

# **Greening Portland's Affordable Housing**

Design and Construction Guidelines to Improving  
Environmental Performance, Tenant Health, and Long-  
Term Durability in Affordable Housing

Prepared by Portland Development Commission  
And City of Portland Green Building Initiative

Portland Development Commission  
Rental Housing Development Program  
1900 SW 4th Avenue, Suite 7000  
Portland, OR 97201  
Phone: 503-823-3200  
Fax: 503-823-3368

City of Portland Green Building Initiative  
1221 SW 5th Ave, Room 706  
Portland, OR 97204  
Phone: 503-823-7725  
Fax: 503-823-5370

## Mission

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The purpose of these guidelines is to establish goals and standards to increase the environmental performance and durability for all affordable housing in Portland. The guidelines represent cost effective options that go beyond current codes and standards. Buildings designed and built using these standards will become the models for healthier, environmentally responsive design and construction where occupants collectively enjoy the benefits of decent and healthy housing regardless of income level.

## Sustainable Development

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The significance of the environmental footprint of buildings is becoming both better and more widely understood by building designers, operators, and owners. According to the Portland Chapter of the American Institute of Architect's Committee on the Environment, the statistics are overwhelming. The construction and operation of buildings consume 35% of total U.S. energy output. More than 60% of the electricity generated in the U.S. is consumed by buildings, accounting for at least 35% of carbon dioxide (CO<sub>2</sub>) emissions. Buildings use over 35% of all materials produced in the U.S. and more than 25% of the world's harvested wood. More than 210 million tons of solid waste is generated and disposed of annually, a substantial portion of which is attributed to construction site and building use waste. In the Portland region, delicate wetland areas are being eliminated by construction at the rate of one acre per day. Portland is one of the first metropolitan areas in the country to be challenged with an Endangered Species Act listing within its urban core, further challenging the building industry to reduce impacts to salmon habitats.

Designing, building, and maintaining buildings that are sustainable is an ambitious long-term goal that will require a long-term process of rethinking building design and construction and learning from our experiences. In most instances this is a common sense approach to development that prevents further depletion of natural resources, water quality, air pollution, and global warming. These guidelines were developed to help affordable housing providers to set measurable goals and performance specifications to better design and evaluate projects. With very limited funds and resources, it is important to invest in practices and technologies that measurably improve building's health and durability over the long term. The goal is to develop affordable housing that:

- Are durable and long lasting
- Are cost effective to build and practical to maintain
- Use natural resources and materials efficiently; use materials and products based on their life-cycle environmental impacts.
- Conserve water usage, reduce runoff, and treat waste on-site.
- Maximize energy conservation and efficiency; use renewable energy resources.
- Reduce building footprints, simplify building shapes, and maximize space efficiency (smaller is better).
- Optimize building orientation; integrate natural daylight and ventilation.
- Are healthy by eliminating toxic and harmful materials and finishes in facilities and their surrounding environment.
- Support transportation alternatives.
- Reduce, reuse and recycle materials in all phases of construction and deconstruction; reduce harmful waste products produced during construction.

- Apply maintenance and operational practices that reduce or eliminate harmful effects on people and the natural environment.
- Is designed for future flexibility, expansion, and building demolition; capable of safe and efficient deconstruction

## Integrated and Total Systems Approach

The most important element to building a building that achieves environmental goals in a cost-effective manner is using an integrated or total systems approach in its design and construction. The guidelines solidify systems thinking by organizing goals into strategies that should be addressed from the moment the developer sits down with its architect, engineer, and contractor. It is never too early to integrate the strategies into the building's RFP bid process, design strategies, and construction schedule and specs. By developing goals early, first costs can be better contained by making appropriate trade-offs that reduce the likelihood of sensible strategies being value engineered out.

- Retaining professional development team (developer, architect, engineer, landscape architect, contractor, and project manager) knowledgeable and eager to apply environmentally sensitive building principles and practices
- Integrate planning and design process.
- Select qualified contractors by developing a selective bidding process.

## Execution

These guidelines are meant to help guide the design and construction of more efficient, healthy, and durable buildings. While not a complete resource - the criteria are designed to help affordable housing providers develop a framework for increased success. The many strategies give the developer, design team, and contractor a variety of options to develop creative solutions and to not preclude rapidly changing technologies and practices. The guidelines are broken into six major categories. Each category area contains a number of cost effective thresholds as indicated in bold. They represent a new base level of performance. **These are new threshold criteria that PDC now requires for a proposal to be considered.** The remaining criteria are voluntary. They provide flexibility to weigh how applicants address green building. PDC encourages every applicant to maximize the number of strategies incorporated into a project. Like other performance criteria, the more strategies incorporated into a proposed project, the more likely it will be funded. An applicant must take the following actions for their projects to be eligible:

- Document how thresholds will be included into the project. Incorporate into overall project cost estimates.
- Provide a brief narrative that addresses each of the six major category areas including specific non-threshold criteria to be incorporated in the project.

