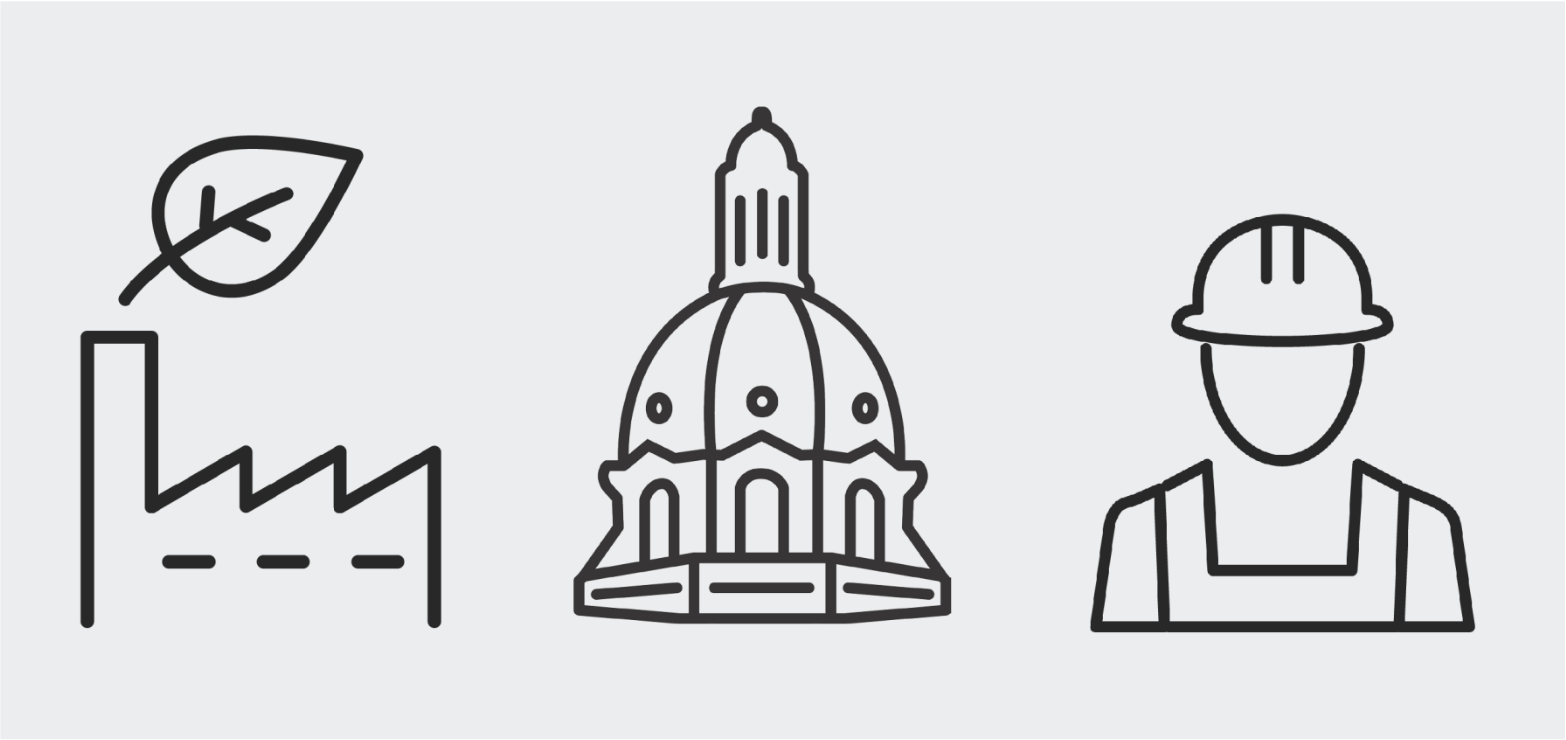
Technical Design Requirements

for Alberta Infrastructure Facilities



March 2019

Alberta Infrastructure

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0.0 General Requirements

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 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 Technical Resource Centre on the Alberta Infrastructure website.

New items within the TDR v5 document are:

- Section 0.0 – Design Principles
- Section 13.0 – Digital Project Delivery
- Appendix I – Workspace Furniture Typicals

Your input to the progressive updating of this document is invited. Please direct comments to the undersigned:

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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:

http://www.infrastructure.alberta.ca/Content/docType486/Production/TechDesignRequirements.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
    - TDR – Solar Photovoltaic Guidelines (Dec. 2017)

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
    - TRC 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
    - TRC whitepapers on flood and wildfire mitigation
  - Avoid cascading roofs and waterfall roof edges.
    - ARCA, TRC

3) PV standards for best practice, efficiency, warranty, safety, and durability

  - ARCA, TRC

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 - TSB 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) Restrained 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
    - Alberta Safety Codes Council – Barrier Free Design Guide - 2017
    - 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. ABC); 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 Absorptive 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. TSB Technical Resources Centre
   http://www.infrastructure.alberta.ca/500.htm

2. Technical Design Requirements for Infrastructure Facilities
   http://www.infrastructure.alberta.ca/Content/docType486/Production/TechDesignRequirements.pdf

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

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

5. Technical Services Branch Solar Guidelines
   http://www.infrastructure.alberta.ca/Content/docType486/Production/SolarPVGuide.pdf

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 Branch Flood Guidelines
   http://www.infrastructure.alberta.ca/Content/docType486/Production/FloodRiskMgmt.pdf

10. Technical Services Branch Wildfire Guidelines
    http://www.infrastructure.alberta.ca/Content/docType486/Production/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/

18. Barrier Free Design Guide 2017
    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 Branch is available as a planning and architectural resource to the Project Team as the design develops.

Contact:

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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 LEED Reference Guide for Building Design and Construction, 2013 Edition, U.S. Green Building Council

.2 LEED Reference Guide for Interior Design and Construction, 2013 Edition, U.S. Green Building Council

.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.

.6 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. The Province requires specific mandatory credits using LEED v4 as chart illustrates on following page:

Mandatory LEED v4 credit point requirements for AI projects

Category	Credit		Tier 1		Tier 2		Tier 3	
			BD+C		BD+C	ID+C	BD+C	ID+C
			New Construction	Major Renovation	Major Renovation	Commercial Interior	Major Renovation	Commercial Interior
Water Efficiency	*Water Metering*		1	1	1	1	1	1
Energy & Atmosphere	*Enhanced Commissioning,* Option 1 & Option 2 Enhanced & monitoring-based commissioning and envelope commissioning		6	4 or 6	4	5	4	5
	Optimize Energy Performance	Office/ Schools	12	8	8	8	a	a
		Healthcare	11	7	7		a	
	Advanced Energy Metering		1	1	b	b	b	b
Material & Resources	*Building Disclosure & Optimization (3 credits)*		3	3	2	2	c	c
	Construction & Demolition Waste Management		b	b	1	1	1	1

a. Projects to assess the scope and determine if energy modelling is required
b. Credit is not required, but is recommended based on project scope
c. Credit may not apply to this project scope

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. We require this approach for all Tier 1 and Tier 2 projects and is strongly encouraged for all projects. The functional, environmental, and economic goals are better defined and realized by proceeding from whole building system strategies, through increasing levels of specificity, to achieve more optimally integrated solutions. The integrated design process is more effective the earlier it begins in the project timeline.

.2 Life Cycle Costing (LCC) analysis is to be conducted throughout the project to ensure 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.

.3 The Province encourages higher levels of sustainable strategies beyond LEED v4 Silver certification. Project teams are required to explore the Net-Zero Assessment and Additional Certification Systems as outlined in the Deeper Greening Analysis section of the Appendix G Green Building Standards and provide the appropriate documentation.

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
f. Pacific Northwest National Laboratory ANSI/ASHRAE/IES Standard 90.1-2010 Performance Rating Method Reference Manual

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 *ASHRAE Handbook of Fundamentals*, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, 2009.

.2 *Part 2, Architectural Details for Insulated Buildings*, Brand, Ronald, Van Nostrand Reinhold, 1990.

.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).

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

.7 *Designing the Exterior Wall: An Architectural Guide to the Vertical Envelope* Brock, L, (2005).

.8 *Alberta Roofing Contractors Association (ARCA) Roofing Application Standards Manual*.

.9 *Alberta Building Code* (2014), including amendments.

.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 must come together, renovations for example, provide complete detailing for 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.

.2 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.

.3 Where high humidity space cannot be "buffered" from the building envelope, the building envelope assembly will need to be designed to prevent surface condensation.

.4 Air Barrier

.1 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*.

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

.3 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.

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

.5 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.

.6 Do not extend roof deck through the air barrier at canopies and overhangs. Provide separate structure outside the envelope, and minimize penetrating structure.

.7 Air barrier detail continuity and constructability must 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 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 as required by *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 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.

.2 For projects contemplating roof mounted photovoltaics, consult Alberta Infrastructure's *Solar Photovoltaic Guidelines: Planning and Installation for Alberta Infrastructure Projects.*

.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 Branch 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. If a varying perimeter elevation cannot be avoided, provide dimensioned details indicating low and high perimeter conditions. This does not include roof to high wall transitions.

.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 200mm 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 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 (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 Branch. The report conclusions and recommendations should be reviewed by Technical Services Branch 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 Branch 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 Provide a protected roofing membrane detail to include exterior insulation and metal flashing at the base of all walls.

.17 Generally the re-roofing membrane would consist of two-ply modified bituminous membrane (MBM). Consult Technical Services Branch 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.

.18 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.

.19 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.

.20 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.

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

.22 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.

.23 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.

.24 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*).

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

.26 Include mechanical instructions for removal and replacement of roof top units in the design.

.27 Include mechanical plumbing instructions for adding and removing roof drains and associated piping.

.28 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 Size wall cavities 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*.

.2 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 Branch for approval before specifying other systems. For isometric details refer to *Appendix D – Standard Envelope Details*.

.3 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 Branch for approval before specifying these systems.

.4 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.

.5 Mechanically retain the membrane with the anti-rotation device.

.6 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.

.7 Do not extend curtain wall to grade at the exterior or to the floor at the interior. Interior glazing should be minimum 150 mm above the floor for safety, durability and maintainability. Provide an exterior curb or other durable construction to minimize damage due to maintenance and abuse.

.8 Avoid using curtain wall at parapets on all buildings. Do not use curtain wall as envelope at parapets for facilities where indoor humidity levels will be maintained at levels higher than the design criteria in Section 5.0 – Mechanical (for example, health care facilities) (refer to Appendix D – Standard Envelope Details, Series Curtain Wall Details, #4-6).

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

.10 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.

.11 Coordinate the selection of glazing with lighting, mechanical and other systems to avoid glare and solar overheating.

.12 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.

.13 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 Branch 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. Spaces beneath or adjacent roof mounted mechanical components must be accessible 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 Basic lighting needs to be provided for the space (refer to *Section 6.0 – Electrical*) for safety and to make the crawl space inspectable.

.5 Mechanical ventilation is required (refer to *Section 5.0 – Mecha*nical) 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

Appendices:

Interior Design Definition:

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.

3.1 Fit-Up Design Guidelines and Requirements

.1 References

.1 Meet or exceed the following guidelines and standards:

.1 Current Alberta Building Code.

.2 Technical Resource Centre - Guidelines and Standards, http://www.infrastructure.alberta.ca/500.htm

.3 Current Standards for Consultant Deliverables, http://www.infrastructure.alberta.ca/Content/docType486/Production/ConsultantDeliverables.pdf

.4 Alberta Infrastructure Technical Specifications (as a basis for developing project specifications), http://www.infrastructure.alberta.ca/3885.htm

.5 Section 5.0 – Mechanical, of the Technical Design Requirements for Alberta Infrastructure Facilities.

3.2 General Fit-Up Requirements

.1 Intent

.1 The intent of *Section 3.0 - Interior Design*, of the *Technical Design Requirement for Alberta Infrastructure Facilities*, is to act as a guideline for all upgrades, renovations and new development of Government of Alberta (GoA) owned, operated and leased facilities. The major benefit of this section is to provide consistency in the planning of GoA facilities.

.2 Vision

.1 Accommodation that meets the functional program needs of GoA Ministries; supporting rapidly changing office environments, delivering long-term value, cost effectiveness, sustainable practices and green initiatives.

.3 Guiding Principles

.1 Our vision is supported by a set of guiding principles:

  - .1 Support function-based needs and workspace allocation;
  - .2 Reduction in renovation and reconfiguration costs;
  - .3 Allocation of space consistently and equitably;
  - .4 Provide flexible and adaptable work environments;
  - .5 Promote the flow of natural light into the space (Right-to-Light);
  - .6 Promote and support user control, productivity and effectiveness;
  - .7 Support common collaborative tools, technology and Alternative Workplace Arrangements (AWA);
  - .8 Promote a healthy work environment;
  - .9 Support LEED Silver standards and sustainable initiatives;
  - .10 Promote staff satisfaction, retention and recruitment;
  - .11 Support the Asset Management Plan;
  - .12 Improve density.

.4 Interior Finish and Material Considerations

.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 All finishes and materials must meet the minimum performance requirements as set out in the Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications http://www.infrastructure.alberta.ca/500.htm.

.3 Materials and finishes should be selected based on durability, maintenance, availability, and aesthetics.

.4 Whenever possible, use finishes and materials that are environmentally friendly and sustainable.

.5 Interior finish and material locations should allow for future adaptability and flexibility so as to not cause major impact to the finish design concept.

.6 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).

.5 Reflected Ceiling

.1 Ceiling treatments shall meet the performance requirements as set out in *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.*

.2 Acoustic ceiling treatments in enclosed and open spaces shall meet the acoustical performance requirements as set out in *Section 7.0 – Acoustical.*

.3 Choice of product should be made on the basis of acoustics, security objectives, aesthetics and end use requirements, as well as based on the building standard. Ceilings shall support the acoustical requirements required in the space.

.4 Every effort is to be made to allow the leased or owned facility to be reconfigured without major impact to the ceiling.

  .1 Ceilings shall allow for work environments such as workspaces, offices and support spaces to be reconfigured and moved without major impact to the ceiling above resulting in minimal to no associated costs.
  .2 Bulkheads shall be used only as required, and shall not be used as design features or way-finding. Bulkheads, specialty ceiling elements and suspended ceiling treatments shall be limited, and only used as required to serve a purpose.

.5 Reuse existing acoustic ceiling tile and T-bar ceiling grid whenever possible. When re-using existing acoustic ceiling tile, confirm that they meet the Province’s acoustical requirements as set out in *Section 7.0 – Acoustical*.

.6 Take into consideration when designing GWB ceilings mechanical access. Coordinate mechanical access and lighting layouts with Mechanical Engineer and Electrical Engineer.

.6 Paint

.1 Paint shall meet the performance requirements as set out in *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications*.

.2 Select a paint product suitable to the site conditions. Paint selection while based on the site requirements/end user requirements and shall be maintainable.

.3 Paint shall be low VOC.

.4 Multiple paint colour locations are to be clearly identified on the finishes plan. A finish schedule of the selected paint is to be either in the specifications or on the working drawings.

.5 The finish schedule is to have manufacturer information, paint number (and within brackets an explanation of the colour), sheen and any special instructions.

.6 Consider the location of paint colours, i.e. dark colours may not be appropriate in areas that will cause them to be scuffed or marked up easily.

.7 Paint colours shall be kept to a minimum and selected from manufacturer’s standard running line. Custom paint colours are not acceptable.

.8 Consider the use of corner guards to protect corners in high traffic areas. Corner guards must be minimum 2438mm high, clear or of a manufacturer’s standard colour to match the walls, and adhered (not mechanically fastened) to the wall.

.7 Wallcovering

.1 Wallcoverings shall meet the performance requirements as set out in Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.

.2 Specify vinyl-faced gypsum board or site-applied Type II commercial grade wallcovering.

.3 Multiple wallcovering colour locations are to be clearly identified on the finishes plan. A finish schedule of the selected wallcovering is to be either on the finishes plan drawings or in the specifications.

.4 The finish schedule is to have manufacturer information, pattern number, colour number and any special instructions with regards to pattern repeat and/or direction.

.5 Wallcoverings are to be selected based on the required functional aesthetics. Every effort should be made to avoid “trendy” wallcovering solutions that will date quickly.

.6 Vinyl graphic images are acceptable solutions for wallcoverings.

.8 Carpet Tile

.1 Carpet tile shall meet the performance requirements as set out in *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.*

.2 Take into consideration where carpet tile is being installed. Carpet tile shall be used in open work environments, offices, meeting spaces, support space and any other area's required by the program.

.3 Carpet tile is not recommended to be used in wet areas.

.4 When selecting carpet tile consider the soil and stain hiding capabilities, colour, tone value and pattern.

.5 When selecting accent coloured carpet tile, preference is to have the accent carpet tile be multi-tone single (tone on tone) colour.

.6 When selecting more than one carpet tile, ensure heights are consistent.

.7 Use a Floor Finishes Plan if there is more than one type of carpet or pattern detail. Large Scale Plans are to reflect carpet types and all required information necessary to install carpet as per the required design.

.9 Broadloom Carpet

.1 Broadloom carpet shall meet the performance requirements as set out *in Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.*

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

.3 Broadloom carpet is not recommended to be used in wet areas.

.4 When selecting broadloom carpet consider the soil and stain hiding capabilities, colour, tone value and pattern.

.5 When selecting an accent colour for broadloom carpet, the preference is to have the accent carpet in a single (tone on tone) colour.

.6 When selecting more than one broadloom carpet, ensure heights are consistent.

.7 Use a Floor Finishes Plan if there is more than one type of carpet or pattern detail. Large Scale Plans are to reflect carpet types and all required information necessary to install carpet as per the required design.

.10 Resilient Flooring

.1 Resilient flooring shall meet the minimum performance requirements as set out in the *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.*

.2 Resilient flooring shall be used in areas that require daily maintenance such as kitchens, washrooms, custodial, data rooms, vestibules or specialty spaces. Locate sheet, tile and VCT flooring where appropriate.

.11 Flooring Accessories

.1 Accessories may include, but are not limited to, transition strips, stair nosings, and wall base and etc. Accessories shall meet the minimum performance requirements as set out in the *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications*.

.2 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.

.3 Carpet stair nosings to be barrier free and appropriate for the application. Carpet stair nosing shall be one piece for all stair nosings.

.4 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. Broadloom carpet base to be bound on the top edge.

.5 Carpet base to be the same material, colour, pattern and texture as adjoining carpet. Exposed edges to be bound, cap strip to accommodate base carpet thickness.

.6 Resilient base may be rubber, thermoplastic, solid, cove, and 3.2 mm x 102mm (4”) thick. Resilient base to be installed in one continuous piece length. Base edge shall end at inside corners only.

.7 Porcelain/ceramic tile base if applicable, to be 102 mm (4 inches) complete with a factory edge and edge protection profile.

.12 Architectural Woodwork

.1 Casework shall meet the minimum performance requirements as set out in the *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.*

.2 Modular millwork is acceptable and shall meet the performance requirements as set out in Alberta Infrastructure, *Technical Resource Centre, Guidelines and Standards/Technical Specifications,* and shall be based on the program requirements.

.3 Casework shall allow for barrier-free access at counter height and above.

.4 Casework shall allow for client specific equipment and standard equipment. All sizes shall be obtained prior to detail development.

.5 Casework shall have a minimum of plastic laminate countertop. When required based on the program requirements an alternate more durable countertop can be specified.

.6 Provide casework in accordance with current Architectural Woodwork Manufacturer's Association of Canada (AWMAC) standards.

.7 All casework hardware should be made on the basis of utility, aesthetics, security objectives and end user performance requirements.

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

.9 Refer to *Appendix E*, for standard interior millwork details.

.13 Glazing and Glazing Film

.1 Glazing and glazing film shall meet the minimum performance requirements as set out in Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.

.2 Glazing film shall be incorporated into offices, meeting rooms and support spaces based on the program requirements.

.3 The use of glazing must be considered when constructing rooms that require a high acoustic separation.

.4 Glazing film shall obscure items from being visible. Film shall not block light distribution and shall allow the natural light to flow into the office space.

.5 At a minimum glazing film height shall be for seated privacy.

.6 Coloured film may be used on glazing, as part of a pattern, for way finding or room identification.

.14 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. As both effective signage and intuitive wayfinding increase the inclusiveness of the built environment and are integral to safe and efficient navigation and orientation of space, both aspects must be incorporated in Government of Alberta facilities.

.2 Wayfinding strategies should be planned in the early stages of a project.

.3 All signage and wayfinding shall comply with the most recent version of the Alberta Building Code and be barrier-free. Refer to the most current version of the Safety Codes Council Barrier-Free Design Guide: https://intranet.infrastructure.alberta.ca/capitalprojects/ts/Facility%20Planning%20%20Architecture/Barrier-Free-Design-Guide_WEB-VERSION2017.pdf

.1 Signage

.1 If signage is specified for a leased building, confirm with Landlord for requirements regarding matching the existing base building signage.

.2 Signage must conform to the current Corporate Identity Manual, as published by Public Affairs Bureau. Refer to the Alberta Corporate Identity Guidelines at https://www.corporateidentity.alberta.ca/ for information on how to use the various elements of the Alberta Corporate Identity, or refer to the current GoA Corporate Identity Manual, Provincial Signage and Current Brand Elements.

.3 Signage plans are to clearly identify location, type, and appropriate dimensions for installation.

.2 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 formal entry, reception, or main entrance to departments should be clearly visible upon arrival.

.4 Emphasize the “legibility” of the space. Minimize the number of intersections and plan configurations that are easy to understand, easy to navigate, and where the spaces’ intended uses are clear and obvious.

.5 Differentiate the main path of travel, by using alternate materials, colours or textures.

.6 Use distinctive visual and tactile treatments on the ceiling, floor, or walls, and prominent interior architectural features (such as a wall with a contrasting color or graphic, or other elements) to act as landmarks upon which people can orientate themselves in space.

.7 Wherever possible, allow visual access to exterior landmarks for navigation.

.15 Window Treatment

.1 Window treatments shall meet the minimum performance requirements as set out in *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.*

.2 The use of interior window treatments is restricted to program areas requiring visual privacy (for example, observation rooms)

.3 Perimeter windows are typically Landlord or base building standard.

.4 Draperies, vertical louvre blinds or horizontal blinds selected in lieu of landlord standard must be similar in colour or lined in order to appear compatible from the exterior.

.16 Specialty and Accent Light Fixtures

.1 Specialty and accent light fixtures shall meet the minimum performance requirements as set out in *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.*

.2 Specialty and/or accent light fixtures for meeting spaces shall be based on the program requirements.

.3 Fixtures shall easily be moved to allow for a flexible and adaptable space.

.4 Fixtures are to be sourced, so that replacement parts and pieces are easily obtainable.

.5 Lamps for both standard fixtures and LED’s must be able to be purchased locally.

.6 Include accent perimeter lighting to support and enhance presentations. Perimeter lighting to be on a separate switch and be dimmable.

.7 Specialty and accent light fixtures shall have location and heights indicated on the coordinating construction documents.

.17 Tackable and Writeable Surfaces

.1 Tackable and writeable surfaces shall meet the minimum performance requirements as set out in the *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications*.

.2 Tackable and writeable surfaces shall be located throughout the space and based on the project requirements.

.3 Whiteboards shall be magnetic to allow for dual purposes.

.18 Partitions (Conventional Construction)

.1 Partitions shall meet the minimum performance requirements as set out in *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards*.

.2 Interior partitions are to follow the ceiling grid, wherever possible.

.3 Provide adequate support in partition cavity for wall hung equipment and displays.

.4 Refer to *Appendix F* for interior standard partition details.

.19 Moveable Wall Systems (Architectural Walls)

.1 Whenever possible and appropriate, as well as based on the program requirements, moveable wall systems should be used to allow for maximum flexibility, adaptability and re-configurability of the work environment.

.2 Moveable wall system shall:

  - .1 Meet the minimum performance requirements as set out in Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.
  - .2 Be a non-progressive, unitized system of panels, from a single manufacturer.
  - .3 The moveable wall system shall be fabricated off-site in a controlled factory environment and be delivered fully finished to site for installation with no construction or finishing required.
  - .4 Have adequate support for wall hung equipment.
  - .5 Have the ability for each wall section be able to be removed, relocated and re-installed in different locations without disturbing adjacent panels, with all parts reusable.
  - .6 The acoustical performance of the moveable wall system shall comply with AI’s minimum STC ratings.
  - .7 Whenever possible glass (full height and/or clerestory) shall be used to allow natural light to flow into the space.
  - .8 Modular power and voice/data distribution shall be factory installed.
  - .9 The moveable wall system must provide a freestanding option that does not require a mechanical fastener connection or attachment to the floor and ceiling.
  - .10 The moveable wall system shall be able to integrate furniture systems, modular millwork and be able to incorporate plumbing as required for Java Centers or Lunch Rooms.
  - .11 Use 1118 mm (44 inches) modules for architectural wall systems.

.20 Demountable Wall Systems

.1 Demountable wall systems shall meet the minimum performance requirements as set out in *Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.*

.2 Demountable wall systems are an economical alternate to painted gypsum wall board.

.3 Demountable walls differ from moveable walls, whereby the parts are delivered to site and assembled to create the wall on site.

.4 Adequate support is to be provided in the demountable wall cavity to support wall hung equipment and displays.

3.3 Planning Criteria

.1 Overview

.1 It is important to provide spaces that are functional and flexible which allow for:

.1 Adaptability for growth and change.
.2 Spaces that change in function through reconfiguration.

.2 Work environments are typically based on a 1524mm x 1524mm (or 5’-0” x 5’-0”) building grid and shall have dimensional logic through consistency in sizes of workspaces, offices, meeting rooms and miscellaneous support spaces. It should be noted, that the physical layout of the building will ultimately influence what can be efficiently achieved. Plan spaces to be compatible with building grids. Confirm building and ceiling grid sizes on site.

.3 Plan space so that short term space requirements are isolated from longer term requirements to enable future space reductions.

3.4 Space Area Definitions

.1 Building Owners and Managers Association (BOMA)

.1 Currently the GoA uses and defines space as per the *Standard Method for Measuring Floor Area in Office Buildings ANSI/BOMA Z65.1-1996.*

.2 Density Target

.1 The GoA wide density target is a maximum of 18 useable metres squared (um$^{2)}$/occupant of useable office space. The density target is a guide for all upgrading, renovation and new development of GoA office accommodations. If program needs are met and achieved in less than the 18 um^2, this is deemed acceptable.

.2 Density is the average area allocated by position. It is based on all the usable office space and the occupants in the whole building (allocated to the Client Ministry).

.3 Calculating Density

.1 Density (um^2 per occupant) = useable area m^2/total # of occupants.

.1 A density calculation shall be used for all occupant open and enclosed workspace and support space.

.2 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 staff and seasonal staff that occupy the space,
- .5 Summer students or practicum students.

.3 Support spaces are defined as:

- .1 Hoteling and Alternate Work Arrangements (AWA),
- .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 (standard and secure),
- .10 Java centers,
- .11 File/storage rooms (standard and secure),
- .12 Building amenities (locker rooms or fitness areas),
- .13 Shower facilities,
- .14 Hearing rooms,
- .15 First-aid rooms,
- .16 Computer training rooms,
- .17 Mail rooms,
- .18 Building services,
- .19 Children’s play areas.

.4 Included in the density calculation is:

- .1 Primary circulation space,
- .2 Secondary circulation space.

.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 as defined below.

.6 Special purpose space is defined as:

  .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.

.2 Special purpose space is NOT included in the useable density calculations. There may be circumstances (e.g. very small groups in rural locations) where the density target cannot be met. For such groups, space requirements will be based on the application of workspace guidelines for the people and the functional needs of that group for support space.

.3 Public interaction service areas that are publicly accessible (front-end), such as *Alberta Works Support Centre,* shall not be included in the usable density calculation. Office areas (back-end) shall conform to density requirements.

3.5 Design Guidelines and Planning Criteria

.1 Space Allocation Overview

.1 The space allocations are designed to support the GoA wide useable density target of 18 m^2/person. The Alberta wide density target will ensure that workspace types focus on the function of the position within the organization.

.2 The space allocation will act as maximum guide, for planning workspace and office accommodation, and do not entitle a specific space allocation.

.2 Workspace Allocation

.1 The following tables illustrate the workspace allocations that will act as a maximum guide for planning workspace and office accommodation.

Position Type	Workspace Size	Workspace Type
Hoteling Staff Staff who are mobile workers, or are part of other Alternate Workplace Arrangements (AWA)	2.4 m^2	Open
Rover Staff Staff who work either primarily in special purpose areas or occupy their designated workspace, less than 50% of their time; summer students; interns; contractors	5.0 m^2	Open
Resident Staff Managers, Staff who spend the majority of time, more than 50%, in their primary workspace	6.7 m^2	Open
Senior Manager/Director Senior Managers, Directors and equivalents	10.0 m^2	Open
Executive Director/Executive Manager Executive Directors, Executive Managers and equivalents	13.9 m^2	Open or Closed
Assistant Deputy Minister Assistant Deputy Ministers and equivalents	20.9 m^2	Closed
Deputy Minister Deputy Ministers and equivalents	27.9 m^2	Closed

3.6 Workspace Allocations and Planning Criteria

.1 Overview

.1 Open workspaces will be the norm for all of the function types except for Deputy Minister, Assistant Deputy Minister and Executive Director.

Workspaces shall support functional job requirements, through adaptable and flexible workspaces that allow individual and group adjustment.

Overview con't:

To ensure the workspaces align with the changing needs of individual users and groups, the workspace guidelines have been developed with a key set of "Kit-of-Parts", which allow for user and group reconfiguration and adjustments.

.2 The workspace guiding principles are:

- .1 Health, LEED Silver standards and sustainable initiatives,
- .2 Workspaces will support function based needs and workspace allocation,
- .3 Reduction in renovation and reconfiguration,
- .4 Space will be allocated consistently and equitably,
- .5 Flexible and adaptable workspaces,
- .6 Right-to-light with enclosed rooms located on the core of the building,
- .7 Support user control, productivity and effectiveness,
- .8 Common collaborative tools and technology and Alternative Workplace Arrangements (AWA),
- .9 Staff satisfaction, retention and recruitment.
- .10 Standardized furniture and finishes within each building.

.3 When locating workstations in high traffic areas, consider increasing the workstation panel height on the corner side and/or applying a film to the glazed panels.

.4 A restrictive workspace is an enclosed office and is allocated to the positions of Deputy Minister, Assistant Deputy Minister, and Executive Director (optional). 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 allocated an enclosed office as an exception, based on the restrictive workspace questionnaire, may receive a 7.0 m^2 office, 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 Demised Suite Spaces:

- .1 Deputy Minister
- .2 Human Resources
- .3 Case/Investigations

.4 Finance is not eligible for a demised suite. Where HR & Finance wish to jointly share a demised suite this is deemed acceptable. Separation between the two units shall be provided through zoning solutions. Support space such as meeting rooms and etc. shall be shared. No individual support space will be allocated to specific units within a demised space.

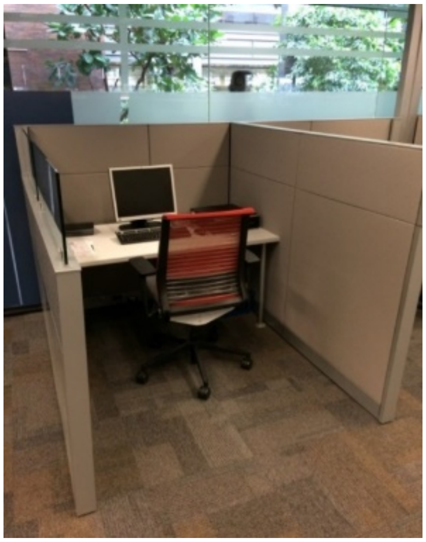
.2 Hoteling Workspace

.1 The following table illustrates the space allocation for hoteling workspace:

No. of persons	Dimensions	Size (m^2)
1	1600 mm x 1524 mm (5’-3” x 5’-0”)	2.4
2	1600 mm x 2972 mm (5’-3” x 9’-9”)	4.8

.2 Planning Guidelines

.1 A minimum of one 2.4 m^2 single hoteling station shall be allocated for each Ministry Program’s space. Additional hoteling workspace shall be based on the identified functional and program requirements.



Hoteling Workstation

.3 Hoteling workspace shall be:

.2 Allocated for non-desk based, mobile staff who visit the office on an occasional basis,

.3 Unassigned,

.4 Located on the core, if possible.

.4 Hoteling workstations shall be:

.1 Freestanding, height adjustable work surfaces (no panel hung work surfaces),
.2 Work surfaces and storage shall have dimensional logic and consistency,
.3 Panels are to have a height of 1372mm (54”) +/- (stacking from desk height up). Panels to have clear frameless glass,
.4 Allocated with 1-triplex outlet, 1-voice and 1data.

.5 Each hotel workspace shall have a dedicated storage tower located outside of the workspace.

.6 Refer to Appendix I, for workspace details.

.3 Rover Workspace

.1 Rover workspaces shall be:

.1 Allocated a space of 5.0 m^2 (+/- 1867mm x 2629mm [6’-1 1/2” x 8’-7 ½”]),
.2 Allocated to staff that are in the office less than 50% of the time,
.3 Allocated to office based summer students, interns and contractors,
.4 Located on the core,
.5 Can be assigned, shared, or unassigned.

.2 Rover workstations:

.1 Shall have the primary work surface freestanding and electric or pneumatic height adjustable, and the secondary work surface freestanding and pin height adjustable. Panels hung work surfaces are not acceptable.
.2 Work surfaces and storage shall have dimensional logic and consistency,
.3 All storage shall be lockable and keyed alike,
.4 Panels shall have a height of 1372mm (54”) +/- stackable from desk height up. Top panels shall have clear frameless glass on corridor side (an exception to obscure glass may be considered if the workstation is adjacent to a high traffic area),
.5 Shall have a minimum of 2- triplex outlets, 1- voice and 1-data.

.3 Refer to Appendix I, for workspace details.

.4 Resident Workspace

.1 Planning Guidelines

.1 Resident workspace shall be:

- .1 Allocated a space of 6.7 m^2 (+/- 2362mm x 2819mm [7’-9” x 9’-3”]),
- .2 Located on the perimeter.

.2 Resident workstations shall be:

- .1 Shall have the primary work surface freestanding and electric or pneumatic height adjustable, and the secondary work surface freestanding and pin height adjustable. Panel hung work surfaces are not acceptable.
- .2 Work surfaces and storage shall have dimensional logic and consistency.
- .3 All storage shall be lockable and keyed alike.
- .4 Panels shall have a height of 1372mm (54”) +/- stackable from desk height up. Top panels shall have clear frameless glass on corridor side (an exception to obscure the glass may be considered if the workstation is adjacent to a high traffic area).
- .5 Shall have a minimum of 2- triplex outlets, 1- voice and 1-data.

.3 Refer to Appendix I, for workspace details.

.5 Senior Manager / Director Workspace

.1 Planning Guidelines

Senior Manager/Director workspace shall be:

- .1 Allocated a space of 10.0 m^2 (+/- 3581mm x 2819mm [11’-9” x 9’-3”]),
- .2 Located on the perimeter.

.2 Senior Manager/Director workstations:

- .1 Shall have the primary work surface freestanding and electric or pneumatic height adjustable, and the secondary work surface freestanding and pin height adjustable. Panel hung work surfaces are not acceptable.
- .2 Work surfaces and storage shall have dimensional logic and consistency,
- .3 All storage shall be lockable and keyed alike,

  .4 Panels shall have a height of 1372mm (54”) +/- stackable from desk height up,
  .5 Workstations shall have a minimum of 2- triplex outlets, 1- voice and 1-data.

.2 Refer to Appendix I, for workspace details.

.6 Executive Director / Executive Manager

.1 Recommended Planning Guidelines

Executive Director’s (ED) shall have an allocation of 13.9 m^2 (+/- 3048mm x 4572mm [10’-0” x 15’-0”]).

.2 Restrictive Workspaces (enclosed offices) shall be:
  .1 Located along the core;
  .2 Moveable walls are permitted to be used to create restrictive workspaces (enclosed offices) for EDs; however they must adhere to AI’s STC requirements.

.3 An open workspace shall be provided to the ED requesting their workspace to be allocated along the perimeter windows. ED workspace shall have an allocation of 14.2 m2.

.4 Executive Director open workstations along the perimeter windows shall be:

  .1 Shall have the primary work surface freestanding and electric or pneumatic height adjustable, and the secondary work surface freestanding and pin height adjustable. Panel hung work surfaces are not acceptable.
  .2 Work surfaces and storage shall have dimensional logic and consistency,
  .3 All storage shall be lockable and keyed alike,
  .4 Panels are to have a height of 1372mm (54”) +/- stackable from desk height up,

.5 Workspace shall have a minimum of 3- duplex outlets, 1- voice and 1-data.

.6 Refer to Appendix I, for workspace details.

.7 Assistant Deputy Minister

.1 Recommended Planning Guidelines

Assistant Deputy Minister’s (ADM) shall have an allocation of 20.9 m^2 (+/- 4572mm x 4572mm [15’-0” x 15’-0”]).

.2 Restrictive Workspace (Enclosed offices) shall be:

  .1 Located along the core. When located in an executive suite and space is limited, an office is permitted to be located on the perimeter if no core located is possible.

.3 Moveable walls are permitted to be used to create restrictive workspaces (enclosed offices) for Assistant Deputy Ministers; however they must adhere to AI's STC requirements.

.4 Work area shall have a minimum of 3- duplex outlets, 1- voice and 1-data.

.5 Refer to Appendix I, for workspace details.

.8 Deputy Minister

.1 Deputy Minister's (DM) shall have an allocation of 27.9 m^2 (+/- 6096mm x 4572mm [20'-0" x 15'-0"]).

.2 Restrictive Workspace (enclosed office) shall be:

  .1 Located along the core. When located in an executive suite and space is limited, an office is permitted to be located on the perimeter if no core location is possible.

.3 Moveable walls are permitted to be used to create restrictive workspaces (enclosed offices) for Deputy Minister's however; they must adhere to AI's STC requirements.

.4 Work area shall have a minimum of 3- duplex outlets, 1- voice and 1-data.

.5 Refer to Appendix I, for workspace details.

.9 Alternative Workplace Arrangement (AWA)

.1 Planning Guidelines
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 by using appropriate technology and furniture;

  - .5 Have workspaces that are temporary, non-assignable, non-reserveable, shareable, and available on a “first-come, first-serve” basis,
  - .6 Be non-ministry assigned, in some cases,
  - .7 Allow users to move from workplace to workplace.

.2 On-site AWA Space Planning Criteria:

  - .1 On-site AWA may include desk sharing or touching down in hoteling workstations or quiet rooms.

.3 Off-site AWA Space Planning Criteria:

  - .1 Off-site AWA may be non-territorial hoteling workspaces, in convenient locations across the province to supporting telework, mobile and virtual initiatives for interested Ministries.
  - .2 Off-site mobility can be supported through:
  - .3 Telework/Telecommuting: working from remote locations (e.g. home offices),
  - .4 Satellite Office: small office centers with support staff that act as extensions of the main office, normally located more conveniently to employees' homes,
  - .5 Mobile Office: work in specific non-stationary places (e.g. vehicles),
  - .6 Third Places: public space (e.g. coffee shops),
  - .7 Virtual Office: work anywhere, anytime.

Note: Activity-based work environments, in which a variety of spaces are provided to accommodate different types of activities for staff that work flexibly, are currently being studied.

3.7 Support Space Allocations and Planning Criteria

.1 Overview

.1 Planning Guidelines
Support space shall:

  - .1 Be analyzed and allocated based on the functional program requirements,
  - .2 Be allocated to one group alone or may be shared between multiple groups based on the functional program requirements,
  - .3 Be incorporated throughout the work environment,
  - .4 Be located on the core,
  - .5 Maximize the amount of glazing used, allowing natural light to flow into the space,

    - .6 Have dimensional logic, allowing for maximum utilization and reconfiguration for current and future groups,
    - .7 Be clustered together, support growth and change through the adoption and removal of parts and pieces allowing change in size and usage,
    - .8 Accommodate a person in a wheelchair and be barrier-free,
    - .9 Permit moveable walls to be used to create support spaces; however they must adhere to AI's STC requirements, if required.
    - .10 Have an acoustical mobile room divider to create a larger meeting space if required based on the functional requirements allowed for meeting rooms.
    - .11 Have security requirements defined based on the functional program requirements for secure support spaces.

- .2 Finishes shall be based on the program requirements or match existing.

- .3 Support spaces can vary from:

    - .1 Java Centers,
    - .2 Waiting Areas,
    - .3 Meeting Rooms,
    - .4 Quiet Rooms,
    - .5 Training Rooms,
    - .6 Collaborative Areas,
    - .7 Hoteling Workstations,
    - .8 Resource Areas,
    - .9 Copy/print Areas,
    - .10 File and Storage Rooms,
    - .11 Therapy Rooms,
    - .12 Interview Rooms, etc.

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

.2 Adjacency Matrix

As part of the program requirements (program document) adjacencies should be defined. The chart on the following page illustrates typical mandatory and secondary adjacencies:

X = Mandatory Adjacency

* = Secondary Adjacency

	Reception	Meeting Rooms	Quiet Rooms	Training Rooms	Hoteling	Resource Area	File Storage	Printer Area	Open Workspace	Enclosed Offices	Located on the Core	Located on the Perimeter
Reception		X	*	X	*						X	
Waiting Area	X	X	*	*							X	
Java Centre	*			X		*						
Meeting Rooms	X										X	
Quiet Rooms		*		*	*				*	*	X	
Training Rooms	X	*	*		*						X	
Hoteling	*	*	X	*							X	
Resource Area							X				X	
File Storage						X					X	
Hoteling	*							*			X	
Rover								*			X	
Resident								*				X
Mgr./Sr. Mgr.								*				X
Director								*				X
ED – Enclosed Office											X	
ED – Open Workspace												X
ADM Office									*		X	X
DM Office									*		X	X

.3 Waiting Area

.1 Planning Guidelines

The following table illustrates the space allocation for waiting areas.

No. of Seats	Approximate Dimensions	Size (m^2)
2	1829 mm x 1829 mm (6’-0” x 6’-0”)	3.3
4	2743 mm x 2743 mm (9’-0” x 9’-0”)	7.5
6	3658 mm x 3658 mm (12’-0” x 12’-0”)	13.4

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

.2 Waiting areas shall:

.1 Be based on the identified functional program requirements,

.2 Be aligned with large collaboration/meeting spaces and should be located to ensure passive supervision as a minimum or aligned with reception areas based on the function and program requirements,

.3 Have appropriate seating for the waiting area (size, scale, maintenance, durability and function),

.4 Have a minimum of 1-duplex outlet, 1- voice/data

Waiting Area

.4 Open Collaborative Area

.1 Planning Guidelines

Open collaborative areas shall:

.1 Be based on the functional program requirement,
.2 Have flexible furniture that can be arranged and rearranged in any configuration,
.3 Act as a quick informal team meeting space without the need to book a meeting room,
.4 Have the ability to be converted into an alternate type of support space or workspace,
.5 Be located as to not cause disruption to open workspace staff.

.2 A planning ratio of approximately 5% (max.) of the floor area can be used for open collaborative area.

.3 Open collaborative areas may not be applicable to all user groups.

Four Person Open Collaborative Area

Open Collaborative Area

.5 Quiet Room

The following table illustrates the space allocation for Quiet Rooms:

No. of Seats	Dimensions	Size (m^2)
2	2286 mm x 3048 mm (7’-6” x 10’-0”)	7

.1 Planning Guidelines

Quiet rooms shall:

Two Person Quiet Room

- .1 Be based on the identified functional program requirements,
- .2 Accommodate up to two people.
- .3 Be non-reserveable enclosed shared spaces,
- .4 Be flexible, adaptable and reconfigurable,
- .5 Be allocated consistently and equally,
- .6 Be supplementary to persons who normally occupy open workspaces,
- .7 Be used to provide an environment to facilitate private phone conversation, a required higher level of concentration and/or impromptu 2-person meetings,
- .8 Be located on the core,
- .9 Maximize the amount of glazing used allowing natural light to flow into the space. The use of glazing must be considered when constructing rooms that require a high acoustic separation,
- .10 Accommodate a person in a wheelchair and be barrier-free,
- .11 Allow for maximum utilization and reconfiguration by planning two phone rooms next to each other wherever possible, if more than one is required. The area of two phone rooms located back to back equal that of one 6-person meeting room or one Executive Director's office,
- .12 Have a minimum of 1-duplex, 1-voice/data. Optionally, a video/monitor to electronically access files may be provided based on the functional program requirements (adequate support in the partition cavity shall be provided).

.2 Number of Quiet Rooms

The chart on the following page illustrates a minimum number of Quiet Rooms based on the number of GoA occupants working in a building. The number of quiet rooms may be increased based on the functional requirements for support spaces of the primary user group.

GoA Occupants per Building	Two-person Quiet Room
0 - 25	1
26 - 75	2
76 - 150	3
151+	4

.6 Meeting Spaces

The following table illustrates the space allocation for support spaces:

Meeting Space	Approximate Dimensions	Sizes (m^2)
4 person Meeting Room o Training Room o Interview Room	3048 mm x 3810mm (10’-0” x 12-6”)	11.6
6 person Meeting Room o Training Room o Interview Room	3048 mm x 4572 mm (10’-0” x 15’-0”)	13.9
8 person Meeting Room o Training Room	4572 mm x 3810 mm (15’-0” x 12’x6”)	17.4
10 person Meeting Room o Training Room	6096 mm x 3810 mm (20’-0” x 12’-6”)	23.2
14 person Meeting Room o Training Room	7620 mm x 3810 mm (25’-0” x 12’-6”)	29

Note: For larger meeting space, allocate 2.0m^2 per person for rooms up to 20 people. For over 20 people, allocate 1.5m^2 per person.

.1 Planning Guidelines

Meeting, Interview, and Training space shall:

.1 Be considered in the identified functional program requirements of the primary user group, and should include usage verification of meeting room booking statistics,

.2 Be an enclosed space for either shared or dedicated use, and should be located for easy access by other groups (eliminating outside individuals from access into the open work environment),

.3 Be allocated consistently and equally,

.4 Maximize the amount of glazing used allowing natural light to flow into the space. The use of glazing must be considered when constructing rooms that require a high acoustic separation,
.5 Accommodate a person in a wheelchair and be barrier-free,
.6 Have a minimum of one writeable surface,
.7 Use a moveable wall system wherever possible to allow for a flexible and adaptable workspace, allowing for reconfiguration and growth. Moveable walls must adhere to AI's STC requirements,
.8 Have electrical and data for video conferencing, SMART board technology, Polycom and any additional Service Alberta Sector technology requirements,

.9 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, as well as an allowance for convenience outlets,
.10 Have a table sized for the functional requirement of the space; modular with multiple pieces as required.


4 person Meeting Room


8 person Meeting Room


20 person Meeting Room

.2 Number of Meeting Rooms

The chart on the following page illustrates a minimum number of rooms utilized for meetings, interviews or training. Additional support space MUST be determined based on the primary user group's functional requirements and confirmed by reviewing the meeting room utilization.

GoA Occupants per Building	4 Person Meeting Room	6 Person Meeting Room	8 Person Meeting Room	10 Person Meeting Room	14 Person Meeting Room
0-10	-	-	1	-	-
11-25	-	-	-	1	-
26-50	1	-	1	-	-
51-75	1	-	1	1	-
76-100	1	-	1	1	1
101-150	1	1	1	1	1
150-200	2	1	1	1	2

.7 Java (Coffee Centre)

The following table illustrates the space allocation for Java Centre's:

GoA Occupants per Building	Dimensions (counter, upper/lower storage & Aisle access)	Size (m^2)
1-10	1524 mm x 2134 mm (5'-0" x 7'-0")	3.3
11-25	2438 mm x 2134 mm (8'-0" x 7'-0")	5.2
26-50	3048 mm x 2134 mm (10'-0" x 7'-0")	6.5

.1 Planning guidelines

Java Centers shall:

.1 Be based on the number of occupants.
.2 Be located throughout the building appropriately, equally for easy shared access for all staff.
.3 Include space to allow for a fridge, microwave, garbage/recycling area and a sink. A dishwasher and/or a filtered hot/cold water dispenser may be considered depending on the requirements of the user group. It should be noted that Ministries are typically responsible for their own appliances.
.4 Have modular millwork, whenever possible.
.5 Have microwave cabinets located so that they are accessible to all users.
.6 Have upper cabinets accessible to all users.
.7 Have cabinets raised over the sink location to accommodate for the faucet/sink.

.8 Allow for barrier-free access in the millwork at the sink (for at least one of the Java Centre's on the floor).

.9 Provide visual division between Java Center's and the work environment; so as to prevent disruption to staff, due to noise generating activities.

.10 Have grommet holes located behind coffee machines and other small appliances so as to not be visible.

.11 Have pull-out units in the cabinets for odour control of recycle and waste.

.12 Be complete with electrical for equipment, plus a minimum of two GFI outlets above the counter. Additional outlets shall be based on the functional program requirements.

.13 Refer to *Appendix E* for interior standard millwork details.

3.8 Document Management Allocations and Planning Criteria

.1 Print Areas

The following table illustrates space allocation for print areas:

.1 Planning Guidelines

Quantity	Dimensions	Size (m^2)
1 per 35 people	2743 mm x 1524 mm (9'-0" x 5'-0")	4.2

Print areas shall:

.1 Be based on the identified functional program requirements for low quantity printing.

.2 Be distributed in relation to existing or expected patterns of use throughout the space to allow for convenient access.

.3 Consist of a multi-functional unit (MFU) with a freestanding furniture cabinet beside it for a work area and storage for paper and supplies. Tabletop printers can sit on a low (2 high) closed storage cabinet with a durable top. Millwork at printer locations is not recommended.

.4 Be provided in addition to a centrally located resource area (for mass production and noise generating activities).

.5 Have appropriate aisle space in front (minimum of 1524mm [5'-0"]).

.6 Located in areas where the noise generated will not disturb nearby occupants.

Print Area – Tabletop Printer

Print Area - MFU

.2 Resource Area

The following table illustrates space allocation for resource areas:

Quantity	Dimensions	Size (m^2)
1 per 50 people	3048 mm x 4572 mm (9’-0” x 5’-0”)	13.9

.1 Planning Guidelines

Resource area shall be:

Resource Area

- .1 Located on the core.
- .2 Located away from open workspaces to prevent disruption to staff, due to noise generating activities.
- .3 Distributed in relation to existing or expected patterns of use.
- .4 Shared functions unless there is a confidential requirement stating otherwise.
- .5 Accommodating to include space for general storage, paper storage (boxes and recycling containers) and document handling (plotter, laminators, collating, sorting, binding, etc.).
- .6 Able to be used to incorporate filing and/or general storage (if applicable).
- .7 Designed to contain a minimum of one multi-function unit (MFU).

.3 File Storing Area

The following table illustrates typical storage cabinet widths and depths:

Description	Size
General Storage	Width - 914 mm (36”), 1067 mm (42”), 1219 mm (48”)
General Storage	Depth – 305 mm (12”), 457 mm (18”), 610 mm (24”)
High-density storage (Various types)	Various heights and widths

.1 Planning Guidelines

Filing areas shall:

.1 Be based on the identified functional program requirements confirmed through site visits.
.2 Have appropriate security or secure file requirements based on the program requirements.
.3 Be located on the core.
.4 Be reviewed by a Structural Engineer prior to proceeding with design development.
.5 Have appropriate fire suppression systems based on the functional program requirements.
.6 Have cabinets of the appropriate height so as to not impede proper operation of ceiling sprinklers and be in compliance with NFPA 13 codes.
.7 Have appropriate space in front of file cabinets when placed in corridors and open areas, in compliance with the current Alberta Building Code.
.8 Be combined within the resource room if necessary to maximize space utilization.
.9 Maximize space utilization by storing active files on site only and semi-active files off-site. Off-site storage is the Ministry’s responsibility.
.10 Not house office supplies. Office supplies may be housed in furniture cabinets throughout the work environment.

File Area

File Room (High Density)

3.9 Special Purpose Spaces

.4 Planning Guidelines

.1 Based on the identified functional program requirements.

.2 Some special purpose space shall NOT be included in the density calculation. Refer to the density section to confirm what is considered special purpose space and what is included and not included in calculating density.

.3 Special-Purpose Space shall be:

- .1 Shared whenever possible.
- .2 Be non-occupiable.
- .3 Be unable to meet the operational, functional or personal needs of the office occupants.
- .4 Routinely and frequently service the needs of a significant number of occupants from more than one building.
- .5 Meet a program delivery need that involves significant and frequent service to members of the general public.

3.10 Security

.1 Planning Guidelines

.1 The Security office is to be engaged at the beginning of every project to provide a security assessment, if required. Some client groups may have security policies and procedures in place.

.2 Upon completion of the security assessment, the Security office will provide policy and procedure standards to be implemented.

.3 Security requirements must be fully integrated in the planning of GoA facilities.

.4 Refer to the *Physical Security Guidelines and Standards for Government of Alberta Facilities* http://www.infrastructure.alberta.ca/Content/docType486/Production/SecurityGuidelinesStandards.pdf

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

3.11 Acoustics

.1 Achieving Acoustic Performance in Open Office Settings

.1 Meet the minimum performance requirements for Acoustics as set out in the Alberta Infrastructure, Technical Resource Centre, Guidelines and Standards/Technical Specifications.

.2 One of the advantages of an open office environment is the ability to accommodate a maximum number of staff in a given amount of space.

.3 Acoustical considerations are key in the design of open plan office environments to ensure acoustical privacy is maximized and noise distractions are reduced. With good acoustical design, an open plan office environment comfortably accommodates many occupants and promotes collaboration.

    .1 Ceiling Systems
    .2 Electronic Sound Masking Systems
    .3 Systems Furniture
    .4 Carpet

.5 Other elements such as light fixtures, workstation layouts as well as an awareness of office etiquette will contribute to acoustic performance in the open office.

.6 Open Office Acoustics- Intelligible speech/conversation is limited to immediate neighbors, directly adjacent workstations. Words beyond the immediate neighbor are muffled (not intelligible) and very low level. Typical office noises are not noticeable.

.7 Confidential conversations are held in telephone rooms and support spaces provided.

.8 Consult with Technical Services Branch, Building Engineering Section, attention the Acoustical Engineer, 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.

3.12 Furniture

.1 Overview

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

.2 Furniture shall be as per the space allocations and kit-of-part standards.

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

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

.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.

.2 In order to maximize the value of furniture, AI has identified a need to develop a corporate approach. This centralized approach to design of space, purchasing and ownership of furniture allows for more flexible accommodation of 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 Logic

.1 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 through consistency in sizes of parts, pieces, as well as consistency in finishes and material.

.2 To ensure that workspaces align with the changing needs of individual users and groups, workspaces shall be designed to align with the space accommodation vision and guiding principles, allowing for flexible and functional work environments.

.4 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 Branch.

.5 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 value 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 For 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* or unless a standing offer contract is in place for net new.

.6 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 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.

  .1 Alberta Building Code, 2014 Edition (ABC 2014).
  .2 User's Guide – NBC 2010 Structural Commentaries (Part 4 of Division B).
  .3 CSA S413-14 – Parking structures.
  .4 CSA S478-95 (R2007) – Guideline on Durability in Buildings.
  .5 CSA SPE-900-13 – Solar photovoltaic rooftop-installation best practices guideline.

.2 The following material design standards shall be used (notwithstanding the editions listed in Section 1.3 of ABC 2014):

  .1 CSA A23.3-14 – Design of concrete structures.
  .2 CSA O86-14 – Engineering design in wood.
  .3 CSA S16-14 – Design of steel structures.
  .4 CSA S136-16 – North American specifications for the design of cold-formed steel structural members.
  .5 CSA S304-14 – Design of masonry structures.

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 ABC 2014 or the concentrated loads listed in Item 4.1.5.9 of ABC 2014, 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 S16-14 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 4.1.8.18.8(a) of ABC 2014.

.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.

.4 Design structural steel supporting floors to prevent transient footstep induced vibration from exceeding the annoyance threshold. Refer to Appendix E in CSA S16-14 (Design of Steel Structures), Guide for Floor Vibrations, and Structural Commentary D in the National Building Code of Canada (2010 Edition), Deflection and Vibration Criteria for Serviceability and Fatigue Limit States.

.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 ABC 2014.

.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 Alberta Building Code (ABC) 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 ABC 2014 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 ABC 2014 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 ($S_a(t_i)$, PGA, Site Class, F_a, F_v), type of Seismic Force Resisting System (SFRS) used, the force modification factors (R_d, R_o) per ABC 2014 Table 4.1.8.9, and the design interstorey drift limit.

.9 Serviceability Criteria for:
  .1 Deflection Limit under specified live load for floor and roof supporting members.
  .2 Lateral Drift limit for total drift and interstorey drift under wind loads.
  .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 be Shown 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 A23.1-14), 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 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. The use of Standards not listed here shall be discussed with the Province and decisions shall be documented in design reports. Where conflicts or omissions exist between various Codes and Standards, the design report shall indicate which measure was taken including the reasoning to support that decision.

.2 Follow the edition of the Codes and Standards referenced in the current *Alberta Building Code*. The use of more recent edition of Standards not listed in the *Alberta Building Code* shall be discussed with the Province and decisions shall be documented in design reports.

.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 Alberta Building Code
    .2 Alberta Fire Code
    .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 The Schematic Design Submission must provide conceptual mechanical design and any viable alternatives with recommendations.

.2 As a minimum, Schematic Design Report shall 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, medical gas system testing, commissioning, fire protection engineering, exhaust air re-entrainment investigation, wind tunnel study, etc.

.4 Design Development Submission

.1 The Design Development Submission must fully convey the design intent of all mechanical systems. All design related issues, technical criteria and performance shall be included in the 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 Smoke control system
    .9 Energy Management Control System, communication protocol and any interface to subsystems such as security, fire alarm and lighting
    .10 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 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/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 basis to 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 point verification for commissioning including control point/logic verification and calibration.

    .1 Ensure that the controls contractor verifies every physical point and submits physical point confirmation sheets showing all calibration values as well as actuator spans for pneumatic actuators.
    .2 Ensure that the contractor submits sequence checks and trend data showing that all control loops have been verified and tuned.

.3 Requirements for seismic supports and restraints for mechanical services and equipment where required by the *Alberta Building Code*.

.4 Requirements for O&M manuals including system descriptions, design set points, sequences of operations, maintenance requirements, training literature, tests performed, and shop drawings.

.5 Requirements for duct, pipe, control point, valve, and equipment labeling including colour coding and naming nomenclature.

.6 All applicable requirements in Alberta Infrastructure EMCS Technical Specifications:

  .1 23 08 95 EMCS Start-Up and Testing
  .2 .223 09 10 Control Systems
  .3 23 09 23 EMCS General Requirements
  .4 23 09 24 EMCS Network Communications and System Configuration
  .5 23 09 25 EMCS Central/Portable Control Stations and Peripherals
  .6 23 09 26 EMCS Remote Control Units
  .7 23 09 27 EMCS Terminal Control Units
  .8 23 09 28 EMCS Field Work
  .9 23 09 29 EMCS Sensors, Devices and Actuators
  .10 23 09 30 EMCS Point Schedules
  .11 23 09 93 EMCS Control Sequences

B. Specific Requirements for Healthcare Facilities

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

  .1 Mechanical system schematics:

    .1 Medical gases

.2 Prepare contract document specifications using the Alberta Infrastructure Technical Specifications as a basis to include, but not be 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 Alberta Building Code.

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

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

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

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

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

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

.18 Coordinate noise data emitted from mechanical equipment.

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

.20 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.

.21 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 Except where indicated otherwise in this section, coordination shall be provided to the same standards as Healthcare Facilities.

.8 Commissioning

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

.2 Commissioning for mechanical systems shall be in compliance with the CSA Z320, *Building commissioning* and as required by the LEED strategy.

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

.4 Incorporate 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 Commissioning for mechanical systems shall be in compliance with the CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities, CSA Z8001, Commissioning of Health Care Facilities, and as required by the LEED strategy.

.C Specific Requirements for Continuing Care Facilities

.1 Except where indicated otherwise in this section, commissioning shall be provided to the same standards as Healthcare Facilities.

.9 Renovations and Additions

.1 All new and existing air and water systems that are modified or extended as part of a renovation shall be rebalanced.

.2 The capacity and overall capability of the existing mechanical systems and equipment to service the planned functions shall be assessed and documented during schematic design.

.3 Existing mechanical systems serving renovated areas shall be analyzed to identify adverse environmental impacts such as energy consumption, emissions of greenhouse gases, and emissions of ozone-depleting substances. Consideration should be given to renewable energy resources and environmentally sustainable practices.

.4 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.

.5 All new and existing air ductwork shall be cleaned prior to occupancy for both new and renovation projects.

.B Specific Requirements for Healthcare Facilities

.1 HVAC systems serving areas that are renovated shall be upgraded 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 Except where indicated otherwise in this section, commissioning shall be provided 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).

.2 Connect mechanical equipment to the electrical system in accordance with CSA C22.1, *Canadian Electrical Code, Part I* and CSA C282*, Emergency Electrical Power Supply for Buildings*.

.B *Specific Requirements for Healthcare Facilities*

.1 Connect mechanical equipment to the essential electrical system in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities and CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities designating the vital, delayed vital, and conditional loads.

.C *Specific Requirements for Continuing Care Facilities*

.1 Except where otherwise indicated in this section, emergency power shall be to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.12 Energy Efficiency and Sustainability

.1 Design mechanical systems in accordance with the National Energy Code of Canada and ANSI/ASHRAE.IESNA, Standard 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

.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 shall 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.

.7 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.

5.2 Mechanical Design Criteria

.1 HVAC Design Criteria

.1 HVAC systems shall be designed 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 Facilities shall be designed to provide heating and cooling capacities based on the outdoor ambient temperatures given in the *Alberta Building Code*:

- 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 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.b.(1) and Table 5.2.2.b.(2).

  .1 Use table 5.2.2.b.(1) for spaces with overhead air distribution
  .2 Use table 5.2.2.b.(2) for spaces with displacement ventilation

Table 5.2.2.b.(1): Mechanical System Design Parameters for Schools - Overhead Air Distribution

Space	Temperature Range °C (1)	Relative Humidity (2)	Total Air Changes Per Hour (3)	Relative Pressurization (4)	Noise Level RC (N) (5)	Remarks
Auditorium	22 - 25	see note 2	12 *	Neutral (E)	20-25	* based on 3m height space
Cafeteria	22 - 25	see note 2	12	Negative (-)	40	
Classrooms	22 - 25	see note 2	6 * (see note 3d)	Neutral (E)	25-30	* design based on 30 students
Computer	22 - 25	see note 2	12	Neutral (E)	35	
Conference Rooms	22 - 25	see note 2	10	Neutral (E)	30	

Table 5.2.2.b.(1): Mechanical System Design Parameters for Schools - Overhead Air Distribution

Space	Temperature Range °C (1)	Relative Humidity (2)	Total Air Changes Per Hour (3)	Relative Pressurization (4)	Noise Level RC (N) (5)	Remarks
Corridors	22 - *	see note 2	2	Neutral (E)	40	* uncontrolled summer design temperature; ventilation to be provided continuously during times of normal building occupancy
Gymnasium	22 - *	see note 2	6	Neutral (E)	35	* mechanical cooling not required See note (6) below
Home Economics	22 - 25	see note 2	6 *	Negative (-)	30	* may require higher to satisfy exhaust demand.
Industrial Arts	22 – *	see note 2	6 **	Negative (-)	35	* mechanical cooling not required ** may require higher to satisfy exhaust demand.
Kitchen	22 - *	see note 2	12 10	Negative (-)	45	* mechanical cooling not required
Laboratories	22 - 25	see note 2	10	Negative (-)	30	
Library	22 - 25	see note 2	6	Neutral (E)	30	

Table 5.2.2.b.(1): Mechanical System Design Parameters for Schools - Overhead Air Distribution

Space	Temperature Range °C (1)	Relative Humidity (2)	Total Air Changes Per Hour (3)	Relative Pressurization (4)	Noise Level RC (N) (5)	Remarks
Locker Rooms	22 - *	see note 2	10	Negative (-)	45	* uncontrolled summer design temperature; ventilation to be provided continuously during times of normal building occupancy
Music Room	22 - 25	see note 2	8	Neutral (E)	30	
Office	22 - 25	see note 2	6	Neutral (E)	35	
Reception	22 - 25	see note 2	6	Neutral (E)	35	
Server Room*	22 - 25	see note 2	8	Neutral (E)	45	*Provide stand-alone AC unit
Staff Room	22 - 25	see note 2	8	Negative (-)	40	
Gymnasium Storage Room	22 - *	see note 2	4	Negative (-)	45	* - uncontrolled summer design temperature; ventilation to be provided continuously during times of normal building occupancy
Washrooms	22 - *	see note 2	12	Negative (-)	45	* - uncontrolled summer design temperature; ventilation to be provided continuously during times of normal building occupancy

Table 5.2.2.b.(1) 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.*

- *.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:*
    - *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 to zero when space is unoccupied except where specifically noted otherwise.*
    - *d. In Classrooms with high ceiling air changes to be based on 3m height ((i.e. occupied zone).*

- *.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 to be reviewed with school board, i.e. 250 plus. Air changes to be based on 3m height (i.e. occupied zone).*

Table 5.2.2.b.(2): Mechanical System Design Parameters for Schools						
Space	Temperature Range °C (1)	Relative Humidity (2)	Total Air Changes Per Hour (3)	Relative Pressurization (4)	Noise Level RC (N) (5)	Remarks
Auditorium	22 - 25	see note 2	3.6	Neutral (E)	20-25	
Cafeteria	22 - 25	see note 2	3.6	Negative (-)	40	
Classrooms	22 – 25 *	see note 2	3.6 (see note 3d)	Neutral (E)	25-30	* design based on 30 students
Computer Rooms	22 - 25	see note 2	3.6	Neutral (E)	35	
Conference Rooms	22 - 25	see note 2	3.6	Neutral (E)	30	
Corridors	22 - *	see note 2	2	Neutral (E)	40	* - uncontrolled summer design temperature; ventilation to be provided continuously during times of normal building occupancy
Gymnasium	N/A	N/A	N/A	N/A	N/A	This space type is not suitable for displacement ventilation - refer to table 5.2.2.b.(1)
Home Economics	22 - 25	see note 2	3.6 *	Negative (-)	30	* may require higher to satisfy exhaust demand.
Industrial Arts	N/A	N/A	N/A	N/A	N/A	This space type is not suitable for displacement ventilation - refer to table 5.2.2.b.(1)
Kitchen	N/A	N/A	N/A	N/A	N/A	This space type is not suitable for displacement ventilation - refer to table 5.2.2.b.(1)
Laboratories	22 - 25	see note 2	3.6	Negative (-)	30	
Library	22 - 25	see note 2	3.6	Neutral (E)	30	
Locker Rooms	N/A	N/A	N/A	N/A	N/A	This space type is not suitable for displacement ventilation - refer to table 5.2.2.b.(1)
Music Room	22 - 25	see note 2	3.6	Neutral (E)	30	

Table 5.2.2.b.(2): Mechanical System Design Parameters for Schools

Space	Temperature Range °C (1)	Relative Humidity (2)	Total Air Changes Per Hour (3)	Relative Pressurization (4)	Noise Level RC (N) (5)	Remarks
Office	22 - 25	see note 2	*	Neutral (E)	35	* as required to meet ventilation standards and cooling requirements
Reception	22 - 25	see note 2	*	Neutral (E)	35	* as required to meet ventilation standards and cooling requirements
Server Room*	22 - 25	see note 2	8	Neutral (E)	45	*Provide stand-alone AC unit
Staff Room	22 - 25	see note 2	3.6	Negative (-)	40	
Storage Room	N/A	N/A	N/A	N/A	N/A	This space type is not suitable for displacement ventilation - refer to table 5.2.2.b.(1)
Washrooms	N/A	N/A	N/A	N/A	N/A	This space type is not suitable for displacement ventilation - refer to table 5.2.2.b.(1)

Table 5.2.2.b.(2) 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.*

.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:

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 to zero when space is unoccupied except where specifically noted otherwise.

d. In high ceiling Classrooms air changes to be based on 3m height ((i.e. occupied zone).

.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 Gymnasium normal occupancy 30 to 60 students for outdoor air requirements. Peak occupancy to be reviewed with school board, i.e. 250 plus. Air changes to be based on 3m height (i.e. occupied zone).

.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.).

.2 Type I areas (as defined in CAN/CSA Z317.2, *Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities*) shall be designed to provide heating and cooling capacities based on the outdoor ambient temperatures given in the *Alberta Building Code*:

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

.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.

Table 5.2.2.c: Mechanical System Design Parameters for Continuing Care Facilities

Space	Temp. Range °C	Relative Humidity Range (%) (2)	Zoning	Min. Total Air Changes Per Hour (3)	Min. Outdoor Air Changes Per Hour (3)	Relative Press. (4)	All Air Exhausted Directly to Outdoors	Minimum Filter Efficiency (MERV)	Noise Level RC (N) (5)	Remarks
Activity Rooms	25-28	30-50	H, C	6	2	Neutral (E)	Opt.	13	35-40	
Administrative/ Offices	21-24	30-50	G	6	2	Neutral (E)	Opt.	13	30-35	
Barber/Beauty Parlour	25-28	30-50	H, C	12	3	Negative (-)	Yes	13	35-45	
Central Bath	25-28	30-50	H, C	9	3	Negative (-)	Yes	13	40-45	
Clean Linen Storage	21-28	30-50	G	4	1	Positive (+)	Opt.	13	40-45	
Clean Utility	21-28	30-50	G	6	2	Positive (+)	Opt.	13	35-40	
Dining	25-28	30-50	H, C	6	2	Negative (-)	Opt.	13	35-40	
Dishwashing	21-28	30-50	G	10	2	Negative (-)	Yes	-	40-45	
Examination & Treatment	25-28	30-50	H, C	6	2	Neutral (E)	Opt.	13	35-40	
Housekeeping Closets	21-28	30-50	G	10	Opt.	Negative (-)	Yes	-	-	
Kitchen	21-28	30-50	H, C	10	2	Negative (-)	Yes	13	40-45	
Laundry	21-28	30-50	H, C	12	3	Negative (-)	Opt.	13	40-45	
Lounges	25-28	30-50	H, C	6	2	Neutral (E)	Opt.	13	30-35	
Nursing Stations	22-25	30-50	H, C	6	2	Neutral (E)	Opt.	13	30-35	
Physical Therapy	25-28	30-50	H, C	9	3	Neutral (E)	Opt.	13	35-40	
Public Washrooms	21-28	30-50	G	12	Opt.	Negative (-)	Yes	-	40-45	

Space	Temp. Range °C	Relative Humidity Range (%) (2)	Zoning	Min. Total Air Changes Per Hour (3)	Min. Outdoor Air Changes Per Hour (3)	Relative Press. (4)	All Air Exhausted Directly to Outdoors	Minimum Filter Efficiency (MERV)	Noise Level RC (N) (5)	Remarks
Resident Bedrooms	25-28	30-50	H, C-G	4	2	Neutral (E)	Opt.	13	30 max	
Resident Area Common Corr.	25-28	30-50	G	3	1	Neutral (E)	Opt.	13	35-40	
Resident Washrooms	25-28	30-50	G	9	Opt.	Negative (-)	Yes	-	35-40	
Smoking Room	25-28	30-50	H, C	See remarks	Opt.	Negative (-)	Yes	8	35-40	30 l/s per person
Soiled Linen Storage	21-28	30-50	G	10	Opt.	Negative (-)	Yes	8	-	
Soiled Utility	21-28	30-50	G	10	Opt.	Negative (-)	Yes	8	40-45	
Storage - General	21-28	30-50	G	2	Opt.	Negative (-)	Opt.	8	40-45	

Table 5.2.2.c: Mechanical System Design Parameters for Continuing Care Facilities. Con't

Table 5.2.2.c. Notes:

.1 Where a temperature range is shown (i.e. 25°C-28°C), select the upper value as the summer design temperature and the lower value as the winter 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 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 Sewage pumps shall be duplex, be of the macerator type, controlled to automatically alternate between lead/lag status, and have alarms for the lag pump start and high water level.

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

.5 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.

.6 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 Except where otherwise indicated in this section, sanitary sewer systems shall be 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 Storm water shall be piped separately from the 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 shall 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. The pumping compartment shall be sized to limit the frequency of pump starts to that recommended by the manufacturer.

.9 Sump pumps designed for permanent installation shall be duplex, controlled to automatically alternate between lead/lag status, and have alarms for the lag pump start and high water level.

.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.*

.2 Provide white fixtures of any one type by the same manufacturer with chrome-plated fixture trim and accessories.

.3 Provide barrier-free fixtures where required by the *Alberta Building Code* that are installed in accordance with the requirement of CSA-B651, *Accessible Design for the Built Environment* and the *Alberta Building Code*.

.4 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

.1 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

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

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

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

.4 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

.1 Except where otherwise indicated in this section, plumbing fixtures and equipment shall be to the same standard as Section B – Specific Requirements for Healthcare Facilities.

.2 Floor Drains

.1 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 Washrooms (ECS)

  .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.

.2 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 n 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 wheel-chair accessible water closet (in coordination with the Architect).

.5 Urinals

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

.6 Washroom Lavatories

.2 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, the remaining shall be infra-red 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.

.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.
- .2 Refer to Alberta Health Services Infection Prevention and Control, – *Health Care Facility Design Guidelines and Prevention Measures for Construction, Renovation and Maintenance Activities.*

.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 Provide plumbing and water systems that conform with the *National Plumbing Code* and the *Alberta Building Code*.

.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 shall 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 Cold water pipes shall be insulated and provided 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 Potable water distribution pumps, storage tanks and other main components shall be provided with redundancy.

.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 Except where otherwise indicated in this section, domestic cold water systems shall be 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 Domestic hot water recirculating piping and pumps shall be provided. Branch piping from a fixture to a circulated main shall not exceed 8 m (25 ft).

.4 Do not exceed 0.76 m/s (2.5 ft/s) for hot water supply and recirculating piping to minimize erosion and corrosion.

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

.6 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 Water distribution systems shall be arranged 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 Except where otherwise indicated in this section, domestic hot water systems shall be 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

.1 Provide fuel storage sufficient for operating emergency generators in accordance with CSA-C282*, Emergency Electrical Power Supply for Buildings.*

.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 *Alberta Fire Code*.

.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 Except where otherwise indicated in this section, 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 Air compressors for dental air systems shall be duplex and oil-free type.

.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 Dental vacuum pumps shall be duplex and 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 Isolation valves shall be provided at all risers, branch mains, and at the equipment.

.6 Provide cleanouts for the distribution system.

.7 Vacuum exhaust shall be discharged through the roof to the atmosphere 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.

.2 Provide medical gas systems in accordance with CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases and Vacuum.*

.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

.1 New or altered medical gas piping systems shall be tested and certified in accordance with CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases and Vacuum* and the *Alberta Building Code*.

.10 Renovating Existing Facilities

.1 Additions and modifications to an existing medical gas system shall meet the current requirements of the *Alberta Building Code,* CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases and Vacuum* and the *Alberta Building Code,* and the local Authorities having Jurisdiction.

.2 When adding medical gas or vacuum outlets to existing systems, the Design Consultant shall 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.

.5 Medical air systems shall be used exclusively for patient care and not connected to other compressed air systems.

.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 The type of central oxygen system selected shall be based 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 as a guide to determine the central oxygen source type:

Table 5.8.3.a: Oxygen Source – Bed Rating

Number of Beds	Type of System
Less than 50	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.
50 – 100	A duplex mini-bulk (liquid cylinders) and a reserve supply of high pressure gas cylinders.
101 – 500	A bulk storage tank and a reserve supply of high pressure gas cylinders. Include an emergency oxygen inlet to the pipeline distribution system.

Table 5.8.3.a: Oxygen Source – Bed Rating

Number of Beds	Type of System
Over 500	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.

Table 5.8.3.b: Oxygen Source – Known Consumption

Consumption Cubic Meters per Month	**Type of System**
Less than 250	High pressure gas cylinder
250 - 750	Min-bulk
Over 750	Bulk

.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 Bulk (liquid) nitrogen storage is required only in large facilities. High pressure nitrogen cylinders or mini-bulk liquid cylinders shall be used for other facilities.
.2 Coordinate with the Facility Administrator to determine the quantity of present and future cylinder quantities for sizing the cylinder manifold.
.3 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 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

.1 Design fire and life safety systems in accordance with the requirements of the *Alberta Building Code*, the *Alberta Fire Code*, and the *National Fire Protection Agency.*

.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

.1 Design standpipe and hose systems in accordance with the *Alberta Building Code*, the *Alberta Fire Code*, and the requirements of NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*.

.4 Sprinkler System

.1 Design sprinkler systems in accordance with the *Alberta Building Code*, the *Alberta Fire Code*, and the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*.

.2 Sprinklers subject to damage shall be protected by sprinklers guards.

.3 In areas with low ceiling (bulkheads) sprinklers shall 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

.1 Provide fire extinguishers in accordance with the *Alberta Building Code* , the *Alberta Fire Code*, and the requirements of NFPA 10*, Standard for Portable 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) CO_2 fire extinguisher (Class BC) mounted just inside the entrance of each operating room. Do not use water-based, water-mist, dry-powder, or halon-replacement 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 hinged and latches to facilitate cleaning.

.6 Smoke Control System

.1 Provide smoke control systems that meet the requirements:

  .1 The Alberta Building Code
  .2 The Alberta Fire Code
  .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 (2014), Standard for Control Units for Fire Alarm Systems Third Edition

.2 Smoke control shall be coordinated, commissioned, and tested in accordance with the applicable standard and the Authority Having Jurisdiction.

.3 Smoke control systems shall be coordinated with Authority Having Jurisdiction.

.4 Smoke control zones shall correspond to the fire alarm and sprinkler zones. Special consideration should be given to interconnected floor spaces (e.g. atriums) and coordination with adjacent areas.

.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 Alberta Building Code.

.C Specific Requirements for Continuing Care Facilities

.1 Except where indicated otherwise in this section, ventilation systems shall be designed 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 Heading 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.

.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 Consider primary-secondary pumping systems where they reduce power consumption and provide better control.
.2 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.
.3 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.
.4 Provide means for balancing and flow measuring for all major circuits. Provide balancing valves at each terminal heating unit.
.5 On heating systems, grooved-type pipe joints are permitted within mechanical rooms.
.6 On heating systems, butterfly valves are permitted within mechanical rooms only.

.2 Heading 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 The heating plant shall be sized to reflect the seasonal nature of the heating load to allow efficient operation under varying loads.

.3 Boilers shall be specified 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. The radiant panel shall be controlled 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 The primary objective of the heating plant design is to ensure that the operating and maintenance of the system is as simple as possible. Complex, multi-temperature, multi-loop systems should be avoided.

.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 Steam boilers shall 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.
 .3 Low or high pressure steam boilers shall be capable of producing steam within 5 minutes of a cold start.

.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 Chemical treatments of the steam system shall be metered. Batch feed systems shall not be used.
 .4 Steam plants shall have provisions for an alternative or standby water supply to allow continued operation for 24 h after failure of the normal water supply.

.3 Steam Pipe Distribution

 .1 Use separate pipes for steam and steam condensate return piping. Single pipe steam systems shall not be used.
 .2 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. Cooling system shall be designed to operate 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 Consider primary-secondary pumping systems where they reduce power consumption and provide better control.
- .2 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.
- .3 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.
- .4 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.

.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 Boards 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 the supply air temperature control. The recommended supply air temperature for displacement ventilation systems is 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. Space temperature shall not exceed those indicated in Table 5.2.2.c.

.2 Mechanical cooling systems shall be provided for dining areas, corridors, program/activity areas, lounges, kitchens, and laundry spaces.

.3 Resident bedrooms shall have an air tempering system to keep space temperature at a level that considers resident comfort and needs. Individual temperature control shall be provided.

.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 Chilled water systems designed to operate on a year-round basis shall be designed with cooling towers that are fully winterized.

- .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 five duct diameters of straight ductwork upstream of VAV terminal boxes inlets (or as required by the manufacturer’s literature - whichever is greater).
- .3 Where low-level displacement diffusers are provided, coordinate locations to prevent obstructions from furniture or millwork.
- .4 Mechanical rooms and mechanical shafts shall not be used as return air plenums. Provide ducted return air.
- .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 Supply air and return air for any given room shall 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 The bottom of outdoor air intake louvers shall be at least 2m (6 ft) above grade level. If the outdoor air intake is supplied through the roof, it shall extend 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 Control

    .1 Where required by the smoke control system, the ventilation system shall work in conjunction with the exhaust system to assist with smoke control.

.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.

.A Specific Requirements for Schools

.1 Gymnasium Ventilation

    .1 Provide a separate air system with free-cooling capability. Typically mechanical cooling and heat recovery are not required.
    .2 Design air systems to vary outdoor air volume for normal and high occupant usage utilizing CO_2 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 Ceiling spaces shall not be used as a 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 shall 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. Non-patient care rooms (i.e. office areas) may be permitted to have

.5 Operating room supply 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 Control

.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 Alberta Building Code. 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.

.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 Do not use variable air volume systems where a specific positive or negative pressure relationship is required.
- .4 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. Outdoor air intakes shall be located at least 7.6 m (25 ft) from outlets exhausting air that could be recirculated in an occupied space, plumbing vents, and natural gas or propane combustion equipment exhausts. Consider the effect of the predominant wind direction and increase distances as appropriate.
- .5 Do not circulate air from an areas 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 Except where indicated otherwise in this section, ventilation systems shall be designed 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. Doors shall be arranged 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 Drains shall be provided 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 shall 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 Air handling units shall be equipped with an economizer and return fan section.

.2 Location

.1 Air handling units shall be located 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 Provide humidification systems to maintain the conditions as identified in ASHARE Handbook, *HVAC Systems and Equipment – Humidifiers*.

.2 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. Headers shall include solenoid valves and adjustable flow control. A stainless steel drain pan shall be provided. The air handling unit shall be controlled to shut off only when the media is dry.

.3 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.

.4 Humidifier Feed-Water

.1 Provide an appropriate water treatment system for humidifier feed-water to control mineral scaling.

.5 Electrode and electrical steam generators for humidification shall 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 Air-handling units shall be provided 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 Construction

.1 Air-handling unit walls shall be acoustically insulated, without perforation, and of solid, double-skin construction.
.2 Air-handling units serving Type 1 areas (as defined in CAN/CSA Z317.2, *Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities)* shall be provided with glazed windows to allow assessment of fan operation, final filter integrity, humidifier operation, and cooling coil drainage.
.3 Where air handling units provide 100% outdoor air under normal operation, they shall be designed and controlled to be able to recirculate 100% of the airflow when outdoor ambient air conditions are non ideal (weather pollution).
.4 Provide deep traps in each section of an air-handling unit where water might accumulate and that are sized to ensure an air seal is maintained in the drains over the full range of fan operation. Avoid the use of common headers and gang trapping. Provide trap seals for each drain c/w air gap and shall take into account winter operation.

.2 Redundancy and Standby Capacity

- .1 Provide redundancy in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities

.3 Humidification

- .1 Provide humidification systems 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 Use steam humidifiers in all air handling systems injected into the supply air through a steam distribution manifold. Electric humidification shall not be permitted.
- .3 Building envelope condensation:
  - .1 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.
  - .2 Where high humidity spaces cannot be “buffered” from the building envelope, provide other means to prevent condensation within the building envelope.

.4 Filtration

- *.1* Provide central ventilation or air-conditioning systems with filters having minimum efficiencies 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 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

.1 Provide ventilation in rooms where combustible fuels are stored within the building in accordance *Alberta Building Code* and *Alberta Fire Code*.

5.13 Exhaust Systems

.1 General Requirements

.1 Provide exhaust air systems to remove odors, smoke, fumes, or heat.

.2 Ceiling spaces or mechanical rooms shall not be used 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 Except where indicated otherwise in this section, ventilation systems shall be designed 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

.1 Kitchen ventilation design shall comply with NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 Kitchens shall be provided 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 If radon air testing after building construction is determined to have an average concentration in excess of 200 Becquerels per cubic meter (Bq/m3), appropriate radon mitigation will need to be taken to reduce the concentration as low as practical in the building interior.

.3 Possible mechanical radon remedial measures include:

  - .1 Active soil depressurization (ASD) systems which create a negative pressure on the soil side relative to the building interior by exhausting the radon laden soil gas to the outdoors where it can be rapidly diluted.
  - .2 Positive building pressurization to prevent radon entry.

.4 For new building construction, ASD is the method of choice.

.5 The design team and the radon mitigation professional will design a radon rough-in mitigation system to facilitate the building with ASD capability should this prove necessary by radon air testing in the future. Mechanical considerations for rough-in system include:

  - .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 Control Systems

.1 General Requirements

.1 Use BACnet compliant Direct Digital Control (DDC) Energy Management Control System (EMCS) to:

  - .1 Control heating, ventilation, and air conditioning systems
  - .2 Execute control strategies to minimize energy consumption
  - .3 Monitor and record mechanical systems performance
  - .4 Provide dial out of alarm signals

.2 Provide commercially available, field proven control systems that shall be 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 to follow applicable requirements specified in Alberta Infrastructure Technical Specifications, 23 09 28 – EMCS Field Work.

.4 Startup and testing to follow applicable requirement specified in Alberta Infrastructure Technical Specification, Section 23 08 95 EMCS Start-Up and Testing.

.5 Develop a 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 Ensure that Contractor provides 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 Ensure that access is provided at all points of measurement to allow 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 5.1.4 for EMCS contract document requirements.

.10 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 23 EMCS General Requirements* for further details.

.2 Energy management Control System (ECMS) Major Components

.1 Network Communication and System Configuration

  - .1 BACnet only system is preferred for all new works. LonMarks devices can be accepted for retrofit projects if circumstances dictate.
  - .2 The EMCS shall support a two tiered network.
  - .3 Support direct peer-to-peer data sharing between all Remote Control Unit (RCU) on primary network.
  - .4 Where BACnet communication is specified between a unitary equipment controller and the EMCS, ensure that the extent of communication is clearly specified. In particular:

    - .1 Specify 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 Specify each BACnet communicated point within the specification section pertaining to the relevant unitary equipment and its controller.

.4 Clearly define which BACnet 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 Provide Central/Portable Control Station (CCS/PCS) with a user friendly interface and control language that allows user reprogramming of the control sequences. Provide program and graphics editing software including operating manuals. Consult with Project Manager to determine if PCS is required.

.2 Provide dynamic graphics for all mechanical systems and interface to any other systems. Include all EMCS controlled space temperatures zoned with associated air system.

.3 Display 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.

.4 Trend 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.

.5 Provide for offsite support access by including a modem or serial device service for telephone or internet connectivity.

.6 Provide trend log, reports to support applicable LEED credit requirements.

.7 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.

.8 Discuss with project manager and facility administrator to determine EMCS server redundancy requirement.

.9 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's)

.1 Each air handling unit shall be provided with its own remote control unit (RCU). Using one RCU for multiple air handling units shall not be acceptable.

.2 Redundancy, backup power and location fire protection rating of RCUs shall match 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 (TCUs)

.1 Use terminal control units (TCU's) in new construction or in retrofits where the majority of the terminal equipment will be upgraded.

.2 TCU's should not be used for control of major equipment (i.e. boilers, air-handling units, etc.).

.3 Specify 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.

.4 Ensure that control valves are selected with flow characteristics to match the application. Size the valve to maintain a reasonably linear control profile.

.5 Consider the use of 1/3 and 2/3 sized control valves for coils with a wide range of expected load variations.

.6 Match the damper type, face area, power of actuator, and method of rod and damper linkage to give a linear volume control characteristic.

.7 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.

.8 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.

.9 Locate flow measuring devices according to the manufacturer's recommended locations and dimension the required straight length entering and leaving each device.

.10 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 27 – EMCS Terminal Control Units* for further details*.*

.5 Field Devices

.1 Specify 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 Ensure control valves are selected with 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 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.) and lighting systems 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 Utility meters or real time monitoring meters shall be connected to the EMCS to facilitate automatic tracking of energy usage.

.4 For variable air volume systems, monitor the supply and return air flow from the air handling unit.

.5 Provide airflow monitoring stations on supply, return, intake, and exhaust duct for air handling units that have a mixing section and are over 5,000 L/s.

.6 Provide necessary points and field devices to meet applicable LEED credit requirements.

.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 Use 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 minute intervals at temperatures below.

.11 Provide necessary control logics and functions to meet applicable LEED credit requirements.

.12 Provide control logics and functions to prevent thermal shock to boilers.

End of MechanicalSection

6.0 Electrical

Section Contents

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 Infrastructure so that the Project Manager can obtain all necessary approvals.

