriate LEED Reference Guide for full details.

If LEED certification is pursued, the design team registering the project through GBCI to add infras-leed@gov.ab.ca (TSPB Review) to the LEED Online project database.

Deeper Greening Analysis

Net Zero Assessment:
Teams are to complete the “Net Zero Feasibility” tab in the Green Building Standards Deliverables Checklist. If the project sets a net-zero goal, it is recommended that certification through a governing body is required, such as the CaGBC or the International Living Future Institute (ILFI). Note that the ILFI certifications require one year of operating data for compliance, which requires commitment during operations from the client/stakeholder group.

Alternative Certification Paths
Evaluate the feasibility of pursuing one of the following alternative certification systems. These certifications assess the impact of the project beyond the energy focus within the LEED certification to determine if the project goals align.

---

4 https://www.alberta.ca/assets/documents/tr/tr-appendix-checklist.xlsx
- WELL Building Standard: complete the checklist available on the WELL website and provide a narrative as to the feasibility.\(^5\)
- Living Building Challenge: complete the “LBC Feasibility” tab in the Green Building Standards Deliverables Checklist\(^6\) and provide explanations as appropriate.

**Building Life-Cycle Impact Reduction**

Where appropriate, whole building LCA evaluations are to be conducted accordance with the LEED v4 BD+C Building Life-Cycle Impact Reduction credit, Option 4. Projects are to explore options for variations in structural systems such as wood, concrete, and steel, assessing the high-level aesthetic options with a focus on the impact of greenhouse gas emissions. This can be done using the using the most current Athena Impact Estimator tool available in North America or equivalent.\(^7\)

**Life Cycle Costing**

During the project phases, Life Cycle Costing (LCC) will be performed to quantify the 50-year impacts on GHG emissions, energy and water costs, maintenance costs, etc. The scope of LCC will vary depending on project, but will typically include envelope, HVAC, and electrical systems. Requirements by design phase include:

<table>
<thead>
<tr>
<th>Planning / Conceptual Design</th>
<th>Initial LCC scoping, explore project elements that will benefit most from LCC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schematic Design</td>
<td>LCC calculations presenting options for major energy-consuming systems.</td>
</tr>
<tr>
<td>Value Engineering</td>
<td>LCC calculations presenting impacts beyond initial capital outlay.</td>
</tr>
</tbody>
</table>

**Energy Modeling**

The following deliverables or reports summarizing these deliverables are required:

---


\(^6\) [https://www.alberta.ca/assets/documents/tr/tr-appendix-checklist.xlsx](https://www.alberta.ca/assets/documents/tr/tr-appendix-checklist.xlsx)

\(^7\) [https://calculatelca.com](https://calculatelca.com)
T1.2 LEED Certification

Project performance must meet the requirements of select LEED v4 BD+C rating system and achieve at least LEED v4 Silver certification. For LEED v4 credits listed below, refer to the Reference Guide for detailed credit requirements.

Mandatory Credits

The following credits are mandatory based on the project type and corresponding certification (BD+C).

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Required Credit</th>
<th>Additional Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Efficiency</td>
<td>Water Metering</td>
<td>For metered systems, consider recommendations from the building’s operations team.</td>
</tr>
<tr>
<td>Energy &amp; Atmosphere</td>
<td>Enhanced Commissioning Option 1, Path 2</td>
<td>The project’s Commissioning (Cx) Plan should determine the system monitoring that is required for the project goals and address recommendations from the building’s operations team. Enhanced, monitoring-based and building envelope commissioning are mandatory for new construction and major renovations if envelope upgrades are included in scope.</td>
</tr>
<tr>
<td></td>
<td>Office/School</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Energy Performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optimize Energy Performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Healthcare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advanced Energy Metering</td>
<td>If included in the project, consider with recommendations from the building’s operations team, separate metering for parking garages, large kitchens, data centres, large data closets, and other unique space types.</td>
</tr>
</tbody>
</table>

9 https://www.usgbc.org/credits/eapc95v4
In addition to the 3 of 6 points available, project teams are encouraged to prioritize use of products within 160km of project site.

Recommended Credits

To meet the minimum credit requirements to achieve LEED Silver, projects teams are encouraged to review the list of recommended credits and consider if these can be achieved for their project.

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Potential Credits</th>
<th>BD+C</th>
<th>NC</th>
<th>BD+C</th>
<th>MR</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material &amp; Resources</td>
<td>Construction &amp; Demolition Waste Management</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>Best practices include responsible waste management that should be a focus of all projects to maintain the sustainability objectives.</td>
</tr>
<tr>
<td>Indoor Environmental Quality</td>
<td>Low-Emitting Materials</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.</td>
</tr>
<tr>
<td>Indoor Environmental Quality</td>
<td>Thermal Comfort</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>The requirements of this credit are in line with the TDR Mechanical Design Criteria.</td>
</tr>
<tr>
<td>Indoor Environmental Quality</td>
<td>Acoustic Performance</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>The acoustic performance in school projects provides an optimal space for learning.</td>
</tr>
<tr>
<td>Sustainable Sites</td>
<td>Integrative Process</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>In addition to the three design charrettes required for Tier 1 projects, teams are encouraged to formalize the integrated design process that focuses on energy and water analysis.</td>
</tr>
<tr>
<td>Sustainable Sites</td>
<td>Rainwater Management</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>With a focus on resilience to the changing climate, review the feasibility to incorporate green infrastructure and low impact development strategies into the site design.</td>
</tr>
<tr>
<td>Sustainable Sites</td>
<td>Light Pollution Reduction</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.</td>
</tr>
<tr>
<td>Water Efficiency</td>
<td>Outdoor Potable Water Use Reduction</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>Irrigation is not needed on the majority of AI projects when natural vegetation is selected. If irrigation is provided, Alberta Infrastructure recommends this be included as a sub-metered system in the Water Metering credit.</td>
</tr>
<tr>
<td>Energy &amp; Atmosphere</td>
<td>Indoor Potable Water Reduction</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td></td>
<td>To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.</td>
</tr>
<tr>
<td>Energy &amp; Atmosphere</td>
<td>Renewable Energy Production</td>
<td>&gt;1</td>
<td>&gt;1</td>
<td>&gt;1</td>
<td></td>
<td>Upon reviewing the Net Zero Feasibility Checklist, consider including renewable technologies into the project scope.</td>
</tr>
</tbody>
</table>
T1.3 Close-out Documentation and O&M Readiness

Projects must collect and turn over documentation (including electronic files) that will assist with efficient operations of the space or will be beneficial to the performance of future Alberta Infrastructure projects. This process should be done in a consistent and thorough process and includes the following requirements:

- Follow an asset management program and coordinate all documentation to follow a consistent naming convention.
- Prepare and turn over to the Owner a Systems Manual following the requirements of ASHRAE Guideline 4-2008. This is frequently delivered as part of the project’s commissioning (Cx) efforts.
- Official acceptance of O&M documentation must be approved by the building’s facility director (or designated appointee).
- Turn-over documentation to include the final energy model report with summary of inputs and outputs.
Tier 2 – Renovations, Building Additions, and Interior Fit-outs

The following requirements and recommendations apply to the project unless the affected system or strategy is specifically excluded from the scope of the project.

