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Design Considerations for Preventive Conservation in New Heritage Collection Facilities

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List of abbreviations

µW/lm	microwatt per lumen
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CCI	Canadian Conservation Institute
CCTV	closed-circuit television
CRI	colour rendering index
HVAC	heating, ventilation and air conditioning
IPM	integrated pest management
kN/m^2	kilonewton per square metre
MERV	minimum efficiency reporting values
mW/m^2	milliwatt per square metre
NFPA	National Fire Protection Association
nm	nanometre
psf	pounds per square foot
RH	relative humidity
VOC	volatile organic compound

Introduction

These requirements are intended as a first step towards ensuring that basic preventive conservation features are included in the design of a heritage collection facility, but they do not guarantee a successful application to federal (or other) heritage programs. After having reviewed this document and the checklist, institutions are invited to contact the Canadian Conservation Institute (CCI) to discuss their specific project and to contact the Designation of institutions and public authorities program or the Canada Travelling Exhibitions Indemnification Program for further information about these programs.

This document outlines various considerations when planning for a new heritage collection facility that provides optimal preventive conservation features. As a companion to this document, a checklist is provided in Appendix C to help project managers track progress during a capital project. This guidance focuses mainly on facility design features; it does not include recommendations for the policies, procedures and practices that are also required to protect collections from the agents of deterioration (with the exception of integrated pest management [IPM] and emergency response).

This document can also be used by existing institutions wishing to obtain an overview of preventive conservation requirements in a heritage collection facility. As each institution has a specific operational context and each collection has a specific vulnerability, please contact CCI to discuss your particular case.

For Canadian institutions wishing to participate in various heritage programs of the Department of Canadian Heritage, namely, the Designation of institutions and public authorities program (“Designation”) or the Canada Travelling Exhibitions Indemnification Program (“Indemnification”), both administered by the Heritage Policy and Programs Directorate, additional considerations are provided under each section.

1. Building

1.1 Location

The building should not be located in areas that are prone to flooding, that have a high crime rate or that are in close proximity to industrial facilities, or anywhere that could significantly increase risks associated with fire, security, water, pollutants, pests or vibrations/shocks. If flood-prone areas cannot be avoided, any room that could contain collections should be situated above the anticipated flood level. Institutions in facilities that are shared with other occupants must manage the associated risks as well. A regularly updated emergency response plan must be in place.

Designation
Institutions located in flood-prone areas must demonstrate that the risks are well managed. As well, institutions located in shared facilities must demonstrate that any resulting fire, security, water, pollutant, pest and vibration/shock risks are well managed. Assessors will expect to see that an up-to-date emergency response plan is in place and that it includes specific considerations for collections salvage.

Indemnification
Institutions located in flood-prone areas must demonstrate that the risks are well managed. As well, institutions located in shared facilities must demonstrate that any resulting fire, security, water, pollutant, pest and vibration/shock risks are well managed. Assessors will expect to see that an up-to-date emergency response plan is in place and that it includes specific considerations for collections salvage.

1.2 Envelope

Ideally, all climate-controlled collection areas would be located in interior rooms with sealed walls, where risks and climate can be more easily controlled. When this is not possible, any exterior wall within climate-controlled spaces will need sufficient insulation and continuous vapour barriers to permit acceptable control of temperature and relative humidity (RH) without damaging the building envelope. Avoiding exterior glass walls, skylights or large windows in collection areas is highly recommended to maximize security, light damage protection, water damage prevention and efficient climate control. Access doors into climate-controlled spaces must be well sealed to prevent air infiltration and exfiltration, which can compromise climate control. Unframed glass doors are always challenging from this point of view and are thus not recommended. Two sets of doors (that is, a vestibule) may be required to ensure that RH levels remain stable. The building envelope must also protect the collection from pests, water infiltration and external pollutants.

Designation
Assessors will look for recurring problems with the building (leaks, evidence of mould, pest infestations, flooding, structural damage, etc.) and will expect details on the causes of these issues and on the corrective measures implemented.

Indemnification
When determining qualification under the program, assessors will look for recurring problems with the building (leaks, evidence of mould, pest infestations, flooding, structural damage, etc.) and will expect details on the causes of these issues and on the corrective measures implemented.

1.3 Interior finishes

All exposed concrete surfaces must be sealed, as unsealed concrete generates a fine abrasive alkaline dust. Coatings that are acceptable for collection areas are described in Appendix A. As a general rule, any acceptable interior coating must have a minimum drying time of four days before any collection object is introduced into the space. For airtight enclosures (such as display cases), the minimum drying time is four weeks. Carpet is not recommended in collection areas for several reasons: it contributes to higher dust levels and is more difficult to keep clean, it may harbour pests (wool carpet in particular) and it may lead to mould issues in the event of a water leak or flood if not dried quickly. Floors, walls and ceilings should be of a light colour so as to make it easier to detect insect infestations, condensation or water leaks.

Designation
This often has no direct implications for designation applications.

Indemnification
This often has no direct implications on applications to qualify for the program. However, when applying for the indemnification of a specific exhibition, specifications for display cases are reviewed.

1.4 Clearance: ceiling height, hallways, doorways and elevators

Clearance requirements for ceilings, hallways, doorways and elevators should be based on the maximum height or length of objects in the collection and on how they would be moved in and out of spaces. For ceiling height, the space occupied by building fixtures and fittings (such as fire sprinklers, heating, ventilation and air conditioning [HVAC] ducting and lighting) and any clearance requirements must be accounted for. As much ventilation ductwork as possible should be routed outside of storage (for example, in hallways or other non-collection areas) to maximize available room height.

Designation
Institutions collecting large objects may be asked to demonstrate that clearance is sufficient.

Indemnification
This often has no direct implications on applications to qualify for the program. However, when applying for the indemnification of a specific exhibition that contains large objects, institutions may be asked to demonstrate that clearance is sufficient.

1.5 Structural

The building meets current seismic codes (*National Building Code of Canada*).

Designation
Seismic stabilization is required in high-risk seismic zones.

Indemnification
Seismic stabilization is required in high-risk seismic zones.

2. Collection storage rooms and support spaces

2.1 Location

Ideally, no collection storage room would be located in spaces below grade; this must simply be avoided if the building is located in a flood-prone area. Several insurance companies do not cover flood-related collection damage sustained in basement or subterranean locations if the building is located on a flood plain. Basement storage rooms must be designed in a way that allows water to be drained away (for example, with a sump pump or floor drain), that prevents water from flowing back into the space (a backflow preventer, also called a “backflow valve” or “backwater valve”) and that provides for the detection of flooding (floor-level water detectors, preferably wired into the building’s alarm system). Whenever possible, water pipes or plumbing fixtures of any kind (overhead pipes in particular, except those for fire suppression) should be routed outside storage rooms. Storage rooms must be located away from areas that could contain food or food waste, which may attract pests.

Designation
For buildings with basement storage, assessors will expect to see a sump pump, a floor drain with a backflow valve, and water detectors. Institutions may be asked to describe the protective measures in place should storage rooms be adjacent to catering food preparation areas, catering stations, dining areas, kitchens or garbage rooms. Below-grade collection storage in flood-prone areas is not acceptable.

Indemnification
For basement storage rooms to qualify for the program, assessors will expect to see a sump pump, a floor drain with a backflow valve, and water detectors. Below-grade collection storage in flood-prone areas is not acceptable. Institutions may be asked to describe the protective measures in place should storage rooms be adjacent to catering food preparation areas, catering stations, dining areas, kitchens or garbage rooms. In certain cases, assessors may recommend that indemnified exhibitions be stored in the exhibition areas.

