

### ***General Principles***

1. Understand Local Pest Pressures – Architects, builders, and engineers need not be pest experts, but a general familiarity with local pest species is essential in order to make the best design choices.
2. Keep In Mind The Physical Context For Each Building Situation – Animal buildings are prime attractors for rodents. Buildings near damp areas are more likely to be subject to insect infestations.
3. Design For The Necessary Level Of Pest Tolerance – The tolerance to pest infestation varies with the use of individual facilities and should be considered at the design stage. Kitchens, health care facilities, and mission-critical manufacturing areas require greater detailed and more careful design than office and classroom spaces.
4. Use Durable Pest-Resistant Materials – Selecting pest-resistant materials can exclude pests from a structure or deny pests harborage once they are there. Some materials may provide resistance to pests while other materials may provide 100% exclusion. Selecting materials based on “best practices” is essential.
5. Design For Easy Inspection – Built-in access to critical areas, such as foundations, false ceilings, or triple wall voids, greatly assists pest control technicians in early detection of insect or rodent infestations, potentially saving substantial costs in material replacement and protecting the health of the building.
6. Seal Off Openings – While building codes require that certain openings, such as crawl-space and soffit vents, be screened, effectively sealing off all openings to the building exterior, as well as openings between interior rooms, improves the odds of maintaining a pest-free environment.
7. Eliminate Potential Harborage – Minimizing inaccessible spaces can assist pest management efforts. False ceilings, false bottoms under cabinetry, uncapped concrete blocks, air plenums, and gaps behind permanent machinery are examples.
8. Engineer Slabs And Foundations To Minimize Pest Entry – Sufficient separation between the soil and a structure’s wooden elements is required by building codes, but a variety of further tactics can be employed to enhance pest exclusion. Examples are the use of appropriate concrete admixtures, monolithic pours, minimization of expansion joints, termite-resistant mesh, and other barriers.
9. Design Buildings To Be Unattractive To Pests – Excessive or poorly designed exterior lighting can attract hordes of night flying insects. Vines up the sides of buildings are conduits for rodents. Trees that are planted too close to the structure are pathways for insects, and bushes and shrubs planted too close to foundations are pest sanctuaries.

### ***Foundations and Slabs***

#### ***Drainage Design***

- Provide ¼” slope at patio slabs, sidewalks, and driveways away from building.
- Tamp backfill to prevent settling and slope final grade away from the foundation at a rate of ½” per foot over a minimum distance of 10 feet.

#### ***Reduce Moisture***

- Do not block foundation vents with shrubbery, mulch, or other landscaping materials. Maintain vent openings to crawl spaces.
- Use a continuous, durable subgrade membrane sealed at all splices, perimeters, and protrusions in order to minimize foundation moisture problems. The membrane product

selected should be specifically manufactured for use as a subgrade membrane and conform to ASTM E1745, latest edition, 0.1 perm maximum. Installation should conform to ASTM E1643, latest edition.

### ***Prevent Pest Access***

- For any ground-level space (e.g. raised foundation crawl space) requiring foundation vents, specify corrosion resistant vent material (e.g. bronze) and a vent opening size smaller than the pest to be inhibited. For example, for typical ants and termites, use #50 bronze mesh between layers of ½ to 1-inch mesh for durability. Building codes generally require mesh with maximum opening of 1/4 inch, which will block rodent access.
- Foundation vents should be at least 150 mm (6 inches) above finished ground level.
- For visual access the upper 100 mm (4 inches) of the edges of a slab should remain exposed at all times; it should not be concealed by masonry, timber, soil, paving, etc.
- The vapor barrier underneath a slab should end no higher than the level of the finished soil or paving level. Slab formwork should include 100 mm (4 inches) of smooth faced timber around the top of the slab edge. The purpose of these construction details is to avoid indentations which allow undetected termite access.

### ***Foundation Access***

- Provide 18" clearance beneath and 6" clearance between accessory structures and exterior wall coverings at decks, fences, patios, planters, and other accessory wood structures. If this clearance is not possible, construct accessory structures so that they are easily removable to allow inspection for termites.
- Provide easily removable components to allow access to foundation for inspections.
- In order to minimize entry of pests via joints, pour concrete patios as part of the main slabs.