T2.1 Integrated Design

If LEED certification is pursued, the design team registering the project through GBCI to add infras-leed@gov.ab.ca (TSPB Review) to the LEED Online project database.

Deeper Greening Analysis

Early in the project, explore LEED Certification including Deeper Greening opportunities where appropriate to the project type.

LEED Certification

During the charrettes, the projects are required complete the LEED feasibility assessment for pursuing LEED v4 BD+C or LEED ID+C, to be submitted with the initial design. For LEED v4 BD+C projects, the USGBC recommends that a 40/60 rule, where the percentage of floor area associated with the project exceed 60% of the gross floor area. Additionally, enough system components must be in the scope make certification practical to pursue.

If the project decides that LEED certification is not within the project scope, projects are still to comply with the requirements identified in the appropriate LEED v4 Guidelines.

Life Cycle Costing

Life Cycle Costing (LCC) will be performed to quantify the 20-50 year impacts on GHG, energy costs, maintenance costs, etc. The scope of LCC will vary depending on project, but will typically include envelope, HVAC, and electrical. For a preliminary LCC analysis, the Harvard Life Cycle Costing Calculator is available\(^\text{10}\). Requirements by design phase include:

\(^{10}\) http://energyandfacilities.harvard.edu/green-building-resource/green-building-tools-resources/life-cycle-costing
### Energy Modeling:

Projects are to assess the scope of the project to determine energy modelling is required. If energy modelling is deemed appropriate for the project scope, the following deliverables or reports summarizing these deliverables are required:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schematic Design</td>
<td>Initial model results for major HVAC and lighting systems with sensitivity analysis.</td>
</tr>
<tr>
<td>Design Development</td>
<td>Multiple parametric runs comparing options of systems and strategies as determined in the initial and/or subsequent integrated design charrettes.</td>
</tr>
<tr>
<td>Contract Documents</td>
<td>Complete design and base case model for LEED v4, which can be used for NECB 2011 code compliance verification. The LEED v4 Alternative Compliance Path (Canada ACP – NECB) outlines the conditions for projects using an NECB 2011 baseline model.</td>
</tr>
<tr>
<td>Document Turnover</td>
<td>Final energy model report with summary of inputs and outputs.</td>
</tr>
</tbody>
</table>

If no energy modeling is required for the project, the design shall follow the ASHRAE 50% design guidelines for the appropriate project scope. meet the prescriptive compliance path for Option 2.

### T2.2 LEED Certification

Projects are to review the LEED scorecard and the Reference Guide to determine the pre-requisites and credits that apply to the project scope. Projects are to comply with the requirements identified in the appropriate LEED v4 Reference Guide.

---

11 [https://www.cagbc.org/cagbcdocs/leed/LEED_v4_Canadian_ACP_Language_as_of_20170420.pdf]
Mandatory Credits

The following credits are mandatory based on the project type and corresponding certification (BD+C or ID+C).

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Required Credit</th>
<th>BD+C MR</th>
<th>ID+C CI</th>
<th>Additional Guidance</th>
</tr>
</thead>
</table>
| Energy & Atmosphere | Enhanced Commissioning Option 1, Path 2 Or Option 1, Path 1 & Option 2 | 4 | 5 | The project’s Commissioning (Cx) Plan should determine the scope of the project:  
- Projects that impact the mechanical systems should identify the system monitoring for the project goals, addressing input from the building’s operations team.  
- Projects that primarily impact the building envelope pursue the Envelope Commissioning credit in lieu of Monitoring Based Commissioning. |
| | Office/ School | 8 | 8 | The minimum point requirements are based on Option 1, using the established cost model. Projects are encouraged to review the LEED v4 Alternative Energy Performance Metric\(^{12}\) pilot ACP to achieve additional points. For projects pursuing Option 2, the points achieved shall reflect the scope of the project. |
| | Healthcare | 7 | 7 | If included in the project, consider with recommendations from the building’s operations team, separate metering for parking garages, large kitchens, data centres, large data closets, and other unique space types. |
| Material & Resources | Building Disclosure & Optimization (3 credits) | 2 | 2 | In addition to the 2 of 6 points available, project teams are encouraged to prioritize use of products within 160km of project site. |
| | Construction & Demolition Waste Management | 1 | 1 | Best practices include responsible waste management that should be a focus of all projects to maintain the sustainability objectives. |

\(^{12}\) [https://www.usgbc.org/credits/eapc95v4](https://www.usgbc.org/credits/eapc95v4)
Recommended Credits

Projects teams are encouraged to review the list of recommended credits and consider if these can be achieved as project scope, budget, and other considerations allow for their project.

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Potential Credits</th>
<th>BD+C BMP</th>
<th>ID+C CI</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Sites</td>
<td>Integrative Process</td>
<td>1</td>
<td>1</td>
<td>In addition to the two design charrettes required for Tier 2 projects, teams are encouraged to formalize the integrated design process that focuses on energy and water analysis.</td>
</tr>
<tr>
<td></td>
<td>Rainwater Management</td>
<td>1</td>
<td>1</td>
<td>With a focus on resilience to the changing climate, review the feasibility to incorporate green infrastructure and low impact development strategies into the site design.</td>
</tr>
<tr>
<td></td>
<td>Light Pollution Reduction</td>
<td>1</td>
<td>1</td>
<td>The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.</td>
</tr>
<tr>
<td>Water Efficiency</td>
<td>Outdoor Potable Water Use Reduction</td>
<td>1</td>
<td>1</td>
<td>Irrigation is not needed on the majority of AI projects when natural vegetation is selected. If irrigation is provided, AI recommends this be included as a sub-metered system in the Water Metering credit.</td>
</tr>
<tr>
<td></td>
<td>Indoor Potable Water Reduction</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.</td>
</tr>
<tr>
<td>Energy &amp; Atmosphere</td>
<td>Advanced Energy Metering</td>
<td>1</td>
<td>1</td>
<td>If this level of sub-metering is not part of the project scope, teams are encouraged to design systems that sub-metering may be utilized at a later date to help identify utility demand and consumption by end use.</td>
</tr>
<tr>
<td></td>
<td>Renewable Energy Production</td>
<td>&gt;1</td>
<td>&gt;1</td>
<td>Upon reviewing the Net Zero Feasibility Checklist, consider including renewable technologies into the project scope.</td>
</tr>
<tr>
<td>Indoor Environmental Quality</td>
<td>Low-Emitting Materials</td>
<td>3</td>
<td>3</td>
<td>The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.</td>
</tr>
<tr>
<td></td>
<td>Acoustic Performance</td>
<td>1</td>
<td>1</td>
<td>The acoustic performance in school projects provides an optimal space for learning.</td>
</tr>
</tbody>
</table>

**T2.3 Close-out Documentation and O&M Readiness**

Projects must collect and turn over documentation that will assist with efficient operations of the space or will be beneficial to the performance of future Alberta Infrastructure projects. This process should be done in a consistent and thorough process and includes the following requirements:

- Follow an asset management program and coordinate all documentation to follow a consistent naming convention.
- Prepare and turn over to the Owner a Systems Manual following the requirements of ASHRAE Guideline 4-2008. This is frequently delivered as part of the project’s commissioning (Cx) efforts.
- Official acceptance of O&M documentation must be approved by the building’s facility director (or designated appointee).
- Turn-over documentation to include the final energy model report with summary of inputs and outputs.
Tier 3 – Limited Scope System Upgrades with Energy and GHG Impact

The following requirements and recommendations apply to the project unless the affected system or strategy is specifically excluded from the scope of the project.

