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## **Building Envelope Tip Sheet**

The building envelope can be defined as the barrier that separates the exterior environment and the interior environment of a building. The physical components of a building envelope consist of the foundation, walls, roof, windows and doors.

The building envelope should be the primary protective barrier between pests and your collections. This sheet contains recommendations that, when implemented, may help protect your collection and building from pests. Of these recommendations, regular building maintenance and inspection are of utmost importance to ensure that pests are excluded.

A building's integrity directly affects pest activity. Ensuring that all holes, gaps and voids are closed and that all possible wall, floor, and roof penetrations are appropriately sealed is the number one method for excluding pests from museum buildings.

### **IPM Tips for the Physical Components of Building Envelopes:**

#### **Foundation/walls/roof:**

- If your museum site is home to more than one building remember to inspect all outbuildings in the same manner as you would inspect the main building.
- Check the building exterior for holes, cracks, gaps, and crevices. Insects can enter through 0.5 mm cracks, while bats and rodents can gain access through anything larger than 5 mm. Rats can get through a space as small as 12 mm.
- Thoroughly caulk or seal all openings found in the building exterior to effectively block pest entry.
- Remember to seal around any areas where plumbing, electrical, or cable services enter the building. Gaps around conduit lines, piping, and ventilation ducts are all common ways for pests to enter buildings.
- Wall-mounted equipment and fixtures must be properly installed and tightly sealed upon installation.
- In addition to sealing any foundation gaps make sure to seal gaps at the roof level to prevent climbing animals from gaining access.
- Note any loose or damaged areas on walls, flashings, and visible roofing.
- Roofs should be in good condition and drain properly.
- Gutters should be clear of debris and drain freely. Remove any buildup of dirt and leaves from the roof and in gutters. Clogged gutters increase the chance of wood rot and water damage to exterior walls. When clogged they also fill with standing water.
- Painting the building exterior in light colors results in much easier visual inspections for pests.
- If fortunate enough to be involved in the planning of a new building it is best to avoid: recessed windows, flat ledges, flat roofs, roof edges, nooks, and columns. All provide excellent roosting and nesting sites for birds.

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- Entranceway overhangs and sun shades can be nesting sites for birds and stinging insects.
- Building fabric options made of metal and concrete slab control insect entry.
- Perform repairs as needed to prevent pests from entering the building.

## **Chimneys:**

- Install screening on functional chimneys to prevent bird access.
- Unused chimneys can be blocked at roof level using sheet metal caps.

## **Doors:**

- Doors that do not seal properly are the primary way for pests to enter a building. If, while standing inside the building, light is visible under a door then that door is not properly sealed, and pests can gain entry.
- Ensure that all exterior doors are properly fitted with door sweeps. Door sweeps should fit snugly against the threshold and be flush with the door frame on both sides.
- In addition to door sweeps it is recommended that weatherstripping be added along both sides of a door and across the top of the door frame.

## **Windows:**

- Like doors, all windows should be sealed properly.
- Use weatherstripping around window frames to create a tight seal.
- Blade seals can be applied to opening windows.
- Screens should be present, tightly fitted, and in good repair on all exterior windows that open.
- Screens should also be sealed tightly around their frames with gaskets.
- Using aluminum screening (10 mesh or smaller) is recommended. Aluminum can be stretched more tightly.
- Do not prop open doors or windows, especially in kitchens or those located near exterior garbage receptacles or dumpsters.
- To block pests from gaining access to buildings make sure to replace or fix any broken screens or lattice work around crawl spaces, stoops, porches and steps.

## **Exterior Air Intakes/Vents:**

- All exterior vents should be fitted with a screen. Many vents are constructed with screens, but screens should be made for those without them.
- Use a heavy gage, non-corroding wire mesh when fabricating screens for exterior vents. 6 mm mesh works well against mice, while a 1 mm mesh will restrict most insects.
- Ensure these screens can be easily removed for cleaning.
- Ventilation intakes should be free from obstruction. Remove any mammal, bird, or insect nests found on roof, especially if close to air intakes and exhaust.
- It is very important that any changes you make do not interfere with the normal ventilation of the building. You must ensure that air flow remains adequate.