2.2 Structural

The floor in a storage room should be able to support the types of objects the institution collects and the storage furniture that it uses. Compact storage is the most space-efficient system. Even if such an installation is not possible in the short term, having a floor loading capacity that can withstand this load is an important feature to allow for a possible future upgrade. The required floor loading capacity will depend on the type of materials stored and the number of tiers of shelving. Appendix B lists examples of floor loading capacities by object type. Moreover, institutions located in high-risk seismic zones must ensure that collections are protected against seismic shock (for example, by bolting down storage units, by installing connecting bars between storage units and/or by installing a protective barrier to prevent objects from falling off shelves during extreme vibrations).

Designation
For institutions located in high-risk seismic zones, assessors will expect to see evidence that they have taken measures to protect their collection from seismic shock.

Indemnification
To qualify for the program, institutions located in high-risk seismic zones will be required to provide evidence that they have taken measures to protect their collection from seismic shock.

2.3 Lighting

It should be possible to turn lights off when storage rooms are unoccupied. When rooms are occupied, light levels should be sufficient to allow safe movement through the space. Motion sensors and/or light zones can be used to exclusively illuminate areas where staff is present and to provide light levels customized to the activity carried out in each zone. In general, lighting fixtures are best oriented perpendicular to the storage aisles to ensure good visibility of the collection in all aisles. Light sources should emit no or very little UV (no more than 10 µW/lm), which can be ensured by using no- or low-UV-emitting sources (such as LEDs or low-UV fluorescent tubes) or UV filters that exclude up to 400 nm. The amount of absolute UV received by the objects should be below 10 mW/m^2. There should be no windows in storage rooms.

Designation
Assessors will expect to see that lights are kept off in storage when the space is unoccupied and that any windows in storage are blocked in adapted buildings. If means of egress illumination is required, assessors will expect to see that sensitive materials are protected from light by storage furniture (such as drawers and cabinets) or by being stored in boxes.

Indemnification
As indemnified works are generally crated when in storage, this has no direct implications on applications to qualify for the program.

2.4 Support spaces

Storage should be reserved for accessioned collection objects. Non-collection items (for example, exhibition panels, display cases, packing materials and non-accessioned objects) should not be stored there. Any function other than collection storage (for example, documentation, research, packing and exhibition preparation) should be conducted outside of storage but should be well connected to collection areas to ensure functionality. Reducing traffic in storage minimizes many risks related to security, climate and pollution, among others. It is also highly recommended to have a quarantine space to inspect incoming objects for signs of pests, dampness or mould, especially for collections that contain textiles, furs, hair, skins or insect specimens (that is, objects at high risk of pest infestation). Quarantine spaces should provide good visibility (that is, well-lit, light-coloured walls and floors) and have well-sealed doors; these are transitory areas, not permanent storage.

Designation
Assessors will expect to see that the storage rooms are primarily used for collection storage, that sufficient storage space is available to house proposed and/or future acquisitions and that storage equipment is sufficient and adequate; furthermore, that incoming objects are systematically inspected before being introduced into the storage rooms, that an IPM program is in place and that adequate procedures have been established to deal with mould or pest infestations.

Indemnification
For qualification under the program, assessors will expect confirmation that access to storage is restricted during the indemnification period if storage rooms are used for the temporary storage of indemnified works at any point. Furthermore, assessors will expect to see that an IPM program is in place and that adequate procedures have been established to deal with mould or pest infestations.

3. Exhibition areas

3.1 Lighting

It should be possible to provide light levels as low as 50 lux everywhere in each of the exhibition areas where light-sensitive objects could be displayed. This will ensure that the institution is able to fulfill the loan requirements of most lenders. It will also provide the institution with a high level of flexibility for the display of their own light-sensitive objects. Light sources should emit no or very little UV (no more than 10 µW/lm), which can be ensured by using no- or low-UV sources (such as LEDs or low-UV fluorescent tubes) or UV filters that exclude up to 400 nm. The amount of absolute UV received by the objects should be below 10 mW/m^2. Light fixtures should have a colour rendering index (CRI) above 90.

Designation
Assessors will expect the institution to be measuring light and UV levels for new exhibits and to be using filters on UV-emitting light sources.

Indemnification
For qualification under the program, assessors will expect the institution to be measuring light and UV levels for new exhibits and to be using filters on UV-emitting light sources. When applying for the indemnification of a specific exhibition, institutions will be required to specify the lighting conditions for the exhibition (visible and UV levels).

3.2 Windows and skylights

It is best to avoid windows and skylights in exhibition areas. Careful consideration is needed to determine how to manage the risks resulting from increased visible light and UV levels, extra solar loads on the HVAC system and increased security risks when windows are present, particularly if windows are on the ground floor. Be aware that these factors may impact an institution's ability to meet the loan requirements of other institutions or to provide adequate preventive conservation conditions for their own collection. Skylights can also be a source of water leaks if not maintained adequately. This may not manifest itself immediately, but perhaps 10–15 years after construction. Therefore, institutions who choose to accept these risks must be prepared to bear the costs of ongoing maintenance that comes with their mitigation over time. It should also be noted that skylights will not eliminate the need for artificial lighting, as daylight may not light objects sufficiently, may not be available during some business hours and may not save electricity. UV must be filtered at all glazing in rooms where sensitive objects are exhibited.

Designation
Assessors will expect to see that climate conditions are maintained reliably over time (section 6) and that there are no recurring issues with water leaks or condensation on windows or skylights. An intrusion alarm system that detects unauthorized entry via windows and skylights must be present. Assessors may require applicants to demonstrate how the following risks are managed: visible light and UV exposure, security and potential leaks.

Indemnification
For qualification under the program, assessors will expect to see that climate conditions are maintained reliably over time (section 6), that there are no recurring issues with water leaks or condensation on windows or skylights, that ground-level windows are equipped with glass break detection and that any skylights are alarmed. Assessors may require applicants to demonstrate how the following risks are managed: visible light and UV exposure, security and potential leaks.

3.3 Structural

The way in which objects will be hung on walls, or from the ceiling in some cases, should be carefully planned. For art galleries especially, wall sections that include 3/4 in. (19 mm) plywood behind the drywall can be particularly useful for hanging and providing a hollow space behind the wall that makes it possible to conceal electrical cords. Some institutions also require anchor points on the ceiling, which can be embedded into the structural fabric of the building during construction. The type, load rating and location of these anchor points will depend on the types of objects the institution is most likely to display. Finally, institutions that regularly display large

and heavy objects (machinery, vehicles, etc.) may require reinforced floors to accommodate the extra load.

Designation
This often has no direct implications on applications for category A designation. When applying for a category B designation for objects that are large and/or heavy and require hanging, the institution may be asked to demonstrate that it has the adequate mechanisms and structural features to guarantee the safety of the objects.

Indemnification
This often has no direct implications on applications to qualify for the program. However, when applying for the indemnification of a specific exhibition, institutions will be asked to provide detailed specifications for mounts, anchors or other mechanisms used to guarantee the safety of especially large and/or heavy objects.

4. Collection reading rooms

4.1 Lighting

As light exposure in reading rooms is intermittent, higher light levels that facilitate reading are acceptable. However, light sources should emit no or very little UV (no more than 10 µW/lm), which can be ensured by using no- or low-UV sources (such as LEDs or low-UV fluorescent tubes) or UV filters that exclude up to 400 nm.

Designation
Assessors will expect the institution to be measuring light and UV levels and to be using filters on UV-emitting light sources.

Indemnification
Not applicable (section 3).