T3.1 Integrated Design

Review applicable Alberta Infrastructure Green Building Standards with design team when the project begins. There are no formal requirements, though project teams are encouraged to pursue integrated design practices to the extent that it is feasible.

Deeper Greening Analysis

Early in the project, explore LEED Certification including Deeper Greening opportunities. If project is primarily a landscape project, consider the Sustainable Sites Initiative requirements\(^{13}\).

Life Cycle Costing

Life Cycle Costing (LCC) will be performed to compare the design options based on 20 year impacts on GHG, energy costs, maintenance costs, etc. The scope of LCC will vary depending on project, but will typically include envelope, HVAC, and electrical. For a preliminary LCC analysis, the Harvard Life Cycle Costing Calculator is available\(^{14}\). Requirements by design phase include:

<table>
<thead>
<tr>
<th>Schematic Design</th>
<th>LCC calculations presenting options for major energy-consuming systems.</th>
</tr>
</thead>
</table>

T3.2 LEED Certification

For Tier 3 projects, LEED certification is beyond the scope of the project. Projects are to review the LEED scorecard and the Reference Guide to determine the pre-requisites and credits that apply to the project scope. Projects are to comply with the requirements identified in the appropriate LEED v4 Reference Guide.

\(^{13}\) [http://www.sustainablesites.org](http://www.sustainablesites.org)

## Mandatory Credits

The following credits are mandatory based on the project type and corresponding certification (BD+C or ID+C).

<table>
<thead>
<tr>
<th>Cat.</th>
<th><strong>Required Credit</strong></th>
<th>BD+C</th>
<th>MR</th>
<th>ID+C</th>
<th>CI</th>
<th><strong>Additional Guidance</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy &amp; Atmosphere</td>
<td>Fundamental Commissioning</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Depending on the project scope, fundamental commissioning is required.</td>
</tr>
<tr>
<td></td>
<td>Optimize Energy Performance Option 2</td>
<td>&gt;1</td>
<td>&gt;1</td>
<td>&gt;1</td>
<td>&gt;1</td>
<td>It is likely this project will not require energy modeling, therefore, meet the prescriptive compliance paths for Option 2 as applicable.</td>
</tr>
<tr>
<td>MR</td>
<td>Construction &amp; Demolition Waste Management</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Best practices include responsible waste management that should be a focus of all projects to maintain the sustainability objectives.</td>
</tr>
</tbody>
</table>

## Recommended Credits

<table>
<thead>
<tr>
<th>Cat.</th>
<th><strong>Potential Credits</strong></th>
<th>BD+C</th>
<th>MR</th>
<th>ID+C</th>
<th>CI</th>
<th><strong>Rationale</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Sites</td>
<td>Rainwater Management</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>With a focus on resilience to the changing climate, review the feasibility to incorporate green infrastructure and low impact development strategies into the site design.</td>
</tr>
<tr>
<td></td>
<td>Light Pollution Reduction</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.</td>
</tr>
<tr>
<td></td>
<td>Outdoor Potable Water Use Reduction</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Irrigation is not needed on the majority of AI projects when natural vegetation is selected. If irrigation is provided, AI recommends this be included as a sub-metered system in the Water Metering credit.</td>
</tr>
<tr>
<td></td>
<td>Indoor Potable Water Reduction</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.</td>
</tr>
<tr>
<td>EQ</td>
<td>Enhanced Commissioning Option 1, Path 2</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>The project’s Commissioning (Cx) Plan should determine the scope of the project and identify the mechanical systems monitoring for the project goals, addressing input from the building’s operations team.</td>
</tr>
<tr>
<td>EQ</td>
<td>Low-Emitting Materials</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.</td>
</tr>
</tbody>
</table>
T3.3 Close-out Documentation and O&M Readiness

Projects must collect and turn over documentation that will assist with efficient operations of the space or will be beneficial to the performance of future Alberta Infrastructure projects. This process should be done in a consistent and thorough process and includes the following requirements:

- Follow an asset management program and coordinate all documentation to follow a consistent naming convention.
- Prepare and turn over any energy conservation measure details to the Project Manager for adding to the Owner’s database.
Tier 4 – Limited Scope with No or Limited Energy/ GHG Impact

The following requirements and recommendations apply to the project as applicable.

T4.1 Integrated Design

Review applicable Alberta Infrastructure Green Building Standards with design team when the project begins.

Deeper Greening Analysis

Early in the project, explore LEED Certification including Deeper Greening opportunities. If project is primarily a landscape project, consider the Sustainable Sites Initiative requirements\textsuperscript{15}.

T4.2 LEED Certification

For Tier 4 projects, LEED certification is beyond the scope of the project. Projects are to review the LEED scorecard and determine the pre-requisites and credits that apply to the project scope. Projects are to comply with the requirements identified in the appropriate LEED v4 Guidelines.

The following credits are available based on the project type and corresponding certification (\textit{BD+C} or \textit{ID+C}). There are no mandatory LEED credits in this Tier.

\textsuperscript{15} \url{http://www.sustainablesites.org}
Recommended Credits

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Potential Credits</th>
<th>BD+C NC</th>
<th>BD+C MR</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Sites</td>
<td>Rainwater Management</td>
<td>1</td>
<td>1</td>
<td>The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.</td>
</tr>
<tr>
<td></td>
<td>Light Pollution Reduction</td>
<td>1</td>
<td>1</td>
<td>The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.</td>
</tr>
<tr>
<td>Water Efficiency</td>
<td>Outdoor Potable Water Use Reduction</td>
<td>1</td>
<td>1</td>
<td>Irrigation is not needed on the majority of AI projects when natural vegetation is selected. If irrigation is provided, Alberta Infrastructure recommends this be included as a sub-metered system in the Water Metering credit.</td>
</tr>
<tr>
<td></td>
<td>Indoor Potable Water Reduction</td>
<td>&gt;3</td>
<td>&gt;3</td>
<td>To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.</td>
</tr>
<tr>
<td>MR</td>
<td>Construction &amp; Demolition Waste Management</td>
<td>1</td>
<td>1</td>
<td>Best practices include responsible waste management that should be a focus of all projects to maintain the sustainability objectives.</td>
</tr>
<tr>
<td>IEQ</td>
<td>Low-Emitting Materials</td>
<td>3</td>
<td>3</td>
<td>The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.</td>
</tr>
</tbody>
</table>

**T4.3 Close-out Documentation and O&M Readiness**

Projects must collect and turn over documentation that will assist with efficient operations of the space or will be beneficial to the performance of future Alberta Infrastructure projects. This process should be done in a consistent and thorough process and includes the following requirements:

- Follow an asset management program and coordinate all documentation to follow a consistent naming convention.
References


Deliverables Checklists and Spreadsheet Tools

All projects are required to submit Green Building Standards Deliverables Checklist for their respective Tier using the spreadsheet tool: [https://www.alberta.ca/assets/documents/tr/tr-appendix-checklist.xlsx](https://www.alberta.ca/assets/documents/tr/tr-appendix-checklist.xlsx). Tier 1 projects are also required to submit the Net Zero Feasibility tab and Living Building Challenge (LBC) Feasibility Checklist in the spreadsheet tool. Finally, TSPB has developed a Project Assessment tool designed to assist teams in Tier identification at project start up. The pages to follow showcase images of these tools. It is appropriate to use the Deliverables Checklists in this document. It is not appropriate, however, to use the Tier Assessment, Net Zero, or LBC tools in this pdf document as they do not include the drop down menus from the spreadsheets.