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## Lighting:

- To discourage pests from entering buildings lights should not be mounted directly over doors. Many insects and some vertebrates are attracted to light.
- Wherever possible, and without compromising security, exterior lighting should be positioned and directed away from entrances and ventilation intakes. Doing so will actually help to draw pests away from the building.
- Reflected light can be used to illuminate doorways effectively.
- It is recommended that high-pressure sodium vapor exterior lighting be used. The sodium vapor lighting is less attractive to insects, while traditional mercury vapor lighting is very attractive to them. Sodium vapor lighting is also more energy efficient.
- A reduction in the use of interior lighting visible to the outside can help reduce the amount of pests attracted to a building
- Lighting can be used strategically to draw pests away from building entrances at night.
- The design of light fixtures and their installation can provide pest harborage. Overhead lighting with open hollow areas can become nesting sites to insects and birds. Overhead lighting with flat upper surfaces can become nesting and roosting sites for birds.
- The power conduit for the lights should also be designed to prevent birds from roosting or nesting on it.

## **IPM Tips for Landscaping and the Site around the Building Envelope:**

### Vegetation and planting:

- Create a vegetation free zone around the perimeter of all buildings. Ideally, this perimeter should be 1 meter (3 feet) in width and constructed from durable materials like landscape cloth covered by pea gravel. A non vegetative boarder around buildings will allow for easier visual inspections and promote better air circulation along the building walls while preventing rodent burrows, plant colonization, and insect harborage. This vegetation-free zone also acts to prevent plant roots from damaging building foundations.
- Do not plant wildflowers or fruit trees in close proximity to the buildings. Wildflowers are feeding and mating sites for adult dermestids.
- Avoid the use of window boxes and elevated planters. They can become a harborage for rodents and will accumulate debris and food trash. If window boxes and planters are being used, make sure to add these features to your regular building inspection IPM routine.
- Roof top gardens and/or eating areas are to be avoided.
- Cut back overhanging branches so they are 3 meters (10 feet) or more away from the building. Roof rats and many insects enter buildings via overhanging branches and power lines.

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- Remove any vines that rodents could use to climb up and along the building.
- Trees and shrubs should not come in contact with any part of the building. All trees, shrubs and ornamentals should be 1 meter (3 feet) away from buildings. Cut back any encroaching growth because it can shelter pests, increase moisture content along foundation walls due to shade, become a fire risk, and make visual inspections of building walls difficult.
- All trees, shrubs and ornamentals should be spaced far enough apart to allow for a 30 cm (1 foot) separation at full growth. Dense plantings can harbor pests and obstruct pest management inspection and control activities.
- There should be some ground clearance beneath trees and shrubs to discourage pest harborage and aid in IPM activities.
- Avoid creating conditions where soil and/or mulch extends above the top of the building foundation. Such a condition is conducive to pests.
- Do your research when planning your landscape planting. What you choose to plant may have considerable impact on the number and types of pests found around the exterior of the building. For example, many ground covering plants provide cover and harborage for rodents, while many ornamentals attract dermestids. In addition, mulch is a great food source for termites.

## **Vertebrate pests:**

- Do not allow staff and/or visitors to deliberately feed animals found around building. Unnecessary feeding will encourage roosting, soiling, and nesting by animals. These activities, in turn, will attract insect pests that feed on bird detritus.
- Installing bird and bat houses away from your building may reduce the pressure on these animals to find roosting/nesting spots. These alternate habitats may work in keeping them off of your building.
- Wire screening or agricultural netting/black nylon bird mesh can be used to cover bird roosting sites. Permanent nesting and roosting activity increases the chances of harmful museum pests gaining access to the building interior. Dermestids and clothes moths are commonly found in nesting sites.
- Strips of sheet metal bent at a 45° angle can be applied to window ledges and other roosting sites to discourage use by birds.
- Bird spikes can be used to discourage birds from roosting on beams and other architectural features like window ledges.
- Bird curtains or shrouds can be connected to truck trailers while in loading bays. These will block most pest access during the time that the cargo is being unloaded and the access doors into the museum remain open.
- To avoid trapping young bats in their roosts it is best to seal entry holes in April, October, or November. This reference is for Canadian use. Please check with your local authorities for bat roosting patterns in your area.
- Pay close attention in the autumn months for signs of rodent activity. Rodents are looking to gain access to buildings for winter shelter.