4.2 Windows and skylights

It is best to avoid windows and skylights in reading rooms. Careful consideration is needed to determine how to manage the risks resulting from increased visible light and UV levels, extra solar loads on the HVAC system and increased security risks when windows are present, particularly if windows are on the ground floor. Skylights can also be a source of water leaks or condensation if not maintained adequately. This may not manifest itself immediately, but perhaps 10–15 years after construction. Therefore, institutions who choose to accept these risks must be prepared to bear the costs of ongoing maintenance that comes with their mitigation over time. It should also be noted that skylights will not eliminate the need for artificial lighting, as daylight may not light objects sufficiently, may not be available during some business hours and may not save electricity. UV must be filtered at all glazing in rooms where sensitive objects are used.

Designation
Assessors will expect to see that climate conditions are maintained reliably over time (section 6) and that there are no recurring issues with water leaks or condensation on windows or skylights. An intrusion alarm system that detects unauthorized entry via windows and skylights must be present. Assessors may require applicants to demonstrate how the following risks are managed: visible light and UV exposure, security and potential leaks.

Indemnification
Not applicable (section 3).

5. Loading dock

Ideally, the largest of the transport trucks used by the institution should be able to back up fully into the loading dock, allowing the external door to close. This is an excellent feature for security and protection of objects from inclement weather during loading and unloading operations. At minimum, an external loading dock with a shelter should be provided. Preferably, the dock should have a dock leveller and/or scissor lift. There should be no garbage bins or dumpsters in the loading dock, and all exterior doors should be pest proof. The design of the loading dock apron and access routes should facilitate access by the largest of the transport trucks used by the institution and be reflective of the size of the items they may contain.

Designation
Assessors will expect to see that collection objects can be loaded and unloaded safely while protected from the elements. If garbage bins or dumpsters are present in the loading dock, the institution will have to demonstrate how it manages this pest risk.

Indemnification
For qualification under the program, assessors will expect to see a loading dock where objects can be loaded and unloaded safely while fully protected from the elements. If garbage bins or dumpsters are present in the loading dock, the institution will have to demonstrate how it manages this pest risk. Given the high value of indemnified exhibitions, in situations where security may be an issue (for example, a loading dock that is not fully enclosed), assessors may recommend the presence of a security guard during loading and unloading.

6. Heating, ventilation and air conditioning

6.1 Relative humidity and temperature control

As a primary objective, all areas of the building where collection objects are either displayed, used, stored or transported (exhibition areas, storage rooms, reading rooms, workshops or preparation areas, quarantine rooms and hallways between these spaces) should provide climate conditions that eliminate all major risks to the collection (incorrect temperature and incorrect RH leading to mould, active corrosion, internal chemical degradation, fractures, delamination and deformation). What are considered to be “ideal climate-controlled conditions” will vary from institution to institution, as these depend on the vulnerability of a collection and on the specific

operational context of an institution. In general, from a preventive conservation point of view, it is better to provide conditions that are less tightly controlled but controlled reliably over time than very tightly controlled conditions only some of the time. For a more detailed discussion on this topic, including a description of the damage caused by incorrect temperature and RH, of the vulnerability of different objects, of the classes of control for temperature and RH and of requirements for special collections, consult the Environmental guidelines for museums.

Designation

As part of a designation application, assessors will expect to see evidence, in the form of temperature and RH charts covering 12 consecutive months, that climate can be controlled to meet certain specifications, depending on the classes of cultural property, in all areas where collection objects could be exhibited, given public access (archives or library reading rooms), stored or transported. Note that for category B designation, application requirements may be different depending on the vulnerability of the acquisition for which designation is sought. Refer to the document "Formatting RH and T charts" (can be obtained from CCI, the Designation program or the Indemnification Program) to ensure that charts are submitted in the correct format.

- For classes 1, 2, 3, 4, 5, 6 and 8 (archaeology and natural history objects, material of ethnographic culture, military objects, objects of applied and decorative arts, objects of fine arts, scientific or technological objects and musical ASHRAE control type A1 or A2 (that is, good control of some gradients or seasonal changes, but not both) (Table 1).

Table 1: description of the two options for ASHRAE control type A (ASHRAE 2019, p. 24.21)

Control parameter	Type A1	Type A2
RH: setpoint	50% (or historic annual average for permanent collections)	50% (or historic annual average for permanent collections)
RH: short-term fluctuations	±5%	±10%
RH: maximum seasonal adjustments from annual average	up 10% and down 10% RH	None
RH: long-term outer limits	≥ 35% and ≤ 65%	≥ 35% and ≤ 65%
Temperature: setpoint	set between 15°C and 25°C	set between 15°C and 25°C
Temperature: short-term fluctuations	±2°C	±2°C
Temperature: maximum seasonal adjustments from annual average	up 5°C and down 10°C (progressively, over 3 months, for example)	up 5°C and down 10°C (progressively, over 3 months, for example)
Temperature: long-term outer limits	≥ 10°C and ≤ 25°C	≥ 10°C and ≤ 25°C

Note

Rooms intended for loan exhibitions must handle the setpoint specified in the loan agreement, typically 50% RH, 21°C, but sometimes 55% or 60% RH.

- For class 7 (archival material), provide at least ASHRAE control type A1 or A2 (Table 1), and/or at least one of the ASHRAE specifications for chemically unstable collections (cool, cold or frozen storage) (Table 2). ASHRAE control type A1, A2 or better should be provided in the reading rooms, where applicable.

Table 2: ASHRAE specifications for chemically unstable collections (ASHRAE 2019, p. 24.24)

Storage conditions	RH	Temperature setting
Cool	Between 30% and 50%	Between 8°C and 16°C
Cold	Between 30% and 50%	Between 0°C and 8°C
Frozen	Between 30% and 50%	Between −20°C and 0°C

For class 9 (audiovisual collections), provide at least one of the ASHRAE specifications for chemically unstable collections (cool, cold or frozen storage) (Table 2). Low-temperature storage spaces should be monitored for equipment failure using an alarm. A low-temperature storage retrieval procedure that reduces the risk of condensation associated with rapid temperature changes should be in place.

Indemnification

To qualify for the program, institutions must provide evidence, in the form of temperature and RH charts covering 12 consecutive months, that climate can be controlled to meet at least ASHRAE control type A1 or A2 in all areas where indemnified objects could be exhibited or stored. Refer to the document "Formatting RH and temperature charts" (can be obtained from CCI, the Designation program or the Indemnification Program) to ensure that charts are submitted in the correct format. When submitting an application for indemnification, be aware that individual lenders may have specific climate control requirements that need to be reconciled.

6.2 Sensors

RH and temperature sensors should be located within the spaces and not only in the return air ducts to ensure that the conditions measured reflect those in which collection objects are kept. Sensors should be placed in a location where there is no interference (that is, not near windows or open doors, not in front of vents, not on exterior walls and not in full sun). It should be possible to take readings at 20-minute intervals and to download the data and archive it for later interpretation.

Designation
Institutions will be asked to identify on the temperature and RH charts the specific room, and in some cases, the specific location where the sensors or data-loggers are located.

Indemnification
To qualify for the program, institutions will be asked to identify on the temperature and RH charts the specific room, and in some cases, the specific location where the sensors or data-loggers are located.