### ***Foundation and Slab Isolation***

- No cellulose-containing material (wood scraps, form boards, vegetation, stumps, large dead roots, cardboard, trash, and foreign material) should be buried on the construction site within fifty feet of any building, especially in areas with high termite pressure.
- Fill material used around structures should be clean and free of vegetation and cellulose material.
- Prior to concrete placement, clean all cellulose-containing material from cells and cavities in masonry units to inhibit termite colonization.
- After all foundation work is completed, remove all loose wood and debris from the crawl space and within one foot of the perimeter of the building.

### ***Termite Resistant Materials***

- Use steel posts for post and beam foundations, especially in areas with high termite pressure. The ends of the posts should be sealed at both ends with welded plates and the posts should be set in concrete foundations.
- In areas of high termite hazard, avoid Exterior Insulation and Finish Systems (EIFS, commonly referred to as synthetic stucco).
- In areas of high termite hazard, avoid subgrade foam insulation on the exterior of the foundation, or pre-formed closed cell foam foundation systems.

### ***Foundation and Slab Joints***

- Minimize need for expansion joints when designing slabs. When expansion joints are used, inspection access should be readily available and the use of termite-resistant mesh should be considered. In one study, 83% of subterranean termites entering buildings came in through expansion joints in concrete slabs.
- In order to minimize voids in concrete slabs, mechanically compact concrete with a vibrator when pouring a slab.
- Cure concrete slabs slowly to reduce shrinkage and cracks. Moist curing periods should generally not be less than seven days. Consult a structural engineer for design standards.
- Embed anchor bolts in slabs as the slab is poured. If additional anchors are necessary, use adhesive anchoring systems rather than expanding fasteners to avoid causing cracks.
- For foundations and slabs up to about 50 feet in dimension, use liberal applications of topical curing compounds to decrease cracking.
- For foundations about 50 to 100 feet in dimension, use adequate concrete reinforcing and proper concrete mix design, placement, finishing, and curing techniques. Additionally, use a shrinkage limiting concrete admixture.
- Concrete slab foundations should be monolithic (floor slab integrated and poured simultaneously with footings). Unplanned construction joints should be minimized. In areas of high termite pressure any joints should be protected with mesh barriers or sand (graded stone) barriers. Mesh barriers should be laid on top of the vapor barrier and have a 15 mm accordion fold under the joint. Edges should be turned up 25 mm to be cast into the slab. The accordion fold should be protected by a strip of vapor barrier material so that the concrete does not bond to the accordion fold. Alternatively, a mesh barrier with an accordion fold can be parged to the top of the slab. Sand barriers should be confined within a void adjoining the joint that is at least 75 mm deep and at least 50 mm wide. A retainer cast into the slab should be used to confine the sand particles.

### ***Termite Shielding***

- If termite shields are used to reduce subterranean termite damage, they should be constructed of galvanized steel at least 0.5 mm thick; sheet copper at least 0.4 mm thick; stainless steel at least 0.4 mm thick; aluminum alloy at least 0.5 mm thick; copper and zinc alloys at least 0.5 mm thick; or woven stainless steel mesh. Joints and corners should be mitered and soldered, welded, or brazed. Shields should extend 70-80 mm past the foundation or foundation component. The last 30 mm of the shield should be bent downward at a 45 degree angle to reduce injuries during inspection. In addition, corners should be rounded. The slippery metal of termite shields provides a poor footing for termites and their tubes, although there is controversy about their effectiveness. They are perhaps most valuable for increasing the ability of inspectors to spot signs of infestation. The shields should be constructed by qualified professionals, with no gaps for termite access, and in settings that permit inspection.
- When stainless steel mesh is used as a termite barrier, the mesh should be made from grade 304 or 316 wire with a minimum diameter of 0.18 mm. The maximum aperture size should be 0.66 mm x 0.45 mm. This maximum size should be reduced if local termite species are known to be small. As necessary the mesh should be parged to concrete foundations with a grout consisting of water-dispersed copolymer, Type GP Portland cement and sieved aggregate that can pass through the stainless steel mesh. The mesh should not contact dissimilar metals that will produce a corrosion reaction. If pieces of mesh need to be joined,

the joint should consist of an area 10-15 mm wide where the edges of the two pieces are folded together 2 1/2 times or a parged area 35 mm wide where the pieces overlap. Mesh can be used as a perimeter barrier for masonry exterior walls when parged to the concrete slab, draped across the cavity, and then built into the exterior wall. It can also be used as a continuous barrier under concrete slabs, or as a barrier under joints and for utility penetrations.