## Criteria Categories

1. **Enhanced Design & Site:** Sustainable design and site planning integrates design and construction strategies to minimize environmental site impacts, reduce construction costs, maximize energy and resource conservation, improve operational efficiencies, and promote alternative transportation by providing good access to transit, pedestrian, and bike systems.
2. **Energy Conservation:** Energy conservation helps maximize tenant comfort and reduce utility bills. Conservation measures also slow the accumulative impacts of energy production and delivery;

extraction of non-renewable natural resources, degradation of regional air quality, global warming, and increased concentration of pollutants.

3. **Water Conservation:** Water conservation practices help reduce both water and the energy used to deliver and heat water for tenant use. In addition, water conservation cuts down on the amount of water discharged from a building, lessening the amount of untreated discharges into the Columbia and Willamette Rivers and the stress on the City's wastewater treatment facilities.
4. **Conserving Materials & Resources:** Reducing, reusing, and recycling building materials helps conserve local and regional natural resources. There are many green building products on the market and techniques like advanced framing that contribute to more durable and less toxic buildings.
5. **Enhanced Indoor Air Quality** - Minimize exposure of construction and building occupants to toxic materials. Use safe, biodegradable materials and alternatives to hazardous materials. Require and monitor safe handling and disposal of any hazardous materials.
6. **Operations & Maintenance:** The most overlooked element of green building is operations and maintenance (O & M) practices. O & M practices impact both the bottom line building owner's costs and tenants' health, comfort, and safety. Green building O & M practices enhance both environmental quality and the economic performance. Building O & M goals should protect the tenant's health; maintaining proper building temperature and humidity; promote the ventilation, dilution, and removal of airborne contaminants; eliminate the use of toxic cleaners and pesticides, and provide appropriate lighting and acoustics. In addition, appropriate O & M by tenants and building occupants.

## Technical Assistance

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- Michael O'Brien, Green Building Specialist, Office of Sustainable Development - Green Building Services, 503-823-5494, [mobrien@ci.portland.or.us](mailto:mobrien@ci.portland.or.us)
- Greg Acker, Architect, Office of Sustainable Development – Green Building Services, 503-823-5431, [gacker@ci.portland.or.us](mailto:gacker@ci.portland.or.us)
- Michael Prothe, Construction Coordinator, Portland Development Commission, 503-823-3277, [prothem@portlanddev.org](mailto:prothem@portlanddev.org)

<b>Green Building Criteria for Affordable Housing</b>		<b>New</b>	<b>Rehab</b>	<b>Code Required</b>	<b>CSI Division</b>	
<b>Category</b>	<b>Strategies</b>					
site inventory	Threshold: Inventory site's sunlight, wind/natural cooling capacity and prospects. Survey existing site conditions including structures, lead and/or asbestos, ground contamination, building orientation(s), adjacent buildings, sewer, and water lines. Confirm easements, street and curbs, curb cut locations, gutter and sidewalk. Review locations for storm sewer, surface water drainage pattern, trees and shrubs. Review of trees to be saved should include existing drip line, and required root/drainage protection.			DONE	02	
soil & vegetation protection	Threshold: When surveying site, verify conditions with a minimum level 1 survey to determine soil condition. This should include water table, underground water streams, drainage conditions, compaction, and overall soil quality and/or fill capable for supporting structural footings, slabs, new drainage, and surface pavement. Minimum overall soil condition should not require substantial replacement with clean, uncontaminated and supporting fill without prior knowledge of cost impact. A level 2 survey may be required if undetermined through a level 1 base study.			DONE	02	
	Threshold: Evaluate health and viability of existing trees and shrubs on site. Protect root system of any trees and plants to be preserved. Fence drip zones. Do not allow excavation, piling of soil or vehicles to enter the fenced zones. Trees over 8" caliper will be retained unless hazardous or cannot be incorporated into site plan. Such trees will be replaced 1-to-1 in landscaping. Plants may be relocated to provide for efficient use of the site. Specify shade trees whenever possible. Preserve existing street trees or plant new ones at appropriate intervals.			DONE	02	
	Do not apply herbicides or pesticides during site prep.			DONE	02	
	Protect and enhance green space - create landscaping plan that provides for bird and insect habitat, west and south side shading, and tenant gardening. Create native plant associations and communities.			DONE	02	
building design & orientation	Threshold: 1. For new construction, design roof eaves (where applicable to building type and location) to overhang exterior walls and exterior surfaces (12 " minimum). 2 For rehab, construct patios, decks, windowsills, and thresholds to properly drain water away from buildings.	(1)	(2)	N/A	02,06,07,09	
	Threshold: Design building orientation to maximize solar exposure in winter and shade building from summer sun. Design and dimension building overhangs to protect windows, doors, and people from sun and weather. Plant trees to shade structure's south and west sides where possible.			DONE	02,06,07,09	
	When possible, reuse large portions of existing structures during renovation or redevelopment.			N/A	02,06,07,08,09	
	Reduce building footprint, simplify building shapes, and maximize space efficiency.			DONE	02	
stormwater management and water pollution	Threshold: Protect site from runoff erosion during construction. Design site erosion control plan based to City of Portland's Erosion Control Manual specifications.			DONE	02	
	Threshold: Maximize onsite drainage and water catchment capacity. Design on-site stormwater facilities to City of Portland's Stormwater Manual specifications.			DONE	02	
	Specify and install permeable surfaces and paving in low traffic areas (fire access, overflow parking, pathways, etc.).			N/A	02,03,04	
transportation access	Threshold: Provide secure bicycle parking.			DONE	02	