6.3 Filtration and ventilation

Air filtration in all areas of the building where collection objects are displayed, used, stored or moved throughout the facility should meet at least minimum efficiency reporting values (MERV) 12 (ASHRAE Standard 52.2, 2017). However, if higher than normal pollutant concentrations are expected, either internally generated (for example, an actively deteriorating collection of cellulose acetate negatives or cellulose nitrate film) or externally generated (for example, an urban area with high traffic levels of diesel-fueled vehicles or nearby industrial activity), higher classes of specification — sometimes including gas filtration — may be required. Consult Agent of deterioration: pollutants – Control strategies for airborne pollutants for further information. It is important to ensure that workshops and preparation areas that generate dust as well as kitchens are well sealed (by using double doors, for example) and have proper extraction or filtration to protect collections from dust and for health reasons. The HVAC system should maintain positive air pressure in areas where collection objects are displayed and stored as compared to the other spaces of the building to minimize the infiltration of pollutants and to optimize climate control. The overall building pressure relative to outdoors should be appropriate for the local climate. In the event of a fire, the HVAC dampers should shut down automatically.

Designation
Assessors will expect to see evidence of reasonable control of dust and pollutants in all collection spaces. In some cases where collection objects are boxed and the presence of staff in storage areas is kept to a minimum, filtration to a lower specification may be adequate. MERV 12 filter system performance is only slightly better than minimum conditions for office spaces; therefore, it is not an unrealistic goal for most institutions that have mechanical ventilation.

Indemnification
Even though the pollutant risk for many indemnified objects may be low given the short-term nature of exhibitions, assessors expect to see filter system performance of at least MERV 12 in institutions that are applying to the Indemnification Program. On occasion, some types of objects (such as unglazed paintings or drawings, other porous surfaces and polished metals) will require added protection (such as stanchions, other physical barriers, glazing and display cases) from pollutants generated by contact (for example, oils from visitors touching the surface). Similarly, objects with very high sensitivity to gaseous pollutants (such as lead and silver) may require added protection within display cases.

7. Security

The building should provide for clear sightlines to all entrances and have vandal-proof external lighting. The roof should not be accessible from the exterior. Walls, roof, doors, windows, security grilles and locks should be robust in order to delay intruders, allowing time for security and/or police to respond. An intrusion alarm system must be installed and monitored 24/7. This system should include multiple controls that work together to detect unauthorized entry into the building from the exterior and into storage rooms, exhibition areas and the loading dock. Access points (doors and openable windows, roof hatches, loading dock garage door) require contact sensors, as do the doors leading into collection storage rooms and exhibition areas. Rooms adjacent to exterior walls and collection spaces should also be covered by motion detectors. Any windows or glass walls on the ground floor should have a glass break detector. All skylights should be alarmed. Ideally, it should be possible to alarm storage room doors even during business hours. Storage room doors should be solid, preferably made of steel, with at least a deadbolt lock that is keyed separately so that access can be limited to collection staff who need it. An electronic card access system (or equivalent) throughout the facility is highly recommended. CCTV camera coverage is highly recommended (with footage retained for a minimum of 30 days), particularly at key entry points, in exhibition areas and in the loading dock. During public hours, a staff member or security guard should be stationed near the main entrance at all times, and some level of physical presence should be provided in the exhibition areas. Potential thieves should not be able to exit the building directly from exhibition areas. The building should be equipped with a backup power supply to allow the security system to function in the event of a power outage.

Designation
Assessors will expect to see all features listed above, but they recognize that CCTV camera coverage is more useful for reviewing incidents after they occur than for prevention; therefore, more importance is placed on detection mechanisms. As a minimum requirement, the following must be present: an intrusion alarm system that detects unauthorized entry via exterior doors and windows; and motion detection at all entry/exit points of the building, and in collection storage, collection reading rooms and exhibition areas. Furthermore, having a staff member or security guard stationed near the entrance during public hours is required.

Indemnification
For qualification under the program, assessors will expect to see all features listed above and will additionally require complete camera coverage of all galleries where indemnified objects are exhibited. When applying for the indemnification of a specific exhibition, applicants will be required to submit a detailed security layout that includes the location of security guards and of all detection devices (CCTV cameras, motion detectors, contact sensors). In most cases, licensed security guards must be permanently stationed in exhibition areas where indemnified objects are displayed during public hours and at the building's public entrances and exits. Furthermore, a dedicated guard to monitor the exhibition's CCTV camera feed during public hours and 24/7 guard presence on premises during the indemnification period is usually required. The sightlines of cameras and of security guards in relation to indemnified objects will be examined in detail.

8. Fire protection

A regularly inspected fire detection and alarm system, as well as an automatic fire suppression system installed in compliance with NFPA (National Fire Protection Association) 13, should cover the entire building, including exhibition areas and collection storage rooms. CCI recommends wet pipe sprinklers because they are simpler, more reliable systems that are less costly to install and to maintain over time compared to other options. However, for collection areas, some institutions prefer systems that reduce the risk of water damage due to accidental discharge (such as pre-action sprinkler systems) or that minimize the amount of water released during fire suppression (such as water mist or gaseous systems). Automatic smoke detection must be provided in collection areas, including storage. The building should be non-combustible or fire resistive. Exhibition areas, collection storage rooms, collection reading rooms and collection workspaces should have a fire resistance rating of 60 minutes (that is, with regards to walls [including exterior], ceiling, doors and hardware). There should be fire walls, barriers, stops and separations, and any penetrations in fire-rated walls and ceilings should be sealed with fire-rated materials. Furthermore, it is highly recommended to have a separate fire zone for collection storage rooms as part of the alarm system to enable a timely response. Fire extinguishers are expected in or close to all collection areas (exhibition areas, collection storage rooms, collection reading rooms, collection support spaces). Other requirements may apply, but these are generally part of the *Fire Code*. The building should be equipped with a backup power supply to allow the fire alarm system to function in the event of a power outage.

Designation
Assessors will expect to see good overall fire prevention measures in place; they will insist that automatic smoke detection be provided and that walls, ceiling, doors and hardware be fire-rated for 60 minutes in storage where certified cultural property is kept. Although fires are more likely to start outside collection spaces, CCI will always recommend that automatic fire suppression be installed throughout the building, including in collection spaces. Fire, which consistently ranks among the highest risks to collections in buildings lacking fire suppression, can potentially lead to the total loss of a collection and building.

Indemnification
For qualification under the program, assessors will expect to see good overall fire prevention measures in place and will insist that automatic smoke detection be provided in exhibition areas and collection storage, along with automatic fire suppression in collection storage rooms. Although fires are more likely to start outside collection spaces, CCI will always recommend that automatic fire suppression be installed throughout the building, including in collection spaces. Fire, which requires ongoing vigilance even in well-protected buildings, can lead to the total loss of a collection and building. When applying for indemnification of a specific exhibition, note that certain lenders may have specific fire protection requirements (such as the type of automatic fire suppression or fire extinguisher) that will need to be negotiated by the borrower.

9. Additional reminders

- Flat roofs over collection areas should be well designed (that is, slightly sloped with a membrane and proper drainage) to minimize the risk of leaks.

- Avoid locating washrooms, kitchens, air handlers or mechanical rooms above collection areas (storage, exhibition areas) and ensure that no water pipes (except for fire suppression) run through or above collection areas.

- Rectangular storage floor plans (without rounded or polygonal walls) make it easier to optimize the use of space when designing the storage furniture layout.

- Design the paths by which food and food waste are transported throughout the facility so as to avoid areas where collection objects may be present.

- Ensure that all doors that lead into conditioned spaces are tightly sealed. This point is often overlooked and makes precise climate control difficult (if not impossible). Glass doors present challenges when it comes to creating tight seals; this should be kept in mind at the design phase.

- Throughout the various phases of the project, keep a close eye on the clear height of collection rooms, as space will be required below the ceiling for building system components (for example, ductwork), for certain structural elements (such as beams) or to meet certain requirements of the *National Building Code of Canada*, or other codes, (for example, clearance below fire sprinkler heads). These may impact the usable room height.

