Technical Design Requirements for Alberta Infrastructure Facilities

Version 8

March 2025

Alberta Infrastructure

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0.0 General Requirements

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

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0.1 Introduction

The **Technical Design Requirements for Alberta Infrastructure Facilities (TDR)** document provides a comprehensive set of standards for architects, engineers, contractors, client groups, facility administrators, and operators involved in the design and construction of Alberta Infrastructure facilities. Developed by Alberta Infrastructure's **Technical Services and Procurement Branch (TSPB),** the TDR consolidates best practices from the perspective of a knowledgeable owner and incorporates insights from national and international subject matter experts. The requirements are based on proven components and systems that are reliable, efficient, cost-effective over their lifecycle, and responsive to user needs. The TDR establishes minimum standards for planning new facilities as well as renovating and operating existing facilities. Innovative designs, products, systems, and technologies are encouraged after thorough evaluation of potential benefits and risks, value analysis, and life cycle cost. Early and regular engagement *with* TSPB *is* recommended when considering alternatives.

As *a* **living document***,* the TDR is regularly updated to reflect advancements in facility design and technology. The latest version can be viewed or downloaded in electronic format, through the Infrastructure Technical Resources (ITR) website. (https://www.alberta.ca/infrastructure-technical-resources.aspx)

.1 Design Principles

All Government of Alberta projects shall receive a high degree of design consideration; however, distinctions must be made between signature, above average, and routine buildings. This should be identified in the project charter, the Statement of Design Objectives (SDO), or during early pre-design stages.

- **Signature:** A high-profile facility that impacts a large region or sector, involves a significant budget, and garners substantial public interest. These projects prioritize exemplary form, materials, scale, and public prominence, ensuring a best-in-class architectural and functional outcome. Examples of such projects include museums and capital buildings.
- **Above Average:** A large project impacting the general municipal area, distinguished by its unique approach or program, higher budget, and local public interest. These facilities, such as hospitals and university buildings, prioritize above-average aesthetics and quality in form, materials, and scale.
- **Routine:** A typical new or modernization project impacting the local community, with a standard program and budget. The building form should align with its typology, prioritizing simplicity, efficiency, durability, economy, and operational effectiveness. Appropriate examples of routine buildings include schools, circuit courts, health clinics, and service/office buildings.

Design Principles for Publicly Funded Vertical Infrastructure outline the required outcomes for the design, construction, operation, and maintenance of all Government of Alberta-funded facilities. This disciplined planning approach ensures balanced and holistic results that align the short-term goals of the Project Team with the long-term needs of the Owner.

.2 Statement of Design Objectives (SDO)

The SDO is developed by the Owner for inclusion in the project's Request for Proposal(s) (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, to demonstrate intended objectives are being met. A sample template SDO is available at the end of this Design Principles Section.

0.2 Design Principles for Publicly Funded Vertical Infrastructure

As a knowledgeable owner, Alberta Infrastructure has extensive experience with the design, construction, and operation of its facilities. Based on this experience, Alberta Infrastructure has developed a set of Design Principles 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.

.1 Infrastructure's Responsibility to Albertans:

The design, delivery, operation, and maintenance of quality infrastructure is central to the Government's commitments to Albertans. Alberta Infrastructure is responsible for the provision of public facilities that meet stakeholder needs in a cost-effective and efficient manner, aligning with the province's environmental, social, and economic values. In collaboration with boards, agencies, and industry, the Ministry enhances the value of building infrastructure by leveraging collective technical experience across planning, design, construction, acquisition, and renovation.

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

Aligned with the Government's priorities, Infrastructure projects must achieve effective and efficient program outcomes while adhering to time, budget, scope, and quality parameters. Optimizing infrastructure and asset management requires overarching principles that align practices, standards, and programs to deliver effective, affordable, and sustainable publicly funded facilities.

The Design Principles emphasize building performance and use over the life of a facility, fostering innovative solutions that are fiscally responsible, functionally appropriate, and operationally efficient. A clear understanding of the functional, physical, and operational requirements is essential for project success. The six foundational design principles guiding this approach are:

.2 Functionality

Every design is expected to perform a primary function. While functions can be achieved in a variety of ways, basic elements must be considered to create solutions that best fulfill the building's intended purpose.

A project's development stems from an endorsed need, purpose, or mission, with a clear desired outcome. A facility is functionally successful when its design meets the technical, operational, cognitive, cultural, and accessibility needs of its users. A key indicator of a high-quality building is its ability to function as intended throughout its lifespan.

Functional design is both a process and an outcome. Functionality must be considered alongside all other principles to ensure a fully integrated and effective approach. Even when compromises and trade-offs are necessary, functionality should remain a core priority in decision-making.

.3 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:

.1 Optimize site selection: the location, orientation, and landscaping of a building affects local ecosystems, transportation methods, and energy use. Soil conditions, 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.

.2 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 or net zero carbon may be appropriate for certain projects. Close the gap between design energy targets and actual energy consumption through integrated monitoring to inform the evolution and improvement of future design standards.

.3 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.

.4 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. The use of locally manufactured forest and engineered wood products certified under a recognized certification system is encouraged.

.5 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 and replacement needs.

.6 Enhance indoor environmental quality: 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.

.7 Integrate sustainability in a collaborative, consistent manner. From the outset of a project, apply a holistic approach that evaluates all design options for practicality, economy, and best value to the project and to the environment. Sustainability principles are most effective and valuable when integrated from project initiation.

.8 Consider the durability of the building and its various systems and utilities: considering durability will minimize degradation and obsolescence. 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.

.4 Flexibility and Adaptability

Most public infrastructure is built for long lifespans, yet predicting future social, technological, or functional needs is challenging. To ensure long-term usability, flexibility and adaptability are key priorities. Flexible designs allow for reconfiguration of spaces for similar uses. Adaptable designs accommodate change in use over time. Flexible, adaptable infrastructure supports long-term efficiency, functionality, and economy.

Two 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 reused or reconfigured easily for multiple uses. Wherever possible, design flexible floor plans to allow for multiple uses and easy reconfiguration.

To adapt to evolving technology and new programs, a facility must be flexible throughout its lifetime. Open floor plans, grid layouts, and adaptable systems facilitate reconfiguration and renovation. Choose furniture, movable modular walls, and smaller components that align harmoniously with the architectural form. Operating systems (e.g., HVAC, operable walls) should enable efficient use of occupied areas while allowing others to remain closed, supporting diverse functions over the building's life cycle. Floor plans should be prioritized for their flexibility as much as their overall size.

.5 Affordability

Alberta continues to be one of Canada’s fastest growing provinces. As such, 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 best quality outcomes can be delivered with the limited resources available.

Financial comparisons extend beyond initial construction costs. Projected annual operating and maintenance costs, component life cycle costs, and ease of operation significantly affect a facility's long-term cost and performance. Operating and maintenance costs can far exceed the initial capital investment; addressing life-cycle costs early in the design phase can minimize total expenses and optimize the use of scarce resources. Design energy modeling and post-construction performance verification offer metrics to enhance model accuracy, improving both capital and operational cost estimations.

.6 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 neurodiversity, gender identity, and respect for cultural, religious, and mental health considerations. Examples: inclusive washroom design, respite rooms, sensory rooms, and smudging rooms.

.7 Form

A well-designed building reflects and responds to its site, climate, culture, and local materials. Factors such as accessibility, circulation, solar orientation, program, and topography influence design, and the building form should respond to each in a considered and meaningful way.

Form is the primary driver for all building systems and should prioritize simplicity and rational planning. Key architectural features, such as main entrances, canopies, and double-height spaces can be enhanced through thoughtful, low-complexity engineering solutions.

Pursue value through innovation; not every building requires a fully custom design. A standardized approach, incorporating modularity and prefabrication, allows for site-specific features while maintaining cost efficiency. Using a limited selection of local materials helps reduce the carbon footprint and enhances integration with the environment. Additionally, incorporating existing facilities into new projects – rather than relying solely on replacement – can functionally enhance the overall outcome and better meet user needs.

.8 Summary

Good design is a process that delivers long-term value, functionality, innovation, and inspiration. Design provides value by delivering high quality, sustainable facilities that enhance quality of life and address user needs. Design provides value through:

.1 Functional value – meeting and adapting to the long-term needs of all users;
.2 Environmental value – ensuring efficient and responsible use of resources;
.3 Viability – delivering good long-term value for public investment;
.4 Social value – fostering a positive sense of identity and community;
.5 Physical value – enhancing the built environment and urban planning.

Sustainability and affordability are supported by optimizing life-cycle costs, ensuring the longevity of building components, designing for straightforward maintenance and repairs, and incorporating durable, low-maintenance materials. These Design Principles apply to GoA funded projects, guiding facility design and operation to align with the Province's environmental, social, and economic goals. While they cannot address every condition, the Principles highlight key considerations for integrated, effective, and sustainable design solutions. The Design Principles compliment, but do not replace, the responsibilities and due diligence of contracted consultants, and should be applied alongside professional judgment appropriate to each project.

0.3 Functionality Standards:

.1 Health, Safety and Wellness of Building Users

.1 Codes and Safety

.1 Current Safety Code minimums provide a base level of compliance. Where relevant to future growth, durability, and safety, minimums may be exceeded to allow for future adaptability, beyond prescribed program needs (e.g., ramps at 1:20 preferred over 1:12, egress stairs sized for potential increased occupancy).

.2 For GoA Tier 2 or 3 projects (refer to section 1.2.1 for project tier definitions), do not provide exemptions for non-complying existing safety issues:

- .1 Affected areas could include sprinklering, alarm systems, firewalls, fire compartments, egress widths, door count, and door swing direction, etc.
- .2 Scope of work may need to adapt – safety is always a priority.

.3 If incorporating Child Care Spaces into Government Buildings refer to requirements laid out within the Alberta Health Services Health and Safety Guide for Operators of Child Care Facilities and the Early Learning and Child Care Regulation.

.2 Accessibility and Inclusivity

.1 Universal, Active and Accessible Design

- .1 Provide equal, dignified access to all users.
- .2 Promote physical activity through building, site, and landscape design.
- .3 Implement best practices for barrier-free access: Alberta Safety Codes Council – Barrier Free Design Guides

.2 Diversity and Inclusivity

- Design with respect and acknowledgement of all Albertan's diversity.

.3 Health and Wellness

.1 Democratization of office space and classrooms

- .1 Fair access to light and view for users.
- .2 Flexibility in work areas to suit focused vs social tasks.

.2 Long corridors

- .1 End in natural light or feature view (e.g., art).
- .2 Visually group zones or areas to assist wayfinding.

.3 Light Quality

- .1 Daylighting and Fenestration – appropriate window sizes, orientation, and controllability.
- .2 Balance natural lighting with sun glare control, and shading needs.
- .3 Zone lighting to allow for various areas to be controlled independently.
- .4 Implement dimming controls and intermittent operation controls (e.g., occupancy sensors, programmed schedules) to increase energy efficiency, comfort, and task specific needs.

.5 Consider the use of photocells to harvest daylight near window areas.
.6 Utilize full spectrum lighting and varied lighting types to enhance visual comfort, aesthetics, and functionality.

.4 Comfort Features

.1 Ergonomics in task and respite areas.
.2 Thermal comfort, including individual control.

.5 Air Quality

.1 Air quality standards, VOC reduction, filtration, pollution control and monitoring.
.2 Incorporate smoke and scent free zones.
.3 If required, designate smoking areas away from public entrances and air intakes.

.4 Security

.1 Sightlines

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

.2 Physical security

.1 Where necessary, incorporate passive site and building defense/hardening into the architectural and landscape design.
.2 Crime Prevention Through Environmental Design (CPTED): apply principles of natural access control, natural surveillance, territorial reinforcement, and maintainability.

.5 Acoustics (See also Section “7.0 Acoustical”, pdf page 209)

.1 Acoustics are a key component of occupant comfort and productivity. Acoustically effective spaces:

.1 Enhance speech clarity: ensure effective communication in offices, classrooms, and meeting spaces.
.2 Reduce noise distractions: minimize disruptions from background noise, improving focus and efficiency.
.3 Improve privacy: prevent sound transmission in confidential or sensitive areas (e.g., offices, healthcare settings).
.4 Support well-being: reduce stress and fatigue by controlling sound levels in busy environments.
.5 Optimize multi-use spaces: ensure adaptability for various activities without excessive noise interference.
.6 Meet accessibility needs: improve sound conditions for individuals with hearing impairments.
.7 Ensure robust vibration and sound isolation detailing and installation.

.2 Non-Progressive Moveable Walls

.1 Not suitable for quiet spaces requiring high levels of speech privacy/sound isolation.

.2 Sound leaks in construction joints at ceiling, floor, and wall intersections are common.
.3 Costlier than conventional construction; requires specialized technicians for relocation.

.3 Operable Partitions
.1 Minimize use: challenging to properly install, requires routine maintenance.
.2 Can limit future use of the space and are expensive.
.3 Avoid use where sound isolation is a priority (difficult to achieve/maintain desired STC).
.4 End users should be thoroughly informed of acoustics outcomes.

.4 Glazing in Interior Walls
.1 Minimize size, maximize pane thickness.
.2 Use laminated glass and double glazing with maximum air space thickness.
.3 Correct design will provide acoustic separation and allow light/views.

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

.6 Acoustically Absorptive Building Materials
.1 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.
.2 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.
.3 Open plan spaces (e.g., classrooms, offices) require ceilings with very high sound absorption; minimum standards may be too low for some situations.
.4 Provide high quality flanking walls and ceiling baffles.

.2 Durability and Maintainability

.1 Durability

.1 Strengths and Properties of Materials

.1 Prioritize inert materials: metal, glass, stucco, stone, concrete, mass timber.
.2 Avoid plastics and unusual composites: avoid face-sealed approaches (e.g. reliance on foam or sealant for water, air, vapour seals).
.3 Understand metallurgy and impacts of dissimilar materials.
.4 Avoid sole sourced and unproven technologies.
.5 Consider the effects of Alberta's climate on exterior materials (e.g., flood, wildfire).

.2 Vandalism, weather, and maintenance will damage inappropriate materials:

.1 Use robust, durable materials (e.g. masonry, concrete, etc.) at grade.
.2 Avoid climbable features.
.3 Understand and practice CPTED principles.

.3 Alberta Flood and Wildfire Risk:

.1 Low combustibility roofing, materials, and details; flood resilient design.

.2 Review ITR white papers on flood and wildfire mitigation.
.3 Refer to Resilient Design Institute recommendations.
.4 Refer to Institute for Catastrophic Loss Reduction recommendations.
.5 Refer to https://firesmartalberta.ca/resources/ recommendations.

.4 Material Redundancy
.1 Protect sensitive materials and finishes (e.g., utilize rubber nosings, metal corner guards, etc.).
.2 Understand user behaviour (e.g., students, patients, elderly, vulnerable, etc.) when evaluating material options.
.3 Select materials appropriate for use/users (e.g., masonry at grade, reinforced drywall, mold resistant drywall, etc.).
.4 Avoid locating sinks and plumbing fixtures on exterior walls to reduce the risk of freezing plumbing lines and maintenance issues.
.5 Incorporate redundancies in systems to reduce negative outcomes from possible component failure and extend the expected life span of buildings (building envelope e.g.: double layer of membrane at wall corners, secondary air and water seals, overflow scuppers.)

.2 Constructability

.1 Utilize consistent repetition and modulation to streamline constructability.

.2 Enable modularity and pre-fabrication

.1 Rational building layout (e.g., conventional grid, right angles) streamlines coordination with modular components for dimensional compatibility and flexibility.
.2 Prioritize standardized components over customized forms to minimize waste and maximize flexibility.

.3 Constructible systems and details

.1 Anticipate the rational sequence of the construction process when making design decisions.

.3 Maintainability

.1 Common component sizing (e.g., rectangular vs. raked windows).
.2 Rectilinear geometries and forms that are easier to repair and replace.
.3 Accessibility: provide stairs and doors for safer and more convenient roof access instead of hatches and ladders.
.4 Ease of component replacement: consider access, cleaning, and future maintenance (e.g., re-roofing).
.5 Consider location and elements susceptible to vandalism/damage; consider cleaning, repair, or replacement tasks/costs.

.3 Building Science

.1 Building Envelope

.1 Current Building Code minimums provide a base level of compliance. Minimums may be exceeded where appropriate to allow for more durable construction, reduced maintenance requirements and life cycle costs, improved energy efficiency, improved indoor comfort, and in anticipation of near-term changes to Building Code relating to sustainability.

.2 Manage water and control unwanted moisture penetration to reduce risk of moisture-related deterioration.

- ,1 Use rain screen methods to deflect and drain bulk water.
- .2 Provide a moisture-resistant barrier (e.g. membrane, building paper) to protect the structure from incidental moisture that penetrates past the rain screen.
- .3 Incorporate flashings to direct water out of the envelope assembly and away from the building.
- .4 Control water run-off from roofs, downspouts, and scuppers.
- .5 Slope grading and provide appropriate grade separation.
- .6 Detail penetrations through walls (windows, doors, vents, pipes, etc.) with waterproof membrane.

.3 Control unwanted air and vapour movement to improve energy efficiency, reduce risk of condensation (and related moisture-related deterioration, mould), and improve indoor comfort (reduce drafts).

- .1 Provide a continuous air barrier that also functions as a vapour retarder (and water-resistive barrier, where appropriate), to simplify design and construction detailing. Detail assemblies that can be reasonably and sequentially constructed.
- .2 Air-seal penetrations through walls (windows, doors, vents, pipes, etc.) with membrane. Compatible sealant may be incorporated into complex details to reinforce the membrane air (and water) seal, but should not be relied on as the primary air barrier.
- .3 Mechanically secure and clearly detail air-tight membrane tie-ins.
- .4 Do not rely on spray foam as the primary air seal, as it contracts, cracks with movement, leading to air leakage. It does not perform favorably as a combined air-vapour-water seal.
- .5 Design for simplicity: minimize building articulation (unnecessary corners and changes in elevation) and complex membrane transitions.

.4 Control heat loss to improve energy efficiency, improve indoor thermal comfort, and reduce temperature-related expansion/contraction of structural building components.

- .1 Detail continuous exterior insulation where conditions permit.
- .2 Avoid thermal bridging: minimize envelope penetrations and incorporate thermal breaks.
- .3 Avoid heating “dead space”; run insulation (and air barrier) through architectural features and build-outs instead of around them.

.5 Fenestration

  .1 Strategically size and place windows to save energy, improve durability, and minimize costs.
  .2 Prioritize long-term performance and maintenance needs over short-term capital savings.
  .3 Carefully detail windows and doors to prevent air and water leakage.
  .4 Avoid sloped glass, in favour of clerestory windows to reduce risk of water leakage and excessive solar heating.

.6 Passive Climatic Response

  .1 Orient building for energy conservation, natural lighting, and solar gain.
  .2 Consider value of building-defined outdoor microclimates for users.
  .3 Protect against winter winds, minimize glazing to prevailing winter winds.
  .4 Take advantage of southerly exposures. Avoid north facing curtain walls and clerestories, to reduce building heat loss.
  .5 Anticipate seasonal changes in sunlight exposure and consider favourable and unfavourable solar heat gain.
  .6 Utilize National Energy Code for Buildings (NECB) and energy modelling to achieve data-driven design solutions.

.2 Roofing

.1 Design all non-vertical surfaces to perform as roofs.

.2 Design roof/parapet details to facilitate future roofing replacement.

.3 Design roofs to promote longevity:

  .1 Uniform insulation, with sloped structure.
  .2 Redundant drains to handle normal rainfall and scuppers for overflow and extreme events.
  .3 Direct water away from walls/parapets, walks/ramps, sensitive landscaping, etc.
  .4 Steep flashing slopes over porous materials for shedding (e.g., brick sills).
  .5 Higher-wear surfaces in traffic areas, and stair access for servicing.
  .6 Mitigate wildfire risk with low combustibility materials and careful detailing.
  .7 Avoid cascading roofs and waterfall roof edges.

.4 Implement photovoltaic array standards for best practice, efficiency, warranty, safety, and durability (e.g., Alberta Roofing Contractors Association Standards).

.5 Design for safety of workers

  .1 Design controls for snow slides, icicle prevention, and over-flowing water at gutters.
  .2 Provide safe roof access (e.g., door is safer than hatch).

.6 Avoid complexity in roof design

  .1 Minimize elevation changes to maintain a consistent roof height where possible.
  .2 Use uniform structural slopes to reduce the need for multiple roof planes.
  .3 Align roof levels with the primary building grid to reduce complexity.
  .4 Reduce mechanical penthouses and bulkheads by integrating equipment into fewer, centralized enclosures.

.4 Sustainability

.1 Integrated Design

.1 Engage project stakeholders (clients, facility managers, user groups, Technical Services, etc.) early to determine the project requirements and goals.

.2 Prioritize opportunities to achieve high performance building energy goals and promote the health and well-being of end users.

.2 Prioritize Building Envelope

.1 Through preliminary energy modeling, validate implications of building massing, form, and orientation.

.2 Validate the impact of improved envelope performance on the operation of the facility.

.3 Optimize HVAC System Design

.1 Where applicable, perform life-cycle cost analysis of system options, such as Ground-Sourced Heat Pumps and Variable Refrigerant Flow, including carbon pricing.

.2 Consider HVAC system impacts on building maintenance costs.

.4 Consider Incorporating Renewable Energy

.1 Review options for incorporating present or future solar PV panels into the design with client group.

.5 Consider the Life-Cycle Embodied Carbon

.1 Optimize material selection: consider implementing low maintenance, high durability, easily repaired and carbon-sequestering materials.

.6 Support Greener Transportation Options

.1 Provide or plan for future electric vehicle parking and charging stations.

.2 Provide secure, passively supervised, sheltered bicycle and scooter storage.

.5 Flexibility/Adaptability

.1 Loose fit plans; general vs. specific fit

.1 Adaptive grids and geometries using planning modules.

.2 Rectilinear rooms: various furniture orientation and layout options.

.3 Plan for adaptive furniture over built-in fixtures and millwork.

.2 Interior Program Expansion and Increased Occupant Load

.1 Ensure stairwells and exiting capacity will accommodate future growth within the planned space; avoid minimum program occupancy to establish safety features.

.3 Accommodate future growth at building scale

.1 Consider site drainage and uniform tie-in of floor levels.

.2 Siting for future growth for both building and parking (e.g., plan for potential expansion area or accommodation of modular classrooms).

.6 Responsible Architecture and Life Cycle Costing

.1 Rational Planning

.1 Purposeful, simple geometries in plan and in massing (e.g., rectilinear). Avoid over-articulation of forms to reduce complexity and cost.

.2 Use site data to inform building layout, orientation, and form

- .1 Solar direction, prevailing winds, site geometry and topography.
- .2 Pedestrian, bicycle, passenger, and service vehicle access.
- .3 Shadow studies with correct solar orientation.
- .4 Positive drainage away from building: avoid natural low points of site.
- .5 Favour natural light at building entrances.
- .6 Review for area wildfires and flooding risks.

.2 Value by Design

.1 Consider first cost, life-cycle cost (e.g., 50 year), carbon emissions and energy metrics.

.2 Design/construction cost is a small fraction of a facility's lifecycle cost.

- .1 Ensure sufficient time to understand (pre-plan) and optimize design.
- .2 Know the long-term impacts of short-term gains.
- .3 Develop sustainability strategies and major systems (e.g., mechanical, electrical, circulation, etc.) in-step with design.

.3 Thoughtful Design

.1 Aspire to design for good value: appropriate to building classification of signature building, above average, or routine building.

.2 Refined, disciplined, and purposeful in material use, form, and detailing.

.3 Evaluate the merits of reusing existing structures where opportunities exist.

- .1 Understand cultural value of existing facilities to community identity.
- .2 Determine the environmental impact of demolition and landfilling materials vs. adaptive reuse; consider the embodied carbon in existing facilities vs. new carbon emissions created as a result of new construction.
- .3 Provide a fair evaluation of the pros and cons of building retention that recognize the triple bottom line: financial, environmental, and social impacts.
- .4 Consider opportunities to enhance project outcomes through careful integration of old and new structures.

.4 Community

.1 Design for appropriate response, in scale, material, and cadence, to the community served.

.2 Appropriate (easily identified and dignified) sense of entrance, circumstance, and occasion.

- .1 Include (secure) opportunities for after-hours uses by community.
- .2 Provide plenary spaces: coats, concession, queueing, etc.
- .3 Prioritize naturally lit east, south, or west entrances (vs. dark northern orientation).

.3 Provide distinct features for the main entrance, urban corner, or similar high-profile locations, for identity and community presence.

- .1 Distinguish places of gathering and assembly, entrances, etc.
- .2 Avoid over articulated elements that are incongruous or unrelated to the community.

.4 Develop hard and soft landscape features connecting the building to its urban landscape.

- .1 Provision of flags, signage, site furnishings.
- .2 Follow GoA signage standards.
- .3 Rational circulation paths for pedestrians, cyclists, and vehicles.
- .4 Covered, secure bicycle parking near entrances and sightlines.
- .5 Specify landscaping for durability and ability to thrive with minimal maintenance.
- .6 Accessibility: prioritize gentler ramps (1:15 or 1:20) and wider sidewalks.
- .7 Central lobby/ main entrance has obvious circulation, wayfinding cues (e.g., signage, passage, location, landscaping).

.5 Inspiration

.1 Experience

- .1 Envision how the end user will socially, emotionally, and physically experience the building and site, and design to enhance this experience.
- .2 Inspiration should focus on connectivity of users, community fit, and facility functions.

.2 Beauty and Delight

- .1 Incorporate art and nature where possible.
- .2 Maintain design language and visual identity of public institutions to ensure they are recognizable, functional, and representative of their civic role

.7 Links

1. Infrastructure Technical Resources:

   https://www.alberta.ca/infrastructure-technical-resources.aspx
2. Technical Design Requirements for Infrastructure Facilities:

   https://www.alberta.ca/system/files/custom_downloaded_images/infra-technical-design-requirements.pdf
3. Leadership in Energy and Environmental Design (LEED): https://www.usgbc.org/
4. WELL Building Standard: https://www.wellcertified.com/
5. Technical Services and Procurement Branch Solar Guidelines:

   https://www.alberta.ca/system/files/custom_downloaded_images/tr-solar-energy-for-alberta-final.pdf
6. Zero Carbon Building – Design Standard: https://www.cagbc.org/
7. Crime Prevention Through Environmental Design (CPTED): http://www.cpted.net/
8. Technical Services and Procurement Branch Flood Guidelines:

   https://www.alberta.ca/system/files/custom_downloaded_images/tr-floodriskmgmt.pdf
9. Technical Services and Procurement Branch Wildfire Guidelines:

   https://www.alberta.ca/system/files/custom_downloaded_images/tr-wildfireprotection.pdf
10. Resilient Design Institute: https://www.resilientdesign.org/the-resilient-design-principles/
11. Institute for Catastrophic Loss Reduction: https://www.iclr.org/
12. Alberta Roofing Contractors Association: https://arcaonline.ca/
13. Active Design Guidelines: https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/active-design-guidelines/adguidelines.pdf
14. 7 Principles of Universal Design: https://universaldesign.ie/about-universal-design/the-7-principles
15. Athena Impact Estimator: http://www.athenasmi.org/our-software-data/impact-estimator/
16. Accessibility Design Guide, 2024: https://open.alberta.ca/publications/accessibility-design-guide
17. Fitwell: https://fitwel.org/
18. Canadian Handbook of Practice for Architects: https://chop.raic.ca/

0.4 Statement of Design Objectives (SDO)

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

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

Contact:
Standards and Specifications
Technical Services and Procurement Branch
Alberta Infrastructure
3rd Floor, 6950 - 113 Street
Edmonton, AB T6H 5V7
T | 780-422-7456
infras.trc@gov.ab.ca

Sample Statement of Design Objectives

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 Alberta Association of Architects (AAA) & the Association of Professional Engineers and Geoscientists of Alberta (APEGA), National Building Code – Alberta Edition Schedules User Guide

.2 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
   - .1 ASHRAE 50 Percent Advanced Energy Design Guide series (2011, 2012)
   - .2 ANSI/ASHRAE 55, Thermal Environmental Conditions for Human Occupancy
   - .3 ANSI/ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality
   - .4 ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
   - .5 ANSI/ASHRAE 209, Energy Simulation Aided Design for Buildings Except Low-Rise Residential Buildings

.3 Canadian Commission on Building and Fire Codes, National Research Council of Canada, National Energy Code for Buildings (NECB) 2020

.4 City of Toronto Energy, Toronto Green Building standard, Energy Modeling Guidelines V4, Appendices and Excel Workbooks

.5 Harvard University, Green Building Standards (2016). Retrieved from: https://green.harvard.edu/topics/green-buildings/green-building-standards

.6 U.S. Department of Energy (DOE), ASHRAE 90.1 Section 11 and Appendix G Submittal Review Manual

.7 U.S. Green Building Council (USGBC)
   - .1 LEED v4.1 Building Design and Construction Getting Started Guide for Beta Participants
   - .2 LEED v4.1 Interior Design and Construction Getting Started Guide for Beta Participants
   - .3 LEEDv5, Retrieved from: https://www.usgbc.org/leed/v5

1.2 General

.1 The Sustainability requirements were incorporated into the TDR from the Green Building Standards, which were originally established 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.

For additional resources regarding projects with unique requirements or projects that do not fall into the Tiers, contact the TSPB (780-422-7456).

.2 Project Tier

.1 Alberta Infrastructure projects shall meet our prescriptive sustainability requirements as defined in the project Tier descriptions that follow.

.2 **Tier 1**: New Buildings, Major Building Additions, and Major Renovations

  .1 New Buildings, Major Building Additions and Major Renovations with energy and GHG impacts, including Building Envelope, Mechanical and Electrical Systems, and Occupant Density.

.3 **Tier 2**: Renovations, Minor Building Additions, and Full Interior Fit-outs

  .1 Partial Building Renovations and Building Additions with one or more Mechanical and Electrical System or Building Envelope within the project scope, as well as Full Interior Fit-Outs of an existing floor or building.

.4 **Tier 3**: Limited Scope System Upgrades with an Energy and GHG Impact

  .1 Limited Scope Projects with Energy impact but are focused on those systems such as HVAC replacement, Building Envelope replacement, Energy Management Control System upgrades, lighting replacement, etc.

.5 **Tier 4**: Limited Scope with No or Limited Energy/GHG Impact

  .1 Limited Scope Projects with no or Limited Energy and GHG Impacts such as minor interior renovations, space alterations, and landscaping.

.3 LEED v4.1 Certification

.1 Tier 1 projects are required to register and achieve LEED Silver certification using version 4.1[1] of the USGBC Leadership in Energy and Environmental Design (LEED®) green building rating system.

  .1 The design team registering the project through LEED Online shall add infras-leed@gov.ab.ca (TSPB Review) to the project.

  .2 The achievement of LEED Silver cannot commit the building owner to the purchase of certificates or other financial support payments.

  .3 A split review is now required for Tier 1 projects. The design phase credits must be submitted for review 60 days after the contract or tender documents are final.

.2 Tier 2 projects do not require LEED certification. However, the project is required to follow the overall LEED guidelines, including prerequisites and meet the Mandatory Credit requirements identified under Tier 2.

.3 Tier 3 and Tier 4 projects are required to meet the credit requirements identified in the respective sections.

[1] LEED version 5 (LEED v5) is scheduled to be released in early 2025. The mandatory adoption date for LEED v5 will take precedence over these LEED v4.1 requirements identified in this document.

1.3 Tier 1 – New Buildings, Major Building Additions and Major Renovations

.1 Integrated Design

.1 Project teams must adhere to the requirements of LEED v4.1 BD+C Integrative Process credit. Projects shall analyze Energy-Related Systems[2] and Health & Well-Being as the two required areas for the credit.

  .1 The term "simple box" model must follow ASHRAE Standard 209 Informative Appendix C: "where design parameters are known, those should be used".

.2 In line with the Flood Risk Management Guidelines and Guideline for Wildfire Protection, project teams are encouraged to review the requirements of LEED v4.1 BD+C Assessment and Planning for Resilience pilot credit, including Option 1: Climate Related Risk Management Planning.

.2 Energy Performance

.1 For the Optimize Energy Performance credit, projects must use the Zero Energy Performance Index (zEPI) Alternative Compliance Path (ACP) with NECB 2020 as the reference code.

  .1 For the air leakage rate modeled, NECB 2020 Article 8.4.3.3 does NOT allow for the results of the airtightness test to be assumed.

  .2 For compliance with the TDR Optimize Energy Performance credit mandatory requirements, the design team may assume the results of the airtightness test if the following conditions are met (adapted from the National Building Code – Alberta Edition Schedules User Guide):

    .1 A building envelope consultant is engaged as a secondary design professional by the architect of record.

    .2 The building envelope consultant provides authenticated design documents, stating the designed air leakage rate, as a referenced supplement to the architectural design documents.

    .3 The project specification stipulates that airtightness testing, in accordance with NECB 2020 Articles 3.2.4.2 and 8.4.2.9, must occur at 60% and 100% construction.

    .4 The building envelope consultant completes a field review of the 60% and the 100% airtightness test.

      .1 For both these field reviews the building envelope consultant shall submit a report to the architect of record with recommendations.

    .5 The energy model submitted for final LEED review must be updated with the 100% tested air leakage rate as per NECB 2020.

      .1 The zEPI ACP credit mandatory requirements must be achieved.

[2] ASHRAE 209 Modeling Cycle #2 and #3 are required for the LEEDv4.1 Integrative Process credit.

.2 Design teams are to follow the ASHRAE 209 requirements in conjunction with the LEED requirements including the following modelling cycles.

 .1 Pre-Design[3]: Modeling Cycle #2–Conceptual Design Modeling[2]
 .2 Schematic Design: Modeling Cycle #3–Load Reduction Modeling[2]
 .3 Design Development 30%: Modeling Cycle #4–HVAC System Selection Modeling
 .4 Construction Documents 60%: Modeling Cycle #5–Design Refinement[4]
 .5 Pre-Tender (100%): Modeling Cycle #8–As-Designed Energy Performance[4]

.3 Documentation for Technical Services review must comply with ASHRAE 209 section 5.7 General Modeling Cycle Requirements and the CAGBC guidance document Zero Energy Performance Index (zEPI) EA Pilot ACP 143.[5]

.3 LEED Certification

.1 Project performance must meet the requirements of select LEED v4.1 BD+C rating system and achieve at least LEED v4.1 Silver certification. For all LEED v4.1 credits, refer to the most recent Reference Guide for detailed credit requirements.

Table 1.3.3.2: Mandatory Credits		BD+C NC	BD+C MR
Integrative Process Credits			
Integrative Process		1/1	1/1
Water Efficiency			
Water Metering		1/1	1/1
Energy & Atmosphere			
Enhanced Commissioning - Option 1, Path 2 and Option 2		6/6	6/6
Optimize Energy Performance - Zero Energy Performance Index ACP[a][d]	Office	12/18	8/18
	School	12/16	8/16
	Healthcare	11/20	7/20
Advanced Energy Metering[b]		1/1	1/1
Material & Resources			
Environmental Product Declarations		1/2	1/2
Sourcing of Raw Materials		1/2	1/2
Material Ingredients		1/2	1/2
Construction and Demolition Waste Management - Option 1. Diversion		1/2	1/2
Indoor Environmental Quality			
Low Emitting Materials		2/3	2/3
Enhanced Indoor Air Quality Strategies[c][d]		1/2	1/2
Construction Indoor Air Quality Management Plan		1/1	1/1

[3] Technical Services does not review the Pre-Design submission; however, project experience has demonstrated that decisions regarding massing and orientation need to occur at pre-design.
[4] Thermal bridging calculations required to be submitted for the 60% and Pre-Tender review.
[5] An example of the energy modeling reporting forms can be taken from the Toronto Green Building standard, Energy Modeling Guidelines V4, Appendix A2 and B2.

Notes to Table1.3.3.2:

(a) NECB 2020 must be used as the reference code.

(b) Implementing metering for existing buildings can be limited by the scope of the renovation. Contact TSPB if the project faces challenges in achieving this credit.

(c) Strategy 1 & 3 are consistent with requirements defined in the Building Envelope and Mechanical sections.

(d) CO2 setpoints used for demand control ventilation and system alarms must demonstrate calculations in compliance with ASHRAE 62.1-2016 Informative Appendix D, or refer to ASHRAE 62.1-2022 addendum ab.

Table 1.3.3.3: Recommended Credits		BD+C NC	BD+C MR
Sustainable Sites			
Light Pollution Reduction		1/1	1/1
Water Efficiency			
Outdoor Water Use Reduction		1/1	1/1
Indoor Water Use Reduction[a]		>3/6	>3/6
Indoor Environmental Quality			
Thermal Comfort	School[a]	1/1	1/1
Acoustic Performance		1/1	1/1
Innovation			
All-Gender Restrooms[b]		1/1	1/1
Assessment and Planning for Resilience - Option 1. Climate Related Risk Management Planning		1/1	1/1

Notes to Table 1.3.3.3:

(a) With recent droughts and water shortages, reducing water use is becoming and increase focus. There is the perception of conflict between reducing water use and universal washrooms. It is important to recognize that the pilot credit allows for the use of urinals.

(b) Compliance with the ASHRAE 55 is required in the Mechanical section. However, there may be limitations based on space type such as Industrial Arts spaces.

.4 Deliverable Requirements

.1 SCHEMATIC DESIGN

.1 LEED v4.1 report, including the LEED scorecard and credit strategies.

.1 As per 1.2.2, confirm infras-leed@gov.ab.ca is added to LEED Online for the project.

.2 Integrative Process credit report highlighting the analysis and outcomes for Energy Systems and Health & Well-being

.3 Energy model report, as per the LEED v4.1 Integrative Process requirements including ASHRAE 209 Modeling Cycle #2–Conceptual Design Modeling completed during the conceptual design phase[6] and Cycle #3–Load Reduction Modeling.

[6] Technical Services does not review the Pre-Design submission; however, project experience has demonstrated that decisions regarding massing and orientation need to occur at pre-design.

.2 DESIGN DEVELOPMENT – 30%

.1 Access to the LEED-Online project been provided to TSB.

.2 Energy model report, as per ASHRAE 209 Modeling Cycle #4–HVAC System Selection Modeling.

.3 CONSTRUCTION DOCUMENTS – 60% COMPLETE

.1 Updated LEED v4.1 report, including the LEED scorecard and credit strategies.

.1 Documentation for design phase prerequisite and credits must be made available upon request from TSPB.

.2 Confirm an independent commissioning agent has been engaged.

.3 Energy model report as per ASHRAE 209 Modeling Cycle #5–Design Refinement, including thermal bridging calculations.

.1 While ASHRAE 209 states refinement is required for “at least one building system”, this is to be interpreted as all applicable building systems for that project.

.4 LEED related Specification sections are included for review.

.4 PRE-TENDER DOCUMENTS

.1 Updated LEED v4.1 report, including the LEED scorecard with design phase credits finalized and any updates to the construction phase credits.

.1 Documentation for design phase prerequisite and credits must be included.

.2 Energy model report as per ASHRAE 209 Modeling Cycle #8–As-Designed Energy Performance.

.1 The energy model report must include the “Required Documentation” for LEED review of the Optimize Energy Performance credit, including the energy model inputs, input-output reports, exceptional calculations including thermal bridging, the energy consumption and demand for each building end use.

.2 Additional reports may be requested as per the ASHRAE 90.1 Section 11 and Appendix G Submittal Review Manual

.3 Provide *the Commissioning Plan for review.*

.4 LEED related Specification sections are included for review.

1.4 Tier 2 – Renovations, Building Additions, and Full 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.

.1 Integrated Design

.1 Project teams must adhere to the "goal setting" requirements of LEED v4.1 BD+C Integrative Process credit for Energy-Related Systems and Health & Well-Being as the two required areas for the credit.

.2 Energy Performance

.1 When energy modeling is developed for building permit, projects must use the Zero Energy Performance Index (zEPI) Alternative Compliance Path (ACP) with NECB 2020 as the reference code.

  .1 The energy modelling process must follow the Tier 1 requirements in section 1.3.2.

    .1 As the 30% Design Development submission is not required Tier 2 projects, the Schematic Design submission, may choose either: Modelling Cycle #3–Load Reduction Modeling OR Modeling Cycle #4–HVAC System Selection Modeling

.2 If energy modeling is not required, 6 points must be achieved through the Optimize Energy Performance credit Option 2: Prescriptive Compliance: ASHRAE Advanced Energy Design Guide.[7]

.3 LEED Certification/ Sustainability Requirements

.1 Projects teams are to review the LEED v4.1 scorecard and the Reference Guide to determine the prerequisites and credits that apply to the project scope.

.2 If LEED certification will not be pursued, compliance with the Mandatory Credits and related prerequisites (P) must be documented by the project team and confirmation of compliance given to the project manager at the end of the project.

[7] As per the credit requirements projects must demonstrate compliance with the ASHRAE 90.1-2016 Prescriptive compliance path in Prerequisite Minimum Energy Performance.

Table 1.4.3.2: Mandatory Credits		BD+C NC/MR	ID+C CI
Integrative Process Credits			
Integrative Process[a]		1/1	1/1
Water Efficiency			
Indoor Water Use Reduction		P	P
Outdoor Water Use Reduction		P	P
Energy & Atmosphere			
Enhanced Commissioning - Option 1, Path 1 and/or Option 2[b]		3-5/6	4/5
Optimize Energy Performance[c][e]	Office	8/18	8/24
	School	8/16	
	Healthcare	5/20	
Material & Resources			
Environmental Product Declarations		2/6	2/6
Sourcing of Raw Materials			
Material Ingredients			
Construction and Demolition Waste Management - Option 1. Diversion		1/2	1/2
Indoor Environmental Quality			
Low Emitting Materials		2/3	2/3
Enhanced Indoor Air Quality Strategies[d][e]		1/2	1/2
Construction Indoor Air Quality Management Plan		1/1	1/1

Notes to Table 1.4.3.2:

(a) Compliance with the goal setting requirements of the Integrative Process credit is required.

(b) Enhanced Commissioning, Option 1, Path 1: Enhanced Commissioning is required for all Tier 2 projects. If the relevant scope of work is included in the project, Option 1, Path 2: Enhanced and Monitoring-Based Commissioning and Option 2: Building Enclosure Commissioning are required.

(c) As per section 1.4.2 Energy Performance.

(d) Strategy 1 & 3 are consistent with requirements defined in the Building Envelope and Mechanical sections of the TDR.

(e) CO2 setpoints used for demand control ventilation and system alarms must demonstrate calculations in compliance with ASHRAE 62.1-2016 Informative Appendix D, or refer to ASHRAE 62.1-2022 addendum ab.

Table 1.4.3.3: Recommended Credits		BD+C NC/MR	ID+C CI
Sustainable Sites			
Light Pollution Reduction		1/1	1/1
Water Efficiency			
Outdoor Water Use Reduction		1/1	-
Indoor Water Use Reduction[a]		>3/6	>6/12
Indoor Environmental Quality			
Acoustic Performance		1/1	2/2
Thermal Comfort	School[b]	1/1	-
Innovation			
All-Gender Restrooms[a]		1/1	1/1

Notes to Table 1.4.3.3:

[a] With recent droughts and water shortages, reducing water use is becoming and increase focus. There is the perception of conflict between reducing water use and universal washrooms. It is important to recognize that the pilot credit allows for the use of urinals.

[b] Compliance with the ASHRAE 55 Standard is required in the Mechanical section of the TDR. Past projects have stated local controls for temperature allow credit compliance. There are limitations based on space type such as Industrial Arts spaces.

.4 Deliverable Requirements

.1 SCHEMATIC DESIGN

- .1 LEED v4.1 report outlining compliance with Mandatory Prerequisites and Credits as well as Recommended Credits as applicable to the project scope.
- .2 If applicable, the Healthcare documentation requirements for the Integrative project planning and design prerequisite.
- .3 Documentation of energy performance compliance
  - .1 If energy modelling will be used, Modelling Cycle #3 – Load Reduction Modeling OR Modeling Cycle #4 – HVAC System Selection Modeling,
  - .2 If the ASHRAE 50% AEDG will be used, provide compliance table indicating the systems included in the project scope. https://www.usgbc.org/resources/aedg-tables

.2 CONSTRUCTION DOCUMENTS – 60% COMPLETE

- .1 Updated LEED v4.1 report demonstrating compliance Mandatory Credits and Recommended Credits as applicable to the project scope.
  - .1 Documentation for design phase prerequisite and credits must be made available upon request from TSPB.
- .2 Updated energy performance documentation.
  - .1 Energy model report as per ASHRAE 209 Modeling Cycle #6 – Design Integration and Optimization, including thermal bridging calculations.
  - .2 Updated ASHRAE 50% AEDG table providing details on compliance with design. Including documentation for compliance with the he ASHRAE 90.1-2016 Prescriptive compliance path.
- .3 Confirmation a third-party commissioning agent has been engaged.
- .4 LEED related Specification sections are included for review.

.3 PRE-TENDER DOCUMENTS

.1 Updated LEED v4.1 report demonstrating compliance Mandatory Credits and Recommended Credits as applicable to the project scope.

.1 Documentation for design phase prerequisite and credits must be included.

.2 Updated energy performance documentation.

.1 Energy model report as per ASHRAE 209 Modelling Cycle #8 – As Designed Energy Performance.

.1 The energy model report must include the 'Required Documentation' for LEED review of the Optimize Energy Performance credit, including the energy model inputs, input-output reports, exceptional calculations including thermal bridging, the energy consumption and demand for each building end use.

.2 Finalized ASHRAE 50% AEDG table providing details on compliance with design. Including documentation for compliance with the he ASHRAE 90.1-2016 Prescriptive compliance path.

.3 Provide *the Commissioning Plan for review.*

.4 LEED related Specification sections are included for review.

1.5 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.

.1 Sustainability Requirements

.1 For Tier 3 projects, LEED certification is beyond the scope of the project. However, Projects are to comply with the prerequisite and credit requirements identified in the appropriate LEED v4.1 Reference Guide.

.2 Compliance with the Mandatory Credits and related prerequisites (P) must be documented by the project team and confirmation of compliance given to the project manager at the end of the project.

Table 1.5.1.2: Mandatory Credits		BD+C NC/MR	ID+C CI
Energy & Atmosphere			
Fundamental Commissioning		P	P
Optimize Energy Performance, Option 2[a]		>1	>1
Material & Resources			
Construction and Demolition Waste Management - Option 1. Diversion		1/2	1/2
Indoor Environmental Quality			
Minimum Acoustic Performance	School	P	-
Low Emitting Materials		>1/3	>1/3

Table 1.5.1.3: Recommended Credits	BD+C NC/MR	ID+C CI
Sustainable Sites		
Light Pollution Reduction	1/1	1/1
Water Efficiency		
Indoor Water Use Reduction	>1/6	>2/12
Outdoor Water Use Reduction	1/1	-

Notes to Table 1.5.1.2:

[a] As per the credit requirements projects must demonstrate compliance with the ASHRAE 90.1-2016 Prescriptive compliance path in Prerequisite Minimum Energy Performance.

.2 Deliverable Requirements

.1 SCHEMATIC DESIGN

- .1 LEED v4.1 report demonstrating compliance Mandatory Credits and Recommended Credits as applicable to the project scope.
- .2 Confirmation if the project will be demonstrating compliance with the Tier 3 requirements with adherence to the ASHRAE 50% AEDG as applicable.

.2 CONSTRUCTION DOCUMENTS – 60% COMPLETE

.1 Updated LEED v4.1 report including documentation demonstrating compliance Mandatory Credits and Recommended Credits as applicable to the project scope.

.2 Updated ASHRAE 50% AEDG table providing details on compliance with design, including documentation for compliance with the he ASHRAE 90.1-2016 Prescriptive compliance path.

.3 Confirm an independent commissioning agent has been engaged. The commissioning agent can be a part of the consultant's team if they report directly to Alberta Infrastructure.

.4 LEED related Specification sections are included for review.

.3 PRE-TENDER DOCUMENTS

.1 Updated LEED v4.1 report including documentation demonstrating compliance Mandatory Credits and Recommended Credits as applicable to the project scope.

.2 Updated ASHRAE 50% AEDG table providing details on compliance with design, including documentation for compliance with the he ASHRAE 90.1-2016 Prescriptive compliance path.

.3 Provide *the Commissioning Plan for review.*

.4 LEED related Specification sections are included for review.

1.6 Tier 4 – Limited Scope with No or Limited Energy/ GHG Impact

The following requirements and recommendations apply to the project as applicable.

.1 Sustainability Requirements

.1 For Tier 4 projects, LEED certification is beyond the scope of the project. However, Projects are to comply with the prerequisite and credit requirements identified in the appropriate LEED v4.1 Reference Guide.

.2 Compliance with the Mandatory Credits and related prerequisites (P) must be documented by the project team and confirmation of compliance given to the project manager at the end of the project.

Table 1.6.1.2: Mandatory Credits	BD+C NC/MR	ID+C CI
Material & Resources		
Construction and Demolition Waste Management - Option 1. Diversion	1/2	1/2
Indoor Environmental Quality		
Low Emitting Materials	>1/3	>1/3

Table 1.6.1.3: Recommended Credits	BD+C NC/MR	ID+C CI
Sustainable Sites		
Light Pollution Reduction	1/1	1/1
Water Efficiency		
Indoor Water Use Reduction	>1/6	>2/12
Outdoor Water Use Reduction	1/1	-

.2 Deliverable Requirements

.1 SCHEMATIC DESIGN

.1 LEED v4.1 report demonstrating compliance Mandatory Credits and Recommended Credits as applicable to the project scope.

.2 CONSTRUCTION DOCUMENTS – 60% COMPLETE

.1 Updated LEED v4.1 report demonstrating compliance Mandatory Credits and Recommended Credits as applicable to the project scope.

.2 LEED related Specification sections are included for review.

.3 PRE-TENDER DOCUMENTS

.1 Updated LEED v4.1 report demonstrating compliance Mandatory Credits and Recommended Credits as applicable to the project scope.

.2 LEED related Specification sections are included for review.

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). 2020 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 *National Building Code – 2023 Alberta Edition* including amendments.

.2 General

.1 Building envelope assemblies separate spaces requiring differing environmental conditions by controlling the flow of water, air, vapour, and energy (heat). The components that make up the building envelope (control layers) must be carefully detailed to create a continuous and effective building envelope.

.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 Continuous insulation mainly located to the exterior of structural components, in direct contact with and exterior to the air barrier system.

  .3 A continuous 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, incorporates redundancies, and minimizes the following:

.1 Moisture-related deterioration to the building envelope and underlying structure due to ingress of exterior bulk moisture and trapped 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 Excessive moisture.

.3 Thermally induced movement of structural elements and any connected air barrier.
.4 Heat loss through structural elements.

.4 Detail the building envelope to ensure that water, snow, and ice are shed safely from exterior surfaces. Prevent build-up of water, ice, and snow against and within the building envelope assembly, to reduce the risk of trapped moisture that can lead to deterioration and staining. Any non-vertical surface should be treated as a roof and/or protected with flashing sloped a minimum 1:6. Flashings shall include a drip edge to help direct water away from walls.

.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 Technical Services and Procurement Branch (TSPB) approval before using exterior cladding materials requiring frequent maintenance.

.7 Avoid combining design approaches, for example, a cavity-insulated wall system in combination with the PERSIST approach. Avoid use of the Airtight Drywall Approach (ADA) as it is difficult to implement and maintain. Where different systems come together, renovations for example, complete detailing should be provided to show continuity, compatibility, and constructability.

.8 Design to minimize the area of building envelope and the volume requiring conditioning. Do not design projecting elements, overhangs, or canopies to create additional area of insulated air barrier. These elements should be exterior to the building envelope.

.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, avoid condensation with carefully detailing of the building envelope assembly.

.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 air-sealing element (usually an SBS sheet membrane) exterior to the major structural elements.

.3 The air barrier typically consists of a number of materials and components acting together as a system. Minimize the number and type of materials used to form the air barrier and ensure dissimilar materials in contact with one-another are compatible.

.4 Minimize changes of plane in the air barrier system:

1. Avoid unnecessary articulation that increases the number of and complexity of corners and elevation changes requiring air barrier detailing.
2. Avoid changes in plane at membrane connections to windows and other fenestrations and transitions between new and existing construction.
3. Where unavoidable, detail a method of supporting the transition such as galvanized sheet metal transition strips (mechanically fastened) to assist in bridging abrupt changes in plane.

.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 (coordinate with Structural Engineer), 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. Each component penetrating the envelope should have it’s own opening for ease of effective air-sealing. Refer to Appendix D – Standard Envelope Details.

.6 Do not extend roof deck through the air barrier at canopies and overhangs. Provide separate structure exterior to the building envelope to avoid complex air barrier detailing around (and to minimize thermal bridging at) structural penetrations.

.7 Air barrier detail continuity, constructability, compatibility, and durability should be given particular attention at:

.1 Window and door frames,

.2 Mechanical, electrical, and structural penetrations,

.3 Wall-to-roof and parapet connections,

.4 Changes in plane,

.5 Joints between dissimilar materials, and

.6 Building expansion and movement joint locations.

.7 Reinforce the air barrier membrane at complex and critical details. Examples may include strip seals at wall corners, membrane edges sealed with compatible sealant or mastic, or incorporation of a sealant joint as a secondary air seal, as appropriate to each condition.

.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 primary air barrier elements. Consult TSPB before considering these systems. Caulking and sealants may be used as secondary (back-up) air seals for redundancy in critical and complex details.

12. Membranes shall be supported in accordance with manufacturer requirements. This can be achieved with bent sheet metal backing, elastic slip sheet, caulked joint, or similar means. Ensure membrane support is compatible with the membrane used. Ensure the membrane and backing have sufficient length and elasticity to facilitate anticipated movements without deterioration or breakage. The use of looped membranes to air and water-seal deflection joints is not permitted.

A. Specific Requirements for Healthcare Facilities

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

.5 Insulation

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

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

.3 Design to prevent condensation on interior surfaces caused by thermal bridging:

.1 Minimize thermal bridging at penetrations and connections, considering methods such as structural thermal breaks for projecting steel elements (coordinate with Structural Engineer) and thermally improved cladding and metal roofing support systems, such as insulated double Z-bars or thermal clips.

.2 For unavoidable structural penetrations, such as concrete slabs projecting from the interior of the insulated structural plane, extend insulation out four times the thickness of the projection. If the projection distance is less than four times its thickness, encapsulate with continuous insulation.

.6 Roofs

.1 General

.1 Design the roof and provide details to meet or exceed the requirements of the ARCA Roofing Application Standard Manual. All materials used within the specified roof composition must be included on the ARCA Accepted Products Listing.

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

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

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

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

.6 Lead sheets are not to be used in any drain assemblies.

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

.8 New/Existing Parapets - (re) construction should be built with a minimum of 38 mm x 140 mm wood framing with cap sloped 1:6 towards the roof.

.9 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.

.10 No pitch pans (gum boxes) are permitted on any new or re roofs. 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).

.11 The use of looped membranes to waterproof expansion joints is not permitted. Use a pre-manufactured expansion joint membrane that is compatible with the primary roofing membrane. This applies to both roof deck and top of curb locations.

.2 Near-Flat Roofs

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

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

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

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

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

.6 Each contained roof area must be designed to have a minimum of two drains. The intent is that if one drain is blocked, water can flow into an adjacent drain. Provide overflow scuppers where a structural hazard would result from a blocked drainage. Do not locate scuppers at roof expansion joints and over building access points. Lead sheets are not to be used in any drain assemblies. Exceptions could include small canopy roofs with low parapets.

.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 and Procurement Branch for approval of variance requests due to design constraints.

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

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

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

- .1 Drains at both deck and membrane levels, designed to allow for differential movement between those levels.
- .2 Venting of insulation layer and concrete above roof membrane, and
- .3 Geotechnical type filter fabric between concrete and insulation below, to prevent concrete penetrating into insulation layer.
- .4 A drainage mat between the insulation layer and membrane. This acts as both an uninhibited drainage plane, as well as a separator sheet between the insulation and membrane.

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

.3 Steep Roofs

.1 Design the steep slope roof and provide details to meet or exceed the requirements of Part 3 and 4 of the ARCA Roofing Application Standard Manual.

.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 1:4 for cedar shingles, and

   .3 1:3 for cedar shakes.

.8 Minimize thermal bridging and provide sufficient insulation to prevent ice damming on steep roofs.

.4 Green Roofs

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

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

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

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

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

.7 Re-Roofing

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

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

.3 If a roof requires replacement prior to the normal life expectancy, the roof condition report should summarize the cause of the failure, for example, poor initial installation, material failure, design defect, etc.

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

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

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

.9 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.

.12 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.

.13 Provide a minimum of two 100 mm roof drains per roof zone. Exceptions could include small canopy roofs with low parapets.

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

.15 Determine if the roof to wall tie-ins have an adequate air seal. If the existing wall air seal membrane is weak or non-existent, provide the roof to wall connection membrane stripping that could be tied into if the wall if re-cladded at a later date.

.16 Generally the re-roofing membrane would consist of two-ply modified bituminous membrane (MBM). Consult Technical Services and Procurement before specifying other systems. Where there is a potential fire hazard with the original building construction or building occupancy creates an unacceptable fire risk, a flameless roofing system (cold applied SBS membranes, single ply membranes, etc.) should be specified.

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

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

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

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

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

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

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

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

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

.8 Walls

.1 Design exterior walls as "PERSIST" assemblies consisting of:

.1 Exterior cladding to deflect the majority of bulk water,

.2 Ventilated air space to act as a capillary break and allow drainage and air circulation.,

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

.4 Air/vapour barrier system on exterior of structure.

.2 Wall assemblies should be sized to provide minimum 25 mm clearance (air space) between exterior face of insulation and back face of exterior cladding. Provide additional clearance where construction tolerances are greater (for example, in concrete structures and high-rise buildings). Consult TSPB before considering alternative systems with smaller gaps.

.3 Provide appropriately located openings (weep holes and through-wall flashings) in the cladding to promote drainage and provide pressure equalization of the air space. Through-wall flashings shall incorporate a drip edge and folded end-dams.

.4 Compartmentalize air spaces in the wall cavity to restrict air flow around corners and promote regular drainage from behind claddings. 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,* using thermally improved framing systems. Exterior window and door frames shall be thermally broken at a minimum. Consideration should be given to durable, thermally non-conductive frames where budgets and frame spans permit.

.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 and Procurement (TSPB) for approval before specifying other systems. For isometric details refer to Appendix D – Standard Envelope Details.

.3 Select window and door properties for durability:

1. Exterior and interior metal door face sheets thickness shall be minimum 1.6mm to enhance dent resistance and overall durability.

2. Glazing shall be minimum 6mm thick interior and exterior glass.

.4 Minimize the use of spandrel framing and other opaque glazing approaches, as they tend to introduce additional thermal bridging and are prone to air leakage, condensation and trapped moisture. PERSIST wall assemblies provide superior performance, durability, and service life.

.4 The design of the curtain wall should have mechanically keyed, replaceable gaskets in the box section and pressure plate. Avoid structural silicone glazing: consult TSPB for approval before specifying these systems.

.5 Adhere membrane directly to the tube face of the frame, and secure with an appropriately rigid, thermally improved (non-conductive or thermally broken) anti-rotation device. Rigid insulation is not an acceptable anti-rotation device as it is easily compressed and damaged.

.6 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 frame.

.7 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.

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

.9 Avoid using curtain wall as building envelope at parapets. Consult TSPB for approval before including these details. (refer to Appendix D – Standard Envelope Details, Series Curtain Wall Details, Detail 5).

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

.11 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.

.12 Exterior entrances without vestibules require adequate mechanical treatment to minimize ice buildup. Do not consider interior space within 2 m of an exterior door without vestibule or other protection as suitable for seated occupants.

.13 Avoid superfluous exterior singles doors without vestibules (as per NECB code).

.14 Designing for clerestory windows is encouraged to provide natural light into interior instructional spaces, and patient care spaces. Avoid attempts to provide clerestory natural lighting into every occupied areas.

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

.1 Triple glazed sealed vision units with minimum 6mm interior and exterior glass. Consult TSPB for approval before specifying other systems.

.2 At a minimum, exterior door glazing shall consist of double-glazed sealed vision units with minimum 6mm interior and exterior glass. Consideration and preference should be given to triple-glazed doors where available and appropriate and if a vestibule is not present to provide buffer space.

.2 Low emissivity coating(s) for the insulating glass units. Select surfaces to be coated to provide optimum benefit in the climate zone and building orientation where the project is located as part of the design for energy use and comfort.

.3 Inert gas fill.

.4 Window spacer and edge seal systems with improved thermal performance.

.14 Detail windows and doors to minimize thermal bridging:

.1 Extend exterior wall insulation as close to frames as is reasonably practicable.

.2 Do not bypass thermal breaks with thermally conductive materials. Metal flashings shall be installed to the exterior side of anti-rotation devices.

.3 Do not use installation clips and anchors that project through or cross the air barrier plane.

.4 Shim punched windows with non-conductive materials that will not decay, such as plastic.

.10 Skylights and Sloped Glazing

.1 Skylights and sloped glazing systems frequently become building envelope problems, triggering significant operation and maintenance costs to building owners. New design should not incorporate sloped glazing.

.2 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, solar glare, and water leakage.

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

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

.11 Concealed Spaces

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

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

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

.12 Crawl Spaces

.1 If crawl spaces are required, design them 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 for maintenance and inspection. Provide sufficient clearance around structure and equipment for routine maintenance.

.3 Crawl spaces must be cleanable and inspectable (floor slab, mud slab, or inspectable ground cover). Sand on polyethylene often becomes contaminated, often before construction is completed, and is not appropriate. If durable floor ground covers are provided, ensure there are additional pathway covers to protect the ground covers.

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

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

.7 Consider necessity of crawl spaces. Avoid crawl spaces where basement construction or slab-on-grade construction will fulfill the design intent and function instead.

End of Building Envelope Section

3.0 Interior Design

Section Contents

Appendices:

3.1 Interior Design:

.1 Definition

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

.2 References

Meet or exceed the following guidelines and standards:

.1 National Building Code – 2023 Alberta Edition

.2 National Fire Code – 2023 Alberta Edition

.3 Infrastructure Technical Resources - Guidelines and Standards, https://www.alberta.ca/infrastructure-technical-resources.aspx

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

.3 Deliverable Requirements: Interior Design

A quality control check is expected to be completed by the Consultant prior to each submission.

.1 SCHEMATIC DESIGN

- .1 Programmatic requirements of interior spaces
- .2 Functional relationships identified
- .3 Life safety and universal design requirements
- .4 Proposed general interior finishes
- .5 Preliminary floor plans, with room names and North arrow

.2 DESIGN DEVELOPMENT

- .4 All floor plans (Demolition, Construction, Reflected Ceiling Plan, Finishes, Furniture)
- .5 Life safety plans, showing travel paths around typical furniture
- .6 Room names and numbers
- .7 Partition types identified (including conventional construction, architectural wall systems, or operable)
- .8 Preliminary interior elevations
- .9 Preliminary millwork

.3 CONSTRUCTION DOCUMENTS – 60% COMPLETE

.1 Preliminary coordination with all engineering disciplines (i.e. structural, mechanical, electrical, etc.), shown on floor plans and elevations

.2 Door, frame, hardware, and glazing schedules

.3 All partition type details, heights, and acoustic ratings

.4 Interior elevations, sections, and details

.5 Furniture, fixtures, and equipment (FF&E) identified and located

.6 Millwork elevations and preliminary sections

.7 All interior finish locations identified on drawings; basis-of-design products specified and coordinated.

.8 Preliminary technical specifications

.4 CONSTRUCTION DOCUMENTS – 90% COMPLETE

.1 Complete floor plans with legends and notes

.2 Complete interior partition details

.3 Complete elevations, sections, and details

.4 Complete specifications for all interior finishes

.5 Complete millwork details

.6 Complete technical specifications

.7 Coordinated cross-referencing between plans, details, and specifications

.5 CONSTRUCTION DOCUMENTS – 100% COMPLETE

.1 Final floor plans, elevations, sections, and details fully coordinated with all disciplines

.2 Final specifications

.3 All previous comments fully addressed

.4 Interior Finishes and Materials

.1 Finishes and materials must:

.1 be durable, low maintenance, readily available, and aesthetically pleasing.

.2 be environmentally friendly and sustainable, whenever possible.

.3 not be overly trendy to become dated quickly.

.4 allow for future adaptability and flexibility.

.5 be specified as a basis of design and not sole sourced.

.6 be selected from the manufacturer’s standard running line; customization should be avoided.

.5 Walls

.1 Paint:

.1 Paint quality, colours and gloss levels must be durable, maintainable, and appropriate for the usage, site conditions, and lighting levels.

.2 Multiple paint colour locations should be kept to a minimum.

.2 Wallcovering:
  .1 Site applied wallcovering shall be Type II commercial grade, minimum.
  .2 Vinyl graphic images are acceptable solutions for wallcoverings, when used in limited locations as an accent.

.3 The wall area surrounding electric hand dryers, drinking fountains, mop sinks, etc. must be protected from water stains and potential damage, with a durable material (e.g. ceramic tile, stainless steel, etc.).

.4 The surface of masonry walls must be smooth, and the corners bullnosed.

.5 Corner guards should be used to protect outside gypsum wallboard corners in high traffic areas. Corner guards must be stainless steel, or of a manufacturer's standard colour to match the walls, and adhered (not mechanically fastened) to the wall. Full height is preferred.

.6 Adequate blocking to support wall hung equipment and displays must be provided in partition cavities.

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

.8 Interior Wall Construction (Typical)
  .1 Standard Construction:
    .1 Conventional gypsum board and stud construction method may be used where future reconfiguration of the interior environment is not anticipated and a cost benefit can be achieved.

  .2 Architectural Wall Systems:
    .1 Use where appropriate to allow flexibility and re-configurability of the interior environment.

.2 Determine the most appropriate wall system type (demountable, modular, movable, unitized, frame and tile, etc.) based on:
    .1 Type of space (office, warehouse, etc.)
    .2 Current and future functional requirements
    .3 Ease of installation, relocation, and reconfiguration
    .4 Code requirements
    .5 Cost effectiveness
    .6 Acoustical requirements
    .7 Aesthetic requirements and finish options
    .8 Maintainability, durability, and product quality
    .9 Integration of glazing, power and data, plumbing, millwork, accessories, and systems furniture, if required
    .10 Building site parameters
    .11 Amount of disruption to existing staff or environment
.3 Incorporate full height or clerestory glass to allow natural light to flow into the space, where suitable.
.4 Must not require a mechanical connection or attachment to the floor or ceiling.
.5 Must be from a single manufacturer within a building, although various product lines from the same manufacturer may be used if suitable.

.3 Moisture resistant substrate must be used in shower rooms and areas of high humidity.

A. Specific to Educational Facilities

.1 Ensure that the lower (minimum 1800mm) portion of gymnasium walls are smooth with no projections that could cause injury or abrasion.

B. Specific to Healthcare Facilities

.1 Provide stiffeners to interior non-load bearing stud walls at 1200mm A.F.F., to protect against damage from stretchers, carts, etc.

.6 Floors

.1 Carpet
    .1 Modular carpet tile shall be used in most office workspaces and meeting spaces.
    .2 Broadloom carpet should only be used in locations where modular carpet is not practical.
    .3 Carpet should not be used in wet areas.
    .4 Heights must be consistent where one carpet butts up to another.

.2 Resilient and Tile Flooring
    .1 Must be used in wet or high maintenance areas.

.2 Slip resistant flooring should be provided within a shower stall as well as the floor area immediately outside of it (to prevent slips when stepping out of the shower).

.3 Flooring Accessories

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

.2 Stair nosings must be one piece.

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

.4 Resilient base may be solid rubber or thermoplastic, minimum 100mm high. Resilient base shall be installed in one continuous piece length. Base edge shall end at inside corners only.

.5 Porcelain tile floors shall have wall base of the same material; minimum 100mm high, factory edge; edge protection profile, or a metal trim cap.

.6 Flooring transitions between rooms shall be located at the centerline of the door, to avoid a sliver of different material being visible when the door is closed.

A. Specific to Educational Facilities

.1 Science rooms and cosmetology labs must have chemical and stain resistant flooring.

.2 Foods labs and serveries used for food preparation must have slip-resistant flooring.

.3 Fitness rooms must have flooring that is designed to prevent physical injury and damage to equipment.

.7 Interior Doors

.1 Doors swinging out into a high traffic corridor should be avoided, unless they are recessed or protected by a barrier, such as a stub wall, millwork or a railing.

.2 Interior double door openings should be free of mullions, wherever possible. If they are deemed necessary, use removable mullions in openings where there is a requirement for large items to pass through.

A. Specific to Educational Facilities:

.1 Doors between a clean space, (i.e. a classroom) and a dirty space (i.e. a construction lab) must be properly sealed to prevent dust transfer.

.2 Lockers and boot racks etc. should not be located directly behind door swings.

.8 Interior Glazing and Glazing Treatments

.1 Glazing is encouraged to allow natural light to flow between spaces; however, the amount of glazing should be limited when constructing rooms that require a high acoustic separation.

.2 Glazing should not extend to the floor. The bottom horizontal mullion should be no lower than the adjacent wall base.

.3 The use of interior glazing treatments other than film (e.g. horizontal blinds) is restricted to program areas requiring variable visual privacy (e.g. observation rooms).

.4 The operating system of all types of window coverings must comply with current safety regulations.

.5 Film
- .1 Privacy film should be applied to glazing in offices, meeting rooms and support spaces.
- .2 Privacy film should obscure items from being visible at eye level between a seated and standing position. A white 20% opacity film is a guide but may be more or less, dependent on program privacy requirements.
- .3 If security film is needed, based on program requirements, it may be used in combination with a privacy film. Refer to the Physical Security Guidelines for Government of Alberta Facilities.
- .4 A cloaking film that blocks the visibility of digital screens may be considered, based on the program requirements.
- .5 Coloured film may be used as part of a pattern, for wayfinding or room identification.
- .6 Glazing film should be applied to the side of the glass that is subject to the least amount of traffic.

.6 Perimeter Window Treatments
- .1 Perimeter windowcoverings are typically Landlord or base building standard.
- .2 If perimeter windowcoverings are used in lieu of Landlord or base building standard, they must be similar in colour, or lined to appear compatible from the exterior.

A. Specific to Educational Facilities:
- .1 In gymnasiums, interior glazing should be mounted flush to the room side of the frame, to reduce ledges and protrusions.
- .2 Glass mirrors used in areas that are vulnerable to breakage, such as fitness rooms, must be impact resistant.

.9 Ceilings

.1 Existing acoustic ceiling tile and T-bar ceiling grid should be reused if in good condition, wherever possible.

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

.3 Ceiling products must meet acoustic requirements, security objectives, aesthetics, end use requirements and the base building standard.

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

.5 Bulkheads, specialty, and suspended ceiling elements shall be limited, and serve a functional purpose.

.6 Ceiling plans and treatments must be designed in consideration of mechanical, electrical, or structural elements. Coordination at an early stage of design is essential. Refer to Sections *4.0 Structural, 5.0 Mechanical and 6.0 Electrical.*

.7 Specialty and Accent Light Fixtures
  - .1 Specialty and/or accent light fixtures may be used if required for specific program requirements, or to enhance presentations.
  - .2 Accent lighting should be on a separate switch and be dimmable.
  - .3 The location and heights of specialty and accent light fixtures must be identified in the construction documents.

.8 Moisture resistant gypsum board must be used in washrooms, shower rooms and areas of high humidity.

.9 Washable ceiling tile must be used in rooms where food is being prepared.

A. Specific to Educational Facilities:
  - .1 A clear unobstructed ceiling height of 3m above the finished floor is recommended in standard classrooms.
  - .2 A clear unobstructed ceiling height of 8m minimum above the finished floor is recommended in most gymnasiums. To prevent the need for specialized equipment to perform maintenance, the ceiling height should not exceed 11m.

.10 Millwork

.1 Must comply with current Architectural Woodwork Manufacturer's Association of Canada (AWMAC) and North American Architectural Woodwork Standards (NAAWS)

.2 In locations where accessibility is required, barrier-free sections must allow for access both above and below the counter.

.3 Sizes and functional requirements of all equipment and appliances must be confirmed prior to millwork fabrication.

.4 Millwork with a plastic laminate countertop shall have a 2-3mm colour-matched PVC edge, or a more durable material if required to suit program requirements.

.5 Plywood is not an acceptable substrate for cabinet door and drawer fronts.

.6 In wet areas, countertops and cabinets shall have a moisture-resistant substrate, and a backsplash.

.7 If electrical outlets for countertop appliances and/or equipment are located below the counter, concealed grommets shall be provided.

.8 If microwaves are incorporated, they should be located at a height appropriate for accessibility and safety.

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

A. Specific to Educational Facilities:

.1 Countertops in science rooms and prep areas should be a solid core chemical and heat resistant material.
.2 Coat hooks, shelves, and other applicable millwork should be located at an appropriate height for the age group of the students.
.3 An accessible millwork section should be provided at one sink location in food labs, science rooms, and staff rooms, as a minimum.

.11 Signage and Wayfinding

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

.2 Wayfinding strategies should be planned in the early stages of a project and be intuitive, simple, consistent, and coordinated throughout the space.

.3 Signage
.1 For signage in a leased building, the requirements to match existing base building signage must be confirmed with the Landlord.
.2 Location, type, and installation dimensions must be clearly identified on signage plans.
.3 Signage must meet code and accessibility requirements.

.4 Intuitive Wayfinding
.1 Destination points and intersections should be well lit.
.2 Where applicable, the reception, or main entrance should be clearly visible upon arrival.
.3 Alternate materials, colours, textures, or interior architectural features (such as a wall with a contrasting colour or graphic) may be used to differentiate the main path of travel and/or act as landmarks upon which people can orientate themselves in the space.

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 National Building Code, 2023 Alberta Edition [hereinafter referred to as NBC (AE)].
.2 Structural Commentaries (User's Guide – NBC 2020, Part 4 of Division B).
.3 CSA S413-14 – Parking structures.
.4 CSA S478:19 – Durability in buildings.
.5 CSA SPE-900-13 – Solar photovoltaic rooftop-installation best practices guideline.
.6 CAN/CSA S6-14 – Canadian Highway Bridge Design Code.

Commentary:
The following abbreviations are used for the documents referenced in the Commentary to the Structural TDR:
.A NBC (AE): The National Building Code – 2023 Alberta Edition.
.B Structural Commentaries: Structural Commentaries, User's Guide – NBC 2020, Part 4 of Division B).
.C ASCE/SEI 7-22: Minimum Design Loads and Associated Criteria for Buildings and Other Structures, American Society of Civil Engineers, 2022.
.D NIH 2024: Design Requirements Manual, Division of Technical Resources, National Institutes of Health, Rev. 2.1, 8/2/2024
.1 NBC (AE) is adapted from the 11th Edition of the NBC. It applies to the design and construction of new buildings, change in occupancy, addition, alteration, and demolition of existing buildings, renovations of building damaged by fire, earthquake or other causes and correction of unsafe conditions in any building.
.2 The Structural Commentaries provide background to the NBC (AE) provisions. Commentary L is used for structural evaluation and upgrading of existing buildings that are deficient and it does not apply to new additions to an existing building. Structural evaluation becomes necessary when (a) there is a change in the use of a building, and (b) when there are known potential defects which are a safety concern.
.3 CSA S413-14, Parking structures. This standard specifies the minimum design, construction, and maintenance requirements necessary for the structural durability of new parking structures, storage garages, parts of buildings subject to vehicular traffic or used for parking, and pedestrian areas adjoining to or contained within parking structures. Table 1 of the Standard lists acceptable protection systems for floors and roofs, such as, membrane, corrosion inhibitor and C-XL concrete.

.4 CSA S478. Specifies the design service life of buildings per Table 2:

Table 2 in CSA S478

Category	DSL	Examples
Temporary	*Up to 10 years*	* Non-permanent construction buildings (sales offices, bunkhouses) * Temporary exhibition buildings
Medium Life	*25 to 49 years*	* Most industrial buildings * Most parking structures
Long Life	*50 to 99 years*	* Most residential, commercial and office buildings * Health and education buildings * Parking structures below buildings designed for long life category
Permanent	*100 years minimum*	* Monumental buildings * Heritage buildings

.5 CSA SPE-900-13 guideline addresses structural analysis of the building and the roof mounted solar PV racking. The primary loads on the solar PV system are wind and seismic. Solar PV arrays may be (a) attached to the building structure (penetrating system), or (b) rely on self-weight (ballasted system). Dead load of solar PV systems is noted to be in the range of 0.15 to 0.50 kPa. The structural consultant to coordinate with solar PV consultant to confirm the load.

.6 The Canadian Highway Bridge Design Code, CAN/CSA S6-14, provides axle load configuration and distribution, and wheel load and its footprint (loading area) for traffic loads (CL-W loading) and maintenance vehicles in Section 3. The distribution of wheel loads through fill over a buried structure and the effect of vehicle (live) load surcharge on basement walls is discussed in Section 6.

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

Commentary:

.1 Table 1.3.1.2 of Division B provides the list of all documents including CSA Standards with edition that are referenced by the NBC (AE). Some CSA material design standards relevant to the structural discipline are:

a. CSA A23.1:19, Concrete materials and methods of concrete construction
b. CSA A23.3:19, Design of concrete structures
c. CSA A23.4-16, Precast concrete – Materials and construction
d. CSA S16:19, Design of steel structures
e. CSA S136-16, North American specification for the design of cold-formed steel structural members
f. CSA S304-14, Design of masonry structures
g. CSA O86-19, Engineering design in wood

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. Specify 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 For buildings with storey height such that a mechanized manlift / boom is required to access the ceiling / underside of floor structure above for maintenance work:

  .1 The Consultant shall confirm that the design live load (both uniformly distributed and concentrated) for the floor can support the live load effect imposed by operation of the mechanized manlift / boom within its operational envelope.
  .2 An access path for entry and egress of the mechanized manlift / boom is provided.
  .3 The name, model number, and approximate gross operating weight of minimum three (3) mechanized manlifts / booms, one from each different manufacturer (such as, Genie, Haulotte, JLG, Skyjack, and others), be specified as the maintenance vehicle design live load for such floor.

.9 Provide design calculations if requested by the Province.

.10 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.

Commentary:

.1 For office areas, Table 4.1.5.3 of the NBC (AE) specifies a design live load of 4.8 kPa for the basement and first storey and 2.4 kPa for floors above the first storey. Table 4.1.5.9 specifies a concentrated live load of 9.0 kN over an area of 750 mm x 750 mm for floors of offices. In the TDR, 3.6 kPa for floors above the first storey allows future flexibility / adaptability in use of the space.

.2 NBC (AE) specifies a design live load of 7.2 kPa for library stack rooms. The NIH 2024, in Section 5.2 – Structural Loads and Demands, Table 5.2.1(A), specifies 7.2 kPa (150 psf) for standard file rooms and 12.0 kPa (250 psf) for dedicated areas for compact file systems. The Spacesaver Corporation (www.spacesaver.com) document titled “Floor Loading Considerations High-Density Mobile Storage”, 2013, recommends 125 to 200 psf (6 kPa to 9.6 kPa) for paper files and books and 275 to 300 psf (13.2 kPa to 14.4 kPa) for museums, depending on number of tiers of shelving and type of floor system. ASCE/SEI 7-22 specifies 250 psf (12 kPa) for storage warehouses (heavy) and manufacturing (heavy).

.3 The NIH 2024 in Section 5.2 – Structural Loads and Demands, Table 5.2.1(A), specifies a minimum design live load of 1.9 kPa (40 psf) for catwalks and Interstitial platform (exclusively walking surfaces).

.4 The NIH 2024 in Section 5.2 – Structural Loads and Demands, Table 5.2.1(A), specifies a minimum design live load of 7.2 kPa (150 psf) for mechanical areas (or weight of equipment if greater) along with 2.5 kPa at housekeeping pad locations (assumed 100 mm thick).

.5 Tables 4.1.5.3 and 4.1.5.9 of the NBC (AE) specify a minimum design live load of 1.0 kPa and 1.3 kN (on an area of 200 mm x 200 mm) for roofs. ASCE/SEI 7-22 specifies 1.0 kPa (20 psf) and 1.33 kN (300 lbs) [weight of a maintenance worker] over an area of 762 mm x 762 mm. NIH 2024 specifies 1.9 kPa (40 psf) for roofs not designed for future expansion. The TDR values (1.5 kPa and 1.5 kN over an area of 200 mm x 200 mm) allow for higher loads.

.7 The floor plate in some facilities (healthcare) may be designed for a greater live load to allow future flexibility / adaptability in use of the space.

.8 Some spaces in institutional buildings, such as main foyers in pavilions and hospitals, may have ceiling heights that require use of a mechanized manlift / boom for safe access for maintenance work. The floors of such spaces shall be designed for the live load effects imposed by commercially available mechanized manlifts / booms.

.10 Location and site specific requirements should be considered when determining the design life of the building. Structures located in a flood plain should include appropriate design parameters to ensure the building life for design flood condition.

A. Specific Requirements for Schools

.1 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.

The concrete floor finish of the gymnasium slab should satisfy the requirements of the intended flooring and as a minimum shall be Class B slab and floor finish classification with Ff=25 and Fl=20 as per Table 21 of CSA A23.1:19.

.2 Design structural steel floors to prevent floor vibration due to walking from exceeding comfort thresholds for all areas. Typically, a peak acceleration less than 0.5% g (within 4-8 Hz) for office and classroom occupancy is acceptable.

.3 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.

Commentary:

.1 Approximate load of:

Moveable partitions: typically 0.5 kPa (extended position); for stacked weight, multiply above intensity by approximate length of the partition.