.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 Alberta Building Code (ABC)

.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
    .8 TIA TSB-162-X, Telecommunications Cabling Guidelines for Wireless Access Points.

.7 CSA Z462, Workplace Electrical Safety
.8 APEGA Guidelines
.9 ANSI/ASHRAE/IESNA, Standard 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings
.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
.14 CAN/ULC-S1001, Integrated Systems Testing of Fire Protection and Life Safety 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)

.2 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 Alberta Building Code (ABC).

.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 Fire Alarm, Communications, and Electronic Safety and Security System conduit/raceways to be shown on floor plans for all system devices.

.4 Life Safety Systems: Identification of fire-rated feeders/cables to be shown. Fire-rated feeders/cables to be Mineral Insulated (MI) type.

.5 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.

.6 Block Diagrams for all electrical systems, Communications and Electronic Safety and Security Systems, to be provided.

.7 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.

.8 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).

.9 Electrical systems and distribution 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.

.10 Rooms housing electrical distribution equipment shall not contain communications equipment, mechanical equipment, ducts, pipes, shafts or water mains unless the equipment is serving the room. Provide separate communication rooms for major data and electronic equipment.

.11 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.

.12 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.

.13 Any additional fees written in specifications or drawings are not to be included for items such as record drawings, fire alarm verification, operation and maintenance manuals, etc. unless specifically reviewed with and approved by the Province.

.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.

.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.

.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.

.2 For projects not soliciting proposals for commissioning, provide integrated systems test. As a minimum meet standard CAN/ULC-S1001, “Integrated Systems Testing of Fire Protection and Life Safety Systems and Fire Protection Commissioning”.

.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 Integrated systems testing involving architectural, mechanical and electrical system coordination such as elevators, vertical conveyance, smoke control and extraction, door operation, security system overrides. As a minimum, meet standard CAN/ULC-S1001, Integrated Systems Testing of Fire Protection and Life Safety 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.
  - .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 Target illumination levels for all interior and exterior lit spaces. Include light loss factors and reflectances that will be used in calculating light levels. Include proposed correlated colour temperatures and colour rendering indexes.
  - .7 Target interior and exterior lighting power densities.
  - .8 Detailed 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 Z8001, Commissioning of Health Care Facilities.
.4 CSA Z317.5 Illumination Design in Healthcare Facilities.
.5 ANSI/TIA 1179, Healthcare Facility Telecommunications Infrastructure Standard.
.6 ANSI/IES RP-28 Lighting and the Visual Environment for Seniors and the Low Vision Population
.7 ANSI/IES RP-29 Lighting for Hospitals and Healthcare Facilities
.8 UL 1069 Standard for Safety – Hospital Signaling and Nurse Call Equipment
.9 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 and an arc flash hazard 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.

.4 Harmonic distortion and noise: As a minimum, undertake the following steps:

  .1 Identify non-linear loads, including Uninterruptible Power Supplies (UPS's), computers, rectifiers, variable frequency drives, and electronic ballasts or Light-emitting diode (LED) drivers, and consider their effects on power distribution system.
  .2 Provide harmonic filtration, either with the specified equipment, or separately, to limit total harmonic distortion at the utility Point of Common Coupling (PCC) as per IEEE 519-2014, "Recommended Practice and Requirements for Harmonic Control in Electric Power Systems".
  .3 Electric motor starters, drives and controllers provided packaged with mechanical equipment are to be reviewed by the Electrical Consultant for conformance with required performance characteristics outlined within this design guide and coordinated with the Mechanical Consultant in a similar fashion to all other aspects of the mechanical design.

.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. 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 Use industrial duty, draw out type power circuit breakers, complete with electronic trip units and trip indication, for main service and feeders 800 Amps and over in new installations. Fixed mounted with side access enclosure products may be used in existing facilities where space is a concern. Discuss with the Province prior to proceeding.
- .2 Use circuit breakers with maintainable contacts, complete with electronic trip units and trip indication for all main service or feeders 400 Amps and over and under 800 Amps.
- .3 Use molded case thermal magnetic breakers for feeders under 400 Amps.

   - .4 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.
   - .5 Obtain the approval of the Province for the use of fused equipment. (Consideration will only be given where fault duties of equipment require a limitation of the available fault current).

.2 Bussing: Use solid copper.

.3 Metering: Provide panel mounted digital owner's metering for all services and feeders 600 kVA and over, 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 42. Double wide is acceptable. Provide minimum 225A bussing for panelboards with 42 or more positions.
   - .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 Size feeders for a maximum 2% voltage drop from main distribution to branch circuit panelboard under full load conditions.

.2 Use copper conductors.

.3 Provide a ground conductor and a full capacity neutral.

.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.

.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) built into all drives. Consider passive filter for 29.8kW (40HP) and larger at 100% load. Consider active filter for 74.5kW (100HP) 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.

  .3 Ensure that a harmonic digital simulation is completed to demonstrate that with the drives supplied, the limits set out in IEEE Standard 519 – 2014 "IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems", are met.

.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. Review loading and if required provide a load bank sized appropriately so the monthly testing will be at least 40% of the generator set kW rating.

.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 project ground fault protection strategy.
.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.
.6 Provide elevator pre-transfer signaling feature for use in test mode.

.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 Provide electrical design features as follows:

  - .1 Individual computer work station areas to be supplied with a minimum of two shared circuits.
  - .2 Generally supply only four outlets per circuit. Review the options for circuiting with the Province.
  - .3 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.

.5 Do not provide protection for properly grounded metal buildings.

.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 In instances where a school is being modernized, where the main service breakers is up to and including 1200A, moulded case circuit breaker with electronic trip units and trip indication may be utilized to conserve space in the existing electrical room.

.2 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.

.3 Where schools are located in rural areas, provide Levels 1 and 2 of SPD per Section 6.2.10 of this document.

.4 Receptacles – do not use any circuits in more than one classroom.

.5 Switch and receptacle cover plates shall be stainless steel type 302/304, #4 finish, and stainless steel screws.

.6 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.

.7 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. Provide grounding as per CSA-Z32.2.

.5 Provide independent, self-contained emergency power generation in accordance with CAN/CSA C282, Emergency Electrical Power Supply for Buildings and as defined by the Alberta Building Code (ABC) and the Health Care Facility (HCF) classification determined by CSA-Z32.

.6 Comply with CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems, with respect to emergency generation.

.7 Provide emergency power to essential loads as outlined in CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

.8 Generator Sizing:

  .1 Size emergency generator for minimum 50% demand loading during regular testing.

  .2 Size generator to carry the load of one elevator in addition to fire fighters' designated elevator(s).

.9 Transfer Equipment:

  .1 Provide drawout type automatic transfer switch complete with bypass isolation feature to allow servicing without the interruption of power.
  .2 Drawout air circuit breaker transfer schemes are acceptable in large emergency power systems. Include interlocks.

.10 Isolation of Emergency Power Generation and Distribution:

- .1 Where two or more generator sets are used, provide independent distribution systems with provisions to tie highest priority loads on to one generator in the event of one generator failing. Provide each generator with its own day tank and cooling equipment.
- .2 Separate multiple generators with barriers/fire curtain.
- .3 Provide fire rating, using rated cables or enclosures, for emergency power feeders.

.11 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.

.12 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 Provide maintenance-free, sealed lead acid batteries where discharge of hydrogen is not acceptable.
- .3 Maintain battery operating ambient temperature above 20°C.
- .4 Provide battery chargers with bulkcharge, overcharge protection and floatcharge features.

.13 Additional Considerations for the Emergency Power System:

- .1 Make provisions for connection to load bank to facilitate annual full load testing; size only for additional required load.
- .2 Classify emergency loads as:
  - .1 Life support
  - .2 Life safety
  - .3 Communications
  - .4 Patient comfort and prevention of property losses
- .3 Identify load classifications as:
  - .1 Vital
  - .2 Delayed Vital
  - .3 Optional

.14 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 lamicoid 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 Only use the task-ambient approach where work surface and task orientations are predetermined and as agreed to by the Province.

.3 Designs should be generally based on target illumination levels as described in the IES Lighting Handbook. Designs shall be supported by reference to the appropriate section of the Handbook.

.4 Design to minimize glare. Carefully review glare implications and select luminaires cognizant of intensities at user viewing angles.

.5 Design files shall include the following information which may be requested by the Province for review:

  .1 Complete a photometric plot showing illumination values on an appropriate grid scale to demonstrate compliance with IES recommended best practices.
  .2 Include 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 Interior Lighting Sources

.1 Only use sources which are readily available from local distributor's stock.

.2 Light-emitting diode (LED) type lighting is acceptable provided items in LED’s and Drivers section below are met.

.3 Lighting design may be fluorescent, using energy saving T8, tri-phosphor lamps. 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 fluorescent T8 lamps.

.4 Use LED sources for all interior applications involving recessed downlighting, accent lighting, and direct/indirect ambient lighting.

.5 Do not use incandescent sources.

.6 For exit signs use LED type.

.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 Ballasts

.1 Use programmed start ballasts for fluorescent luminaires. Electronic ballasts to have Total Harmonic Distortion of less than 10% and a Power factor of better than 0.95.

.2 For acoustical and electromagnetic interference considerations, refer to Section 7.0 - Acoustical. Review use of electronic ballasts for luminaires in courtrooms with the Province

.8 LED’s and Drivers

.1 Ensure LED lighting equipment meets the following specifications:

  .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 LED drivers for exterior applications shall be suitable for operation to –40°C.

.2 For interior linear 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 60,000 hours at L70.
  .2 Generally provide a Colour Rendering Index (CRI) greater than 80. Ideally a CRI of 85 (site measured) or higher should be attainable. Generally, Correlated Colour Temperature (CCT) to be 3500K.
  .3 The luminaire must have replaceable drivers and LED arrays. For recessed fixtures, consider fixtures serviceable from below where ceiling access is troublesome.
  .4 Ensure that the manufacturer will have compatible LED arrays and drivers readily available from a local supplier for a minimum of 10 years.
  .5 Luminous efficacy of the source to be a minimum of 85 lumens per watt (delivered fixture lumens).

.9 Interior Lighting Control

.1 Lighting control to be a wired system. Do not use breaker switching.

.2 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 emergency lighting units with a minimum one hour capacity in all electrical, generator and mechanical rooms.

.4 Integral battery power back-up ballasts/drivers in Luminaire is not acceptable.

.11 Exterior Lighting

.1 Use fully shielded LED luminaires with a CCT of 3000K or less for all building exterior, parking, roadway and area lighting.

.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.

.3 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, specifically refer to ANSI/IES RP-3 – Standard Practice on Lighting for Educational Facilities.

.2 Design lighting control to comprise a significant part both of the energy management of the School and 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 the 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. In rooms where audio/visual presentations are likely, provide a second level of lighting through switching a small number of luminaires separately from the main lighting. Do not use center lamp switching of three lamp luminaires.

.5 Ensure all lighting in communal and administration areas are capable of being operated from a central location.

.6 Provide sensors to automatically turn off the room lighting after the room is vacated in classrooms, shops, staff areas, gymnasium, student washrooms, storage and service rooms as reviewed by the school.

.7 Lighting control system field devices to be non-addressable.

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.

.4 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 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 Vertical riser cable for data shall be a combination of UTP Category 6, 4 pair, 6-strand 50 ɥm core diameter/125 ɥm cladding diameter multimode fiber and 6-strand single mode fiber.

.8 Vertical riser cables 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.

.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”. This document is for the design team and not to be attached into the contract documents. (http://www.infrastructure.alberta.ca/Content/docType486/Production/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 For addressable technology use Class A circuit (Return Loop Circuit) wiring for initiating devices. Where loops are used for multiple fire alarm zones use Data Communication Link style C. Where fault isolation modules are used, they shall be addressable. Review capabilities of manufacturer’s devices.

.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 Alberta Building Code for edition reference (ie. for a project utilizing Alberta Building Code 2014, 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 engineers expectations will be during verification.

.15 Provide a completed fire alarm verification report reviewed by the electrical engineer of record that incudes 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 Conduit/raceway Banding Tape: 25 mm wide adhesive backed plastic tape integrally coloured,

.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:

	Voltage	Colour (See Section 13)
.1	High Voltage (in excess of 750 V):	Brown
.2	347/600 V:	Sand
.3	277/480V:	Bronze

.4 120/208 V:	Grey
.5 Emergency Power:	Associated Voltage Colour
.6 Fire Alarm & Firephone:	Red
.7 Security/Intrusion/Surveillance:	Green
.8 Low Voltage Switching:	Black
.9 Annunciator Cabinets:	Black
.10 Data/Telephone Cabinets:	Blue
.11 Telephone Backboards:	Grey
.12 Television:	White
.13 Public Address/Intercom:	Purple

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:

System	Colour
.1 347/600 V:	Sand
.2 347/600 V Emergency:	Sand (covers marked “EM”)
.3 277/480V:	Bronze
.4 277/480 V Emergency:	Bronze (covers marked “EM”)
.5 120/208 V:	Grey
.6 120/208 V Emergency:	Grey (covers marked “EM”)
.7 In Excess of 750 V:	Brown
.8 In Excess of 750 V – Emergency:	Brown (covers marked “EM”)
.9 Fire Alarm & Firephone:	Red
.10 Security/Intrusion/Surveillance:	Green
.11 Data/Telephone (VoIP):	Blue
.12 Public Address/Intercom:	Purple
.13 Sound Masking:	Orange
.14 Nurse Call:	Yellow

.15 Television:	White
.16 Low Voltage Switching:	Black
.17 Low Voltage Switching – Emergency:	Black (covers marked “EM”)

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 Use boxes which are prefinished in coded colours, or spray paint inside and outside of boxes prior to installation, 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.

.2 Identify pull and junction boxes 100 mm or less in size as follows:

    - .1 Spray paint inside of 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. 4/0 AWG wiring and smaller by continuous insulation colour.

.2 Identify wiring larger than No. 4/0 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

Equipment	Colour	Nameplate Identification	Lamicoid Nameplate Size
Main Distribution Centre	Voltage Colour	Building name, consulting engineer, date installed, amperage, voltage	3
		Main breaker Metering cabinet	2
		Instrument transformer enclosure	2
		Loads controlled by each overcurrent protective device	1
		Metering devices	1
Distribution Centres	Voltage Colour	Distribution centre designation, amperage, and voltage	2
		Loads controlled by each overcurrent protective device	1
Panelboards	Voltage Colour	Panelboard designation	2
Motor Control Centres	Voltage Colour	M.C.C. designation, amperage and voltage	2
		Motors or loads controlled by each unit and mnemonics	1
		Relay terminal and transformer compartments	1
Manual Motor Starters	N/A	Load controlled and mnemonics	1
Ground Bus	N/A	System Ground	1
On/Off Switches	N/A	Load controlled	1
Disconnect Switches, Magnetic Motor	Voltage Colour	Voltage and equipment controlled mnemonics	2

Starters and Contactors			
Transformers	Voltage Colour	Transformer designation, capacity, secondary and primary voltages	2
Emergency Power Equipment	Voltage Colour	Designation and voltage	2
Wireways	N/A	Voltage and system designation	2
Line Voltage Cabinets and Enclosures	Voltage Colour	Designation and voltage	2
Low Voltage Cabinets and	System Colour	System name; system name and number if more than one cabinet or enclosure	2
Enclosures		Major components within cabinets and enclosures	1
Communication Outlet and Outlet Assemblies	N/A	Outlet Designation	1
Communication Panels	N/A	Panel Designation	1
Communication Ports	N/A	Panel Designation	1

.13 Colour Schedule

Electrical Colours	Federal Standard 595C Colour Numbers
Blue	15052
Green	14449
Brown	10114
Sand	13613
Grey	16307 or ASA61 Grey
Black	17038
Bronze	13275

Purple	17100
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

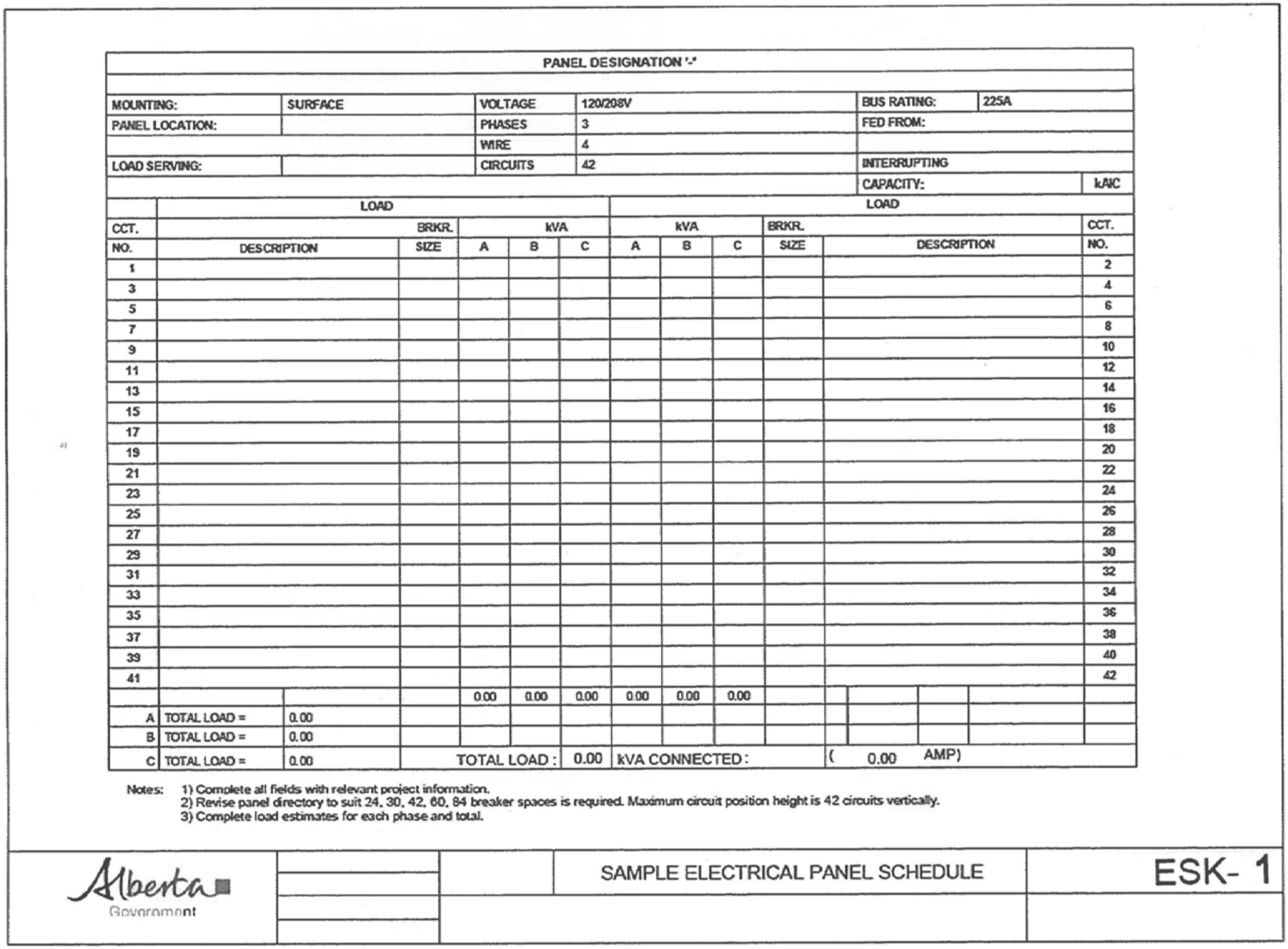
.1 All devices shall be labeled on the external fixed portion of the device, or next to the device, with applicable node, loop, address, or circuit number.

  a. Example: For addressable “N1-L2-Ø5” representing Node 1 / Loop 2 / Device 5, or for conventional “N1-Z2-cct3” representing Node 1 / Zone 2 / Circuit 3.

.2 End-of-line resistors, duct detectors and remote indicators: Identify with 6 mm high white lettering on red background lamicoid located on wall next to device.

Electrical – Appendix B

.1 Sample Electrical Panel Schedule



PANEL DESIGNATION '-'

MOUNTING: SURFACE

PANEL LOCATION:

LOAD SERVING:

VOLTAGE 120/208V

PHASES 3

WIRE 4

CIRCUITS 42

BUS RATING: 225A

FED FROM:

INTERRUPTING CAPACITY: kAIC

	LOAD						LOAD				
CCT.		BRKR.	kVA			kVA			BRKR.		CCT.
NO.	DESCRIPTION	SIZE	A	B	C	A	B	C	SIZE	DESCRIPTION	NO.
1											2
3											4
5											6
7											8
9											10
11											12
13											14
15											16
17											18
19											20
21											22
23											24
25											26
27											28
29											30
31											32
33											34
35											36
37											38
39											40
41											42
			0.00	0.00	0.00	0.00	0.00	0.00			

A TOTAL LOAD = 0.00

B TOTAL LOAD = 0.00

C TOTAL LOAD = 0.00

TOTAL LOAD : 0.00 kVA CONNECTED : (0.00 AMP)

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.

Alberta Government

SAMPLE ELECTRICAL PANEL SCHEDULE

ESK- 1

7.0 Acoustical

Section Contents

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
- .6 ASTM E557-12, Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions
- .7 ASTM E336-16 Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
- .8 FGI Guidelines for Design and Construction of Residential Health, Care, and Support Facilities – 2018 edition
- .9 FGI Guidelines for Design and Construction of Residential Health, Care, and Support Facilities – 2018 edition
- .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 celling 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

.8 Completed mechanical schedules with acoustic specifications for silencers, terminal boxes, diffusers, cooling towers, fans, generators, etc.

.9 Mechanical details for unusual or specialty acoustical treatment (e.g. pipes in floating floors, acoustical plenums, etc.)

.10 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.

.11 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

.1 General

.1 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.

.2 Floor Construction

.1 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.

.2 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:

Space Description	ASTC Rating[1] (minimum)
Moderate Privacy Requirements • General Office Space, Small Meeting Rooms	35
Confidential Privacy Requirements • Interview rooms, quiet rooms, telephone rooms • Executive Offices • Large Conference Rooms, Training Rooms	40
Acoustically Critical Spaces	
• Video conference rooms	45
• Demising wall between departments or GOA and non-GOA space	45
• Washrooms	50
• Mechanical room	50+
Other Acoustically Critical Spaces (see Section 7.4) • Therapy Rooms, Courtrooms • Studios, Auditoria, Lecture Halls	45+ (varies)

[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 <u>Classrooms:</u>

- .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.

.5 Consider a ceiling height of 4m - 5m. Unlike classrooms, music rooms benefit from additional volume.
.6 Avoid concave ceiling profiles or domes.
.7 Consider making portions of the ceiling reflective to promote sound diffusion and ensemble between musicians.
.8 Consider pyramidal or convex ceiling diffuser panels set into the T-bar grid covering approximately 10% - 20% of the ceiling.
.9 Consider non-parallel sidewalls or provide sound diffusing elements on sidewalls such as open instrument storage.
.10 Where the instructor’s teaching position is fixed because of risers, the wall behind the instructor should have acoustic wall treatment.
.11 Acoustic wall treatment should have a minimum NRC 0.80.

.4 Practice Rooms:

.1 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.
.2 Locate practice rooms, where possible, so they do not open directly into a music room. Consider using corridors or vestibules as a buffer.
.3 Reverberation in unoccupied practice rooms shall not exceed RT 0.5 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.
.4 Provide acoustic ceiling with minimum NRC 0.80.
.5 Provide acoustic wall treatment with minimum NRC 0.80, distributed over approximately 50% of the total wall area.
.6 Provide insulated metal or solid core door with acoustic door seals.

.5 Common Areas:

.1 Reverberation in unoccupied common areas shall not exceed RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.
.2 Typically, corridors and lunchrooms require a ceiling with a minimum NRC 0.55. Note that high ceilinged spaces require higher sound absorption.
.3 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:

Space Description	**ASTC Rating[2] (minimum)**
Offices	40
Classrooms, Computer Labs, Libraries	45
Gathering Spaces, Drama Rooms, Washrooms, Maker space	50
Music Rooms (Elem.), Practice Rooms, Gymnasium/Fitness Rooms, Mechanical room	55
Music Rooms (Jr./Sr.), Woodshop, Automotive, Metal work	60

[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 gymnasia.

.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 L_{AS} 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 ABC 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 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:

Space Description	Room Criterion (RC)
Radio/Recording Studio, Auditorium	20 Maximum
Audio/Visual Room, Courtroom, Teleconference Room	25 Maximum
Large Conference Room, Observation/Therapy Room, Classroom, Lecture Hall, Secure Interview rooms	25-30
Enclosed Office, Meeting Room, Open-Plan Areas	30-35
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:

Space Description	Room Criterion (RC)
Patient Room	30
Medication Room	40
Multiple occupant patient care areas	35
NICU sleep areas	25
NICU staff and family areas	30
Operating rooms	35
Corridors and public spaces	40
Private offices, exam rooms	35
Conference rooms	30
Teleconference rooms	25
Auditoria, large lecture rooms	30

.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.

.2 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.

.3 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.

.4 Use reactive (packless), Mylar lined, or foam lined silencers for all clean room applications.

.3 Plumbing Noise

.1 Divide water supply lines at the riser with each room fed separately. Tee takeoffs serving back-to-back fixtures in separate washrooms are undesirable.

.2 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.

.4 Vibration Isolation

.1 Consider the effects of vibration on medical equipment. Refer to Structural Section 4.5 A.

.5 Community Noise (Mechanical)

.1 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.

.2 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).

.3 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:

	Near Non-Critical Areas		Near Critical Areas	
Size (kVA)	**Isolator Type**	**Min. Static Deflection**	**Isolator Type**	**Min. Static Deflection**
Under 50	Neoprene pad	3 mm	Neoprene isolator	10 mm
50 - 250	Neoprene isolator	10 mm	Spring isolator or hanger	19 mm
Over 250	Spring isolator or hanger	19 mm	Spring isolator or hanger	25 mm

.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 Barrier-Free (BF) accessibility in our existing and new buildings is important to the Province. All requirements of the latest edition of the Alberta Building Code (ABC) 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 ABC 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 ABC; 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.

8.2 References

.1 *Alberta Building Code*, latest edition

.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.

.3 *CAN/CSA-B651-95, Barrier-Free Design,* Canadian Standards Association.

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:

<u>Number of Floors</u>

- Main Floor only
- Main Floor plus other floor(s)
- All Floors

<u>Extent of Upgrade</u>

- Public Areas Only
- Throughout

<u>Standard of Upgrade</u>

- To meet the Alberta Building Code (ABC)
- To meet the ABC 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/ABC 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 Alberta Building Code (ABC), 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 ABC 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 ABC 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 ABC, 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 ABC 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

9.1 References

.1 *Geometric Design Guide for Canadian Roads; Manual of Uniform Traffic Control Devices for Canada*; by the Transportation Association of Canada.

.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)

.6 Barrier-Free Design Guide, by Alberta Safety Council.

.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 Complete site investigations on proposed sites, 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 Confirm that 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 Confirm the need for stormwater management on site.

- .4 Confirm that the site 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”.

- .5 Confirm that the site 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, include these items on the site plan in the contract documents:

    - .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 geodetic datum and the equated elevation, and
    - .5 All utilities including power and telephone

.2 Access

.1 Design the location of site access in consideration to driveways and intersections adjacent to and opposite the site.

.3 Signage

.1 Determine the locations of all signs with due consideration to vehicular and pedestrian sight lines.

.4 Roads, Walks and Parking

.1 Design driveways and off-site walks to meet local municipal standards.

.2 Provide barrier free access walkways, entrances and parking spaces, along with appropriate surfaces that do not restrict the mobility of physically challenged people.

.3 Lay out parking lots and parking appurtenances to facilitate snow removal and to prevent damage by snow moving equipment.

.4 Allow for snow dumping areas to reduce snow removal requirements.

.5 Provide protective concrete sealers on concrete walks located in prominent areas where de-icing agents will be used.

.6 Provide a concrete pad for garbage bin and recycling bin, and locate bins for ease of access and safety.

.7 In order to address potential safety concern, efforts should be made to separate main vehicular traffic from main pedestrian traffic.

.8 Identify light and heavy asphalt pavement locations and provide asphalt pavement structure details on drawings in accordance with recommendations in the geotechnical investigation report for the subject site.

.9 Specify Reclaimed Asphalt Pavement (RAP) and Recycled Asphalt Shingles (RAS) in the contract documents. Alberta Infrastructure (AI) might accept that asphalt mix design contains a maximum of 10% RAP by weight. AI doesn’t accept any asphalt mix design containing RAS.

.5 Grading

.1 Maintain minimum grade of 1% for concrete and asphalt surfaces in parking lots.

.2 Maintain minimum grade of 2% for graveled surfaces.

.3 Provide roadways with a 2% crown or crossfall and sidewalks with 2% crossfall.

.4 Minimum grades from foundation walls: A positive sloped surface is required 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

.5 Drainage Swales: minimum swale slope requirements:

  .1 1.5% for a grass drainage swale

  .2 1% for a concrete drainage swale

.6 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.

.7 Identify ponding areas on site, and ensure meet the following requirements:

  .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 Provide dimensions of utilities to property lines or use a grid co-ordinate system.

.2 Where utilities are to be connected to municipal systems, confirm with municipalities and utility companies the adequacies of their systems to service the site.

.3 Where utilities are to be connected to existing on-site system, confirm that the existing on-site system can accommodate the additional loads.

.4 Early in the design, confirm with municipalities about any restrictions on stormwater discharge to their stormwater drainage system.

.5 Contact the local municipality to confirm the municipal water pressure available. Determine whether or not an on-site boosting is required for a fire sprinkler system.

.6 On large sites locate utilities in utility corridors keeping in mind any potential for future development.

.7 Prior to any expansion, confirm that existing utilities will provide adequate capacity to service the site.

.2 Stormwater Management System

.1 Running the storm mains under buildings is not permitted.

.2 The minimum velocity shall be 0.6 m/s. Where design velocities in excess of 3.0 m/s are proposed, special provision shall be made to protect against displacement of sewers by erosion or shock.

.3 Provide design slopes for storm sewer pipes in accordance with *Alberta Environmental Guidelines and local municipal standards, whichever set higher standards.*

.4 The minimum diameter for storm sewers shall be 300 mm. the minimum diameter for catch basin shall be 250 mm.

.5 Foundation drain sewers are not to be less than 200 mm diameter.

.6 Provide a minimum cover from finished grade to pipe crown of 2.0 m for storm sewer and foundation drain sewer for all pipes smaller than 610 mm diameter. Provide a minimum cover from finished grade to pipe crown of 1.5 m for storm sewers equal to or larger than 610 mm in diameter.

.7 Manholes:

  - .1 Manholes shall be located at the upstream end of each line, at all changes in pipe size, grade, material and alignment.
  - .2 Manhole spacing on storm sewers may not exceed 120 m.
  - .3 Manhole spacing on curved sewers shall not exceed 90 m along the curve. Manholes shall be located at the beginning and end of curve.

.8 Catch Basin Leads:

  - .1 The catch basin lead size and grade shall be based upon hydraulic capacity requirements, except that the minimum inside diameter for any catch basin lead shall be 250 mm and the minimum grade shall be 1.0%.
  - .2 Catch basin leads must enter a manhole. Catch basin leads may not connect directly to a sewer, or a downstream catch basin.
  - .3 The minimum length of a catch basin lead is 600 mm; and the maximum length is 30 m.
  - .4 If the length of a catch basin lead is over 30 m, a catch basin manhole must be used as the upstream inlet, rather than a catch basin.

.9 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 sewers shall be designed to achieve a mean flow velocity not less than 0.6 m/s to provide for self-cleansing.

.2 The maximum flow velocity shall be limited to 3.0 m/s. This is to prevent undue turbulence, minimize odors due to sulphide generation, and limit the erosive and momentum effects of the flow.

.3 Minimum pipe diameters for gravity sewer shall be 200 mm with a minimum design slope of 0.40%.

.4 Provide design slopes for sewer pipes in accordance with *Alberta Environmental Guidelines and local municipal standards, whichever set higher standards.*

.5 The maximum slope will be based upon limiting to the maximum flow velocity of 3.0 m/s.

.6 No direct connections are allowed. All Sewer pipes shall be connected through a manhole.

.7 To prevent freezing and damage due to frost, pipes shall have a minimum cover above the crown of the pipe of:

  .1 2.5 m, or
  .2 The depth of frost penetration for the location based on the coldest three years during the past 30 years, or, where this period of record is not available, the coldest year during the past 10 years with an appropriate safety factor.

.4 Drop Manholes

.1 Drop manholes should be used when invert levels of inlet and outlet sewers differ by 600mm or more.

.2 Baffled vertical drop shafts are not permitted due to potential maintenance and access problems.

.5 Water Services

.1 Provide fire department connection and fire hydrants in accordance with the *Alberta Building Code* and the *Alberta Fire Code*.

.2 Frost protection criteria for water mains is the same as for sewer lines (see above 9.4.3.7 for details)

.6 Cross Connections

.1 Horizontal Separations of Water Mains and Sewers:

  .1 The minimum horizontal separation between a water main and a storm or sanitary sewer or manhole shall be 2.5 m, the distance being measured center to center.
  .2 Unusual conditions including excessive rock or congestion with other utilities may prevent the normal required horizontal separation of 2.5 m. a minimum vertical separation of 0.5 m from sewer crown to the watermain invert.

.2 Pipe Crossing

- .1 Water mains shall cross above sewers with a minimum of 0.5 m vertical separation to allow for proper bedding and structural support of the water and sewer mains.
- .2 Where it is necessary for watermain to cross below the sewer, the watermain shall be protected by providing:
  - .1 A vertical separation of at least 0.5 m from watermain crown to sewer invert;
  - .2 Structural support of the sewer to prevent excessive joint deflection and setting; and
  - .3 Centering of the length of watermain at the point of crossing so that the joints are equidistant from the sewer.

9.5 Environmental Site Assessment

.1 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.

.3 Clean up contaminated sites according to Tier 1 or Tier 2 Alberta Soil and Groundwater Remediation Guidelines, published by Alberta Environment and Parks.

.2 Investigation, Remediation, and Risk Management

.1 Complete all Environmental Site Assessments in accordance with the *Contaminated Sites Policy Framework*.

.2 Phase I Environmental Site Assessment (ESA):

- .1 Complete the Phase I ESA in accordance with the *Alberta Environmental Site Assessment Standard*.

.3 Phase II Environmental Site Assessment (ESA):

- .1 If the Phase I ESA identifies any potential environmental concerns, and further investigation is recommended, conduct a Phase II ESA.

.2 The objective of the Phase II ESA is to confirm the presence or absence of the contaminants of potential concern, through intrusive sampling. If contamination is identified, it must be fully delineated in all directions.

.3 Complete the Phase II ESA in accordance with the *Alberta Environmental Site Assessment Standard*.

.4 Compare soil and/or groundwater samples to the current applicable Tier of *Alberta Soil and Groundwater Remediation Guidelines*.

.4 Remediation:

.1 Conduct remediation according to the applicable Tier of the *Alberta Soil and Groundwater Remediation Guidelines*.

.5 Exposure Control / Risk Management:

.1 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.

.2 A Risk Management Plan shall be developed in accordance with the *Alberta Exposure Control Guide*, and the *Alberta Risk Management Plan Guide*.

End of Municipal and Environmental Engineering Section

10.0 Landscape Development

Section Contents

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 shall include municipal boulevards and easement areas.

.2 Minimum gradient of landscaped areas shall be 2% 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. Existing trees that remain shall be adequately protected 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, unsuitable or which are considered hazardous to property and public safety shall be removed complete with stump.

.4 Site landscaping shall consist of a variety of hardy trees, shrubs and others plants in a cohesive design layout. Selected plant species shall be tolerant of local growing conditions, have adequate space to reach their natural form at maturity and be spaced appropriately to avoid overcrowding. Monoculture plantings shall be avoided. Species diversity shall be emphasized in the landscape design.

.5 Provide a landscape design that respects and improves site visibility and security through selection and layout of plant material. Ensure that future plant maturity size of selected plants does not interfere 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.

.7 Selected plant species that are susceptible to pest infestations considered difficult to control or eliminate must not be installed. Plants that possess significant nuisance problems shall not be planted on site. Plants that are prone to branch and other structural failure shall not be specified.

.8 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. Shrub beds shall be continuous with minimum 450 mm depth of acceptable soil mix.

.9 Install appropriate plant species along parking structures, retaining walls and other wall structures that reduce opportunities for graffiti vandalism.

.10 All trees provided for planting shall be a minimum 60 mm caliper for deciduous trees and minimum 200 cm in height for coniferous trees. All shrubs provided for planting shall be a minimum height or spread of 450 mm. All perennials provided for planting shall be supplied in minimum #1 sized containers.

.11 Keep all plantings clear of utilities, services, walkways and buildings.

.12 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.

.13 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.

.14 Provide shredded coniferous bark mulch for all plant beds and tree pits to an appropriate minimum depth of 100 mm. Under building overhangs and along building foundations install appropriate and durable mulch covering.

.15 Install 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.

.16 Ensure landscape development is subject to a minimum one year of maintenance/warranty services in contract which shall commence from date of approval of completed landscape works. For smaller landscape project the length of maintenance in contract shall be determined in collaboration with the Owner.

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.

11. Environmental Hazards

Section Contents

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 Branch, 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 maintenance, 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 Branch, Government of Alberta, Ministry of Infrastructure.

.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 http://www.infrastructure.alberta.ca/2691.htm 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. Contact the Building Environment Unit Section, Technical Services Branch if in doubt.

.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 Building Environment Unit Section, Technical Services Branch for accredited laboratories specializing in hazardous materials analysis.

.5 For additional hazardous materials information refer to *Division 02 – Existing Conditions*, Technical Specifications, Alberta Infrastructure, Technical Resource Centre, http://www.infrastructure.alberta.ca/3467.htm.

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 Branch 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. The 2014 Alberta Building Code (ABC) references this installation, and it is a requirement of the Province as of February 2016.

.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 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 should follow EPA 625/R-92/016, Radon Prevention in the Design and Construction of Schools and Other Large Buildings, as found in the 2014 Alberta Building Code (ABC), https://www.educateiowa.gov/sites/files/ed/documents/Radon%20Prevention%20in%20Design%20%26%20Construction%20of%20Schools_0.pdf

.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 rough-in is 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 and documented 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 Building Environment Unit Section, Technical Services Branch if in doubt.

.8 Radon air testing is to follow the Health Canada document, *Guide for Radon Measurements in Public Buildings*, http://hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/radiation/radon_building-edifices/27-15-1468-RadonMeasurements_PublicBuildings-EN13.pdf.

.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/m^3), 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 the Province Radon Mitigation Rough-in Master Specification: 31 21 13.

.12 Refer to *Section 5.0 – Mechanical, paragraph 5.13.5* for additional information on radon gas exhaust.

End of Environmental Hazards Section

12.0 Crime Prevention Through Environmental Design (CPTED)

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

http://www.infrastructure.alberta.ca/Content/docType486/Production/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 there 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

- o 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-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-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

AC/h (also ACH)	air changes per hour
ADA	Americans with Disabilities Act
APEGGA	Association of Professional Engineers, Geologists and Geophysicists of Alberta
ARCA	Alberta Roofing Contractors Association
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
ASTM	American Society for Testing and Materials
CAC	ceiling attenuation class
CCU	central control unit
CFC	chlorinated fluorocarbon
CISC	Canadian Institute of Steel Construction
CMHC	Canada Mortgage and Housing Corporation
CSA	Canadian Standards Association
CSC	Construction Specifications Canada
CSTC	ceiling sound transmission class
DDC	distributed digital control
EMCS	energy management control system
HID	high intensity discharge

HVAC	heating, ventilating & air conditioning
IEEE	Illumination, Electrical and Electronic Engineers
IES	see IESNA
IESNA	Illuminating Engineering Society of North America
LAN	local area network
LED	light emitting diode
MBM	modified bituminous membrane
MCC	motor control centre
NC	noise criteria
NRC	noise reduction coefficient (also National Research Council)
PERSIST	Pressure Equalized Rain Screen Insulated Structure Technique
RC	room criterion (acoustics)
RCU	remote control unit
RSI	thermal resistance in SI units
SI	Système Internationale (metric system)
SMACNA	Sheet Metal & Air Conditioning Contractors National Association
STC	sound transmission class
TCU	terminal control unit
ULC	Underwriters Laboratories of Canada
UPS	uninterruptible power supply

UV	ultraviolet
VAV	variable air volume

End of Appendix A

Appendix B – Flood Risk Management Guidelines

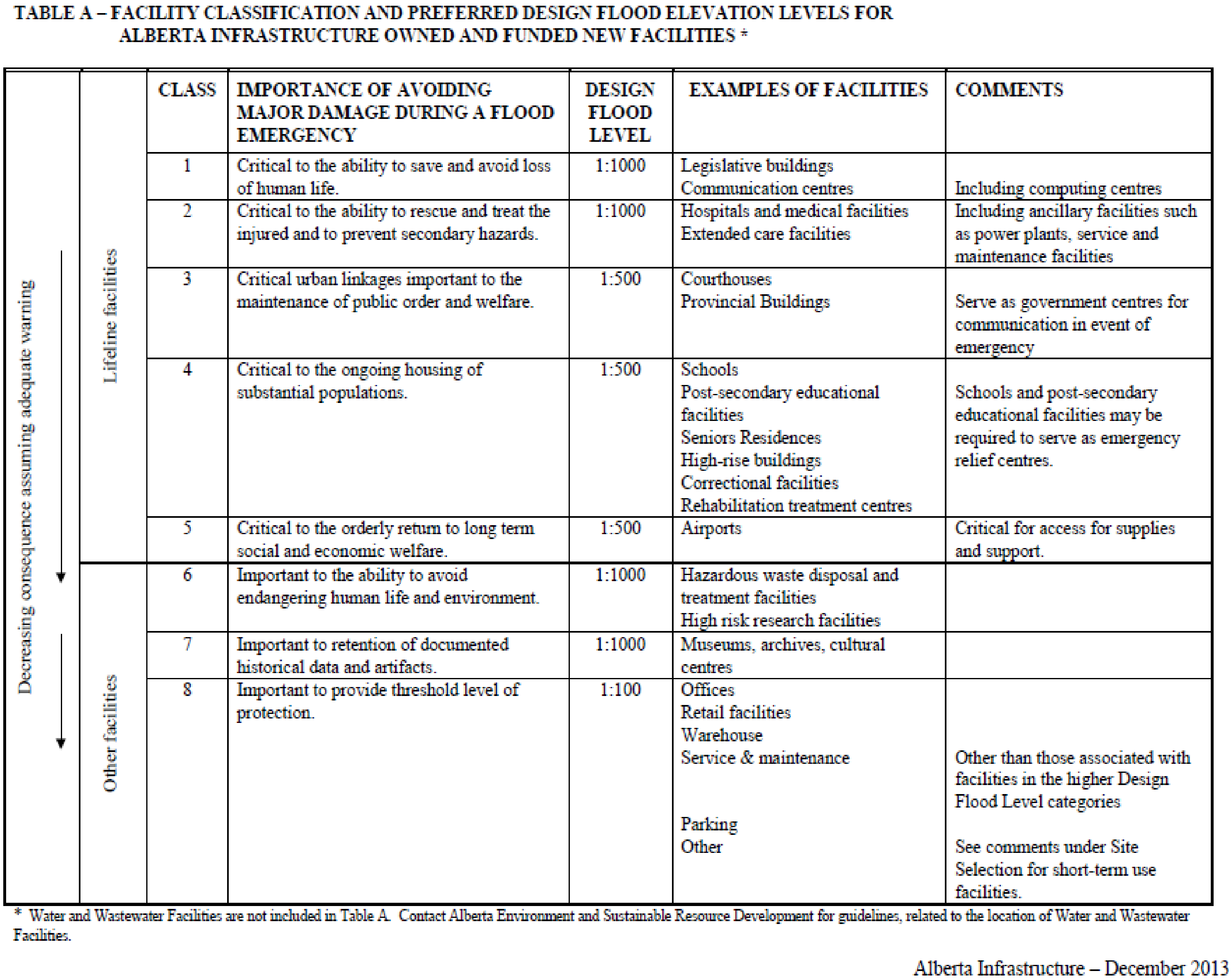


TABLE A – FACILITY CLASSIFICATION AND PREFERRED DESIGN FLOOD ELEVATION LEVELS FOR ALBERTA INFRASTRUCTURE OWNED AND FUNDED NEW FACILITIES *

		CLASS	IMPORTANCE OF AVOIDING MAJOR DAMAGE DURING A FLOOD EMERGENCY	DESIGN FLOOD LEVEL	EXAMPLES OF FACILITIES	COMMENTS
Decreasing consequence assuming adequate warning	Lifeline facilities	1	Critical to the ability to save and avoid loss of human life.	1:1000	Legislative buildings Communication centres	Including computing centres
		2	Critical to the ability to rescue and treat the injured and to prevent secondary hazards.	1:1000	Hospitals and medical facilities Extended care facilities	Including ancillary facilities such as power plants, service and maintenance facilities
		3	Critical urban linkages important to the maintenance of public order and welfare.	1:500	Courthouses Provincial Buildings	Serve as government centres for communication in event of emergency
		4	Critical to the ongoing housing of substantial populations.	1:500	Schools Post-secondary educational facilities Seniors Residences High-rise buildings Correctional facilities Rehabilitation treatment centres	Schools and post-secondary educational facilities may be required to serve as emergency relief centres.
		5	Critical to the orderly return to long term social and economic welfare.	1:500	Airports	Critical for access for supplies and support.
	Other facilities	6	Important to the ability to avoid endangering human life and environment.	1:1000	Hazardous waste disposal and treatment facilities High risk research facilities	
		7	Important to retention of documented historical data and artifacts.	1:1000	Museums, archives, cultural centres	
		8	Important to provide threshold level of protection.	1:100	Offices Retail facilities Warehouse Service & maintenance Parking Other	Other than those associated with facilities in the higher Design Flood Level categories See comments under Site Selection for short-term use facilities.

* 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

Alberta Infrastructure

Guideline for Wildfire Protection of Institutional Buildings in Forested Regions in Alberta

March 2013

Preface

Use of the Guideline

This document will be used as a resource during planning and designing of new buildings or upgrades to existing institutional buildings that may be exposed to the threat of a wildfire.

Owners of institutional buildings shall comply with all applicable legislation. This guideline is intended to supplement, not replace existing codes and regulations. In addition, it can be used as a reference and guide to best practices when designing or upgrading institutional buildings located within forested regions of Alberta. The guideline will assist in evaluating whether the design of existing buildings or facilities presents an unacceptable risk, or may result in an increased risk in the event of a wildfire. The evaluation of the design must consider various risk factors in determining whether an existing institutional building or facility should undertake improvement in order to conform to the guideline criteria. The risk assessment factors must cover, but may not be limited to, the following areas:

- Building Construction (roof, walls, openings)
- Building Services (utilities, HVAC Isolation)
- Topography (slope, evacuation routes)
- Passive Exposure (tree line distance, other buildings, barriers, ground cover)
- Water Supply (fire suppression water)
- Active Suppression (sprinklers)

To determine the requirement for fire protection mitigation, a scoring table has been developed and presented in Appendix A. This table can be used to evaluate the fire protection mitigation requirement of the building in question and, as a result, guide in the building design decision making process or evaluation of existing buildings.

Relation to Codes and Regulations

In preparing this document, Alberta Infrastructure recognizes that viable alternative solutions may exist and they may be equivalent to or exceed the fire protection measures contained within this guideline.

It must be noted that this guideline is a “starting point” for the evaluation of wildfire protection of institutional buildings in forested regions of Alberta. There is currently no single document that provides specific recommendations for wildfire protection design for buildings located in wildfire prone areas. The Environmental and Sustainable Resources Development group in collaboration with Partners in Protection (referenced in this document) has provided programs (FireSmart) to assist building owners and communities in understanding and applying best practices in wildland-urban interface areas.

As noted above, this document is a guide to best practices and is not all encompassing. Wildfire protection of institutional buildings also requires a further understanding of building and fire codes, best practice measures, and documents produced by professional associations. It must be noted that every new building and its operation in Alberta must meet the minimum regulatory requirements of the Alberta Building Code, Fire Code and the related codes and standards.

Through the adoption of fire protection measures, adherence to regulatory requirements and installation of proper controls, the hazards associated with wildfires can be minimized and reduce the likelihood of the devastating impact of wildfires on life and property.

Commendations

In conjunction with various codes and standards a number of studies and programs have been utilized in the development of this document. The list of reference material is in Appendix C.

The authors of the guideline would like to acknowledge the individuals who assisted in the development of this guideline:

- Mr. Troy Holloway, *Senior Design Architect, Capital Projects, Alberta Infrastructure*
- Mr. Murray Johnson, *Planning Manager, Northern Region, Property Development, Alberta Infrastructure*
- Mr. Brian Oakley, *Director of Architecture, Capital Projects, Alberta Infrastructure*
- Mr. Brian Vance, *Chief Administrative Officer (CAO) Slave Lake*
- Mr. Trent West, *Alberta Fire Commissioner/Executive Director*
- Mr. Bruce Jackson, *Royal Canadian Mounted Police (RCMP) Arson investigator*
- Mr. Wendell Pozniak, *Environmental and Sustainable Resource Development (ESRD)*

Morrison Hershfield Team

This guideline was developed by a diverse team of expertise at Morrison Hershfield Limited

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- Mr. James Eduful, *Fire Protection E.I.T.*
- Mr. Mike Danilowich, *Senior Mechanical Engineer*
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- Mr. Kalum Galle, *LEED® Project Manager/Sustainability*
- Ms. Cheryl Dorsey, *Executive Assistant*

GUIDELINE

For Wildfire Protection of Institutional Buildings in Forested Regions in Alberta

for

Alberta Infrastructure, Technical Services Branch, Capital Projects Division

Contents

1 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. Wildfires can be a devastating experience but are an essential part of the forest ecosystem for renewal[1]. Fire will recycle nutrients, help plants reproduce and create a diverse habitat that benefits a variety of wildlife. It has long been accepted that forests protected from fire are more ingrown and selective of the types of trees developing[2]. Undergrowth and decaying materials in these areas increase the likelihood and intensity of a fire when an ignition source is provided.

Figure 1.1 *Undergrowth fire igniting 'ladder fuels'*

The Government of Alberta owns and operates a large number of buildings that could be exposed to wildfires. Appendix E provides a list of current facilities considered under this guideline. In this case, *institutional* refers to all buildings operating government programs.

It is a necessity that some government buildings be located in forested areas in order to serve the citizens of Alberta. This guideline is developed to increase the survivability of buildings located within forested areas, to function during and after a wildfire. Occupied buildings shall have an emergency plan in place that includes evacuation or Shelter-in-Place with sufficient resources to survive for at least 3 days (72 Hours) as a minimum requirement following a disaster.

After the passing of a wildfire through an area, when a building survives, people describe these events using terms like luck, miracle, or divine will. These terms describe people's emotions of being powerless and unable to control the outcome. With proper planning and preventive measures the notion that all wildfires are uncontrollable and their damage unavoidable can be addressed and exposed as incorrect. There are numerous tested and proven methods available to reduce losses resulting from wildfires. Short of constructing an underground bunker or removing all of the trees, shrubbery and organic matter in the vicinity of a building, it is difficult to create a building that is 'guaranteed' to survive the worst wildfire scenario. The intent of this guideline is to enhance the survivability of a building exposed to wildfires by allowing informed decisions to be made on the value of building upgrades that will withstand the potential disasters of wildfire incidents.

1.1 Glossary

Appendix D provides a list of terms and acronyms used in this guideline.

1.2 Wildfire Prevalence

The total area burned by wildfires in Canada has increased steadily since the 1970s along with an increase in temperatures during the wildfire season[3]. Furthermore, it has been shown that there is a trend of decreasing relative humidity in the spring and autumn in Alberta producing an expansion of the fire seasons duration[4]. This is of particular note, as Alberta may develop a longer spring wildfire season. The recent devastating Slave Lake fire in 2011 occurred in the spring. Wind events are increasing in Alberta[4] and theoretical forest modeling indicates the Midwest boreal forests may be reaching a tipping point that is increasing the threat of wildfires[5]. The combination of the above with the expansion of rural communities and the continuing trend of our desire to live near forested areas means the prevalence and impact of wildfires will continue to increase in Alberta and across North America.

1.3 Building Ignition

The ignition and spread of fire is a simple combustion process. The requirements for combustion are fuel, heat, oxygen, and a chemical chain reaction (Figure 1.2). Fire spreads as a continuing ignition process either from the propagation of flames or from spot ignitions by fire brands. A fire will continue to spread as long as all four elements are present. Once ignited, removal of any one of the four elements will extinguish the fire.

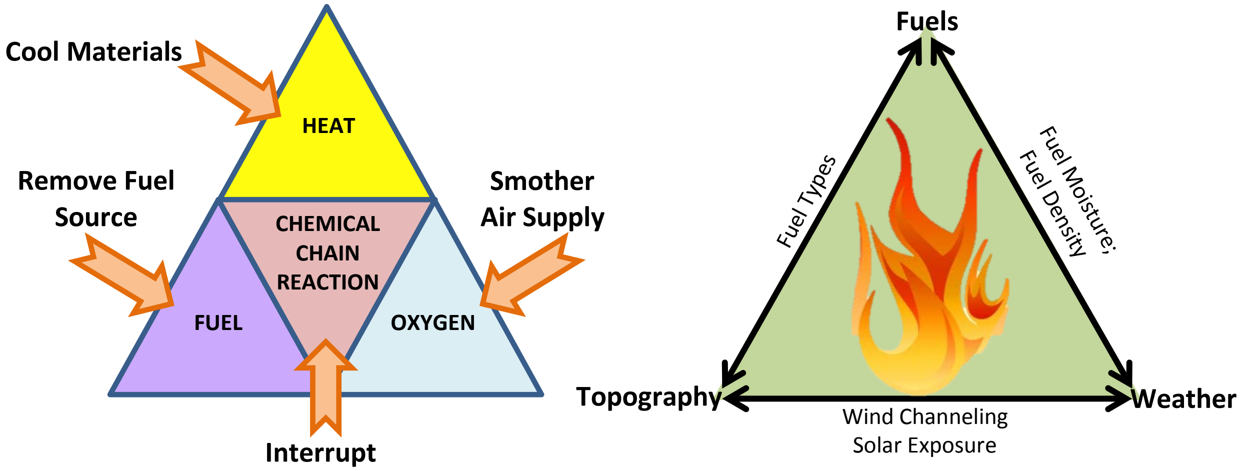


Figure 1.2 Fire Tetrahedron and Wildfire Triangle *- Fire ignition and burning process*

The fire triangle demonstrates other factors that impact risks addressed in this guideline.

Wildfires are detrimental to buildings in three ways:

- **Radiation: excessive quantities of heat will cause exposed building materials to fail, which may result in its collapse and/or failure of systems, even if they are not directly exposed to flames. It is also probable that a particular material is elevated to auto-ignition temperatures, causing spontaneous combustion.**
- **Direct flame impingement: results in collapse and/or failure of systems and will set ablaze any exposed combustible building material.**
- **Lofted fire brands: airborne burning embers and fire brands are carried on the updraft created by the concentrated heat of a forest fire. Low pressure and air drawn from around the fire can carry the burning brands significant distances. When embers encounter a low pressure stratum on a building they will settle on available surfaces as a result of gravity. One ember may not cause combustion but an accumulation of embers will ignite combustible material under the proper conditions.**

The best way to ensure a building's survival is to prevent ignition. Research and professional experience indicate that the main flame front passes through an area in as little time as 50-70 seconds[6]. Cohen concluded, based on model results of experimental burns of forest test plots and case studies, that radiant heat from an intense *crown fire* will not ignite wood panels greater than 40 metres from the flame front[6]. In a subsequent study the same author reduced this distance to 30 meters[7].

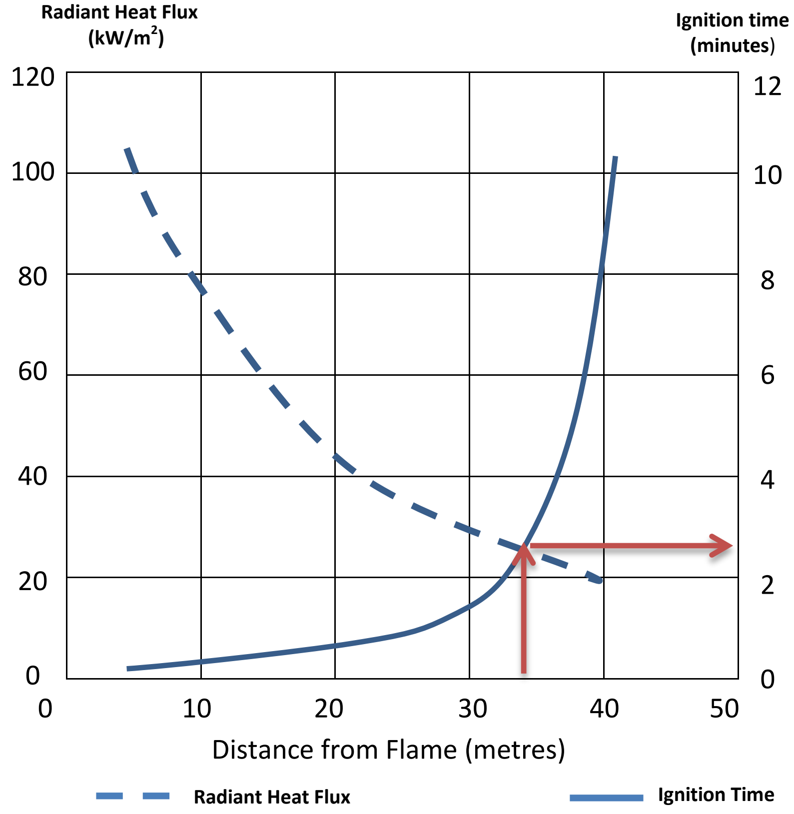


Figure 1.3 - ***Radiant Heat Flux*** - *The incident radiant heat flux is shown as a function of a wall's distance from a flame 20 meters high by 50 meters wide, uniform, constant, 1,200 K, black-body*[6].

Figure 1.3 demonstrates a correlation between radiant heat flux, ignition time, and distance from flame. Note that approximately 3 minutes is required for piloted wood located 30 metres from the flame front to ignite.

It has been proven statistically that the majority of buildings lost due to a wildfire are ignited by embers or fire brands that cause small fires on or around a building[8].

These small spot fires can ignite through contact directly with flames or due to radiant heat. If left unmitigated and with access to sufficient fuel, these fires will propagate into large fires that will significantly increase the likelihood of igniting surrounding buildings. Whether a building survives a wildfire disaster will initially depend on whether the building will ignite. Once ignited, as burning continues, the survivability of the building will depend on intervention with suppression efforts. Mitigating the fuel load and quantity of heat are also factors that will affect the combustibility of a building and significantly reduce the probability of ignition.

***Figure 1.4 Fire Tornado** - Although a rare occurrence this photo demonstrates the exposure risk of a 'fire whirl' that would impact almost any building design.*

Heat reduction (siting), limiting combustibility (building construction) and fire suppression (building protection) are all addressed to mitigate the impact of fire, while allowing some flexibility in the final building design.

2 Site Planning

2.1 Building Location

Individual buildings located within a forest provide a challenge with respect to available resources that could improve survivability. In an urban setting the allocation of resources must also consider the neighborhood context. Each scenario has challenges and expectations which must be satisfied when developing the final building design in a location exposed to the potential risks of wildfires.

Defensible Zone (U.S. terminology) or Asset Protection Zone (Australian terminology) shall be provided. Defensible Space or Zone provides a break between the front of fire and the exposing building face being protected. This buffer space while distancing the fire, also allows access for emergency response and working space for the responders and their equipment. This zone also limits the likelihood of a building (which may have already ignited) to contain the fire. Asset Protection Zone is similar to the Defensible Zone but is defined as the highest level of strategic protection to human life, property and high value assets vulnerable to radiant heat or embers.

2.1.1 Urban or Rural

Many buildings are designed and constructed in rural areas in response to the desire to take advantage of the natural setting and aesthetics. Aesthetics must be weighed against the risks to the building imposed by its surroundings and available access of rescue services. Many rural locations also require the building to be self-sufficient for all or some of the utility services required to function.

Some regions, towns, and municipalities may provide planning for buffer zones using parks, golf courses, roadways and other open spaces around buildings to protect them from the risk of wildfires. They may also allow for community-based central services such as fire prevention services, quick action rescue services, utilities, and roads.

When a building is located within a municipal center amongst other buildings, its actual exposure may no longer be the forest but the surrounding buildings. The close proximity of buildings in an urban environment could spread the fire into the heart of that community, as demonstrated in Slave Lake. The exposure between buildings now becomes a primary concern that would go beyond the expectations as presented in ABC 3.2.3 (Alberta Building Code) due to involvement of multiple buildings ignited by the forest fire. Reduction in the occurrences of destructive fires is the intent of the building code. A wildfire is a conflagration, or extensive fire, that can threaten a municipal center. Irrespective of the location of the building, the intent of the ABC is to prevent the fire from spreading to neighbouring structures. There are no provisions under ABC to address wildfires. The International Code Council family of documents has been updated to include a new standard under the title ‘2012 International Wildland-Urban Interface Code’.

2.1.2 Access Routes

Infrastructure through planning and development provides roads which are navigable through all seasons and weather conditions. Some Alberta Infrastructure owned buildings are built deeper in the forest due to necessity. At such locations, while the threat of wildfires is increased, the quality and quantity of available access roads are diminished. It is advisable to have two accessible routes for evacuation and training protocols to simulate an evacuation.

2.1.3 Climate

The flow, speed and direction of prevailing winds have a significant impact on how a wildfire will travel. The wind also impacts the distance and direction of travel for fire brands. Wind-borne fire brands are one of the sources of ignition which propagate a wildfire.

The use of the *Prometheus*© software program will assist in the modeling of the winds and evaluation of the safe fuel load in proximity to the building analyzed. The program factors in the geographical location as well as the species of indigenous trees, providing a realistic view of the risks associated with the location of the buildings.

Rainfall levels and humidity also have a significant impact on the moisture content present in a forest and must be considered when the risk of a wildfire is assessed during building planning, or during annual forest fire risk assessments conducted by authorities with jurisdiction. These conditions are usually localized and analyzed when determining the likelihood of ignition and development of wildfires.

2.1.4 Topography

Topography of a building site or region has a significant impact on access routes for rescue or suppression, the speed of access, and the speed and intensity of the spread of the wildfire. A wildfire burning up a slope will progress more rapidly and with greater intensity than a wildfire on level terrain. Natural features such as valleys can channel and intensify the wildfire.

Figure 1.5 Fire travel - *Photo illustrates the fire progression climbing a hillside with an abundance of fuel.*

Different features can provide barriers to the propagation of *ground* or *surface fires*:

- **Natural barriers: rocky outcroppings, bodies of water, large expanses of barren land, etc.**
- **Constructed barriers: roads, paths, stone walls of sufficient height, etc.**

These features provide a point of defense and can reduce the quantity of resources needed to eliminate or divert the propagation of a fire.

2.1.5 Major Considerations

Siting of the building should be done with due consideration of available building protection methods and proposed construction materials. Use the best practices advice developed through the *FireSmart Program* and other standards and codes to assist in reducing the losses potentially sustained due to wildfires.

To minimize the risk of fire spread onto a building, the following site planning considerations must be made:

- **Use open spaces as barriers to fire spread. To reduce the probability of building ignition, provide open barriers at least 30 metres wide. When buildings are located near slopes (devoid of vegetation), allow up to 50 metres of clearance. (Note: clear area must be maintained through fire prevention practices).**
- **Consider the height of the surrounding trees when clearing so that the trees do not compromise the safety distance required.**

- **Provide access to property for emergency responders and provide evacuation routes for building occupants. Roads should be at least 6.1 m wide with turn-around space as required by the Alberta Building Code Division B, Part 3.3.2.5.6.**
- **Provide a fire resistance rating for the building exterior, commensurate with the risk. See section 5: Building Design and Utility Services.**
- **Provide a water supply that meets or exceeds the minimum requirements of the Alberta Building Code for the building design.**

2.2 Building Separation

Two basic scenarios must be considered for all buildings when discussing exposure to a fire. The impact of a wildfire on buildings and occupants is the primary concern of this study. The scenario of a fire starting in a structure and becoming the ignition source for a wildfire must also be considered when reviewing exposure.

2.2.1 Forest

It is impractical to turn all of Alberta forests into safely managed parks that limit the probability of uncontrolled wildfires. Many documents have been developed to address wildland-urban interface that can be applied to individual structures or entire communities. Alberta's Environmental and Sustainable Resource Development (ESRD) initiative has had the FireSmart Program available since 2000.

Depending on the size and type of trees (i.e. Aspen versus Black Spruce) the wildfire will burn very differently. The size of the tree, particularly the trunk circumference, will impact the rate of burning and quantity of heat released. The continual build-up of dead plant material on the forest floor provides fuel for a potentially intense fire which could be easily ignited and difficult to control. Undergrowth also provides small, easily ignitable fuel for a fire, while hindering emergency access. *Ground* and *surface fires* have a greater fuel load but a *crown fire* will travel much faster and respond more readily to wind conditions. However, selective removal of this 'accumulated fuel' is impractical and interferes with the natural forest lifecycle, which can impact the health of the forest and create a greater disaster when a fire does occur.

2.2.2 Exposures

Considering the number of variables involved, accurately defining and predicting the risk of exposure to a wildfire is a challenge. While constantly changing weather conditions provide many variables, the wind and moisture content are two significant variables that can impact the parameters of a fire and the area of probable impact of wind-borne embers. The amount and type of fuel will also impact the intensity and duration of exposure to the fire. Topography can impact the speed of fire spread and the intensity of radiated heat while limiting accessibility to escape routes.

- **Subsection 3.2.3 of the ABC provides spatial separation between buildings, limitations to the area of the exposed building face and the limitations to unprotected openings in that exposed building face.**
- **Increasing the defensible zone allows more leeway in building design but increases the impact on the existing forest.**
- **The architectural response for designing buildings located in forested areas is usually to design in harmony with nature and integrate the building with trees and natural features of the site. Although this approach is aesthetically desirable, it presents the greatest danger when dealing with wildfire risks. Mitigating the risk of fire to such structures is a combination of reducing the exposure to the fire while upgrading the building to withstand remaining exposure.**

2.2.3 High Intensity Residential Fires (HIRF)

In 2009, The Alberta Building Code was amended to address exposure fires in residential buildings. The amendments were applied to all buildings outside a 10 minute response capability of the local fire department. This level of protection has been applied to other occupancies threatened by increased exposure. The amendments address exposure by requiring application of at least one of three options:

- **Increase the distance between houses**
- **Provide a greater fire resistance rating for the building envelope**
- **Install sprinklers in the residences**

In the aftermath of the wildfire in Slave Lake, the municipality has initiated a policy that no emergency response to a building can guarantee fire department suppression in 10 minutes, requiring all new construction to meet the HIRF stipulations.

2.2.4 Parking

Parking lots provide wide open areas devoid of combustible materials, which can provide a buffer - until the lot is filled with vehicles. Vehicles located in parking lots can become hazards in an intense wildfire. The gasoline or other fuels in the vehicles and the combustible material content of the vehicles will provide increased risk to the buildings through explosions and production of toxic fumes created by intense combustion.

Ensuring a minimum 3 metre separation of vehicles from the building will reduce the threat to the building. Ensuring that vehicles in the parking lot are separated from the threat of wildfires to maintain any developed defensive zone shall be a primary consideration. Parking vehicles next to or near a building could compromise the safety distance.

2.2.5 Landscaping

The ESRD FireSmart Program for Landscaping provides guidance for preparing the defensive zone around a building. This document should be referenced by all personnel responsible for maintaining the landscaping for buildings in forested areas.

Ornamental trees, shrubs, mulch and peat moss can provide sources of heat and fire brands within the defensive zone, should they ignite. These materials provide less fuel than trees but are more easily ignited and can create fire brands close to the building. Other combustible material, outdoor furniture, and equipment within the defensive zone or attached to the building provides potential ignition points. Pergolas and breezeways, gazebos, wooden shutters and louvers, awnings, decking, combustible projections, park benches and picnic tables, BBQs, wood piles, etc. are materials and installations which are discouraged within the defensible zone or attached to the building.

Natural and constructed barriers such as fences (brick vs. wood) or natural formations (rock outcroppings) provide either a route for fire or a barrier (as discussed under 2.2.2 Exposures). Noncombustible landscaping elements in the form of fences, area demarcations, nodes, monuments, screens, etc. are encouraged to separate surrounding combustible plant material from the building envelope. Such construction shall not create 'negative pressure areas' where wind-borne fire brands and embers could settle and concentrate in intensity. Combustible landscaping elements shall not be attached to the buildings. Water features with independent reliable power sources that spray water into the air with a collection system, which then recirculates (i.e. pumps) through the system are encouraged.

2.2.6 Siting Criteria

Good landscaping practices can also provide water for firefighting. Drainage of rainwater to a basin or underground containment tank for future use in routine ground maintenance or emergency sprinkler application is one practice. As a benefit, this would qualify the building project for LEED® credit.

As discussed in this section, when reviewing a potential site the following factors must be considered:

- **Slope of site (a level site is preferable to locating on a slope or crown of a hill since a fire burns rapidly with greater intensity in sloped areas)**
- **Predominant prevailing winds for building location**
- **Fuel content in the form of combustible building and plant material**
- **Available access routes (multiple routes are preferable for evacuation or emergency response)**
- **Density of the forest and species of trees (this would determine the fuel supply that helps define the intensity and duration of a wildfire exposure)**
- **Available sources for water (consideration of volume, accessibility and reliability will allow more options in designing the building protection)**

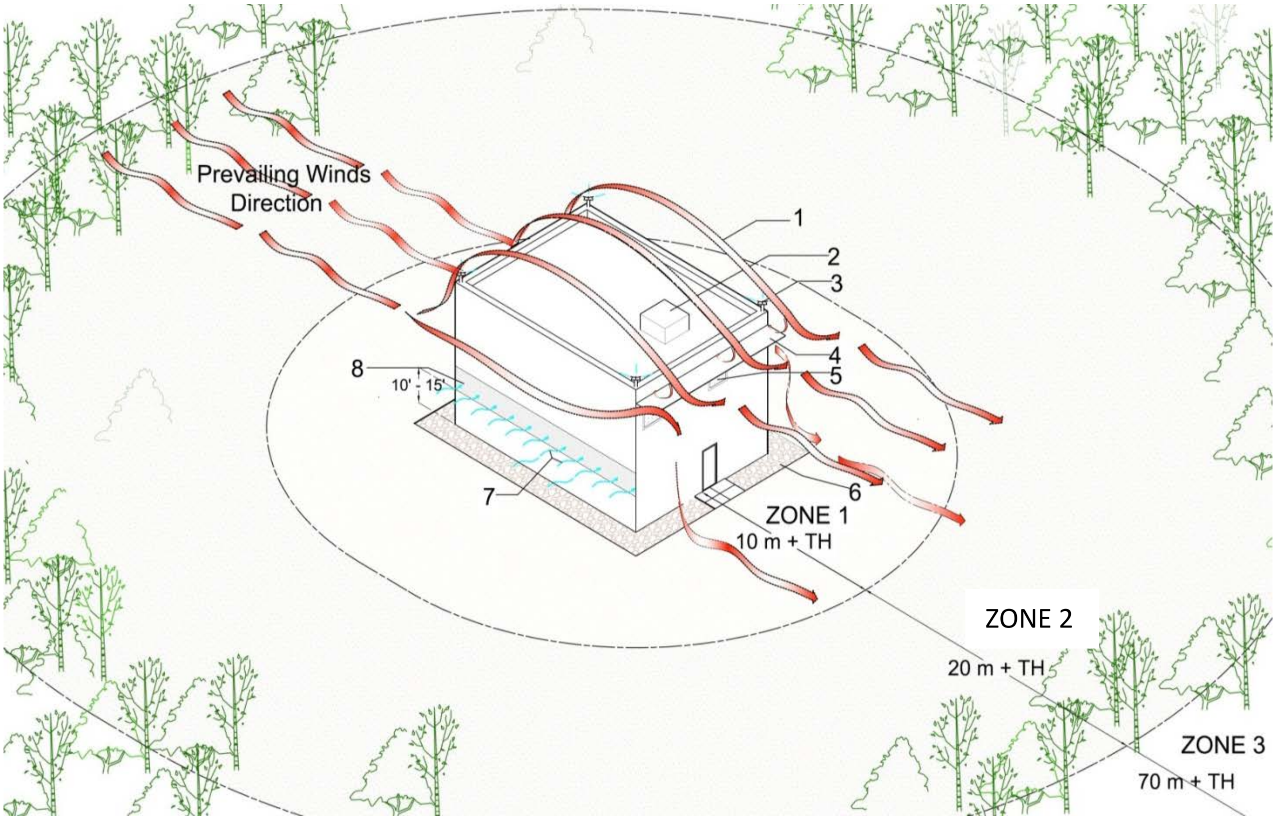


Figure 1.6 *Schematic sketches of site considerations*

Key

1 – Hot gases from wildfire
2 – HVAC roof to unit (protected)
3 – Exterior sprinklers
4 – Non-combustible solar shading
5 – Windows with non-combustible shutters
6 – Non-combustible semi-permeable material (e.g. gravel) for fire water re-circulation). *Refer to Section 5.4 for details*
7 – Air intake
8 – Air intake location with smoke detectors
TH: refers to anticipated tree height based on species type

Zone 1

Wildfires occurring within this zone will generate enough radiant energy to ignite most combustible materials through radiation. Exposed noncombustible structural assemblies are likely to lose their structural integrity.

Zone 2

Wildfire in this zone has the potential to generate enough heat flux to ignite combustible materials. Ignition and survivability will depend on the exterior materials, the design of the building, and amount of heat that impinges on the building’s exposed elements.

Zone 3

Wildfires occurring in this zone will not directly ignite buildings located beyond 70m + TH through radiant exposure. Primarily building survivability concern will be to protect the building or area from spot ignition from lofted fire brands.

3 Local Resources

3.1 Communications

During any emergency, good communication is critical to ensure a timely, planned, and orderly response. A wildfire can cover a large area of land or region and move quickly under opportune conditions. Building operators should be familiar with local emergency procedures and the methods of communication to be utilized by the governing agency during an emergency. All communications equipment shall be connected to a reliable back-up power source. They shall have data connectivity independent of systems that could be interrupted due to a potential incident of a wildfire.

3.2 Emergency Response

The first responders to an emergency caused by a wildfire are firefighting personnel. In addition, many other organizations may get involved, including police, emergency medical services, search and rescue, and support organizations (e.g. Red Cross). Heavy equipment may also be employed to prevent the spread of a wildfire. This may include bulldozers, skidders, graders, and other support equipment for fire breaks and removal of fuel sources.

3.2.1 Alberta Environmental and Sustainable Resource Development (ESRD)

ESRD Forest Protection employs over 300 Type I wildland firefighters for initial deployment and has access to over 2,000 Type IF or Type II crews for sustained action. Cooperative agreements with other Canadian provinces and neighbouring states can allow for the deployment of additional wildland firefighters and equipment.

The firefighters on the ground are supported by air tankers, helicopters, dozers, skidders, water tenders, catering camps and a plethora of other heavy equipment used to assist in containing and extinguishing wildfires.

ESRD has developed mobile sprinkler trailers which are used during wildland urban interface events. These trailers consist of portable sprinklers, hose lines, pumps and water tanks which can be set up in a relatively short time period to protect buildings threatened by wildfire.

When a wildfire threatens a populated area, firefighters will evaluate and prioritize buildings that are defendable and those which likely cannot be saved.

Pre-fire planning will identify those buildings that require a higher level of protection.

3.2.2 Fire Department

The resources of the local fire department can vary widely in Alberta. In the areas exposed to the highest risk of wildfires, the primary fire department response team may only be staffed with volunteers or paid on-call firefighters and located a significant distance from the emergency. A local fire department's wildfire fighting skills and their level of knowledge can also vary greatly through the province. All fire departments will have basic wildland firefighter training, but some fire departments will be well versed in wildland tactics and have an excellent working relationship with ESRD in their area, while some fire departments may only have limited experience with minor grass fires.

Allowing that these resources would be utilized at the front line of operations in an emergency situation, the designs based on this guideline have considered that the emergency response will be engaged elsewhere.

It is recommended that building operators liaise with the local fire department on a regular basis to ensure that the fire department is familiar with the building location, typical occupancy, fire protection measures in place, and any special needs required from within to help the firefighters to pre-plan for any potential incident.

3.3 Water Supply

3.3.1 Planning and Evaluation

Assessing the availability of a reliable supply of water for fire suppression is critical in planning for the potential risk of a wildfire. When the building location and its size is determined, the availability of a sustainable water supply for an emergency must be made.

In some locales, a municipal distribution network of water with hydrants may provide the necessary water flow for the building being designed or evaluated. Such a system is beyond the control of this guideline but the source and reliability of the water supplying this network should be considered during design.

In many isolated forested areas the water supply must be stored on site. Natural sources of water; such as lakes, rivers and streams, can provide the necessary water but must be evaluated for available quantity and accessibility during planning. Other sources could be a reservoir, well or storage tank with sufficient water to meet the calculated water flows. The final option is to supply the water using water tenders or tankers; in the event of a wildfire this source may quickly become unavailable.

To evaluate the available water supply the first step is to calculate the demand to meet either minimum code requirements, insurance recommended levels, or risk specific demands for the site. Meeting Building Code requirements is a simple calculation based on building volume, construction and exposure for a building without sprinklers as described in The Alberta Building Code, Division B, 2006 (ABC) 3.2.5.7. If the building has sprinklers, the calculation is based on NFPA 13 (2002) Table 11.2.3.1.1 and Figure 11.2.3.1.5. Insurance requirements are calculated using Water Supply for Public Fire Protection Fire Underwriters Survey (FUS), based on construction, area, contents, and exposures. It should be noted that these methods calculate the requirements to extinguish a fire occurring within the building and not from an exposure fire. Controlling an interior fire to avoid the building becoming the start of a wildfire is as important as protecting the building from exposure, so the requirement for the interior fire water supply is a necessary part of the evaluation. The final step is to protect the building from exposure in the event of a wildfire. Exposure can take the form of radiated heat, direct flame or fire brands. The size of the risk is determined by many factors covered elsewhere in this guideline and ranges from the distance of the forest fuel load to the materials of construction.

For calculating the required water supply, the method of protection should be the first data determined. A fixed external sprinkler system can easily be designed to operate on a given volume of water based on flow and duration. Manual firefighting is more difficult to determine, particularly for duration. The actual water demand for suppression is covered under the building design section.

3.3.2 Water Storage

Water supplied from hydrants, reservoirs and storage tanks is relatively constant once designed, provided the proper maintenance occurs to ensure reliability.

For natural sources of water, topography, vegetation and weather can impact availability. Obviously, the highest risk of a wildfire occurs during the high summer heat as well as the fall while a building fire can occur at any time. Hot summer weather can impact the water source by reducing the quantity of available water through absorption and evaporation. Wet weather can reduce the risk of wildfires but can also impact accessibility to the water source and response routes. Vegetation growth, both in the water and along the banks, can also negatively impact the availability of water. The final risk is ice formation (unless a viable means of accessing water under the ice has been developed). Improving accessibility can be accomplished with the installation of a dry hydrant adjacent to a developed access route suitable for a firefighting vehicle.

Figure 1.7 Dry Hydrant - *An example of a dry hydrant installed on a pond with gravel surface off main road for access. See detailed example in Appendix F*

3.3.3 Volume of Water

The actual volume of water required to effectively fight a fire is based on the required water flow and the duration that the supply must last. A forested area has a finite amount of heat to release when burned. The quantity of heat potentially released is dependent on the volume of fuel and types of wood present on the site. The exposure, however, can be short and intense or an extended release at a lower rate. The amount of water needed will be relatively similar for both scenarios but the rate of application could change significantly based on the fire's heat release rate. Although the local conditions may provide some factors in determining a suitable amount of water storage, calculations for the actual required water supply must consider both extremes.

Since it is not easy to adjust the water flow for fire suppression systems during an emergency, the most successful approach would be to provide a flow of water that matches the worst-case scenario for a duration that would equal the expected exposure time of a slow burning fire. This approach could result in a significant volume of water, depending on the existing fuels within a risk area, and is not always practical.

By recirculating the water used for firefighting or for sprinklers, better use of the suppressant could be achieved. Designing the facility to collect the water after usage in a reservoir for quick filtration and recirculation as a suppressant should be considered, where feasible. It is normal that some of the water would evaporate or be absorbed during use.

Water Demand Example

A single-storey, public service building having an area of 600 square metres (6,460 sq. ft.) and of combustible construction can be designed to meet the risks from a wildfire. Assuming the building is 3 metre (10 ft.) high, it would require 72,900 liters (19,260 usg) of water delivered at a rate of 45 L/s (713 gpm) to meet the Alberta Building Code if it has no sprinklers. If interior sprinkler protection is provided as a low hazard occupancy, the building would require 12.5 liters per second (200 gpm) for a period of 30 minutes or 22,500 liters (5,945 gpm) of water to meet the ABC requirements.

The same building, using Fire Underwriters Survey (FUS), would require 188.3 liters per second (2,985 gpm) if without sprinklers, and 121.3 liters per second (1,923 gpm) if protected with interior sprinklers.

NFPA 13 11.2.3.7 provides basic requirements for exposure requiring the minimum pressure to be 48.3 kPa (7 psi), which would equate to a flow of 0.95 liters per second (15 gpm) when the sprinkler constant is 8.14 (metric) or 5.65 (imperial).

3.3.4 Delivery of Water

Water can be delivered to the area requiring protection by three methods: fixed systems, semi-fixed systems, or manual discharge of water as suppressant but each requires sufficient water pressure to operate the system of delivery.

Fixed systems are already in place and capable of immediate operation upon receiving the activation. Semi-fixed systems require personnel to position and/or activate the suppression. After activation these systems are typically able to operate independently. Manual suppression requires active firefighting by the local fire department or Alberta Sustainable Resources to actively suppress the threat using hose streams, monitors or other available resources. It also requires personnel to be at the boundary of the fire.

Water pressure can be provided from a site remote from the building through a municipal distribution system or local pump installed as part of the building. The alternative source of pressure comes from the fire engine or other portable pump used by the responding emergency team.

Should the system be designed to pressurize with an on-site pump, a power supply with a reliable back-up power source shall be provided to operate the pump.

3.3.5 Water Criteria in Summary

1. **Determine the demand based on building size, construction and usage**
2. **Determine the application rate based on the type of mitigation**
3. **Determine the preferred local water supply based on the demand, rate, accessibility, reliability, and cost**
   Note: There may be co-operative reasons for water storage in community, site, and building design. Stormwater management, LEED, thermal exchange, and aesthetics are a few examples.

4 Building Usage

The Alberta Building Code provides direction on the minimum standard for construction based on the building size, usage and accessibility under ABC Subsection 3.2.2. Before upgrade of existing or design of a new building is undertaken, the proposed occupancy and use, from routine to post-disaster requirements, must be considered. Once the occupancy and use have been determined, the building can be designed to meet that level of construction. Alternative usage should not be considered without a full evaluation considering the same risk factors for a building renovation.

The combination of occupancy, occupant load and usage (category) of the building will determine the level of safety necessary based on the need for survival.

4.1 Occupancy

Occupancy is defined in ABC Table 3.1.2.1 under six major classifications ranging from Assembly (A) to Industrial (F). This occupancy will determine the minimum code compliance for building design. It should be noted that minimum code design is based on assumptions as listed in the Alberta Building Code, Division B, Appendix A. Designers are familiar with the code requirements but this guideline does address areas where the minimum standard is considered insufficient to address the expected risk from a wildfire.

4.2 Building Use (Category)

Building type will have to consider high occupancy loads such as hospitals, schools, and nursing homes. This includes buildings identified in the Alberta Building Code Importance Category of High, which could be used as *post disaster* shelters, or classified as *post disaster* buildings. These structures require special design and spatial separation considerations to ensure their survivability from a wildfire threat. Buildings identified as having a high occupancy load, particularly hospitals and nursing homes, will add considerable logistics to already overtaxed emergency resources if evacuation is required during a wildfire event.

Not all buildings or functions are critical. Financial loss must be considered, yet when it costs more to protect an asset than the value of the asset, the priority has not been met. For this guideline, three levels of building importance have been considered to guide judgment of value.

4.2.1 Low

Low Importance buildings represent a low direct or indirect hazard to human life in the event of failure, which include minor storage buildings and low occupancy buildings. Siting consideration must be given to these structures to ensure they do not contribute to the fire load or fire spread during a wildfire event.

4.2.2 Normal

Loss of these buildings would impact routine operations, however, the contents can be replaced and temporary arrangements made during replacement if necessary. Most buildings would be considered Normal Importance for design purposes.

4.2.3 High

High Importance is given to buildings where the functions or contents cannot be lost or interrupted. An additional category are those buildings that present an unacceptable threat, such as manufacturing and storage facilities containing toxic substances, explosives or other substances in sufficient quantities to be dangerous to the public if released. Post-disaster buildings as listed below are prime examples of High Importance for maintaining operations during and after an emergency. Other examples are museums, schools, cultural resources (ie. Historic churches) community centres or buildings designated as shelters during an emergency.

4.2.3.1 Shelter-in-Place Facilities

Sheltering in place may be an option to consider for high occupancy facilities as long as the building has all the required protection systems in place, including: fire resistive exterior walls/roof, spatial separations, protected window openings, ventilation systems that control smoke entry into building, emergency backup utilities, water supply, washroom facilities etc.

The Alberta Building Code High Importance category includes buildings that are likely to be used as shelters, including those where the primary use is:

- **An elementary, middle or secondary school**
- **A community centre**
- **Similar public facilities**

4.2.3.2 Post Disaster Buildings

The 2006 Alberta Building Code defines a Post-Disaster Building as a building that is essential to the provision of services in the event of a disaster, and includes:

- **Hospitals, emergency treatment facilities and blood banks**
- **Telephone exchanges**
- **Power generating stations and electrical substations**
- **Control centers for land transportation**
- **Public water treatment and storage facilities**
- **Water and sewage pumping stations**
- **Emergency response facilities**
- **Fire, rescue and police stations**
- **Storage facilities for vehicles or boats used for fire, rescue and police purposes**
- **Communications facilities, including radio and television stations**

Buildings that are classified as either High Importance or Post-Disaster are required to meet more stringent Alberta Building Code design requirements than buildings classified under Normal or Low Importance. Part 5 of this guideline is considered a vital addition to the Building Code requirements in developing designs for High Importance buildings.

5 Building Design and Utility Services

The survivability of a building subjected to the threat of fire from the interior or exterior depends on two primary factors: the performance of the building envelope and the structure of the building. In addition, the failure of any one of the utility services could impact the efforts to suppress the fire and will make the building uninhabitable during the event. The performance of the building envelope and its resistance to temperature increase and ignition are important factors in the performance of the building structure. Building design decisions such as choice of building form, size and massing, envelope, material, and fire protection principles and techniques, determine the performance of the building when exposed to a wildfire.

In the wake of the 2011 Slave Lake fire, Alberta Infrastructure intends to upgrade existing facilities (which are vulnerable to wildfire) for their continued operation where warranted and economically justifiable.

Upgrades to existing buildings would require the evaluation of the building and its utility services for necessary redress and the improvement of its preparedness for a wildfire incident. The aspects and elements that can be modified during the redesign can be affected and completed using the same methodology used to design a new building. The only criteria which could not be redressed is the siting of the building, however, changing the characteristics of the site to improve its survivability should be examined. A sample case study for the Slave Lake Warehouse can be found in Appendix J.

In a building categorized as High Importance, it would be necessary to evaluate the utility services to maintain a minimum level of health and safety needs for the occupants (in addition to resisting fire). This would include identifying any other persons who need to be added to the occupant load from designated neighbouring buildings. The air quality and temperature within the building must remain within tolerable limits while the power and water services continue to flow (uninterrupted) to protect occupants' safety and health.