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	Size parking capacity to meet only minimum local zoning requirements.			DONE	02	
	Site building within ¼ mile of mass transit and within ½ mile of stores and services.			DONE	02	
<b>building envelop &amp; weatherization</b>	<b>Threshold: In new construction, install high recycled-content insulation with following R values: R-38 ceilings/R-21 walls/R-30 floors/R-15 slab edge. Rehab insulation values depend on preexisting conditions.</b>			DONE	07	
	<b>Threshold: Specify and install double glazed, low-e windows and sliding doors with U value 0.35 or less.</b>			DONE	08	
	<b>Threshold: Flash and seal all penetrations between interior spaces and outside. Seal all penetrations for ducting, wiring, plumbing, lights, and fans.</b>			DONE	07	
	Perform blower door test to determine cost-effective air sealing and combustion safety.			NO	06,07	
	Increase insulation and reduce heat loss on one- and two-story walls with normal loads by using 2x6 @24" on center framing module for exterior walls.			N/A	06,07	
	Specify and install exterior insulated core doors.			N/A	08	
	Specify and install insulated concrete forms.			N/A	03,07	
	Insulate perimeter edge of concrete slab floor with code approved foam board. Insulate between heated space and garage slab.			DONE	07	
<b>heating systems</b>	<b>Threshold: Install radiant/hydronic heating with digital thermostat located in main living area. Systems may include: hydronic baseboard, radiant cove heaters, water heater / water boiler supplied fan assisted heaters. (i.e. "Turbonics"). Size heat supply based on weatherization measures (gas preferred).</b>			N/A	11, 15, 16	
	Preferred Path: Install high efficiency gas sealed combustion forced air furnaces (minimum 92% Efficiency Rating) with digital thermostat in main living area. Systems may include gas furnace, gas furnace with integrated water heater. Size heat supply based on weatherization measures.			DONE	11, 15, 16	
	Install ductwork inside conditioned space OR seal ductwork in crawls and attics with mastic. Design short runs. Use flex only for straight runs; otherwise use metal.			DONE	15	
	Thermally separate living areas from less energy consuming zones like entry, storage, mechanical, and utility areas.			DONE	15	
<b>electrical and lighting</b>	<b>Threshold: Specify and install Energy Star-rated appliances if available, fixtures and lighting systems.</b>			DONE	11,12,15,16	
	<b>Threshold: Specify and install efficient outdoor lighting (30 lumens per watt or better) with low temperature ballasts. Install lamps with automated controls including but not limited to photo sensors, timers, and motion control sensors.</b>			DONE	16	
<b>renewables</b>	Install solar water heating system.			NO	10,11,15,16	
	Purchase green power from local utility.			NO	15,16	
<b>plumbing</b>	<b>Threshold: Install water conserving plumbing fixtures: 2.0 gpm showerheads &amp; 1.5 gpm faucet aerators.</b>			DONE	15	
	<b>Threshold: Install high energy factor water heater (.60 for gas, .93 for electric).</b>			DONE	15,16	
	<b>Threshold: Insulate bottom of hot water tank. Set electric tank on foam board; set gas tank on raised platform. Insulate hot water pipes.</b>			N/A	07	
<b>irrigation</b>	<b>Threshold: Use only native and low maintenance plant materials for landscaping, except for edible landscaping, street trees, and lawn. Minimize total area of turf.</b>			DONE	02	
	Install high efficiency drip irrigation system.			DONE	02, 15	
	Install rainwater catchment system for non-potable water reuse.			DONE	02, 15	

