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

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Mission

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

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 (CO₂) 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 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 new thresholds have been integrated into the PDC Rental Housing RFP process as required criteria. All RFP project proposals must demonstrate and commit to the comprehensive inclusion of these threshold criteria to receive funding awards through the RFP process. The remaining criteria are voluntary. They provide flexibility to weigh how applicants address green building. PDC encourages every applicant to explore cost-effective ways to maximize the number of strategies incorporated into a project. Like other performance criteria, the more strategies incorporated into a project, the more likely it will be funded. However, PDC reserves the right, at its sole discretion, to approve any and all non-threshold criteria (voluntary criteria) contained in a project proposal.**

Please see the Rental Housing RFP for a complete description of RFP required information.

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 reduces 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 facilitates.
- 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 enhances both environmental quality and the economic performance. Building O & M goals should protect the tenant 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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Category	Strategies	New	Reha		Code Requ	CSI D	Cost Prem
ENHANCED DE	SIGN & SITE	·	_	•	·•	. •	
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.	Ĵ	Í			02	0%
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.	Ĵ				02	0%
	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.	Ĵ	1		Ĵ	02	0%
	Do not apply herbicides or pesticides during site prep.	f	í			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.	Ĵ	ĺ			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)	(02,06,07 ,09	< 5%
	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.	Ĵ	Í			02,06,07 ,09	0%
	When possible, reuse large portions of existing structures during renovation or redevelopment.		I			02,06,07 ,08,09	
	Reduce building footprint, simplify building shapes, and maximize space efficiency.	ſ				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.	Ĵ	Ĵ		Ĵ	02	0%
	Threshold: Maximize onsite drainage and water catchment capacity. Design on-site stormwater facilities to City of Portland's Stormwater Manual specifications.	Í	ĵ		Î	02	0%
	Specify and install permeable surfaces and paving in low traffic areas (fire access, overflow parking, pathways, etc.).	ĵ	ĵ			02,03,04	
Transportation access	Threshold: Provide secure bicycle parking.	ĵ	Í		ĵ	02	0%

	Size parking capacity to meet only minimum local zoning requirements.	í	a	í	02	
	Site building within 1/4 mile of mass transit and within 1/2 mile of stores and services.	ī			02	
I. E	NERGY CONSERVATION					
building envelop & weatherization	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.	Ì	Ĵ		07	< 5%
	Threshold: Specify and install double glazed, low-e windows and sliding doors with U value 0.35 or less.	Í	Í		08	0%
	Threshold: Flash and seal all penetrations between interior spaces and outside. Seal all penetrations for ducting, wiring, plumbing, lights, and fans.	Í	í		07	0%
	Perform blower door test to determine cost-effective air sealing and combustion safety.	ĵ	Í		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.	ĵ			06,07	
	Specify and install exterior insulated core doors.	Í	Í		08	
	Specify and install insulated concrete forms.	Í			03,07	
	Insulate perimeter edge of concrete slab floor with code approved foam board. Insulate between heated space and garage slab.	ĵ			07	
heating systems	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).	ĵ	Ĵ		11, 15, 16	5%
	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.	ĵ	ĵ		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.	Í	í		15	
	Thermally separate living areas from less energy consuming zones like entry, storage, mechanical, and utility areas.	Í			15	
electrical and lighting	Threshold: Specify and install Energy Star-rated appliances if available, fixtures and lighting systems.	Í	Í		11,12,15 ,16	< 5%
	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.	ĵ	Ĵ		16	< 5%
Renewables	Install solar water heating system.	ĵ	Í		10,11,15 ,16	
	Purchase green power from local utility.	Í	Í		15,16	
II. W	ATER CONSERVATION					
Plumbing	Threshold: Install water conserving plumbing fixtures: 2.0 gpm showerheads & 1.5 gpm faucet aerators.	Í	Ĵ		15	< 5%
	Threshold: Install high energy factor water heater (.60 for gas, .93 for electric).	ĵ	Í		15,16	< 5%
	Threshold: Insulate bottom of hot water tank. Set electric tank on foam board; set gas tank on raised platform. Insulate hot water pipes.		Í		07	< 5%
Irrigation	Threshold: Use only native and low maintenance plant materials for landscaping, except for edible landscaping, street trees, and lawn. Minimize total area of turf.	ĵ	Í		02	0%
	Install high efficiency drip irrigation system.	í	ſ		02, 15	