- Where graded particles (sand or basalt) are used as a termite barrier, the particles should be graded and shaped so that a sufficient proportion of them are of a size that cannot be transported by local termite species. They also should be able to be placed so that voids between particles do not permit penetration of local termite species. They can be either igneous or metamorphic stone. The wet/dry analysis must have less than 35% variation and their specific gravity must be at least 2.52. Graded particles can be used as a perimeter barrier when installed in wall cavities or in a trench around the foundation. In either case the minimum depth of the particles should be 75 mm. Trenches should be at least 100 mm wide. Graded particles can also be used as a continuous under-slab barrier. These barriers should be 75-100 mm deep and compacted with a vibrating plate-type tamper. Graded particles can also be used as a barrier under joints and around utility penetrations. Appropriate diameters for particles are 1.2-1.7 mm for the western subterranean termite, 1.7-2.8 mm for the eastern subterranean termite, and 1.7-2.4 mm for the Formosan termite.

### ***Utility Penetration of Foundations and Slabs***

- Use epoxy immediately prior to pouring a slab to seal concrete around utilities.
- Mesh barriers should consist of a flange of mesh 50 mm wide. The mesh flange should be attached to the penetrating utility with a stainless steel clamp and embedded in the slab. Alternatively, the mesh flange can be attached with a stainless steel clamp and then parged to the top surface of the slab.
- For sand barriers, concrete should be poured in a circular area 25 mm around the utility pipe. That void should then be filled with sand at least 75 mm deep. The sand should be capped at the top of the slab, and a retainer cast into the slab below the sand should be used to prevent sand loss beneath the slab.

### ***Clearances***

- There should be a minimum clearance of 18 inches between beams or joists and soil.
- In areas of high termite hazard, clearance between beams or joists and soil should be 36 inches.

***Curtain Walls Where Necessary:*** Rodents may burrow under foundations of buildings without basements. Vertical curtain walls 2 feet (0.6 m) below the surface with an 8 inch (20 cm) horizontal "L" or flange directed away from the building are usually effective in preventing rats from burrowing under foundations. Construct curtain walls of 29-gauge corrugated iron, concrete, or bricks.

### ***Siding***

- Siding Material
- For wood siding, durable species include Western red cedar, Redwood, and (less commonly) Incense cedar, Port Orford cedar, Black locust, Northern white cedar, Eastern red cedar, and Alaska yellow cedar. Only heartwood of these species has resistant qualities.

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- Other pest-resistant siding options include fiber-cement, aluminum, and steel. Some of these materials may not be appropriate for residential structures.
- On siding, use high quality, exterior grade caulks and sealants that meet ASTM standard C-920. Caulk should be compatible with both siding materials and trim materials.
- Caulk or seal the following areas: wherever siding meets trim, around windows and doors, and around any penetrations (pipes, wires, etc.) that are not self-flashing.
- Use back flashing at siding butt joints to minimize openings that might allow entry of pests.
- Siding and stucco should begin at least six inches above soil level. This decreases the risk of subterranean termites reaching the wood, and makes their mud tubes more visible to inspectors.

## ***Building Exterior***

### ***Exterior Lighting***

- Choose light fixtures with sloping surfaces rather than horizontal surfaces to deter bird roosting and nesting.
- Install bird spikes, "porcupine wire," netting, or similar devices to discourage birds from nesting on light fixtures.
- Use bird exclusion devices, including wires, springs, nets, and electrical strips, to prevent birds from reaching light fixtures.
- Motion detectors allow lights to be on for shorter amounts of time and can reduce accumulation of insects around lights.
- Use timers to restrict light operation to high traffic times as appropriate. This may reduce the volume of insects attracted to the lights.
- Use reflected light rather than direct light to illuminate doorways, as appropriate and allowed by local codes. Insects are more attracted to point sources of light and are therefore less likely to enter doorways.
- Minimize direct lighting to high priority areas that maximize resident safety, especially near structures. All such lighting should meet local code requirements. This will minimize insect attraction to point source lights.
- Use yellow lights ("bug" bulbs or sodium vapor lights, for example) in exterior areas where insect attraction to lights is an issue. Both intensity and color are important in insect attraction.

### ***Miscellaneous***

- To minimize moisture accumulation, all downspouts and gutters should discharge at least one foot away from structure wall, using a connection to storm sewers, tail extensions, splash blocks, or dry wells.
- Use gutters with downspouts on all buildings with eaves of less than 6 inches of horizontal projection except for gable ends and roofs above other roofs.
- In areas of high rodent pressure, use flap valves to prevent rodents from entering downspouts. Mesh is also an option, but periodic cleaning will be necessary.
- In areas of high rodent pressure, use cones or discs (typically metal) to prevent rodents from traveling up downspouts and pipes. Cones should be mounted with the wide end of the cone facing down and should be 12 inches in diameter and 12 inches long. Discs should be 18 inches in diameter.
- Prevent mice and Norway rats from climbing on exterior vertical pipes by applying a 12 inch band of glossy paint around the pipe.