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<b>waste management &amp; recycling</b>	<b>Threshold: Develop a waste minimization plan, establishing targets for demolition and construction waste recycling by types of materials. Set up on-site storage for wood, drywall, metal, cardboard, rubble, and organic debris or contract with recycling provider to handle mixed waste. (goal: 80% total waste reuse and recycling by weight).</b>			DONE	01, 02	
	Minimize non-recyclable/non-reusable packaging during construction.			DONE	01	
<b>foundation</b>	Specify concrete mix with 25% fly ash substitution for Portland cement. Specify recycled aggregate base.			DONE	03	
<b>framing</b>	<b>Threshold: Specify and install engineered structural lumber products.</b>			NO	06	
	<b>Threshold: In wood framing, employ advanced framing techniques. This includes 24" framing modules and box headers.</b>			N/A	06	
	Specify and install salvaged, recycled, and/or certified sustainably harvested lumber products. Do not specify old growth lumber, other than "recovered" or "reused" materials.			NO	06	
	Specify and install regionally manufactured building materials when possible (within 500 miles).			DONE	01	
<b>roof &amp; skin</b>	<b>Threshold: Specify and install durable and recycled content roof and siding with a 25 - 50 year lifetime warranty. When using asphalt composition shingles, install moss inhibitor component such as 'Algae Block'. Install roofing underlay with a minimum 30 lb. building paper. Install siding air infiltration barrier such as Tyvek or Tytar per manufacturer's specifications.</b>			DONE	07	
<b>materials &amp; finishes</b>	<b>Threshold: If dropped ceiling panels are specified, install panels with recycled content.</b>			DONE	09	
	Install formaldehyde-free or low-formaldehyde composites. Replace particleboard with plywood or MDF (e.g., Medite II or Medex) in underlayment, cabinets and storage units.			DONE	09,10,12	
	For cabinets and other finish woodwork, use certified sustainably grown wood and			NO	12	
	Specify and install low-toxic, decay-resistant, (no persistent compounds or heavy metals) outdoor materials (ACQ treated wood, plastic lumber, etc.). When possible, consider patio treatment instead of decking.			N/A	02,03,04,06,09	
	Specify and install recycled content drywall. Install hard surface drywall in high-wear areas.			DONE	09	
<b>flooring</b>	<b>Threshold: Use natural linoleum, tile, or other vinyl alternative in kitchen and bathrooms (if vinyl is necessary, specify vinyl composition tile).</b>			DONE	09	
	<b>Threshold: Specify and install solid floor finishes and/or nylon or PET carpeting with fiber or waffle pad.</b>			DONE	09	
	Specify and install formaldehyde free underlayment (no particleboard).			N/A	06, 09	
<b>finishes</b>	<b>Threshold: Specify and install solvent free, no VOC or low VOC (below 20 g/liter) paints and primers. Specify and install water-based wood finishes and stains.</b>			DONE	09	
	<b>Threshold: Specify and install low toxic adhesives and sealants.</b>			DONE	09	
<b>fresh air ventilation</b>	<b>Threshold: Specify and install continuous exhaust ventilation OR central exhaust fan ducted to bath. Provide make-up air vents. Specify rated fans with delayed timer controls. Install medium efficiency air filters in ducted forced air systems.</b>			DONE	15,16	
	<b>Threshold: Properly ventilate building prior to occupancy.</b>			DONE	01	
	Install kitchen range hood or ceiling exhaust fan to remove excess moisture and odors OR install multi-port attic fan to exhaust kitchen and bathroom.			DONE	15,16	
	Use operable windows AND mechanical ventilation systems to assure ample fresh air for building occupants.			DONE	08	
	Encourage no smoking policy for building (during construction & occupancy). RESIDENTS CAN SMOKE IN UNITS			DONE	01	

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	<b>Threshold: Develop maintenance and tenant "operating manual" with specific actions. Provide an operating manual outline with project submittal.</b>			DONE	01	
	<b>Threshold: Provide adequate space for comprehensive tenant recycling.</b>			DONE	01	
	<b>Threshold: Develop O &amp; M plan for scheduled maintenance of vents, filters, plumbing, and combustion equipment.</b>			DONE	01	
	<b>Threshold: Eliminate pesticides and herbicide use on and around building.</b>			DONE	01	
	<b>Threshold: Use low toxic or citrus based cleaning supplies. Eliminate use of solvents.</b>			DONE	01	
	<b>Threshold: Design properly ventilated separate storage area for cleaning supplies and paints.</b>			DONE	01	
	<b>Threshold: Eliminate wet carpet cleaning (steam OK). Use HEPA filters on vacuum cleaners.</b>			DONE	01	

**Bold indicates required *Threshold Criteria*.**