- Locate mechanical rooms and panels outside of restricted collection areas.

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Appendix A: Coatings

This appendix is adapted from Tétreault 2011.

Table 3: suitability of different wet coatings for enclosures and rooms

Type of wet coating	Enclosures[1]	Rooms (includes walls, floors, exterior of cases)[2]	Comments
Common emulsion (latex or waterborne) coating or recycled emulsion coating; (excludes alkyd emulsions)	• Suitable	• Suitable • For floors, use a harder resin such as acrylic-urethane resin	• Medium-to-good vapour barrier. • Acetic acid emissions level off after four weeks during the drying process. • The resin and a good part of the solvents are from petroleum resources (as are many synthetic coating resins). • Brushes and rollers, while still wet, are cleaned easily with water. • No petroleum-based solvent is required for cleaning.
Zero- or low-VOC emulsion	• Suitable	• Suitable	• Darker colours have increased VOC content. • A very dark paint film will remain sticky for a long time. • Emission of acetic acid and ammonia during the drying process.
Two-part epoxy or two-part urethane (including low-VOC formulation)	• Suitable, provided the mixing is done carefully	• Suitable	• More expensive, less common to find on the market and less environmentally friendly than emulsion coatings.

Type of wet coating	Enclosures[1]	Rooms (includes walls, floors, exterior of cases)[2]	Comments
			• Well adapted for public or industrial floors. • The film is formed by catalyzed polymerization and solvent evaporation. • These coatings should be safe to use after the recommended drying time. • A solvent is needed to clean brushes and rollers.
Shellac or any film formed by solvent evaporation	• Suitable in enclosures • Avoid direct contact with object in a humid environment (surface becomes sticky)	• Safe for most types of collections • See comments for its limitations	• Tends to be a poor vapour barrier unless varnish is built up in many layers. • The dry film becomes sticky in moist environments and can get stained easily by moist fingers. • Denatured alcohol is the main VOC.
Casein and soy protein (non-alkyd based)	• Suitable for most objects • Use with caution for sulfur-sensitive objects	• Suitable	• Be sure there is no drying oil in the formula. • The long-term risk to objects from contact with casein is unknown. • Brushes and rollers, while still wet, should clean easily with water.
Cellulose-based	• Insufficient data: probably suitable	• Suitable	• Be sure there is no drying oil or alkyd resins in the formula. • Casein or soy protein may be present.

Type of wet coating	Enclosures[1]	Rooms (includes walls, floors, exterior of cases)[2]	Comments
Mineral (potassium silicate and whitewash)	• Suitable	• Suitable	• Appropriate for concrete, stucco, brick, plaster or any adobe-type of surfaces. • Brushes and rollers, while still wet, should clean easily with water.
Natural drying oil, (unbaked) alkyd solvent-based, alkyd emulsion, oil modified urethane, epoxy ester (1-part), melamine, recycled alkyd, soy-based alkyd as well as soy protein and casein paints having drying oil in them	• Not recommended	• Not recommended for large surfaces • Acceptable for small surfaces when applied in a ventilated room	• Known to release peroxides for the first few days and carboxylic acids for many weeks or months. • A solvent is needed to clean brushes and rollers.
Moisture-cured urethane, marine coating	• Insufficient data: caution required	• Caution is recommended for large surfaces • Acceptable for small surfaces when applied in a ventilated room	• Cures in the presence of humidity in the air. • Needs at least 35% RH; otherwise, the film does not cure fully and remains sticky. • VOCs have a very unpleasant smell.

Notes

1. Default drying time is four weeks. The four-week drying period also helps to minimize the risk of an object sticking to the painted surface. Use of an interleaf such as a sheet of Melinex (Mylar) is recommended to avoid potential damage due to direct contact.
2. Default drying time is four days. Excludes contact of coating with objects.

Table 4: suitability of alternatives to wet coatings for enclosures and rooms

Type of coating	Enclosures	Rooms (includes walls, floors, exterior of cases)	Comments
Powder coating (all resins)	• Suitable • Can be used immediately (no airing out required)	• Suitable • Can be used immediately (no airing out required)	• Usually used on metal structures. • Some can be applied on medium-density fibreboard. • No solvent involved in the film forming process. • Emissions from the coating after baking is assumed to be safe for collections (an odour can be detected).
Baked (alkyd) enamel coating	• Suitable if properly baked • Preferable to let it ventilate a few weeks before using	• Suitable • Can be used immediately (no airing out required)	• For metal structures. • If the coating is underbaked, it may release some harmful vapours, just as unbaked alkyd does.
Radiation-cured coating	• Suitable • Can be used immediately (no airing out required)	• Suitable • Can be used immediately (no airing out required)	• Mainly for varnished wood panels or boards • After curing, the amount of VOCs emitted is expected to be negligible.
Laminate of phenol and/or melamine formaldehyde for wood panels	• Suitable as long as no unsealed surfaces of wood are exposed inside the enclosure (for example, end grain) • Can be used immediately	• Suitable • Can be used immediately (no airing out required, except if airing out emissions from the glue is needed)	• Very good vapour barrier properties. • The amount of pollutants emitted by the laminate itself is negligible. • Contact cement (made of neoprene and/or synthetic rubber) is the

Type of coating	Enclosures	Rooms (includes walls, floors, exterior of cases)	Comments
			most recommended adhesive. • It could contain sulfur compounds, but according to the literature, this is unlikely. • Poly(vinyl acetate) (PVAC or “white glue”) may also be used to glue the laminate, although acetic acid will be emitted from the edges.
Laminated aluminum foil, heat-sealed onto wood surfaces	• Suitable as long as no unsealed surfaces of wood are exposed inside the enclosure • Can be used immediately	• Suitable • Can be used immediately (no airing out required)	• Excellent vapour barrier as long as the aluminum foil is not damaged. • In North America, Marvelseal 360 is commonly used. • Examples of application are found in the literature. • The use of metal foils may not be an environmentally friendly option compared to paint.

Appendix B: Examples of floor loading capacities

This appendix is adapted from Maximea 2012.

- Uncompacted racking, shelving or cabinets: minimum of 7.2 kN/m^2 (150 psf).
- Picture/paint racking: 7.2 kN/m^2 (150 psf).
- Books and archives stacks, uncompacted: 13.2 kN/m^2 (200 psf).
- High-density mobile storage: up to 21.5 kN/m^2 (250 psf).
- Temporary and crate storage: up to 13.2 kN/m^2 (200 psf).
- Large and heavy objects: 21.5 kN/m^2 (250 psf).

Appendix C: Design features checklist for new heritage collection facilities

This checklist includes all the preventive conservation features that are highly recommended by CCI as those that are specifically required by the Designation and Indemnification programs.

●	Features that are highly recommended by CCI.
♦	Features that are required by the Designation of institutions and public authorities program (Designation) or Canada Travelling Exhibitions Indemnification Program (Indemnification).
▲	If these features are not present, assessors for the Designation or Indemnification programs are likely to require further clarifications. Please contact CCI to discuss your specific case.
(blank)	Features not directly assessed by facility evaluation forms or specific to the Designation or Indemnification programs; assessors may require further clarification.