Basketball backboards: about 15 kN total divided over 4 to 6 connection points to roof joists above.

Verify loads with the equipment supplier.

.3 The deflection limit (about L/1143) for structural support is for proper sound isolation between spaces separated by operable partitions per ASTM E557-12.

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. Provide adequate capacity in affected structural elements of walls, floors and ceilings, including those on access routes.

Commentary:

.1 For patient's bedrooms, Table 4.1.5.3 of the NBC(AE) specifies a design live load of 1.9 kPa and Table 4.1.5.9 specifies a concentrated live load of 9.0 kN for floors of hospital wards. ASCE/SEI 7-22 specifies 40 psf (1.9 kPa) for patient rooms. The higher design value (of 2.4 kPa) in the TDR is for future adaptability; in some facilities, this may be increased to 3.6 kPa if patient bedrooms are anticipated to be converted to clinical areas in the future.

.2 The NIH 2024 in Section 5.2 – Structural Loads and Demands, Table 5.2.1(A), specifies minimum design live loads of:

a.	Equipment imaging spaces	9.6 kPa	(200 psf)
b.	Frozen storage / Refrigeration	9.6 kPa	(200 psf)
c.	Laboratories	4.8 kPa	(100 psf)
d.	Operating rooms	4.8 kPa	(100 psf)
e.	Offices	4.8 kPa	(100 psf)
f.	Reception lobby areas	6.0 kPa	(125 psf)
	-		

For operating rooms and laboratories, NBC(AE) specifies 3.6 kPa and ASCE/SEI 7-22 specifies 60 psf (2.9 kPa).

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.

Commentary:

.1 The specified design live load for some occupancies that may be present in Government facilities include:
Per ASCE/SEI 7-22:

Access floor systems (computer use)	4.8 kPa	(100 psf)

D. Specific Requirements for Correctional Facilities

.1 Crawl space of appropriate height (generally 2 m) recommended for easy access to clean-outs for the plumbing system. Refer to section 4.3.9 for design requirements for the perimeter foundation wall / grade beam / strip footing adjacent to crawl spaces.

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. Basement walls shall be designed for a minimum live load surcharge of 12 kPa.

.6 Below-grade extensions. The roof of basements extending beyond the exterior façade of the building shall be designed to support the live load of firefighting equipment and maintenance vehicles, such as boom lifts that may be required to access the façade or roof of a building for inspection and maintenance. The specified live load on such roofs shall not be less than the uniformly distributed live load of 12 kPa per Table 4.1.5.3 of NBC (AE) or the concentrated loads listed in Item 4.1.5.9, 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.”

.7 Screw piles shall not be used for the permanent core structure (the use of screw piles may be approved on a case-by-case basis if project constraints preclude the use of other foundation types. In such an instance, a design exception must be obtained from Alberta Infrastructure Technical Services prior to the use of screw piles).
The use of screw piles is allowed for modular structures, such as modular classrooms and courthouses, for supporting the free end of the exterior apron slab at doorways, and for supporting garbage enclosure slabs.

.8 Driven piles shall not be used.

.9 Considerations for Provision of Crawl Space that is fully / partly below grade:
The perimeter foundation wall / grade beam / strip footing will be retaining earth on the outside and needs to be designed for the appropriate earth pressure. Usually the "At Rest" earth pressure coefficient is assumed as it is conservative and may also be appropriate as the top and bottom of the retaining wall is restrained by the floor slab above and slab-on-grade below. If pile foundations support the grade beam / foundation wall and if there is no slab on grade at the bottom, the piles will be subject to lateral earth pressure and this lateral load should be indicated in the pile schedule.

Commentary:

.1 Structural design should follow the recommendations in the project geotechnical report.

.3 Tie-back earth retaining systems use ground anchors that project into the ground behind the retained face. The ground anchors may prevent future development in the adjacent site and hence may not be used in permanent earth retaining systems. A design exception may be considered for a site where economical options for an earth retaining system do not exist and where future development is unlikely to be constrained by the permanent ground anchors.

.6 ASCE/SEI 7-22 specifies a design live load of 250 psf (12 kPa) and a concentrated load of 8,000 lbs (35.6 kN) over an area of 4.5 inch x 4.5 inch (114 mm x 114 mm) for sidewalks, vehicular driveways and yards subject to trucking.

.8 Vibration and noise impact of pile driving may cause disruption to the function, use or occupancy of the adjacent properties and may lead to damage claims.

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 Specify 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 engineered sub-base. 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.

.5 Consider providing shrinkage strips (also referred to as closure strips or pour strips) in reinforced concrete buildings with a large floor plan (generally exceeding about 60 to 76 m) to reduce shrinkage stresses and mitigate crack formation due to shrinkage restraint provided by vertical structural elements such as columns, shear walls and shear cores.

.6 Do not specify fly ash in exterior concrete slabs subjected to De-icing chemicals and Freeze Thaw cycles. The exterior concrete containing fly ash is less resistant to scaling when subjected to De-icing chemicals and Freeze Thaw cycles.

.7 Limit fly ash content to a maximum of 6% of mass of cementitious materials if polished concrete floor finish is to be provided by grinding and polishing of the floor surface. The action of concrete hardeners and densifiers used for polishing may be hindered by high fly ash content. Take precautions to reduce the risk of pop outs while grinding and polishing the concrete surface.

.8 All concrete elements shall be reinforced, including concrete topping. The reinforcement should be provided in two primary directions.

Commentary:

.1 There are concerns about corrosion-protection and durability of unbonded post-tensioning systems; hence their use is not recommended.

.2 Exterior slabs (apron slabs at entrances / exits, garbage enclosure slabs) should preferably be pile supported (or foundation supported and not just a floating slab or asphalt on subgrade) with crushable void form below the slab to mitigate the effects of frost heave. The slabs are typically dowelled into the grade beam at the face of the exterior doorway to prevent any differential movement at this location. The slab is usually provided a drainage slope of 2% away from the door.

.3 The traditionally used 6 mil (0.15 mm) thick poly vapour barrier is thin and prone to puncture from construction workers walking on it. A thicker poly (10 mil minimum, 15 mil preferred) is recommended also due to the requirements for the Radon barrier membrane (minimum 10 mil thickness) that needs to be air tight.

.4 The project specifications should require the contractor to submit a thermal control plan for any mass concrete pours (that is, concrete placement thicker than 1.0 m). Ensure that the instrumentation required (thermocouples, other) including its installation is the responsibility of the contractor (and not the independent 3rd party materials testing agency appointed by the Province). The Alberta Infrastructure sample technical specification Section 03 30 00 has requirements for mass concrete.

.5 It is recommended to provide shrinkage strips in concrete slabs greater than 76 m in extent (Suprenant, B.A., Shrinkage and Temperature Reinforcement, Concrete International, Vol. 24, No. 9, September 2002, pp. 72-76). Shrinkage strips containing lap splices are typically 900 to 1200 mm wide. They are cast 2 to 12 weeks later than the adjacent slabs. The stiffness and distribution of vertical elements (columns, shear walls and shear cores) restrain the slab and influence its shrinkage behavior.

.6 Concrete with fly ash is less resistant to scaling when subjected to freezing and thawing in the presence of de-icing chemicals. This has been reported in literature.

Mixtures containing fly ash may experience a delay in early-age strength development, especially in cooler weather. This could delay the concrete set time and the ability to saw without excessive raveling. After setting, the time available for sawing before cracking begins may be shorter than normal. This decrease in available sawing time increases the risk of uncontrolled cracking in cooler weather.

To mitigate Alkali Aggregate Reaction, cement with low alkali content may be used in lieu of using fly ash.

.7 Fly ash reacts with calcium hydroxide to form hydration products; this is the same calcium hydroxide needed to react with the liquid surface treatment that eventually hardens at the floor slab surface; therefore, less calcium hydroxide may be available to the floor treatment if higher dosage of fly ash is used in concrete to be polished.

Pop outs of aggregate have been reported in floors being ground and polished. Pop outs are due to presence of deleterious substances in the aggregate, such as coal, shale, ironstone and limestone. Specify concrete made with aggregates having low percentage of deleterious substances (refer limits for low-density granular materials in Table 12 of CSA A23.1:19) and a good performance history for such applications.

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 S16:19 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 construction workers.

.4 Where the underside of metal deck is exposed (exposed ceiling), consider using acoustic deck or other treatment to meet acoustic requirements.

.5 Specify ASTM A992 / 992M for wide flange sections in lieu of CSA G40.21 350W. This may result in greater flexibility in sourcing material.

.6 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 specify gap connections with positive eccentricity, when possible.

.7 For all HSS members subject to freezing, specify drain holes at lowest point to allow the release of water and specify neoprene seals around all fastening penetrations exposed to water. Provide cap plates at column ends.

.8 Specify Class C for square and rectangular HSS sections. Class H sections may require a special mill order, are more expensive, and their use is justifiable only if the additional compressive resistance (over Class C sections) is required. Specify ASTM A500 round hollow sections as they are easier to procure than CSA G40.21 350W.

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

.10 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.

.11 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.

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

.13 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.

.14 Connection design is usually delegated to a specialty connection design engineer. Specify connection design forces for steel members for the specialty connection design engineer to design and detail the connections.

.15 Unless specified otherwise, structural steel outside of the building envelope shall be hot-dip galvanized.

.16 Guardrails and other structural posts subject to application of spray of de-icing salts; ladders, platforms and covers in areas of moisture exposure such as sumps; and their supporting frames, baseplates and anchor rods are to be hot-dip galvanized or of stainless steel. Any repairs to damaged hot-dip galvanizing shall be done in accordance with ASTM A780.

Commentary:

.1 Use of cantilever Gerber girder system is not recommended for floors due to past failures in such systems (1988 Station Square collapse in Burnaby, B.C., involving four bays of a supermarket with a rooftop parking facility; 2011 Texas warehouse partial roof collapse). The failures were due to distortional buckling of the girder web at the column support location arising from inadequate lateral support at the top of the column and lateral torsional support to the girder. The 1989 CISC publication identifies specific structural concerns with this framing system and provides guidance on addressing the instability issues. Gerber systems do not allow sufficient flexibility for future modifications.

.5 For wide flange sections, it is preferable to specify ASTM A992 / 992M in lieu of CSA G40.21 Grade 350W. CSA S16:19 explicitly recognizes this grade. A992 / 992M has enhanced properties for seismic applications (better production control on maximum yield stress limit, maximum yield to tensile strength ratio).

.6 For HSS truss members, square and rectangular sections are preferred over circular sections that require profile cutting at member connections. Use of gap connections with positive eccentricity may reduce member overlap and alleviate complicated weld geometry at diagonal and vertical to chord connections. HSS truss diagonals appropriately smaller in size than the chords allow simple fillet welds to make the diagonal to chord connections (and thereby avoid expensive flare-bevel welded joints that are not prequalified per CSA W59 and require the fabricator to demonstrate the effective weld throat by preparing mock samples and sectioning them).

.9 Trusses with W-shaped members are cost effective when the W-shapes for chords, diagonals and verticals are from the same family (that is, similar depth) to facilitate welding. The webs of the chords and diagonals are turned 90 degrees from the vertical plane (resulting in an H shape) to allow direct welding of the members at the truss nodes without the need for stiffeners and gusset plates.

.10 CSA S16:19, Clause 10.4.2.2 specifies a limit of 300 on the effective slenderness ratio (k L/r) for tension members. This limit assist in the handling of members and may prevent flutter under oscillating loads such as those induced in wind bracing designed for tension loads only. This limit may be waived if other means are provided to control flexibility, sag, vibration, and slack in a manner commensurate with the service conditions of the structure (for example, use of turnbuckles in rod bracing). This all applies to normal importance category buildings.

For high and post-disaster buildings, tension-only bracing is not allowed. It is reported in literature that such bracing has performed poorly in past earthquakes. The lack of compressive brace resistance leads to inelastic behaviour with slack braces that have little or no stiffness until the slack is taken up. Slack braces may lead to progressively increasing lateral drift, possible impulse loading on the brace and its connections, and early brace / connection fracture due to low cycle fatigue caused by cyclic buckling.

.11 Boron is added to fully killed steel to improve hardenability. Boron-treated steels are typically produced to a range of 0.0005% to 0.003%. Boron is not typically added to structural grade steels, nor are the maximum levels in Standards typically controlled or specified. Mills would not typically add boron to structural grade steels due to cost. A very small amount of boron has a significant effect on hardenability and weldability. Hardness, tensile strength and yield strength increase with elevated boron concentrations. However, elongation and impact properties (in the form of Charpy V-Notch absorbed energy values) can be compromised with elevated boron contents. Brittle fracture modes over ductile can be favored with higher concentrations of boron. In the case of structural steel welds containing elevated levels of boron, various crack mechanisms can occur, including cold cracking, hot cracking, and stress-corrosion cracking (source – Acuren).

.12 The silicon content limits in steel to be hot-dip galvanized are based on the Sandelin curve (refer to the American Galvanizers Association). Silicon content between 0.04% and 0.15% results in galvanizing having a dark grey appearance, a thicker zinc layer, and reduced adhesion of the zinc layer to the steel substrate. Silicon content greater than 0.25% results in a similar dark grey appearance and a missing substrate layer required for galvanizing adhesion; any defects to such galvanizing cannot be repaired by the methods outlined in ASTM A780.

.13 Steel is being supplied by mills from around the world, whether it is to the North American Standards or other standards. There have been reports of non-conformity, incorrect mill test reports and material that contains elements not normally expected or controlled by the material standard. This problem is applicable to rebar as well as to structural steel. Hence the need for verification of mill test reports for imported structural steels by a certified laboratory in Canada.

.15 Structural steel outside of the building envelope is exposed to weather elements, which may lead to corrosion. Hot-dip galvanizing will protect the exposed steel from corrosion.

C. Concrete Masonry

.1 Concrete masonry units shall be as per CSA A165-14 Series, “CSA standards on concrete masonry units”. The specified compressive strength of masonry blocks shall be 15 MPa or higher.

.2 Type “S” mortar shall be used in all load bearing masonry.

.3 Specify grout as per CSA A179-14, “Mortar and grout for unit masonry”.

.4 Bond beams shall be provided at the top of all walls, including both load bearing and non-load bearing walls.

.5 Provide lateral support at the top for all masonry walls.

.6 Provide lintel beams at all wall openings.

.7 Provide connection details of equipment connection to masonry walls, such as basketball back-stops mounted on masonry walls.

.8 Coordinate with Architectural and provide acoustic masonry blocks where required.

.9 Provide connection details of any structural elements (steel, wood) connected to masonry.

.10 Consider using masonry walls only above grade supported by foundation wall / grade beam. Adequate moisture mitigation measures, such as use of waterproofing, drainboard, and appropriate exterior drainage, shall be used if masonry walls are to extend below grade.

Commentary:

.1 CSA A165-14 Series, “CSA Standards on concrete masonry units” specifies minimum requirements for concrete block masonry units. The standard identifies four physical properties: solid content; specified compressive strength; concrete type; moisture control. 15 MPa masonry units are the most common and provide flexibility in procurement than units with other specified compressive strength.

.2 Type “S” mortar should be used in load bearing walls since it provides higher fm’ (compressive strength of masonry normal to the bed joint at 28 days) for a given specified compressive strength of masonry unit.

.3 CSA A 179-14, “Mortar and grout for unit masonry” provides minimum requirement for grout to be used in masonry walls and beams.

.4 Bond beams provide a solid bearing surface for supported beams / columns and tie the vertical blocks together.

.5 Masonry walls are generally designed with the assumption of pin support at the top. Hence, a lateral support at the top is required to justify the analysis / design assumption.

.6 Portion of wall above any wall opening has to be supported by a beam element (lintel).

.7 Details of equipment connection to masonry walls, such as basketball back-stops mounted on masonry walls, will help the steel fabricator to fabricate appropriate connection elements.

.8 Acoustic masonry blocks are usually required in school gymnasiums, music rooms, and cultural rooms. The Architectural / Acoustic discipline usually takes the lead in specifying the extent of wall requiring acoustic block.

.9 The Structural Engineer of Record (SER) is responsible to provide connection details at the intersection of different structural materials. Details of any structural elements (steel, wood) connected to masonry will help the steel or wood subcontractor to fabricate appropriate connection elements.

D. Wood

.1 Provide wood connection details including the nailing requirements for built-up members, connection of wall studs to wall plates, connection requirements (nailing or other fastener, blocking) for floor and roof diaphragms, and connection requirements (nailing or other fastener, blocking, hold-downs and anchorage) for shear walls.

.2 Provide connection details for all wood to concrete, wood to steel, and wood to masonry connections.

.3 Provide lintels at all wall openings.

.4 Untreated wood members shall not be in direct contact with concrete or masonry without protection.

.5 For all wood members exposed to weather, provide protection requirement on the drawings such as pressure treatment and / or preservative treatment.

.6 Design wood framing to accommodate shrinkage of wood floor joists, studs and columns.

Commentary:

.1 Connection details including the nailing requirements for built-up members and connection of wall studs to wall plates are required to be shown on structural drawings for the contractor to use the appropriate connectors. The SER is responsible for lateral load design of the building. Lateral capacity and stiffness of wood structure is dependent on its connections.

.3 Portion of wall above any wall opening has to be supported by a beam element (lintel).

.4 Untreated wood members in direct contact with concrete or masonry will deteriorate over time. Pressure treatment and / or preservative treatment will protect the exposed wood element from deterioration.

.5 See Commentary on 4 above.

E. Precast Concrete

.1 Precast concrete is generally a delegated design item to be designed by a specialty engineer. The Structural Engineer of Record (SER) should provide design requirements on structural drawings, which should include (but not limited to) the following:

- .1 Design gravity loads to be used by the specialty engineer to design the precast elements and connections for gravity loads.
- .2 Design seismic and wind loads to be used by the specialty engineer to design the precast walls, precast floor and roof diaphragms, and the connections.
- .3 Any performance requirements such as deflection, camber, and tolerances.
- .4 Concrete mix specifications based on the concrete exposure class.
- .5 Building envelope details and requirements which the precast designer should follow in detailing the precast concrete components and connections.

.2 Provide connection details between precast element and the base structure, including the connection of precast walls to grade beams / foundation walls and connection of structural steel to precast elements.

.3 Any steel connectors and embed plates outside of the building envelope shall be hot-dip galvanized.

.4 Precast walls shall be supported by grade beams / foundation walls and shall not be in contact with subgrade. Bottom of precast walls shall be above grade.

.5 Coordinate finish requirements with the Architectural / Interior Design discipline.

Commentary:

.1 Even though precast concrete is generally a delegated design item to be designed by a specialty engineer, the SER takes responsibility of overall gravity and overall lateral design. Items listed in (1) to (5) should be provided for the specialty engineer to design the structure consistent with base buildings design assumptions.

.3 Steel connectors and embed plates outside of the building envelope are susceptible to corrosion and hot-dip galvanizing is an effective method to protect the exposed steel.

.4 Precast walls, if detailed to be in contact with subgrade, are susceptible to damage due to moisture and chemicals in the soil. To obviate this concern, the precast wall should be above subgrade supported by foundation wall / grade beam.

F. Other

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

.2 Specify 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 Provide expansion joints when required based on building configuration and dimensions. Design expansion joints, including those between existing and new structures, so that an abrupt change in floor elevation is prevented. Detail the expansion joints appropriately from a building envelope perspective.

.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 non-structural components.

Commentary:

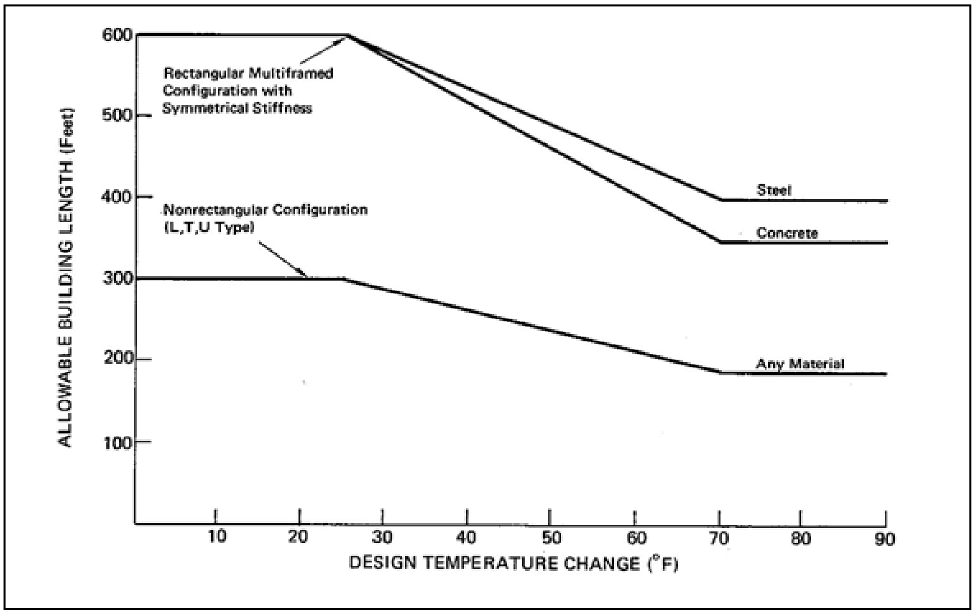
.1 Refer to structural commentary to TDR Item 4.1.1.3.

.2 A chemical resistant coating system may be required to protect the underlying concrete (such as, Sikagard CRV 20 topping over Sikagard WDE primer and Sikafloor 81 Epocem). Specifications for preparation of concrete surface prior to application of coating should be as per the manufacturer's recommendations. This may involve shot blasting of existing concrete surface or equivalent mechanical means to achieve an appropriate surface profile equivalent to International Concrete Repair Institute (ICRI) CSP 3 to 4 or as specified by the manufacturer.

.3 Aluminum is towards the anodic / less noble / corroded end of the Galvanic scale as compared to galvanized steel, mild steel, stainless steel that are increasingly cathodic / more noble / protected. In the presence of an electrolyte (such as rain water), a galvanic cell is set up and the less noble Aluminum is corroded. Hence an inert separator is required.

.4 Refer to Technical Report No. 65, National Academy of Sciences, 1974 titled "Expansion Joints in Buildings." The empirical approach uses the figure below and assumes a design temperature change between 50 to 70 degrees F for an enclosed heated / air conditioned building to determine the allowable length of building beyond which an expansion joint is required.

Chart for item 4.4.F.4



.4 Expansion joints are expensive and may be difficult to detail correctly from a building envelope perspective. Complexities include:

   a. Need to be carried through the roofing membrane.
   b. Additional structural framing required at the joint (typically a double line of structural columns is provided along the joint).
   c. Independent LLRS in two orthogonal directions is required on each side of the expansion joint.
   d. The expansion gap needs to be designed and detailed appropriately for thermal, wind and seismic effects.
   e. Wall cladding should be detailed appropriately to accommodate the movement at the expansion joint.

.5 Refer to the structural commentary to TDR Item 4.1.1 regarding renovations to existing facilities.

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 (HLLRS) and the vertical LLRS (VLLRS). Although the SER may rely on other structural engineers to be responsible for some 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 Specify details that allow for 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. Specify anticipated movements of the primary structural system that the cladding system shall accommodate.

.7 Where a grade-supported floor slab (i.e., a slab-on-grade) will be constructed over a significant depth (> 1 m) of engineered backfill, determine the probable long-term settlement with the geotechnical engineer. If the expected movements of a slab-on-grade cannot justifiably be accommodated or tolerated, use a structural slab. For use of a slab-on-grade, the post-construction settlement / heave should be limited to about 25 mm. Movements exceeding this limit may result in distress at T-junctions of interior partitions and exterior walls, possible cracks in interior partitions, and cracks in the slab-on-grade that are visible to building occupants that may raise concerns regarding maintenance and structural safety. Where a slab-on-grade is used, it shall be minimum 130 mm thick and shall be reinforced. 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 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. This also applies to drainage of elevator pits and sump pits.

.9 Radon gas mitigation. Construction of new buildings should employ techniques to minimize entry of Radon gas and allow for its 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 the Architectural discipline.

.11 Specify concrete floor flatness that is consistent with the flooring material to be applied and the aesthetic requirements. Due to the higher placing and finishing cost involved, specify unconventionally stringent flatness and levelness only for areas where there is a justifiable benefit. CSA A23.1:19 provides guidance on slab and floor finish for various facilities. Do not specify floor levelness for elevated concrete slabs of Class A and B.

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

.15 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 may be restricted by hail associated with a major rainfall or accumulation of debris. The structural design must consider the 1/50 One Day Rain including effect of ponding assuming that roof drains are plugged.

.16 Structurally design and detail required guardrails.

Commentary:

.1 Steel roof diaphragms often act as the HLLRS in buildings. The design of the roof diaphragm for transfer of lateral loads from wind or earthquake to the VLLRS is the responsibility of the SER. This typically involves specifying the appropriate steel deck thickness, its span layout (continuity), and its connections (weld / mechanical fastener size and spacing) to underlying structural steel members to provide the required stiffness for SLS and shear strength for the ULS. Similar considerations apply to composite steel floor diaphragms and reinforced concrete roof and floor diaphragms.

.2 Review details at entrance slabs / ramps, canopies, balconies, entrance projections and rooftop mounted mechanical units (RTUs). Some proprietary thermal bridging / isolation systems are commercially available.

.4 CSSBI B15B-17 (Serviceability Design Criteria for Low Rise Steel Building Systems) provides serviceability considerations for various types of cladding supported by foundation or spandrel beams.

.5 A vertical deflection gap of 25 mm (1 inch) is typically provided between top of non-load bearing partitions and underside of the structure above. An isolation joint or expansion joint is provided between existing building and any new addition. Buildings with complicated floor plan (e.g., L, T and U shape) may warrant appropriate seismic isolation joints for improved seismic response.

.7 Use of a slab-on-grade:

a. Geotechnical engineers estimate the settlement of engineered fill at about 1% to 2% of fill thickness. Hence, engineered fills in excess of about 1.0 to 1.5 m in thickness may result in settlements exceeding the 25 mm limit.

b. Ground improvement techniques maybe considered to facilitate use of a slab-on-grade at marginal sites; discuss with a ground improvement specialist. Ensure that vibration monitoring is carried out in urban sites to protect the Province from any damage claims if vibro-improvement techniques are employed. A post-improvement geotechnical assessment report should be requested of the contractor.

c. Caution on sites with near surface high plastic clay. Such soils are known to undergo shrinkage / swelling in response to decrease / increase in moisture content, resulting in distress to the slab-on-grade.

.8 Weeping tile details are typically shown on architectural, structural and mechanical drawings and requires coordination between disciplines.

.9 Radon gas mitigation details on drawings include location of radon collection pits, piping for the system, sleeves through interior grade beams for radon piping, radon rock and membrane (10 or 15 mil poly) under the slab-on-grade.

.11 Table 21 of CSA A23.1:19 provides slab and floor finish classifications with suggested floor flatness (F_F) and floor levelness (F_L) numbers.

Table 21
Slab and floor finish classifications
(See Clauses 7.6.1.1, 7.6.1.4, and 9.2, and Figure D.2.)

Class	Examples	Recommended procedures	Overall *F*-number F_F	Overall *F*-number F_L
A	"Conventional" slab on grade and elevated floors	Hand screeded and steel trowel finished	20	15*
B	"Flat" slab on grade and elevated floors or surfaces with thin applied finishes.	Advanced hand or mechanical screeding, pan floating, and steel trowel finished	25	20*
C	"Very Flat" slab on grade floors	Specialized materials, advanced hand or mechanical screeding, pan floating, and steel trowel finished	35	25
D	"Extremely Flat" slab on grade floors	Specialized: materials, advanced mechanical screeding, large pan float, highway straightedged, and steel trowel finished	45	30

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 should 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 Annex E (Floor vibrations) in CSA S16:19 and Structural Commentary D in the National Building Code of Canada, 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 minimum 1.5 times the weight of the equipment or as recommended by the manufacturer.

.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.

Commentary:

.4a CSA S16:19, Annex E (informative) – Floor vibrations. This annex only mentions the items to evaluate in assessing the potential for floor vibrations and does not provide any detail. It refers the users to the NBC Structural Commentaries and AISC Steel Design Guide 11 by Murray et al.

.4b Commentary D of the Structural Commentaries to the NBC summarizes the maximum deflection-to-span ratios in the NBC Part 9 and in the CSA material design standards referenced therein; these ratios have traditionally been used as the serviceability criterion but may not be adequate to assess the potential for disturbing floor vibrations. Commentary D mentions two types of vibration problems in buildings – (a) continuous vibrations arising from cyclic forces of machinery or certain human activities such as dancing that may be further amplified due to resonance with the building frequency, and (b) transient vibrations due to persons walking, jumping, or other impact such as dropping weights in an exercise room and vehicle impact in parking garages. Commentary D refers to the AISC Steel Design Guide 11 for assessing transient vibrations in steel construction and ATC Design Guide 1, 1999 for all materials.

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, and cafeterias. Typically, a peak acceleration less than 0.5% g (within 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 (within 4-8 Hz). Less sensitive patient rooms may have slightly higher levels of floor vibration; 0.1% g (within 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.

Commentary:

.1 The following items and Figure 2-1 are from Chapter 2 (Evaluation Criteria for Human Comfort) of the AISC Steel Design Guide 11 by Murray et al., 2nd Edition, 2016:

a. Continuous (steady-state) vibrations can be more objectionable to occupants than vibrations caused by infrequent impact (transient).

b. Continuous vibrations have a duration of more than 30 minutes per 24 hours.

c. Reaction of occupants to vibrations depends on what they are doing; occupants in offices or residences find peak accelerations above about 0.5% g to be distinctly perceptible, whereas occupants taking part in an activity may accept vibrations 10 to 30 times greater (5% g to 15% g or more).

d. The range of resonance frequencies of human internal organs is between 4 and 8 Hertz. Occupants accept higher accelerations outside this frequency range.

e. Figure 2-1 has the recommended tolerance limits for human comfort.

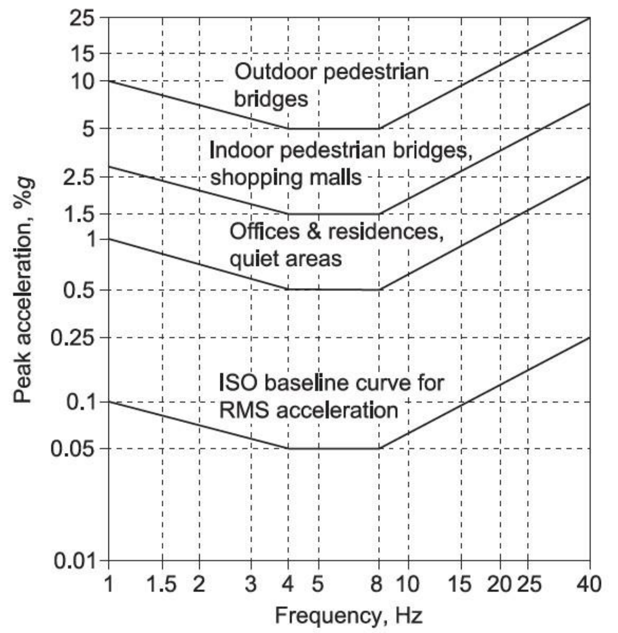


Fig. 2-1. Recommended tolerance limits for human comfort.

.3 Chapter 6 of the AISC Steel Design Guide 11 provides information on vibration criteria for operation of sensitive equipment. Suppliers of sensitive equipment often specify tolerance limits in terms of RMS spectral velocity. These limits are referred to as Vibration Criteria (VC) curves [VC-A to VC-E]. Table 6-2 of this guide has generic vibration criteria tolerance limit for various equipment. NIH 2024, Table 5.2.2 provides recommended floor vibration velocity limits for various spaces including laboratories and equipment (bench microscopes of various magnification, electron microscopes, surgery suites, laser based optical systems, MRI, and NMR).

4.7 Structural Design of Non-Structural Components

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

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

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

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

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

4.8 Schematic Design Report

The Schematic Design (SD) report shall contain a section for the structural discipline with a narrative outlining the following information:

.1 Building code and design guidelines used in design, including the edition of the NBC (AE) and the Technical Design Requirements for Alberta Infrastructure Facilities.

.2 CSA material design standards including edition used for design of concrete, cold-formed steel, masonry, steel, wood, and other materials.

.3 The importance category for the building per NBC (AE) Table 4.1.2.1 (low, normal, high, or post-disaster).

.4 Design gravity loads – List the specified dead, superimposed dead, and live loads for each level. The specified uniformly distributed live loads shall be listed by occupancy, per NBC (AE) Table 4.1.5.3.

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

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

.7 Wind load – List the importance factor (Iw) for the ULS and SLS, the 1/50 hourly wind pressure, internal pressure coefficient (Cpi), uplift and downward wind pressure on roofs, and the design lateral drift limit for the SLS. Post- disaster buildings shall be designed with an internal pressure coefficient, Cpi of -0.7 to +0.7.

.8 Earthquake load – List the importance factor (I_E) for the ULS, the seismic data (S_a(T, X), PGA, PGV, Site Class, Seismic Category), type of Seismic Force Resisting System (SFRS) used, the force modification factors (R_d, R_o) per NBC (AE) Table 4.1.8.9, and the design interstorey drift limit.

.9 Serviceability criteria for:
  - .1 Deflection limit under specified live load for floor and roof supporting members so that Others designing the building envelope and finishes may account for these movements in their designs.
  - .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), masonry, cold-formed steel and wood.

.11 Geotechnical report – Provide a brief 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 requirements (cement type), frost protection measures (void form thickness, minimum depth of burial for foundations), and any special considerations. In addition, provide the reference to the geotechnical report (title, consultant's name, date, and report number).

.12 Structural system – Provide a narrative describing the proposed structural system (foundation, framing, floor system, roof system, and shear cores) 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 Design Development Report

The Design Development (DD) report shall contain a section for the structural discipline. The deliverables shall include a report and drawings. The report shall contain the information listed in the SD report (as per Section 4.8), but it should be updated to include any information that may not have been provided in the SD report and developed in more detail. Drawings shall use the Alberta Infrastructure standard title block / fence surround noted in Section 4.10. The drawings are expected to contain the following information:

.1 General notes [ensure that the information provided below conforms with the text in the DD report]:
- .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. Care should be taken to ensure that details noted "typical" are applicable to the condition being portrayed and that their location and extent are made explicit.

.4 Foundation plan:
- .1 Structural grid with labels and dimensions (applies to all plans and sections).
- .2 Foundation layout including location and dimensions 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 Elevations, including Top of floor elevation, slopes, and depressions.
- .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:
- .1 Top of roof elevation and slopes. Specify elevation of high points and low points in a sloped roof.
- .2 Roof deck profile and thickness.

.3 Layout of beams, columns, vertical cores, and braced bays (with preliminary member sizes).
.4 Major openings in the roof deck.

.7 Building elevations:
  .1 Show major building exterior elevations and prominent interior elevations (if there are large interior openings requiring structural framing).
  .2 Building elevations to show location and sizes of headers, locations of braced bays (VLLRS) and size of VLLRS members.

.8 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 Contract Drawings

Contract drawings shall be prepared following the guidelines in Chapter 6.4 - Construction Documents, of the Canadian Handbook of Practice for Architects 2021, published by the RAIC. Include Items 4.9.1 to 4.9.8 from the DD drawings with additional details as appropriate.

All contract drawings shall use the Alberta Infrastructure standard title block / fence surround available at https://www.alberta.ca/guidelines-and-standards-owned-and-supported.aspx under Section “Title block drawings.”

Include 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 fire truck, storage areas, landscaped areas, areas with heavy equipment, loading from OH & S fall protection requirements, 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, 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, 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 Serviceability criteria as per Item 4.8.9. Specify minimum moment of inertia required of the floor joists for vibration control of suspended floors.

.12 Geotechnical design parameters – provide the reference to the geotechnical report (title, consultant's name, date, and 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 A23.1:19), 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) and provide design criteria for these items.

.17 Elevations of the existing grade, finished grade, foundation, floors and roofs. Geodetic elevation of the top of the main floor slab.

.18 Foundation plans: As listed in 4.9.4. In addition, provide:

- .1 Location of known existing services and existing foundations that conflict with structural foundations and the source where this information can be found should be referenced.
- .2 If underpinning or temporary shoring is specified to be designed by others, there should be indication on the drawings of the areas designated to be shored or underpinned. If shoring or underpinning is designed by the structural engineer of record, there should be indication of all details and construction sequences.

.19 Floor plans: As listed in 4.9.5. In addition, provide:
  - .1 Wherever applicable, locations and details of control, construction, contraction and expansion joints.
  - .2 Governing member forces (axial forces, moments, shears, or torsion) required for the preparation of shop and detail drawings.
  - .3 Reinforcing bar sizes and details with placing criteria.

.20 Roof plans: As listed in 4.9.6. In addition, provide:
  - .1 Wherever applicable, locations and details of construction, contraction and expansion joints.
  - .2 Governing member forces (axial forces, moments, shears, or torsion) required for the preparation of shop and detail drawings.
  - .3 Reinforcing bar sizes and details with placing criteria.

.21 Building elevations: As listed in 4.9.7

.22 Building sections: As listed in 4.9.8

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

.24 Connections: Where connections are specified to be designed by specialty structural engineer, the contract drawings should indicate all required information and governing forces. Where connections are designed by the structural engineer of record, they should show all dimensions and comprehensive connection details requiring no further engineering input.

.25 General arrangement and connection details at intersections of different structural materials should be shown.

.26 Schedules and details for columns, beams and walls should include:
  - .1 Element sizes.
  - .2 Anchorage to supporting elements.
  - .3 Elevation of bottom of columns.
  - .4 Reinforcing steel and splice details for concrete columns.
  - .5 Splice locations for structural steel columns.
  - .6 Structural details of masonry or reinforced concrete walls, including lintels, details and reinforcing of significant openings.
  - .7 Stiffeners, lateral bracing and local reinforcements for steel members.

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 drawing submittals required 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 SER for review before the first-level concrete is poured.

Sample generic specification sections are provided on the Alberta Infrastructure Technical Resources website. (https://www.alberta.ca/infrastructure-technical-resources) Consultants may use these generic specifications and adapt them to meet project specific needs.

The following is a list of Specification Sections that are Structural or related to Structural. The Consultant shall review and provide the appropriate specification sections in the Contract Documents. Section numbers below are suggested for reference only:

00 21 13	Instructions to Bidders (check with Prime Consultant / AI PM)
01 33 50	Delegated Design Submittals
01 43 20	Geotechnical Testing and Inspection (foundation installation, backfill and slab-on-grade subgrade compaction)
01 45 00	Quality Control
01 62 00	Product Options and Substitutions (required if specific Product names are used, such as Hilti, Dywidag, etc.)
02 41 16	Building Demolition / Selective Building Demolition
02 90 00	Radon – Readily Remediated New Construction

03 05 05	Concrete Testing and Inspection – including Mortar / Block / Grout Testing
03 11 00	Concrete Forming and Accessories
03 15 19	Under-Slab Vapour Barriers
03 20 00	Concrete Reinforcing
03 30 00	Cast-in-Place Concrete
03 33 00	Architecturally Exposed Concrete
03 35 00	Concrete Finishing (for Slab-on-Grade and Structural Slab)
03 45 00	Precast Architectural Concrete
03 52 16	Lightweight Insulating Concrete
04 20 00	Concrete Unit Masonry including Grouting
04 23 00	Glass Unit Masonry
04 42 19	Stone Cladding
05 05 05	Steel Inspection and Testing (for Structural Steel Framing, OWSJ and Steel Deck)
05 12 00	Structural Steel Framing
05 21 00	Open Web Steel Joists
05 31 00	Metal Decking
05 41 00	Wind Load Bearing Metal Stud Framing
05 50 00	Metal Fabrications
05 51 00	Metal Stairs, Railings and Ladders
05 70 00	Ornamental Metal Fabrications
05 73 13	Decorative Metal and Glass Railings
06 10 00	Rough Carpentry
06 15 00	Wood Decking
06 17 53	Prefabricated Wood Trusses
06 18 00	Glued Laminated Structural Units
07 21 20	Rigid Board Insulation
31 23 16	Building and Structure Excavating
31 23 35	Building and Structure Backfilling
31 32 13	Soil Cement Base Course (mud slab if required below spread and strip footings)
31 62 13	Cast-in-Place Concrete Piles (drilled concrete piles, CFA piles)
31 62 19	Timber Piles
31 66 15	Screw Piles

Please ensure that specification sections 00 21 13 and 01 62 00 are included in the construction documents to allow for naming products for basis of design

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).

.2 The structural consultant shall provide the material testing requirements including scope of work to the Province. The Alberta Infrastructure Technical Resources Centre website has sample specification sections that provide generic quality assurance testing requirements for cast-in-place concrete, masonry and structural steel. The Consultant may adapt these to the project specific requirements.

.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 specified in the contract documents.

Commentary:

.2 The sample specification sections at the Alberta Infrastructure Technical Resources Centre website have testing requirements for the following materials:

- a. 03 05 05 – testing of cast-in-place concrete, reinforcement, mortar and grout for masonry
- b. 04 20 00 – field control tests for masonry
- c. 05 05 05 – testing and inspection of structural steel framing, open web steel joists, steel deck, headed shear connectors, structural fasteners and post-installed fasteners.

Any project specific structural concerns should be brought to the attention of the Alberta Infrastructure Project Manager. Structural consultants are encouraged to provide their input in terms of feedback, concerns, experience in projects, and suggest items for consideration in the TDR or its commentary via email to the Standards and Specifications Specialist at infras.trc@gov.ab.ca

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

.2 Follow editions of Codes and Standards referenced in current *National Building Code - Alberta Edition*. Use of more recent edition of Standards not listed in the *National Building Code - Alberta Edition* shall be discussed with the Province when impact the cost and complexity of the project and decisions 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 - American National Standard for Laboratory Ventilation
  .3 NSF/ANSI/CAN 61, Drinking Water System Components – Health Effects
  .4 NSF/ANSI/CAN 372, Drinking Water System Components – Lead Content

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

  .1 ASHRAE Handbooks
  .2 ASHRAE Guideline 12, Managing the Risk of Legionellosis Associated with Building Water Systems
  .3 ASHRAE Guideline 1.5 – 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 and Acceptable Indoor Air Quality and addenda
  .7 ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
  .8 ASHRAE 110, Method of Testing Performance of Laboratory Fume Hoods
  .9 ANSI/ASHRAE Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Building

.10 ASHRAE Standard 241 Controls of Infections Aerosols
.11 ASHRAE, Laboratory Design Guide- Planning and Operation of Laboratory HVAC Systems

.7 American Society of Plumbing Engineers (ASPE), *Plumbing Engineering Design Handbooks*

.8 Occupational Health and Safety (OHS)

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

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

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

.10 Canadian Council on Animal Care (CCAC), *Guidelines on Laboratory Animal Facilities*

.11 *U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) green building rating system (LEED v4.1).*

.12 Canadian Standards Association (CSA)

.1 ASME A17.1/CSA B44, Handbook on 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 C282, Emergency Electrical Power Supply for Buildings
.12 CSA C390, Test Methods, Marking Requirements, and Energy Efficiency Levels for Three-Phase Induction Motors

.13 CSA C22.1, Canadian Electrical Code, Part 1
.14 CSA Z316.5, Fume Hoods and Associated Exhaust Systems
.15 CSA Z320, Building Commissioning Standard & Check Sheets
.16 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 Protection
.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 Ventilating 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
.10 NFPA 770, Standard on Hybrid (Water and Inert Gas) Fire Extinguishing Systems

.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 Healthcare Facility Design Requirements
.2 Infection Control Risk Assessment (ICRA) and Preventive Measures Toolkit for Construction, Renovation and Maintenance
.3 Best Practice Recommendations: Hand Hygiene Sink Requirements
.4 Standards for the Reprocessing of Reusable Medical Devices and for the Use of Single-use Medical Devices in all Health Care Facilities and Settings
.5 AHS POLICY PS-47, Safe Bathing Temperatures
.6 AHS PROCEDURE PS-47-01, Safe Bathing Temperatures and Frequency
.7 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 Health Care Waste Materials
.6 CSA Z317.13, Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities
.7 CAN/CSA Z7396.1, Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems
.8 CSA Z8001, Commissioning of Health Care Facilities

.4 Facility Guidelines Institute (FGI)

.1 Guidelines for Design and Construction of Hospitals
.2 Guidelines for Design and Construction of Outpatient Facilities
.3 Guidelines for Design and Construction of Residential Health, Care, and Support Facilities

.5 Canadian Tuberculosis Standards, Chapter 15 Prevention and Control of Tuberculosis Transmission in Health Care and Other Settings

.6 National Fire Protection Association (NFPA)

.1 NFPA 99, Health Care Facilities Code
.2 NFPA 418, Standard for Heliports

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

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

.3 Schematic Design Submission

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

.2 As a minimum, Schematic Design Report needs to include the following:

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

.4 Design Development Submission

.1 Design Development Submission needs to fully convey the design intent of all mechanical systems. All design related issues, technical criteria and performance shall be included in Design Development Report.

.2 As a minimum, the Design Development Report shall include the following:

.1 Written Information:

.1 Referenced Codes and Standards (with applicable version or edition).
.2 Detailed mechanical systems description.
.3 Deviations from Owner's Project Requirements or this document requirements and potential impacts.
.4 Building overall heating and cooling loads.
.5 .For health care facilities identify room type as per Table 1 of CSA Z317.2
.6 Major equipment selections with capacities.
.7 System and equipment redundancies and essential electrical system requirements.
.8 Vibration and noise control.
.9 Seismic supports and restraints for mechanical services and equipment.
.10 Smoke control system.
.11 Energy Management Control System, communication protocol and any interface to subsystems such as security, fire alarm and lighting
.12 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 protection mains, fire protection zone boundaries and hazard classifications, sprinkler tree and fire pump locations.
.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 all existing and new 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 Room temperature thermostats and sensors (CO2, humidity, etc.)
.5 Locations of flow measuring devices (airflow stations, etc.).
.6 Equipment access/pull/removal areas.
.7 Locations of fire protection mains, fire protection zone boundaries and hazard classifications, sprinkler tree and fire pump locations.
.8 Total connected gas load summary including planned future load.
.9 Seismic supports and restraints for mechanical services and equipment.
.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
.7 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 reference. See Section 5.14 for specific EMCS Specification requirements. Edit relevant sections to suit the project. Specifications should include, but not be limited to the following:

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

B Specific Requirements for Healthcare Facilities

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

- .1 Mechanical system schematics:
  - .1 Medical gases

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

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

.6 Accessibility

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

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

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

.3 Refer to each section for specific accessibility requirements.

.7 Coordination with Other Disciplines

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

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

    .1 Base mechanical systems on building code studies to determine occupancy classification, high-rise requirements, and defined areas of refuge.
    .2 Base mechanical systems on studies produced by other consultants including geotechnical reports, acoustic requirements, elevator requirements, and helipad requirements.
    .3 Coordinate the space requirements for mechanical services with other services sharing the ceiling space for distribution.
    .4 Coordinate mechanical equipment weights, locations, and dimensions.
    .5 Coordinate the locations, dimensions, and height of roof-mounted mechanical equipment.
    .6 Coordinate the location of mechanical equipment mounted within the ceiling system (diffusers, grilles, sprinkler heads, access panels to service equipment, etc.) with other ceiling-mounted components (lights, speakers, signs, etc.).
    .7 Base heating and cooling load calculations on the actual envelope construction details using actual glazing shading coefficients and thermal resistance values (that account for the thermal bridging through the window frames).
    .8 Base seismic and expansion compensators for mechanical systems on the maximum displacement due to the wind or seismic forces where building expansion joints are required.
    .9 Base supports and restraints for mechanical systems on the seismic loads as required by the National Building Code - Alberta Edition.
    .10 Determine the details of the foundation drainage system and whether or not a sump is required within the building.

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

.12 Coordinate noise data emitted from mechanical equipment.

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

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

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

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

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

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

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

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

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

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

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

.A Specific Requirements for Schools

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

.B Specific Requirements for Healthcare Facilities

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

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

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

.C *Specific Requirements for Continuing Care Facilities*

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

.8 Commissioning

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

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

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

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

.5 Participate in the commissioning process.

.B *Specific Requirements for Healthcare Facilities*

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

.C *Specific Requirements for Continuing Care Facilities*

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

.9 Renovations and Additions

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

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

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

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

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

.B Specific Requirements for Healthcare Facilities

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

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

.C Specific Requirements for Continuing Care Facilities

.1 Provide renovations and additions 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 7.7 - 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 Provide emergency power 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 Ultra-low flow plumbing fixtures where adequate slope could be accommodated
  - .2 Condensing water heaters
  - .3 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 per ASHRAE 62.1 and addenda
.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 Variable speed drives on pumps to maintain system pressure
.2 Pumps controlled to shut down when heating is not required
.3 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 Discuss with the Project Manager, Facility Manager and Energy Manager to determine which additional systems shall be monitored through the building management system. As a minimum the following systems should be considered.

.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

.5 Provide high efficiency motors in accordance with CSA 390, Test methods, marking requirements, and energy efficiency levels for three-phase induction motors.
.6 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.
.7 See Section 1.0 -– Sustainability for additional project requirements.

.13 Carbon-monoxide (CO) Detection

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

5.2 Mechanical Design Criteria

.1 HVAC Design Criteria

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

.2 Design mechanical systems to provide heating and cooling capacities based on the outdoor ambient temperatures given in the *National Building Code - Alberta Edition*:
Cooling – July, 2.5% value
Heating – January, 1% value

.3 Design mechanical systems to provide 30% relative humidity at outdoor temperatures above 0°C; 15% relative humidity below -30°C and reset relative humidity on a linear scale between 0 and -30°C unless otherwise required by the specific space requirements. Where codes or standards prescribe more stringent values, use those criteria in coordination with envelope design.

.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 62.1, *Ventilation and Acceptable Indoor Air Quality*.

.A Specific Requirements for Schools

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

.1 Use table 5.2.2.A for spaces with mixed flow ventilation

.2 Use table 5.2.2.B for spaces with displacement ventilation

Table 5.2.2.A: Mechanical System Design Parameters for Schools - Mixed Flow Ventilation

Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC	Remarks
Auditorium	22 - 25	see Note 2	4*	Neutral (E)	see Note 5	* See Note 3c
Cafeteria	22 - 25	see Note 2	6*	Negative (-)	see Note 5	* See Note 3c
Classrooms	22 - 25	see Note 2	4*	Neutral (E)	see Note 5	* See Note 3c
Conference Rooms	22 - 25	see Note 2	6*	Neutral (E)	see Note 5	* See Note 3c
Copier work/ Printer Room	22 - 25	see Note 2	6*	Negative (-)	see Note 5	* May require higher ACH to meet ASHRAE 62.1 requirements
Corridors	22 - *	see Note 2	2	Neutral (E)	see Note 5	* See Note 1b
Daycare Room	24 - 26	see Note 2	4*	Neutral (E)	see Note 5	* See Note 3c

Table 5.2.2.A: Mechanical System Design Parameters for Schools - Mixed Flow Ventilation						
Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC	Remarks
Gymnasium*	22 - **	see Note 2	6***	Neutral (E)	see Note 5	* Mechanical cooling not required ** See Note 1b *** See Note 6
Home Economics/ CTS Foods/ Cosmetology	22 - 25	see Note 2	6 *	Negative (-)	see Note 5	* May require higher ACH to meet ASHRAE 62.1 requirements
Industrial Arts*	22 – **	see Note 2	6 ***	Negative (-)	see Note 5	* Mechanical cooling not required ** See Note 1b *** May require higher ACH to meet ASHRAE 62.1 requirements
Kitchen / Cooking*	22 - **	see Note 2	6 ***	Negative (-)	see Note 5	* Mechanical cooling not required ** See Note 1b *** May require higher ACH to meet ASHRAE 62.1 requirements
Laboratory/Science	22 - 25	see Note 2	6*	Negative (-)	see Note 5	*See Note 3c
Library	22 – 25	see Note 2	6	Neutral (E)	see Note 5	
Locker Rooms	22 - *	see Note 2		Negative (-)	see Note 5	*See Note 1b
Music Room	22 - 25	see Note 2	4*	Neutral (E)	see Note 5	*See Note 3c
Office	22 - 25	see Note 2	4*	Neutral (E)	see Note 5	*See Note 3c
Reception	22 - 25	see Note 2	4*	Neutral (E)	see Note 5	*See Note 3c
Server Room*	22 - 24	see Note 2		Neutral (E)	see Note 5	*Provide stand-alone AC unit

Table 5.2.2.A: Mechanical System Design Parameters for Schools - Mixed Flow Ventilation						
Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC	Remarks
Staff Room	22 - 25	see Note 2	6*	Negative (-)	see Note 5	*See Note 3c
Gymnasium Storage/ Equipment Room	22 - *	see Note 2	4	Negative (-)	see Note 5	*See Note 1b

Table 5.2.2.A Notes:

.1 Temperature Range:

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

.2 Relative Humidity:

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

.3 Total Air Changes Per Hour (ACH):

- *a. Refers to total mechanical air circulation provided to a space. May be comprised of outdoor air, return air or transferred air. Outdoor air for ventilation must be provided per applicable codes.*
- *b. Values listed are minimum values and do not preclude the use of higher or more appropriate values based on more stringent standards or cooling requirements.*
- *c. Where no mechanical cooling is provided, a minimum 6 ACH should be provided for higher air circulation in the learning and administration areas; 8 ACH in the music room and staff room; 10 ACH in the conference rooms and laboratories; 12 ACH in the cafeteria.*

d. *Values refer to occupied spaces; ventilation can be reduced when space is unoccupied except where specifically noted otherwise.*

.4 *Relative Pressure:*

a. *"E" denotes equal or neutral relative pressure to surrounding spaces.*
b. *"+" denotes positive relative pressure to surrounding spaces.*
c. *"-" denotes negative relative pressure to surrounding spaces.*

.5 *Refer to Section 7.0 – Acoustics.*

.6 *Gymnasium normal occupancy 30 to 60 students for outdoor air requirements. Peak occupancy rate to be coordinated with the school board. Air changes to be based on 3m height (i.e. occupied zone).*

Table 5.2.2.B: Mechanical System Design Parameters for Schools

Displacement Ventilation

Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC	Remarks
Auditorium	22 - 25	see Note 2	3.6 - 4	Neutral (E)	see Note 5	
Cafeteria	22 - 25	see Note 2	3.6 - 4	Negative (-)	see Note 5	
Classrooms	22 – 25	see Note 2	3.6 - 4	Neutral (E)	see Note 5	
Conference Rooms	22 - 25	see Note 2	3.6 - 4	Neutral (E)	see Note 5	
Copier work/ Printer Room*						*See Note 6
Corridors	22 - *	see Note 2	2	Neutral (E)	see Note 5	*see Note 1b
Daycare Room	24 - 26	see Note 2	3.6 - 4	Neutral (E)	see Note 5	
Gymnasium*						*See Note 6
Home Economics /CTS Foods/ Cosmetology*						* See Note 6

Table 5.2.2.B: Mechanical System Design Parameters for Schools Displacement Ventilation						
Space	Temperature Range °C (Note 1)	Relative Humidity (Note 2)	Minimum Total ACH (Note 3)	Relative Pressurization (Note 4)	Noise Level RC	Remarks
Industrial Arts*						*See Note 6
Kitchen/ Cooking*						*See Note 6
Laboratories*						*See Note 6
Library	22 - 25	see Note 2	3.6 - 4	Neutral (E)	see Note 5	
Locker Rooms*						*See Note 6
Music Room	22 - 25	see Note 2	3.6 - 4	Neutral (E)	see Note 5	
Office	22 - 25	see Note 2	3.6 - 4	Neutral (E)	see Note 5	
Reception	22 - 25	see Note 2	3.6 - 4	Neutral (E)	see Note 5	
Server Room*	22 - 25	see Note 2		Neutral (E)	see Note 5	*Provide stand-alone AC unit
Staff Room	22 - 25	see Note 2	3.6 - 4	Negative (-)	see Note 5	
Gymnasium Storage/ Equipment						*See Note 6

Table 5.2.2.B Notes:

.1 Temperature Range:

a. Where a temperature range is shown (i.e. 22°C-25°C), select the upper value as the maximum summer design temperature and the lower value as the minimum winter design temperature.

b. No requirement for maximum summer design temperature.

.2 Relative Humidity:

a. Maintain minimum 30% RH at outdoor temperatures above 0°C; 15% RH below -30°C and reset RH on linear scale between 0 and -30°C.

b. Notwithstanding point a. above; lower humidity levels may be needed in existing buildings; coordinate with Architect the humidification capability of existing buildings in renovation projects.

c. Maintain the humidity level for gymnasiums to meet the manufacturers requirements for the wood flooring

.3 *Total Air Changes Per Hour (ACH):*

a. *Minimum 3.6 ACH applicable for 100 percent outside air systems, for mixed flow systems use minimum 4 ACH.*

b. *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.*

c. *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.*

d. *Values refer to occupied spaces; ventilation can be reduced when space is unoccupied except where specifically noted otherwise.*

.4 *Relative Pressure:*

a. *"E" denotes equal or neutral relative pressure to surrounding spaces*

b. *"+" denotes positive relative pressure to surrounding spaces*

c. *"-" denotes negative relative pressure to surrounding spaces*

.5 *Refer the Section 7.0 – Acoustics.*

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

.B Specific Requirements for Healthcare Facilities

.1 Design mechanical systems in healthcare facilities to meet the criteria set out in CAN/CSA-Z317.2, *Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities* (i.e. temperature range, relative humidity, minimum total air changes per hour, minimum outdoor air changes per hour, relative pressurization, filtration requirements, for noise levels refer to Section 7.0 – Acoustic, etc.).

.C Specific Requirements for Continuing Care Facilities

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

Table 5.2.2.C: Mechanical System Design Parameters for Continuing Care Facilities								
Space	Temperature Range °C (Note 1) (1)	Relative Humidity Range (%) (Note 2)	Minimum Total ACH (Note 3)	Minimum Outdoor ACH (Note 3)	Relative Pressurization (Note 4)	All Air Exhausted Directly to Outdoors	Noise Level RC	Remarks
Activity Rooms	22-24	30-60	6	2	Neutral (E)	-	see Note 5	
Administrative/ Offices	22-24	30-60	6	2	Neutral (E)	-	see Note 5	
Barber/Beauty Parlour	22-24	30-60	12	3	Negative (-)	Yes	see Note 5	
Assisted Bath	24-27	30-60	9	3	Negative (-)	Yes	see Note 5	
Clean Linen Storage	22-24	30-60	4	1	Positive (+)	-	see Note 5	
Clean Utility	22-24	30-60	6	2	Positive (+)	-	see Note 5	
Conference Rooms	22-24	30-60	10	*	Neutral (E)	-	see Note 5	See Note 3a
Dining	22-24	30-60	6	2	Negative (-)	-	see Note 5	
Dishwashing	22-24	30-60	10	2	Negative (-)	Yes	see Note 5	
Examination & Treatment	22-24	30-60	6	2	Neutral (E)	-	see Note 5	
Housekeeping Closets	22-*	30-60	10	-	Negative (-)	Yes	see Note 5	*See Note 1b
Kitchen	22-24	30-60	10	2	Negative (-)	Yes	see Note 5	
Laundry	22-24	30-60	12	3	Negative (-)	-	see Note 5	
Lounges	22-24	30-60	6	2	Neutral (E)	-	see Note 5	

Table 5.2.2.C: Mechanical System Design Parameters for Continuing Care Facilities								
Space	Temperature Range °C (Note 1) (1)	Relative Humidity Range (%) (Note 2)	Minimum Total ACH (Note 3)	Minimum Outdoor ACH (Note 3)	Relative Pressurization (Note 4)	All Air Exhausted Directly to Outdoors	Noise Level RC (N) (Note 5)	Remarks
Nursing Stations	22-24	30-60	6	2	Neutral (E)	-	see Note 5	
Physical Therapy	22-24	30-60	9	3	Negative (-)	-	see Note 5	
Public Washrooms	22-*	30-60	9	-	Negative (-)	Yes	see Note 5	*See Note 1b
Resident Bedrooms	22-24	30-60	4	2	Neutral (E)	-	see Note 5	
Corridors	22-24	30-60	3	1	Neutral (E)	-	see Note 5	
Resident Washrooms	22-24	30-60	9	-	Negative (-)	Yes	see Note 5	
Soiled Linen Storage	22-24	30-60	10	-	Negative (-)	Yes	see Note 5	
Soiled Utility	22-*	30-60	10	-	Negative (-)	Yes	see Note 5	*See Note 1b
Storage - General	22-24	30-60	2	-	Negative (-)	-	see Note 5	

Table 5.2.2.C. Notes:

.1 Temperature Range:

a. Where a temperature range is shown (i.e. 22°C-24°C), select the upper value as the maximum summer design temperature and the lower value as the minimum winter design temperature.

b. No requirement for maximum summer design temperature.

.2 Relative Humidity:

a. Maintain minimum 30% RH at outdoor temperatures above 0°C; 15% RH below -30°C and reset RH on linear scale between 0 and -30°C.

b. *Notwithstanding point a. above; lower humidity levels may be needed in existing buildings; coordinate with Architect the humidification capability of existing buildings in renovation projects.*

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

a. *Conference rooms should have 9.5 L/s per person of outdoor air.*

.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 *Refer the Section 7.0 – Acoustics.*

5.3 Drainage Systems

.1 General Requirements

.1 Design plumbing, drainage, and vent systems in accordance with the *National Plumbing Code.*

.2 Avoid installation of drainage pipes above the ceiling of electrical, server and telecommunication rooms.

.2 Sanitary Sewer System

.1 Coordinate the requirement for a sampling manhole with the Authority Having Jurisdiction and the Civil Consultant for facilities containing laboratories.

.2 Provide interceptors and neutralization tanks with adequate service space.

.3 Provide duplex sanitary sump pumps. Size pumps to prevent short cycling. Control to alternate between lead/lag operations and provide with high-level alarm. Design sump with a separate discharge line out of the pit. Do not combine the discharge pipes until out of the sump. Install check Valves and shut-off valves outside the sump for easy access. When required by client, set up the system to have both pumps working at the same time in the event of flood or an emergency. Size the discharge pipe for two pumps operation if this feature is included.

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

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

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

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

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

.B Specific Requirements for Healthcare Facilities

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

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

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

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

- .1 Fracture rooms sinks and other room where casts may be applied or removed.
- .2 Autopsy suites.

.5 Provide vapor vents to atmosphere sterilizer units.

.C Specific Requirements for Continuing Care Facilities

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

.3 Laboratory / Hazardous Waste Drainage Systems

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

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

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

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

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

.B Specific Requirements for Healthcare Facilities

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

.4 Storm Drainage System

.1 Pipe storm water separately from 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 ductile iron or aluminum dome strainers over roof drains.

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

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

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

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

.B Specific Requirements for Healthcare Facilities

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

5.4 Plumbing Fixtures and Equipment

.1 General Requirements

.1 Provide plumbing fixtures in accordance with the requirements of the *National Plumbing Code.*

.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 National Building Code - Alberta Edition that are installed in accordance with the requirement of CSA-B651, Accessible Design for the Built Environment and the National Building Code - Alberta Edition.

.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 Provide plumbing fixtures and equipment 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.
.2 Use electronic trap seal primer to prevent floor drain traps from losing their water seal by evaporation.
.3 Do not use membrane waterless traps.

.B Specific Requirements for Healthcare Facilities

.1 Floor drains shall not be provided for drench showers located in public and patient care areas.
.2 Select lower levels floor drains with the ability to accept temporary plugs if there is a potential of back flow during a flood event.

.3 Interceptions

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

.4 Water Closets

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

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

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

.A Specific Requirements for Schools

.1 Student/Staff Washrooms

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

.2 Early Childhood Services (ECS) Washrooms

.1 Provide flash tank high performance low flow toilets to reduce noise and promote acceptance by elementary students, who can be intimidated by noisier more powerful syphon jet or blowout flush.

.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 an alternative. When a bariatric commode is being used, ensure that the flush valve assembly does not interfere with its operation or provide an unattached flush tank.

.C Specific Requirements for Continuing Care Facilities

.1 Resident Washrooms

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

.2 Public Washrooms

.1 Provide at least one 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

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

.A Specific Requirements for Schools

.1 Student/Staff Washrooms

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

.C Specific Requirements for Continuing Care Facilities

.1 Resident Washrooms

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

.2 Public Washrooms

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

.7 Sinks

.1 Mechanical Rooms

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

.A Specific Requirements for Schools

.1 Classrooms

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

.2 Workshop/all type of CTS

.1 Provide sediment and solids interceptors for sinks.

.3 Science rooms and science preparation rooms

.1 Provide acid neutralizer below sinks.

.B Specific Requirements for Healthcare Facilities

.1 Handwash/Hand Hygiene Sinks

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

.2 Refer to Alberta Health Services Infection Prevention and Control Healthcare Facility Design Requirements.

.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 Eyewash 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.

.4 Provide hose bibbs in mechanical room.

.11 Drinking Fountains

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

.A Specific Requirements for Schools

.1 Core Spaces

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

5.5 Domestic Water and Specialty Water Systems

.1 General Requirements

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

.2 Refer to Alberta Infrastructure's Technical Specifications, *Section 20 20 10 Pipe and Pipe Fittings* for pipe material and *Section 20 20 30 Piping and Equipment Insulation* for insulation thickness schedule.

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

.4 All products including pipes, valves, fittings, accessories factory supplied as well as fabricated assemblies that will come in contact with domestic (potable) water shall be tested, listed and certified to NSF/ANSI/CAN 61 and 372.

.5 Avoid installation of water pipes in exterior walls which could freeze and burst during extreme cold events.

.6 Consider system's pressure for selecting domestic water distribution components (pipes, valves, fittings, joint types, adaptors, and seals).

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

.1 Building incoming water main.

.2 Branches connected to a water main.

.3 Base of a riser and each floor branch connection on a riser.

.4 Connection at each fixture.

.5 Connection to equipment.

.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-B64* Series.

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

.3 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.

.4 Insulate cold water pipes and provide with a continuous vapor barrier. Plumbing fixture supplies need not be insulated, except fixture supplies on barrier-free lavatories (e.g. stops, supplies, traps, and drains).

.B Specific Requirements for Healthcare Facilities

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

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

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

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

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

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

.C Specific Requirements for Continuing Care Facilities

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

.3 Domestic Hot Water System

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

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

.3 Provide domestic hot water recirculating pump and piping.

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

.5 Provide recirculating piping with a balancing valve for branches which exceed 15 m (49 ft) in length.

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

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

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

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

.B Specific Requirements for Healthcare Facilities

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

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

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

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

.5 Hot Water Temperature

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

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

.3 Provide mixing valves compliant with the applicable ASSE Standard to prevent thermal shock and scalding where required.

.6 Consider copper/silver ionization technology for the domestic hot water system on the recirculation piping for new healthcare facilities.

.C Specific Requirements for Continuing Care Facilities

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

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

.1 AHS POLICY PS-47, Safe Bathing Temperatures,

.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 regardless of water hardness at a location. The intent is to reduce scaling for glassware, dishwashing, plumbing fixtures, etc.

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

.B Specific Requirements for Healthcare Facilities

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

.C Specific Requirements for Continuing Care Facilities

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

5.7 Specialty Gases and Vacuum Systems

.1 Laboratory Gas Systems

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

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

.2 Dental Compressed Air System

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

.2 Provide duplex and oil-free type air compressors for dental air systems.

.3 The dental compressed air system shall not be combined with medical compressed air systems.

.3 Dental Vacuum System

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

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

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

.4 Slope distribution piping back to the source equipment.

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

.6 Provide cleanouts for the distribution system.

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

.4 Central Vacuum Cleaning System

.B Specific Requirements for Healthcare Facilities

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

.2 Where central vacuum systems are required

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

5.8 Medical Gas Systems

.1 General Requirements

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

.2 Provide medical gas systems in accordance with CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging systems*.

.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, medical vacuum, medical support gases, and anesthetic gas scavenging systems.*

.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, medical vacuum, medical support gases, and anesthetic gas scavenging systems* 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 Test and certify new or altered medical gas piping systems in accordance with CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging systems* and the *National Building Code - Alberta Edition*.

.10 Renovating Existing Facilities

.1 Additions and modifications of existing medical gas system to meet the current requirements of the *National Building Code - Alberta Edition,* CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging systems* and the *National Building Code - Alberta Edition,* and the local Authorities having Jurisdiction.

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

.2 Medical Air System

.1 Source of Supply:

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

.2 Consider a cylinder manifold system for small facilities with no medical ventilators or anesthesia machines.

.3 For existing facilities with a history of low medical air usage, evaluate the feasibility of converting the medical air compressor system to a cylinder system when it becomes necessary to replace existing compressors.

.4 Air intake for the medical air compressor will be from a non-contaminated location outside the building complete with insect screen and elbow turned downward. Refer to CAN/CSA Z7396.1, *Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anesthetic gas scavenging 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 Base the type of central oxygen system selection on:

.1 The size of the facility
.2 The type of facility (i.e. level of care)
.3 Extent of respiratory therapy (i.e. mechanical ventilators or anesthesia machines)
.4 Projected rate of consumption
.5 Remoteness of facility
.6 Frequency of service from medical gas supplier

.2 Use the following tables (5.8.3.A & 5.8.3.B) as a guide to determine the central oxygen source type:

Table 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.
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 Coordinate with the Facility Administrator to determine the quantity of present and future cylinder quantities for sizing the cylinder manifold.

.2 Where information on nitrogen usage is not available, consider providing cylinder storage capacity based on one cylinder per bank for each operating room or workroom requiring nitrogen.

.7 Nitrous Oxide System

.1 Source of Supply:

.1 Coordinate with the Facility Administrator to determine the type and quantity of present and future cylinder quantities for sizing the cylinder manifold.

.2 Where information on nitrous oxide usage is not available, consider providing cylinder storage capacity based on one half a cylinder per bank per anesthetizing location, with a minimum of two bottles.

.8 Anesthetic Gas Scavenging System

.1 Source of Supply:

.1 Provide anesthetic gas scavenging in accordance with, CAN/CSA Z7396.1, Medical Gas Pipeline Systems – Part 1: Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anesthetic Gas Scavenging Systems.

5.9 Fire & Life Safety Systems

.1 General Requirements

.1 Design fire and life safety systems in accordance with the requirements of the *National Building Code - Alberta Edition*, the *National Fire Code - Alberta Edition*, 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 *National Building Code - Alberta Edition*, the *National Fire Code - Alberta Edition*, 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 *National Building Code - Alberta Edition*, the *National Fire Code - Alberta Edition*, 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 *National Building Code - Alberta Edition*, the *National Fire Code - Alberta Edition*, and the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*.

.2 Electrical Rooms:

- .1 To help avoid water-incurred damage to electrical equipment, do not provide wet, non-interlock and single interlock pre-action system in electrical rooms containing equipment greater than 750 volts. Coordinate with Fire Specialist, and Architectural and Electrical divisions to ensure that the room design complies with all applicable codes..
- .2 Coordinate with Electrical Division for electrical rooms containing equipment less than 750 volts.

.3 Provide sprinkler guards for sprinklers subject to damage.

.4 In areas with low ceiling (bulkheads) sprinklers to be of the concealed type.

.B Specific Requirements for Healthcare Facilities

.1 Provide pre-action sprinkler system to avoid accidental discharge in rooms where water damage can affect the operation including operating rooms, delivery rooms, recovery rooms, intensive care units, main electrical rooms, main IT rooms, and rooms containing high value equipment including CT rooms, MRI rooms, linear accelerator rooms and PET scanner rooms.

.2 In areas that require cleaning and sanitation of sprinkler heads, concealed sprinkler heads shall be used.

.3 Sprinkler heads in forensic and mental health facilities should be suitable for such facilities, and in all cases appropriate for patient care areas.

.4 Provide sprinkler head guards in areas where there are no ceilings and there is a risk that the sprinkler head might be damaged.

.1 Fire Extinguishers

.1 Provide fire extinguishers in accordance with the *National Building Code - Alberta Edition*, the *National Fire Code - Alberta Edition*, 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 clean agent extinguishers in the OR.
.2 Provide a 9.1 kg (20 lb) dry-powder (Class ABC) type fire extinguisher for the OR suite (not each room) as a minimum.
.3 Fire hose cabinets, where present, shall have recessed hinges and latches to facilitate cleaning.

.5 Smoke Control System

.1 Provide smoke control systems that meet the requirements:

.1 The National Building Code - Alberta Edition
.2 The National Fire Code - Alberta Edition
.3 NFPA 92, Standard for Smoke Control Systems
.4 ASHRAE Guideline 1.5, The Commissioning Process for Smoke Control Systems

.2 Coordinate, commission and test smoke control system design in accordance with the applicable standards and the Authority Having Jurisdiction.

.3 Coordinate smoke control zones with the fire alarm and sprinkler zones.

.B Specific Requirements for Healthcare Facilities

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

.2 Coordinate with the architect to identify the Areas of Refuge and provide smoke-free ventilation in accordance with the National Building Code - Alberta Edition.

.C Specific Requirements for Continuing Care Facilities

.1 Design smoke control systems to the same standards as Healthcare Facilities.

5.10 Heating Systems

.1 General Requirements

.1 Heating Criteria

- .1 Select systems on the basis of energy efficiency, controllability, maintainability, and life-cycle costs.
- .2 Select equipment to account for the heating load profile, thermal energy storage, equipment reliability, and availability of spare parts for servicing.
- .3 Design heating systems to work in conjunction with the ventilation system and building envelope to prevent condensation on interior surfaces and components of the building envelope assemblies.
- .4 Design for decoupled heating/ventilation systems to be able to provide better occupant comfort and temperature control and not rely on the ventilation system for heating.
- .5 Avoid combining copper and aluminum heating components in the same system.
- .6 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.
- .7 Provide heating to crawlspaces.
- .8 Design coils using the largest temperature drop practical in order to minimize pipe sizes and pump flow rates.

.9 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.

.2 Heating Source

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

.3 System Cleaning and Chemical Treatment

.1 Provide cleaning, degreasing, and chemical treatment on hot water heating systems. Refer to the Alberta Infrastructure Technical Specifications, *Section 23 25 00* series.

.2 Provide a chemical pot feeder on each closed loop of water or glycol systems.

.4 Accessibility and Maintenance

.1 Ensure equipment and valves are easily accessible for cleaning and inspection.

.2 Provide isolation valves at all terminal heating equipment, supply and return mains, zone branches, and risers.

.5 Pipe Distribution

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

.2 Consider primary-secondary pumping systems where they reduce power consumption and provide better control.

.3 Two-pipe, reverse return systems are preferred for heating water piping. Two-pipe, direct-return systems may be used only if the design properly guards against flow imbalance to terminal units.

.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. Coordinate with the client for the approval of using Mechanical Grooved Piping systems outside the mechanical rooms.

.6 On heating systems, butterfly valves are permitted within mechanical rooms only.

.7 Avoid installation of heating pipes above the ceiling of electrical, server and telecommunication rooms.

.2 Heating Water System

.1 Heating Water Boilers

.1 Provide multiple identical boilers to provide a minimum of 60% of design load when one is out of service.
.2 Size the heating plant to reflect the seasonal nature of the heating load to allow efficient operation under varying loads.
.3 Specify boilers to have a minimum thermal efficiency of 90% 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. The system intended to be operational during winter needs to be designed for both freezing and burst protection.

.3 Heating Water Pumps

.1 Use variable speed drives on pumps and two-way control valves on terminal devices to maintain system design pressure under variable flow conditions. Indicate the sensor location(s) on the plans.
.2 Provide 100% redundancy for heating water pumps.

.4 Finned Radiation

.1 Where finned radiation is used behind millwork, ensure there is access for cleaning.

.5 Radiant Panels

.1 Consider the use of radiant panels where perimeter furniture and cabinets restrict the use of finned radiation.
.2 Use special care when locating radiant panel thermostats. Control the radiant panel as first stage heating before the air system reheat coil (where present).

.3 Do not schedule the temperature of the radiant panel water heating system so low as to adversely affect the performance of the panel when combined with other types of terminal heating equipment.

.4 Consider architectural details, window coverings, and perimeter air supply outlets in the use of radiant panel heating systems. Ensure that the glazing is completely exposed to the radiation effect.

.6 Terminal Box Reheat Coils

.1 Terminal boxes serving interior zones shall be equipped with reheat coils.

.2 Where terminal boxes provide makeup air supply for variable exhaust conditions, size the reheat coil (when present) based on the lowest seasonal heating water supply temperature the boiler is controlled to.

.A Specific Requirements for Schools

.1 Design heating system to provide ease of operation and maintenance.

.2 Size the heating plant with boilers which have heating surface area such that the ABSA rating kW rating for the boilers is less than 750 kW so that an ABSA certified building operator is not required to make regular checks on the boiler system.

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.3 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.

.4 Provide individual thermostatic zoning for each instructional space.

.5 Provide gymnasiums with a heating system independent from the gymnasium ventilation system.

.B Specific Requirements for Healthcare Facilities

.1 Heating water systems shall conform to CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities.

.2 Provide separate boilers for the building heating system, process loads (sterilizers, humidification), and the domestic hot water heating system.

.3 Provide an ancillary heating connection on the outside of the building for temporary connection to a portable boiler under emergency conditions and a means to allow for load shedding to match essential loads against available boiler capacity.

.4 Where heating water mains are buried, provide a redundant pipe sized for 100% of the design load complete with valves to allow 50% of the flow through both pipes under normal operation. A loop system with suitable sectional valves may be considered in lieu of two mains.

.C *Specific Requirements for Continuing Care Facilities*

.1 Provide an ancillary heating connection on the outside of the building for temporary connection to a portable boiler under emergency conditions and a means to allow for load shedding to match essential loads against available boiler capacity.

.3 Steam heating and Condensate System

.1 Steam Boilers

.1 Avoid designing steam boilers that deliver high pressure steam (103 kPa or greater steam pressure). Where high pressure steam systems are proposed, consider system operating costs including mandatory supervision requirements and discuss with the Facility Administrator.

.2 Makeup Water and Chemical Treatment

.1 Feed water to all steam-producing equipment shall be pre-treated and preheated to ensure the water quality meets the minimum requirements of the equipment and to minimize the operations and maintenance requirements for the equipment.

.2 Chemicals used for corrosion control of steam piping shall not be hazardous to health. The level of impurities used for sterilization shall comply with *CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities*.

.3 Meter chemical treatments for steam system. Avoid batch feed systems.

.3 Steam Pipe Distribution

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

.2 Use separate pipes for steam and steam condensate return piping.

.3 Where a steam coil could have an entering air temperature less than 4°C (40°F), provide two steam traps that are each sized for full capacity.

.B Specific Requirements for Healthcare Facilities

.1 Where a steam supply main must be buried, provide a redundant pipe sized for 100% of the design load complete with valves to allow 50% of the flow through both pipes under normal operation. A loop system with suitable sectional valves may be considered in lieu of two mains.

5.11 Cooling Systems

.1 General Requirements

.1 Cooling Criteria

- .1 Select cooling systems on the basis of energy efficiency, controllability, maintainability, and life-cycle costs.
- .2 Design refrigeration systems in conformance with CSA B52*, Mechanical Refrigeration Code.*
- .3 Provide cooling to serve data and server rooms year-round. Where appropriate, provide multiple cooling units for continuous cooling in event of equipment failure.
- .4 Do not provide mechanical cooling for mechanical equipment rooms unless specifically required to keep equipment within the ambient temperature conditions recommended by the equipment manufacturer (i.e. electrical panels, etc.). Provide a means to free-cool equipment where possible.

.2 Cooling Source

- .1 Chilled water is the preferred means of cooling when the total building cooling load is over 280 kW (80 ton).
- .2 Limit the use of direct expansion (DX) refrigeration in air handling units for cooling capacities up to 105 kW (30 ton). Multiple DX air handling units are acceptable for a total cooling load not exceeding 280 kW (80 ton). Provide staged compressors for capacity control in DX systems.
- .3 Use outdoor air for free cooling where ambient conditions permit.

.3 Accessibility and Maintenance

- .1 Ensure equipment and valves are easily accessible for cleaning and inspection.
- .2 Provide isolation valves at all terminal cooling equipment, supply and return mains, zone branches, and risers.

.4 Pipe Distribution

.1 Refer to Alberta Infrastructure’s Technical Specifications, *Section 20 20 30 Piping and Equipment Insulation* for insulation thickness schedule.
.2 Consider primary-secondary pumping systems where they reduce power consumption and provide better control.
.3 Two-pipe, reverse return systems are preferred for cooling water piping. Two-pipe, direct-return systems may be used only if the design properly guards against flow imbalance to terminal units.
.4 Provide means for balancing and flow measuring for all major circuits. Provide balancing valves at each terminal cooling unit.
.5 Avoid installation of cooling pipes above the ceiling of electrical, server and telecommunication rooms.

.5 System Cleaning and Chemical Treatment

.1 Provide cleaning, degreasing, and chemical treatment on chilled water systems. Refer to the Alberta Infrastructure Technical Specifications, *Section 23 25 00* series.
.2 Provide a chemical pot feeder on each closed loop of water or glycol systems.

.A Specific Requirements for Schools

.1 Cooling Criteria

.1 Coordinate with the Project Manager and the School Board to determine where cooling is required to maintain health and comfort conditions (considering local ambient conditions and the School Boards regional requirements).
.2 Provide mechanical cooling in high heat gain areas such as data and server rooms etc.

.2 Displacement ventilation systems

.1 Mechanical cooling shall be provided to maintain supply air temperature within the range 17 - 20°C.

.3 Adiabatic humidification system shall not be used as cooling system.