Building designers must consider a design that takes into consideration the following:

- **Preventing ignition of the building and any items or fuel within close proximity of the building (defensible zone)**
- **Provision of fire suppression systems to the building beyond code requirements**
- **Providing adequate Fire Resistant Rating (FRR) to building assemblies**
- **Reduction of radiated heat flux impact on exposed building envelope**

5.1 Building Form

The form and orientation of a building to the wildfire have major impacts on its survivability. The choice of building may create spaces that are likely to trap the fire's heat and also create undesirable areas of negative pressure. Concentration of heat is not desirable as it may raise and exceed the temperatures of the building material causing them to melt, ignite or lose structural integrity. Some building materials, once heated to a vaporized or molten state, would require only a source of ignition to initiate the process of combustion. Areas with negative pressure promote the accumulation of embers and fire brands. Where the material in contact with this accumulation is combustible, it will start the ignition and initiate the combustion process. Example of elements that can create heat traps include: areas of negative pressure on the leeward side of parapet walls, solar collectors mounted on buildings, roof/wall intersections, roof valleys, and decks. The designer should take the utmost care to ensure that the abrupt transition of wall and roof planes is minimized. Computer programs are available to model and address these conditions.

Although the direction of a fire is difficult to predict, one could presume that it would most likely be determined by the prevailing wind direction of the site and probable location of fuel in the form of plant matter. The resulting exposure (mitigated by landscaping) will then dictate the construction requirements for the building to meet a predetermined risk level based on the building category. Appendix A provides a calculation sheet to determine the comparative level of safety.

5.1.1 Size and Massing

Small and slender exposed building elements of combustible construction can be the weakest element of a building in a wildfire. Smaller combustible elements that are exposed are often easy to ignite due to size. Unprotected slender non-combustible elements may also be susceptible to the exposed radiant heat energy due to their low thermal mass.

In general terms, compact buildings with simple forms are comparatively easy to defend when located in an area or region prone to wildfires. Under 2006 ABC 3.2.3 the exposure risk is determined by several factors beyond the building material. The width and height of the building face, as well as the ratio of those two dimensions, are combined with the total percentage of unprotected openings and wall fire resistance ratings to determine exposure. The measurement for spatial separation must also begin at the farthest projection of the wall, thus, a smooth face would require the least separation.

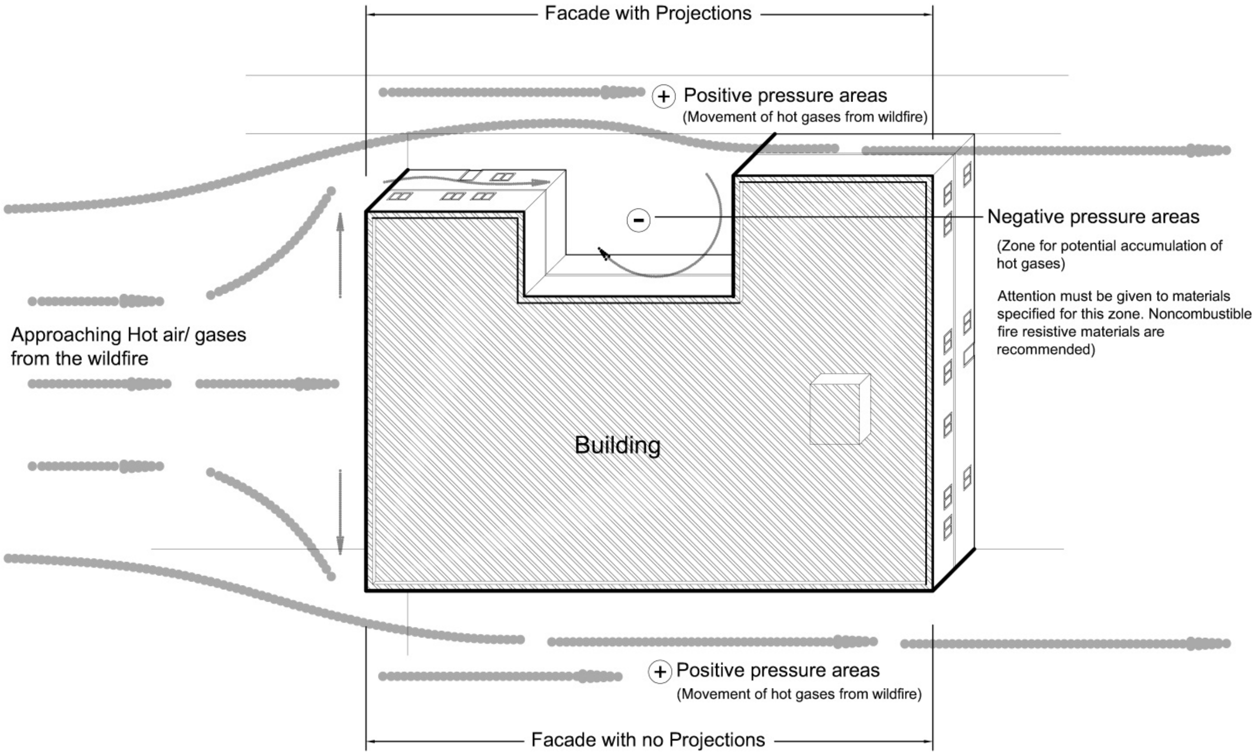


Figure 1.8 Building Forms *– illustration demonstrates the impact of wildfire on buildings with and without projections*

Generally, any projection from the building envelope would provide opportunity for embers to collect or hot eddies to be created, increasing the risk of fire. Where feasible, such conditions should be avoided or close attention paid to the detailing of such projections mitigate risks. A couple of embers landing on a building may self-extinguish. However, a large accumulation of embers would increase the temperature and most likely start a fire.

Fire brands would accumulate within negative pressure ‘voids’ and increase the probability of starting a fire. Observations from the Slave Lake fire support this fact.

Figure 1.9 Residential building in Helsinki - *Although the aesthetics are pleasing and it is blended into the environment; the building is at extreme risk for fire damage and potential loss.*

5.2 Building Envelope

The probability of the building catching fire from an external source is directly proportional to the amount of combustible building envelope that is exposed to the fire. Hence, all attempts should be made to minimize the combustible proportion of the building envelope. The survivability of a building, when subjected to the forces of a wildfire, is primarily dependent upon its ability to maintain the integrity of the envelope throughout the event. Should the building envelope fail even partially, the resulting ingress may compromise the structure to the point of collapse. It is also important to have uninterrupted utility services to activate and maintain the building's fire suppression and smoke control systems in order to maintain the health and safety of its occupants. Fire Protection Engineering defines failure under three themes:

1. **Integrity Failure (cracks, fissures, etc. as a result of the fire that allows fire or fire gases to penetrate an assembly)**
2. **Insulation Failure (increase in temperature on the unexposed side of an assembly, usually an average temperature of 140°C and no more than 180°C in any one location on the unexposed side.)**
3. **Structural failure (loss of load carrying capacity of a structural element exposed to fire). Often the critical factor is the temperature at which the yield stress has been reduced to about 50-60%**

For a building to survive fire exposure from the outside, the building envelope or exposed structural assemblies must be able to perform in all the three areas described above. For instance, if the integrity of the building fails, smoke may enter and affect residents (for Shelter-in-Place facilities). Fire can also travel through cracks to ignite the inside of a building.

If the insulation in an assembly fails, the increased temperature on the unexposed side of the assembly can ignite objects inside of the building in direct contact with the assembly (e.g. wall).

Structural collapse occurs when the structural supports give way due to fire exposure. Survivability of the structure of a building is important as failure may result in total investment loss as well as injury or loss of life of occupants (and rescue personnel).

5.2.1 Exterior Walls

Exterior walls receive most of the thermal impact from wildfires as they receive direct exposure to the fire and its resultant radiant energy.

Design recommendations:

- **Where possible do not use synthetic materials on exterior building walls, doors, and windows (polycarbonates, methacrylate, PVC, etc.)**
- **Materials used for exterior cladding should be fire resistant e.g. stucco, masonry, cement shingles, concrete, stone, etc. (FireSmart recommends a minimum of 12 mm thickness for exterior fire resistant or non-combustible siding materials to protect interior). An exterior wall assembly with sufficient thickness and material properties reduces heat transfer through the material or assembly into the interior space.**
- **Do not use vinyl siding, foam filled material, Aluminum Composite Material (ACM) panels, etc. that can ignite or melt, exposing interior combustible elements or openings**
- **Design the building envelope as a fire separation with a minimum of a 2 hour fire resistance rating.**
- **Avoid designing buildings without defined exterior corners as these areas if not prominent, are prone to accumulating debris and act as a trap for fire brands (refer to Section 5.1)**

5.2.2 Fenestration

5.2.2.1 Windows and Glazing

In the event of a fire, windows and glazed façades become one of the easiest points through which the fire may reach the interior. Glass will crack when exposed to fire or as a result of temperature differences between the exposed and unexposed side. A splash of water across a heated pane of glass may cause it to fail. Window size, frame type, glass thickness, glass defects, glazing methods, and vertical temperature gradient all have an effect on the likelihood of failure. Glazing may also be penetrated by projectiles from the fire or by direct impact from any tall falling trees or structures.

Design recommendations:

- **Clear vegetation and fuel within 10 m of glazed openings and/or provide rated shutters.**
- **Use tempered or preferably Fire Resistance Rated (FRR) insulated glazing (limiting the pane area as much as possible). There are UL listed FRR glass assemblies that can resist fire exposure for 60 – 120 minutes based on the testing protocol. These FRR glass assemblies have specific construction details: thickness (19mm to 60mm), maximum exposed dimension (2.4m to 2.8m), and maximum areas (2.4m^2 to 2.9m^2).**
- **Use non-combustible shutters or metal fire screens with corrosion-resistant mesh coarse enough to prevent fire brands from accumulating on the window sill. (The NFPA 1144 suggests using mesh coarser than 6.3mm whereas FireSmart suggests 3 mm).**
- **All exterior glazing, windows, glazed doors, and skylights should be considered for protection. If not protected by shutters, utilize tempered glass, multilayered glazed panels, or glass block in accordance with NFPA 1144. The Building Importance classification should dictate the FRR based on the building design evaluation chart in Appendix A. Buildings or structures of High Importance (such as Shelter-in-Place) may require a higher FRR.**

5.2.2.2 Doors, Openings and Vents

Openings for vents, crawl spaces, attic spaces, roof cavities, fans, mechanical equipment, etc. often provide the means of access for fire and smoke to reach the interior spaces of buildings. Exterior doors may also provide access for wildfires if in an opened position or if not of sufficient fire resistance to maintain its integrity throughout the exposure period.

Design recommendations:

- **Vent openings should be made of non-combustible materials and screened with a wire mesh that is sufficiently fine to prevent the passage of sparks and flames. [The NFPA 1144 suggests using mesh with openings not to exceed 6.35mm].**
- **Openings for air intakes should be protected with smoke sensor activated dampers or smoke filters as appropriate**

- **All exterior doors, frames, and hardware should be metal UL/ULC labelled fire rated assemblies**

5.2.3 Roofs

Although flat roofs are not directly exposed to the fire front, they present challenges from air borne fire brands. Pitched roofs stand exposed to the fire front and are more challenging than the vertical façade of a building to protect.

Large wildfires often produce fire brands and air borne embers that are lofted by the prevailing winds over great distances. The fire brands may ignite spot fires in other areas or within built up areas. Fires can be started as a result of fire brands landing and accumulating on combustible roofs. According to the FireSmart manual, roofs that catch fire are the main cause of building losses in wildland and urban interface areas. Fire brands or embers which get lofted and wind borne are relatively small and may be extinguished when they land on a negative pressure area of a roof. However, accumulation of fire brands or embers creates dangerous conditions when such accumulation takes place on a combustible building surface, like an asphaltic roof. Provided fire brands do not accumulate in concentration, a flat, fire rated roof would perform better, when compared to a pitched roof due to its reduced exposure to the heat flux.

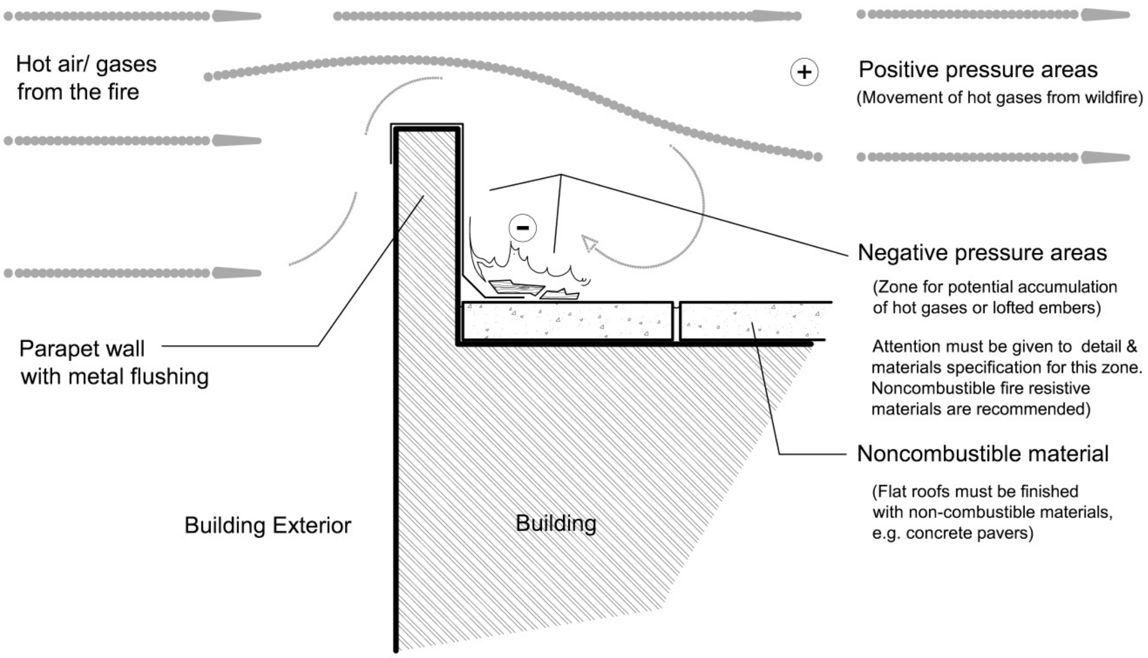


Figure 1.10 Accumulation of Fire Brands *- Illustration shows considerations in the design of a flat roof*

Design recommendations:

- **Use only FRR roof of A, B, or C based on the risk assessment matrix to determine rating requirements. The Class A classification may be restricted with roof slope and its use should be verified with the manufacturer.**
- **Always use a classified roof assembly. Non-combustible materials (such as metal roofs, concrete shingles and tile, slate shingles, clay tiles, etc.) are recommended because they often provide a stand-alone Class A covering rating. However, most metal sheet roofs (such as aluminum, which has a low melting point) must be installed with additional materials under the roof covering to receive Class A (by assembly) rating.**
- **Some wood shakes treated with specialized pressure-impregnated, fire-retardant chemicals can achieve a Class A assembly rating. It must be noted that these roof assemblies must be tested in accordance with ASTM E-108 standards and given a fire-resistant rating. In addition, other combustible roof covering materials (such as membrane roofs) can be applied over a gypsum underlayment to attain a Class A assembly rating.**
- **Use fire resistant materials to construct penthouses on roof tops.**
- **Avoid creating roof forms or shapes where air borne embers could accumulate.**
- **Application of pea gravel is not recommended for standard SBS membranes. This would require embedment into a hot asphalt flood coat (or cold applied mastic) to prevent wind scour and erosion, particularly at corners and low-parapet perimeters. Application of pea gravel to a modified bitumen membrane surface would add extra weight, capital cost and extra costs in the future for repairs, additions, or recovery options.**
- **For asphaltic roof surfaces where risk assessment requires greater protection; protect the roof with concrete pavers or loose gravel with grain size of 40mm to 75mm, provide newer high performance roofing systems intended for embedded pea gravel application or consider an inverted roof assembly of 2ply SBS.**
- **Protect areas prone to the accumulation of embers (negative pressure areas) with concrete pavers.**
- **Green roofs may provide additional risk to structure loss in the event of a wildfire unless carefully designed and maintained. Appropriate fire protection mitigation/suppression measures shall be provided to mitigate the risk. In critical areas requiring burning ember protection, install non-combustible roof coverings as “fire breaks” near roof perimeters, roof/wall junctions, and roof penetrations (i.e. concrete pavers, loose gravel with grain size of 40mm to 75mm).**

Material recommendations:

- **It is a misconception that a metal roof covering will eliminate the risk of a fire start on a roof. Always use a classified roof assembly.**
- **A vegetated roof covering per LEED® must be designed and maintained to provide protection in a wildfire scenario. Avoid combustible vegetative matter and soils containing peat moss, and combustible composted plant matter on roof.**
- **Green roof growing medium composition may be considered an alternative roof covering for fire protection. Newer green roof soil standards suggest selecting low organic compositions with high ratio of non-combustible aggregate materials. Plant selection such as using only succulents (sedums) can slow down ignition and have shown to survive better with low maintenance than other plant types on rooftops. Avoid grasses and woody herbaceous plants on roof tops.**

5.2.3.1 Parapet Details and Metal Flashings

- **Plywood facings on parapets as a nailable support is essential for most roof membrane applications. The roof membrane, electrical appurtenances, and metal flashings rely on wood blocking and wood sheathing for effective attachment on vertical surfaces.**
- **Metal flashings (base and cap) covering parapets are a Building Code requirement for buildings classified for non-combustible construction when wood sheathing is used in the parapet construction. Non-combustible gypsum roof boards (coated glass-faced, acrylic gypsum core) as a substrate for membrane flashings can act as a fire separation over top of combustible plywood facings.**
- **Some membrane manufacturers may void warranties if there are mechanical fasteners going through the membrane when installing metal flashings.**
- **The bottom edges of metal base flashings are not to be in contact with the roof membrane to avoid puncture and tears. The metal base flashing terminated at roof level must be 1 to 2 inches above the roof surface. This may defeat the protection from burning embers collecting in these areas. Use concrete pavers and extend the metal base flashing with a horizontal leg on top of the paver as shown in the first roofing graphic. Where loose gravel is used, it should cover the horizontal leg of the base flashing.**

5.2.3.2 Skylight

Skylights may provide an entry point for fires and should be avoided. When light is to be introduced through the roof, vertical clerestory glazing is preferred over sloped glazing. If, after considering the risks and alternatives, designers still opt for skylights and clients accept the risks associated, the following recommendations will reduce the risk of skylights providing an entry point for fires:

- **Skylights must be designed with fire protection shutters that can be closed with minimal risk to residents in the event of a wildfire**
- **The design must consider configurations that will prevent accumulation of airborne fire embers or hot wildfire gases on the roof. Slender projections should be avoided.**
- **The use of fire resistant glazing is recommended (Refer to 5.2.2.1)**

5.2.4 Eaves and Projections

As fire approaches a building, hot gases are often deflected by the exterior wall up into the eaves. Open and combustible materials may be prone to ignition. Furthermore, the modifying effects on the stream of hot air caused by the ‘air dams’ may create heat concentrations and settlement of fire brands on undesirable surfaces and locations.

Architectural design recommendations:

- **Avoid overhangs where practical. Solar shading could be achieved with metal louvers.**
- **Cover eaves with a fire rated or non-combustible soffit. Eaves must be covered creating sloping soffits or cavities which may trap the heat. Flat soffits may help deflect the impinging hot gases on the building outwards. NFPA 1144 recommends boxing eaves with 15.8mm nominal sheathing or non-combustible material.**

- **The NFPA 1144 recommends the use of heavy timber, a 1 hour FRR assembly, or noncombustible material for all overhanging projections**
- **Avoid placing combustible content where there is a probability of fire brand accumulation**
- **Avoid open roof vents underneath soffits that are likely to encounter rising hot fire gases from the exterior wall (see Figure 1.11 and 1.12)**

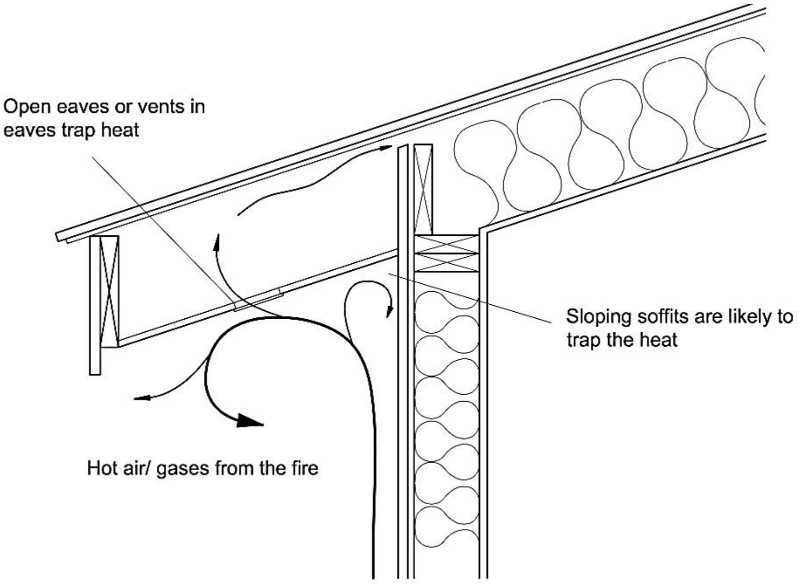


Figure 1.11 Closed eave with flat soffit

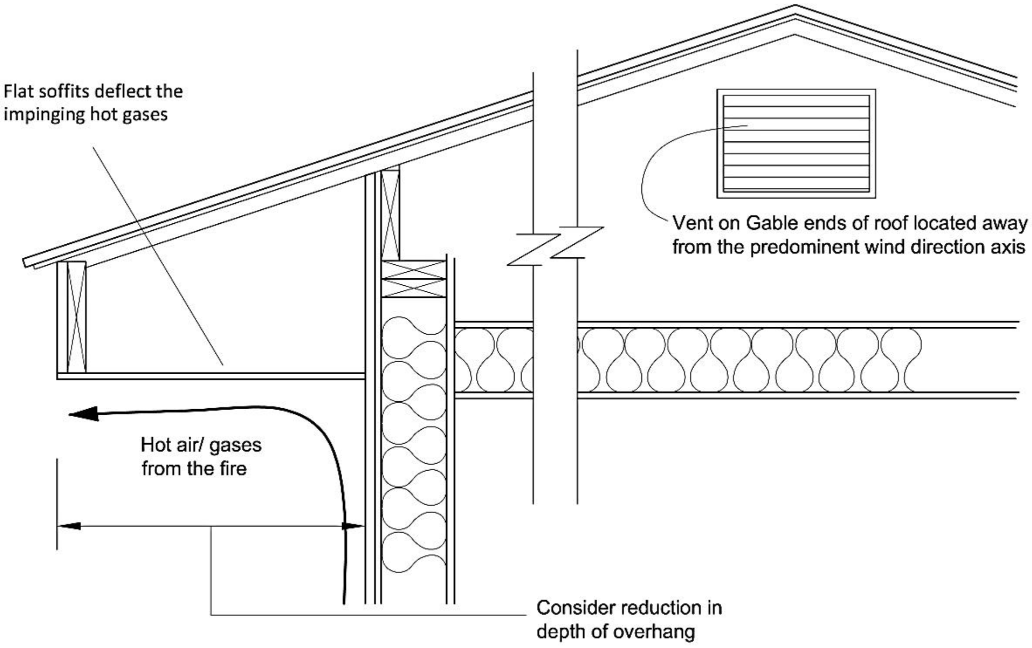


Figure 1.12 Open eave with sloping soffit

5.2.5 Combustible Projections and Additions

Many additions can be added to a building for decorative or functional purposes: canopies, brise soleil, porte-cochere, porches, decks, and balconies are some examples.

The shape and design of these projections often create heat traps for hot air from an approaching fire front. If the projection is made out of combustible materials the fire hazard becomes amplified when it comes in contact with fire brands and super-heated air causing the material in contact to reach ignition temperatures. Projections also provide shelves that collect fire brands and embers, eventually setting the projections on fire along with any adjacent combustible material on the building envelope.

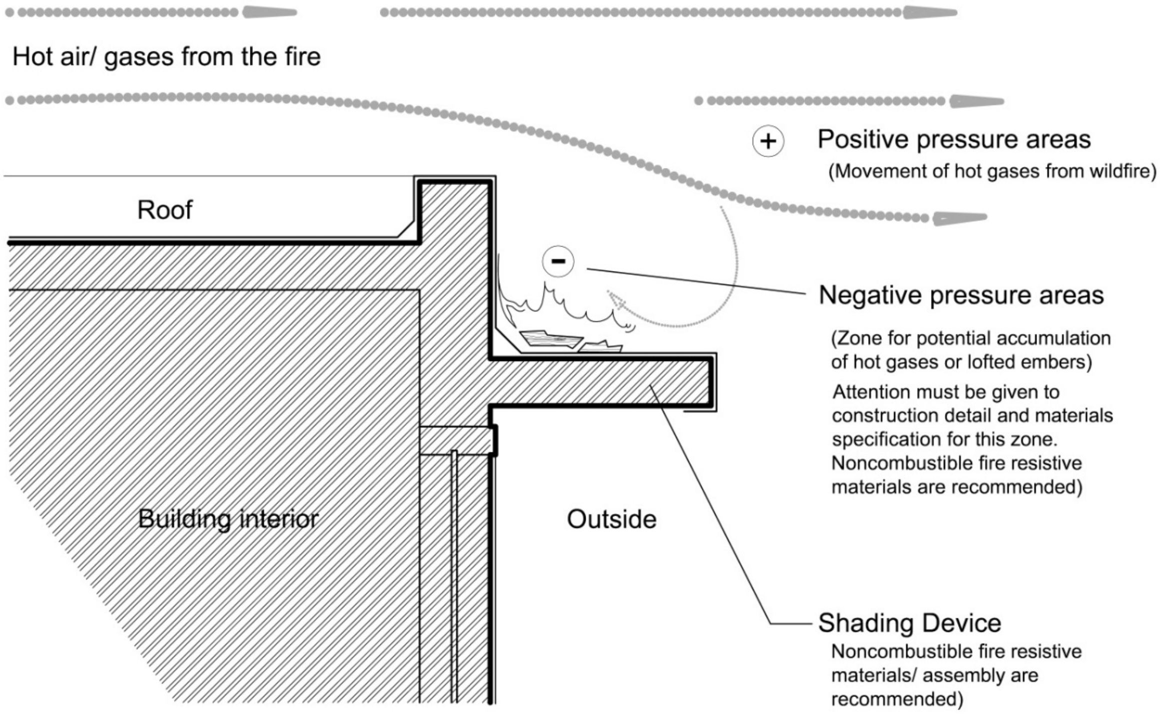


Figure 1.13 Solar shading

Design recommendations:

- **Avoid using combustible material for their construction when these projections are a necessity**
- **Do not use combustible railing or stilts with non-combustible materials to provide a fire resistance**
- **Eliminate heat traps at the underside of decks**
- **Enclose the underside of decks to reduce the risk of ignition, while providing access to clean out debris from underneath decks on a regular basis**
- **Avoid landscape ‘structures’ and their connectivity to a building**

5.2.5.1 Gazebos and Canopies

Gazebos and canopies promote outdoor living and allow enjoyment of favourable weather during the warmer seasons. However, in urban and wildland interface regions it also means an increased risk of wildfires, especially when they are located within 3 meters of a building. Combustible components of gazebos, when ignited near a building will generate enough radiant energy to shatter unprotected glass openings or ignite other exposed and unprotected combustible components in buildings.

Design Recommendations:

- **Avoid direct attachment of combustible components of gazebos or canopies onto buildings**
- **Avoid locating a gazebo close to unprotected combustible building components or in areas of unprotected openings**

5.3 Building Materials

5.3.1 Stone, Masonry, and Concrete

Stone, masonry, and concrete are three building material groups which can resist fire effectively, especially wildfires, as they usually extinguish once the fuel for the fire is consumed. As materials for building envelopes, stone, masonry and concrete have traditionally been used successfully and have proven durable while requiring very little maintenance.

Design Recommendations:

- **Stone, Masonry and Concrete, alone or in combination, would be ideal for protecting the building envelope from the forces of a wildfire.**
- **Stone, Masonry and Concrete, alone or in combination, would be ideal in the construction of a one storey building**

5.3.2 Structural Steel and Metals

Steel will lose its load-carrying capacity in fire when it reaches its *critical temperature* (i.e. the temperature at which it cannot safely support its load). The critical temperature is often considered as the temperature at which the steel's yield stress has been reduced to about 60%. The time it takes for an exposed steel element to reach this critical temperature depends on several factors including: fire exposure, structural element type, configuration and moment of inertia of section to height of member ratio (slenderness ratio), and orientation. It must be noted that the time to reach the critical temperature of an exposed non-combustible element (e.g. steel) is a function of the sectional properties of the member. This is because smaller sections tend to heat up faster than larger sections.

Fireproofing sprayed on coatings and intumescent paints are two methods of coating steel so it will withstand temperature increases due to fire. Wrapping steel components with UL/ULC rated cementitious assemblies or encasing the steel in masonry or concrete are other methods to achieve fireproofing.

Usually steel is used to fabricate the structure of a building and would be located in the interior of the building. When steel is subjected to the stress of temperature increase due to fire, the probability is that the fire has penetrated the building envelope. In this case, the furniture inside the building would provide more fuel than the surrounding forest. Unless the fire could be suppressed with a sprinkler system, one could assume that inevitably the building would sustain extensive damage.

Aluminum is another material used in building construction to fabricate non-structural components, such as window frames. Aluminum has a very low melting point compared to steel, quickly losing any structural properties when exposed to heat, and would not withstand the forces of a wildfire. Use of an aluminum curtain wall is discouraged. Galvanized steel performs better than aluminum when exposed to heat.

5.3.3 Heavy Timber Construction

As stated by the Canadian Wood Council, large dimension wood sections have an inherent resistance to fire. Wood burns slowly at approximately 0.6mm/minute. The char created on the wood surface as it burns helps protect and insulate unburned wood below the charred layer. The unburned portion of a thick member retains 85 –90% of its strength. Hence, a wood member with a large cross-section can burn for a significant amount of time before its size is reduced to the point where it can no longer carry its assigned loads.

Where combustible materials cannot be avoided, heavy timber construction in conformance with sections 3.1.4.5 to 3.1.4.6 of the ABC could be considered to fabricate the structure of a building. Exposed surfaces should minimize thin sections and sharp projections that would increase burn rates. Heavy timber construction can provide a 45 minute fire resistance rating as per ABC Article 3.4.1.5 and, when combined with an operational suppression system, can be expected to maintain its integrity for longer periods.

Fire tests have shown that glulam members exposed to fires behave in the same way as solid sawn-timber members of the same cross section. Advancement in fire performance of wood products research has proven that glulam beams and columns can be designed to provide up to one hour fire resistant rating. The 2009 International Building Code (IBC), Section 721.6 provides a methodology for calculating the ability of glulam beams or columns to resist fire up to one hour.

5.4 Fire Protection

General building code requires larger buildings to have sprinklers to prevent an interior fire from developing before evacuation and emergency response can be completed. No such requirement exists for preventing an exterior fire from entering the building. In the National Building Code and Alberta Building Code, this risk is addressed by spatial separation. As previously mentioned, spatial separation when faced with a wildfire is often not sufficient. The values for spatial separation between buildings as per ABC 3.2.3 calculations should be doubled for protection due to the increased risk from radiated heat of a wildfire unless exterior sprinklers are provided.

Another consideration for fire protection is that a building fire should not present a risk which would result in a wildfire that threatens nearby structures and the forest. The provision of sprinkler systems in the building should be considered in the risk evaluation during design.

Exterior sprinklers have proven successful when used in combination with a basic defensive zone. In California, it is recommended that exterior sprinklers be designed for a minimum 10.2 L/min/m^2 of flow for wood construction and 4.1 L/min/m^2 for steel construction. Wetting the exterior of the building provides protection from burning fire brands carried by the wind and direct heat from the fire. These systems require a pump with a reliable power supply and a water source sufficient to meet the demand throughout the event. When the system is an integral part of the building it can be activated with short notice, while a portable system requires time to position the nozzles and piping, activate the water source and initiate the wetting of the building envelope. This requires sufficient notification or results in personnel working under significantly adverse and hazardous conditions.

Failure of any water supply components due to susceptibility to heat would render any sprinkler system inoperable. Those components (power, pump, water tank, etc.) must be protected from the fire during the emergency.

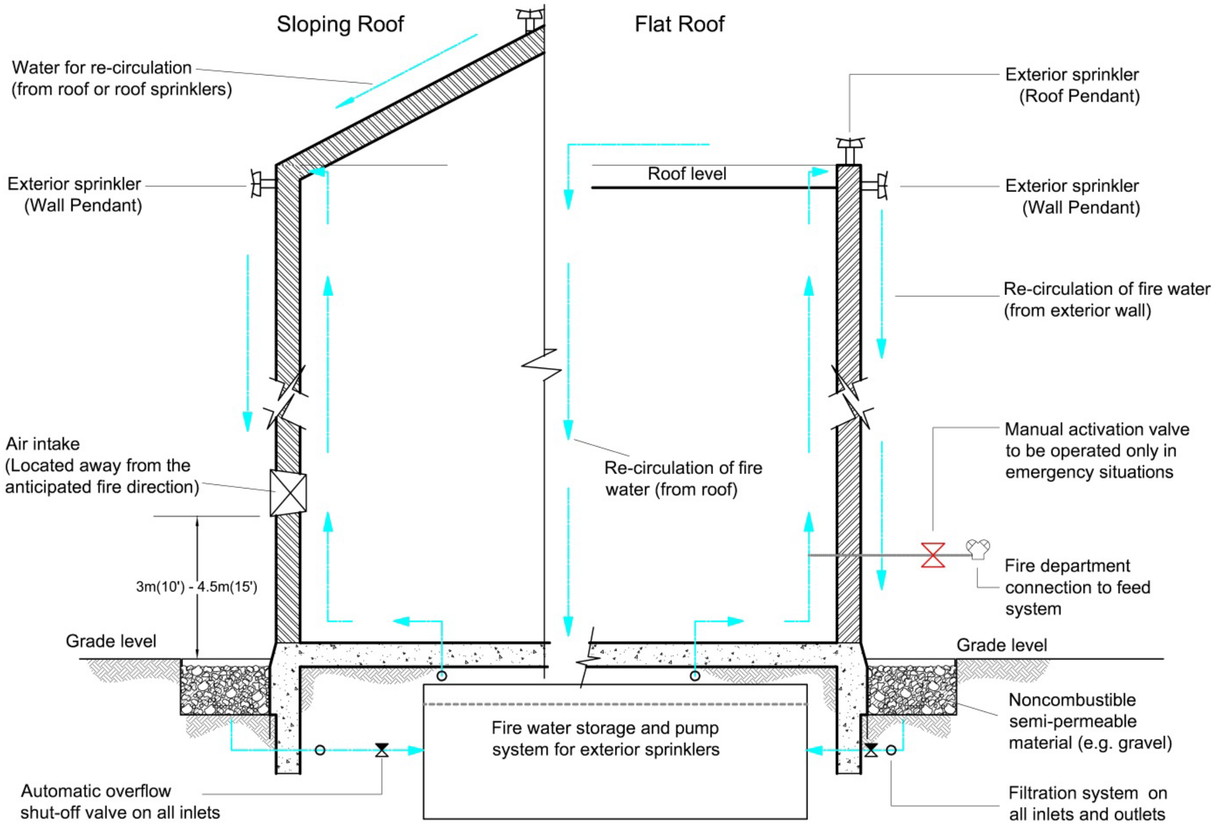


***Figure 1.14 Shelter-in-place wildfire protection measures**. Note: Refer to Section 2.1 for site planning overview*

5.5 Building Utilities

Building utilities, power, fuel, water and air treatment are essential to the operation of any facility. These components can also have a negative impact on emergency operations and building survival if damaged. Danger from downed power lines, exploding fuel tanks or the inhalation of smoke are obvious risks. Damage to generators, pumps or piping can also reduce or eliminate vital resources essential in an emergency.

Utilities include:

- Power
- Fuel
- Water
- Communications

The risks and requirements for each element; natural gas connections, location of regulators, overhead power versus buried power lines, water (potable and firefighting), transformers and their location are covered in this guideline, as are recommendations for upgrades in protection of services or backup facilities in the event of failure.

5.5.1 HVAC

Building ventilation systems require fresh air to ensure occupant health as mandated by the building code. Isolation or shut down of ventilation systems to avoid intake of contaminated air from the exterior of the building is important to minimize or reduce smoke ingress, to ensure occupant health, and to protect from property damage. This is particularly important for a building which is designated as a Shelter-in-Place. When used as a Shelter-in-Place, the number of occupants and duration of emergency must be evaluated against the amount of air and the ability to maintain an acceptable level of air quality.

HVAC smoke detection:

- **Must be provided in all outside air intakes and at individual return air intakes of all air-handling systems to initiate automatic fire mode operation**
- **Must operate at an obscuration level less than 0.5% per metre with compensation for external airborne contamination as necessary**
- **Systems must be located at all air intakes, return, and relief air openings associated with the building air-handling systems, and should be:**

    (a) of the sampling type system, or, duct detector,

    (b) of the point type optical smoke detection system.

The ventilation air system should include a carbon monoxide detector system. The detectors should be installed according to the ABC, with the installation of additional detectors at the fresh air intake openings. A suitable location would be on the inside of the louvers inside the intake, similar to the installation for the return openings. Design and install a strategically located alternate fresh air intake location where the probability of both locations being exposed to smoke would be low. Where feasible, install smoke filters and dampers to shut down any fresh air intake when smoke is encountered. It would be prudent to circulate air inside the building without contaminating it with smoke until the emergency has passed. The University of Lethbridge utilizes this type of intake louver system due to the large number of grass fires occurring in the surrounding area each year. Once smoke is detected, the intake louvers close and the HVAC system continues to circulate air within the building.

If the building is to be utilized for Post-Disaster or a longer term Shelter-in-Place (>12 hours, <72 hours) the design should incorporate a secondary air handling system (low level) with recommended installation at 3m (10 ft) to 4.5m (15 ft) above grade. The system would have to be installed with the intakes on an opposite side from the windward and leeward side, taking into consideration the topography and prevailing winds (see Site Planning in Section 2). This low level air handling system will require smoke and carbon monoxide detectors located at all air intake, return, and relief air openings associated with the building(s).

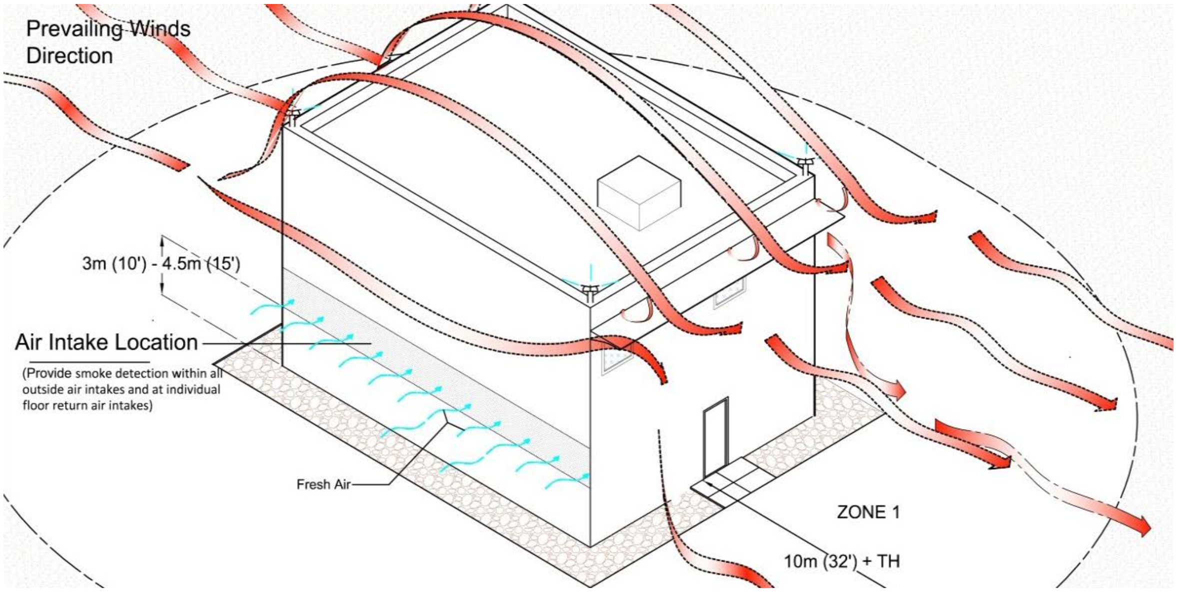


Figure 1.15 Close up of exterior vent/intake

5.5.1.1 Air quality

There are complex solutions around “scrubber” systems where compromises need to be made to achieve an optimum solution. Air scrubbers are used to remove contaminants when fresh air is at a premium. Engineered design applications of these systems would be an asset to the sustainability of the buildings. The ABC requires smoke exhaust fans as detailed below in the ‘Exhaust’ section.

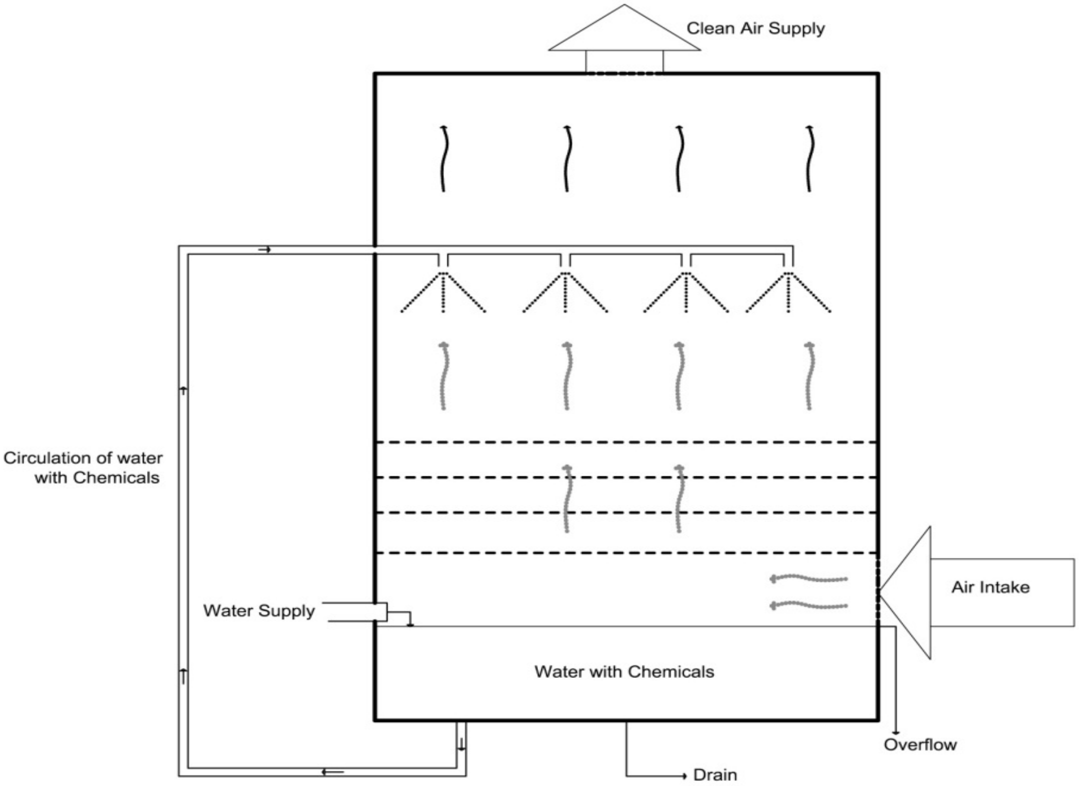


Figure 1.16 Example of a Scrubber system

5.5.1.2 Exhaust

- **Smoke exhaust should be provided using fans capable of continuous operation for a period of not less than 1 hour when handling exhaust gases at 200 degrees Celsius.**
- **All building entranceways should have air locks equipped with ventilation and exhaust fans. The air locks assist in preventing smoke from the exterior from entering the building.**

5.5.2 Plumbing System

Basic needs for a Shelter-in-Place or Post-Disaster building include shut-off valves with electronic and manual by-pass systems. Post disaster requirements include a stored supply of water to last a minimum of 72 hours duration. Elements of the plumbing systems can be augmented with the use of no-to-low-flow toilets and urinals, but potable water would still be required for hygiene purposes (washing and cleaning).

5.5.3 Utility Power

The primary transmission of power in Alberta is via overhead power lines, often strung on combustible poles. This configuration makes it highly susceptible to damage by a wildfire, and should be considered during the site planning.

5.5.4 Standby Power System

(a) A suitable alternative power supply must be provided to operate required life safety systems, including sprinkler systems, hydrant pumps, air handling systems, alarms, warning and communication systems, and emergency and exit lighting circuits.

(b) The alternative power supply must:

- (i) be connected automatically if the normal power supply fails;
- (ii) if located within the building, be separated from the remainder of the building by an enclosure with an FRR of at least 120;
- (iii) be connected to the safety systems by means of cabling.

5.5.5 Alternate Power Sources

When the normal electrical power supply is lost because the poles and cables have succumbed to the wildfire, what power is available to support building functions, communications and fire protection features? Battery power or emergency generators could be a dedicated or a local shared resource. For a shared resource, the distribution system would need to be protected. These backup systems must also be maintained regularly and designed to last for the expected duration of the emergency. See Section 5.6 'Support Facilities' for additional information.

5.6 Support Facilities

When a building must accommodate a Post-Disaster function many requirements must be considered; foremost is the number of people in the area that would use the facility, and the length of time before those occupants would be relocated. For longer periods, food and shelter for an acceptable level of comfort becomes critical. Support facilities would be equivalent to that of an Emergency Operations Centre (EOC) which includes back up power, communications, rest areas, medical rooms and sustenance provision.

Electric-driven municipal fire pumps should be provided with an alternate power supply such as a diesel powered generator to ensure reliable pumping capabilities. Ensure that the fuel source(s) for the generator are protected and include automatic shut-off systems with adequate separation distance from the building(s), in compliance with code.

5.6.1 Fuel Supply and Storage

In more remote areas fuel is normally stored on site in atmospheric or pressurized tanks depending on the type of fuel. Any fuel tank located adjacent to a building provides an additional risk when exposed to the heat of a fire.

Barbeque fuel tanks or wood piles provide additional sources of fuel and routes to transfer flames closer to the building, increasing exposure. Pressurized cylinders provide an additional explosion risk that can cause severe damage to a building and associated systems.

Keep barbeques and open pit fires (which are not recommended in forested areas) outside the defensible space. Do not store propane canisters near buildings.

5.7 LEED® (Leadership in Energy and Environmental Design)

LEED® certification has become an essential component of sustainable design in the building and construction industry. It ensures that the building project is environmentally responsible, by introducing high-performance design and market leading construction and operation practice. Green building practices are primarily concerned with water efficiency, energy saving capability, indoor environmental quality, carbon dioxide emissions, and resource preservation. The LEED® rating system is considered during all building phases from design, construction, and operations, to tenant fit, maintenance, and significant retrofit.

Obtaining a LEED® certification is achievable when enough measures are incorporated across a spectrum of fire disciplines. The main credit categories are:

1. Sustainable sites that minimize impact on ecosystems and water resources.

   Choosing a site that has been previously developed is preferable over a greenfield site where trees may have to be removed. Wetlands, water bodies, and agricultural lands are to be avoided.

2. Water Efficiency credits promote smarter use of water, inside and out, to reduce potable water consumption.

   Normal building water usage can be developed to satisfy water reduction credits which meet LEED® and exterior fire protection may be possible in an eco-friendly manner using non-potable water. Such a design could gain credit through innovative use of water supplies for fixed fire suppression systems.

3. Energy and Atmosphere credits promote better building energy performance through design of high performance building envelopes and innovative strategies. (i.e. Low VOC, Durable Building, Measurement and Verification detectors)

   Constructing the building envelope of fire resistive materials does not conflict with the ideals of better energy performance and could provide credits for some solutions.

4. Materials and Resources credits encourage using sustainable building materials, locally sourced products and reducing waste. (i.e. sprinklered green roof or “living walls”).

   As for any building project, this credit can be applied through proper design and choice of materials. Adding a fire resistive component to the project does not negate its LEED® potential, although it may reduce the material choices available.

   Vegetated roofs, although available as a green technology, is discouraged when designing a building under the threat of wildfire (refer to landscaping section of this document).

5. Indoor Environmental Quality credits promote better indoor air quality and access to daylight and views.

   Developing an HVAC system with built-in redundancy and/or back-up power that can continue to operate successfully during a forest fire should enhance air quality and may provide innovative credits for the design. Providing additional natural lighting may be restricted to some degree but can be addressed under current fire resistive designs or alternative protection features such as suppression or shutters. Use of skylights would not be encouraged in a fire-safe design but larger windows with rated shutters could actually increase survivability level.

LEED® Certification considers survivability as a desirable feature, (constructing a building to survive a specific risk), and may contribute to an innovation credit.

5.8 Emerging trends

Technology continually creates better materials suppression, and detection, which further enhances procedures for the protection of lives and property. Compliance with various codes is not always sufficient, nor are minimum standards (particularly when faced with a fire). Designers should always be aware of innovations to improve mitigation. Listed below are a few trends recognized by this guideline:

5.8.1 BIM

Building Information Modeling (BIM) is increasingly used to design and maintain a data base for building management. This method lends itself to effective modeling and analysis of a design to include the context. The possibilities for this tool to ‘fine tune’ a design to react favorably to a probable wildfire are many, and software programs are evolving for this purpose at a rapid pace. Although all these analyses are approximations, they increase the chances of survival of the building.

Hypothetically, the building could be monitored remotely by trained staff to react to the emergency while the onsite staff is attending to other emergency issues. With strategically placed smoke, radiation, and heat sensors, the sprinkler system, evacuation fans, dampers, etc. could be activated selectively to protect the building and its occupants without activating all systems and wasting precious resources to provide optimum results.

5.8.2 Prometheus© (shareware)

What is Prometheus©?

Prometheus© is a spatially explicit fire growth simulation model that provides operational and strategic assessments of fire behavior potential over time and space. Alberta Sustainable Resource Development led the creation of this new state-of-the-art national tool in collaboration with fire management agencies across Canada. Prometheus© simulates the spread of one or more fires across a landscape with heterogeneous fuels and topography based on daily, hourly or sub-hourly weather data. Spatial wind grids (wind speed and wind direction) produced by WindWizard® or WindNinja®, and multiple weather stations can also be used in Prometheus© to create more spatially accurate fire growth simulations.

The foundation of the Prometheus© model is the Canadian Forest Fire Behavior Prediction (FBP) System and the most recent wave propagation algorithms that were developed with input from various university research teams. The FBP System is a complex, semi-empirical system that mathematically expresses and integrates many of the fuels, weather and topographic features that influence fire behavior. The FBP System is used across Canada and in other parts of the world to predict fire behaviors in a quantitative and structured manner. It produces outputs that describe the physical characteristics of a wildfire such as rate of spread, fuel consumption, head fire intensity and degree of crowning.

How is Prometheus© used?

Fire growth simulation can be a valuable tool in today's wildfire manager's toolbox to provide decision support to suppress fires, plan for the use of prescribed fire, and design future desired FireSmart communities and landscapes. Prometheus© can be used not only by fire management agencies across Canada, but also by other interested stakeholders such as landscape modelers, university fire researchers, forest management planners, municipal planners, and educators. As a result, the program is open and flexible, easy to use, and easy to integrate with other applications.

Prometheus© provides operational decision support by predicting wildfire behavior during escape fire situations. This is important when the fire load exceeds the resource availability to fight all of the fires. Fires are assigned a priority based on values-at-risk and the potential fire behavior. Prometheus© allows users to complete single or multi-day fire spread simulations. The potential threat that a wildfire poses to a community or other important values-at-risk can be evaluated using Prometheus©. This includes the amount of time available to evacuate if a change in weather occurs.

5.8.3 LEED®

LEED® certification may not be possible in conjunction with current defined levels for scoring but both LEED® and withstanding the threat of forest fires are aimed at sustainability and are united by their common goals of longevity and durability. This guideline may assist in future iterations of LEED® certification considering other practical choices when defining survivability.

6 Building Systems and Their Performance in Fire Disaster Conditions

In designing new buildings, it is important to determine the usage and expectations of the building to justify the capital costs to attain an adequate level of protection for sustainability.

It is natural that people expect buildings to provide them with protection and comfort during an event when the natural environment is threatening them. It would be a sound investment to 'go the extra mile' to enhance the building with external sprinklers, self-sufficient localized water storage for suppression, auxiliary sources for power, redundancy for critical equipment, remote temperature probes, reliable communications systems, etc. It is recommended that all critical systems have redundancy measures built into them. Not all building types need the same level of protection (i.e., hospital vs. storage or utility building). Refer to Appendix B, Building Survival Flow Chart.

When discussing the importance of building preparedness three key areas must be considered apart from loss of life or injury to occupants and rescue personnel:

- **Impact of partial or total loss of the building in terms of reconstruction costs and the time needed to rebuild**
- **Impact from loss of the function and loss of services, etc. to the local area**
- **Property and heritage losses that may be more than the value of the building, such as a museum, designated historical or cultural resource**

7 Existing Facilities

This section presents examples of the actual post-wildfire level of survivability for existing infrastructure.

7.1 Example 1 - Slave Lake Government Centre and Library

***Figure 1.17 Slave Lake Government Centre and Library** – Building pre-fire, during fire and post fire*

This municipal building in the center of Slave Lake caught fire among other buildings in the vicinity (brick building construction). The fire started on the roof and destroyed the entire facility. The introduction of combustible materials to the façade increased the risk of fire load and the fire started (wooden framing on the exterior and wooden shutters/louvers). Adding fire load for aesthetics is not recommended in forested regions. Please reference Section 5 for additional recommendations with regards to building materials and decreasing the risks by eliminating combustible materials.

7.2 Example 2 - Hillcrest Log Cabin

***Figure 1.18 Hillcrest Log Cabin** – illustration showing building sustainability*

Hillcrest Log Cabin is a fully combustible wood cabin that survived the major wildland fire in Lost Creek, near Hillcrest Alberta, in 2003. The cabin survived due to the protection zones (clearance) and the installation of two external sprinkler heads supplied with water from a portable pump and water storage tank installed by ESRD crews. Numerous trailers and recreational vehicles located in the protection zone were destroyed, but the correct installation of sprinklers was able to save the cabin.

Appendix A - Building Design for Forested Areas

ALBERTA INFRASTRUCTURE BUILDING DESIGN FOR FORESTED AREAS

Scenario	**BUILDING CONSTRUCTION** Combustible or noncombustible					**Topography** Slope %	**Passive Exposure Protection**				**Water Supply**	**Active Suppression**	**Risk Score**
	Roof	Walls	Unprotected Openings	Utilities	HVAC Isolation	Slope	Tree Line	Other Building	Barrier	Ground Cover	Reliable	Exterior Sprinkler	max. 100
Scoring	15	10	5	5	5	10	10	5	5	10	10	10	100
A	15	5	5	4	5	8	8	5	2	7	10	10	84
B	10	0	3	2	0	8	5	3	3	3	10	10	57
C	2	0	0	0	0	10	2	5	0	2	5	0	26

This score sheet automatically tallies the values entered when using the attached criteria and indicates the acceptability of the design.

			Usage	Minimum Target
Scenario A scoring	**Consider Mitigation**	USAGE:	**High**	75
Scenario B scoring	**Acceptable**	USAGE:	**Low**	35
Scenario C scoring	**Mitigate**	USAGE:	**Shelter**	85

Multiple scenarios allow comparison of the same building with different options or uses.
Scoring allows an increased risk in one area to be offset by a decrease in other columns
These evaluations must be knowledge based since reducing opening to offset a decrease in wall ratings can be counterproductive.
Building designs that meet the minimum design score are acceptable but should be considered for additional mitigation before final acceptance

SAMPLE

ALBERTA INFRASTRUCTURE BUILDING DESIGN FOR FORESTED AREAS

Scoring chart guideline - actual value can vary to meet site conditions or design not specifically covered

Values are relative for comparison only

BUILDING CONSTRUCTION Combustible or noncombustible										**Topography** Slope Incline		**PASSIVE EXPOSURE**								**Water Supply**		**ACTIVE SUPPRESSION**	
Roof	Score	Walls	Score	HVAC Isolation	Score	Utilities	Score	Unprotected Openings	Score	Slope	Score	Tree Line Distance	Score	Other small Buildings	Score	Barriers	Score	Ground Cover	Score	Reliability	Score	Exterior Sprinkler	Score
Combustible unrated	0	Combustible unrated	0	None	0	No back-up	0	50 - 100%	0	30 +	0	Less than tree height	0	Combustible < 3 m	0	None	0	Uncontrolled vegetation	0	No water	0	No protection	0
Rated less than one hour C rated roof	4	Rated less than one hour	2	Manual	1	Battery Pumps	1	25 - 50%	1	20 - 30	2	Tree height	2	Combustible 3 m	2	Cover 25% of perimeter	2	Flower beds with combustible materials	4	Natural supply without pump	4	Portable sprinkler partial coverage	4
Rated one hour B rated roof	8	Rated one hour	5	Automatic with air volume for two hours	3	Available Generator pumps	2	10 – 25 %	3	10 - 20	4	Tree height +10 m	4	Combustible 3 to 5 m	3	Cover 50% of perimeter	3	Lawn with shrubs	6	Natural/tank supply & pump	6	Fixed sprinkler partial coverage	6
Rated two hour A rated roof	12	Rated two hour no combustible projections	7	Automatic with air over 2 hour	4	Protected Generator Pumps, etc.	4	0 – 10%	4	0 -10	7	Tree height +20 m	8	Combustible 6 - 10m	4	Cover 75% of perimeter	4	Lawn	8	Available with sufficient flow	8	Portable sprinkler full coverage	8
Noncombustible	15	Noncombustible	10	Automatic with air scrubber	5	Basic shelter services	5	0%	5	0	10	Tree height +30 m	10	Combustible >10 m	5	Cover 100% of perimeter	5	Irrigation or parking , drives	10	Dedicated with sufficient flow	10	Fixed sprinkler full coverage	10
Differing risks exist for flat versus sloped roofs		*Size, orientation & simplicity of wall can impact risk*		*Volume of air to maintain O_2 over expected time*		*Energy reliability or backup source on standard equipment*		*Protection can increase score Rated shutters=0%*		*Bare rocky slope less risk than tree covered*		*Requires maintenance for growing trees*		*Larger buildings use ABC 3.2.3 to determine distance*				*Well maintained lawn less risk than natural look*		*Size/type of water source & method of pressurizing*		*Quality of water based on source, pressure & flow*	

- The requirement for mitigation varies depending on the classification of the building
- Protection of occupants significantly increases expectation for building survival and maintaining a comfortable environment
- The accompanying worksheet provides the acceptable scoring goals for designs
- This score sheet should be used by knowledgeable designers capable of determining a fair score in each category.
- The above numbers are for comparison and should be reflective of actual expectations (an actual maintained tree height of 15 m with a clearance of 30 m could score as 6)
- Another example is under Slope where a 5% slope may score an 8 or 9 depending on site conditions

Appendix B - Building Survival Flow Chart

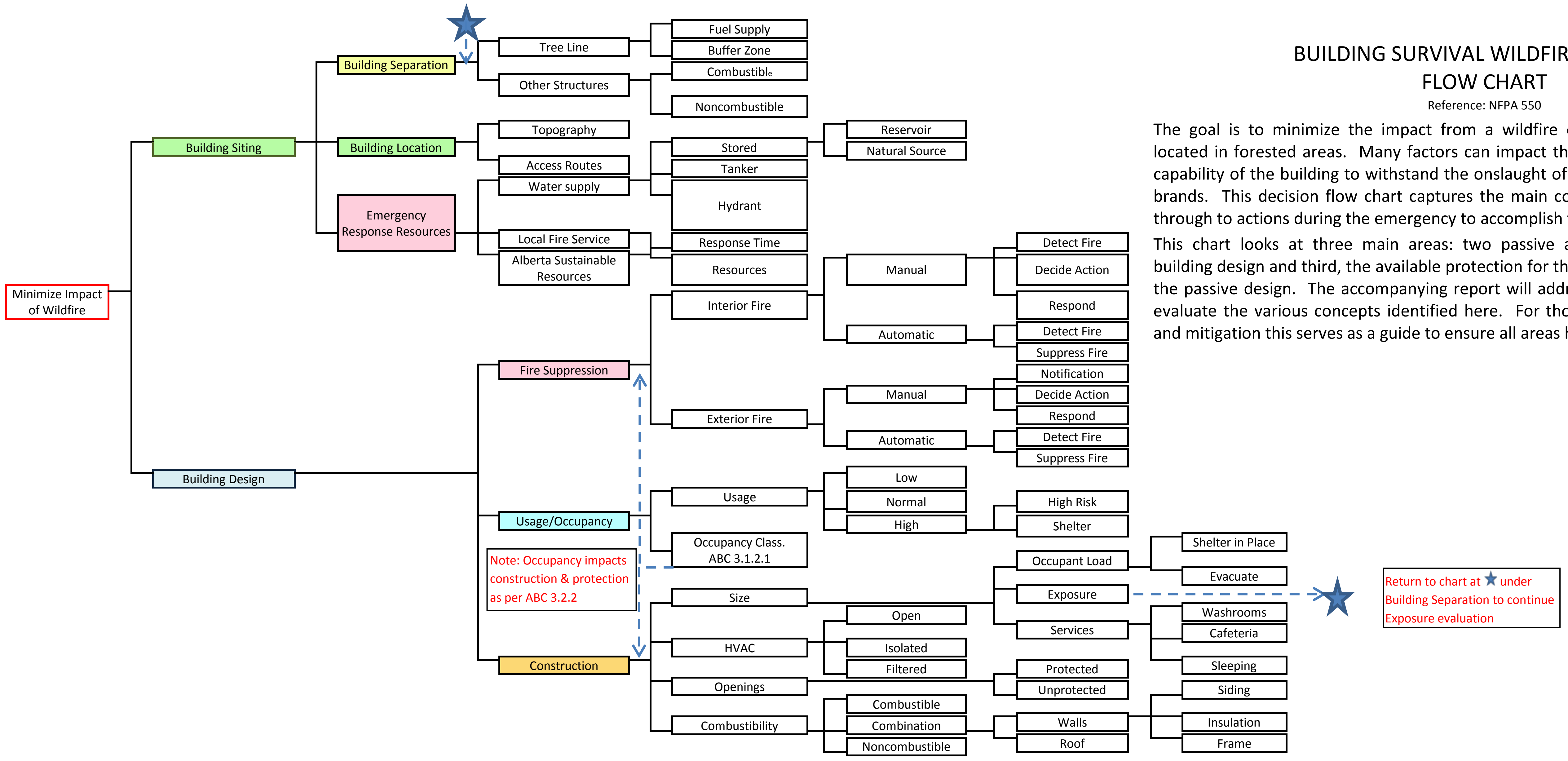
The following flow chart provides various steps in developing this guideline and outlines the options that must be considered globally (versus individually), when designing a building within a specific location where the potential of wildfire is a concern

BUILDING SURVIVAL WILDFIRE CONCEPT
FLOW CHART

Reference: NFPA 550

The goal is to minimize the impact from a wildfire on government buildings located in forested areas. Many factors can impact the size of the risk and the capability of the building to withstand the onslaught of heat, smoke and burning brands. This decision flow chart captures the main considerations from design through to actions during the emergency to accomplish that goal.

This chart looks at three main areas: two passive approaches in siting and building design and third, the available protection for the expected risks based on the passive design. The accompanying report will address the methods used to evaluate the various concepts identified here. For those familiar with the risks and mitigation this serves as a guide to ensure all areas have been considered.



Appendix C - Bibliography

ICC (International Code Council)	International Wildland Urban Interface Code
ICC (International Code Council)	International Building Code - Appendix D Fire Districts
Fire Underwriter Survey	Water Supply for Firefighting
Fire Smart	Protecting your Community from Wildfire
Solano Press Books	Managing Fire in the Urban Wild land Interface
Canadian Association of Petroleum Producers (CAPP)	Best Management Practices Wildfire Prevention
NFPA – Fire Wise	Regulations and Plans
	Wildland/Urban Interface Fire Hazards
The Wildland-Urban Interface Fire Problem	http://www.foresthistory.org/publications/FHT/FHTFall2008/Cohen.pdf
Scientific and Social Challenges for the Management of Fire – prone Wildland – urban Interfaces	http://iopscience.iop.org/1748-9326/4/3/034014/pdf/erl9_3_034014.pdf
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	Alberta Fire Code 2006
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	STANDATA 06-BCI-025 Fire Department Response Time

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Appendix D - Glossary

Asset Protection Zone	The highest level of strategic protection to human life, property and high value assets vulnerable to radiant heat or embers
BIM	Building Information Modeling
Boreal Forest	Forest areas of the northern North Temperate Zone, dominated by coniferous trees such as spruce, fir, and pine
Brise-soleil	A variety of permanent sun-shading structures
Building Envelope	The physical separator between the interior and the exterior environments of a building. It serves as the outer shell to help maintain the indoor environment (together with the mechanical conditioning systems) and facilitate its climate control.
Building Usage Classification	Low Importance buildings represent a low direct or indirect hazard to human life in the event of failure, which include minor storage buildings, and low occupancy buildings. Siting consideration must be given to these structures to ensure they do not contribute to the fire load or fire spread during a wildfire event. Normal Importance, loss of these buildings would impact routine operations, however, the contents can be replaced and temporary arrangements made during replacement if necessary. Most buildings would be considered Normal Importance for design purposes. High Importance is given to buildings where the functions or contents cannot be lost or interrupted. An additional category are those buildings that present an unacceptable threat, such as manufacturing and storage facilities containing toxic substances, explosives or other substances in sufficient quantities to be dangerous to the public if released. Post-disaster buildings are prime examples of High importance for maintaining operations during and after an emergency. Other examples are museums or buildings designated as shelters during an emergency.
Combustion	An act or instance of burning, usually a rapid chemical process (as oxidation) that produces heat and usually light
Conflagration	A large disastrous fire
Defensible Space	An area either natural or man-made, where material capable of allowing a fire to spread unchecked has been treated, cleared or modified to slow the rate and intensity of an advancing wildfire and to create an area for fire suppression operations to occur. (ICC)
ESRD	Environment and Sustainable Resource Development; stewards of air, land, water and biodiversity, will lead the achievement of desired environmental outcomes and sustainable development of natural resources for Albertans.

Exposure	The subjection of a material or construction to a high heat flux from an external source, with or without flame impingement
Façade	Generally one exterior side of a building, usually, but not always, the front
Fenestration	Refers to the design and/or disposition of openings in a building or wall envelope. Fenestration products typically include: windows, doors, louvers, vents, wall panels, skylights, storefronts, curtain walls, and slope glazed systems.
Fire brand	A piece of burning wood
FireSmart	FireSmart uses preventative measures to reduce wildfire threat to Albertans and their communities while balancing the benefits of wildfire on the landscape.
Forest Fire	See Wildfire Ground fires occur on the ground, often below the leaves. Surface Fires occur on the surface of the forest up to 1.3 metres high Crown fires occur in the tops of the trees and can spread the fastest
Forested Region	In Alberta the forested region is primarily in the north and western portions of the province (boreal region) See attached maps
FRR	Fire resistance rating usually expressed in number of hours
FUS	Fire Underwriters Survey
ICC	International Code Council is a US Association that publishes a collection of 14 safety codes that are adopted in whole or part by all US States and a number of other countries
Ignition	The starting of a fire
Institutional Building	All buildings operating government programs
LEED®	Leadership in Energy and Environmental Design (LEED) consists of a suite of rating systems for the design, construction and operation of high performance green buildings, homes and neighborhoods.
NFPA	National Fire Protection Association standards. Several standards are referenced by Canadian Codes for compliance.
Porte-cochere	A roofed structure extending from the entrance of a building over an adjacent driveway and sheltering those getting in or out of vehicles or passageways through a building or screen wall designed to let vehicles pass from the street to an interior courtyard
Post-Disaster	A building that is essential to the provision of services in the event of a disaster
Prevailing Wind	A wind that blows predominantly from a single general direction
Prometheus©	Prometheus© the Canadian Wildland Fire Growth Simulation Model is a computer program that mathematically expresses and integrates many of the fuels, weather and topographic factors influencing forest fire

	behaviour.
Radiant heat flux	The rate of heat energy transfer through a given surface heat as a rate per unit area measured in W/m^2
Scrubber	An air scrubber is a device that is used to remove particles, gases, or chemicals from the air within a given area. While most air filtration systems of this type are designed to handle only one of these types of pollutants, there are a few industrial air cleaners that will handle two and even all three contaminants. Most scrubbers are configured to complete at least six cycles of operation each hour, helping to keep the air in the space free of any type of contamination.
Shelter-in-Place (SIP)	A process for taking immediate shelter in a location readily accessible to the affected individual by sealing a single area (an example being a room) from outside contaminants
Wildfire	An uncontrolled fire in an area of combustible vegetation that occurs in the countryside or a wilderness area. Other names such as brush fire, bushfire, forest fire, desert fire, grass fire, hill fire, peat fire, vegetation fire, and wildfire may be used to describe the same phenomenon.
Wildland-Urban Interface Area	That geographical area where structures and other human developments meet or intermingle with wildland or vegetative fuels

Appendix E - Alberta Government Buildings

The following is a list of municipal and forested areas within the Province that are at a higher risk of wildfire potential.

North-East:

- Boyle
- Fort McMurray
- Fort Chipewyan
- Athabasca

North-West:

- Whitecourt
- Hinton
- Grande Cache
- Fox Creek
- High Level
- Red Earth
- Wabasca –Desmaris
- Swan Hills

Foothills and Mountain Parks:

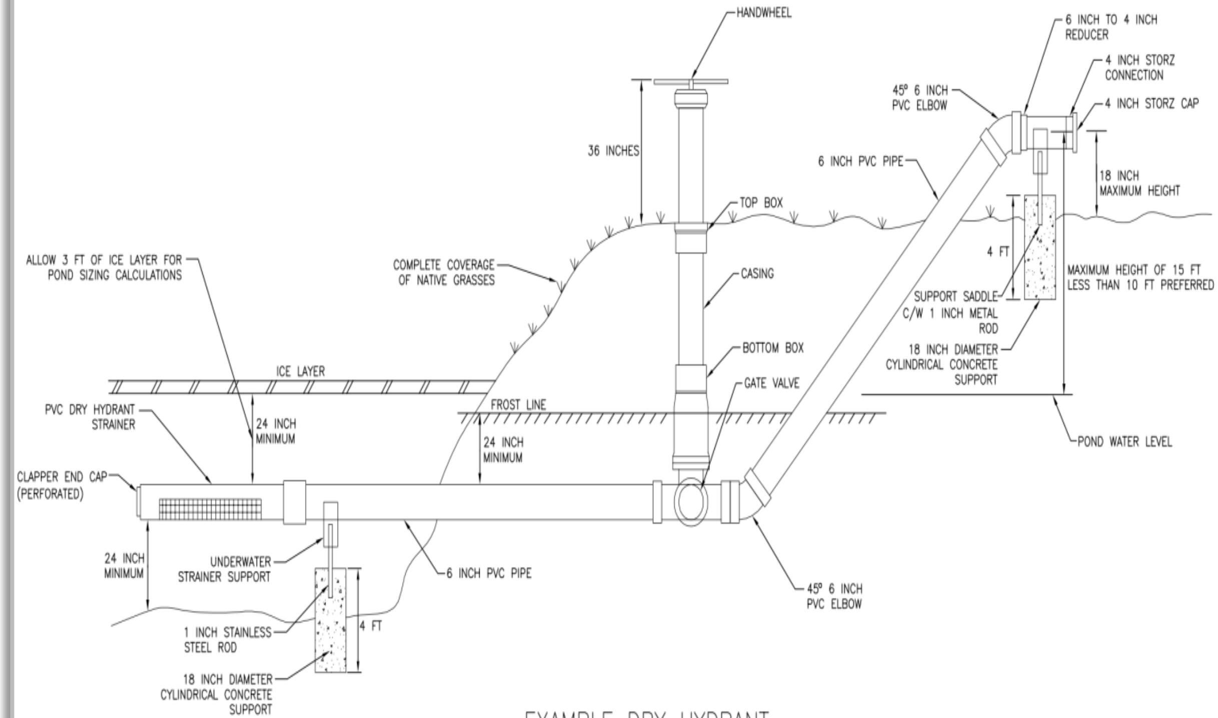
- Crowsnest Pass
- Canmore
- Jasper
- Banff

Appendix F - Dry Hydrant

Example Dry Hydrant Design

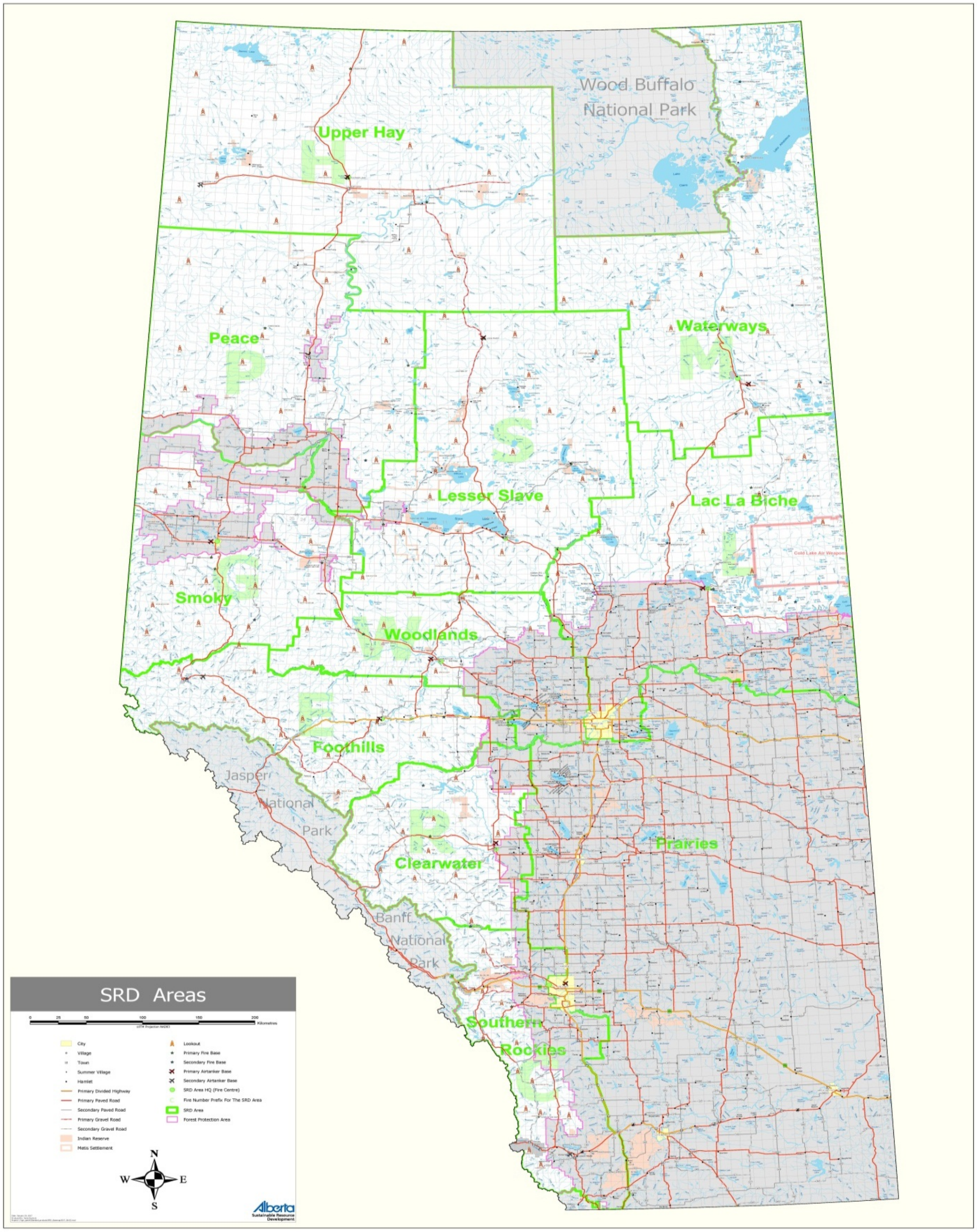
DRY HYDRANT DESIGN NOTES

1. DRY HYDRANT SHALL BE DESIGNED AND INSTALLED AS PER NFPA 1142
2. DRY HYDRANT SHALL BE INSTALLED DURING CONSTRUCTION OF THE POND AND BEFORE THE POND IS FILLED WITH WATER
3. LOW LEVEL ALARM SHALL BE INSTALLED IN POND TO ENSURE SUFFICIENT WATER VOLUME IS ALWAYS AVAILABLE. LOW LEVEL ALARM SHALL BE TIED INTO THE FIRE ALARM PANEL
4. DRY HYDRANT TO BE LOCATED A MINIMUM OF 100 FT AWAY FROM ANY STRUCTURE
5. FIRE APPARATUS SHALL BE PROVIDED WITH SUFFICIENT ACCESS TO DRY HYDRANT SO THAT NOT MORE THAN 20 FT OF HARD SUCTION HOSE IS REQUIRED
6. ACCESS SHALL BE PROVIDED TO THE DRY HYDRANT AND THE STRUCTURE IN ACCORDANCE WITH ABC 3.2.5.5 & 3.2.5.6
7. OWNER SHALL PROVIDE 2 LENGTHS OF 10 FT HARD SUCTION HOSE TO BE STORED ONSITE ADJACENT TO THE DRY HYDRANT IN A SHELTERED CABINET
8. THE PROVIDED ONSITE HARD SUCTION HOSE SHALL UTILIZE SUCTION GASKETS
9. DRY HYDRANT VALVE SHOULD ONLY BE OPENED IMMEDIATELY BEFORE USE
10. DRY HYDRANT VALVE SHALL BE CLOSED AFTER EACH USE AND ALL WATER REMAINING IN THE PIPE ABOVE THE VALVE SHALL BE PUMPED OUT. ENVIRONMENTALLY FRIENDLY ANTI-FREEZE SOLUTION SHALL BE POURED INTO THE HYDRANT ONCE THE WATER IS PUMPED OUT.
11. A CONSPICUOUS IDENTIFICATION SIGN SHALL BE INSTALLED THAT CLEARLY STATES 'DRY HYDRANT – FIRE DEPT. USE ONLY – OPEN HYDRANT VALVE BEFORE USE – NO PARKING'
12. ABOVE GROUND DRY HYDRANT COMPONENTS SHALL BE PRIMED AND PAINTED RED, PLUS REFLECTIVE TAPE SHALL UTILIZED TO ENSURE THE HYDRANT AND HANDWHEEL ARE VISIBLE
13. TWO BOLLARDS SHALL BE INSTALLED IN FRONT OF THE DRY HYDRANT TO PROTECT AGAINST MECHANICAL DAMAGE
14. STRAINER CAP TO BE HINGED TO ALLOW FOR BACK FLUSHING
15. DRY HYDRANT PIPE TO BE FLUSHED AFTER INSTALLATION
16. DRY LUBRICANT SHALL BE APPLIED TO REDUCE GRIT ON HYDRANT STORZ CONNECTION
17. PVC PIPE MUST BE A MINIMUM OF SCHEDULE 40
18. IT IS THE OWNERS RESPONSIBILITY TO ENSURE THE DRY HYDRANT IS MAINTAINED AND TESTED IN ACCORDANCE WITH REGULATIONS SET OUT BY NFPA 1142
19. DRY HYDRANT SHALL BE FLOW TESTED ANNUALLY AS PER NFPA 1142

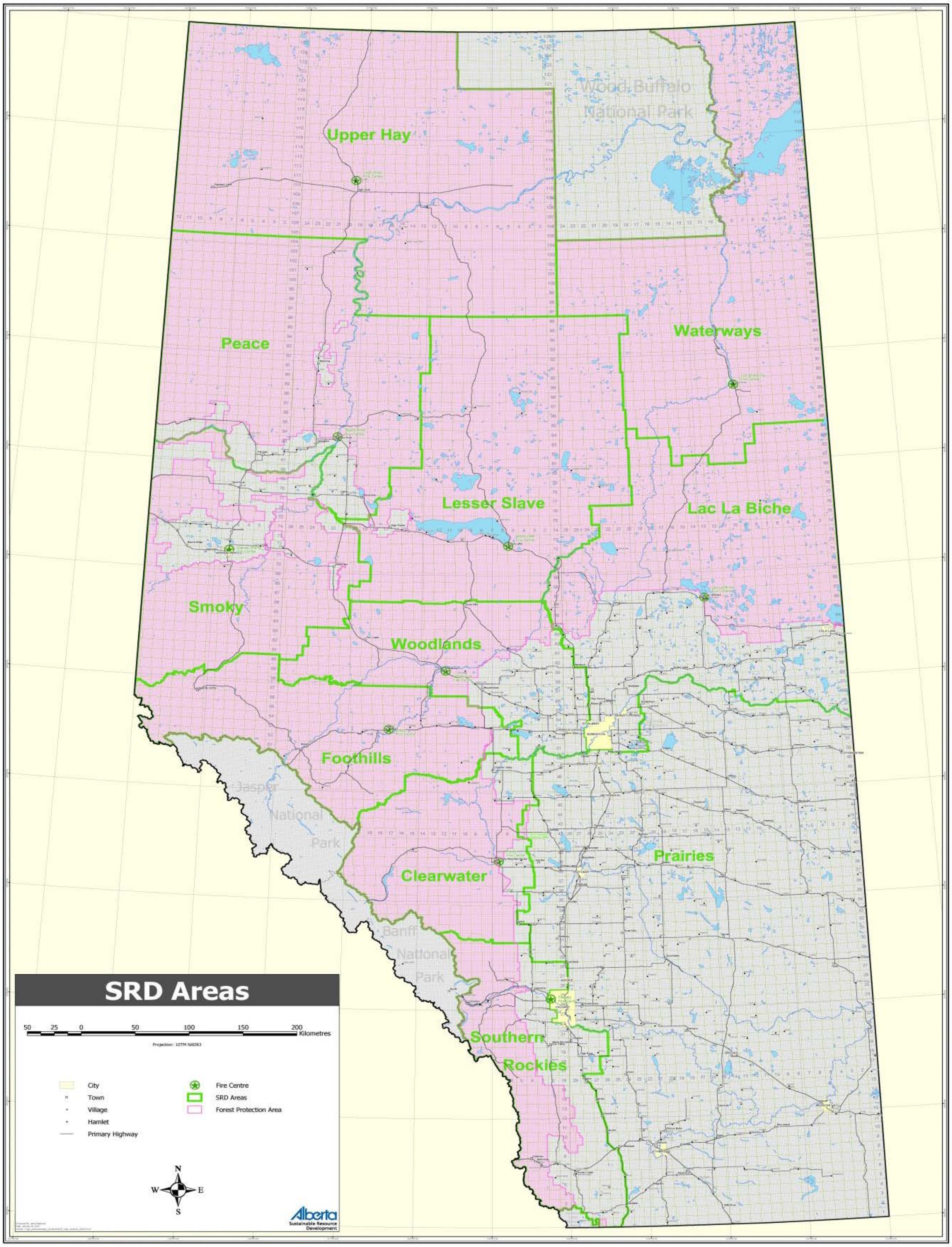


EXAMPLE DRY HYDRANT

Appendix G – Sustainable Resource Development Basemap



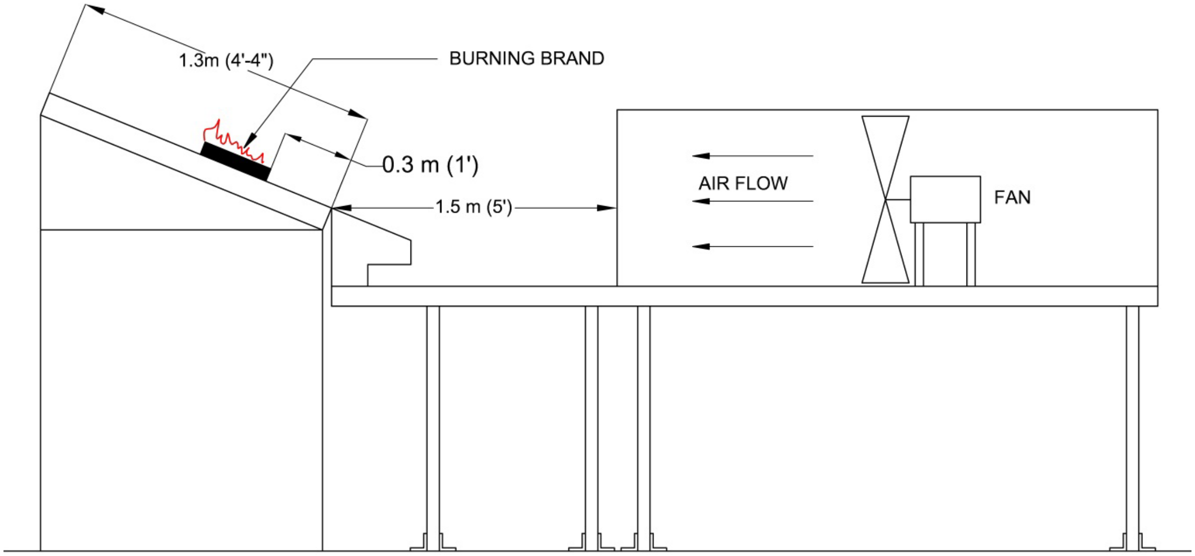
Appendix H - Sustainable Resource Development Sections



Appendix I - Roof Fire Resistance Rate Testing

http://firecenter.berkeley.edu/new_bwmg/roof/code

"Fire ratings for roof coverings are *based on test methods developed by standards writing organizations. These include the American Society for Testing and Materials (ASTM) Standard E-108, Underwriters Laboratory (UL) Standard 790 and National Fire Protection Association (NFPA) Standard 276. These standards evaluate three fire-related characteristics of a roof covering, including 1) the ability to resist the spread of fire into the attic (or cathedral ceiling) area, 2) resist flame spreading on the roof covering, and 3) resist generating burning embers.*



This is a diagram of the test apparatus used in the ASTM E-108 test. It is a small wind tunnel. The view shown here is for the 'penetration' test, consisting of a 3 ft by 4 ft test deck at the (left) end. The distance between the end of the tunnel and the test deck is specified, as is the location of the burning brand on the test deck and the air flow velocity.

The test deck for the spread of flame test is a different size.

Fire ratings for roof coverings are 'A', 'B', 'C' or 'nonrated'.

- *A - brand: 12"x12" three layer sandwich made from ¾" square Douglas-fir sticks*
- *B - brand: 6"x6" three layer sandwich made from ¾" square Douglas-fir sticks*
- *C - brand: Small piece of Douglas-fir, about the size of an ice cube*

In the brand portion of the ASTM E-108 test one 'A' or one to two 'B' brands will be ignited and placed on the sample roof deck during the test. Multiple 'C' brands are placed on the roof deck during the course of the test. "

Appendix J –
Environment and Sustainable Resource Development Storage Sample Case Study

Environmental and Sustainable Resource Development (ESRD)

Storage Building - Slave Lake, AB

Garage, Warehouse and Workshop (F3) Design Evaluation for Survival in a Forest Fire

The building is classified as a low hazard industrial occupancy with a normal usage. It is not expected to be used as a shelter or post-disaster building.

Located on the NE corner of the tarmac adjacent to the airfield, the building is located on flat terrain bounded by a gravel storage yard (24 m x 60 m) to the west and asphalt parking to the east between warehouses that are approximately 35 m apart. Between the air strip to the south and the storage building is existing bush that is approximately 5 m from the building. The north side has a landscaped lawn with individual trees.

The storage building consists of steel framing with insulated metal panels and translucent panels for light below the eaves. Although constructed of steel with insulation the building does not have any fire resistance rating. A sloped metal roof covers the majority of the building with a flat centre section. The centre section does provide an ideal zone for capturing fire brands and is covered by a bitumen roofing system.

The eaves overhang by almost one metre protecting the walls and windows from burning brands but providing an area for trapping radiated heat.

The building has no internal or external fire suppression systems and the water supply is provided through the Slave Lake municipal system. The new reservoir and pumping system has been activated since the forest fire that impacted much of Slave Lake. The facility must rely on the utilities provided by Slave Lake for operation so any interruption in those services could impact operations.

Based on the above information an evaluation sheet was completed. Using the work sheet under ***Scenario A***, the construction and exposure rating indicates a reasonable expectation that the building would survive a forest fire. The evaluation also indicates that fully protecting the building with portable exterior sprinklers as shown in ***Scenario B*** below would provide an acceptable level for survival.

The building is not designed to provide shelter or be a post-disaster facility. Since this is an ESRD facility, the personnel would most likely be employed in an emergency response role in the event of a forest fire. The area does have the normal evacuation routes along the municipal roads and an alternative along the air strip if necessary.