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N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
1. Building						
Architectural						
A1.01	Facility is not located in a flood-prone area.	●	▲	▲	☐	
A1.02	Facility is located in a flood-prone area, but all rooms that could contain collections are situated above the anticipated flood level.	●	▲	▲	☐	
A1.03	Facility is not located in an industrial area or near other activities exposing the collection to fire, theft, water, pollutants, pests or vibrations/shocks.	●	▲	▲	☐	
A1.04	Site is graded to provide drainage away from building.	●	▲	▲	☐	
A1.05	Facility is not shared with occupants that are unprotected against fire.	●	▲	▲	☐	
A1.06	There are clear sightlines to all entrances.	●	▲	▲	☐	
A1.07	Non-emergency exterior doors have deadbolt locks.	●	▲	▲	☐	
A1.08	Hinges for exterior doors are designed so that pins cannot be removed.	●	▲	♦	☐	
A1.09	Exterior doors have high performance, pest-proof seals.	●			☐	
A1.10	Construction is fire resistive or non-combustible.	●	▲	♦	☐	
A1.11	Clearance is sufficient to manoeuvre objects safely throughout the facility (ceiling heights, door widths, elevator size, turning radius).	●			☐	
A1.12	Roof is not accessible from exterior.	●	♦	♦	☐	
A1.13	Ducts or vents are larger than 25 cm × 25 cm (10 in. × 10 in.), are alarmed and have security screens and/or bars.	●	♦	♦	☐	
A1.14	Building has fire walls, barriers, stops and separations.	●	♦	♦	☐	
A1.15	Penetrations in fire-rated walls and ceilings are sealed with fire-rated materials.	●	♦	♦	☐	
A1.16	Combustible and flammable liquids have proper storage.	●	▲	▲	☐	
A1.17	Freight elevator is restricted to staff (it cannot be used by the public or caterers).	●	▲	▲	☐	
A1.18	Emergency staircase in multi-level buildings is enclosed.	●	♦	♦	☐	

N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
Electrical						
E1.01	Main entrances are lit from the outside.	●	▲	▲	☐	
E1.02	Exterior lighting is vandal-proof.	●	▲	▲	☐	
E1.03	Intrusion alarm system is monitored 24/7.	●	♦	♦	☐	
E1.04	Ground-floor windows are protected from intrusion (for example, glass break detection, functioning locks and security bars).	●	▲	♦	☐	
E1.05	Skylights are alarmed and/or have security bars.	●	▲	▲	☐	
E1.06	There is CCTV camera coverage of the facility's main entrances and exits.	●	▲	♦	☐	
E1.07	There is CCTV camera coverage of areas where collections are present.	●	▲	▲	☐	
E1.08	There are door contact sensors on all exterior doors.	●	♦	♦	☐	
E1.09	There is an uninterrupted power supply (UPS) for the security alarm system.	●	♦	♦	☐	
E1.10	The fire alarm is located throughout the building (listed with Underwriters Laboratories of Canada and installed in accordance with approved standards).	●	♦	♦	☐	
E1.11	The fire alarm has a dedicated phone line supervised for breaks, grounds and other faults.	●	▲	▲	☐	
E1.12	Fire alarm is monitored 24/7.	●	♦	♦	☐	
E1.13	Fire alarm system operates on standby power during a power failure.	●	♦	♦	☐	
E1.14	There is a fire zone annunciator panel.	●	♦	♦	☐	
E1.15	Any fire doors kept open are equipped with automatic closing devices.	●	♦	♦	☐	
Mechanical						
M1.01	Automatic fire suppression system is installed throughout the facility.	●	▲	▲	☐	
M1.02	Automatic fire suppression system is designed and installed in accordance with NFPA 13.	●	♦	♦	☐	
M1.03	In the event of a fire, the air circulation system shuts down automatically.	●	▲	♦	☐	
M1.04	HVAC system has built-in redundancy.	●			☐	
M1.05	Overall building pressure relative to outdoors is appropriate to the local climate.	●			☐	
M1.06	Final stage air filtration is a minimum MERV 12.	●	▲	▲	☐	
M1.07	Facility located in areas with higher pollutant concentrations have corresponding filtration.	●	▲	▲	☐	

N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
2a. Collection storage rooms						
Architectural						
A2a.01	Storage is not located in the basement, particularly if the building is in a flood-prone area.	●	▲	▲	☐	
A2a.02	Climate-controlled areas do not have exterior walls. If this is unavoidable, the areas are insulated and have continuous vapour barriers.	●			☐	
A2a.03	There are no windows.	●	▲	▲	☐	
A2a.04	It has a rectangular floor plan (without rounded or polygonal walls).	●			☐	
A2a.05	Access doors to climate-controlled areas have high performance seals.	●			☐	
A2a.06	There are two sets of doors (vestibule) to separate climate-controlled areas from those that are not.	●			☐	
A2a.07	Clearance height is sufficient.	●			☐	
A2a.08	Selected finishes and coatings for rooms are safe for collection objects. The minimum four days of drying time is respected.	●			☐	
A2a.09	There is no carpet.	●	▲	▲	☐	
A2a.10	Exposed concrete surfaces are sealed/painted.	●			☐	
A2a.11	Walls, ceiling, doors and hardware are fire-rated for at least 60 minutes.	●	♦	♦	☐	
A2a.12	A fire extinguisher is nearby.	●	♦	♦	☐	
A2a.13	Any cellulose nitrate film has proper storage.	●	♦	▲	☐	
A2a.14	A minimum of 10% of the space is available for collection growth.	●	▲	▲	☐	
A2a.15	Location does not have overhead flat roofs.	●			☐	
A2a.16	Location does not have overhead pipes, washrooms, kitchens, air handlers and mechanical rooms.	●	▲	▲	☐	
A2a.17	Location is separated from areas that could contain food or food waste (preparation areas, catering stations, kitchens, garbage rooms).	●	♦	♦	☐	
A2a.18	Collection objects are stored 10–15 cm above floor level.	●	▲	▲	☐	
A2a.19	Solid doors, preferably steel doors, with non-removable hinge pins and deadbolt lock are keyed separately.	●	▲	▲	☐	
Electrical						
E2a.01	Lights can be switched off when the space is unoccupied.	●	▲	▲	☐	
E2a.02	Light sources emit no or very little UV (no more than 10 µW/lm), which is ensured by using no- or low-UV sources (for example, LEDs or low-UV fluorescent tubes) or UV filters that exclude up to 400 nm.	●	▲	▲	☐	
E2a.03	Motion detectors (security device) are installed.	●	♦	♦	☐	
E2a.04	CCTV cameras capture who enters and exits the space.	●		▲	☐	

N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
E2a.05	There are door contact sensors.	●	♦	♦	☐	
E2a.06	Storage rooms can be alarmed during public hours.	●			☐	
E2a.07	There is an electronic card access system (or equivalent).	●			☐	
E2a.08	Ground-level water detectors are connected to the alarm system for storage rooms that are below grade or exposed to water pipes.	●	▲	▲	☐	
E2a.09	There is a separate fire zone for collection storage rooms.	●			☐	
E2a.10	There is automatic smoke detection.	●	♦	♦	☐	
Mechanical						
M2a.01	Climate conditions (temperature and RH) eliminate all major risks to the collection.	●	♦	♦	☐	
M2a.02	Facility maintains at least ASHRAE "A1" or "A2" for cultural property classes 1, 2, 3, 4, 5, 6 and 8.		♦	n/a	☐	
M2a.03	Facility maintains at least ASHRAE "A1" or "A2" and/or cool, cold or frozen storage for cultural property class 7 (archival material).		♦	n/a	☐	
M2a.04	Facility provides at least cool, cold or frozen storage for cultural property class 9 (audiovisual collections).		♦	n/a	☐	
M2a.05	Facility maintains at least ASHRAE "A1" or "A2" or meets lenders' requirements.			♦	☐	
M2a.06	Final stage air filtration is a minimum MERV 12.	●	▲	▲	☐	
M2a.07	Facility located in areas with higher pollutant concentrations have corresponding filtration.	●	▲	▲	☐	
M2a.08	Ductwork is minimized inside storage areas.	●			☐	
M2a.09	Positive pressure is maintained.	●			☐	
M2a.10	RH and temperature sensors are located in the spaces and not only in the return air ducts.	●			☐	
M2a.11	RH and temperature sensors are not located near open doors, in front of vents, on exterior walls or in full sun.	●			☐	
M2a.12	Climate readings can be taken at frequent (for example, 20-minute) intervals, and data can be downloaded and archived for later interpretation.	●	♦	♦	☐	
M2a.13	Floor drains, a sump pump and backflow preventers are installed in storage rooms that are below grade or that are exposed to water pipes.	●	♦	▲	☐	
M2a.14	There is automatic fire suppression.	●	▲	▲	☐	
Structural						
S2a.01	Floor can withstand the weight of collection and storage furniture.	●			☐	
S2a.02	There are adequate mechanisms and structural features to guarantee the safety of objects.	●			☐	
S2a.03	Collection is protected against seismic shock in high-risk seismic zones.	●	♦	♦	☐	