.B Specific Requirements for Healthcare Facilities

.1 Cooling Criteria

.1 Design the cooling plant to maintain comfort conditions in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

.2 Accessibility and Maintenance

.1 In multi-chiller cooling plants, provide motorized chilled water isolation valves c/w manual wheels to override the valve actuator position.

.C Specific Requirements for Continuing Care Facilities

.1 Cooling Criteria

.1 In continuing care facilities provide a means of limiting interior temperatures in summer such as through the use of operable windows and air conditioning.
.2 Provide mechanical cooling for dining areas, corridors, program/activity areas, lounges, kitchens, and laundry spaces.
.3 Provide individual temperature control zone for resident bedrooms.
.4 Provide kitchens/serveries with cooling and dedicated temperature control.
.5 Provide living rooms/activity spaces with cooling and dedicated temperature control.

.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 Consider heat recovery chillers integrated with heating and cooling system to avoid cooling tower operation in winter and winterization.

.6 If heat recovery is not feasible, winterize cooling towers for chilled water systems which are designed to operate on a year-round basis.

.7 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.

.8 Provide clearances around cooling towers in accordance with the manufacturers' recommendations accounting for the height of adjacent surfaces.

.9 Provide VFDs on cooling tower fans 5 HP or larger.

.10 Consider specifying stainless steel construction for cooling tower basins.

.11 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 When replacing a chiller plant, always test and replace/right-size pumps as necessary. 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 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.

.4 Critical Cooling System

.1 Provide a separate cooling system to serve equipment that requires cooling during times that are significantly different from that of the building cooling system or requires a different chilled water temperature or requires chilled water year round (MRI rooms/Server Rooms, etc.).

5.12 Ventilation Systems

.1 General Requirements

.1 Duct Distribution

.1 Design ductwork in accordance with SMACNA standards with particular emphasis on minimizing the external static pressure of air handling units.

.2 Provide a minimum of four duct diameters of straight ductwork upstream of VAV terminal boxes inlets (or as recommended by manufacturer's literature - whichever is greater).

.3 Where low-level displacement diffusers are provided, coordinate locations to prevent obstructions from furniture or millwork.

.4 Do not use mechanical rooms and mechanical shafts as return air plenums.

.5 Public corridors or exit shall not be used as return air plenum.

.2 Ventilation Zones

.1 Design the ventilation zones in coordination with the perimeter heating system and building envelope to prevent condensation on exterior walls and glazing.

.2 Design supply air and return air for any given room should be provided by the same air handling unit.

.3 Provide a separate ventilation zone for corner spaces when cooling/heating 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. Maintain negative pressurization to the adjacent spaces.
.6 Where constant volume air systems are used, consider reheat requirements for interior zones.
.7 To the extent possible, match heating and cooling zones.
.8 Where areas with different occupancy schedules are served by the same air handling unit, provide a means of area isolation to reduce air flow and energy use.

.3 Diffusers, Grilles, and Louvers

.1 Locate ceiling mounted diffusers and grilles to align with lights and other ceiling mounted devices whenever possible.
.2 Locate supply and return air diffusers/grilles to prevent short cycling.
.3 Design duct distribution systems using appropriate diffuser/grille type, locations, air velocities, and air-flow patterns to maximize occupant comfort.
.4 Install bottom of outdoor air intake louvers at least 2m (6 ft) above grade level. If outdoor air intake is installed above the roof, extend it at least 1 m (3 ft) above roof level or as required due to local snow conditions.

.4 Duct Cleaning

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

.5 Accessibility and Maintenance

.1 Provide access doors upstream of fire dampers.
.2 Provide a minimum of 1 m (3 ft) clearance between the underside of the roof-mounted equipment and the roof surface when the unit is not mounted directly on a curb.
.3 Where possible, install air-handling units within the building rather than on rooftops.
.4 Where motorized dampers are provided separate from a packaged air-handling unit, locate the actuator where it is visible, accessible, and in a heated space.
.5 Provide removable terminal box sensors for periodic cleaning to prevent buildup of lint.
.6 The use of a ships ladder shall not be considered an acceptable means of servicing equipment in high locations where filters or other components need to be replaced.

.7 Consider means to mitigate snow entrainment and hoarfrost on air handling unit intakes.

.8 Provide access doors upstream and downstream of duct-mounted heating coils.

.6 Smoke Management

.1 Smoke management systems shall be designed, commissioned, and tested in accordance with the applicable requirements.

.7 Dedicated Smudging Areas

.1 Provide dedicated exhaust and negative pressure relationship to the adjacent spaces to contain, capture and remove smoke.

.2 At minimum provide 12 air changes per hour (ACH) of dedicated exhaust.

.3 Provide control damper for isolating the return air from the smudging room during the ceremony.

.4 Provide a manually operated switch with timer to activate the exhaust fan and close the control damper on the return side during the ceremony.

.8 Smudging Ceremony in other areas:

1. Coordinate design requirements with client and appropriate stakeholders.

.A Specific Requirements for Schools

.1 Duct Distribution

.1 Do not use school corridors as a return air plenum.

.2 Gymnasium Ventilation

.1 Provide a separate air system with free-cooling capability. Mechanical cooling is not required.

.2 Design air systems to vary outdoor air volume for normal occupancy (classes) usage and high occupancy (community events) usage utilizing CO_2 sensors.

.3 Provide a system override local control.

.3 Core Building Ventilation

.1 Design air circulation/distribution at the boot racks and cubbies to avoid potential odor and moisture issues.

.B Specific Requirements for Healthcare Facilities

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

.2 Duct Distribution

- .1 Do not use ceiling spaces as return air plenum.
- .2 Design air distribution systems to limit air velocities or control drafts in special draft-sensitive areas/rooms (dialysis area, certain laboratories, isolation rooms, etc.).
- .3 Ventilation systems should be zoned accounting for room/space function, occupied hours and air quality requirements. Ventilation systems may be permitted to serve areas of different use provided that the requirements of the most critical occupancy are satisfied. Consider the requirements for continuous airflow to Areas of Refuge when zoning air-handling systems.
- .4 All clinical/patient-care rooms shall have dedicated supply and return air terminal boxes.
- .5 Operating room supply and exhaust/return grilles, and air boots shall be manufactured from stainless steel.

.3 Accessibility and Maintenance

- .1 Provide HVAC system for Type I areas (as defined in CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities) that are capable of being shut down for maintenance and emergency repair without jeopardizing the relative pressurization of adjoining spaces.

.4 Smoke Management

- .1 Areas of refuge (operating rooms, delivery rooms, intensive care units, and other areas where it is impractical to move a patient in an emergency) shall be provided with a mechanical air supply that will continue to operate during a fire to assist in keeping the areas smoke free for the duration required by the National Building Code - Alberta Edition. Ductwork passing through other zones that is required to keep the areas smoke free shall be protected with a fire rating equivalent to the length of time that the areas is required to be kept smoke free.

.2 Sleeping room fire compartments shall be designed, installed and commissioned to prevent smoke from spreading to other compartments or areas of the Healthcare Facility, to allow for horizontal relocation of patients to a smoke-free area. Provide fire and smoke dampers on any duct penetrations and air transfer openings at fire separations in accordance with the National Building Code - Alberta Edition.

.5 Infection, prevention, and control, and health considerations

.1 Provide outdoor air change and total air change rates to all rooms and areas within a healthcare facility to control contaminant levels, temperature, and humidity while minimizing stratification and drafts.

.2 Design ventilation systems that move air from clean to less clean areas and with air patterns designed to direct fresh air towards the breathing zone of the occupants.

.3 Design outdoor air intakes to maintain the minimum separation distances to potential outdoor air contaminant sources in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities. Consider the effect of the predominant wind direction and increase distances as appropriate.

.4 Do not circulate air from an 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 Design ventilation systems to the same standards as Healthcare Facilities.

.2 Resident bedrooms

.1 Provide each resident bedroom with individual air temperature controls that are controllable within a range.

.2 Provide ventilation air directly into each resident room. Transferred air from the corridor into the resident room is not acceptable.

.3 Assisted bathing rooms

.1 Provide assisted bathing rooms with a dedicated temperature control that is separate from other rooms.

.2 Air Handling Units

.1 General Construction

.1 Provide hinged doors to all compartments within air-handling units (filter banks, coils, etc.) for accessibility. Arrange doors to open against internal air pressure. In negative pressure sections, the doors should open outward; in positive pressure sections, the doors should open inward. Give consideration to door construction and gasketing material to ensure tightness and durability of the seal.

.2 Provide switches to control internal lighting (except for small packaged rooftop units).

.3 Arrange air handling unit compartments to promote good mixing of air streams and uniform air flow through each component. Use factory mounted air blenders to prevent air stratification and provide uniform flow across coils.

.4 Provide a heated and full-sized, enclosed service corridor within rooftop units where practical. Access to the service corridor is preferable from within the building.

.5 Provide non-ferrous materials in locations where condensation or moisture can occur (i.e. drain pans, cooling coil headers, casings and racks, and cooling coil and humidifier sections).

.6 Provide drains in each section of an air-handling unit where water might accumulate. Design air-handling units to continuously drain water present in outdoor air intakes, cooling coil drain pans, and humidifier drain pans to prevent the accumulation of standing water within the unit. Drain pans to be sloped to drain in a minimum of two directions and at a minimum slope of 2%.

.7 Design air handling unit curb/housekeeping pads of a sufficient height to accommodate the drain condensate trap outside of the unit.

.8 Equip air handling units with an economizer and return fan section.

.2 Location

.1 Locate air handling units indoors within designated mechanical rooms unless otherwise permitted by the Project Manager and Facility Administrator.

.2 Locate air handling equipment over corridors or other non-critical areas that are least impacted by noise and vibration transmission.

.3 Design outdoor air intakes to maintain the minimum separation distances to potential outdoor air contaminant sources in accordance with ANSI/ASHRAE 62.1*, Ventilation for Acceptable Indoor Air Quality*. Consider the effect of the predominant wind direction and increase distances as appropriate. Where other codes or standards indicate higher separation distances, use the larger value.

.3 Redundancy and Standby Capacity

.1 Consider parallel air handling units or interconnected air systems for ventilation systems that serve critical areas. Discuss redundancy requirements with Project Manager and the Facility Administrator.

.4 Humidification

.1 Where wetted media type evaporative humidification is used, it shall be ‘once-through’ type. Arrange the media and water spray headers in sections to achieve a minimum of three stages of capacity control. Provide stainless steel drain pans and adjustable flow control. The air handling unit should be controlled to shut off only when the media is dry.

.2 Steam generated at the central steam plant may be used for humidification provided that the chemical treatment used in the boilers is appropriate.

.1 Verify that the boiler water does not contain chemicals that are known to be hazardous to health, or which might contribute to an indoor air quality problem. Chemical concentrations shall not exceed the levels acceptable under the Alberta Occupational Health and Safety Regulations.

.2 Alternatives to using a central boiler to provide direct steam humidification include, a dedicated gas-fired steam boiler, point-of-use gas-fired steam humidifiers, and a steam-to-steam converter system.

.3 Electrode and electrical steam generators for humidification should only be considered when the humidification load is less than 45 kilograms of steam per hour.

.5 Air Filtration

.1 Provide ventilation systems equipped with filtration in accordance with *ANSI/ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality (*as a minimum).

.2 Provide ventilation air filtration systems in accordance with ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (as a minimum).

.3 Provide air-handling units with both summer and winter filters sections where frost may occur.

.4 Provide filtration as required to meet the projects targeted Indoor Environmental Quality credits for LEED projects.

.5 Provide MERV 8 pre-filters and MERV 13 final filters in air handling units (as a minimum).

.6 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.

.B Specific Requirements for Healthcare Facilities

.1 General

.1 Design air handling units in accordance with CAN/CSA Z317.2, *Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities*.

.2 Humidification

.1 Use steam humidifiers in all air handling systems injected into the supply air through a steam distribution manifold.
.2 Where feasible, provide lower humidity “buffer spaces” to separate spaces with high relative humidity from the building envelope. Design partitions and mechanical system air pressure differentials to minimize humid air transfer to buffer spaces.
.3 Where high humidity spaces cannot be “buffered” from the building envelope, provide other means to prevent condensation within the building envelope.

.C Specific Requirements for Continuing Care Facilities

.1 General

.1 Design air handling units in accordance with CAN/CSA Z317.2, *Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities*.

.2 Humidification

.1 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.
.2 Where direct -fired MAUs are used provide CO/NOx sensors in the space to monitor/control air quality.

.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 *National Building Code - Alberta Edition* and *National Fire Code - Alberta Edition*.

5.13 Exhaust Systems

.1 General Requirements

.1 Provide exhaust air systems to remove odors, smoke, fumes, or heat.
.2 Do not use ceiling spaces or mechanical rooms as exhaust air plenums.
.3 All exhaust systems shall be ducted to the inlet of the exhaust fan.
.4 General return shall not be provided to the areas served by an exhaust system.
.5 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, recycling room, 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, food labs 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.

.5 Coordinate, commission and test dust collectors fire protection and explosion systems in accordance with the applicable standards and the Authority Having Jurisdiction.

.B Specific Requirements for Healthcare Facilities

.1 Provide exhaust systems to maintain environmental conditions or to achieve pressure relationships in accordance with CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air Conditioning Systems (HVAC) in Health Care Facilities.

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

.C Specific Requirements for Continuing Care Facilities

.1 Design ventilation systems to the same standards as Healthcare Facilities.

.2 Provide exhaust in beauty shops to remove odors related to hair styling chemicals.

.3 Provide negative air pressurization with exhaust to the outside in spaces such as washrooms, bathrooms, housekeeping rooms, soiled utility rooms, kitchens, and laundry rooms to control odor and control humidity.

.2 Kitchen Exhaust System

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

.2 Provide kitchens with makeup air and maintain negative pressurization in the space during cooking periods.

.3 When exhaust hoods are shut down, reduced makeup air flow may be considered.

.3 Smoke Exhaust Systems

.1 Refer to Section 5.9.5 – Smoke Control System.

.4 Fume and Process Exhaust Systems

.1 Design fume exhaust systems in accordance with ASHRAE, Laboratory Design Guide – Planning and Operation of Laboratory HVAC Systems.

.2 Exhaust duct materials:

  .1 Use corrosion resistant materials for exhaust ducts conveying corrosive fumes and vapor.

  .2 Use stainless steel for exhaust ducts conveying moisture-laden vapors.

.3 Fume Hoods:

  .1 Where fume hoods are provided as part of the mechanical scope of work, consider the use of variable speed fume hoods, sash stops, and proximity sensors.

  .2 Where fume hoods are provided as part of the mechanical scope of work, provide fume hoods with factory supplied face velocity monitor and alarm.

.5 Radon Gas Exhaust

.1 Refer to Section 11.0 – Environmental for radon mitigation rough-in system requirements.

.2 The building design team to retain a C-NRPP Radon Mitigation Professional in good standing to design the radon "rough-in" mitigation system to facilitate the building with possible Active Soil Depressurization (ASD) systems capability. Mechanical considerations for rough-in system include, but not limited to:

- .1 Rough-in riser vent pipes.
- .2 Future tie-in and venting configurations. Radon venting discharges shall be located away from any building air intake and public spaces.
- .3 Future exhaust fan locations and coordination for electrical requirements.

5.14 Energy Management Control System (EMCS)

.1 General Requirements

.1 Specify all applicable requirements in Alberta Infrastructure EMCS Technical Specifications.

- .1 Technical Specification sections for Direct Digital Control (DDC) System:

  23 08 95 EMCS Start-Up and Testing

  23 09 23 EMCS General Requirements

  23 09 24 EMCS Network Communications and System Configuration

  23 09 25 EMCS Central/Portable Control Stations and Peripherals

  23 09 26 EMCS Remote Control Units

  23 09 27 EMCS Terminal Control Units

  23 09 28 EMCS Field Work

  23 09 29 EMCS Sensors, Devices and Actuators

  23 09 30 EMCS Point Schedules

  23 09 93 EMCS Control Sequences

.2 Technical Specification section for pneumatic, electric and electronic controls systems, where the project size and complexity do not warrant use of a DDC system:

23 09 93 Control Systems

Above EMCS Technical Specifications can be downloaded at https://www.alberta.ca/facility-services-sub-group.aspx

.2 Provide BACnet Testing Laboratories (BTL) certified components to:

.1 Control heating, ventilation, and air conditioning systems
.2 Minimize energy consumption
.3 Monitor and record mechanical systems performance
.4 Dial out of alarm signals

.3 Provide commercially available, field proven EMCS that is installed, engineered, and commissioned by trained and qualified personnel, employed by companies that can provide an acceptable level of service after completion of the contract.

.4 Field installation needs to meet applicable requirements specified in Alberta Infrastructure Technical Specifications, 23 09 28 – EMCS Field Work.

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

.6 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

.7 Provide adequate operator training to utilize the EMCS system to its full potential including training on how to interpret energy consumption reading, adjust set points, and modify sequences (where possible).

.8 Provided access to all EMCS field devices for calibration/maintenance or replacement.

.9 Control components to have same level of redundancy, backup power and location fire protection rating as equipment being controlled.

.10 Refer to Section 5.1.5 for EMCS contract documents requirements.

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

.12 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 10 Control Systems* for requirements on projects, where size and complexity do not warrant use of Direct Digital Control system.

.2 Requirements for EMCS Major Components

.1 Network Communication and System Configuration

.1 BACnet only system for all new works. LonMarks devices can be accepted for retrofit projects if circumstances dictate.

.2 Two-tiered network separating communication traffic between controls for major mechanical equipment and zone control.

.3 Direct peer-to-peer data sharing between all Remote Control Unit (RCU) on primary network.

.4 Where communication is specified between a unitary equipment controller and the EMCS, ensure that the extent of communication is clearly specified. In particular:

.1 Each point (including virtual points) that is to be communicated.
.2 Between the EMCS and the unitary controller. List each point discreetly on the EMCS points list.
.3 Each communicated point within the specification section pertaining to the relevant unitary equipment and its controller.
.4 Clearly define which points may be read-only by the EMCS and which points must be read/write by the EMCS.

.5 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 24 EMCS Network Communication and System Configuration* for further details.

.2 Central/Portable Control Station (CCS/PCS)

.1 User-friendly interface and control language that allows user reprogramming of the control sequences.

.2 Program and graphics editing software including operating manuals.

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

.4 Remote access by telephone or internet connectivity.

.5 Trend log, reports to support applicable LEED credit requirements.

.6 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.

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

.8 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 25 EMCS Central/Portable Control Stations and Peripherals* for further details.

.3 Remote Control Units (RCU)

.1 Provide each air handling unit with its own remote control unit (RCU). Using one RCU for multiple air handling units is not acceptable.

.2 RCU to have same level of redundancy, backup power and location fire protection rating as equipment being controlled.

.3 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 26 – EMCS Remote Control Units* for further details.

.4 Terminal Control Units (TCU)

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

.2 Floating point control shall not be used for terminal box actuators serving critical care areas. Where floating point control is used, terminal boxes shall not all recalibrate at the same time.

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

.5 Field Devices

.1 Provide electrically powered actuators to drive all valves, dampers and other control devices, except that central equipment actuators may be pneumatically powered in extensions or renovations to existing facilities where pneumatic power of adequate capacity is available.

.2 Select control valves with proper flow characteristics to match the application. Size so as to maintain reasonably linear control characteristics.

.3 Consider the use of 1/3 and 2/3 sized control valves for coils with large load variations.

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

.5 Install flow measuring devices according to the manufacturer's recommendation.

.6 Where variable volume control is being used with non-filtered supply or return air, a true differential pressure sensor shall be utilized. Flow-through sensors shall not be permitted.

.7 Refer to Alberta Infrastructure Technical Specification, *Section 23 09 29 – EMCS Sensors, Devices and Actuators* for further details.

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.3 Control Point Schedule

.1 Identify EMCS control points according to the Alberta Infrastructure EMCS Guideline for Logical Control Point Mnemonics.

.2 Every major mechanical system and piece of equipment (heating plant, cooling plant, major ventilation equipment, medical gas/vacuum pumps, domestic water heaters, etc.) shall be provided with sufficient control points to:

.1 Control heating, ventilation, and air conditioning systems.
.2 Execute control strategies to minimize energy consumption.
.3 Monitor and record mechanical system's performance and trend data for the current and previous years in operation.
.4 Provide dial out of alarm signals.

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

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

.B Specific Requirements for Healthcare Facilities

.1 Control Points

.1 Track run time for vacuum pumps and medical air compressors.

.4 Sequence of Operations

.1 Provide custom control sequences and application programs to conserve energy by:

.1 Optimizing operation of controlling primary energy consuming equipment.
.2 Specifying optimum start and stop times for equipment and systems that do not operate 24 hours per day.
.3 Resetting air and heating water supply temperatures using feedback from occupied space demand and outside air temperature.
.4 Resetting relative humidity based on outside air temperature.
.5 Using air systems to preheat, pre-cool or purge to achieve the objective space temperature at the start of occupancy.
.6 Controlling variable air flow by using system pressure to control fan and pump VFD speed.
.7 Reset supply air temperature on VAV systems based on feedback from VAV damper position in order to reduce simultaneous heating & cooling.
.8 Schedule VAV terminal boxes where areas with different occupancy schedules are served by the same ventilation system.
.9 Reset supply air temperature on constant volume systems based on feedback from reheat coil/radiant panel/radiation valve position in order to reduce simultaneous heating & cooling.
.10 Controlling car plug power to lock out at -10°C (2°F) and above, and to cycle on/off for 20 minutes intervals at temperatures below.

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

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

End of Mechanical Section

6.0 Electrical

Section Contents

6.1 General Electrical

.1 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 Do not sole source or use proprietary equipment or systems for any new facility or major renovation where existing equipment is being replaced. In cases of renovation, campus or addition type projects, specific equipment or systems may be required. If this is the case, these must be itemized and reviewed with the Infrastructure Project Manager.

.2 References

.1 In addition to the Alberta Safety Codes Act, the following standards and guidelines shall be followed where applicable.

Referenced Documents (Where applicable, latest revisions/edition and changes).

- .1 Telecommunications Referenced Standards:
  - .1 ANSI/TIA-568.0, Generic Telecommunications Cabling for Customer Premises
  - .2 ANSI/TIA-568.1, Commercial Building Telecommunications Cabling Standard
  - .3 ANSI/TIA-568.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard
  - .4 ANSI/TIA-568.3, 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, Telecommunications Cabling Guidelines for Wireless Access Points.

.9 Canadian Standards Association (CSA)
.10 Illuminating Engineering Society (IES)
.11 Institute of Electrical and Electronic Engineers (IEEE)
.12 Underwriters Laboratories Canada (ULC) / Underwriters Laboratories (UL)

.3 Key Design and Performance Requirements

.1 The Design shall follow the Alberta Safety Codes Act and all referenced codes and standards. 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.

.2 Develop a conduit/raceway/cable tray description/schedule and include in specifications/drawings. Provide Electrical Metallic Tubing (EMT) for all interior locations such as ceiling spaces and concealed in walls, except where otherwise indicated in specifications/drawings or required by Canadian Electrical Code. Provide details and/or specification for specialized wiring (eg. dedicated neutral circuits) and raceway methods. All low voltage (below 120V) wiring to be installed in a conduit/raceway/cable tray. Do not use Electrical Non-metallic Tubing (ENT).

.3 Equipment essential to the operation of the facility is to be located and protected to minimize exposure to hazards that could impact its continued operation.

.4 Provide block diagrams for all electrical systems. Provide riser diagrams for multi-level buildings for all electrical systems over two floors.

.5 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.

.6 Power distribution and service equipment are to be located in secure, dedicated vaults, rooms and closets with sufficient clearance, access routes and access panels to allow for the installation, removal and replacement of equipment and to provide maximum flexibility for power distribution to floor area served.

.7 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.

.8 Provide separate communication rooms for major data and electronic equipment.

.9 Electrical equipment shall not be located in or below Janitor rooms, water closets or other rooms with liquids, and shall only be located in mechanical equipment rooms if required to service mechanical equipment. All electrical equipment is to be suitably protected from leakages from the sprinkler system. Any major electrical equipment greater than 750 Volts shall not have sprinkler system or water lines located within the room. Avoid sprinkler systems and water lines in electrical rooms containing equipment less than 750 Volts and greater than 2000 Amps. Coordinate with Architectural and Mechanical divisions to ensure all codes are addressed.

.4 Identification

.1 Equipment to be identified in a clear, consistent manner. Nomenclature describing tagging method shall be shown. Refer to Technical Specifications Section 26 05 53 “Identification for Electrical Systems” for additional requirements where user groups standards are not in place. Edit the section to make it specific to the project.

.5 Operation and Maintenance Manuals

.1 Ensure all data required for the operation and maintenance of the equipment is collected and included in the Manuals. Refer to Technical Specifications Section 26 01 10 “Electrical Operation and Maintenance Data” for minimum requirements. Edit the section to make it specific to the project.

.2 Refer to Technical Specification Section 26 01 11 “Electrical Operation and Maintenance Manual” for manual requirements and organization. Edit the section to make it specific to the project.

.6 Spare Parts and Maintenance Materials

.1 Include spare parts and maintenance materials to the building operator. Refer to Technical Specification Section 26 01 90 “Electrical Spare Part and Maintenance Materials” for manual requirements and organization. Edit the section to make it specific to the project.

.7 Starting and Testing

.1 Include electrical starting and testing requirements. Refer to Technical Specification Sections: 26 08 10 “Electrical Starting and Testing - General Requirements”, 26 08 20 “Electrical Starting and Testing by Contractor”, and 26 08 30 “Electrical Starting and Testing by Contractor's Testing Agent”. Edit the sections to make them specific to the project.

.8 Equipment and Systems Demonstration

.1 Ensure that proper demonstration and instruction procedures are performed for the Province's maintenance personnel. Refer to Technical Specification Section 26 08 40 "Electrical Equipment and Systems Demonstration and Instruction". Edit the section to make it specific to the project.

.9 Commissioning

.1 It is the intent of the Province to solicit proposals for Commissioning Consultant Services and Independent Commissioning Authority to meet Leadership in Energy and Environmental Design (LEED) Fundamental and Enhanced Commissioning requirements.

.2 Over and above LEED commissioning requirements, the Commissioning Authority is required to undertake commissioning in accordance with CSA **Z320 – Building Commissioning** for all systems including:

- .1 Electrical power and distribution.
- .2 Emergency power and distribution.
- .3 Transfer Switch operation.
- .4 Lighting levels.
- .5 Lighting control including daylight sensor calibration, occupancy sensor calibration and astronomical time clock settings and adjustments.
- .6 Clock System.
- .7 Functional testing of Security and Card Access Systems.
- .8 Testing of Surveillance System.
- .9 Sound Systems.

.10 Submission Requirements

.1 Schematic Design Report Submission

- .1 The Schematic Design Report (SDR) shall contain a section for the Electrical discipline.
- .2 The SDR shall include all referenced codes and standards, including the most recent "Technical Design Requirements for Alberta Infrastructure Facilities (TDR)".
- .3 Convey the design intent of all electrical systems proposed. There must be enough information in the descriptions to ensure that the TDR is being followed.
- .4 For renovation projects include description of existing systems and equipment.

.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 Single Line Diagram (SLD) indicating basic intent.
.2 Estimated service size using Canadian Electrical Code including minimum 20% for future load growth.
.3 Arc flash mitigation strategies.
.4 Requirements of incoming electrical and telecom/data services (eg. Supernet) and location and space requirements for the main service equipment.
.5 Locations of electrical, emergency/standby generator and data rooms/closets and preliminary size of rooms.
.6 Determination of lightning protection and risk assessment as per CSA B72.
.7 Description of lighting for interior and outdoor lit spaces, including but not limited to styles and metrics. .
.8 Indicate areas where specialized lighting is expected and description of how lighting will be addressed.
.9 Description of lighting control system being proposed.
.10 For Healthcare Facilities, include preliminary risk classification of patient care areas for review by client group.

.3 **Contract Documents (90% Submission)**

.1 Include a specification.
.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/luminaire/motor 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 CSA Z8001, Commissioning of Health Care Facilities.
.2 ANSI/TIA 1179, Healthcare Facility Telecommunications Infrastructure Standard.
.3 UL 1069 Standard for Safety – Hospital Signaling and Nurse Call Equipment

.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 requirements as stipulated by Alberta Health Services (AHS) and Alberta Infrastructure (AI).

.4 Include Patient Area Classification drawing(s) indicating Basic, Intermediate and Critical Care areas as defined in CSA Z32 and Canadian Electrical Code.

.5 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).

6.2 Power Distribution and Service

.1 General

.1 This section describes general requirements for power distribution and service. Identify any specialized requirements at the design development stage.

.2 Provide a preliminary short circuit study showing all fault levels prior to completion of design documents. Include this information on the Power Single Line.

.3 Prior to final acceptance of the project, ensure a full coordination study, fault and arc flash incident energy analysis study has been completed and implemented. The maximum arc rating of electrical equipment on the load side of the main breaker is not to exceed 12 cal/cm^2. If this cannot be achieved, proposed solution with recommendation shall be submitted to the Province. Labels to meet the requirements of CSA Z462. Refer to Appendix B for minimum report requirements.

.4 Harmonic distortion and noise:

.1 Identify non-linear loads, including Uninterruptible Power Supplies (UPS's), computers, rectifiers, variable frequency drives, elevator systems (variable speed drives and/or regenerative systems) and electronic ballasts or Light-emitting diode (LED) drivers, and consider their effects on power distribution system. Meet IEEE 519, "Recommended Practice and Requirements for Harmonic Control in Electric Power Systems" at the utility Point of Common Coupling. Provide corrective measures as required.

.5 Avoid use of fused equipment. Obtain acceptance of the Province for the use of fused equipment. Consideration will only be given where fault duties of equipment require the limitation of available fault current.

.2 Single Line Drawings

.1 Provide electrical single line diagrams, as part of the Contract Documents, indicating the following:

.1 Configuration, type, voltage and amperage ratings of switchgear, transformers, panelboards and motor control centres (MCCs).
.2 Type, size and amperage ratings of services and feeders.
.3 Type, frame size and trip rating of overcurrent protective devices.
.4 Estimated available fault current at switchgear, distribution panelboards, branch circuit panelboards, transformer secondaries and overcurrent devices.
.5 Service and distribution grounding.

.2 Provide copies of single line diagrams from Record Drawings, recording actual construction as follows:

.1 Incorporate into Operating and Maintenance (O & M) Manuals.
.2 Frame and hang in each major electrical equipment room, with equipment in the room highlighted.
.3 For existing buildings, any changes to the power distribution system is to be reflected on the original or latest building SLD and a new Record Drawing provided with updated revision number and date.

.3 Protection and Control

.1 Ensure priority tripping and coordination of overcurrent and ground fault devices on feeders. Provide final consolidated trip curves for services sized 600 kVA and over and multi-building sites.

.2 Ensure adequate fault duty ratings of all switchgear, panels, MCCs and overcurrent devices. Provide calculation results when requested by Alberta Infrastructure.

.3 Provide all services and feeders with ground fault protection as required by the Canadian Electrical Code. Where ground fault protection is provided on services and feeders, ensure protection is also provided for downstream feeders and loads that are susceptible to nuisance ground faults.

.4 Do not provide undervoltage protection on main breakers. For 3 phase motor starters provide single phase motor protection using differential overloads or phase loss shutdown by the Energy Management Control System (EMCS).

.5 For services over 750V, provide relaying using relay accuracy class CTs with test block and solid state relays with trip indication for each function. Provide a DC battery source for control and tripping power.

.4 Power Service

.1 Sizing

- .1 Allow minimum 20% future load growth.

.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 acceptance 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 voltages over 750 V applications and vault installation. Review with the Province.

.1 Use 55°C - 65°C insulation and equip with cooling fan.
.2 Equipment with sudden pressure relays.

.5 Switchgear, Switchboards, Distribution Panelboards, Motor Control Centres and Panelboards

.1 Switching and Overcurrent Devices:

.1 Main Service (750 V or Less) including future allowances:

.1 Over 1200 A: Main breaker to be industrial duty, draw-out Low Voltage Power Circuit Breaker (LVPCB), complete with LSI and G if applicable (Long Time, Short Time, Instantaneous or Ground Fault) adjustable trip units and trip indication for each. Fixed mounted with side or front access enclosure products may be considered.
.2 Over 2400 A: All switchgear feeder breakers fed from main breaker to match main breaker type and have the same front to back dimension as the main breaker. Provide minimum one installed spare breaker of the largest frame size in the lineup, and provide minimum one prepared space.
.3 1200 A and Less: Main breaker to be a Molded Case Circuit Breaker (MCCB) with LSI and G (if applicable) adjustable trip units.

.2 Distribution:
.1 Provide molded case thermal magnetic circuit type breaker for feeders under 400 A.
.2 For feeders 400 A and over, use molded case breakers complete with LSI and G (if applicable) adjustable trip units and trip indication for each.

.3 Main Service Over 750V:
.1 Use metalclad switchgear with draw-out air or vacuum circuit breakers for all medium voltage equipment. The use of metal enclosed switchgear with interrupter switches to be reviewed with the Province.
.2 Provide maintenance grounding feature for on-going maintenance such as ground balls, or grounding truck.
.3 Provide remote switching of breakers complete with locked cabinet. Coordinate location with the Province.

.2 Bussing: Use plated copper.

.3 Metering: Provide panel mounted digital owner's metering as follows:

  .1 All incoming services over 100 A and distribution equipment over 1000 A. Review metering locations with the Province.
  .2 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.
  .3 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 Distribution Panelboards:

  .1 Provide door-in-door construction.

.9 Branch Circuit Panelboards (Panelboards):

  .1 Copper Bussing.
  .2 Breakers to be “bolt-on”.
  .3 Maximum number of breaker positions in a single tub to be 72. Provide a double wide tub for breaker positions greater than 72 to a maximum of 84 positions. Maximum 84 positions per panelboard. Provide minimum 225A bussing for panelboards with 42 or more positions. Feeder to be sized allowing for the required spares and spaces plus an allowance for future load growth for remaining space unused in the panel.
  .4 Do not use feed through lugs.
  .5 Do not locate panelboards in corridors or public spaces. Use “Closet” in corridor. Do not locate in any areas where damage will be incurred via regular equipment movement, or clearances cannot be maintained. 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 A for minimum requirements for the Schedules.
  .7 Recessed panelboards: Provide minimum of two 21 mm empty conduits/raceways stubbed to ceiling space.

.8 All doors to be lockable.

.10 Spares and Spaces:

.1 Switchboards and distribution panelboards: Provide minimum 10% spare breakers and 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 Provide harmonic mitigating transformers and strategies for installations which include harmonic content in the load.

.3 Acoustical Considerations:

.1 Ensure adequate acoustic ratings, treatment, location and mounting of transformers. Refer to Section 7.0 – Acoustical for specific requirements and include in project specifications.
.2 Use flexible conduit/raceway connection to transformer for primary and secondary feeders. (Liquid tight flex conduit/raceway in wet areas).

.7 Feeders

.1 Use copper conductors.

.2 All feeders to be complete without splices and have a bonding conductor.

.3 Size of neutral conductor to be at least the same size as the phase conductors.

.4 Avoid installing 53 mm (2”) conduit/raceway or larger in-slab. If required coordinate with structural.

.8 Power Factor

.1 Correct power factor to at least 0.95 lagging where normal loading yields a power factor of less than 0.90.

.2 In cases where variable frequency drives (VFD) are not used, provide fixed power factor correction capacitors on load side of starter for motors 22.4 kW and larger.

.9 Motor Protection and Control

.1 Group motor starters in common areas within mechanical or electrical rooms.

.2 Starters to be National Electrical Manufacturers Association (NEMA) rated, Size 1 minimum, complete with hand-off-auto selector switch, minimum of 2 N.O. and 2 N.C. auxiliary contacts and pilot lights.

.3 Do not use fuses for individual motor overcurrent protection.

.4 Provide single phase protection for all three phase motors either by relaying, differential overloads or EMCS shutdown.

.5 Ensure EMCS provides time delay between start-up of each motor over 5 kW on emergency/standby power after transfer to emergency/standby generator, starting largest motor first.

.6 Provide time delay on speed change for two-speed starters.

.7 Provide space on backpan of starter or provide separate enclosure for mounting of EMCS current sensors.

.8 Variable Frequency Drives:

.1 Whether supplied by the electrical or mechanical sub-trade, drives to be of six (6)-pulse, pulse-width modulation (PWM) type. Drives 22.4 kW (30 HP) and larger to be rated for 690V +/- 15%. Provide minimum 5% iron core reactor (line side) or equivalent DC Link Reactor built into all drives. Consider passive filter for 29.8kW (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.

.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 complete with indicator lights on utility incoming mains.

Level 2 For areas containing a large group of electrically sensitive loads, provide surge protection complete with indicator lights on panelboards serving the area.

.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/Standby Power

.1 Provide a minimum of one receptacle in electrical and mechanical rooms connected to emergency/standby power where a generator is installed.

.2 Criteria for generator installation:

.1 Dedicated indoor, climate-controlled, fire-rated room. Locate within main building or in a sound attenuated, environmentally controlled, walk-in enclosure. 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 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. Locate enclosure at ground level at an accessible location.

.3 Generator Sizing:

.1 Size generator for peak demand loads, plus 20% spare for identified expansion, if applicable.

.4 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.

.5 Transfer Equipment:

.1 For emergency power application, automatic transfer switches to be complete with two-sided by-pass. For Standby power application, review use of two-sided by-pass automatic transfer switches with The Province.
.2 Select either three-pole or four-pole application based on ground fault protection strategy and neutral current control.
.3 Select open or closed transition based on project load characteristics and application. Closed transition is preferred.
.4 Provide time delay or in-phase monitoring in transfer scheme to prevent motor damage upon transfer to utility power.

.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 top of covers are mounted flush with finished floor.

.2 Vehicle 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.

.4 Consider the use of flexible type pedestals.

.13 Provisions for Mechanical

.1 Provide trace heating 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, generally motors larger than 0.37 kW (1/2 HP) to be three phase, and motors 0.37 kW (1/2 HP) and smaller to be single phase, 120V.

.5 Review connection requirements for electric motor starters, drives and controllers provided packaged with mechanical equipment.

.14 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 Identify electronic equipment and systems likely to be affected by disturbances and the extent of protection necessary for normal operation.

.3 Individual computer work station areas: depending on loading, maximum four receptacle locations per circuit.

.15 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 CSA-B72:20, "Installation Code for Lightning Protection Systems". If the annual threat occurrence is greater than the tolerable lightning frequency (Nd > Nc), provide lightning protection. If annual threat occurrence is less than the tolerable lightning frequency (Nd < Nc) depending on the type of facility, review requirement for lightning protection with the Province.

.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.

.16 Uninterruptible Power Supplies (UPS)

.1 Size UPS batteries for minimum of 20 minutes.

.2 Connect UPS to emergency/standby power system where applicable.

.3 Use lithium-ion type batteries.

.4 All UPS's to have hot swappable components.

.17 Envelope Penetrations

.1 Ensure adequate treatment for all envelope penetrations such as generator exhaust piping, lightning down conductors and service masts. Refer to Section 2.0 - Building Envelope for specific requirements.

A. Specific Requirements for Schools

.1 Generally, emergency/standby 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/standby generator may be required.

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

.3 Receptacles – classroom circuits not to be used in more than one classroom.

.4 Wall mounted switch, receptacle, and low voltage (under 120V) systems cover plates shall be stainless steel type 302/304, #4 finish, and stainless steel screws.

.5 Gymnasium electrical components shall be protected by recessing in custom housing in wall or wire guard. All clocks, emergency luminaires, exit lights, and any other surface mounted equipment shall be protected by wire guard. All receptacles, switches, fire alarm manual stations, microphone outlets, T.V. outlets and other flush devices shall be recessed into wall. Wall mounted speakers shall have integral speaker protection. Ensure a minimum of three circuits for gymnasium receptacles.

.6 Where emergency shutoff switches are located in rooms to de-energize a panelboard via contactor, the switches are to be complete with a keyed reset.

.7 For modular classroom power feeder allow single phase 3-wire 120/208V or 120/240V with 2P-100A breaker.

.8 Provide staff parking vehicle block heater receptacles.

.9 Feeders 200A and larger: aluminum is acceptable.

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.

.5 Review use of any in-slab conduit/raceway with Province.

.6 The electrical distribution system serving all essential loads as defined in CSA-Z32 shall be designed with redundancy so that there will be no areas without power while performing maintenance.

.6 Harmonic Distortion and Variable Frequency Drives:

  .1 Identify non-linear loads as identified in item 6.2.1.4.1 and additional equipment in health care facilities such as MRI’s, CT Scanners and X-ray equipment.

  .2 Ensure that a harmonic digital simulation is completed to demonstrate that the limits set out in IEEE Standard 519-2014 “Recommended Practice and Requirements for Harmonic Control on Electric Power Systems” are met. Simulation to be from Main Switchboard to Distribution Panels feeding the major/large non-linear loads.

.7 Uninterruptible Power System:

.1 Minimize battery requirements for UPS by feeding unit from emergency power system. Size UPS batteries for maximum 20 minute outage, except in special cases.
.2 Provide local UPS to serve individual loads, or a centralized UPS system for groups of loads. As a minimum provide centralized UPS for IT equipment, Nurse Call and Security (ie. Equipment located in Telecommunication Rooms)
.3 Where larger centralized UPS is used, provide redundancy and a sectionalized load-side distribution system. The UPS shall have hot swappable components.
.4 Review with the province other systems such as: Operating room surgical lights, gas shut off solenoid valves, etc.

.9 Wiring Devices:

.1 Use hospital grade receptacles for patient care receptacles and specification grade convenience receptacles.
.2 Identify all receptacles as to panel and circuit number on plastic engraved lamicoid tag, permanently affixed to wall directly above device cover plate; tag to be same width as cover plate.
.3 Wall mounted switch and receptacle cover plates shall be stainless steel type 302/304, #4 finish, and stainless steel screws.

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 to 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, and where failure or damage to fixtures occur, availability of replacement components needs to be taken into consideration.

.2 Design to be based on current applicable IES recommendations and standards including addenda.

.3 Use the ambient/task approach where work surface and task orientations are predetermined and as agreed to by the Province.

.4 Designs to be generally based on maintained illuminance targets and luminance values/ratios/gradients as described in the applicable IES recommendations and standards. Designs shall be supported by reference to the appropriate IES recommendations and standards.

.5 Design a luminous environment minimizing glare (luminance values/ratios/gradients) and shadowing for visual comfort. Carefully review glare implications and select luminaires cognizant of intensities at user viewing angles. Reduce shadowing in typical work space areas by avoiding the use of point source type lighting such as small aperture recessed downlights.

.6 For maintenance purposes, provide a table in the operations and maintenance manual listing designed maintained illuminance values for each type of lit space.

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

.1 Photometric plot showing illumination values on an appropriate grid scale to demonstrate compliance with IES recommended best practices.

.2 Tabular format of information summarizing the values provided and a description of design assumptions and recommendations.

.8 Provide luminaire schedule showing as a minimum: Type, wattage, lumens, physical description, CCT, CRI, luminous flux maintenance, makes and models.

.2 Lighting Design Parameters

.1 Follow applicable IES recommendations and standards.

.2 Light loss factor: Refer to IES RP-36 Lighting Maintenance, see Light Loss Factors section.

.3 Uniformity

.1 All areas in a space need not be to minimum average maintained values if functions permit. Lighting levels may be non-uniform. For example, circulation areas in an office may be of a lower level than recommended for the work surface.

.4 Interior Landscape Lighting

.1 Where interior lighting is required to sustain plant growth, coordinate with the landscape consultant to provide the appropriate illumination levels, light spectra, and control.

.5 Lighting Sources

.1 Use sources which are readily available from local distributor's stock, unless specialty lighting is required.

.2 Fluorescent type lighting is acceptable provided items in Fluorescent Lamps and Ballasts section below are met.

.3 Light-Emitting Diode (LED) type lighting is acceptable provided items in LED’s and Drivers section below are met.

.4 For acoustical and electromagnetic interference considerations, refer to Section 7.0 - Acoustical.

.6 Fluorescent Lamps and Ballasts

.1 Colour Rendering Index (CRI) to be minimum 85. Generally Correlated Colour Temperature (CCT) to be 3500K. Minimum lamp life of 36,000 hours. (Rated Average Life – 12 hour start). Do not use U shaped lamps.

.2 Use programmed start electronic ballasts with ballast factor less than 1.0, less than 10%Total Harmonic Distortion and Power factor not less than 0.95.

.7 LED’s and Drivers

.1 LED lighting shall be selected from production-proven models available at the time of construction and not prototypical or unproven technology.

.2 LED luminaires shall have photometric data in accordance with IES LM-79- Optical and Electrical Measurements of Solid-State Lighting Products.

.3 LED’s shall have test reports in accordance with IES LM-80 Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources and IES TM-21 Projecting Long-Term Luminous, Photon, and Radiant Flux Maintenance of LED Light Sources.

.4 Dimming should only be provided where necessary.

.5 Flicker/Modulation of Luminous Flux to be minimized. Review flicker implications throughout lighting levels for each driver type especially at lower levels. To help reduce affects of flicker, meet no-effect region of Figure 18 from IEEE 1789-2015 'Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers' is beneficial.

.6 Drivers to be rated minimum 50,000 operating hours for integrated LED luminaires.

.7 Luminous flux maintenance for integrated LED luminaires, reported projection as per IES TM-21 to be minimum of 30,000 hours at L90, with calculated or theoretical minimum 60,000 hours at L80, or 90,000 hours at L70. Luminous flux maintenance for non-integrated linear LED luminaires reported projection as per IES TM-21 to be minimum 20,000 hours at L90, with calculated or theoretical minimum 40,000 hours at L80, or 60,000 hours at L70.

.8 Interior LED lighting:

- .1 Color Rendering Index (CRI) to be minimum 80 range, targeting 85 or higher site-measured. Generally Correlated Color Temperature (CCT) to be 3500K to 4000K.
- .2 Luminous efficacy of the source to be a minimum of 85 lumens per watt (delivered fixture lumens).
- .3 To reduce direct glare for direct type lighting, generally select luminaires with larger full area lenses/diffusors/cells to reduce peak direct luminance and help reduce luminance variance across the area of the fixture.
- .4 Avoid the use of small aperture luminaires unless luminance ratios or peak direct luminance can meet IES recommendations and standards.
- .5 Obtain acceptance of the Province for the use of tuneable-white systems, which shall be for specific situations only.

.8 Interior Lighting Control

.1 Lighting control to be a dedicated/stand-alone wired system. Do not use breaker switching.

.2 Provide the simplest system to meet the needs of the facility and requirements by code. For example: Automatic Daylight responsive controls to be provided only if required by code. Where applicable show primary and secondary zones on drawings where NECB required Automatic Daylight responsive controls. 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 a minimum of manual on/off 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 centralized low voltage control systems with analog field devices appear to be proven for maintainability for a building to last for many years.

.8 Occupancy/vacancy sensors to be dual technology type with sensitivity and settings to accommodate quiet and small motion activities.

.9 Emergency and Exit Lighting

.1 Where emergency power is not available, provide battery powered emergency lighting unit equipment.

.2 Provide battery powered unit equipment type lighting with a minimum one hour capacity in all electrical, generator and mechanical rooms.

.3 Integral battery power back-up ballasts/drivers in Luminaires are not acceptable.

.4 Exit signs to be LED type

.10 Exterior/Outdoor Lighting

.1 Provide lighting at all building entrances/exits, walkways, parking lots, and other areas requiring lighting determined by user group and site evaluation.

.2 Use fully shielded (zero uplight component) luminaires with a CCT of 3000K or less for building exterior, parking, roadway, walkway and area lighting. For LED type lighting, where possible select lower drive current to increase LED life and reduce glare. Ensure direct luminance levels are controlled to help reduce direct glare for those viewing towards luminaires. The use of warmer color temperatures (eg. 2700K or 2200K) is encouraged. Where color rendering is of less importance consider amber or narrowband amber LEDs.

.3 Control of outdoor 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.

.4 Where applicable, include programming of the EMCS for control of the outdoor lighting.

.5 Luminaires shall be suitable for operation to –40°C.

.6 Review use of obstruction and aircraft warning lights where applicable.

A. Specific Requirements for Schools

.1 Design to the latest IES standards, specifically refer to ANSI/IES RP-3 –Lighting Educational Facilities.

.2 Design lighting control to have the flexibility required to adjust lighting to suit functions and activities.

.3 Lighting control to be conveniently and appropriately located for each area and allow for control of lighting in their environment.

.4 Provide individual manual on/off switches for lighting in classrooms and like rooms to control room lighting, independent of other lighting control systems in the school. Ensure these on/off manual switches have the capability to turn lights off and remain off, and manual on after manual off. Each classroom and meeting room provide two or more independently switchable zones. Each gymnasium provide three or more independently switchable lighting zones controlled from more than one location where required by school board.

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

.6 Use battery pack type unit equipment type system for emergency lighting.

.7 Ensure gymnasium lighting glare (peak direct luminances and luminance ratios) is controlled at all viewing angles including nadir. Activities where users are looking straight up shall not be affected by glare.

B. Specific Requirements for Healthcare Facilities

.1 References

- .1 ANSI/IES RP-28 – Lighting and the Visual Environment for Older Adults and the Visually Impaired
- .2 ANSI/IES RP-29 – Lighting Hospital and Healthcare Facilities
- .3 CSA-Z317.5 – Illumination Design in 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 Confirm service requirements with Province and Client Groups, eg. SuperNet, telephone, cable television, etc.

.3 Coordinate with SuperNet provider, service conduit/raceway and termination location room requirements, eg. power, lighting, raceways/conduit, etc.

.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:

- .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. Provide two data cables to each wireless access point (WAP).
- .4 Utilize standard cross-connect wire, 483 mm, 2 or 4 post communication rack(s) or wall mount cabinet(s), power bars, vertical and horizontal cable managers, patch panels and wall mounted connector with Insulation Displacement Connection (IDC) punchdown clips.
- .5 Office workstations shall consist of two data cable outlets housed in one wall mounted or systems furniture mounted single gang interface.
- .6 All horizontal cable shall be Unshielded Twisted Pair (UTP), Category 6, 4 pair. Modular jack pin pair assignment shall be to T568A requirements.
- .7 Backbone cabling for data shall be a combination of UTP Category 6, 4 pair, 6-strand 50 ųm core diameter/125 ųm cladding diameter multimode fiber and 6-strand single mode fiber. Coordinate with user for specific requirements.

.8 Backbone cabling for voice shall be multi-pair Category 3 with a grey jacket terminated on IDC distribution connectors.

.9 Labelling and identification of the cables shall conform to facility requirements.

.10 A ground bus shall be provided in each communication room wall mounted with stand-off supports.

.11 For analog voice system, provide applicable identification at ports.

.12 The structured cabling installation shall be performed by a Telecommunications Contractor whose normal business is the installation of voice, data and image cabling systems, and to perform associated testing.

.13 Provide conduit, raceway, cable tray or cable tray with barrier to separate systems.

.14 Provide permanent link type testing as per TIA standards.

.3 Paging and Public Address Systems

.1 Review with the Province and Client Group the requirements of a Paging and Public Address System and the extent of the system area coverage.

.2 Where a Paging and Public Address System is determined to be required it shall consist of microphones, mixer preamplifier, dynamic range limiters, solid state audio power amplifiers, telephone paging interface, loudspeakers, system rack, wiring, remote jacks and controls. In addition, the system will generally conform to the following:

.1 Provisions for multi-point microphone input facilities and provisions for background music.

.2 Provisions to integrate with the facility communications system.

.3 Install all system wiring in conduit/raceway and cable tray.

.4 The paging system shall be supplied and installed by a firm that has provided and installed paging system components for a minimum of five years.

.5 Ensure speech intelligibility reproduced by the installed system, including room reverberance and expected background noise, is part of the design process. Reference IEC 60268, Part 16, Objective Rating of Speech Intelligibility by Speech Transmission Index.

.4 Sound Masking System

.1 Review with the Province and Client Group the requirements of a Sound Masking System and the extent of the system area coverage. Refer to Section 7 – Acoustics, for details of the system.

.2 Coordinate power, raceway and low voltage interface requirement.

.5 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.

.6 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 system 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/Telecommunication System

- .1 A telephone/telecommunication system may be purchased through the construction contract or separately by the School Board.

.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/microphones at all applicable locations.

.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 27 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 Clocks

.1 Provide clock system to meet the requirements of the school board.

.6 Structured Cabling
.1 Free air horizontal cabling acceptable in ceiling space from tray to vertical wall stub.

B. Specific Requirements for Healthcare and Continuing Care Facilities

.1 Structured Cabling – Voice and Data

.1 Reference AHS Standard – Structured Cabling Requirements, Version 2.3, September 8, 2016

.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 battery/back-up power for security systems and all systems with volatile electronic memory.

.5 Review the use of UPS systems with the Province.

.6 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. (https://www.alberta.ca/system/files/custom_downloaded_images/tr-securityguidelinesstandards.pdf)

.7 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 wired dedicated physically isolated system that operates independently.

.2 System to be designed, installed and verified as per the regulations under the current Safety Codes Act.

.3 Where addressable technology is used for initiating devices use Data Communication Link (DCL) style C as per CAN/ULC-S524. Where fault isolation modules are used, they shall be clearly shown where they are located on the floor plans and clearly described where they are located within a DCL in the verification report.

.4 Avoid the use of optical beam smoke detection where air aspiration type can be used.

.5 Provide static graphic mounted in frame securely fastened to the wall adjacent to annunciator at firefighters entrance. Graphic to clearly show all fire zones, sprinkler valve locations, "You Are Here" indication, and a north arrow.

.6 Refer to CAN/ULC S524 "Plans and Specifications" requirements for design.

.7 Show the wiring routing path between each device on record drawings.

.8 All devices shall be labelled on the external fixed portion of the device with applicable loop/address number or circuit number. Refer to identification section above for identification requirements.

.9 Program by-pass switches at central panel as coordinated with requirements of user (eg; Smudging).

.10 Indicate in the contract documents which edition of CAN/ULC S524 and CAN/ULC S537 is referenced for Alberta. Refer to Building Code for edition reference (ie. for a project utilizing National Building Code 2019 Alberta Edition, see section 1.3.1.2). Confusion can be remedied for the parties involved if they have the correct standard with them during construction and provide fair preparation for what the expectations will be during verification.

.11 Identify wiring at all panels and junction boxes identifying zone/loop numbers/etc.

.12 Fees for witnessing the fire alarm verification are typically included in the Infrastructure consultant services agreement. Review/confirm with Infrastructure project manager.

A. Specific Requirements for Schools

.1 Provide as a minimum, an empty conduit/raceway/cable tray system for the following electrical systems:

   .1 Electronic Access Control System
   .2 Video Surveillance System.
   .3 Lock down system

.2 Review with the Province Project Management the local school board's additional requirements. Coordinate systems with school board.

.3 Determine security needs in accordance with the School Threat and Risk Assessment and in consultation with the School Board.

.4 Provide 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 Provide connection between fire alarm control panel and master clock system controller to inhibit period signal tones and exterior horns during alarm.

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 Sample Electrical Panel Schedule

PANEL DESIGNATION '-'

MOUNTING:	SURFACE	VOLTAGE	120/208V	BUS RATING:	225A
PANEL LOCATION:		PHASES	3	FED FROM:	
		WIRE	4		
LOAD SERVING:		CIRCUITS	42	INTERRUPTING CAPACITY:	kAIC

CCT. NO.	LOAD DESCRIPTION	BRKR. SIZE	kVA A	kVA B	kVA C	kVA A	kVA B	kVA C	BRKR. SIZE	LOAD DESCRIPTION	CCT. 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 breaker spaces
3) Complete load estimates for each phase and total.

Alberta Government

SAMPLE ELECTRICAL PANEL SCHEDULE

ESK- 1

Electrical – Appendix B

.1 Coordination, Fault and Arc Flash Incident Energy Analysis Report Requirements:

.1 Include an APEGA licensed professional authenticated report including items as identified in IEEE 1584.1 "IEEE Guide for the Specification of Scope and Deliverable Requirements for an Arc Flash Hazard Calculation Study in Accordance with IEEE Std 1584.

.2 As a minimum report to include:

- APEGA licensed professional authenticated cover page.
- Executive Summary
- Scope of Study and Results Summary
- Background Information used such as available utility fault current used, cable sizes, types and lengths etc., including software used, configuration settings and assumptions used. Include copy of building SLD in an Appendix and ensure labelling between software and SLD are compatible. Include all digital back-up, custom files and any custom library files are submitted with the report in a flash drive.
- Short circuit analysis listing all equipment and verifying that equipment is properly rated for the available short circuit rating.
- Coordination study including results and any recommendations. Include all time-current characteristics curves used. Include potential changes to lower incident energy levels for review by Engineer.
- Arc Flash Incident Energy analysis. Include a spreadsheet listing all equipment. Include recommendations for incident energy reduction.
- Conclusion/ Recommendations

7.0 Acoustical

Section Contents

7.1 References

.1 Meet or exceed the guidelines and standards of the following, as applicable:

.1 ASHRAE: 2019 HVAC Applications Handbook (SI), Chapter on Noise and Vibration Control
.2 National Building Code – 2023 Alberta Edition: Division B – Sections 5.8, 9.11, Sound Transmission, and Tables 9.10.3.1.-A, 9.10.3.1.-B.
.3 National Building Code – 2023 Alberta Edition: Division B, Part 11, Exterior Acoustic Insulation
.4 ASTM E557-12, Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions
.5 ASTM E336-23 Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
.6 ASTM E1007-21 Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures
.7 FGI Guidelines for Design and Construction of Residential Health, Care, and Support Facilities – 2022 edition
.8 FGI Guidelines for Design and Construction of Hospitals – 2022 edition
.9 CSA Z8000, Canadian Health Care Facilities – 2018 edition
.10 ANSI/ASA S12.60-2010/Part 1 Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 1: Permanent Schools

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 Sound Transmission Class (STC): A single-number rating of the sound transmission loss properties of a wall, floor, window or door. STC can only be determined in a laboratory. A good reference for wall and floor STC ratings is the National Building Code – Alberta Edition.

.2 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 5 points of the STC measured in a laboratory.

.3 Noise Isolation Class (NIC): Describes the total noise isolation observed between two spaces. Different from ASTC, it does not correct for acoustic absorption in the receiving space and the partition area. If the tested spaces have been furnished, NIC is a good representation of real-world conditions and easiest to measure.

.4 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.

.5 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.

.6 Noise Criteria (NC): A method of rating HVAC system noise. NC is used as a design criterion because many manufacturers of mechanical equipment continue to use it, and because it requires less subjective interpretation than RC.

.7 Room Criterion (RC Mark II): A more recent rating for HVAC system noise. RC Mark II assigns a sound quality descriptor to the mid-frequency noise level value. The Quality Assessment Index (QAI) of this rating is a good indicator for objectionable sound quality.

.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 surfaces. While RT is defined as the time it takes for sound to decay by 60 dB (RT60), in practice RT20 is typically measured, which extrapolates this metric based on a 20 dB decay.

.9 Impact Insulation Class (IIC): A single-number rating describing the performance of a floor/ceiling assembly to attenuate footfall noise and other impacts from above to the space below. Measured in-situ as the Apparent Impact Insulation Class (AIIC).

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 Consult with the Province on unusual situations, where adjacent occupancies may not be acoustically compatible and special construction is required.

.3 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 STC required, particularly where additional ceiling height may be required due to the need of floating floors or specialty resilient acoustic ceilings.

.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 STC performance.

.2 Propose the construction of interior partitions and exterior walls including the STC performance (National Building Code – Alberta Edition 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 wastewater 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 of the 75% requirements.

.2 Clear coordination between specialties (e.g. diffusers are at the same place on the architectural and mechanical drawings, structural extent of acoustic deck agrees with reflected ceiling plan).

.3 Door schedules with acoustic door seals (if necessary) identified 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, if applicable. Mechanical systems must specify maximum noise levels for major equipment and minimum performance of silencers, vibration isolators and such noise control elements.

.12 If applicable, provide any required acoustic reports prepared for LEED certification for review (e.g. background noise calculations for LEED Acoustic Prerequisite in Schools).

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:

7.6.3.1 Space Description	STC Rating[1] (minimum)
Moderate Privacy Requirements • General Office Space, Small Meeting Rooms	40
Confidential Privacy Requirements • Interview rooms, quiet rooms, telephone rooms • Executive Offices • Large Conference Rooms, Training Rooms	45
Acoustically Critical Spaces	
• Video conference rooms	50
• Demising wall between departments or GOA and non-GOA space	50
• Washrooms	55
• Mechanical room	55+
Other Acoustically Critical Spaces (see Section 7.4) • Therapy Rooms, Courtrooms • Studios, Auditoria, Lecture Halls	50+ (varies)

Notes:
[1]These are laboratory STC ratings. The field performance of a partition, including all flanking paths, is determined by the in-situ measured partition ASTC rating, or the NIC rating between two adjacent spaces. ASTC or NIC are required to be no more than 5 points below these STC ratings. This requires proper detailing as described in this subsection.

The above STC ratings are required for walls without doors. A relaxation of 10 STC points is acceptable for partitions that include non-acoustical doors that open to normally non-occupied spaces (e.g. corridors). The exception is for rooms that may produce very high noise levels.

.2 Partitions should generally be full height or incorporate a gypsum board or dedicated plenum barrier board. Where this is not possible, extend partitions slightly above suspended ceiling, maximize the separation between return air openings and use ceiling boards with a minimum CAC rating of 35.

.3 Use full-height wall construction or drywall ceilings in rooms that require STC 50 or greater.

.4 To ensure the field performance (NIC or 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 junctions between acoustically rated partitions and metal deck. The objective is to provide a continuous, airtight seal at these junctions. Fibreglass insulation inside the deck flutes alone is not acceptable. A strip of metal, gypsum board, or plenum barrier board, cut to deck shape, and caulked with non-hardening acoustic caulk is also required for airtightness.

.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 STC greater than 40.

.10 Do not use operable partitions between areas that require a high degree of speech privacy. Consider using a different system for STC greater than 45. 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 envelope). 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 or 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 with a minimum CAC rating of 35 for areas where the ceiling plenum contains noisy mechanical equipment (e.g. fan coils, high-velocity ductwork, exhaust fans), and/or foot fall noise from above is a concern.

.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 0.70.

.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. If these spaces have a volume larger than 800 m^3, the reverberation time must not exceed RT 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.6 In Correctional Facilities, the reverberation time in unoccupied open concept living units and other common use spaces, must not exceed RT 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. If these spaces have a volume larger than 800 m^3, the reverberation time must not exceed RT 1.5 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.7 Therapeutic Living Units (TLU) in Correctional Facilities generally require more acoustic treatment, compared to typical living units. In TLU classrooms, the maximum reverberation time is 0.6 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. In TLU Lounges and Central Activity Areas, the maximum reverberation time is 0.8 seconds, and 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. If these spaces have a volume larger than 800 m3, the reverberation time 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 is required for open-plan office conditions (including Call Centers).

.1 Specify ceiling boards that have a minimum NRC rating of 0.9. This supports speech privacy and reduces noise distractions.
.2 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.
.3 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.
.4 Avoid flat light lenses. Parabolic or deep “egg-crate” diffusers are preferable.
.5 Specify electronic sound masking. (See 7.8.3 Sound Masking System)

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 0.7. Wall surfaces should generally remain hard to promote the distribution of speech throughout the room. Classrooms with a continuous acoustic ceiling, minimum NRC 0.7 and at typical height, are considered compliant.
.3 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.
.4 Avoid highly elongated classrooms.
.5 During RT commissioning testing of unoccupied and unfurnished Classrooms, add test procedure steps as outlined in: “Guide for Sufficient Diffusion for Reverberation Time Testing of Unoccupied and Unfurnished Gymnasium or Modular Classroom”. This document can be found on the Alberta Infrastructure Technical Resource Center – Guidelines and Standards Page.

.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 is specified to meet the minimum required NRC 0.70, to avoid problems with selective frequency absorption. (Caution – some acoustic concrete block products have been found to reduce STC performance. Be sure that a product is selected that provides minimum STC 50, similar to regular concrete block)

.12 During RT commissioning testing of unoccupied and unfurnished Gymnasium, add test procedure steps as outlined in: “Guide for Sufficient Diffusion for Reverberation Time Testing of Unoccupied and Unfurnished Gymnasium or Modular Classroom”. This document can be found on the Alberta Infrastructure Technical Resource Center – Guidelines and Standards Page.

.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 Provide acoustical doors or full perimeter, adjustable acoustic seals and door bottoms closing onto smooth threshold at music room doors. Consider providing a vestibule (sound lock).
.5 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.
.6 Consider a ceiling height of 4m - 5m. Unlike classrooms, music rooms benefit from additional volume.
.7 Avoid concave ceiling profiles or domes.
.8 Consider making portions of the ceiling reflective to promote sound diffusion and ensemble between musicians.
.9 Consider pyramidal or convex ceiling diffuser panels set into the T-bar grid covering approximately 10% - 20% of the ceiling.
.10 Consider non-parallel sidewalls or provide sound diffusing elements on sidewalls such as open instrument storage.
.11 Where the instructor’s teaching position is fixed because of risers, the wall behind the instructor should have acoustic wall treatment.
.12 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 full perimeter, adjustable acoustic door seals and door bottom closing onto smooth threshold. Consider acoustical doors.

.5 Common Areas and Learning Commons:

.1 Reverberation in unoccupied common areas shall not exceed RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. If the Common Area has volume larger than 800 m^3, the reverberation in unoccupied Common Areas must not exceed RT 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.
.2 Typically, corridors and lunchrooms require a ceiling with a minimum NRC 0.70. 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, Maker Spaces, Library:

.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. If the space has a volume larger than 800 m^3, the reverberation must not exceed RT 1.0 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 Unless determined otherwise by a qualified acoustical consultant (e.g. for very large theatres), 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, (other offered courses):

.1 Reverberation these unoccupied spaces shall not exceed RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. If the space has a volume larger than 800 m^3, the reverberation must not exceed RT 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

.9 Foods Rooms:

.1 Avoid locating Foods rooms and kitchens next to classrooms or other noise sensitive rooms.
.2 Provide a washable ceiling finish with minimum NRC 0.55 in Foods spaces that are used for teaching activities.
.3 Reverberation these unoccupied spaces shall not exceed RT 0.8 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 sound isolation requirements. Refer to the National Building Code – Alberta Edition, Division B – Table 9.10.3.1.-A to assist in selecting suitable wall assemblies.

7.6.A.2.1 Space Description	STC Rating[1] (minimum)
Offices	45
Classrooms, Computer Labs, Libraries, Wrap Rooms, Breakout Rooms	50
Gathering Spaces, Drama Rooms, Washrooms, Maker space, Daycare space, Foods, Sensory Room	55
Music Rooms (Elem.), Practice Rooms, Gymnasium, Fitness/Dance Rooms, Mechanical room	60
Music Rooms (Jr./Sr.), Woodshop, Automotive, Metal workshop	65

Notes:

[1]These are laboratory STC ratings. The field performance of a partition, including all flanking paths, is determined by the in-situ measured partition ASTC rating, or the NIC rating between two adjacent spaces. ASTC or NIC are required to be no more than 5 points below these STC ratings. This requires proper detailing as described in subsection 7.6.3.

The above STC ratings are required for walls without doors. A relaxation of 10 STC points is acceptable for partitions that include non-acoustical doors that open to normally non-occupied spaces (e.g. corridors), except Music Rooms (Jr./Sr.), Practice Rooms, Woodshop, Automotive, Metal Workshop.

.2 Avoid continuous drywall bulkhead construction between classrooms. Provide a complete structural discontinuity of the bulkhead at all common walls between classrooms.
.3 Provide a complete air-tight seal around piping, duct and conduit/raceway penetration through walls.
.4 Use massive wall construction (e.g. concrete block with an insulated furring assembly, consistent with STC requirements) around areas that produce high levels of low frequency sound such as mechanical rooms and gymnasia.
.5 Do not locate duct shafts in classrooms.
.6 Avoid locating doors in the common wall between classrooms. Where this is necessary, consider double doors with full perimeter acoustic seals.
.7 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. See Section 7.6.3.10
.8 Glazed partitions typically have poor acoustic performance. Provide multi-pane or thick laminated glass in partitions that require STC 50 or higher.
.9 Avoid sharing common walls with Gymnasia and Learning Spaces due to ball impact noise generated in the Gymnasia.

.3 Impact Isolation

Design Floor/ceiling constructions and floor coverings to minimize impact noise transmission into core learning spaces. Footstep noise and noise from moving furniture is a demonstrated source of annoyance, particularly with uncarpeted, lightweight floors separating vertically adjacent classrooms.

.1 Normally occupied rooms located above core learning spaces shall be designed for a laboratory test rating of at least IIC 45. Gymnasia, dance studios, and similar rooms with high floor-impact activity when located above core learning spaces shall either be relocated or the IIC rating of the separating floor-ceiling assembly shall be at least IIC 70. An AIIC field performance of no more than 5 points below these ratings is acceptable.
.2 Provide resilient flooring that includes an acoustic foam backing layer or carpet. Acoustical Impact Sound Reduction of floor finishes is often given in manufacturer datasheets and should be maximized where possible.
.3 For high-risk adjacencies, provide a resiliently suspended gypsum board ceiling directly below the structural floor slab or deck. The cavity above this ceiling should be filled with acoustic batt insulation.

.4 Site Planning

.1 Assess the noise impact of nearby major arterial roads, highways, rail roads, airports, and industry. Conduct an on-site sound survey if any significant noise sources are within 800 m of the project site. This is required to meet the LEED Minimum Acoustic Performance prerequisite.
.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 L_{eq} of 35 dB(A) maximum L_{AS} of 50dB(A). A professional acoustic engineer should review noise assessment and abatement techniques.

.4 Do not locate classrooms so that exterior windows are exposed to busy loading docks or dust collectors.

B. Specific Requirements for Healthcare Facilities

As a minimum CSA Z8000 and the following requirements are to be met, whichever is more stringent. Consider meeting FGI recommendations.

.1 Sound Isolation:

.1 Comply with Z-8000 12.2.7.2 “Architectural sound insulation”.

.2 Use the following table for determining minimum wall sound isolation requirements. Refer to the National Building Code – Alberta Edition, Division B – Table 9.10.3.1.-A to assist in selecting suitable wall assemblies.

7.6.B.1.2 Space Description	STC Rating[1] (minimum)
Administrative Offices	40
Patient Interview/Treatment/Doctor’s Offices, Senior Administrative Offices/Pastoral, Inpatient Bedroom	45
Quiet Counselling Rooms, Operating Rooms, Meeting/Seminar Rooms, Critical Care	50
Labour/Delivery Rooms, Inpatient Bedroom (to noisy public space), Nurseries	55
Washrooms	55
Mechanical Rooms, Kitchens, Laundry	55+

Notes:

[1]These are laboratory STC ratings. The field performance of a partition, including all flanking paths, is determined by the in-situ measured partition ASTC rating, or the NIC rating between two adjacent spaces. ASTC or NIC are required to be no more than 5 points below the STC ratings. This requires proper detailing as described in subsection 7.6.3.

The above STC ratings are required for walls without doors. A relaxation of 10 STC points is acceptable for partitions that include non-acoustical doors that open to normally non-occupied spaces (e.g. corridors).

.2 Reverberation and Noise Control

.1 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 0.8 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 0.7.

.2 Provide a highly sound absorptive ceiling for open offices – see requirements outlined in 7.6.5 Open Plan Offices.

.3 Consider additional sound absorbing wall finishes for nurse stations, special care nurseries, recreation rooms and other patient activity areas, especially within continuing care facilities.

.4 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 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 Residential Health, Care, and Support Facilities

.1 FGI guidelines are to be met.

.2 For long-term care resident suites or rooms, the minimum acoustic separation of ASTC 47 is required (refer to National Building Code – Alberta Edition: Division B, Section 9.11.1)

D. Specific Requirements for Court Facilities

Refer to “Design Guidelines for Regional Courthouses, Subsection 5.7 – Acoustics and Sound Control”. This document is available upon request.

.1 Sound Isolation

.1 Courtrooms must provide a minimum STC 55 to adjacent spaces.

.2 Judicial offices require a minimum STC 50 to adjacent spaces.

.3 Secure Interview Rooms in court facilities require specific soundproofing requirements, as outlined in the Provincial document, Acoustical and Security Requirements for Secure Interview Rooms in Court Facilities. This document can be found on the Alberta Infrastructure Technical Resource Center – Guidelines and Standards Page.

.2 Reverberation and Noise Control

.1 Reverberation in unoccupied courtrooms shall be RT 0.7 - 0.8 seconds, averaged over the frequency range of 250 Hz – 4,000 Hz.

7.7 Mechanical

.1 Background Noise

.1 Design mechanical systems to provide background noise levels, as follows:

7.7.1.1 Space Description	Noise Criteria[1] (NC)
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	30-35
Cafeteria, Reception/Waiting Areas, Open-Plan Areas*	35-40
Computer Room, Kitchen	45 Maximum
Light Maintenance Shop	50 Maximum

Note:

[1]Regardless of NC rating, background noise from building services shall not contain objectionable tones or sound quality such as rumble, roar, or hiss, as defined by an RC Mark II QAI (Quality Assessment Index) > 10 dB (as per ASHRAE).

* If sound masking is specified, use optimum sound masking spectrum as the target background noise (see 7.8.3 Sound Masking System).

.2 Consult with the Province on spaces that require a noise level of NC 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, vibration isolation, 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 in-duct 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 NC 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 Use acoustically lined return air transfer ducts (sound traps) between critical areas with enclosed plenum spaces.

.14 Design ductwork to promote uniform air flow through fans and filter banks to the extent possible.

.15 Provide at least 1m (3 ft) of flexible acoustic duct at diffuser inlet for acoustically critical spaces, to minimize cross-talk between rooms. Flexible duct is not to be used for significant changes of duct direction. Exception: For Healthcare Facilities consult with the project team on acceptable products, considering the specifics of the healthcare environment.

.16 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 Refer to the 2019 ASHRAE HVAC Applications Handbook, Noise and Vibration Control, for acceptable plumbing noise levels.

.2 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.

.3 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.

.4 Where double plumbing walls are used (e.g. washrooms), attach supply piping only to the fixture side of the wall structure.

.5 Consider the use of pressure reducing valves (PRVs) in the system to minimize plumbing noise for noise sensitive areas. Size PRVs to limit the pressure at fixtures to 375 kPa.

.6 Install water hammer arrester adjacent to any quick-acting solenoid valves.

.4 Vibration Isolation

.1 Use the 2019 ASHRAE HVAC 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 Rooftop equipment located on lightweight roof over sensitive areas requires careful selection of vibration isolation. Refer to ASHRAE for sizing of vibration isolators, considering the roof stiffness.

.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 dB(A) for neutral sounding equipment and 45 dB(A) if the equipment has a tonal noise (e.g. axial fans). These levels are determined at the residential property line nearest to the equipment.

.3 Silence the outside air intake and discharge openings, and the engine exhaust for emergency generators to meet local municipal noise by-law requirements. In the absence of a noise by-law, 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 or otherwise sensitive receptor but should not exceed 70 dB(A).

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A. Specific Requirements for Schools

.1 Background Noise

.1 Design mechanical systems to provide background noise levels, as follows:

7.7.A.1.1 Space Description	Noise Criteria[1] (NC)
Auditorium, Drama Theatre	25
Classrooms, Conference Rooms, Daycare Room, Library, Music Room	30
Gymnasium, Office, Reception	35
Learning Commons, Cafeteria, Corridors, Staff Room	40
Home Economics, Cosmetology, Foods Classroom	30*
CTS / Industrial Arts	35*
Kitchen / Cooking	45*

Notes:

[1]Regardless of NC rating, background noise from building services shall not contain objectionable tones or sound quality such as rumble, roar, or hiss, as defined by an RC Mark II QAI (Quality Assessment Index) > 10 dB (as per ASHRAE).

* Noise Criteria requirement for CTS Shops, Industrial Arts, Foods Rooms applies to continuous base building ventilation only. The on-demand operation of exhaust systems, dust collectors, kitchen hoods, and associated Make-Up Air units is not part of this requirement, however noise from these systems should be minimized as much as feasible.

.2 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.

.3 Locate mechanical room or main air handling equipment away from instructional spaces or other noise sensitive areas.

.2 Outdoor Noise (Mechanical)

.1 Provide discharge silencers for dust collectors, minimizing noise impacts on existing and future residential developments, sports fields, and play areas.

B. Specific Requirements for Healthcare Facilities

.1 Background Noise

.1 Design mechanical systems (including generator systems) to provide background noise levels, as follows:

7.7.B.1.1 Space Description	Noise Criteria[1] (NC)
Patient Room	30*
Medication Room, Open-plan Work Areas	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

Notes:

[1]Regardless of NC rating, background noise from building services shall not contain objectionable tones or sound quality such as rumble, roar, or hiss, as defined by an RC Mark II QAI (Quality Assessment Index) > 10 dB (as per ASHRAE).
* Sound masking is recommended for these spaces. If sound masking is specified, use optimum sound masking spectrum as the target background noise (see 7.8.3 Sound Masking System).

.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 Where acoustic duct liner, silencers, attenuators, or acoustic flex duct are deemed necessary to meet background noise requirements, consult with the project team on acceptable products, considering the specifics of the healthcare environment.

.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 4.6 A.

.5 Outdoor Noise (Mechanical)

.1 Ensure that mechanical noise level in outdoor patient lounge areas and public sidewalks does not exceed 55 dB(A).
.2 Outdoor mechanical equipment shall not produce sound that exceeds 65 dB(A) at the hospital facade unless special consideration is given to facade sound isolation design in impinged areas.
.3 Prepare a survey of existing ambient noise conditions if the Health Care Facility is to be built near an established residential community. A minimum 24-hour noise measurement around the site is required to determine meaningful design criteria to minimize impact on the community. Refer to 7.7.5 Community Noise.

C. Specific Requirements for Residential Health, Care, and Support Facilities

As a minimum FGI guidelines are to be met.

.1 Background Noise

.1 Design mechanical systems to provide background noise levels, as follows:

7.7.C.1.1 Space Description	Noise Criteria[1] (NC)
Resident Bedrooms, Quiet Rooms, Conference Rooms	30
Examination, Treatment, Physical Therapy, Administrative Offices, Nursing Stations	35
Activity Rooms, Lounges, Dining, Corridors	40
Indoor Swimming Pool, Kitchen	45

Note:

[1]Regardless of NC rating, background noise from building services shall not contain objectionable tones or sound quality such as rumble, roar, or hiss, as defined by an RC Mark II QAI (Quality Assessment Index) > 10 dB (as per ASHRAE).

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:

.3 Provide flexible conduit/raceway to make the connection to the transformer.

7.8.2.2	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 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). Addressable Decentralized Sound Masking Network Infrastructure Specification Section 27 51 21B is available here: https://www.alberta.ca/system/files/custom_downloaded_images/tr-27-51-21b.doc

.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 airport vicinity protection area regulation under the Municipal Government Act. Use Division B, Part 11 of the most recent National Building Code – Alberta Edition to develop exterior construction details.

End of Acoustical Section

8.0 Accessible Design

Section Contents

8.1 Introduction

.1 Creating fair opportunities for all in the built environment is vital to the Province of Alberta. All designs of new and renovation projects are to ensure the maintenance of safety and universal usability of public buildings.

.2 To determine the level of accessibility required for buildings, refer to the current NBC (AE) for the minimums and then refer to the requirements of the project for the appropriate improvements. For example, seniors' housing projects will require a greater accessibility integration than the minimums stated in the NBC (AE).

.3 This Section identifies items to be considered when addressing the issue of accessibility for existing buildings for persons with a range of physical, cognitive, and sensory disabilities. These items are broken down 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 door opening size and all washroom items. If there is not the required space adjacent to the door to accommodate the operation of the door by persons with disabilities, the washroom is not barrier-free accessible.

8.2 References

.1 **National Building Code - 2023 Alberta Edition, NBC (AE) 2023**

.2 **Accessibility Design Guide, 2024**, (https://open.alberta.ca/publications/accessibility-design-guide)

.3 **CAN/CSA-B651:23**, Accessible design for the built environment, Canadian Standards Association.

.4 **Guidelines for Inclusive Design** – Universal Washroom Facilities for Alberta Infrastructure Facilities February 2019 (https://www.alberta.ca/system/files/custom_downloaded_images/tr-guide-universal-washroom.pdf)

8.3 Level of Accessibility

.1 The first step in upgrading the project is to set the level of accessibility based on general objectives and the funding available. Select a level for each of the three variables below:

<u>Number of Floors</u>

.1 Main Floor only
.2 Main Floor plus other floor(s)
.3 All Floors

<u>Extent of Upgrade</u>

.1 Public Areas Only
.2 Throughout

<u>Standard of Upgrade:</u>

.1 To meet the latest version of NBC (AE)
.2 To meet the latest version of NBC (AE) and latest version of CSA Standard B651

.2 The minimum level of accessibility upgrade, based on this classification system, is Main Floor/Public Areas Only, as indicated in the NBC (AE) and the maximum level of upgrade is All Floors/Throughout/NBC (AE) and CSA-B651.

.3 Notwithstanding the preceding, the level of 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 NBC (AE), which provides the minimum requirements for Accessible design. As all projects are unique, some may require minimal renovations to achieve accessibility requirements, while extensive renovations may be necessary in other cases. These circumstances should be identified early in the pre-design/programming phase 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 accessible design.

.3 Refer to the CSA Standard B-651 for design assistance. Some of the requirements of this standard are more stringent than the requirements of NBC (AE). Wherever possible, incorporate the provisions of this standard into the project's scope of work. Where the NBC (AE) and CSA Standard B-651 address the same issues, when practical, the more stringent recommendations should govern.