Recommendations

1. **Ensure a clearing of bush on the south side of the storage building, so that burning trees could not fall onto the building.**
2. **Pre-plan for deployment of portable exterior sprinklers in the event of a forest fire to enhance survivability of the building.**

ALBERTA INFRASTRUCTURE BUILDING DESIGN FOR FORESTED AREAS

Building: ESRD Storage, Slave Lake, AB

Date: 15-Apr-13

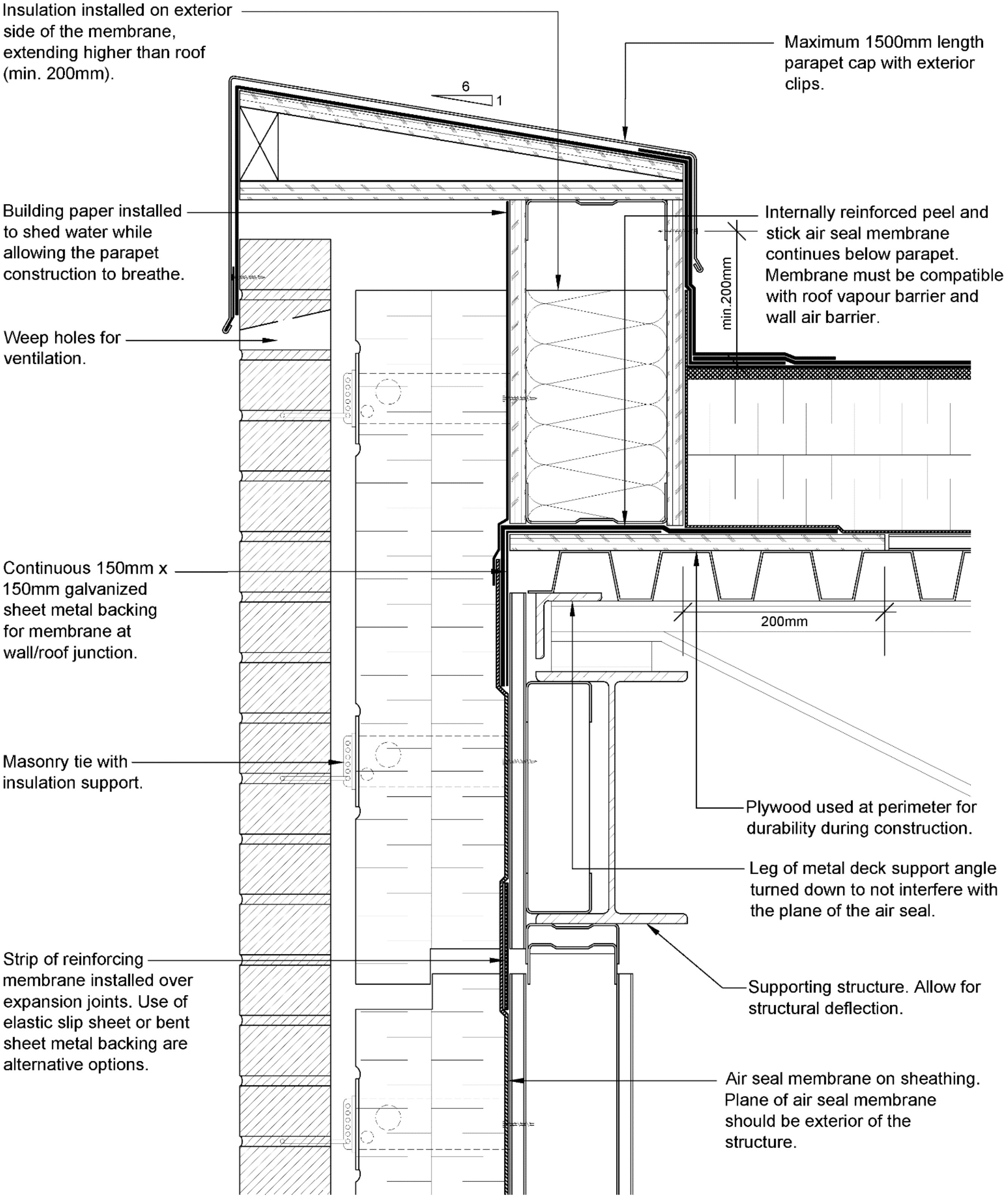
Scenario	**BUILDING CONSTRUCTION** Combustible or noncombustible					**Topography** Slope %	**Passive Exposure Protection**				**Water Supply**	**Active Suppression**	**Risk Score**
	Roof	Walls	Unprotected Openings	Utilities	HVAC Isolation	Slope	Tree Line	Other Building	Barrier	Ground Cover	Reliable	Exterior Sprinkler	max. 100
Scoring	15	10	5	5	5	10	10	5	5	10	10	10	100
A	10	8	2	1	1	10	3	4	2	8	8	0	57
B	10	8	2	1	1	10	3	4	2	8	8	8	65
C													0

This score sheet automatically tallies the values entered when using the attached criteria and indicates the acceptability of the design.

			Usage	Minimum Target
Scenario A scoring	**Consider Mitigation**	USAGE:	**Normal**	55
Scenario B scoring	**Acceptable**	USAGE:	**Normal**	55
Scenario C scoring	**Not Applicable**	USAGE:	**Shelter**	85

Alberta Infrastructure

Appendix D – Standard Envelope Details



Insulation installed on exterior side of the membrane, extending higher than roof (min. 200mm).

Maximum 1500mm length parapet cap with exterior clips.

Building paper installed to shed water while allowing the parapet construction to breathe.

Internally reinforced peel and stick air seal membrane continues below parapet. Membrane must be compatible with roof vapour barrier and wall air barrier.

Weep holes for ventilation.

Continuous 150mm x 150mm galvanized sheet metal backing for membrane at wall/roof junction.

Masonry tie with insulation support.

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.

Strip of reinforcing membrane installed over expansion joints. Use of elastic slip sheet or bent sheet metal backing are alternative options.

Supporting structure. Allow for structural deflection.

Air seal membrane on sheathing. Plane of air seal membrane should be exterior of the structure.

Alberta
Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
PARAPET OPTION 1

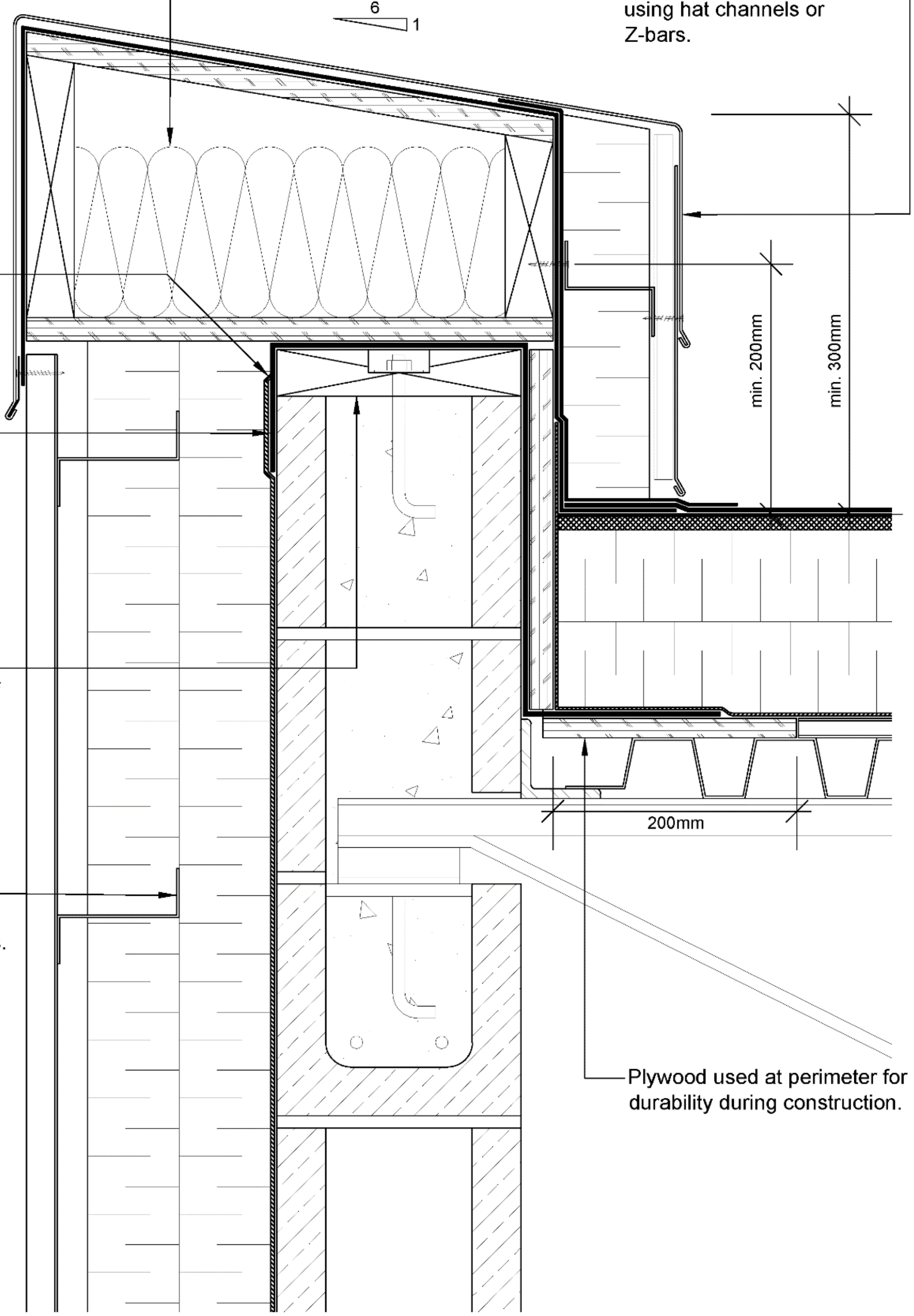
TECHNICAL SERVICES BRANCH

DETAIL NUMBER
1

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5

Insulation must be installed exterior of the roof membrane.

Removable flashing and insulation for future re-roofing. Attached using hat channels or Z-bars.



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.

Plywood used at perimeter for durability during construction.

Alberta
Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
PARAPET OPTION 2

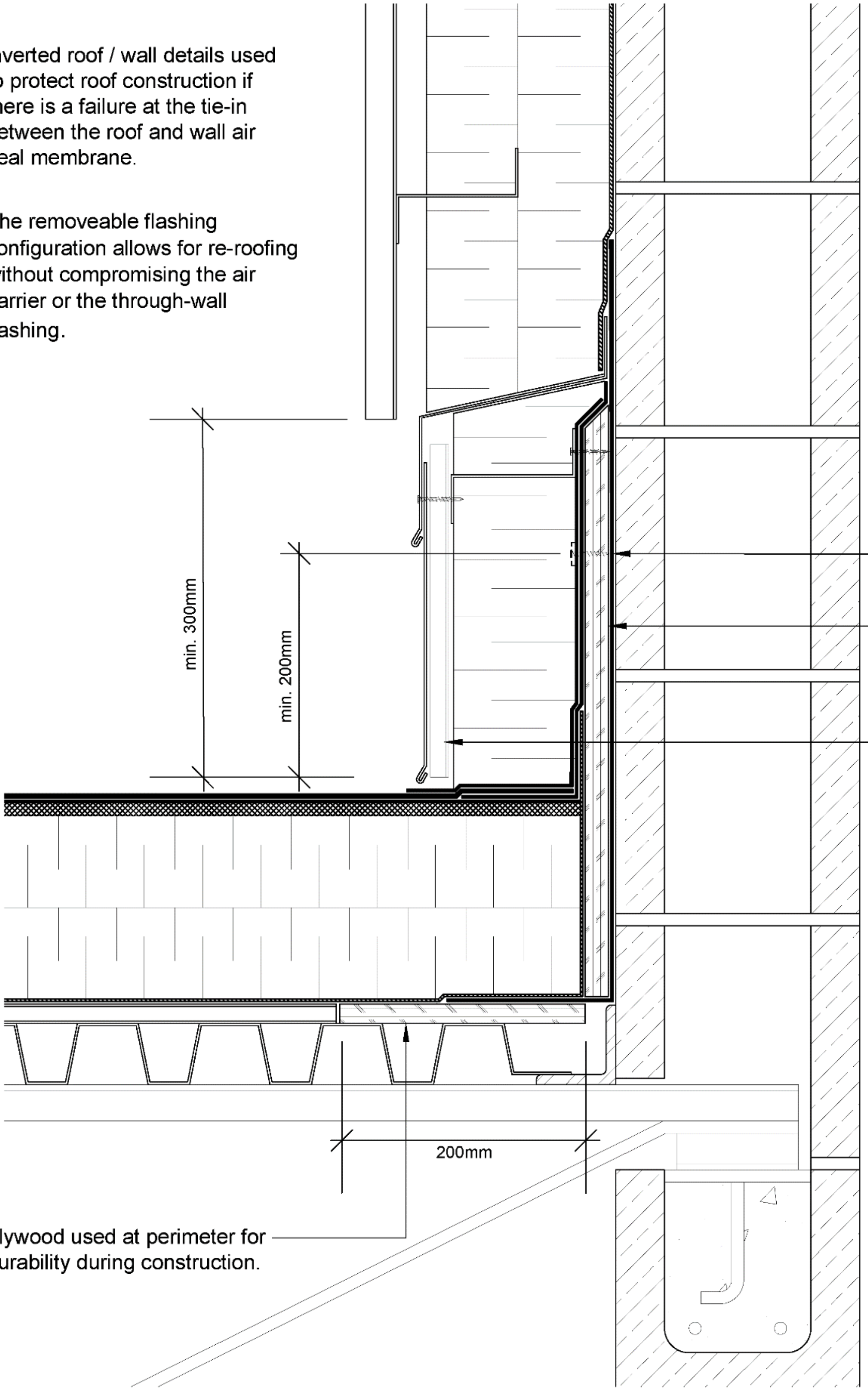
TECHNICAL SERVICES BRANCH

DETAIL NUMBER
2

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5

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.



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.

Plywood used at perimeter for durability during construction.

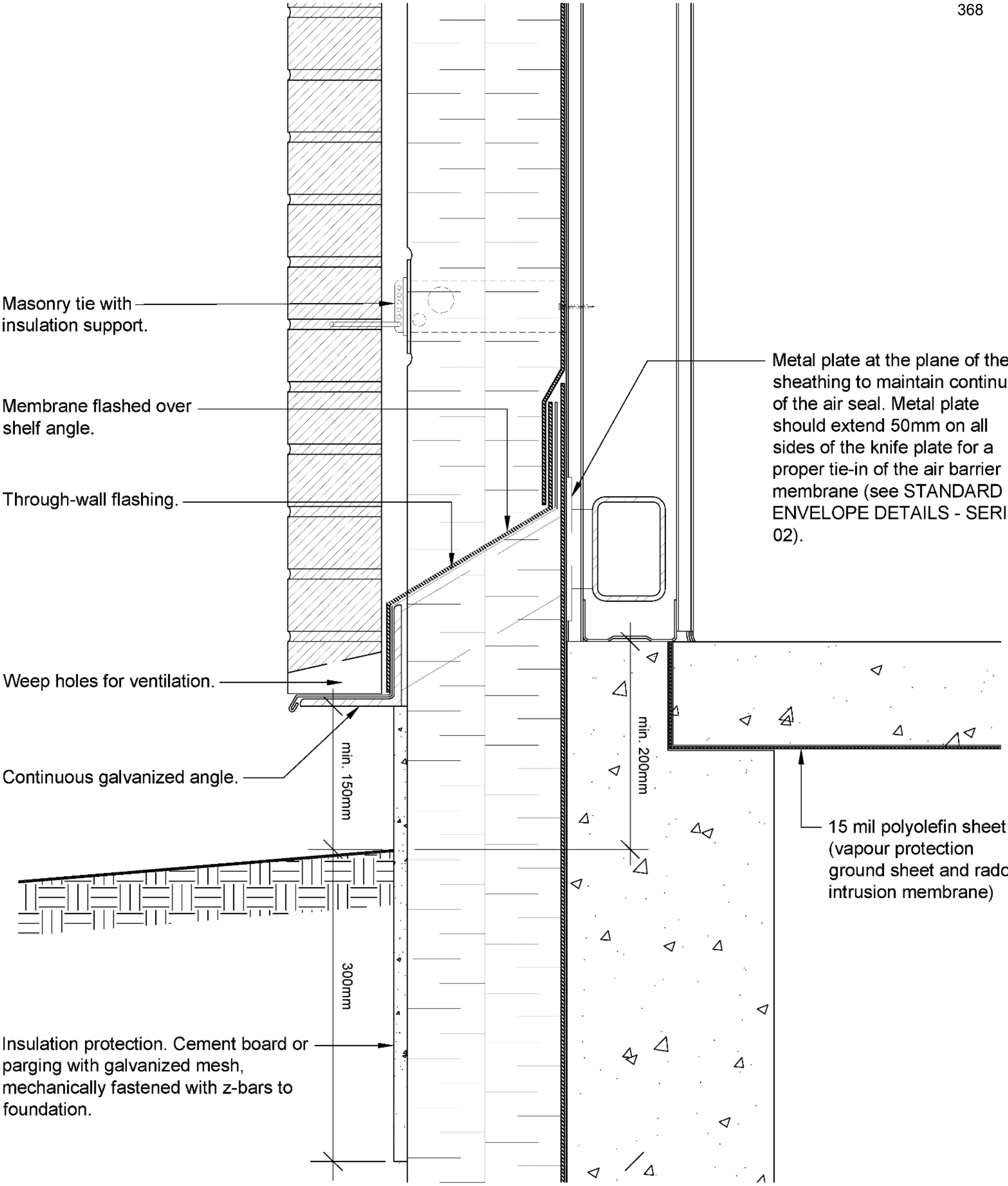
Alberta Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
INVERTED ROOF TO WALL

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
3

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5



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)

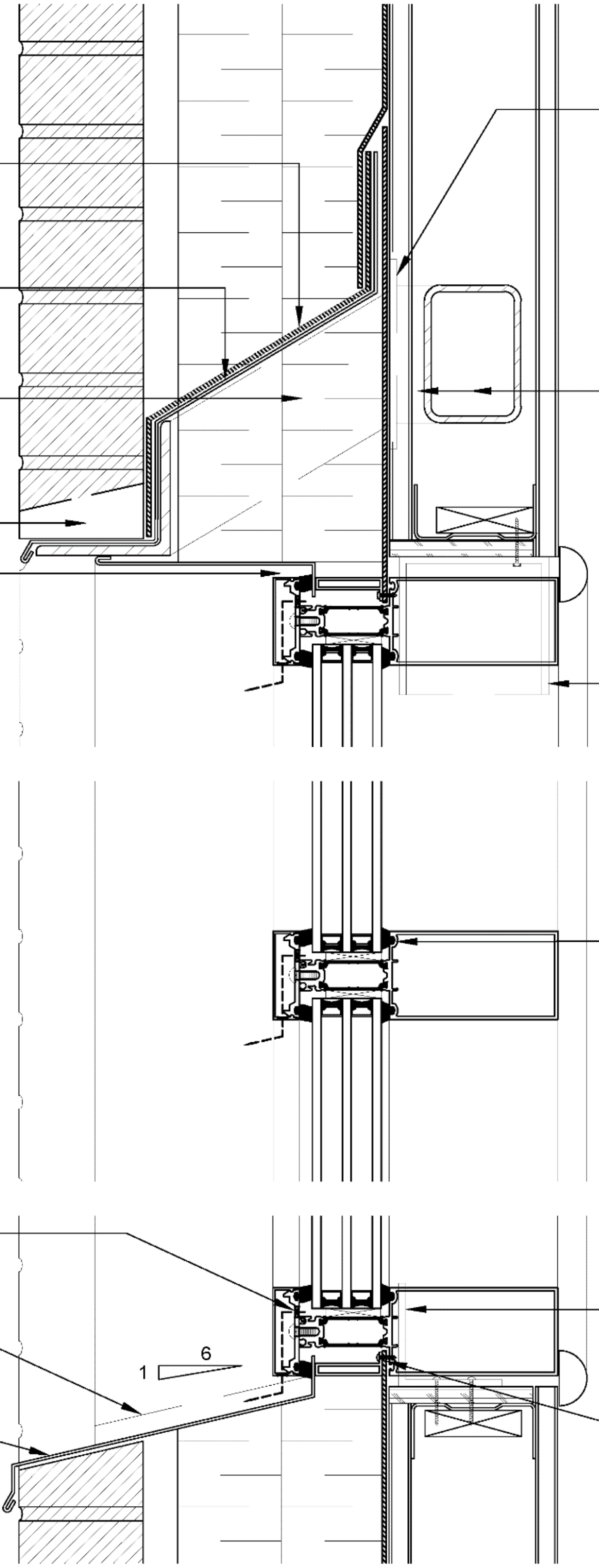
Alberta
Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
FOUNDATION

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
4

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5



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.

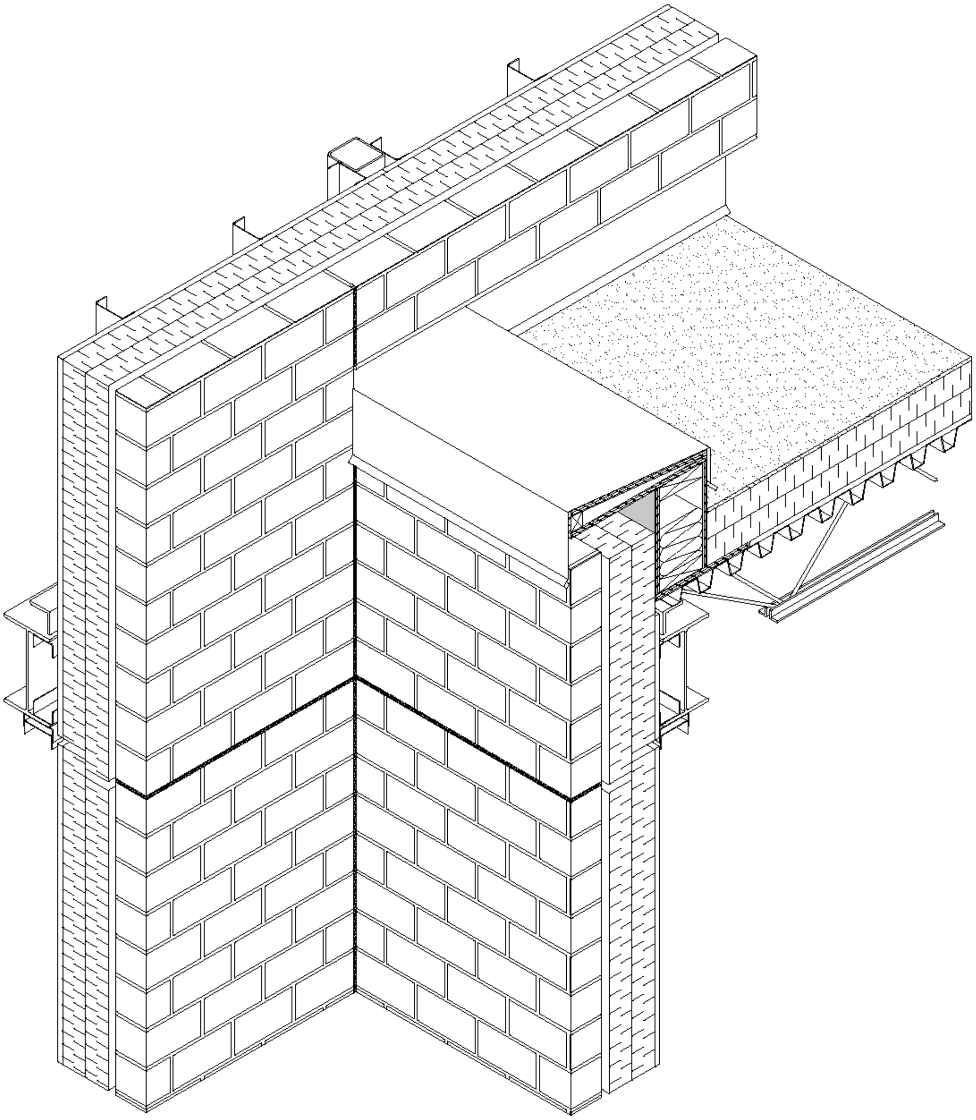
Alberta Infrastructure

SERIES 01
STANDARD ENVELOPE DETAILS
PUNCHED WINDOW

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
5

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-04	V. SOLBAK	1:5



Alberta Infrastructure

SERIES 02

STANDARD ENVELOPE ASSEMBLY

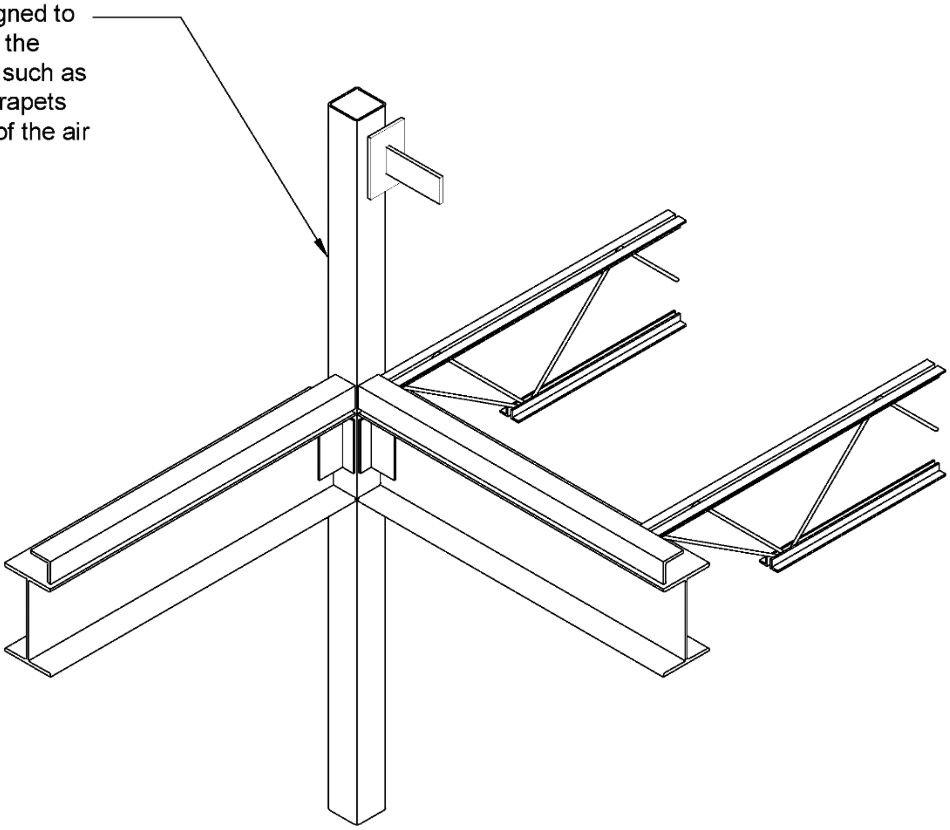
ISOMETRIC DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER

0

DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-05	V. SOLBAK	NTS



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.

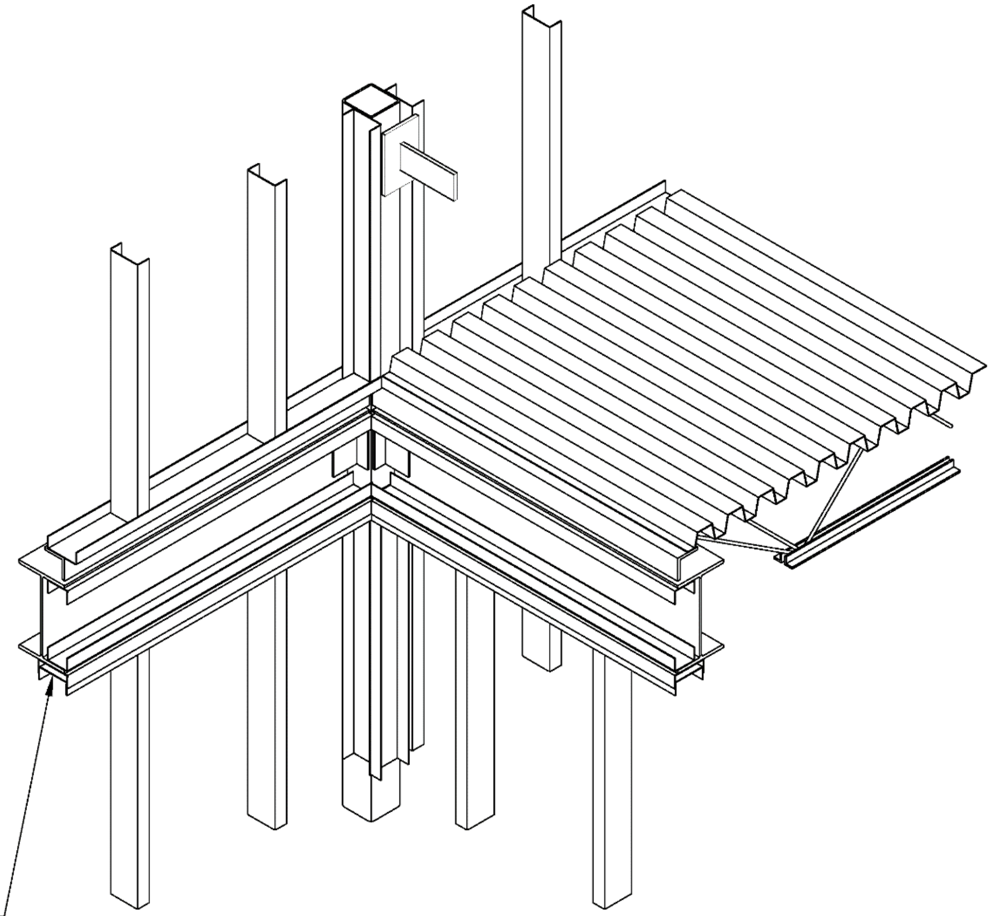
Alberta
Infrastructure

SERIES 02
STANDARD ENVELOPE ASSEMBLY
ISOMETRIC DETAILS

TECHNICAL SERVICES BRANCH

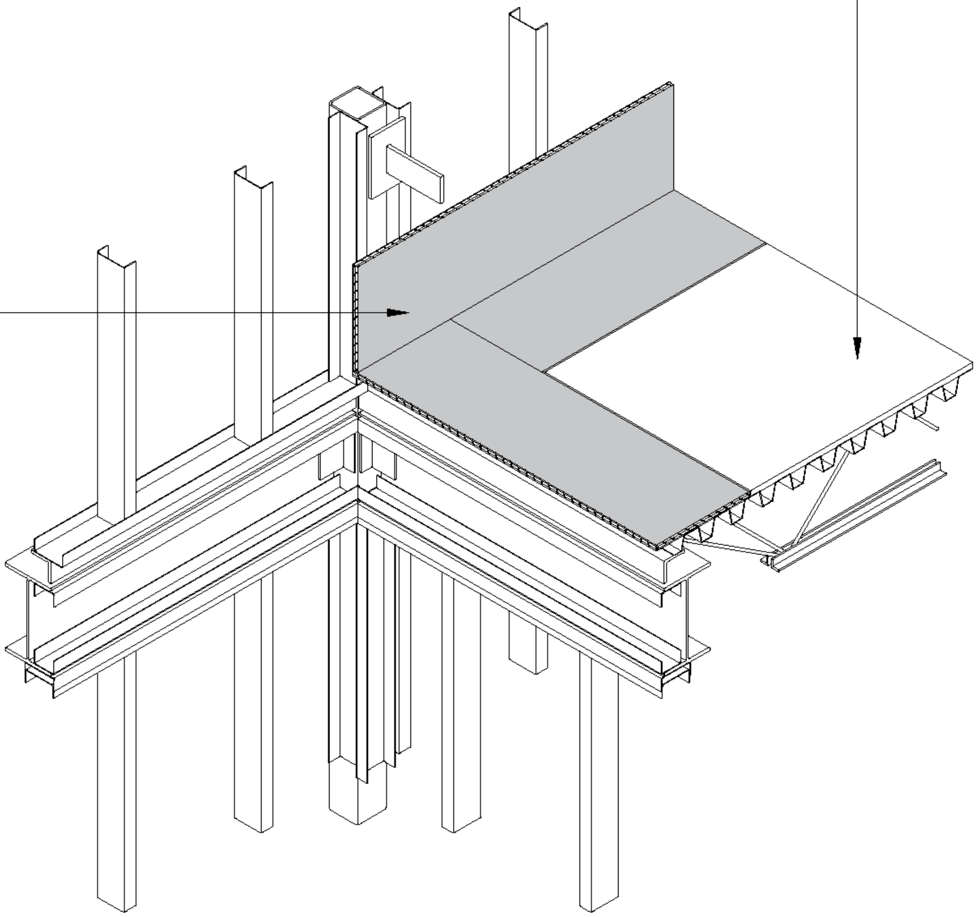
DRAWN BY	DATE	CHECKED BY	SCALE
E. RIVERA / M. WHITE	2016-10-05	V. SOLBAK	NTS

DETAIL NUMBER
1

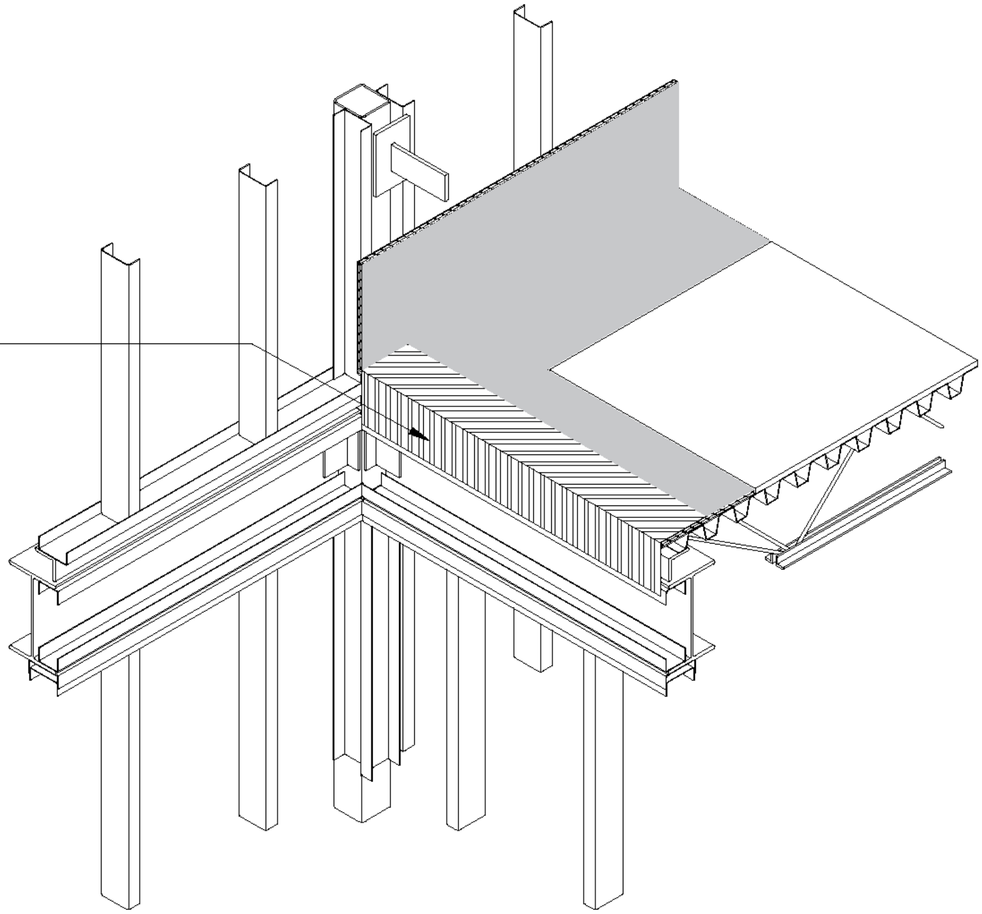


Allow for structural deflection.

Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 2
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS

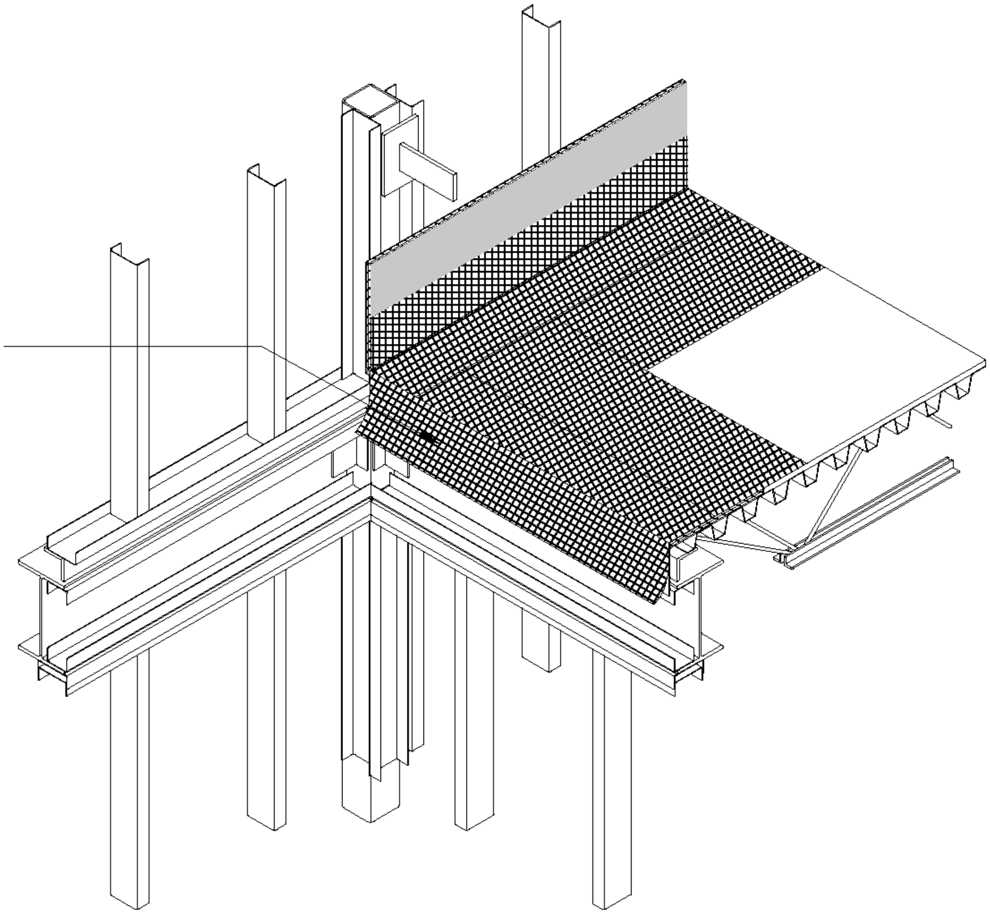


Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 3
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



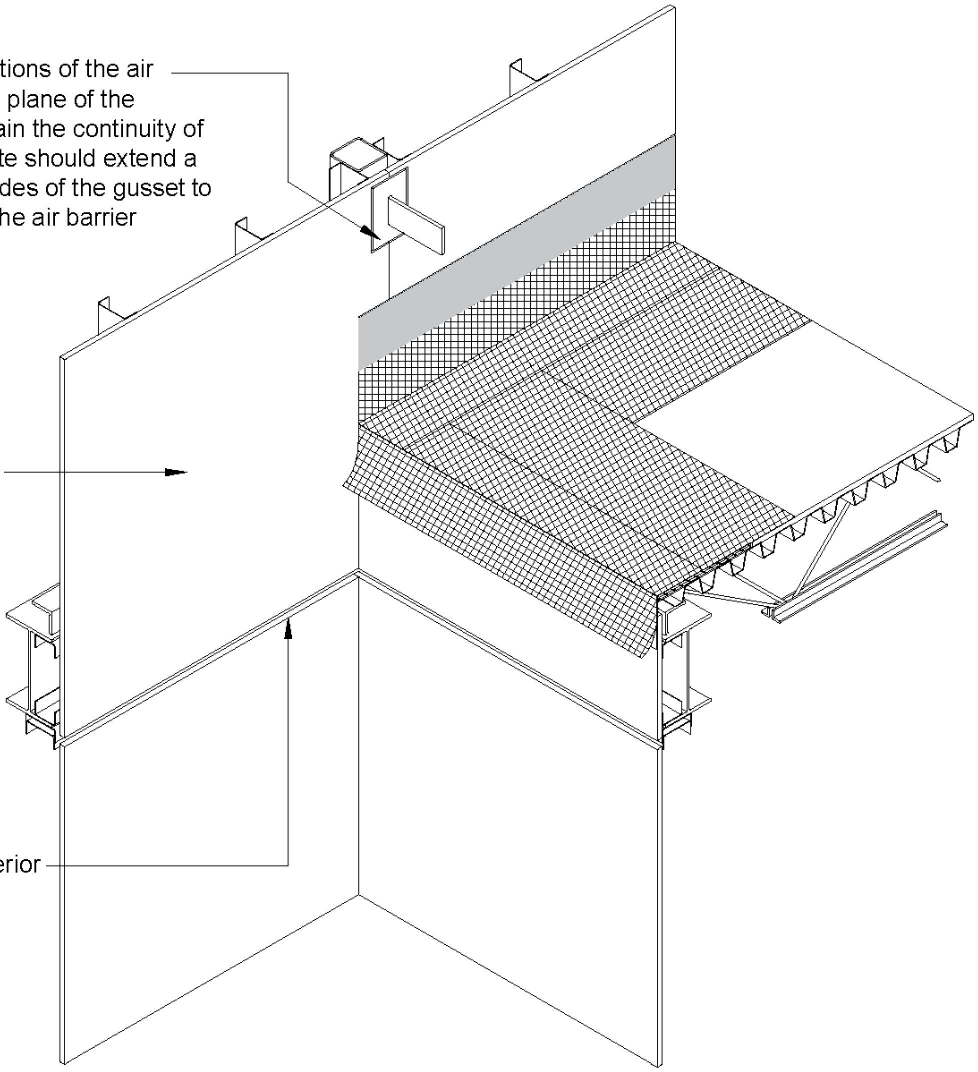
Continuous 150mm x 150mm galvanized sheet metal backing for membrane at wall/roof junction.

Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 4
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



Lapped downward (these laps are covered later).

Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 5
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



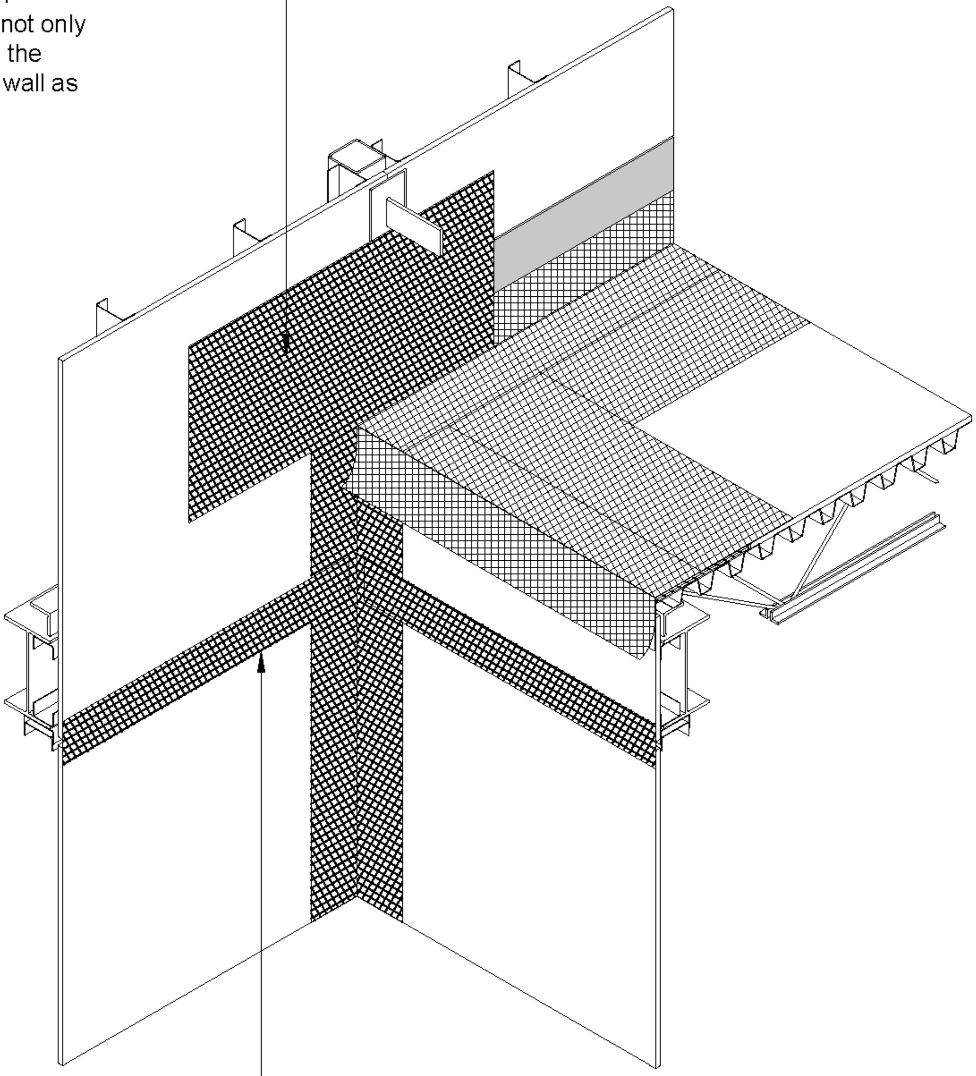
For structural steel penetrations of the air barrier, a metal plate at the plane of the sheathing is used to maintain the continuity of the air seal. The metal plate should extend a minimum of 50mm on all sides of the gusset to allow for a proper tie-in of the air barrier membrane.

Exterior gypsum sheathing layer added.

Movement joints in the exterior sheathing.

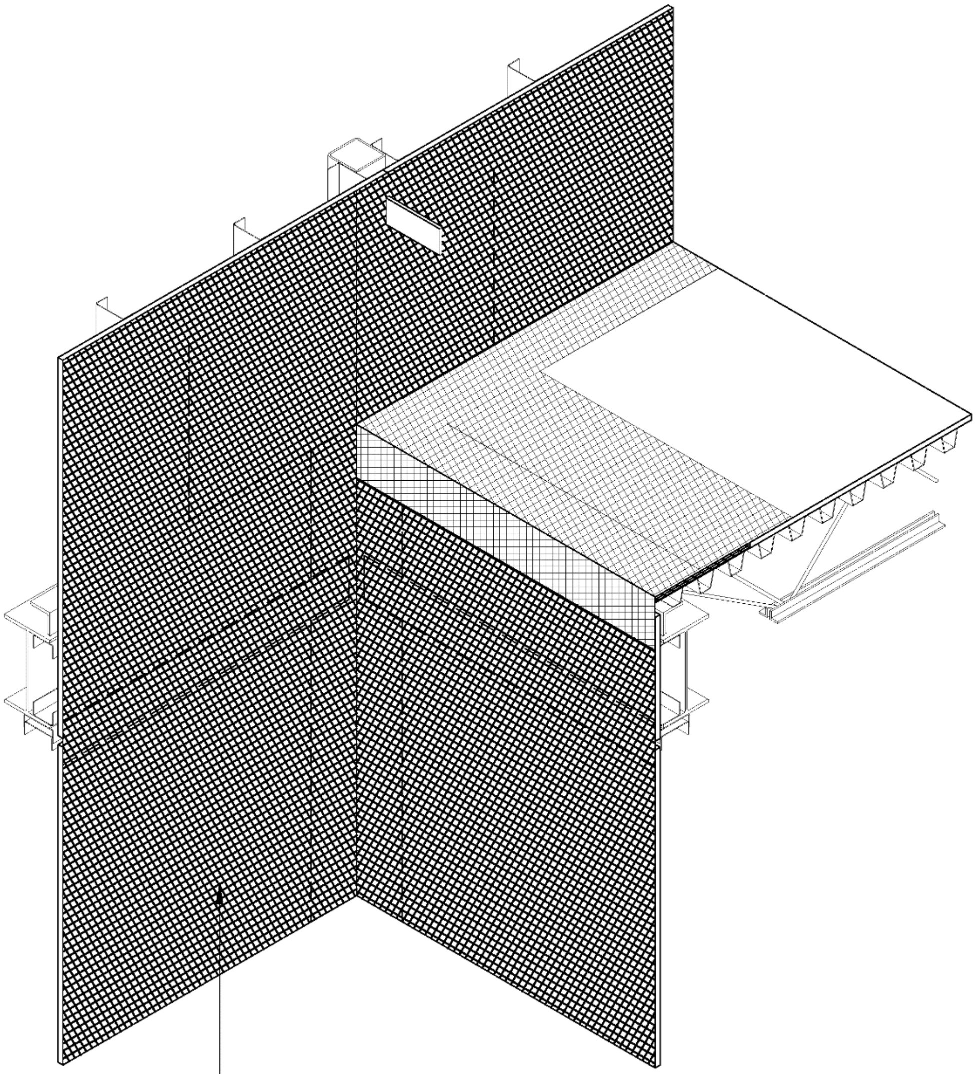
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS			TECHNICAL SERVICES BRANCH	DETAIL NUMBER 6
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	

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.



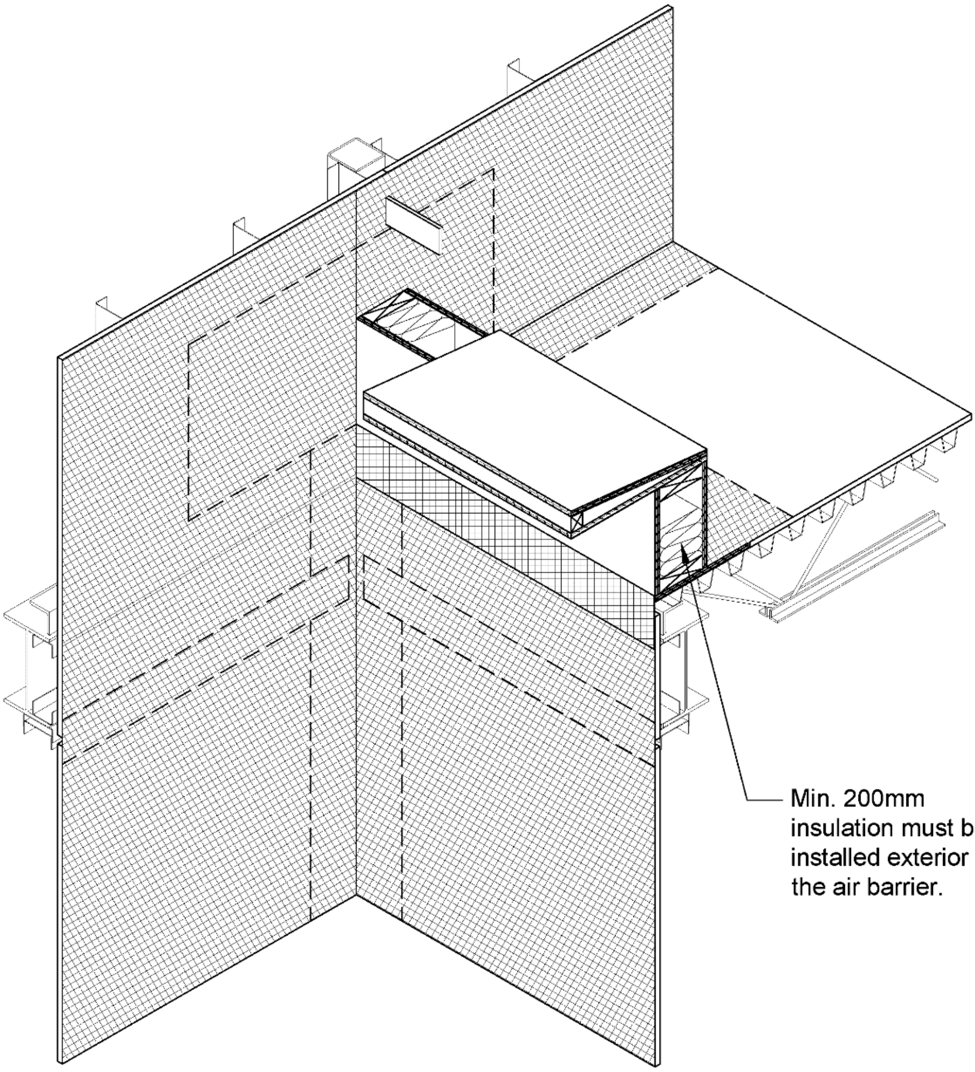
Strip of reinforcing membrane installed over movement joints. Depending on the amount of expected deflection, a slip sheet or sheet metal backing are alternative options, or consider a higher performing material such as silicone transition strips that have better expansion characteristics.

Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS			TECHNICAL SERVICES BRANCH	DETAIL NUMBER 7
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	

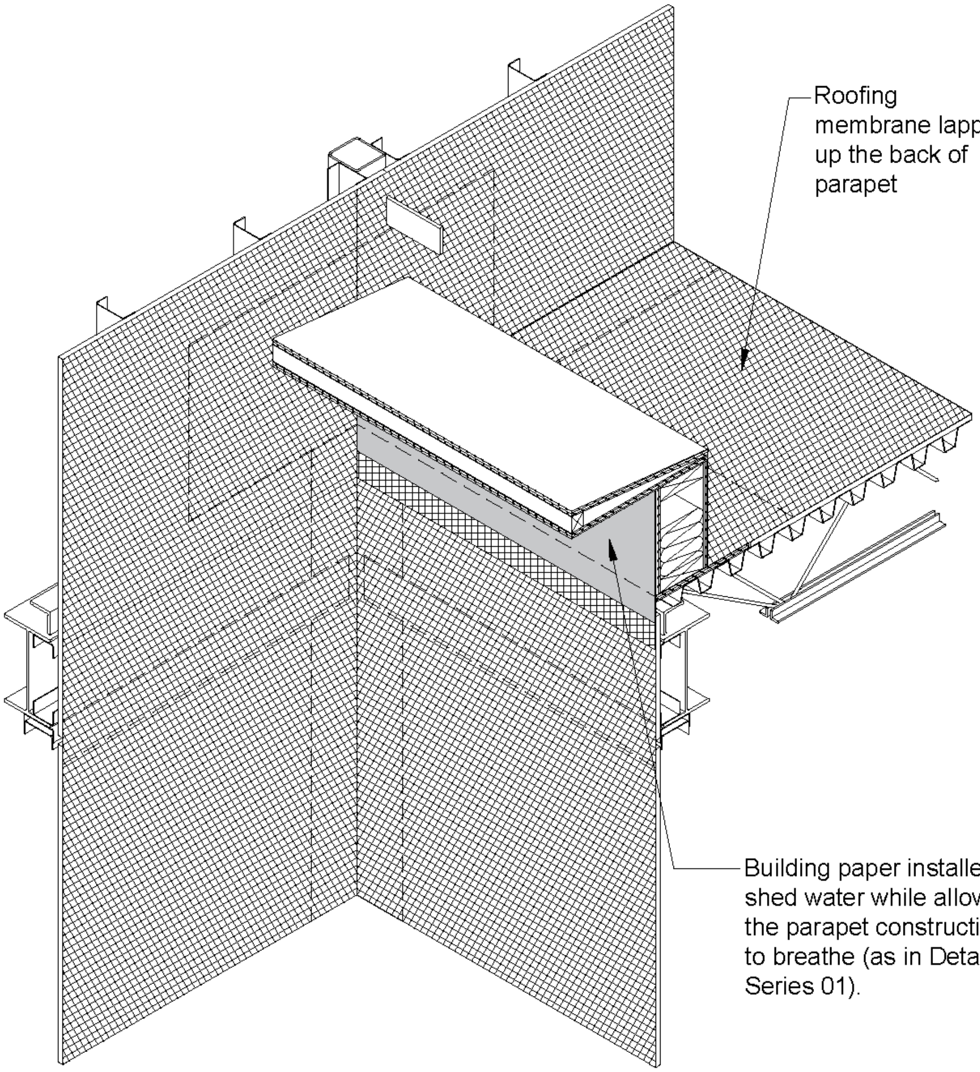


Wall air barrier membrane.

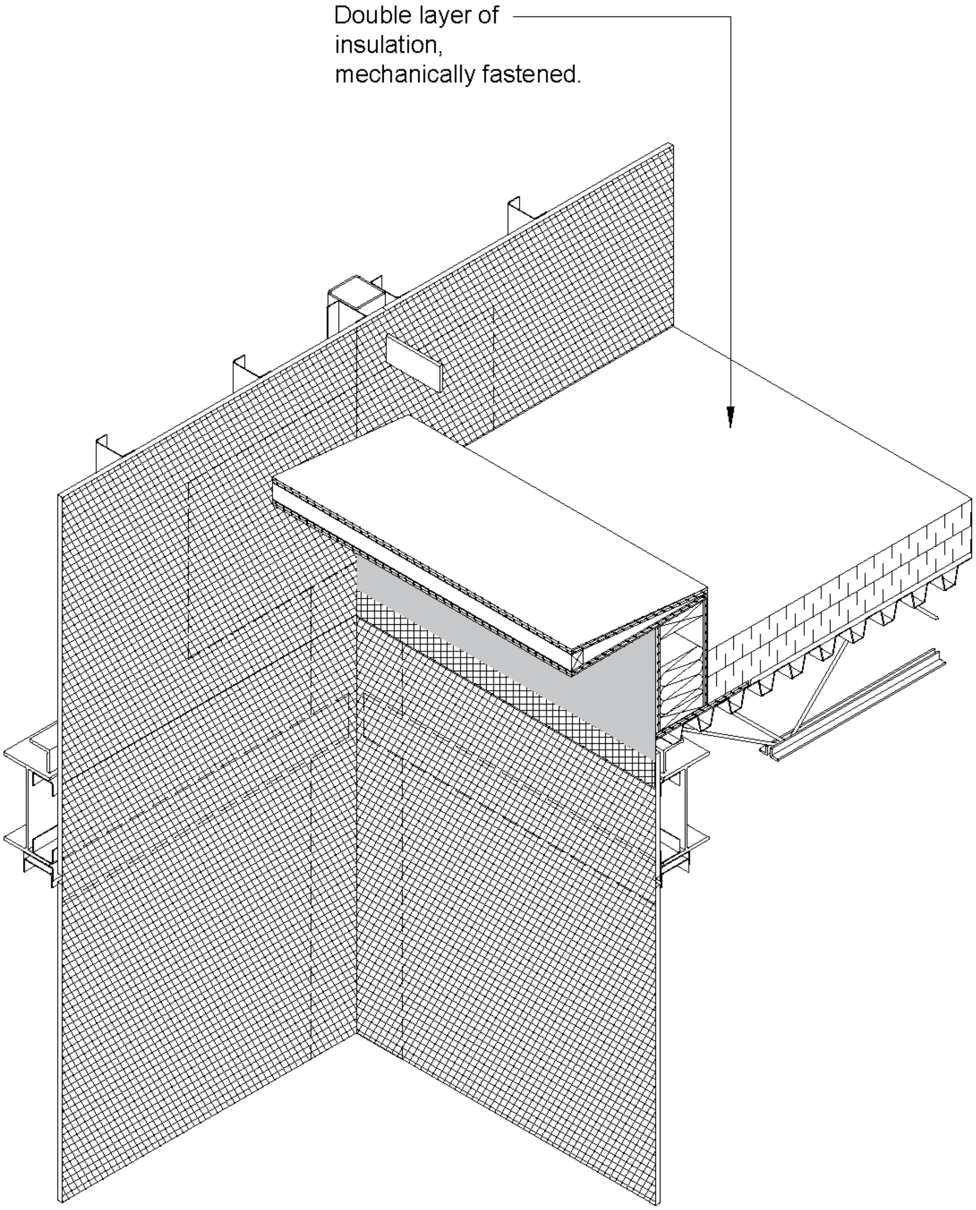
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS			TECHNICAL SERVICES BRANCH	DETAIL NUMBER 8
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



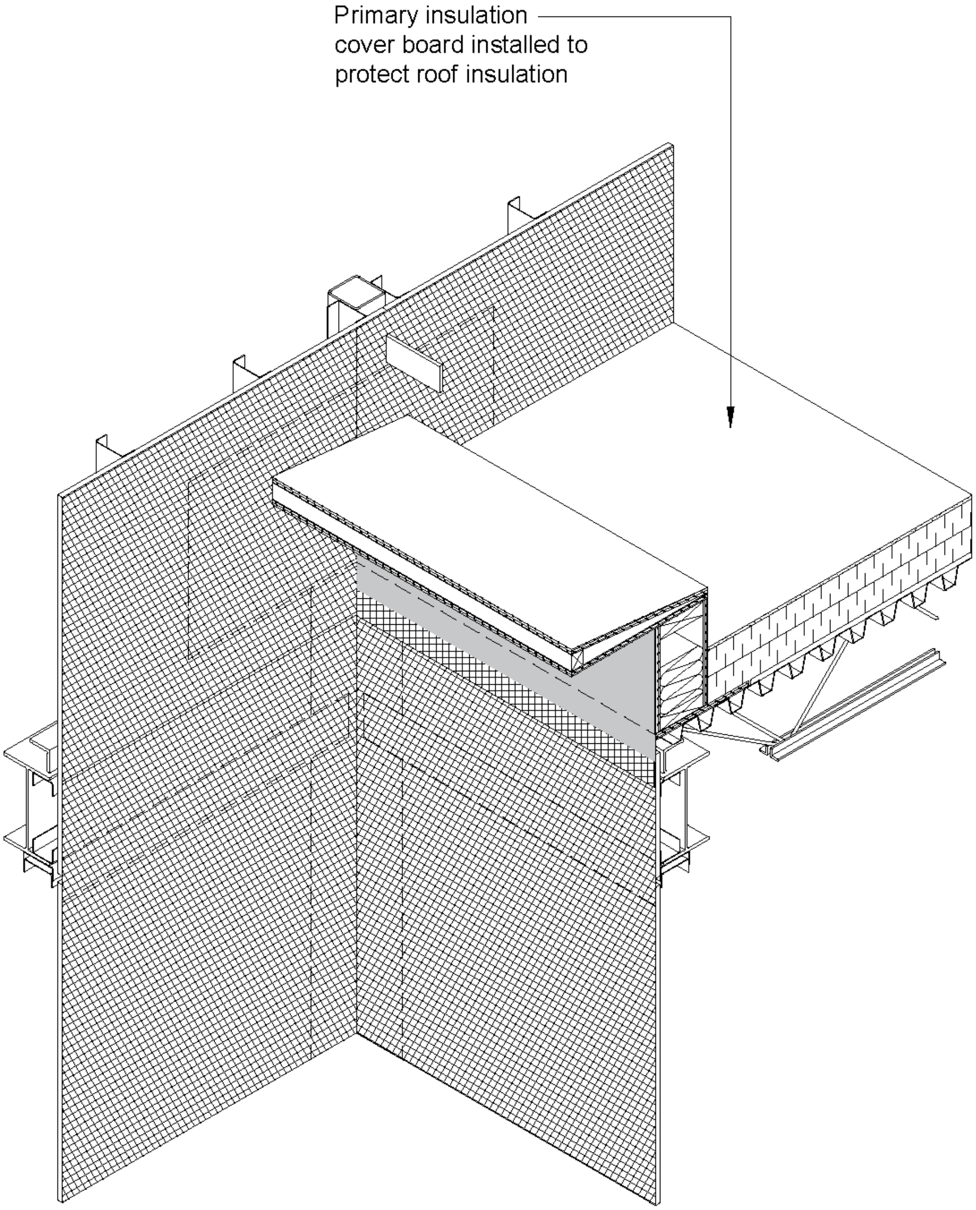
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 9
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



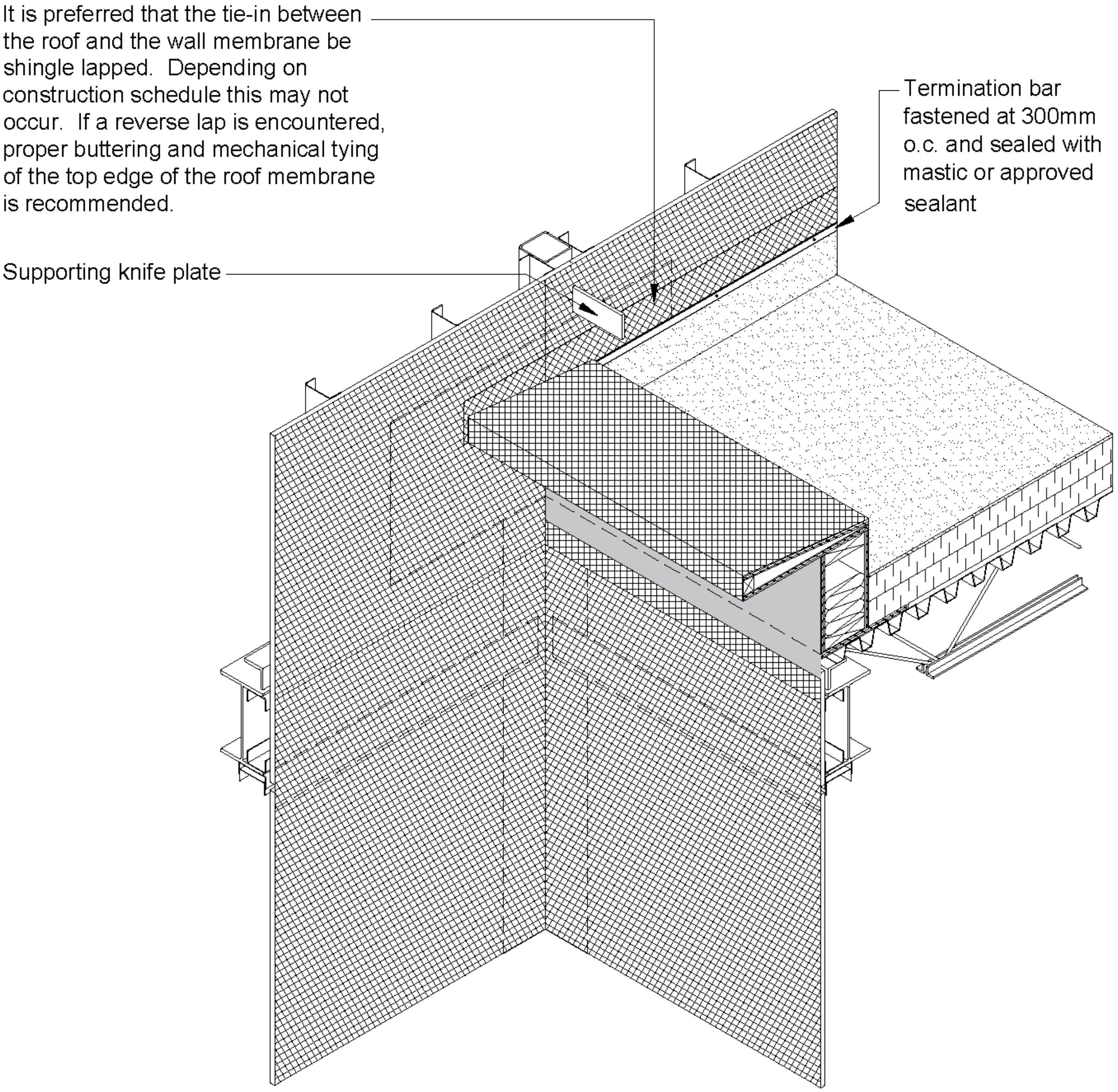
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 10
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



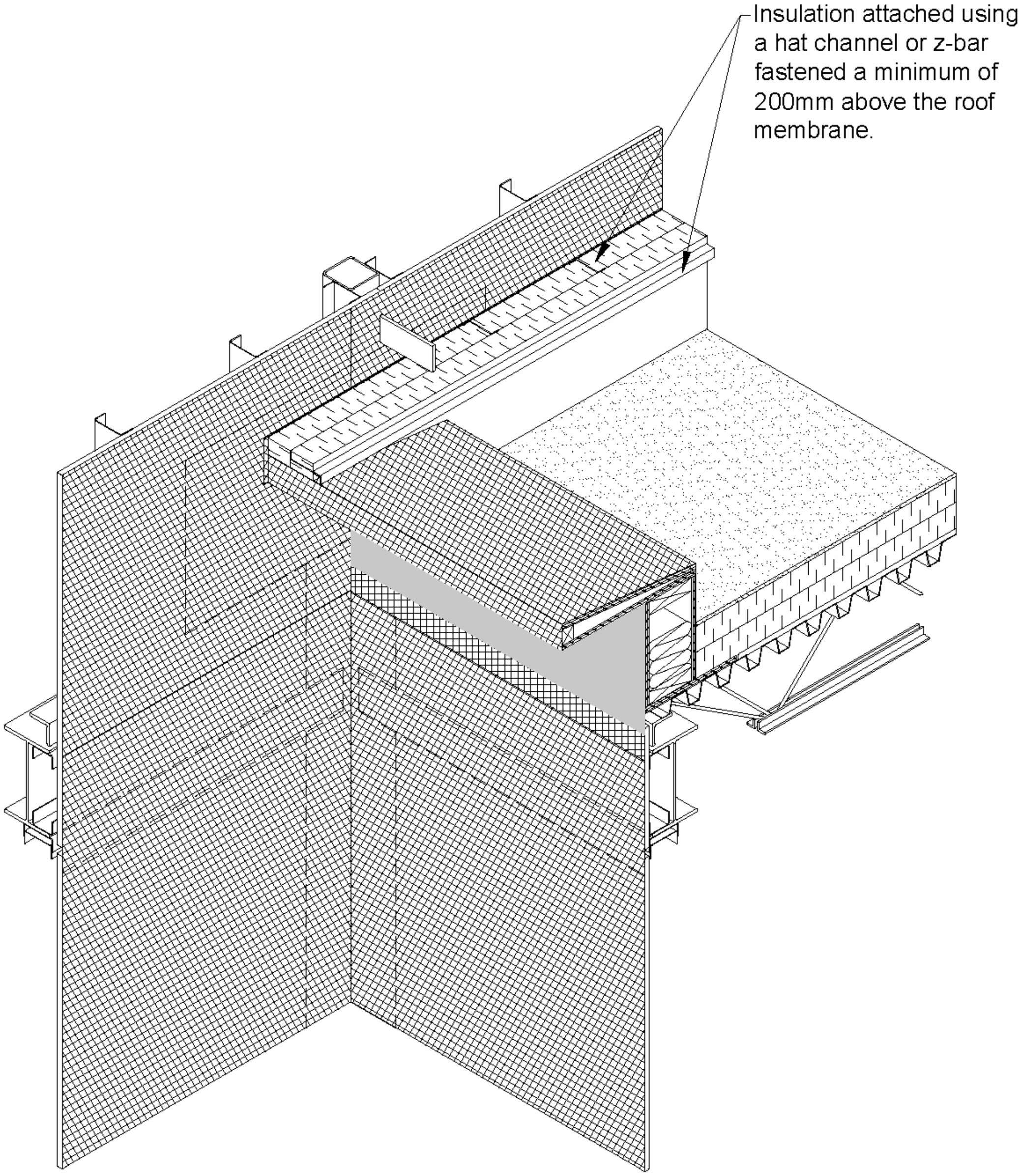
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	11



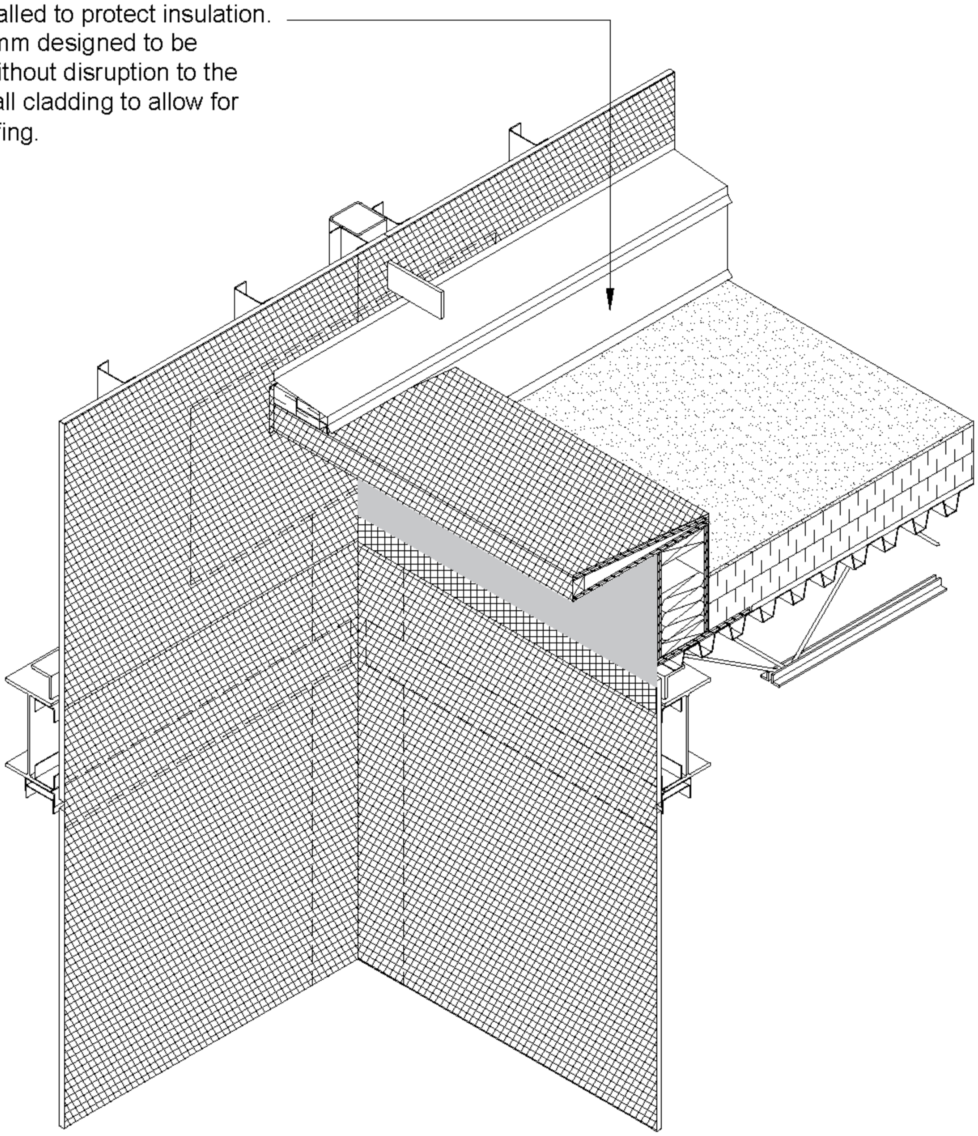
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 12
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



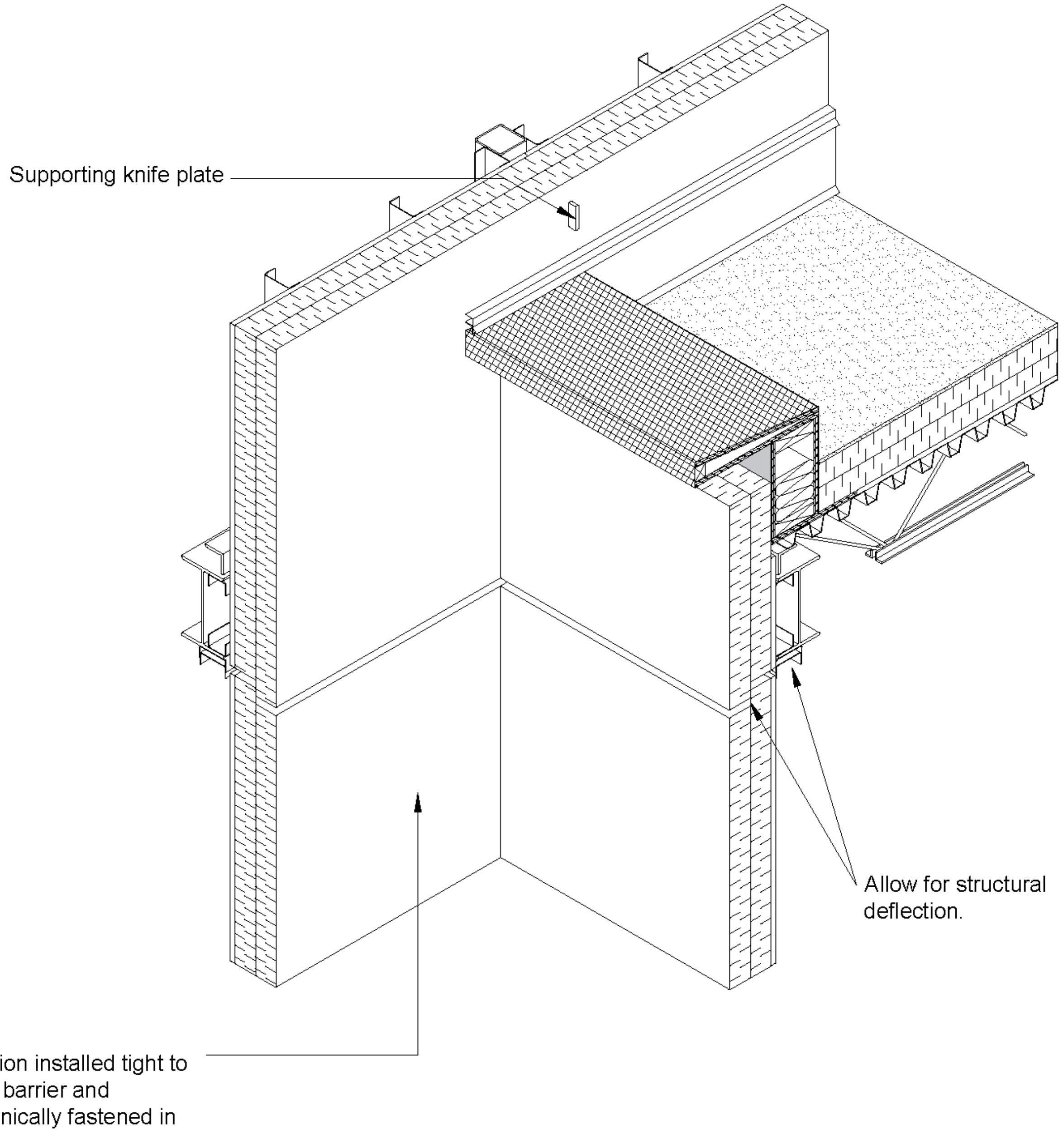
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 13
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



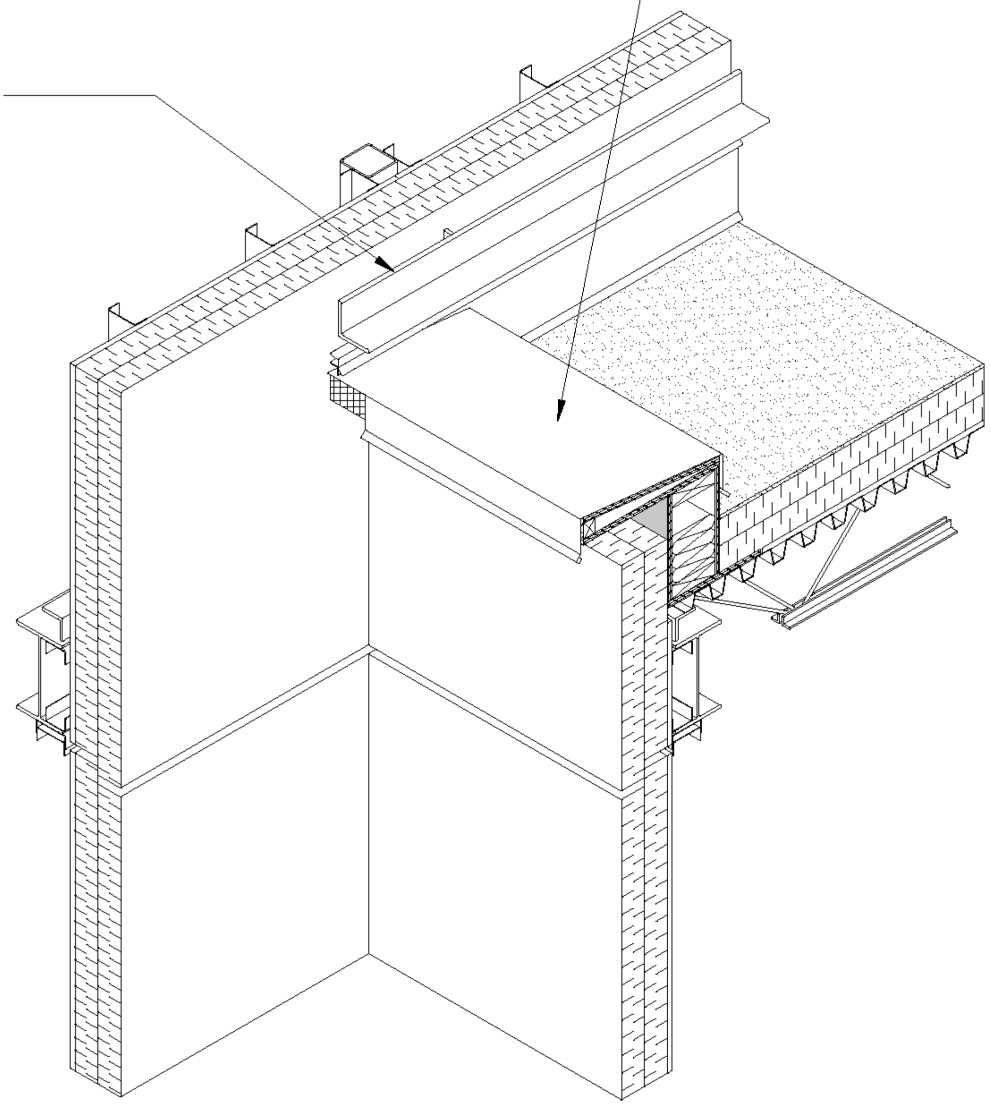
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 14
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



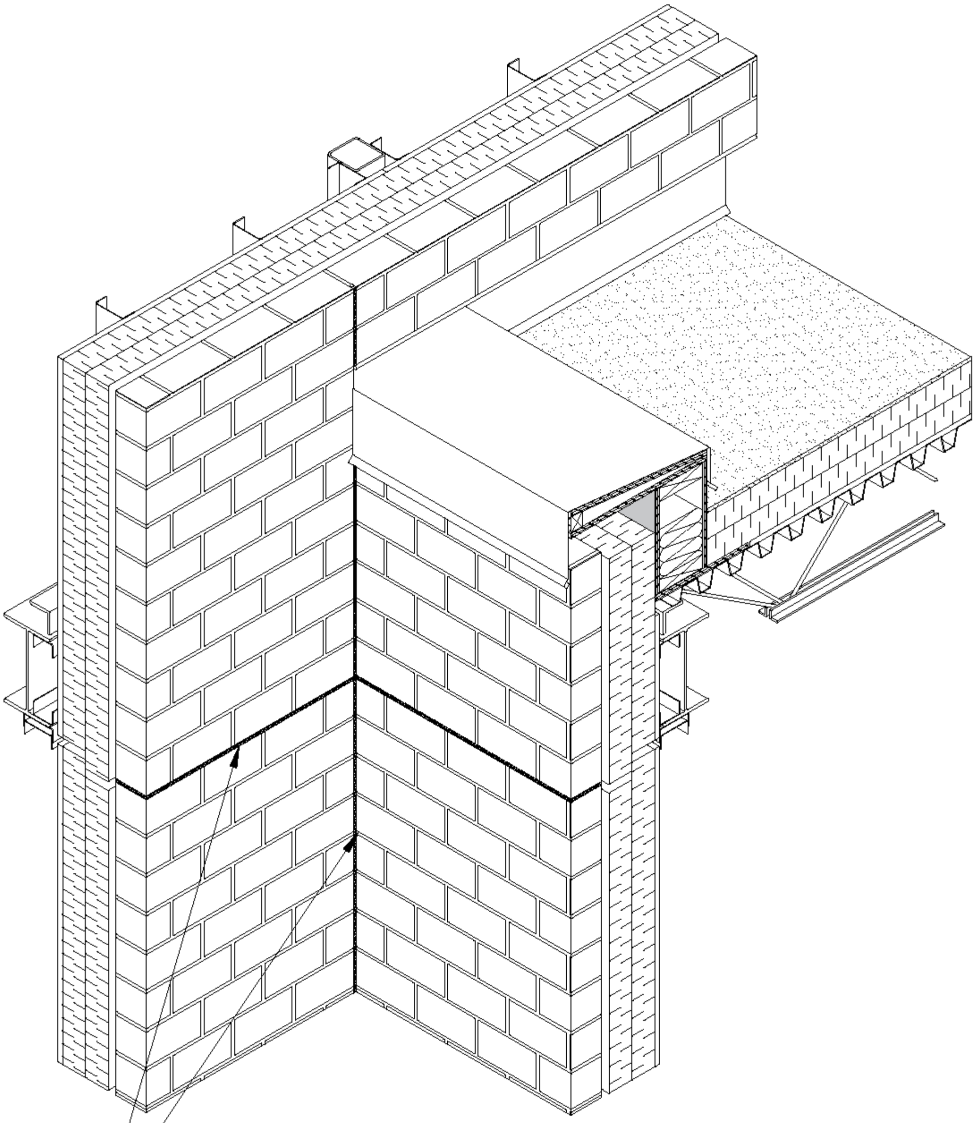
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 15
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS			TECHNICAL SERVICES BRANCH	DETAIL NUMBER 16
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	

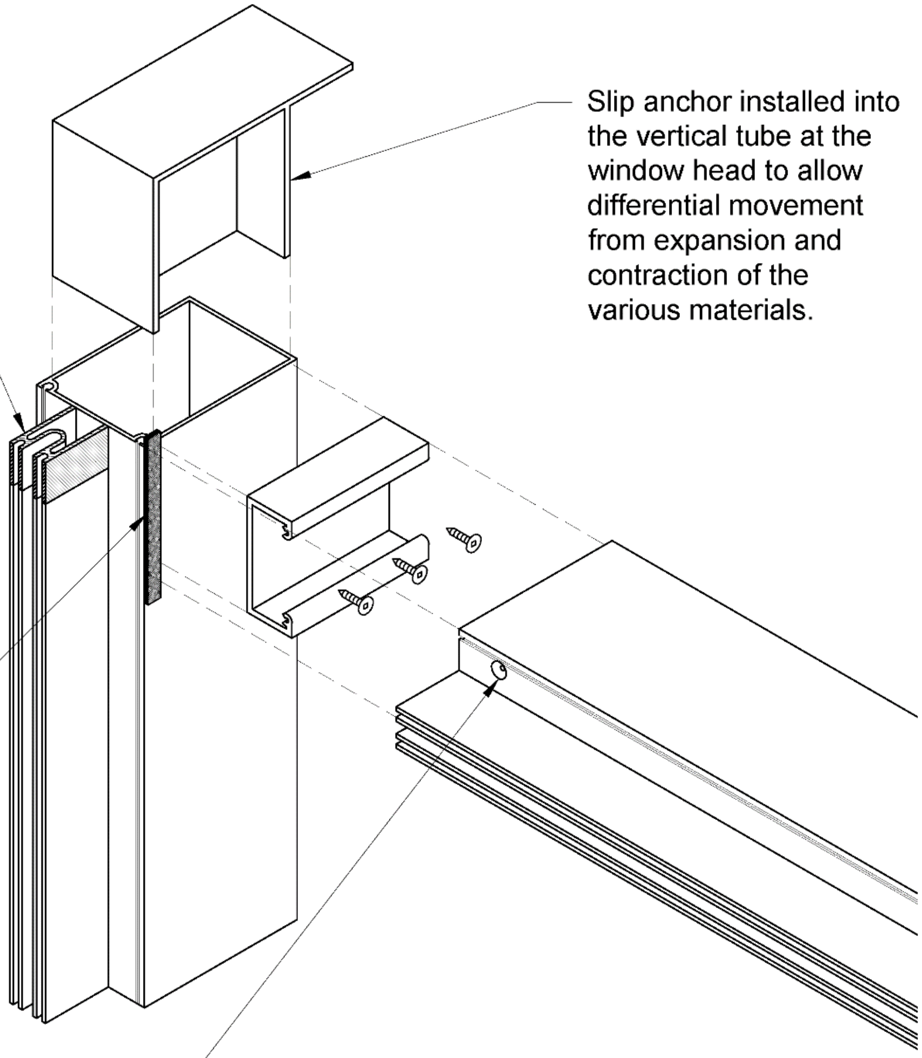


Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 17
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



Masonry control joints.

Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 18
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



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.)