	Install rainwater catchment system for non-potable water reuse.	ſ			02, 15	
III. C	ONSERVING MATERIALS & RESOURCES					
waste management & recycling	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).	Ĩ	Ĩ	Ĵ	01, 02	0%
	Minimize non-recyclable/non-reusable packaging during construction.	ſ	Í		01	
foundation	Specify concrete mix with 25% fly ash substitution for Portland cement. Specify recycled aggregate base.	Ĩ			03	
framing	Threshold: Specify and install engineered structural lumber products.	1	Î		06	< 5%
	Threshold: In wood framing, employ advanced framing techniques. This includes 24" framing modules and box headers.	đ			06	0%
	Specify and install salvaged, recycled, and/or certified sustainably harvested lumber products. Do not specify old growth lumber, other than "recovered" or "reused" materials.	Í	Î		06	
	Specify and install regionally manufactured building materials when possible (within 500 miles).	Í	Î		01	
roof & skin	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 Typar per manufacturer's specifications.	Î	Î		07	< 5%
materials & finishes	Threshold: If dropped ceiling panels are specified, install panels with recycled content.	ſ	ſ		09	0%
	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.	D	Í		09,10,12	
	For cabinets and other finish woodwork, use certified sustainably grown wood and	Í	Í		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.	Ĩ	ĵ		02,03,04 ,06,09	
	Specify and install recycled content drywall. Install hard surface drywall in high-wear areas.	í	Î		09	
flooring	Threshold: Use natural linoleum, tile, or other vinyl alternative in kitchen and bathrooms (if vinyl is necessary, specify vinyl composition tile).	Ĵ	Ī		09	< 5%
	Threshold: Specify and install solid floor finishes and/or nylon or PET carpeting with fiber or waffle pad.	đ	Í		09	< 15%
	Specify and install formaldehyde free underlayment (no particleboard).	I	Î		06, 09	
IV. E	NHANCED INDOOR AIR QUALITY					
finishes	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.	đ	ſ		09	< 5%
	Threshold: Specify and install low toxic adhesives and sealants.	ſ	ſ		09	0%
fresh air ventilation	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.	đ	ĵ		15,16	< 5%
	Threshold: Properly ventilate building prior to occupancy.	ſ	í		01	0%
	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.	ĵ	ſ		15,16	
	Use operable windows AND mechanical ventilation systems to assure ample fresh air for building occupants.	Í	ſ		08	

	Encourage no smoking policy for building (during construction & occupancy).	ĵ	ĵ		01			
V. OPERATIONS & MAINTENANCE								
	Threshold: Develop maintenance and tenant "operating manual" with specific actions. Provide an operating manual outline with project submittal.	ĵ	Ĩ		01	0%		
	Threshold: Provide adequate space for comprehensive tenant recycling.	ſ	Î		01	0%		
	Threshold: Develop O & M plan for scheduled maintenance of vents, filters, plumbing, and combustion equipment.	Ì	Ì		01	0%		
	Threshold: Eliminate pesticides and herbicide use on and around building.	ſ	Î		01	0%		
	Threshold: Use low toxic or citrus based cleaning supplies. Eliminate use of solvents.	ſ	Î		01	0%		
	Threshold: Design properly ventilated separate storage area for cleaning supplies and paints.	ſ	Î		01	0%		
	Threshold: Eliminate wet carpet cleaning (steam OK). Use HEPA filters on vacuum cleaners.	ĵ	ĺ		01	0%		

Bold indicates required Threshold Criteria.

*Cost premium column identifies our best attempt to approximate the cost premium-per-measure. The percentages indicate the cost premium above standard practice or code. Zero-percent indicates cost neutral measures. Costs vary depending on local design and construction costs, materials availability, etc. All cost premium information was verified in discussions with industry practitioners, vendors, developers, and contractors, recognizing that costs will vary from project to project. When properly packaged together, many of the threshold criteria's cost premiums are reduced due to favorable payback periods (payback = the time it takes to pay down/off capital investments through utility and operations & maintenance savings over time)

<u>CONSTRUCTION SPECIFICATION INSTITUTE REFERENCES.</u> (C.S.I. DIVISIONS)

- **DIVISION 01: General Work**
- DIVISION 02: Site Work
- DIVISION 03: Concrete
- DIVISION 04: Masonry
- **DIVISION 05:** Metals
- **DIVISION 06: Wood & Plastics**
- DIVISION 07: Thermal & Moisture Protection
- DIVISION 08: Doors & Windows

- DIVISION 09: Finishes
- **DIVISION 10:** Specialties
- **DIVISION 11:** Equipment
- **DIVISION 12:** Furnishings
- **DIVISION 13:** Special Construction
- **DIVISION 14:** Conveying Systems
- **DIVISION 15:** Mechanical
- **DIVISION 16: Electrical**

APPENDIX B: Application Forms