- Use expanded strainer leaf guards (made for keeping leaves out of downspouts) to keep rodents from entering open pipes.
- To discourage rodent burrowing, install a gravel strip of 1-inch (2.5 cm) diameter or larger, laid in a band at least 2 feet (60 cm) wide and 1/2 foot (15 cm) deep.
- Maintain plants, grass, and mulch several inches away from the foundation of buildings to minimizing nesting sites for ants.
- Design exterior landscaping so it does not cause moisture build-up around the foundation. Consider use of drip irrigation. Maintain clearances between vegetation and exterior walls.
- Construct decks, fences, patios, planters, or other wooden structural components that directly abut the sidewall of the foundation or structure to provide: (a) an 18-inch clearance beneath the component, or (b) a 6-inch clearance between the top of the component and the exterior wall covering, or (c) have components that are easily removable by screws or hinges to allow access for inspection of the foundation sidewall.
- Use termite-resistant fence and post materials, including naturally durable wood, concrete and steel.
- Wood steps should rest on a concrete base at least 6 inches above grade to minimize access by wood-destroying pests, particularly in areas with high termite pressure.
- Install quality 1/4 or 1/2 inch galvanized hardware cloth from the bottom of the shed/porch/decks without perimeter foundations to 3-4 inches below the ground and then out in a perpendicular fashion at least 12 inches from the vertical line. To improve appearance of hardware cloth used under sheds, decks, and porches, cover with lattice after installation.
- Seal all holes or joints in exterior or other cavity walls that are larger than 1/4 inch diameter to prevent access by mice. Where larger holes or joints are necessary they should be screened with 1/4" mesh or otherwise shielded from pest intrusion. Seal smaller holes to eliminate access from smaller pests. Use caulk (non-elastomeric, does not return to original shape when stretched or compressed) for openings of 1/4" diameter or less. Use an elastomeric sealant to close larger openings. Use a liquid sealer to close pores and hairline cracks.
- "Cap" concrete masonry unit walls by filling the top row of blocks with cement to eliminate rodent access to the interior of the wall.
- For standard stucco weep-screed construction, seal along foundation with 6-inch minimum rubberized asphaltic, self-adhesive membrane extending down over foundation 1-2 inches. At point above screed section, also seal back of flashing to foundation with generous bead of foundation mastic. Use vinyl weep screed in corrosive environments.
- For offset weep-screed installation use weep-screed flashing with offset in the flashing equal to actual framing offset. Install per standard weep-screed construction procedures except use 8-inch minimum self-adhesive membrane extending to bottom of weep-screed. Use small bead of caulking between base of framing and flashing.
- Design exterior structures like decorative screens, moldings and lattices, siding, awnings, window sills, signs, fire sprinkler pipes, and column capitals so that they do not provide opportunities for bird perching, roosting, or nesting especially near building entrances. Use smooth materials and avoid horizontal surfaces. Where necessary, retrofit existing structures with exclusion devices (looped wires, sheet metal spikes, springs, nets, etc.), although these devices are not foolproof and require maintenance. Openings in buildings, exposed rafters on overhanging dock roofs, or any likely perches in semi-enclosed areas can be screened with rust-proof, 3/4 inch wire or plastic mesh, or 1/2 inch mesh to also exclude rodents. Plastic netting is less durable and must be replaced more often.

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- Semi-enclosed alcoves or courtyards, especially with open roofs, provide ideal roosting and nesting opportunities for pigeons and other birds. If these structures must be included in the building design, include bird barriers and minimize horizontal surfaces.

### ***Roofs***

- Fit eave roof tiles with commercially available bird stops, which also exclude bats and flying insects.
- Attic and chimney screens can prevent problems with bats, squirrels, and birds. In areas of where drywood termites are known to be a problem, consider replacing screens on attic vents (typically 1/4 inch) with window screening. This may not be appropriate in damp climates, because the smaller mesh screening can impede air flow. Building codes generally allow attic vent screening as long as the mesh size is greater than 1/16 inch.