.2 Level of Accessibility

.1 Consult with Alberta Infrastructure to determine the level of accessibility required for the project in consultation with the project stakeholders and /or pre-design parameters.

.3 Code Analysis

.1 Perform a comprehensive building code analysis of the project, 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 Accessible design and section 3.8 of the current NBC (AE), as these relate to the building to be renovated.

Note: the occupant load is based upon the total area available for people, not the number of persons using the building. Exiting requirements must follow NBC (AE) 2023 code requirements by area (not set by program limitations or enrollment limits – refer to STANDATA 23-BCI-010/23-FCI-013, January 2025),

.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 exterior paths of travel, accessible parking, curb cuts/ramps, tactile walking surface indicators (TWSIs), stairs, exterior lighting, and signage.

.2 Building Access

.1 Building Entrance Accessibility: consider a 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.

.3 Consider the 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 accessibility requirements beyond code minimums. For example, seniors housing should have wider than minimum 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 washroom that can serve as a baby change room and a gender-inclusive washroom.
.4 Public assembly facilities with occupancies over 500 persons require one adult changing universal 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. Identify an area of refuge by directional and identification signage. Often these are provided within stairwells, but not always. Coordinate an emergency evacuation plan 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 the chair lift is in operation.
.4 Platform Lifts: consider the travel distance limits and location. Generally, platform lifts are only acceptable for use within a 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 (to allow for a stretcher), 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 accessibility provided on the first level.

.7 Emergency Services: Emergency Lighting, Exit Signs, Fire Alarm, Area of Refuge

.8 Signage within accessible Path of Travel

.1 Minimum NBC (AE) requirements. Consider providing accessibility signage, including tactile, Braille, contrasting, and audible signs.

.9 Millwork

.1 Cabinetry should function for all users. Consider the knee space at sink locations, the grasp of pulls, and the height of shelving, counters, appliances, outlets, and coat hooks

.10 Building Security

.1 User Actuated Systems: consider mounting heights of actuation devices and requirements for audible and visual signals to indicate when a door lock is released.
.2 Remote Actuated Systems: consider mounting heights of call devices and requirements for audible and visual signals to indicate when a door lock is released.

End of Accessible Design 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 Standard*
  .4 *Alberta Soil and Groundwater Remediation Guidelines*
  .5 *Alberta Exposure Control Guide*
  .6 *Alberta Risk Management Plan Guide*
  .7 *Contaminated Sites Policy Framework*

.3 *National Fire Code – 2023 Alberta Edition*

.4 Local municipal standards, guidelines, and bylaws

.5 *Flood Risk management Guidelines for Location of New Facilities Funded by Alberta Infrastructure*, (November 2022)

.6 Accessibility Design Guide, 2024,*(https://open.alberta.ca/publications/accessibility-design-guide)*

.7 Alberta Energy Regulator (AER) Guidelines

.8 Alberta Utilities Commission

.9 *Guideline for Wildfire Protection of Institutional Buildings in Forested Regions,* by Alberta Infrastructure (Appendix C)

9.2 Site Selection

.1 Site investigations on proposed sites are including the following:

  .1 Land Status / Zoning requirements
  .2 Services to the Site and Capacities
  .3 Traffic Impact Assessment
  .4 Geotechnical Studies
  .5 Phase I Environmental Site Assessment
  .6 Topographic Survey

.7 Floodplain Studies
.8 Archeological Sensitivity Assessment
.9 Arborist Study
.10 Digital Photographs
.11 Additional Information: Identify and significant features on and off site within 2 km that could affect the proposed development.

.2 Minimum Setback requirements for Alberta Infrastructure Projects:

.1 Powerlines:

.1 Setback requirements for overhead transmission lines:
30 m for 50-133 kV
46 m for 220-230 kV
107 m for 500 – 550 kV

.2 Setback requirements for underground transmission lines:
8 m for 50 – 133 kV
12 m for 220 – 230 kV
27 m for 500 – 550 kV

.2 High Vapour Pressure Pipeline / High-Pressure Pipelines:

High Vapour Pressure Pipeline: A pipeline system containing hydrocarbons or hydrocarbon mixtures in the liquid or quasi liquid state with a vapour pressure greater than 110 kPa absolute at 38 Degree Celsius. Some examples are liquid ethane, ethylene, propane, butanes, and pentanes.

A Large Diameter/High-Pressure Pipelines is defined as a hydrocarbon pipeline with both an outside diameter equal or greater than 323.0 mm, and a maximum operating pressure equal to or greater than 3475 Kpa.

A setback of 200 meters is required from the center line of these pipelines to public institutions where people are dependent upon others for evacuation such as hospitals, schools, and senior citizen homes.

.3 Sour wells, Pipelines, and Facilities:

Please following the setback distances recommended by Alberta Energy Regulator.

.4 Landfills:

.1 a minimum of 450 meters away from an operating landfill and a hazardous waste management facility.
.2 a minimum of 300 meters away from a non-operating landfill.

.5 Cell Towers:

A minimum of 50 meters from school and hospital boundary to minimize exposure to radiofrequency radiation.

.6 Cannabis Stores:

.1 300 meters setback is required from schools and public institutions. From boundary line to boundary line.
.2 No setbacks required for hospitals.

.3 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”).

9.3 Site Plan

.1 Survey Plan

.1 From the information on the site survey plan, items to be shown on the site plan in the contract documents, but not limited to:

.1 Legal description and address of the property, property lines and their legal dimensions, and legal pins,
.2 Adjacent trees, sidewalks, roadways, utilities, easements and how the new development will tie to them,
.3 Work of the contract and any work by other forces and contracts,
.4 Main floor elevations, and geodetic datum and the equated, and
.5 All utilities on site and adjacent to the site.

.2 Access

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

.3 Signage

.1 Locations of all signs with due consideration to vehicular and pedestrian sightlines.

.4 Roads, Walks and Parking

.1 Driveways and off-site walks meet local municipal standards.

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

.3 Parking lots and parking appurtenances are to facilitate snow removal and to prevent damage by snow moving equipment.

.4 A concrete pad is need for garbage bin and recycling bin and locate bins for ease of access and safety.

.5 To address potential safety concern, efforts should be made to separate main vehicular traffic from main pedestrian traffic.

.6 Alberta Infrastructure (AI) might accept that asphalt mix design contains a maximum of 10% Reclaimed Asphalt Pavement (RAP) by weight. AI does not accept any asphalt mix design containing Recycled Asphalt Shingles (RAS).

.7 Parking Islands: It is recommended to pave the parking island if its width is less than 1.5 m.

.5 Grading

.1 Maintain minimum grade of 1% and maximum grade of 4% for concrete and asphalt surfaces in parking lots, and grade of 2% for graveled surfaces.

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

.3 A positive sloped surface is to effectively drain water away from the foundation walls. Minimum grade requirements are:

- .1 10% for 2 meters (Foundation with basement) – Minimum 20 cm drop for final grade on soft landscaping.
- .2 5% for the first 2 meters (Slab-on-grade) – Minimum 10 cm drop for final grade on soft landscaping.
- .3 1% for concrete, asphalt, or other impervious surface treatment

.4 Drainage Swales: minimum swale slope requirements:

- .1 1.5% for a grass drainage swale
- .2 1% for a concrete drainage swale

.5 Address potential ponding and icing problems associated with downspouts. Provide splash pads under downspouts. The recommended minimum standard size for concrete splash pad is 30 cm X 107 cm.

.6 Design considerations for surface ponding:

- .1 The maximum depth should not exceed 0.5 m. For school sites, the maximum depth should not exceed 0.3 m.

.2 Trap low should be a minimum of 0.3 m lower than foundation elevations.
.3 Ponding areas should be located a minimum of 4 m away from building foundations.

9.4 Site Servicing

.1 General Requirements for Utilities

.1 Dimensions of utilities to property lines or use a grid co-ordinate system.

.2 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 systems, advise the user department, and confirm that the existing on-site systems can accommodate the additional loads.

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

.5 Contact the local municipality or conduct water pressure test to confirm the municipal water pressure and fire flow capacity. Determine whether on-site boosting is required or not for a fire sprinkler system.

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

.2 Stormwater Management System

.1 Stormwater Management System is designed in accordance with *Standards and Guidelines for Municipal Waterworks, Wastewater* and *Storm Drainage Systems and Local Municipal Standards,* whichever set higher standards.

.2 Consult with Technical Service regarding the design standards if local municipal standards are not available.

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

.4 To prevent any potential freezing issues, roof drain should be connected to a manhole not a catch basin manhole.

.3 Sanitary Sewer Services

.1 Sanitary Sewer system is designed in accordance with *Standards and Guidelines for Municipal Waterworks, Wastewater* and *Storm Drainage Systems and Local Municipal Standards,* whichever set higher standards.

.2 Consult with Technical Service regarding the design standards if local municipal standards are not available.

.4 Water Services

.1 Water systems comply with *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* and *Local Municipal Standards,* whichever set higher standards.

.2 Consult with Technical Service regarding the design standards if local municipal standards are not available.

.3 Fire department connection and fire hydrants are in accordance with National Building Code – 2023 Alberta Edition and National Fire Code – 2023 Alberta Edition.

.5 Cross Connections

.1 Comply with *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* and *Local Municipal Standards,* whichever set higher standards.

9.5 Design Document Requirements:

.1 Schematic Design Report

.1 The Schematic Design Report shall provide a section for the civil discipline with a narrative outlining the following information:

a. Referenced codes and standards.
b. Site investigation report
c. Site services: water, sanitary sewer, and storm sewer
d. Stormwater management and drainage design
e. Site grading
f. Site accesses

.2 Design Development Report

.1 The Design Development Report shall contain a section for civil discipline. The deliverables include a report and drawings. The report shall contain the information listed above and provide details on the site services (existing locations and capacities, the sizes of new utilities, and connections).

.2 The drawings are expected to have:

a. Existing site grades
b. Site Servicing Plan
c. Stormwater management plan
d. Site grading plan

.3 Contract Drawings

.1 Civil drawings shall include the following:

a. Existing site grades
b. Site Servicing Plan
c. Stormwater management plan
d. Site grading plan
e. Pavement Plan
f. Fire emergence movement plan
g. Detail drawings
h. Erosion and sediment control plan

.4 Contract Specifications

.1 Prepare contract document specifications using the Alberta Infrastructure Technical Specifications as a basis to include, but not to be limited to the following:

a. Local municipality's design standards
b. Standards and Guidelines for Municipal waterworks, wastewater, and storm drainage systems (Alberta Environmental Guidelines)
c. Barrier-Free Design Guidelines
d. All applicable requirements in Alberta Infrastructure Technical Specifications:
    a. Earthwork Testing
    b. Fill material
    c. Site Clearing
    d. Earthwork General Requirements
    e. Site Excavating, Filling and Grading
    f. Trench Excavating and Backfilling
    g. Granular Base
    h. Asphalt Concrete Pavement
    i. Concrete Paving, Curbs and Gutters
    j. Pavement Markings
    k. Chain Link Fencing
    l. Piped Utility Systems General Requirements
    m. Water System
    n. Sewer System

9.6 Environmental Site Assessment

.1 Investigation, Remediation, and Risk Management

.1 Conduct all Environmental Site Assessments (ESAs) according to the *Contaminated Sites Policy Framework*.

.2 Phase I and II ESAs are to be conducted according to the *Alberta Environmental Site Assessment Standard*.

.3 If the Phase I ESA identifies any potential environmental concerns and it recommends further investigation, proceed with a Phase II ESA.

.4 Remediation is to be conducted according to the applicable Tier of the *Alberta Soil and Groundwater Remediation Guidelines*.

.5 In circumstances where remediation is not viable under present circumstances, and the site can be managed through administrative controls or exposure barriers, the exposure control approach can be used to manage the contaminated site.

.6 Risk Management Plan are to be developed in accordance with the *Alberta Exposure Control Guide*, and the *Alberta Risk Management Plan Guide*.

.2 Tanks for Petroleum Products

.1 Comply with the requirements of the *Alberta Fire Code*, Alberta Fire Prevention Council.

.2 Consider using day tanks for emergency generators.

End of Municipal and Environmental Engineering Section

10.0 Landscape Development

Section Contents

10.1 References

.1 Alberta Yards and Gardens: What to Grow; Backyard Pest Management; by Alberta Agriculture and Irrigation.

.2 ANSI A300 Tree Care Standards (American National Standards Institute) as advocated by the International Society of Arboriculture (ISA).

.3 Canadian Standards For Nursery Stock: latest edition by Canadian Nursery Landscape Association (CNLA).

.4 Manual for Maintenance of Grounds, by Alberta Infrastructure.

.5 Plant Hardiness Zones In Canada: latest edition by Agriculture and Agri- Food Canada.

.6 Canadian System of Soil Classifications: latest edition by Agriculture and Agri-Food Canada.

.7 Local municipality Land Use Bylaws for landscape requirements.

10.2 Landscape Development Guidelines

.1 Provide a landscape design that is aesthetically pleasing, enjoyable, practical, functional and which utilizes sustainable design practices.

.2 Landscape design shall emphasize ease of maintenance. Design with consideration as to whether the on-site client has the means and resources to provide adequate and proper plant care.

.3 Landscape development shall include municipal boulevards and easement areas.

.4 Provide a minimum 2% gradient away from buildings and other hard surfaces.

.5 Identify and preserve healthy suitable trees and other plants on site, where feasible. If required, properly prune existing trees that remain using the services of a certified arborist unless directed otherwise by the Province. Protect existing trees that remain including exposed roots to prevent damage during construction. Maintain existing grades to the drip lines of existing trees. Existing trees and other plants that are deemed dead, unhealthy, or unsuitable and which are considered hazardous to property and public safety shall be removed from site complete with stump removal.

.6 Use a variety of hardy trees, shrubs and other plants in a cohesive landscape design layout to provide year-round interest, colour and aesthetic appeal. Select plant material that are tolerant of drought conditions, deicing salts in winter, local soil conditions and changing environmental conditions. Incorporate a mixture of deciduous and coniferous plants into the design. Monoculture plantings must be avoided. Emphasize species diversity in the landscape design.

.7 Provide a landscape design that respects and accommodates site security, visibility, safety and accessibility through good design practices, selection and layout of plant material. Site landscaping shall not interfere or obstruct building and parking light fixtures, security camera sightlines, site and street signage, building entries and natural surveillance from windows, utility boxes, fire hydrants, and other public or utility infrastructure.

.8 Locate and space plants to avoid overcrowding and to ensure the plants reach their natural form at maturity. Excessive or overplanting that requires later plant removal is not desirable and shall be avoided.

.9 Prohibited Plants: plant species that are susceptible to pest infestations or prone to disease deemed difficult to control or eliminate must not be installed. Avoid planting trees and shrubs that possess significant nuisance problems such as large fruit or thorns or plants which are deemed to be invasive. Trees that are prone to branch and other structural failures should be avoided.

.10 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 and contain a minimum 450 mm depth of acceptable planting media.

.11 Plant Selection: all plants shall be healthy and of specimen quality and of the following minimum size:

.1 Deciduous trees: minimum 60 mm caliper,
.2 Coniferous trees: minimum 200 cm in height,
.3 Deciduous shrubs: supplied in minimum #2 container,
.4 Coniferous shrubs: supplied in minimum #5 container,
.5 Perennials / Ornamental grass: supplied in minimum #1 container.

.12 Keep all plantings clear of buildings, walkways, roadways, fences, walls, swales, and drainage facilities. Tree canopies should not conflict with the safe movement of pedestrians and vehicles.

.13 Provide minimum 1.5 m setback from edge of parking curb to edge of planting beds and deciduous tree locations to allow for vehicle overhang and snow accumulation. Coniferous trees shall be planted minimum 2.2 m from edge of parking curb.

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

.15 Select tree and shrub species with root growth habits that will not cause damage to sidewalks, curbs, sound walls, adjacent properties, overhead and underground utilities and other site infrastructure. Species with invasive roots should be sited away from hardscape areas.

.16 Apply and maintain organic mulches to a depth of 100 mm in plant beds and tree saucers to assist soils in retaining water, reducing weed growth, and preventing erosion. Use a fibrous shredded coniferous bark mulch as it holds together better to prevent removal in windy conditions. Weed barriers shall not be permitted under organic mulches. Under building overhangs and along building foundations install appropriate and more durable mulch covering such as crushed stone complete with geotextile fabric and metal edging materials.

.17 Select nursery grown sod in vicinity of buildings and walkways, parking areas, and all other areas of high pedestrian traffic where turf seed establishment would be difficult and the seed bed would be subject to continuous damage. Where turf seed is required, use an appropriate custom seed mixture to suit local soil conditions, water availability and maintenance requirements for site.

.18 Landscaped parking islands should have a minimum width of 1.5 m inside of curbs and a minimum 900 mm depth of planting media to ensure plant growth is sustainable. Otherwise, parking islands of less width should be finished with hardscaping. Planting media should be mounded to a centre height which has a 1 to 2% slope above the top of the curb height. Use drought tolerant and salt resistant plants with organic mulch in the landscaping of parking islands. Select high headed canopy trees and other shrubs and grasses that will not interfere with parked vehicles or pedestrian passage and which are able to tolerate snow being dumped on the plantings.

.19 Maintenance / Warranty Requirements:

a. Two (2) Years: all new landscape projects, including irrigation systems, shall be maintained and warranted for a minimum period of two (2) years from date of acceptance of the landscape work, except as noted below.
b. One (1) Year: landscape projects that involve minor landscape upgrades, restorations or repairs shall be maintained and warranted for a period of one year from date of acceptance of the landscape work.

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 along building facades and retaining wall shall be of adequate size and width to reduce opportunities for vandalism and graffiti.

.5 Do not install trees along building structure or which will obscure view of building entrances and exits.

.6 Shrub plantings shall be designed to form thickets and barriers 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 Irrigation systems shall be water efficient. Irrigation design must be prepared by a certified irrigation designer.

.3 Irrigation system shall be installed and maintained so that sprinkler heads do not overspray onto non-pervious areas such as sidewalks, buildings, parking lots, and roadways. Use a smart irrigation controller and rain/freeze sensors to prevent irrigation system from operating during rain events or when temperatures drop below freezing.

.4 Irrigation system shall be designed to provide full head to head coverage and match precipitation rates. Contain system within the property lines, as reasonably feasible. Plant beds shall be zoned separately from turf areas.

.5 Provide pipe sleeves for irrigation systems under roadways and sidewalks. Design irrigation systems to allow for emptying water from distribution pipes.

.6 In municipalities where sewage treatment charges are based on water consumption, provide separate meter if cost efficient.

.7 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 organic mulch to reduce maintenance and watering requirements for trees and shrubs. Re-mulch on an annual to semi-annual basis to maintain required depth of organic mulch.

.3 Choose hardy native or adapted plants having low water demands, are reasonably free from pest infestations and which are suitable for local soil conditions. Use low maintenance ground covers and various drought tolerant grass plants.

.4 Group plants with similar water needs into hydrozones or the same area of a plant bed to minimize water waste.

.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 Utilize alternative sources of water to potable water, such as harvested rainwater and treated wastewater.

.7 Use selected large canopy trees to reduce heating and cooling requirements for buildings.

.8 Use selected shrubs and shrubby trees with dense branches that extend to the ground to control blowing and drifting snow.

End of Landscape Development Section

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 and Procurement, 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 owned and supported facilities, a comprehensive hazardous building materials assessment is to occur whenever a building will be maintained, renovated, sold or demolished, and when suspect hazardous building materials are present in poor condition (i.e. severely damaged, deteriorated or delaminated). The area of the assessment shall reflect the project scope. The assessment is to be conducted by a qualified and competent Environmental Consultant experienced in the hazardous materials identified in this section including a competent understanding of the sampling methodologies and procedures involved in inspecting and testing hazardous materials

.2 A comprehensive hazardous building materials assessment should include identification, recommendations, and order of magnitude removal budget cost estimate for the following:

- .1 Asbestos-containing building materials;
- .2 Lead based paints/glazes, sheeting and miscellaneous lead-containing materials (bulk paint scrapping and glazes is the only sample method and analysis permitted);
- .3 Mercury-containing equipment (thermostats) 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 equipment and components;
- .8 Visible mould on building materials;
- .9 Biohazards (animal waste, sharps waste, stinging insects); and
- .10 Building Use Chemicals.

.3 Analysis of asbestos bulk samples should be conducted using "Positive Stop" methodology whereby if one layer of a homogeneous or heterogeneous sample material is found to contain asbestos, the remaining layers samples of that material are not analyzed.

.4 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.

.5 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.

.6 For additional hazardous materials information refer to *Division 02 – Existing Conditions*, Technical Specifications, Infrastructure Technical Resources website, https://www.alberta.ca/facility-construction-sub-group.aspx. Removal of all identified hazardous building materials are to be conducted in accordance with Infrastructure's Technical Specification documents.

11.3 Other Building Considerations

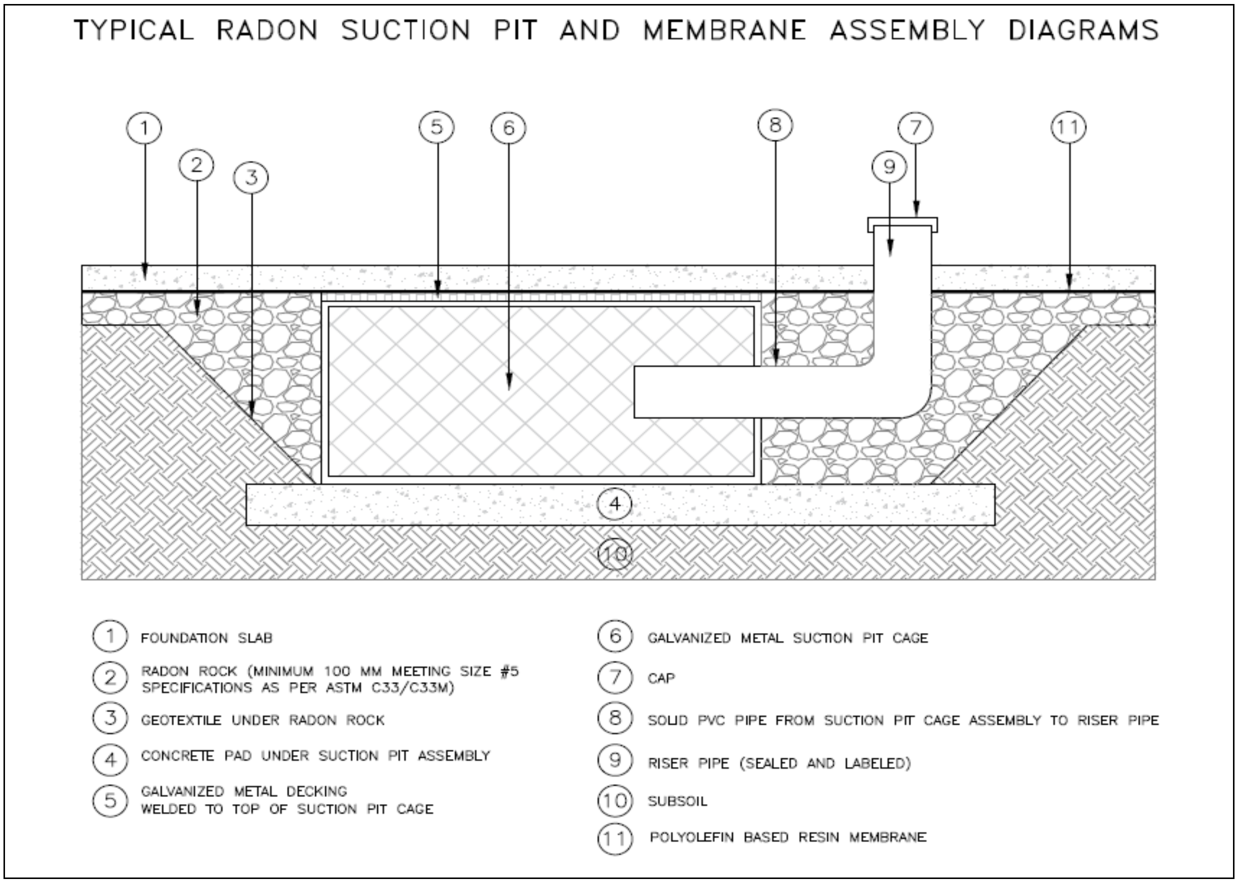
.1 When selecting materials for a new building or an existing building renovation, no asbestos-containing materials are to be chosen or installed. Also, consider mould resistant products as they are becoming readily available.

.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.

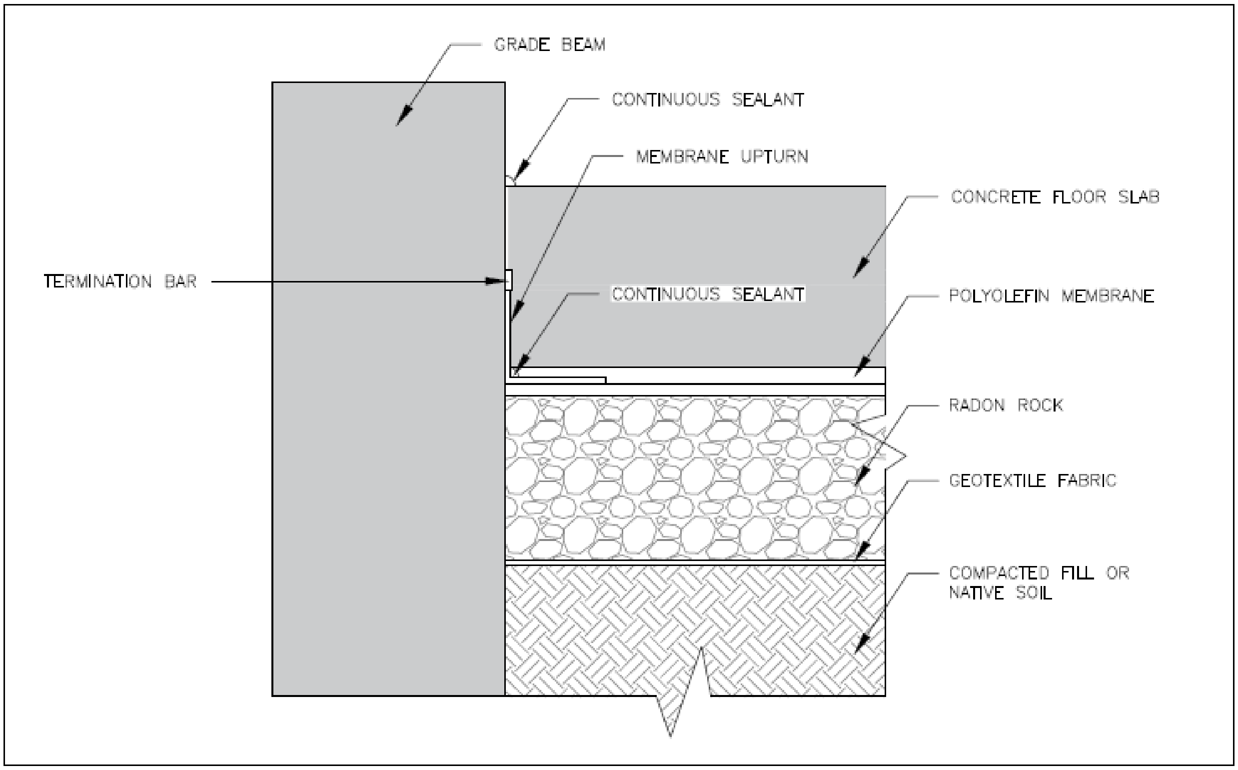
.3 Construction dust control and clean-up procedures should be implemented to assure building occupants are not exposed to dust. Controls would include dust barriers, directional airflow fans, negative air pressure within the construction area, and sealing/isolation of mechanical ventilation ductwork. 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 Infrastructure uses and defines radon mitigation "rough-in" system as a depressurization system which extends the radon pipe (riser) from the sub slab radon venting system to above the foundation slab and capped. Refer to the diagrams on the following page. For Infrastructure Owned and Supported buildings, consult with the Alberta Infrastructure Building Environment Unit Section, Technical Services and Procurement Branch if in doubt.



TYPICAL RADON SUCTION PIT AND MEMBRANE ASSEMBLY DIAGRAMS
1
2
3
5
6
8
7
9
11
4
10
1 FOUNDATION SLAB
2 RADON ROCK (MINIMUM 100 MM MEETING SIZE #5 SPECIFICATIONS AS PER ASTM C33/C33M)
3 GEOTEXTILE UNDER RADON ROCK
4 CONCRETE PAD UNDER SUCTION PIT ASSEMBLY
5 GALVANIZED METAL DECKING WELDED TO TOP OF SUCTION PIT CAGE
6 GALVANIZED METAL SUCTION PIT CAGE
7 CAP
8 SOLID PVC PIPE FROM SUCTION PIT CAGE ASSEMBLY TO RISER PIPE
9 RISER PIPE (SEALED AND LABELED)
10 SUBSOIL
11 POLYOLEFIN BASED RESIN MEMBRANE



GRADE BEAM
CONTINUOUS SEALANT
MEMBRANE UPTURN
CONCRETE FLOOR SLAB
TERMINATION BAR
CONTINUOUS SEALANT
POLYOLEFIN MEMBRANE
RADON ROCK
GEOTEXTILE FABRIC
COMPACTED FILL OR NATIVE SOIL

.2 A radon mitigation "rough-in" system is required to be installed in all new Government of Alberta Owned or Supported permanent buildings occupied by persons for more than 4 hours per day and it is a requirement of the Province as of February 2016. A radon mitigation "rough-in" system may not apply to buildings or portion of buildings that are intended to be occupied for less than four hours per day. The National Building Code - Alberta Edition (current edition) references this installation.

.3 The decision of the Consultant's building design team not to install a radon rough-in mitigation system during construction would have significant costs incurred by the Consultant, once the building is occupied and operating under normal conditions, should radon air testing confirm the need for installation of radon mitigation. Note that cost of materials and equipment are not consideration factors when choosing to use alterative products from those materials outlined in Infrastructure's Technical Specification for radon mitigation rough-in systems.

.4 The Consultant's building design team to retain a Certified Radon Mitigation Professional in good standing from the Canadian National Radon Proficiency Program (C-NRPP) to implement Infrastructure's Technical Specification for radon mitigation rough-in system 31 21 13B for a possible future Active Sub-Slab Depressurization (ASD). Alternatively, the radon mitigation rough-in system alternative void space technology 31 21 13.03B can be used if radon mitigation rough-in system 31 21 13B is impracticable. The specifications are found here: https://www.alberta.ca/site-and-infrastructure-sub-group.aspx The specifications and associated drawings are to be signed off by the C-NRPP Certified Mitigation Professional.

.5 Infrastructure's Technical Specifications for radon mitigation rough-in system are considered standard and are not to be altered. The C-NRPP Mitigation Professional is to design the number of extraction points and locations and to inspect, photograph, test and sign off on the completed radon mitigation rough-in system to ensure compliance with Infrastructure's Technical Specification.

.6 After the radon "rough-in" system and building completion and normal operating conditions, the Building Owner is to retain a C-NRPP Certified Radon Measurement Professional in good standing conduct air testing to determine the radon levels in the building.

.7 Radon air testing is to follow the Health Canada document, *Guide for Radon Measurements in Public Buildings* (current edition).

.8 If radon air testing after building construction and occupation determines that average long term (91 days to 1 year) radon concentration in occupied areas exceeds the Health Canada guideline limit, then the long-term measurement is to be immediately followed by short term (1 week) continuous radon monitoring (CRM) for the locations exceeded the guideline limit to calculate the assumed occupied exposure. The basis for mitigation is to be made on the assumed occupied exposure.

.9 Where unacceptable levels of radon are found, thorough follow-up investigation is to be conducted if the assumed occupied exposure continues to be above the Health Canada guideline limit to identify the cause of the exceedance and mitigated. Commonly, insufficient ventilation and unsealed radon entry routes can cause the exceedance of the radon levels. If the mitigation was not successful, the installation of the Active Sub-Slab Depressurization (ASD) must be finalized by extending the rough-in riser pipe from above the slab to the outside of the building and mechanically depressurize the sub-slab environment by a suction fan installed along the pipe. The outside exhaust outlets are to be located to not allow the radon gas to re-enter the building.

.10 Active Sub-Slab Depressurization (ASD) is the most common and usually the most reliable radon reduction method according to Health Canada and the United States Environmental Protection Agency. The radon mitigation "rough-in" allows for this method to be used.

.11 Refer to *Section 5.0 – Mechanical, paragraph 5.13.5* for additional information on radon gas exhaust. Installation of any radon piping above the capped riser is not permitted. As this is a rough-in system, the vertical riser must not be extended through the roof. The C-NRPP Mitigation Professional is to confirm Mechanical schematic drawings do not include the installation or continuation of radon piping.

11.5 Review Submission Requirements

.1 The schematic design and design development submissions for all project delivery methods (DBB, DB, CM, P3), must include information related to hazardous building materials, including survey report as well as preliminary detailed drawings of proposed radon mitigation "rough-in" system. The radon mitigation system must be designed by a C-NRPP mitigation professional, following Infrastructure's technical specifications. Name and credentials of the C-NRPP Mitigation Professional to be submitted for review.

.2 The 60% contract documents should include consultant's responses addressing all of the Hazmat and Radon related feedback at SD and DD stages.

.3 The pre-tender submission should include all comments previously identified must be reflected and included at this stage with no further comments from our unit.

.4 The radon mitigation rough-in system specification and the drawings are to be submitted in the stand alone Environmental Hazards section, not in the Mechanical, Architectural, Structural or other like sections.

.5 If a C-NRPP issued certification stamp is not provided, then a letter of assurance for the rough-in system technical specification and schematic documents shall be provided by the C-NRPP Professional who is registered in good standing with the Canadian – National Radon Proficiency Program (C-NRPP).

End of Environmental Hazards

12.0 Crime Prevention Through Environmental Design (CPTED)

Crime Prevention through Environmental Design (CPTED) is a proactive design approach based on the belief that the proper design and effective use of the built environment can reduce the fear and incidence of crime. The core set of principles is natural access control (entry and exit points), natural surveillance (increased visibility), and territorial reinforcement (clear boundaries, a sense of ownership). When applied early, those concepts can be integrated into any facility providing layers of protection for clients, visitors, and staff.

Government of Alberta facilities are to be designed with these principles in mind. For more information on how to apply these principles, refer to the following document:

“Physical Security Design Requirements for Government of Alberta Facilities”:

https://www.alberta.ca/system/files/custom_downloaded_images/tr-securityguidelinesstandards.pdf

End of CPTED

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

.1 All projects shall comply with Alberta Infrastructure's Asset Information Requirements.

.2 Refer to Project contract for applicable Building Information Modelling Requirements.

.2 Specific Requirements for Health Care Facilities

.1 Coordinate with Alberta Health Services and the Project Manager to determine the desired Digital Project Delivery requirements.

.3 Specific Requirements for Education Facilities

.1 Coordinate with the School Board and Project Manager to determine the desired Digital Project Delivery requirements.

.2 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

1. Digital Project Delivery – Asset Information Management – Consultant Requirements

    .1 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.

2. Digital Project Delivery-Asset Information Management-Contractor Requirements

    .1 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.

3. Digital Project Delivery-Asset Information Management-Design Builder Requirements

    .1 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.

4. Digital Project Delivery-Building Information Modelling-Consultant Requirements

    .1 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.

5. Digital Project Delivery-Building Information Modelling-Design-Builder Requirements

    .1 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.

6. Digital Project Delivery-COBie Requirements

    .1 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

.1 NBIMS-US V3 COBie Standard

End of Digital Project Delivery Section

Appendix A – Acronyms

AC/h (also ACH)	air changes per hour
ADA	Americans with Disabilities Act
APEGA	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
ITR	Infrastructure Technical Resources website
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
TDR	Technical Design Requirements for Alberta Infrastructure Facilities
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

*“**Introduction***

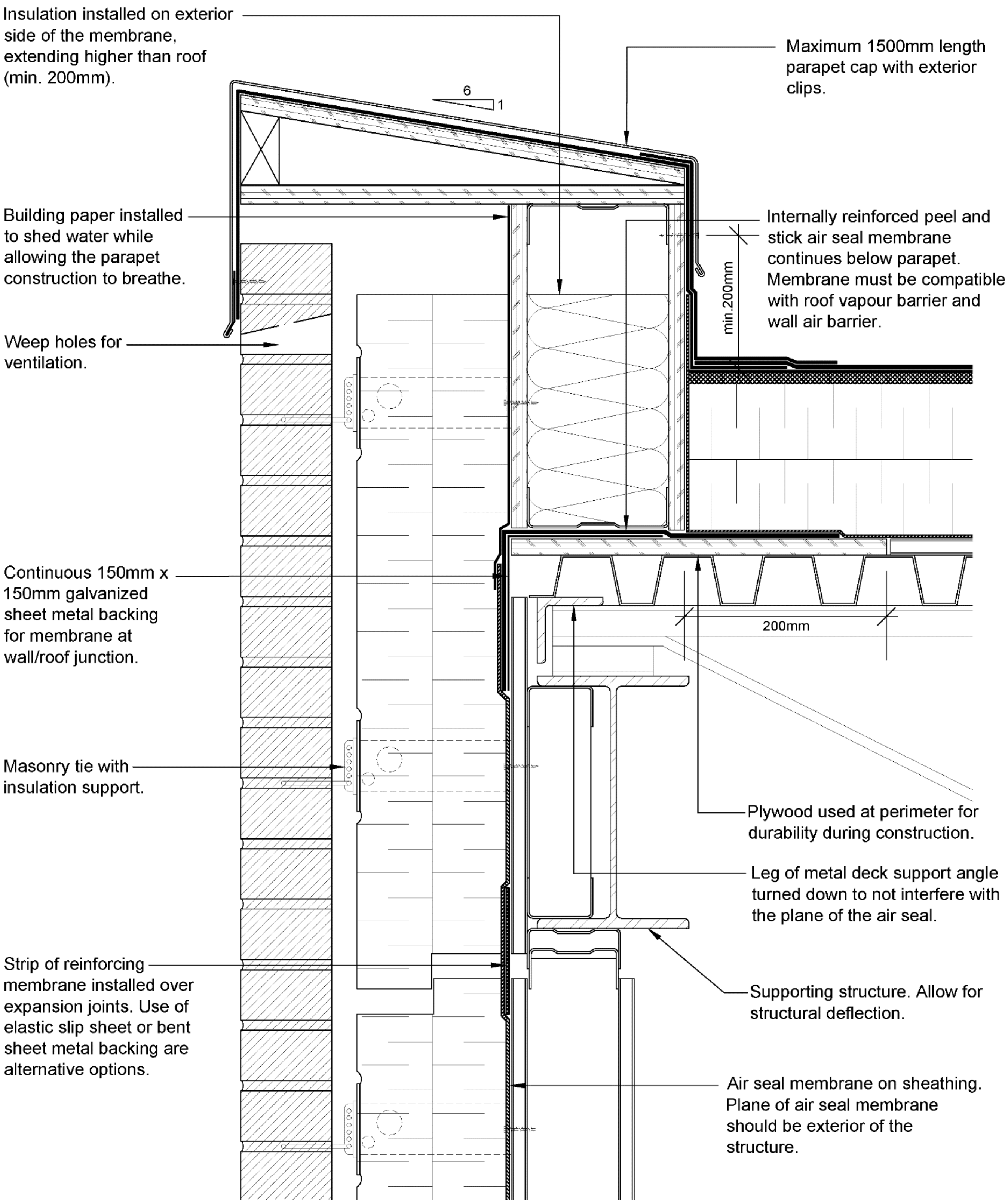
Wildfires are named as such for a reason; they are often uncontrollable. What is controllable is the preparation and planning taken to protect buildings from damage and loss when a wildfire occurs.”

This document is housed on the Infrastructure Technical Resources website:
https://www.alberta.ca/infrastructure-technical-resources.aspx

The document direct link:

https://www.alberta.ca/assets/documents/tr/tr-wildfireprotection.pdf

Appendix D – Standard Envelope Details



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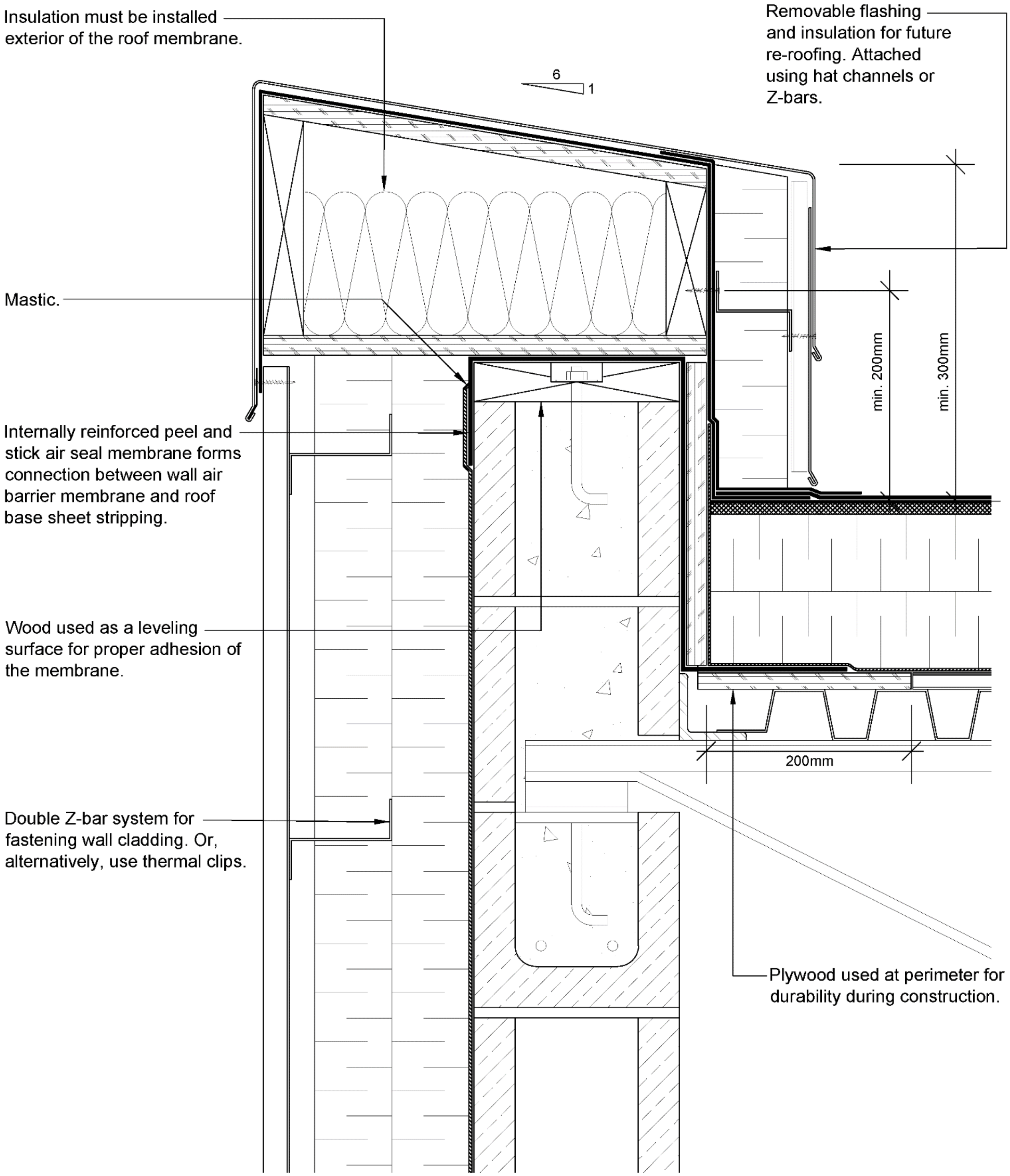

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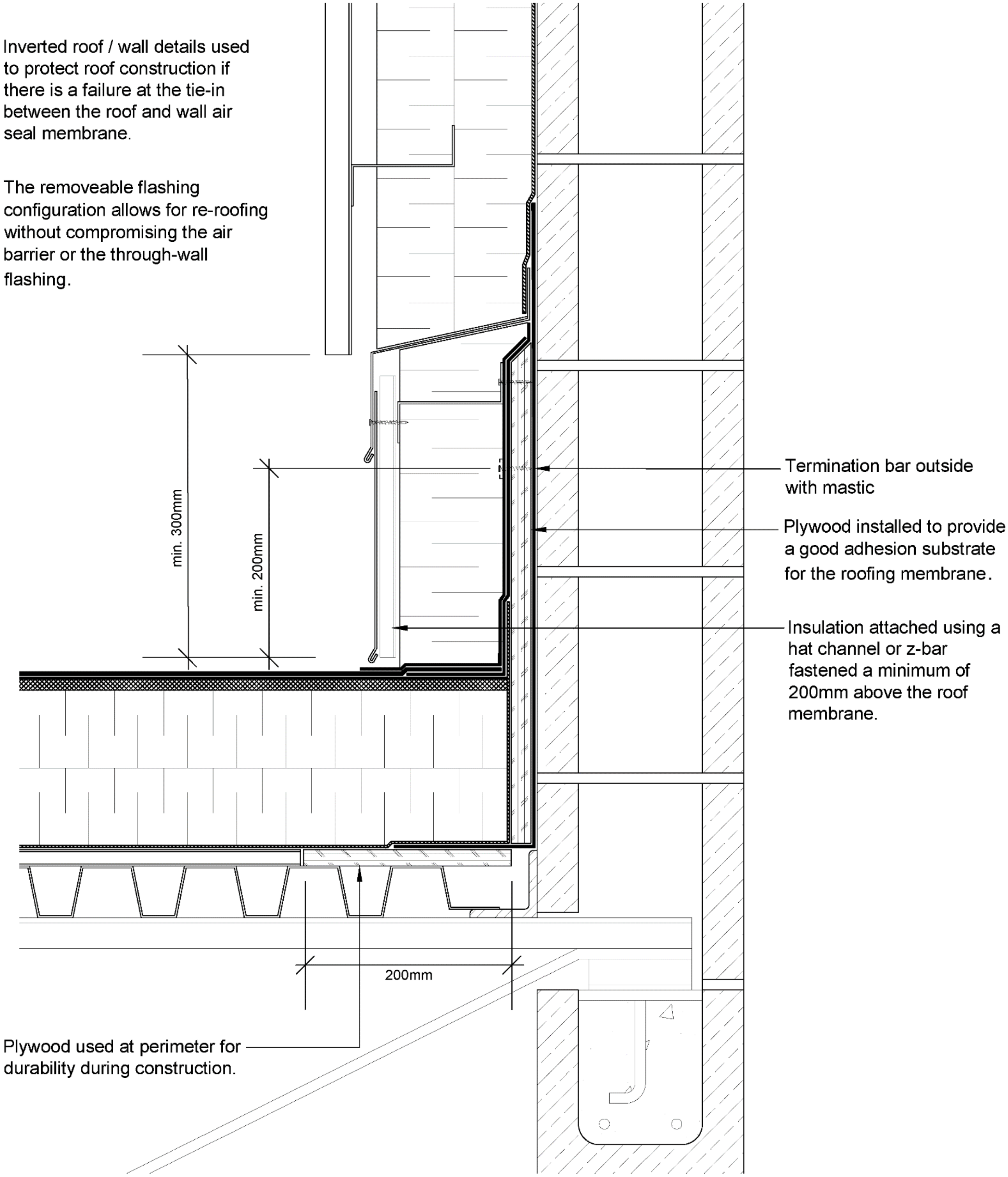
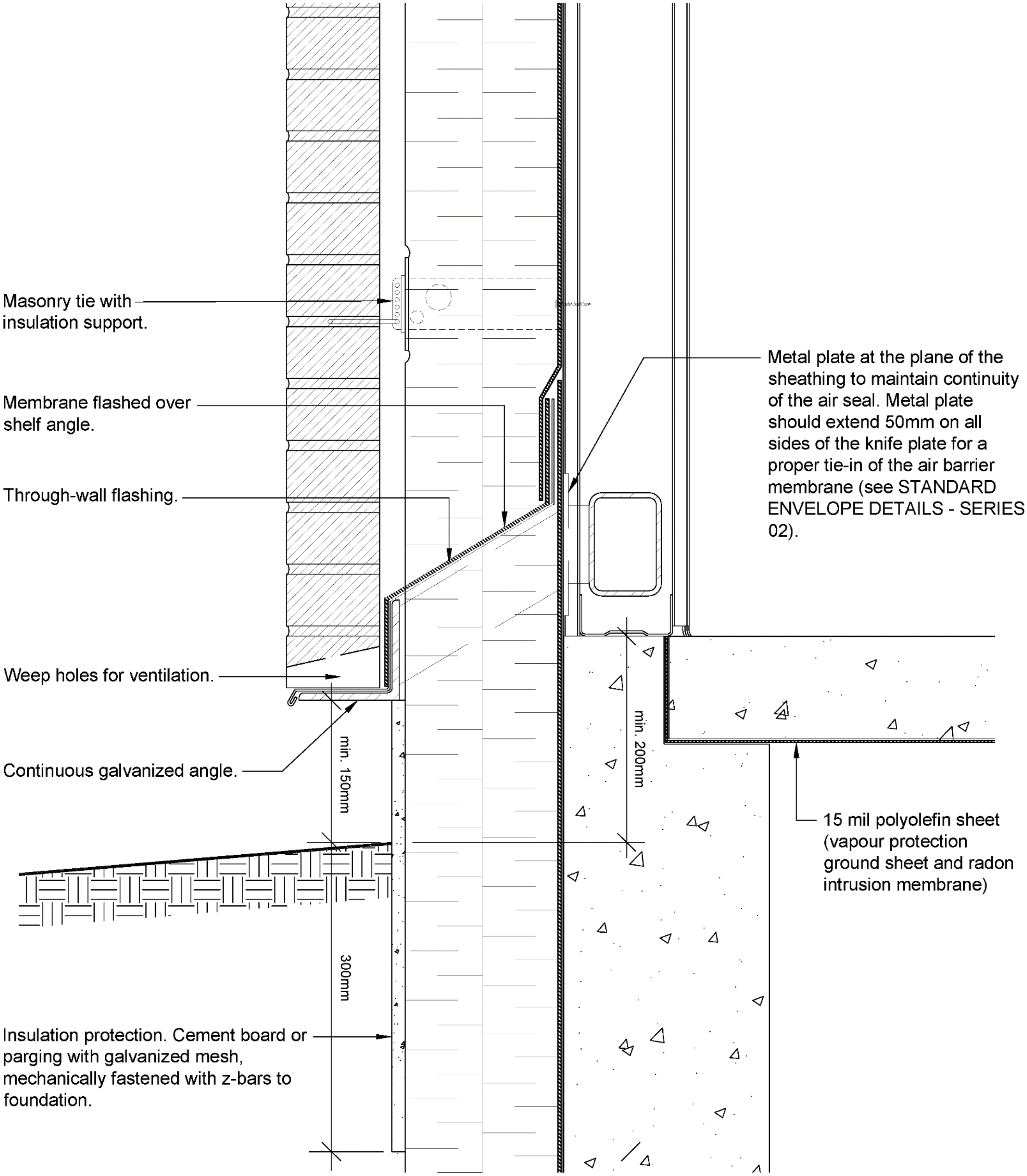


Alberta Infrastructure	SERIES 01 STANDARD ENVELOPE DETAILS INVERTED ROOF TO WALL		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 3
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-04	CHECKED BY V. SOLBAK	SCALE 1:5

Classification: Public



Alberta Infrastructure	SERIES 01 STANDARD ENVELOPE DETAILS FOUNDATION		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 4
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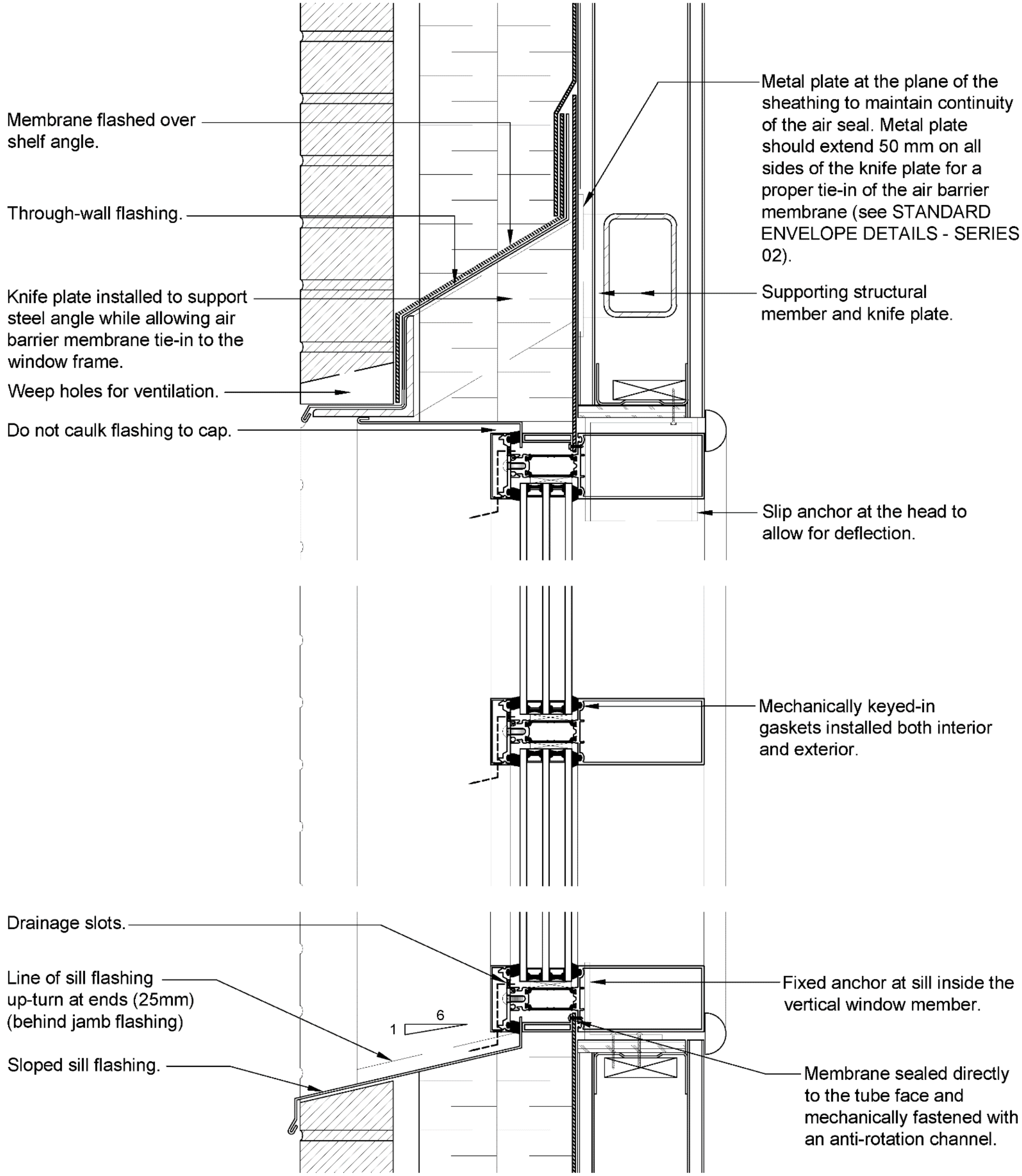
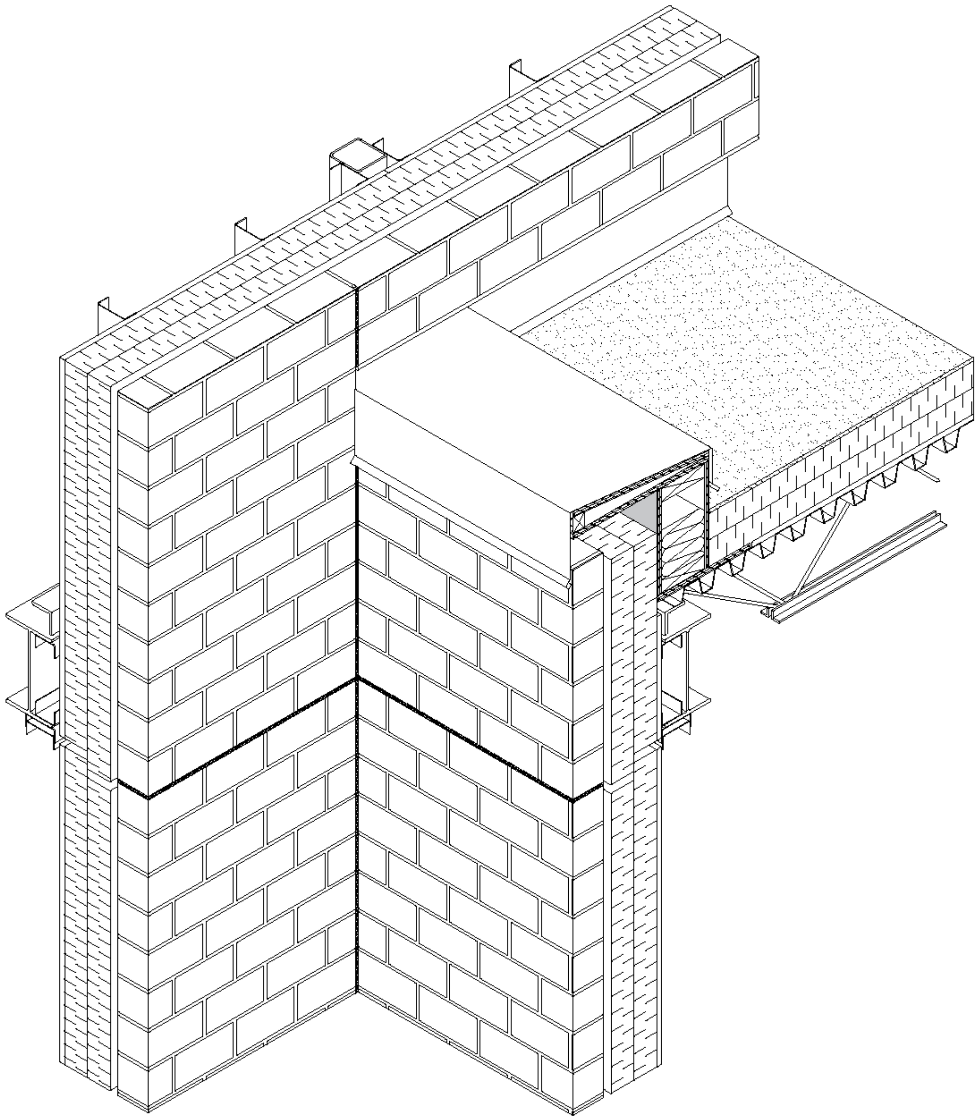
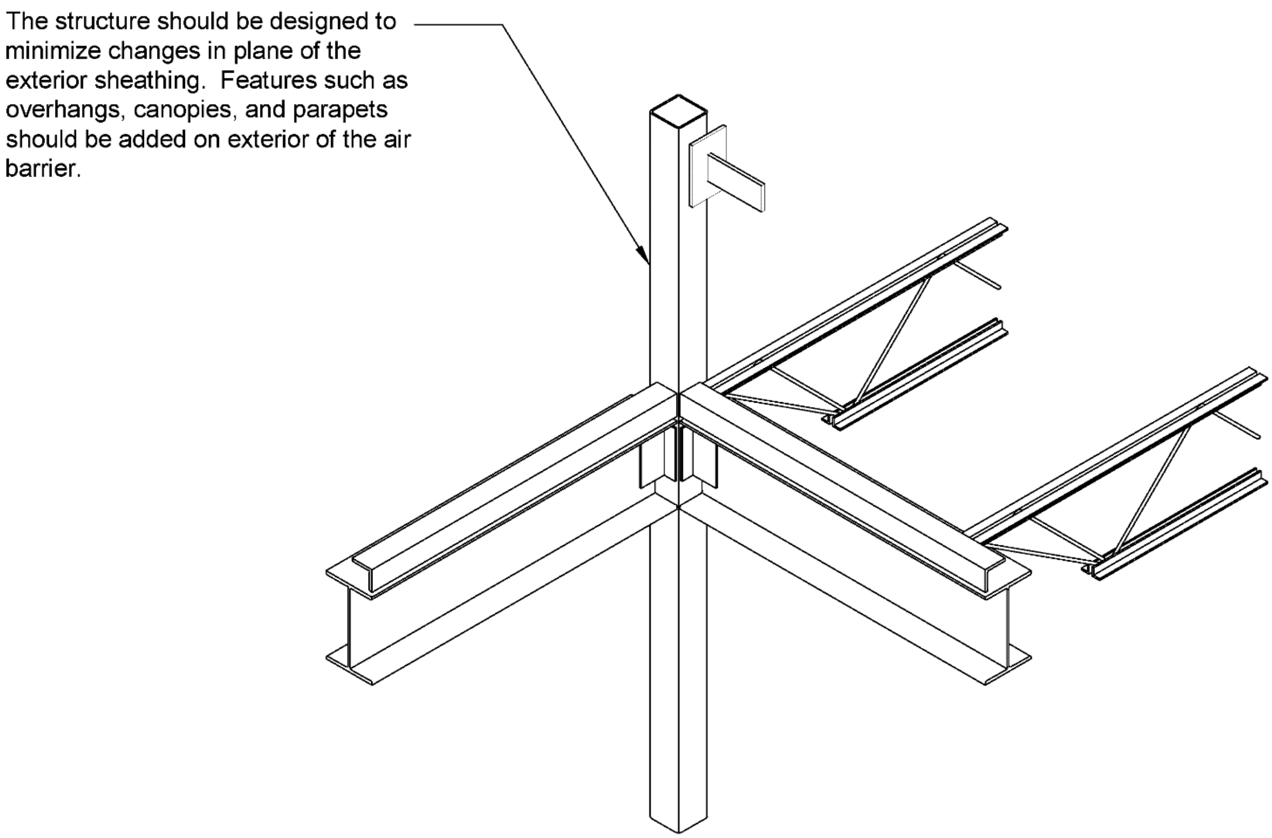


Alberta Infrastructure	SERIES 01 STANDARD ENVELOPE DETAILS PUNCHED WINDOW		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 5
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-04	CHECKED BY V. SOLBAK	SCALE 1:5	

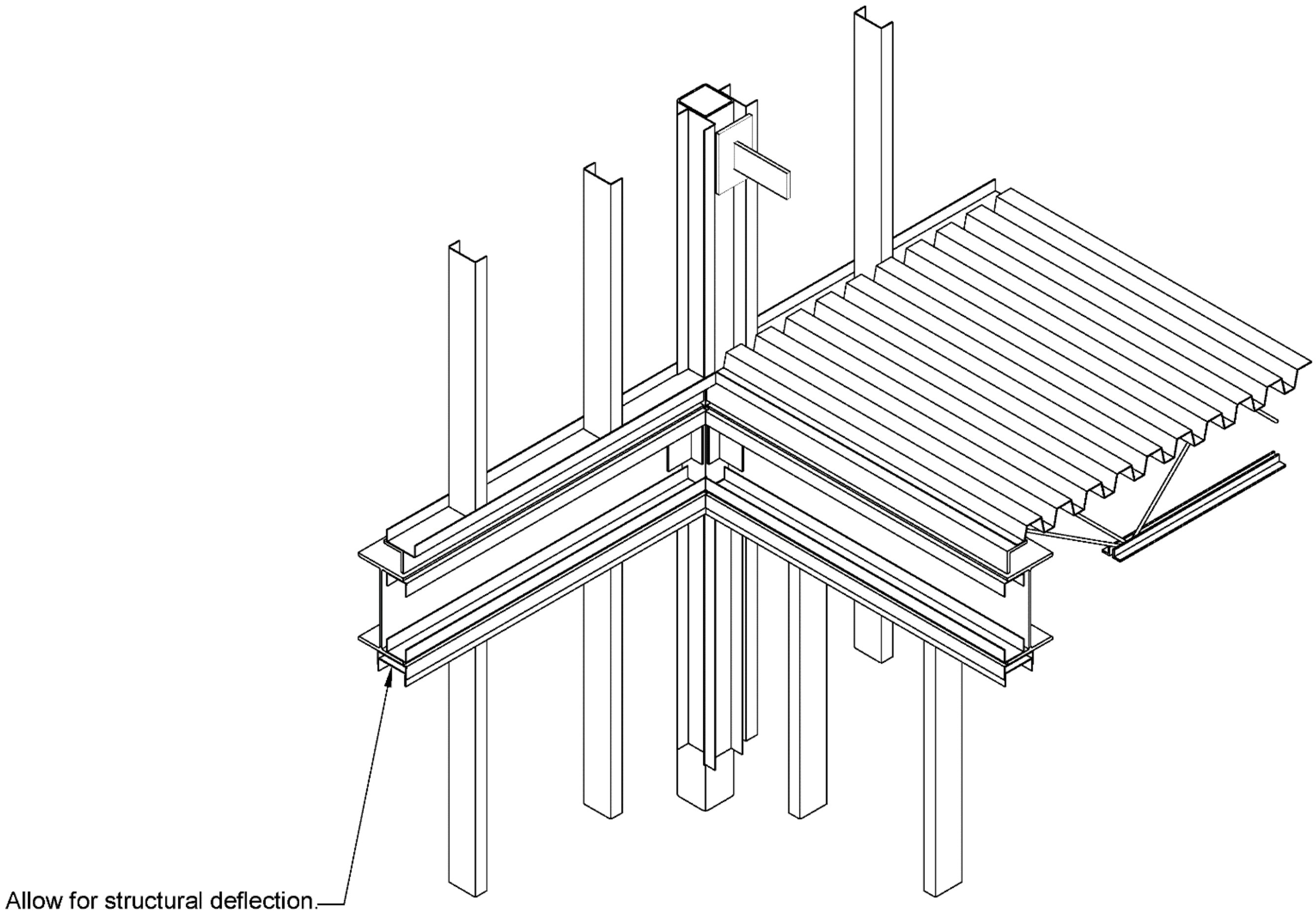
Classification: Public



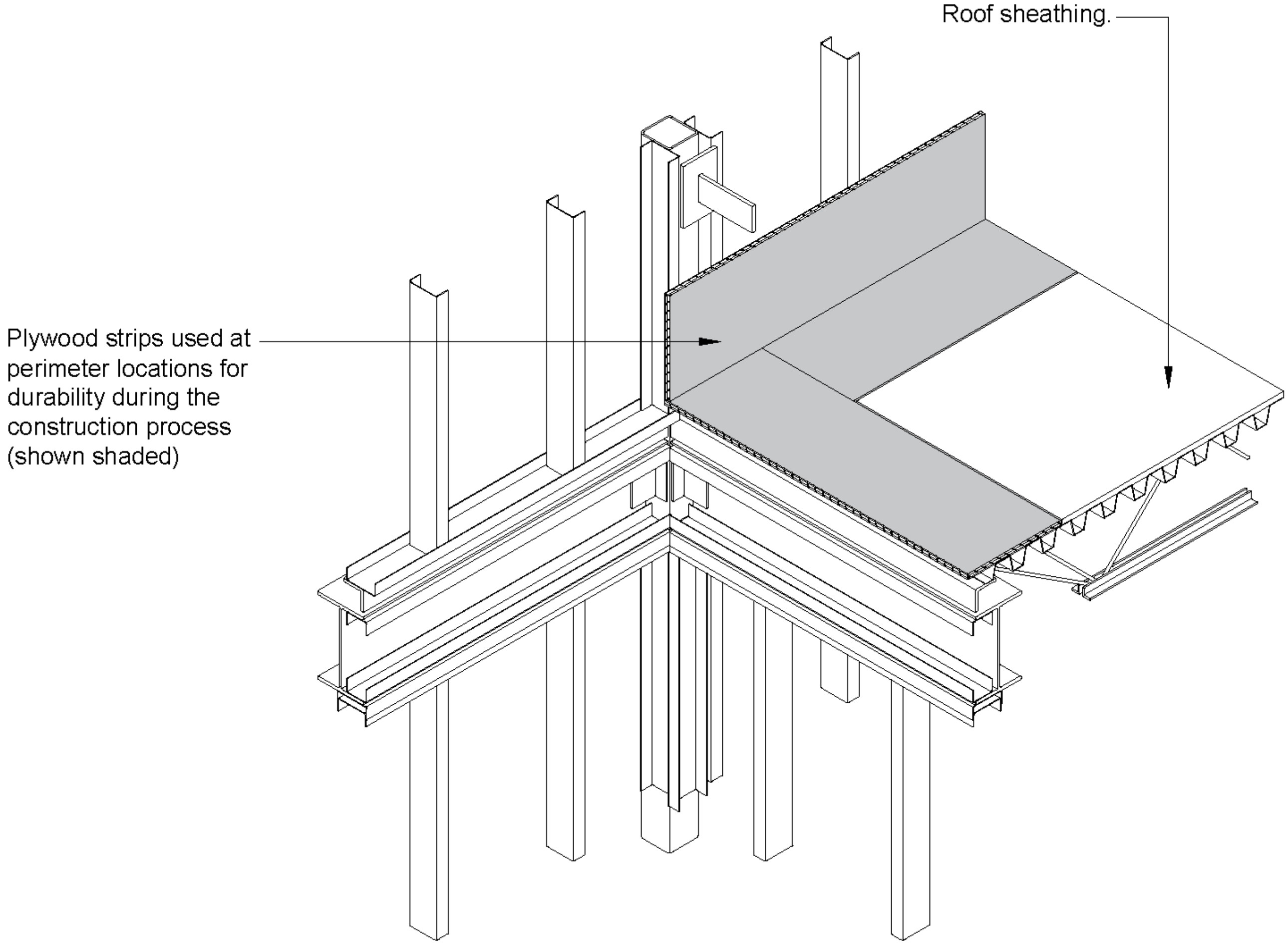
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 0
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



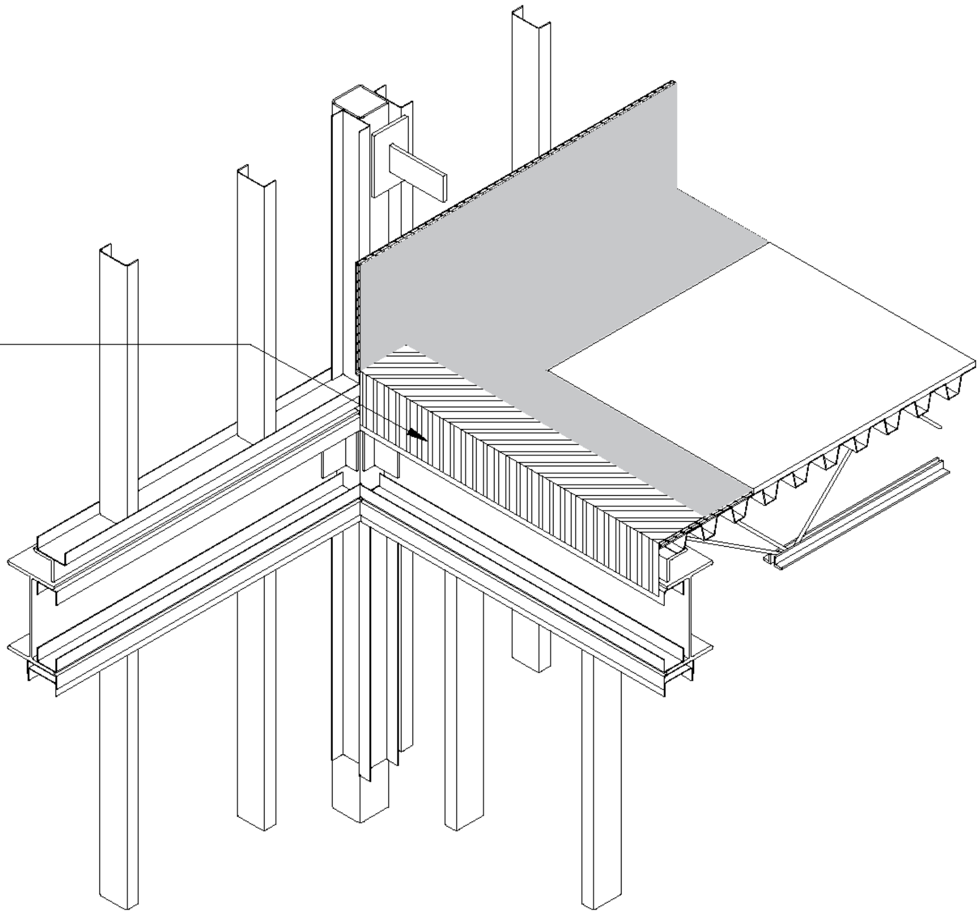
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 1
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



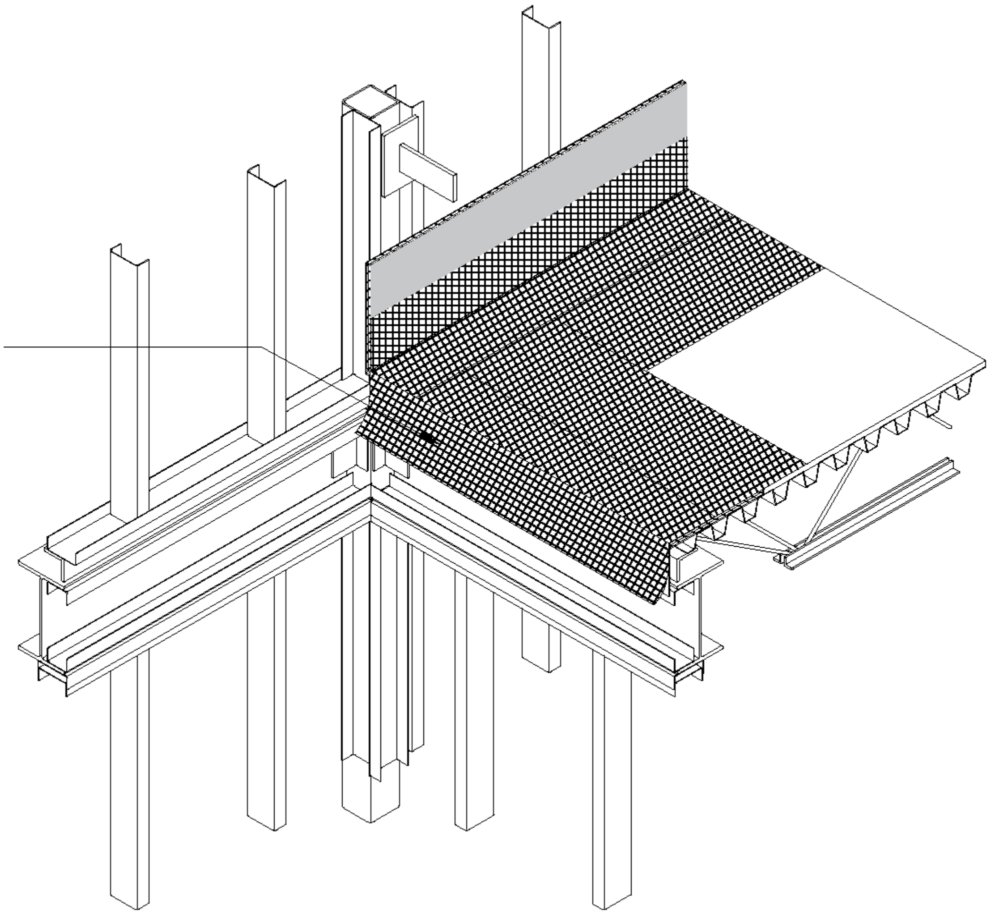
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 2
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



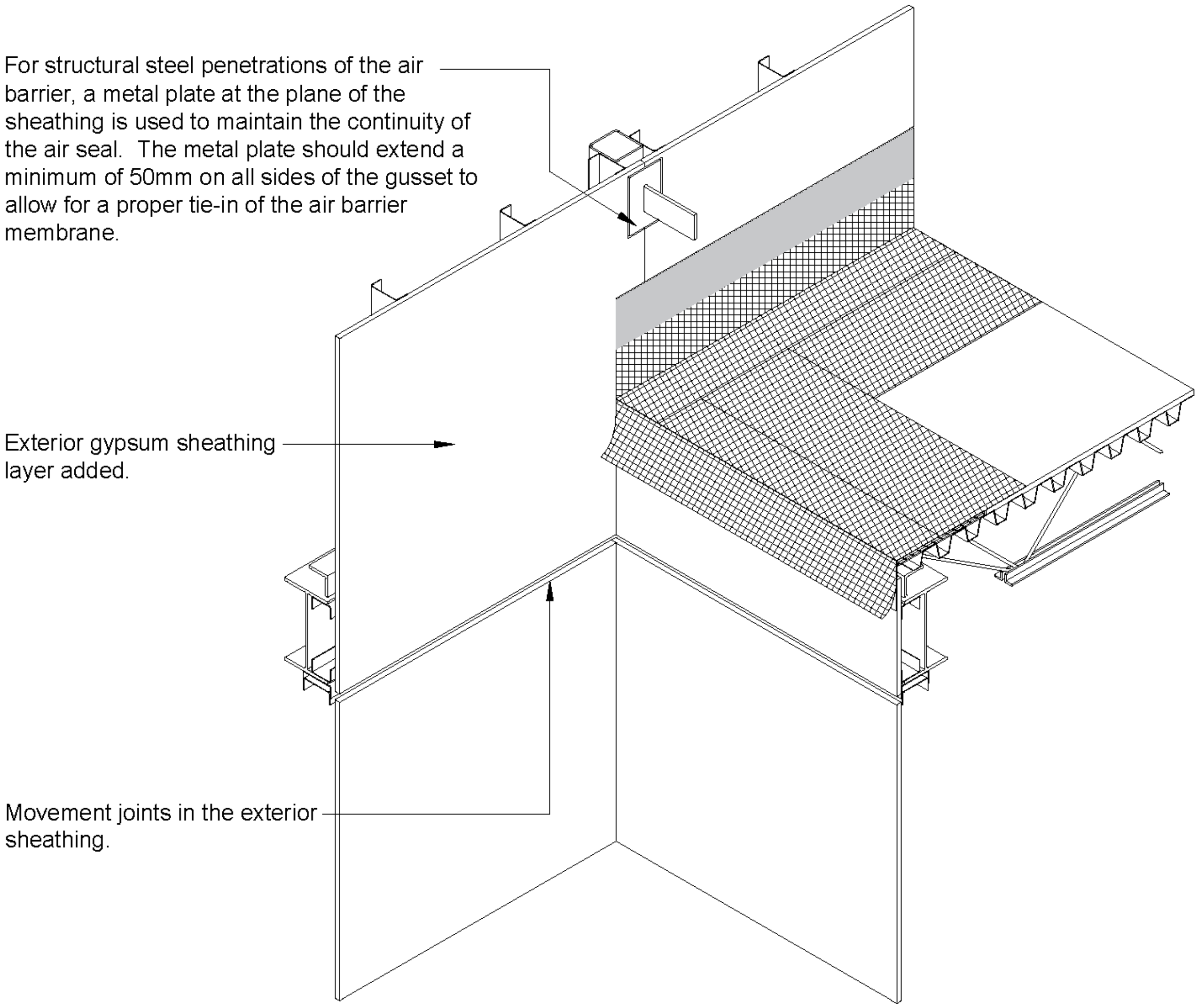
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 3
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



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	

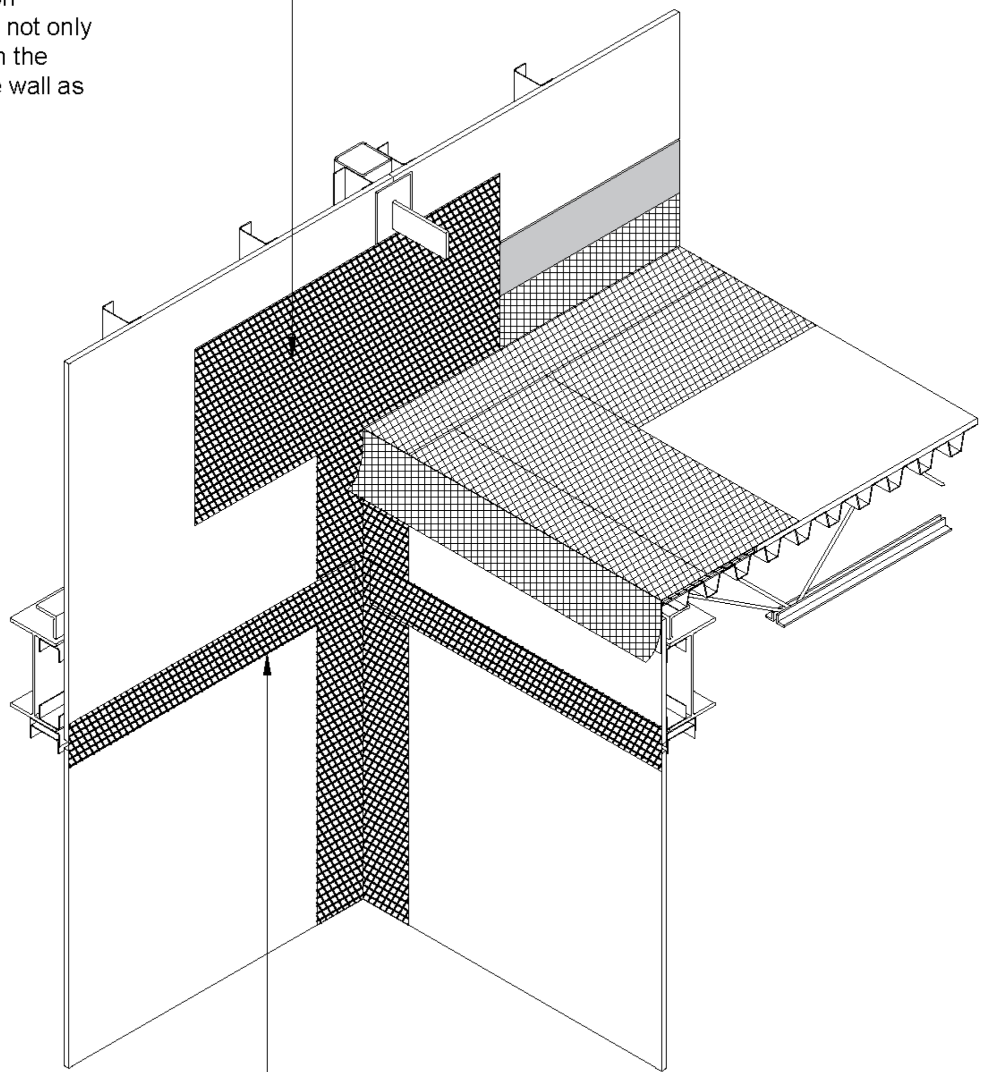


Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 5
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



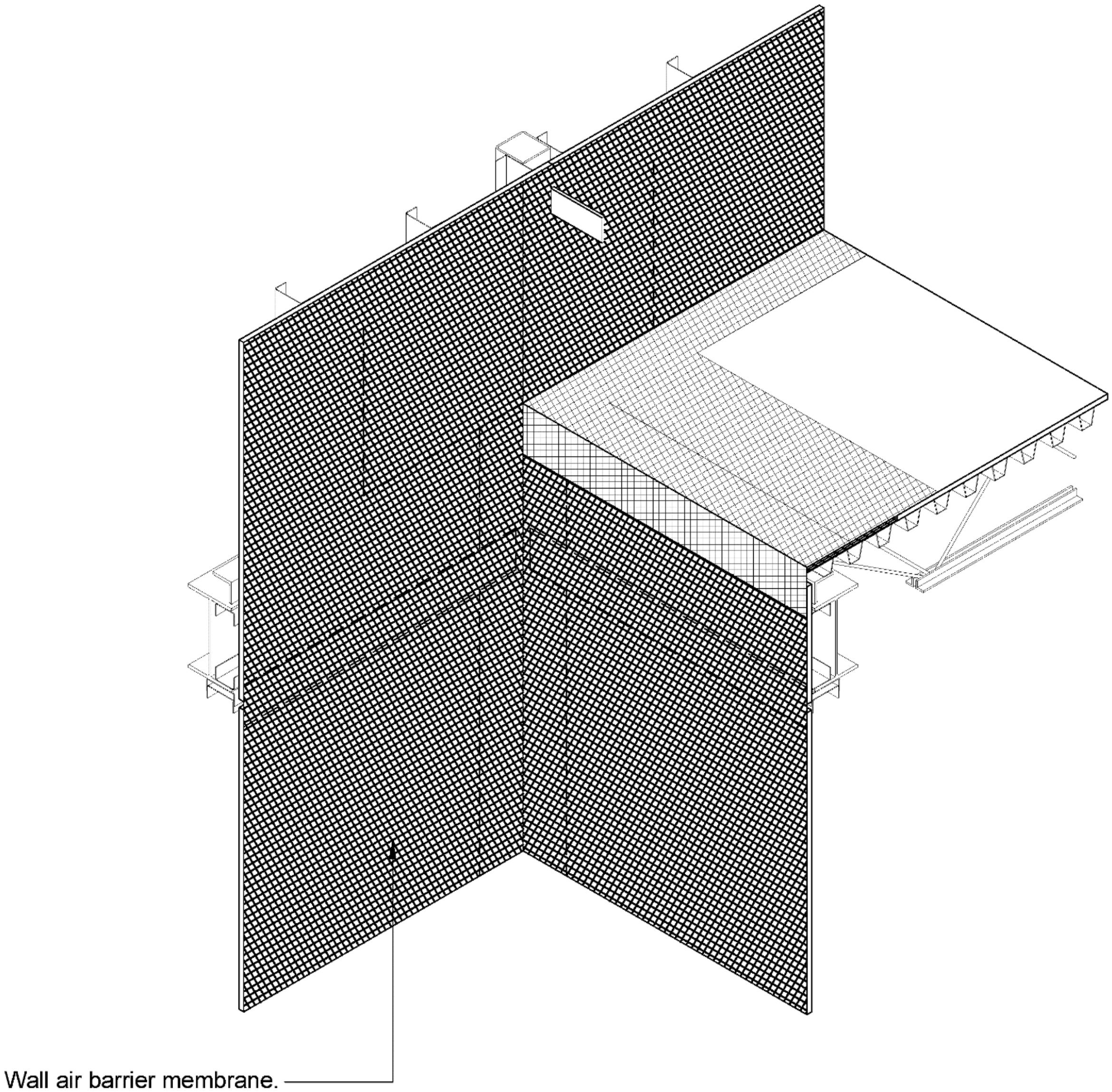
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 6
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS

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.

