

## Chapter 5 Materials Efficiency

Reducing, reusing, and recycling building materials conserves local and regional natural resources. There are many building products on the market and techniques that contribute to more durable and less resource intensive buildings.

## Waste Management & Recycling

**5-1** **Essential:** Develop and implement a waste minimization plan, establishing targets for demolition and construction waste reuse and recycling by types of materials. (Goal: 80% total waste reuse and recycling by weight).

<b>WHY</b>	<ul style="list-style-type: none"> <li>• Reduces impact on landfills. Construction, demolition and land-clearing (CDL) waste accounts for 25% of the materials sent to regional landfills. More than half of this waste comes from the demolition phase.</li> <li>• Executing a waste minimization plan and salvaging, reusing, and recycling C&amp;D waste reduces disposal costs and may provide cost savings and revenue.</li> <li>• The following materials are readily recyclable in the Seattle area and generally cost less to recycle than to dispose of as garbage: cardboard, clean wood, engineered products, concrete, asphalt, brick, drywall, land clearing debris, metals, paper and beverage containers from the job</li> </ul>
<b>HOW</b>	<ul style="list-style-type: none"> <li>• Specify preparation and submittal of a waste minimization plan for the project that identifies demolition goals (if applicable) and establishes policies and procedures to recycle the maximum construction waste. Require general contractors and their subs to participate in the program by making this a condition of the contract specifications. Contact the Business &amp; Industry Resource Venture (see Resources) to request a sample Job-site Specification and Construction Waste Management Plan, and assistance in writing and reviewing both.</li> <li>• Consider deconstruction/salvage for the demolition phase of the project rather than a regular demolition contractor. Remember to address hazardous materials. Since the majority of construction waste originates in the deconstruction phase, it is a key element in reaching the 80% total waste reuse and recycling goal.</li> <li>• Set up on-site collection for materials called out in the plan or consider contracting with a recycling provider that handles mixed waste.</li> <li>• Create salvage and recycling staging and sorting area.</li> </ul>
<b>COST</b>	<ul style="list-style-type: none"> <li>• Little or no cost premium and could provide savings. Waste mitigation activities and deconstruction costs are offset by the reduction in tipping fees.</li> <li>• Donations of salvaged materials from deconstruction to a non-profit, such as The RE Store, are tax deductible.</li> </ul>

## 5-2

**Essential:** Require subcontractors to participate in waste minimization efforts.

### WHY

Subcontractors typically are responsible for managing their own waste. Subcontractors need to be aware and committed to the program you've established, or it will not succeed.

### HOW

- Include requirement in bid and contract negotiation process.
- Include a preference to buy recycled-content products.
- Make sure each sub has a copy of the plan and has been trained in the recycling program. Ask them for input and suggestions about collection containers and project phasing.
- Recognize and support subcontractor participation. Monitor activity and contractor's log regarding transport of waste materials.

## 5-3

**Essential:** Include Seattle/King County's Construction Recycling Directory and the Contractors Guide as part of the bid package.

### WHY

- These easy-to-use documents will assist contractors in achieving Action Items 1, 2 and 4.
- The Construction Recycling Directory is a directory of recycling haulers, recycling facilities, reuse and salvage services, and materials exchanges.
- The Contractors Guide has simple how-to's for reducing waste, recycling and using recycled-content building products.

### HOW

- Contact the Business and Industry Resource Venture for copies of these documents (see Resources).

### COST

- Free

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**5-4** Reuse and recycle parts or all of existing building during renovation or redevelopment. Install used/salvaged building materials where appropriate.

**WHY**

- The energy spent to extract, process, transport, and install materials is significant. Reusing and recycling parts or all of an existing structure saves resources, reduces waste, and saves landfill tipping costs.
- Reusing and restoring older structures supports historic preservation and

**HOW**

- Evaluate viability of reusing existing structure, including foundations, footings, slabs, and sidewalks, at the beginning of the design process. Review regulatory requirements needed to bring structure up to current codes.
- Focus on improving energy efficiency in reused structures. New insulation can be blown into walls, studs can be furred out to allow more room for insulation, or foam panel insulation may be installed under exterior siding.
- Incorporate salvaged building elements like studs, doors, and hardware into project. Inspect, mark, and warehouse materials to be reused or recycled during demolition. Note, salvaged studs can only be used for non-structural walls unless the lumber is professionally re-graded. See DCLU Client Assistant Memo #224 for code issues related to reusing building materials.
- Evaluate viability of deconstruction in lieu of traditional demolition. Deconstruction diverts most C&D waste from landfills and is cost competitive.