### ***Landscape***

- Maintain at least 10 feet of clearance between exterior walls and tree limbs/branches that might provide vertebrate pest access.
- Use plants that shed a minimum of seeds and fruits, since the seeds and fruit may attract and support insects, rodents, and undesired birds.
- Avoid planting Algerian or English ivy, star jasmine, and honeysuckle on fences or buildings, as they provide shelter and food for rats.
- Where Argentine ants are common, avoid bamboo, cherry laurel, fig, pine, and roses near buildings. These plants often have abundant scale and aphid populations, and excreta from these insects provides food for ant colonies.
- Separate the canopy of densely growing plants from one another and from buildings by a distance of 2 feet or more to make it more difficult for rats to move between them.
- Decorative wood chips and mulch should be used sparingly in situations where termite infestation is a high probability. Wood chips should never be allowed to contact wood siding or framing of doors or windows. Crushed stone or pea gravel are alternative solutions and may also discourage ants and spiders.

### ***Floors***

- In food preparation areas, use quarry tile, poured seamless epoxy floor, approved commercial grade vinyl, or similar materials to avoid moisture accumulation and harborage of insect pests.
- Where floor drains are installed, slope surrounding floors 1/4 inch per foot to the drain
- Floor drains should be easily accessible to enable cleaning and inspection. Floor drains should not be located under fixed kitchen equipment.

### ***Doors***

- Use solid-core doors where possible. Solid-core doors are more durable and do not have hidden recessed areas or cavities that could harbor pests
- In areas of high rodent pressure, fit external doors with 26-gauge sheet metal kick plates 12 inches tall and mounted no more than 1/4 inch from the bottom of the door. Metal plates should not interfere with the swinging of the door.
- Doors should fit tightly; the distance between the bottom of the door and the threshold should not exceed 1/4 inch. Use tight-fitting door sweeps if gaps are larger than 1/4 inch. If appropriate, use automatic door sweeps, which drop to seal against the floor when the door

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is closed. If automatic sweeps are not possible, bristle sweeps are preferable to rubber or plastic. If rodent pressure is high, protect rubber and plastic sweeps with metal kick plates installed on the outside of the door.

- Use weather-stripping of all exterior doors to better seal against pest entry.

### ***Windows:***

- Slope smooth-surfaced window ledges and projections at 45 degrees to minimize bird perching and roosting.
- Use weather-stripping for all operable windows.

### ***Bedrooms***

- Moldings and joints around the room perimeter (floors, doors, cabinets, and windows) should be caulked with a silicone sealant to eliminate hiding spots for bed bugs.
- Use wood, tile, linoleum, or similar flooring materials instead of carpets or rugs.
- Built-in furniture provides harborage for bedbugs that is difficult to inspect. If built-in furniture is used, provide access for inspection.
- Use leather, metal, plastic or laminate furniture rather than upholstered, wicker, or wood furniture. Metal and laminate furniture is harder for bedbugs to climb than wood furniture. If upholstered furniture is used, it should have metal legs and the fabric should be at least a few inches from the floor and from any other pieces of furniture. If possible, use furniture that is easily washable and light colored. Beds should not have headboards and mattresses should be encased in commercially available, insect-proof coverings.
- Openings around pipes or other structures that come through walls, floors and ceilings should be sealed. Caulk, foam, seal, paint, or otherwise fill any cracks and holes larger than the thickness of a credit card.

### ***Bathrooms***

- All penetrations of floors, walls, and ceilings should be sealed with metal escutcheon plates if feasible, or with polyurethane foam, silicone sealant, or other flexible sealant. Penetrations include electrical wires, supply and drain pipes, heating and ventilation systems, and recessed lights. Larger gaps may require the addition of copper or stainless steel wool to the foam, in order to effectively bar access to rodents.
- Countertops should be one piece if possible, that is, with an attached backsplash. If this is not feasible, use an elastomeric sealant to seal along edges of countertops and backsplashes where they meet walls.
- Use one-piece tub or shower enclosures where they are appropriate with the bathroom design, to minimize potential infiltration of moisture.
- In large shower enclosures, offset water controls so that they are close to the door. This makes them easier to use, and lessens the likelihood of water escaping the shower.
- Slope horizontal surfaces of soap holders, shampoo cubbies, and shower seats so water drains into the shower or tub. This reduces moisture buildup.
- Ensure horizontal ventilation ducts are sloped so that condensation water doesn't accumulate in the ducts.

### ***Kitchens***

- Food storage should be elevated off the floor and away from walls to facilitate inspection and cleaning.