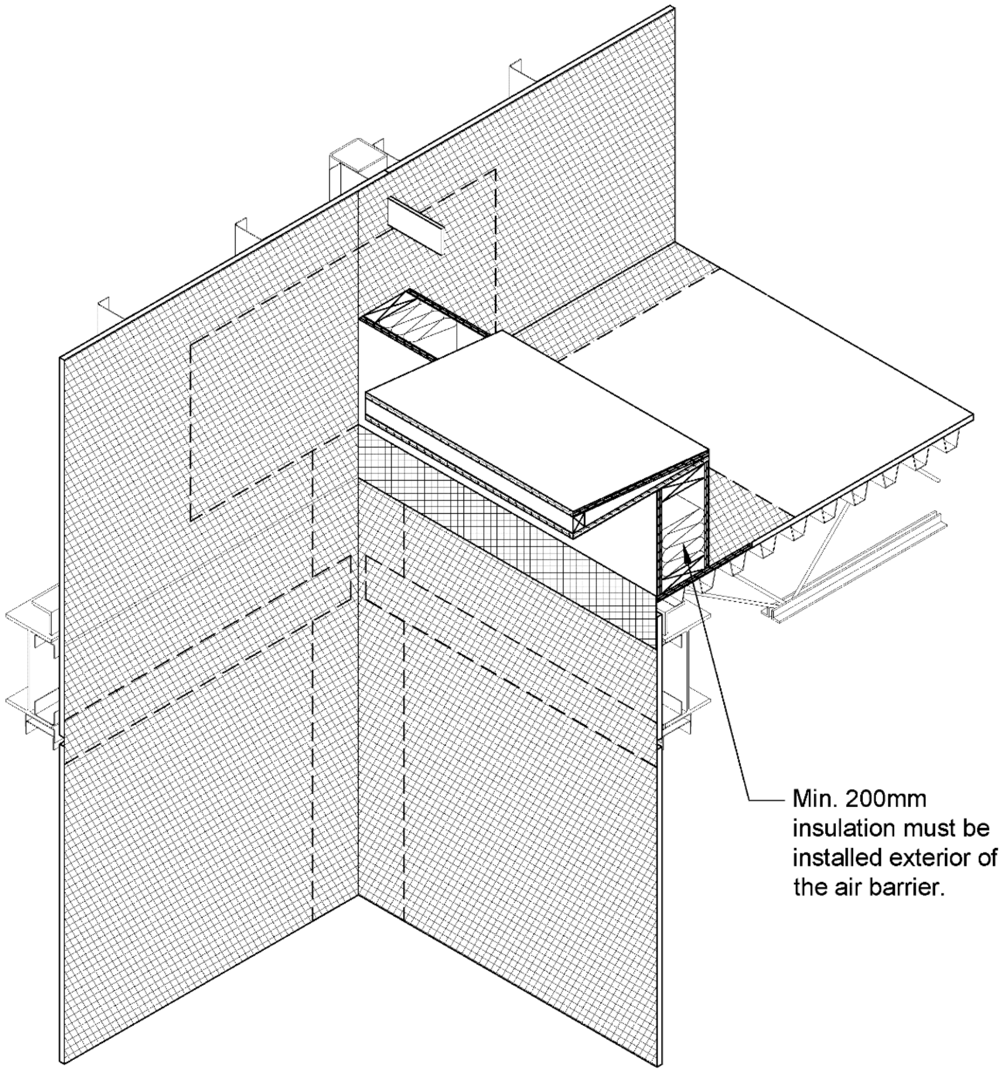


Strip of reinforcing membrane installed over movement joints. Depending on the amount of expected deflection, a slip sheet or sheet metal backing are alternative options, or consider a higher performing material such as silicone transition strips that have better expansion characteristics.

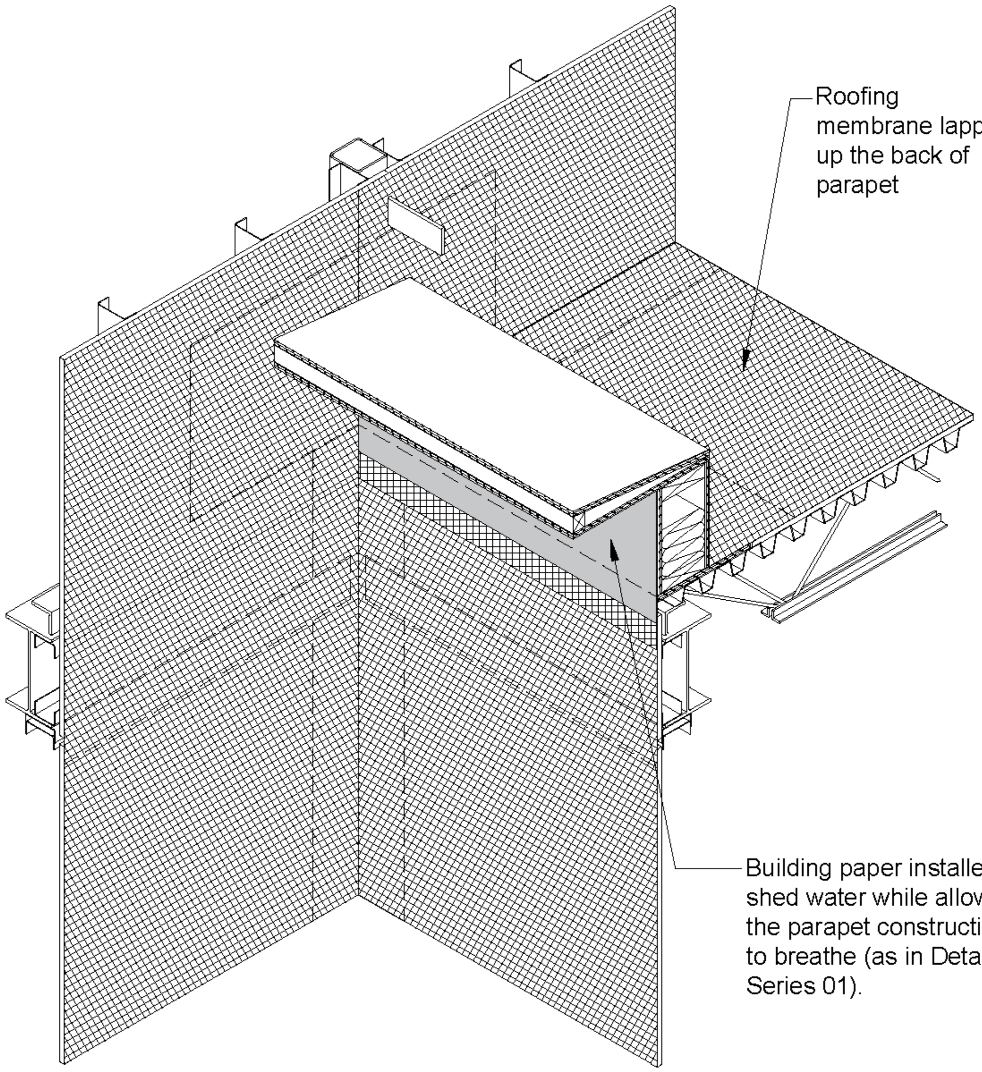
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 7
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



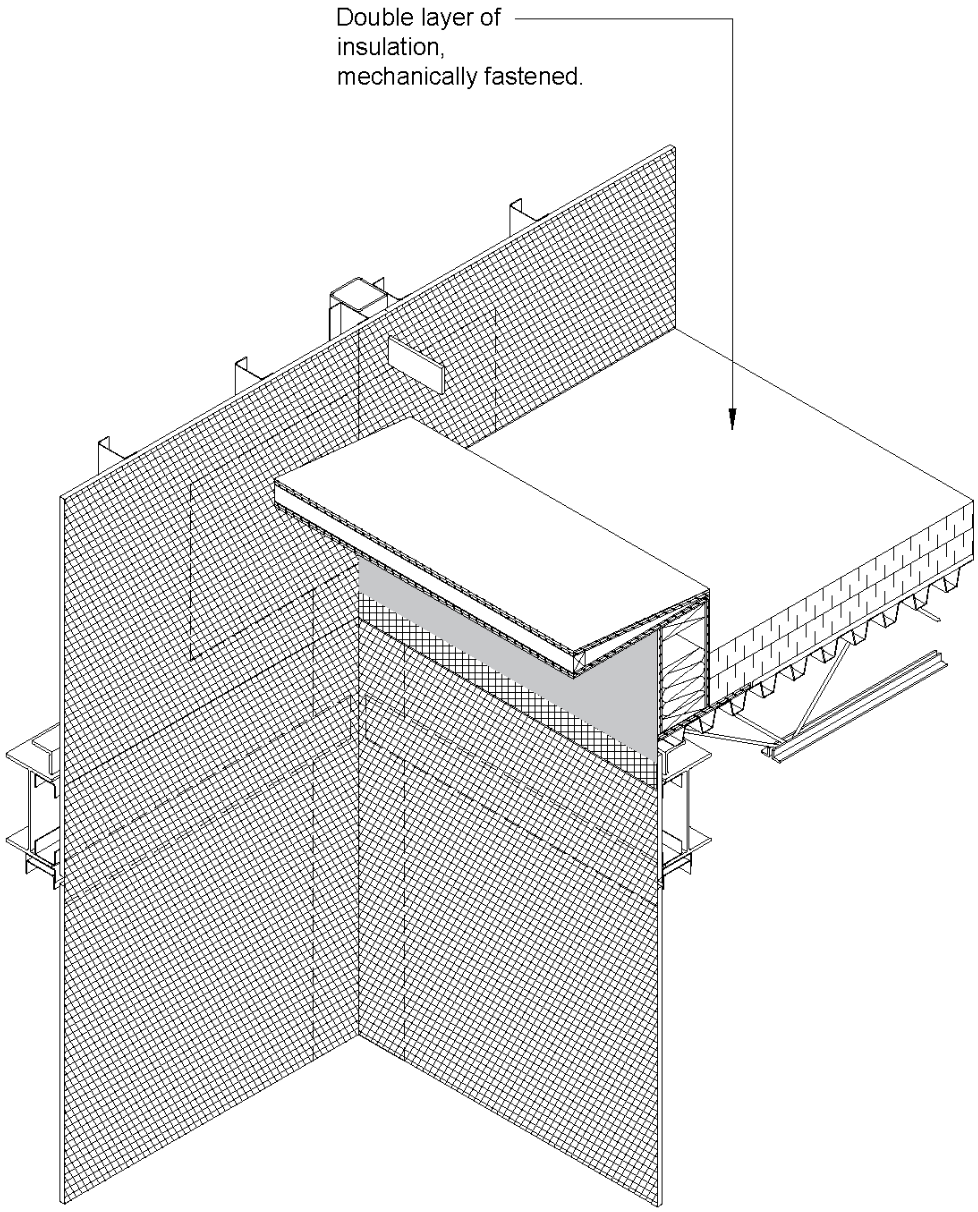
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 8
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



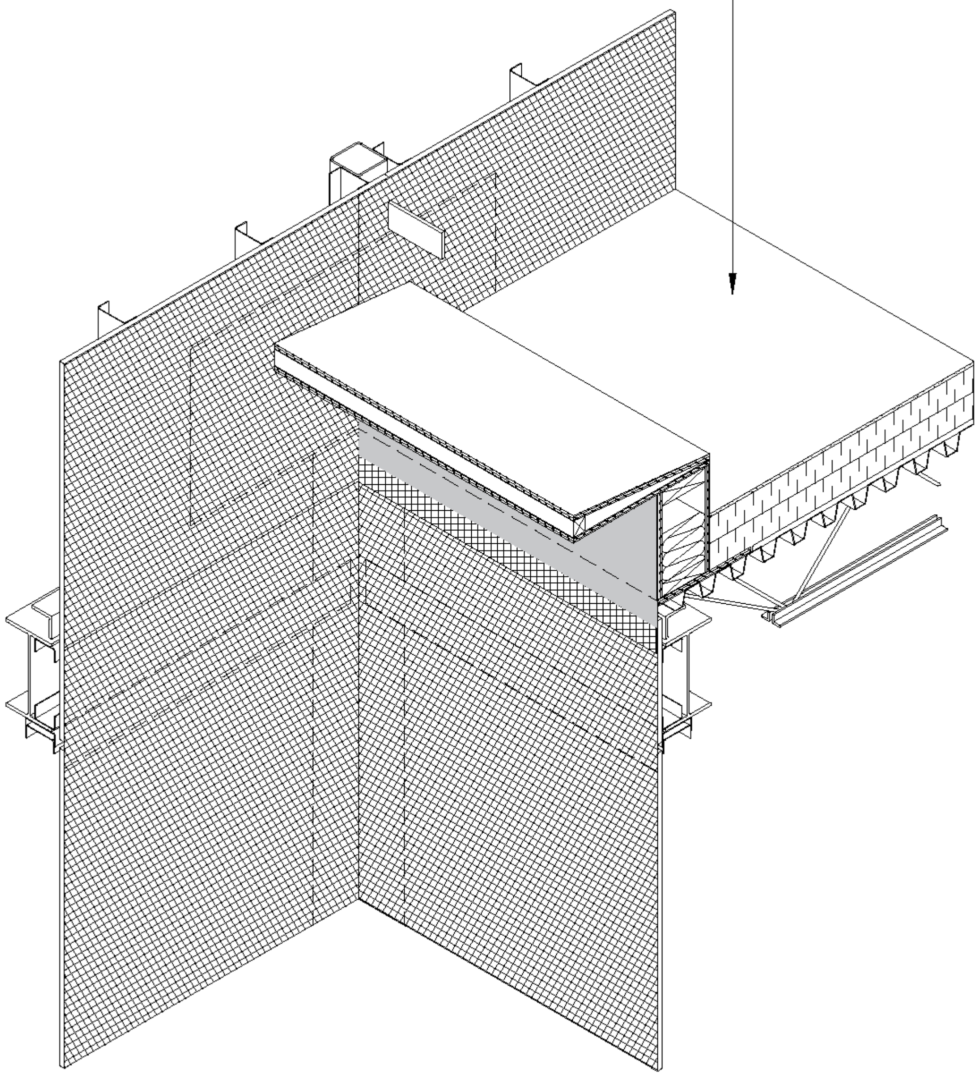
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 9
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



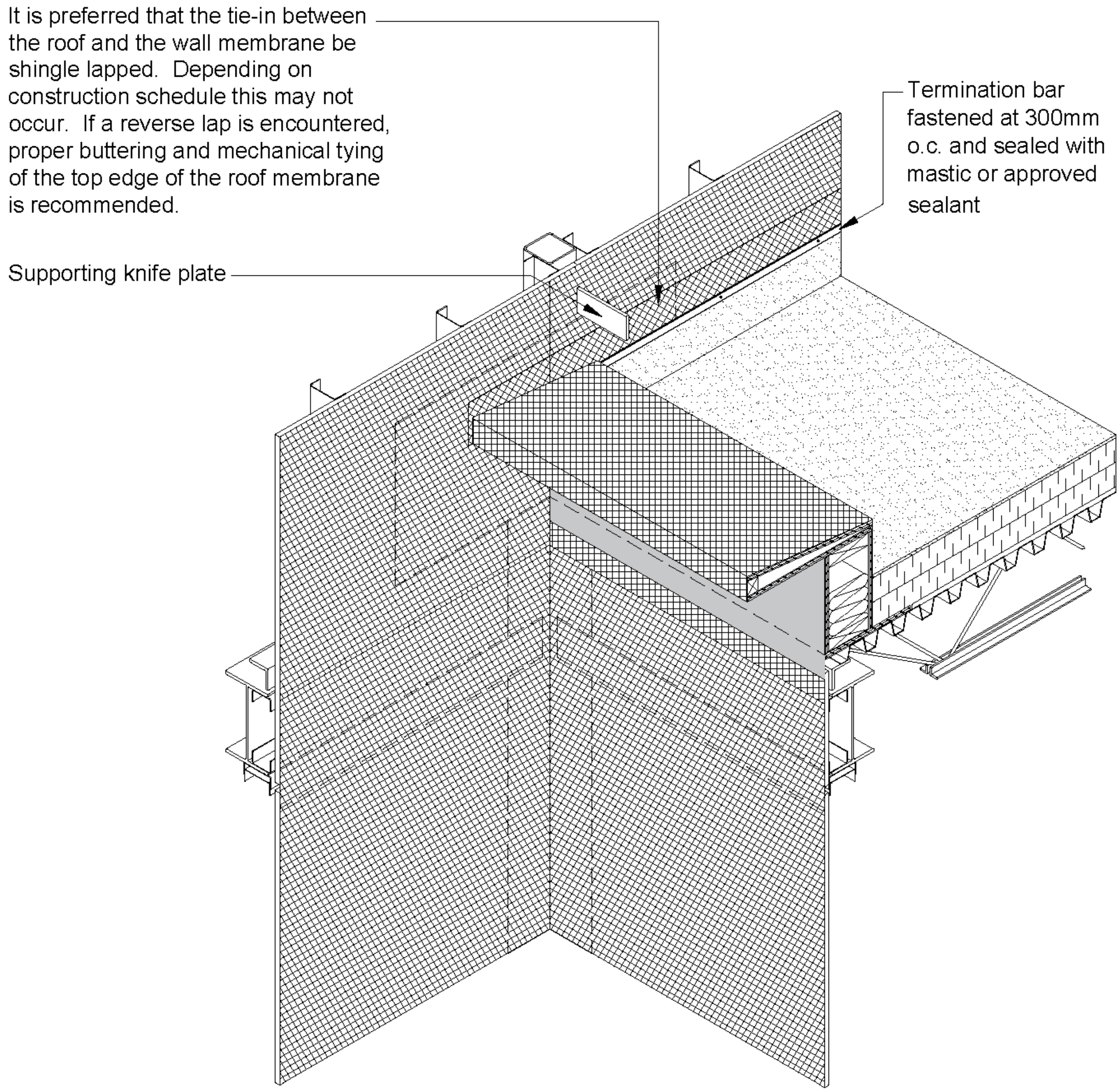
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 10
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



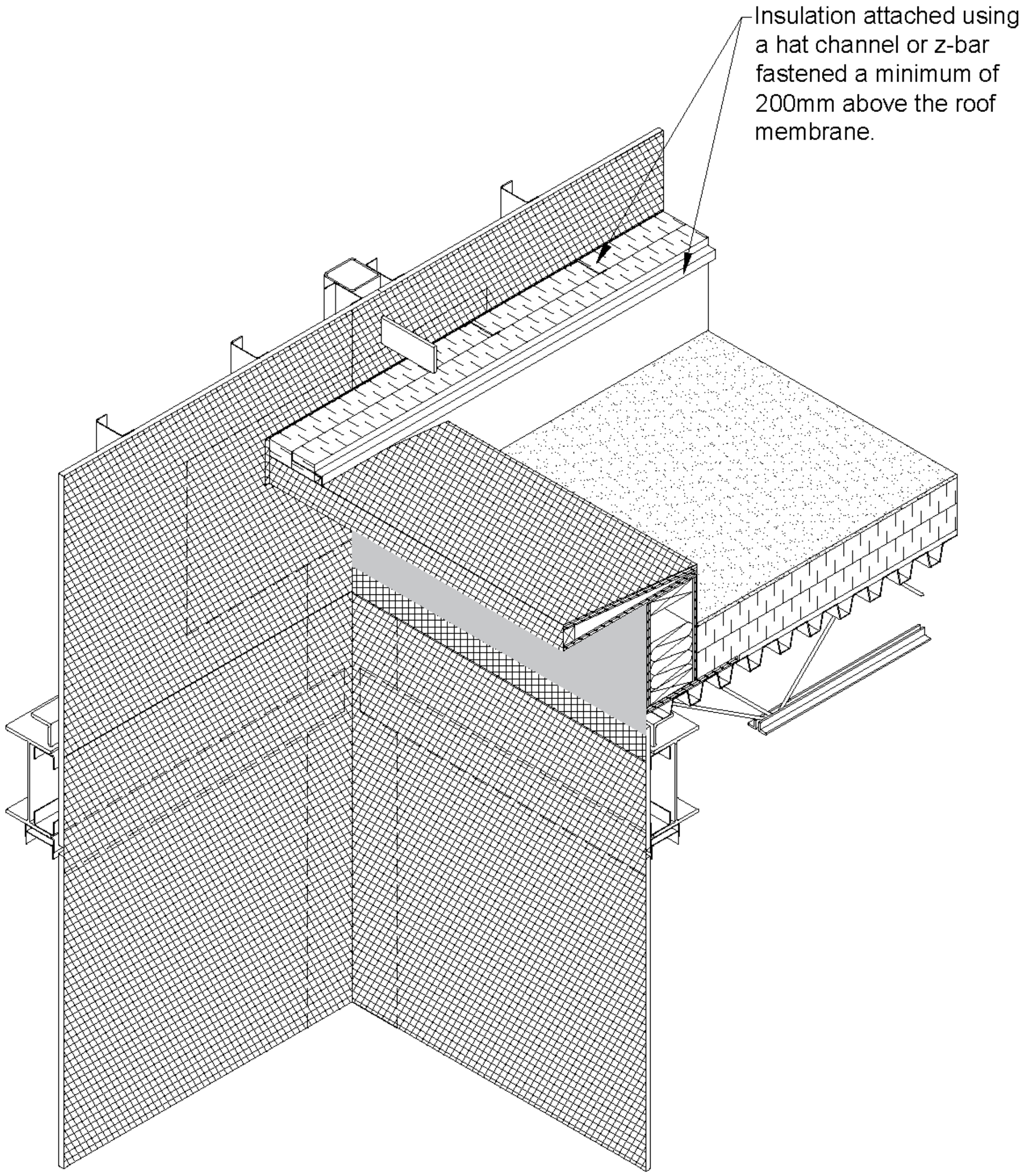
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 11
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



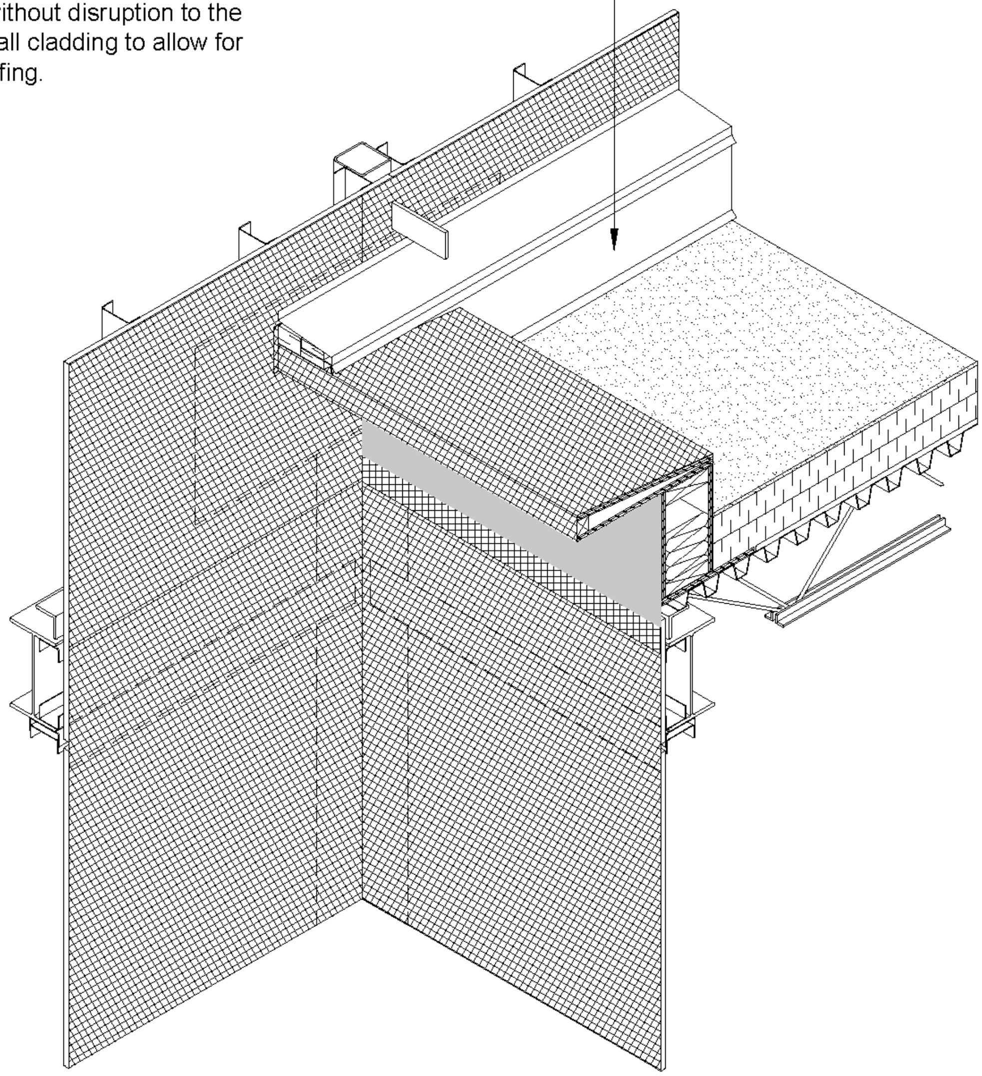
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 12
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS



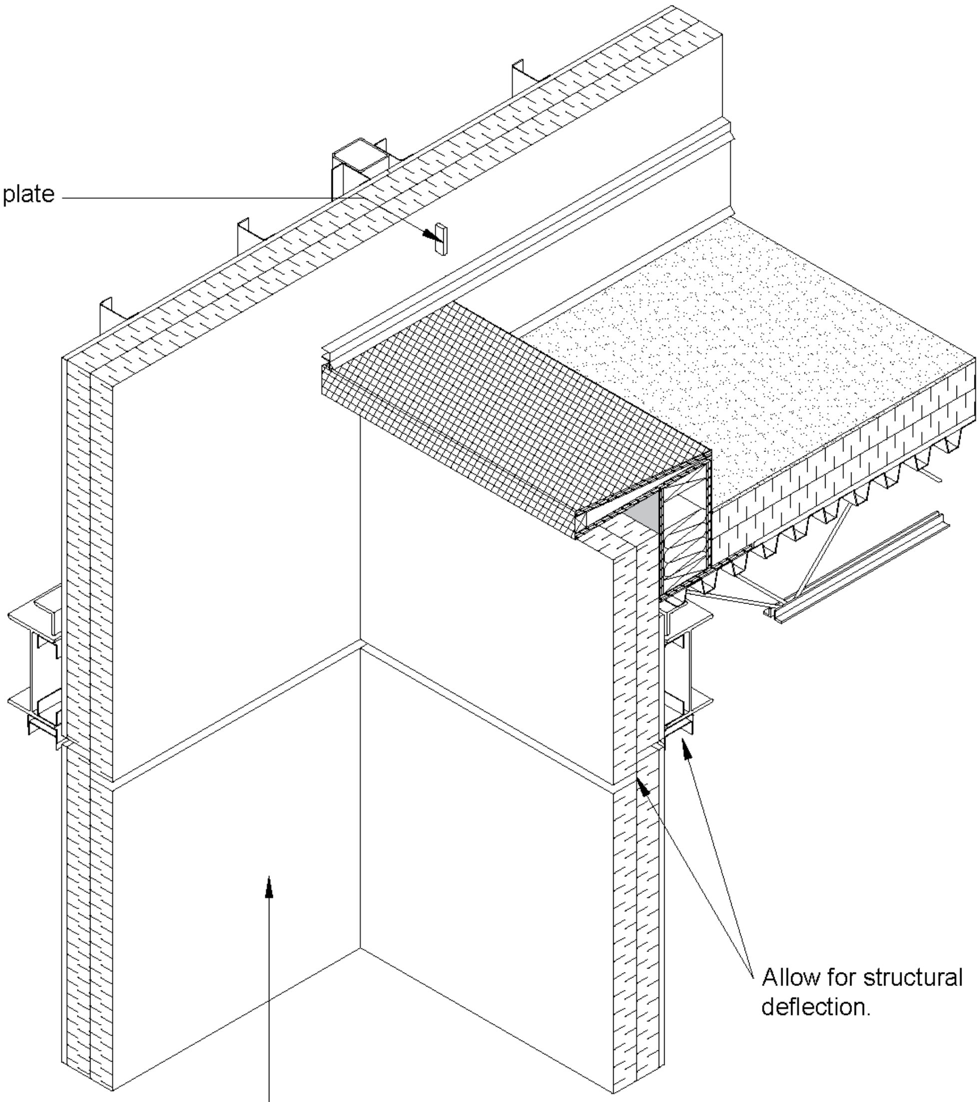
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 13
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



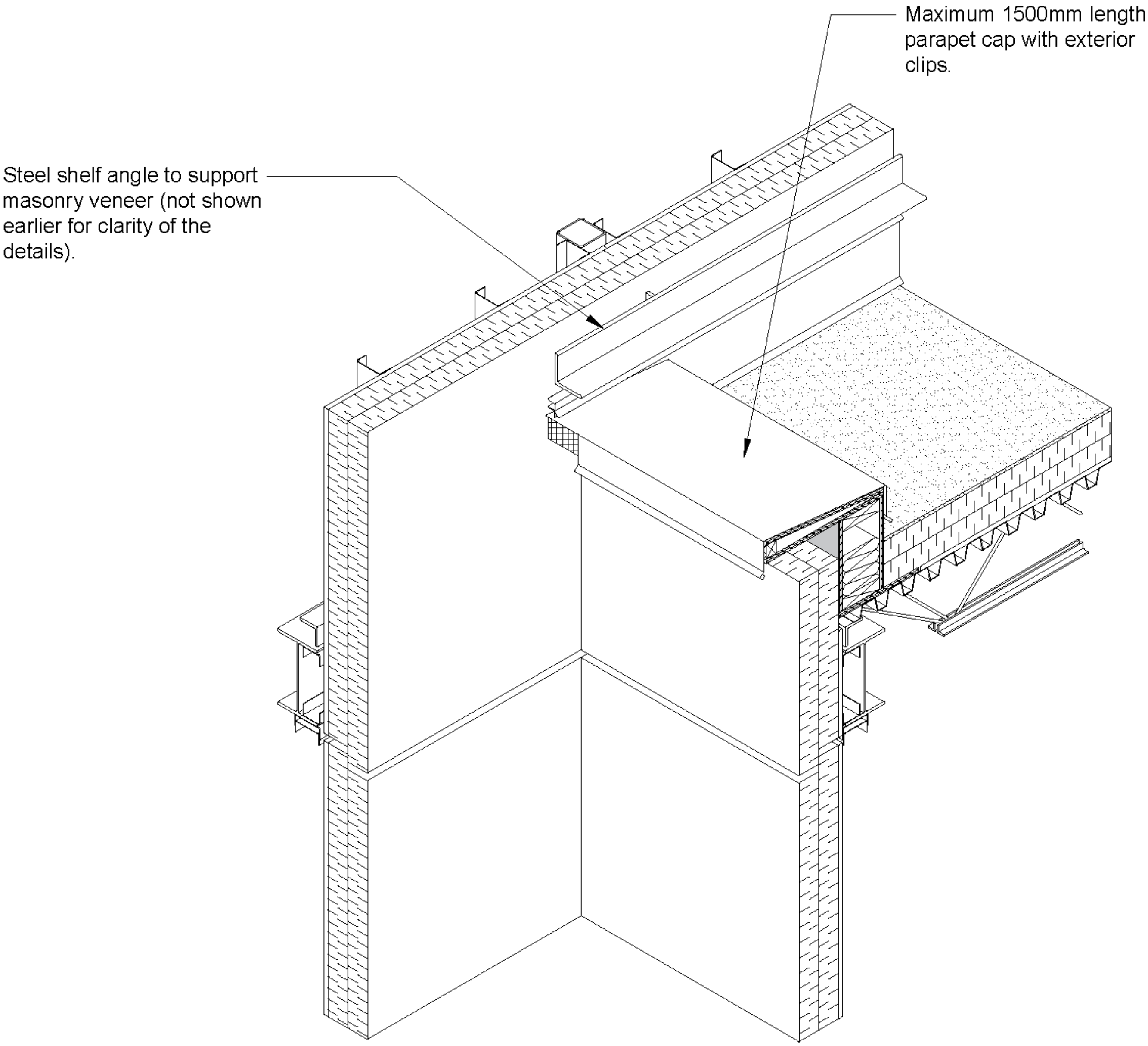
Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 14
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	



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	

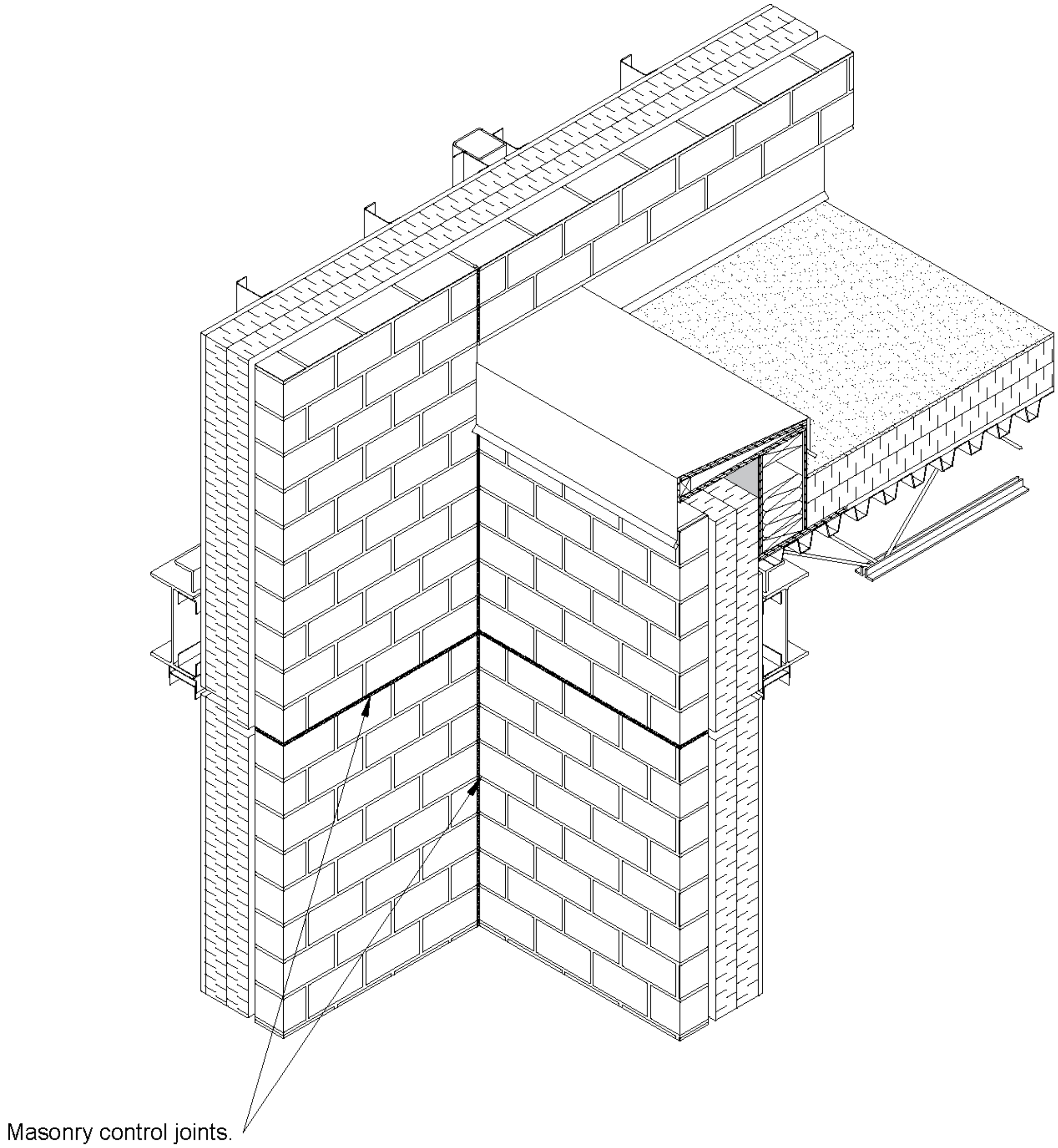


Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 16
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	

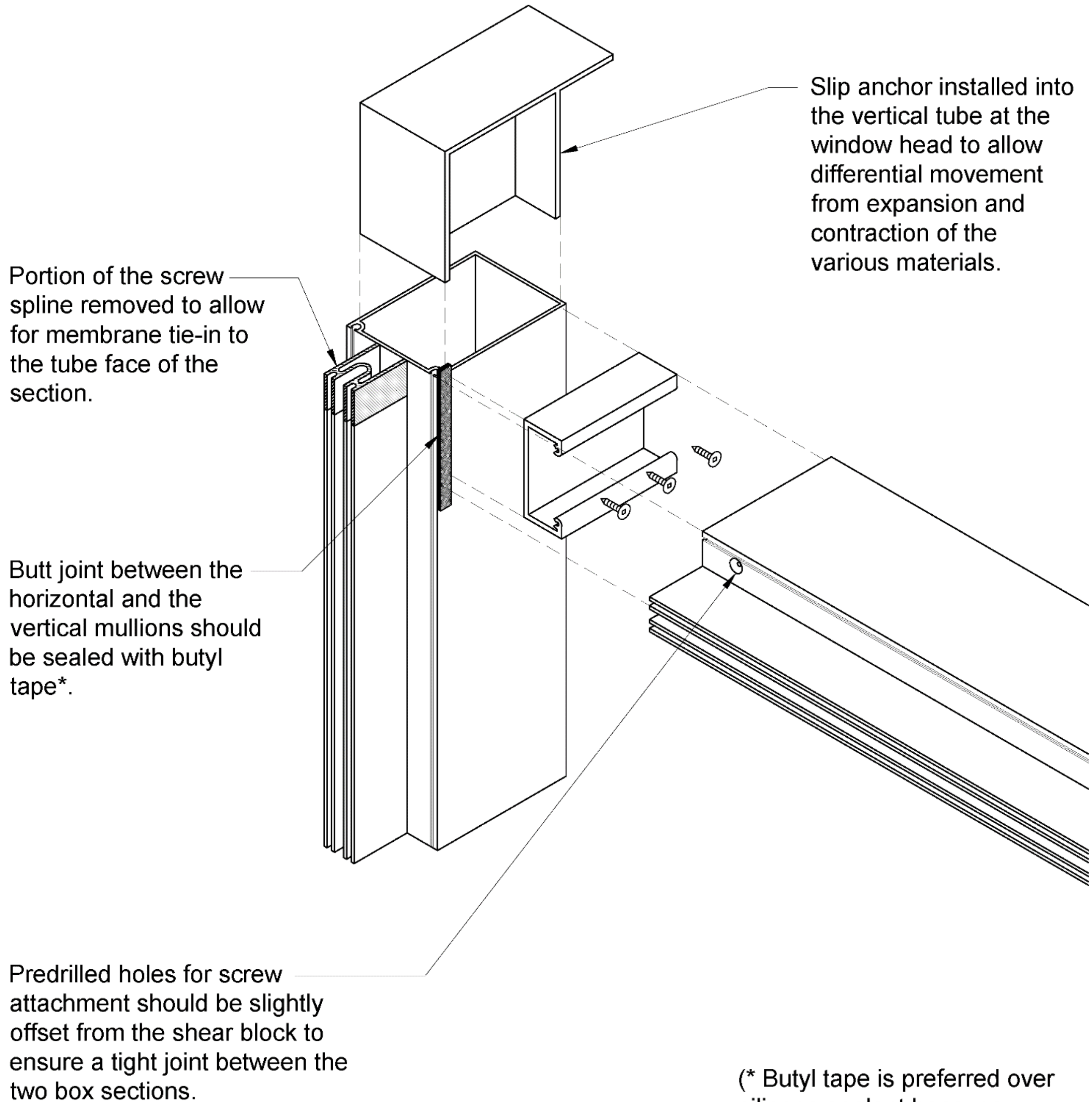


Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 17
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	

Classification: Public

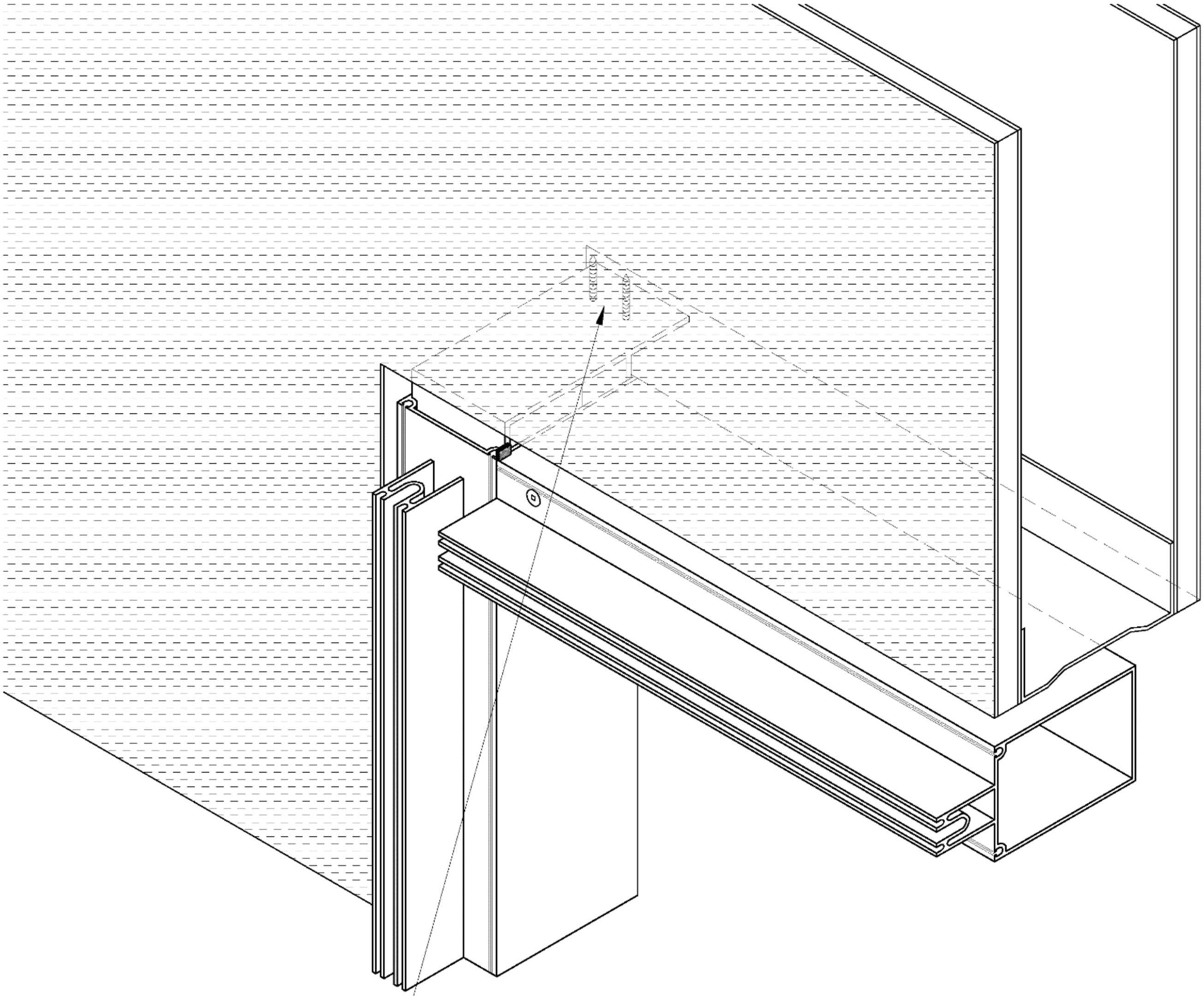


Alberta Infrastructure	SERIES 02 STANDARD ENVELOPE ASSEMBLY ISOMETRIC DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 18
	DRAWN BY E. RIVERA / M. WHITE	DATE 2016-10-05	CHECKED BY V. SOLBAK	SCALE NTS	

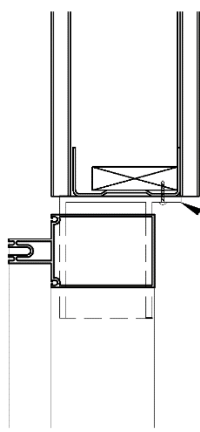


(* Butyl tape is preferred over silicone sealant because silicone will set up over time and if the seal fails it will not re-seal. Butyl will remain tacky and will re-seal when the temperature of the frame is increased.)

Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 1
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	

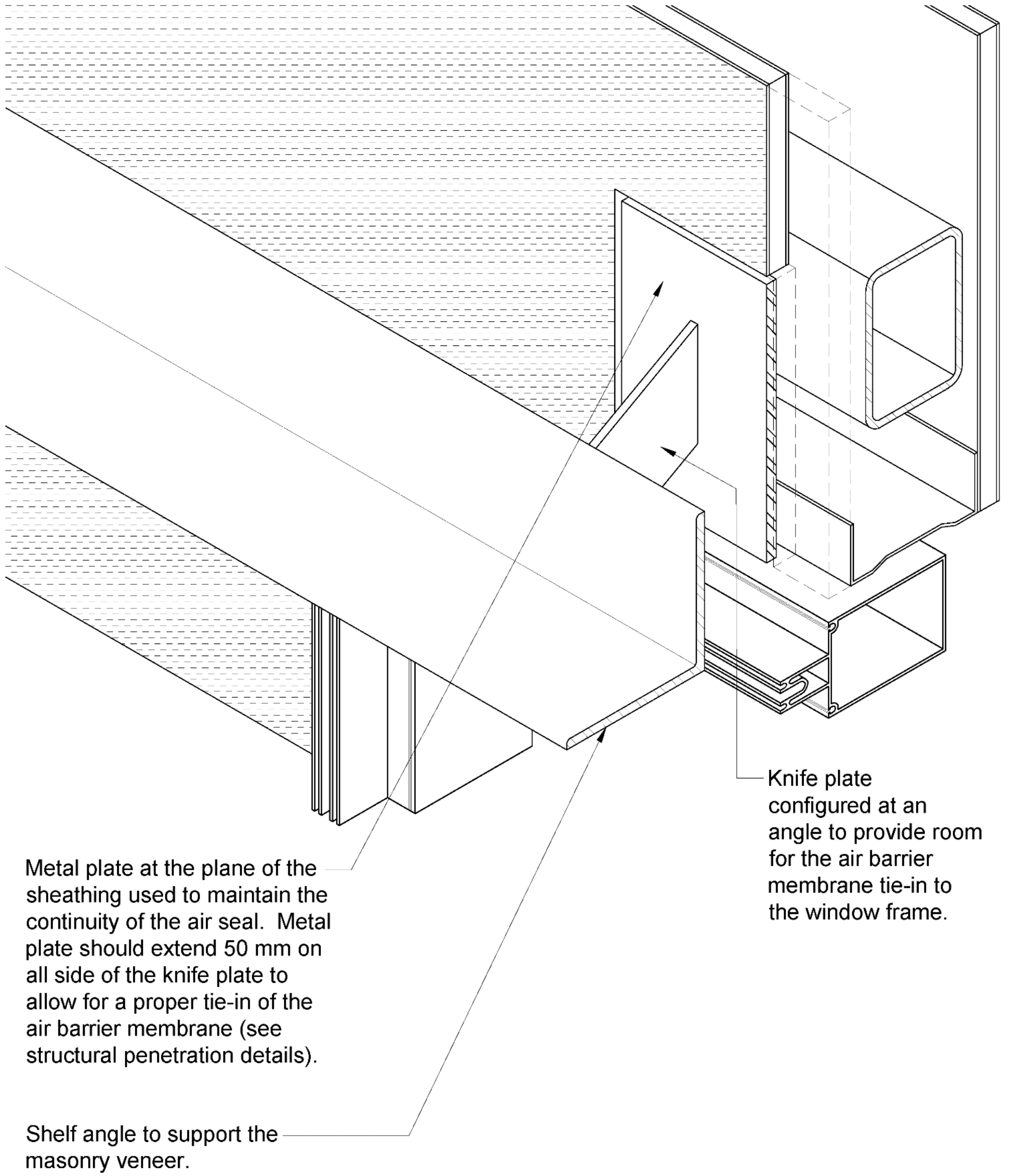


Window frame tilted up into the rough opening and the slip anchor at the head is fastened into the structure. The frame is positioned so the tube face of the box curtain-wall section is in plane with the face of the exterior sheathing.

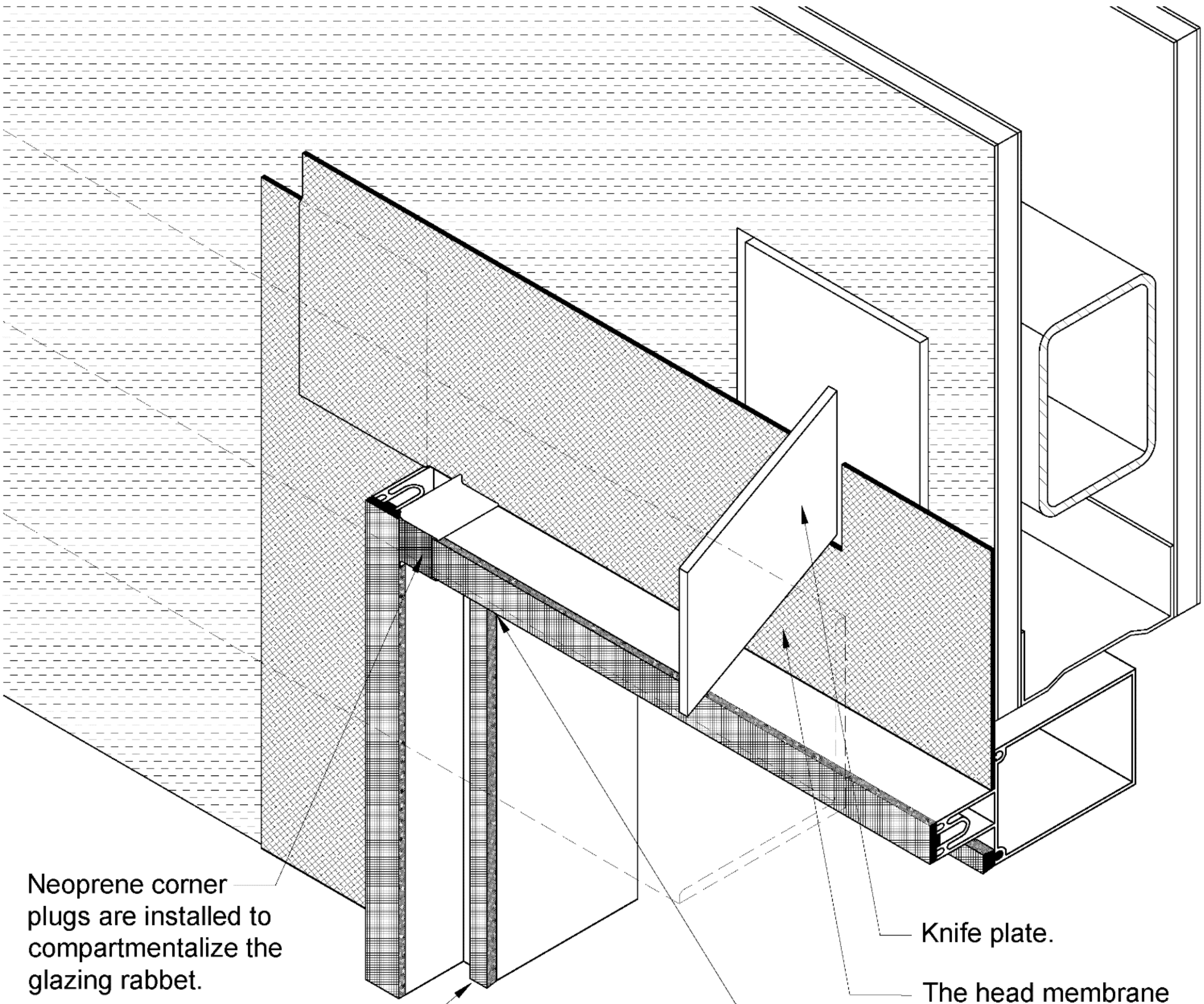


Flange on the slip anchor needs to extend far enough beyond the frame to allow for fastening into the head of the rough opening after the frame is set in place.

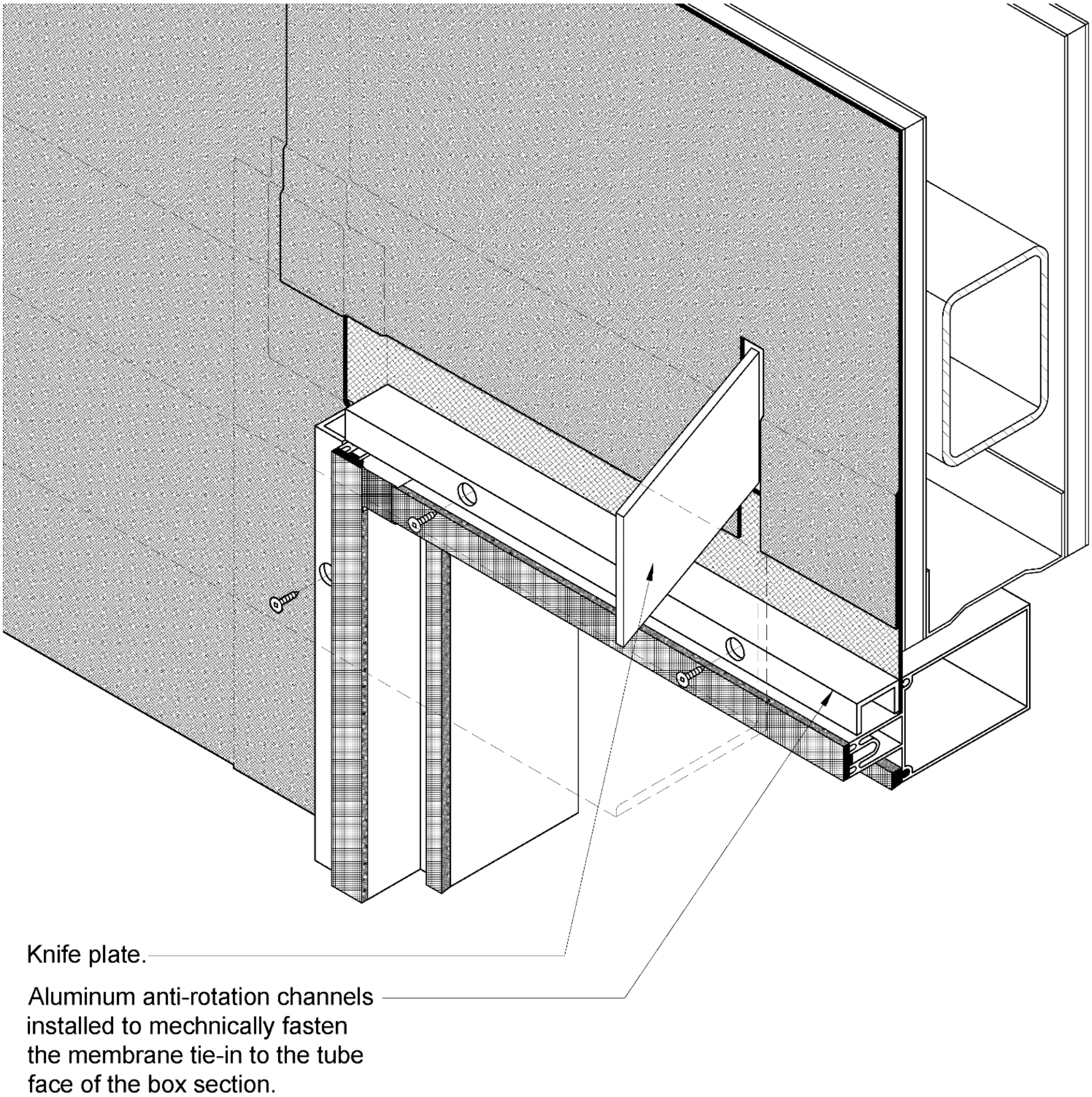
Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 2
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



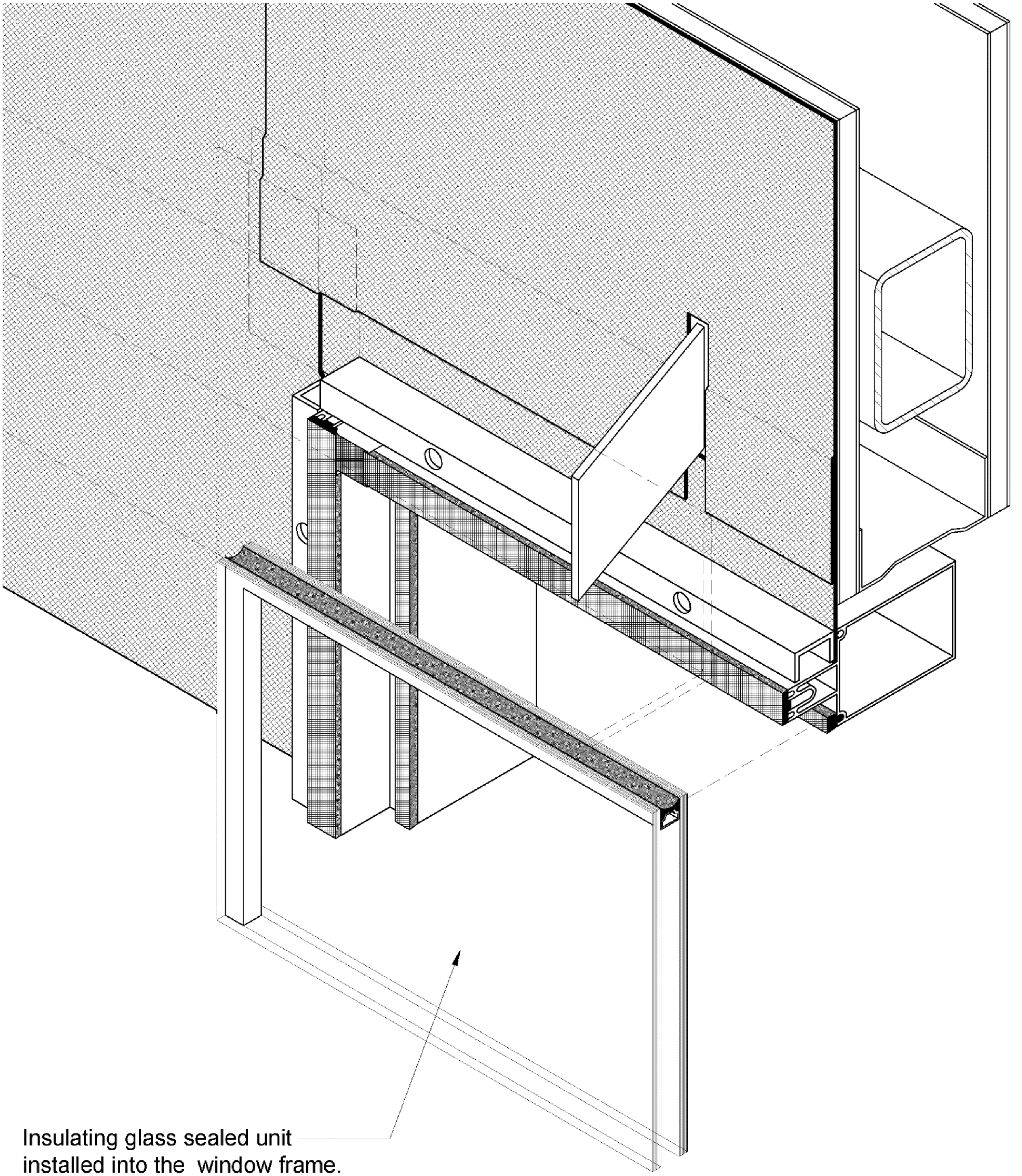
Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 3
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



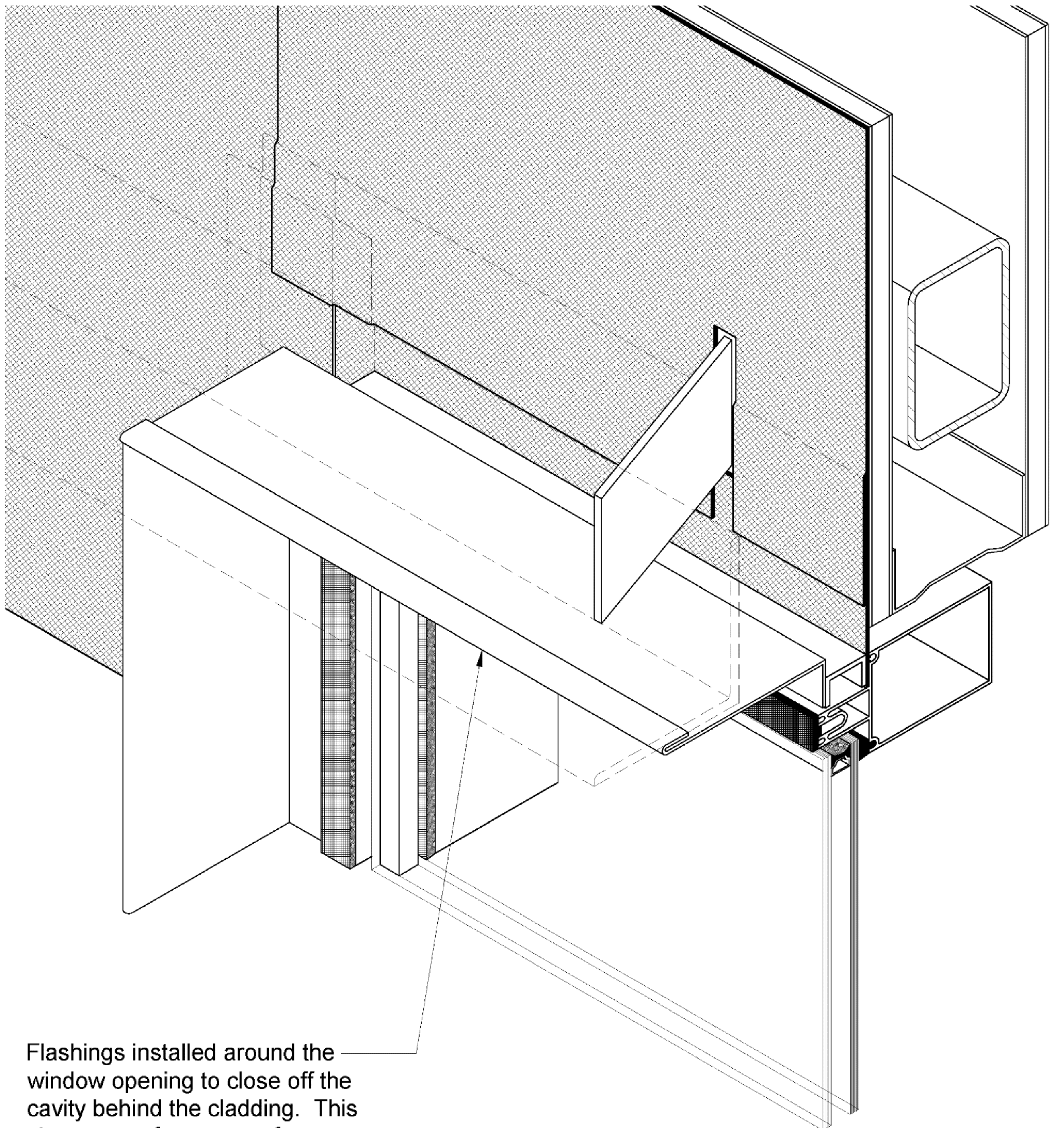
Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 4
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



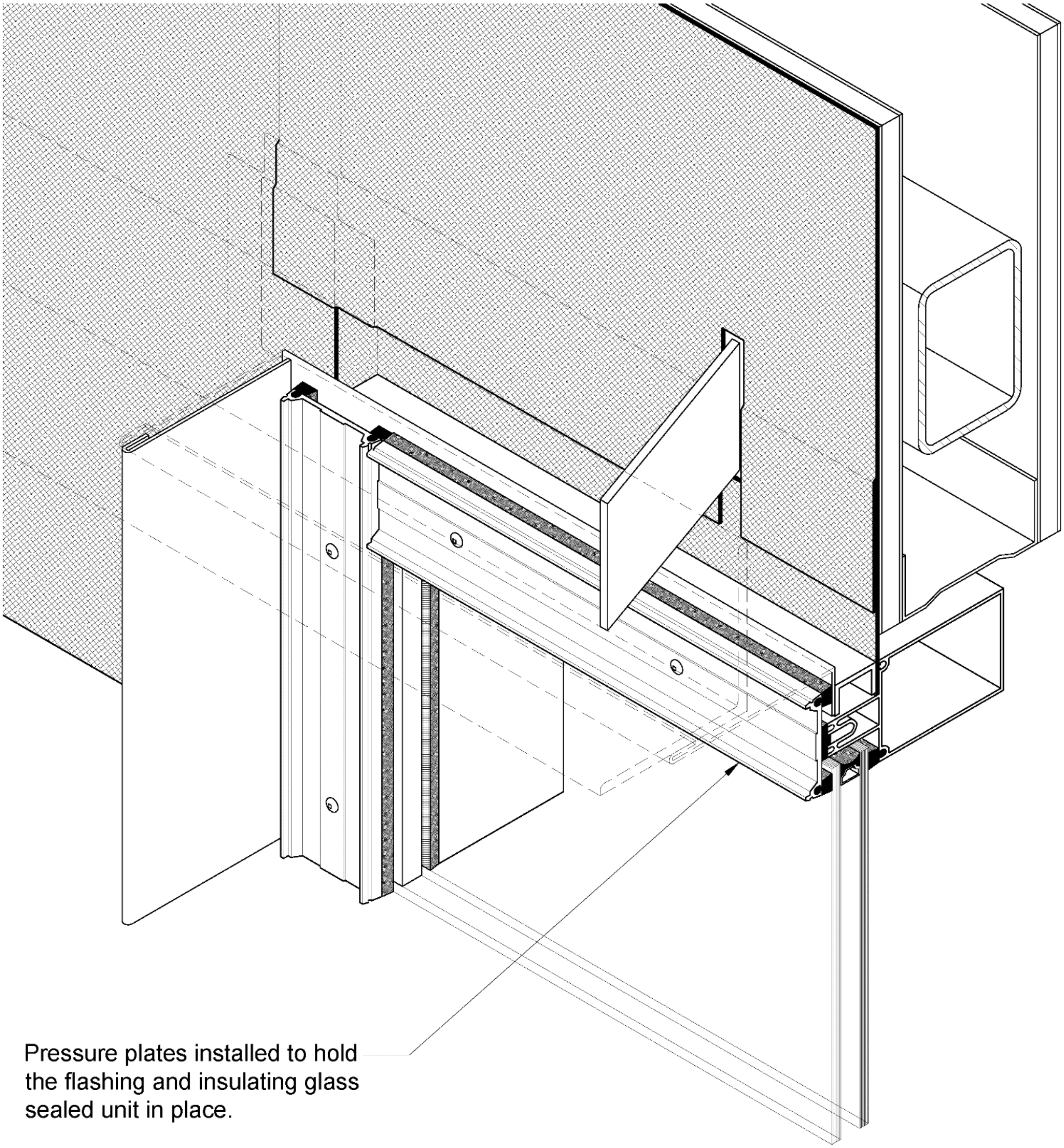
Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 5
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 6
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14

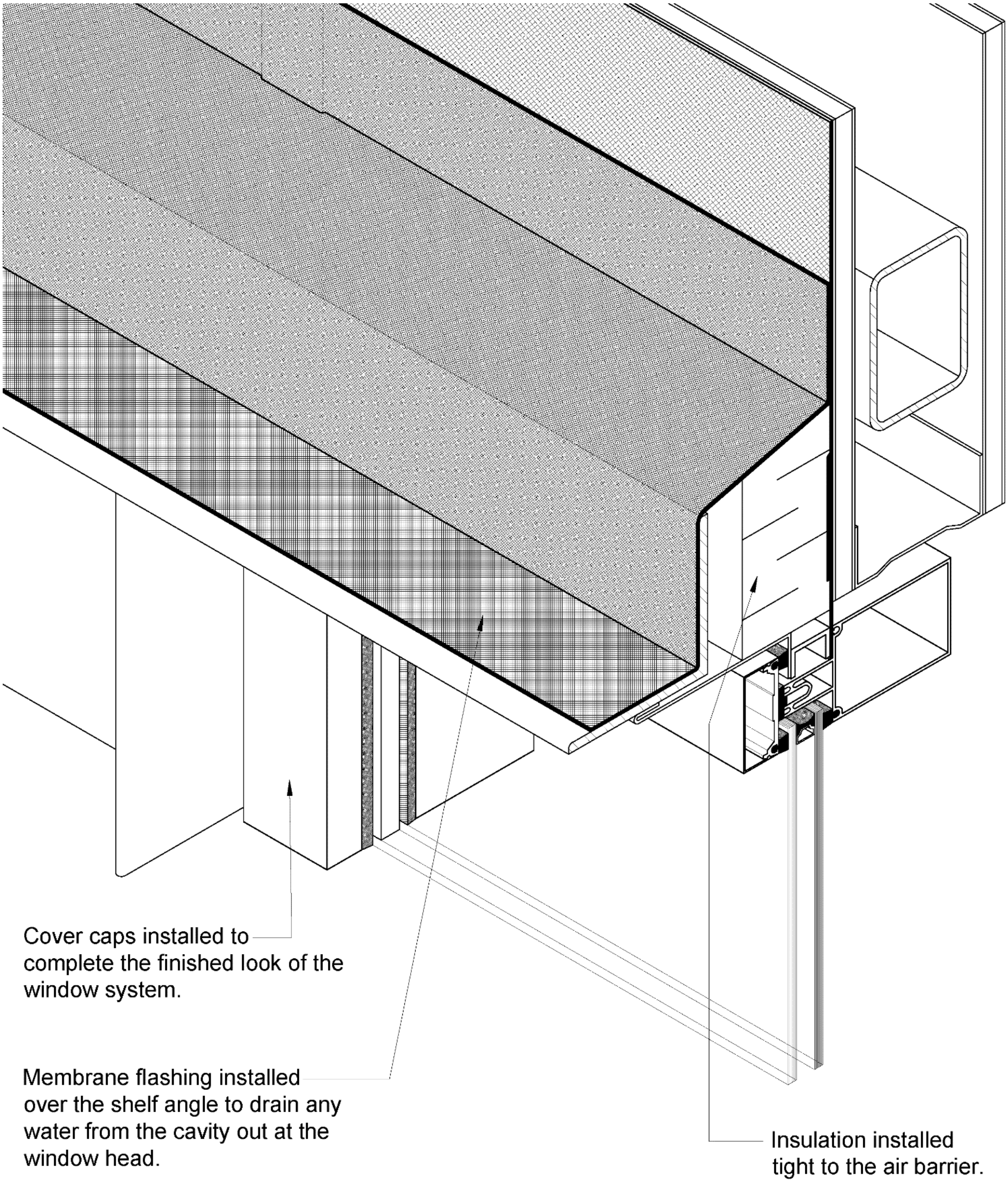


Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH	DETAIL NUMBER 7
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14

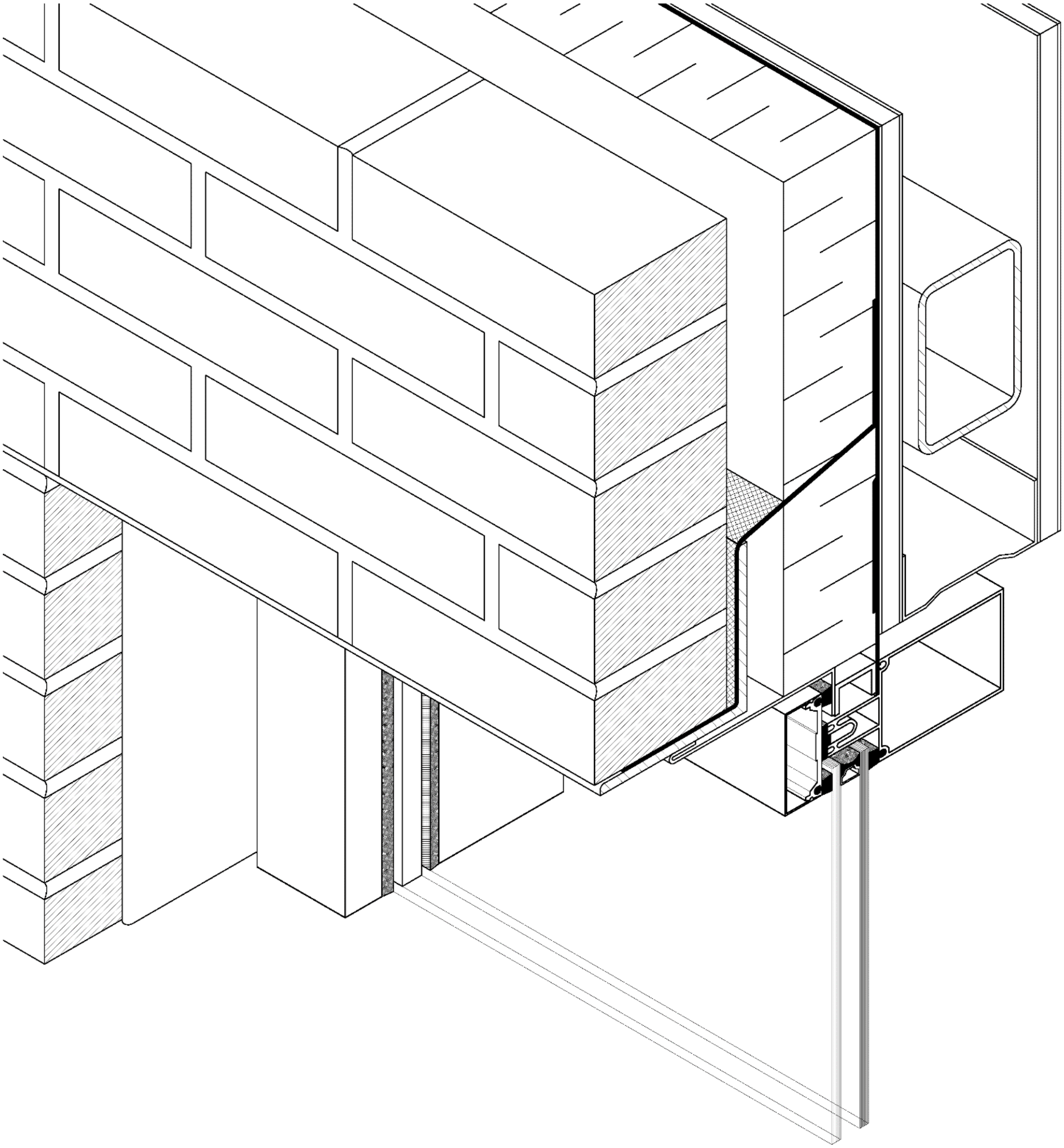


Pressure plates installed to hold the flashing and insulating glass sealed unit in place.

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



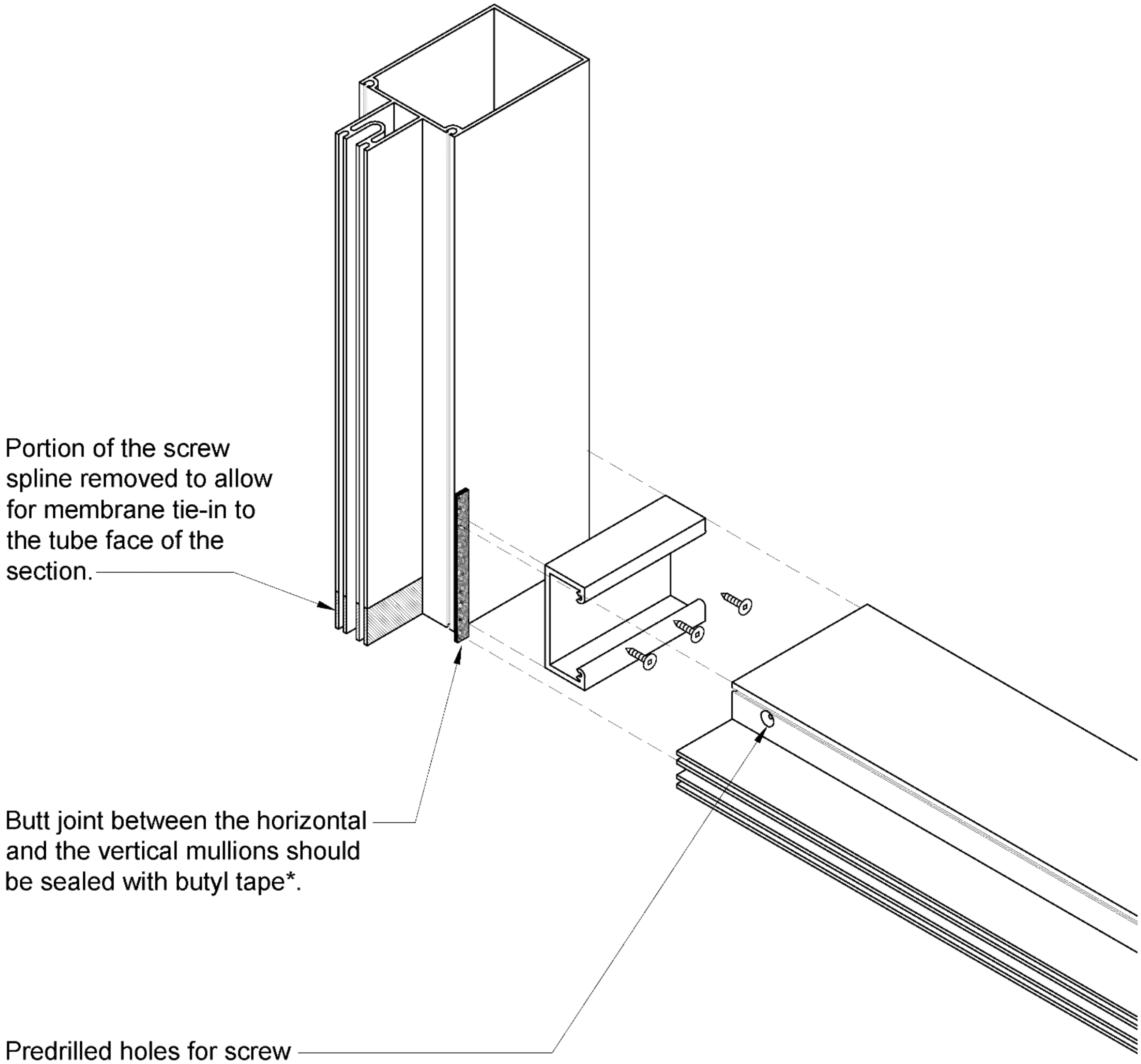
Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 9
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



Completed installation.