*The shell of this existing brick apartment building was retained and reused. Behind and integrated with the old brick building is a new courtyard and five-story structure.*

## 5-5

Use suppliers who offer reusable or recyclable packaging.

### WHY

• Packaging adds significantly to the amount of waste generated on-site. Much of it cannot be recycled.

### HOW

• Convey to suppliers about using materials with reduced packaging and a take-back policy.

## Foundation

## 5-6

**Essential:** Specify cast-in-place concrete mix with minimum 25% fly ash substitution for Portland cement. Preferred 50%.

### WHY

• The production of cement is highly energy- and resource-intensive.

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	<ul style="list-style-type: none"><li>• Substituting fly ash for a percentage of cement strengthens and improves the workability of concrete, reduces CO<sub>2</sub> emissions, and reuses a waste product from coal power plants.</li></ul>
<b>HOW</b>	<ul style="list-style-type: none"><li>• Specify a concrete mix with 25-50% fly ash content.</li><li>• Fly ash concrete takes longer to cure to full strength that could affect construction schedules on large projects. Low-rise construction scheduling should not be affected. A 25% fly ash mix reaches 50%</li></ul>
<b>COST</b>	<ul style="list-style-type: none"><li>• No cost premium.</li></ul>

### 5-7

**Essential:** Specify recycled aggregate base.

<b>WHY</b>	<ul style="list-style-type: none"><li>• Portland cement concrete can be reclaimed during demolition operations and crushed into a coarse granular material that can be used as a substitute for crushed virgin rock.</li><li>• Recycled concrete aggregate is increasingly available and is often an economical alternative to new aggregate. Project managers can ensure that their contractors are aware of opportunities to recycle this material</li></ul>
<b>HOW</b>	<ul style="list-style-type: none"><li>• Users of recycled concrete aggregate should take customary precautions to ensure the material is suitable for the intended application.</li><li>• Specifications are available for several applications, including backfill, general fill, pipe-bedding, and as aggregate base course for pavement construction in new construction.</li><li>• Crushed glass also works well and is free draining.</li></ul>



*This affordable housing project used structural insulated building panels (SIPs).*

## Framing

5-8

Use efficient structural systems, such as Advanced Framing, engineered structural lumber, etc.

### WHY

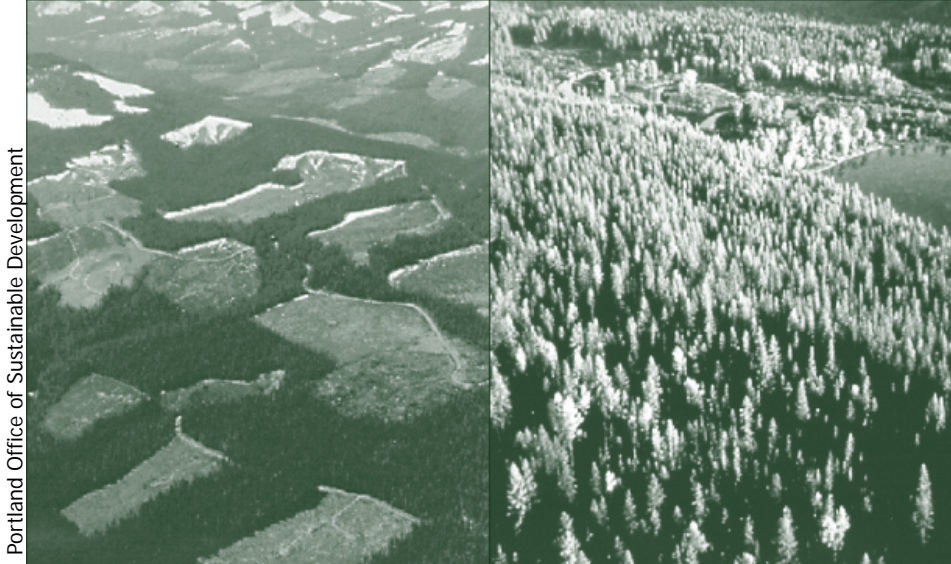
- Efficient structural systems reduce wood waste. Structural insulated building panels (SIPs) — custom-cut wall and roof systems of rigid insulation sandwiched between exterior layers of wood composite board—have excellent air sealing and insulation properties, use less wood, and save installation time. Note, SIPs cannot be reused or recycled.
- Advanced Framing improves building envelope performance and reduces lumber use by 20-30%.
- Engineered wood utilizes more of the tree and incorporates under-sized or under-valued species that might otherwise go to waste.
- Engineered joists are lighter weight and more dimensionally stable than traditional joists.