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- Wall-wall and wall-floor junctions should be coved to facilitate easier cleaning and prevent the accumulation of debris. Wall-ceiling junctions should be coved or sealed. Rubber or flexible plastic baseboard coving should be avoided, since it is very difficult to remove and inspect. Avoid cove base that is installed with adhesive. Choose coving that does not include an air gap under the curve, which could provide harborage for cockroaches.
- Storage areas should have adequate lighting to allow efficient cleaning and easy pest inspection.
- Provide access to voids above suspended ceilings for inspections and cleaning. In large buildings, provide walkways for this purpose.
- Specify cabinets with legs to facilitate cleaning underneath. Legs should either be bolted to the floor with gaskets or sealant to eliminate gaps, or should be on wheels to enable easy moving.
- Specify the use of wheeled stoves, mixers, refrigerators, and other appliances to encourage regular cleaning. Wheel fenders should include adequate clearance for cleaning around the wheels.
- Locate drains so that they are accessible for cleaning.
- When possible use flush thresholds in doorways. Thresholds collect dirt and food debris that can attract fruit flies or roaches.
- When possible, locate food preparation areas on islands rather than against walls. Cleanup is generally easier around islands.
- Install stainless steel backsplashes behind sinks and work surfaces for easier cleaning and avoid moisture buildup. Use sealant around edges.
- Refuse disposal, recycling areas, and food delivery entrances should ideally be located away from frequently used entries. Refuse disposal and recycling areas attract flies and other pests, even when bins are well sealed and frequently cleaned. If the disposal area is adjacent to frequently used entries, such as those used for food deliveries, it is easier for the flies to enter the kitchen.
- Use self-closing doors for food storage rooms to shut out rodents and some insect pests. Doors should be adequately sealed around the edges, with door sweeps or bottoms and no gaps over 1/4 inch.
- Seal all penetrations through walls and floors, including wiring and pipe penetrations through wall framing at top and bottom plates. Use either an elastomeric sealant or fire block, depending on the size of the gap, its location, and local building codes. This is especially important in institutional kitchens where there is no tolerance for pest infestations. For larger gaps, including copper or stainless steel wool with foam may be necessary to exclude rodents.
- Any wall storage, ornamentation, signage, bulletin boards, etc. should be sealed using elastomeric sealant or hung at least 1/4 inch from the wall to discourage pest harborage.
- If rodent pressure is high, design food storage rooms without double walls, false ceilings, enclosed staircases, boxed plumbing, and voids under cabinets. This permits easy inspection and removes harborage.
- Avoid use of ceramic outside corner tiles. Ceramic tiles located in heavily used areas are highly prone to breakage. Broken tiles provide access to voids that can harbor pest insects. Durable outside corners, such as metal or plastic, are preferred alternatives.

### ***Utilities, HVAC, and Chutes***

- Use escutcheons, cement mortar, or copper mesh or hardware cloth embedded in patching plaster to seal any openings around utility or HVAC penetrations.

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- Where rodent pressure is not high, or with gaps < ¼", use silicone sealant to seal around utility penetrations to deter insect movement.
- Use foam gaskets behind electrical cover plates to seal off access to pests, particularly in pest sensitive areas such as kitchens.
- There should be adequate space and access for cleaning around utility penetrations.
- Trash and laundry chutes should have tight-fitting doors. Avoid any gaps between door and surrounding wall.
- Use metal garbage and laundry chutes with a circular cross section to avoid accumulation of debris in hard-to-clean corners.
- Hopper doors into vertical trash chutes should be large enough to fit a full trash bag, to avoid the accumulation of debris from torn bags and keep chutes cleaner.

### **Refuse and Recycling**

- Design refuse and recycling areas with concrete pads that extend past the boundaries of the enclosure so that rodents cannot burrow into the enclosed area.
- Enclose refuse and recycling areas with metal, concrete, or similar materials to prevent vertebrates from gnawing or climbing the enclosure. Enclosures should be solid and extend all the way to the ground. Do not plant ivy around enclosures.
- Use refuse containers that are heavy duty, rust resistant, rat and damage resistant, and equipped with tight-fitting lids. Racks or stands prevent corrosion or rusting of containers, reduce rat shelter under containers, and minimize the chance of containers being overturned.
- Use concrete floors in refuse and recycling areas.
- Slope floor of recycling and refuse area to a drain connected to the sanitary sewer.
- Provide a hose bib near the enclosure for periodic cleaning.