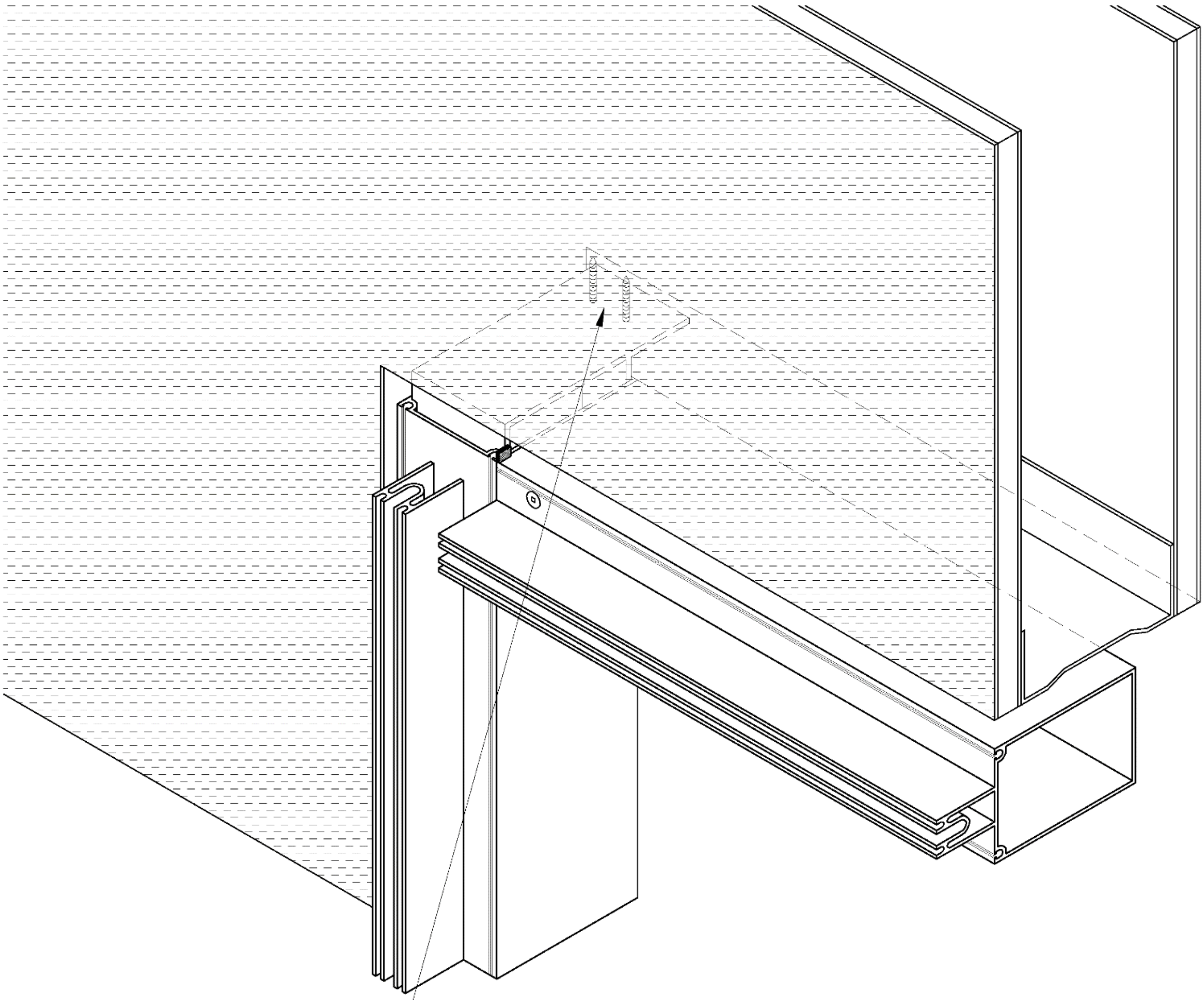
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

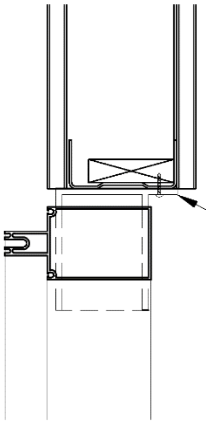
TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

DETAIL NUMBER
1



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.

Alberta Infrastructure

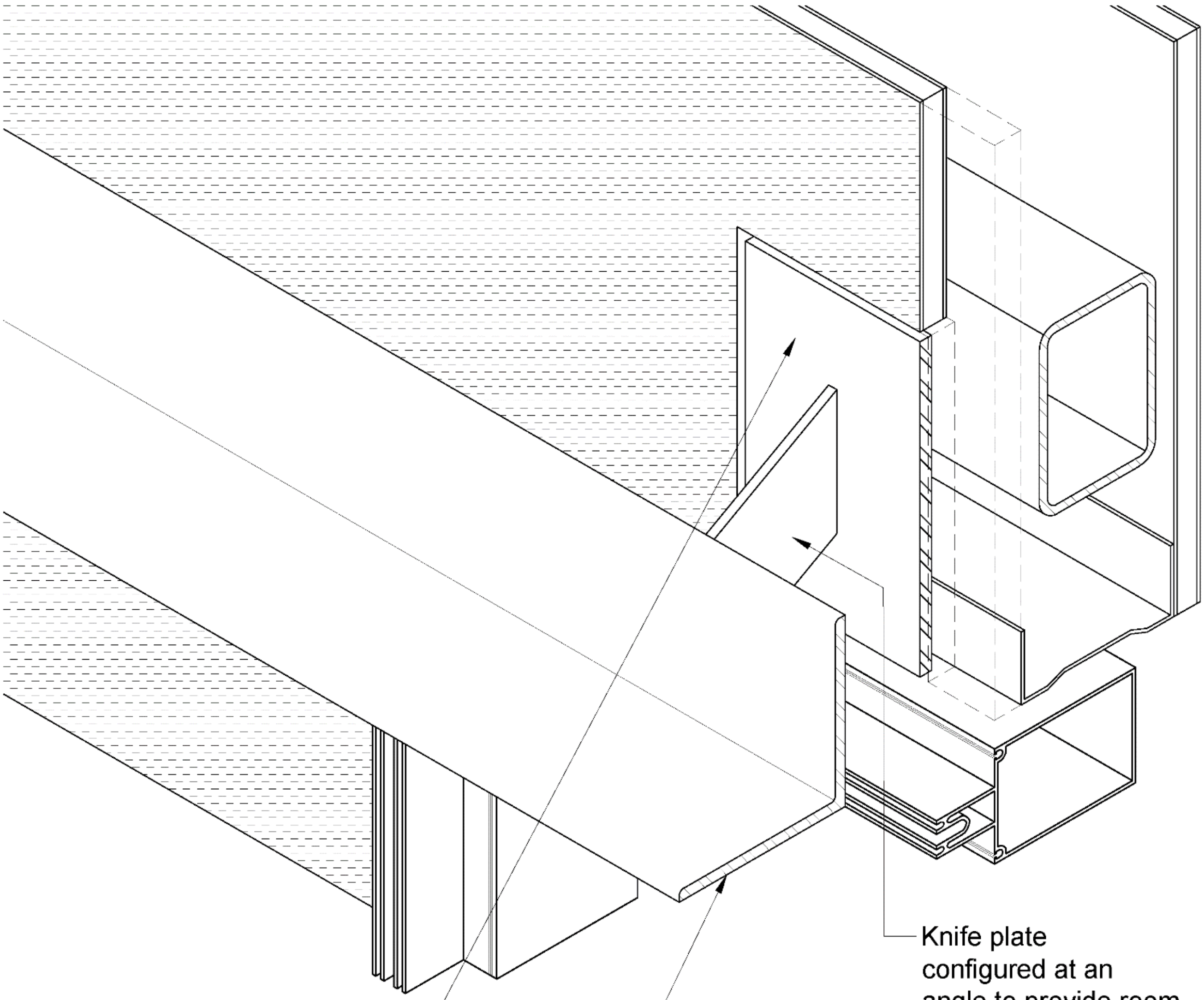
SERIES 03
INSTALLATION SEQUENCE

ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
2

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



Knife plate configured at an angle to provide room for the air barrier membrane tie-in to the window frame.

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.

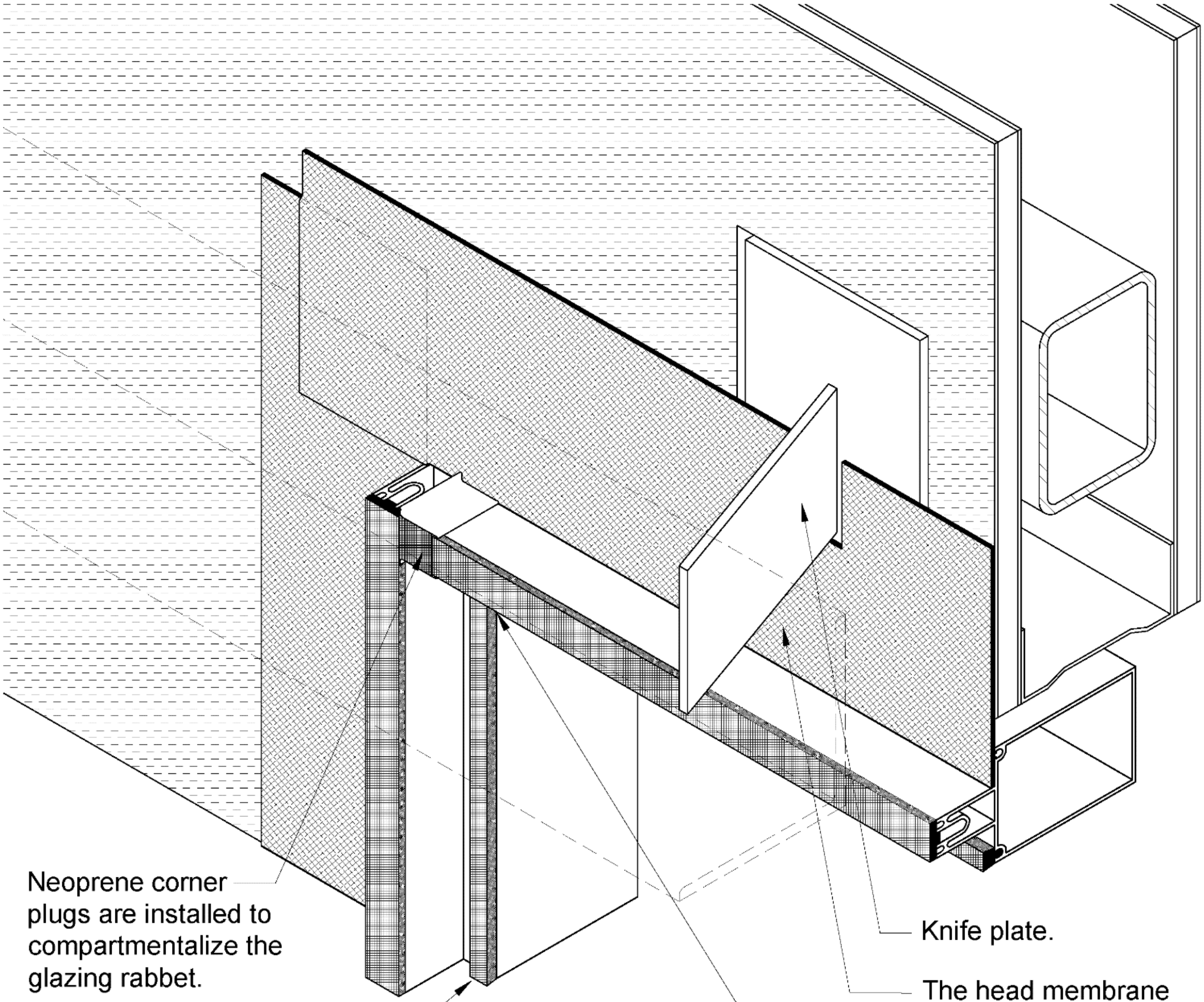
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
3

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



Neoprene corner plugs are installed to compartmentalize the glazing rabbet.

The installed length of the gaskets must be greater than the opening to accomodate 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.

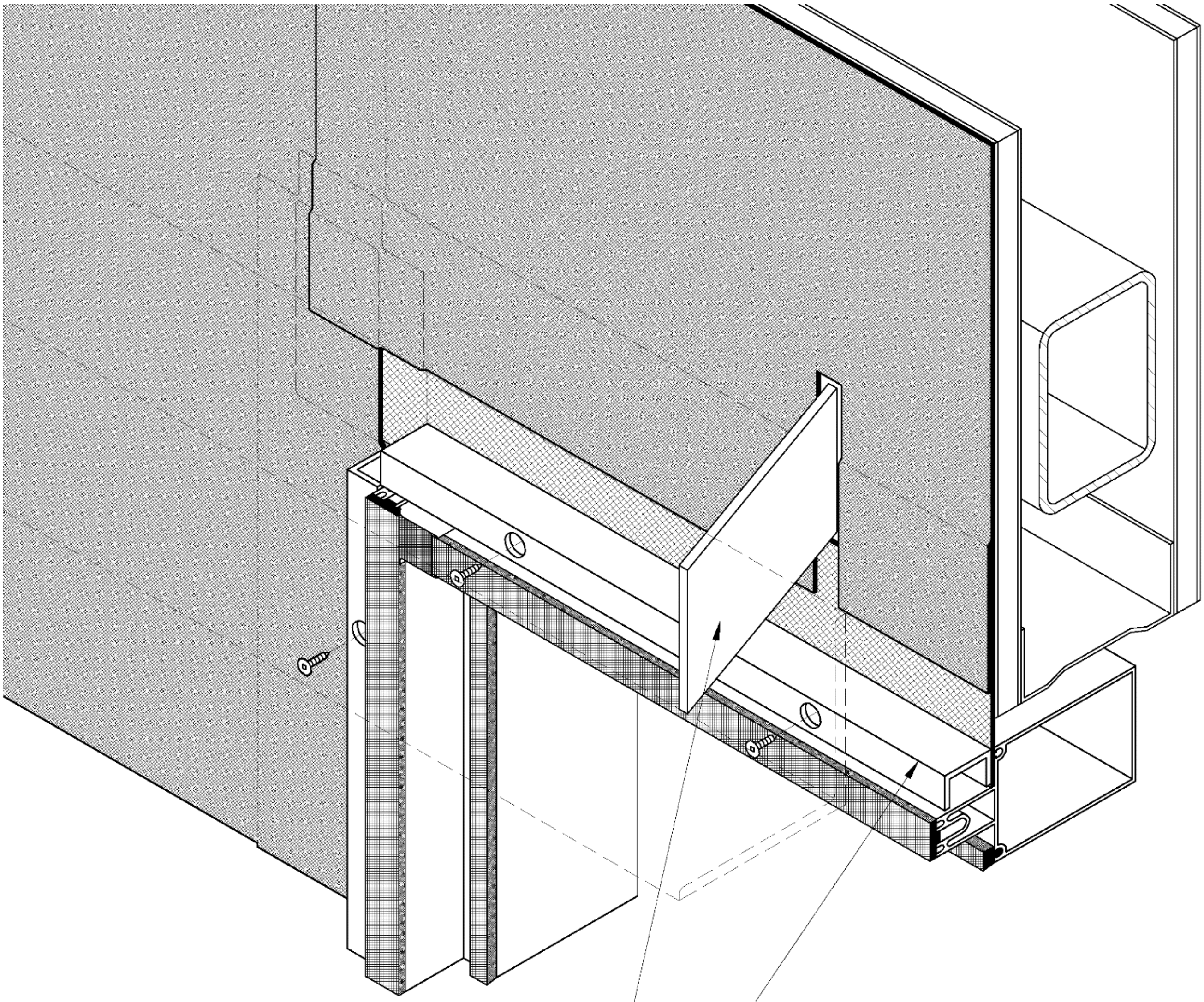
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

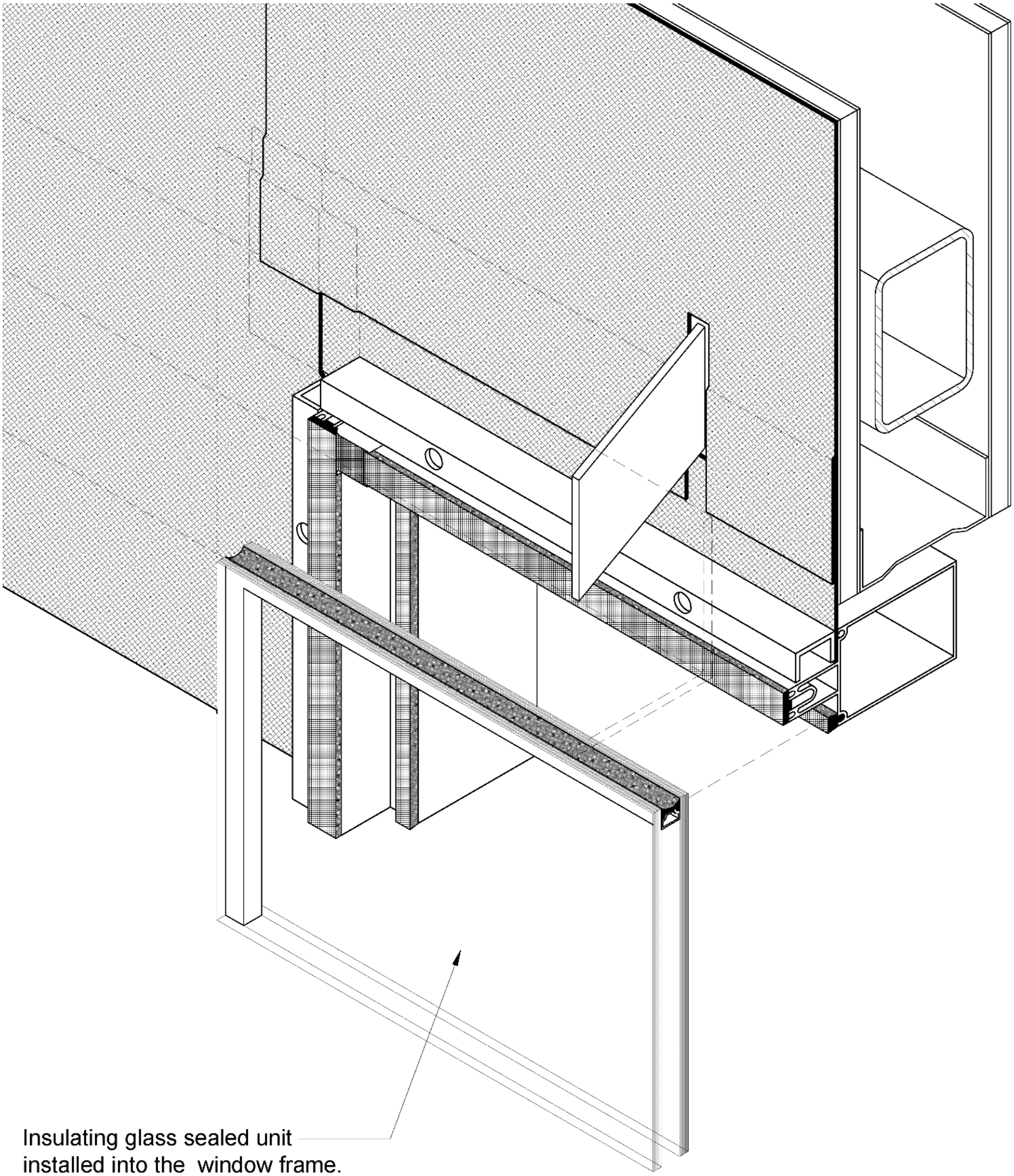
DETAIL NUMBER
4



Knife plate.

Aluminum anti-rotation channels installed to mechnically fasten the membrane tie-in to the tube face of the box section.

Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 5
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14



Insulating glass sealed unit installed into the window frame.

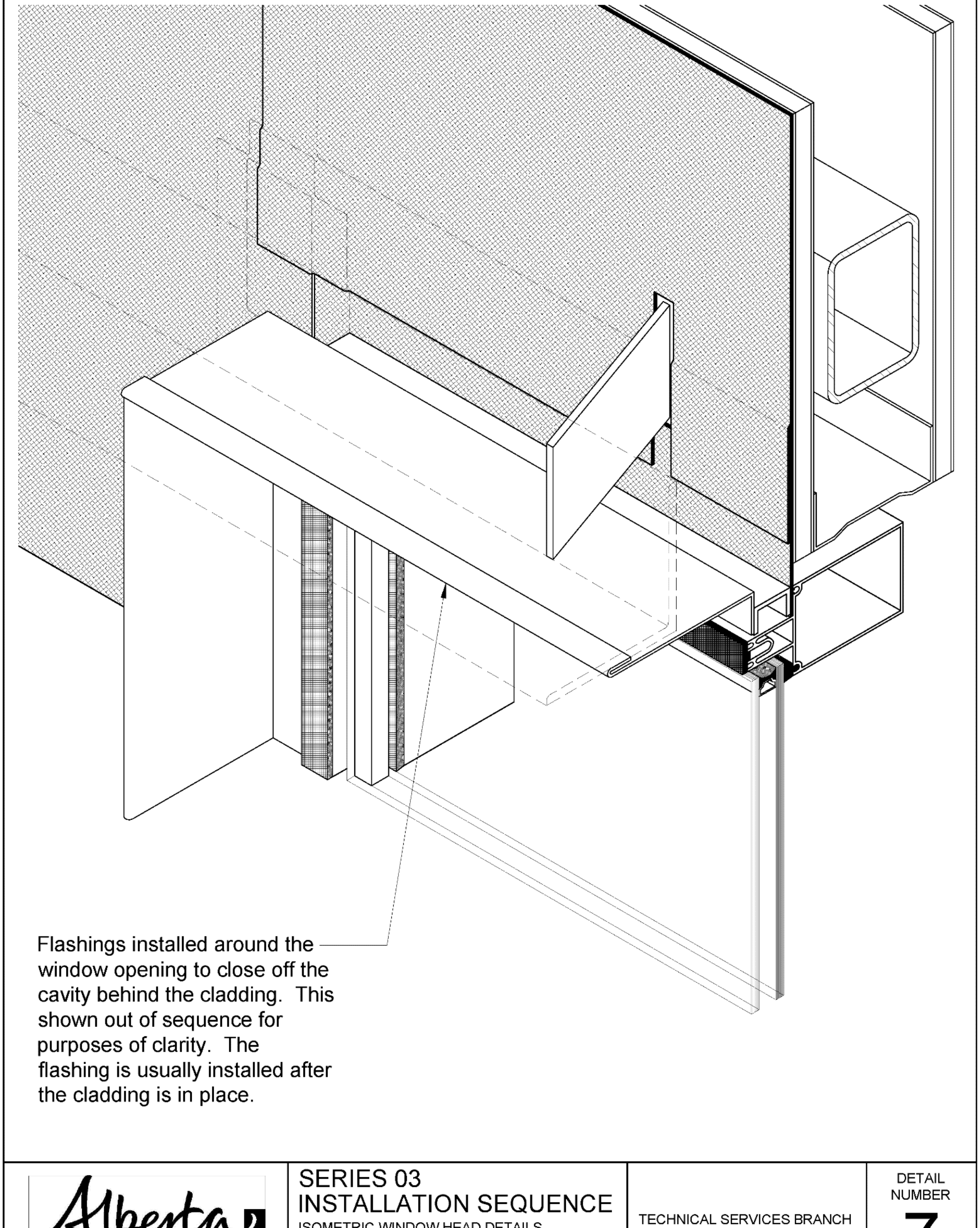
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

DETAIL NUMBER
6



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.

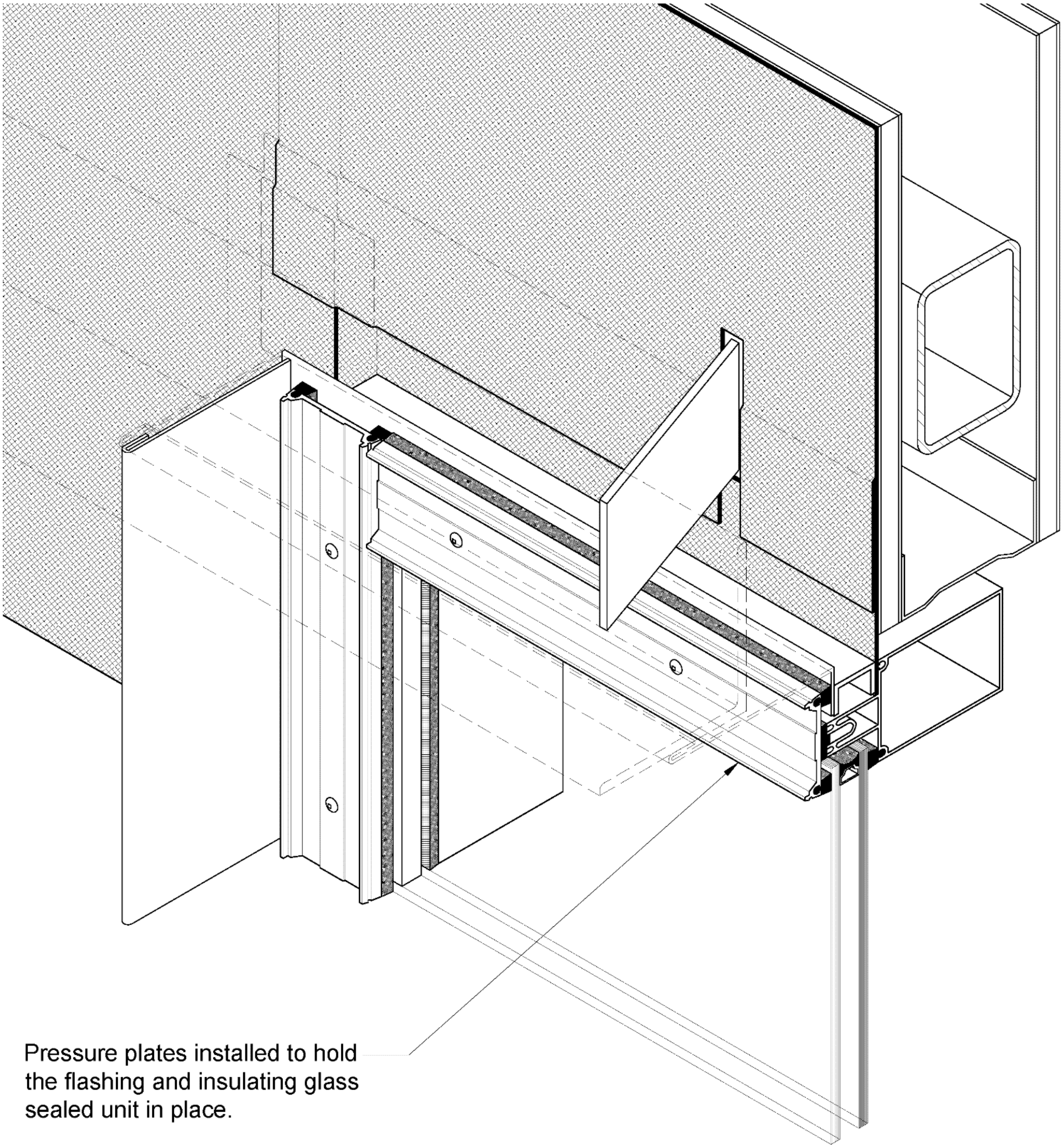
Alberta Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

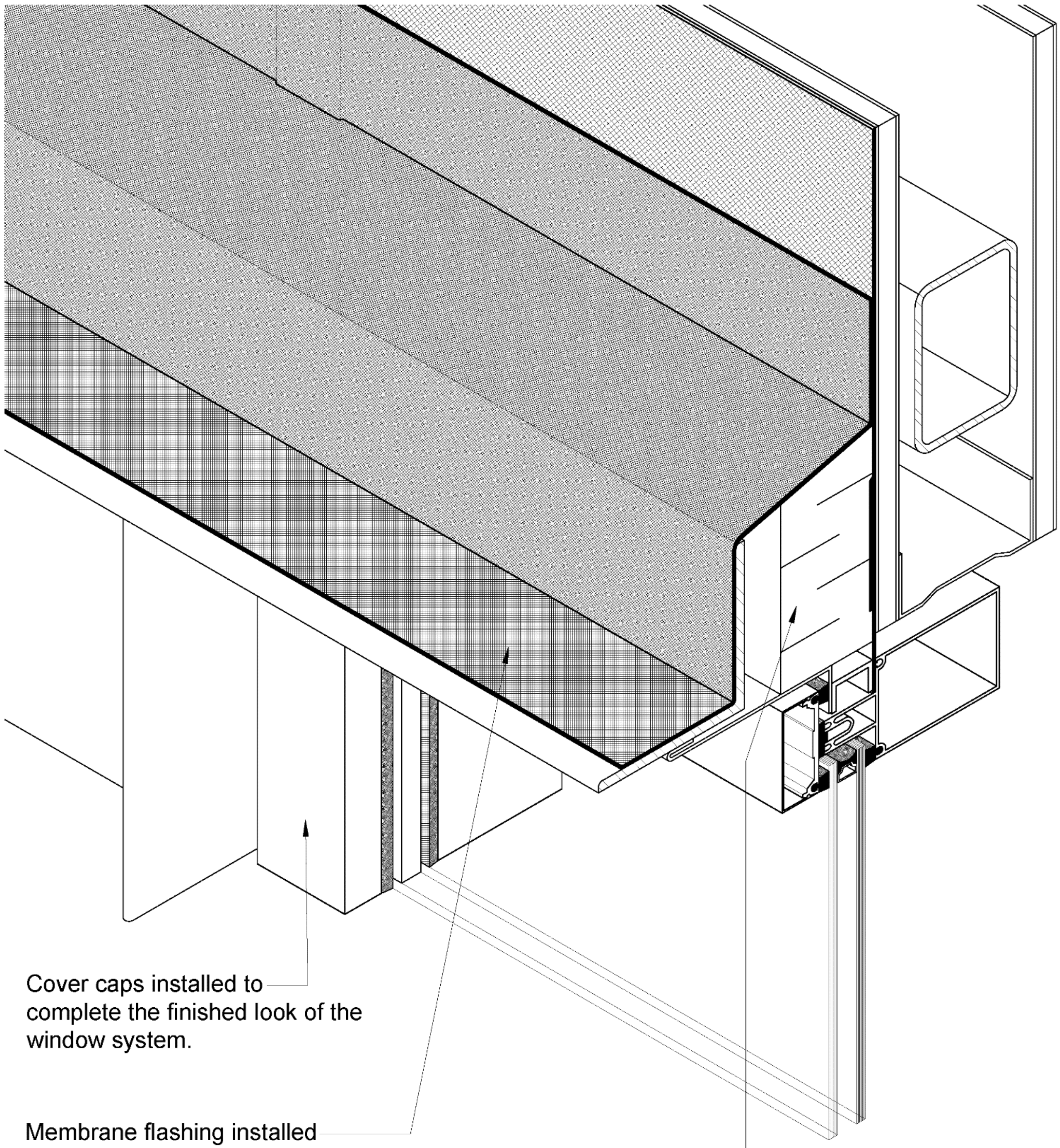
DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

DETAIL NUMBER
7



Pressure plates installed to hold the flashing and insulating glass sealed unit in place.

Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 8
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14



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.

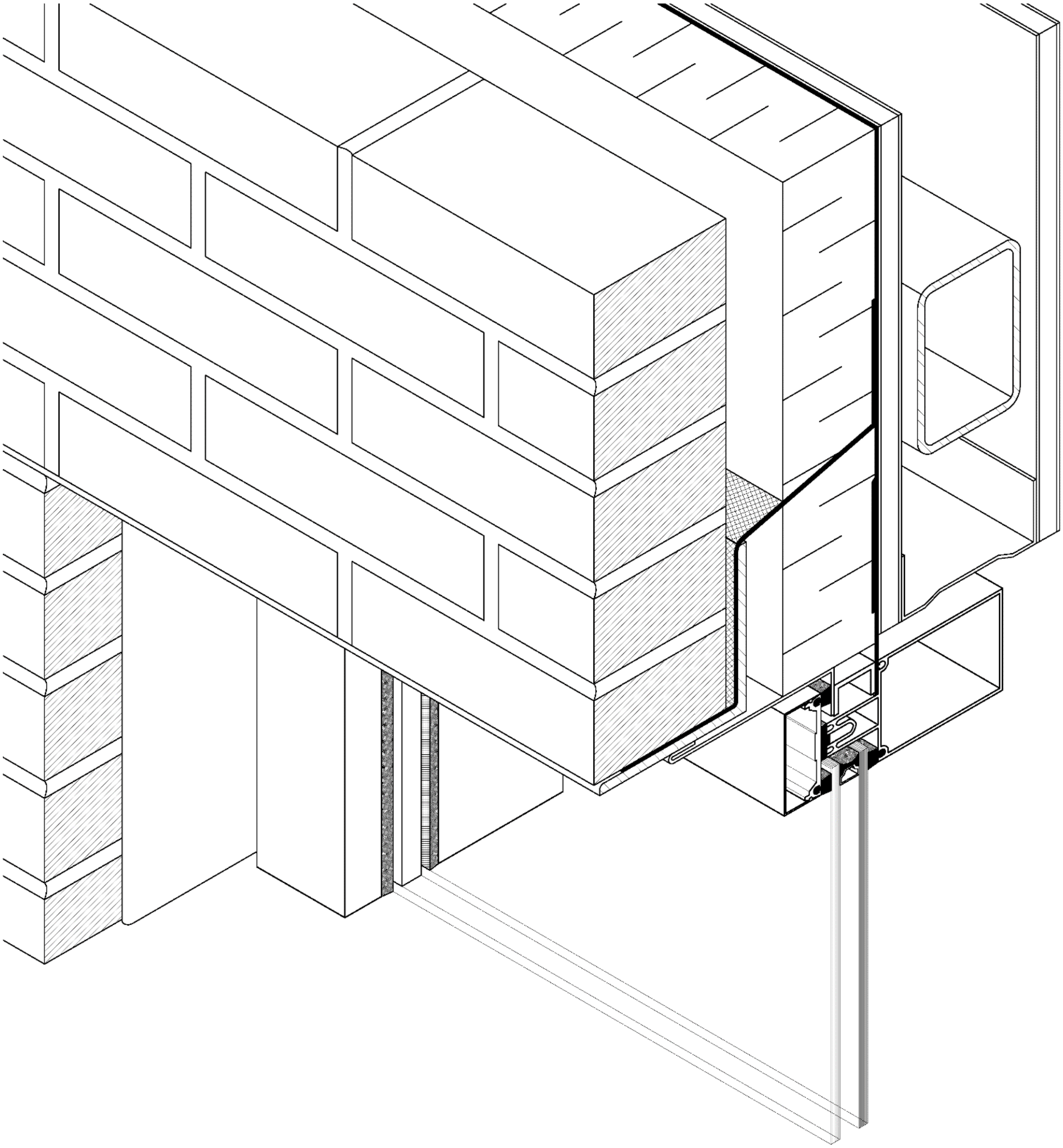
Alberta
Infrastructure

SERIES 03
INSTALLATION SEQUENCE
ISOMETRIC WINDOW HEAD DETAILS

TECHNICAL SERVICES BRANCH

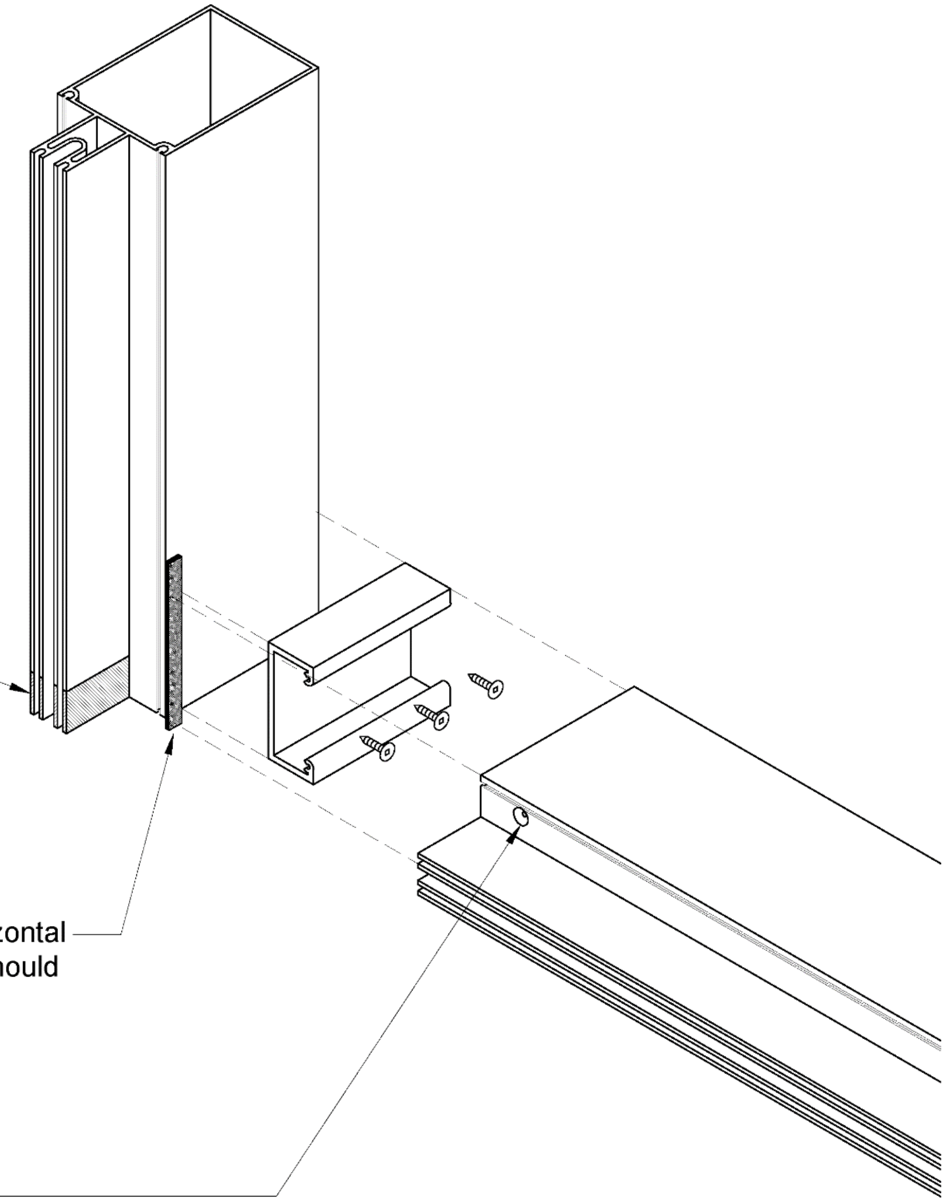
DETAIL NUMBER
9

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



Completed installation.

Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 10
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14



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.)

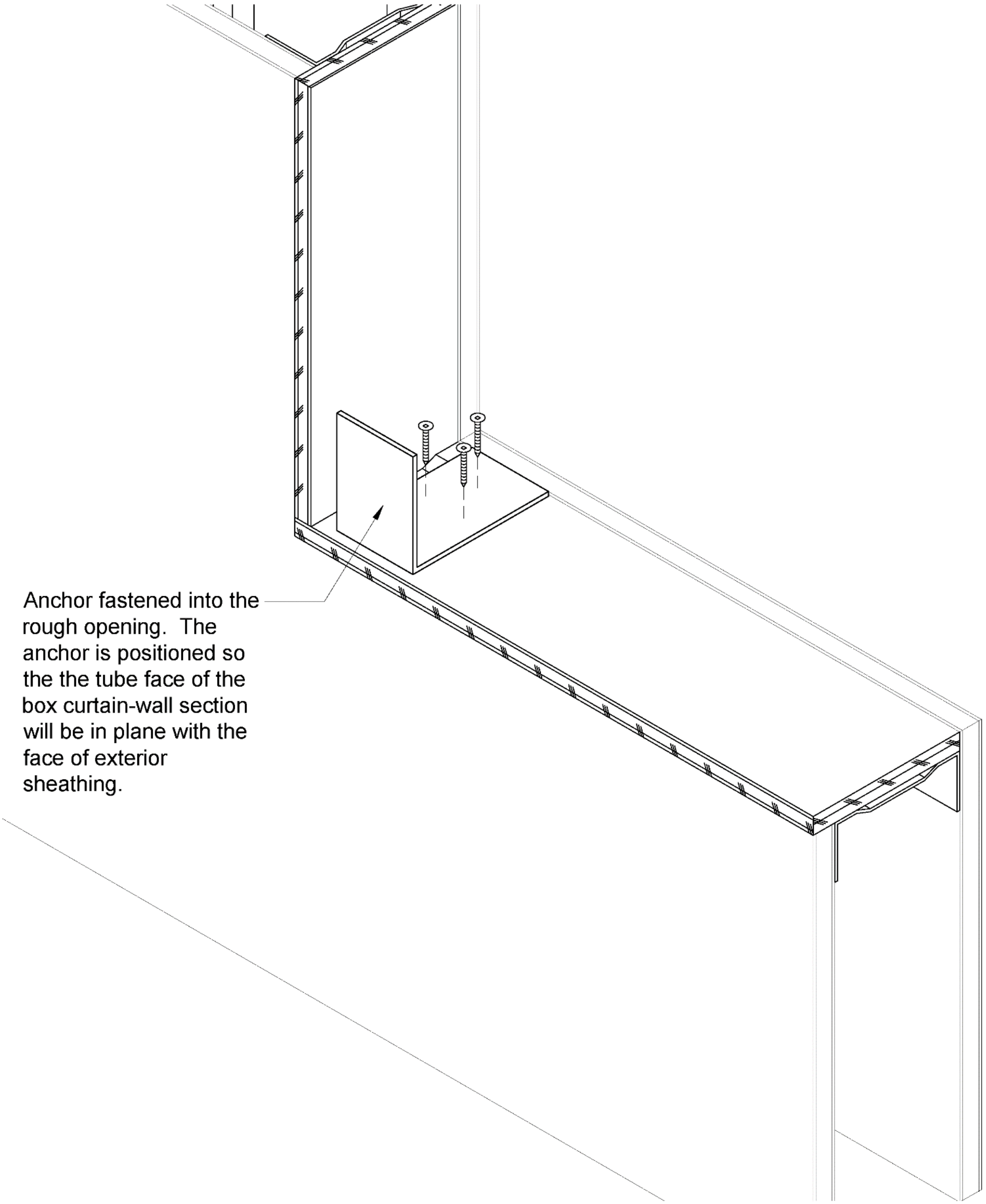
Alberta Infrastructure

SERIES 04
INSTALLATION SEQUENCE
ISOMETRIC WINDOW SILL DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
1

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



Anchor fastened into the rough opening. The anchor is positioned so the the tube face of the box curtain-wall section will be in plane with the face of exterior sheathing.

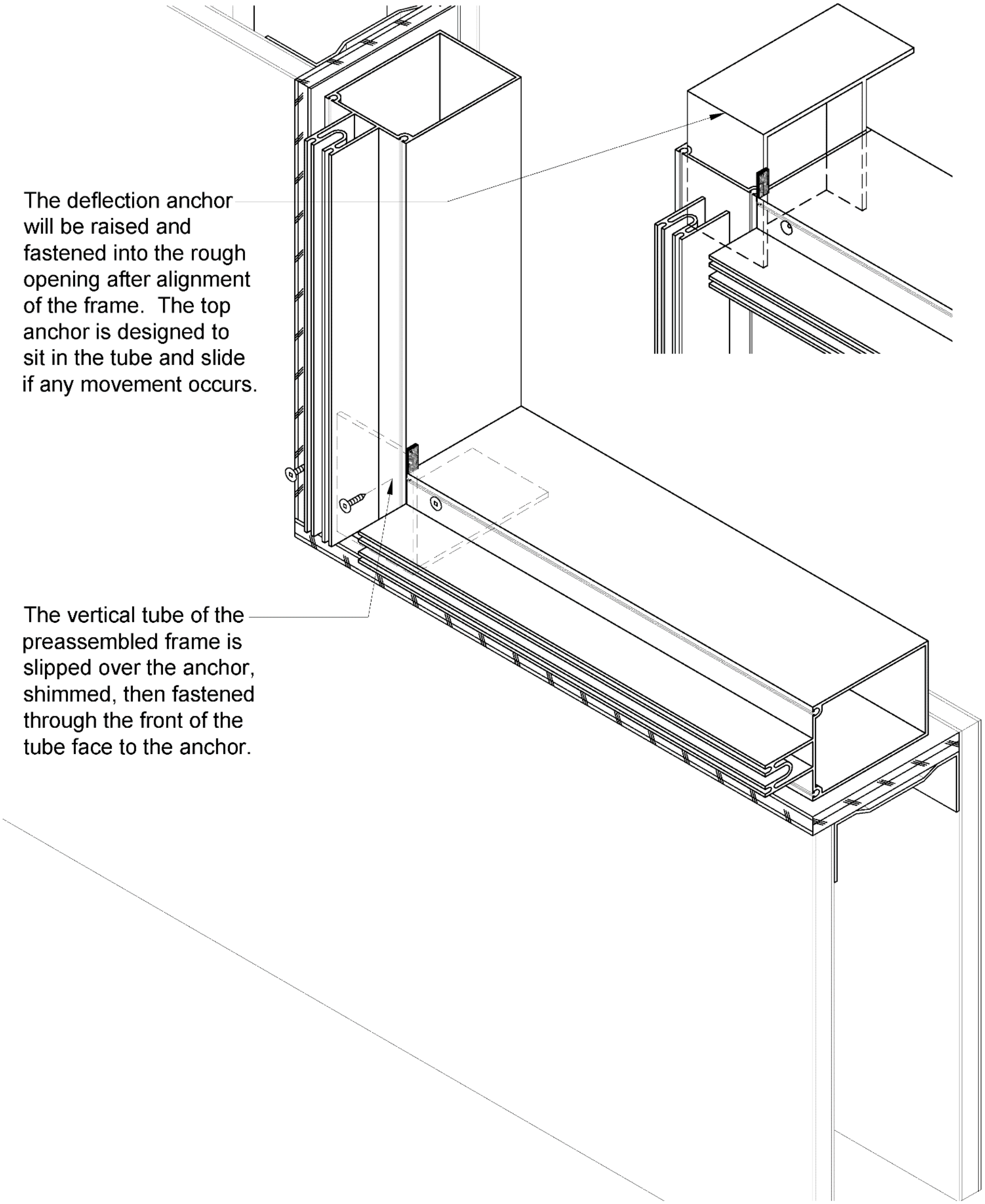
Alberta Infrastructure

SERIES 04
INSTALLATION SEQUENCE
ISOMETRIC WINDOW SILL DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
2

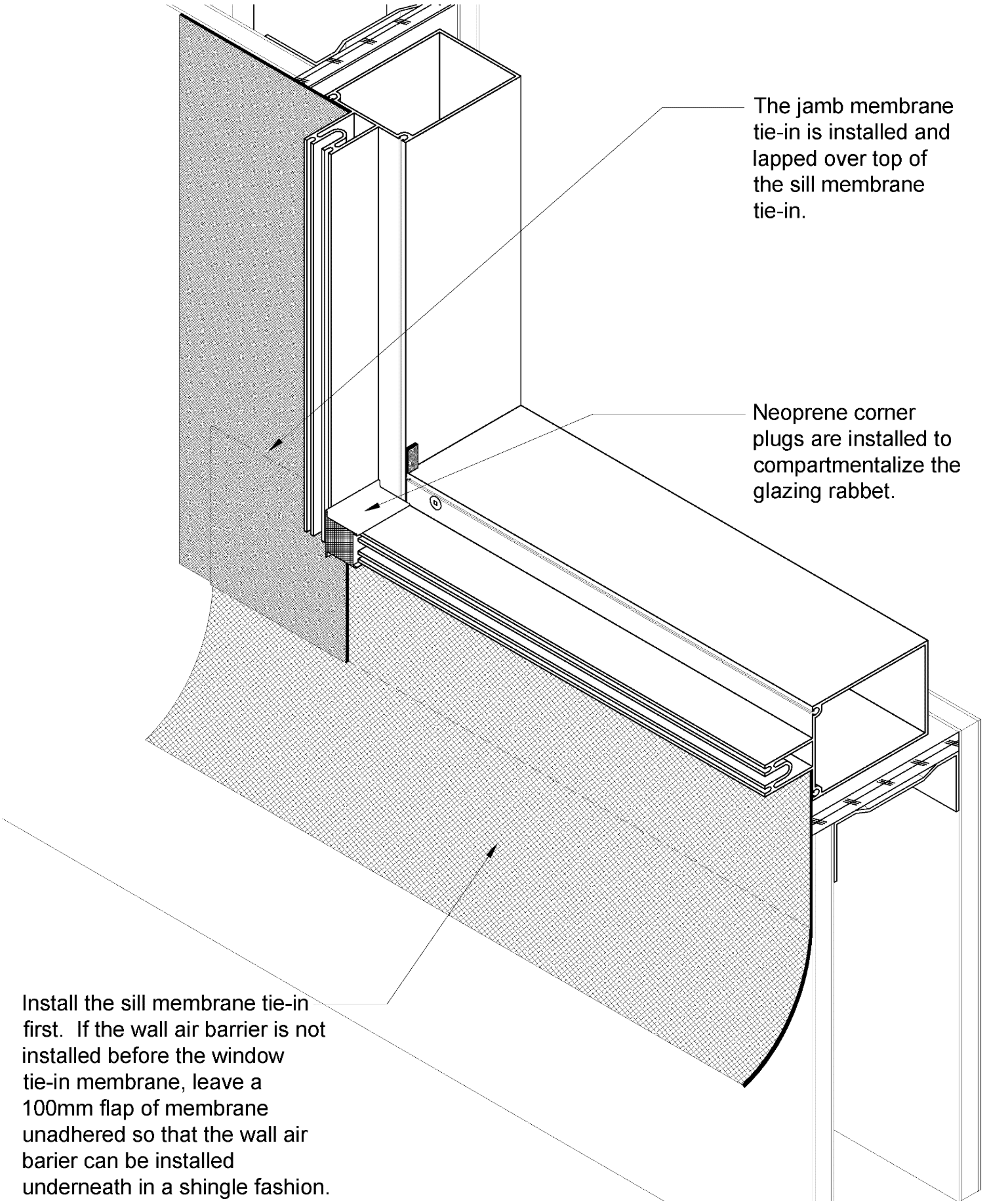
DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14



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.

Alberta Infrastructure	SERIES 04 INSTALLATION SEQUENCE ISOMETRIC WINDOW SILL DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 3
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14



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.

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 barier can be installed underneath in a shingle fashion.

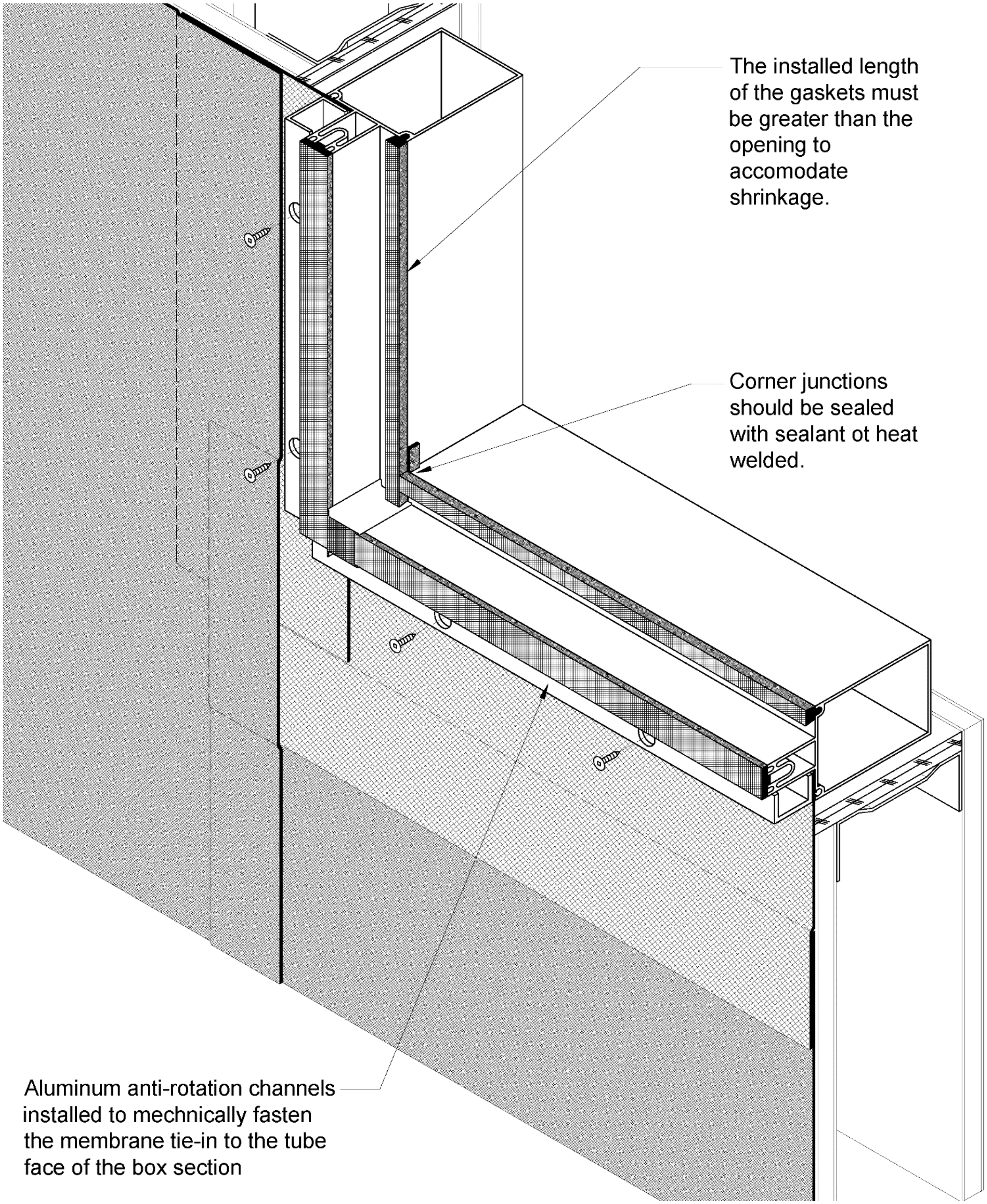
Alberta Infrastructure

SERIES 04
INSTALLATION SEQUENCE
ISOMETRIC WINDOW SILL DETAILS

TECHNICAL SERVICES BRANCH

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

DETAIL NUMBER
4



The installed length of the gaskets must be greater than the opening to accomodate shrinkage.

Corner junctions should be sealed with sealant ot heat welded.

Aluminum anti-rotation channels installed to mechnically fasten the membrane tie-in to the tube face of the box section

Alberta Infrastructure

SERIES 04
INSTALLATION SEQUENCE
ISOMETRIC WINDOW SILL DETAILS

TECHNICAL SERVICES BRANCH

DETAIL NUMBER
5

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

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.

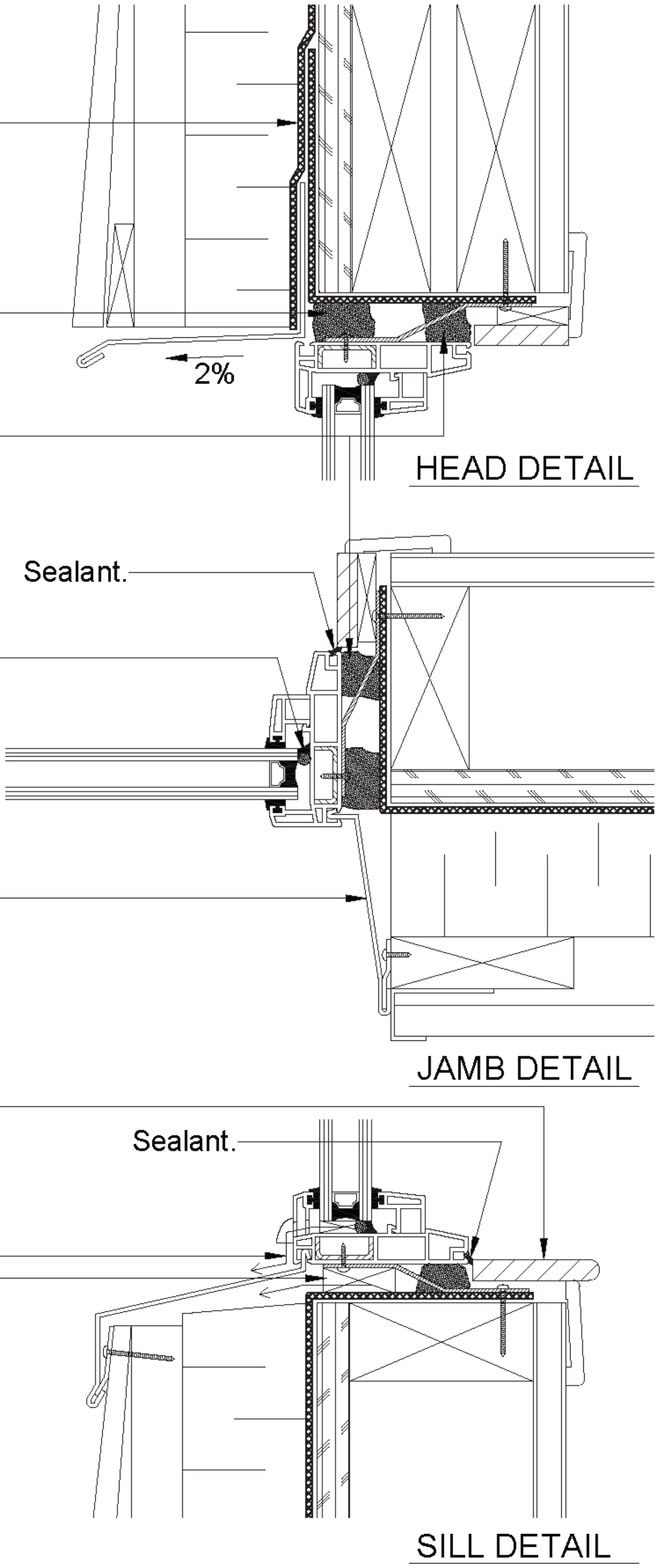
Heal bead to complete the air seal between the frame and the sealed unit

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.



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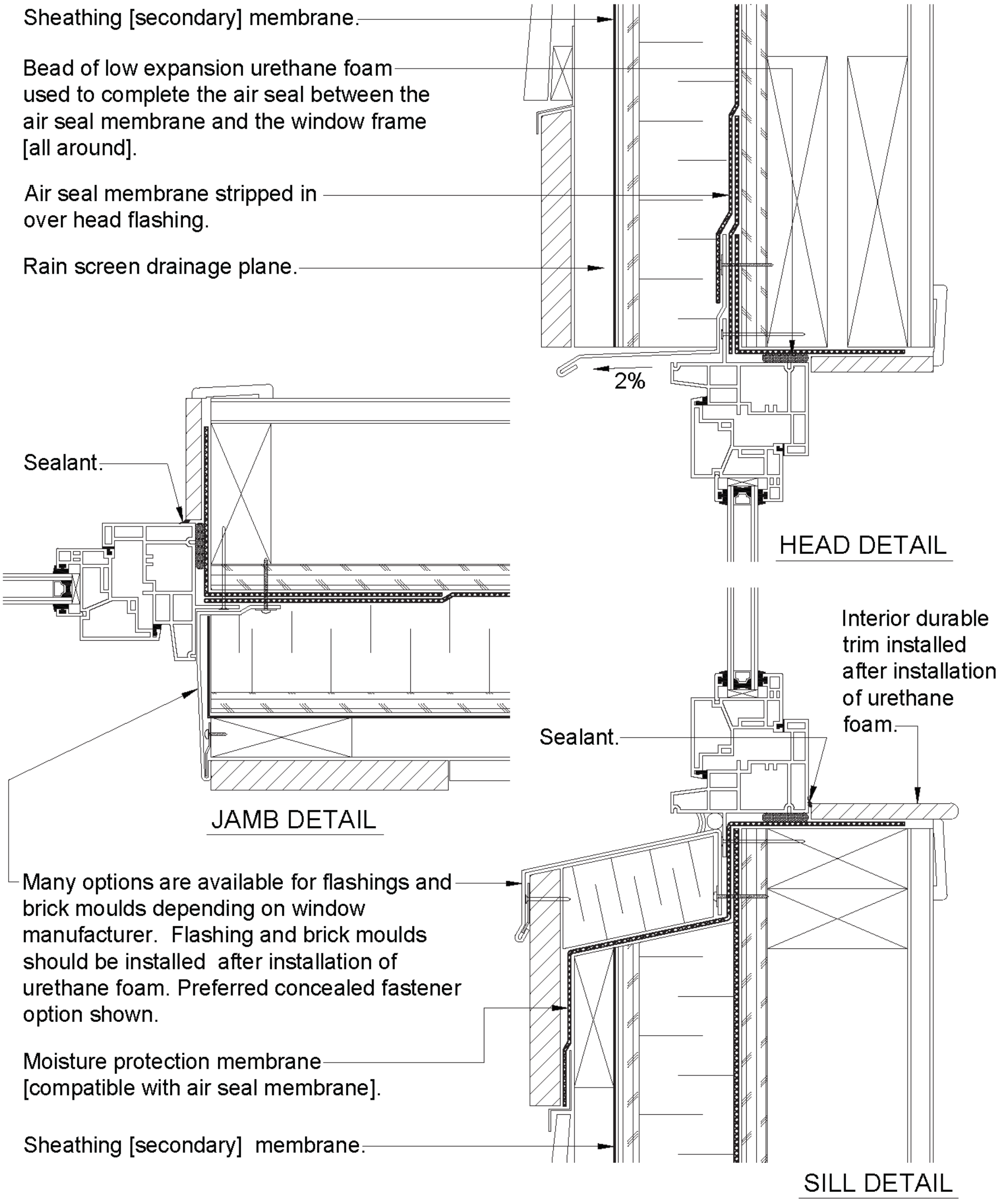
Alberta Infrastructure

EXTERIOR GLAZED WINDOW
INSTALLATION - SERIES 05
Punched [Heavy Duty] Window Option 1a

BUILDING SCIENCES SECTION

DETAIL NUMBER
1a

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V.SOLBAK	2012-02-23



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.

Interior durable trim installed after installation of urethane foam.

Alberta Infrastructure

EXTERIOR GLAZED WINDOW INSTALLATION - SERIES 05 Punched [Light Duty] Window Option 1b		BUILDING SCIENCES SECTION		DETAIL NUMBER 1b
DRAWN BY E. RIVERA	DATE 2012-02-23	CHECKED BY V.SOLBAK	DATE 2012-02-23	

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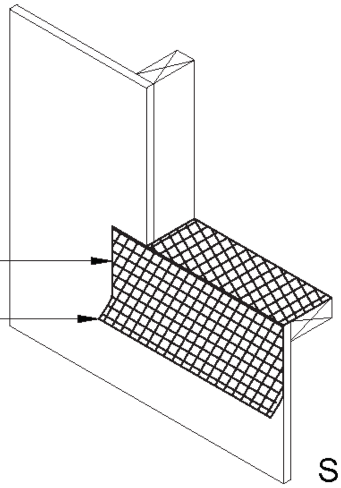
Sill membrane installed first.

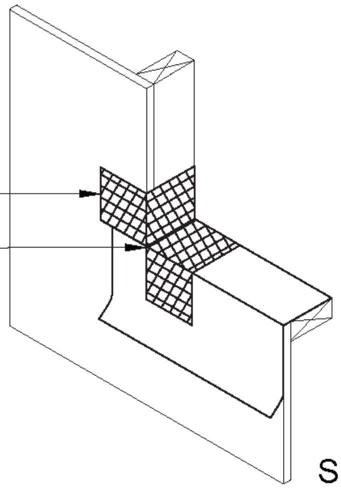
If wall air seal membrane is not installed prior to window membrane, a flap of membrane at the sill should be left to allow for the wall membrane to be installed underneath creating a shingle lapped joint.



STEP 1

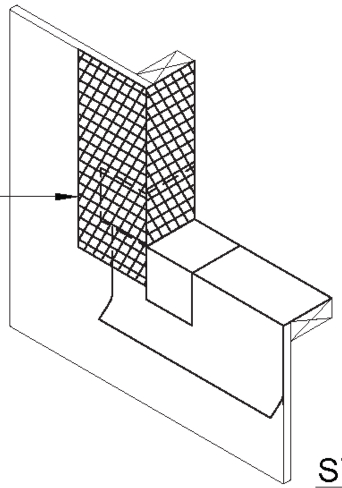
A small piece of membrane should be used in the corner at the transition between the sill and the jamb. Small pieces of membrane are easier to work with for detail work. It is important that the membrane be installed tight into the corner as this is the most critical location for water entry.

A small amount of mastic that is compatible with the membrane should be used in the corner where the membranes meet.



STEP 2

Jamb membrane installed after sill and transition strips.



STEP 3

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Alberta Infrastructure

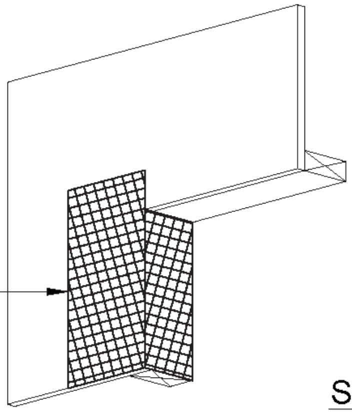
EXTERIOR GLAZED WINDOW INSTALLATION - SERIES 05
MEMBRANE INSTALLATION AT SILL AND JAMB

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23

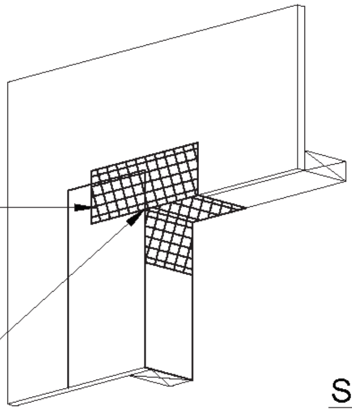
DETAIL NUMBER
2a

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.



STEP 4

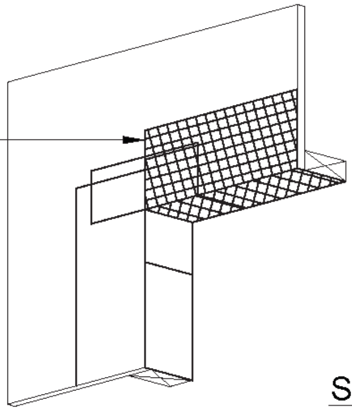
A small piece of membrane should be used in the corner at the transition between the head and the jamb. Small pieces of membrane are easier to work with for detail work. It is important that the membrane be installed tight into the corner as this is the most critical location for water entry.



STEP 5

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.



STEP 6

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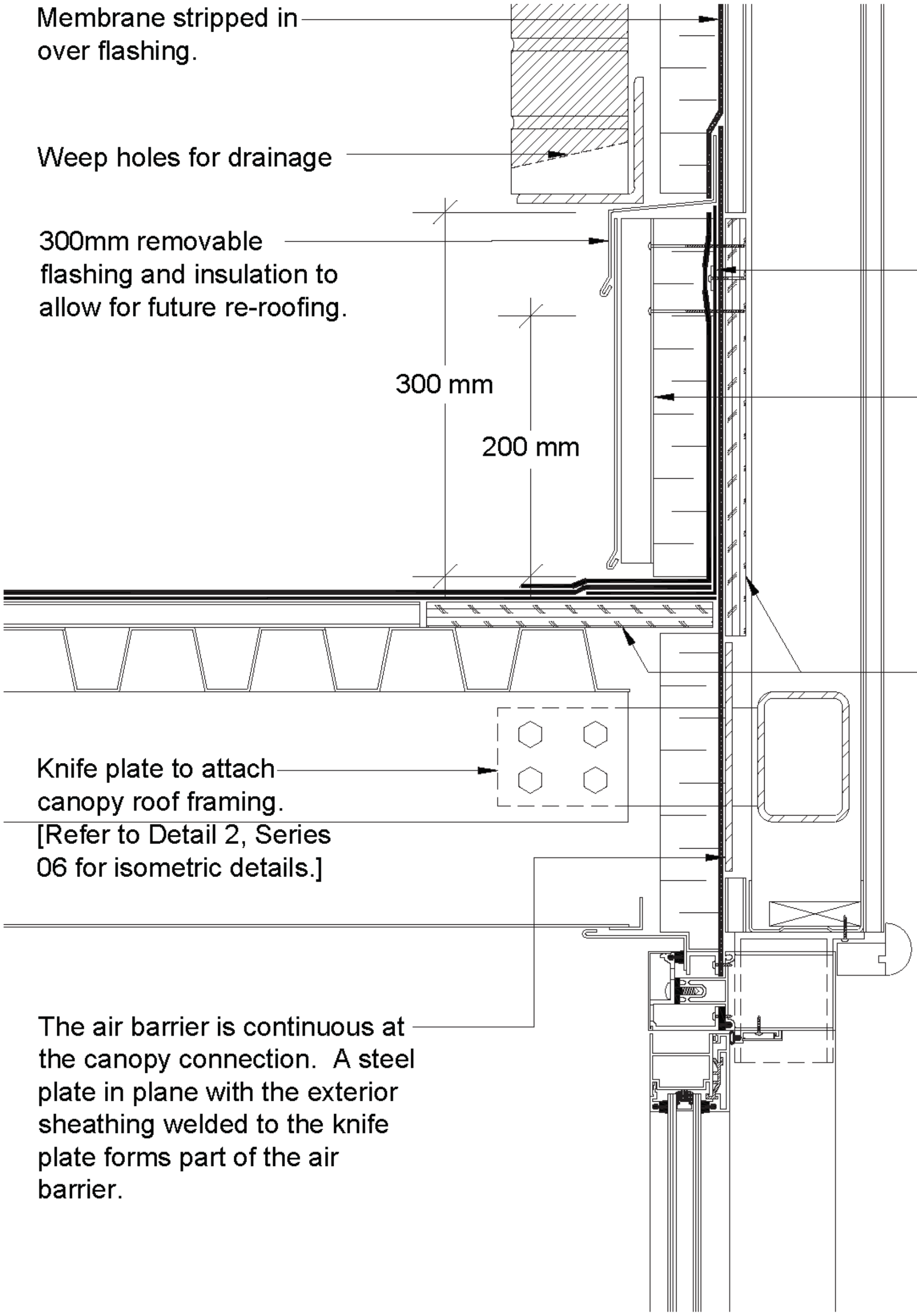
Alberta Infrastructure

EXTERIOR GLAZED WINDOW
INSTALLATION - SERIES 05
MEMBRANE INSTALLATION AT JAMB AND HEAD

BUILDING SCIENCES SECTION

DETAIL NUMBER
2b

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23



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.

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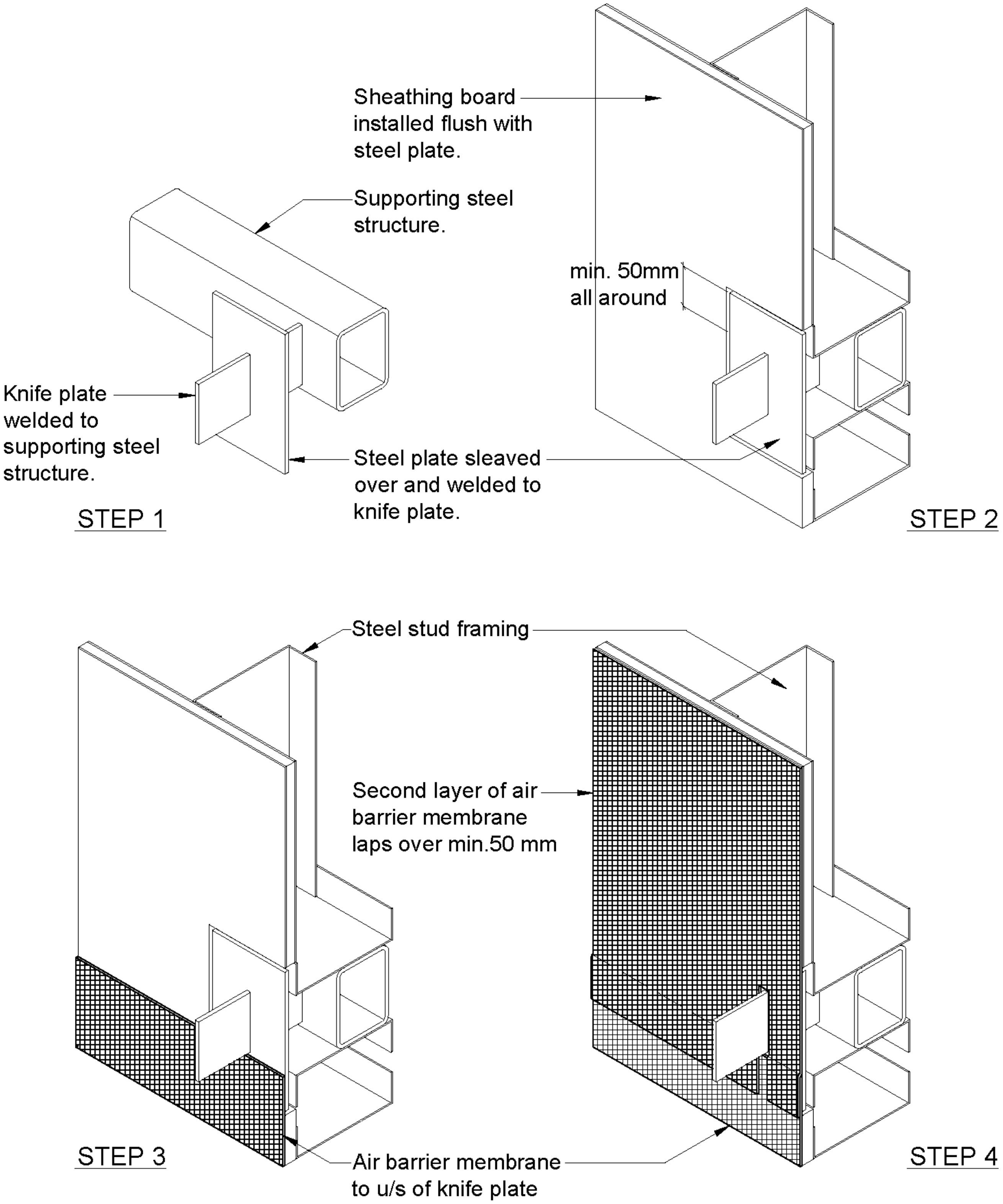
Infrastructure

STRUCT. PENETRATION
DETAILS - SERIES 06
UNHEATED CANOPY OPTION

BUILDING SCIENCES SECTION

DETAIL NUMBER
1

DRAWN BY	DATE	CHECKED BY	DATE
E.RIVERA	2012-02-23	V. SOLBAK	2012-02-23



Alberta
Infrastructure

STRUCT. PENETRATION DETAILS - SERIES 06

ISOMETRIC PLATE SEQUENCING DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER

2

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23

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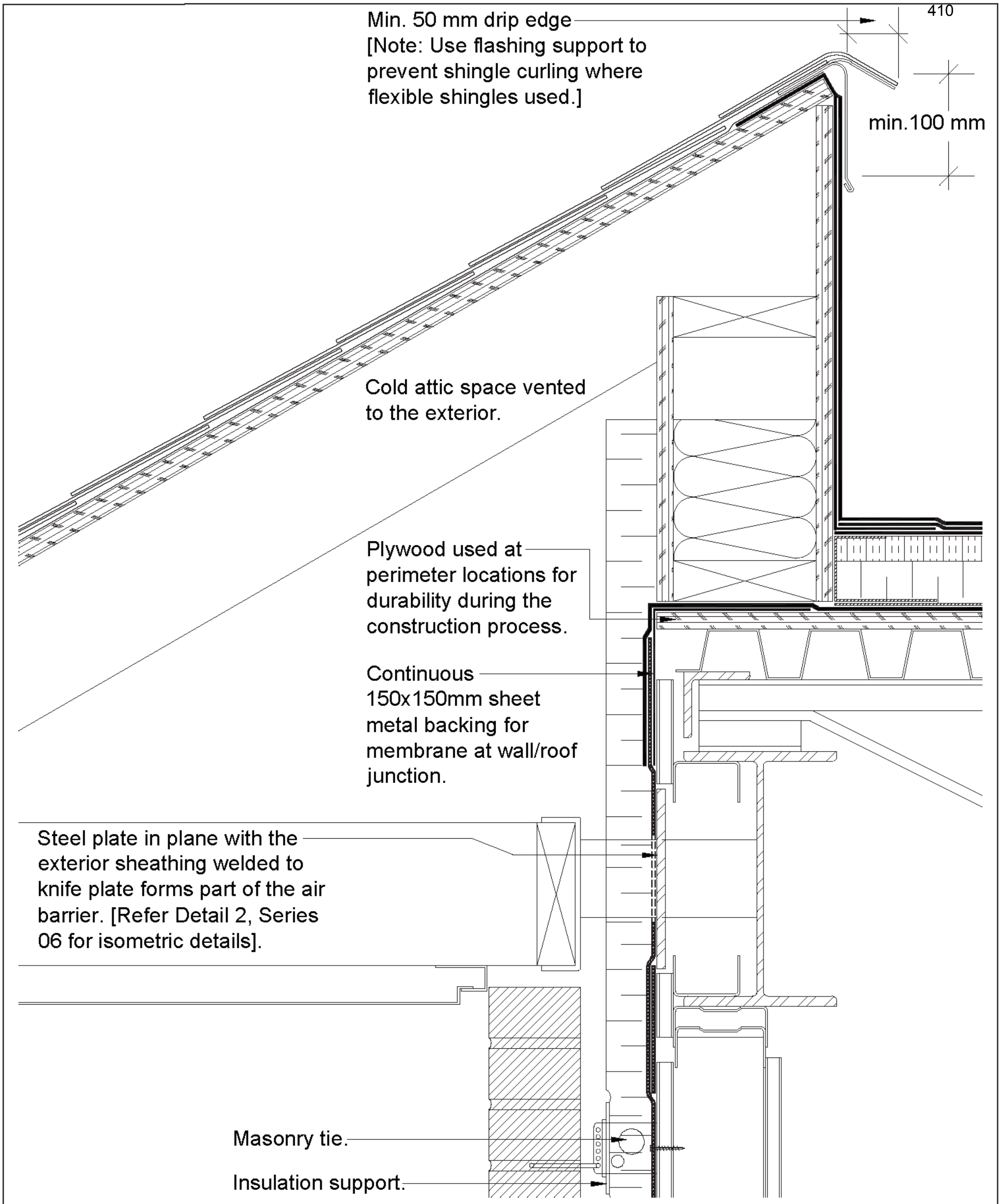

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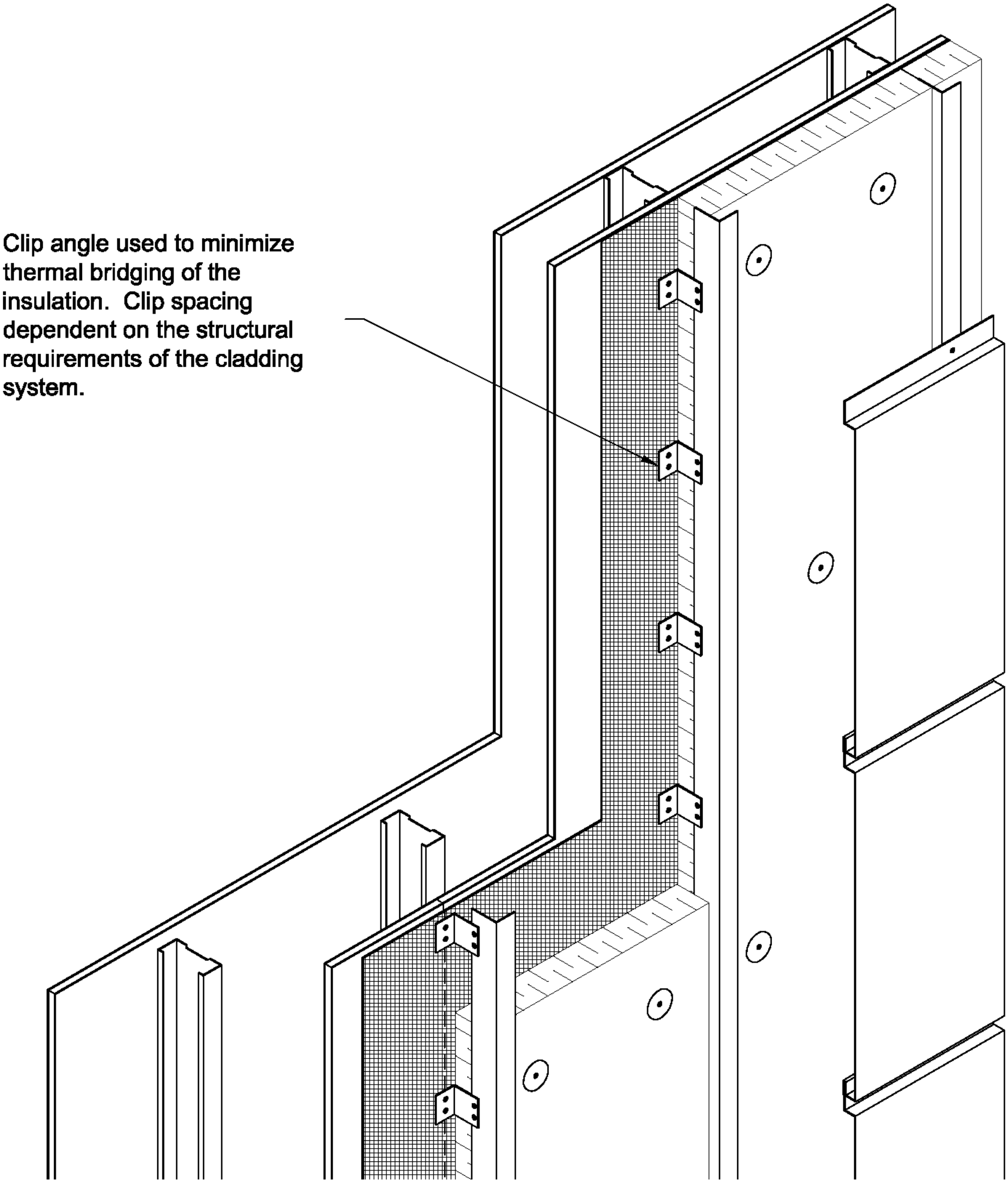
Infrastructure

STRUCT. PENETRATION
DETAILS - SERIES 06
UNHEATED CANOPY OVERHANG OPTION

BUILDING SCIENCES SECTION

DETAIL NUMBER
3

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23



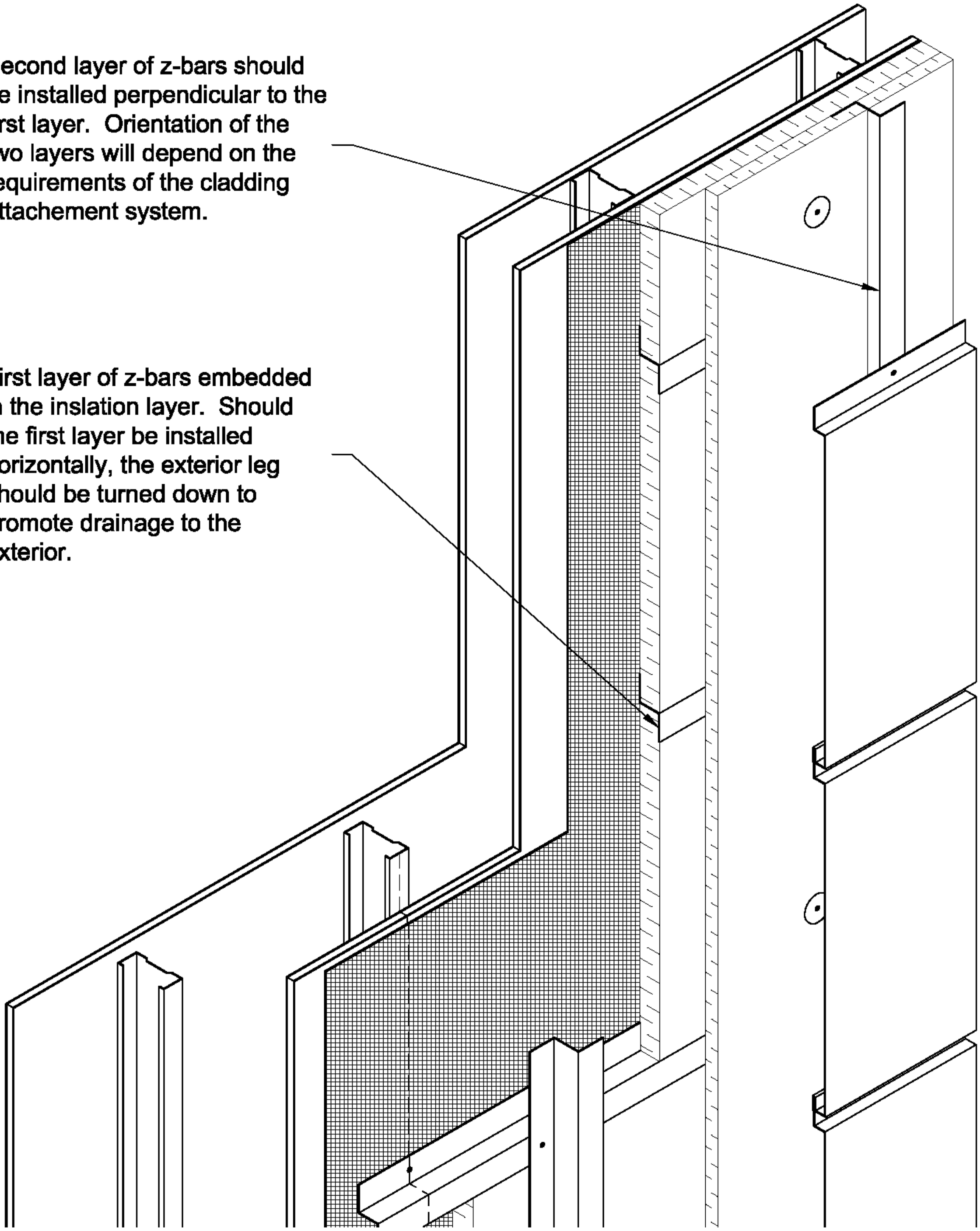
Alberta Infrastructure

THERMAL CLIPS

CLADDING ATTACHMENT DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE	DETAIL NUMBER
PETER BAKER	01-01-2005			1



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 attachement system.

First layer of z-bars embedded in the inslation layer. Should the first layer be installed horizontally, the exterior leg should be turned down to promote drainage to the exterior.

Alberta
Infrastructure

DOUBLE Z-BARS

CLADDING ATTACHMENT DETAILS

BUILDING SCIENCES SECTION

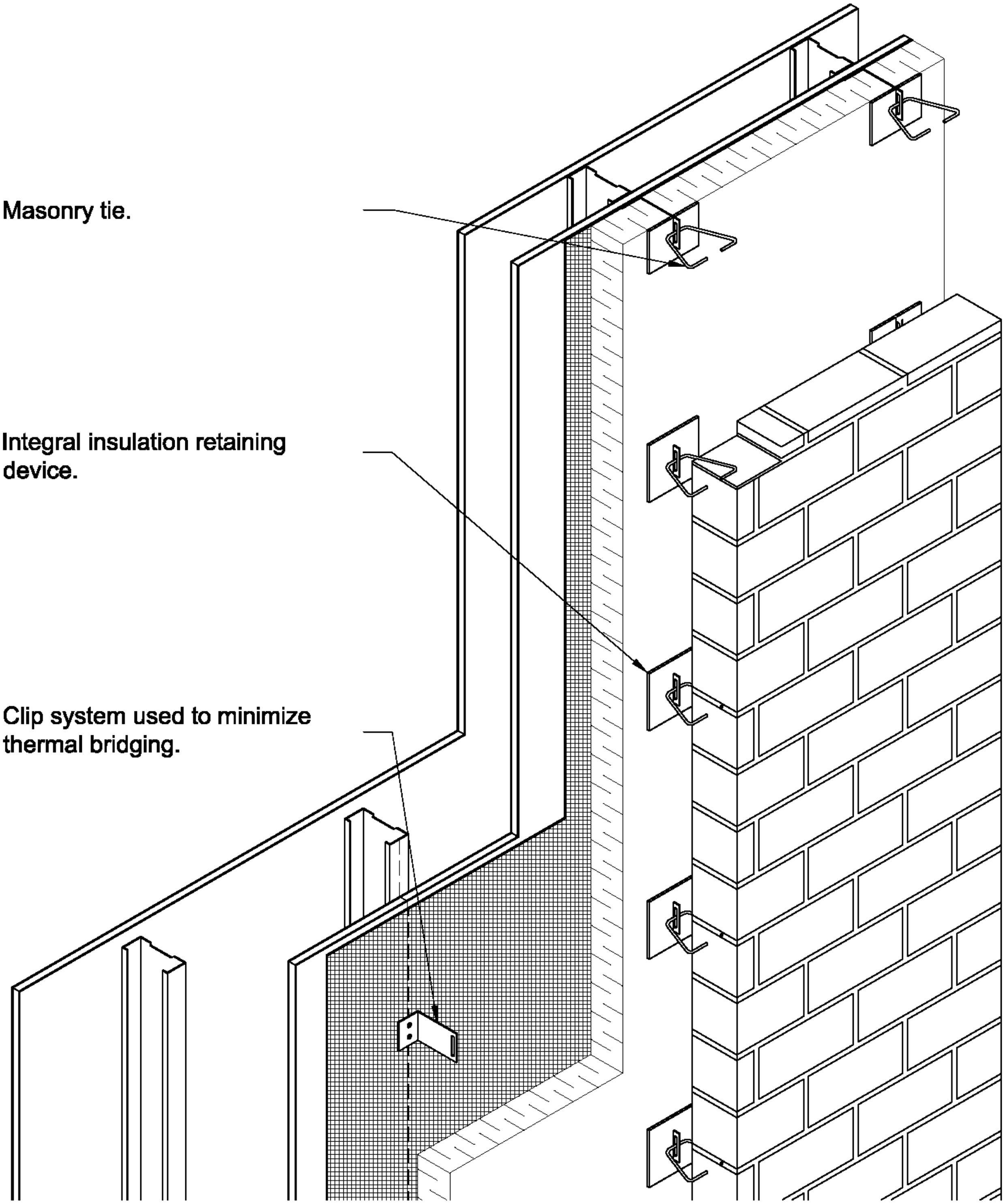
DRAWN BY
PETER BAKER

DATE
01-01-2005

CHECKED BY

DATE

DETAIL NUMBER
2



Masonry tie.