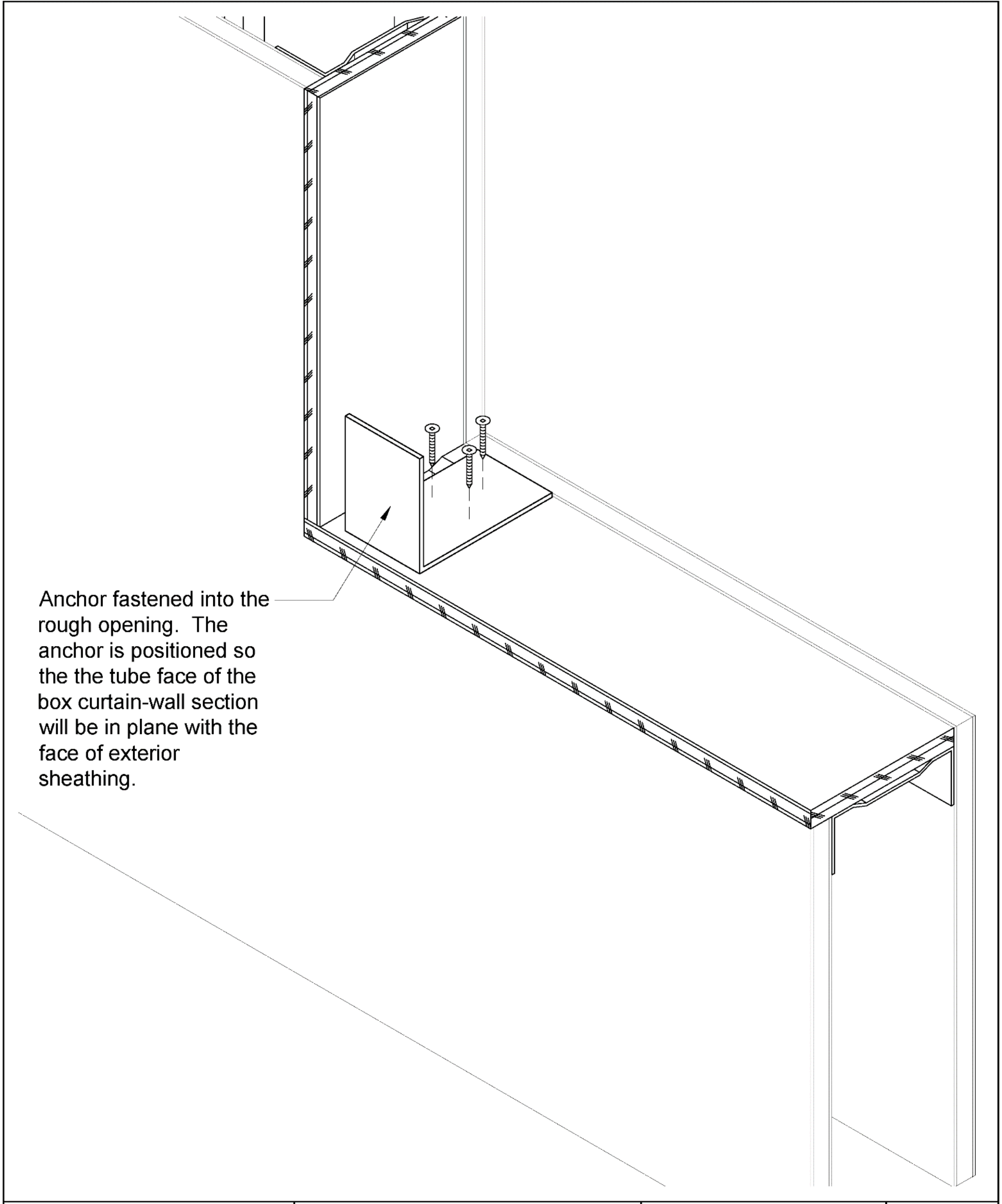
Alberta Infrastructure	SERIES 03 INSTALLATION SEQUENCE ISOMETRIC WINDOW HEAD DETAILS	TECHNICAL SERVICES BRANCH	DETAIL NUMBER 10

DRAWN BY	DATE	UPDATED BY	DATE
PETER BAKER	01-01-2005	V. SOLBAK	2016-10-14

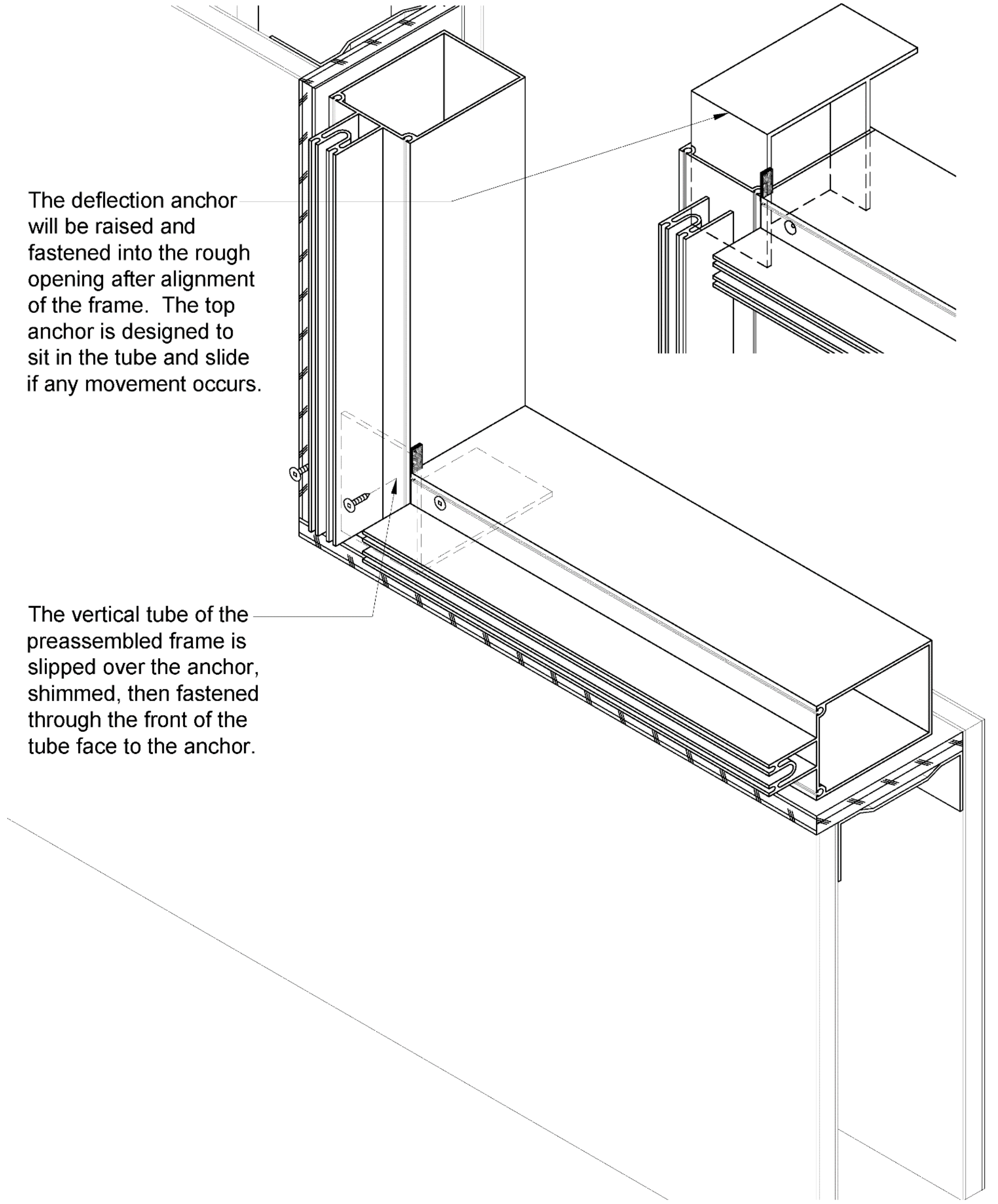


(* Butyl tape is preferred over silicone sealant because silicone will set up over time and if the seal fails it will not re-seal. Butyl will remain tacky and will re-seal when the temperature of the frame is increased.)

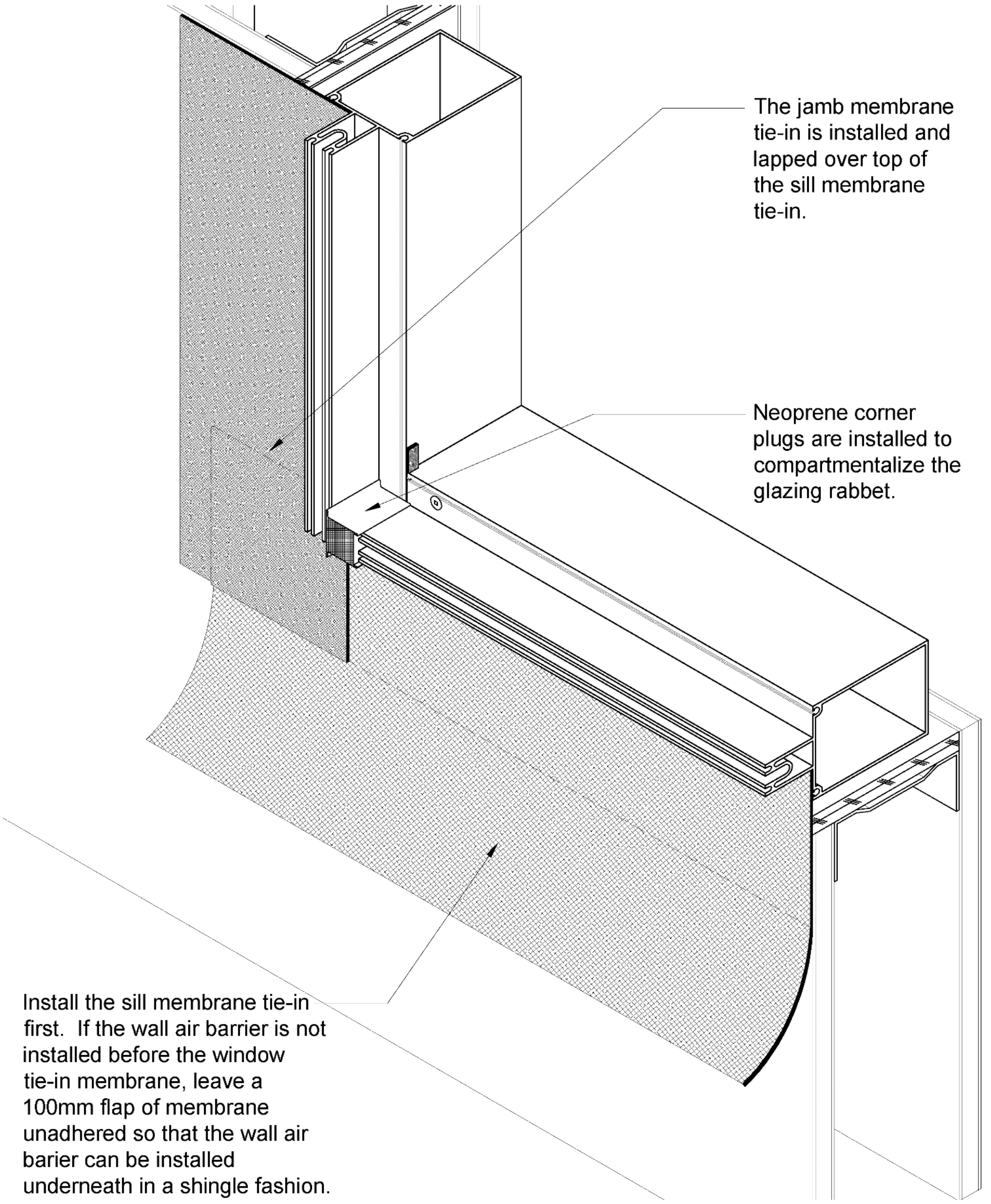
Alberta Infrastructure	SERIES 04 INSTALLATION SEQUENCE ISOMETRIC WINDOW SILL DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 1
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



Alberta Infrastructure	SERIES 04 INSTALLATION SEQUENCE ISOMETRIC WINDOW SILL DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 2
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



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	



Alberta Infrastructure	SERIES 04 INSTALLATION SEQUENCE ISOMETRIC WINDOW SILL DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 4
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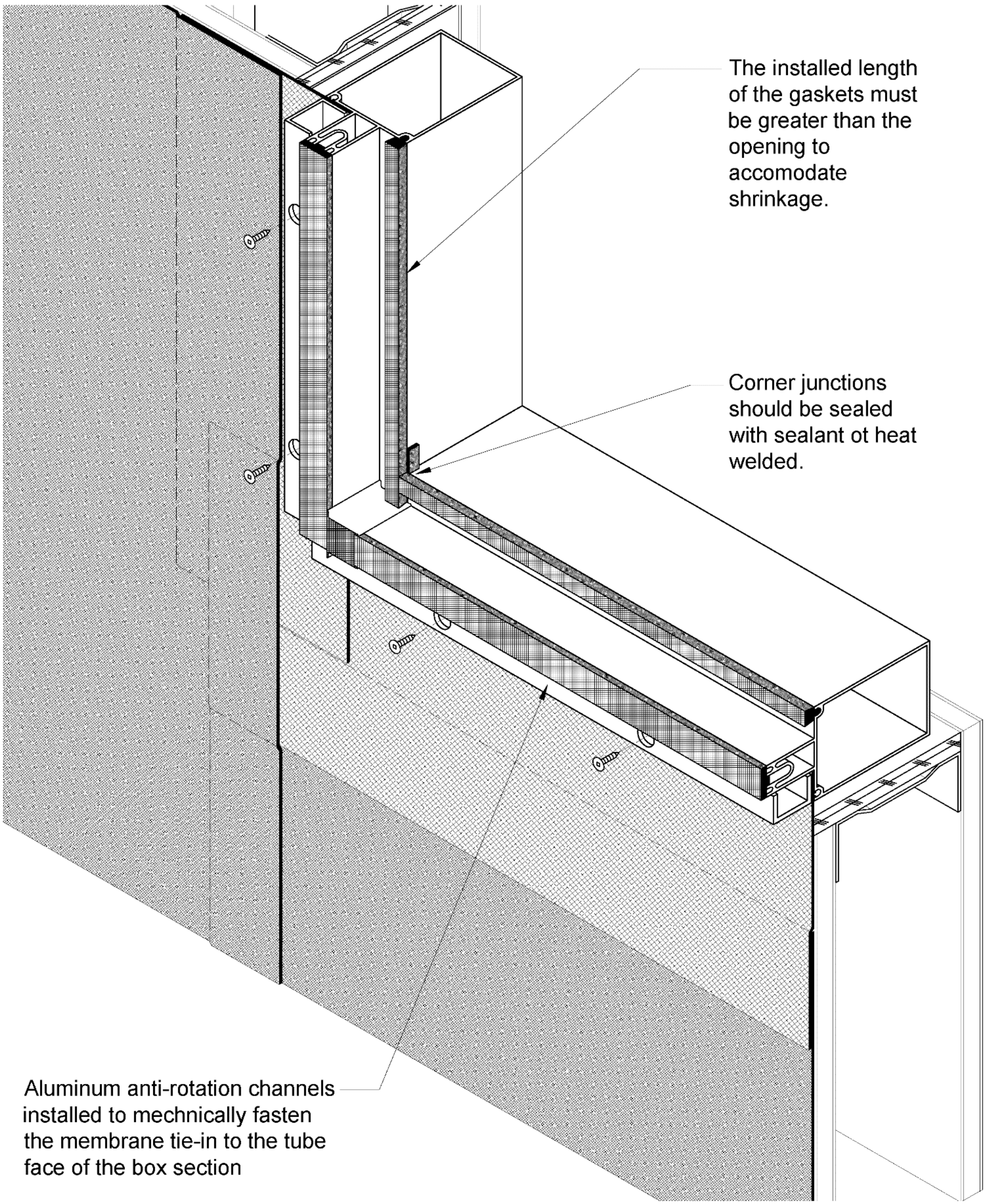
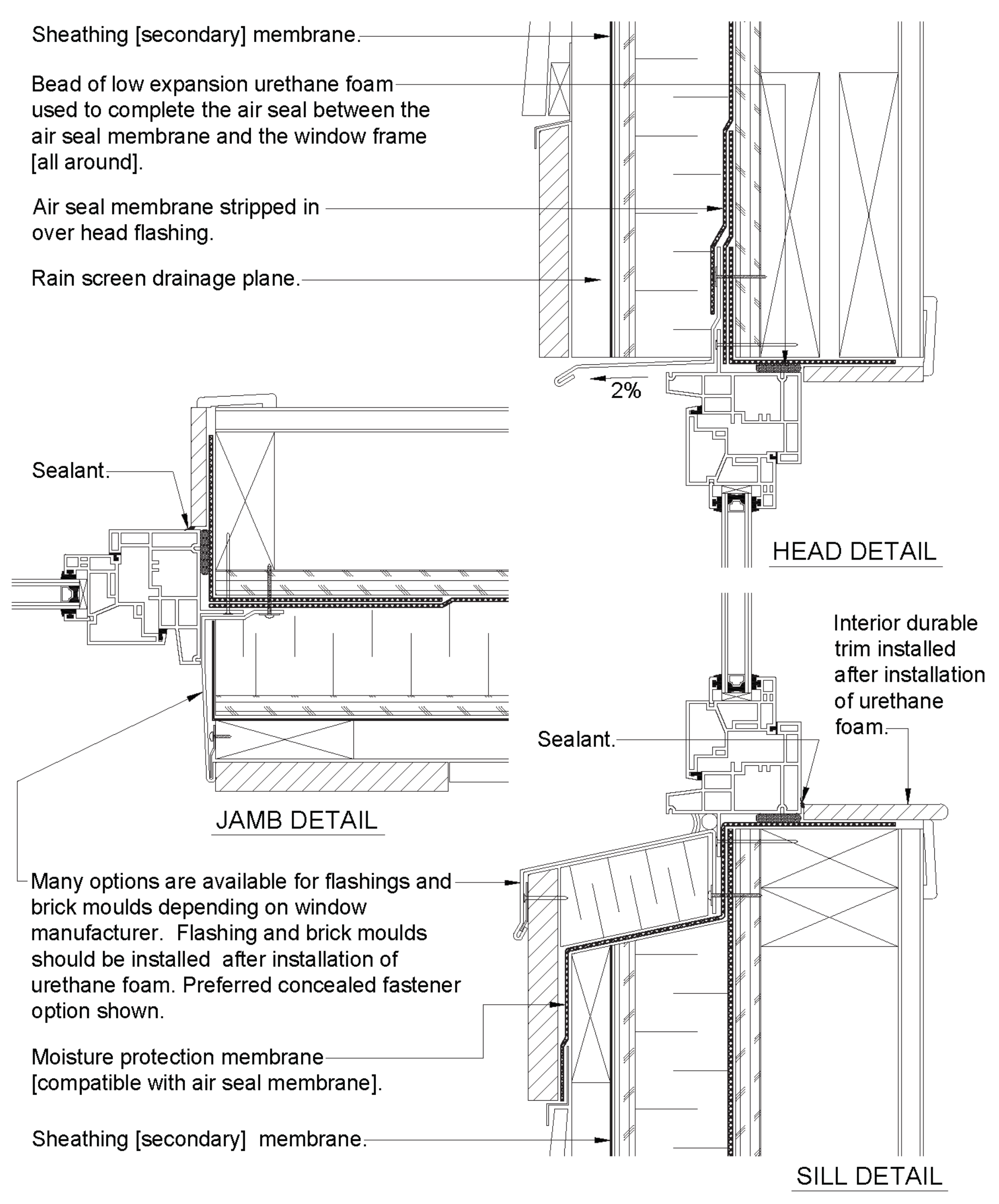


Alberta Infrastructure	SERIES 04 INSTALLATION SEQUENCE ISOMETRIC WINDOW SILL DETAILS		TECHNICAL SERVICES BRANCH		DETAIL NUMBER 5
	DRAWN BY PETER BAKER	DATE 01-01-2005	UPDATED BY V. SOLBAK	DATE 2016-10-14	



Alberta Infrastructure

EXTERIOR GLAZED WINDOW INSTALLATION - SERIES 05

Punched [Light Duty] Window Option 1b

BUILDING SCIENCES SECTION

DETAIL NUMBER 1b

DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V.SOLBAK	2012-02-23

Login: elizabeth.rivera M:\SharedCAD\CivilCAD\Drafting\Spec_Details\BUILDING ENVELOPE DETAILS\R2\05 punched windows details.dwg Feb 23, 2012 - 10:55am

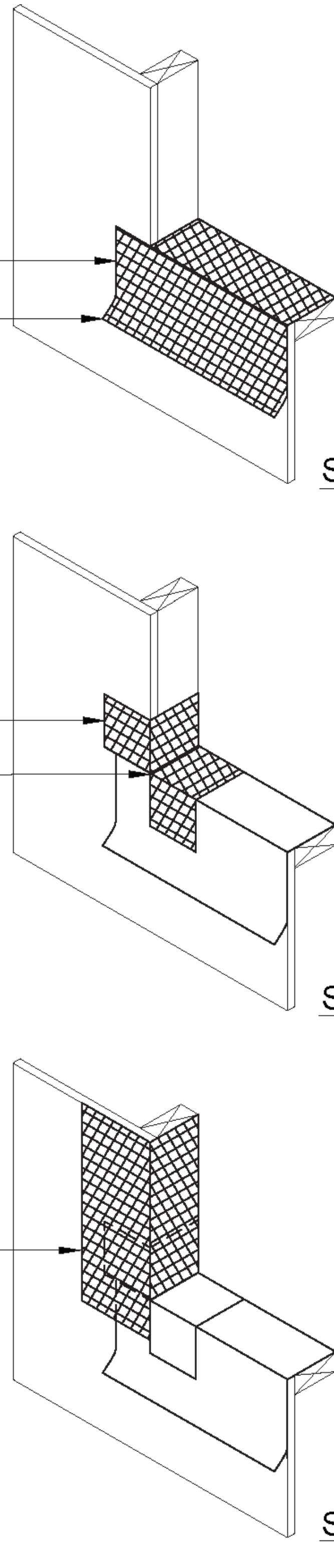
Sill membrane installed first.

If wall air seal membrane is not installed prior to window membrane, a flap of membrane at the sill should be left to allow for the wall membrane to be installed underneath creating a shingle lapped joint.

A small piece of membrane should be used in the corner at the transition between the sill and the jamb. Small pieces of membrane are easier to work with for detail work. It is important that the membrane be installed tight into the corner as this is the most critical location for water entry.

A small amount of mastic that is compatible with the membrane should be used in the corner where the membranes meet.

Jamb membrane installed after sill and transition strips.



STEP 1

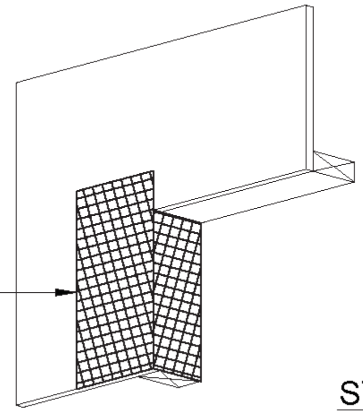
STEP 2

STEP 3

Alberta Infrastructure	EXTERIOR GLAZED WINDOW INSTALLATION - SERIES 05 MEMBRANE INSTALLATION AT SILL AND JAMB		BUILDING SCIENCES SECTION	DETAIL NUMBER 2a
	DRAWN BY E. RIVERA	DATE 2012-02-23	CHECKED BY V. SOLBAK	DATE 2012-02-23

Login: elizabeth.rivera M:\SharedCAD\CivilCAD\Drafting\Spec_Details\BUILDING ENVELOPE DETAILS\R2\05 punched windows details.dwg Feb 23, 2012 - 10:55am

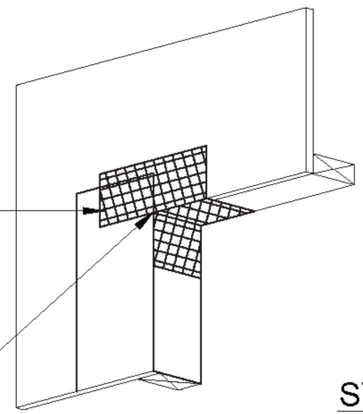
Continue jamb air seal membrane to top in single piece, if possible, or shingle lapped if not practical to do in a single piece. Extend past top of opening as indicated.



STEP 4

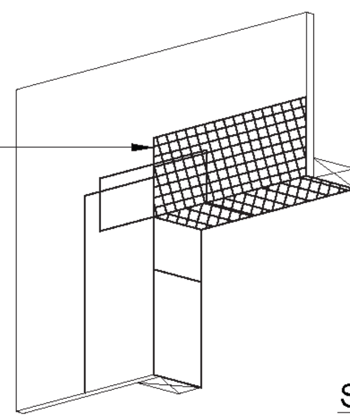
A small piece of membrane should be used in the corner at the transition between the head and the jamb. Small pieces of membrane are easier to work with for detail work. It is important that the membrane be installed tight into the corner as this is the most critical location for water entry.

A small amount of mastic that is compatible with the membrane should be used in the corner where the membranes meet.



STEP 5

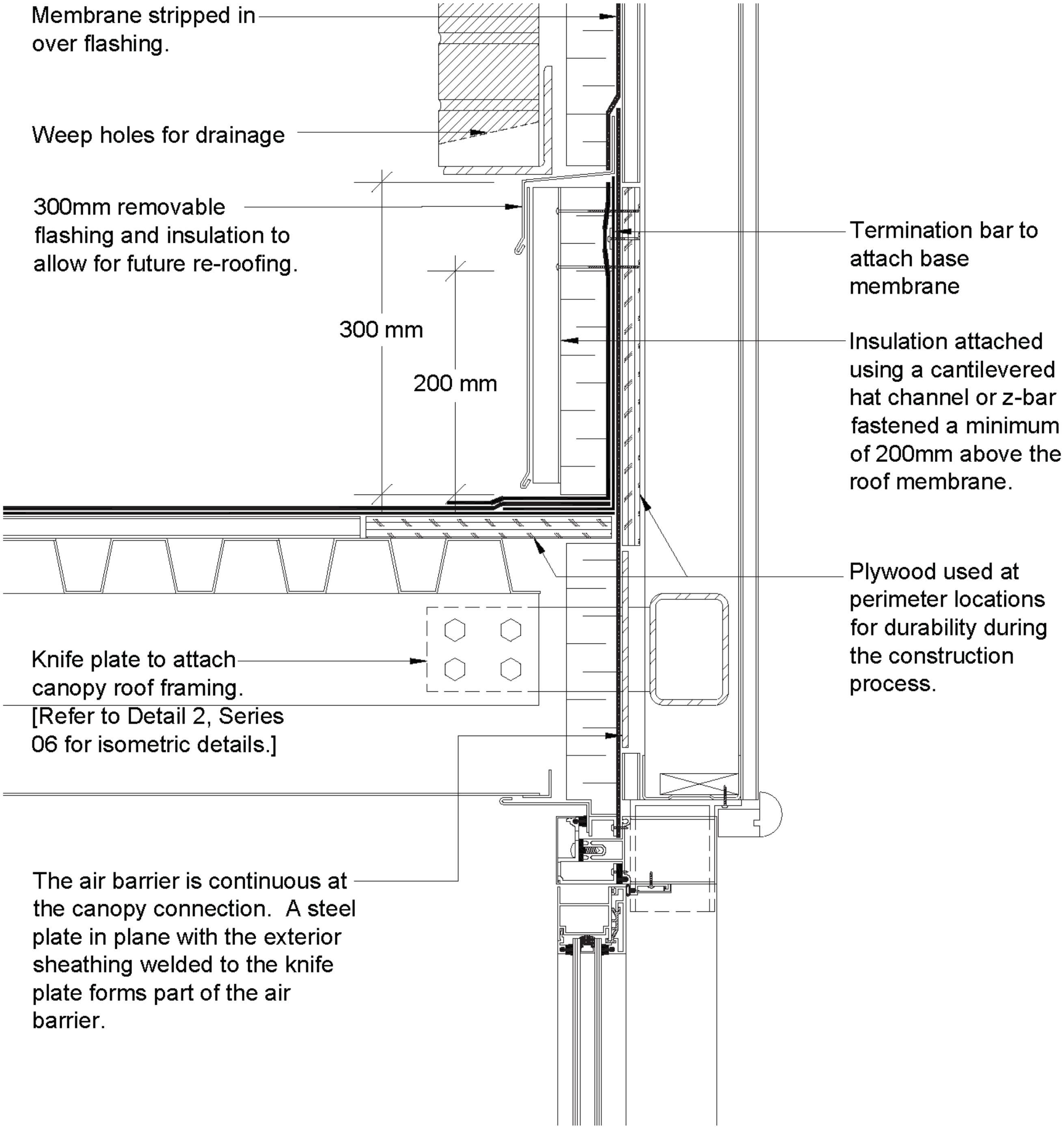
Head membrane installed last.



STEP 6

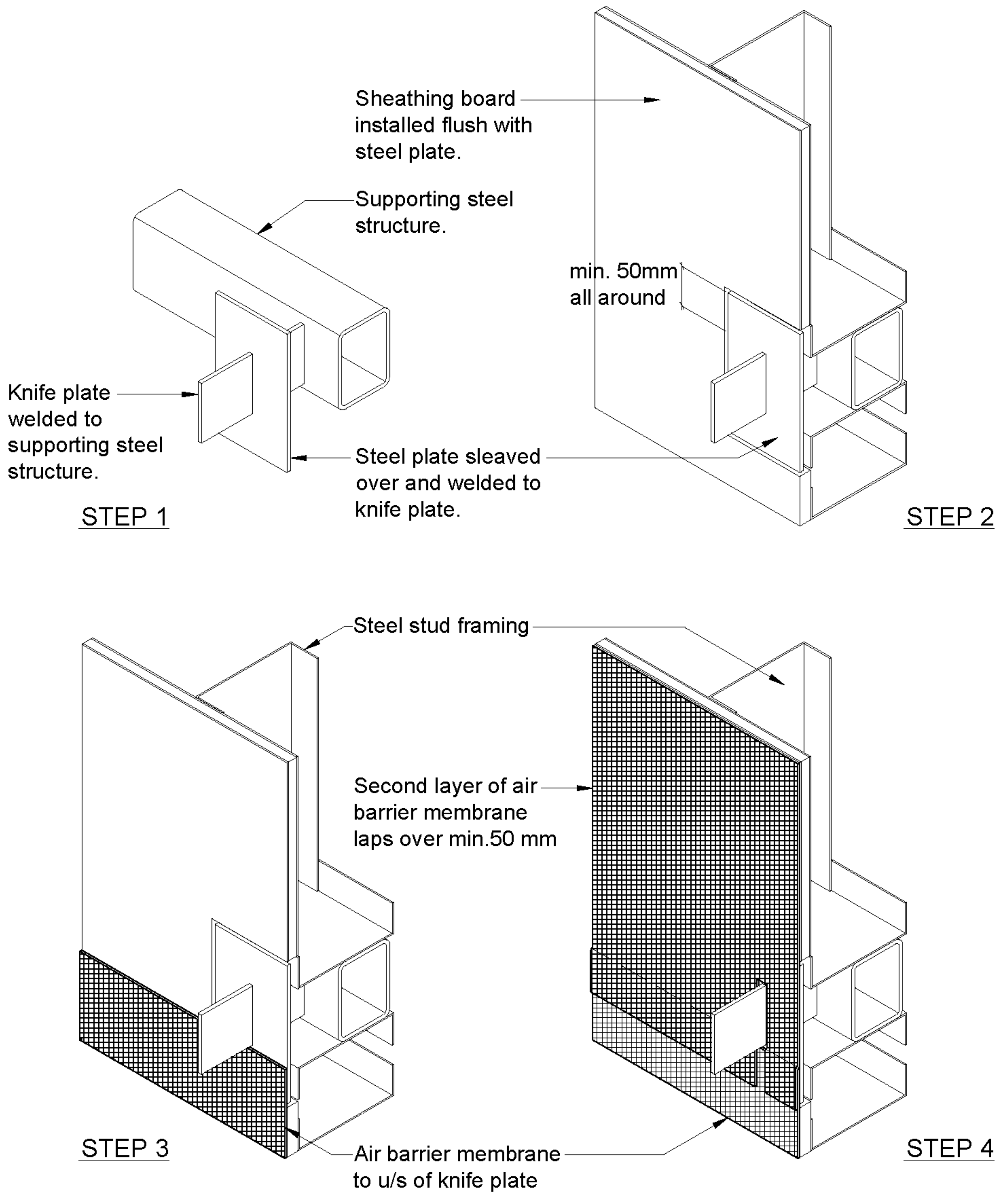
Login: elizabeth.rivera M:\SharedCAD\CivilCAD\Drafting\Spec_Details\BUILDING ENVELOPE DETAILS\R2\05 punched windows details.dwg Feb 23, 2012 - 10:55am

Alberta Infrastructure	EXTERIOR GLAZED WINDOW INSTALLATION - SERIES 05 MEMBRANE INSTALLATION AT JAMB AND HEAD		BUILDING SCIENCES SECTION	DETAIL NUMBER 2b
	DRAWN BY E. RIVERA	DATE 2012-02-23	CHECKED BY V. SOLBAK	DATE 2012-02-23

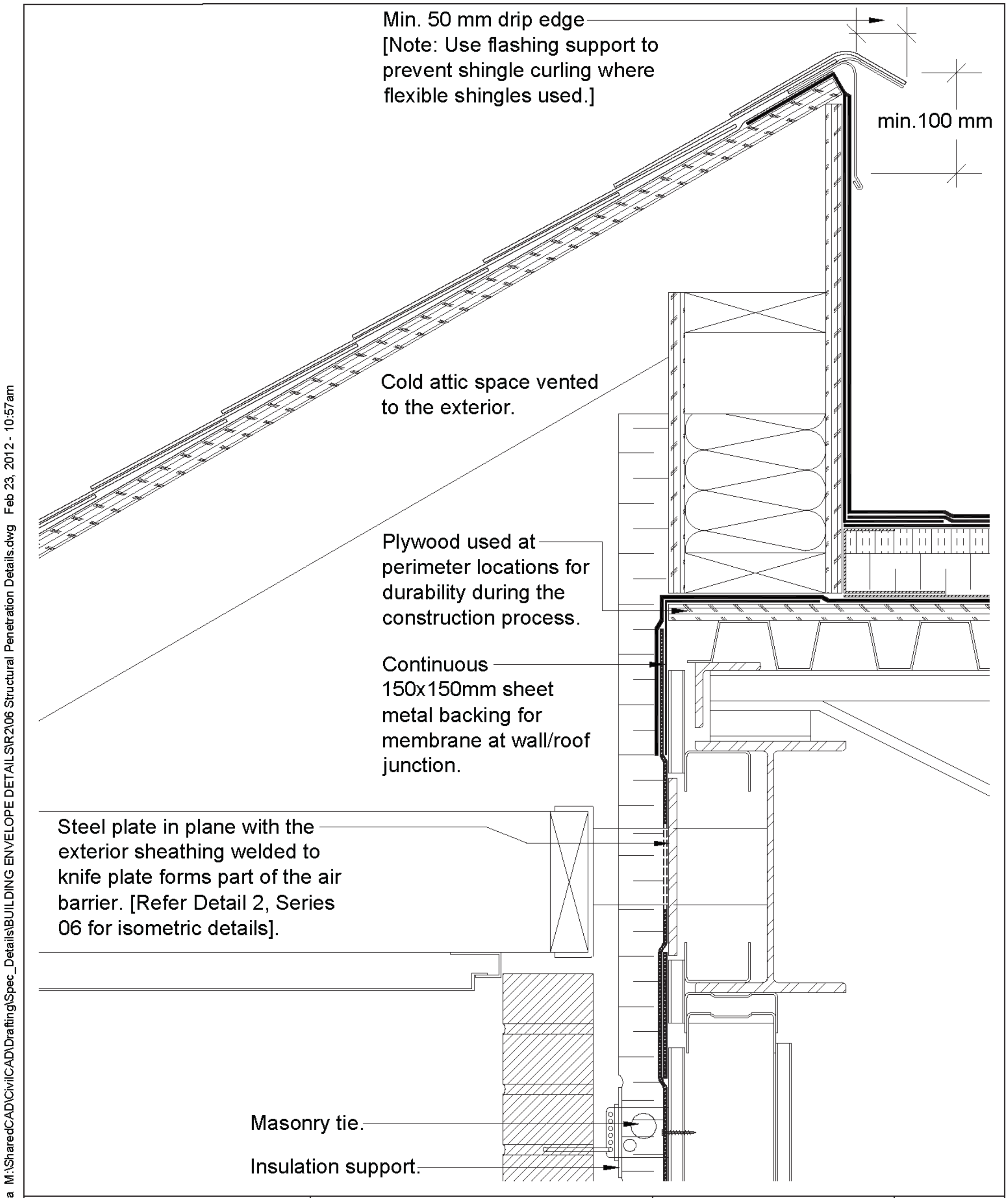


Login: elizabeth.rivera M:\SharedCAD\CivilCAD\Drafting\Spec_Details\BUILDING ENVELOPE DETAILS\R2\06 Structural Penetration Details.dwg Feb 23, 2012 - 10:57am

Alberta Infrastructure	STRUCT. PENETRATION DETAILS - SERIES 06 UNHEATED CANOPY OPTION		BUILDING SCIENCES SECTION	DETAIL NUMBER 1
	DRAWN BY E.RIVERA	DATE 2012-02-23	CHECKED BY V. SOLBAK	DATE 2012-02-23



Alberta Infrastructure	STRUCT. PENETRATION DETAILS - SERIES 06 ISOMETRIC PLATE SEQUENCING DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 2
	DRAWN BY E. RIVERA	DATE 2012-02-23	CHECKED BY V. SOLBAK	DATE 2012-02-23



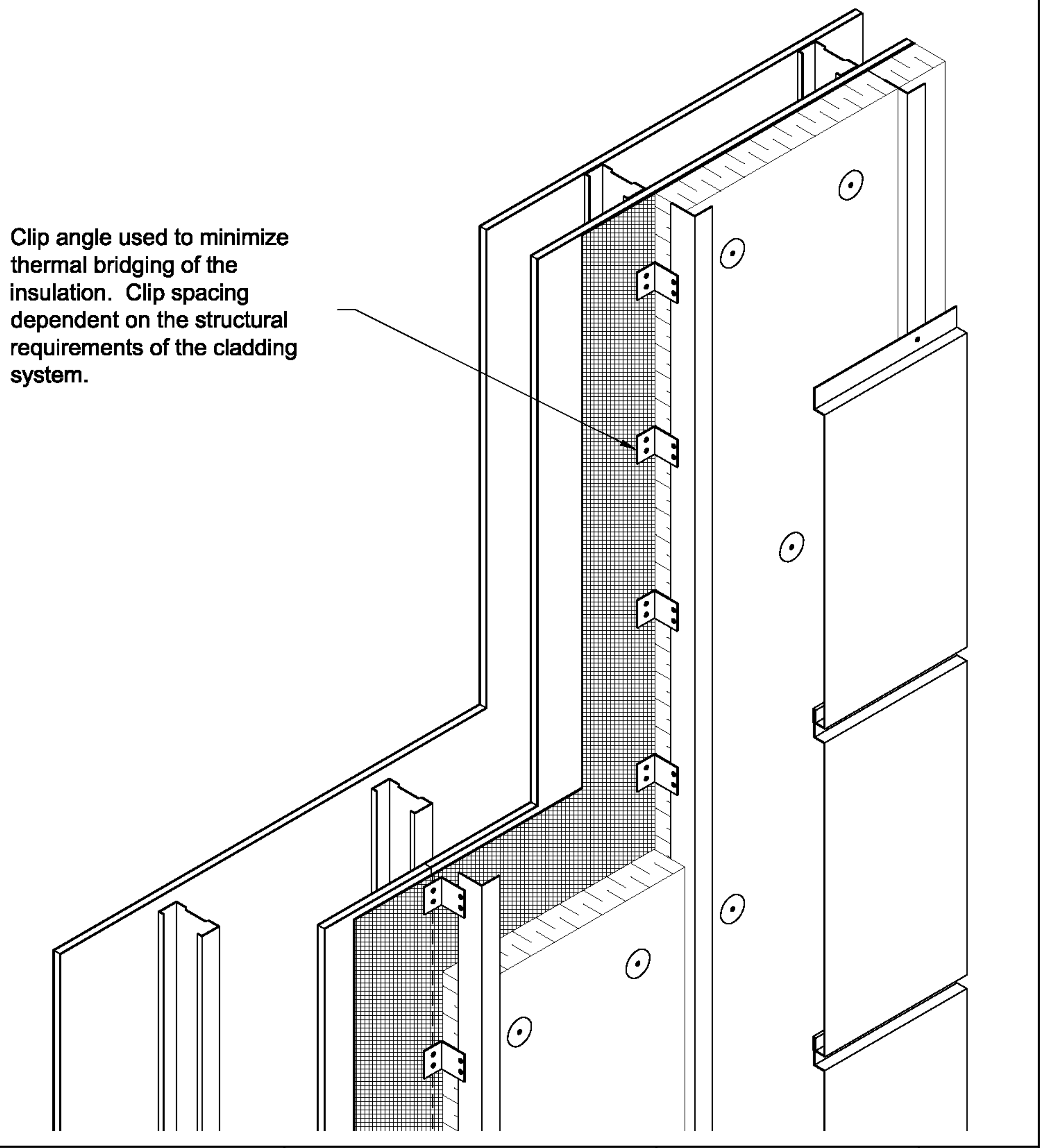
Alberta Infrastructure

STRUCT. PENETRATION DETAILS - SERIES 06
UNHEATED CANOPY OVERHANG OPTION

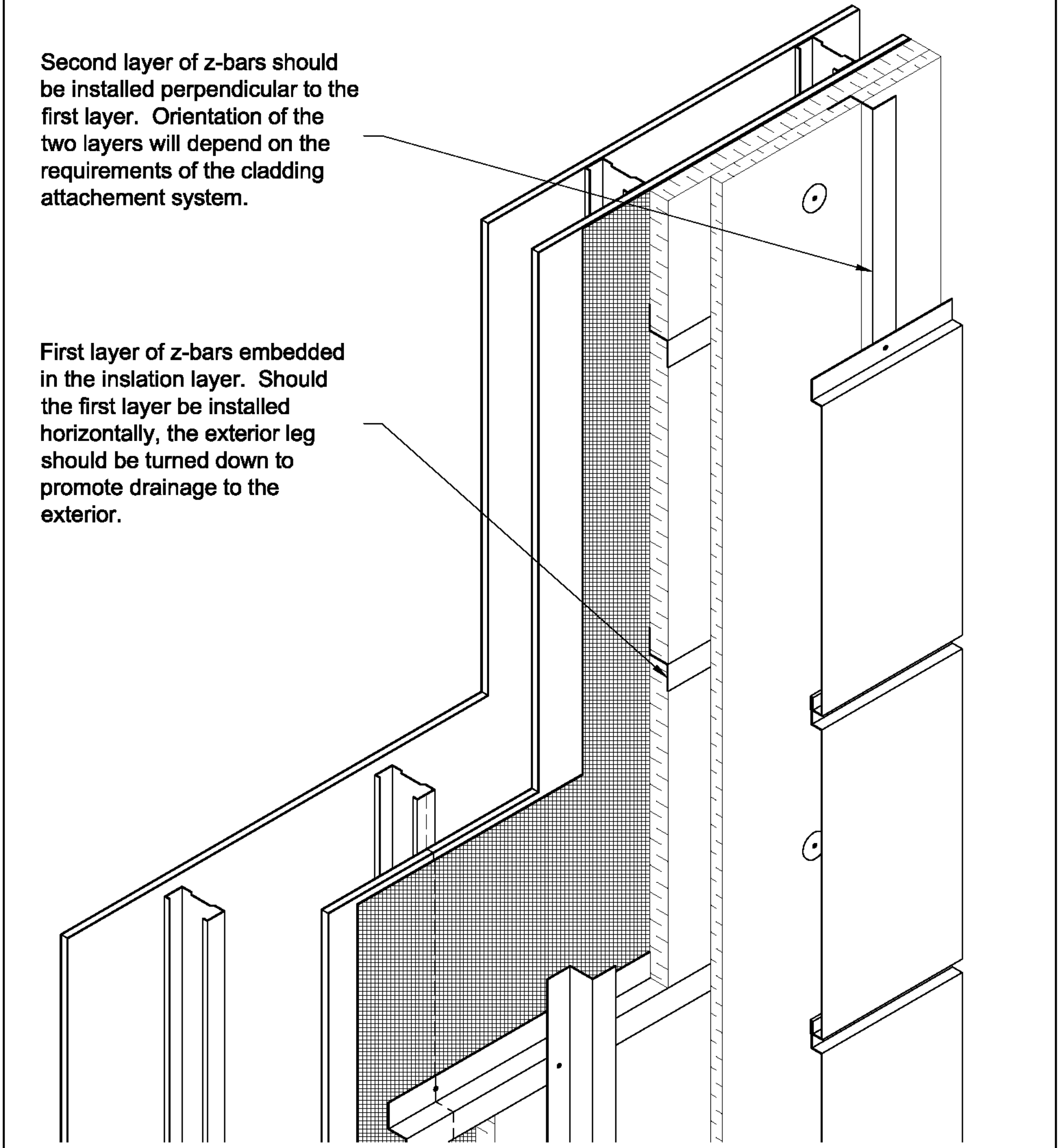
BUILDING SCIENCES SECTION

DETAIL NUMBER 3

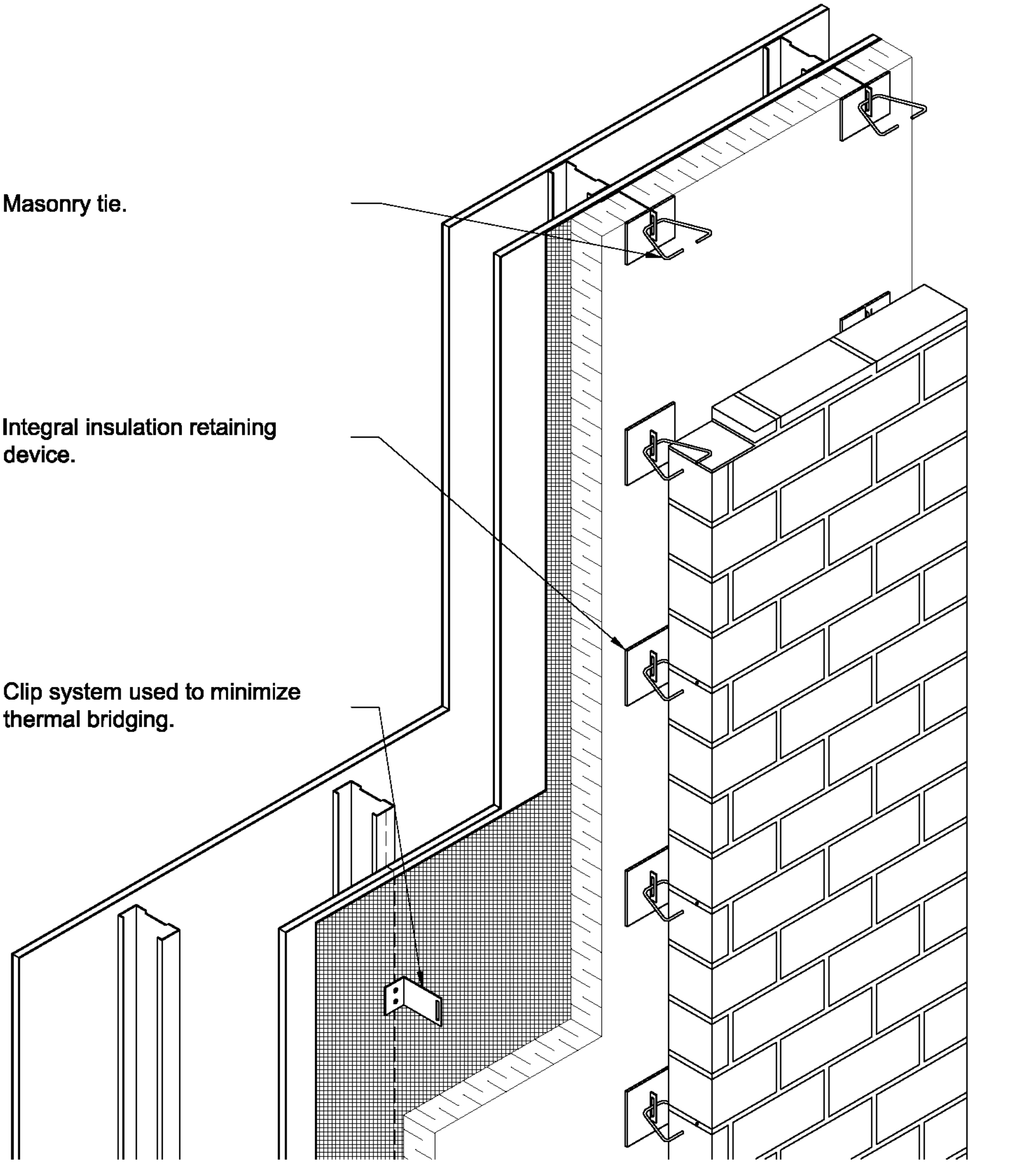
DRAWN BY	DATE	CHECKED BY	DATE
E. RIVERA	2012-02-23	V. SOLBAK	2012-02-23



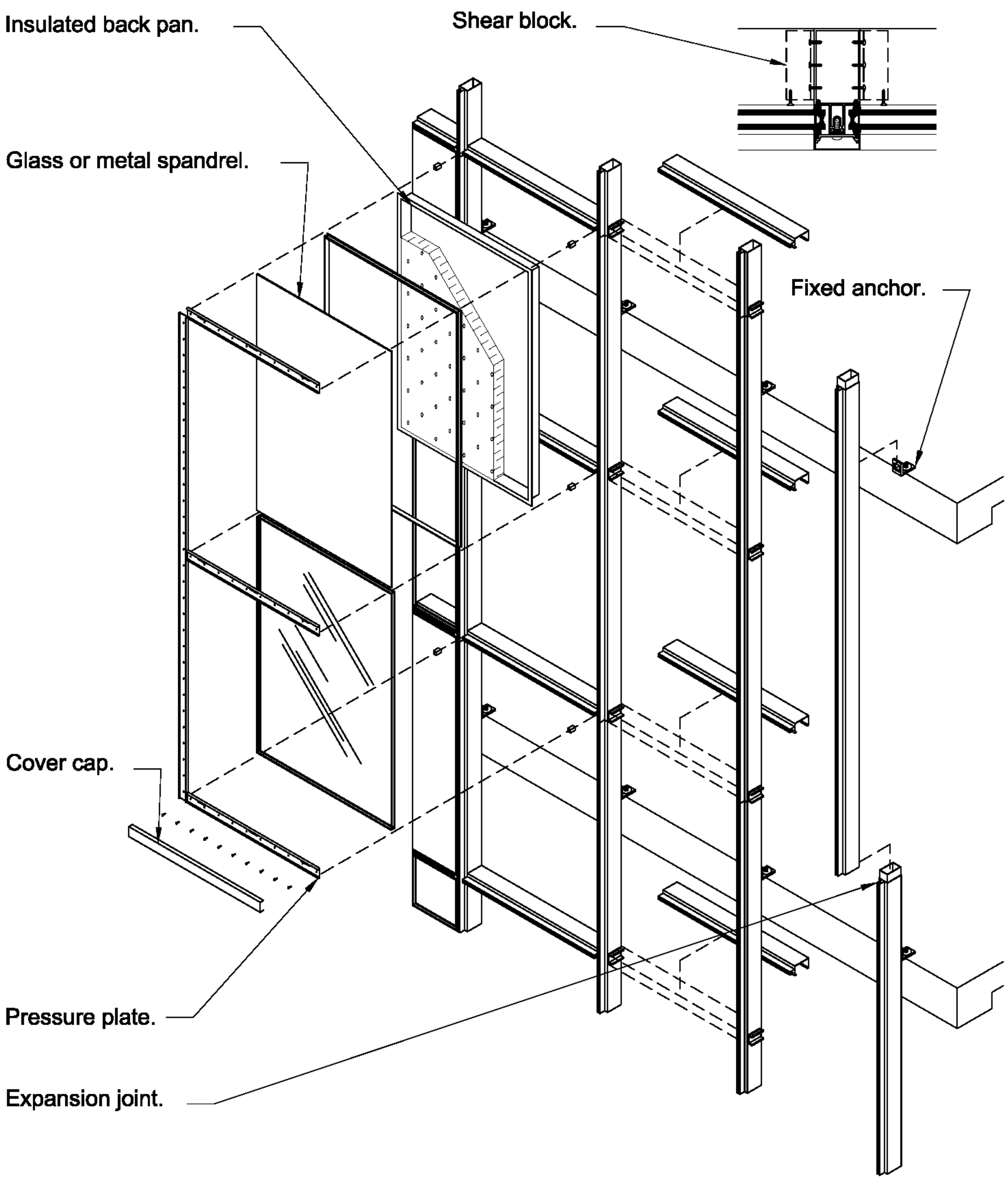
Alberta Infrastructure	THERMAL CLIPS CLADDING ATTACHMENT DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 1
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE	



Alberta Infrastructure	DOUBLE Z-BARS CLADDING ATTACHMENT DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 2
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE



Alberta Infrastructure	MASONRY TIES CLADDING ATTACHMENT DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 3
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE	



Alberta Infrastructure	STICK SYSTEM CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 1
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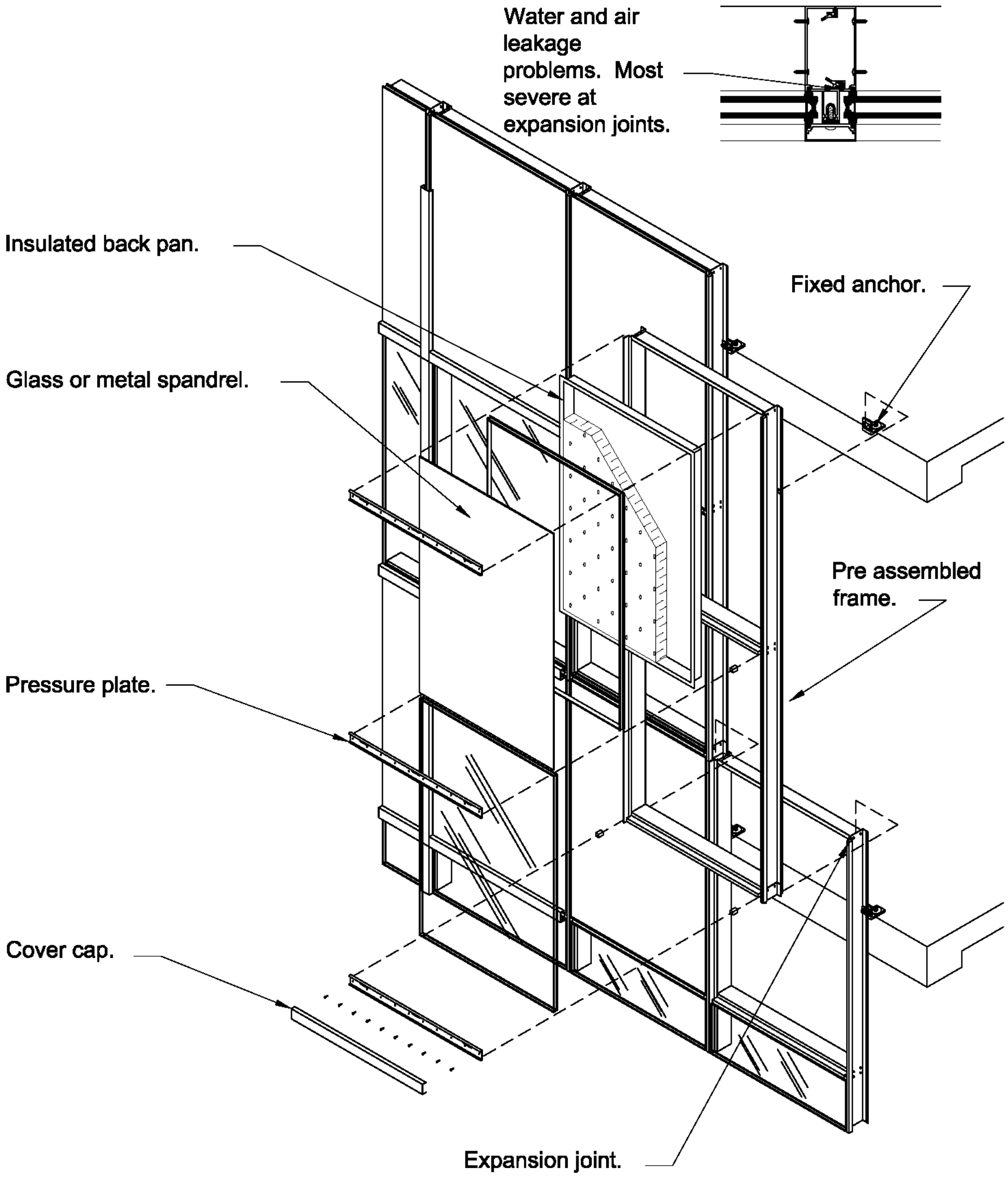

Alberta Infrastructure

SPLIT MULLION SYSTEM CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 2
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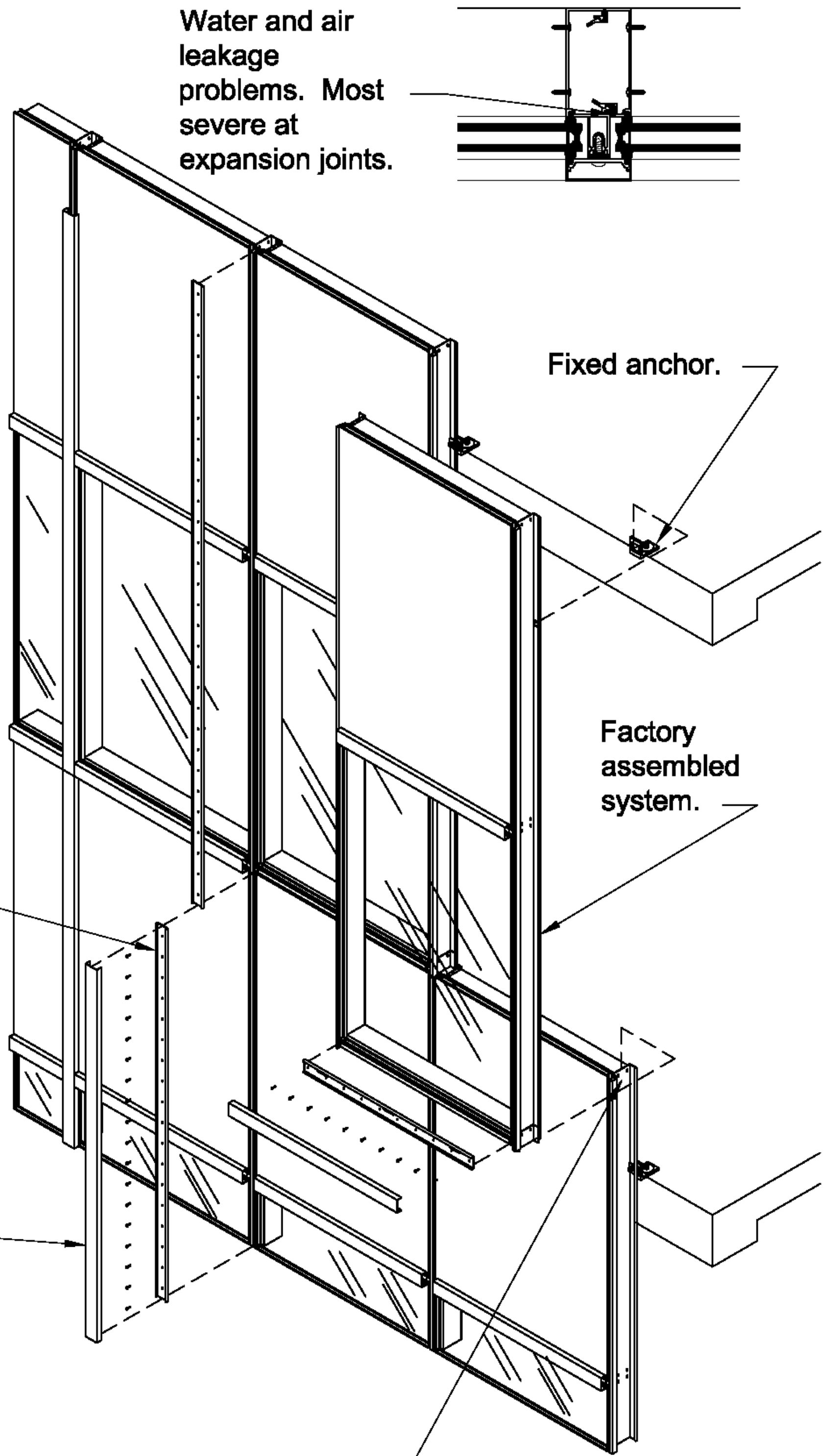

Alberta Infrastructure	PANELIZED SYSTEM CURTAIN WALL DETAILS			BUILDING SCIENCES SECTION	DETAIL NUMBER 3
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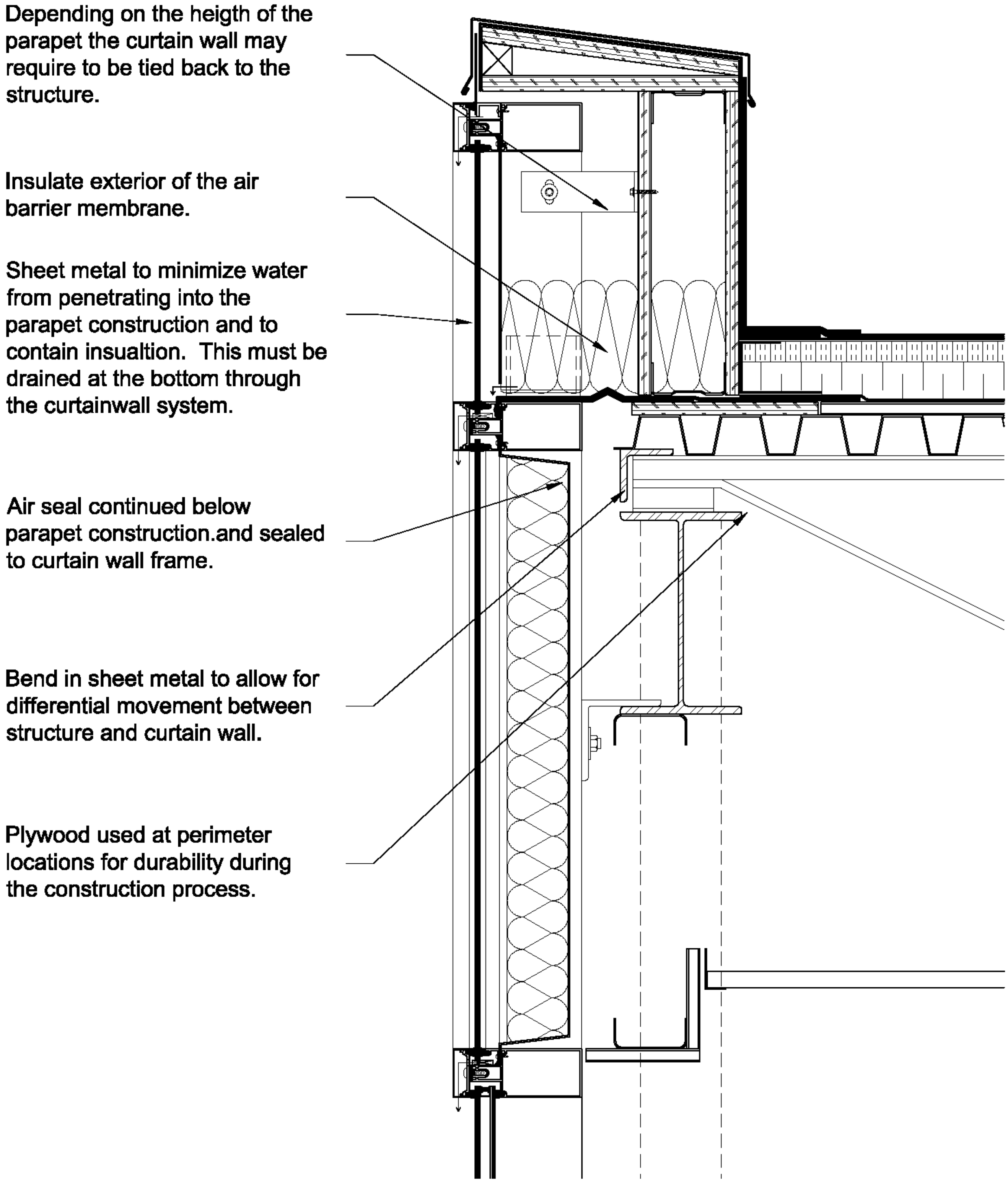
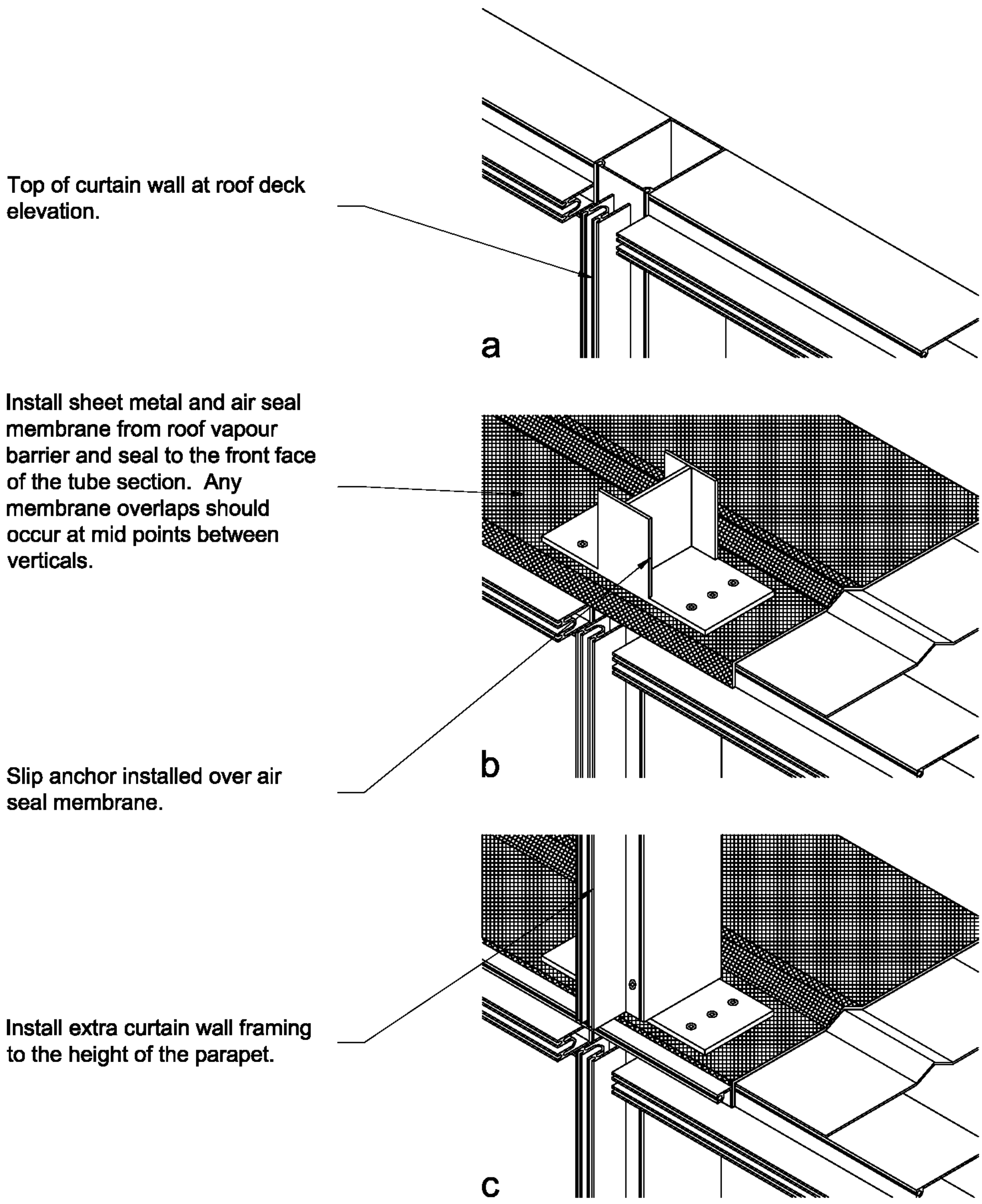


Alberta Infrastructure	PARAPET 2 CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 5
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE	



Alberta Infrastructure	AIR SEAL DETAIL CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 6
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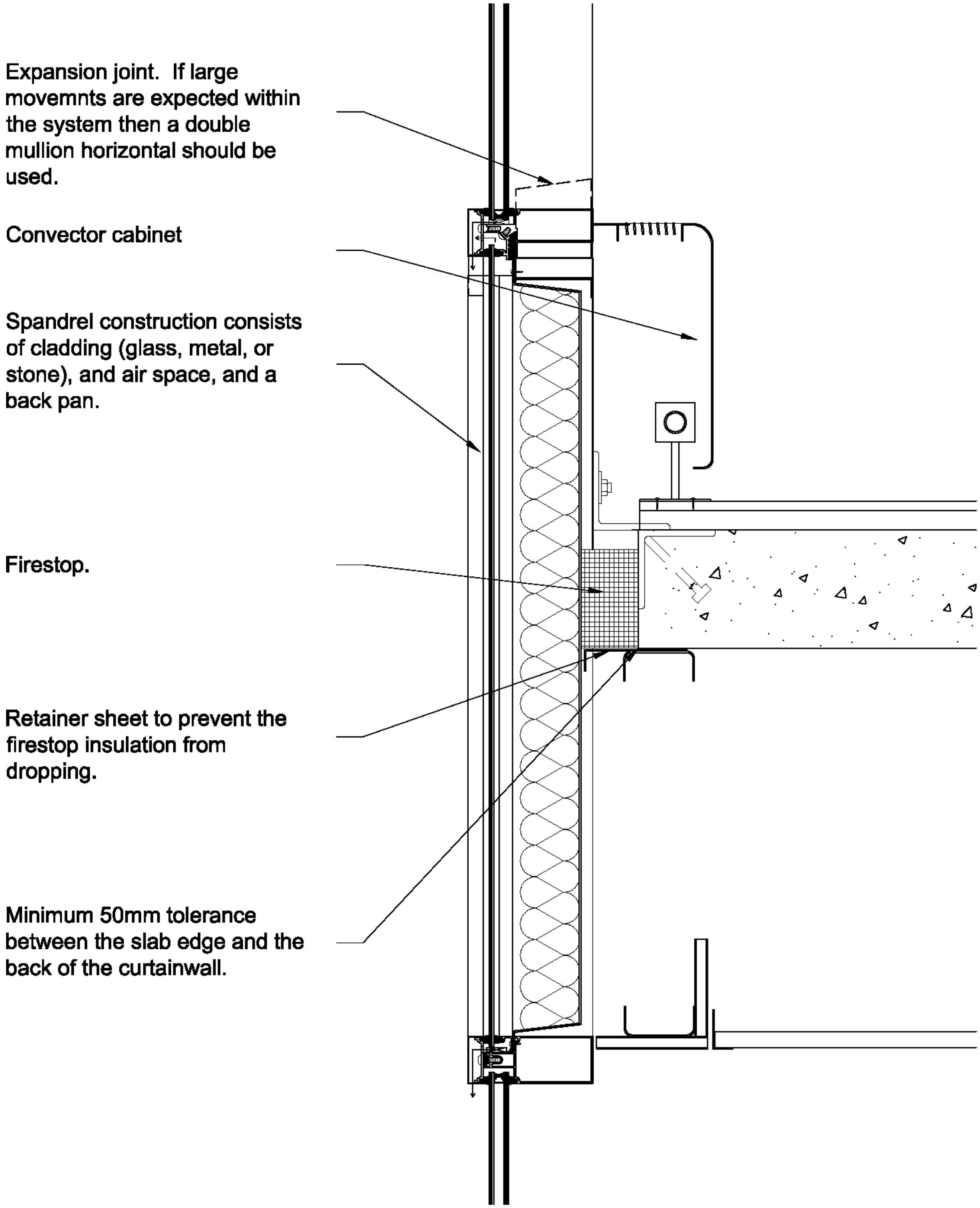
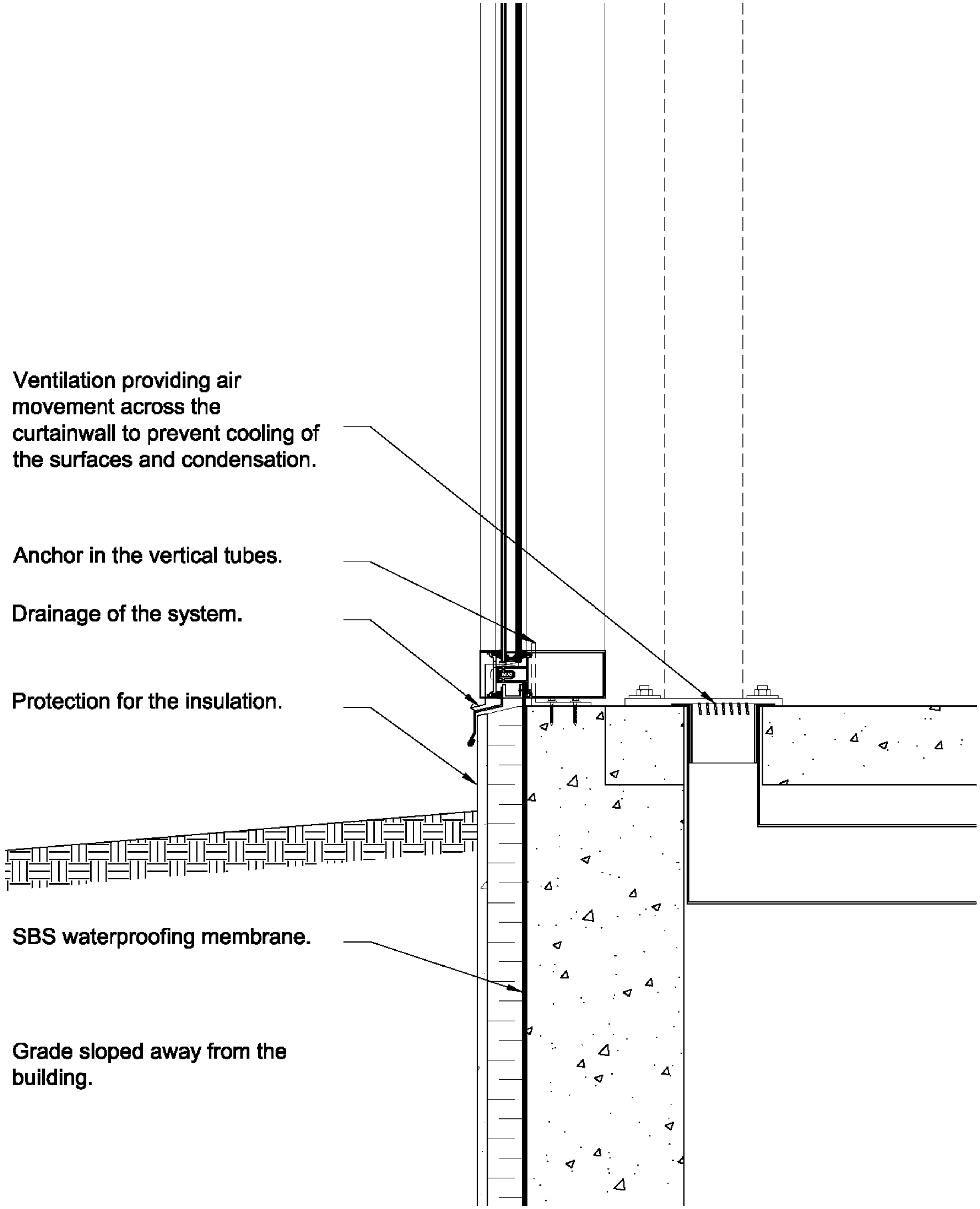
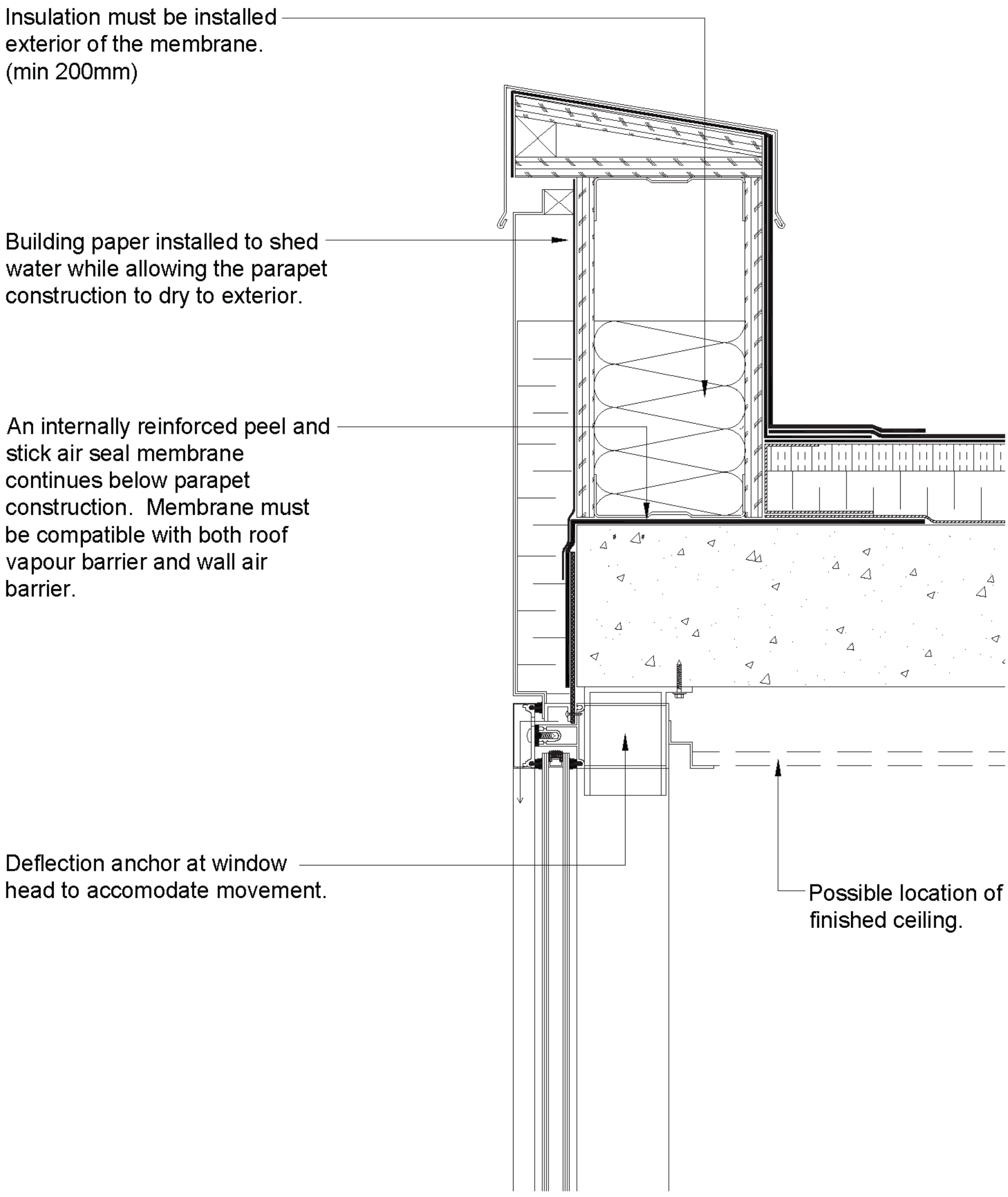