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- Sheet metal cladding can be applied to exterior framework when evidence of rodent gnawing has been found. This should act as a deterrent to further gnawing activity.

## **Standing water:**

- Avoid standing water. Check air conditioner drain pans for water. These often provide enough water for pests to live on. Standing water on a roof near a ventilation system intake louver can raise humidity levels and provide an excellent environment for insects.
- Do not overwater plants. This leads to standing water.
- Do not use fountains and ponds as landscaping elements near your building. If fountains and ponds are part of your landscaping, then make sure they are part of the regular building inspection IPM routine.
- The ground should always slope away from the building. Low ground areas or standing water next to foundation walls lead to high moisture areas, which promote mold and mildew. The mold and mildew then support pests.
- Eavestroughs and downspouts should drain 2 meters (6.5 feet) from the building. Ensure that eavestroughs have outflow pipes to carry water well away from building foundations. Runoff from the roof can attract and support pests around the building exterior.
- Repair any detected leaks immediately to eliminate standing water.
- Inspect external drains, sewers, sumps and ditches. These areas should be listed as areas to inspect as part of a routine IPM program.
- Black stains on brick or concrete walls may be an indication of poor foundation or roof drainage.

## **Outdoor maintenance:**

- Seal cracks in pavement and concrete slabs.
- Keep the outdoor areas around your building well maintained and clutter free.
- Good disposal and recycling practices need to be in place. Piles of debris, leaves, and building materials should be avoided, as they make it difficult to see pests, leading to problems going undetected for some time.
- Remove stumps, dead trees, scrap wood, and rotting wood fencing from the landscape. These are common habitats for ants, wood beetles, and termites.
- Try to eliminate conditions that promote moisture accumulation.
- Ideally, store any firewood 6 meters (20 feet) from buildings and 1.5 meters (5 feet) off the ground.
- Wherever possible, it is important to break any wood to soil contact occurring on site. Reducing ground contact will slow fungal growth and attack from burrowing insects.
- Moisture barrier sheeting can often be inserted under objects to reduce the moisture resulting from contact with the soil. Doing so will slow fungal attack.
- If a moisture barrier is being used ensure that it properly drains away from the object so no puddles form against the object.

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## **Garbage:**

- Keep your site free of trash and spills.
- Ensure that garbage receptacles are available on your site and that they are emptied on a regular basis. Overflowing garbage receptacles suggest the need for more garbage receptacles or more frequent pickups.
- Garbage receptacles should be cleaned periodically or as needed.
- Self closing garbage receptacle lids are recommended. These will discourage wasps, bees, and other pests.
- Ensure that dumpster lids seal properly. Dumpsters that do not seal completely can provide a food source for rodents, birds, flies, and other pests.
- It is recommended that all dumpsters, garbage receptacles, and composters be rodent proof.
- Keep garbage receptacles and dumpsters a minimum of 15 meters (50 feet) from doors and windows. Being located too close to openings in the building envelope can result in a greater likelihood of fly, and other pest, infestations indoors.
- Dumpsters and other garbage receptacles should always be situated on concrete or well maintained asphalt pads. Dumpsters and garbage receptacles situated on soil or damaged asphalt encourage rodent burrowing and may result in large rodent populations.
- Ideally, garbage receptacles should be elevated off the ground and set in concrete slabs.

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Strang, T.J.K., and R. Kigawa. *Combating Pests of Cultural Property* Technical Bulletin 29. Ottawa: Canadian Conservation Institute, 2009.

## **Websites:**

IPM School Technical Resource Center *Integrated Pest Management for Schools and Childcare Facilities*.

<http://extension.entm.purdue.edu/schoolipm/1pmp/pmpins.htm>

Safer Pest Control Project

<http://www.spcpweb.org/index.php>