Integral insulation retaining device.

Clip system used to minimize thermal bridging.

Alberta Infrastructure

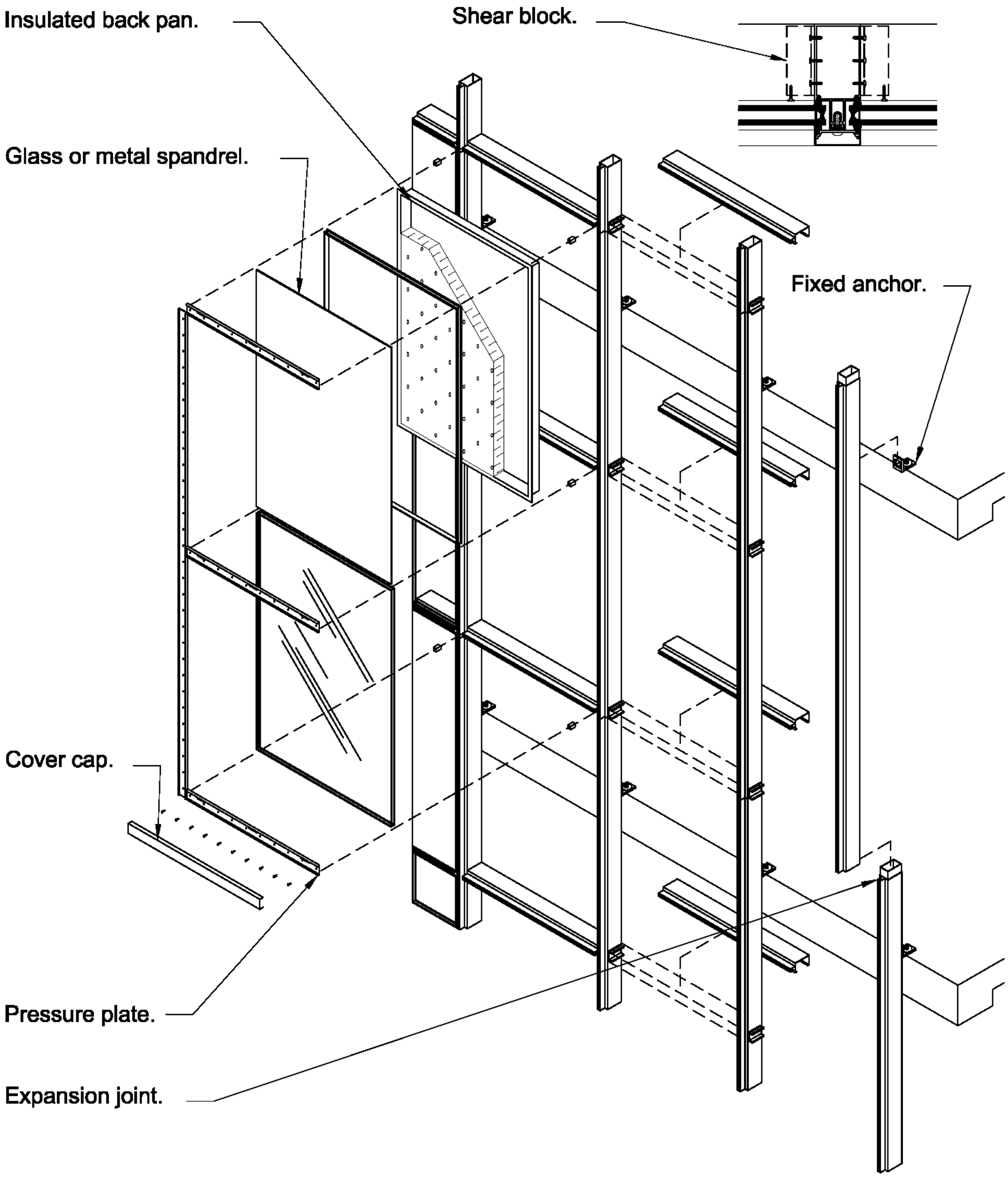
MASONRY TIES

CLADDING ATTACHMENT DETAILS

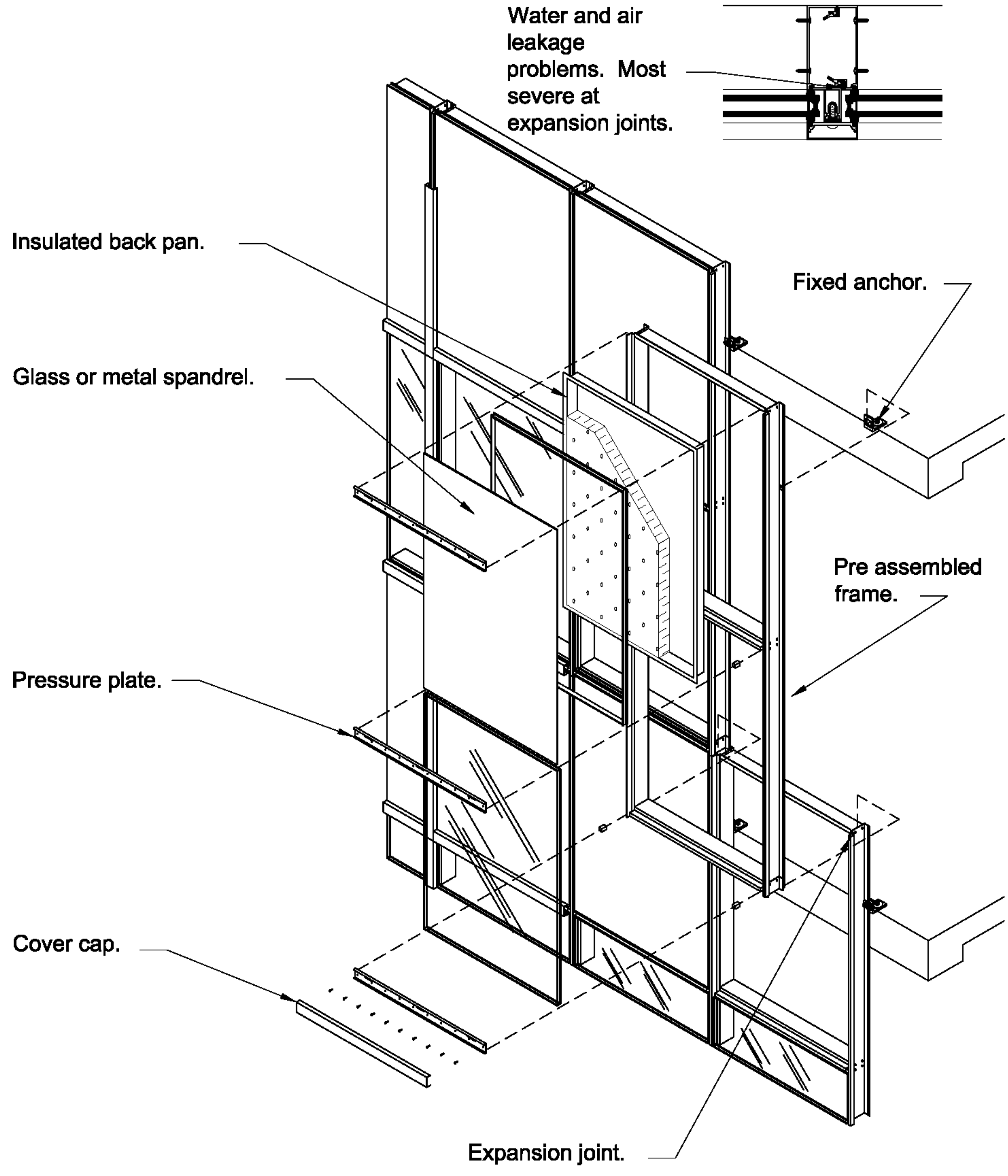
BUILDING SCIENCES SECTION

DETAIL NUMBER 3

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		



Alberta Infrastructure	**STICK SYSTEM** CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 1
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE



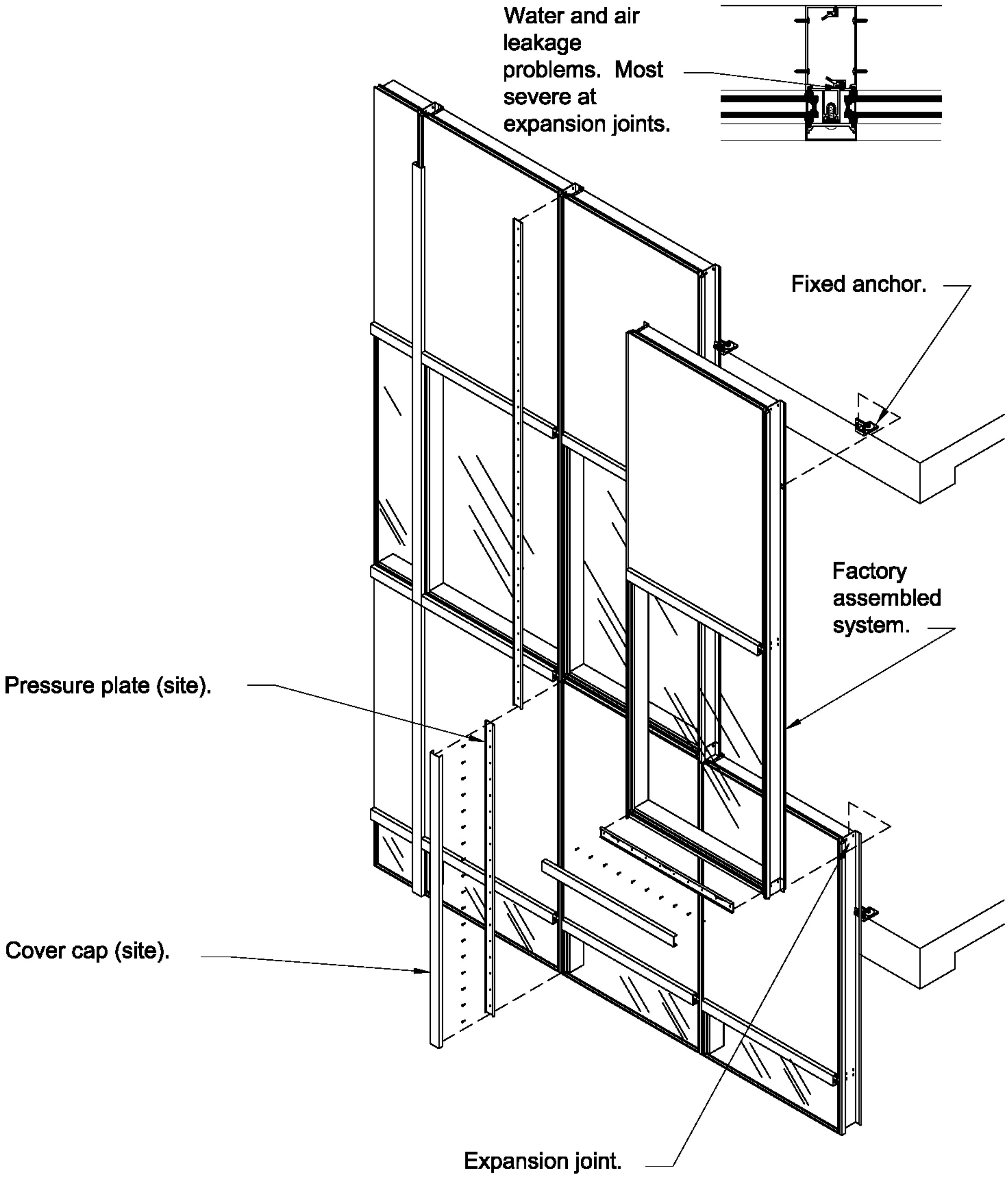
Alberta Infrastructure

SPLIT MULLION SYSTEM

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE	DETAIL NUMBER
PETER BAKER	01-01-2005			2



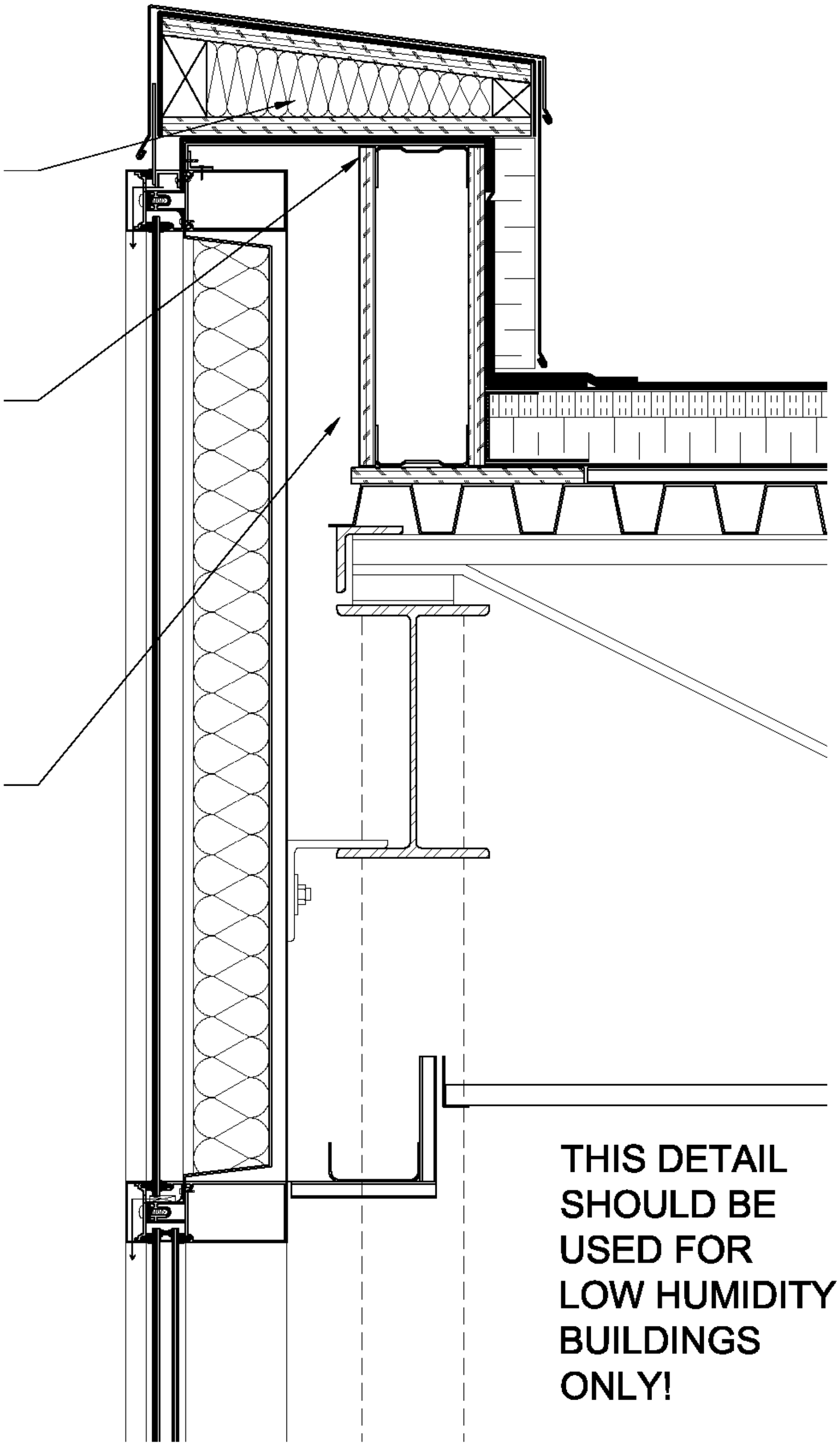
PANELIZED SYSTEM

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 3

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		



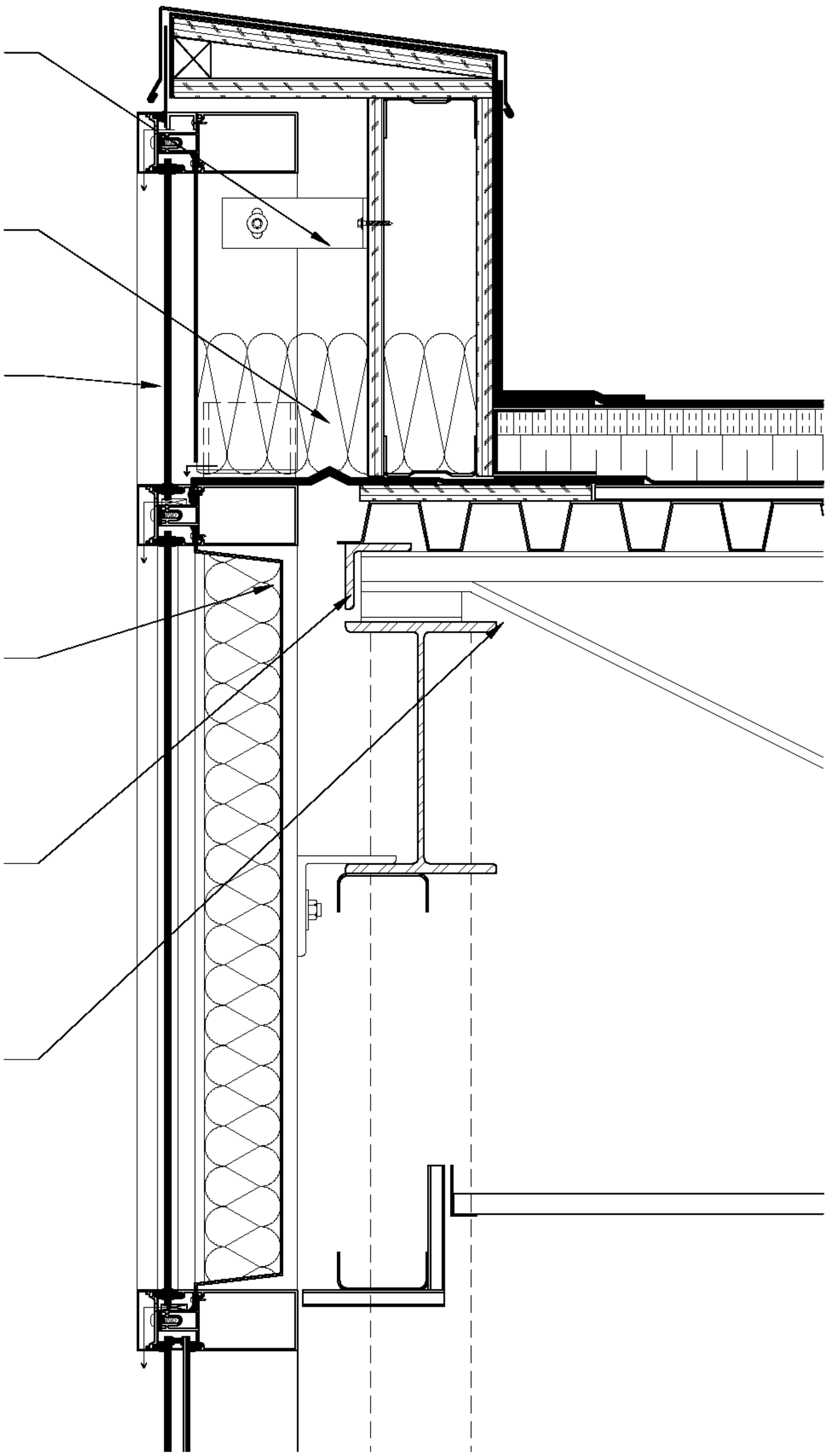
Insulate exterior of the air barrier membrane.

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!

Alberta Infrastructure	PARAPET 1 CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 4
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE	



Depending on the heigth of the parapet the curtain wall may require to be tied back to the structure.

Insulate exterior of the air barrier membrane.

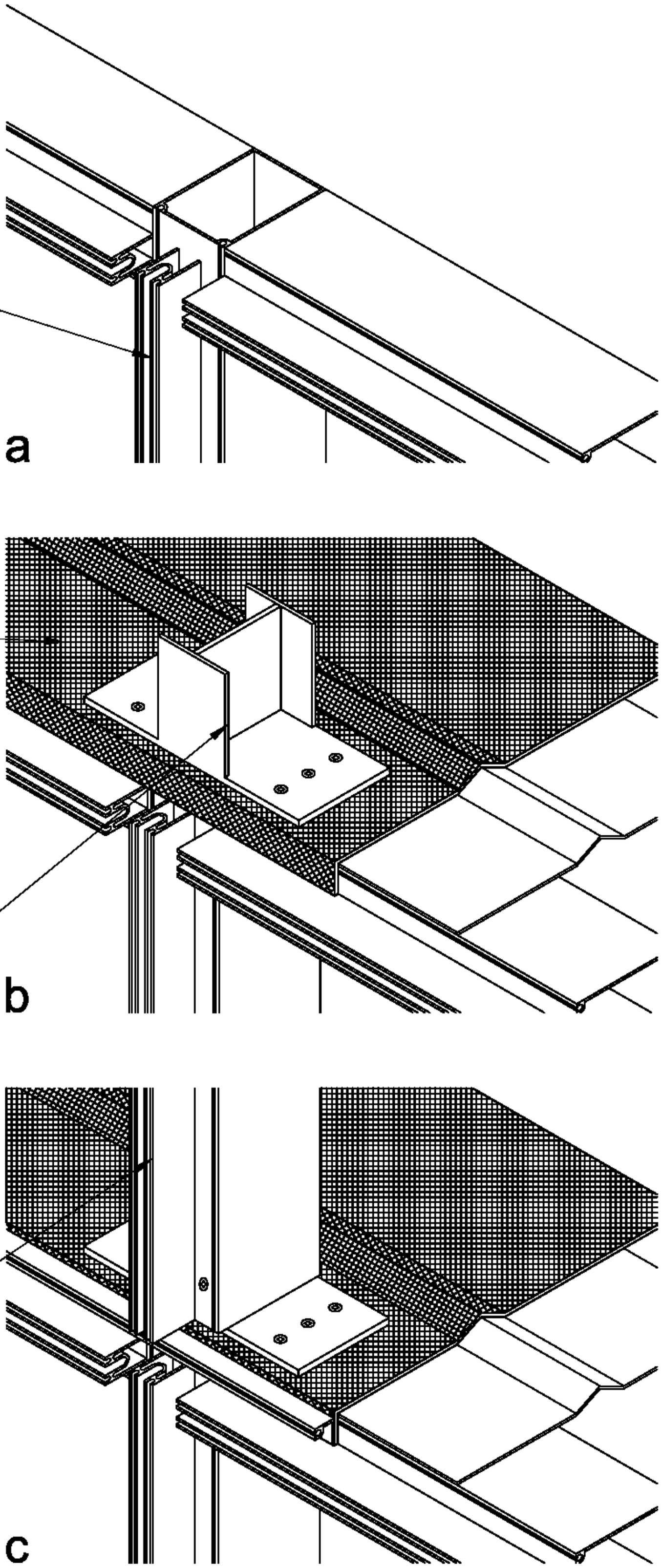
Sheet metal to minimize water from penetrating into the parapet construction and to contain insualtion. This must be drained at the bottom through the curtainwall system.

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.

Alberta Infrastructure	**PARAPET 2** CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 5
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE



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.

Alberta Infrastructure

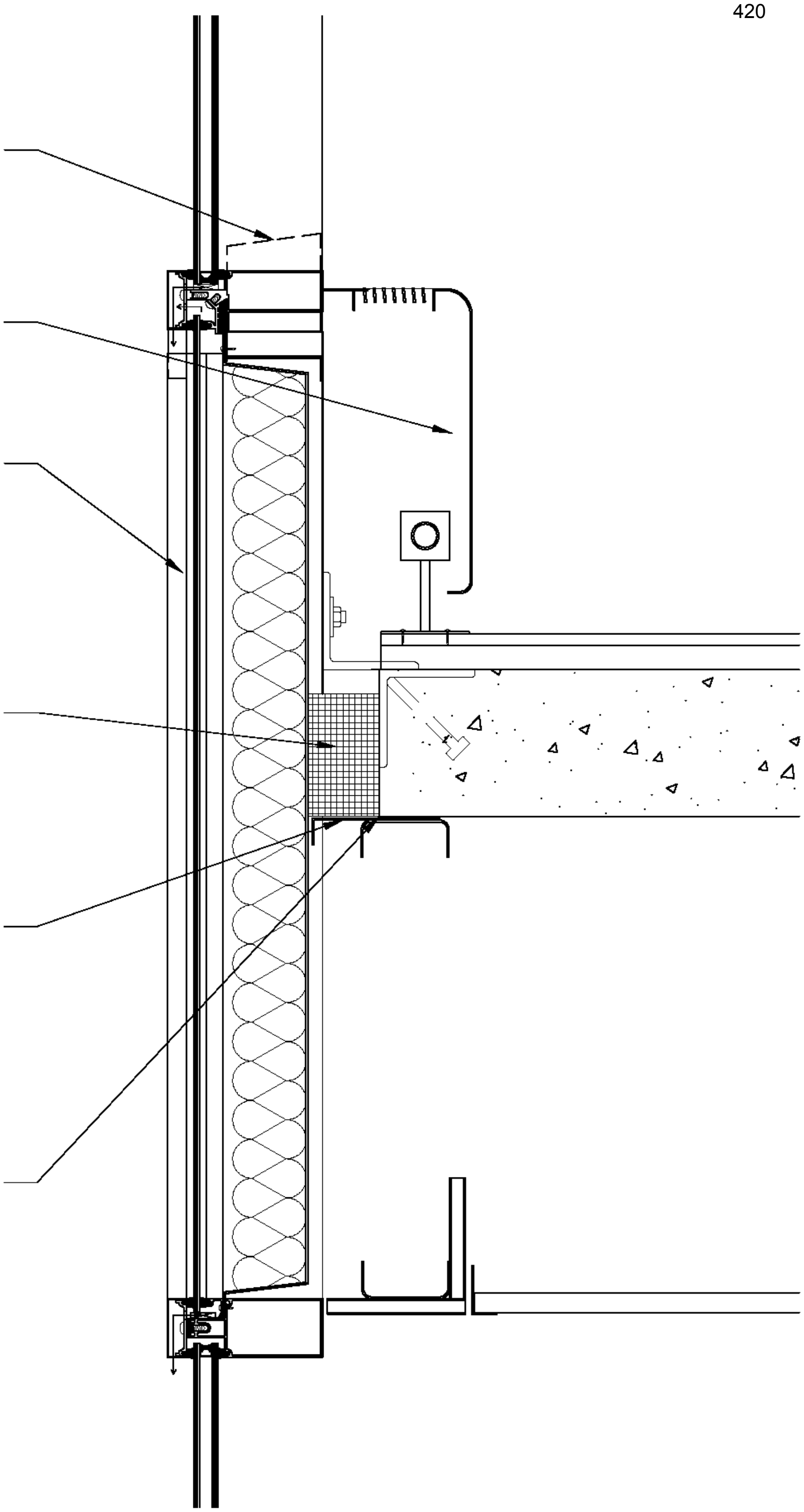
AIR SEAL DETAIL

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		

DETAIL NUMBER
6



Expansion joint. If large movemnts are expected within the system then a double mullion horizontal should be used.

Convector 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.

Alberta Infrastructure

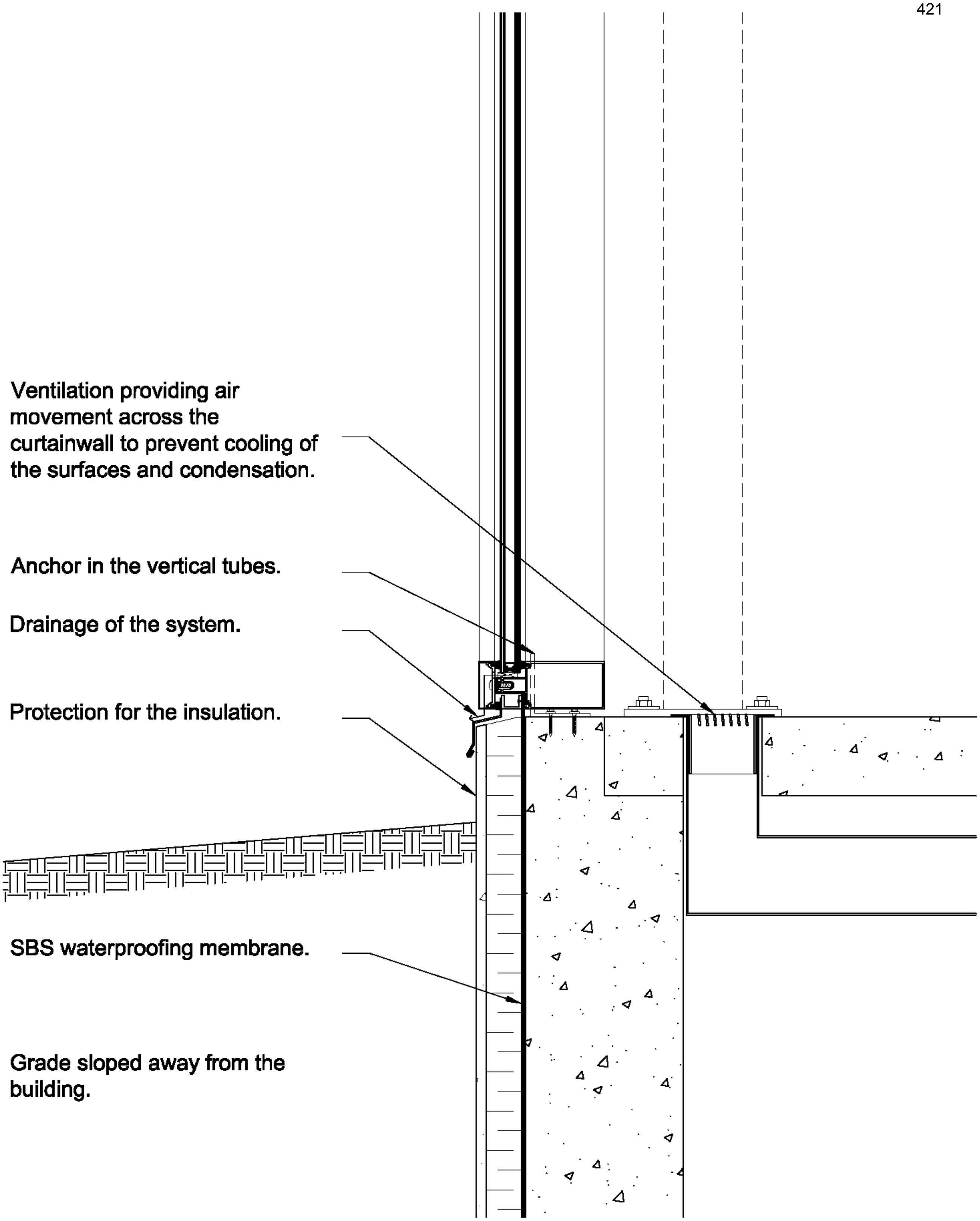
FLOOR SPANDREL

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
7

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		



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.

Alberta Infrastructure

FOUNDATION

CURTAIN WALL DETAILS

BUILDING SCIENCES SECTION

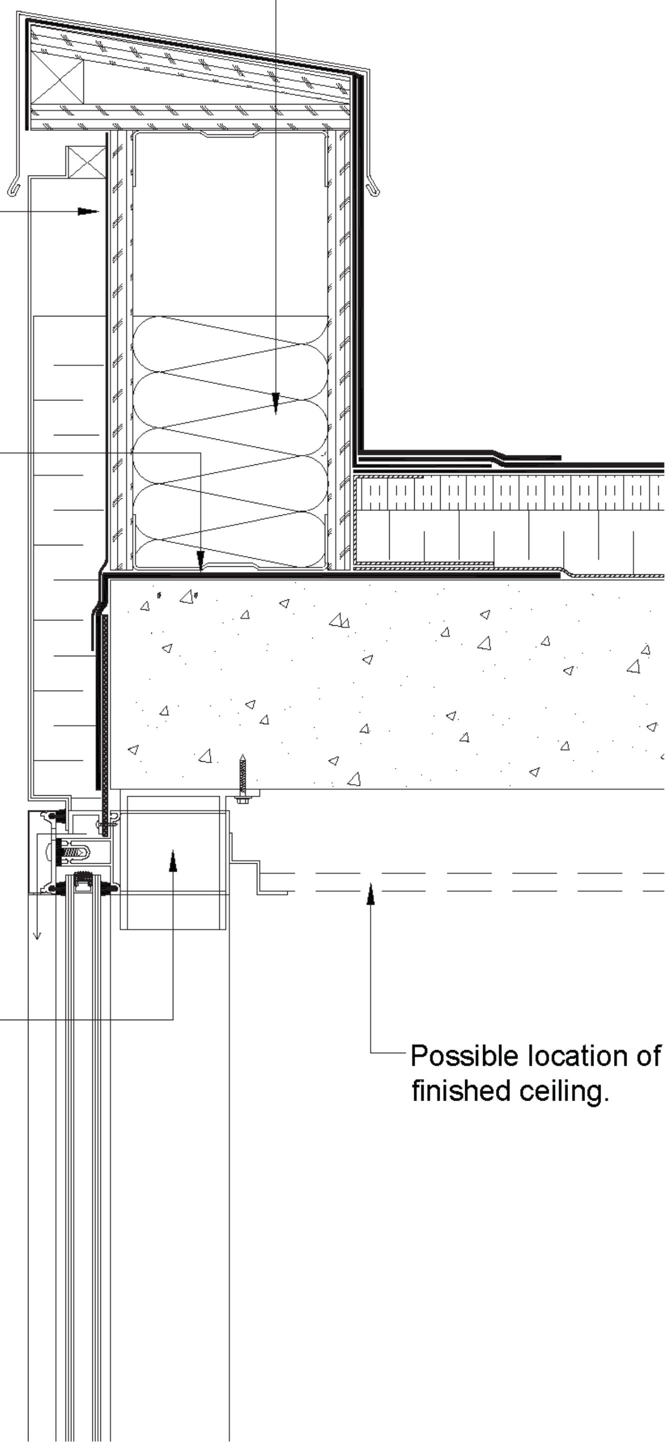
DETAIL NUMBER
8

DRAWN BY
PETER BAKER

DATE
01-01-2005

CHECKED BY

DATE



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 accomodate movement.

Possible location of finished ceiling.

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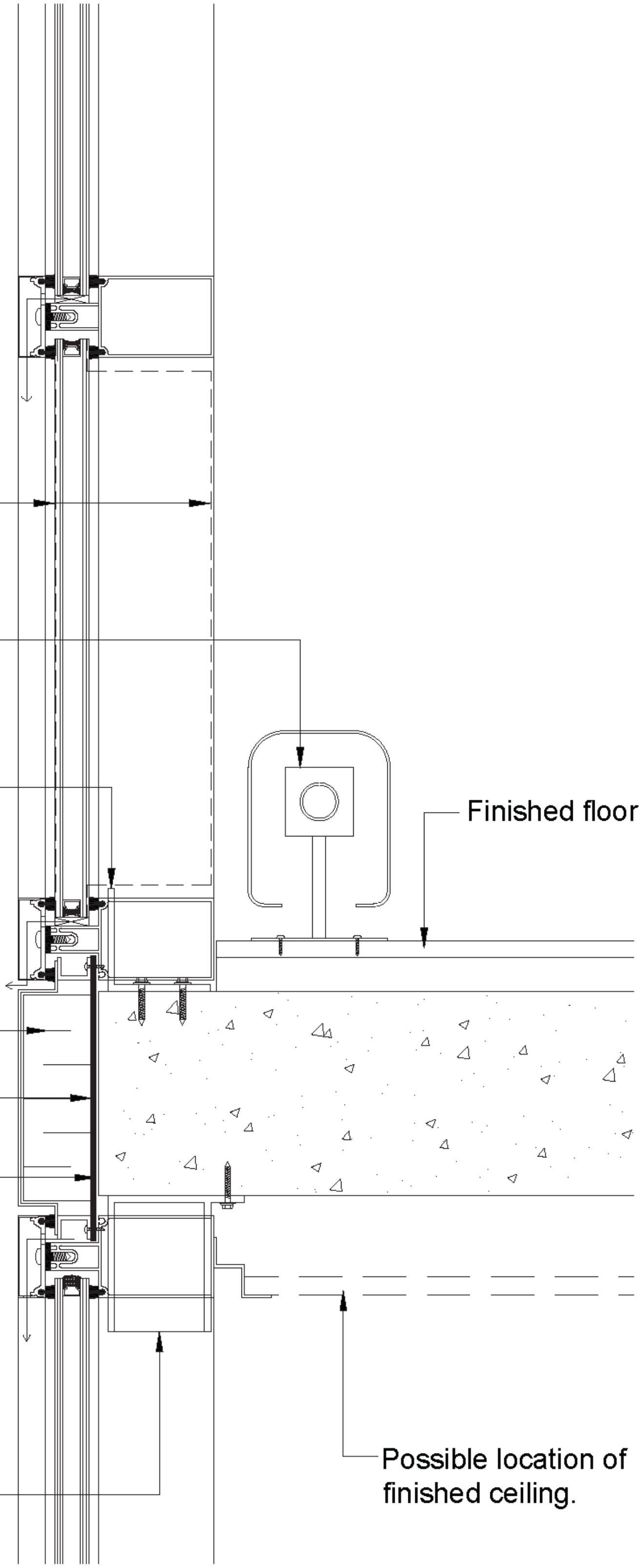
SLAB TO SLAB CURTAIN
WALL DETAILS - SERIES 09
PARAPET

BUILDING SCIENCES SECTION

DETAIL NUMBER
1

DRAWN BY E. RIVERA	DATE 2012-02-23	CHECKED BY V. SOLBAK	DATE 2012-02-23



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)

Finished floor

Possible location of finished ceiling.

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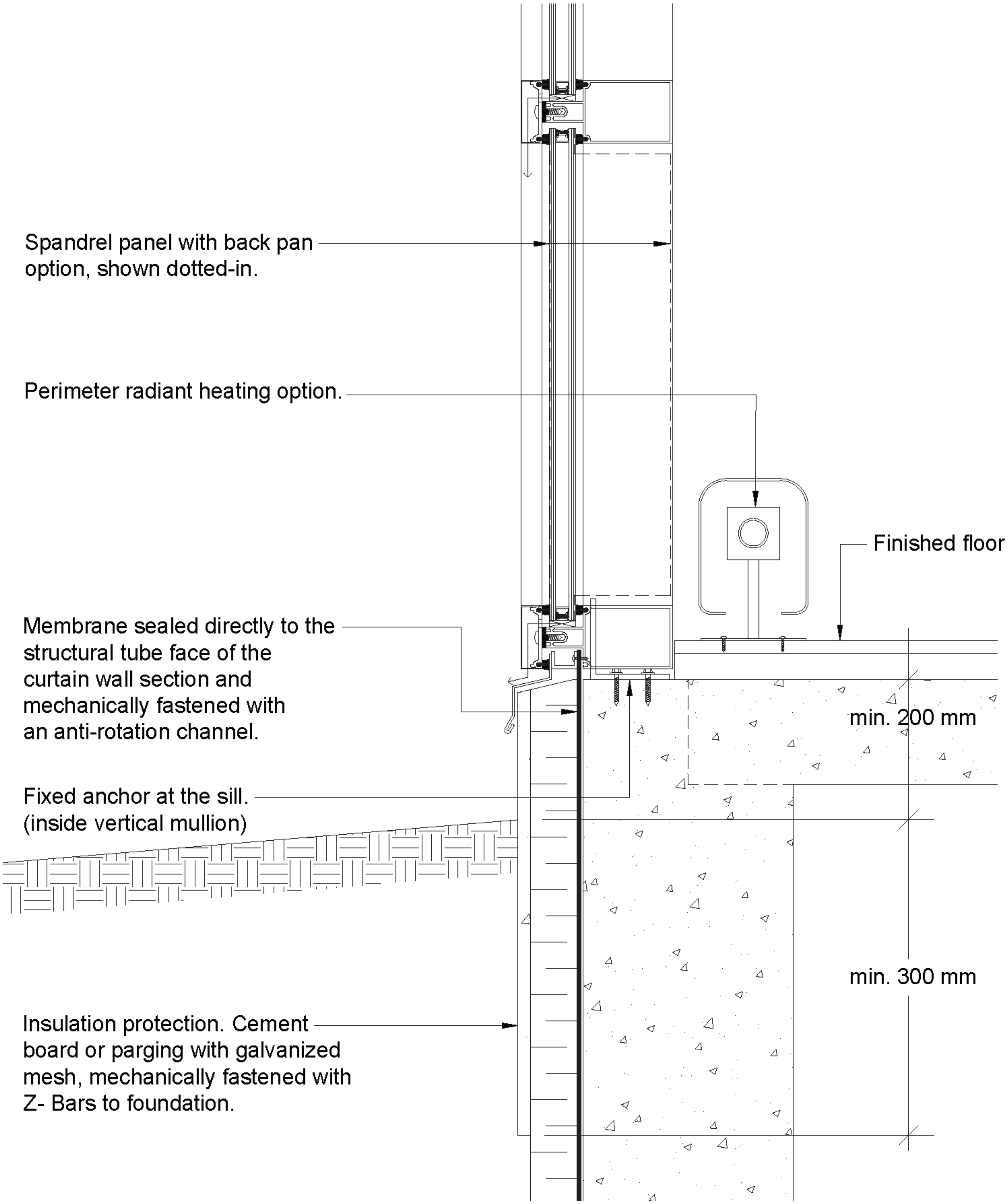
Alberta
Infrastructure

SLAB TO SLAB CURTAIN
WALL DETAILS - SERIES 09
INTERMEDIATE FLOOR

BUILDING SCIENCES SECTION

DETAIL NUMBER
2

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23



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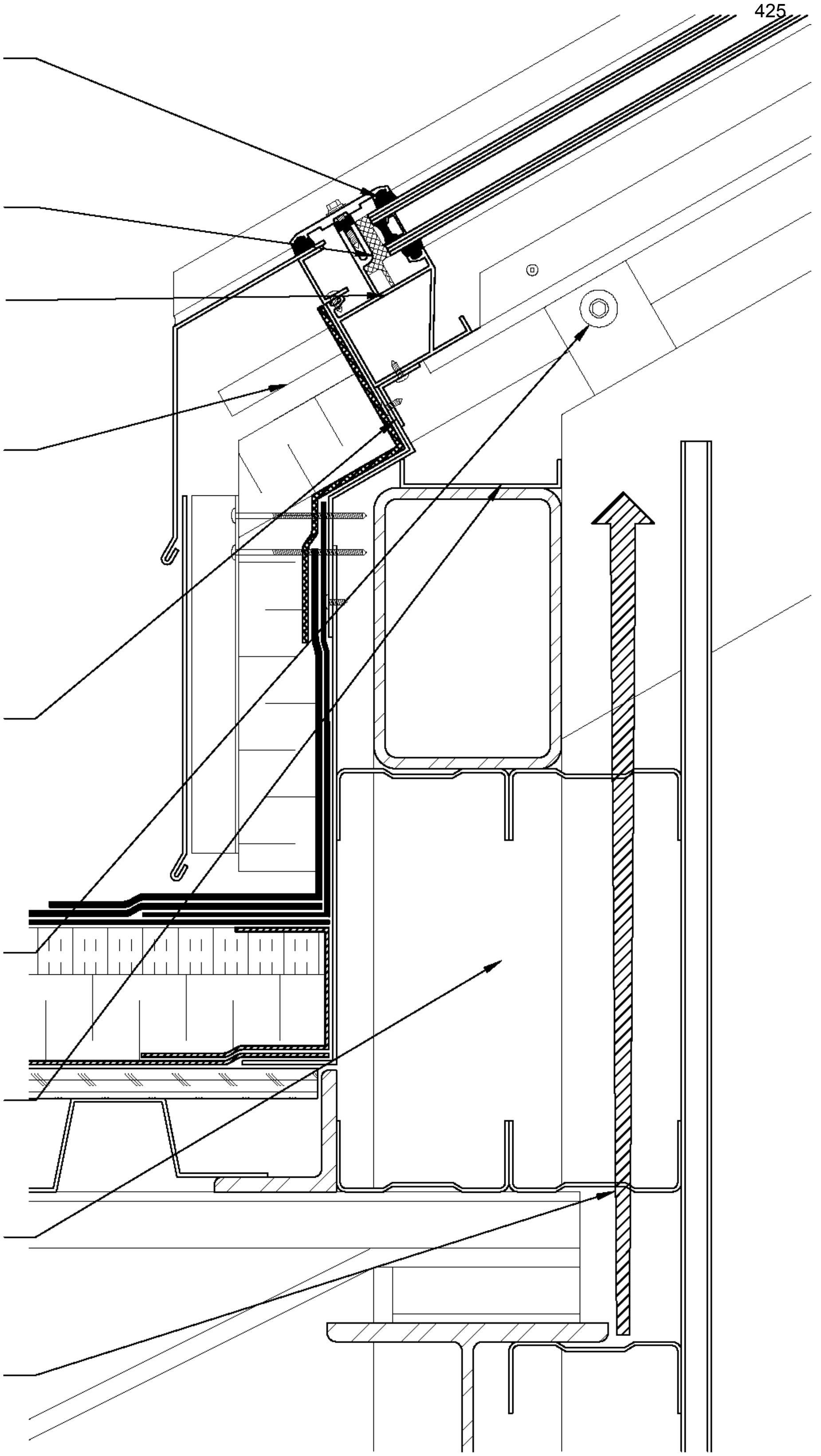
Infrastructure

SLAB TO SLAB CURTAIN
WALL DETAILS - SERIES 09
FLOOR AT FOUNDATION LEVEL

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE
E . RIVERA	2012-02-23	V . SOLBAK	2012-02-23

DETAIL NUMBER
3



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 accomodate the tolerances of the structural steel.

Condensation gutter.

Structural steel support system

Mechanical induced air movement (required for higher humidity buildings).

Alberta
Infrastructure

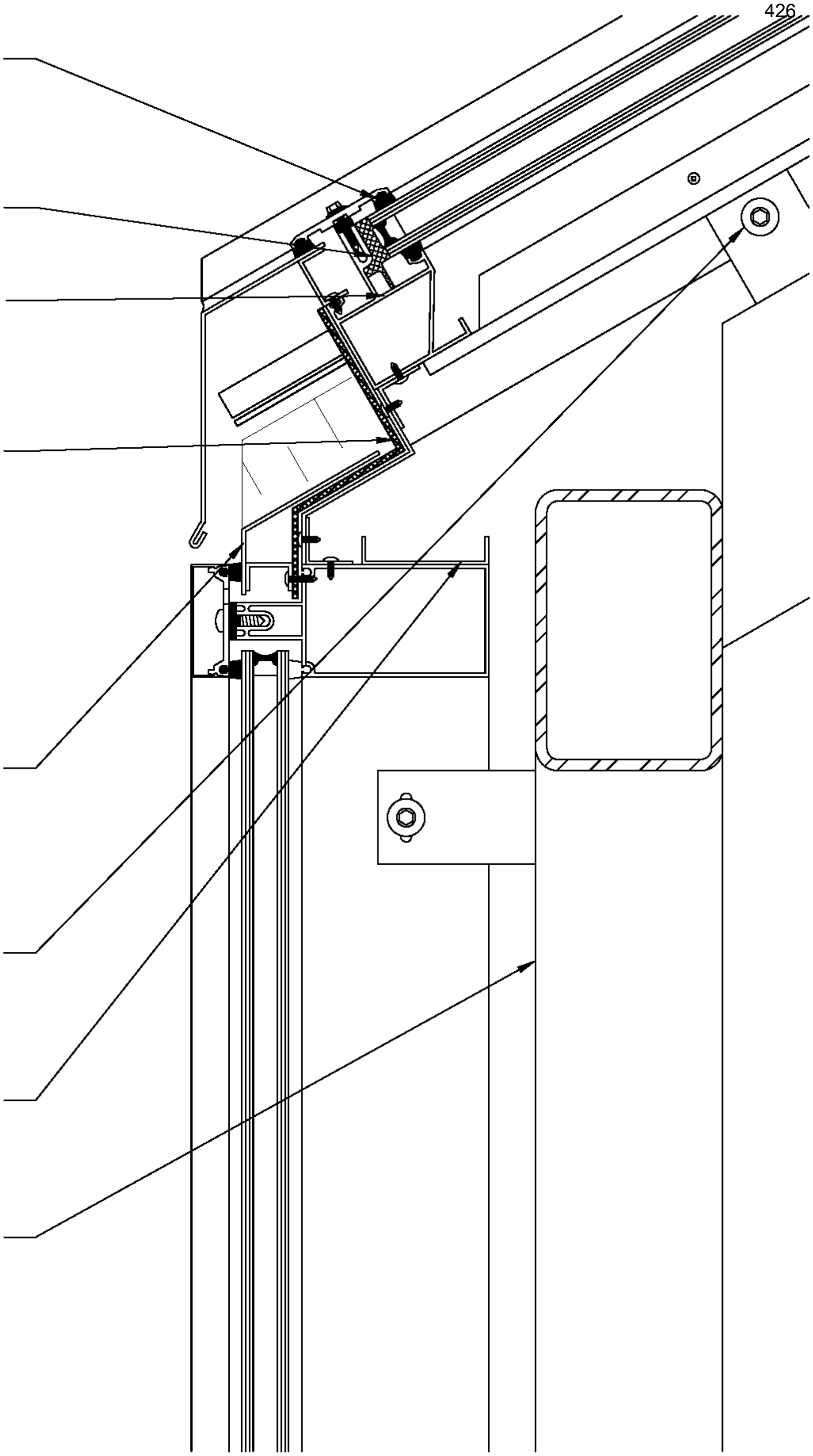
SILL TO ROOF

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		

DETAIL NUMBER
1



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 sklylight 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 accomodate the tolerances of the structural steel.

Condensation gutter.

Structural steel support system

Alberta
Infrastructure

SILL TO CURTAIN WALL

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

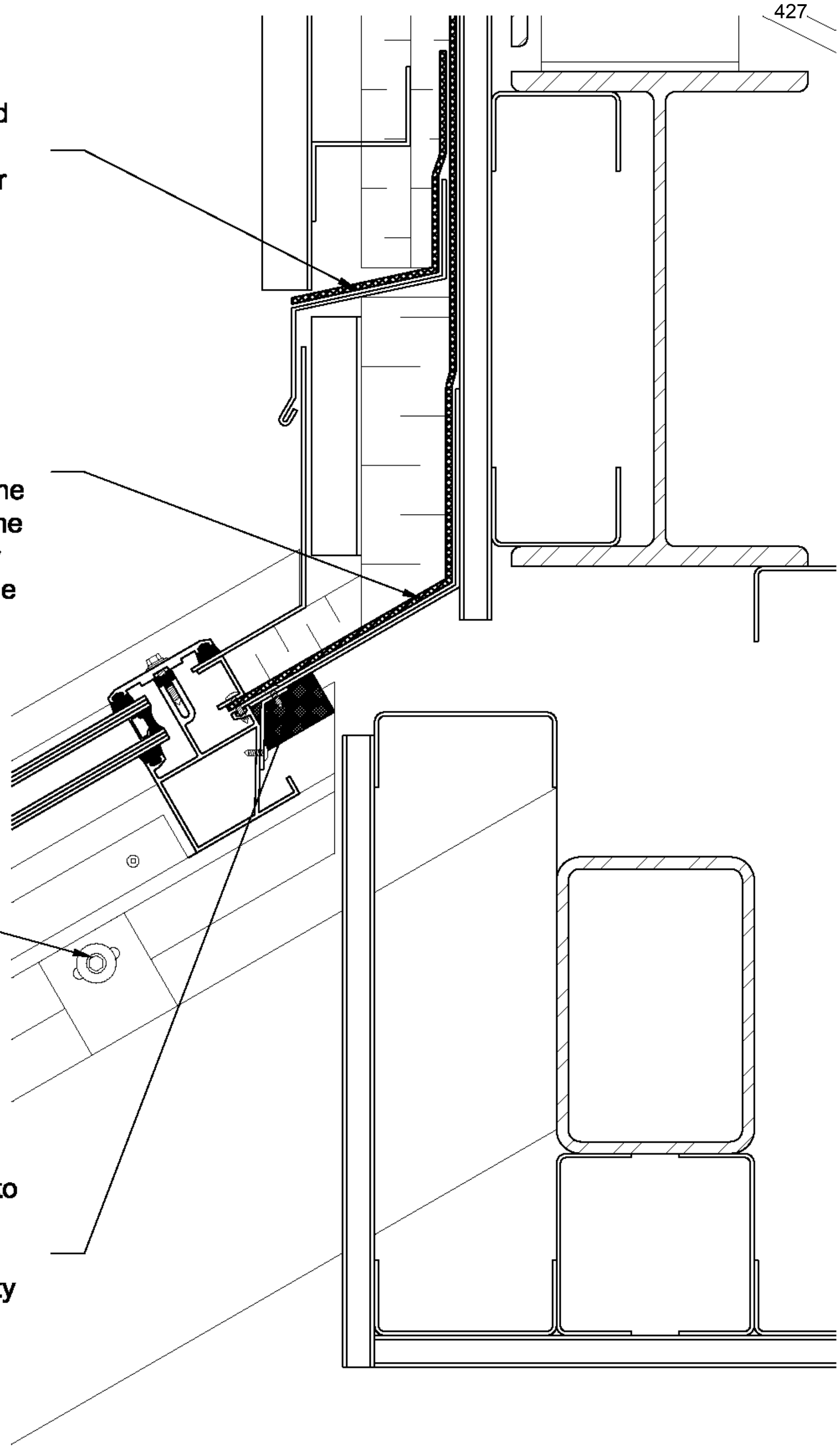
DRAWN BY
PETER BAKER

DATE
01-01-2005

CHECKED BY

DATE

DETAIL
NUMBER
2



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.

Alberta Infrastructure

HEAD TO WALL

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

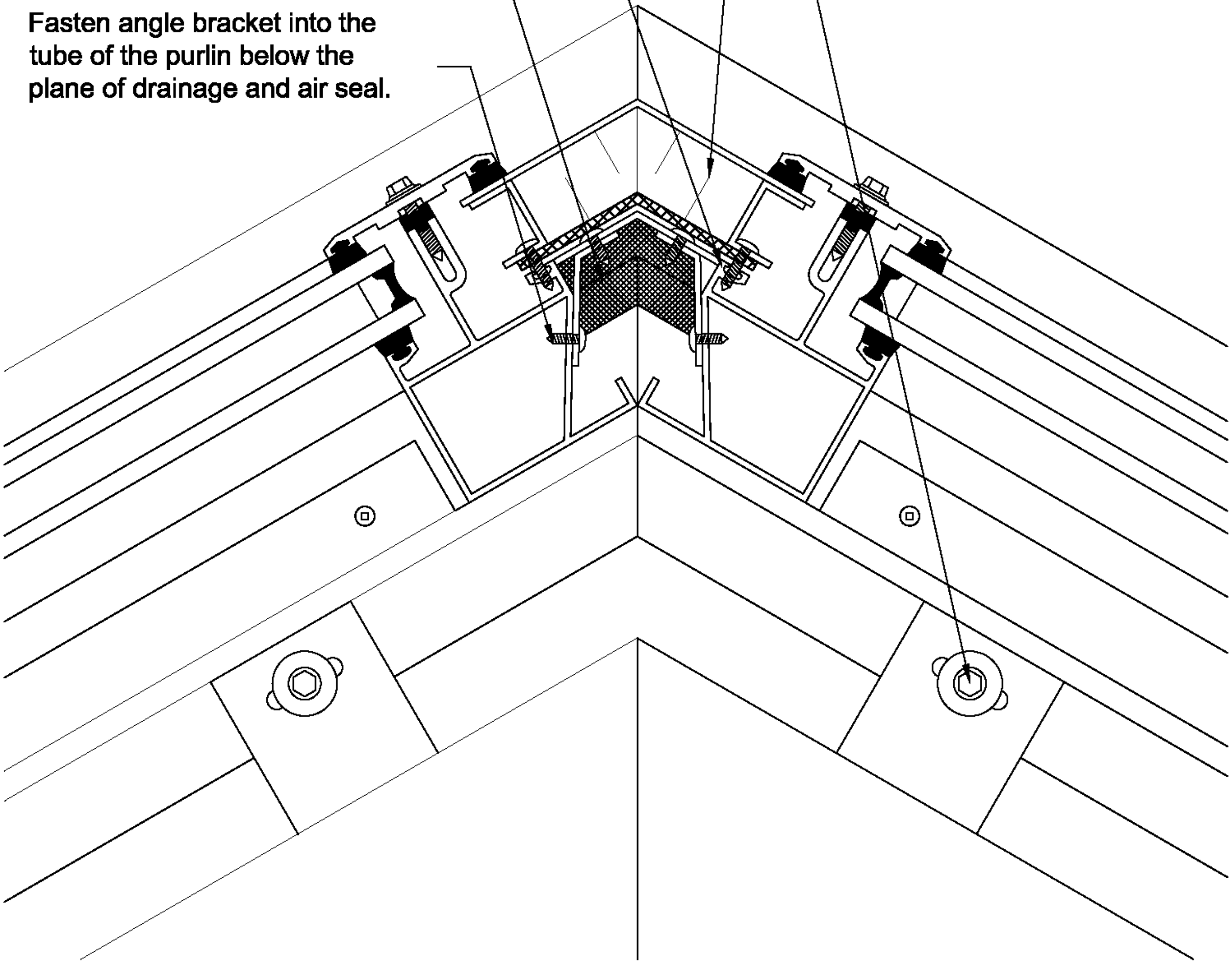
DRAWN BY PETER BAKER

DATE 01-01-2005

CHECKED BY

DATE

DETAIL NUMBER 3



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 ensue the continuity of the air seal.

Fasten angle bracket into the tube of the purlin below the plane of drainage and air seal.

Alberta Infrastructure

RIDGE

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

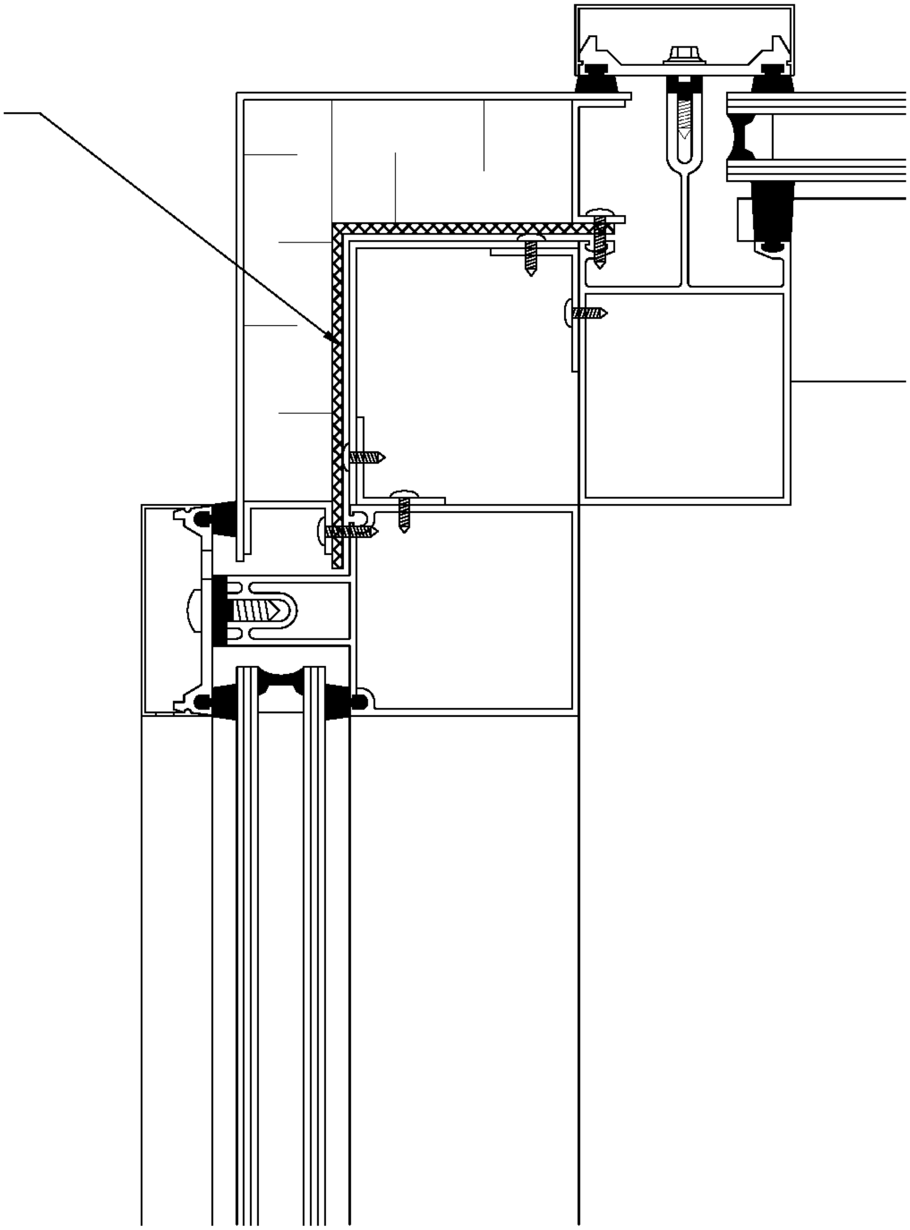
DRAWN BY
PETER BAKER

DATE
01-01-2005

CHECKED BY

DATE

DETAIL NUMBER
4



Sheet metal is used along with aluminum angles to support the air seal membrane from the curtainwall glazing rabbet to the sklylight rafter framing. The sheet metal should not interfere with the sealing of the membrane to the aluminum sections.

Alberta Infrastructure

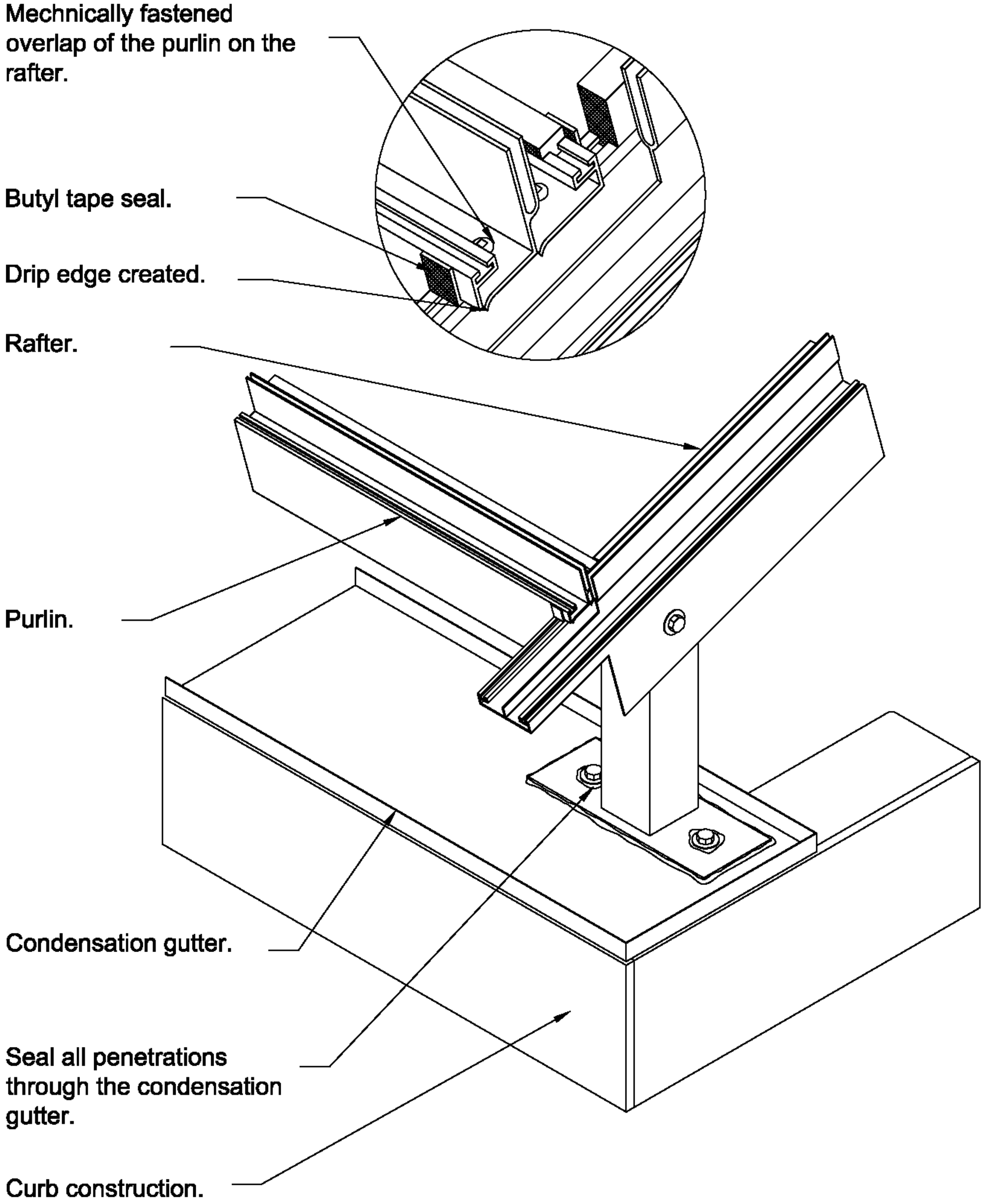
GABLE END

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

DETAIL NUMBER
5



Alberta
Infrastructure

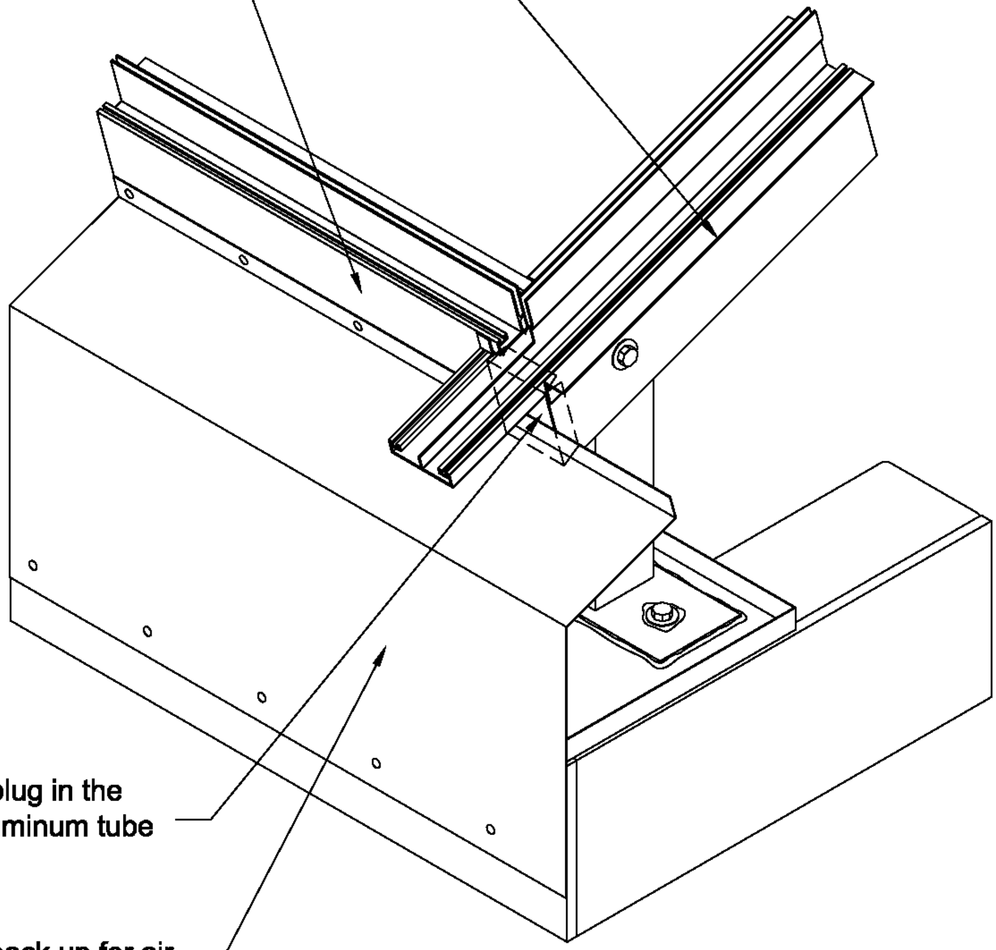
ASSEMBLY SEQUENCE 1

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER
6

DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		



Angle used to support the sheet metal fastened into the tube section of the rafter.

Maximize the surface area of the face of the purlin 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

Alberta Infrastructure

ASSEMBLY SEQUENCE 2

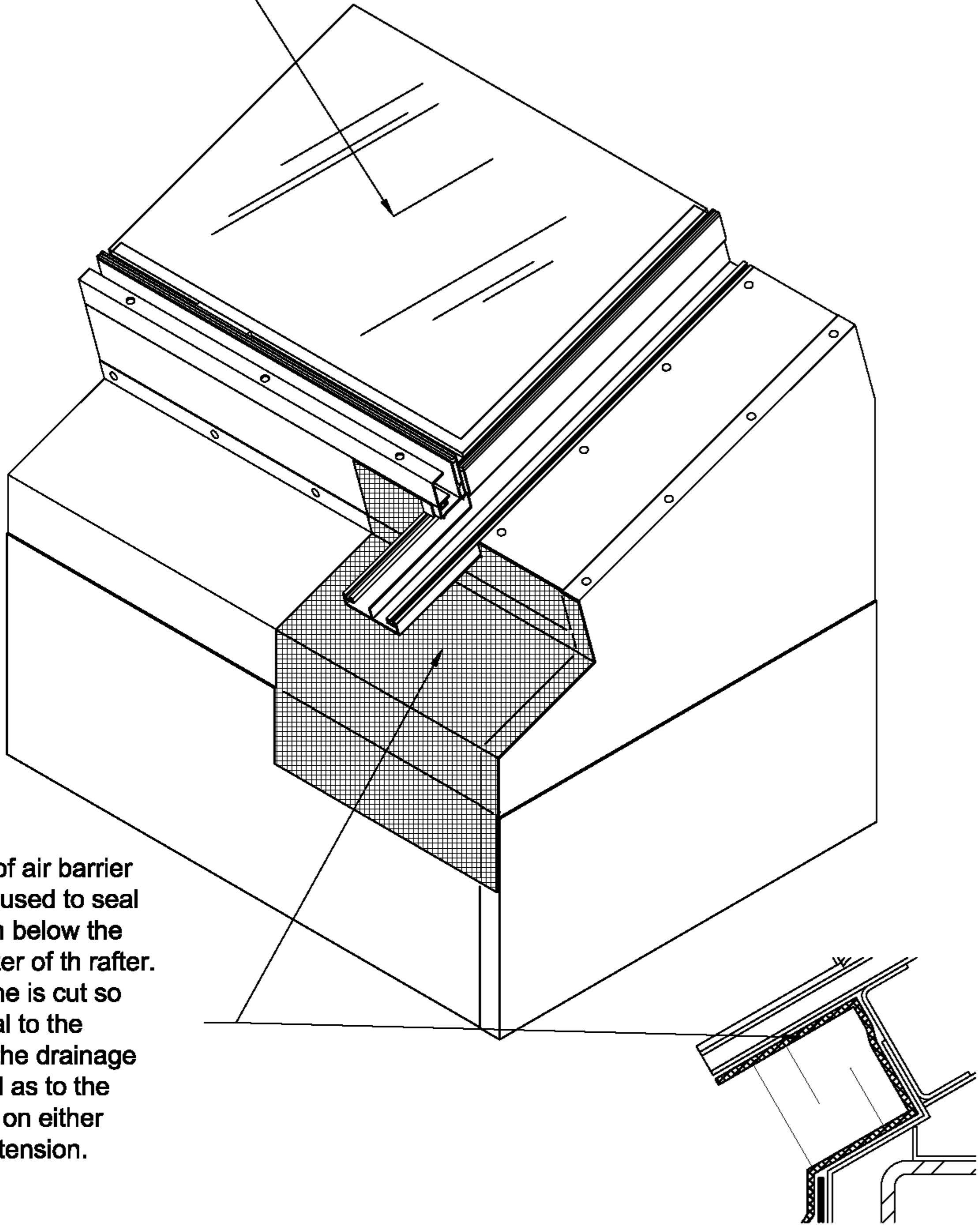
SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

DETAIL NUMBER
7

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 th 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.

Alberta Infrastructure

ASSEMBLY SEQUENCE 3

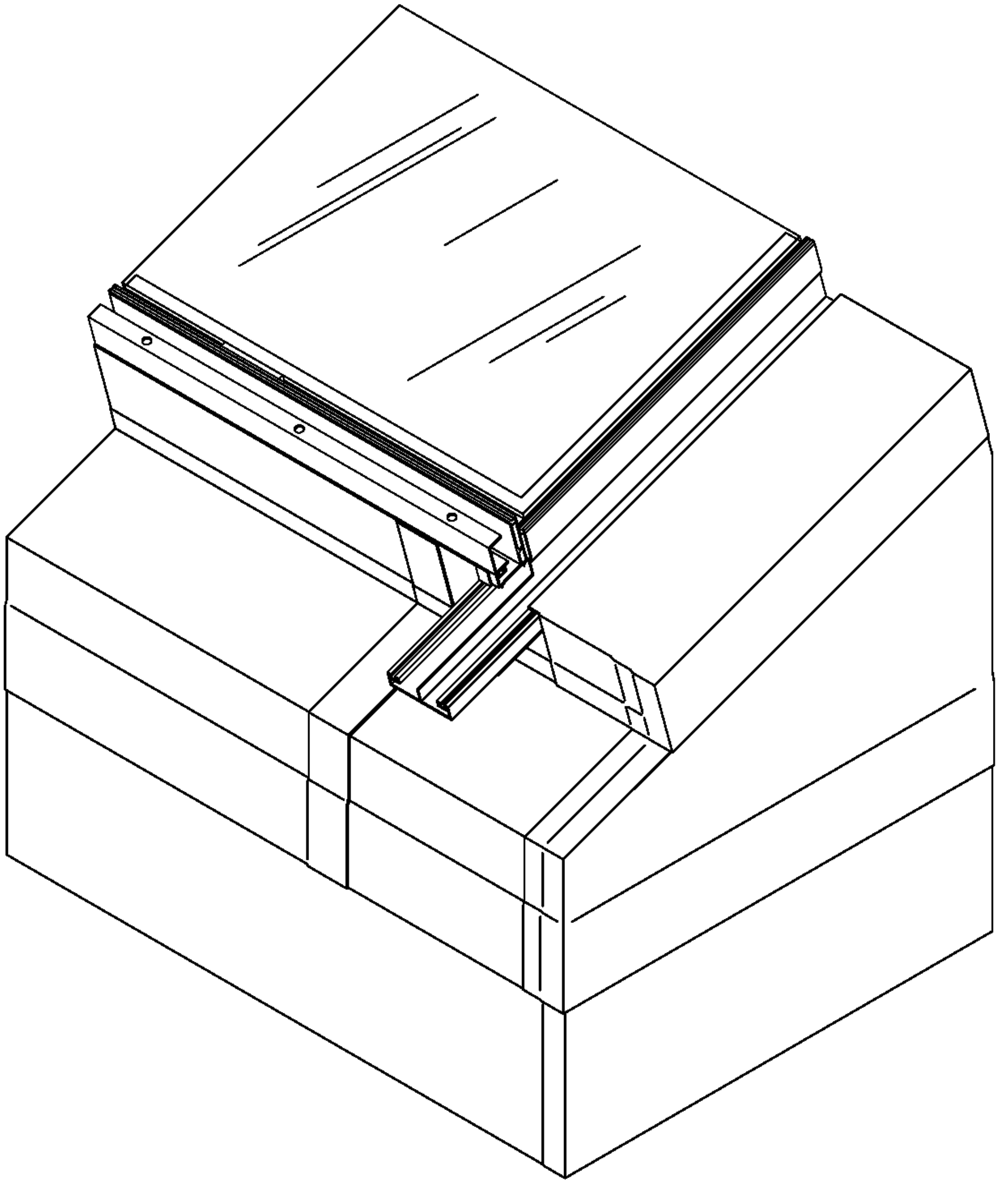
SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

DETAIL NUMBER 8

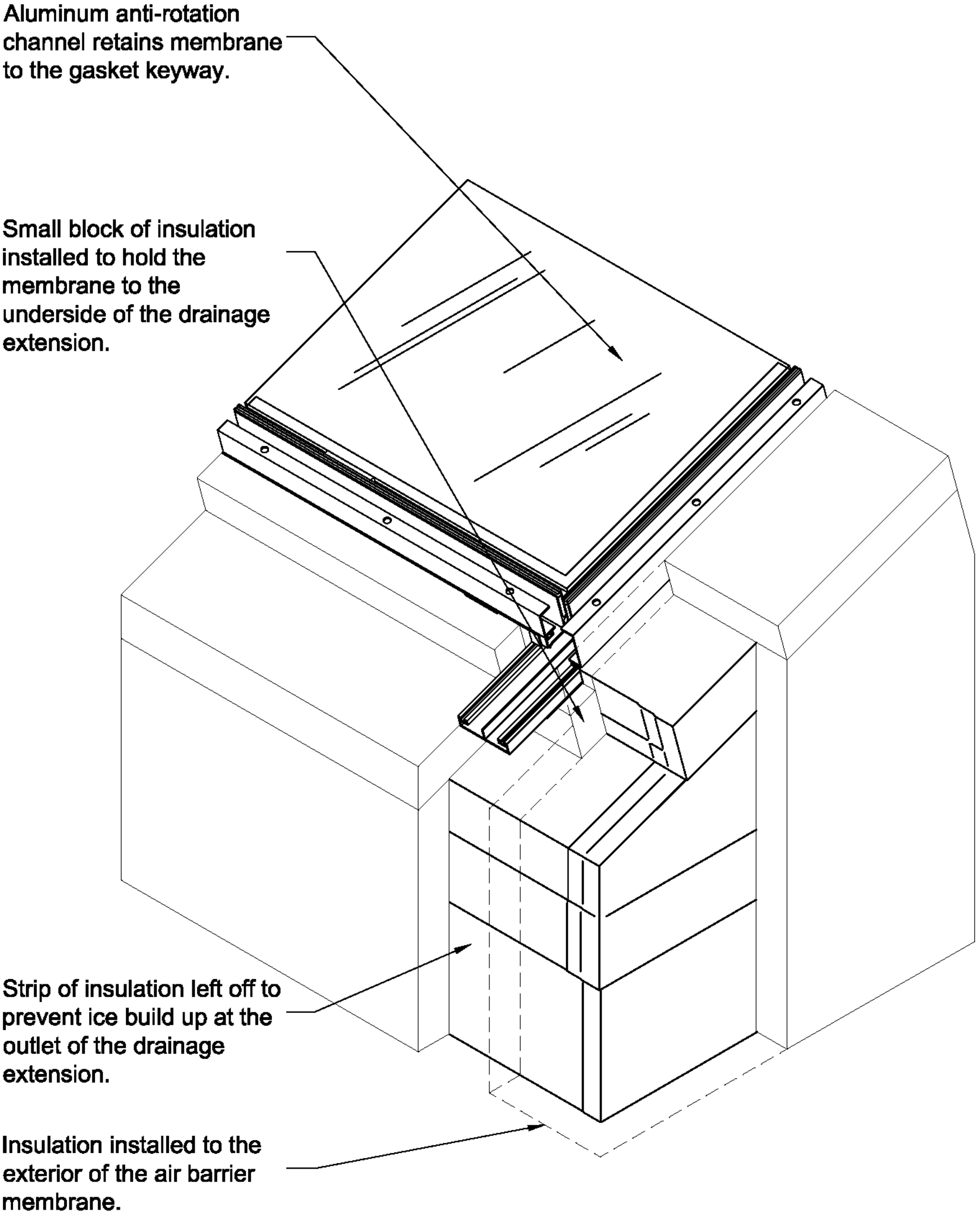
DRAWN BY	DATE	CHECKED BY	DATE
PETER BAKER	01-01-2005		

Completion of the membrane seal.