### Tier Assessment

The intent of this tool is to provide guidance for projects to determine the Tier for their project based on the guidelines provided.

**Instructions:** Enter the information in the cells highlighted green.

<table>
<thead>
<tr>
<th>BLIMS #:</th>
<th>CAPS #:</th>
<th>Design SIE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project:</td>
<td>Const. SIE:</td>
<td></td>
</tr>
</tbody>
</table>

#### Project Information

**Tier 1**

- LEED BD+C NC
- LEED BD+C MR
- LEED v4 Silver Certification is required for Tier 1 Projects.

**Tier 2**

- LEED BD+C MR
- LEED v4 Certification for Tier 2 projects is not required, but it is strongly recommended that projects assess the feasibility.

**Tier 3**

- LEED BD+C MR
- LEED ID+C CP

Notes:

1. An addition may certify independently, excluding the existing building in its entirety. Alternatively, the addition and the entire existing building may certify as one project.

2. Note if the project boundaries have clear, physical boundaries, certification can apply only to the renovated portion.
## Net Zero Feasibility

**Intent:** The intent of this tool is to provide a quick assessment, suitable at the conceptual and schematic design stages of a project, to determine reasonable reference energy use intensities (EUIs) and the potential renewable generation capacity of the project site and roof. This allows projects to determine the further work necessary to meet advanced certification strategies.

**Instructions:** Enter the information in the cells highlighted green. Start with the general project info and PV Potential. There are additional PV inputs in the grouped cells that can be accessed through the +/– on the side. Based on the project, the Deeper Greening section allows you to see the estimated impact of different technologies based on studies for Alberta Infrastructure.

### BLIMS#: CAPS #: Design S/E: Project: Const. S/E:

### PROJECT INFORMATION

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Office</th>
<th>Baseline Energy Budget</th>
<th>#DIV/0!</th>
<th>kWh/yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Floor Area</td>
<td>0 m²</td>
<td>#Floors</td>
<td>#DIV/0!</td>
<td></td>
</tr>
<tr>
<td>Building Footprint</td>
<td>0 m²</td>
<td>Baseline EUI</td>
<td>#DIV/0!</td>
<td>kWh/m²/yr.</td>
</tr>
<tr>
<td>Dataset</td>
<td>Alberta Infrastructure Study</td>
<td>Baseline TEDI</td>
<td>#DIV/0!</td>
<td>kWh/m²/yr.</td>
</tr>
<tr>
<td>Electricity Grid Emissions</td>
<td>0.64 tonnes/MWh</td>
<td>Baseline Emissions</td>
<td>#DIV/0!</td>
<td>tonnes CO2</td>
</tr>
<tr>
<td>Natural Gas Emissions</td>
<td>0.21 tonnes/MWh</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Energy Use Intensity taken from referenced studies. Estimations are applied to derive the estimated EUI for building types. **Not all building types have an EUI established in all studies.**

### PV POTENTIAL

| Total Site Area | 0 m² | Site PV Production | #DIV/0! | kWh/yr. |
| Total Roof Area | 0 m² | Roof PV Production | #DIV/0! | kWh/yr. |
| South Facing Wall | 0 m² | S. Wall PV Production | #DIV/0! | kWh/yr. |
| Wind/Wall Ratio | 0 % | | #DIV/0! |         |

### ADDITIONAL PV INPUTS

| Solar pot. tilt | 0 | kWh/kWh/yr. | #DIV/0! | kWh/m²/yr. |
| Solar pot. vertical | 0 | kWh/kWh/yr. | #DIV/0! | kWh/m²/yr. |
| Roof PV density | 0 % | Solar PV til cap | #DIV/0! | kWh/m²/yr. |
| Solar PV eff. | 0 | kWh/kWh | #DIV/0! | kWh/m²/yr. |
| System Losses | 0% | Solar PV wall cap | #DIV/0! | kWh/m²/yr. |

### DEEPER GREENING (from AI baseline)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Converting Boilers</th>
<th>Condensing Boilers</th>
<th>Final Energy Budget</th>
<th>#DIV/0!</th>
<th>kWh/yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>0</td>
<td>N/A</td>
<td>Achieved EUI</td>
<td>#DIV/0!</td>
<td>kWh/m²/yr.</td>
</tr>
<tr>
<td>N/A</td>
<td>0</td>
<td>N/A</td>
<td>Achieved TEDI</td>
<td>#DIV/0!</td>
<td>kWh/m²/yr.</td>
</tr>
</tbody>
</table>

### PROJECT TARGETS

<table>
<thead>
<tr>
<th>Certification Requirements</th>
<th>Pass/Fail</th>
<th>Building Solar %</th>
<th>Site Solar %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero Carbon (CaGBC)</td>
<td>#DIV/0!</td>
<td>#DIV/0!</td>
<td>#DIV/0!</td>
</tr>
<tr>
<td>5% Renewables</td>
<td>#DIV/0!</td>
<td>TEDI</td>
<td>EUI</td>
</tr>
<tr>
<td>Zero Carbon (ILF)</td>
<td>#DIV/0!</td>
<td>#DIV/0!</td>
<td>#DIV/0!</td>
</tr>
<tr>
<td>Zero Energy (ILF)</td>
<td>#DIV/0!</td>
<td>#DIV/0!</td>
<td>#DIV/0!</td>
</tr>
<tr>
<td>Zero Energy (ILF)</td>
<td>#DIV/0!</td>
<td>#DIV/0!</td>
<td>#DIV/0!</td>
</tr>
<tr>
<td>Zero Energy (ILF)</td>
<td>Fail</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# LIVING BUILDING CHALLENGE (LBC) v3.0

## FEASIBILITY CHECKLIST

The intent of this exercise is for project teams to develop an early phase analysis of whether Living Certification, Petal Certification, or Net Zero Energy Certification may be possible using the Living Building Challenge system. Teams should review the requirements of each imperative and determine, using the information available to the team about the project at Schematic Design, whether each credit is likely to be achievable based on the current understanding of the project scope, budget, and design options. Please provide a 1-2 sentence explanation for each credit that is deemed not to be feasible.