### HOW

- Specify the use of engineered floor, roof, and rim joists. Investigate the viability of SIPs.
- Evaluate use of Advanced Framing features including 24" on-center, 2-stud corners, and insulated headers.
- **See also** Chapter 3: Energy Efficiency, Action Item 7 and Appendix A.

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- COST**
- On a per-linear foot basis, engineered joists cost 40% more than solid sawn lumber. Price premiums are offset through reduced labor costs, increased spacing of components, and fewer problems with material flaws. 24" o.c. framing can reap substantial savings from reduced labor in wallboard finishing.



Portland Office of Sustainable Development

*Conventional timber harvest practices fragment landscapes, cause erosion and accelerate habitat loss.*

5-9

Specify 3<sup>rd</sup>-party certified sustainably harvested framing. Do not specify old growth lumber, other than "recovered" or "salvaged" materials.

### WHY

- Less than 10% of the United States' old growth forest remains.
- Second-growth uncertified lumber material comes from tree farms replanted with a single tree crop, and treated with herbicides and pesticides.
- Salvaged, recovered, and recycled materials are a less expensive and environmentally responsible alternative to virgin materials.
- Sustainably harvested lumber refers to timber that has been certified by an independent, third-party organization such as Rainforest Alliance or Scientific Certification Systems.
- Currently, Forest Stewardship Council (FSC) standards are considered the world's most stringent. FSC-certified lumber is available in our region.

<b>HOW</b>	<ul style="list-style-type: none"> <li>• Specify FSC-certified lumber products, including framing material and sheet goods. In the Northwest, FSC-certified Douglas fir is in short supply at this time. However, FSC-certified Hemlock fir is more plentiful and less expensive. Order framing material at the beginning of design/ engineering process — at least three months in advance of delivery date to avoid delay. Contact the non-profit Certified Forest Products Council to help write project specifications. This resource is free.</li> <li>• Specify reclaimed lumber and recycled-content finish materials. Both are readily available in the Seattle area.</li> <li>• Re-grade salvaged material for structural use. Contact a lumber grader to learn more about re-grading services.</li> </ul>
<b>COST</b>	<ul style="list-style-type: none"> <li>• FSC-certified materials carry a 5-10% price premium.</li> <li>• When combined with advanced framing, certified wood products become more cost effective.</li> <li>• Salvage lumber can be purchased for less than half the price of new wood. It must be professionally re-graded for structural use. Grading costs range from \$300 per half day to \$500 per full day. A lumber grader</li> </ul>

## Roof & Skin

5-10

Select durable and recyclable roofing and siding materials.

<b>WHY</b>	<ul style="list-style-type: none"> <li>• Exterior cladding and roofing materials with longer warranties offer better protection from the elements, improving building envelope performance and reducing maintenance costs over the lifetime of the building.</li> <li>• Several new composite options are available that provide lower maintenance along with durability. Many of these options include recycled-content or reclaimed materials: fiber-cement composites, asphalt shingles, plastic shakes, ridged sheet material made with fiber</li> </ul>
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	<ul style="list-style-type: none"><li>• Fiber-cement composites that contain reclaimed wood fiber are resource-efficient, durable, low maintenance, and offer a very good fire rating when compared to wood or metal siding. Sometimes the wood can also be harvested from small diameter, fast-growing tree species. Many of the fiber-cement composites offer a 50-year warranty.</li><li>• Metal siding currently includes recycled-content, and offers durable and low-maintenance alternatives to wood siding. Metal offers the greatest opportunity to use post-consumer recycled-content in your project. Aluminum or steel siding products contain high percentages of recycled metal—up to 100%. The scrap is also recyclable.</li><li>• The use of vinyl siding raises concerns for several reasons. When burned, it releases dioxins. Also, one of its constituent chemicals is vinyl chloride,</li></ul>
<b>HOW</b>	<ul style="list-style-type: none"><li>• Specify roof and siding materials with maximum durability and warranty.</li><li>• Specify and install 30-lb. building paper for roof underlayment.</li><li>• Install siding air infiltration barriers per manufacturer's specifications. Follow installation instructions carefully to minimize infiltration rates.</li><li>• Establish guidelines within the operations and maintenance manual for annual or biannual cleaning of the roof. Specify that no bleach or other harmful cleaning solutions be used. Such solutions poison adjacent soils and plants.</li><li>• Consider specifying cementitious siding such as Hardiplank. When properly installed, cementitious siding can last three times longer than wood siding and takes paint well. Cementitious siding requires additional installation time.</li><li>• If your goal is to use a durable, low maintenance, economical alternative to vinyl, consider a polypropylene siding that is comparable in</li></ul>
<b>COST</b>	<ul style="list-style-type: none"><li>• There is a slight cost premium for 25- to 30-year roof and siding products over products with a 15- to 20-year warranty.</li></ul>

## 5-11

Use recycled-content insulation (e.g. cellulose insulation.)