Alberta Infrastructure	FLOOR SPANDREL CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 7
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE	



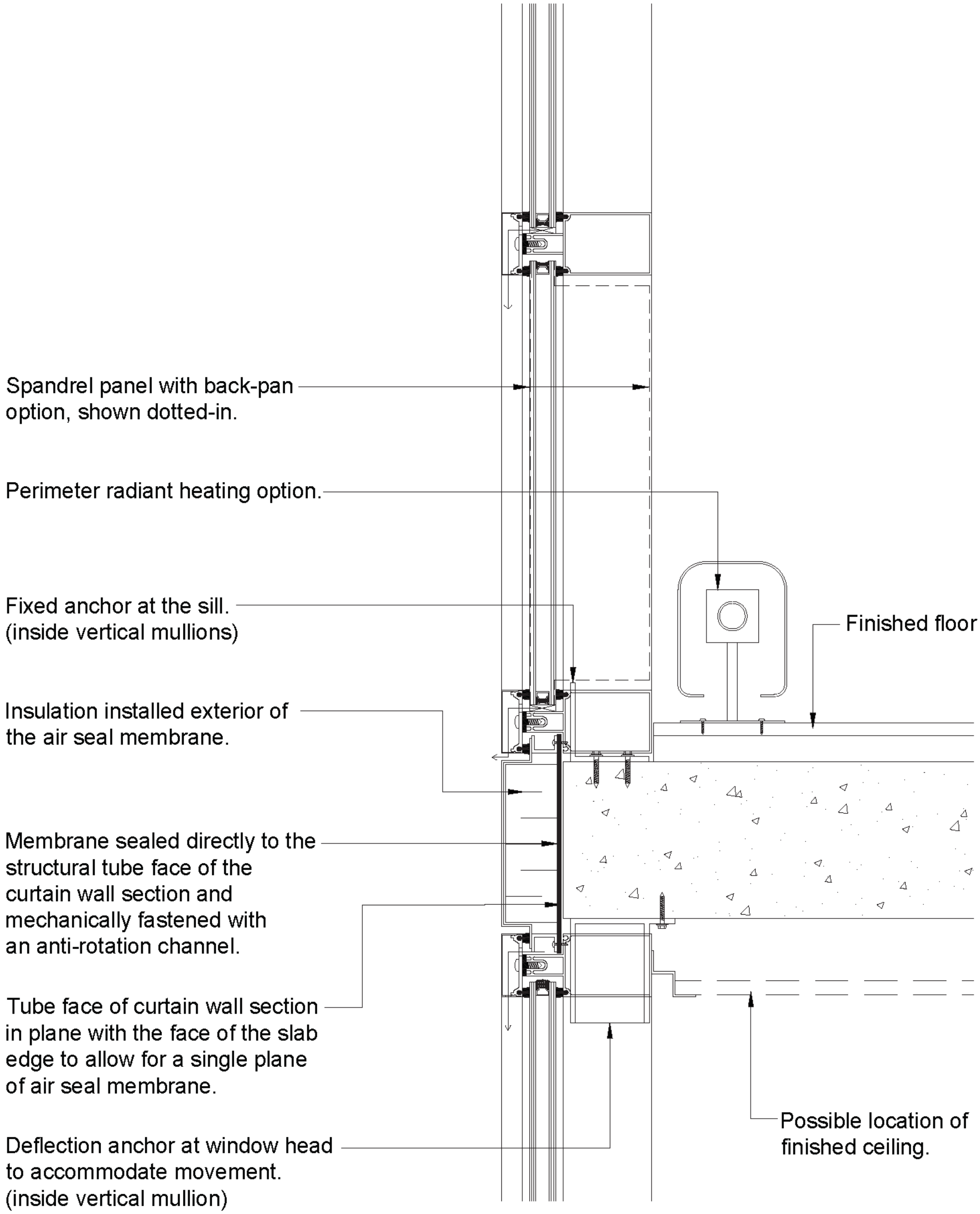
Alberta Infrastructure	FOUNDATION CURTAIN WALL DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 8
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

Classification: Public



Alberta Infrastructure	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	

Login: elizabeth.rivera M:\SharedCAD\CivilCAD\Drafting\Spec_Details\BUILDING ENVELOPE DETAILS\R2\09 floor to floor curtain wall detail.dwg Feb 23, 2012 - 11:07am

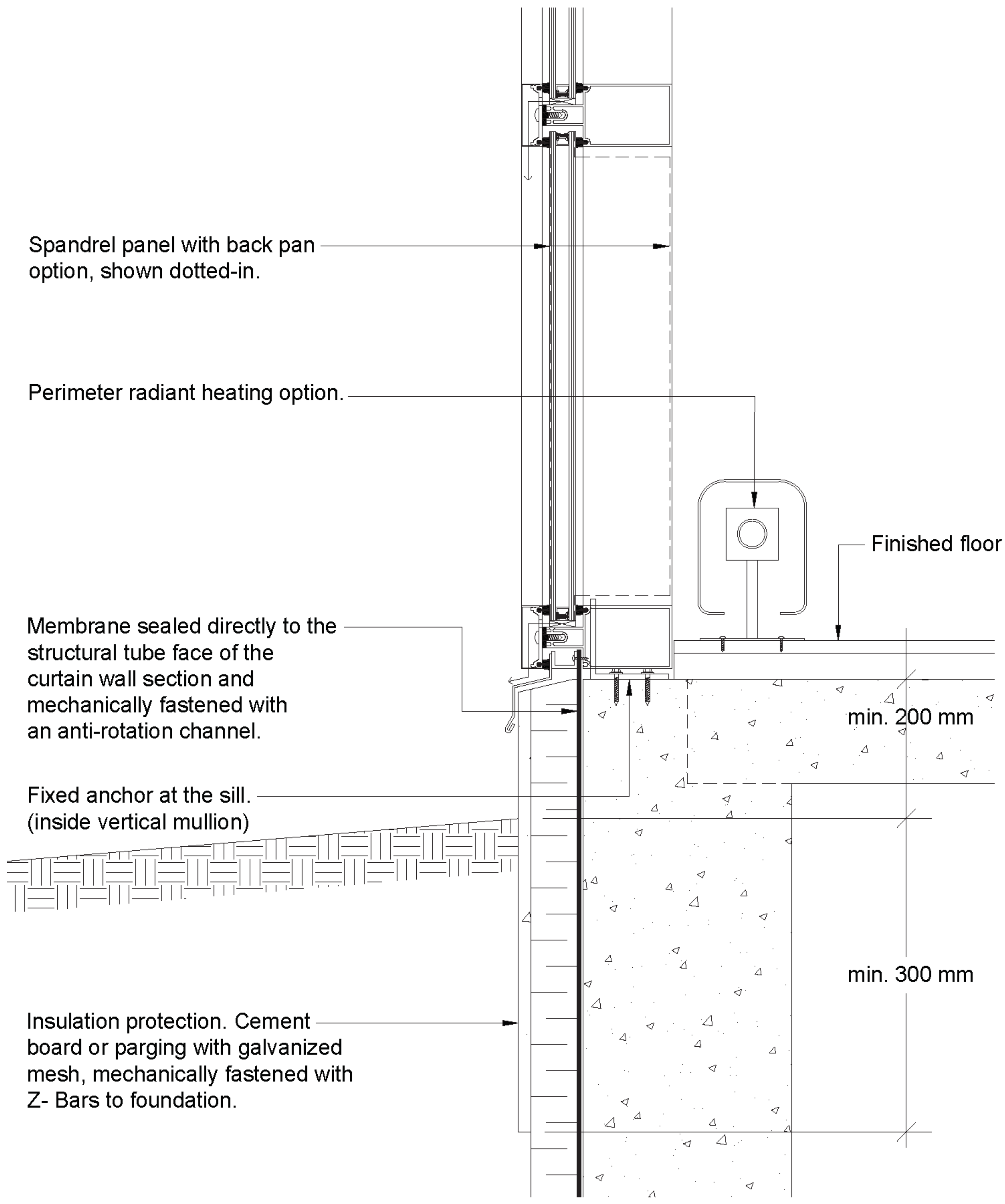


Login: elizabeth.rivera M:\SharedCAD\CivilCAD\Drafting\Spec_Details\BUILDING ENVELOPE DETAILS\R2\09 floor to floor curtain wall detail.dwg Feb 23, 2012 - 11:07am

Alberta Infrastructure

SLAB TO SLAB CURTAIN WALL DETAILS - SERIES 09 INTERMEDIATE FLOOR		BUILDING SCIENCES SECTION		DETAIL NUMBER
DRAWN BY E. RIVERA	DATE 2012-02-23	CHECKED BY V. SOLBAK	DATE 2012-02-23	2

Login: elizabeth.rivera M:\SharedCAD\CivilCAD\Drafting\Spec_Details\BUILDING ENVELOPE DETAILS\R2\09 floor to floor curtain wall detail.dwg Feb 23, 2012 - 11:07am



Alberta Infrastructure

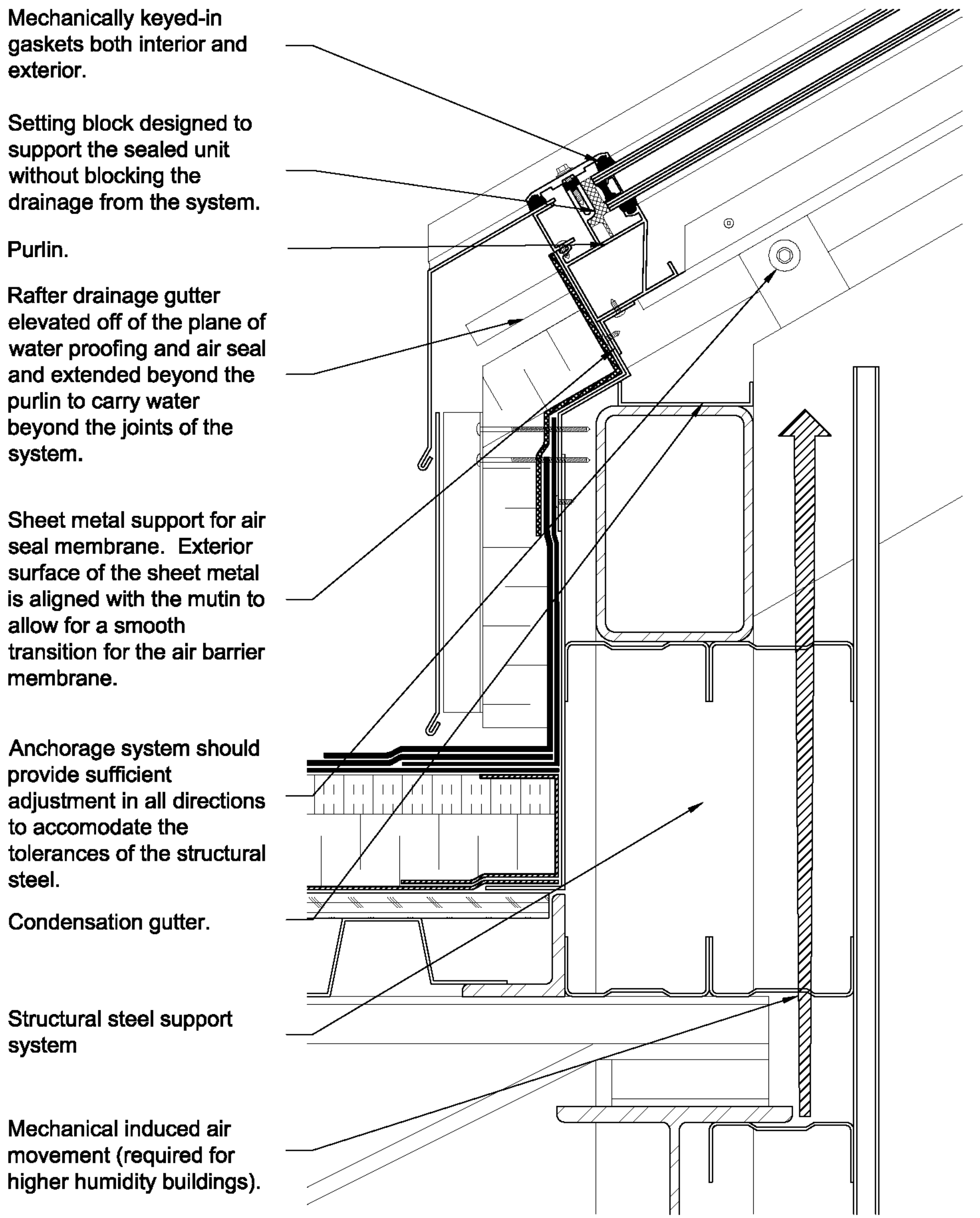
SLAB TO SLAB CURTAIN WALL DETAILS - SERIES 09

FLOOR AT FOUNDATION LEVEL

BUILDING SCIENCES SECTION

DETAIL NUMBER 3

DRAWN BY	DATE	CHECKED BY	DATE
E . RIVERA	2012-02-23	V . SOLBAK	2012-02-23



Alberta Infrastructure	SILL TO ROOF SKYLIGHT DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 1
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE	

Mechanically keyed-in gaskets both interior and exterior.

Setting block designed to support the sealed unit without blocking the drainage from the system.

Purlin.

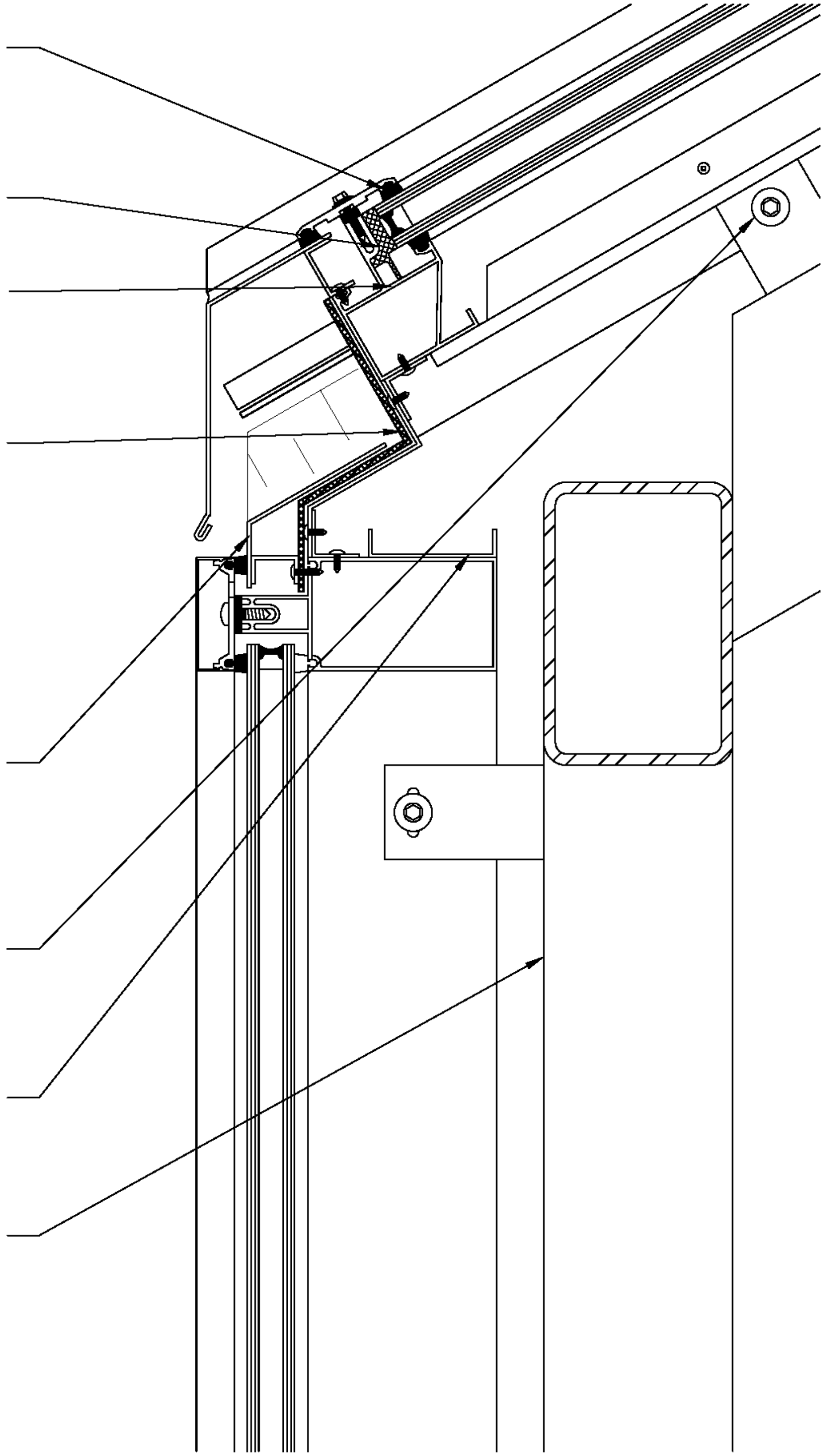
Sheet metal is used along with aluminum angles to support the air seal membrane from the curtainwall glazing rabbet to the sklylight sill purlin framing. The sheet metal should not interfere with the sealing of the membrane to the aluminum sections.

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



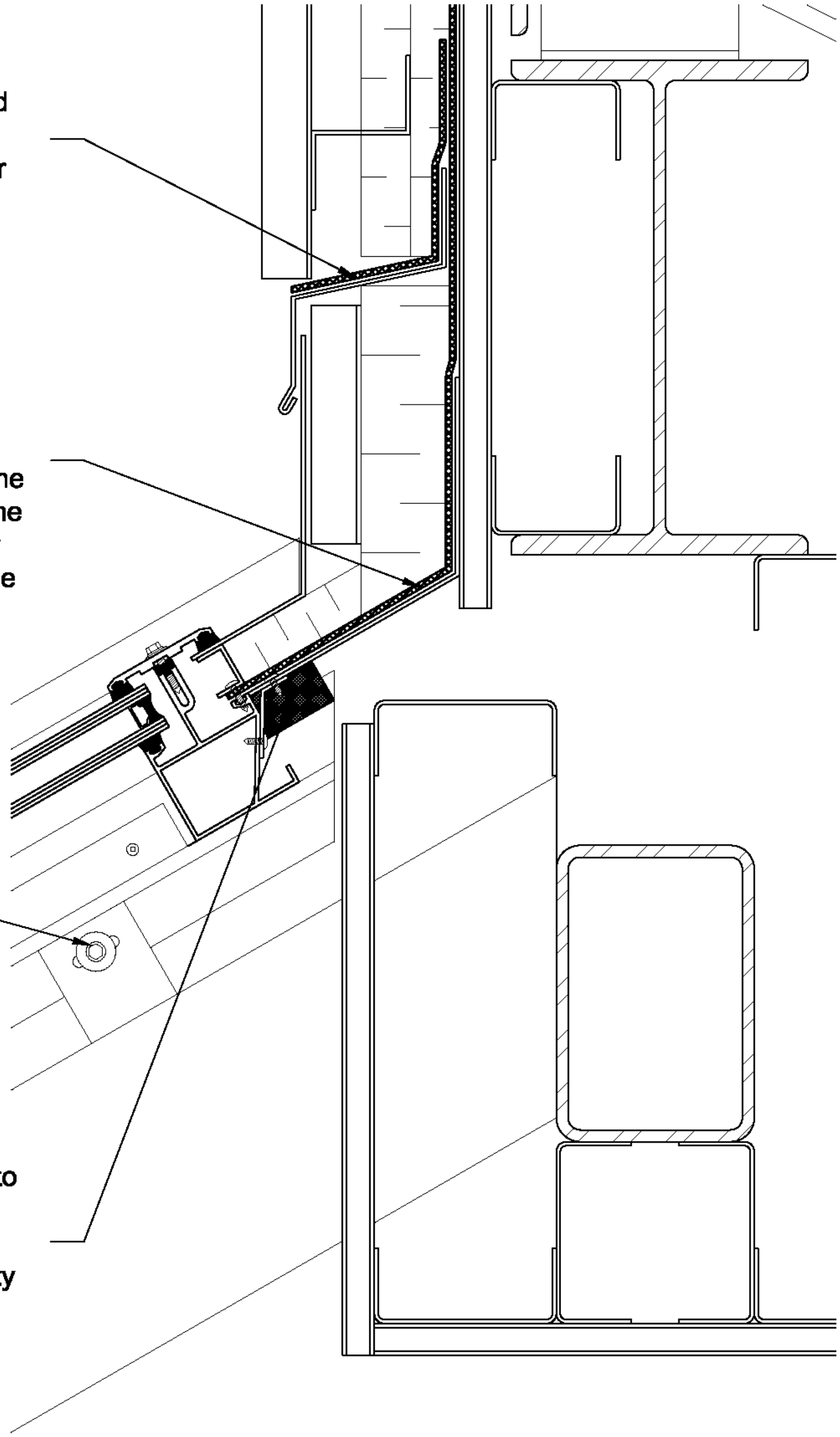
Alberta Infrastructure	SILL TO CURTAIN WALL SKYLIGHT DETAILS		BUILDING SCIENCES SECTION	DETAIL NUMBER 2
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

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		DETAIL NUMBER 3
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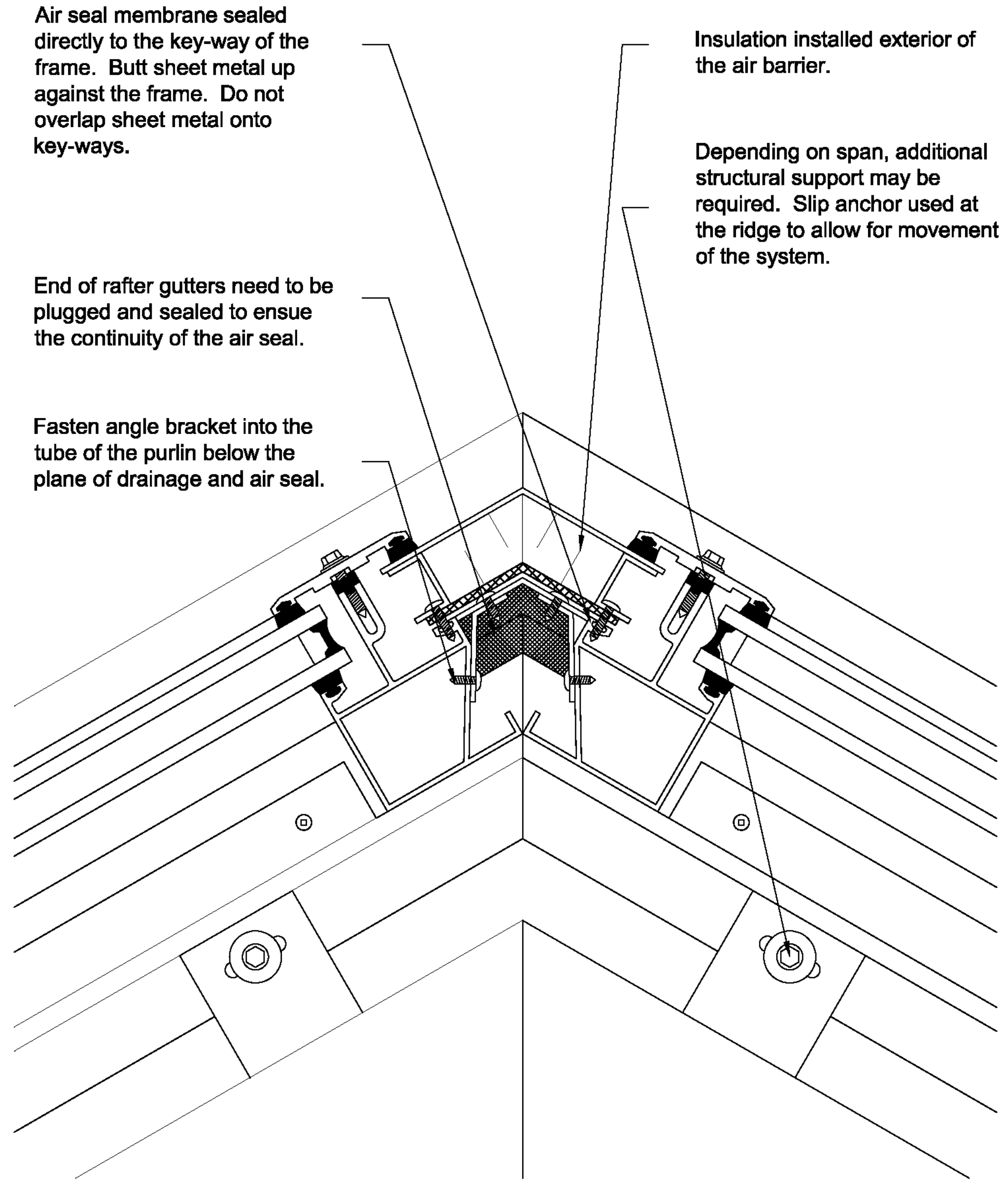
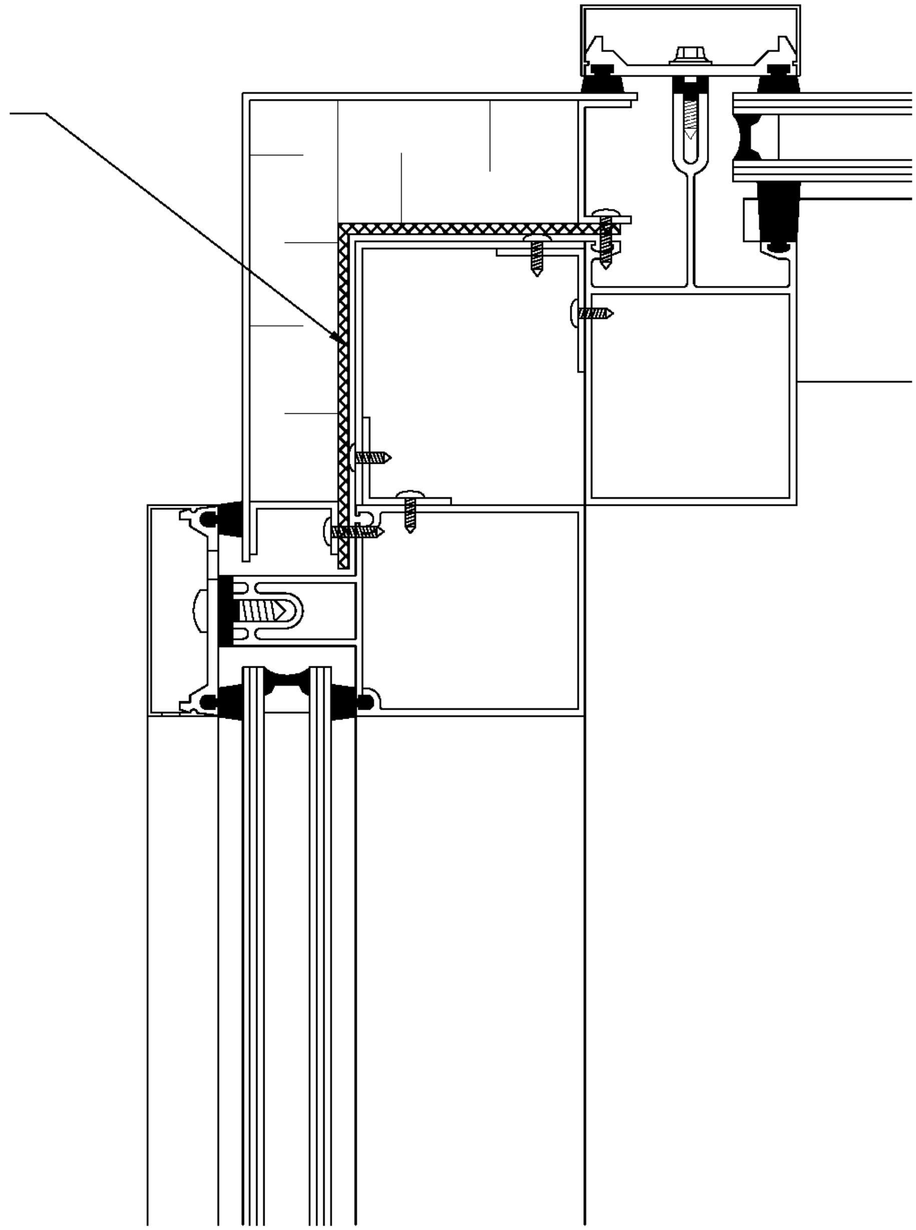


Alberta Infrastructure	RIDGE SKYLIGHT DETAILS	BUILDING SCIENCES SECTION		DETAIL NUMBER 4
	DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE

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	DETAIL NUMBER 5
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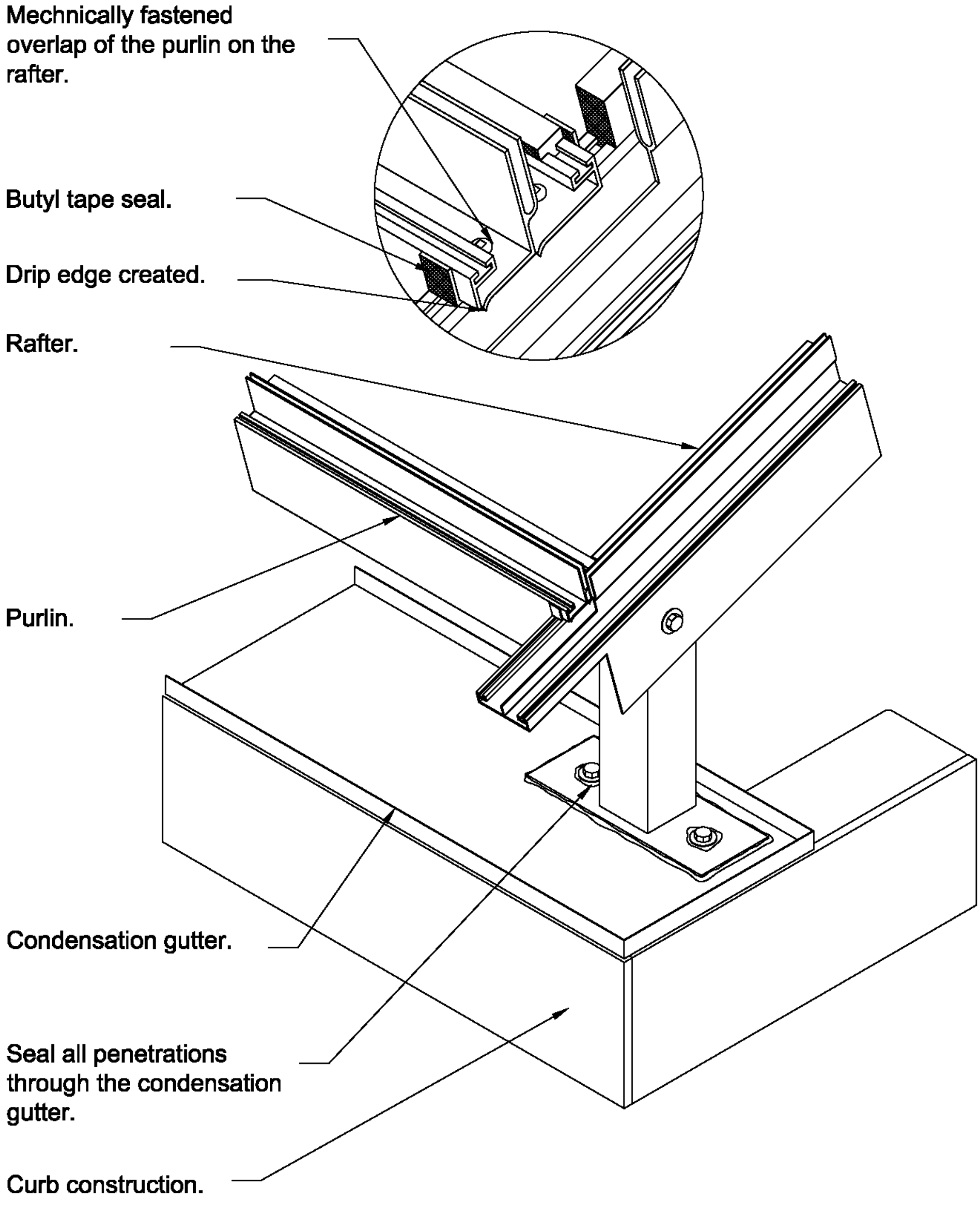

Alberta Infrastructure	ASSEMBLY SEQUENCE 1 SKYLIGHT DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 6
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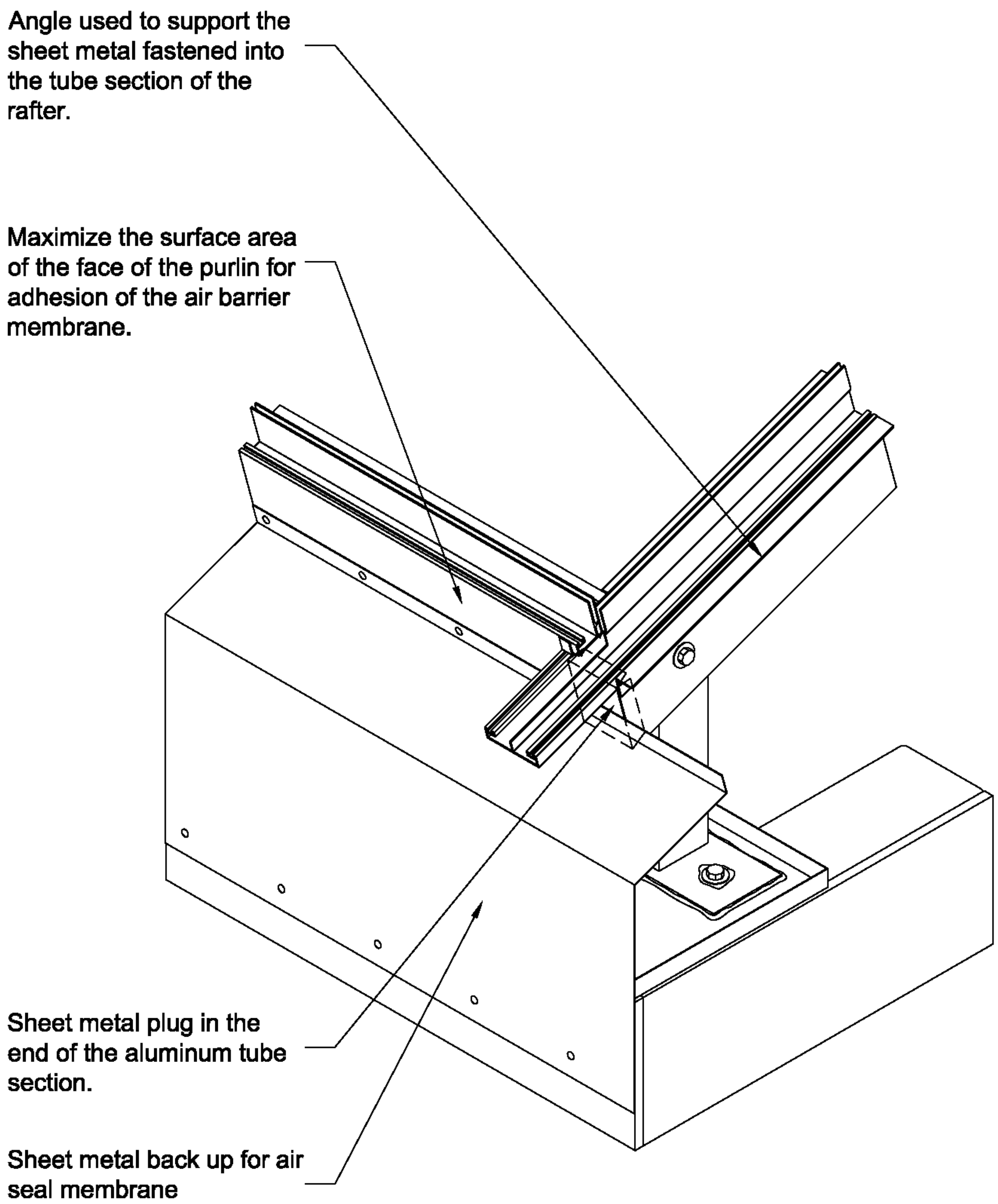

Alberta Infrastructure	ASSEMBLY SEQUENCE 2 SKYLIGHT DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 7
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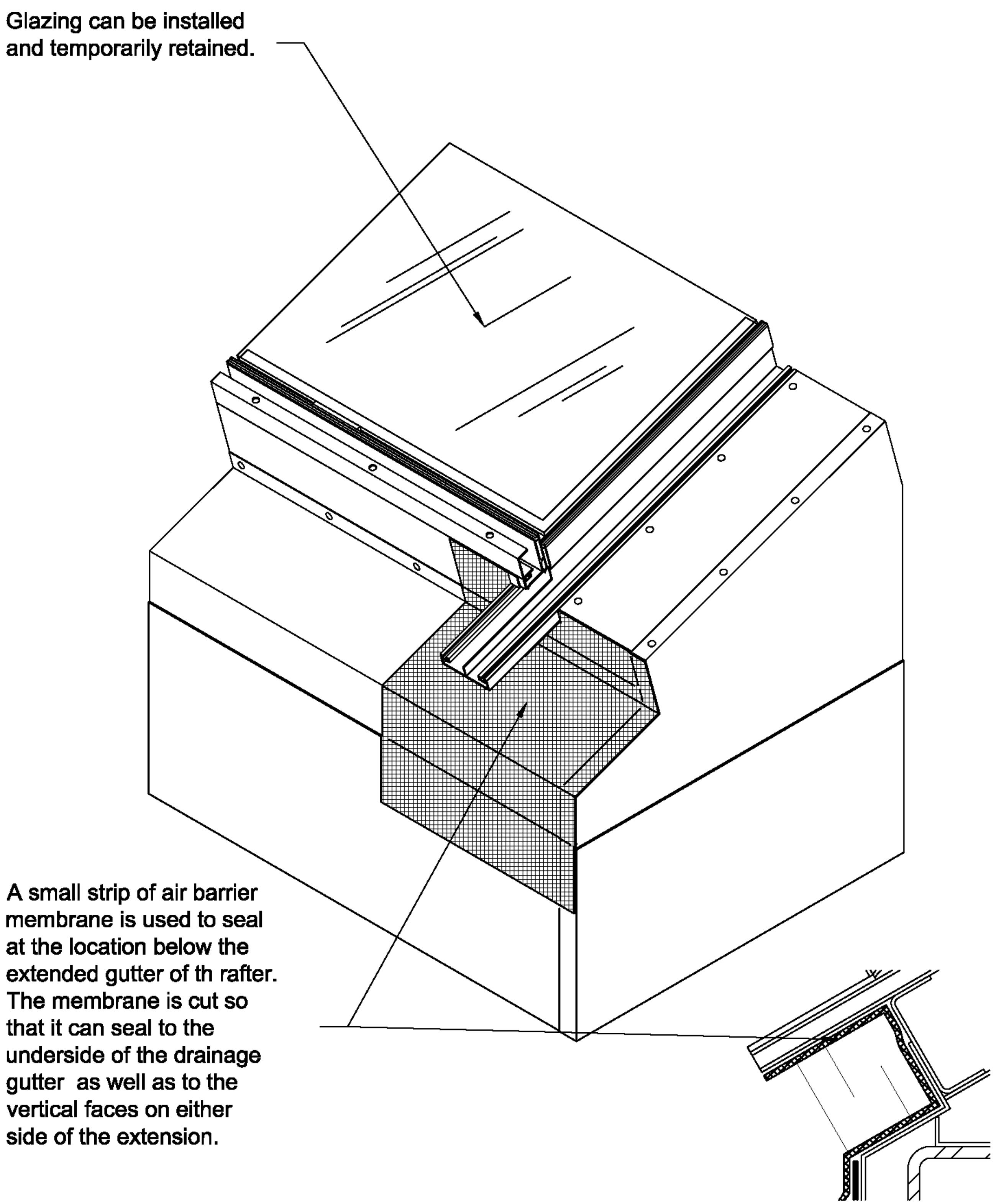
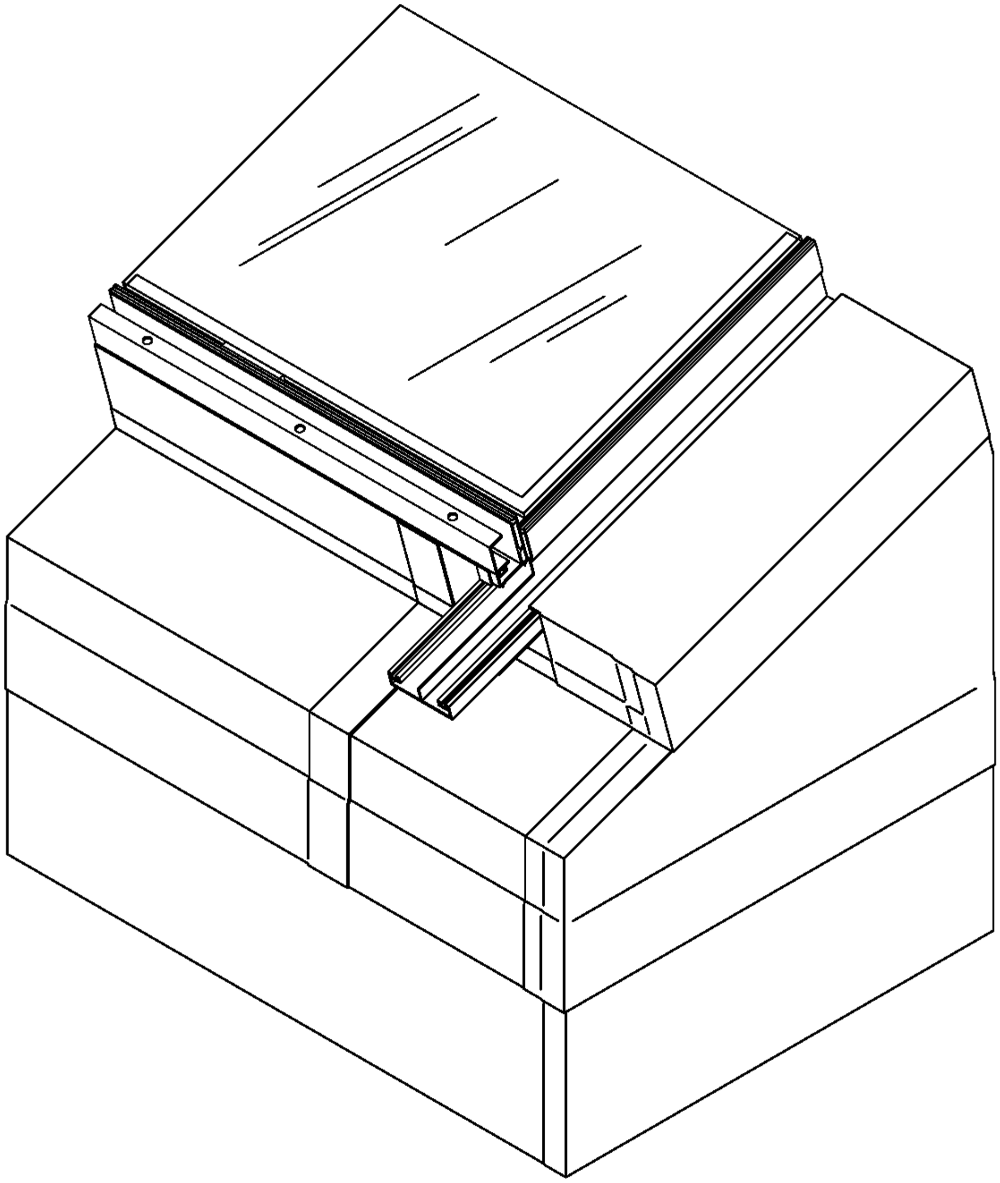


Alberta Infrastructure

ASSEMBLY SEQUENCE 3 SKYLIGHT DETAILS		BUILDING SCIENCES SECTION		DETAIL NUMBER 8
DRAWN BY PETER BAKER	DATE 01-01-2005	CHECKED BY	DATE	

Completion of the
membrane seal.



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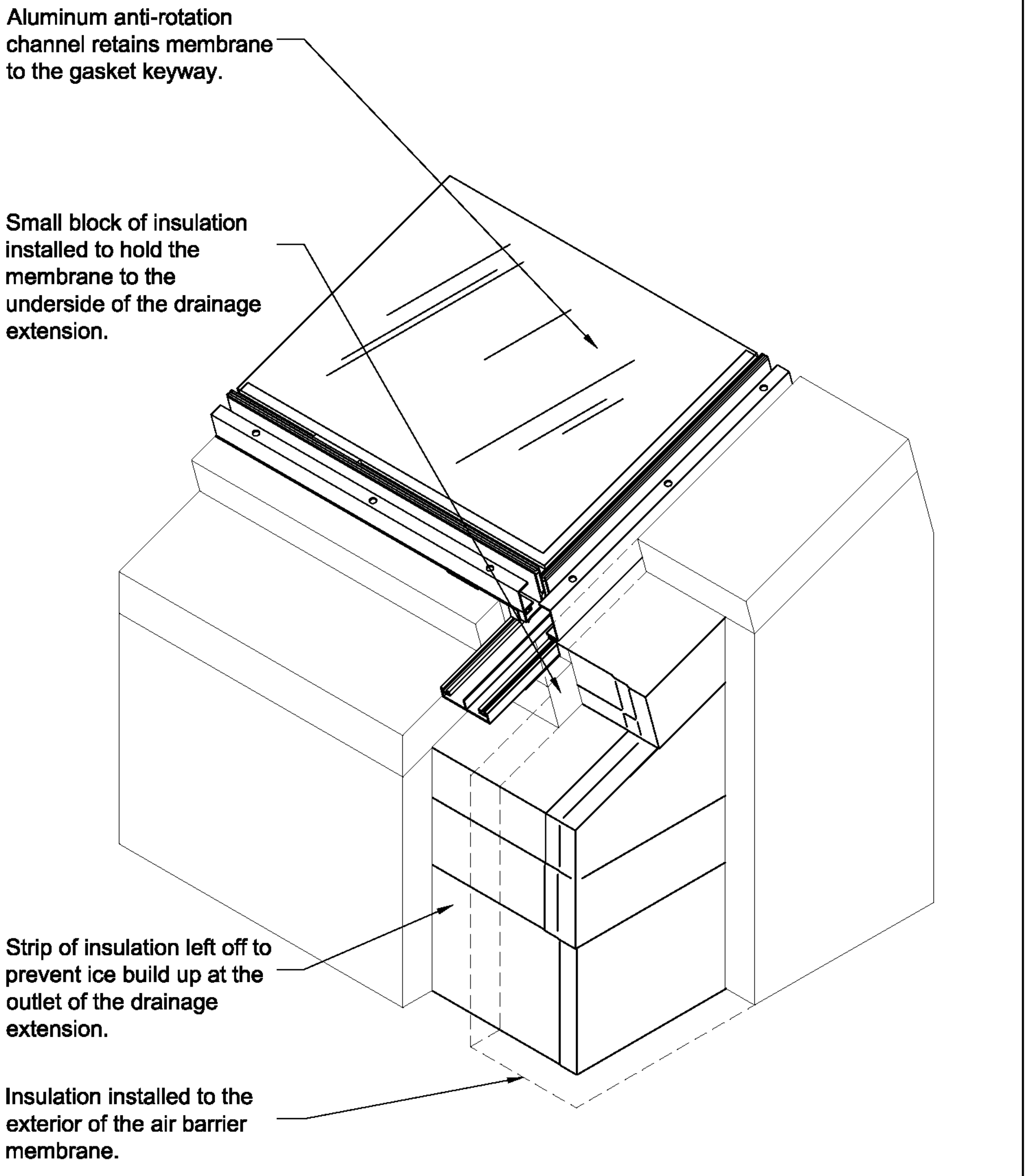

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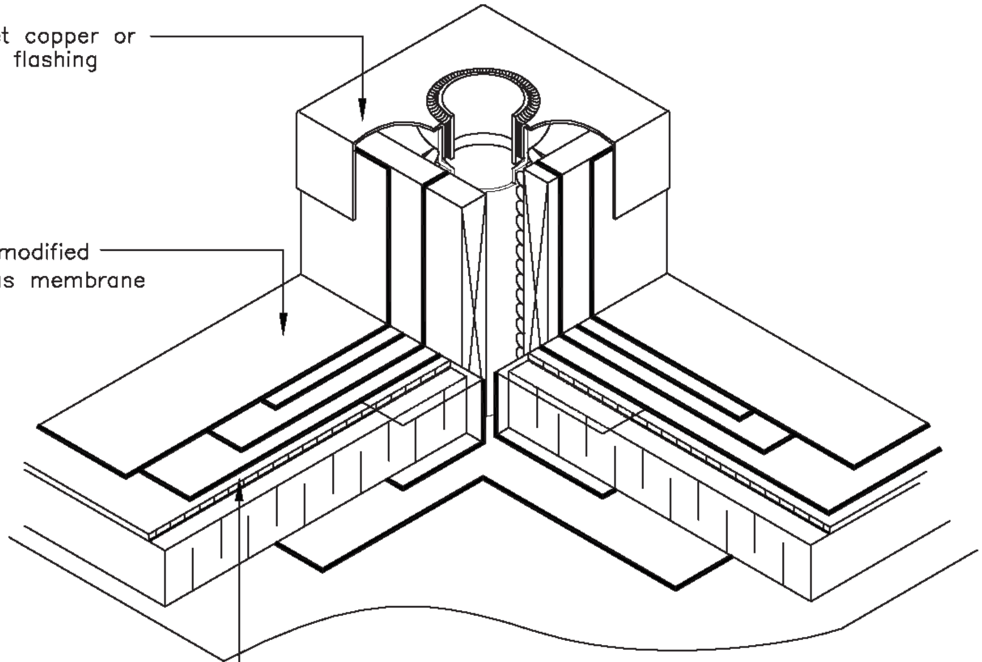

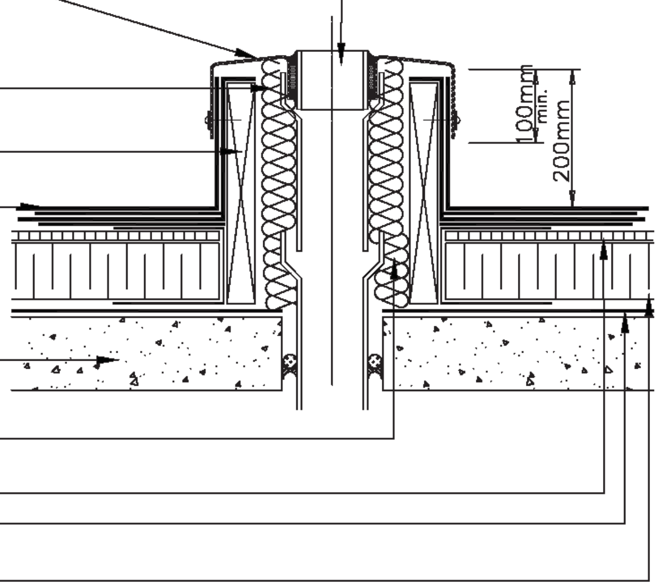

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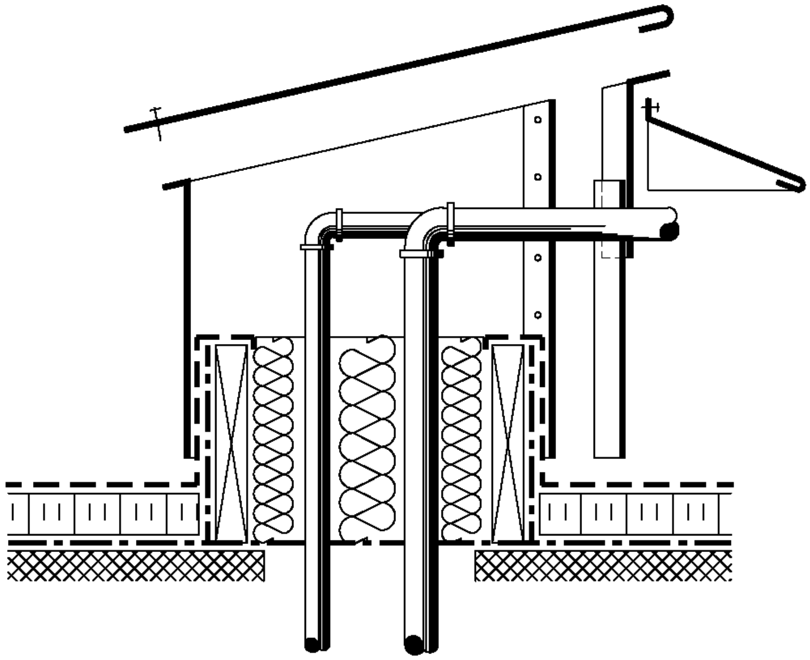
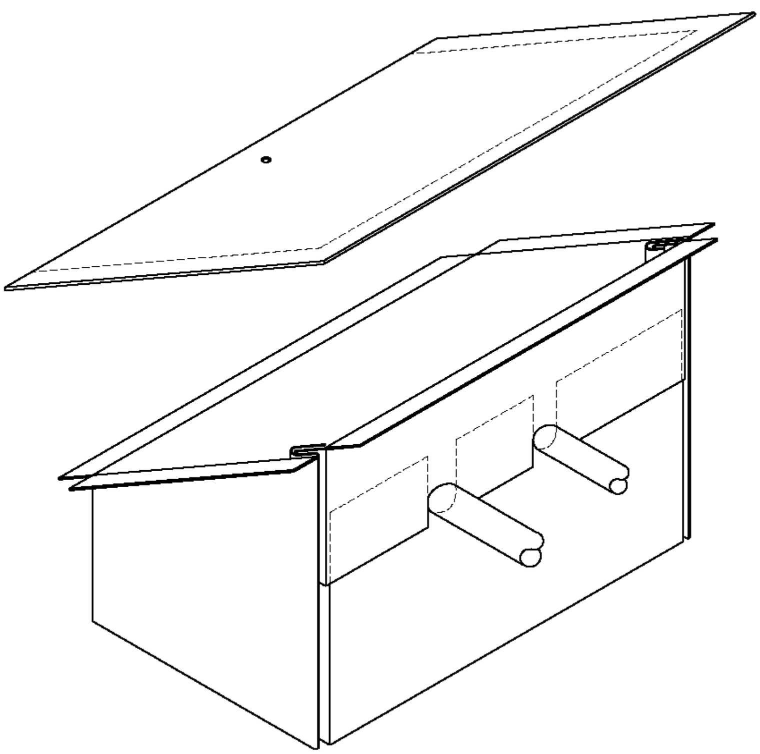
Alberta Infrastructure	PLUMBING VENT		BUILDING SCIENCES SECTION TSB		DETAIL NUMBER 1
	DRAWN BY E. RIVERA	DATE 2012-05-03	CHECKED BY V. SOLBAK	DATE 2012-05-03	





Alberta Infrastructure	ROOF JACK DETAIL		BUILDING SCIENCES SECTION TSB		DETAIL NUMBER 1
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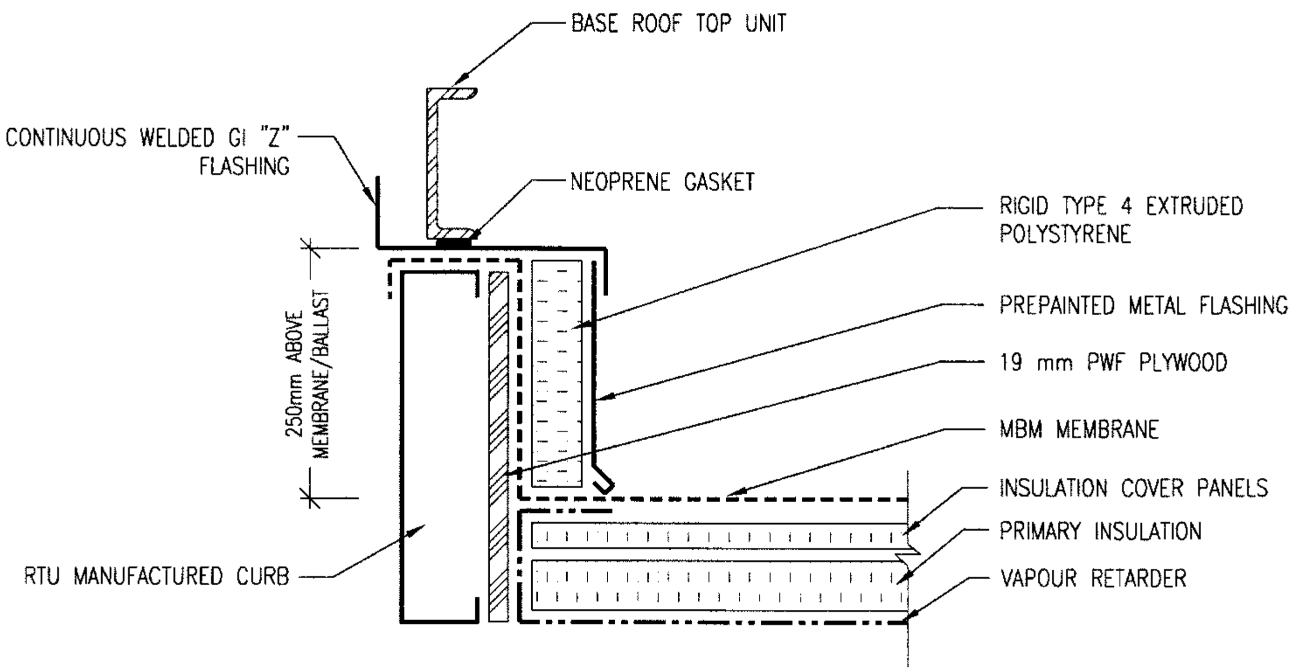
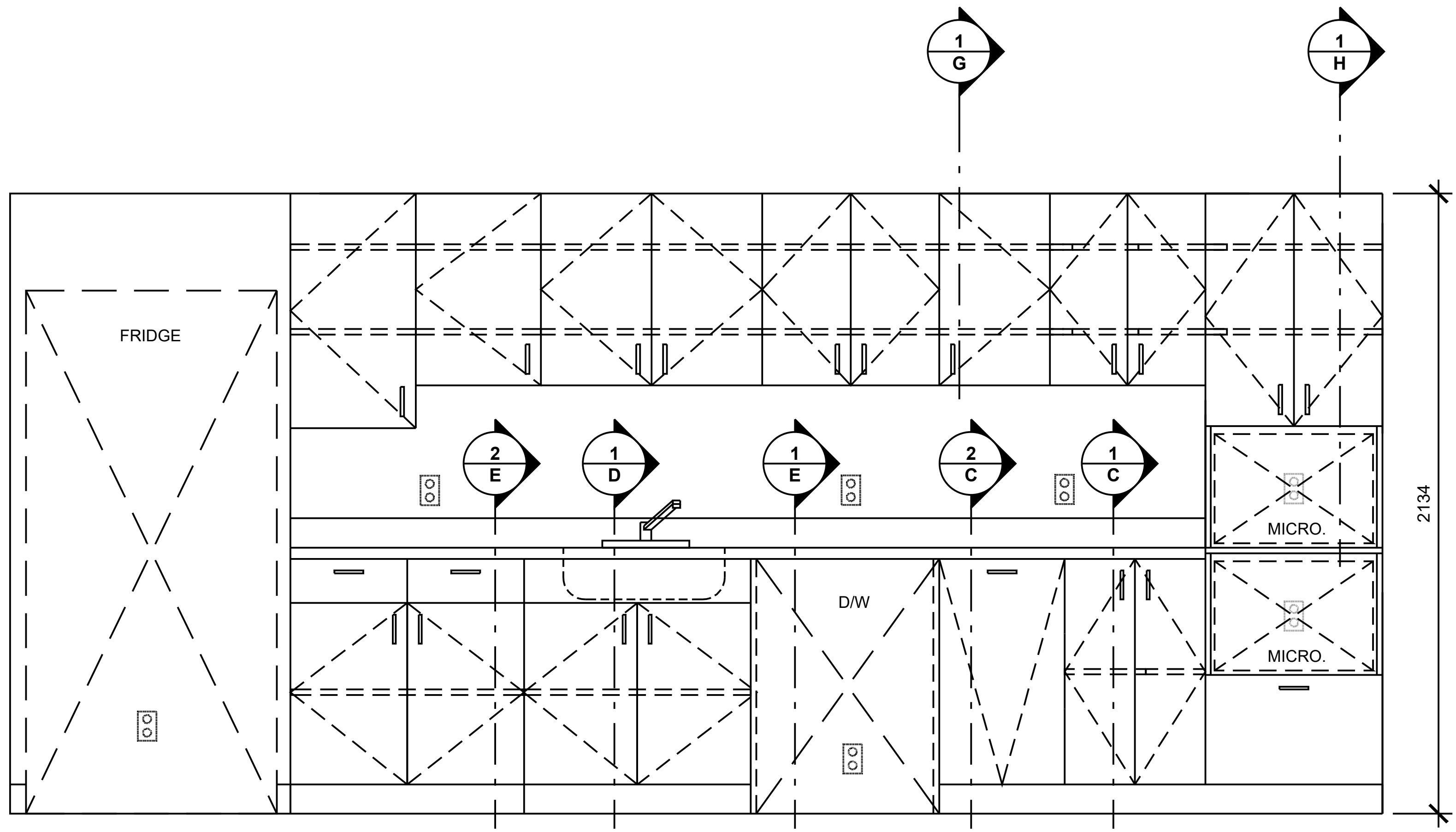


Login: Ela.Gozdzik S:\INFRAS\SharedCAD\CivilCAD\TRSD\Building Sciences\General Details\Roof\Roof Top Unit.dwg Jan 03, 2007 - 11:26am

Alberta Infrastructure	LOCATION – BLDG NAME BID # ROOF TOP UNIT DETAIL				Building Sciences TSB	
	project ID: BID...	drawn by: E. Gozdzik	date: M/YY	checked by: WJK	date: M/YY	scale: NTS	drawing no.: R..

Appendix E – Standard Millwork Details



1
A

STANDARD KITCHENETTE- TYPICAL

Scale: NTS

GENERAL NOTES:
-APPLIANCES ARE SHOWN FOR LOCATION PURPOSES ONLY.
-CONTRACTOR TO CONFIRM ALL EQUIPMENT AND APPLIANCE SIZES PRIOR TO FABRICATION.

Alberta
Infrastructure

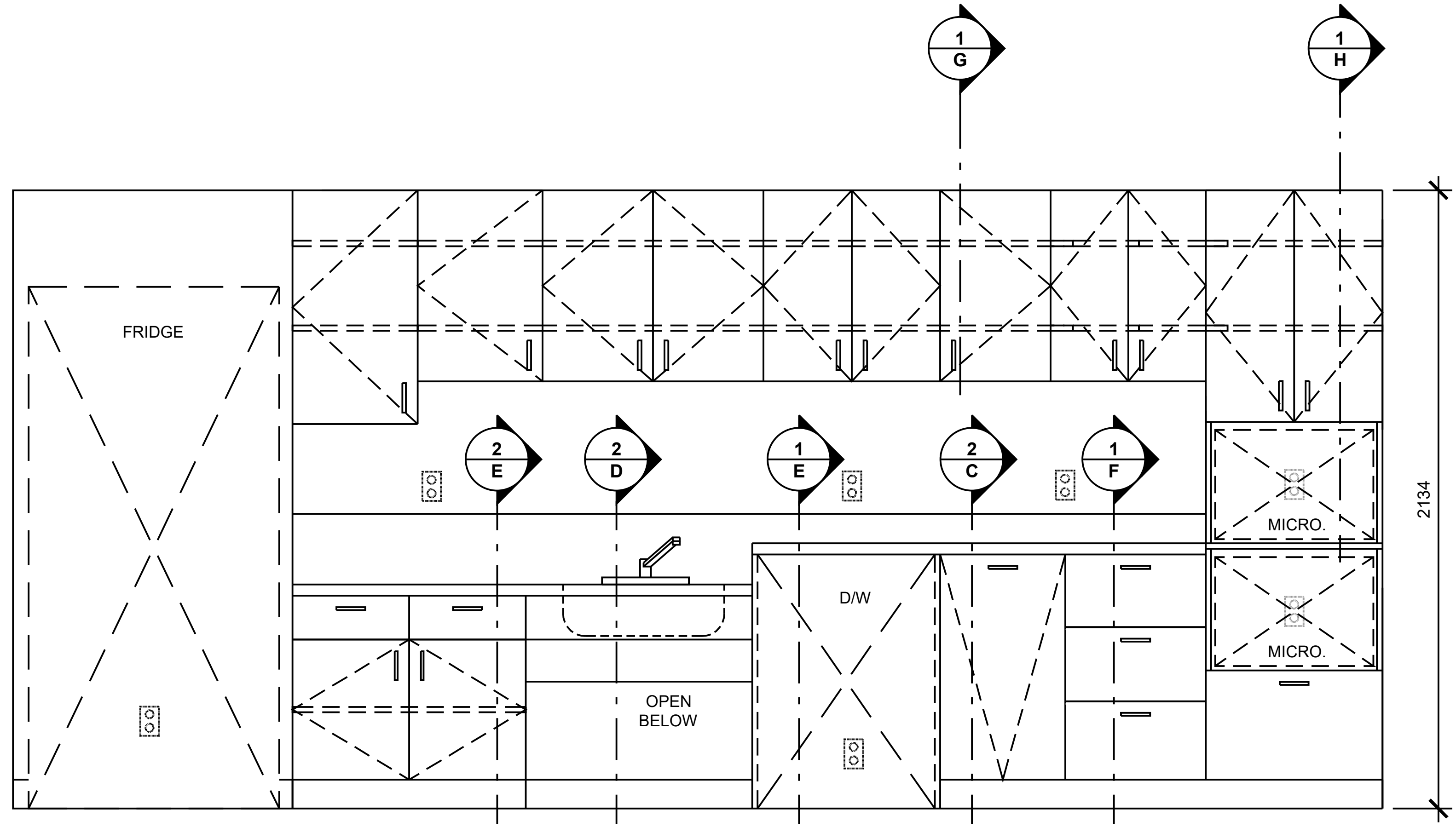
CONSULTANT

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_TDR.V8_2025

PROJECT
Technical Design Requirements
Version 8

TITLE
MILLWORK ELEVATION
STANDARD KITCHENETTE- TYPICAL

DRAWN BY	CHECKED BY	SCALE
JH	KM	NTS
DATE	SITE ID	BUILDING ID
02-21-2025	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-
PROJECT ID.	SHEET NO.	
Appendix E	A	



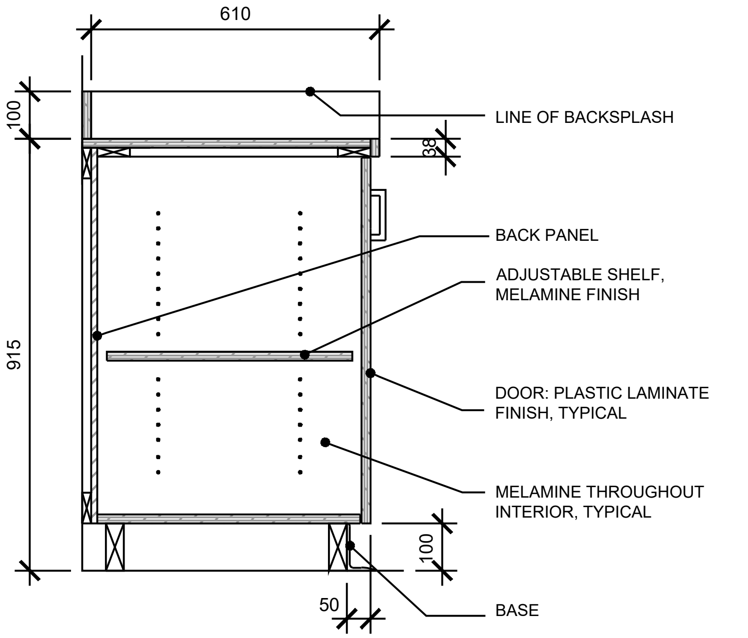
1
B

BARRIER-FREE KITCHENETTE- TYPICAL

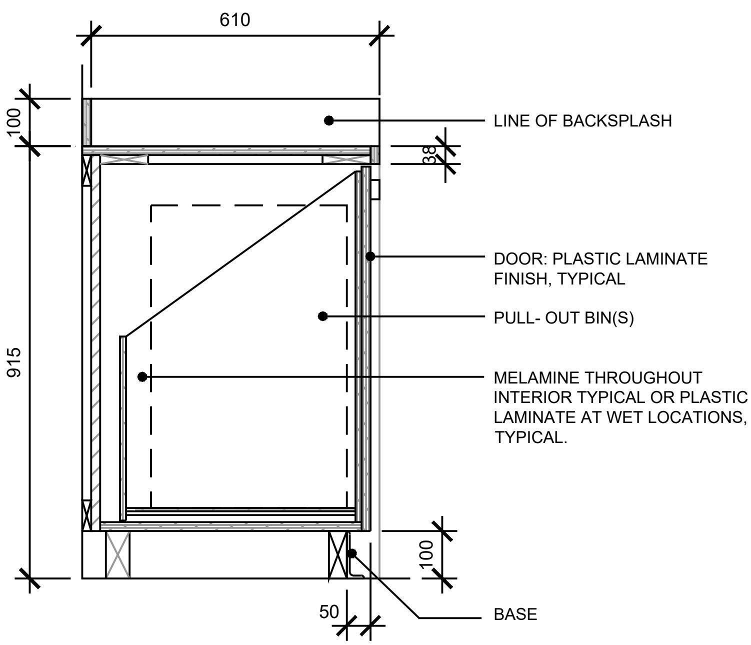
Scale: NTS

GENERAL NOTES:
-APPLIANCES ARE SHOWN FOR LOCATION PURPOSES ONLY.
-CONTRACTOR TO CONFIRM ALL EQUIPMENT AND APPLIANCE SIZES PRIOR TO FABRICATION.

Alberta Infrastructure	CONSULTANT	PROJECT: Technical Design Requirements Version 8	DRAWN BY: JH	CHECKED BY: KM	SCALE: NTS
			DATE: 02-21-2025	SITE ID: -	BUILDING ID: -
		TITLE: MILLWORK ELEVATION BARRIER-FREE KITCHENETTE- TYPICAL	PLAN NO.: -	PHASE: -	DISCIPLINE: -
	DOCUMENT CODE: STANDARD MILLWORK DETAILS_ APPENDIX E_TDR.V8_2025		PROJECT ID.: Appendix E	SHEET NO.: B	



1 / C **STANDARD COUNTER**
Scale: NTS



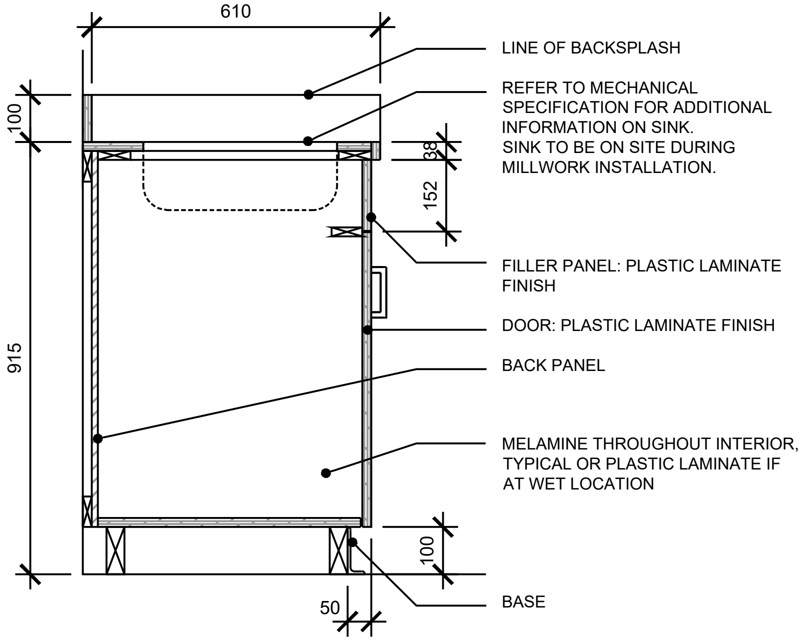
2 / C **COUNTER WITH WASTE**
Scale: NTS

DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE NATIONAL BUILDING CODE-ALBERTA EDITION.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

Alberta Infrastructure

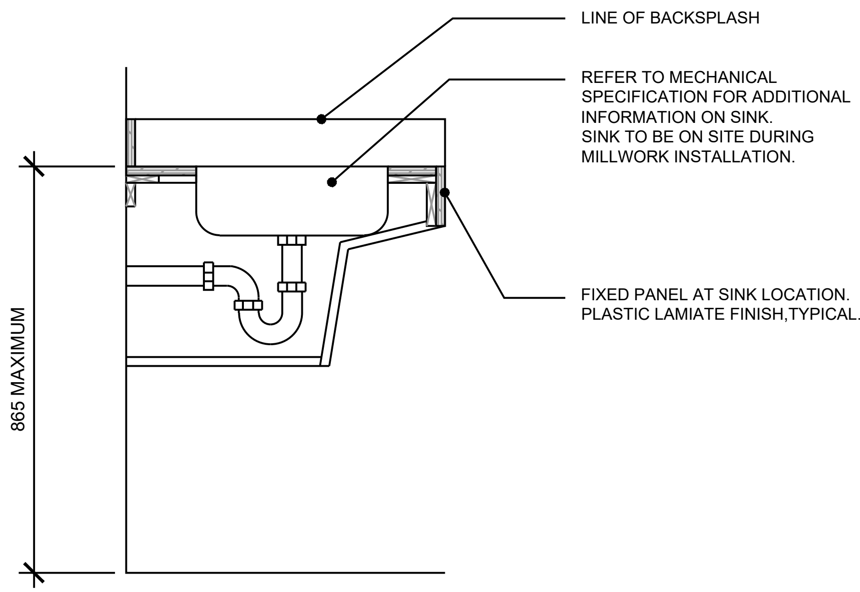
CONSULTANT	PROJECT **Technical Design Requirements** Version 8	DRAWN BY **JH**	CHECKED BY **KM**	SCALE **NTS**	
		DATE **02-21-2025**	SITE ID **-**	BUILDING ID **-**	
	TITLE **MILLWORK SECTION DETAIL 'C'**	PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**	
DOCUMENT CODE STANDARD MILLWORK DETAILS_ APPENDIX E_TDR.V8_2025		PROJECT ID. **Appendix E**		SHEET NO. **C**	



DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE NATIONAL BUILDING CODE-ALBERTA EDITION.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.
- PROVIDE MOISTURE RESISTANT SUBSTRATE AT ALL WET AREAS.