### PLACE

<table>
<thead>
<tr>
<th>Feature</th>
<th>Feasible?</th>
<th>Explanation [Response required if listed as not feasible]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Links to Growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Agriculture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Habitat Exchange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Powered Living</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### WATER

<table>
<thead>
<tr>
<th>Feature</th>
<th>Feasible?</th>
<th>Explanation [Response required if listed as not feasible]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Positive Water</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ENERGY

<table>
<thead>
<tr>
<th>Feature</th>
<th>Feasible?</th>
<th>Explanation [Response required if listed as not feasible]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Positive Energy</td>
<td></td>
<td>Complete &quot;Net Zero Feasibility&quot; Tab for explanation information</td>
</tr>
</tbody>
</table>

### HEALTH & HAPPINESS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Feasible?</th>
<th>Explanation [Response required if listed as not feasible]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civilized Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy Indoor Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biophilic Environment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### MATERIALS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Feasible?</th>
<th>Explanation [Response required if listed as not feasible]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red List</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Embodied Carbon Footprint</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### EQUITY

<table>
<thead>
<tr>
<th>Feature</th>
<th>Feasible?</th>
<th>Explanation [Response required if listed as not feasible]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Scale + Human Places</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universal Access to Nature and Place</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### BEAUTY

<table>
<thead>
<tr>
<th>Feature</th>
<th>Feasible?</th>
<th>Explanation [Response required if listed as not feasible]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beauty + Spirit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspiration + Education</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# TIER 1 DELIVERABLES CHECKLIST

Please use this cover sheet to submit Alberta Infrastructure Green Building Standards documentation as part of the capital project review process. Email this Excel file and required deliverables to the Project Manager (PM) each time a formal design review is requested, and provide information relevant to each stage of construction. Please use the comments box to 1) explain any areas of non-compliance with the Standards or the required deliverables, and 2) highlight any area of innovation or unexpected results. Deliverables at Schematic Design, Design Development, and Construction Documents, must also be submitted to TSB.

<table>
<thead>
<tr>
<th>DELIVERABLE</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Integrated Design</strong></td>
<td>Design Start/End:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the integrated design charette meeting notes, with sustainability goals, attached? (TIER 1: minimum 3 meetings)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has access to the LEED-Online project been provided to the PM and to TSB?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If the project is pursuing the LEED v4 credit integrative Process, has the team reviewed the additional credit requirements?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Deeper Greening</strong></th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the Net Zero Feasibility Tab in the document complete with full consideration given to the incorporation of renewable resources? This is to be completed once at either Pre-Design or Schematic Design.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is either the BRC Feasibility Tab in this document or the WELL building standard checklist complete? This is to be completed once at either Pre-Design or Schematic Design.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If pursuing the LEED v4 credit Building Life-Cycle Impact Reduction, has a whole-building LCA with the necessary credit documentation been completed?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Life Cycle Costing</strong></th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have the completed LCC calculations been included in the submittal?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LEED v4 Certification</strong></th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is a LEED v4 scorecard demonstrating minimum LEED Silver attached? Include confirmation that LEED credits required by Alberta Infrastructure will be achieved.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Energy Modeling and GHG Calculations</strong></th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are the model results comparing potential options, with a summary of assumptions, inputs and outputs, attached?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Enhanced Commissioning</strong></th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has the project established the Owner’s Project Requirements and Basis of Design, and has a third party commissioning agent been hired?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the project Commissioning Plan current?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have the Commissioning Authority reports been reviewed?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Closeout Documentation and O&amp;M Readiness</strong></th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
<th>20XX.XX.XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirm submission of all closeout documentation including record drawings, Energy Modeling Report, O&amp;M Manuals, CU Report, O&amp;M Plan, warranties and all other documents not previously submitted. Is the narrative about the level of certifications achieved, including challenges and lessons learned, attached?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Important document submittal to TSB**

---

**Project Team Comments:**

---

*Please print this document only if necessary. If printing is required, please print double sided and recycle when finished.*
# TIER 2 DELIVERABLES CHECKLIST

Please use this cover sheet to submit Alberta Infrastructure Green Building Standards documentation as part of the capital project review process. Email this Excel file and required deliverables to the Project Manager (PM) each time a formal design review is requested, and provide information relevant to each stage of construction. Please use the comments box to (1) explain any areas of non-conformance with the Standards or the required deliverables, and 2) highlight any areas of innovation or unexpected results. Deliverables at Schematic Design, Design Development, and Construction Documents must also be submitted to TSB.

<table>
<thead>
<tr>
<th>BLURS #</th>
<th>CAPS Number</th>
<th>Design Start/End</th>
<th>Construction Start/End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project:</td>
<td>C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DELIVERABLE</th>
<th>Pre-Design</th>
<th>Schematic Design</th>
<th>Design Development</th>
<th>Construction Documents</th>
<th>Closeout Turnover</th>
</tr>
</thead>
</table>
| Integrated Design | | | | | | Are the integrated design charrette meeting notes with sustainability goals attached? (Tier 3 minimum 2 meetings, ideally these 2 meetings occur in Pre-Design and Schematic Design. They must at least occur by Schematic Design and Design Development.
If applicable, has access to the LEED Online project been provided to the PM and to TSB?
If the project is pursuing the LEED v4 credit Integrative Process, has the team reviewed the additional credit requirements?
| Deeper Greening | | | | | | If pursuing the LEED v4 credit Building Life-Cycle Impact Reduction, has a whole-building LCA with the necessary credit documentation been completed?
| Life Cycle Costing | | | | | | Have the completed LCC calculations been included in the submittal?
| LEED v4 Feasibility/Certification | | | | | | Is a LEED-4 scorecard demonstrating LEED feasibility/Certification assessment attached? Include confirmation that LEED credits required by Alberta Infrastructure will be achieved.
| Energy Modeling and GHG Calculations | | | | | | Are the model results comparing potential options, with a summary of assumptions, inputs and outputs, attached?
| Enhanced Commissioning | | | | | | Has the project established the Owner’s Project Requirements and Basis of Design, and has a third-party commissioning agent been hired?
Is the project’s Commissioning Plan current?
Are the Commissioning Authority reports reviewed?
Is the narrative about the level of certifications achieved, including challenges and lessons learned, attached?

## Important document submittal to TSB

Project Team Comments:

---

Please print this document only if necessary.
If printing is required, please print double sided and recycle when finished.
## Tier 3 Deliverables Checklist

Please use this cover sheet to submit Alberta Infrastructure Green Building Standards documentation as part of the capital project review process. Email this Excel file and required deliverables to the Project Manager (PM) each time a formal design review is requested, and provide information relevant to each stage of construction. Please use the comments box to 1) explain any areas of non-compliance with the Standards or the required deliverables, and 2) highlight any areas of innovation or unexpected results. Deliverables as Schematic Design, Design Development, and Construction Documents, must also be submitted to TSB.

### BLIM #:

<table>
<thead>
<tr>
<th>BLIM #</th>
<th>CAPS Number</th>
<th>Design Start/Finish</th>
<th>Project:</th>
</tr>
</thead>
</table>

Please indicate the data that this Alberta Infrastructure Green Building Standards documentation was submitted for review (at each phase): 20XX.XX.XX | 20XX.XX.XX | 20XX.XX.XX | 20XX.XX.XX | 20XX.XX.XX | 20XX.XX.XX |

### Deliverables

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Pre-Design</th>
<th>Schematic Design</th>
<th>Design Development</th>
<th>Construction Documents</th>
<th>Close-out Turnover</th>
</tr>
</thead>
</table>

#### Integrated Design
Are the integrated design charrette meeting notes, with sustainability goals, attached? (Tier 3, minimum 1 meeting). Ideally this occurs at Pre-Design, and must at least occur by Schematic Design.