ASSEMBLY SEQUENCE 4 SKYLIGHT DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 9
DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE	

Alberta Infrastructure



Alberta Infrastructure

ASSEMBLY SEQUENCE 5

SKYLIGHT DETAILS

BUILDING SCIENCES SECTION

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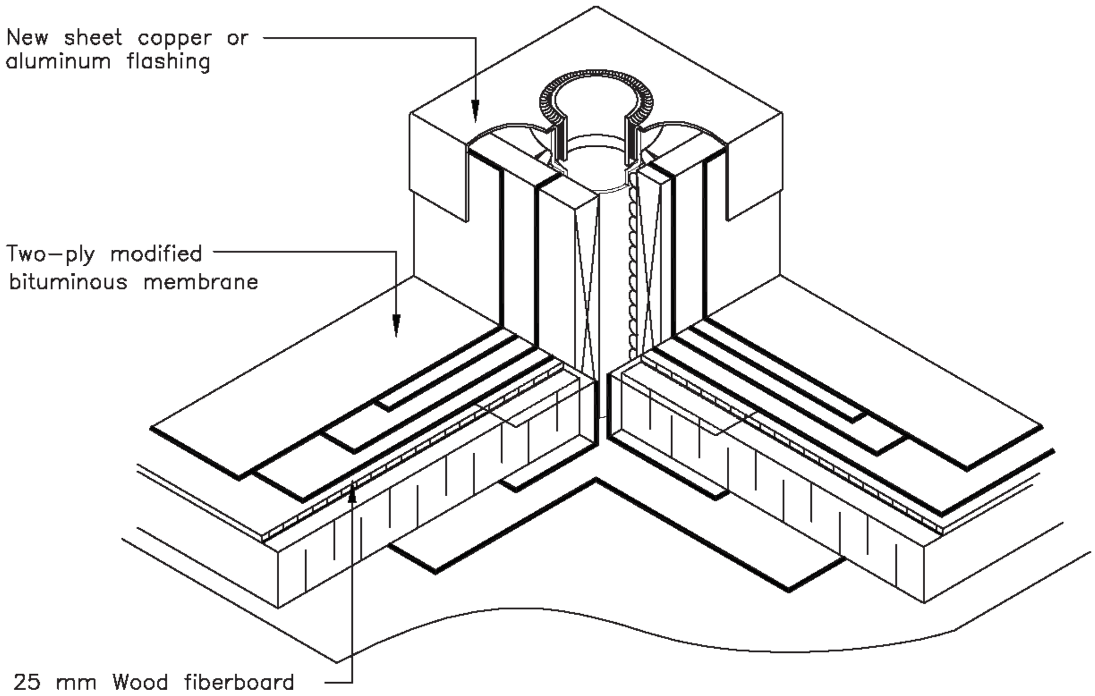

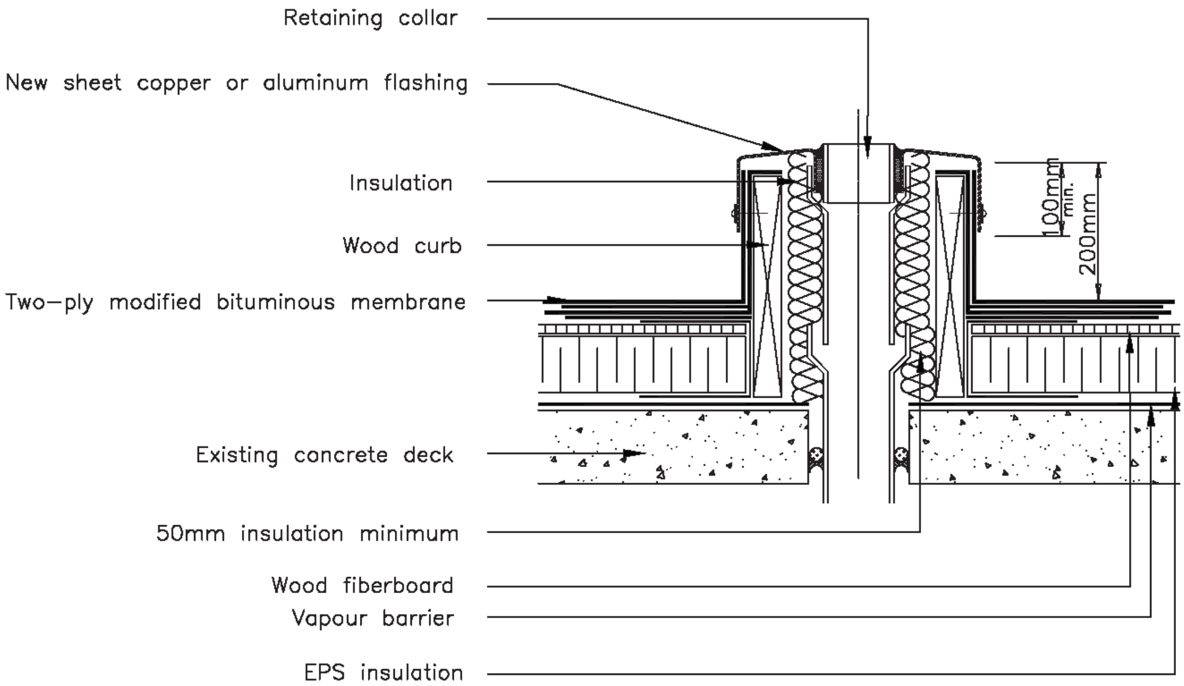

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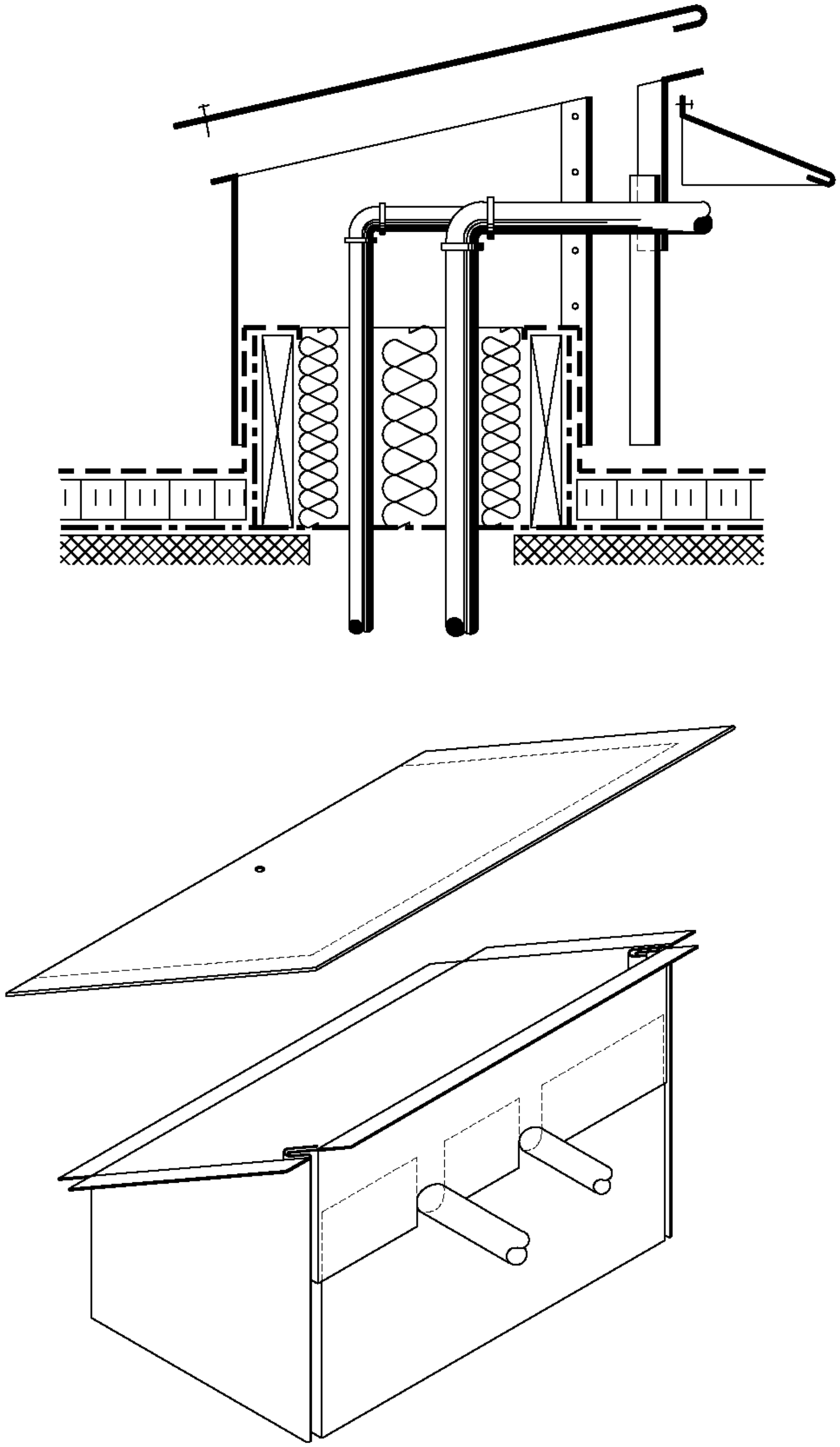
Alberta Infrastructure

PLUMBING VENT

BUILDING SCIENCES SECTION
TSB

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-05-03	V. SOLBAK	2012-05-03

DETAIL NUMBER
1



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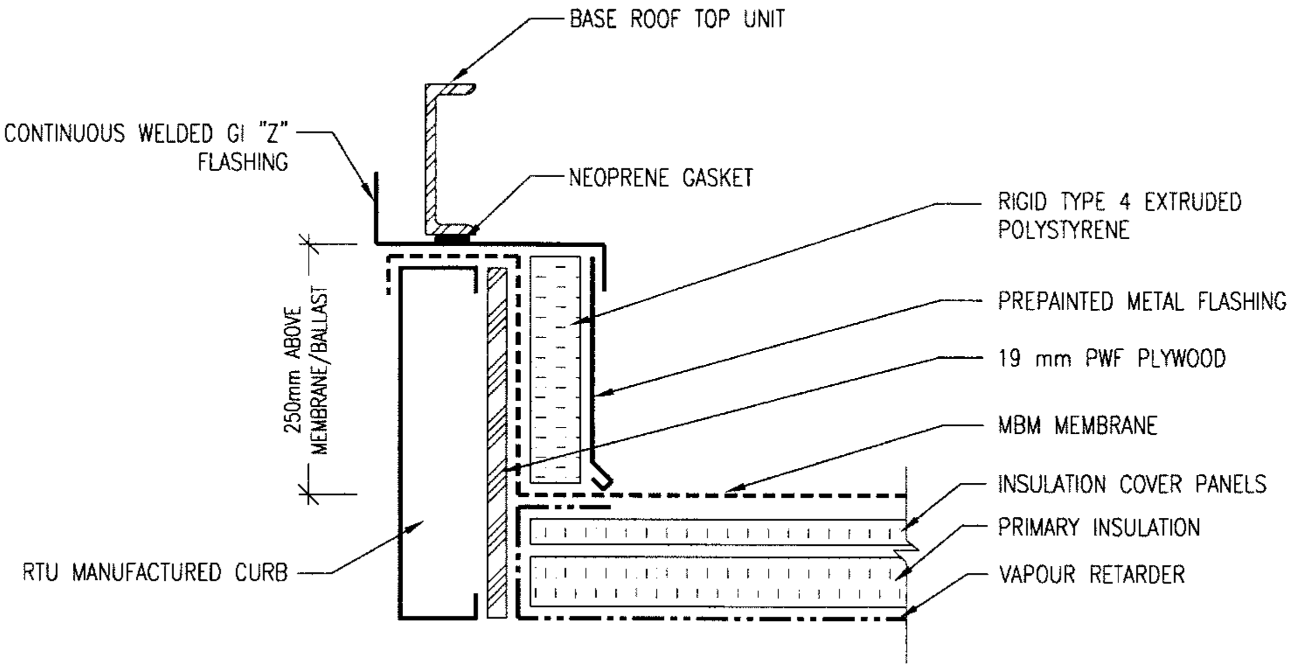
Alberta
Infrastructure

ROOF JACK DETAIL

BUILDING SCIENCES SECTION
TSB

DRAWN BY	DATE	CHECKED BY	DATE	DETAIL NUMBER
E. RIVERA	2012-02-07	V. SOLBAK	2012-02-07	1



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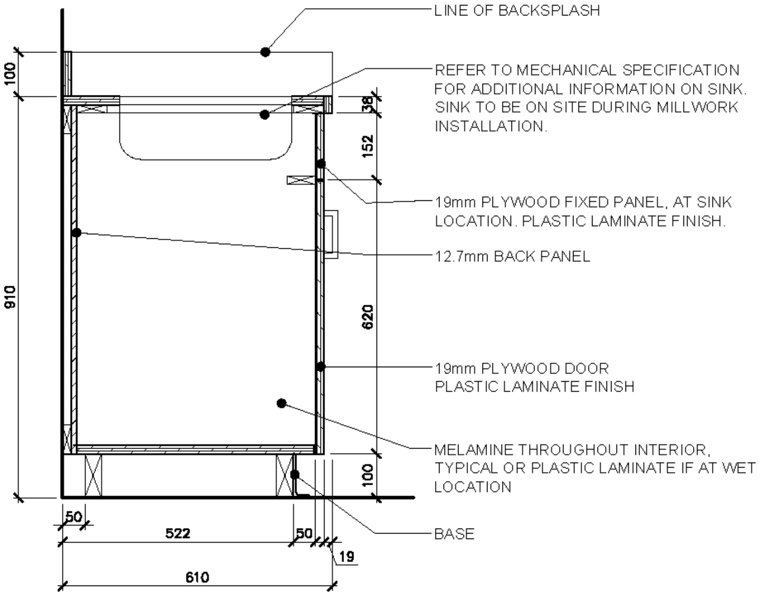
Alberta
Infrastructure

LOCATION - BLDG NAME
BID #
ROOF TOP UNIT DETAIL

Building Sciences
TSB

project ID:	drawn by:	date:	checked by:	date:	scale:	drawing no.:
BID...	E. Gozdzik	M/YY	WJK	M/YY	NTS	R..

Appendix E – Standard Millwork Detail



LINE OF BACKSPLASH

REFER TO MECHANICAL SPECIFICATION FOR ADDITIONAL INFORMATION ON SINK. SINK TO BE ON SITE DURING MILLWORK INSTALLATION.

19mm PLYWOOD FIXED PANEL, AT SINK LOCATION. PLASTIC LAMINATE FINISH.

12.7mm BACK PANEL

19mm PLYWOOD DOOR PLASTIC LAMINATE FINISH

MELAMINE THROUGHOUT INTERIOR, TYPICAL OR PLASTIC LAMINATE IF AT WET LOCATION

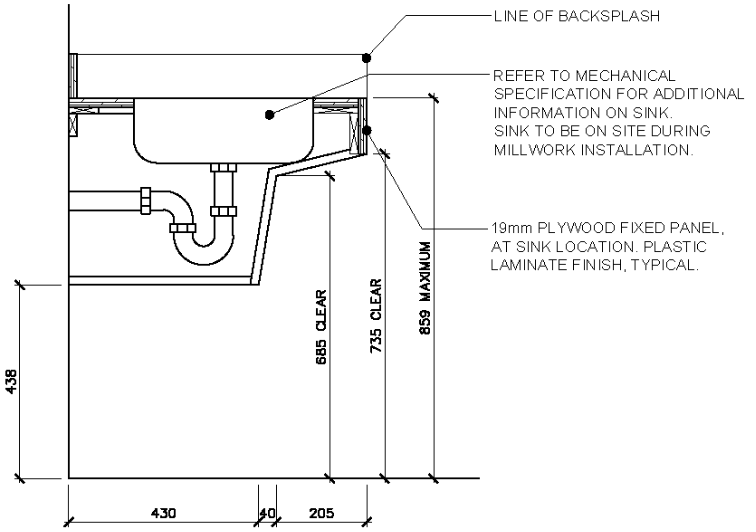
BASE

2A **COUNTER WITH SINK**

Scale: N.T.S

DETAIL NOTES:

- PROVIDE SILICONE SEALANT (CLEAR) AT BACK SPLASH AND COUNTER.
- FINISHES: REFER TO FINISH SCHEDULE AND SPECIFICATIONS FOR SPECIFIC INFORMATION.
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- BASE AND FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.



LINE OF BACKSPLASH

REFER TO MECHANICAL SPECIFICATION FOR ADDITIONAL INFORMATION ON SINK. SINK TO BE ON SITE DURING MILLWORK INSTALLATION.

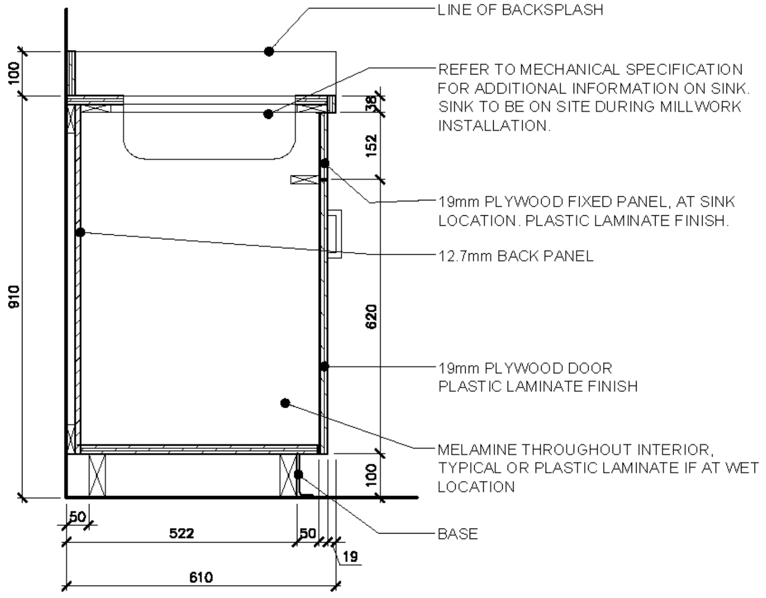
19mm PLYWOOD FIXED PANEL, AT SINK LOCATION. PLASTIC LAMINATE FINISH, TYPICAL.

2B **BARRIER - FREE COUNTER WITH SINK**

Scale: N.T.S

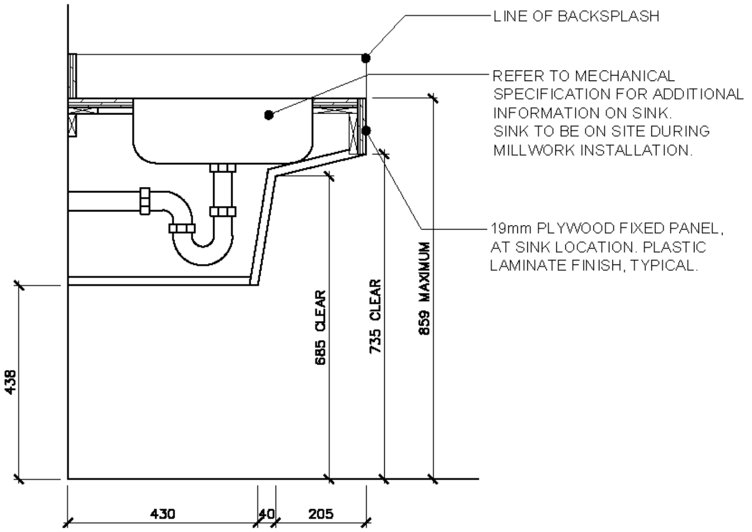
Alberta Infrastructure

MILLWORK SECTION		INTERIOR DESIGN SECTION		DETAIL NUMBER B
DRAWN BY EG	DATE 2015-10-22	CHECKED BY AF	DATE 2015-10-22	



2A **COUNTER WITH SINK**

Scale: N.T.S



2B **BARRIER - FREE COUNTER WITH SINK**

Scale: N.T.S

DETAIL NOTES:

- PROVIDE SILICONE SEALANT (CLEAR) AT BACK SPLASH AND COUNTER.
- FINISHES: REFER TO FINISH SCHEDULE AND SPECIFICATIONS FOR SPECIFIC INFORMATION.
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- BASE AND FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

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MILLWORK SECTION

INTERIOR DESIGN SECTION

DETAIL NUMBER
B

DRAWN BY	DATE	CHECKED BY	DATE
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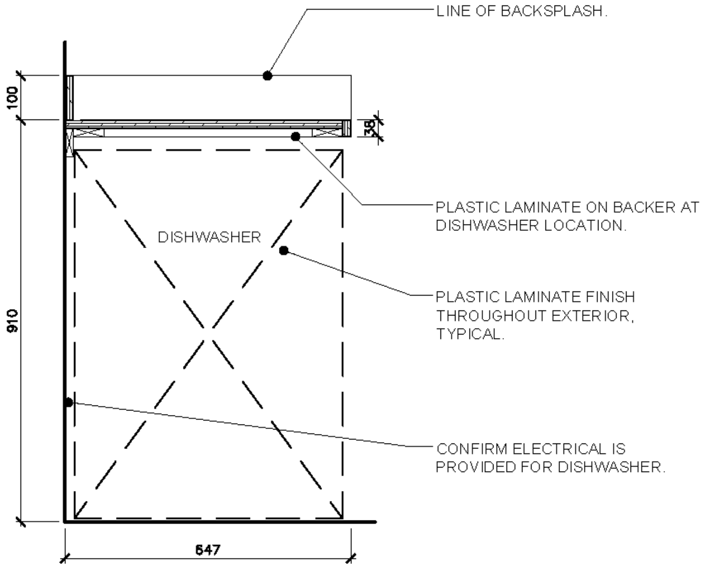


DETAIL NOTES:

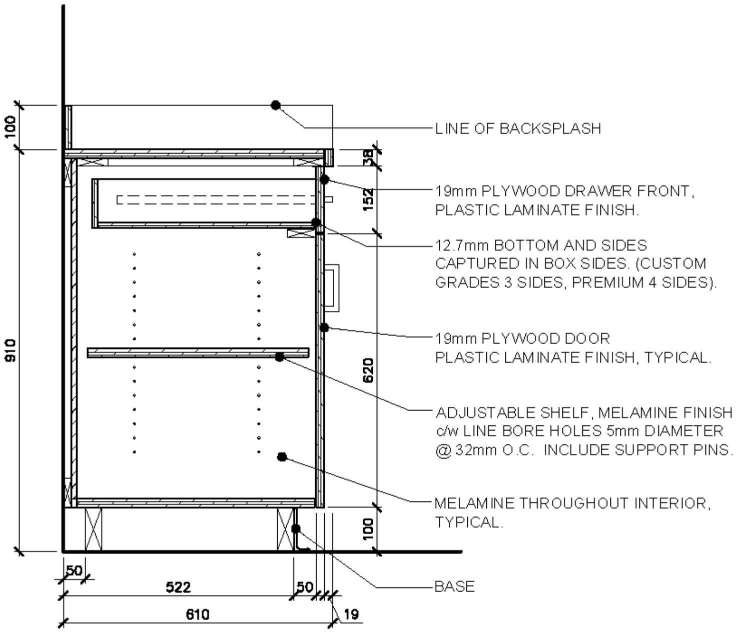
- PROVIDE SILICONE SEALANT (CLEAR) AT BACK SPLASH AND COUNTER.
- FINISHES: REFER TO FINISH SCHEDULE AND SPECIFICATIONS FOR SPECIFIC INFORMATION.
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- BASE AND FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

3 **COUNTER WITH DISHWASHER**

Scale: N.T.S

Alberta Infrastructure

MILLWORK SECTION		INTERIOR DESIGN SECTION		DETAIL NUMBER C
DRAWN BY EG	DATE 2015-10-22	CHECKED BY AF	DATE 2015-10-22	



DETAIL NOTES:

- PROVIDE SILICONE SEALANT (CLEAR) AT BACK SPLASH AND COUNTER.
- FINISHES: REFER TO FINISH SCHEDULE AND SPECIFICATIONS FOR SPECIFIC INFORMATION.
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- BASE AND FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

4 **COUNTER WITH SINGLE DRAWER**

Scale: N.T.S

Infrastructure

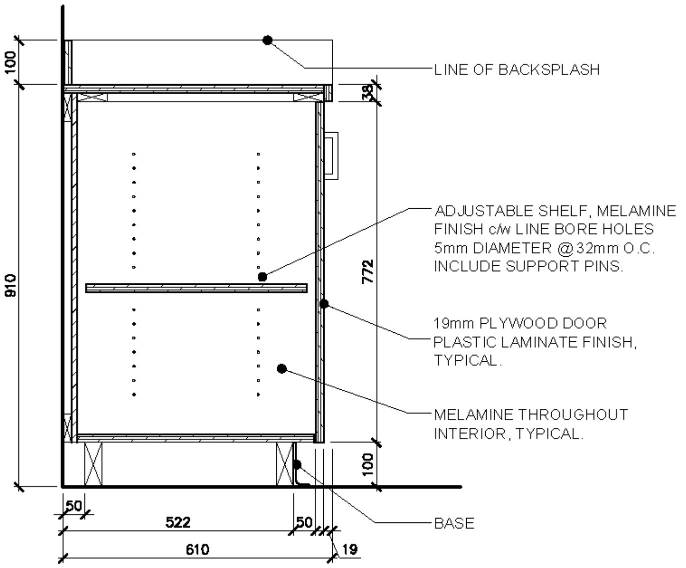
MILLWORK SECTION

INTERIOR DESIGN SECTION

DETAIL NUMBER

D

DRAWN BY	DATE	CHECKED BY	DATE
EG	2015-10-22	AF	2015-10-22



5 **STANDARD COUNTER**

Scale: N.T.S

DETAIL NOTES:

- PROVIDE SILICONE SEALANT (CLEAR) AT BACK SPLASH AND COUNTER.
- FINISHES: REFER TO FINISH SCHEDULE AND SPECIFICATIONS FOR SPECIFIC INFORMATION.
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- BASE AND FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

Alberta
Infrastructure

MILLWORK SECTION

INTERIOR DESIGN SECTION

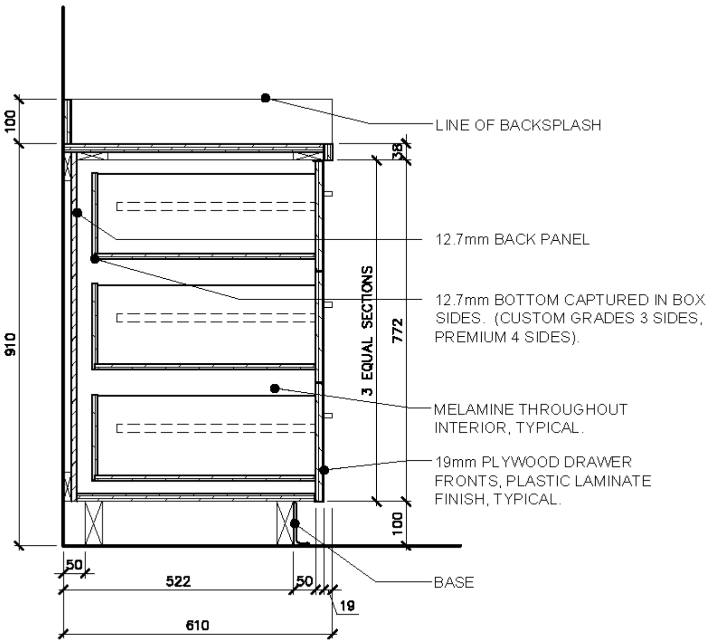
DETAIL NUMBER
E

DRAWN BY
EG

DATE
2015-10-22

CHECKED BY
AF

DATE
2015-10-22



6A **COUNTER WITH 3 DRAWERS**

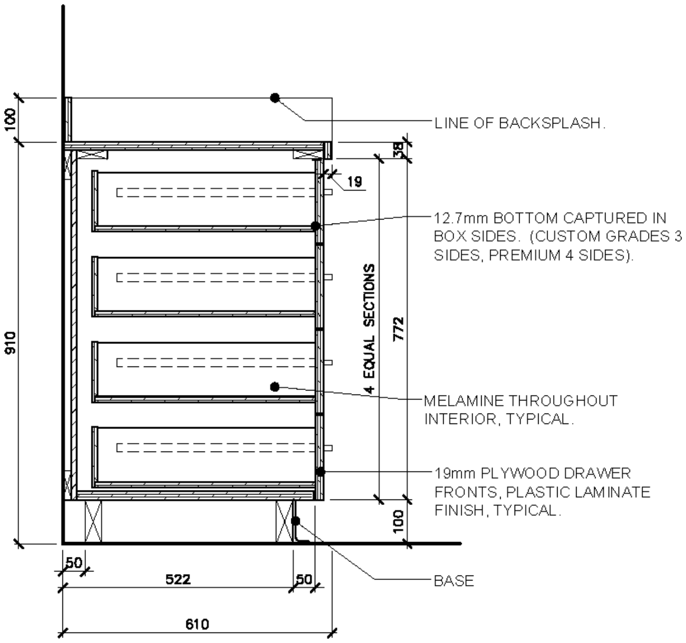
Scale: N.T.S

DETAIL NOTES:

- PROVIDE SILICONE SEALANT (CLEAR) AT BACK SPLASH AND COUNTER.
- FINISHES: REFER TO FINISH SCHEDULE AND SPECIFICATIONS FOR SPECIFIC INFORMATION.
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- BASE AND FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

Alberta
Infrastructure

MILLWORK SECTION		INTERIOR DESIGN SECTION		DETAIL NUMBER F
DRAWN BY EG	DATE 2015-10-22	CHECKED BY AF	DATE 2015-10-22	



6B **COUNTER WITH 4 DRAWERS**

Scale: N.T.S

DETAIL NOTES:

- PROVIDE SILICONE SEALANT (CLEAR) AT BACK SPLASH AND COUNTER.
- FINISHES: REFER TO FINISH SCHEDULE AND SPECIFICATIONS FOR SPECIFIC INFORMATION.
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- BASE AND FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

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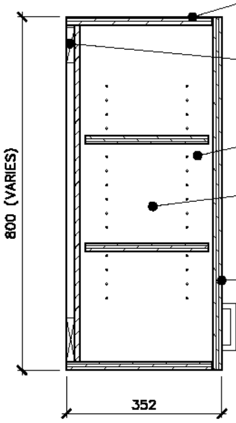
Infrastructure

MILLWORK SECTION		INTERIOR DESIGN SECTION	DETAIL NUMBER G
DRAWN BY EG	DATE 2015-10-22	CHECKED BY AF	DATE 2015-10-22



PLASTIC LAMINATE TO ALL EXPOSED SURFACES, TYPICAL.

PROVIDE BLOCKING IN PARTITION. BLOCKING TO SUIT WALL HANG UPPER CABINET.

MELAMINE THROUGHOUT INTERIOR CABINET, TYPICAL.

ADJUSTABLE SHELVES MELAMINE FINISH c/w LINE BORE HOLES 5mm DIA. @ 32mm O.C. INCLUDE SHELF SUPPORT PINS.

19mm PLYWOOD DOOR PLASTIC LAMINATE FINISH, TYPICAL.

DETAIL NOTES:

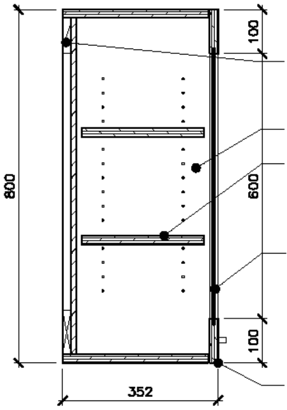
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

7A **OVERHEAD CABINET**

Scale: N.T.S

Alberta
Infrastructure

MILLWORK SECTION		INTERIOR DESIGN SECTION		DETAIL NUMBER H
DRAWN BY EG	DATE 2015-10-22	CHECKED BY AF	DATE 2015-10-22	



PROVIDE BLOCKING IN PARTITION. BLOCKING TO SUIT WALL HANG UPPER CABINET.

MELAMINE THROUGHOUT INTERIOR, TYPICAL.

ADJUSTABLE SHELVES MELAMINE FINISH c/w LINE BORE HOLES 5mm DIA. @ 32mm O.C. INCLUDE SHELF SUPPORT PINS.

6mm TEMPERED FROSTED FINISH SAFETY GLASS SLOTTED INTO 8mm x 13mm DADO, BY MILLWORKER UNLESS SPECIFIED OTHERWISE. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.

19mm PLYWOOD DOOR, PLASTIC LAMINATE FINISH.

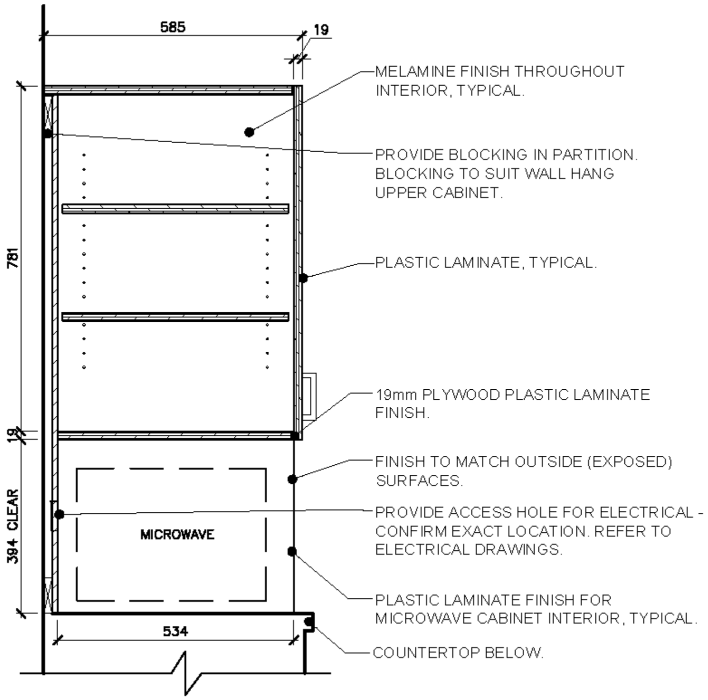
DETAIL NOTES:

- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

7B OVERHEAD CABINET WITH GLASS

Scale: N.T.S

Alberta Infrastructure	MILLWORK SECTION		INTERIOR DESIGN SECTION	DETAIL NUMBER I
	DRAWN BY EG	DATE 2015-10-22	CHECKED BY AF	DATE 2015-10-22



DETAIL NOTES:

- PROVIDE SILICONE SEALANT (CLEAR) AT BACK SPLASH AND COUNTER.
- FINISHES: REFER TO FINISH SCHEDULE AND SPECIFICATIONS FOR SPECIFIC INFORMATION.
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- BASE AND FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- CONFIRM MICROWAVE SIZE WITH CLIENT.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

8A **SINGLE MICROWAVE CABINET**
Scale: N.T.S

Alberta
Infrastructure

MILLWORK SECTION

INTERIOR DESIGN SECTION

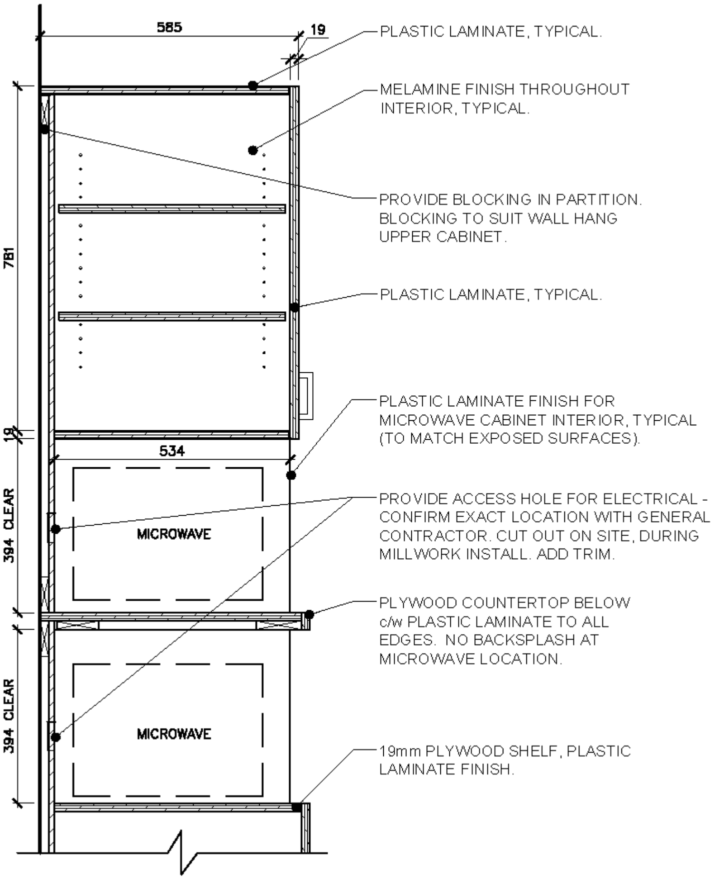
DETAIL NUMBER
J

DRAWN BY
EG

DATE
2015-10-22

CHECKED BY
AF

DATE
2015-10-22



DETAIL NOTES:

- PROVIDE SILICONE SEALANT (CLEAR) AT BACK SPLASH AND COUNTER.
- FINISHES: REFER TO FINISH SCHEDULE AND SPECIFICATIONS FOR SPECIFIC INFORMATION.
- PULLS: REFER TO SPECIFICATIONS FOR SPECIFIC INFORMATION.
- BASE AND FINISHES: REFER TO FINISH SCHEDULE FOR SPECIFIC INFORMATION.
- REFER TO SPECIFICATION FOR SPECIFIC HARDWARE INFORMATION.
- CONFIRM MICROWAVE SIZE WITH CLIENT.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) USE SOLID 3-5mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY (DUE TO TENDENCY OF LAMINATES TO CHIP OR DE-LAMINATE IN THESE APPLICATIONS) OR USE SOLID 3-5mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

8B **DOUBLE MICROWAVES CABINET**
Scale: N.T.S

Alberta
Infrastructure

MILLWORK SECTION

INTERIOR DESIGN SECTION

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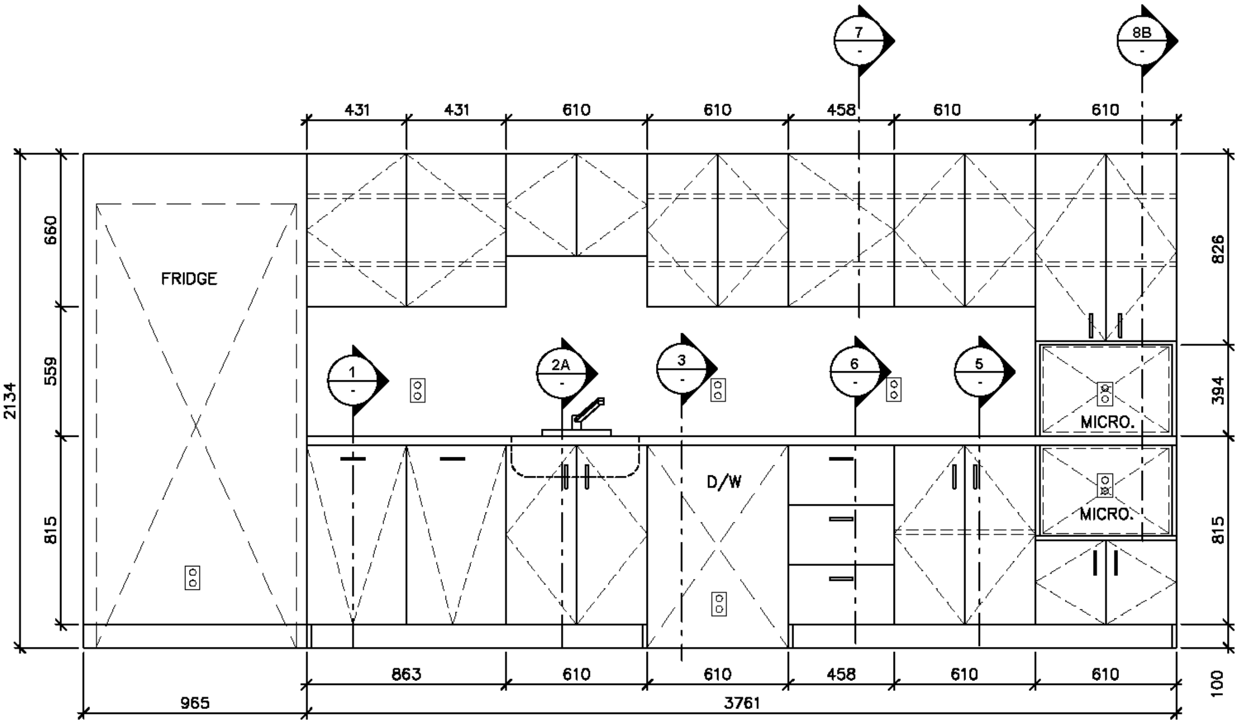
EG	2015-10-22	AF	2015-10-22	K



Alberta
Infrastructure

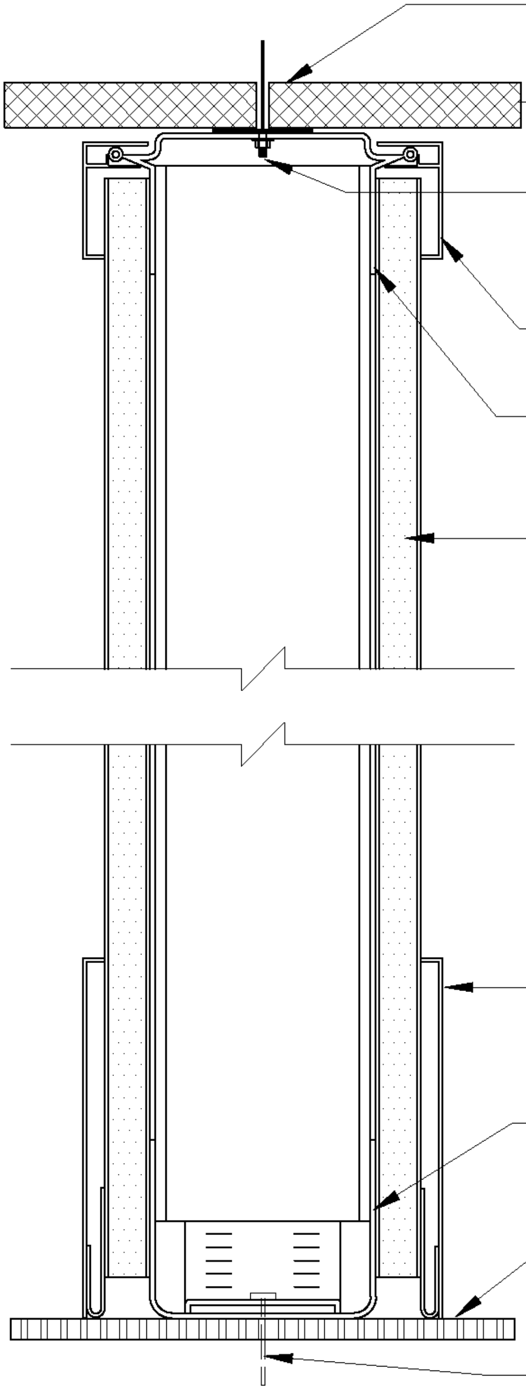
MILLWORK SECTION
KITCHENETTE

INTERIOR DESIGN SECTION

DETAIL
NUMBER
L

DRAWN BY EG	DATE 2015-10-22	CHECKED BY AF	DATE 2015-10-22

Appendix F – Standard Interior Partition Details



T-BAR CEILING

CEILING ASSEMBLY
MINIUMUM CAC 35

STAGGER T-BARS 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 0.C.

100 mm P.V.C. CLIP-ON BASE

64 mm STEEL BASE TRACK

FLOOR MATERIAL

BOTTOM PLATE FASTENED
1200 mm O.C.

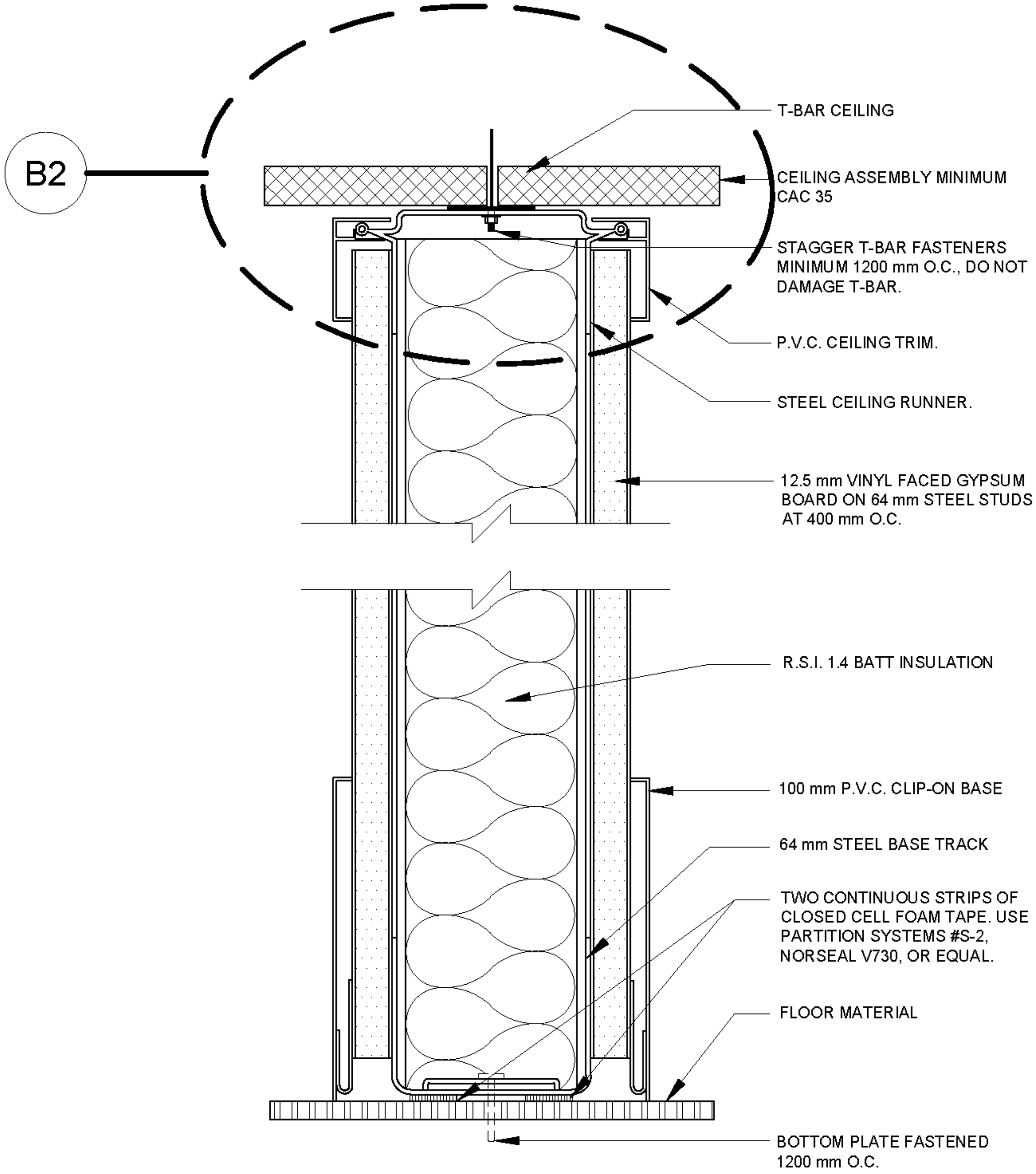
A TYPICAL DEMOUNTABLE PARTITION

SCALE: 1:2

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\A.dwg Dec 09, 2014 - 9:27am

Alberta Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER A
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	



B1 DEMOUNTABLE PARTITION C/W INSULATION

SCALE: 1:2

Alberta
Infrastructure

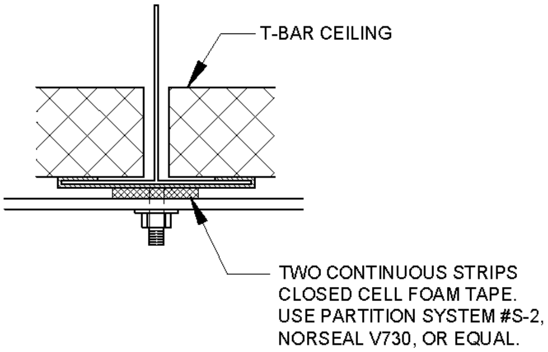
INTERIOR DETAILS

INTERIOR DESIGN SECTION

DETAIL NUMBER
B

DRAWN BY	DATE	CHECKED BY	DATE
E. GOZDZIK	2014-11-28	A. FARHALL	2014-11-28

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\B.dwg Dec 09, 2014 - 9:27am



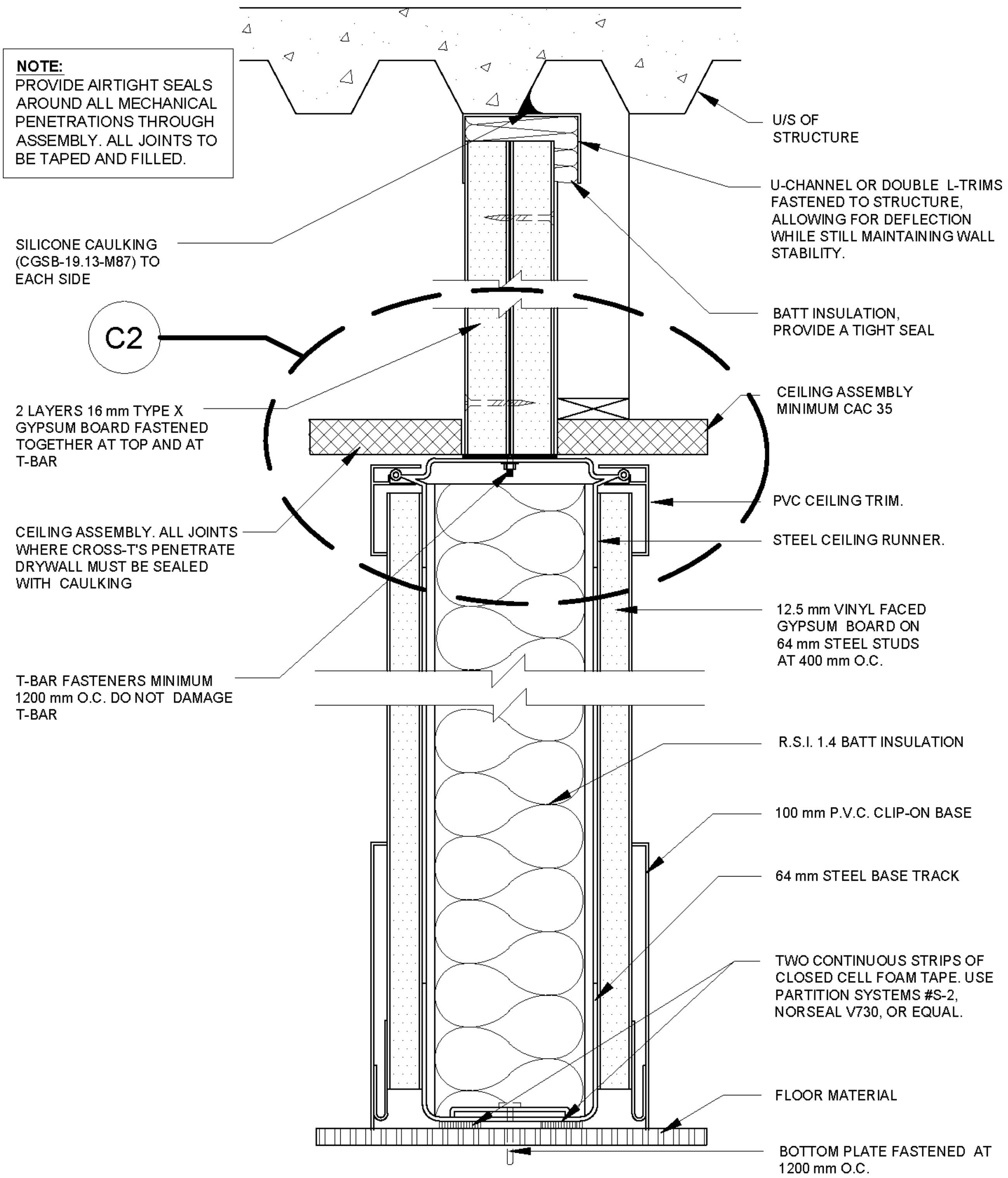
B2 DETAIL OF T - BAR AND CLIP CONNECTION

SCALE: 1:1

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\B.dwg Dec 09, 2014 - 9:36am

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER B
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	

NOTE:
PROVIDE AIRTIGHT SEALS AROUND ALL MECHANICAL PENETRATIONS THROUGH ASSEMBLY. ALL JOINTS TO BE TAPED AND FILLED.



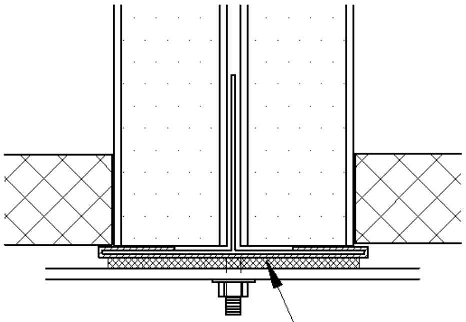
C1 DEMOUNTABLE PARTITION C/W PLENUM SOUND BARRIER

SCALE: 1:2

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\C.dwg Dec 09, 2014 - 9:28am

Alberta Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION	DETAIL NUMBER C
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28



TWO CONTINUOUS STRIPS
CLOSED CELL FOAM TAPE.
USE PARTITION SYSTEM #S-2,
NORSEAL V730, OR EQUAL.

C2 DETAIL OF T - BAR AND CLIP CONNECTION

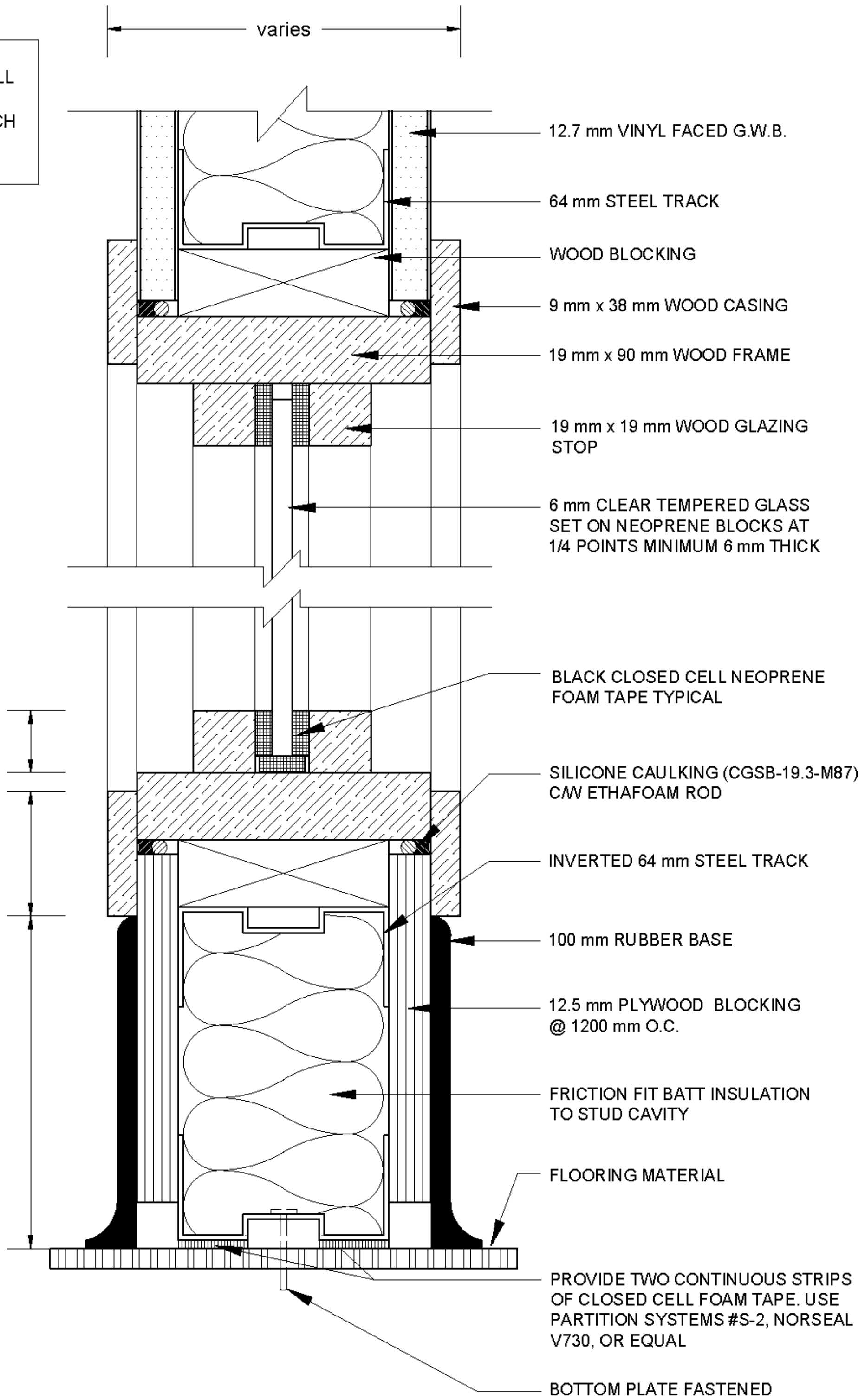
SCALE: 1:1

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\C.dwg Dec 09, 2014 - 9:38am

Alberta Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION	DETAIL NUMBER C
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28

NOTE:
PARTITION TYPE SHALL NOT BE USED WHERE CONFIDENTIAL SPEECH PRIVACY BETWEEN ROOMS IS REQUIRED.



D INSULATED GYPSUM WALL BOARD PARTITION C/W SINGLE GLAZING

SCALE: 1:2

Alberta Infrastructure	INTERIOR DETAILS		INTERIOR DESIGN SECTION	DETAIL NUMBER D
	DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28

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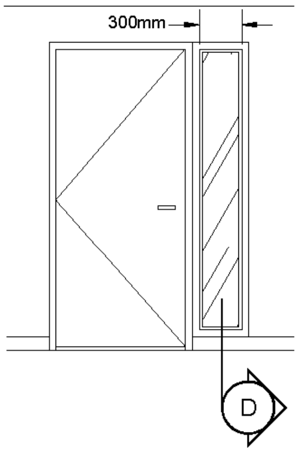
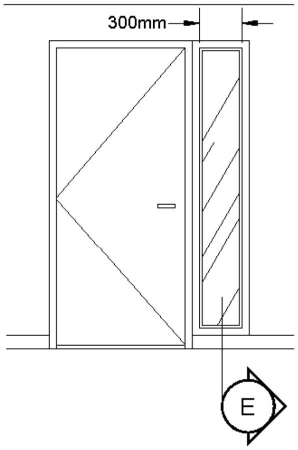


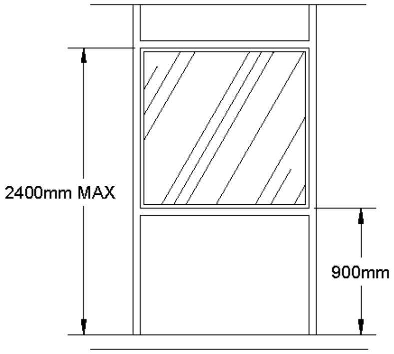
DOOR & SIDELIGHT C/W WOOD FRAMES

SCALE: 1:50



DOOR & SIDELIGHT C/W DEMOUNTABLE PARTITION FRAME

SCALE: 1:50



GLAZING C/W DEMOUNTABLE PARTITION FRAME

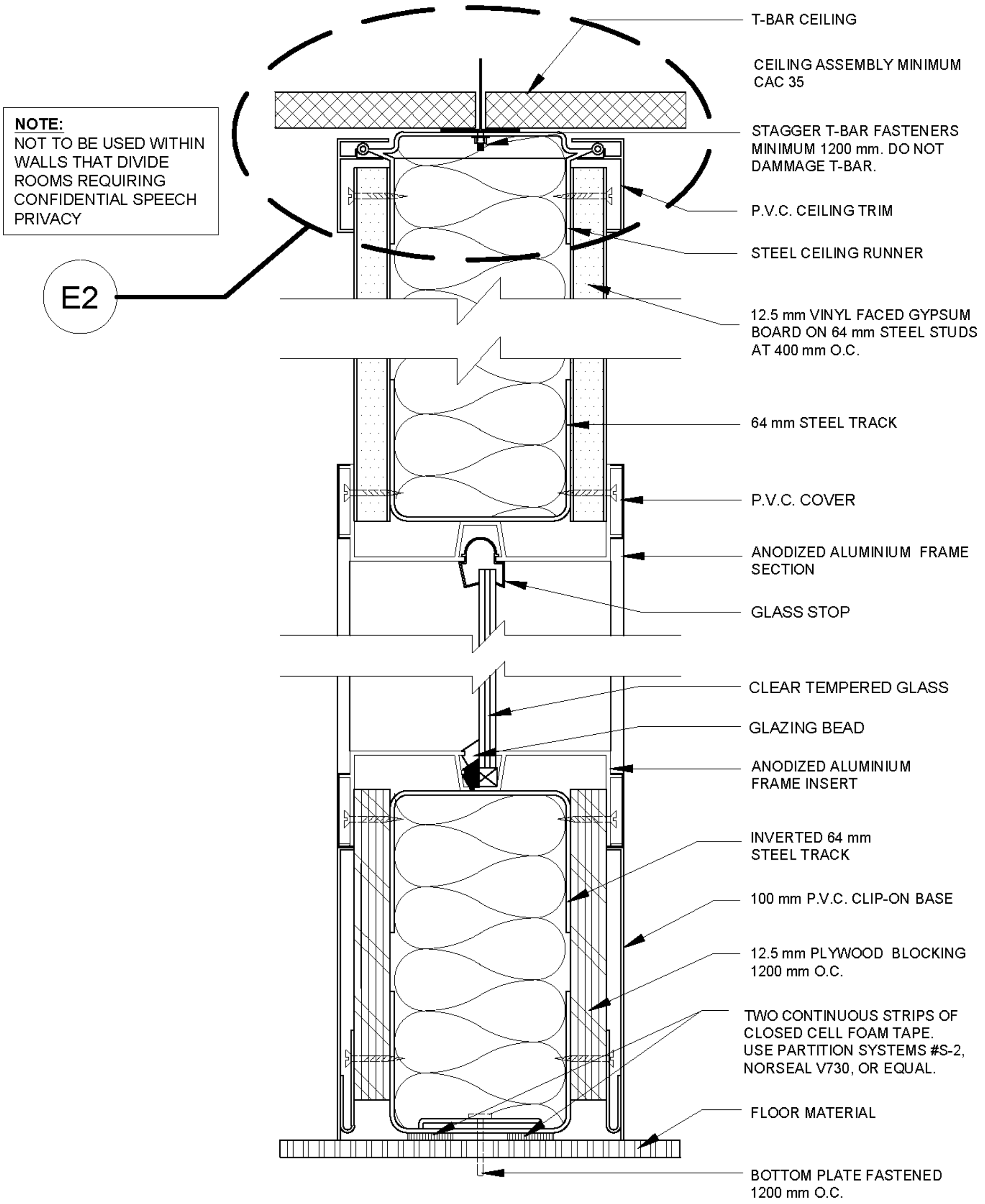
SCALE: 1:50

NOTE: OPTIONAL ELEVATION FOR GLAZING WTHIN TYPE D OR E

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\D_Elevations.dwg Dec 09, 2014 - 9:32am

Alberta
Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER D
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	



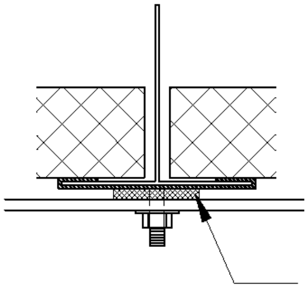
E1 **DEMOUNTABLE PARTITION C/W SINGLE GLAZING**

SCALE: 1:2

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\E.dwg Dec 09, 2014 - 9:34am

Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER E
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	



TWO CONTINUOUS STRIPS
CLOSED CELL FOAM TAPE.
USE PARTITION SYSTEM #S-2,
NORSEAL V730, OR EQUAL.

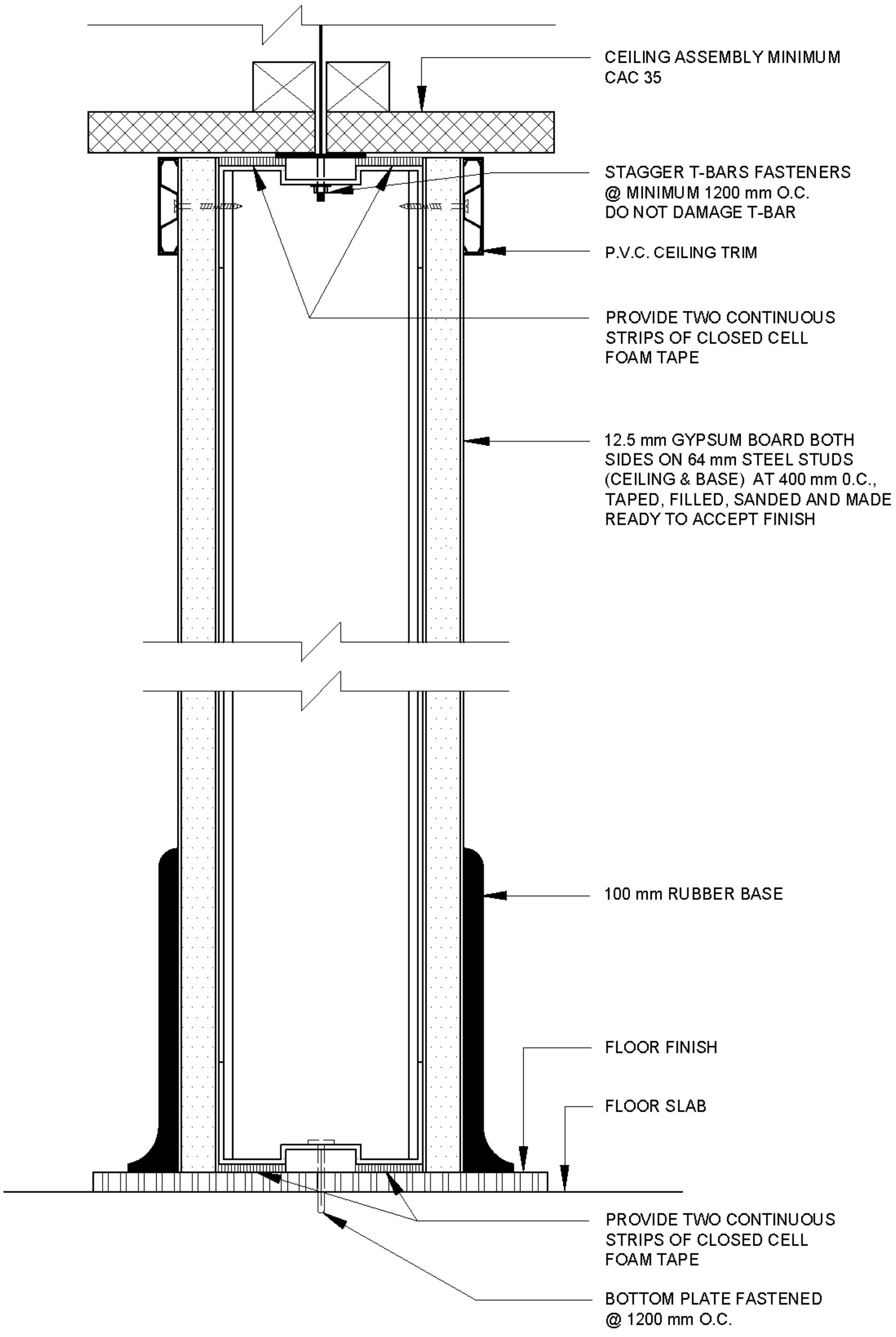
E2 **DETAIL OF T - BAR AND CLIP CONNECTION**

SCALE: 1:1

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\E.dwg Dec 09, 2014 - 9:40am

Alberta Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION	DETAIL NUMBER E
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28



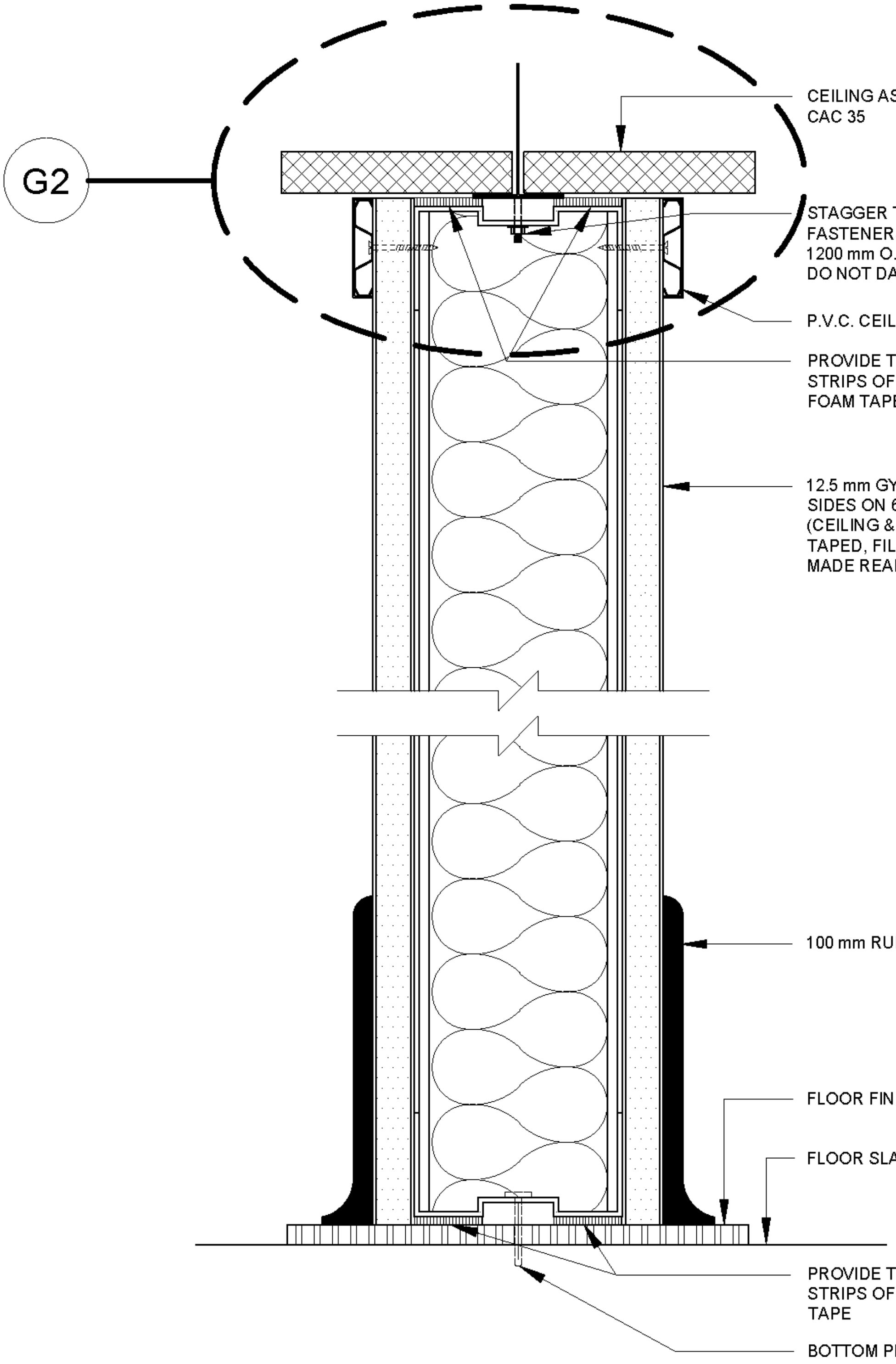
F **GYPSUM BOARD PARTITION**

SCALE: 1:2

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\F.dwg Dec 09, 2014 - 9:41am

Alberta
Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER F
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	



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 0.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.

G1 **GYPSUM BOARD PARTITION C/W INSULATION**

SCALE: 1:2

Alberta
Infrastructure

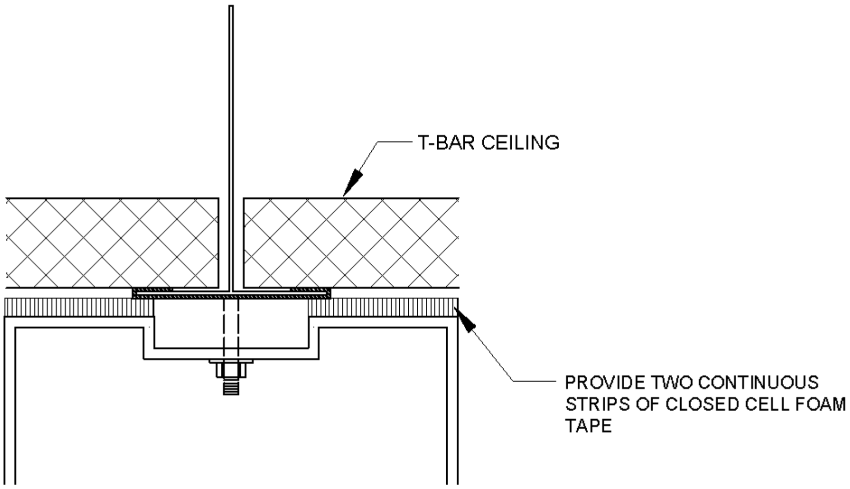
INTERIOR DETAILS

INTERIOR DESIGN SECTION

DETAIL
NUMBER
G

DRAWN BY	DATE	CHECKED BY	DATE
E. GOZDZIK	2014-11-28	A. FARHALL	2014-11-28

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\G.dwg Dec 09, 2014 - 9:42am



G2 **DETAIL OF T - BAR AND CLIP CONNECTION**

SCALE: 1:1

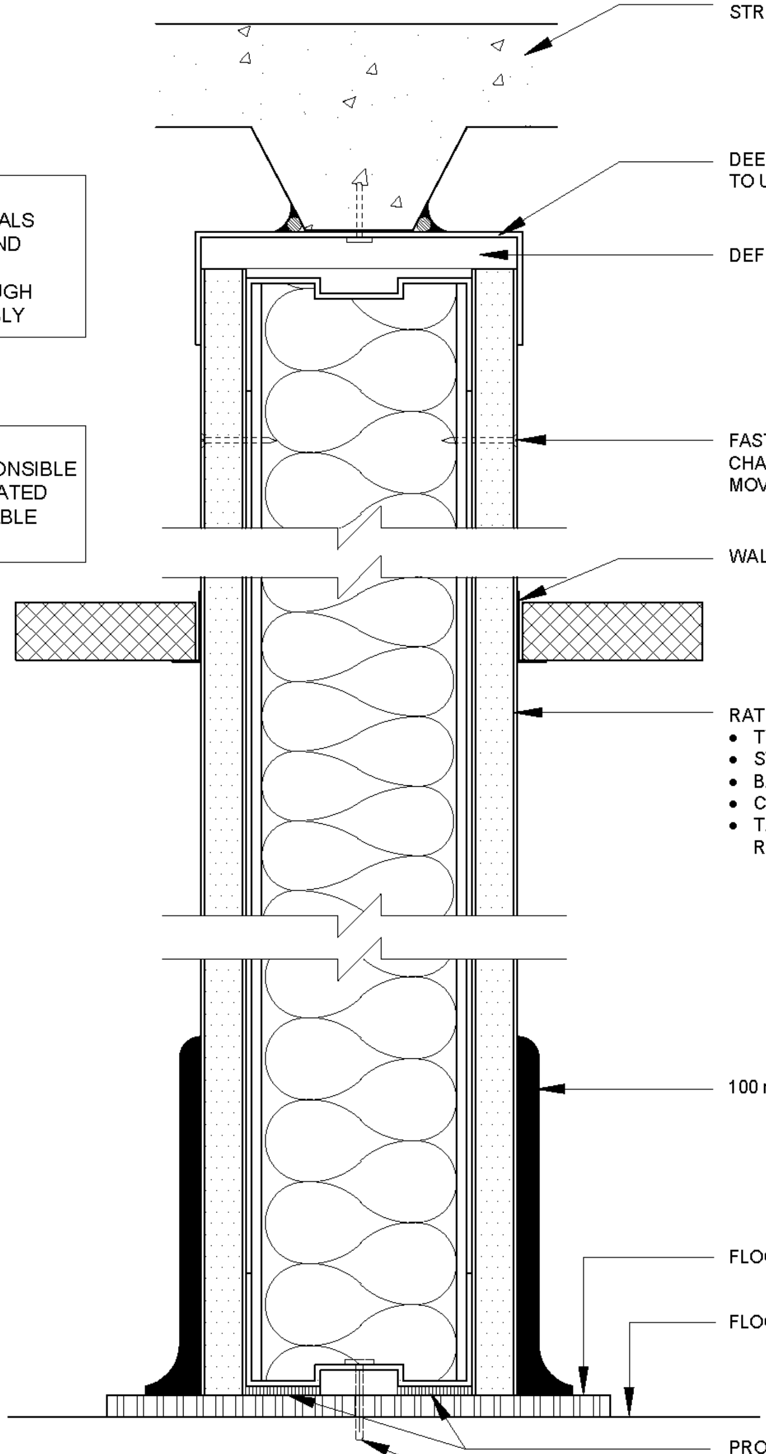
Alberta Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER G
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\G.dwg Dec 09, 2014 - 9:42am

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.



STRUCTURE ABOVE

DEEP TRACK CHANNEL FASTENED TO U/S OF DECK

DEFLECTION JOINT

FASTEN GWB BELOW TRACK CHANNEL TO ALLOW FOR MOVEMENT

WALL ANGLE + CEILING ASSEMBLY

RATED PARTITION:
- TYPE X GWB
- STEEL STUDS @ 400 mm O.C.
- BATT INSULATION TO ALL VOIDS
- CONSTRUCT TO U/S OF DECK
- TAPE, FILL, SAND, MAKE READY TO RECEIVE NEW WALL 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.

H FIRE RATED PARTITION

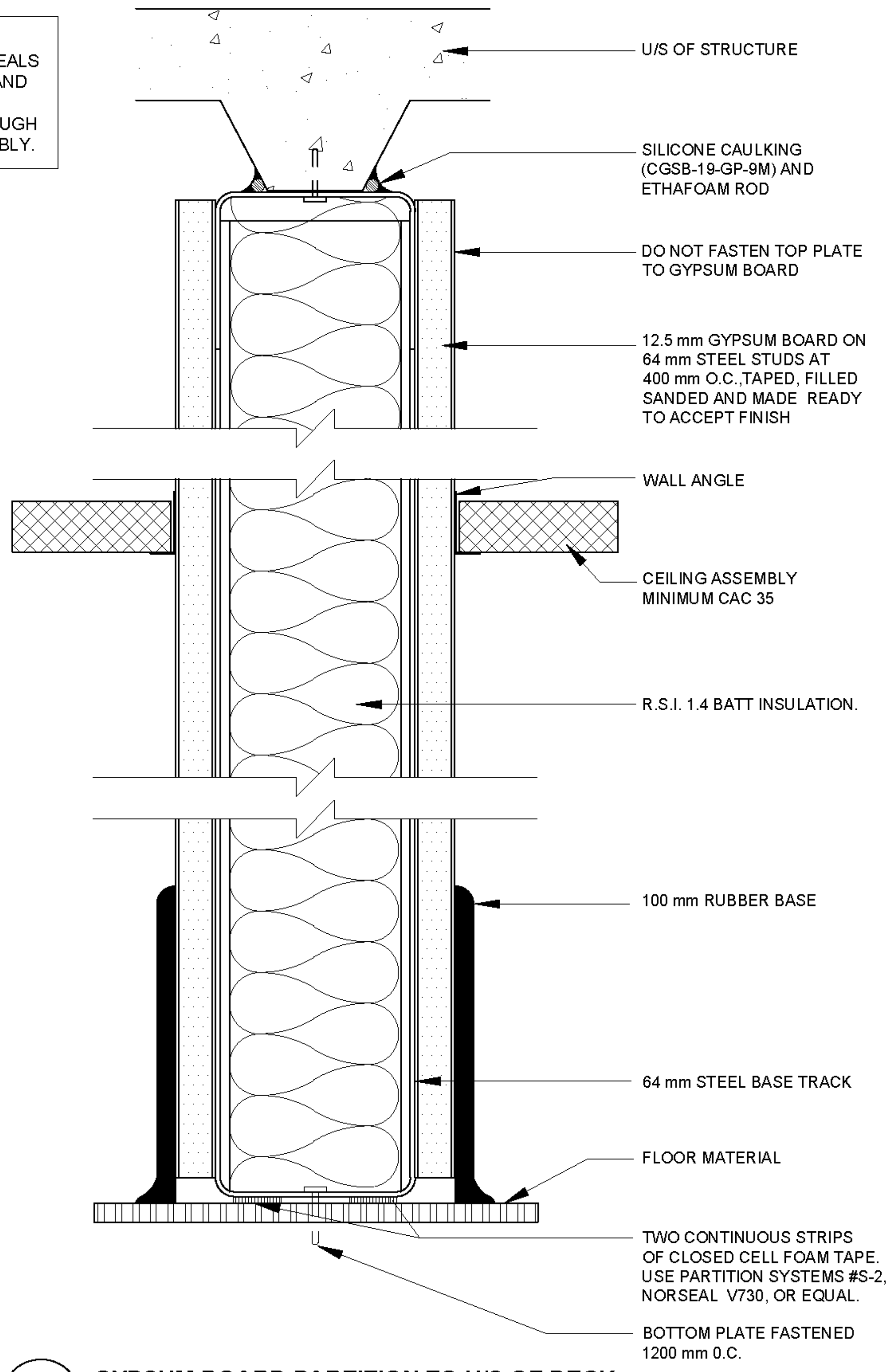
SCALE: 1:2

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\H.dwg Dec 09, 2014 - 9:43am

Alberta Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER H
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	

NOTE:
PROVIDE AIR TIGHT SEALS AROUND ALL PIPING AND OTHER MECHANICAL PENETRATIONS THROUGH WALL CEILING ASSEMBLY.



I

GYPSUM BOARD PARTITION TO U/S OF DECK

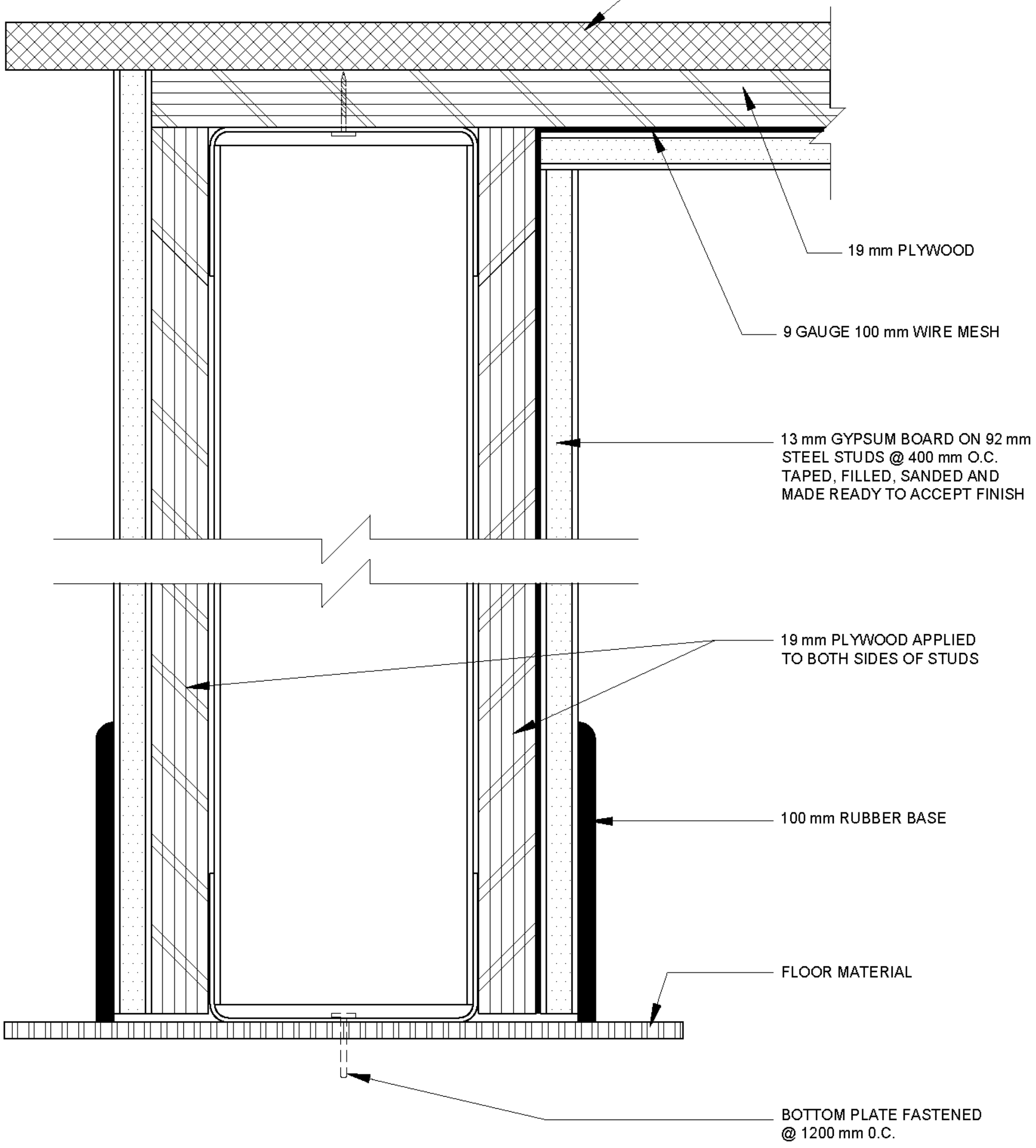
SCALE: 1:2

Alberta
Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER I
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\I.dwg Dec 09, 2014 - 9:43am

NOTE:
REFERE TO "TECHNICAL CRITERIA" DOCUMENT FOR HIGHER LEVELS OF SECURITY NEEDS.



J

GYPSUM BOARD/PLYWOOD PARTITION AND CEILING - SECURE STORAGE

SCALE: 1:2

Alberta
Infrastructure

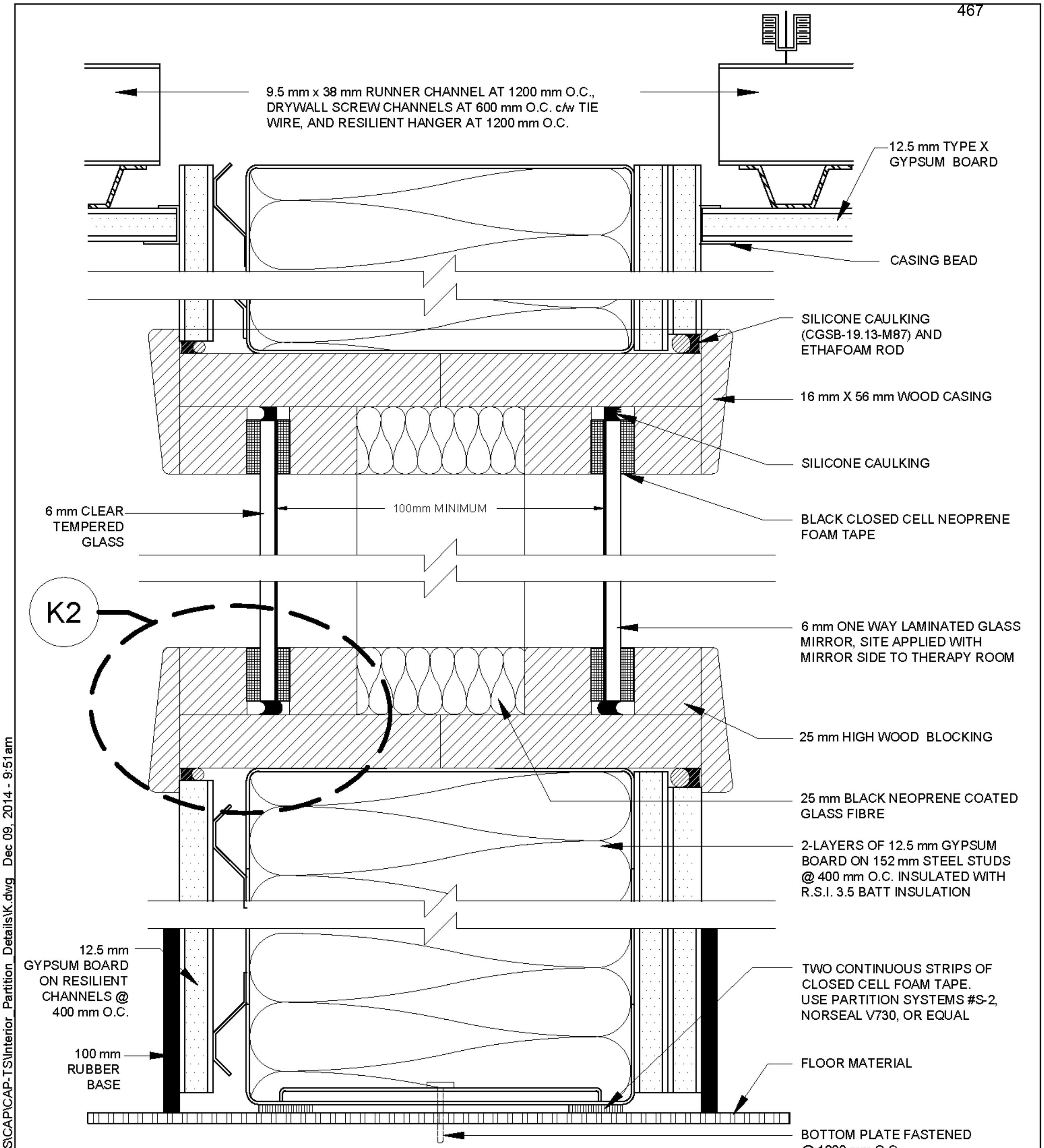
INTERIOR DETAILS

INTERIOR DESIGN SECTION

DETAIL NUMBER
J

DRAWN BY	DATE	CHECKED BY	DATE
E. GOZDZIK	2014-11-28	A. FARHALL	2014-11-28

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\J.dwg Dec 09, 2014 - 9:44am



K1 GYPSUM BOARD PARTITION C/W GYPSUM BOARD CEILING - THERAPY/OBSERVATION ROOM

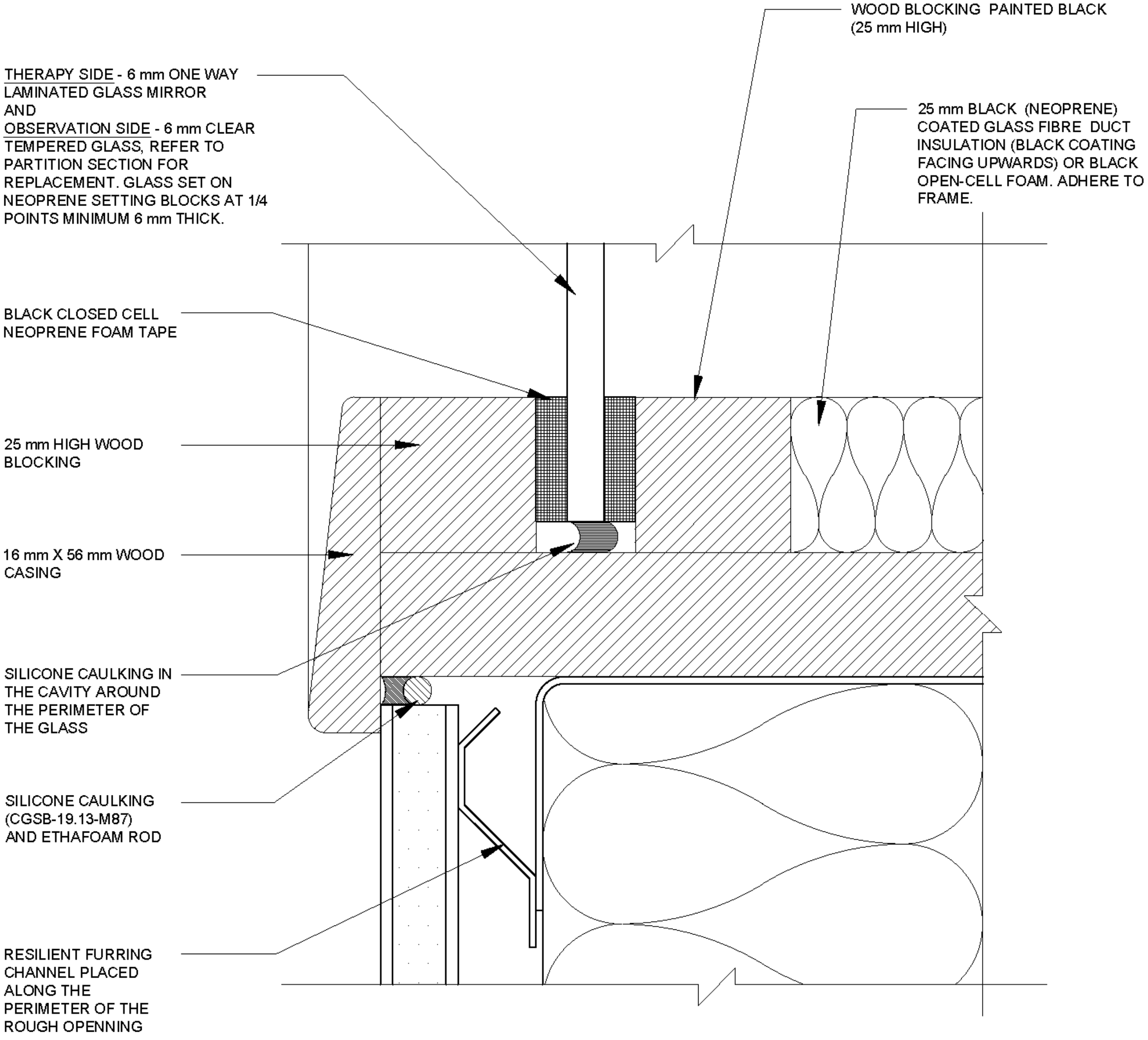
SCALE: 1:2

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\K.dwg Dec 09, 2014 - 9:51am

Alberta
Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER K
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	

NOTE:
PREFINISH WOOD BLOCKING IN ORDER TO PREVENT LEACHING OF THE CAULKING INTO ADJACENT MATERIALS.