1/D **COUNTER WITH SINK**
Scale: NTS



2/D **BARRIER-FREE COUNTER WITH SINK**
Scale: NTS

Alberta Infrastructure

CONSULTANT

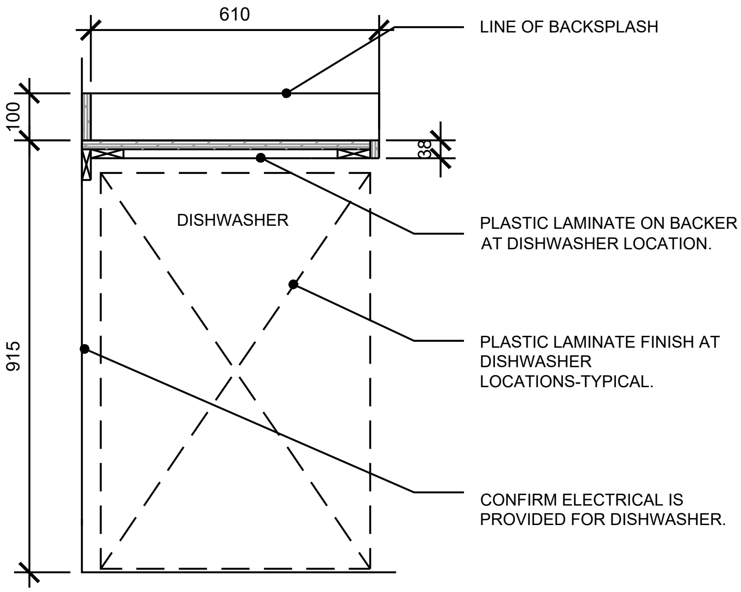
PROJECT
Technical Design Requirements
Version 8

DRAWN BY	CHECKED BY	SCALE
JH	**KM**	**NTS**
DATE	SITE ID	BUILDING ID
02-21-2025	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-

TITLE
MILLWORK SECTION
DETAIL 'D'

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_TDR.V8_2025

PROJECT ID.	SHEET NO.
Appendix E	**D**

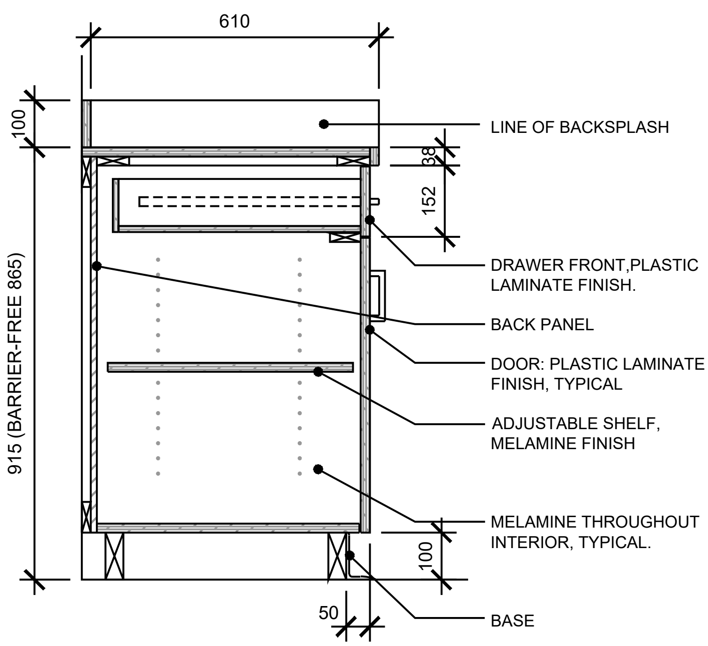


DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE NATIONAL BUILDING CODE- ALBERTA EDITION.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

1 / E **COUNTER WITH DISHWASHER**

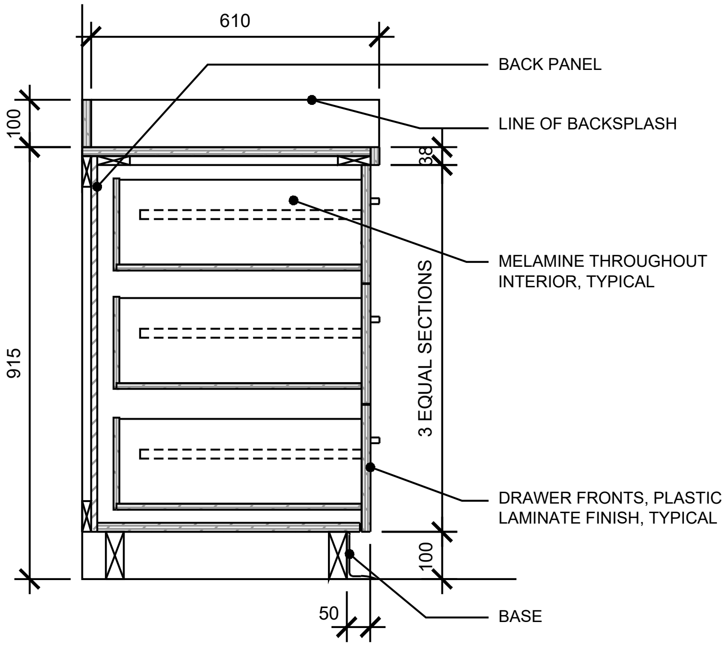
Scale: NTS



2 / E **COUNTER WITH SINGLE DRAWER**

Scale: NTS

Alberta Infrastructure	CONSULTANT	PROJECT **Technical Design Requirements** Version 8	DRAWN BY **JH**	CHECKED BY **KM**	SCALE **NTS**
			DATE **02-21-2025**	SITE ID **-**	BUILDING ID **-**
		TITLE **MILLWORK SECTION DETAIL 'E'**	PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**
DOCUMENT CODE STANDARD MILLWORK DETAILS_ APPENDIX E_TDR.V8_2025			PROJECT ID. **Appendix E**	SHEET NO. **E**	



1/F **COUNTER WITH 3 DRAWERS**
Scale: NTS

DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE NATIONAL BUILDING CODE- ALBERTA EDITION.
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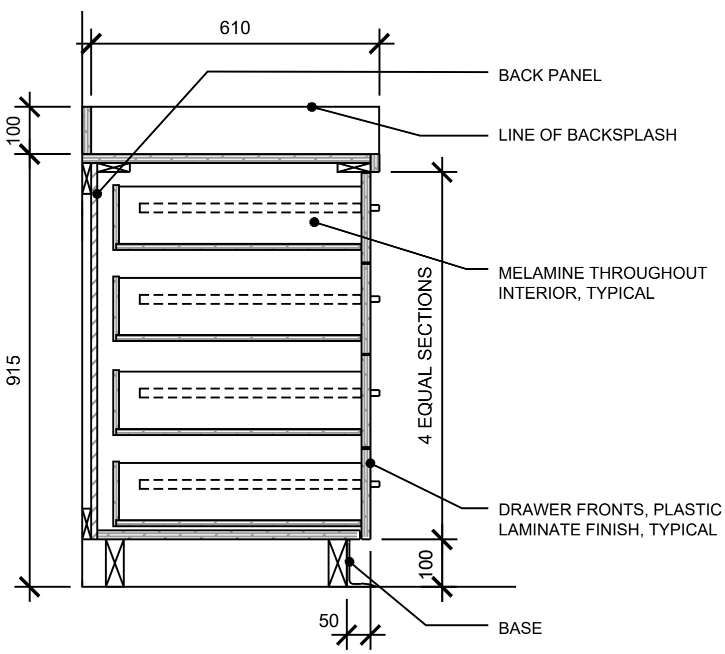
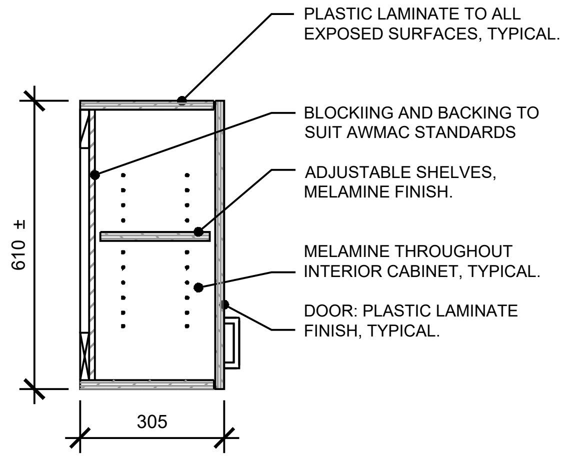


2/F **COUNTER WITH 4 DRAWERS (OPTIONAL)**
Scale: NTS

Alberta Infrastructure	CONSULTANT	PROJECT **Technical Design Requirements** Version 8	DRAWN BY **JH**	CHECKED BY **KM**	SCALE **NTS**
			DATE **02-21-2025**	SITE ID **-**	BUILDING ID **-**
		TITLE **MILLWORK SECTION DETAIL 'F'**	PLAN NO. **-**	PHASE **-**	DISCIPLINE **-**
DOCUMENT CODE STANDARD MILLWORK DETAILS_ APPENDIX E_TDR.V8_2025			PROJECT ID. **Appendix E**	SHEET NO. **F**	

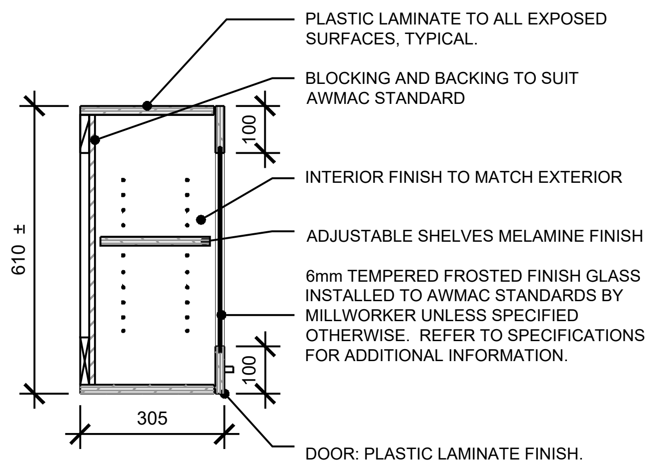


DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

1 / G **OVERHEAD CABINET**

Scale: NTS



2 / G **OVERHEAD CABINET WITH GLASS**

Scale: NTS

Infrastructure

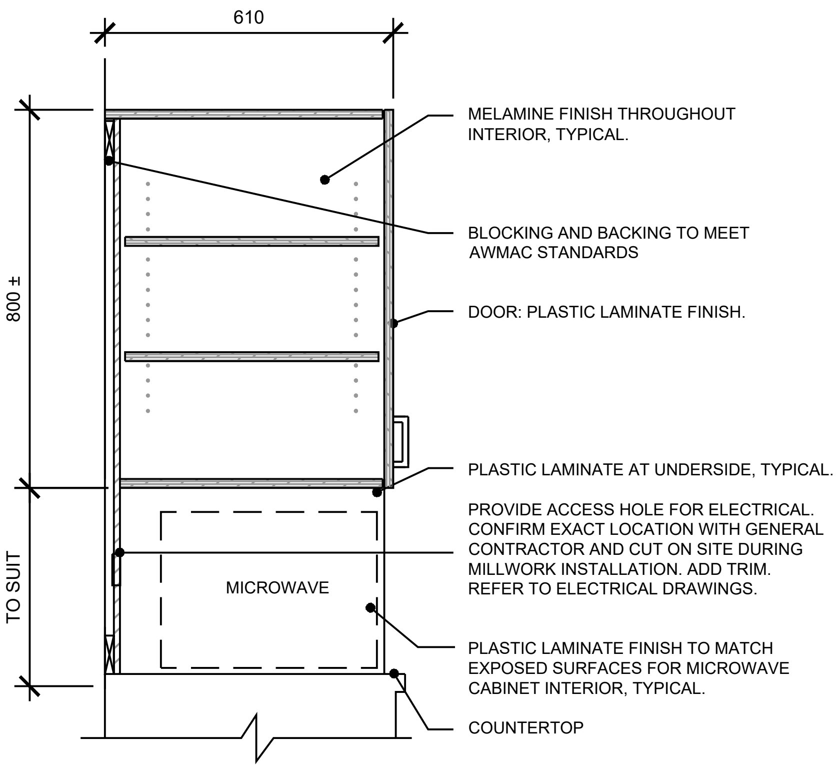
CONSULTANT

PROJECT
Technical Design Requirements
Version 8

TITLE
MILLWORK SECTION
DETAIL 'G'

DOCUMENT CODE
STANDARD MILLWORK DETAILS_ APPENDIX E_TDR.V8_2025

DRAWN BY	CHECKED BY	SCALE
JH	KM	NTS
DATE	SITE ID	BUILDING ID
02-21-2025	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-
PROJECT ID.	SHEET NO.	
Appendix E	G	



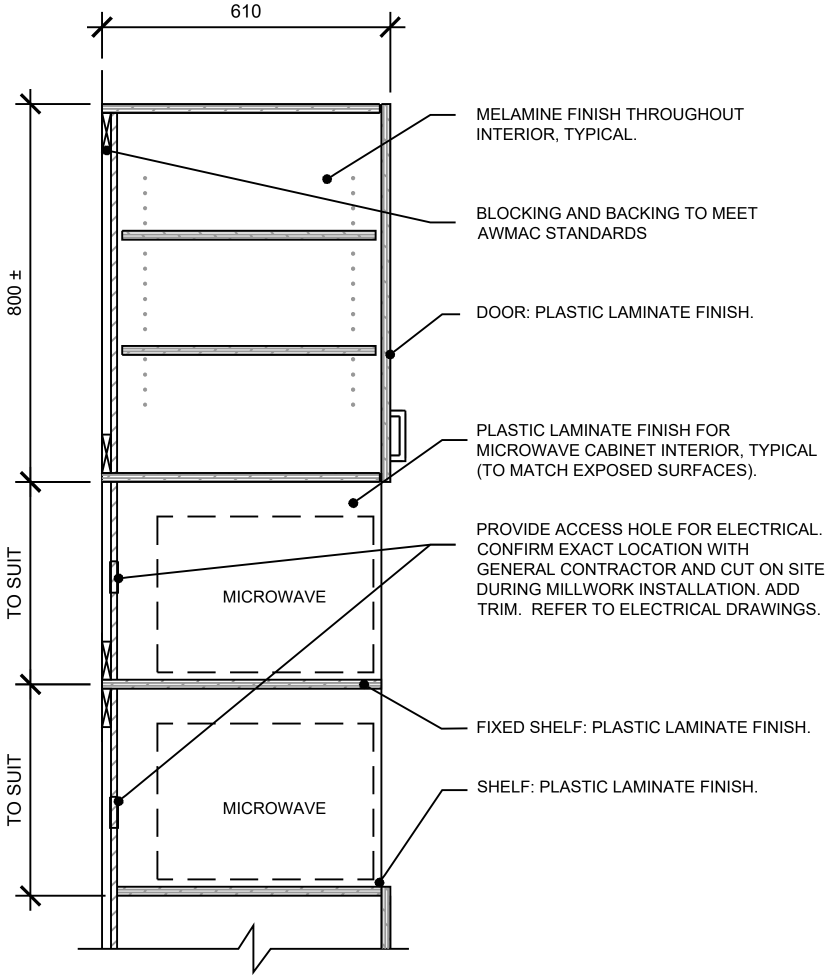
DETAIL NOTES:

- CONSTRUCT TO MEET AWMAC AND NAAWS STANDARDS.
- WHERE APPLICABLE, BARRIER-FREE REQUIREMENTS MUST CONFORM TO THE CURRENT VERSION OF THE NATIONAL BUILDING CODE- ALBERTA EDITION.
- PROVIDE CLEAR SILICONE SEALANT AT BACKSPLASH AND COUNTER.
- CONFIRM MICROWAVE SIZE WITH CLIENT.
- ALTERNATE FINISHES MAY BE CONSIDERED IN APPROPRIATE APPLICATIONS.
- FOR MILLWORK PANEL EDGES (DOORS, GABLES, ENDS, SHELVES, DRAWER FRONTS, ETC.) AND COUNTERTOPS IN HIGH USE AREAS, USE SOLID 2-3mm COLOUR MATCHED PVC EDGING RATHER THAN PLASTIC LAMINATE OR MELAMINE EDGING, FOR DURABILITY - OR USE SOLID 2-3mm SPECIES MATCHED WOOD EDGING WITH WOOD VENEER FACES.

1 / H **SINGLE MICROWAVE CABINET**

Scale: NTS

Alberta Infrastructure	CONSULTANT	PROJECT: **Technical Design Requirements** Version 8	DRAWN BY: **JH**	CHECKED BY: **KM**	SCALE: **NTS**
			DATE: **02-21-2025**	SITE ID: **-**	BUILDING ID: **-**
DOCUMENT CODE: STANDARD MILLWORK DETAILS_ APPENDIX E_TDR.V8_2025		TITLE: **MILLWORK SECTION DETAIL 'H'**	PLAN NO.: **-**	PHASE: **-**	DISCIPLINE: **-**
			PROJECT ID.: **Appendix E**	SHEET NO.: **H**	



DETAIL NOTES:

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1 / I **DOUBLE MICROWAVE CABINET**

Scale: NTS

Alberta Infrastructure	CONSULTANT	PROJECT: **Technical Design Requirements** Version 8	DRAWN BY: **JH**	CHECKED BY: **KM**	SCALE: **NTS**
			DATE: **02-21-2025**	SITE ID: -	BUILDING ID: -
		TITLE: **MILLWORK SECTION DETAIL 'I'**	PLAN NO.: -	PHASE: -	DISCIPLINE: -
DOCUMENT CODE: STANDARD MILLWORK DETAILS_ APPENDIX E_TDR.V8_2025			PROJECT ID.: **Appendix E**	SHEET NO.: **I**	

Appendix F – Design Guidelines for Smudging Rooms in Alberta Infrastructure Facilities

Design Guidelines for Smudging Rooms in Alberta Infrastructure Facilities

1. Purpose

This section is intended to provide practical guidance on the provision of facilities for Indigenous smudging practices for Alberta Infrastructure projects. To achieve a culturally appropriate and functional design, respectful consultation with Indigenous stakeholders is encouraged. This document is not a policy on operations and/or procedures for usage of such facilities.

2. Planning Requirements

2.1. All current regulatory building and fire codes, and the Technical Design Requirements (TDR), must be adhered to, and universal and barrier free design incorporated.

2.2. In keeping with the Guiding Principles outlined in TDR Section 3, spaces should be designed to be shareable, multi-functional, flexible, and adaptable.

2.3. The area used for smudging shall be shared with the allocated programmed space, with no additional space added to the program to accommodate a smudging room.

2.4. Equitable user access from a public area or common corridor should be prioritized.

2.5. Common amenities such as universal washrooms and kitchen facilities should be in convenient proximity, to share resources and assist in wayfinding and navigation.

2.6. The size should be appropriate to the maximum number of participants based on the meeting room sizes outlined in the TDR.

2.7. The room shape should be square or rectangular to allow a multi-functional, flexible, and adaptable space. If desired, a circular gathering can be achieved through creative application of non-permanent decorative elements or placement of non-fixed furnishings.

3. Interior Finishes and Materials

3.1. Finishes and furniture must be fire-resistant and in accordance with all applicable fire codes.

3.2. Materials that absorb smoke and odours, such as fabrics or other soft materials, should be avoided.

3.3. Interior finishes and materials should be neutral in colour.

3.4. Flooring

3.4.1. Carpet should be avoided in environments where smudging takes place, as smoke odour can linger in the fibers. A smooth flooring material, such as resilient flooring, should be used.

3.5. Walls

3.5.1. Wall finishes and other surfaces must be highly cleanable (such as a scrubbable paint).

3.5.2. Vinyl graphic images are acceptable solutions for wallcoverings, however, must be approved for appropriateness prior to application, by Alberta Infrastructure Technical Services (Interior Design section).

3.6. Ceilings

3.6.1. The smoke from smudging can cause ceiling surfaces surrounding mechanical vents/grilles to discolour over time. For this reason, it is recommended that the ceiling colour be beige or grey. Consider the use of ceiling tile, as it can be easily replaced.

3.7. Doors

3.7.1. Doors must have gaskets or sweeps to seal any openings and prevent leakage of smoke or fumes from the room.

4. Furnishings, Fixtures and Equipment (FF&E)

4.1. Consider the provision of furniture or millwork to store smudging materials.

4.2. Provide storage for coats, shoes, and personal belongings if the program requirement includes outside visitors. It is best to avoid a coat hanging rod to avoid the continuous task to oversee the provision of coat hangers.

5. Signage

5.1. Where applicable, ensure signage aligns with the Government of Alberta Visual Identity Standards.

5.2. Consider using signage to inform that smudging will be occurring in the building. Examples of text: *'This is a smudging environment and smudging occurs regularly in this facility. All are welcome to participate as a matter of choice.'*

6. Acoustics

6.1. Interior partitions must have an ASTC rating of 45 (STC 50) or meet the ASTC rating for the room's primary usage, as identified in the TDR, whichever is higher.

6.2. Doors shall be solid wood or insulated metal.

6.3. If the room has a volume lower than 800 m^3, the reverberation in the unoccupied room must not exceed RT 0.8 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz. If the volume is larger than 800 m^3, the reverberation in the unoccupied room must not exceed RT 1.2 seconds, averaged over the frequency range of 500 Hz – 2,000 Hz.

6.4. If ceiling tiles or acoustical wall panels are used, they should be a cleanroom-type product that does not have porous surfaces.

6.5. Design mechanical systems to provide a background noise level maximum RC-N 30. Select a low-noise exhaust fan option.

7. Mechanical

7.1. Provide dedicated exhaust and negative pressure relationship to the adjacent spaces to contain, capture and remove smoke.

7.2. At minimum provide 12 air changes per hour (ACH) of dedicated exhaust.

7.3. Provide control damper for isolating the return air from the smudging room during the ceremony.

7.4. Provide a manually operated switch with timer to activate the exhaust fan and close the control damper on the return side during the ceremony.

8. Electrical

8.1. Where the fire alarm system could be activated by smudging activities, consider providing by-pass switch(es) at the main fire alarm control panel for the affected devices/areas and having an acceptable alternate procedure in place that is coordinated with the AHJ. Activating by-pass switch(es) shall trigger a trouble on the fire alarm system until the by-pass is de-activated.

Appendix G – Geotechnical Investigation Guidelines for Alberta Infrastructure Projects

Geotechnical Investigation Guidelines for Alberta Infrastructure Projects

Version 2.0

Published October 2024

Technical Services & Procurement Branch

Contents

1 Introduction

1.1 Purpose of Guidelines

The Guidelines have been prepared to set out the standards of practice which geotechnical consultants should meet and follow while providing professional engineering services for Alberta Infrastructure projects.

Following are the specific objectives of these guidelines:

.1 Describe the standard of practice that Engineering Professionals should follow when providing professional services related to geotechnical professional activities.

.2 Specify the tasks and/or services that Engineering Professionals should complete or provide to meet the appropriate standard of practice and fulfill their professional obligations under the Act. These obligations include the Engineering Professional's primary duty to protect the safety, health, and welfare of the public and the environment.

.3 Describe the roles and responsibilities of the various participants/stakeholders involved in these professional activities. The document should assist in delineating the roles and responsibilities of the various participants/stakeholders, which may include the Registered Professional of Record, the Geotechnical Engineer of Record (GER), Province, Authorities Having Jurisdiction, Supporting Registered Professionals, and contractors.

.4 Define the skill sets that are consistent with the training and experience required to carry out these professional activities.

1.2 Geotechnical Engineering

Geotechnical engineering is to study the behaviour of soils and rock under the influence of loading forces and soil-water interactions. This knowledge is applied to the design of site grading (cut/fill), foundations, retaining walls, earth dams, and the stability of natural and man-made slopes, etc.

Geotechnical investigation is performed by geotechnical engineers to obtain the subsurface information of a proposed development site. It helps to understand the foundation requirements and constraints posed by soil and groundwater conditions for construction of any new infrastructures, underground utilities, parking lots, and roads. A geotechnical investigation is required for all new infrastructure projects. Insufficient geotechnical information is the main cause of project's delays, disputes, claims, and cost overruns. Inadequate information of subsurface conditions could cause a significant, over-designed solution (high cost) or under-designed solution (potential failures).

The geotechnical report is a communication tool used by geotechnical engineers to provide site specific design parameters, and construction recommendations related to the geotechnical component of the project, such as foundations, excavation, groundwater conditions, retaining walls, ground anchors, earth works, utility installation, etc.

2 Roles and Responsibilities

The geotechnical engineer working for the Province must be licensed by the Association of Professional Engineers and Geoscientists of Alberta (APEGA) to practice in Alberta, and have the necessary qualification and experiences to offer geotechnical engineering services.

2.1 Project Organization and Delivery Methods

Project organizations differ based on the specific needs of the project and involved parties. The Geotechnical Engineer of Record (GER) is typically retained by the Province, they may also be engaged by the Province's Coordinating Registered Professional, the Structural Engineer of Record, a design/build contractor, or other individuals responsible for delivering part or the entire project. The common forms of project organization / delivery methods are:

.1 Design-Bid-Build Delivery
.2 Design-Build Delivery
.3 Construction Management
.4 Public Private Partnership Delivery

2.2 Responsibilities

2.2.1 The Province

In order that the design and construction of the project is carried out in a manner that meets appropriate standards of public safety and requirements of applicable codes and regulation, the Province should:

.1 Retain or cause to be retained qualified Professional Engineers including a Prime Consultant and a GER with responsibility for providing the necessary geotechnical design parameters used in foundation design and construction;

.2 Cooperate with GER to set out a written description of the scope of GER's services and adequate written description of the project;

.3 Before the commencement of the GER's services, finalize a written agreement with GER and other Professional Engineers. It specifies the agreed scope of services, schedules, deliverables, and associated compensation;

.4 Authorize in writing any additional services that may be beyond the original scope of the GER's services, based on recommendations from the GER or other members of the project team;

.5 Ensure that all required approvals, licences and permits from the Authorities Having Jurisdiction are obtained;

.6 Provide the GER with the right of entry onto the project site for exploration purpose;

.7 Recognize that drawings, specifications and other documents prepared by the GER are specific to the project and site and shall not be used or copied for other projects;

.8 Disclose fully and promptly all information that may affect the GER's analysis, work, scheduling of tasks, design, or payment for services, including among other things, any existing geotechnical reports or data, any situations that may require special testing or equipment, and all known potential environmentally sensitive or hazardous site conditions;

.9 Recognize that geotechnical investigations surveyed the subsurface and that unanticipated conditions may be encountered and a reasonable contingency should be included in the Province's budget; and

.10 If the original GER is replaced, the new GER may require additional resources beyond which were originally budgeted and scheduled.

2.2.2 Prime Consultant

To enable the GER to perform his duties properly, the Prime Consultant should do the following, but not limited to:

.1 Interpret and define the needs of the Province. The Prime Consultant should identify any special design criteria and advise the GER accordingly;
.2 Outline the scope of assignment to each design professional for design, preparation of contract documents, review of work during construction and contract administration;
.3 Provide timely information in sufficient detail required by the GER to adequately perform GER's duties;
.4 Coordinate and review the designs, drawings and other contract documents produced by all participants of the design team;
.5 Coordinate communication of information between the Province, the contractor and the design professionals, including the GER, so that the work proceeds in a manner that complies with applicable codes and regulations and meets the Province's needs.

2.2.3 Geotechnical Engineer of Record (GER)

The GER engaged by the Province is responsible for providing geotechnical recommendations and ensuring the geotechnical aspects of the design meet the required safety and regulatory standards. However, the GER should not be hired or contracted by other parties on the same project to provide similar services, as this could create a conflict of interest. Accepting roles from multiple parties within the same project may violate APEGA's ethical guidelines.

The GER should collaborate with the Province to develop a scope of work that enable the GER to fulfill the design and field review requirements in accordance with these guidelines, as well as all relevant codes and regulations.

Overall, the GER has responsibilities for, but not limited to:

.1 Selecting investigation methods and testing soil samples to assess physical characteristics or properties, such as strength and compressibility;
.2 Providing geotechnical and foundation parameters on which the geotechnical aspects are designed;
.3 Ensuring that the design parameters provided meet acceptable engineering standards;
.4 Reviewing final design to determine if the information and parameters provided have been correctly interpreted.

The GER may also provide recommendations for other elements of a building project or other types of projects requiring geotechnical expertise, such as slope stability, earthworks, pavement structures, criteria for design of temporary or permanent earth-retention systems, etc.

If the Province or Prime Consultant fails or refuses to carry out the obligations as set out in sections 2.2.1 and 2.2.2, the GER should consider giving written notice to the Province advising the Province of what GER requires in order to properly perform their duties.

2.2.4 General Contractor

It is not the mandate of this guideline to stipulate the responsibilities of the General Contractor, however, following should be clearly stated in the Contract Documents:

- .1 The General Contractor is responsible for all labour, materials, and equipment required to complete the work;
- .2 The General Contractor is responsible for the construction methods, techniques, sequences, procedures, safety precautions and programs associated with the construction work, all as set out in the Contract Documents;
- .3 The General Contractor is responsible for coordinating the work of the sub-contractors and for checking the sub-contractor's work;
- .4 The General Contractor is responsible for providing reasonable notice to the GER when the work is ready for field inspection and testing;
- .5 The General Contractor is responsible for providing safe access to the GER or their delegates to and within the site for review, inspection, material sampling and testing; and
- .6 The GER's field inspection and testing does not relieve the General Contractor from his responsibilities to complete the work in conformance with the Contract Documents.

3 Guidelines for Providing Geotechnical Engineering Services

This section outlines the services that the Geotechnical Engineer of Record (GER) should consider providing as part of best practice. These guidelines are not intended to be exhaustive and should not be interpreted to limit the GER's responsibilities.

3.1 Scope of Services

Before commencement of design services, the GER should meet with the Province to:

.1 Determine the terms of reference and the scope of work for basic services and additional services;
.2 Clarify the required design life of proposed structure;
.3 Clarify the professional responsibilities for geotechnical design and field review in order to satisfy Occupational Health and Safety Alberta (OHSA) since they relate to excavation and shoring safety;
.4 Reach agreement on fees, payment schedule, and professional liability insurance coverage; and
.5 Reach agreement on other contractual terms and conditions.

3.2 Basic Geotechnical Engineering Services

The typical components of the basic geotechnical services, as outlined below, are generally structured in an agreement based on the sequential stages of a standard geotechnical investigation project.

3.2.1 Desktop Study

During the conceptual planning of a project, a desktop study should be carried out. The GER may attend, as required, periodic meetings with the Province and design team to obtain the Province's instructions regarding project requirements. For the desktop study, the GER may provide the following:

3.2.1.1 Air Photo Interpretation

The following might be indicated on the air photographs for the site and surrounding area terrain:

.1 General drainage patterns;
.2 General surficial soil types (fill or native material);

.3 General slopes and ranges of gradient;
.4 Bedrock outcrops, where present;
.5 Poorly drained or bog areas (peat or muskeg);
.6 Erosion features;
.7 Old or potential slope failure areas; and
.8 Previous land use history: Identify what were the previous uses of the site including but not limited to the following within the area of the site:
    .1 Mining activity;
    .2 Abandoned mines; and
    .3 Landfills.

Some specific projects may also require the review of LiDAR images.

Summarize any risks associated with the above findings regarding the proposed project.

3.2.1.2 Literature Search

The following information may be searched:

.1 The geology of the area;
.2 Physiographical data;
.3 Previous site investigation data; and
.4 Available water well records.

3.2.1.3 Site Reconnaissance

A preliminary site reconnaissance may be made to physically examine landforms, drainage, erosion features, and site access constraints. In addition, hand auger holes may be put down to confirm the general surficial soil conditions.

3.2.2 Extent of Investigation

Upon completion of the desktop study, the GER may attend, if required, meetings with the Province and design team to review the data and plan the field investigation. The extent of the ground investigation is determined by the expected soil type, variability of soils and groundwater conditions, the type of project, and the amount of existing information.

3.2.2.1 Methods of Investigation

There are many different methods available for geotechnical investigation. However, this section summarizes the general local practice in Alberta.

Borehole drilling:

In Alberta, boreholes in the overburden are typically drilled with solid-stem augers. In some areas where boreholes must be cased to remain open due to the presence of high groundwater levels and soft or loose soils, hollow-stem auger drilling may be required. Other forms of drilling may at times be feasible depending on site condition such as: wash boring, air-rotary, sonic, CPTu, etc.

Drilling into bedrock and retrieving bedrock core samples is typically carried out using rotary diamond drilling equipment.

Test pits:

Test pits excavated by a backhoe can often provide valuable information on soil characteristics at shallow depth. ‘Grab’ samples can be obtained from the sides of the test pits or from the excavated spoil. Extra caution should be taken if test pits are excavated in loose sands, soft clays, or close to the water table.

3.2.2.2 Depth and spacing of boreholes

The depth of investigation is determined by many factors, including the type of structure and the associated magnitude of the loading, the subsurface conditions and their variability, the depth of planned excavation, and the types of foundations to be constructed. It is recommended that the site investigation should be carried to a depth that the entire zone of soil affected by changes caused by the structure and construction. However, the foundation type and design may not be finalized or unknown at the beginning of the site investigation, it is prudent to drill holes deeper than originally estimated to allow some variation during project development.

The spacing of boreholes is based on variability of site conditions, size/footprint of structure, type of project, performance requirements, past experiences, and judgement. For less developed areas where previous experiences are limited, more boreholes and closer spacing are generally recommended.

Table 1 Guidelines for Depth and Spacing of Boreholes

Development	Test Spacing	Approximate Depth of Investigation
Building	20 m – 50 m (A minimum of three boreholes is required)	• The depth of investigation will depend on the expected load and site condition: Low rise (≤2 Storeys): 8-10 m depth Mid rise (3 to 5 storeys): 10-15 m depth High rise (≥ 6 storeys): ≥ 20 m depth (*If the structure has a basement or underground parkade, deeper holes may be required*.) • Canadian Foundation Engineering Manual (5th Edition, 2023) recommends extending the boreholes to such a depth that the net increase in soil stress under the weight of the structure is less than 10% of the applied load, or less than 5% of the effective stress in the soil at that depth, whichever is less. A reduction in the depth may be considered if bedrock or dense soil is encountered within the minimum depth. If very compressible normally consolidated clay soil is encountered, it is recommended extending boreholes deeper than determined by the 10% and 5% rules.
Pavements /roads	250 m to 500 m	5 m below existing surface
Local roads < 150 m	2 to 3 locations	
Local roads >150 m	50 m to 100 m (3 minimum)	
Parking lot	2Bhs for <50 parks 3Bhs for 50-100 4Bhs for 100-200 5Bhs for 200-400	5 m below existing surface

Note: Bhs = Boreholes

3.2.2.3 Soil Sampling and In-Situ Testing of Soil

Exploration and field sampling work must be carried out in accordance with the Canadian Foundation Engineering Manual, ASTM, and CSA Standards.

3.2.2.3.1 Field Sampling

The frequency and type of sampling may be varied by the requirements of the project and site condition.

In local practice, for investigation by boreholes, soil sampling is typically obtained by grabbing from drilling auger and using split spoon in conjunction with the Standard Penetration Test. Relatively undisturbed samples can be obtained using Shelby tube samplers.

Standard sampling frequency:

- .1 Grab disturbed samples from auger at 0.75 m depth interval and at changes in strata;
- .2 Obtain samples using split spoon at 1.5 m depth intervals; and
- .3 Obtain undisturbed samples at depths recommended by GER.

In test pit excavation, it is good practice to obtain at least one (grab) sample per test pit and / or one sample per strata encountered in each test pit.

3.2.2.3.2 In-Situ Testing

Field testing must be carried out in accordance with ASTM or CSA Standards, or special instructions set out by the equipment manufacturer.

The common field tests are:

- .1 Standard Penetration Test
- .2 Pocket Penetrometer Test
- .3 Cone Penetration Test
- .4 Field Vane test
- .5 Pressure meter test
- .6 Dilatometer test

Field tests must be carried out properly and at the appropriate place to obtain in-situ soils or bedrock parameters.

Where possible, Standard Penetration Tests should be carried out at 1.5 m depth interval in all boreholes.

3.2.2.4 Groundwater Monitoring

Groundwater level is expected to fluctuate with seasonal variations and rainfall events. The groundwater level should be monitored by standpipes installed during geotechnical investigation. The installation of such instrument should be in accordance with recognized standards and as directed by GER.

It is essential that the field logs record all observations of encountered water seepage, sloughing, and initial water percolation into test pits. The rate of inflow and rise of water levels should be recorded at the time of the initial observations to assess the apparent influence. The water flow may have impact on the project design and construction procedures.

The number of wells required depends on the geology, uniformity, topography and hydrological. It is recommended to complete 50% of the boreholes for short term groundwater monitoring. A minimum of three groundwater monitoring wells is required.

For standpipes in lower permeability soils, the groundwater levels could take up to two weeks to stabilize. The groundwater levels should be measured after stabilization is reached.

Standpipes shall be decommissioned after groundwater levels have been measured by filling the standpipes with Bentonite chips and then removing the top 300 mm (from the ground surface) of the standpipes.

3.2.2.5 Laboratory Testing

It is required that representative samples from the field investigation be tested in the laboratory for the determination of soil properties essential to the preparation of the geotechnical report. After completing the laboratory testing program, the report and recommendations should be provided based on the results obtained.

Conventional laboratory testing includes:

- .1 Visual inspection on all soil samples including disturbed and relatively undisturbed samples;
- .2 Water content;
- .3 Atterberg limits;
- .4 Grain size distribution;
- .5 Laboratory oedometer consolidation testing on compressible clay soils;
- .6 unconfined compressive strength;
- .7 Soil water-soluble sulphate; and
- .8 Soil corrosivity.

All tests must be carried out in accordance with standard procedures outlined by ASTM and CSA Standards. Laboratory testing can only be performed by trained and qualified technicians working under supervision of an experienced GER.

Only necessary tests required to provide data for the geotechnical analyses should be carried out.

3.2.2.6 Frost Penetration:

Provide 50-year return period frost penetration depth/burial depth for both heated and unheated structure, and utility lines that are susceptible to freezing.

3.2.2.7 Geotechnical Reports

Geotechnical report should be clear, concise, and accurate. An adequate, and comprehensive geotechnical report is necessary to carry out a safe, cost-effective project.

A geotechnical report summarizes the results of the site work, laboratory work, and analyses. And it should include recommendations for the geotechnical aspects of design and construction of the project. Generally, the report shall contain:

- .1 An Executive summary including potential risks for the proposed development.
- .2 A description of the site location, current land use, and topography.
- .3 A description of the planned development, including the proposed buildings, site grading (if known), and any significant excavations.
- .4 A summary of desktop study results.
- .5 A description of site investigation (e.g., borehole drilling and sampling, in situ testing, laboratory testing, and groundwater condition).
- .6 A summary of the subsurface conditions on the site and the results of the in situ and laboratory testing.
- .7 A scaled plan showing the site and the locations of the boreholes and test pits.
- .8 Drawings or tables showing the findings of the investigation.
- .9 Drawings or tables showing the factual results of the laboratory testing.
- .10 Statement regarding any Methane gas risks on site.
- .11 Geotechnical recommendations for:
  - .1 Site grading / surface drainage;
  - .2 Subgrade preparation;
  - .3 Foundation options and feasibility;
  - .4 Design parameters for shallow foundations (bearing capacity for strip and spread footings, minimum depth of burial);

    .5 Design parameters for deep foundations;
    .6 Design and construction provisions for groundwater control;
    .7 Grade-supported floor slab including sub-grade preparation required to limit the slab settlement to a maximum of 25 mm;
    .8 Subsurface drainage;
    .9 Design and construction of excavation support system;
    .10 Soil swelling and frost heaving mitigation measures;
    .11 Lateral earth pressure parameters for basement and retaining walls if required;
    .12 Backfill material and compaction;
    .13 Cement type related to soluble sulphate concentrations, freeze-thaw cycles from groundwater level fluctuations;
    .14 1-in-50-year frost penetration depth for both heated and unheated structures, and deep utilities;
    .15 Pavement design and construction, including surfacing type (granular, concrete, asphalt);
    .16 Seismic considerations – seismic site class and potential for ground liquefaction
    .17 Earthworks related to site servicing; and
    .18 Slope stability and retaining walls (if required).

.12 Appendices containing:

    .1 A list of references;
    .2 Borehole and test pits logs;
    .3 Site photographs;
    .4 Laboratory test result sheets;
    .5 Plan drawing with borehole locations; and
    .6 Two (2) stratigraphic cross-sections (along the major and minor axes of the footprint of the proposed development).

Geotechnical report should be prepared, signed, and sealed by a qualified geotechnical engineer licensed in the Province of Alberta.

3.2.3 Services During Construction

Further to the carrying out of a geotechnical investigation and provide a geotechnical report, the GER should also be involved in various supplementary activities during the construction phase. The supplementary services might include, but not limited to:

.1 Foundation Subgrade Inspection
The GER or a qualified and experienced technician under the supervision of the GER should inspect the foundation bearing materials during construction. The GER should verify the expected soil conditions at the bottom of the excavation and confirm that no part of the excavation encounters soil conditions substantially different than anticipated. The foundation designer or structural engineer should verify that the specified bearing values have been achieved at the foundation level.

.2 Pile Installation Inspection
During pile installation, an independent inspection should be carried out by a qualified and experienced technician under the supervision of the GER to ensure installations are in accordance with specifications.

.3 Pile Load Test Supervision
The GER and the Structural Engineer of Record provide recommendations on whether a pile load test should be carried out for the proposed project. The pile load testing should be carried out under the supervision of an engineer working for the GER. All load tests should be carried out in accordance with ASTM. (ASTM-D1143, ASTM-D3689, and ASTM-D3966, as applicable)

.4 Fill Compaction Testing
If fill placement is required, a qualified, experienced technician under supervision of the GER should inspect and test the soil and provide recommendation on whether the fill materials are acceptable or not. Where standards of compaction are required, the physical testing of the fill material should be carried out by a qualified and experienced technician under the supervision of the GER. A report should be submitted to the Province indicating acceptance or rejection of the work as it is performed.

.5 Pavement Subgrade Testing
Road and parking lot subgrade should be inspected and tested by a qualified, experienced technician under supervision of the GER to ensure the soil condition is consistent with what is encountered during investigation. Pavement subgrade tests shall include laboratory testing of samples recovered from the site and in-situ testing of the subgrade in its prepared condition.

.6 Slope Stability Monitoring (if required)
Slope stability monitoring prior to, during and following construction of civil works is essential to the safety of the facility. The installation and monitoring of slope indicators should only be carried out by qualified and experienced engineering technicians under the supervision of a GER.

.7 Field Instrumentation-Settlement (if required)
The GER is frequently required to provide the monitoring of instrumentation established during construction to determine settlement and stress changes. This work should be carried out by qualified experienced technicians acting under the supervision of a GER.

3.3 Additional Geotechnical Engineering Services

In addition to the Basic Services, the GER may provide the following additional services if the GER and the Province reach appropriate mutual agreements. The additional services are not considered intrinsic parts of the basic geotechnical design services as discussed in the Section 3.2.

Examples of Additional Services are:

.1 Review of design drawings and / or specifications prepared by others to determine suitability;
.2 Geotechnical engineering work resulting from changes to the project as originally described and agreed to under the contract between the GER and Province, such as changes in scope, complexity, diversity or magnitude of the project;
.3 Work related to preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
.4 Review of alternative designs or products after completion of the Contract Documents;
.5 Special dynamic analysis beyond that required by codes such as ground-foundation response;
.6 Field investigation of existing buildings and structures including surveys of existing construction;
.7 Design review or field observations of shoring or bracing for excavation and building or under pinning of adjacent structures;
.8 Work resulting from corrections or revisions required because of errors or omissions in construction by the contractor;
.9 Extra work arising from disputes due to problems outside the control of the GER;
.10 Review of the contractor’s methods, procedures and construction equipment with respect to the effect on the project;
.11 Work due to extended time schedules for design or construction, beyond the control of the Prime Consultant or GER;

.12 Services as an expert witness in connection with any public hearing, arbitration, or court proceedings concerning the project, including attendant preparation for same;
.13 Work resulting from damage as the result of fires, flood, man-made disasters or natural disasters;
.14 Overtime work requiring premium pay when authorized;
.15 Travelling time outside of normal requirements;
.16 Provision of special clauses to be included in the specifications where unusual soil, bedrock or groundwater conditions exist and where special expertise is required;
.17 Provision of special sketches for drainage, special foundation measures, safe slopes, and shoring requirements; and
.18 Attendance at special site meetings to review problems of an unforeseen nature that have arisen during foundation or earthworks construction.

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 LEGEND

ELECTRICAL/VOICE/DATA LEGEND (TYPICAL):

DUPLEX OUTLET

VOICE/DATA

POWER FEED

NOTE:

1. PROVIDE ALL NECESSARY ELECTRICAL AND POWER HARNESSES/CABLING REQUIRED.
2. IN PANELED WORKSPACES, LOCATE ELECTRICAL IN BASE. PROVIDE CABLE MANAGEMENT.

PANELS:

PANELS SHALL BE COMPRISED OF 1 (ONE) MANUFACTURER'S STANDARD HEIGHT BASE PANEL AND 1 (ONE) LOAD BEARING STACKED PANEL TO ACHIEVE AN OVERALL HEIGHT OF 54"± (1372 mm±) TO 60"(1524mm).

PANEL WIDTHS SHALL BE 24" (610mm) , 30" (762mm), 42" (1067mm), OR 48" (1219mm) AS REQUIRED TO ACHIEVE THE OVERALL LAYOUT.

BASE PANEL HEIGHT MUST BE 34"(864mm) MINIMUM TO 42" (1067mm) MAXIMUM.

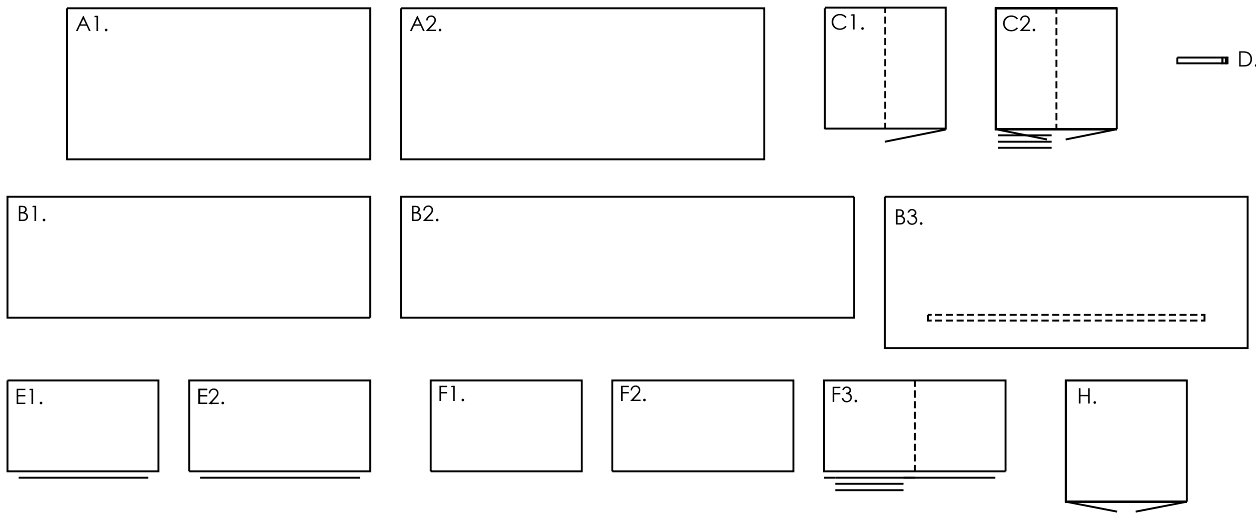
NOTE:

DRAWINGS TO BE READ IN CONJUNCTION WITH THE TECHNICAL DESIGN REQUIREMENTS (TDR).

OPTIONAL: GLASS MAY BE ADDED BASED ON PROJECT REQUIREMENTS.

ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF TECHNICAL SERVICES.

KIT OF PARTS LEGEND:



KIT- OF-PARTS DESCRIPTION:

A1: PRIMARY WORKSURFACE 30"D x 60"W (762 mm D x 1524 mm W)

A2: PRIMARY WORKSURFACE 30" D x 72" W (762 mm D x 1829 mm W)

B1: SECONDARY WORKSURFACE 24" X 60" (610mm D x 1524 mm W)

B2: SECONDARY WORKSURFACE 24" D x 90" W (610 mm D x 2286 mm W)

B3: SECONDARY WORKSURFACE 30" D x 72" W (610 mm D x 1829 mm W)

C1: OPEN/CLOSED INTEGRATED WARDROBE AND STORAGE TOWER-
24" W x 24" D x 54"± H (610 mm W x 610 mm D x 1372 mm ± H)

C2: CLOSED INTEGRATED WARDROBE AND STORAGE TOWER
24" W x 24" D x 72"± H (610 mm W x 610 mm D x 1829 mm ± H)

D: COAT HOOK- OVER PANEL

E1: LOW FILE STORAGE- 30" W x 18" D x 27"± H (762 mm W x 457 mm D x 686 mm ± H)

E2: LOW FILE STORAGE- 36" W x 18" D x 27"± H (914 mm W x 457 mm D x 686 mm ± H)

F1: LOW OPEN STORAGE- 30" W x 18" D x 27"± H (762 mm W x 457 mm D x 686 mm ± H)

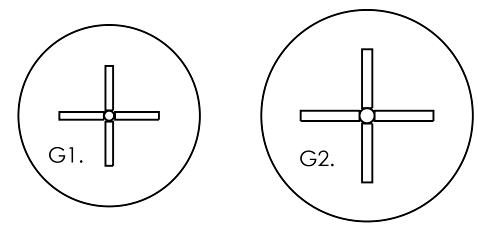
F2: LOW OPEN STORAGE- 36" W x 18" D x 27"± H (914 mm W x 457 mm D x 686 mm ± H)

F3: LOW COMBINATION STORAGE- 36" W x 18" D x 27" ± H (914 mm W x 457 mm D x 686 mm ± H)

G1: DESK HEIGHT TABLE- 36" Dia. (914 mm Dia.)

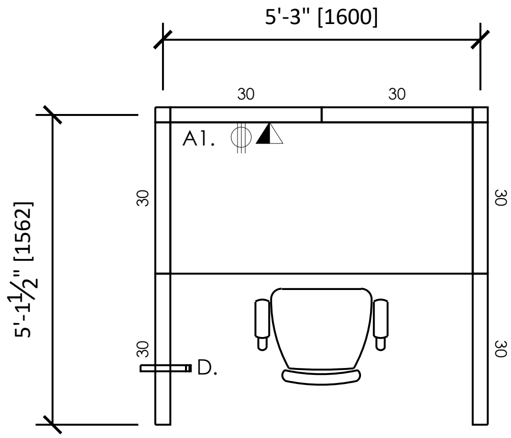
G2: DESK HEIGHT TABLE- 42" Dia. (1067 mm Dia.)

H: CLOSED COMBINATION WARDROBE AND STORAGE CABINET- 24" D x 24" W x 72" H (610 mm D x 610 mm W x 1829mm H)



Alberta Infrastructure

CONSULTANT	PROJECT: TECHNICAL DESIGN REQUIREMENTS VERSION 8	DRAWN BY: JH	CHECKED BY: KM	SCALE: NTS
		DATE: 02-21-2025	SITE ID: -	BUILDING ID: -
	TITLE: TYPICAL WORKSPACE- LEGEND AND NOTES	PLAN NO.: -	PHASE: -	DISCIPLINE: -
DOCUMENT CODE: WORKSPACE FURNITURE TYPICALS_APPENDIX I_TDR.V8_2025		PROJECT ID.: Appendix I	SHEET NO.: A	



1 HOTELING WORKSPACE
2.5 m²

WORKSPACE KIT-OF-PARTS LEGEND:

A1. PRIMARY WORKSURFACE

- 30" D x 60" W (762 mm D x 1524 mm W)
- ELECTRIC HEIGHT ADJUSTABLE. DUAL STAGE, PROGRAMMABLE CONTROLLER
- CABLE MANAGEMENT ALONG BACK

D. COAT HOOK: STANDARD PANEL HUNG

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. TYPICAL PANEL THICKNESS IS 3"± (76 mm ±) AS PER MANUFACTURER'S STANDARD.
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GANGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTERLINE OF THE PANEL.
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
6. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.
7. OPTIONAL: GLASS MAY BE ADDED BASED ON PROJECT REQUIREMENTS.

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOODGRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

STORAGE TOWER: LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL (BARRIER-FREE COMPLIANT)

PANEL FINISHES:

CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)

PANEL FABRIC: GRADE 2/B FABRIC

TOP, END & CORNER TRIMS: FULL-LENGTH, STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

Alberta Infrastructure	CONSULTANT	
DOCUMENT CODE: WORKSPACE FURNITURE TYPICALS_APPENDIX I_TDR.V8_2025	PROJECT: TECHNICAL DESIGN REQUIREMENTS VERSION 8	TITLE: TYPICAL WORKSPACE- HOTELING

DRAWN BY	CHECKED BY	SCALE
JH	KM	NTS
DATE	SITE ID	BUILDING ID
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PLAN NO.	PHASE	DISCIPLINE
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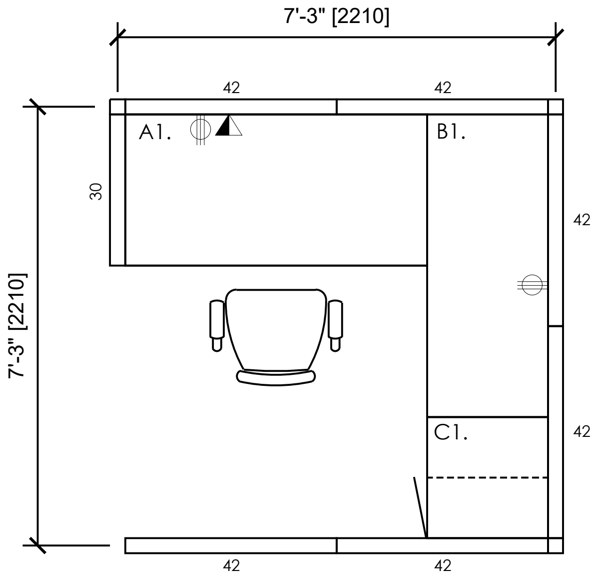
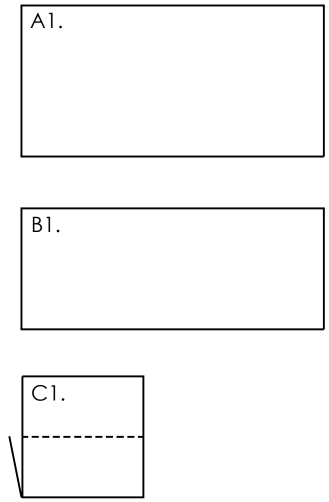
PROJECT ID.	SHEET NO.	
Appendix I	1	



2 STANDARD WORKSPACE
4.9 m²

WORKSPACE KIT-OF-PARTS LEGEND:



A1. PRIMARY WORKSURFACE
- 30" D x 60" W (762 mm D x 1524 mm W)
- ELECTRIC HEIGHT ADJUSTABLE. DUAL STAGE, PROGRAMMABLE CONTROLLER
- CABLE MANAGEMENT ALONG BACK

B1. SECONDARY WORKSURFACE
- 24" D x 60" W (610 mm D x 1525 mm W)
- PIN HEIGHT ADJUSTABLE POST LEGS (C-LEGS OPTIONAL)
- CABLE MANAGEMENT ALONG BACK

C1. OPEN/CLOSED INTEGRATED WARDROBE AND STORAGE TOWER
- 24" W x 24" D x 54"± H (610 mm W x 610 mm D x 1372 mm ± H)
- FULL WARDROBE WITH COAT ROD INCLUDED
- BOX BOX FILE WITH OPEN SHELVING ABOVE FACING WORKSURFACE B1.
- ANTI-TIP
- SIMILAR OVERALL HEIGHT AS STACKED PANEL

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOOD GRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

STORAGE TOWER: LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL: (BARRIER-FREE COMPLIANT)

PANEL FINISHES:

CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)

PANEL FABRIC: GRADE 2/B FABRIC

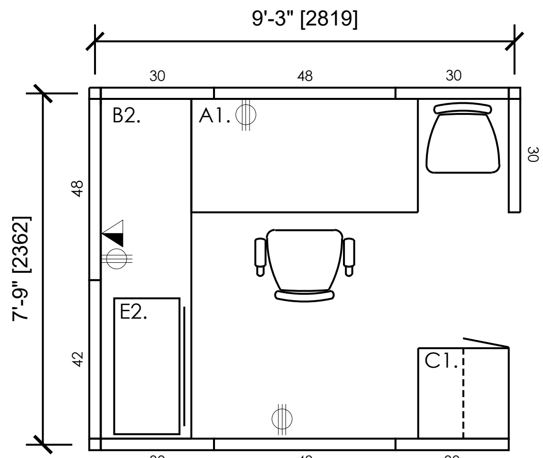
TOP, END & CORNER TRIMS: FULL-LENGTH, STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. TYPICAL PANEL THICKNESS IS 3"± (76 mm ±) AS PER MANUFACTURER'S STANDARD.
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GANGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTERLINE OF THE PANEL.
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
6. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
7. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.
8. OPTIONAL: GLASS MAY BE ADDED BASED ON PROJECT REQUIREMENTS.

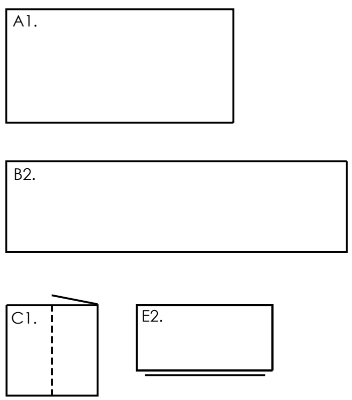
Alberta Infrastructure

CONSULTANT	PROJECT TECHNICAL DESIGN REQUIREMENTS VERSION 8	DRAWN BY: JH / CHECKED BY: KM / SCALE: NTS DATE: 02-21-2025 / SITE ID: - / BUILDING ID: - PLAN NO.: - / PHASE: - / DISCIPLINE: -
DOCUMENT CODE WORKSPACE FURNITURE TYPICALS_APPENDIX I_TDR.V8_2025	TITLE TYPICAL WORKSPACE- STANDARD	PROJECT ID.: Appendix I / SHEET NO.: 2



3 DIRECTOR WORKSPACE
6.7 m ^{2}

WORKSPACE KIT-OF-PARTS LEGEND:



A1. PRIMARY WORKSURFACE

- 30” D x 60” W (762 mm D x 1524 mm W)
- ELECTRIC HEIGHT ADJUSTABLE. DUAL STAGE, PROGRAMMABLE CONTROLLER
- CABLE MANAGEMENT ALONG BACK

B2. SECONDARY WORKSURFACE

- 24” D x 90” W (610 mm D x 2286 mm W)
- PIN HEIGHT ADJUSTABLE POST LEGS (C-LEGS OPTIONAL)
- CABLE MANAGEMENT ALONG BACK

C1. OPEN/CLOSED INTEGRATED WARDROBE AND STORAGE TOWER

- 24” W x 24” D x 54”± H (610 mm W x 610 mm D x 1372 mm ± H)
- FULL WARDROBE WITH COAT ROD INCLUDED
- BOX BOX FILE WITH OPEN SHELVING ABOVE FACING WORKSURFACE B2.
- ANTI-TIP
- SIMILAR OVERALL HEIGHT AS STACKED PANEL

E2. LOW FILE STORAGE (OPTIONAL)

- 36” W x 18” D x 27"± H (914 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

WORKSTATION FINISHES:

WORKSURFACE TOPS: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOODGRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

STORAGE TOWER: LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL (BARRIER-FREE COMPLIANT)

LOW STORAGE:

LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL (BARRIER-FREE COMPLIANT)

PANEL FINISHES:

CLEAR OR FROSTED SINGLE PANE GLASS - FRAMELESS (ACRYLIC IS NOT ACCEPTABLE)

PANEL FABRIC: GRADE 2/B FABRIC

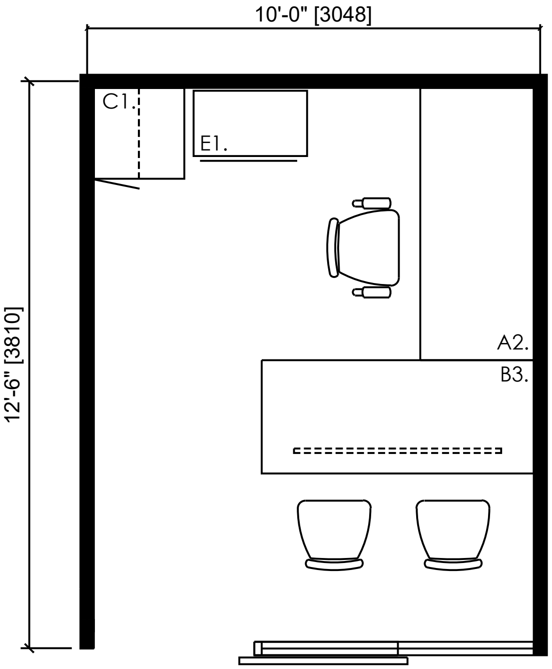
TOP, END & CORNER TRIMS: FULL LENGTH, STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. TYPICAL PANEL THICKNESS IS 3”± (76 mm ±) AS PER MANUFACTURER'S STANDARD.
3. AS COMMON PANELS ARE SHARED WHEN THEY ARE GANGED TOGETHER, THE AREA FOR AN INDIVIDUAL WORKSPACE IS BASED ON THE CENTRELINE OF THE PANEL.
4. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
5. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
6. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
7. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
8. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.
9. OPTIONAL: GLASS MAY BE ADDED BASED ON PROJECT REQUIREMENTS.

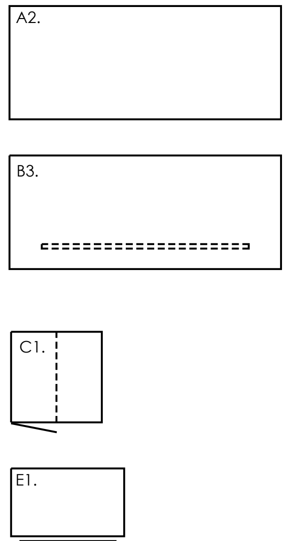
Alberta Infrastructure

CONSULTANT	PROJECT TECHNICAL DESIGN REQUIREMENTS VERSION 8	DRAWN BY JH	CHECKED BY KM	SCALE NTS	
		DATE 02-21-2025	SITE ID -	BUILDING ID -	
	TITLE TYPICAL WORKSPACE- DIRECTOR	PLAN NO. -	PHASE -	DISCIPLINE -	
DOCUMENT CODE WORKSPACE FURNITURE TYPICALS_APPENDIX I_TDR.V8_2025		PROJECT ID. Appendix I	SHEET NO. 3		



4 EXECUTIVE DIRECTOR (& EQUIVALENT) OFFICE
11.6 m²

WORKSPACE KIT-OF-PARTS LEGEND:



A2. PRIMARY WORKSURFACE
- 30" D x 72" W (762 mm D x 1524 mm W)
- ELECTRIC HEIGHT ADJUSTABLE. DUAL STAGE, PROGRAMMABLE CONTROLLER
- CABLE MANAGEMENT ALONG BACK

B3. SECONDARY WORKSURFACE
- 30" D x 72" W (762 mm D x 1829 mm W)
- ELECTRIC HEIGHT ADJUSTABLE SINGLE STAGE, NON-PROGRAMMABLE CONTROLLER
- HALF HEIGHT 'DETACHABLE' MODESTY PANEL
- CABLE MANAGEMENT ALONG SIDE

C1. OPEN/CLOSED INTEGRATED WARDROBE AND STORAGE TOWER
- 24" W x 24" D x 66"± H (610 mm W x 610 mm D x 1676 mm ± H)
- FULL WARDROBE WITH COAT ROD INCLUDED
- BOX BOX FILE WITH OPEN SHELVING ABOVE FACING WORKSURFACE A2.
- ANTI-TIP

E1. LOW FILE STORAGE (OPTIONAL)
- 30" W x 18" D x 27"± H (762 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
3. WORKSPACE IS MEASURED FROM CENTRELINE OF WALL TO CENTRELINE OF WALL.
4. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
5. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
6. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
7. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.
8. THE OVERALL LENGTH AND WIDTH OF THE ENCLOSED OFFICES MAY VARY TO SUIT SITE CONDITIONS, SO LONG AS THE SPACE REMAINS USEABLE, AND THE SIZE (SQ.M) IS MAINTAINED.

FINISHES:

WORKSURFACE TOPS AND TABLE: H.P. PLASTIC LAMINATE C/W STANDARD MATCHING EDGE

LAMINATE: STANDARD GRADE (INCLUDES WOOD GRAIN LAMINATE OPTIONS)

LEGS/BASE: STANDARD PAINTED METAL FINISH (INCLUDES METALLIC OPTIONS)

STORAGE TOWER:

LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULLS (BARRIER-FREE COMPLIANT)

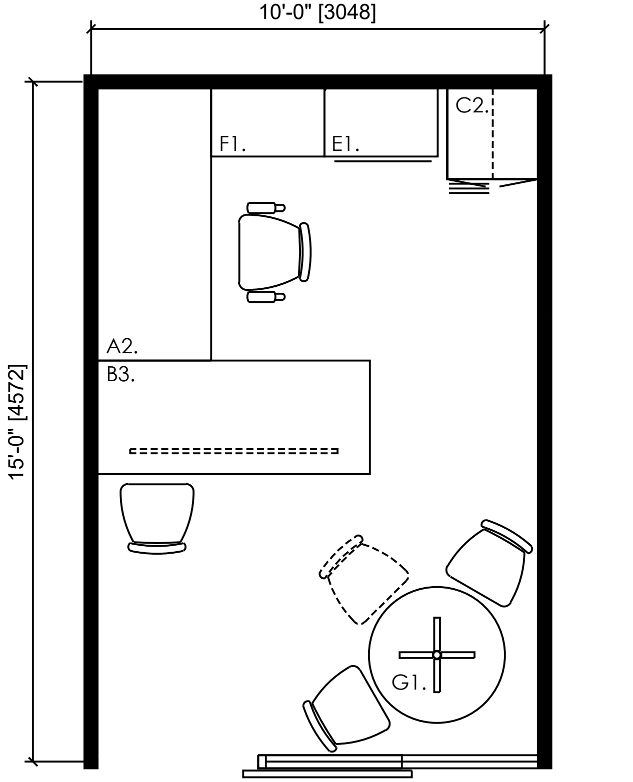
LOW STORAGE:

LAMINATE OR STANDARD PAINTED METAL FINISH

STANDARD PULL - METAL FINISH (BARRIER-FREE COMPLIANT)

Alberta Infrastructure

CONSULTANT	PROJECT TECHNICAL DESIGN REQUIREMENTS VERSION 8	DRAWN BY **JH**	CHECKED BY **KM**	SCALE **NTS**
		DATE **02-21-2025**	SITE ID -	BUILDING ID -
DOCUMENT CODE WORKSPACE FURNITURE TYPICALS_APPENDIX I_TDR.V8_2025	TITLE TYPICAL WORKSPACE EXECUTIVE DIRECTOR (& EQUIVALENT)	PLAN NO. -	PHASE -	DISCIPLINE -
		PROJECT ID. **Appendix I**	SHEET NO. **4**	

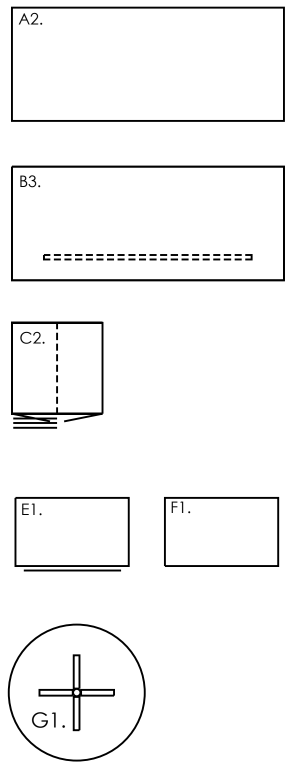


5 ASSISTANT DEPUTY MINISTER (AND EQUIVALENT) OFFICE
14.0 m²

FINISHES:

- WOOD VENEER TOP AND BODY (STANDARD GRADE)
- SQUARE PROFILE EDGE
- FLUSH BACKS AND FINISHED TOPS
- STANDARD METAL PULLS (BARRIER-FREE COMPLIANT)

WORKSPACE KIT-OF-PARTS LEGEND:



A2. PRIMARY WORKSURFACE
- 30” D x 72” W (762 mm D x 1829W)
- ELECTRIC HEIGHT ADJUSTABLE. DUAL STAGE, PROGRAMMABLE CONTROLLER
- CABLE MANAGEMENT ALONG BACK

B3. SECONDARY WORKSURFACE
- 30” D x 72” W (762 mm D x 1829 mm W)
- ELECTRIC HEIGHT ADJUSTABLE SINGLE STAGE, NON-PROGRAMMABLE CONTROLLER
- HALF HEIGHT 'DETACHABLE' MODESTY PANEL
- CABLE MANAGEMENT ALONG SIDE

C2. CLOSED INTEGRATED WARDROBE AND STORAGE TOWER
- 24” W x 24” D x 72”± H (610 mm W x 610 mm D x 1829 mm ± H)
- COAT ROD INCLUDED
- BOX BOX FILE WITH CLOSED SHELVING ABOVE
- ANTI-TIP

E1. LOW FILE STORAGE (OPTIONAL)
- 30” W x 18” D x 27”± H (762 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

F1. LOW OPEN STORAGE (OPTIONAL)
- 30” W x 18” D x 27”± H (762 mm W x 457 mm D x 686 mm ± H)
- ONE SHELF
- FLUSH BACK AND FINISHED TOP

G1. DESK HEIGHT TABLE
- 36” Dia. (914 mm Dia.)
- METAL “X” BASE

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
3. WORKSPACE IS MEASURED FROM CENTRELINE OF WALL TO CENTRELINE OF WALL.
4. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
5. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
6. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
7. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.
8. THE OVERALL LENGTH AND WIDTH OF THE ENCLOSED OFFICES MAY VARY TO SUIT SITE CONDITIONS, SO LONG AS THE SPACE REMAINS USEABLE, AND THE SIZE (SQ.M) IS MAINTAINED.

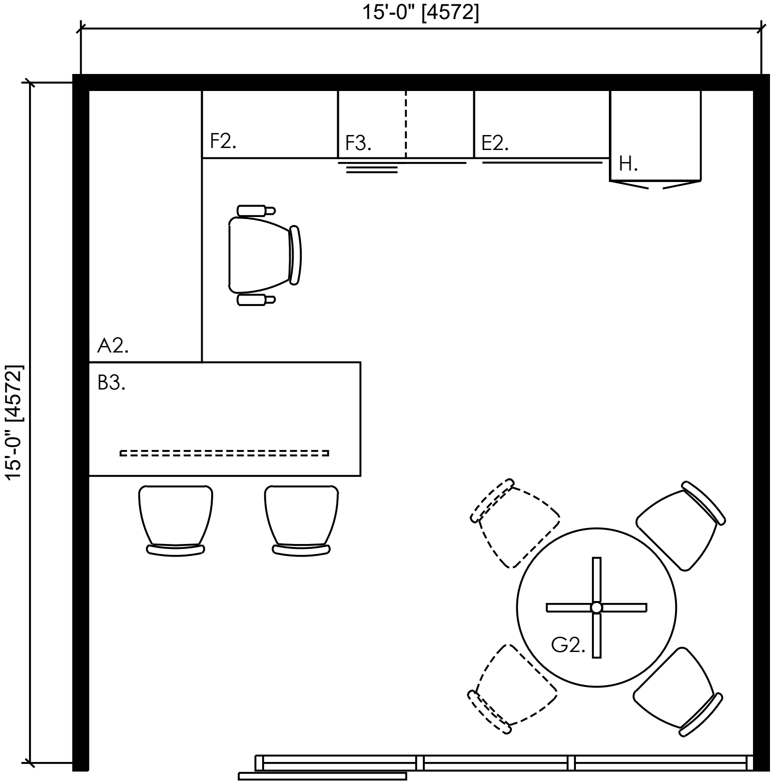
CONSULTANT

DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_TDR.V8_2025

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 8

TITLE
TYPICAL WORKSPACE
ASSISTANT DEPUTY MINISTER (& EQUIVALENT)

DRAWN BY	CHECKED BY	SCALE
JH	KM	NTS
DATE	SITE ID	BUILDING ID
02-21-2025	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-
PROJECT ID.	SHEET NO.	
Appendix I	5	

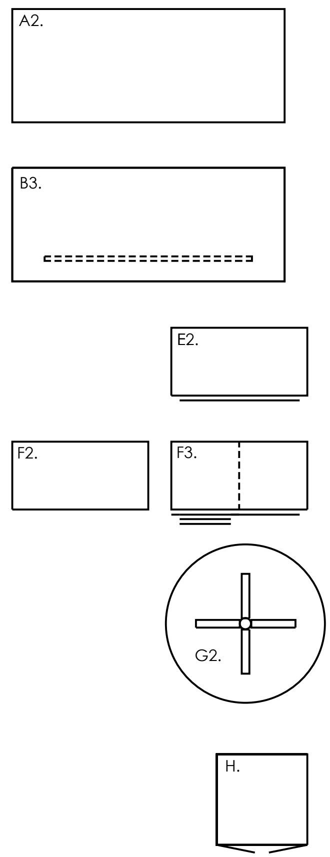


6 DEPUTY MINISTER (AND EQUIVALENT) OFFICE
20.9 m²

FINISHES:

- WOOD VENEER TOP AND BODY (STANDARD GRADE)
- REVERSE CHAMFER EDGE PROFILE
- FLUSH BACKS AND FINISHED TOPS
- UPGRADED METAL PULLS, IF AVAILABLE (BARRIER-FREE COMPLIANT)

WORKSPACE KIT-OF-PARTS LEGEND:



A2. PRIMARY WORKSURFACE

- 30" D x 72" W (914 mm D x 1829 mm W)
- ELECTRIC HEIGHT ADJUSTABLE. DUAL STAGE, PROGRAMMABLE CONTROLLER
- CABLE MANAGEMENT ALONG BACK

B3. SECONDARY WORKSURFACE

- 30" D x 72" W (762 mm D x 1829 mm W)
- ELECTRIC HEIGHT ADJUSTABLE SINGLE STAGE, NON-PROGRAMMABLE CONTROLLER
- HALF HEIGHT 'DETACHABLE' MODESTY PANEL
- CABLE MANAGEMENT ALONG SIDE

E2. LOW FILE STORAGE

- 36" W x 18" D x 27" ± H (914 mm W x 457 mm D x 686 mm ± H)
- 2 DRAWER LATERAL c/w DIVIDERS, LEGAL/LETTER FILE HANGING BARS
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

F2. LOW OPEN STORAGE

- 36" W x 18" D x 27"± H (914 mm W x 457 mm D x 686 mm ± H)
- ONE SHELf
- FLUSH BACK AND FINISHED TOP

F3. LOW COMBINATION STORAGE

- 36" W x 18" D x 27" ± H (914 mm W x 457 mm D x 686 mm ± H)
- 2 BOX DRAWERS, 1 FILE DRAWER OVER LATERAL FILE DRAWER
- FLUSH BACK AND FINISHED TOP
- ANTI-TIP

G2. DESK HEIGHT TABLE

- 42" Dia. (1067 mm Dia.)
- METAL "X" BASE

H. CLOSED COMBINATION WARDROBE AND STORAGE CABINET

- 24" D x 24" W x 72" H (610 mm D x 610 mm W x 1829mm H)
- ANTI-TIP

GENERAL NOTES

1. REFER TO LEGEND SHEET A, AND SECTION 3 OF THE TECHNICAL DESIGN REQUIREMENTS.
2. WORKSPACE IS MEASURED FROM CENTRELINE OF WALL TO CENTRELINE OF WALL.
3. WORKSURFACES AND STORAGE SHALL HAVE DIMENSIONAL LOGIC AND CONSISTENCY.
4. ALL WORKSURFACES TO BE FREE-STANDING (NON-PANEL HUNG).
5. ALL STORAGE TO BE LOCKABLE AND KEYED ALIKE.
6. COMPONENTS LISTED AS OPTIONAL CAN BE MIXED AND MATCHED, OR OMITTED.
7. CHAIRS ARE SHOWN FOR ILLUSTRATION ONLY.
8. THE OVERALL LENGTH AND WIDTH OF THE ENCLOSED OFFICES MAY VARY TO SUIT SITE CONDITIONS, SO LONG AS THE SPACE REMAINS USEABLE, AND THE SIZE (SQ.M) IS MAINTAINED.

Alberta Infrastructure

CONSULTANT

DOCUMENT CODE
WORKSPACE FURNITURE TYPICALS_APPENDIX I_TDR.V8_2025

PROJECT
TECHNICAL DESIGN REQUIREMENTS
VERSION 8

TITLE
TYPICAL WORKSPACE
DEPUTY MINISTER (& EQUIVALENT)

DRAWN BY	CHECKED BY	SCALE
JH	KM	NTS
DATE	SITE ID	BUILDING ID
02-21-2025	-	-
PLAN NO.	PHASE	DISCIPLINE
-	-	-
PROJECT ID.	SHEET NO.	
Appendix I	6	

Appendix J – Accommodation Guidelines and Requirements for Office Space

Alberta Infrastructure

Accommodation Guidelines and Requirements for Office Space

Appendix J:

Supplement to the Technical Services Requirements for Alberta Infrastructure Facilities, v8, Section 3.0 Interior Design

Technical Services & Procurement Branch

This document is a supplement to the Technical Design Requirements for Alberta Infrastructure Facilities, 3.0 Interior Design:

(https://www.alberta.ca/system/files/custom_downloaded_images/infra-technical-design-requirements.pdf)

1.0 Accommodation Guidelines and Requirements for Office Space

.1 Spatial Definitions and Density

.1 The GoA defines space as per the current version of the Building Owners and Managers Association (BOMA).

.2 Density

- .1 Density is the average area allocated by position. It is based on all the useable office space and the GoA occupants in the entire owned or leased space (allocated to the Client Ministry).
- .2 **The GoA wide density target is a maximum of 18 useable metres squared (um^2) per occupant of useable office space.** The density target is a guide for all upgrading, renovation, and new development of GoA office accommodations.
- .3 A density calculation shall be used for all occupant open and enclosed workspace and support space.
  - .1 **Density (um^2 per occupant) = useable area m^2/total number of occupants**
- .4 Circulation space is included in the density calculation
  - .1 The total square metres of **programmed** workspaces and support spaces should be multiplied by a factor of 1.43 to achieve 30 percent circulation (typical).
- .5 **NOT** included in the useable density calculation:
  - .1 staff visiting from other sites
  - .2 special purpose spaces as defined below
  - .3 public interaction service areas (front-of-house); however, office areas (back-of-house) are to be included in density calculations.
  - .4 shared amenity spaces that are common to the building.

.3 Occupants are defined as:

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

.4 Support space examples are:

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

.5 Special purpose space examples are:

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

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

2.0 Workspace Allocations and Planning Criteria

.1 Workspaces

Workspace Allocation Chart:

Occupant	Workspace Allocation	Workspace Type/ Location	Notes
Hoteling Staff Staff or visitors who require a temporary "touch-down" workspace.	2.5 m^2	Open/ Core (if possible)	-Unassigned workspace. -Provision is **optional**, based on programmatic requirements.
Standard Workspace	4.9 m^2	Open/Perimeter	
Director (and Equivalent)	6.7 m^2	Open/ Perimeter	
Executive Director (and Equivalent)	11.6 m^2	Enclosed/Core	
Assistant Deputy Minister (and Equivalent)	14.0 m^2	Enclosed/ Core	
Deputy Minister (and Equivalent)	20.9 m^2	Enclosed/Core (if possible)	-Defined as a restrictive workspace (individual enclosed office), typically located within a Deputy Minister's executive suite (DMO). -Where space is limited, the Deputy Minister workspace (individual enclosed office) is permitted on the perimeter of the building (at the windows) within the suite, if no core location is possible.
Deputy Minister Office (executive suite)	approx. 104m^2 ***** (including circulation; excluding meeting room) *****varies according to Ministry requirements; does not include meeting room	Demised/Core (if possible)	-The DMO suite is permitted on the perimeter if a core location is not possible due to constraints of the building and shall be determined on a case-by-case basis. -Refer to 2.1.10.2 for typical suite inclusions.

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

.2 Occupants are entitled to no more than one designated workspace.

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

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

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

.6 The glazed side of enclosed offices on the core should be facing nearby exterior windows, when possible, to allow natural light to filter into the enclosed office (above the open workstations on the perimeter).

.7 Architectural wall systems that adhere to AI’s acoustic requirements, should be used to create restrictive workspaces (enclosed offices).

.8 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.

.9 Permitted Demised Suites:
 .1 Deputy Minister
 .2 Public Service Commission (PSC)
 .3 Case/Investigations

.10 A Deputy Minister's Office (DMO) is a demised executive suite.

- .1 Work and support spaces within the suite shall conform to space allocations and criteria defined in sections 2.0 and 3.0.
- .2 Program requirements vary according to Ministry and must be determined and confirmed. A suite may ***typically*** contain:
  - .1 one Deputy Minister restrictive workspace (20.9m^2 individual enclosed office)
  - .2 one barrier-free ensuite washroom (approximately 5m^2) with lavatory, toilet, and applicable accessories
  - .3 Standard workstations
  - .4 Director (or equivalent) workstations
  - .5 one small barrier-free java centre
  - .6 one print area
  - .7 one 4-person waiting area
- .3 The DMO is permitted to have direct access to an adjacent, large non-dedicated meeting room (29m^2). Common corridor access into the meeting room should also be provided to allow shared usage of the room when it is not required by the DMO.

Note: Hybrid and Activity-based work (ABW) environments (e.g.: Mobile Suites, Co-Working Hubs, etc.) are currently being studied.

3.0 Support Space Allocations and Planning Criteria

.1 Overview

.1 Support space shall:

- .1 be shared between multiple groups based on the functional program requirements.
- .2 be distributed throughout the work environment.
- .3 be located on the core.
- .4 maximize the amount of glazing used, allowing natural light to flow into the space.
- .5 have dimensional logic, allowing for maximum utilization and reconfiguration for current and future groups.
- .6 be clustered together, support growth and change through the adoption and removal of parts and pieces allowing change in size and usage.
- .7 be designed for accessibility.
- .8 use architectural wall systems where appropriate.
- .9 meet security requirements based on the functional program requirements for secure support spaces.

.2 Examples of support spaces are listed in 1.1.1.4

.2 Waiting Area

Waiting Area Space Allocation:

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.

.1 Waiting areas shall:

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

.3 Open Collaborative Areas

.1 Open collaborative areas:

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

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

.4 Enclosed Meeting Spaces

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

.2 Enclosed meeting spaces shall:

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

Allocation and size of Enclosed Meeting Spaces **(use as a guideline for overall meeting space allocation. How each Ministry allocates the overall space is based on program functional requirements):**

GoA Occupants	1-2 Person Quiet Room (X-SMALL)**	3-6 Person Room (SMALL)	7-10 Person Room (MEDIUM)	11-14 Person Room (LARGE)*	Total # of rooms
	7 m^2 (75 sf)	13.9 m^2 (150 sf)	23.2 m^2 (250 sf)	29 m^2 (312 sf)	
	Approximate size: 2286 mm (7'-6") x 3048 mm (10'—0")	Approximate size: 3048 mm (10'-0") x 4572 mm (15'-0")	Approximate size: 6096 mm (20'-0") x 3810 mm (12'-6")	Approximate size: 7620 mm (25'-0") x 3810 mm (12'-6")	
5-25	1	1			2
26-50	2	2			4
51-75	2	2	1		5
76-100	2	3	1	1	7
101-150	3	4	1	1*	9*
151-200	4	5	1	1*	11*

Notes:

- Seating capacity must be verified for rooms that are set up classroom-style for training purposes.

  * If centralized conference centres are available, the number of large meeting rooms may be reduced or eliminated, as the ability to share would increase.

  ** Quiet (x-small) Rooms:

  - Provide an environment to facilitate private phone conversations, a higher level of concentration and/or impromptu 2-person meetings.
  - The number of quiet rooms may be increased or decreased based on the functional requirements for support spaces of the primary user group.
  - Are non-reservable.

.5 Java (Coffee) Centre

Java Centre Space Allocation:

GoA Occupants	Dimensions (counter, upper/lower storage & aisle access)	Size (m^2)
5-10	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 Java Centres shall:
- .1 be located throughout the building appropriately and equally for easy shared access for all staff.
- .2 include space for (a) fridge(s), microwave(s), garbage/recycling area(s) and sink(s). A dishwasher and/or a filtered hot/cold water dispenser may be provided depending on the requirements of the primary user group.
- .3 allow for sufficient space above the sink to accommodate a standard size faucet.
- .4 have a barrier-free section at the sink in one Java Centre per floor (minimum).
- .5 have visual separation from the work environment, to minimize disruption to staff.
- .6 accommodate electrical requirements for appliances/equipment, plus have a minimum of two GFI outlets above the counter. Functional program requirements may necessitate additional outlets.
- .7 be located adjacent to a large collaborative area (space permitting).

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

4.0 Document Management Allocations and Storage Planning Criteria

.1 Print Areas

Print Area Allocation:

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

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

.2 Resource Area

Resource Area Allocation:

Quantity	Dimensions	Size (m^2)
1 per floor	3048 mm x 4572 mm (10’-0” x 15’-0”)	13.9

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

.3 Storage

.1 Consider that file storage requirements are typically lessening as file digitization becomes more prevalent.

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

Storage Area Allocation:

Description	Typical Size (per unit)
Lateral file/storage cabinet	Width – 914 mm (36”), 1067 mm (42”), 1219 mm (48”)
Lateral file/storage cabinet	Depth – 305 mm (12”), 457 mm (18”), 810 mm (24”)
High-density (HD) file storage – various types	Varies (generally requires approximately half as much floor space as static storage cabinets)

.3 File storage areas:

- .1 shall accommodate the number of physical files that are required on site, as verified through site visits. Off-site storage is the ministry’s responsibility.
- .2 may house active files in open office space. Inactive retention files should be housed elsewhere (e.g. a storage room).
- .3 shall be appropriately secured to suit program requirements.
- .4 shall be located on the core and reviewed by a Structural Engineer prior to proceeding with design development.
- .5 shall have cabinets of the appropriate height so as to not impede proper operation of ceiling sprinklers and be in compliance with applicable mechanical codes, including fire suppression.
- .6 shall have sufficient space in front of file cabinets when placed in corridors and open areas, in compliance with the current Alberta Building Code and Fire Code.
- .7 may be combined with the resource room where feasible to maximize space utilization.
- .8 may utilize a high density (HD) filing system if the requirements for height, weight, floor load, safety, accessibility, codes, building restrictions, and cost are verified, prior to proceeding with design development.

.4 Office supplies may be housed in furniture cabinets in the open work environment.

.5 Ministries must appropriately dispose of non-essential files, office supplies, materials, equipment, surplus furniture, etc.; or be responsible for the storage of such items either within the program’s allocated space, or off-site.

5.0 Special Purpose Spaces

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

.2 Examples of Special Purpose spaces are listed in 1.1.1.5.

6.0 Furniture

.1 Overview

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

.2 Workspaces have a kit-of-parts, to allow re-configurability of the work environment. Workspaces shall have dimensional logic and consistency in sizes of parts and pieces, and material finishes. Refer to Appendix I – *Workspace Furniture Typicals.*

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

.4 AutoCAD blocks for typical workspaces are available in the Alberta Infrastructure Technical Specifications, Division 12 Furnishings: Facility construction sub-group | Alberta.ca

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

.6 Furniture and workspace equipment must support the principles of office ergonomics for safety, comfort, and efficiency. Refer to Workplace Ergonomics in the Infrastructure Technical Resources website: (https://www.alberta.ca/system/files/custom_downloaded_images/tr-workplace-ergonomics.pdf). Further information is available in CSA Workplace Ergonomics Standards.

.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 developed a centralized approach to the design of space and the purchase and ownership of furniture to allow flexibility in accommodating Client Ministry needs. A corporate, strategic long-term plan that sets in place furniture guidelines (e.g. consistent procurement and furniture harmonization) ensures reliable service levels and cost-savings (through economies of scale) for AI's assets.

.3 Equipment

.1 Program specific appliances and equipment are considered fixed assets and are typically purchased by the user group from their operating budgets.