#### Life Cycle Costing
Have the completed LCC calculations been included in the submission?

#### LEED v4 Review
Certification is beyond the scope of the project. Review the LEED scorecard and determine the prerequisites and credits that apply to the project scope.

#### Enhanced Commissioning
- Has the project established the Owner's Project Requirements and Basis of Design, and has a third party commissioning agent been hired?
- Is the project's Commissioning Plan current?
- Have the Commissioning Authority reports been reviewed?

#### Closeout Documentation and O&M Readiness
- Confirm submission of all closeout documentation including record drawings, O&M Manuals, Cx Report, warranties and all other documents not previously submitted.
- Is the narrative about the challenges and lessons learned, attached?

### Important Document Submittal to TSB

**Project Team Comments:**

Please print this document only if necessary.

If printing is required, please print double sided and recycle when finished.
TIER 4 DELIVERABLES CHECKLIST

Please use this cover sheet to submit Alberta Infrastructure Green Building Standards documentation as part of the capital project review process. Email this Excel file and required deliverables to the Project Manager (PM) each time a formal design review is requested, and provide information relevant to each stage of construction. Please use the comments box to 1) explain any areas of non-compliance with the Standards or the required deliverables, and 2) highlight any areas of innovation or unexpected results. Deliverables at Schematic Design, Design Development, and Construction Documents, must also be submitted to TSB.

<table>
<thead>
<tr>
<th>BLIMS#:</th>
<th>CAP's Number:</th>
<th>Design Stand/End:</th>
</tr>
</thead>
</table>

Please indicate the date that the Alberta Infrastructure Green Building Standards documentation was submitted for review (at each phase):

<table>
<thead>
<tr>
<th>DELIVERABLE</th>
<th>Pre-Design</th>
<th>Schematic Design</th>
<th>Design Development</th>
<th>Construction Documents</th>
<th>Close-out/ Turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated Design</td>
<td>Review applicable Alberta Infrastructure Green Building Standards with design team when the project begins. Ideally this occurs at Pre-Design, and must at least occur by Schematic Design.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEED v4 Review</td>
<td>Certification is beyond the scope of the project. Review the LEED scorecard and determine the pre-requisites and credits that apply to the project scope.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closeout Documentation and O&amp;M Readiness</td>
<td>Confirm submission of all close-out documentation including record drawings, O&amp;M Manuals, warranties and all other documents not previously submitted.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Important document submittal to TSB

Project Team Comments:
Appendix H – Transportation and Site Requirements
## Items to consider in the site selection/development process:

<table>
<thead>
<tr>
<th>Item</th>
<th>Yes</th>
<th>No</th>
<th>Problem Resolved</th>
<th>Comments on any problems, project implications and plan to resolve.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is direct or indirect access to a highway required?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is adequate road access available?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is a Traffic Impact Assessment (T.I.A.) required?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is Public Transportation available &amp; adequate?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance with planning / zoning requirements?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1 Environmental Site Assessment completed?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are further environmental assessments warranted?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the site topography suitable for the project?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the site outside appropriate floodplain? (as per Appendix 'B')</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the site have stormwater management requirements?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are offsite services such as power / water / sanitary / storm / gas available?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have geotechnical / foundation concerns been considered?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Concerns:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Completed by: 
Branch: 
Project Manager: 
Date:
Appendix I – Workspace Furniture Typicals
WORKSPACE LEGEND:

PANELS
HEIGHT RANGE: 54” (1372 mm) TO 60” (1524 mm) MAXIMUM
PANELS SHALL BE STACKABLE FROM DESK/WHEELCHAIR HEIGHT UP.

OVERALL PANEL HEIGHT DETAILS:

DESIGN HEIGHT/WHEELCHAIR ACCESS RANGE:
30” (762 mm) TO 36” (914 mm) MAX.

TRANSACTION/WORKSURFACE PRIVACY - 42” (1067 mm):
BASE PANEL (30” (762 mm) TO 36” (914 mm) MAX), PLUS ONE LOAD BEARING STACK TO CREATE 42”
(1067 mm).

SEATED PRIVACY RANGE 44” (1118 mm) MIN. TO 60” (1524 mm) MAX:
BASE PANEL (30” (762 mm) TO 36” (914 mm)), PLUS TWO LOAD BEARING STACKS TO CREATE 44” (1118
mm) TO 60” (1524 mm).

STACK HEIGHTS:
STACK HEIGHTS CAN RANGE.
STACKS ARE TO BE ADDED TO CREATE THE ABOVE NOTED OVERALL PANEL HEIGHTS.
STACKS ARE TO BE LOAD BEARING (ABLE TO HANG BOTH CLOSED OVERHEADS AND OPEN SHELVES).

NOTE:
DRAWINGS TO BE READ IN CONJUNCTION WITH TECHNICAL DESIGN REQUIREMENT (TDR).
UNLESS OTHERWISE NOTED, PANELS SHALL BE STACKABLE FROM DESK HEIGHT.
TOP PANEL TO BE CLEAR GLASS ON CORRIDOR SIDE. IF ADJACENT TO A HIGH TRAFFIC AREA, GLASS MAY
BE FROSTED OR OBSCURED.

ELECTRICAL/VOICE/DATA LEGEND (TYPICAL):

- DUPLEX OUTLET
- VOICE/DATA
- POWER

NOTE: PLEASE PROVIDE ALL NECESSARY ELECTRICAL AND POWER HARNESS/CABLING REQUIRED.
ELECTRICAL TO BE AT BASE (IN THE CASE OF PANELED WORKSPACES), PROVIDE CABLE MANAGEMENT.
WORKSPACE KIT-OF-PARTS LEGEND:

A. PRIMARY WORKSURFACE
- 36" D x 54" W (914 mm D x 1372 mm W)
- PIN HEIGHT ADJUSTABLE LEGS
- CABLE MANAGEMENT ALONG BACK

D. STORAGE TOWER
- 36" W x 24" D x 54" +/- H (914 mm W x 610 mm D x 1372 mm +/- H)
- COAT ROD INCLUDED
- ANTI-TIP
- SAME OVERALL HEIGHT AS STACKED PANEL
- LOCATE OUTSIDE OF WORKSPACE

GENERAL NOTES
1. REFER TO LEGEND SHEET AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS
2. TYPICAL PANEL THICKNESS IS 3/4" (19 mm)
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GANGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTER LINE OF THE PANEL
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG)

WORKSTATION FINISHES:
WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE
LAMINATE TO BE STANDARD GRADE AND MUST INCLUDE WOODGRAIN LAMINATE OPTIONS
LEG/BASE: PAINTED METAL FINISH

STORAGE TOWER:
LAMINATE OR PAINTED METAL FINISH
STANDARD FULL METAL FINISH (ADA COMPLIANT)