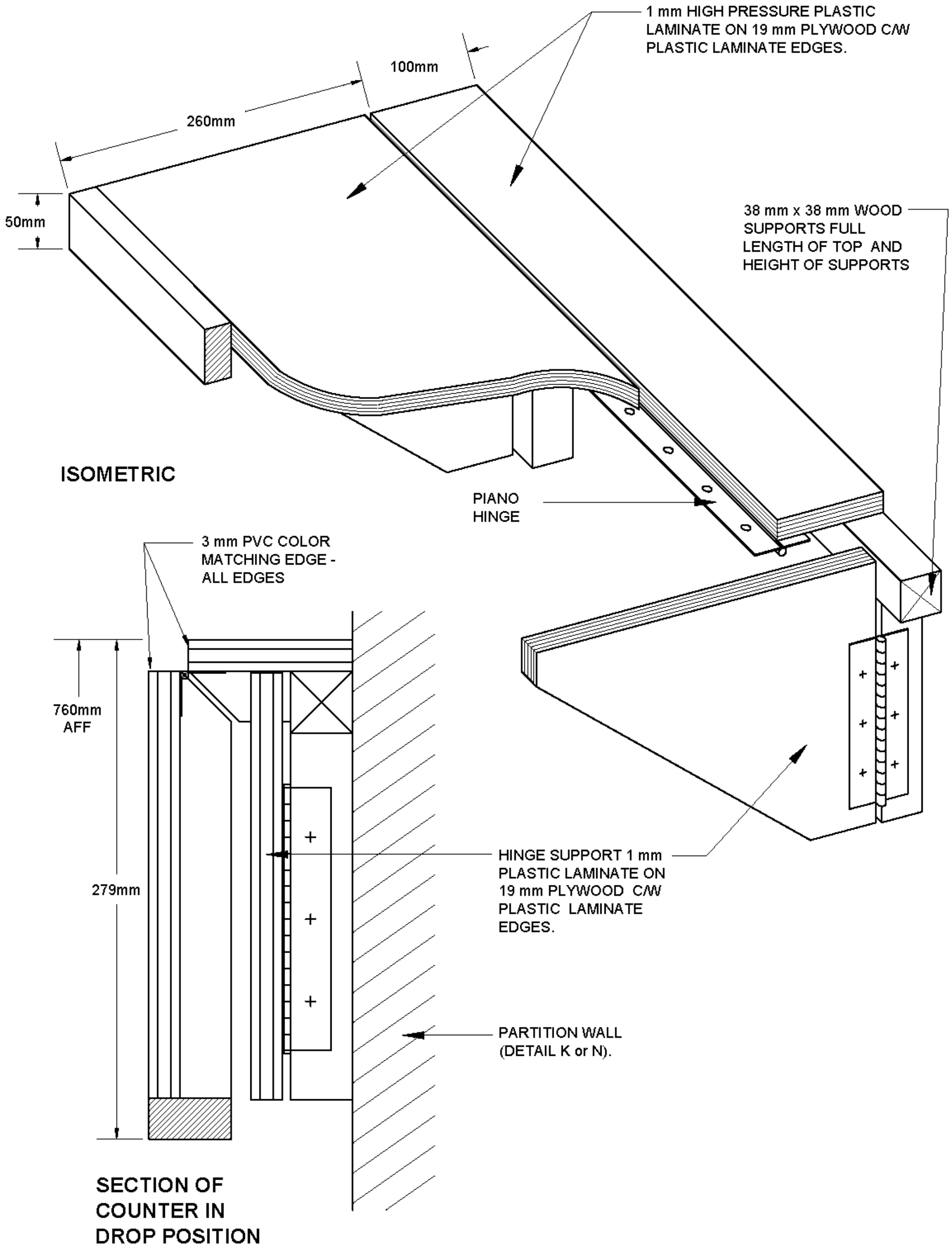


K2 **GLAZING DETAIL - THERAPY/OBSERVATION ROOM**
SCALE: 1:1

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\K.dwg Dec 09, 2014 - 9:56am

Alberta
Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER K
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	



L DROP DOWN COUNTER (OBSERVATION ROOM ONLY)

SCALE: NTS

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\L.dwg Dec 09, 2014 - 9:57am

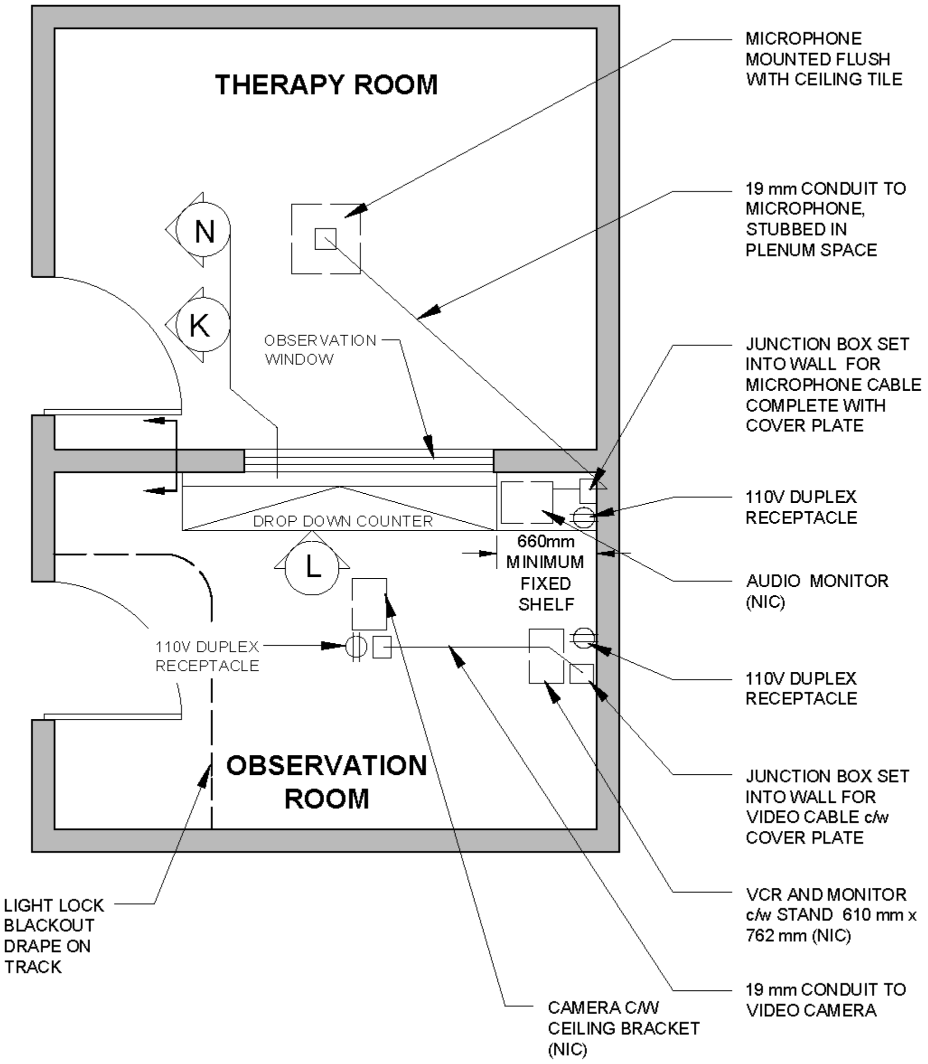
Alberta Infrastructure

INTERIOR DETAILS

INTERIOR DESIGN SECTION

DETAIL NUMBER L

DRAWN BY	DATE	CHECKED BY	DATE
E. GOZDZIK	2014-11-28	A. FARHALL	2014-11-28



M

CONDUIT & ELECTRICAL REQUIREMENTS FOR AUDIO SYSTEM (OBSERVATION/THERAPY ROOM)

SCALE: NTS

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\M.dwg Dec 09, 2014 - 9:57am

Alberta
Infrastructure

INTERIOR DETAILS

INTERIOR DESIGN SECTION

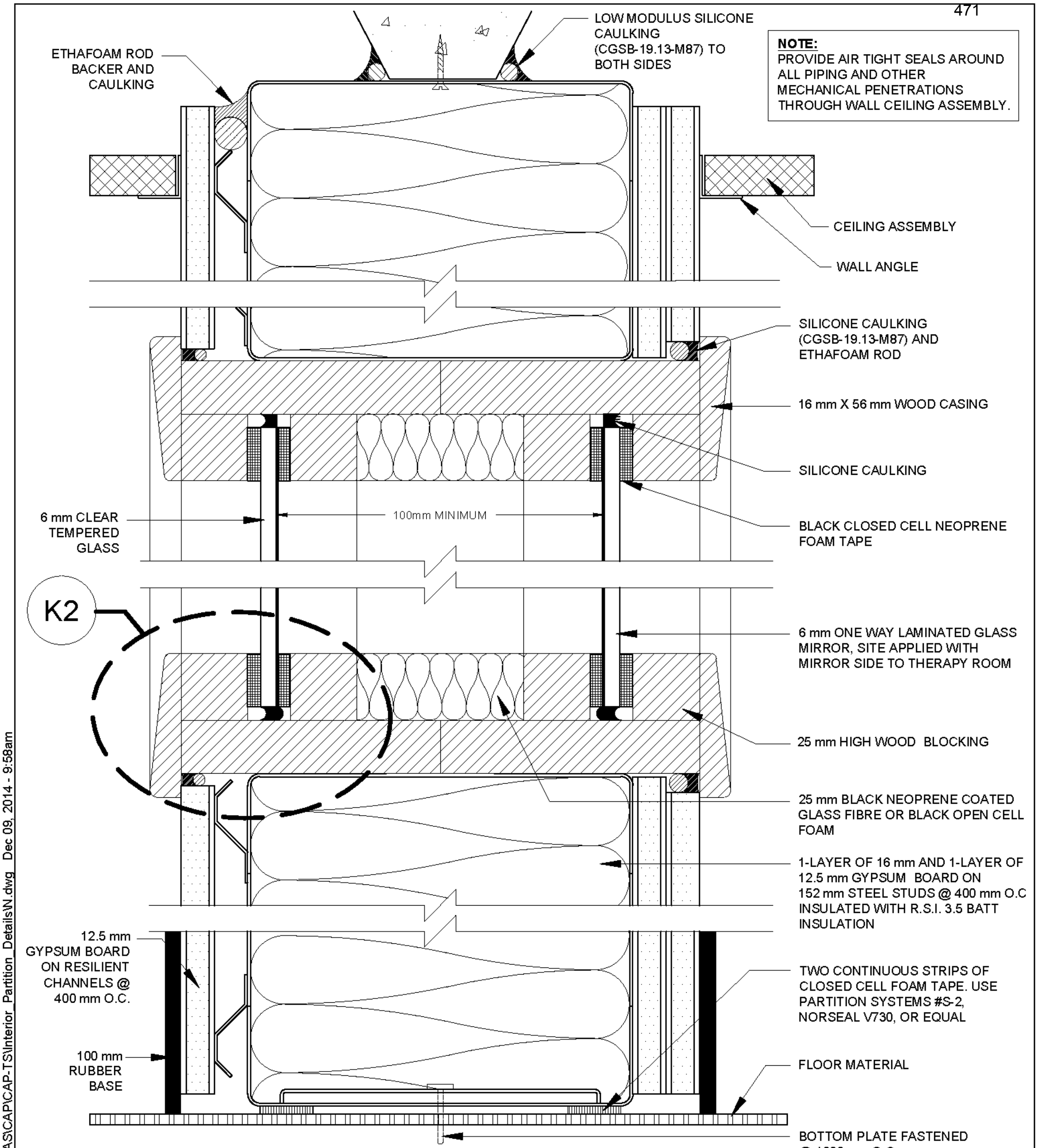
DETAIL NUMBER
M

DRAWN BY
E. GOZDZIK

DATE
2014-11-28

CHECKED BY
A. FARHALL

DATE
2014-11-28



NOTE:
PROVIDE AIR TIGHT SEALS AROUND ALL PIPING AND OTHER MECHANICAL PENETRATIONS THROUGH WALL CEILING ASSEMBLY.

N

GYPSUM BOARD PARTITION, FULL HEIGHT (THERAPY/OBSERVATION ROOM)

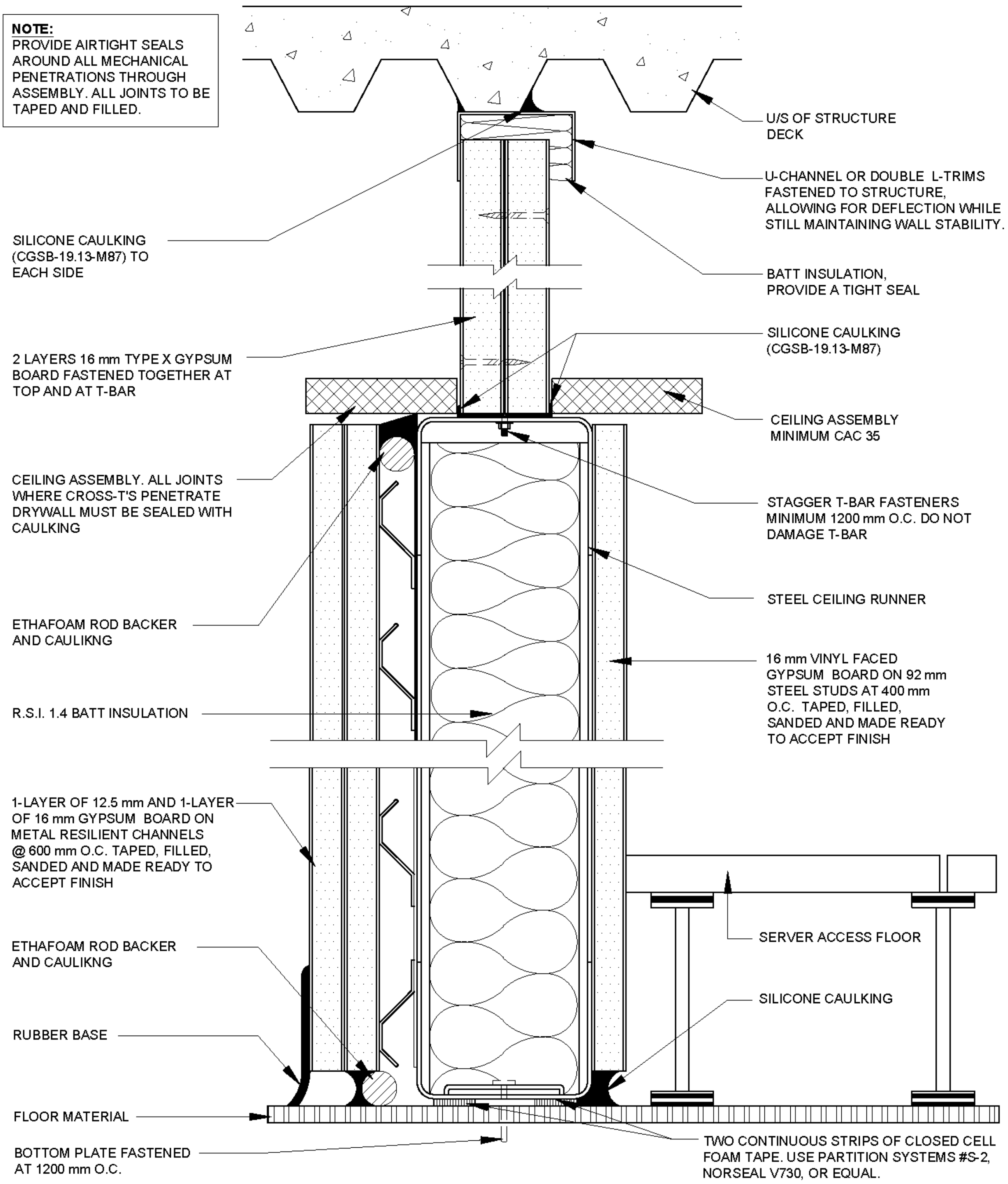
SCALE: 1:2

Alberta Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER N
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\N.dwg Dec 09, 2014 - 9:58am

NOTE:
PROVIDE AIRTIGHT SEALS AROUND ALL MECHANICAL PENETRATIONS THROUGH ASSEMBLY. ALL JOINTS TO BE TAPED AND FILLED.



O

GYPSUM BOARD PARTITION
C/W PLENUM SOUND BARRIER - SERVER ROOM
SCALE: 1:2

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\O.dwg Dec 09, 2014 - 9:59am

Alberta
Infrastructure

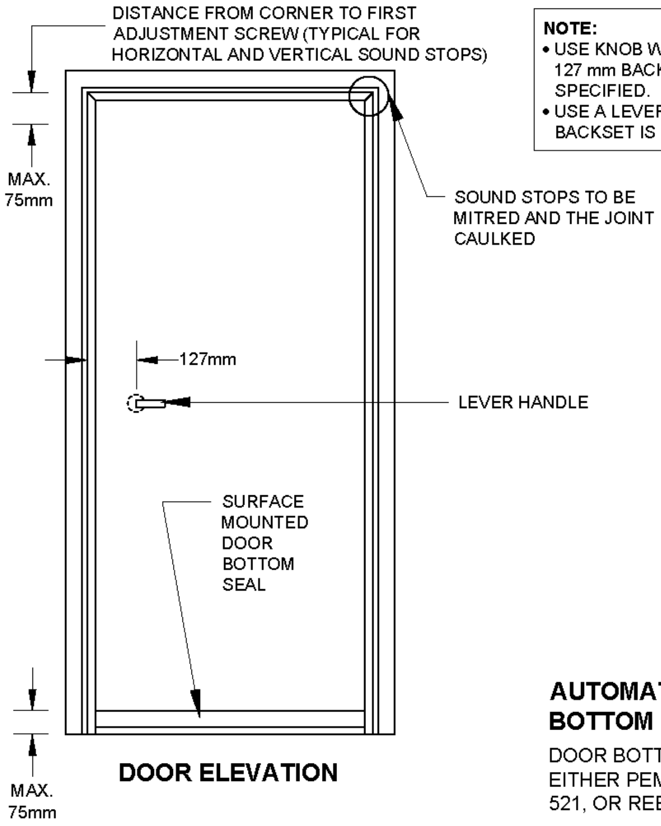
INTERIOR DETAILS

INTERIOR DESIGN SECTION

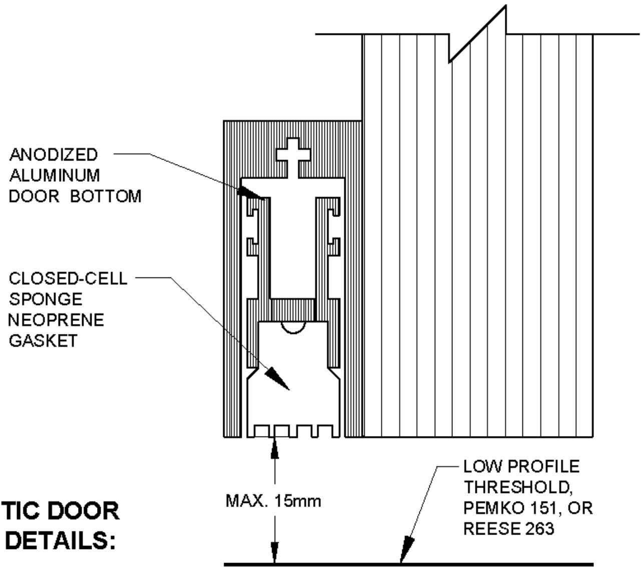
DETAIL NUMBER
O

DRAWN BY	DATE	CHECKED BY	DATE
E. GOZDZIK	2014-11-28	A. FARHALL	2014-11-28

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

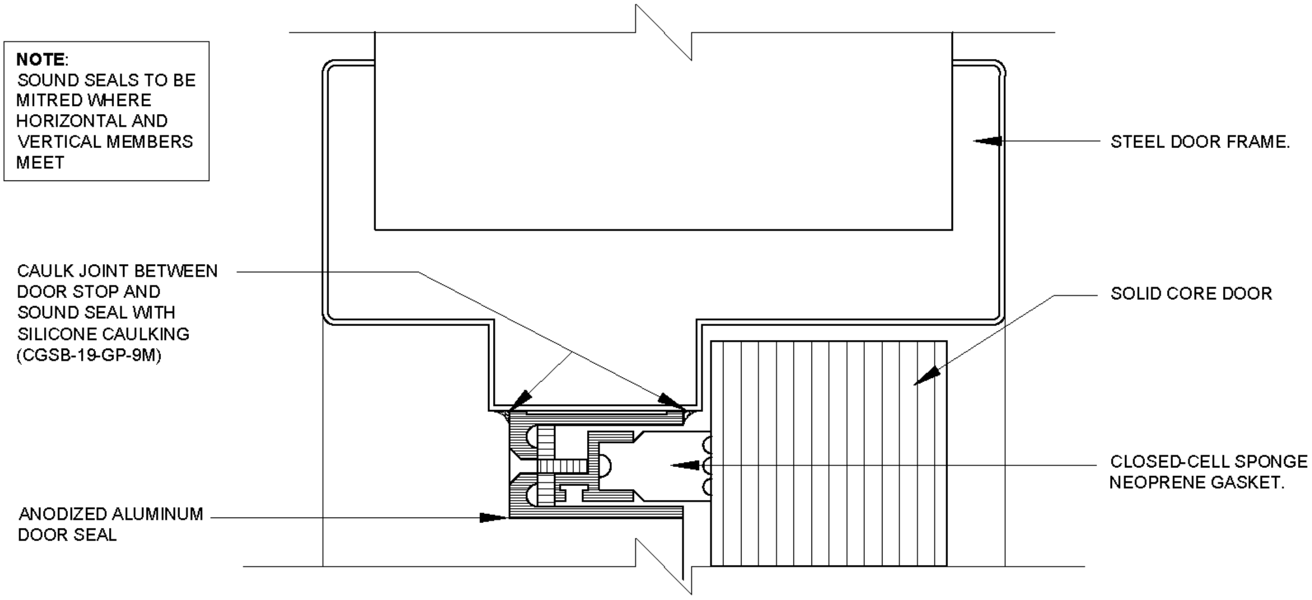


AUTOMATIC DOOR BOTTOM DETAILS:

DOOR BOTTOMS SHALL BE EITHER PEMKO 430, REESE 521, OR REESE 330

SURFACE MOUNTED

NOTE:
SOUND SEALS TO BE MITRED WHERE HORIZONTAL AND VERTICAL MEMBERS MEET



HEAD/JAMB SOUND SEAL DETAIL:

SOUND SEAL SHALL BE REESE 599

P **SOUND - RATED DOOR SEALS**

SCALE: NTS

Alberta
Infrastructure

INTERIOR DETAILS		INTERIOR DESIGN SECTION		DETAIL NUMBER P
DRAWN BY E. GOZDZIK	DATE 2014-11-28	CHECKED BY A. FARHALL	DATE 2014-11-28	

Login: ela.gozdzik \\goa\shared\INFRAS\CAP\CAP-TS\Interior_Partition_Details\P.dwg Dec 09, 2014 - 10:00am

Appendix G

Green Building Standard

Appendix G – Green Building Standards

Section Contents

Related Documents:

Green Building Standards Deliverables Checklist: http://www.infrastructure.alberta.ca/992.htm

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 Plan[1]*.*

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

The *GBS* were developed by Technical Services Branch (TSB) 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 TSB (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] http://www.infrastructure.alberta.ca/992.htm

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 reams 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[3], 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

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[3] 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 (TSB 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*[4]. 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 asses the impact of the project beyond the energy focus within the LEED certification to determine if the project goals align.

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[4] http://www.infrastructure.alberta.ca/992.htm

- 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:

Planning / Conceptual Design	Initial LCC scoping, explore project elements that will benefit most from LCC.
Schematic Design	LCC calculations presenting options for major energy-consuming systems.
Value Engineering	LCC calculations presenting impacts beyond initial capital outlay.

Energy Modeling

The following deliverables or reports summarizing these deliverables are required:

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[5] https://www.wellcertified.com/en/resource-sub-categories/project-checklists
[6] http://www.infrastructure.alberta.ca/992.htm
[7] https://calculatelca.com

Schematic Design	Initial model results of massing, orientation, and/or major HVAC systems with sensitivity analysis.
Design Development	Multiple parametric runs comparing options of systems and strategies as determined in the initial and/or subsequent integrated design charrettes.
Contract Documents	Design and base case model for LEED v4 can be used for NECB 2011 code compliance verification. The Alternative Compliance Path (Canada ACP – NECB) outlines the conditions for projects using an NECB 2011 basel model[8].
Document Turnover	Final energy model report with summary of inputs and outputs.

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*).

Cat.	***Required Credit***		BD+C NC	BD+C MR	Additional Guidance
Water Efficiency	*Water Metering*		1	1	For metered systems, consider recommendations from the building's operations team.
Energy & Atmosphere	*Enhanced Commissioning* Option 1, Path 2 and Option 2		6	4 or 6	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.
	Optimize Energy Performance	*Office/ School*	12	8	The minimum point requirements are based on the established cost model. Projects are encouraged to review the LEED v4 Alternative Energy Performance Metric[9] pilot Alternative Compliance Path (ACP) to achieve additional points.
		Healthcare	11	7	
	Advanced Energy Metering		1	1	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.

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[8] https://www.cagbc.org/cagbcdocs/leed/LEED_v4_Canadian_ACP_Language_as_of_20170420.pdf
[9] https://www.usgbc.org/credits/eapc95v4

Material & Resources	*Building Disclosure & Optimization (3 credits)*	3	3	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.

Cat.	***Potential Credits***	BD+C NC	BD+C MR	Rationale
	Integrative Process	1	1	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.
Sustainable Sites	*Rainwater Management*	1	1	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.
	Light Pollution Reduction	1	1	The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.
Water Efficiency	*Outdoor Potable Water Use Reduction*	1	1	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.
	Indoor Potable Water Reduction	>3	>3	To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.
Energy & Atmosphere	*Enhanced Commissioning, Option 2*	2	2	Envelope commissioning is recommended Tier 1 projects located in more remote areas with reduced access to professional services.
	Renewable Energy Production	>1	>1	Upon reviewing the Net Zero Feasibility Checklist, consider including renewable technologies into the project scope.
Material & Resources	*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.
Indoor Environmental Quality	*Low-Emitting Materials*	3	3	The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.
	Thermal Comfort	1	1	The requirements of this credit are in line with the TDR Mechanical Design Criteria.
	Acoustic Performance	1	1	The acoustic performance in school projects provides an optimal space for learning.

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 (TSB 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[10]. Requirements by design phase include:

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[10] http://energyandfacilities.harvard.edu/green-building-resource/green-building-tools-resources/life-cycle-costing

Planning / Conceptual Design	Initial LCC scoping, explore project elements that will benefit most from LCC.
Schematic Design	LCC calculations presenting options for major energy-consuming systems.
Value Engineering	LCC calculations presenting impacts beyond initial capital outlay.

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:

Schematic Design	Initial model results for major HVAC and lighting systems with sensitivity analysis.
Design Development	Multiple parametric runs comparing options of systems and strategies as determined in the initial and/or subsequent integrated design charrettes.
Contract Documents	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.11
Document Turnover	Final energy model report with summary of inputs and outputs.

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.

Mandatory Credits

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[11] https://www.cagbc.org/cagbcdocs/leed/LEED_v4_Canadian_ACP_Language_as_of_20170420.pdf

The following credits are mandatory based on the project type and corresponding certification (*BD+C* or *ID+C*).

Cat.	***Required Credit***		BD+C MR	ID+C CI	Additional Guidance
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.
	Optimize Energy Performance	*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		
	Advanced Energy Metering		1	1	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.

Recommended Credits

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[12] https://www.usgbc.org/credits/eapc95v4

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.

Cat.	***Potential Credits***	BD+C MR	ID+C CI	Rationale
	Integrative Process	1	1	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.
Sustainable Sites	*Rainwater Management*	1	1	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.
	Light Pollution Reduction	1	1	The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.
Water Efficiency	*Outdoor Potable Water Use Reduction*	1	1	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.
	Indoor Potable Water Reduction	>3	>3	To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.
Energy & Atmosphere	*Advanced Energy Metering*	1	1	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.
	Renewable Energy Production	>1	>1	Upon reviewing the Net Zero Feasibility Checklist, consider including renewable technologies into the project scope.
Indoor Environmental Quality	*Low-Emitting Materials*	3	3	The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.
	Acoustic Performance	1	1	The acoustic performance in school projects provides an optimal space for learning.

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:

Schematic Design	LCC calculations presenting options for major energy-consuming systems.

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.

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[13] http://www.sustainablesites.org
[14] http://energyandfacilities.harvard.edu/green-building-resource/green-building-tools-resources/life-cycle-costing

Mandatory Credits

The following credits are mandatory based on the project type and corresponding certification (*BD+C* or *ID+C*).

Cat.	***Required Credit***	BD+C MR	ID+C CI	Additional Guidance
Energy & Atmosphere	*Fundamental Commissioning*	P	P	Depending on the project scope, fundamental commissioning is required.
	Optimize Energy Performance Option 2	>1	>1	It is likely this project will not require energy modeling, therefore, meet the prescriptive compliance paths for Option 2 as applicable.
MR	*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.

Recommended Credits

Cat.	***Potential Credits***	BD+C MR	ID+C CI	Rationale
Sustainable Sites	*Rainwater Management*	1	1	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.
	Light Pollution Reduction	1	1	The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.
Water Efficiency	*Outdoor Potable Water Use Reduction*	1	1	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.
	Indoor Potable Water Reduction	>3	>3	To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.
EA	*Enhanced Commissioning* Option 1, Path 2	4	5	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.
EQ	*Low-Emitting Materials*	3	3	The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.

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 databa

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[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 (*BD+C* or *ID+C*). There are no mandatory LEED credits in this Tier.

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[15] http://www.sustainablesites.org

Recommended Credits

Cat.	*Potential Credits*	BD+C NC	BD+C MR	Rationale
Sustainable Sites	*Rainwater Management*	1	1	The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.
	Light Pollution Reduction	1	1	The reduction of light pollution helps reduce energy waste, improves neighborhoods, and supports nocturnal wildlife.
Water Efficiency	*Outdoor Potable Water Use Reduction*	1	1	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.
	Indoor Potable Water Reduction	>3	>3	To eliminate unneeded water waste, projects are encouraged to consider achieving additional points, which can contribute to achieving a regional priority credit.
MR	*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.
IEQ	*Low-Emitting Materials*	3	3	The improved air quality that impacts the health and wellbeing of occupants is encouraged for all projects.

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

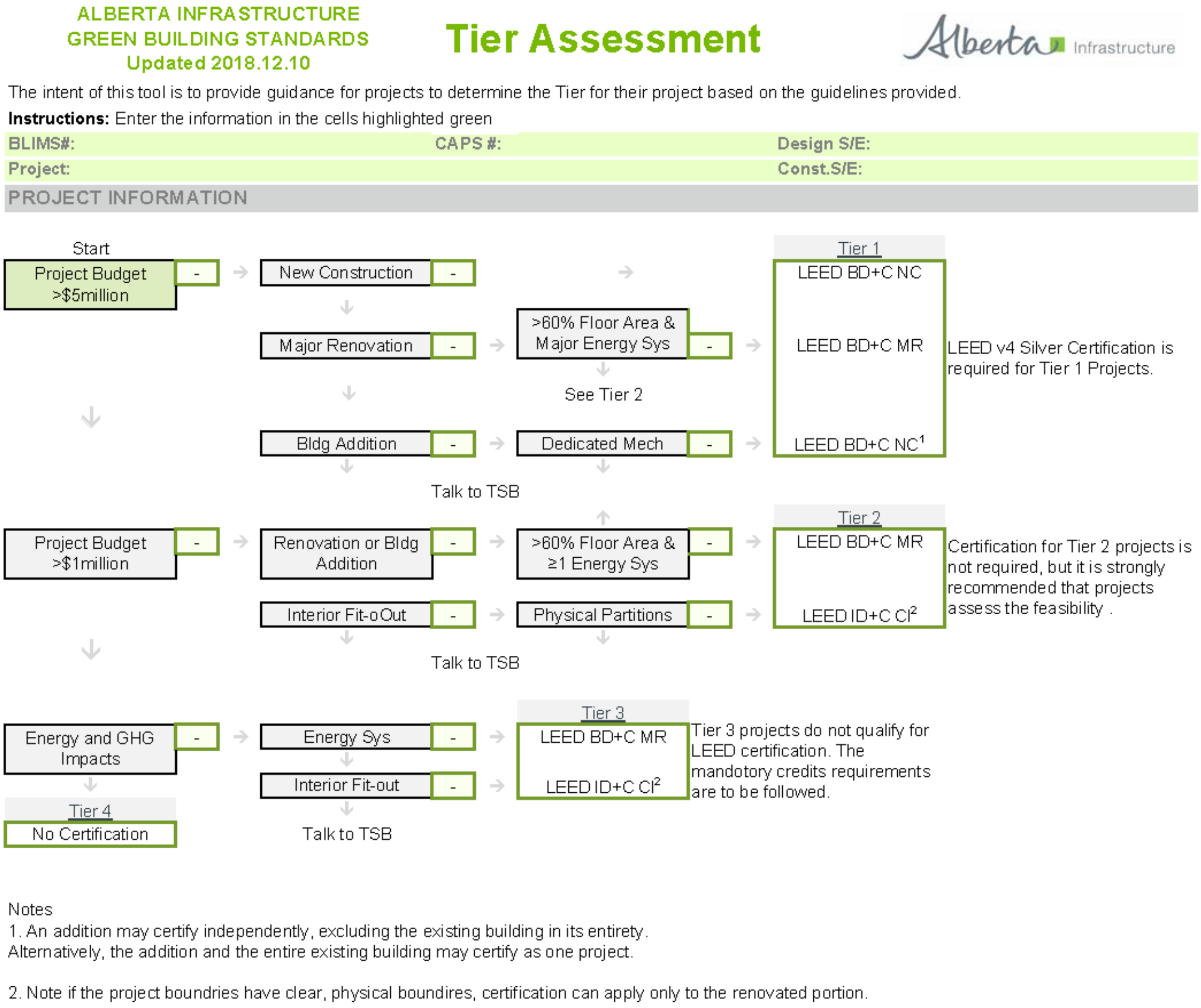
Crawley, D. P. (2009). *Getting to Net Zero.* U.S. Department of Energy, National Renewable Energy Laboratory. doi:NREL/JA-550-46382

Harvard University. (2016). *Green Building Standards.* Retrieved from https://green.harvard.edu/topics/green-buildings/green-building-standards

Pless, S. S. (2014). *NASA Net Zero Energy Building Roadmap.* NREL. doi:NREL/TP-5500-60838

Deliverables Checklists and Spreadsheet Tools

All projects are required to submit Green Building Standards Deliverables Checklist for their respective Tier using the spreadsheet tool: http://www.infrastructure.alberta.ca/992.htm. 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, TSB 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.



ALBERTA INFRASTRUCTURE
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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

BLIMS#:
CAPS #:
Design S/E:
Project:
Const.S/E:

PROJECT INFORMATION

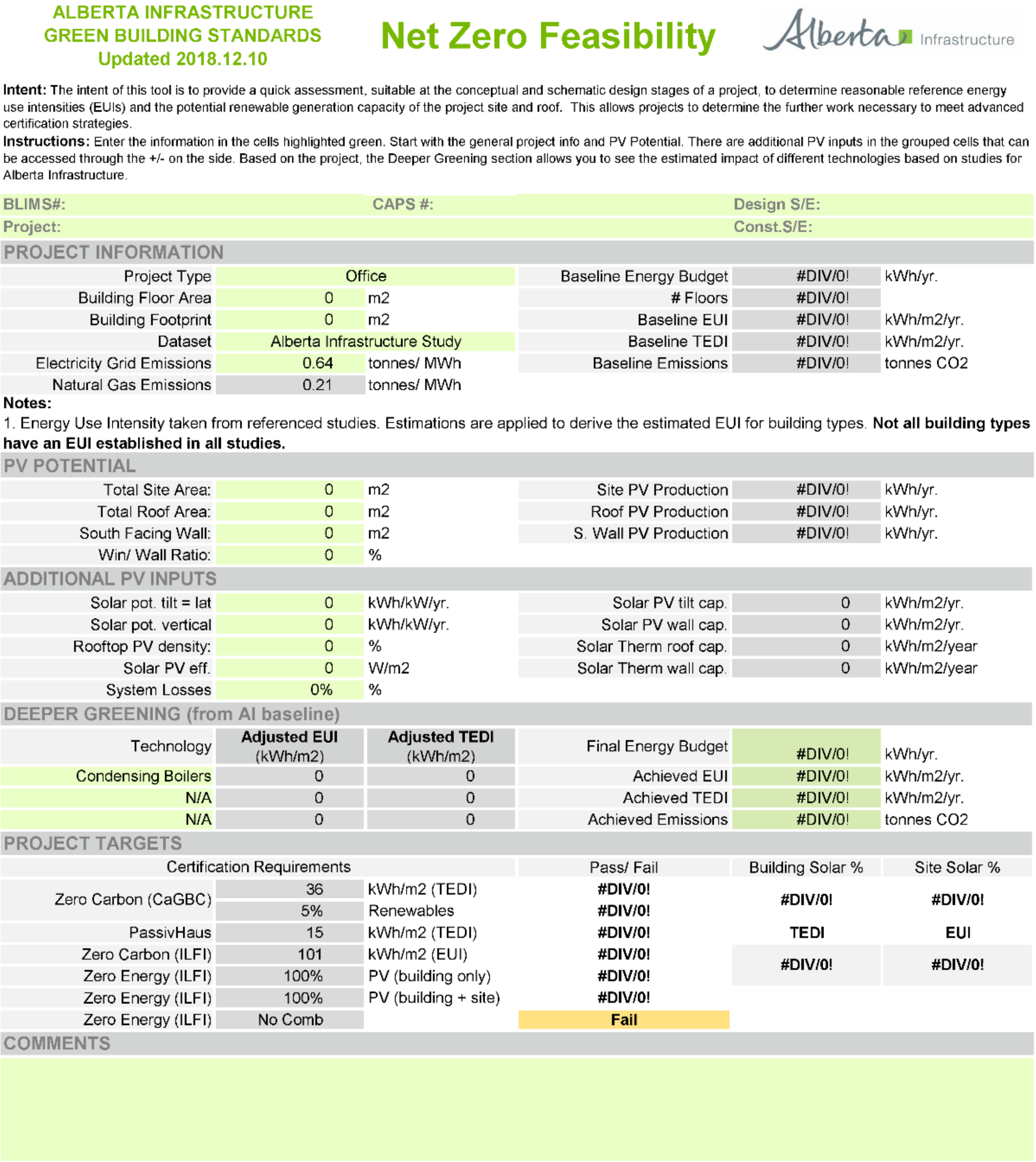
LEED v4 Silver Certification is required for Tier 1 Projects.

Certification for Tier 2 projects is not required, but it is strongly recommended that projects assess the feasibility .

Tier 3 projects do not qualify for LEED certification. The mandotory credits requirements are to be followed.

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 boundries have clear, physical boundires, certification can apply only to the renovated portion.



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Net Zero Feasibility

Alberta Infrastructure

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

Project Type	Office		Baseline Energy Budget	#DIV/0!	kWh/yr.
Building Floor Area	0	m2	# Floors	#DIV/0!	
Building Footprint	0	m2	Baseline EUI	#DIV/0!	kWh/m2/yr.
Dataset	Alberta Infrastructure Study		Baseline TEDI	#DIV/0!	kWh/m2/yr.
Electricity Grid Emissions	0.64	tonnes/ MWh	Baseline Emissions	#DIV/0!	tonnes CO2
Natural Gas Emissions	0.21	tonnes/ MWh			

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.
Win/ Wall Ratio:	0	%			

ADDITIONAL PV INPUTS

Solar pot. tilt = lat	0	kWh/kW/yr.	Solar PV tilt cap.	0	kWh/m2/yr.
Solar pot. vertical	0	kWh/kW/yr.	Solar PV wall cap.	0	kWh/m2/yr.
Rooftop PV density:	0	%	Solar Therm roof cap.	0	kWh/m2/year
Solar PV eff.	0	W/m2	Solar Therm wall cap.	0	kWh/m2/year
System Losses	0%	%			

DEEPER GREENING (from AI baseline)

Technology	**Adjusted EUI** (kWh/m2)	**Adjusted TEDI** (kWh/m2)	Final Energy Budget	#DIV/0!	kWh/yr.
Condensing Boilers	0	0	Achieved EUI	#DIV/0!	kWh/m2/yr.
N/A	0	0	Achieved TEDI	#DIV/0!	kWh/m2/yr.
N/A	0	0	Achieved Emissions	#DIV/0!	tonnes CO2

PROJECT TARGETS

Certification Requirements			Pass/ Fail	Building Solar %	Site Solar %
Zero Carbon (CaGBC)	36	kWh/m2 (TEDI)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
	5%	Renewables	**#DIV/0!**		
PassivHaus	15	kWh/m2 (TEDI)	**#DIV/0!**	**TEDI**	**EUI**
Zero Carbon (ILFI)	101	kWh/m2 (EUI)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
Zero Energy (ILFI)	100%	PV (building only)	**#DIV/0!**		
Zero Energy (ILFI)	100%	PV (building + site)	**#DIV/0!**		
Zero Energy (ILFI)	No Comb		**Fail**		

COMMENTS

ALBERTA INFRASTRUCTURE
GREEN BUILDING STANDARDS
Updated 2018.12.10

LIVING BUILDING CHALLENGE (LBC) v3.0 FEASIBILITY CHECKLIST

Alberta Infrastructure

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.

Project Name:
Project Scale: Building
Date:

PLACE	Feasible?	Explanation (Response required if listed as not feasible)
Limits to Growth		
Urban Agriculture		
Habitat Exchange		
Human Powered Living		

WATER	Feasible?	Explanation (Response required if listed as not feasible)
Net Positive Water		

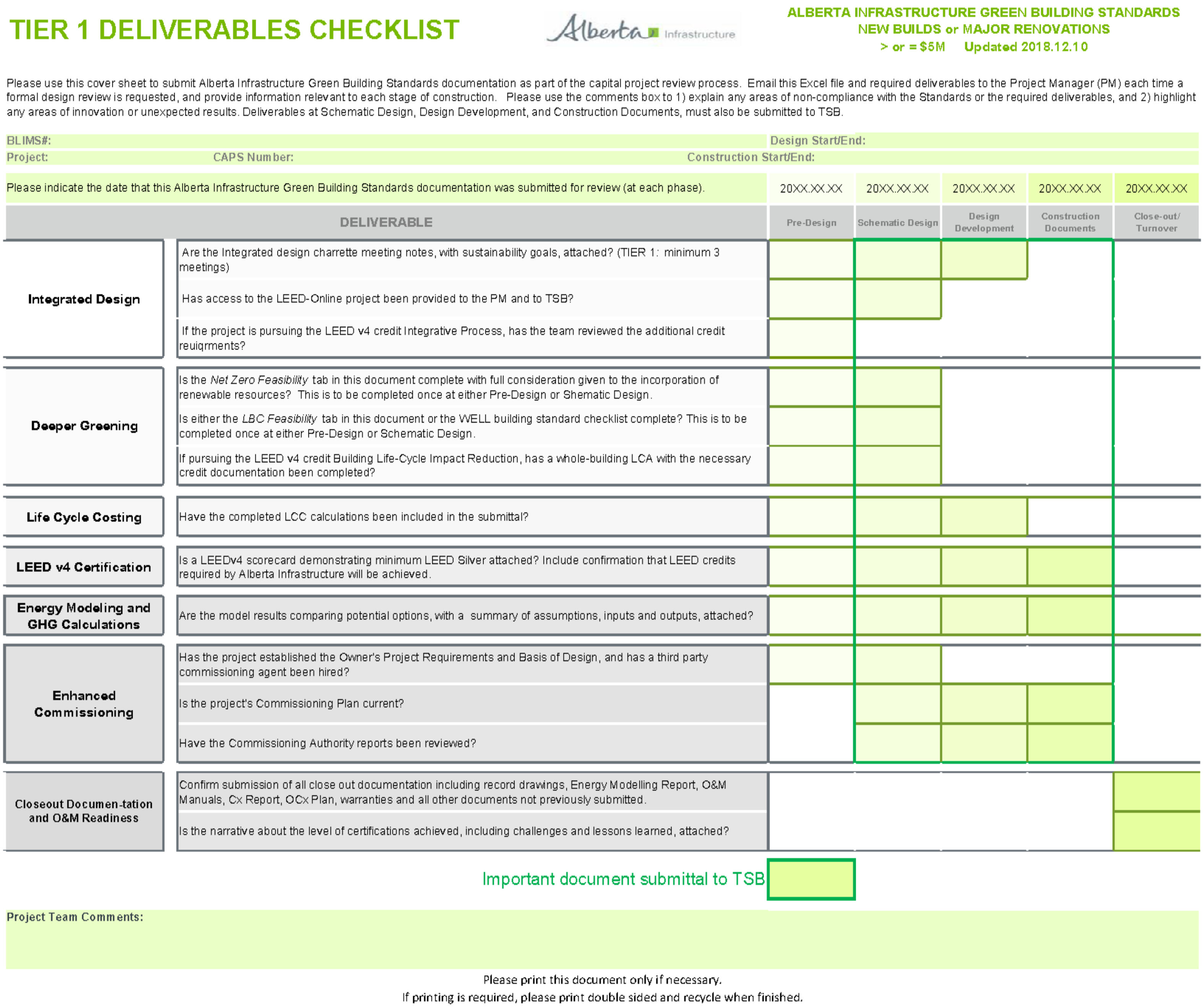
ENERGY	Feasible?	Explanation (Response required if listed as not feasible)
Net Positive Energy		*Complete "Net Zero Feasibility" Tab for explanation information.*

HEALTH & HAPPINESS	Feasible?	Explanation (Response required if listed as not feasible)
Civilized Environment		
Healthy Interior Environment		
Biophilic Environment		

MATERIALS	Feasible?	Explanation (Response required if listed as not feasible)
Red List		
Embodied Carbon Footprint		
Responsible Industry		
Living Economy Sourcing		
Net Positive Waste		

EQUITY	Feasible?	Explanation (Response required if listed as not feasible)
Human Scale + Humane Places		
Universal Access to Nature and Place		
Equitable Investment		
JUST Organizations		

BEAUTY	Feasible?	Explanation (Response required if listed as not feasible)
Beauty + Spirit		
Inspiration + Education		



TIER 1 DELIVERABLES CHECKLIST

ALBERTA INFRASTRUCTURE GREEN BUILDING STANDARDS
NEW BUILDS or MAJOR RENOVATIONS
> or = $5M Updated 2018.12.10

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.

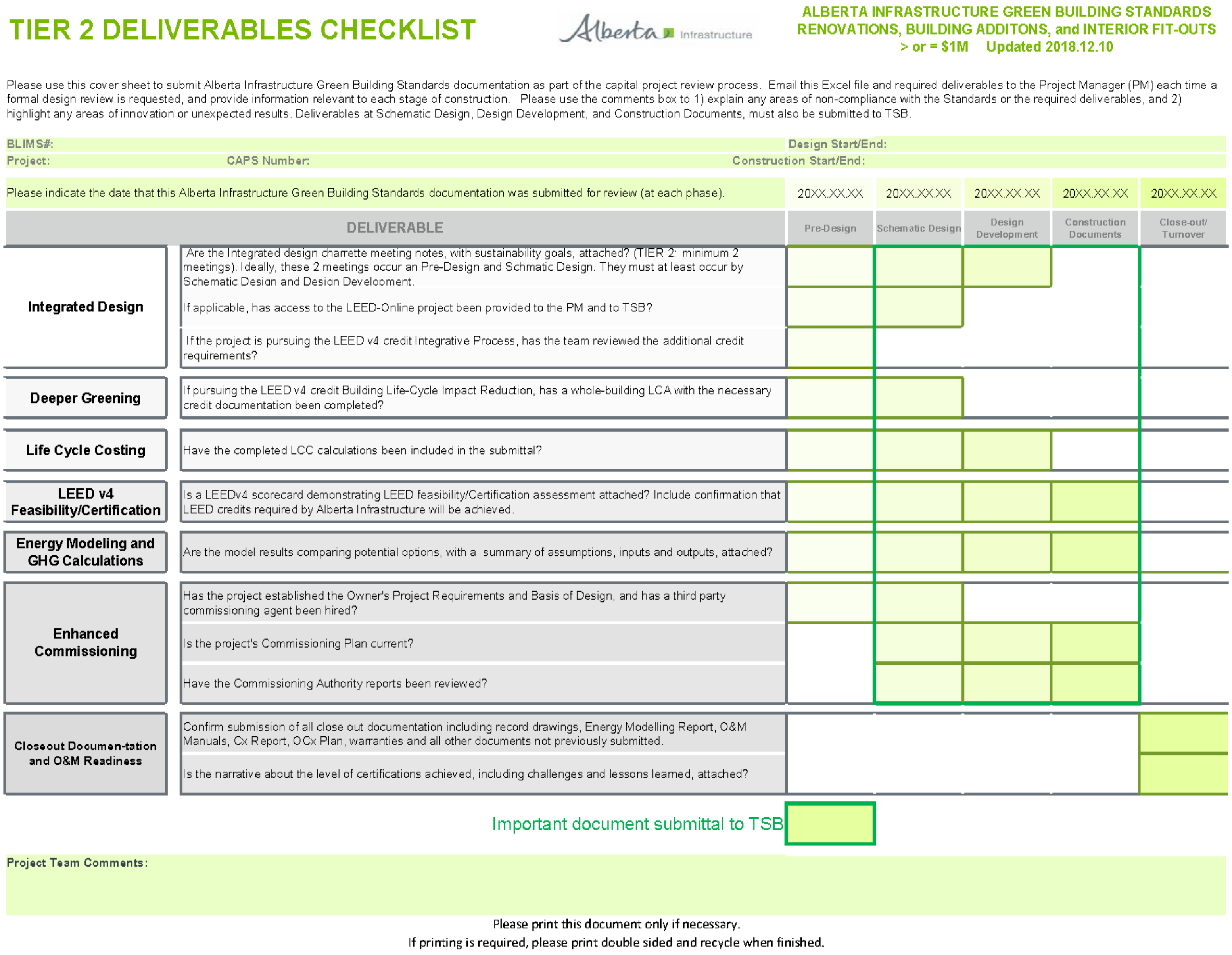
BLIMS#:
Design Start/End:
Project:
CAPS Number:
Construction Start/End:

	Please indicate the date 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
DELIVERABLE		Pre-Design	Schematic Design	Design Development	Construction Documents	Close-out/ Turnover
Integrated Design	Are the Integrated design charrette meeting notes, with sustainability goals, attached? (TIER 1: minimum 3 meetings)	🟩	🟩	🟩		
	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 reuiqrments?	🟩				
Deeper Greening	Is the *Net Zero Feasibility* tab in this document complete with full consideration given to the incorporation of renewable resources? This is to be completed once at either Pre-Design or Shematic Design.	🟩	🟩			
	Is either the *LBC 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.	🟩	🟩			
	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 Certification	Is a LEEDv4 scorecard demonstrating minimum LEED Silver 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?		🟩	🟩	🟩	
	Have the Commissioning Authority reports been reviewed?		🟩	🟩	🟩	
Closeout Documen-tation and O&M Readiness	Confirm submission of all close out documentation including record drawings, Energy Modelling Report, O&M Manuals, Cx Report, OCx Plan, warranties and all other documents not previously submitted.					🟩
	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 2 DELIVERABLES CHECKLIST

ALBERTA INFRASTRUCTURE GREEN BUILDING STANDARDS
RENOVATIONS, BUILDING ADDITONS, and INTERIOR FIT-OUTS
> or = $1M Updated 2018.12.10

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.

BLIMS#:
Design Start/End:
Project:
CAPS Number:
Construction Start/End:

	Please indicate the date 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
	DELIVERABLE	Pre-Design	Schematic Design	Design Development	Construction Documents	Close-out/ Turnover
Integrated Design	Are the Integrated design charrette meeting notes, with sustainability goals, attached? (TIER 2: minimum 2 meetings). Ideally, these 2 meetings occur an Pre-Design and Schmatic 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 LEEDv4 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?		▨	▨	▨	
	Have the Commissioning Authority reports been reviewed?		▨	▨	▨	
Closeout Documen-tation and O&M Readiness	Confirm submission of all close out documentation including record drawings, Energy Modelling Report, O&M Manuals, Cx Report, OCx Plan, warranties and all other documents not previously submitted.					▨
	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

Alberta Infrastructure

ALBERTA INFRASTRUCTURE GREEN BUILDING STANDARDS
LIMITED SCOPE SYSTEM UPGRADES WITH ENERGY and GHG IMPACT < $1M
Updated 2018.12.10

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.

BLIMS#:

Design Start/End:

Project:

CAPS Number:

Construction Start/End:

Please indicate the date 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
DELIVERABLE		Pre-Design	Schematic Design	Design Development	Construction Documents	Close-out/ Turnover
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 submittal?					
LEED v4 Review	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.					
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 Documen-tation and O&M Readiness	Confirm submission of all close out 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

Alberta Infrastructure

ALBERTA INFRASTRUCTURE GREEN BUILDING STANDARDS
LIMITED SCOPE WITH NO ENERGY and GHG IMPACT
Updated 2018.12.10

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.

BLIMS#: **Design Start/End:**

Project: **CAPS Number:** **Construction Start/End:**

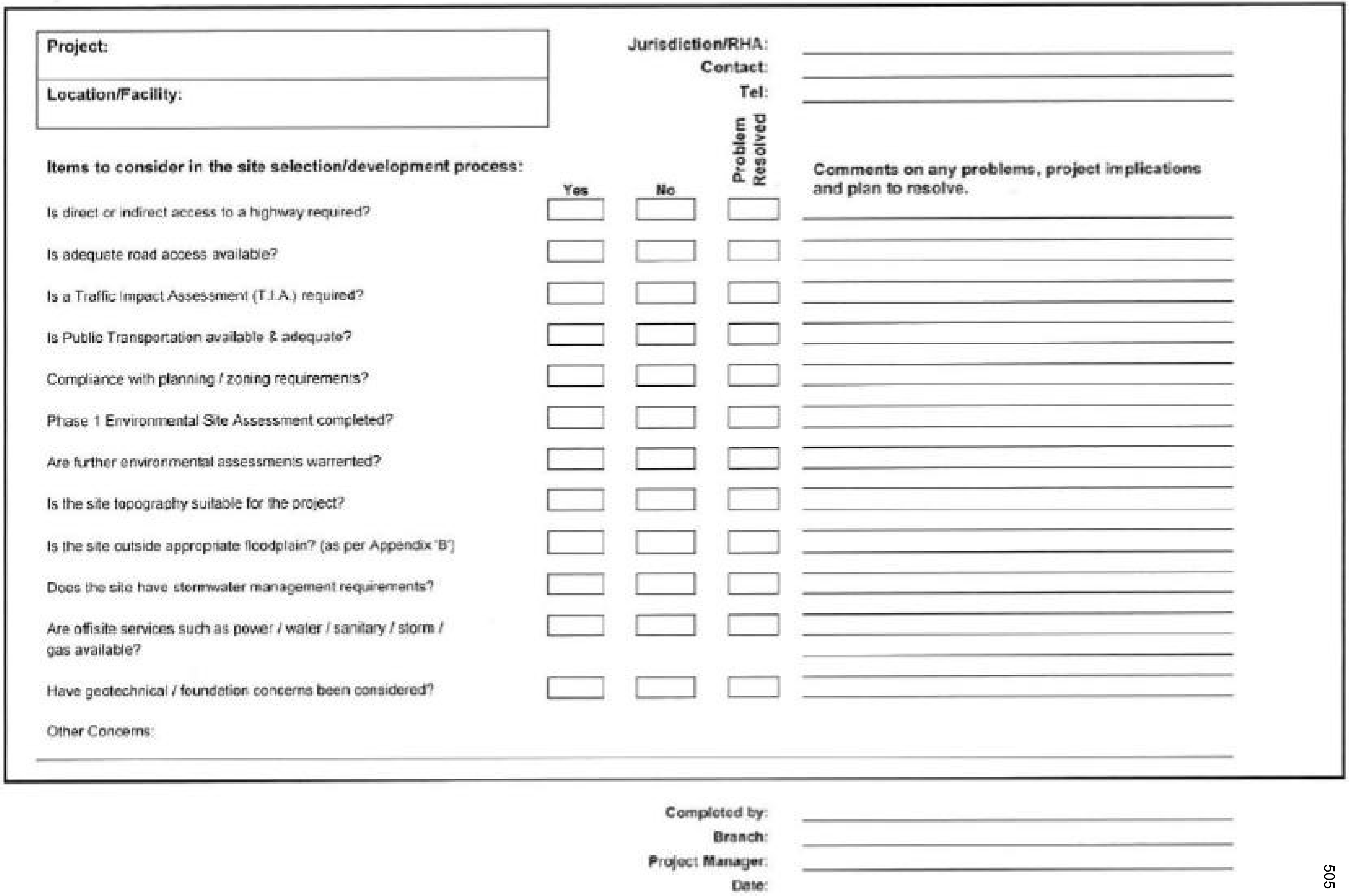
	Please indicate the date that this Alberta Infrastructure Green Building Standards documentation was submitted for review (at each phase).	20XX.XX.XX	20XX.XX.XX	20XX.XX.XX	20XX.XX.XX	20XX.XX.XX
DELIVERABLE		**Pre-Design**	**Schematic Design**	**Design Development**	**Construction Documents**	**Close-out/ Turnover**
Integrated Design	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.					
LEED v4 Review	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.					
Closeout Documen-tation and O&M Readiness	Confirm submission of all close out documentation including record drawings, O&M Manuals, warranties and all other documents not previously submitted.					

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.

Appendix H – Transportation and Site Requirements



Project:

Location/Facility:

Jurisdiction/RHA: ____________________

Contact: ____________________

Tel: ____________________

Items to consider in the site selection/development process:	Yes	No	Problem Resolved	Comments on any problems, project implications and plan to resolve.
Is direct or indirect access to a highway required?	☐	☐	☐	
Is adequate road access available?	☐	☐	☐	
Is a Traffic Impact Assessment (T.I.A.) required?	☐	☐	☐	
Is Public Transportation available & adequate?	☐	☐	☐	
Compliance with planning / zoning requirements?	☐	☐	☐	
Phase 1 Environmental Site Assessment completed?	☐	☐	☐	
Are further environmental assessments warrented?	☐	☐	☐	
Is the site topography suitable for the project?	☐	☐	☐	
Is the site outside appropriate floodplain? (as per Appendix 'B')	☐	☐	☐	
Does the site have stormwater management requirements?	☐	☐	☐	
Are offsite services such as power / water / sanitary / storm / gas available?	☐	☐	☐	
Have geotechnical / foundation concerns been considered?	☐	☐	☐	

Other Concerns:

Completed by: ____________________

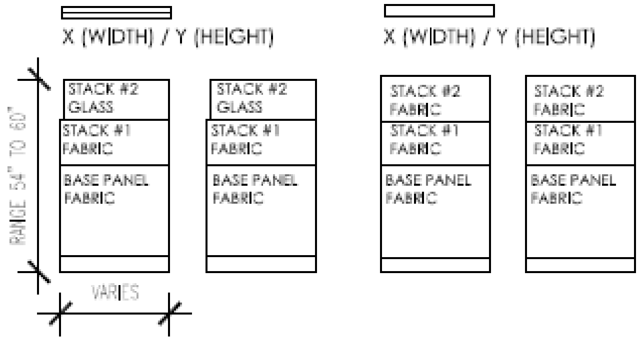
Branch: ____________________

Project Manager: ____________________

Date:

Appendix I – Workspace Furniture Typicals

WORKSPACE PANEL LEGEND:



PANELS:

HEIGHT RANGE: 54" TO 60" MAXIMUM
PANELS SHALL BE STACKABLE FROM DESK/WHEELCHAIR HEIGHT UP.

OVERALL PANEL HEIGHT DETAILS:
DESK HEIGHT/WHEELCHAIR ACCESS RANGE:
30" TO 36" (MAX).

TRANSACTION/WORKSURFACE PRIVACY 42":
BASE PANEL (30" TO 36" MAX). PLUS ONE LOAD BEARING STACK TO CREATE 42".

SEATED PRIVACY RANGE 54" (MIN) TO 60" (MAX):
BASE PANEL (30" TO 36").PLUS TWO LOAD BEARING STACKS TO CREATE 54" TO 60".

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).

PANEL FINISHES:
CLEAR OR FROSTED SINGLE PANE GLASS – FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)
PANEL FABRIC: GRADE 2/B
TOP & END TRIMS: PAINTED METAL GRADE 2/B INCLUDING METALLIC FINISH

NOTE:
DRAWINGS TO BE READ IN CONJUNCTION WITH TECHNICAL SPECIFICATIONS.

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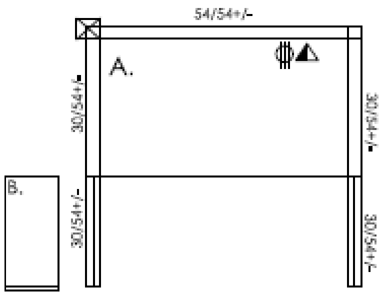
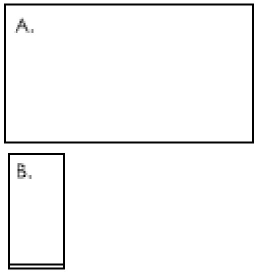
TYPICAL WORKSPACE
SCALE: N.T.S



WORKSPACE KIT-OF-PARTS LEGEND:



PRIMARY WORKSURFACE
C/W PIN HEIGHT ADJUSTABLE LEGS AND CABLE MANAGEMENT (ALONG BACK)
30" D x 54" W

TOWER
12"W X 24"D X 54+/-"H
C/W COAT ROD AND COUNTER WEIGHT AS REQUIRED

NOTE: +/- SAME OVERALL HEIGHT AS THE PANEL (INCLUDING STACKS).

① HOTELING WORKSPACE

2.5 m^2

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE
LAMINATE TO BE GRADE 2/B AND MUST INCLUDE WOODGRAIN LAMINATE OPTIONS
LEGS/BASE: METAL PAINTED FINISH INCLUDING METALLIC FINISHES

STORAGE TOWER:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)

ALL STORAGE TO BE LOCKING AND KEYED ALIKE

PANEL FINISHES:
CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)
PANEL FABRIC: GRADE 2/B
TOP & END TRIMS: PAINTED METAL GRADE 2/B INCLUDING METALLIC FINISH

NOTE: REFER TO PANEL LEGEND SHEET AND TECHNICAL SPECIFICATIONS FOR ADDITIONAL INFORMATION

ELECTRICAL/VOICE/DATA LEGEND:

ⴱ DUPLEX OUTLET

▲ VOICE/DATA

☒ POWER FEED

NOTE: PLEASE PROVIDE ALL NECESSARY ELECTRICAL
AND POWER HARNESSES/CABLING AS REQUIRED.

ELECTRICAL TO BE AT BASE, PROVIDE CABLE MANAGEMENT.

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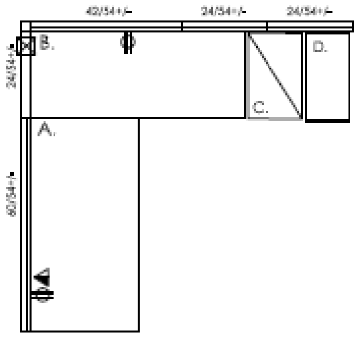
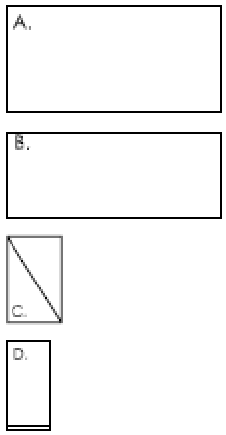
TYPICAL WORKSPACE
SCALE: N.T.S



② ROVER WORKSPACE
5.0 m²

WORKSPACE KIT-OF-PARTS LEGEND:



PRIMARY WORKSURFACE - SIT/STAND
C/W ELECTRIC HEIGHT ADJUSTABLE BASE AND CABLE MANAGEMENT (ALONG BACK)
30" D x 60" W

SECONDARY WORK SURFACE
C/W PIN HEIGHT ADJUSTABLE LEGS C/W CABLE MANAGEMENT (ALONG BACK)
24" D x 60" W

MOBILE PEDESTAL WITH CUSHION TOP
BOX, FILE
24" D

TOWER
12"W X 24"D X 54+/-"H
C/W COAT ROD AND COUNTER WEIGHT AS REQUIRED

NOTE: +/- SAME OVERALL HEIGHT AS THE PANEL (INCLUDING STACKS).
PANEL ATTACHMENT BRACKET TO BE INCLUDED.

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE
LEGS/BASE: METAL PAINTED FINISH INCLUDING METALLIC FINISHES
LAMINATE TO BE GRADE 2/B AND MUST INCLUDE WOODGRAIN LAMINATE OPTIONS
MOBILE BOX, FILE PEDESTAL WITH CUSHION TOP:
CUSHION TOP - GRADE 2/B FABRIC
PAINTED METAL FINISH BODY
STANDARD PULLS (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
AND PENCIL TRAY

STORAGE TOWER:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)

ALL STORAGE TO BE LOCKING AND KEYED ALIKE

PANEL FINISHES:
CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)
PANEL FABRIC: GRADE 2/B
SEGMENTED END AND CORNER TRIMS: PAINTED METAL
TOP TRIMS: PAINTED METAL INCLUDING METALLIC FINISHES

NOTE: REFER TO PANEL LEGEND SHEET AND THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL INFORMATION

ELECTRICAL/VOICE/DATA LEGEND:

⏀ DUPLEX OUTLET
▲ VOICE/DATA
☒ POWER FEED

NOTE: PLEASE PROVIDE ALL NECESSARY ELECTRICAL
AND POWER HARNESSES/CABLING AS REQUIRED.

ELECTRICAL TO BE AT BASE, PROVIDE CABLE MANAGEMENT.

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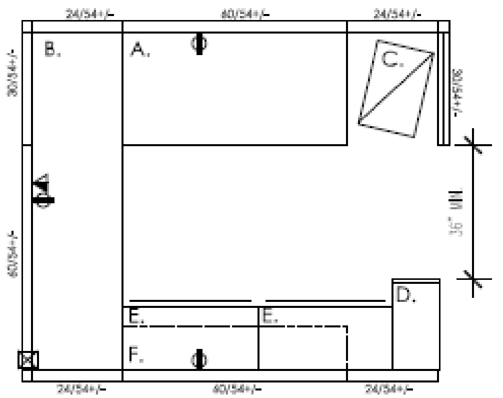
Infrastructure

TYPICAL WORKSPACE
SCALE: N.T.S



③ RESIDENT WORKSPACE
6.7 m²

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE
LAMINATE TO BE GRADE 2/B AND MUST INCLUDE WOODGRAIN LAMINATE OPTIONS
LEGS/BASE: METAL PAINTED FINISH INCLUDING METALLIC FINISHES

MOBILE BOX, FILE PEDESTAL WITH CUSHION TOP:
CUSHION TOP - GRADE 2/B FABRIC
PAINTED METAL FINISH BODY
STANDARD PULLS (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
AND PENCIL TRAY

STORAGE TOWER:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)

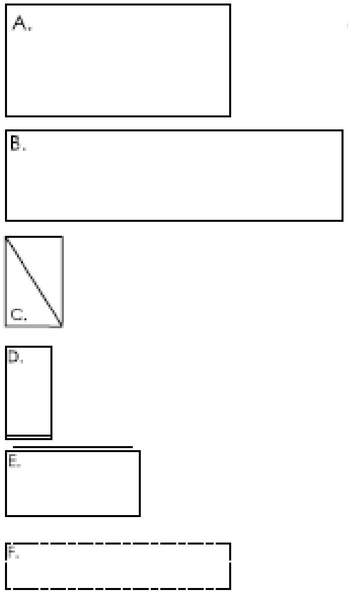
LOW STORAGE:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
C/W FLUSH BACK AND FINISHED TOP

OPEN SHELF:
PAINTED METAL FINISH

ALL STORAGE TO BE LOCKING AND KEYED ALIKE
NOTE: REFER TO PANEL LEGEND SHEET AND TECHNICAL SPECIFICATIONS FOR ADDITIONAL INFORMATION

PANEL FINISHES:
CLEAR OR FROSTED SINGLE PANE GLASS – FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)
PANEL FABRIC: GRADE 2/B
TOP & END TRIMS: PAINTED METAL GRADE 2/B INCLUDING METALLIC FINISH

WORKSPACE KIT-OF-PARTS LEGEND:



A. PRIMARY WORKSURFACE – SIT/STAND
C/W ELECTRIC HEIGHT ADJUSTABLE BASE AND CABLE MANAGEMENT (ALONG BACK)
30" D x 60" W

B. SECONDARY WORK SURFACE
C/W PIN HEIGHT ADJUSTABLE LEGS AND CABLE MANAGEMENT (ALONG BACK)
24" D x 90" W

C. MOBILE PEDESTAL WITH CUSHION TOP
BOX, FILE
24"D

D. TOWER
12"W X 24"D X 54+/-"H
C/W COAT ROD AND COUNTER WEIGHT AS REQUIRED
NOTE: +/- SAME OVERALL HEIGHT AS THE PANEL (INCLUDING STACKS).
PANEL ATTACHMENT BRACKET TO BE INCLUDED.

E. LOW STORAGE
36"W X 18"D X 27+/-"H
2 DRAWER LATERAL c/w COUNTER WEIGHT

F. OPEN SHELF
60"W

ELECTRICAL/VOICE/DATA LEGEND:

⏀ DUPLEX OUTLET

▲ VOICE/DATA

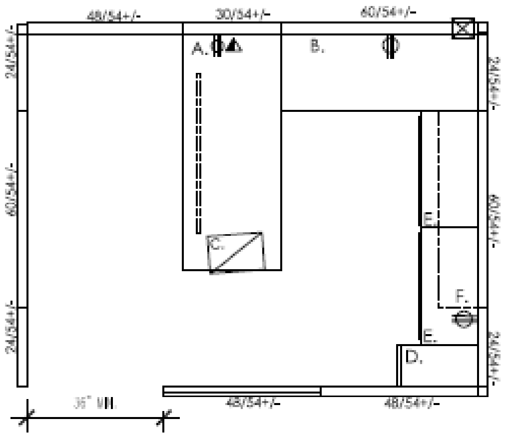
☒ POWER FEED

NOTE: PLEASE PROVIDE ALL NECESSARY ELECTRICAL
AND POWER HARNESSES/CABLING AS REQUIRED.

ELECTRICAL TO BE AT BASE, PROVIDE CABLE MANAGEMENT.

Government of Alberta
Infrastructure

TYPICAL WORKSPACE
SCALE: N.T.S



④ SENIOR MANAGER OR DIRECTOR WORKSPACE
10.0 m²

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE
LAMINATE TO BE GRADE 2/B AND MUST INCLUDE WOODGRAIN LAMINATE OPTIONS
LEGS/BASE: METAL PAINTED FINISH INCLUDING METALLIC FINISHES

MOBILE BOX, FILE PEDESTAL WITH CUSHION TOP:
CUSHION TOP - GRADE 2/B FABRIC
PAINTED METAL FINISH BODY
STANDARD PULLS (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
AND PENCIL TRAY

STORAGE TOWER:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)

LOW STORAGE:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
C/W FLUSH BACK AND FINISHED TOP

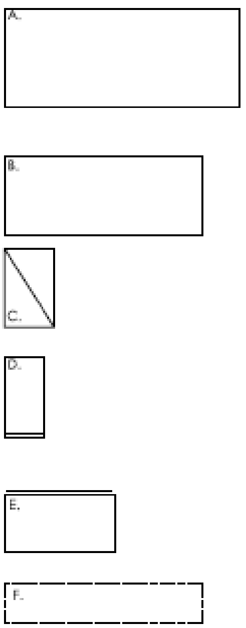
OPEN SHELF:
PAINTED METAL FINISH

ALL STORAGE TO BE LOCKING AND KEYED ALIKE

NOTE: REFER TO PANEL LEGEND SHEET AND TECHNICAL SPECIFICATIONS FOR ADDITIONAL INFORMATION

PANEL FINISHES:
CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)
PANEL FABRIC: GRADE 2/B
TOP & END TRIMS: PAINTED METAL GRADE 2/B INCLUDING METALLIC FINISH

WORKSPACE KIT-OF-PARTS LEGEND:



PRIMARY WORKSURFACE - SIT/STAND
C/W ELECTRIC HEIGHT ADJUSTABLE BASE, CABLE MANAGEMENT (ALONG THE SIDE)
AND HALF HEIGHT MODESTY PANEL
30" D x 72" W

SECONDARY WORK SURFACE
C/W PIN HEIGHT ADJUSTMENT LEGS AND CABLE MANAGEMENT (ALONG THE BACK)
24" D x 60" W

MOBILE PEDESTAL WITH CUSHION TOP
BOX, FILE
24"D

TOWER
12"W X 24"D X 54+/-"H
C/W COAT ROD AND COUNTER WEIGHT AS REQUIRED
NOTE: +/- SAME OVERALL HEIGHT AS THE PANEL (INCLUDING STACKS).
PANEL ATTACHMENT BRACKET TO BE INCLUDED.

LOW STORAGE
36"W X 18"D X 27+/-"H
2 DRAWER LATERAL c/w COUNTER WEIGHT

OPEN SHELF
60"W

ELECTRICAL/VOICE/DATA LEGEND:

⊕ DUPLEX OUTLET

▲ VOICE/DATA

☒ POWER FEED

NOTE: PLEASE PROVIDE ALL NECESSARY ELECTRICAL
AND POWER HARNESSES/CABLING AS REQUIRED.

ELECTRICAL TO BE AT BASE, PROVIDE CABLE MANAGEMENT.

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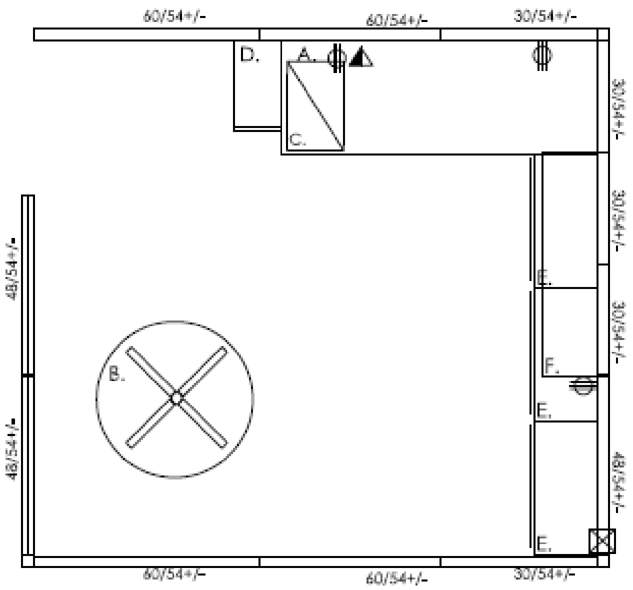
TYPICAL WORKSPACE
SCALE: N.T.S



5a EXECUTIVE DIRECTOR OPEN WORKSPACE
14.0 m²

WORKSTATION FINISHES:

WORKSURFACE TOPS AND TABLE: H.P. PLASTIC LAMINATE C/W STANDARD EDGE
LAMINATE TO BE GRADE 2/B AND MUST INCLUDE WOODGRAIN LAMINATE OPTIONS
LEGS/BASE: METAL PAINTED FINISH INCLUDING METALLIC FINISHES

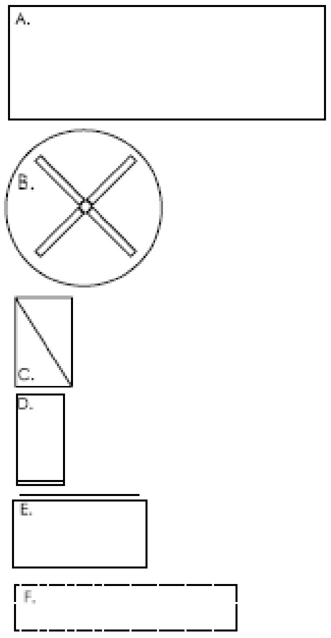
MOBILE BOX, FILE PEDESTAL WITH CUSHION TOP:
CUSHION TOP - GRADE 2/B FABRIC
PAINTED METAL FINISH BODY
STANDARD PULLS (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
AND PENCIL TRAY

STORAGE TOWER:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)

LOW STORAGE:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
C/W FLUSH BACK AND FINISHED TOP

ALL STORAGE TO BE LOCKING AND KEYED ALIKE

WORKSPACE KIT-OF-PARTS LEGEND:



PRIMARY WORKSURFACE - SIT/STAND
C/W ELECTRIC HEIGHT ADJUSTABLE
BASE AND CABLE MANAGEMENT (ALONG THE BACK)
30" D x 84" W

DESK HEIGHT TABLE C/W X-BASE
42" DIAMETER

MOBILE PEDESTAL WITH CUSHION TOP
BOX, FILE
24"D

TOWER
12"W X 24"D X 54+/-"H
C/W COAT ROD AND COUNTER WEIGHT AS REQUIRED
NOTE: +/-SAME OVERALL HEIGHT AS THE PANEL (INCLUDING STACKS).
PANEL ATTACHMENT BRACKET TO BE INCLUDED.

LOW STORAGE
36"W X 18"D X 27+/-"H
2 DRAWER LATERAL c/w COUNTER WEIGHT

OPEN SHELF
60"W

PANEL FINISHES:
CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)
PANEL FABRIC: GRADE 2/B
TOP & END TRIMS: PAINTED METAL GRADE 2/B INCLUDING METALLIC FINISH
OPEN SHELF:
PAINTED METAL FINISH

NOTE: REFER TO PANEL LEGEND SHEET AND TECHNICAL SPECIFICATIONS FOR ADDITIONAL INFORMATION

ELECTRICAL/VOICE/DATA LEGEND:

⌽ DUPLEX OUTLET

▲ VOICE/DATA

☒ POWER FEED

NOTE: PLEASE PROVIDE ALL NECESSARY
ELECTRICAL AND POWER
HARNESSES/CABLING AS REQUIRED.

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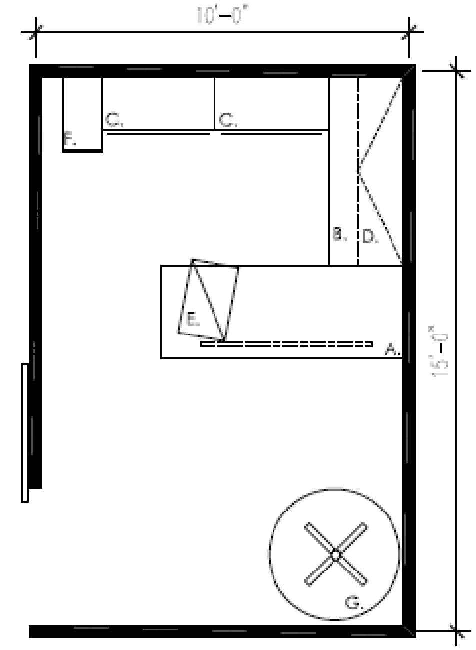
TYPICAL WORKSPACE
SCALE: N.T.S



5b EXECUTIVE DIRECTOR ENCLOSED OFFICE
14.0 m²

WORKSTATION FINISHES:

WORKSURFACE TOPS AND TABLE: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE
LAMINATE TO BE GRADE 2/B AND MUST INCLUDE WOODGRAIN LAMINATE OPTIONS
LEGS/BASE: METAL PAINTED FINISH INCLUDING METALLIC FINISHES

MOBILE BOX, FILE PEDESTAL WITH CUSHION TOP:
CUSHION TOP – GRADE 2/B FABRIC
PAINTED METAL FINISH BODY
STANDARD PULLS (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
AND PENCIL TRAY

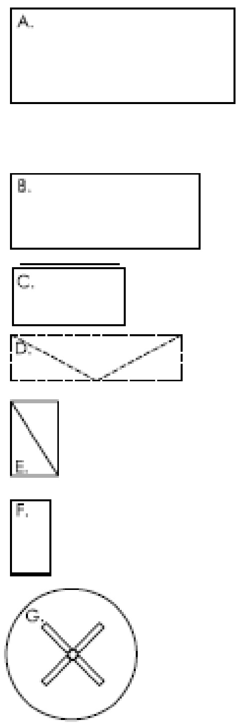
STORAGE TOWER:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)

LOW STORAGE:
LAMINATE OR PAINTED METAL FINISH
STANDARD PULL METAL FINISH (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
C/W FLUSH BACK AND FINISHED TOP

CLOSED OVERHEAD:
LAMINATE OR PAINTED METAL FINISH
C/W TACKBOARD (GRADE 2/B) & TASKLIGHT

ALL STORAGE TO BE LOCKING AND KEYED ALIKE

WORKSPACE KIT-OF-PARTS LEGEND:



PRIMARY WORK SURFACE –SIT/STAND
C/W ELECTRIC HEIGHT ADJUSTABLE BASE, CABLE MANAGEMENT (ALONG THE SIDE)
AND HALF HEIGHT MODESTY PANEL
30"D x 78"W

SECONDARY WORKSURFACE
C/W PIN HEIGHT ADJUSTABLE LEGS AND CABLE MANAGEMENT (ALONG THE BACK)
24"D X 60"W

LOW STORAGE
36"W X 18"D X 27+/–"H
2 DRAWER LATERAL c/w COUNTER WEIGHT

WALL MOUNTED OVERHEAD 60"W
C/W TACKBOARD & TASKLIGHT

MOBILE PEDESTAL
BOX, FILE
24"D

TOWER
12"W X 24"D X 54+/–"H
C/W COAT ROD AND COUNTER WEIGHT AS REQUIRED
GANGING BRACKET TO BE INCLUDED.

DESK HEIGHT TABLE C/W X–BASE
42" DIA.

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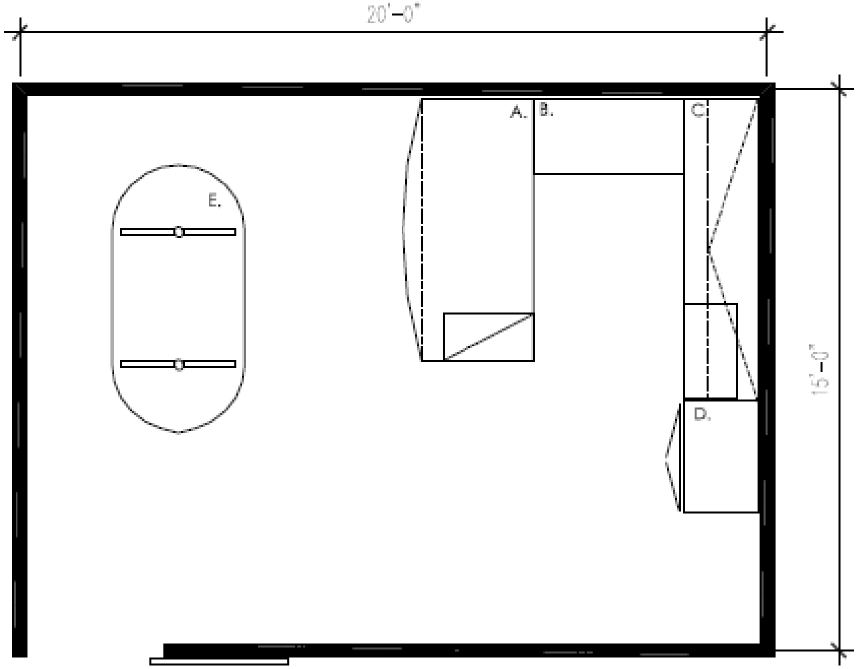
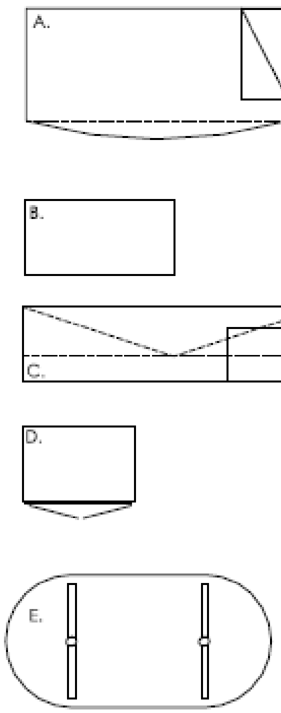
TYPICAL WORKSPACE
SCALE: N.T.S



7 DEPUTY MINISTER OFFICE
28.4 m²

NOTE: REFER TO THE TECHNICAL SPECIFICATIONS FOR ADDITIONAL INFORMATION

WORKSPACE KIT-OF-PARTS LEGEND:



D-TOP WORKSUFACE
C/W FULL HEIGHT MODESTY PANEL,
BBF PEDESTAL AND CABLE MANAGEMENT
36"/42"D X 84"W

BRIDGE WORKSUFACE – SIT/STAND
C/W HALF HEIGHT MODESTY PANEL,
CABLE MANAGEMENT AND ELECTRIC HEIGHT BASE
24"D X 48"W

CREDENZA WITH LOWER LATERAL STORAGE
CLOSED HUTCH C/W TACKBOARD
AND TASKLIGHT
24"D X 96"W

COMBO STORAGE UNIT C/W
UPPER CLOSED AND LOWER FILE STORAGE
HEIGHT TO MATCH HUTCH
24"D X 36"W

DESK HEIGHT TABLE C/W T-BASES
42"D X 72"W

FINISHES:
WOOD VENEER TOP AND BODY (CLASS B)
PROFILE EDGE 2

TACKBOARD FABRIC (GRADE 2/B)

ALL STORAGE TO BE LOCKING AND KEYED ALIKE

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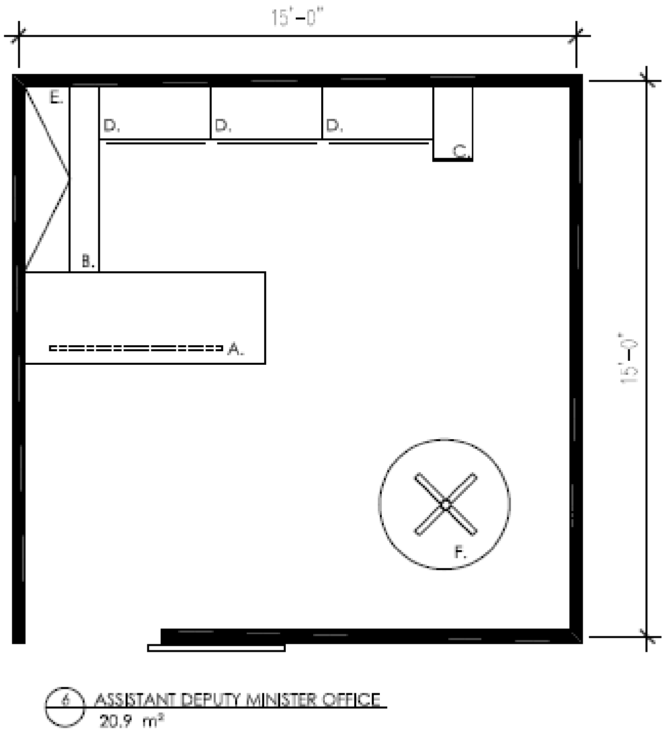
TYPICAL WORKSPACE
SCALE: N.T.S



ASSISTANT DEPUTY MINISTER OFFICE
20.9 m²

FINISHES:
WOOD VENEER TOP AND BODY (CLASS B)
PROFILE EDGE 2

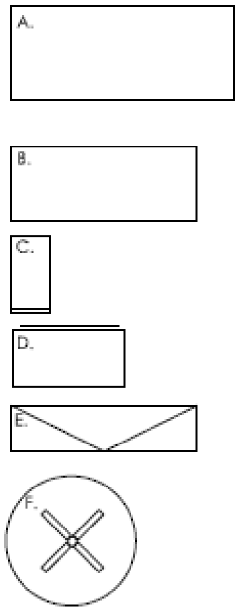
TACKBOARD FABRIC (GRADE 2/B)

ALL STORAGE TO BE LOCKING AND KEYED ALIKE

NOTE: REFER TO TECHNICAL SPECIFICATIONS FOR ADDITIONAL INFORMATION

LOW STORAGE:
STANDARD PULL METAL FINISH (ADA COMPLIANT)
C/W DIVIDERS, LEGAL/LETTER HANGING FILES
C/W FLUSH BACK AND FINISHED TOP

WORKSPACE KIT-OF-PARTS LEGEND:



PRIMARY WORK SURFACE –SIT/STAND
C/W ELECTRIC HEIGHT ADJUSTABLE BASE. CABLE MANAGEMENT (ALONG THE SIDE)
AND HALF HEIGHT MODESTY PANEL
30"D x 78"W

SECONDARY WORKSURFACE
C/W PIN HEIGHT ADJUSTABLE LEGS AND CABLE MANAGEMENT (ALONG THE BACK)
24"D X 60"W

TOWER
12"W X 24"D X 54+/–"H
C/W COAT ROD AND COUNTER WEIGHT AS REQUIRED
GANGING BRACKET TO BE INCLUDED.

LOW STORAGE
36"W X 18"D X 27+/-"H
2 DRAWER LATERAL c/w COUNTER WEIGHT

WALL MOUNTED OVERHEAD C/W TACKBOARD & TASK LIGHT 54"W
C/W TACKBOARD & TASKLIGHT
60"W X 14+/–"D

DESK HEIGHT TABLE C/W X-BASE
42" DIA.

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TYPICAL WORKSPACE
SCALE: N.T.S