N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
2b. Collection support spaces **(workshops, collections preparation, quarantine rooms, etc.)**						
Architectural						
A2b.01	Climate-controlled areas do not have exterior walls. If this is unavoidable, the areas are insulated and have continuous vapour barriers.	●			☐	
A2b.02	Access doors to climate-controlled areas have high performance seals.	●			☐	
A2b.03	There are two sets of doors (vestibule) to separate climate-controlled areas from those that are not.	●			☐	
A2b.04	Clearance height is sufficient.	●			☐	
A2b.05	Selected finishes and coatings for rooms are safe for collection objects. The minimum four days of drying time is respected.	●			☐	
A2b.06	There is no carpet.	●			☐	
A2b.07	Exposed concrete surfaces are sealed/painted.	●			☐	
A2b.08	A fire extinguisher is located nearby.	●	♦		☐	
A2b.09	Location does not have overhead pipes, washrooms, kitchens, air handlers and mechanical rooms.	●			☐	
A2b.10	Workshops where dust is produced are well sealed and equipped with local extraction or filtration.	●			☐	
A2b.11	All spaces where collection objects could be present are separated from areas that could contain food or food waste (preparation areas, catering stations, kitchens, garbage rooms).	●	♦	♦	☐	
Electrical						
E2b.01	Lights can be switched off when the space is unoccupied.	●			☐	
E2b.02	Light sources emit no or very little UV (no more than 10 µW/lm), which is ensured by using no- or low-UV sources (for example, LEDs or low-UV fluorescent tubes) or UV filters that exclude up to 400 nm.	●			☐	
E2b.04	Motion detectors (security device) are installed.	●			☐	
E2b.05	CCTV cameras are installed.	●			☐	
E2b.06	There are contact sensors on doors and operable windows.	●			☐	
E2b.07	Ground-level water detectors are connected to the alarm system for rooms that are below grade or that are exposed to water pipes.	●			☐	
E2b.08	There is automatic smoke detection.	●			☐	
Mechanical						
M2b.01	Final stage air filtration is a minimum MERV 12.	●			☐	
M2b.02	Facilities located in areas with higher pollutant concentrations have corresponding filtration.	●			☐	

N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
M2b.03	If dealing with large quantities of mouldy materials, there are special features to contain the spread of spores throughout the facility (special filtration, negative pressure, vestibules).	●			☐	
M2b.04	Workshops operate with negative pressure.	●			☐	
M2b.05	Conservation labs, collection preparation rooms, quarantine rooms or other spaces where staff work with the collection are climate controlled to the same level as storage rooms and exhibition areas.	●	▲		☐	
M2b.06	Spaces such as hallways that connect areas where collection objects could be present are climate controlled to the same level as storage rooms and exhibition areas.	●	▲		☐	
M2b.07	RH and temperature sensors are located in the spaces and not only in the return air ducts.	●			☐	
M2b.08	RH and temperature sensors are not located near windows, open doors, in front of vents, on exterior walls or in full sun.	●			☐	
M2b.09	Climate readings can be taken at frequent (for example, 20-minute) intervals, and data can be downloaded and archived for later interpretation.	●			☐	
M2b.10	Floor drains, a sump pump and backflow preventers are installed in spaces where collection objects could be present and that are below grade or are exposed to water pipes.	●			☐	
Structural						
S2b.01	Floor can withstand the weight of objects.	●			☐	
S2b.02	Collection is protected against seismic shock in high-risk seismic zones.	●			☐	
# 3. Exhibition areas						
Architectural						
A3.01	Exhibition areas are not located below the anticipated flood level if the building is located in a flood-prone area.	●			☐	
A3.02	Climate-controlled areas do not have exterior walls. If this is unavoidable, the areas are insulated and have continuous vapour barriers.	●	▲	▲	☐	
A3.03	There are no glass walls, large windows or skylights.	●	▲	▲	☐	
A3.04	Access doors to climate-controlled areas have high performance seals.	●			☐	
A3.05	There are two sets of doors (vestibule) to separate climate-controlled areas from those that are not.	●			☐	
A3.06	Clearance height is sufficient.	●			☐	

N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
A3.07	Rooms: selected finishes and coatings are safe for collection objects. The minimum four days of drying time is respected.	●		♦	☐	
A3.08	Display cases: selected finishes and coatings are safe for collection objects. The minimum drying time of four weeks is respected.	●		♦	☐	
A3.09	There is no carpet.	●	▲	▲	☐	
A3.10	Exposed concrete surfaces are sealed/painted.	●			☐	
A3.11	Walls, ceiling, doors and hardware are fire-rated for at least 60 minutes.	●	♦	♦	☐	
A3.12	A fire extinguisher is located nearby.	●	♦	♦	☐	
A3.13	Location is separated from areas that could contain food or food waste (preparation areas, catering stations, kitchens, garbage rooms).	●	♦	♦	☐	
A3.14	Location does not have overhead pipes, washrooms, kitchens, air handlers and mechanical rooms.	●			☐	
A3.15	Direct egress from exhibition areas to outdoors is avoided.	●	▲	▲	☐	
Electrical						
E3.01	Light levels as low as 50 lux can be achieved (some lenders require even lower levels for highly light-sensitive objects).	●			☐	
E3.02	Light sources emit no or very little UV (no more than 10 µW/lm), which is ensured by using no- or low-UV sources (for example, LEDs or low-UV fluorescent tubes) or UV filters that exclude up to 400 nm.	●			☐	
E3.03	Light sources have a CRI above 90.	●			☐	
E3.04	Motion detectors (security device) are installed.	●	♦	♦	☐	
E3.05	CCTV cameras are installed.	●	▲	♦	☐	
E3.06	There are door contact sensors.	●	▲	▲	☐	
E3.07	There is an electronic card access system (or equivalent).	●			☐	
E3.08	Emergency exits are alarmed 24/7, and where direct egress from exhibition areas to outdoors is unavoidable, delayed egress is provided where permissible under the *National Building Code of Canada* or other codes.	●		♦	☐	
E3.09	There is automatic smoke detection.	●	♦	♦	☐	
Mechanical						
M3.01	Climate conditions eliminate all major risks to most of the collection.	●	♦	♦	☐	
M3.02	Area maintains at least ASHRAE "A1" or "A2" for cultural property classes 1, 2, 3, 4, 5, 6, 7 and 8.		♦	n/a	☐	
M3.03	Area maintains at least ASHRAE "A1" or "A2" or meets lenders' requirements.			♦	☐	
M3.04	Final stage air filtration is a minimum MERV 12.	●	▲	▲	☐	