PANEL FINISHES:
CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)
PANEL FABRIC STANDARD GRADE
TOP & END TRIMS: PAINTED METAL

TYPICAL WORKSPACE - HOTEL

<table>
<thead>
<tr>
<th>DRAWN BY</th>
<th>DATE</th>
<th>CHECKED BY</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VF</td>
<td>2020-07-22</td>
<td>LJ</td>
<td>2020-07-22</td>
</tr>
</tbody>
</table>

1
WORKSPACE KIT-OF-PARTS LEGEND:

A. PRIMARY WORKSURFACE
- 30" x 60" W (762 mm x 1524 mm W)
- ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
- CABLE MANAGEMENT AIDING BACK

B. SECONDARY WORKSURFACE
- 24" x 60" W (610 mm x 1524 mm W)
- PIN-HEIGHT ADJUSTABLE LEGS
- CABLE MANAGEMENT AIDING BACK

C. MOBILE PEDESTAL w/ CUSHION TOP
- 24" D (610 mm D)
- BOXFILE DRAWERS w/ DIVIDERS, LEGAL/LETTER/HANGING FILES, PENCIL TRAY

D. STORAGE TOWER
- 12" W x 24" D x 44-1/2" H (305 mm W x 610 mm D x 1132 mm H)
- fiXED SHELF INCL.
- ANTI-TIP
- SAME OVERALL HEIGHT AS STACKED PANEL

GENERAL NOTES
1. REFER TO LEGEND SHEET AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS
2. TYPICAL PANEL THICKNESS IS 3/8" (9.5mm)
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE CAGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS MeASURED ON THE CENTER LINE OF THE PANEL
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG)
6. ALL STORAGE TO BE LOCKABLE AND KEIRED ALU.

WORKSTATION FINISHES:
WORKSURFACE:
TOPS: HPL PLASTIC LAMINATE w/ STANDARD MATCHING EDGE
LAMINATE TO BE STANDARD GRADE AND MUST INCLUDE WOOD GRAIN LAMINATE OPTIONS
MOLD/BASE: PAINTED METAL FINISH

MOBILE BOX/FILE PEDESTAL w/ CUSHION TOP:
CUSHION TOP: STANDARD GRADE FABRIC
PAINTED METAL FINISH BODY
STANDARD PULLS (ADA COMPLIANT)

STORAGE TOWER:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)

PANEL FINISHES:
CLEAR OR FROSTED SINGLE PANNE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)
PANEL FABRIC: STANDARD GRADE
SEGMENTED EDG AND CORNER TRIMS: PAINTED METAL
TOP EDG/END TRIMS: PAINTED METAL

NOTE: REFER TO PANEL LEGEND SHEET AND THE TECHNICAL DESIGN REQUIREMENTS FOR ADDITIONAL INFORMATION.

TYPICAL WORKSPACE - ROVER

<table>
<thead>
<tr>
<th>ALBERTA INFRASTRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPICAL WORKSPACE - ROVER</td>
</tr>
<tr>
<td>DRAWN BY: VF</td>
</tr>
<tr>
<td>DATE: 2020-07-22</td>
</tr>
<tr>
<td>CHECKED BY: LJ</td>
</tr>
<tr>
<td>DATE: 2020-07-22</td>
</tr>
<tr>
<td>APPENDIX I</td>
</tr>
<tr>
<td>DETAIL NUMBER: 2</td>
</tr>
</tbody>
</table>
WORKSPACE KIT-OF-PARTS LEGEND:

A. PRIMARY WORKSURFACE
   - 30" D x 60" W (762 mm D x 1524 mm W)
   - ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
   - CABLE MANAGEMENT ALONG BACK

B. SECONDARY WORKSURFACE
   - 24" D x 90" W (610 mm D x 2286 mm W)
   - PIN HEIGHT ADJUSTABLE C-LEGS
   - CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL w/ CUSHION TOP
   - 24" D (610 mm D)
   - BOX/FILE DRAWERS w/ DIVIDERS, LEGAL/LETTER HANGING FILES, PENCIL TRAY

D. STORAGE TOWER
   - 12" W x 24" D x 54" H (305 mm W x 610 mm D x 1372 mm H)
   - COAT ROD INCLUDED
   - ANTI-TIP
   - SAME OVERALL HEIGHT AS STACKED PANEL

E. LOW FILE STORAGE (OPTIONAL)
   - 36" W x 18" D x 27" H (914 mm W x 457 mm D x 686 mm H)
   - 2 DRAWER LATERAL w/ DIVIDERS, LEGAL/LETTER HANGING BARS
   - FLUSH BACK AND FINISHED TOP
   - ANTI-TIP

F. OPEN SHELF (OPTIONAL)
   - 60" W (1514 mm W)
   - UNDERMOUNT TASK LIGHT (OPTIONAL)

G. LOW OPEN STORAGE (OPTIONAL)
   - 36" W x 18" D x 27" H (914 mm W x 457 mm D x 686 mm H)
   - ONE SHELF
   - FLUSH BACK AND FINISHED TOP

GENERAL NOTES
1. REFER TO LEGEND SHEET AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS
2. TYPICAL PANEL THICKNESS IS 3/4" (19 mm)
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GAVAGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTER LINE OF THE PANELS
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY
5. ALL WORKSURFACES TO BE FREE STANDING (NON-PANEL HUNG)
6. ALL STORAGE TO BE LOCABLE AND KEYED ALIKE
7. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED
WORKSPACE KIT-OF-PARTS LEGEND:

A. PRIMARY WORKSURFACE:
   - 30" D x 78" W (762 mm D x 1981 mm W)
   - ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
   - HALF HEIGHT MODesty PANEL
   - CABLE MANAGEMENT ALONG SIDE

B. SECONDARY WORKSURFACE:
   - 24" D x 60" W (610 mm D x 1524 mm W)
   - PIN HEIGHT ADJUSTABLE LEGS
   - CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL w/CUSHION TOP
   - 24" D (610 mm D)
   - BUILT IN DRAWERS C/W DIVIDERS, LEGAL/LETTER HANGING FILES, PENCIL TRAY

D. STORAGE TOWER
   - 12" W x 24" D x 64" H (305 mm W x 610 mm D x 1626 mm H)
   - COAT HOOK Included
   - ANTI-TIP
   - SAME OVERALL HEIGHT ASSORTED PANEL

E. LOW FILE STORAGE (OPTIONAL)
   - 36" W x 18" D x 27" H (914 mm W x 457 mm D x 686 mm H)
   - 2 DRAWERS, LATERAL C/W DIVIDERS, LEGAL/LETTER HANGING BARS
   - FLUSH BACK AND FINISHED TOP
   - ANTI-TIP

F. LOW OPEN STORAGE (OPTIONAL)
   - 36" W x 18" D x 27" H (914 mm W x 457 mm D x 686 mm H)
   - ONE SHELF
   - FLUSH BACK AND FINISHED TOP

G. PANEL MOUNTED CLOSED OVERHEAD (OPTIONAL)
   - 60" W x 14" H (1524 mm W x 356 mm H)
   - G/F TACKBOARD AND TASK LIGHT

H. DISK HEIGHT TABLE
   - 42" DIA (1067 mm DIA)
   - METAL "X" BASE

EXECUTIVE DIRECTOR AND EQUIVALENT OPEN WORKSPACE OPTION

1.40 m² (N.T.S.)