### WHY

- Three commonly available types of insulation include recycled-content: cellulose, fiberglass, and mineral wool.
- Cellulose insulation is made from 100% post-consumer recycled newspapers or telephone books. The insulation can be dry-blown or poured loose-fill into enclosed cavities, but is most commonly wet-sprayed. When sprayed, the product leaves few voids, reducing problems with air infiltration. Cellulose is usually mixed with boric acid or sodium borate as a fire retardant. An additional benefit of boric acid is that it kills carpenter ants and termites.
- Several brands of fiberglass insulation batts are manufactured using recycled glass, including post-consumer glass collected in curbside recycling programs.
- Mineral wool insulation is another option and is available in loose-fill or

### HOW

- Specify recycled-content insulation.

## Interior Finishes

## 5-12

When suspended ceiling panels are specified, install recycled-content acoustical ceiling tiles.

### WHY

- Recycled content ceiling tiles are becoming the industry standard, making them easy to specify and install.

### HOW

- Specify ceiling tiles with post-consumer recycled content.
- For rehab projects, remove and recycle old ceiling tiles. Call Sepia

### COST

- No cost premium.

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5-13

Specify 3<sup>rd</sup>-party certified sustainably harvested finish woodwork.

**WHY**

- Slow-growing hardwoods have been over-harvested.
- Sustainably forested lumber is certified as sustainably managed by an independent, third-party certification organization. Currently, Forest Stewardship Council (FSC) standards are considered the most rigorous

**HOW**

- Specify certified sustainably harvested finish wood materials. There are many certified solid and veneered products available locally.

5-14

Specify recycled-content drywall. Install hard surface drywall in high-wear areas.

**WHY**

- Recycled-content drywall contains “synthetic” gypsum, a waste byproduct of flue gas scrubbers, and reduces the demand for virgin gypsum, mined from the ocean floor.
- Use of hard-surface drywall in high-wear common areas can reduce maintenance costs. Note that hard-surface drywall is not as easily recyclable as regular drywall.

**HOW**

- Specify drywall with “synthetic” or recycled gypsum.
- Note that all gypsum manufacturers use 100% recycled paper for the facing. Not all drywall suppliers carry drywall with recycled gypsum content. Specify recycled gypsum content or “synthetic” gypsum rather

**Cost**

- Recycled content drywall is widely available and cost-competitive with non-recycled content products.
- Hard surface drywall has a slight cost premium. However, it reduces long term maintenance costs in high-wear areas like common hallways and

## 5-15

Install alternative to sheet vinyl for kitchens and bathrooms. Other flooring choices include natural linoleum, tile and vinyl composition tile (VCT) with recycled-content.

### WHY

• Sheet vinyl is less durable and more toxic than other flooring options. Vinyl is made from polyvinyl chloride (PVC), a petroleum-based, highly toxic substance that contains phthalates used as softeners that are known endocrine disrupters. Vinyl chloride is also a known carcinogen. Production of this material creates air pollution problems, but in addition, it impacts indoor air quality in the building, off-gassing VOCs long after installation is complete.

• Natural linoleum and tile are made from natural and abundant materials and are very durable.

### HOW

• Specifying natural linoleum or tile is the best choice. Verify that the moisture content of the substrate (underfloor) meets the linoleum manufacturer's requirements.

• If vinyl is used, specify vinyl composition tile (VCT). It contains fewer VOCs and phthalates than sheet vinyl. Damaged tiles can be replaced

### COST

• Slight premium: natural linoleum costs about \$16-22 sq. yd. but is extremely durable and can last up to 40 years. Quality sheet vinyl costs about \$16-17 sq. yd. with an average life of 7 years. Small rooms can utilize "scraps" or roll ends of linoleum that cost about \$7 sq. yd. Tile prices begin at \$2 sq. ft. The durability of linoleum and tile make them cost effective over time.