N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
M3.05	Facilities located in areas with higher pollutant concentrations have corresponding filtration.	●	▲	▲	☐	
M3.06	Area maintains positive pressure.	●			☐	
M3.07	RH and temperature sensors are located in the spaces, not only in the return air ducts.	●			☐	
M3.08	RH and temperature sensors are not located near windows, open doors, in front of vents, on exterior walls or in full sun.	●			☐	
M3.09	Climate readings can be taken at frequent (for example, 20-minute) intervals, and data can be downloaded and archived for later interpretation.	●	♦	♦	☐	
M3.10	Each space has independent controls, which can be adjusted based on occupancy loads and/or lender requirements.	●			☐	
M3.11	There is automatic fire suppression.	●	▲	▲	☐	
Structural						
S3.01	Floor can withstand the weight of objects on display.	●			☐	
S3.02	Adequate structural features permit the safe installation of objects on display.	●			☐	
S3.03	Collection is protected against seismic shock in high-risk seismic zones.	●	♦	♦	☐	
4. Collection reading rooms						
Architectural						
A4.01	Climate-controlled areas do not have exterior walls. If this is unavoidable, the areas are insulated and have continuous vapour barriers.	●		n/a	☐	
A4.02	There are no glass walls, large windows or skylights.	●	▲	n/a	☐	
A4.03	Access doors to climate-controlled areas have high performance seals.	●		n/a	☐	
A4.04	There are two sets of doors (vestibule) to separate climate-controlled areas from those that are not.	●		n/a	☐	
A4.05	Rooms: selected finishes and coatings are safe for collection objects. The minimum four days of drying time is respected.	●		n/a	☐	
A4.06	There is no carpet.	●	▲	n/a	☐	
A4.07	Exposed concrete surfaces are sealed/painted.	●		n/a	☐	
A4.08	Walls, ceiling, doors and hardware are fire-rated for at least 60 minutes.	●	♦	n/a	☐	
A4.09	A fire extinguisher is located nearby.	●	♦	n/a	☐	
A4.10	Location is separated from areas that could contain food or food waste (preparation areas, catering stations, kitchens, garbage rooms).	●	♦	n/a	☐	

N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
A4.11	Location does not have overhead pipes, washrooms, kitchens, air handlers and mechanical rooms.	●		n/a	☐	
A4.12	Direct egress from collection reading rooms to outdoors is avoided.	●	▲	n/a	☐	
Electrical						
E4.01	Light sources emit no or very little UV (no more than 10 µW/lm), which is ensured by using no- or low-UV sources (for example, LEDs or low-UV fluorescent tubes) or UV filters that exclude up to 400 nm.	●		n/a	☐	
E4.02	Motion detectors (security device) are installed.	●	♦	n/a	☐	
E4.03	CCTV cameras are installed.	●	▲	n/a	☐	
E4.04	There are door contact sensors.	●	▲	n/a	☐	
E4.05	There is an electronic card access system (or equivalent).	●		n/a	☐	
E4.06	Emergency exits are alarmed 24/7, and where direct egress from exhibition areas to outdoors is unavoidable, delayed egress is provided where permissible under the *National Building Code of Canada* or other codes.	●		n/a	☐	
E4.07	There is automatic smoke detection.	●	♦	n/a	☐	
Mechanical						
M4.01	Climate conditions eliminate all major risks to most of the collection.	●	♦	n/a	☐	
M4.02	Room maintains at least ASHRAE "A1" or "A2" for Designation program cultural property class 7.	●	▲	n/a	☐	
M4.04	Final stage air filtration is a minimum MERV 12.	●	▲	n/a	☐	
M4.05	Facilities located in areas with higher pollutant concentrations have corresponding filtration.	●	▲	n/a	☐	
M4.06	Room maintains positive pressure.	●		n/a	☐	
M4.07	Temperature and RH sensors are located in the spaces, not only in the return air ducts.	●		n/a	☐	
M4.08	Temperature and RH sensors are not located near windows, open doors, in front of vents, on exterior walls or in full sun.	●		n/a	☐	
M4.09	Climate readings can be taken at frequent (for example, 20-minute) intervals, and data can be downloaded and archived for later interpretation.	●	▲	n/a	☐	
M4.10	Each space has independent controls, which can be adjusted based on occupancy loads and/or lender requirements.	●		n/a	☐	
M4.11	There is automatic fire suppression.	●	▲	n/a	☐	
Structural						
S4.01	Collection is protected against seismic shock in high-risk seismic zones.	●	♦	n/a	☐	

N°	Features	Recommended by CCI	Required		Design feature is included √	Comments
			Category "A" designation	Indem-nification		
5. Loading dock						
Architectural						
A5.01	Loading dock is designed for access by the largest trucks used by the institution.	●	▲	▲	☐	
A5.02	Loading dock is fully enclosed and can fit the largest trucks used by the institution.	●	▲	▲	☐	
A5.03	The dock is sheltered if the loading dock is not fully enclosed.	●	▲	▲	☐	
A5.04	There is a dock leveller and/or scissor lift.	●	▲	▲	☐	
A5.05	Exterior doors have high performance, pest-proof seals.	●			☐	
A5.06	There are no garbage bins or dumpsters inside the loading dock.	●	▲	▲	☐	
Electrical						
E5.05	Motion detectors (security device) are installed in interior receiving areas.	●	♦	♦	☐	
E5.06	CCTV cameras are installed.	●	▲	♦	☐	
E5.07	There are door contact sensors on exterior and garage doors.	●	▲	▲	☐	
Mechanical						
M5.01	Interior space is heated in winter.	●			☐	

Bibliography

American Society of Heating, Refrigerating and Air-Conditioning Engineers. “Museums, Galleries, Archives and Libraries.” In *ASHRAE Handbook: Heating, Ventilating and Air-Conditioning Applications*, SI Edition. Atlanta, GA: ASHRAE, 2019, pp. 24.1–24.46.

Maximea, H. “Planning for Collections Storage.” In B. Lord, G. Dexter Lord and L. Martin, eds., *Manual of Museum Planning: Sustainable Space, Facilities and Operations*. Lanham, MD: AltaMira Press, 2012, pp. 250–285.

Tétreault, J. “Sustainable Use of Coatings in Museums and Archives – Some Critical Observations” (PDF format). *e-Preservation Science*, 43 (2011), pp. 39–48.

Further reading

Canadian Conservation Institute. Agents of deterioration. Ottawa, ON: Canadian Conservation Institute, n.d.

Canadian Conservation Institute. CCI Notes. Ottawa, ON: Canadian Conservation Institute, n.d.

Canadian Conservation Institute. CCI Technical Bulletins. Ottawa, ON: Canadian Conservation Institute, n.d.

Canadian Conservation Institute. Framework for Preserving Heritage Collections: Strategies for Avoiding or Reducing Damage. Ottawa, ON: Canadian Conservation Institute, n.d.

Canadian Standards Association. CSA S832:14 (R2019), *Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings*. Toronto, ON: Canadian Standards Association, 2019.

Michalski, S., and D. Grattan. Environmental guidelines for museums, Ottawa, ON: Canadian Conservation Institute, n.d.

National Research Council Canada. *National Building Code of Canada 2015*. Ottawa, ON: National Research Council, 2015.

Tétreault, J. “Fire Risk Assessment for Collections in Museums.” *Journal of the Canadian Association for Conservation*, 33 (2008), pp. 3–21.