WORKSURFACE FINISHES:
WORKSURFACE TOPS: P.F. LAMINATE C/W STANDARD MATCHING EDGE
LAMINATE TO BE STANDARD GRADE AND MUST INCLUDE WOOD GRAIN LAMINATE OPTIONS
LEGS/BASE: PAINTED METAL FINISH

PANEL FINISHES:
CLEAR OR MOTTLED SINGLE PAECE GLASS - PLANELESS (ACRYLIC IS NOT ACCEPTABLE)
PANEL FABRIC - STANDARD GRADE
TOP & TRIM: PAINTED METAL
OPEN HOLE - PAINTED METAL FINISH

TYPICAL WORKSPACE - EXECUTIVE DIRECTOR
(& EQUIVALENT) - OPEN OPTION

APPENDIX I

DETAIL NUMBER 5a

DRAWN BY M.
DATE 2020-07-22
CHECKED BY L.
DATE 2020-07-22
WORKSPACE KIT-OF-PARTS LEGEND:

A. PRIMARY WORKSURFACE
   - 60" x 39" W (1524 mm x 991 mm W)
   - ELECTRIC OR MECHANICAL HEIGHT ADJUSTABLE
   - HALF HEIGHT MODesty PANEL
   - CABLE MANAGEMENT ALONG SIDE

B. SECONDARY WORKSURFACE
   - 24" x 60" W (610 mm D x 1524 mm W)
   - PIN HEIGHT ADJUSTABLE C-LOGS
   - CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL W/ CUSHION TOP
   - 24" H (610 mm)
   - SIDE FILE DRAWERS, V/H DIVIDERS, LEGAL/Letter HANDLING FILES, PENCIL TRAY

D. STORAGE TOWER
   - 12" W x 24" D x 54" H (305 mm W x 610 mm D x 1372 mm H)
   - COMPL. ROD INCLUDED
   - ANTI-TIP

E. LOW FILE STORAGE (OPTIONAL)
   - 18" W x 30" D x 27" H (457 mm W x 610 mm D x 686 mm H)
   - 3 DRAWER LATERAL, V/H DIVIDERS, LEGAL/Letter HANDLING BARS
   - FLUSH BACK AND FINISHED TOP
   - ANTI-TIP

F. LOW OPEN STORAGE (OPTIONAL)
   - 18" W x 30" D x 27" H (457 mm W x 610 mm D x 686 mm H)
   - ONE SHELF
   - FLUSH BACK AND FINISHED TOP

G. CLOSE OVERHEAD HUTCH (OPTIONAL)
   - 50" W x 36" D x 36" H (1270 mm W x 914 mm D x 914 mm H)
   - C/FABRIC COVERED AND FAST LIGHT

H. DESK HEIGHT TABLE
   - 42" W x 24" D (1067 mm W x 610 mm D)
   - METAL "Z" BASE

GENERAL NOTES:
1. REFER TO LOOSE SHEET AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS
2. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY
3. WORKSPACE IS MEASURED FROM CENTER LINE OF WALL TO CENTER LINE OF WALL
4. ALL WORKSURFACES TO BE PRE-GRADE STANDARD-FINISH PANEL HUNGS
5. ALL STORAGE TO BE LOOSEABLE AND FIXED KUNGS
6. COMPONENTS LISTED AS OPTIONAL CAN BE REMOVED OR ADDED AS NEEDED
7. THE EXECUTIVE DIRECTOR (AND EQUIVALENT) WORKSPACE IS EITHER AN OPEN WORKSTATION OPTION OR AN ENCLOSURE OPTION

TYPICAL WORKSPACE - EXECUTIVE DIRECTOR (AND EQUIVALENT) - ENCLOSURE OPTION

<table>
<thead>
<tr>
<th>DRAWN BY</th>
<th>DATE</th>
<th>CHECKED BY</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VF</td>
<td>2020-07-22</td>
<td>LJ</td>
<td>2020-07-22</td>
</tr>
</tbody>
</table>

APPENDIX I  DETAIL NUMBER 5b
WORKSPACE KIT-OF-PARTS LEGEND:

A. PRIMARY WORKSURFACE
   • 36" D x 78" W [914 mm x 1981 mm W]
   • ELECTRIC OR PNEUMATIC HEIGHT ADJUSTABLE
   • HALF HEIGHT MODesty PANEL
   • CABLE MANAGEMENT ALONG SIDE

B. SECONDARY WORKSURFACE
   • 24" D x 60" W [610 mm D x 1524 mm W]
   • PNEUMATIC HEIGHT ADJUSTABLE GADeges
   • CABLE MANAGEMENT ALONG BACK

C. MOBILE PEDESTAL (STANDARD TOP, NO CUSHION)
   • 36" H x 24" R [914 mm H x 610 mm R]
   • BOX/TROUS DRAWER/DRX DIVIDER, LOCAL LETTER HANGING FILES, PEN, TRAY

D. STORAGE TOWER
   • 12" W x 24" D x 54" H [305 mm W x 610 mm D x 1372 mm H]
   • DOORS INCLUDED
   • ARTWORK

E. LOW FILE STORAGE (OPTIONAL)
   • 36" W x 18" D x 30" H [914 mm W x 457 mm D x 762 mm H]
   • 2 DRAWER LETTER/LEGAL DIVIDER, LOCAL LETTER HANGING FILES
   • FOLD BACK AND FINISHED TOP

F. LOW OPEN STORAGE (OPTIONAL)
   • 35 3/4" W x 36" D x 23 3/4" H [908 mm W x 914 mm D x 603 mm H]
   • ONE SHELF
   • FOLD BACK AND FINISHED TOP

G. CUBBY OVERHEAD HATCH (OPTIONAL)
   • 60" W x 56" H [1524 mm W x 1422 mm H]
   • C/W TACKBOARD AND TASK LIGHT

H. DESK HEIGHT TABLE
   • 41 3/4" D x 2047 mm H]
   • METAL "X" BASE

FINISHES:

WOOD VENEER TOP AND BODY (STANDARD GRADE)
SQUARE PROFILE EDGE
TACKBOARD FABRIC (050-055A)

GENERAL NOTES:

1. REFER TO LEGEND SHEET AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS
2. WORKSPACE IS MEASURED FROM CENTER LINE OF WALL TO CENTER LINE OF WALL
3. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL CORRECTNESS, CONSISTENCY
4. ALL WORKSURFACES TO BE DRY-ERASABLE (NON-PAPER) PANELS
5. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE
6. COMPONENTS LATERAL CAN BE MODIFIED AND MATCHED OR DETERMINED

TYPICAL WORKSPACE - ASSISTANT DEPUTY MINISTER (& EQUIVALENT)

T.D.R. | APPENDIX I

DRAWN BY
VF
DATE
2020-07-22
CHECKED BY
LJ
DATE
2020-07-22

DETAIL NUMBER
6